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EXECUTIVE SUMMARY

The Dam Impact Analysis (DIA) Model is a population viability analysis that was developed to help better understand the impacts of dams on the production potential of Atlantic salmon (*Salmo salar*). Dams have been identified as a major contributor to the historic decline and current low abundance of salmon in the Gulf of Maine Distinct Population Segment, which was first listed as endangered in 2000 and then expanded in 2009 to include Atlantic salmon in all rivers from the Androscoggin River north along the Maine coast to the U.S.-Canada border. The DIA Model specifically simulates the interactions of Atlantic salmon and 15 hydroelectric dams in the Penobscot River watershed in Maine.

The modeling approach incorporates life stage-specific information for Atlantic salmon to simulate the life cycle of Atlantic salmon in the Penobscot River. Most model inputs were considered to be random variables, and Monte Carlo sampling from probability density functions was used to create multiple realizations of population trajectories over time. All DIA Model iterations were run for 50 years, roughly ten generations of fish, and 5,000 iterations were run for each simulation. The DIA Model was built in Microsoft Excel with the @Risk add-on.

The DIA Model can be used to compare alternative scenarios of changes in future abundance and identify critical parameters and information needs for recovery efforts. The predicted abundance and distribution of adults and number and proportion of smolts killed due to the effects of dams were reported for several modeling scenarios. The DIA Model simulations are not meant to predict absolute abundance, distribution, or mortality, but rather are meant to project the relative changes under different modeling scenarios. The modeled population of Atlantic salmon in the Penobscot River decreased in abundance and distribution when DIA Model inputs were set at the base case values, whereas abundance increased and Atlantic salmon remained distributed throughout the Penobscot River watershed when marine and freshwater survival rates were increased appreciably in a recovery scenario. The production potential of Atlantic salmon was also more affected by the operational characteristics of mainstem dams than tributary dams in the Penobscot River watershed because mainstem dams tend to impact access to multiple upstream tributary dams. Sensitivity analyses were performed on all input values to determine which model inputs had the greatest impact on the results. The DIA Model results revealed that recovery of Atlantic salmon is most sensitive to marine survival and downstream dam passage survival rates.

1 INTRODUCTION

The Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon is listed as endangered under the U.S. Endangered Species Act (65 Federal Register 69469, November 17, 2000; 74 Federal Register 29344, June 19, 2009). Dams have been identified as a major contributor to the historic decline and current low abundance of salmon in the GOM DPS (NRC 2004; Fay et al. 2006). To better understand the impacts of dams on the production potential of Atlantic salmon, a tool was developed to simulate the interactions of Atlantic salmon and dams, particularly hydroelectric dams in the Penobscot River watershed. The Penobscot River watershed was chosen as the area of study for several reasons. In recent years, approximately 75% of all U.S. Atlantic salmon returns have come from the Penobscot River (USASAC 2011). Also, multiple hydroelectric dams, which reduce migration success for downstream migrating smolts and upstream migrating adults, are located on both mainstem and major tributary reaches. Fifteen Federal Energy Regulatory Commission (FERC)-licensed dams were focused on because these dams are located within designated Atlantic salmon critical habitat (74 Federal Register 39003, August 10, 2009) or currently occupied Atlantic salmon watersheds.

Predicting the future viability of an endangered or threatened species is a vital part of planning management and recovery actions (NRC 1995), and population models are important tools for assessing management strategies and evaluating risks to these species (Morris and Doak 2002; McGowan and Ryan 2009; McGowan and Ryan 2010). A life history modeling approach was undertaken because a large amount of life stage-specific information is available for Atlantic salmon. Life history models can provide biological realism but may require many assumptions regarding the various inputs. Population viability analysis (PVA) is a stochastic life history model for predicting changes in population abundance given uncertain biological parameters (Beissinger 2002).

PVAs vary greatly in their complexity. A simple PVA quantitatively estimates information related to population growth and extinction probabilities for a single population (Dennis et al. 1991). A simple PVA is a stochastic exponential growth model of population size, which is equivalent to a stochastic Leslie-matrix projection with no density dependence. More complex PVA approaches account for a wider range of life history characteristics, such as age distribution, juvenile survival rates, adult survival rates, habitat limitations or degradation, age-specific fecundity, and migration rates (Beissinger 2002). One such life-cycle model, SalmonPVA, was developed for the GOM DPS (Legault 2004). The SalmonPVA is a state-space model structured to represent GOM DPS Atlantic salmon life history characteristics. Results from these more complex PVA models can be used to explore the potential effects of management actions in light of unknown future conditions, variability of input data, and assumptions made when designing the model (Legault 2005). The more complex approach, such as was applied within the SalmonPVA, may provide information to decision makers related to an array of management measures available (Samson 2002).

The Dam Impact Analysis (DIA) Model was built in Microsoft Excel with the @Risk add-on and was developed as a state-space model that is similar in structure to the SalmonPVA but representative of Penobscot River Atlantic salmon life history characteristics. Most DIA Model inputs were specified as random variables with known probability density functions, and Monte Carlo sampling was used to simulate many iterations of the Penobscot River population of Atlantic salmon forward in time. The DIA Model projections of future abundance can identify critical information requirements for recovery efforts. Specifically, the DIA Model was developed to assess the relative impacts of hydroelectric facility operations within the Penobscot

River watershed on the production potential of the Penobscot River Atlantic salmon population. The DIA Model simulations do not predict absolute abundance, but instead project the relative change in abundance and distribution under different modeling scenarios.

This document describes the DIA Model developed for Atlantic salmon in the Penobscot River watershed. A full description of the chronology of the model development (Table 1.1) and modeling approach is presented and all input values, distributions, and assumptions are outlined.

2 MODEL OVERVIEW

An overview of the DIA Model is provided below. A schematic outlining the life stages modeled, additions and subtractions to the population and other metrics effecting the population was developed (Figure 2.1). A full description of all model inputs is provided in Section 3. The DIA model describes the dynamics of a population spatially distributed over 15 sections, hereafter referred to as production units (PUs; Figure 2.2). The linkages among PUs are defined by the physical configuration of the Penobscot drainage and accessibility (i.e., dams).

The initial distribution of salmon in the DIA Model is based on the mean annual number of two sea-winter (2SW) female returns captured at the trap above Veazie Dam during 2002–2011, which equaled 587 fish. These fish were randomly assigned among the PUs according to an underlying multinomial distribution based on the amount of salmon habitat available in each PU (see Section 3.1). Production potential was zero in PUs that could not be accessed due to lack of upstream dam passage, and, therefore, no adults were seeded into these PUs. For all subsequent calculations, the numbers of Atlantic salmon were rounded, rather than binomially assigned, to maintain whole numbers of fish and to minimize computational time.

For each DIA Model iteration, the 2SW females in year 1 were multiplied by the fecundity rate to estimate the number of eggs produced in that same year (see Section 3.2). The number of eggs was then multiplied by the egg to smolt survival rate to estimate the number of two-year old smolts produced in year 4 (see Section 3.3). If the number of smolts in a PU exceeded the production potential cap, then the number of smolts was reduced to the maximum allowed for that PU to ensure that projections remained biologically reasonable. The carrying capacity assigned to each PU defines the maximum potential population size and induces a spatially explicit density dependence in the PU set comprising the Penobscot River watershed. Smolts surviving from the egg stage were considered wild-origin fish. Additionally, the option was available to have hatchery-origin smolts “stocked” into each PU (see Section 3.4). All smolts (hatchery- and wild-origin) then migrated downstream from their initial PU, through subsequent downstream PUs and over dams, to Verona Island. As fish migrated through PUs, the number of surviving smolts in a PU was multiplied by the distance-specific in-river survival rate (i.e., 1 – in-river mortality rate raised to the distance traveled; see Section 3.5). To simplify modeling, smolts were assumed to travel only half the length of their initial PU because fish could start their migration from a variety of locations within the PU (e.g., the furthest point upstream, the furthest point downstream). As smolts migrated downstream through subsequent PUs, they traveled the distance from the point of entry to the point of exit (e.g., fish from PU 7 would travel the distance from Milo Dam to Howland Dam in PU 4). The in-river mortality rate was applied to each PU-specific group of smolts as they migrated downstream through each subsequent PU, until reaching the northern tip of Verona Island.

Smolts exiting a PU had to traverse a dam to enter into a downstream PU. To account for dam-related mortality, the number of smolts above each dam was multiplied by the correlated draws from the dam-specific cumulative distribution functions of total hydroelectric project survival to estimate the number of smolts remaining after passing each dam (see Sections 3.6.1 and 3.6.2). Smolts that started their migration in PU 9, or further upstream, could travel through the Mainstem or Stillwater Branch of the Penobscot River (see Section 3.6.3). The number of smolts reaching PU 9 was multiplied by the Stillwater Branch path choice to estimate the number of smolts that migrated through that branch. The remaining smolts migrated through the mainstem. Smolts continued to migrate downstream through subsequent PUs, encountering in-river and dam-related mortality, until the survivors reached the estuary at Verona Island.

At Verona Island, an option was available to apply an indirect latent mortality rate to account for the negative effects on survival from passing multiple dams (see Section 3.7). An indirect latent mortality rate was calculated for smolts originating in each PU, based on the number of dams that fish from each PU passed.

Although wild- and hatchery-origin smolts were treated the same during downstream migration (i.e., subjected to the same in-river mortality rates, smolt survival probabilities at dams, and indirect latent mortality rates), hatchery-origin smolts typically experience lower survival than wild-origin smolts (see Section 3.8). Hence, a survival discount was applied to hatchery-origin smolts to estimate the total number of wild-equivalents before they migrated out to sea. The remaining number of wild-equivalent smolts was halved to convert the number to wild-equivalent female smolts, which was needed to estimate the number of adult female returns. These wild-equivalent female smolts were considered post-smolts as they migrated beyond Verona Island, and the total number of female post-smolts in year 4 was multiplied by the marine survival rate to estimate the number of 2SW females that returned in year 6 (see Section 3.9).

Maine Atlantic salmon return to their natal river to spawn with high fidelity (estimated straying rates 1–2%; Baum 1997). However, homing to the Penobscot River was assumed to be 100% in the DIA Model, and the proportion of 2SW females that attempted to migrate upstream to each PU equaled the proportion of wild-equivalent female smolts that originated from each PU. Within the Penobscot River watershed, homing to natal PUs is less than 100%, and straying of adults is incorporated by randomly assigning a target PU based on estimated straying rates (see Section 3.10). Adults then migrated upstream from Verona Island and encountered dams as they attempted to migrate to their targeted PU (see Section 3.11). Upstream dam passage rates dictated the proportion of adults that were able to pass each dam. 2SW females that were unable to pass a dam died, returned to sea, or migrated to a different downriver PU to spawn (see Section 3.12). Adults that successfully passed dams continued to migrate upstream through all upriver PUs, until they reached their desired PU. No in-river mortality factor was applied, as freshwater mortality in free flowing stretches of river is assumed to be low for adult Atlantic salmon. In years when hatchery-reared smolts were stocked, 150 2SW females were removed from the migrating population for hatchery broodstock purposes just after passing the Veazie Dam (see Section 3.4). Hatchery broodstock were removed in a way that each PU contributed adult spawners in proportion to their adult returns (except PUs 13 and 14 because adults that returned to these PUs did not pass Veazie dam). The 2SW females that reached their desired PU spawned and produced eggs in that same year (i.e., year 6). This entire process was then repeated for nine more generations (one generation equaled 5 years).

All fish were tracked according to their PU of origin. The adult portion of the Atlantic salmon life cycle focused on 2SW females because the vast majority of females return as 2SW fish and egg production is one of the limiting factors for this population (USASAC 2011). The smolt life stage focused on age-2 fish because the majority (>85%) of naturally-reared Atlantic salmon smolts from Maine, and specifically the Penobscot River, migrate to the ocean as age-2 fish, with smaller proportions of both age-1 and age-3 juveniles present (USASAC 2011). Although kelts play a vital role in the life history of Atlantic salmon, this life stage was not included in the DIA Model due to limited quantitative information for model inputs and the limited number of kelts present.

A cohort of fish and its descendants were tracked through the life stages. Inputs were year- and iteration-specific random draws from distributions to incorporate stochastic variation into the model. All DIA Model iterations were run for 50 years, which equaled ten plus generations of fish, and 5,000 iterations were run for each simulation. All model iterations were run with @Risk.

3 MODEL INPUTS

3.1 Production Units

The DIA Model was built for the Penobscot River watershed comprising 15 sections, or PUs (Table 3.1.1; Figure 2.2). The upstream boundary of each PU was either the headwaters of a tributary or a FERC-licensed hydroelectric dam. The downstream boundary of each PU was a hydroelectric dam, except in PU 14, where the downstream boundary was the northern tip of Verona Island. Using dams as PU endpoints meant that Atlantic salmon could not enter or exit a PU without attempting to pass a dam, with the exception of PU 14. This scheme helped further delineate the salmon-dam interactions in the model.

Total network length, longest segment length, and partial segment length were distances calculated to describe each PU (Table 3.1.1). Total network length represents the sum of all perennial stream kilometers within a particular PU. Longest segment length represents the longest straight path distance that a fish could swim within a PU. Partial segment length represents the distance that a fish would swim when traversing from one PU to another (e.g., fish from PU 2 would travel the distance from Mattaceunk Dam to West Enfield Dam in PU 3; Figure 2.2). PUs can have no partial segment length (e.g., PU 15), one partial segment length (e.g., PU 2), or two partial segment lengths (e.g., PU 4). The longest segment lengths and partial segment lengths were also used to calculate in-river mortality (see Section 3.5).

Each PU has the potential to support a different number of fish based on available habitat. Our measurement unit for Atlantic salmon is a habitat unit (HU) equal to 100 m^2. The number of Atlantic salmon HUs was calculated for each PU using a model which estimated spawning and rearing habitat (Table 3.1.2; Wright et al. 2008). The number of Atlantic salmon HUs was used as a measure of production potential (i.e., the number of Atlantic salmon each PU could produce), and the proportional production potential (i.e., proportion of HUs in a PU compared the total habitat units for the drainage) was used to seed adults as well as to limit the number of smolts in each PU.

The model was seeded with 2SW females that were randomly assigned among the PUs according to an underlying multinomial distribution based on the proportion of HUs in each PU (Table 3.1.2). PUs 1, 7, 8, and 11 were not allotted any HUs because adults were unable to access them due to lack of upstream dam passage. Therefore, no 2SW females were allocated to these PUs.

The number of smolts in each PU was limited with a production potential cap, which was the maximum number of smolts allowed per HU (i.e., 10 smolts per 100 m^2; Table 3.1.2). The cap of 10 smolts per 100 m^2 is greater than the commonly accepted production potential of three smolts per 100 m^2 in the Penobscot River (Meister 1962) but was implemented to prevent biologically unrealistic outputs from being produced via stochastic sampling.

PU 1, which is the West Branch of the Penobscot River above Medway, is different than the other PUs. Medway does not have upstream or downstream passage, so no fish are able to access this PU. Also, no anadromous Atlantic salmon are stocked in PU 1, so no juveniles are produced and no smolts migrate through this PU en route to PU 2 (Figure 2.2). Although PU 1 was built into the DIA Model, this PU did not contribute to the Atlantic salmon population. PU 1 was included in the model because the West Branch was historically important Atlantic salmon habitat and could be recognized as a potential component of Atlantic salmon recovery efforts in the Penobscot River in the future.

3.2 Eggs per Female

Adult female Atlantic salmon spawn at various ages, and typically older females produce more eggs. In the DIA Model, a fecundity rate was applied to the number of 2SW females in a year to estimate the number of eggs that would be produced the same year.

The number of eggs produced per female Atlantic salmon was estimated using fecundity data for Penobscot River sea-run female Atlantic salmon, spawned at Craig Brook National Fish Hatchery during 1997–2010 (Denise Buckley, U.S. Fish and Wildlife Service, personal communication). The data were derived primarily from 2SW females, but a small number of older females were also spawned each year. A distribution was fit to the average number of eggs per female in each year by using a combination of characteristics of the data (e.g., discrete distributions were not considered for values that could be treated as continuous) and goodness of fit tests. The data were best described by a normal distribution with μ = 8,304 and σ = 821 (Figure 3.2.1). Year- and iteration-specific values were drawn from this distribution for base case fecundity values in all DIA Model simulations.

3.3 Egg to Smolt Survival

Atlantic salmon spend the first years of their lives in rivers, from the time they are eggs until they migrate to the ocean as smolts. Atlantic salmon go through several life stages during this time: egg, fry, parr, and smolt. The DIA Model did not calculate the number of fish at all of these life stages. Instead, an egg to smolt survival rate was applied to the number of eggs in a year to estimate the number of smolts that would survive three years later (i.e., age-2 smolts) and be available to initiate a downstream migration to the ocean.

The egg to smolt survival rate was calculated based on the methods of Legault (2004). Egg to fry, fry to parr0+, parr0+ to parr1+, and parr1+ to smolt survival rates were obtained from the literature and were combined using a method that would account for uncertainty in each study. In order to be combined, studies for a particular life stage were standardized to the same time interval. The standardized mean, minimum, and maximum values were used to generate a triangular distribution for each study. The triangles were added together to form a new survival rate distribution for that life stage. This probability distribution function was converted to a cumulative distribution function, and the 10th and 90th percentiles were used as the limits of a uniform distribution. The uniform distribution was used to describe the uncertainty in survival for each life stage. Instream survival studies described in Legault (2004) were augmented with more recent studies.

The egg to fry survival rate came directly from a study of GOM DPS Atlantic salmon (Jordan and Beland 1981) instead of using the objective process described above. The uniform distribution for survival of 15 to 35%, covered most other estimates of survival in the literature (see Table 2 in Legault 2004), and was thought to best represent egg to fry survival of Atlantic salmon in Maine (Legault 2004). Two additional studies were excluded because they were not considered representative of Atlantic salmon survival in Maine (Table 3.3.1; Dumas and Marty 2006; Flanagan et al. 2008).

The fry to parr0+ survival rate was derived using the objective process described above, with the standard time period of two months. Seven studies were included, resulting in a uniform distribution ranging from 31 to 60% (Table 3.3.2; see Table 3 in Legault 2004; Figure 3.3.1). Other studies were excluded because they were not considered representative of Atlantic salmon survival in Maine for various reasons. One study had extremely low survival (Coghlan and Ringler 2004). Another study had a wide range of survival and did not report a mean survival rate (Coghlan et al. 2007). The duration of one study could not be determined (Raffenberg and Parrish 2003). Two studies (Aprahamian et al. 2004; Millard 2005) had multiple survival rate estimates, and these estimates were averaged for each study after standardizing the time period so that neither study would have undue influence on the overall calculation of survival for this life stage. The seven studies which were included had mean standardized survival rates ranging from 40.3 to 59.2% (Egglishaw and Shackley 1973; Egglishaw and Shackley 1980; Gardiner and Shackley 1991; Orciari et al. 1994; McMenemy 1995; Aprahamian et al. 2004; Millard 2005).

The parr0+ to parr1+ survival rate was derived using the objective process described above, with the standard time period of twelve months. Eight studies were included, resulting in a uniform distribution of survival ranging from 13 to 56% (Table 3.3.3; see Table 4 in Legault 2004; Figure 3.3.2). One study was excluded because survival was parsed out by season (Letcher et al. 2002). The eight studies which were included had mean standardized survival rates ranging from 11.3 to 51.0% (Meister 1962; Egglishaw and Shackley 1980; Kennedy and Strange 1980; Kennedy and Strange 1986; Gardiner and Shackley 1991; Orciari et al. 1994; Cunjak et al. 1998; Aprahamian et al. 2004).

The parr1+ to smolt survival rate was derived using the objective process described above, with the standard time period of nine months. Five studies were included, resulting in a uniform distribution ranging from 17 to 50% (Table 3.3.4; see Table 5 in Legault 2004; Figure 3.3.3). One study was excluded because the life stage of the fish was unclear (Letcher et al. 2002). The five studies which were included had mean standardized survival rates ranging from 16.8 to 45.8% (Meister 1962; Myers 1984; Orciari et al. 1994; Cunjak et al. 1998; John F. Kocik, NOAA's National Marine Fisheries Service, personal communication).

Combining the minimum and maximum values across these life stages produced a possible range from 0.10 to 5.88% for the egg to smolt survival rate, with a mean of 1.31% (Table 3.3.5). The egg to fry, fry to parr0+, parr0+ to parr1+, and parr1+ to smolt distributions were each sampled 10,000 times, and the life stage survival values from each iteration were multiplied together to calculate an egg to smolt survival rate. The sum of random values from the egg to fry, fry to parr0+, parr0+ to parr1+, and parr1+ to smolt distributions was approximately normal by the central limit theorem, and egg to smolt survival could be expressed as the sum of the natural logs of each survival rate (Hilborn and Walters 1992; Legault 2004). This meant that the distribution of egg to smolt survival approximated a lognormal distribution (Figure 3.3.4). These data were fitted with a lognormal distribution with μ = 1.31%, minimum = 0.10%, and maximum = 5.88% for the base case egg to smolt survival distribution (Figure 3.3.5). The 90% confidence interval encompasses survival values between 0.5 and 2.4%, which coincides with the general perception that egg to smolt survival should be around 1 – 2% (Legault 2004). Year- and iteration-specific values were sampled for all DIA Model simulations.

3.4 Hatchery Stocking

Hatchery-origin fry, parr, and smolts are stocked annually into the Penobscot River to supplement wild production with the goal of recovery of the Atlantic salmon population in the Penobscot Bay Salmon Habitat Recover Unit. The DIA Model allowed for smolt-stocking, as more than 90% adult returns to the Penobscot River have originated from smolt stocking (USASAC 2011). Within the DIA Model, hatchery smolts were stocked and proceeded through the downstream migration and ocean migration with their wild conspecifics.

Smolt stocking could be turned on or off on a yearly basis in the DIA Model. When smolt stocking was turned on, a total of 550,000 smolts were stocked, to mimic the approximate number stocked annually. Smolts were distributed throughout the watershed according to the mean proportion stocked in each PU during 2003–2012 (Table 3.4.1; USASAC 2011; Justin Stevens, NOAA's National Marine Fisheries Service, personal communication). In years when stocking was turned on, 150 2SW females were removed above Veazie Dam from the upstream migrating population of adults to fulfill the broodstock requirements. If 150 or fewer 2SW females were present above Veazie Dam, all of the fish were removed for hatchery broodstock. A total of 550,000 smolts were stocked annually regardless of the number of 2SW females removed for broodstock as broodstock shortages were assumed to be made up from backup broodstock sources. If smolt stocking was turned off, no broodstock were collected, and all 2SW females that successfully ascended the Veazie Dam fishway proceeded upriver.

3.5 In-river Mortality

Emigrating smolts are subjected to varying levels of in-river natural mortality as they migrate from their rearing habitat to the ocean. To incorporate this dynamic into the DIA Model, a distribution of mortality estimates per km was generated from telemetry studies conducted within the Penobscot River.

A network array of telemetry receivers was deployed throughout the Penobscot River, and groups of both wild- and hatchery-origin smolts were tagged and released at various locations throughout the drainage in 2005 and 2006 (Holbrook et al. 2011) and again in 2009 and 2010 (Joseph Zydlewski, U.S. Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, personal communication). Estimates of mortality per km between successive telemetry unit/array pairs for each year- and origin-specific release group were derived from mark–recapture model outputs performed in Program MARK (White and Burnham 1999). Only fish that survived to the first receiver/array were included to eliminate potential bias associated with tagging-related mortality. Mortality estimates for successive telemetry unit/array pairs that spanned a hydroelectric facility were excluded because dam-related mortality was accounted for in Section 3.6.1. A total of 64 estimates of in-river mortality per km were available. Eleven of these estimates were removed from the analysis due to concerns that they were biased by tagging-release effects, the river segment being too small (<1 km long), or the river segment being flanked by two dams. The resulting dataset included estimates ranging from 0.0 to 2.8% loss per km migrated. These estimates were calculated from river segments that were between one and 20 km long. A cumulative frequency distribution was created from the data (Figure 3.5.1), and 34.6% of the distribution represented a 0.0% mortality per km.

The DIA Model applied year- and iteration-specific values from the in-river mortality distribution, which meant the same mortality per km value was used for all PUs in a year. To avoid the unlikely scenario of 35% of the iterations having 0% mortality per km, a new in-river mortality distribution was developed for use in the DIA Model. This new in-river mortality distribution was created using a sub-model. A total of 500,000 smolts were proportionally distributed across all PUs, according to the production potential of each PU, in the sub-model. No smolts were stocked into PU 1, as this PU was excluded from the DIA Model due to the lack of upstream access into this system. Smolts were not stocked into PU 11 (Stillwater Branch) to simplify the simulation by not requiring an input variable for path choice between the Mainstem and Stillwater branches. PU-specific in-river mortality values were based on random draws from the cumulative distribution in-river mortality estimates described above. To calculate the number of surviving smolts entering each downriver PU, the PU-specific in-river mortalities were subtracted from one and raised to the distance travelled within a PU for each group of smolts (Table 3.1.1). Smolts in the sub-model were stocked in the middle of a PU, and the number of smolts surviving from the PU in which they were stocked was based on half the longest segment length of that PU. Smolts were assumed to have traveled the entire length of subsequent PUs (i.e., partial segment length; Table 3.1.1). The survivors after PU 14 were summed, and an estimated mortality rate per km was calculated as the proportion of smolts that survived divided by the total distance smolts migrated. A total of 10,000 iterations were performed, and the resulting mortality per km distribution was best described by a beta distribution with shape parameters α_1 = 11.245 and α_2 = 9.8007, minimum = zero, and maximum = 0.00038077 (Figure 3.5.2). This distribution was fit by using a combination of characteristics of the data and goodness of fit tests. Year- and iteration-specific values were sampled from this new distribution for base case in-river mortality rates in all DIA Model simulations.

3.6 Downstream Dam Passage Survival Rates

3.6.1 Desktop Survival Analysis

The Penobscot River Basin has been extensively developed for hydroelectric power generation. Approximately 123 dams are located in the Penobscot River watershed, and 31 of these dams operate under a FERC hydropower license or exemption (Tara Trinko Lake, NOAA's National Marine Fisheries Service, personal communication). However, the DIA Model focused only on 15 FERC-licensed dams within designated Atlantic salmon critical habitat (74 Federal Register 39003, August 10, 2009) or occupied Atlantic salmon watersheds.

Hydroelectric dams are known to impact Atlantic salmon through various mechanisms, such as habitat alteration, fish passage delays, and entrainment and impingement (Ruggles 1980; NRC 2004). Site-specific survival studies are available for some hydroelectric facilities in the Penobscot Basin (as summarized by Fay et al. (2006) and Holbrook (2009)). However, the limitations of currently available data are significant. As the DIA Model was designed to understand the impacts of these FERC-regulated dams on the productivity of the Penobscot River Atlantic salmon population, an accurate description of the total mortality associated with each of these facilities was required. Given the paucity of field data to describe these effects, Alden Research Laboratory, Inc. (hereafter referred to as Alden) was contracted to estimate current smolt survival rates at 15 FERC-regulated dams on the Penobscot River, based on site-specific project data (e.g., turbine type, revolutions per minute, head, presence of fishways), fish characteristics, and hydrological records. The factors to be considered were to cover both direct and indirect mortality effects attributable to dam passage as well as delayed mortality based on available literature.

Two types of mortality effects were incorporated within the DIA Model: direct and indirect. Direct mortality is the result of a lethal injury that occurs during passage through turbines, over fishways, or through fish bypasses and leads to death during passage or shortly thereafter (Amaral et al. 2012). An example of direct mortality would be a lethal injury from blade strike. Indirect mortality may occur through a variety of mechanisms such as predation (that may be attributable to reduced migration speed or turbulence at a dam), disease (that may be more likely to occur as a result of sub-lethal injury such as scale loss), and the additive effects of stress and injury associated with passing one or multiple dams. The effects of indirect mortality may be felt during or immediately post-dam passage or sometime thereafter at a later state of migration. Indirect mortality was segregated into two discrete factors for the DIA Model: cumulative and latent. Indirect cumulative mortality can occur when passage through turbines, over spillways, and through bypasses results in injuries such as scale loss, lacerations, bruising, eye or fin damage, or internal hemorrhaging (Amaral et al. 2012). Although indirect cumulative mortality is likely fairly low, this mortality may increase after fish pass multiple dams. An indirect cumulative mortality factor was incorporated into smolt survival rate estimates at each of the 15 hydroelectric dams that were modeled (Amaral et al. 2012). Indirect latent mortality is believed to occur early in the marine phase of the salmon's life history and is discussed further in Section 3.7.

The route that a salmon smolt takes when passing a dam is a major factor in its likelihood of survival. A fish that passes through a properly designed downstream bypass has a better chance of survival than a fish that goes over a spillway, which, in turn, has a better chance of survival than a fish swimming through the turbines. Facility-specific characteristics were obtained and used by Alden to estimate flow-specific total project smolt mortality estimates based on flow-specific turbine, spillway, and bypass mortality estimates with an additional indirect cumulative mortality rate applied (i.e., mortality due to predation and sub-lethal injuries during passage). The probability of all possible flow conditions was estimated in discrete cubic feet per second (cfs) increments at all modeled facilities (Amaral et al. 2012). Cumulative flow probability distributions were generated for each modeled facility (Figure 3.6.1.1) and were used in combination with the total project smolt survival estimates (Figure 3.6.1.2) to generate year- and iteration-specific estimates of smolt survival at each of the 15 dams in the DIA Model, as described in Section 3.6.2. Flow probabilities, and hence total project smolt survival, was not calculated for approximately 0.5% of the flow probability at each of the modeled facilities due to the very low probability of occurrence at the extreme upper and lower cfs bins. These missing probabilities for extreme cfs bins were accounted for by subtracting the sum of the flow probabilities from one, dividing the missing probability in half, and assigning the halves to two new cfs bins, one on each end of the flow probability distribution. The total project smolt survival in each new flow bin was set equal to the survival at the adjacent cfs bin provided by Alden. Although ad hoc, results are likely robust to these probabilities for rare events. A full description of the Alden procedures can be found in Amaral et al. (2012).

The Upper Dover Dam was an exception to the above outlined procedures. The total project survival for this facility was set to 92.15% for each year and iteration of the DIA Model. No turbine entrainment occurs at this facility, as the project is not presently operating. Also, a downstream bypass is not available for smolts to utilize. As such, all migrating smolts must pass the facility via the spillway, which has a set 97% survival rate. Additionally, an estimated 5% indirect cumulative mortality rate (i.e., 95% survival), due to sub-lethal injuries, increased stress, and disorientation, was applied to all smolts migrating past any facility (Amaral et al. 2012). The total project survival of 92.15% for the Upper Dover Dam was calculated as the product of the spillway and the indirect cumulative survival rates.

Alden updated smolt survival estimates for Milford, Great Works, Stillwater, and Orono dams due to a change in the flow allocation to the Stillwater Branch of the Penobscot River. These updates were not used for the analyses reported in this document as they were provided after all DIA Model runs were performed, but the new smolt survival estimates are available for future use (Amaral et al. 2012). The updated smolt survival estimates would not alter the results appreciably as the survival estimates are very similar to the previous estimates (Table 3.6.1.1).

3.6.2 Downstream Passage Correlation

Survival of smolts migrating past hydroelectric facilities is generally positively correlated with river flow. Downstream migrating smolts typically have two or three routes by which they can traverse a hydroelectric facility: a downstream bypass (if available), over the spillway, or through the turbines. Under low flow conditions, more flow is proportioned to the turbines and less flow is proportioned to the downstream bypass and the spillway, thereby increasing the proportion of smolts passing through the turbines. Passing through the turbines generally results in increased mortality and injury rates compared to passing via a downstream bypass or the spillway. Conversely, under high flow conditions, a greater proportion of the flow, and, therefore, downstream migrating smolts, passes through the downstream bypass and spillway where smolt survival is typically higher.

Alden estimated probability of flow and total project smolt survival for all possible flow conditions in discrete cfs increments for 15 FERC-regulated hydroelectric facilities on the Penobscot River (see Section 3.6.1). Within the DIA Model, year-specific random draws from the facility-specific cumulative probability of flow relationships (Figure 3.6.1.1) were used determine the flow levels and subsequent total project smolt survival estimates for each facility (Figure 3.6.1.2). These estimates were used to calculate the number of smolts that survive at each facility as they migrate downstream to the ocean. Within the Penobscot River, if one facility is experiencing high flows and consequentially high smolt survival, all facilities are likely experiencing relatively high flows and high smolt survival. Therefore, a mechanism was needed to correlate total project smolt survival across all facilities within each year and to incorporate the variation in flow documented within the drainage.

Flow data from 24 current and historic monitoring sites within the Penobscot River watershed were accessed through the USGS National Water Information System (http://waterdata.usgs.gov/nwis). Available flow data spanned from the lower reaches of the system to the headwaters, including all major tributaries. Careful review of the available data resulted in 19 sites being removed from the analysis because of a lack of contemporary data, the location within the drainage was not applicable to the DIA Model, or the data series consisted of a single year. Continuous flow data were available for the remaining five sites (USGS gauge 1029500 – East Branch Penobscot River at Grindstone, USGS gauge 1030500 – Mattawamkeag River near Mattawamkeag, USGS gauge 1034000 - Piscataquis River at Medford, USGS gauge 1031500 – Piscataquis River near Dover-Foxcroft, and USGS gauge 1034500 – Penobscot River at West Enfield) for the period 1935–2010. The smolt migration occurs within the months of April through June, so a correlation analysis was run on the mean April – June flow for each site (Table 3.6.2.1). The minimum correlation coefficient (r) = 0.831, maximum = 0.981, and μ = 0.901, suggest that flow within the Penobscot drainage was highly correlated and, therefore, high flow and high smolt survival at one facility should correspond with high flow and high smolt survival at all facilities within the drainage.

As stated above, a year-specific cumulative probability of flow common to all facilities was drawn from a uniform distribution bounded by zero and one. A year- and facility-specific random error drawn from a uniform distribution bounded by ± 0.1695 was added to these year-specific cumulative probabilities. Each year- and facility-specific probability sum was constrained from zero to one. For each of these year- and facility-specific probability sums, corresponding flow rates and smolt survivals were obtained from facility-specific relationships between the cumulative probability of flow rates (Figure 3.6.1.1) and total project smolt survival (Figure 3.6.1.2). This method of combining a year-specific random variable with a year- and facility-specific random variable ensured that smolts experienced similar relative flows among all dams. As an example, if a year-specific cumulative flow probability of 0.40 was drawn, the resulting year- and facility-specific probability sums would range from 0.2305 to 0.5695 (i.e., 0.40 ± 0.1695), with an approximate mean of 0.40. The range of the uniform distribution used for the year- and facility-specific random errors (i.e., ± 0.1695) was specified so that the mean correlation of the subsequent flow rates among all dams equaled 0.901, which approximated the actual correlation of flows for dams in the Penobscot drainage. In a few instances, the distance between neighboring hydroelectric facilities was small enough that flow conditions at the up-river dam were likely identical to the lower dam. In these cases, the same year- and facility-specific random error was used for both dams to match to the cumulative distribution. This occurred with four pairs of facilities: Great Works and Milford, Orono and Stillwater, Brown's Mills and Dover Upper, and Milo and Sebec. Year- and iteration-specific smolt survival estimates were selected in this manner for all DIA Model simulations.

3.6.3 Downstream Path Choice

A unique feature of the Penobscot River is the Stillwater Branch (i.e., Stillwater River). The Stillwater Branch is an approximately 17-km long side channel of the Penobscot River that begins at river km 47 (measured from the top of Verona Island), runs along the north and western sides of Orson and Marsh Islands, and rejoins the mainstem at river km 58.5, upriver of Veazie Dam (Figure 2.2). Smolts originating upriver of the Stillwater Branch have the option of migrating via the Stillwater Branch or the mainstem. Differential survival is likely experienced by smolts migrating through these two routes due to differences in local environs and the presence of multiple hydroelectric facilities. Smolts that migrate via the mainstem encounter 2 dams: Milford and Great Works. (Great Works Dam was still operating at the time the DIA Model was built but was removed in 2012.) Smolts that migrate via the Stillwater Branch encounter 3 dams: Gilman Falls, Stillwater and Orono. Gilman Falls serves to control Stillwater head pond height and was not included within the DIA Model as this dam is assumed to have a minor negative effect on downstream migrating smolts due to the presence of a natural bypass channel adjacent to the dam and the lack of hydroelectric production capacity. However, Milford, Great Works, Stillwater, and Orono dams do have the potential to significantly affect downstream migrating smolts and have been shown to have varying levels of total project smolt survival (Figure 3.6.1.2). Additionally, previous telemetry investigations have shown that the proportion of the smolts accessing the Stillwater Branch varies annually (Holbrook et al. 2011). To accurately assess the impacts that hydroelectric facilities may have on migrating smolts in the Penobscot River, the option of migrating down the Stillwater Branch or mainstem was incorporated into the DIA Model.

As previously mentioned (Section 3.5), a network array of telemetry receivers was deployed throughout the Penobscot River and groups of both wild- and hatchery-origin smolts were tagged and released at various locations throughout the drainage in 2005 and 2006 and again in 2009 and 2010. Release group-specific (2005 and 2006) and origin-specific (2009 and 2010) estimates of Stillwater Branch use were calculated (Holbrook et al. 2011; Joseph Zydlewski, U.S. Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, personal communication). Stillwater Branch use estimates (n = 6) were fitted to a triangular distribution with a minimum value = 4.4%, a most likely value = 25.9%, and a maximum value = 25.9% (Figure 3.6.3.1). This distribution was fit by using a combination of characteristics of the data and goodness of fit tests. A cumulative frequency distribution was developed from 5,000 random draws from the triangular distribution (Figure 3.6.3.2). The proportion of smolts that accessed the Stillwater Branch during their migration was determined via a random draw from the cumulative frequency distribution. Smolts that migrated through the Stillwater Branch were subjected to in-river mortality and mortality associated with the Stillwater and Orono dams. All remaining smolts migrated via the mainstem and were subjected to in-river mortality and mortality associated with the Milford and Great Works dams. Random draws for Stillwater Branch use were correlated with the total project survival estimates according to the methods detailed in Section 3.6.2. Year- and iteration-specific Stillwater Branch use estimates were selected in this manner for all base case DIA Model simulations.

3.7 Indirect Latent Mortality

Additional dam-related mortality that occurs in the early marine phases of the salmon's life history has been previously discussed (Budy et al. 2002; Schaller and Petrosky 2007; Haeseker et al. 2012). This additional dam-related mortality has been identified by a number of different names such as cumulative mortality, latent mortality, and the hydrosystem-related delayed mortality hypothesis. Hereafter, this additional dam-related mortality is referred to as indirect latent mortality. Indirect latent mortality is defined as mortality that occurs in the ocean and estuary after exiting the hydrosystem but is related to the fish's earlier experience within the hydrosystem (Budy et al. 2002). This mortality is due to effects of stress and injury over the course of passing one or multiple dams (Budy et al. 2002; Schaller and Petrosky 2007; Haeseker et al. 2012). Some indirect latent mortality may occur within a hydropower system (Budy et al. 2002), but the cumulative in-river effects are difficult to separate from direct and indirect cumulative mortality that occur at or near individual dams. The DIA Model contained an option to apply an indirect latent mortality rate at Verona Island. This rate was calculated for smolts originating in each PU and was based on the number of dams that fish passed. An indirect latent mortality was applied to smolts at a rate of 10% per dam passed.

Although indirect latent mortality has been demonstrated in other river systems (Budy et al. 2002; Schaller and Petrosky 2007; Haeseker et al. 2012), effectively quantifying this mortality, including in the Penobscot River, has been challenging, mainly because of difficulties directly measuring mortality after fish have left the river system. Due to the number of hydroelectric dams that are currently in the Penobscot River watershed, even a small indirect latent mortality rate can have a large effect on the number of smolts (and consequently 2SW females) in the population. An indirect latent mortality rate of 10% per dam is within the range of estimates for this mortality type developed from individual studies in the Snake River and lower Columbia River basins (Deriso et al. 1996; Schaller and Petrosky 2007).

3.8 Hatchery Discount

Although hatchery- and wild-origin smolts experience the same kinds of mortality, hatchery-origin smolts typically experience lower survival than wild-origin smolts, and so a discount was applied to hatchery-origin smolts to estimate the number of wild-equivalents before they migrated out to sea.

To estimate a hatchery discount, survival rates of wild- and hatchery-origin fish were obtained from the literature. Studies were included or excluded from the hatchery discount calculation with some subjectivity, and the decisions to include or exclude them are described below (Table 3.8.1).

Studies of wild- and hatchery-origin Atlantic salmon were used to estimate the relative difference in survival between hatchery and wild fish from the smolt to adult life stages. Studies were excluded because they were not considered representative of Atlantic salmon in the Penobscot River watershed for various reasons. Studies were excluded if survival rates were not given (De Leaniz et al. 1989; Fleming et al. 1997; Einum and Fleming 2001; Salminen et al. 2007). Other studies were excluded because their study design made the survival rates inapplicable for the hatchery discount (e.g., life stages outside of smolt to adult stages were included, adult Atlantic salmon were captured at sea rather than in the river, survival of wild and semi-wild fish were compared instead of wild and hatchery fish; Jonsson et al. 1991; Jonsson and Fleming 1993; Jonsson 1997; Jonsson et al. 2003; Jokikokko et al. 2006; Peyronnet et al. 2008; Kallio-Nyberg et al. 2011). The data points that were included (n = 17) had wild to hatchery survival ratios ranging from 1.18 to 8.20% (Jonsson et al. 1991; Crozier and Kennedy 1993; Jonsson and Fleming 1993; Jonsson et al. 2003; Jutila et al. 2003; Kallio-Nyberg et al. 2004; Saloniemi et al. 2004; Jokikokko et al. 2006; Peyronnet et al. 2008; Kallio-Nyberg et al. 2011).

A distribution was fit to the included wild versus hatchery survival ratios by using a combination of characteristics of the data and goodness of fit tests. The data were best described by a log logistic distribution, with $\gamma = 1$, $\beta = 1.4271$, $\alpha = 1.9922$, and maximum = 12 (Figure 3.8.1). Year- and iteration-specific values were drawn from this distribution for base case hatchery discount values in all DIA Model simulations. The proportion of hatchery smolts at Verona Island (after the indirect latent mortality rate was applied) was divided by the year- and iteration-specific hatchery discount to estimate the number of wild-equivalent smolts.

3.9 Marine Survival

U.S. Atlantic salmon spend approximately one half of their life in the marine environment. To account for this, the DIA Model estimated the number of female post-smolts that successfully emigrated to Verona Island at the upper-most reaches of Penobscot Bay, and a marine survival distribution was applied to this population to estimate the number of 2SW female returns that would successfully migrate to Greenland and back to Verona Island over the course of the following two years. These 2SW females would then be available to migrate upstream en route to their natal spawning grounds.

Although the marine survival phase has received increased attention in recent times, an accurate assessment of marine survival for the Penobscot River salmon population is not available. Counts of adult returns divided by the total number of smolts stocked into the Penobscot River can be used as a surrogate for the marine survival rate, and these data are available from 1969 through the present. However, these are not accurate estimates of marine survival because they incorporate mortality of smolts in freshwater (i.e., stocking, in-river, and dam-related mortality). Marine survival estimates do exist for the Narraguagus River, a small coastal Gulf of Maine river located approximately 105 km northeast of Penobscot Bay, but the estimates are from a short time series (1997–present) that only includes data from a period of low marine productivity (Chaput et al. 2005). Finally, the DIA Model focused on 2SW female returns, and none of the existing datasets provide sex-specific estimates of marine survival. As such, a new 2SW female-specific marine survival distribution was generated from available data from the Penobscot River, which aimed to remove the freshwater mortality factors.

To estimate a 2SW female marine survival distribution, the number of female smolts at Verona Island had to be estimated first. Year-specific estimates of the number of smolts stocked into the Penobscot River during 1969–2008 (USASAC 2011) were halved to approximate the number of stocked female smolts and then multiplied by the proportion of smolts that survived to Verona Island to adjust for mortality during the freshwater portion of the migration. Smolt survival to Verona Island was estimated from five years (2005, 2006, 2009, 2010, and 2011) of telemetry studies conducted within the Penobscot River (Joseph Zydlewski, U.S. Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, personal communication). Seventeen estimates were obtained from hatchery- and wild-origin groups released at six different locations, and the means were fitted to a beta distribution with shape parameters α_1 = 4.1923 and α_2 = 1.8648, minimum = zero, and maximum = one (Figure 3.9.1). The distribution was fit by using a combination of characteristics of the data and goodness of fit tests. Year-specific values were sampled from this distribution to estimate the number of female smolts that would survive from stocking to Verona Island.

Estimates of 2SW adults returning to the Penobscot River were obtained for return years 1971–2010 (Figure 3.9.2; USASAC 2011). These estimates represented all 2SW returns and, as the DIA Model focused on 2SW female returns, needed to be discounted accordingly. Sex statistics were available for the Penobscot River from 1978 to 2011 (Figure 3.9.3; Maine Department of Marine Resources fishway trap database, 2010 version). During 1978–1999, sex statistics were based on field determinations made at the adult trap. Starting in 2000, fish collected for broodstock were individually tagged in the field and brought to the hatchery, where their sex could accurately be determined during spawning. The 2000–2011 data are considered more accurate because sex determinations made in the field early in the season, prior to sexual dimorphism, are difficult. When converting the 2SW adult returns to female 2SW returns, the year-specific sex ratio estimates were used for 2000–2010, and the 2000–2010 mean ratio was used for all years prior.

Year-specific 2SW female marine survival rates were calculated by dividing the estimated number of 2SW female returns by the estimated number of female smolts at Verona Island. A total of 10,000 iterations were run, where the number of female smolts that would survive from stocking to Verona Island was a stochastic process (as described above). The maximum survival was capped at 25%, which was exceeded in less than 0.05% of the iterations. The resulting 1971–2010 median values were fitted to an inverse gaussian distribution with μ = 0.006265, shape parameter λ = 0.0068723, and a shift of 0.00000813424 (Figure 3.9.4). Year- and iteration-specific values were sampled from this distribution for base case marine survival rates in all DIA Model simulations.

3.10 Straying

Adult Maine Atlantic salmon have been shown to have a high degree of river-of-origin homing, with rates of 98–99% in hatchery-release studies (Baum 1997). However, the in-river migration behavior and the effect of this behavior on reach-level productivity are poorly understood. Within-river homing behavior and its effect on distribution of spawning adults is postulated as being driven by habitat (i.e., temperature, flow, and substrate) (Kocik and Ferreri 1998), the presence of conspecifics (i.e., pheromone cues), and environmental cues (Fleming 1996). Atlantic salmon have a strong tendency to return to river reaches where they have been reared. Saunders (1967) estimated a homing rate of 70% for naturally-reared smolts in the upper Miramichi, NB, Canada. Similarly, Heggberget et al. (1988) showed adult Atlantic salmon returned with very high affinity (μ = 87%) to areas they had selected as spawning grounds when artificially displaced. Evolutionarily, in-river homing is logical as the success of an individual's rearing would provide selection for the local habitat characteristics, and returning adults provide this selective advantage to future progeny. However, limited levels of straying also benefits salmon populations by allowing for plasticity in habitat use in response to varying population levels (i.e., balancing density dependent effects) and the opportunity to colonize new habitat as well as the prevention of genetic bottlenecking (Heggberget et al. 1988).

Estimated in-river homing rates and straying patterns were developed to more accurately model the spatial distribution of Atlantic salmon production in the Penobscot River watershed. PU-specific homing rates and straying patterns were developed through an assessment of all available pertinent data and information including various Atlantic salmon behavioral studies conducted within the Penobscot (Power and McCleave 1980; Shepard 1995; Gorsky 2005; Gorsky et al. 2009; Holbrook et al. 2009; Douglas B. Sigourney, U.S. Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, personal communication), fishway trap data from throughout the drainage (Maine Department of Marine Resources fishway trap database, 2010 version), and Expert Panel recommendations made on the topic (NMFS 2012).

Estimates of PU-specific homing rates and straying patterns could not be developed based on the behavioral studies and fishway trap data for two primary reasons. First, the available data were not representative of the entire drainage as some PUs had no information from which to draw conclusions. Second, the patterns observed within the various datasets could not be delineated into behavioral effects versus effects confounded by upstream passage issues. Estimates of PU-specific homing rates and straying patterns should be based on behavioral patterns only and need to be free from influences of upstream passage issues as these affects are included within the Upstream Dam Passage Inefficiency dynamics (Section 3.12).

A set of logical rules was developed to assist with estimating PU-specific homing rates and straying patterns by using the specific study results combined with the Expert Panel opinions and local knowledge (Table 3.10.1). The logical rules are as follows:

- PUs 1, 2, 3, 4, 5, 6, 7, 8, 13, and 15 were defined as headwater areas.
- Headwater homing rates were set at 90%.
- PUs 9, 10, 11, 12, and 14 were defined as mainstem.
- Mainstem homing rates were set at 70%.
- Straying was proportionally divided according to 90% upriver and 10% downriver.
- Upstream straying was assigned equally to adjacent PUs.
- Downstream straying was assigned to the downstream PU.

Exceptions to these logical rules are as follows:

- PUs 1 and 2 - These PUs are in the upper drainage and straying fish would likely stop in multiple lower PUs (i.e., all straying fish were not confined to straying into the immediate downstream PU).

- PUs 4, 5, and 6 - It was believed some fish would stray into PUs 7 and 8 (i.e., lateral straying).
- PUs 7 and 8 – Similar to the rationale for PUs 1 and 2, straying fish would likely stop in multiple lower PUs (i.e., all straying fish were not confined to straying into the immediate downstream PU).
- PUs 9, 10, 11, and 12 - These PUs contain lower quality spawning habitat compared to adjacent PUs. Therefore, a higher rate of straying into adjacent PUs containing higher quality spawning habitat was assumed (i.e., lateral straying).
- PU 13 - This lower river drainage is unique in that it is a fairly large, self-contained drainage, and all straying was assumed to be upstream due to a lack of suitable habitat downstream.
- PU 14 - This lower river drainage is unique in that it is mostly large mainstem habitat with only a small amount of suitable habitat that is tributaries. All straying was assumed to be upstream due to a lack of suitable habitat downstream.
- PU 15 – Similar to PU 13, this lower river drainage is unique in that it is a fairly large, self- contained drainage. Straying was assumed to be primarily downstream, with a small amount of straying upstream.

The actual rates of homing and straying for returning Penobscot Atlantic salmon are likely determined by a combination of biotic and abiotic factors, but a dataset of homing rates and straying patterns with dam passage factors removed was needed for the DIA Model. Because observational data from the Penobscot was considered biased, model rates were based on logical concepts, field data, expert opinions, and biological theory. The PU-specific homing rates and straying patterns described above were the best available information for use in the DIA Model.

3.11 Upstream Dam Passage Survival Rates

3.11.1 Veazie, Great Works, Milford, and All Other Dams

After spending several years feeding in the ocean, adult Atlantic salmon return to rivers to spawn. As stated in Section 3.6.1, a large number of dams are located within the Penobscot River watershed, and Atlantic salmon must attempt to pass these dams on their upstream migration to their spawning grounds. The DIA Model also addressed upstream passage dynamics at 15 of those dams. The calculation of upstream dam passage was dependent upon each dam.

Numerous telemetry studies have been conducted within the Penobscot River that focused on evaluating upstream passage of adult Atlantic salmon. These studies were conducted in 1987–1990, 1992, and 2002–2006 and have provided estimates of upstream passage at Veazie, Great Works, and Milford dams (Holbrook et al. 2009). Veazie estimates ranged from 0.4210 to 0.9840, with $\mu = 0.6485$ and $\sigma = 0.1907$, Great Works estimates ranged from 0.1190 to 0.9440, with $\mu = 0.6730$ and $\sigma = 0.2783$ and Milford estimates ranged from 0.6670 to 1.0000, with $\mu = 0.8993$ and $\sigma = 0.0958$. These data were used to generate cumulative frequency distributions (Figures 3.11.1.1, 3.11.1.2, and 3.11.1.3). To avoid using outliers from these datasets, minimums and maximums were placed on each of the cumulative distributions, using $\mu \pm \sigma$ to calculate the limits (Table 3.11.1.1). Year- and iteration-specific values were randomly drawn from these cumulative distributions for base case upstream dam passage rates in all DIA Model simulations.

Four dams (i.e., Medway, Milo, Sebec, and Orono) do not have any upstream passage facilities, meaning adults are not able to access the PUs above these dams (i.e., PUs 1, 7, 8, and 11), and so upstream passage was set to zero (Table 3.11.1.1). No adults were seeded in these

PUs (because of the lack of upstream access). Subsequently, no smolts originated in them, and no 2SW females would home to them. However, a small proportion of adults were allowed to attempt to stray to these PUs (see Section 3.10) although their attempts would be unsuccessful due to the lack of passage at the facilities at the lower boundary of the PU. These adults would then die, return to the ocean un-spawned, or stray and spawn in a downstream PU (see Section 3.12).

Upstream passage estimated for the eight remaining modeled dams (i.e., Mattaceunk, West Enfield, Dover Upper, Brown's Mills, Howland, Lowell, Stillwater, and Frankfort) were not available. Generalized estimates were used in previous modeling efforts (USFWS 1988) and were adopted here. A uniform distribution was developed for the eight remaining dams using $\mu \pm \sigma$ (i.e., 0.92 ± 0.0325) as the upper and lower limits of the distributions (Table 3.11.1.1). Year- and iteration-specific values were sampled from the uniform distributions for the base case upstream dam passage rates in all DIA Model simulations. Adults that were not able to pass a dam died, returned to sea, or went to another PU (see Section 3.12).

3.11.2 Upstream Path Choice

As stated in Section 3.6.3, the Stillwater Branch presents a unique situation in the Penobscot River. Fish have the option to migrate through the Stillwater Branch or the mainstem. Whereas smolts were able to migrate downstream through either the Stillwater Branch or the Mainstem in the DIA Model, all adult spawners that attempted to migrate upstream of PU 12 were forced to migrate through the mainstem. This was because Orono Dam, which is the downstream endpoint of PU 11 and the Stillwater Branch, has no upstream fish passage facilities.

No adults were seeded in PU 11 (because of the lack of upstream access). Subsequently, no smolts originated in PU 11, and no 2SW females would home to PU 11. A small proportion of adults attempted to stray to PU 11 (Section 3.10). However, given the lack of upstream passage, all adults were diverted to the mainstem.

3.12 Upstream Dam Passage Inefficiency

Few, if any, upstream fishways provide safe, timely, and effective passage for 100% of migratory fish, including Atlantic salmon. Although multiple studies have been conducted in the Penobscot River to measure the effectiveness of fishways at various hydroelectric facilities, very little data are available concerning the fate of adult Atlantic salmon that are unsuccessful in locating or negotiating upstream fishways at dams.

Within the DIA Model, the fate of adult salmon that were unsuccessful in passing an individual dam needed to be defined to more accurately model the spatial distribution of Atlantic salmon production in the Penobscot River watershed. In the absence of site-specific data, NMFS convened an expert panel, consisting of state, federal, and private sector biologists and engineers with expertise in Atlantic salmon biology and behavior at fishways, to address the issue. Specifically, the Expert Panel was asked if Atlantic salmon that are unsuccessful in locating and negotiating upstream fishways at the 15 hydroelectric projects modeled in the DIA Model die, return to the ocean un-spawned, or stray and spawn in downstream reaches. Through best professional judgment, the Expert Panel reached consensus regarding the fate of adult Atlantic salmon that are unsuccessful at locating and negotiating upstream fishways at the 15 hydroelectric projects modeled in the DIA Model (Table 3.12.1). Hydroelectric projects upstream of the first impassable dam on the West Branch of the Penobscot River were not evaluated by the group (e.g., dams upstream of Medway). A full description of the discussions and decisions reached are detailed in NMFS (2012).

The Expert Panel recognized that no upstream fishway is 100% effective and concluded that a baseline 1% mortality is likely at all fishways for fish that do not successfully pass (Table 3.12.2). Mortality estimates were increased for specific facilities due to a variety of reasons, such as a high percentage of fallback at a dam and, therefore, a high percentage of re-ascent and failure, the possibility of poaching-related mortality caused by migration delays, mortality due to a lack of thermal refuge for delayed adults, and the possibility of predation, mainly by seals, at the lower river dams. The logic behind assigning specific proportions of fish to return to the ocean un-spawned were related to proximity of the facility to the ocean and increased handling at the fishway trapping facility at Veazie Dam. The proportions of fish confined within the various downstream PUs after unsuccessfully attempting to ascend a particular fishway were determined by consensus within the Expert Panel.

Within the DIA Model, adult returns must pass at least one dam en route to their spawning grounds, with the exception of fish destined for PU 14. Some percentage of these fish will not successfully pass each facility according to the upstream dam passage survival rates (see Section 3.11). These unsuccessful fish will die, return to the sea unspawned, or be redirected to a downstream PU according to the proportion detailed in Table 3.12.1.

4 RESULTS

The DIA model was run under two different scenarios: with the base case inputs (see Section 3) and with increased freshwater (i.e., egg to smolt) and marine survival rates. A scenario was run with increased survival rates (i.e., two times the base case freshwater survival and four times the base case marine survival) to simulate a recovering population of Atlantic salmon. The model run that used the base case survival rates is referred to as the “Base Case” scenario, and the model run that used the increased survival rates is referred to as the “Recovery” scenario. Five thousand iterations were run for both the Base Case and Recovery scenarios, and each iteration was run for 50 years (i.e., 10 generations).

The reported results include estimated total adult abundance, distribution of adults, and total number and proportion of smolts killed by dams. These metrics were chosen to help monitor the reproduction, numbers, and distribution of the Atlantic salmon population in different scenarios. Total adult abundance was recorded as the median number of 2SW females across all PUs. For each of three areas of the Penobscot River watershed, the distribution of adults was recorded as the proportion of iterations when at least one 2SW female was present. The three areas of the Penobscot River watershed were the Upper Penobscot (i.e., above West Enfield Dam, PUs 1–3), the Piscataquis (i.e., the Piscataquis River watershed, PUs 4–8), and the Lower Penobscot (i.e., below West Enfield Dam, PUs 9–15) (Figures 2.2 and 4.1). PUs were grouped into these areas because of natural break points in the Penobscot River (i.e., the upper part of the mainstem and tributaries, a large primary tributary, and the lower part of the mainstem) and to avoid spurious results from stochasticity at the PU level. Total number of smolts killed by dams was recorded as the median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Total proportion of smolts killed by dams was recorded as the median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. The total number and proportion of smolts killed by dams did not include mortality due to indirect latent mortality.

4.1 Base Case

Adult abundance and distribution decreased in the Base Case scenario. The median number of 2SW females declined from generation 1 to generation 2, and varied without trend in subsequent generations (Table 4.1.1; Figure 4.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 4.1.2; Figure 4.1.2). The proportion of iterations remained at one for the Lower Penobscot in generations 2–10 but declined from generations 1 to 4 in the Piscataquis and Upper Penobscot.

The number of smolts killed decreased in the Base Case scenario, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generations 1 to 2, and varied without trend in generations 2–10 (Table 4.1.3; Figure 4.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations (Table 4.1.4; Figure 4.1.3).

4.2 Recovery

Adult abundance increased and adult distribution remained near one in all three areas in the Recovery scenario. The median number of 2SW females increased from generation 1 and reached a plateau by generation 7 (Table 4.1.1; Figure 4.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or was close to one in generations 1–10, for all three areas (Table 4.1.2; Figure 4.1.2).

The number of smolts killed increased slightly overall in the Recovery scenario, whereas the proportion of smolts killed remained constant. The median number of smolts killed declined from generations 1 to 2 and then increased in subsequent generations (Table 4.1.3; Figure 4.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was 0.10 or 0.11 for all generations (Table 4.1.4; Figure 4.1.3).

4.3 Summary

Adult abundance, adult distribution, and the number of smolts killed decreased overall in the Base Case scenario, whereas adult abundance increased, adults remained distributed throughout the Penobscot River watershed, and the number of smolts killed increased overall in the Recovery scenario. The median number of 2SW females decreased in the Base Case scenario because survival rates were too low to sustain the initial number of adults. The median number of 2SW females increased in the Recovery scenario because the increase in marine and freshwater survival rates enabled the population to grow. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in all three areas in generation 1 because of the PUs where adults were seeded in this generation (see Section 3.1). In the Base Case scenario, the proportion of iterations when at least one 2SW female was present in the Lower Penobscot equaled one in all generations because returning adults did not have to pass as many dams (no dams for PU 14) to access this area of the watershed. The proportion of iterations was less than one in the Piscataquis and Upper Penobscot because too few 2SW females were able to pass the dams in the Lower Penobscot to enter these areas. The number of adults was also depleted before entering the Piscataquis or Upper

Penobscot because 150 2SW females were removed above Veazie Dam to fulfill hatchery broodstock requirements. The proportion of iterations when at least one 2SW female was present was high in all areas and generations of the Recovery scenario because survival rates were high and more 2SW females returned (enough to fulfill hatchery broodstock requirements and to have a large number left to attempt to pass dams) and produced smolts, which tried to home to their natal PU when they returned as adults. The number of smolts killed in the Base Case scenario decreased after generation 1 because spawning 2SW females were seeded throughout the Penobscot River watershed in generation 1, but low return rates in subsequent generations resulted in fewer spawners and, therefore, fewer smolts being produced. The number of smolts killed in the Recovery scenario increased because more smolts were available and attempted to migrate downstream. More smolts were available because of higher survival rates.

5 ANALYSIS OF HATCHERY AND STATE OF RECOVERY

The DIA Model was used to run scenarios to test the affects of stocking of hatchery-reared smolts, freshwater and marine survival rates, and dams on the Penobscot River population of Atlantic salmon and was divided into these three parts.

- The first part of this analysis was run with the hatchery component of the model turned on for all 50 years and with base case inputs for freshwater and marine survival rates.
- The second part was run with the hatchery component turned off for all 50 years and with base case inputs for freshwater and marine survival rates.
- The third part was run with the hatchery component turned off for all 50 years and with an increase of 2 times the base case freshwater survival rate and 4 times the base case marine survival rate.

Each part of the analysis included five scenarios to test the impact of dams on the Atlantic salmon population (Table 5.1). The first scenario was run as the base case scenario for dams (i.e., all dams turned on). The second scenario incorporated the proposed changes to the Penobscot River watershed that are included in the Penobscot River Restoration Project (PRRP; Trinko Lake et al. 2012). These changes include removing Veazie and Great Works dams and decommissioning and building a bypass around Howland Dam. This second scenario was represented in the DIA Model as all dams turned on with the exception of downstream and upstream passage rates at Veazie, Great Works, and Howland dams being set to one (i.e., all smolts and adults successfully pass). Although 100% survival was assumed at Howland Dam after implementation of the PRRP, this assumption was likely overly optimistic and a small amount of take will still occur. The third scenario was run with all dams turned off (i.e., all smolts and adults successfully pass) with the exception of Medway, which no adults or smolts were allowed to pass. The fourth and fifth scenarios grouped dams by whether they were located in the mainstem or a tributary (Table 5.1). The mainstem of the Penobscot River begins at the confluence of the East Branch and West Branch of the Penobscot River (Baum 1983). Only dams that are physically on the mainstem Penobscot (i.e., below the confluence of East Branch and West Branch and not impounding a tributary) are considered mainstem dams. In the fourth scenario, dams on the mainstem were turned off and dams on a tributary were turned on. In the fifth scenario, dams on the mainstem were turned on and dams on a tributary were turned off.

The reported results for each scenario include estimated total adult abundance, distribution of adults, and total number and proportion of smolts killed by dams, as recorded in

Section 4. Number and proportion of smolts killed by an individual dam were also reported in the third part of this analysis. Number of smolts killed by an individual dam was recorded as the median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Proportion of smolts killed by and individual dam was recorded as the median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. All DIA model iterations were run for 50 years (i.e., 10 generations), and 5,000 iterations were run for each scenario.

5.1 Part 1 – Hatchery On Base Case

Adult abundance and distribution decreased in all five scenarios in part 1. The median number of 2SW females declined from generation 1 to generation 2, and varied without trend in subsequent generations (Table 5.1.1; Figure 5.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 5.1.2; Figure 5.1.2). The proportion of iterations declined from generations 1 to 3 in the Piscataquis and Upper Penobscot and varied without trend in subsequent generations. Adult abundance and the proportion of iterations in the Upper Penobscot and Piscataquis were lowest in the scenario with all dams turned on and highest in the scenario with all dams turned off. Adult abundance and the proportion of iterations were similar in the scenarios with all dams turned on and with mainstem dams turned on and tributary dams turned off.

The number and proportion of smolts killed differed between the scenarios in part 1. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage declined from generations 1 to 2, and varied without trend in generations 2–10 in all scenarios except the one with dams turned off (Table 5.1.3; Figure 5.1.3). In the latter scenario, the number of smolts killed equaled zero in all generations. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant in all generations at different values for each scenario (Table 5.1.4; Figure 5.1.3). The number and proportion of smolts killed were lowest in the scenario with all dams turned off and highest in the scenario with all dams turned on. The number and proportion of smolts killed were similar in the scenarios with all dams turned on and with mainstem dams turned on and tributary dams turned off.

5.2 Part 2 – Hatchery Off Base Case

Adult abundance and distribution decreased in all five scenarios in part 2. The median number of 2SW females decreased to zero by generation 6 in all scenarios (Table 5.2.1; Figure 5.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and declined to zero by generation 10 in all areas and scenarios (Table 5.2.2; Figure 5.2.2).

The number and proportion of smolts killed differed between the scenarios in part 2. The median total number and proportion of smolts killed declined to zero by generation 6 in all scenarios except the one with dams turned off (Tables 5.2.3 and 5.2.4; Figure 5.2.3). In the latter scenario, the number and proportion of smolts killed equaled zero in all generations.

5.3 Part 3 – Hatchery Off Recovery

Adult abundance increased overall and adult distribution remained at or near one in all five scenarios in part 3. The median number of 2SW females decreased from generation 1 to generation 2 and increased in subsequent generations in the scenarios with all dams turned on and with mainstem dams on and dams in tributaries turned off (Table 5.3.1; Figure 5.3.1). The number of 2SW females increased from generation1 to generation 10 in the scenarios with the implementation of the PRRP, all dams turned off, and mainstem dams turned off and dams in tributaries turned on. Adult abundance was lowest in the scenario with all dams turned on and highest in the scenario with all dams turned off. Adult abundance was similar in the scenarios with all dams turned on and with mainstem dams turned on and tributary dams turned off. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or was close to one in generations 1–10 for all three areas in all scenarios (Table 5.3.2; Figure 5.3.2).

The total number and proportion of smolts killed differed between the scenarios in part 3. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased overall in the scenarios with all dams turned on and with mainstem dams turned on and dams in the tributaries turned off, increased overall in the scenarios with the implementation of the PRRP and with mainstem dams turned off and dams in tributaries turned on, and equaled zero in all generations in the scenario with all dams turned off (Table 5.3.3; Figure 5.3.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage declined in the scenarios with all dams turned on, with the implementation of the PRRP, and with mainstem dams turned on and dams in tributaries turned off (Table 5.3.4; Figure 5.3.3). The proportion of smolts killed remained low in the scenarios with mainstem dams turned off and dams in tributaries turned on and with all dams turned off.

5.3.1 Individual Dam Impacts

The number and proportion of smolts killed at individual dams differed between the scenarios in part 3. The number and proportion of smolts killed at Medway, Sebec, and Milo dams equaled zero in all generations for all scenarios because fish are not able to access habitat above these dams. In general, higher numbers of smolts were killed at dams that were located on the mainstem of the Penobscot River and close to the river mouth. The numbers of smolts killed in generation 10 were higher at these dams because fewer 2SW females were able to pass dams that were higher in the watershed in each subsequent generation. Hence, more fish spawned in and migrated out from lower PUs and were killed by dams that were lower in the watershed in later generations. The proportion of smolts killed at each dam depended on the characteristics of each individual dam.

In the scenario with all dams turned on, the median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased from generation 1 to generation 3 or 4 at all dams except at Frankfort Dam, where the number of smolts killed increased in every generation (Table 5.3.1.1; Figure 5.3.1.1). The number of smolts killed in generation 10 was highest at Veazie, Great Works, Frankfort, and Milford dams. In general, the number of smolts killed was lower at dams that were located farther from the mouth of the Penobscot River or on a tributary rather than the mainstem of the Penobscot River. Frankfort Dam was an exception to this rule because it is the closest hydroelectric dam to the mouth of the Penobscot River. The median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at dams that were closer to the mouth of the Penobscot River and decreased at dams that were farther from the river mouth (Table 5.3.1.2; Figure 5.3.1.2). The proportion of smolts killed in generation 10 was highest at Great Works Dam.

In the scenario with the implementation of the PRRP, the median number and proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled zero at Veazie, Great Works, and Howland dams because passage and survival were set to one at these dams due to their removal as part of the PRRP (Tables 5.3.1.3 and 5.3.1.4; Figures 5.3.1.3 and 5.3.1.4). The median number of smolts killed increased overall at the dams that were closer to the mouth of the Penobscot River and decreased overall at dams that were farther from the river mouth. The number of smolts killed in generation 10 was highest at Milford Dam. The median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant or decreased slightly at all hydroelectric dams in the Penobscot River watershed. The proportion of smolts killed in generation 10 was highest at Mattaceunk Dam.

In the scenario with all dams turned off, the median number and proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled zero in all generations. Passage and survival were set to one at all dams in this scenario. Therefore, no smolt mortality occurred.

In the scenario with mainstem dams turned off and dams in tributaries turned on, the median number and proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled zero at Veazie, Great Works, Milford, West Enfield, and Mattaceunk dams because passage and survival were set to one at these dams (Tables 5.3.1.5 and 5.3.1.6; Figures 5.3.1.5 and 5.3.1.6). The median number of smolts killed increased overall at all tributary dams where fish had access to the habitat above the dam. The number of smolts killed in generation 10 was highest at Howland and Orono dams. Although Orono Dam is closer to the mouth of the Penobscot River, fewer smolts were killed at this dam because the lack of upstream passage at Orono Dam likely inhibited adults from returning, spawning, and producing smolts in PU 11. Plus, only a proportion of the smolts migrate downstream through the Stillwater Branch. The median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at all tributary dams where fish had access to the habitat above the dam. The proportion of smolts killed in generation 10 was highest at Brown’s Mills Dam.

In the scenario with mainstem dams turned on and tributary dams turned off, the median number and proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled zero at Frankfort, Orono, Stillwater, Lowell, Howland, Brown’s Mills, and Dover Upper dams because passage and survival were set to one at these dams (Tables 5.3.1.7 and 5.3.1.8; Figures 5.3.1.7 and 5.3.1.8). The median number of smolts killed decreased overall at all mainstem dams. The number of smolts killed in generation 10 was highest at Veazie Dam. The median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at all mainstem dams except Mattaceunk dam, which decreased. The proportion of smolts killed in generation 10 was highest at Great Works Dam.

5.4 Summary

In the DIA Model, stocking of hatchery-reared smolts sustained the Penobscot River Atlantic salmon population when freshwater and marine survival rates were at base case values. In part 1, when the hatchery component of the model was turned on, adult abundance and distribution declined in the first two and three generations, respectively, but lower levels were maintained throughout the rest of the times series. In part 2, when the hatchery component of the model was turned off, adult abundance and distribution declined to zero within a few generations. The numbers of smolts killed decreased in parts 1 and 2 because low return rates of 2SW females after generation 1 resulted in fewer spawners and, therefore, fewer smolts being produced and killed.

In the DIA model, a two-fold increase in freshwater survival and a four-fold increase in marine survival were able to sustain and increase the population of Atlantic salmon in the Penobscot River watershed when no smolts were stocked, as shown in part 3. Adult abundance increased and adult distribution equaled or was close to one when freshwater and marine survival rates were increased and the hatchery component of the model was turned off in part 3. In contrast, adult abundance and distribution decreased in part 1 and declined to zero in part 2. In part 3, the number of smolts killed declined initially but increased at the end of the time series because higher survival rates led to more adults and, therefore, more smolts being in the watershed and attempting to migrate downstream at the end of the time series. In contrast, the numbers of smolts decreased in part 1 and declined to zero in part 2.

The numbers and locations of dams that were turned on in the DIA model affected the population of Atlantic salmon. In parts 1, 2, and 3, adult abundance and distribution were lowest in the scenarios with all dams turned on and highest in the scenarios with all dams turned off (i.e., 100% passage of adults and smolts). Adult abundance and distribution were higher in the scenarios with mainstem dams turned off and dams in tributaries turned on than in the scenarios with mainstem dams turned on and dams in tributaries turned off. Adult abundance and distribution were also higher in the PRRP scenarios than in the scenarios with mainstem dams turned on and dams in the tributaries turned off but were lower in the PRRP scenarios than in the scenarios with mainstem dams turned off and dams in the tributaries turned on. The results of the scenarios with only some dams turned off imply that dams in the mainstem of the Penobscot River are more detrimental to the DIA Model population of Atlantic salmon than dams in the tributaries. This likely occurred because most Atlantic salmon have to attempt to pass dams in the mainstem to reach the ocean or their natal PU, whereas fewer Atlantic salmon migrate through and encounter dams in the tributaries. Aside from the scenarios with all dams turned off, fewer smolts were killed when more dams were turned on and when dams in the mainstem of the Penobscot River were turned on. This occurred because survival rates were higher in the scenarios with fewer dams on overall and fewer dams in the mainstem turned on. Higher survival rates led to more adults and smolts produced in these scenarios, enabling more smolts to be killed. No smolts were killed in the scenarios with all dams turned off because passage and survival were set at 100% for smolts.

6 MODEL DIAGNOSTICS AND SENSITIVITY ANALYSES

The DIA Model was evaluated using model diagnostics and sensitivity analyses (Table 6.1). The model diagnostics (Sections 6.1 and 6.2) examined the appropriate number of model iterations to run for each scenario and the stability in results for a given number of iterations (Legault 2004). The sensitivity analyses (Sections 6.3–6.22) examined which model inputs had the most influence on model results (McCarthy et al. 1996; Cross and Beissinger 2001) and were performed by holding model inputs at the base value while changing one input at a time. The model diagnostics and sensitivity analyses were also run with Base Case and Recovery scenarios (see Section 4). The number of iterations used in the model diagnostics runs depended on the scenario that was being tested, whereas 5,000 iterations were run for all sensitivity analysis scenarios. Each model diagnostic and sensitivity analysis iteration was run for 50 years (i.e., 10 generations). The reported results include estimated total adult abundance, distribution of adults, and total number and proportion of smolts killed by dams and were recorded as in Section 4.

6.1 Number of Iterations

When performing Monte Carlo simulations, the appropriate number of model iterations to use must be found by trial and error. This can be done by conducting trials using different numbers of model iterations and comparing the variability in the results. Conducting more simulations produces more consistent results but takes more computation time. The Base Case and Recovery scenarios were run with 100, 500, 1,000, 5,000, and 10,000 iterations.

Each result (i.e., adult abundance, distribution of adults, and total number and proportion of smolts killed by dams) was similar for all numbers of iterations tested among the Base Case scenarios and among the Recovery scenarios (Tables 6.1.1–6.1.8; Figures 6.1.1–6.1.6). As expected, results varied most when the model was run with 100 iterations and least when the model was run with 10,000 iterations. The decrease in variability seemed especially noticeable when 1,000 or more iterations were run. The variability between results from using 5,000 iterations and 10,000 iterations was considered minimal, and the additional time to run 10,000 iterations compared to 5,000 iterations did not seem justified. Therefore, 5,000 iterations was used as the standard for all Base Case and Recovery scenarios.

6.2 Model Stability

The model was run five times each under the Base Case and Recovery scenarios to look at the variability in the results between runs with 5,000 iterations. This was a second test to ensure the results would be stable when using 5,000 iterations.

Each model result was similar among the five Base Case scenario runs and among the five Recovery scenario runs (Tables 6.2.1–6.2.8; Figures 6.2.1–6.2.6). The variability between runs was considered acceptable. Hence, 5,000 iterations were confirmed as the standard for all Base Case and Recovery scenarios.

6.3 Production Potential Cap

The number of wild smolts that originated in each PU was limited with a production potential cap, which was the maximum number of smolts allowed per HU (i.e., 10 smolts per 100 m^2; Table 3.1.2). The production potential cap represented the number of wild smolts that the habitat could support. No other density-dependent effects were included in the model. Ten smolts per 100 m^2 was used as the base input value, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base value (i.e., 2.5, 5, 20, and 40 smolts per 100 m^2, respectively).

6.3.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios. These results were not sensitive to the production potential cap in the Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2, and varied without trend in subsequent generations (Table 6.3.1.1; Figure 6.3.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 6.3.1.2; Figure 6.3.1.2). The proportion of iterations remained at one for the Lower Penobscot in generations 2–10. The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations for all five scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the production potential cap in the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.3.1.3; Figure 6.3.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations (Table 6.3.1.4; Figure 6.3.1.3).

6.3.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 (Table 6.3.2.1; Figure 6.3.2.1). The plateau occurred at the lowest abundance and earliest generation when the production potential cap was the lowest (2.5 smolts per 100 m^2) and occurred at the highest abundance and latest generation when the production potential cap was the highest (40 smolts per 100 m^2). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or was close to one in generations 1–10, for all three areas (Table 6.3.2.2; Figure 6.3.2.2).

The number of smolts killed differed among the Recovery scenarios, whereas the proportion of smolts killed remained constant among the scenarios. In the scenario with a production potential cap of 2.5 smolts per 100 m^2, the median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage declined from generation 1 to generation 2, and varied without trend in subsequent generations (Table 6.3.2.3; Figure 6.3.2.3). In all other scenarios, the number of smolts killed declined from generation 1 to generation 2 and then increased in subsequent generations. In generation 10, the fewest smolts were killed in the scenario with a production potential cap of 2.5 smolts per 100 m^2, and the most smolts were killed in the scenario with a production potential cap of 40 smolts per 100 m^2. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations (Table 6.3.2.4; Figure 6.3.2.3).

6.4 Eggs per Female

The number of eggs produced per 2SW female was drawn from a normal distribution with μ = 8,304 and σ = 821 (Figure 3.2.1). This distribution was used as the base input, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base.

6.4.1 Base Case

Adult abundance and distribution decreased overall in all five Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 in all scenarios, varied without trend in subsequent generations in the scenarios with 0.25, 0.5 and 1 times the base eggs per female rate, and increased in subsequent generations in the scenarios with 2 and 4 times the base eggs per female rate (Table 6.4.1.1; Figure 6.4.1.1). Adult abundance was lowest in the scenario with 0.25 times the base and highest in the scenario with 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 6.4.1.2; Figure 6.4.1.2). The proportion of iterations remained at one for the Lower Penobscot in generations 2–10. The proportion of iterations for Piscataquis and Upper Penobscot were similar, declining from generation 1 to 3 and varying without trend in subsequent generations for all five scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.4.1.3; Figure 6.4.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was 0.10 or 0.11 for all generations (Table 6.4.1.4; Figure 6.4.1.3).

6.4.2 Recovery

Adult abundance increased in all five Recovery scenarios, whereas adult distribution differed by scenario. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 (Table 6.4.2.1; Figure 6.4.2.1). The plateau occurred at the lowest abundance and earliest generation in the scenario with 0.25 times the base and occurred at the highest abundance and latest generation in the scenario with 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 for all scenarios (Table 6.4.2.2; Figure 6.4.2.2). The proportion of iterations for the Upper Penobscot and Piscataquis declined from generation 1 to 2 and increased in subsequent generations. In the Upper Penobscot and Piscataquis, the proportion of iterations was the lowest in the scenario with the lowest eggs per female rate (i.e., 0.25 times the base) and equaled or was near one in all other scenarios.

The number of smolts killed differed among the Recovery scenarios, whereas the proportion of smolts killed remained constant among the scenarios. In the scenario with 0.25 times the base eggs per female rate, the median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage declined from generation 1 to generation 2 and varied without trend in subsequent generations (Table 6.4.2.3; Figure 6.4.2.3). In the scenarios with 0.5, 1, and 2 times the base, the median number of smolts killed declined from generation 1 to generation 2 and increased in subsequent generations. In the scenario with 4 times the base, the median number of smolts killed increased in all generations. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was 0.10 or 0.11 for all generations (Table 6.4.2.4; Figure 6.4.2.3).

6.5 Egg to Smolt Survival

The survival rate from the egg to smolt life stages was drawn from a lognormal distribution with μ = 1.31%, minimum = 0.10%, and maximum = 5.88% (Figure 3.3.5). This distribution was used as the base input, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base.

6.5.1 Base Case

Adult abundance and distribution decreased overall in all five Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 in all scenarios, varied without trend in subsequent generations in the scenarios with 0.25, 0.5 and 1 times the base egg to smolt survival rate, and increased in subsequent generations in the scenarios with 2 and 4 times the base egg to smolt survival rate (Table 6.5.1.1; Figure 6.5.1.1). The number of 2SW females was lowest in the scenario with 0.25 times the base and highest in the scenario with 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.5.1.2; Figure 6.5.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations for all five scenarios, and were the highest when the egg to smolt survival rate was the greatest (i.e., 4 times the base) and the lowest when the egg to smolt survival rate was the least (i.e., 0.25 times the base).

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2 (base times 0.25, 0.5, and 1) or generation 3 (base times 2 and 4), and varied without trend in subsequent generations (Table 6.5.1.3; Figure 6.5.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was 0.10 or 0.11 for all generations (Table 6.5.1.4; Figure 6.5.1.3).

6.5.2 Recovery

Adult abundance increased in all five Recovery scenarios, whereas adult distribution differed by scenario. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 (Table 6.5.2.1; Figure 6.5.2.1). The plateau occurred at the lowest abundance and earliest generation in the scenario with 0.25 times the base and occurred at the highest abundance and latest generation in the scenario with 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 6.5.2.2; Figure 6.5.2.2). The proportion of iterations remained at one for the Lower Penobscot in generations 2–10 for all scenarios. The proportion of iterations for Piscataquis and Upper Penobscot declined from generation 1 to 2 and varied without trend in subsequent generations. The proportion of iterations in the two latter areas was lowest in the scenario with 0.25 times the base and was at or near one in the scenarios with 2 and 4 times the base.

The number of smolts killed differed between the Recovery scenarios, whereas the proportion of smolts killed remained constant between the scenarios. In the scenario with 0.25 times the base eggs per female rate, the median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage varied without trend in all generations (Table 6.5.2.3; Figure 6.5.2.3). In the scenarios with 0.5 and 1 times the base, the median number of smolts killed declined from generation 1 to generation 2, and varied without trend in subsequent generations. In the scenarios with 2 and 4 times the base, the median number of smolts killed declined from generation 1 to generation 2 and then increased in subsequent generations. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was 0.10 or 0.11 for all generations (Table 6.5.2.4; Figure 6.5.2.3).

6.6 In-river Mortality

The in-river mortality rate was drawn from a beta distribution with shape parameters α_1 = 11.245 and α_2 = 9.8007, minimum = zero, and maximum = 0.00038077 (Figure 3.5.2). This distribution was used as the base input, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base.

6.6.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios. These results were not sensitive to the in-river mortality rate in the Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2, and varied without trend in subsequent generations (Table 6.6.1.1; Figure 6.6.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 6.6.1.2; Figure 6.6.1.2). The proportion of iterations remained at one for the Lower Penobscot in generations 2–10. The proportion of iterations for Piscataquis and Upper Penobscot were similar, declining from generation 1 to 3 and varying without trend in subsequent generations for all five scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the in-river mortality rate in the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.6.1.3; Figure 6.6.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations (Table 6.6.1.4; Figure 6.6.1.3).

6.6.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 (Table 6.6.2.1; Figure 6.6.2.1). The plateau occurred at the lowest abundance when the in-river mortality was the highest (base times 4) and occurred at the highest abundance when in-river mortality was the lowest (base times 0.25). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or was close to one in generations 1–10, for all three areas (Table 6.6.2.2; Figure 6.6.2.2).

The number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage increased overall in the Recovery scenarios, whereas the proportion of smolts killed remained constant. In all scenarios, the median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage declined from generation 1 to generation 2, and increased to generation 10 (Table 6.6.2.3; Figure 6.6.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was 0.10 or 0.11 for all generations (Table 6.6.2.4; Figure 6.6.2.3).

6.7 Marine Survival

The marine survival rate was drawn from an inverse gaussian distribution with μ = 0.006265, shape parameter λ = 0.0068723, and a shift of 0.00000813424 (Figure 3.9.4). This distribution was used as the base input, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base. Because this sensitivity analysis was performed on the marine survival rate, the Base Case and Recovery scenarios are different than most of the other sensitivity analyses. The Base Case scenarios were run with the base freshwater survival rate, and the Recovery scenarios were run with freshwater survival increased by two times the base value, as in the other sensitivity analyses. Unlike the other sensitivity analyses, five marine survival values were tested in both the Base Case and Recovery scenarios.

6.7.1 Base Case

Adult abundance and distribution differed between Base Case scenarios. The median number of 2SW females decreased in the scenarios with 0.25, 0.5, 1, and 2 times the base and increased in the scenario with 4 times the base (Table 6.7.1.1; Figure 6.7.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.7.1.2; Figure 6.7.1.2). The proportion of iterations for Piscataquis and Upper Penobscot were similar in each scenario, with the proportion being the lowest (close to zero) in the scenario with 0.25 times the base and highest (close to one) in the scenario with 4 times the base.

The number of smolts killed differed between Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 in all scenarios except 4 times the base (Table 6.7.1.3; Figure 6.7.1.3). In the latter scenario, the number of smolts killed increased after generation 2. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations (Table 6.7.1.4; Figure 6.7.1.3).

6.7.2 Recovery

Adult abundance and distribution differed between Recovery scenarios. The median number of 2SW females decreased in the scenarios with 0.25, 0.5, and 1 times the base and increased in the scenarios with 2 and 4 times the base (Table 6.7.2.1; Figure 6.7.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.7.2.2; Figure 6.7.2.2). The proportion of iterations for Piscataquis and Upper Penobscot were similar in each scenario, with the proportion being the lowest (close to zero) in the scenario with 0.25 times the base and highest (close to one) in the scenario with 4 times the base.

The number of smolts killed differed between Recovery scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 in all scenarios except 4 times the base (Table 6.7.2.3; Figure 6.7.2.3). In the latter scenario, the number of smolts killed increased after generation 2. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations (Table 6.7.2.4; Figure 6.7.2.3).

6.8 Initial Number of Adults

The model was seeded with 587 2SW females in generation 1, which was the mean annual number of 2SW female returns captured at the trap above Veazie Dam during 2002–2011. This value was used as the base input, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base value (i.e., 147, 294, 1,174, and 2,348, respectively).

6.8.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios. The median number of 2SW females decreased at different rates from generation 1 to generation 2 in the five scenarios, but abundance was approximately the same in all scenarios by generation 10 (Table 6.8.1.1; Figure 6.8.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.8.1.2; Figure 6.8.1.2). The proportion of iterations for Piscataquis and Upper Penobscot declined from one in generation 1 to approximately 0.5 by generation 10 in all five scenarios.

The number of smolts killed decreased in the Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.8.1.3; Figure 6.8.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations (Table 6.8.1.4; Figure 6.8.1.3).

6.8.2 Recovery

Adult abundance increased overall and adult distribution equaled or was close to one in all Recovery scenarios. The median number of 2SW females increased from generation 1 to generation 10 in all scenarios except when starting abundance equaled 2,348 2SW females (Table 6.8.2.1; Figure 6.8.2.1). In the latter scenario, adult abundance decreased from generation 1 to 2 and then increased. By generation 10, median adult abundance was close to the same number in all scenarios. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.8.2.2; Figure 6.8.2.2). The proportion of iterations for Piscataquis and Upper Penobscot decreased from generation 1 to generation 2 but equaled or was near one in generations 3–10 in all scenarios except when starting abundance equaled 2,348 2SW females. The proportion of iterations for Piscataquis and Upper Penobscot equal or was close to one in all generations in the latter scenario.

The number of smolts killed differed between Recovery scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage increased overall when initial adult abundance was 147, 294, and 587 but decreased when initial adult abundance was 1,174 and 2,348 (Table 6.8.2.3; Figure 6.8.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations (Table 6.8.2.4; Figure 6.8.2.3).

6.9 Hatchery Stocking

In the base hatchery input, the hatchery was turned on, meaning 550,000 smolts were stocked and 150 2SW females were removed above Veazie Dam to fulfill stocking requirements. Smolt stocking and removal of adults for broodstock occurred in all 50 years (i.e., ten generations). Sensitivities were run with the hatchery turned off for the whole time period, the hatchery turned on for the first 25 years and off for the second 25 years, and the hatchery turned off for the first 25 years and on for the second 25 years.

6.9.1 Base Case

Adult abundance and distribution differed between Base Case scenarios. The median number of 2SW females decreased to zero when the hatchery was turned off but maintained a low level of abundance when the hatchery was turned on (Table 6.9.1.1; Figure 6.9.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 6.9.1.2; Figure 6.9.1.2). The proportion of iterations decreased to zero or near zero in all three areas when the hatchery was turned off. Adult abundance and distribution increased in generation 6 in the scenario with the hatchery turned on for the first 25 years, whereas adult abundance and distribution remained nearly the same in generation 6 in the scenario with the hatchery turned on for the whole time period. The increase in generation 6 mentioned above was caused by leaving 150 2SW females in the river to spawn when the hatchery was turned off instead of removing them above Veazie Dam for broodstock.

The number and proportion of smolts killed differed between Base Case scenarios. The median total number and total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased to zero when the hatchery was turned off (Table 6.9.1.3 and 6.9.1.4; Figure 6.9.1.3). The number and proportion of smolts killed remained stable when the hatchery was on.

6.9.2 Recovery

Adult abundance and distribution differed between Recovery scenarios. The median number of 2SW females moved toward a lower or higher equilibrium point when the hatchery was turned off or on, respectively (Table 6.9.2.1; Figure 6.9.2.1). By generation 10, adult abundance in the scenario with the hatchery turned on for the first 25 years approached adult abundance in the scenario with the hatchery turned off for the whole time series, and adult abundance in the scenario with the hatchery turned on in the second 25 years approached adult abundance in the scenario with the hatchery turned on for the whole time series. In the scenarios with the hatchery turned on for the first 25 years and the hatchery turned on for the second 25 years, the median number of 2SW females in generation 6 differed from the scenarios with the hatchery turned on and off, respectively. The difference in generation 6 was caused by leaving in or removing 150 2SW females above Veazie Dam. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled or was near one in all generations, areas, and scenarios except in the scenario with the hatchery turned off for the first 25 years and on for the second 25 years (Table 6.9.2.2; Figure 6.9.2.2). In the latter scenario, the proportion of iterations dropped in generation 6 (when the hatchery was turned on) in the Upper Penobscot and the Piscataquis and rebounded in subsequent generations. This was caused by the removal of 150 2SW females above Veazie Dam for broodstock.

The number and proportion of smolts killed differed between Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased overall when the hatchery was turned off and increased when the hatchery was turned on in the Recovery scenarios (Table 6.9.2.3; Figure 6.9.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased when the hatchery was turned off but remained constant at 0.11 when the hatchery was turned on (Table 6.9.2.4; Figure 6.9.2.3).

6.10 Hatchery Discount

The hatchery discount was applied to hatchery-origin smolts to convert the number of wild-equivalents before they migrated out to sea and was drawn from a log logistic distribution, with γ = 1, β = 1.4271, α = 1.9922, and maximum = 12 (Figure 3.8.1). This distribution was used as the base input, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base.

6.10.1 Base Case

Adult abundance and distribution differed between Base Case scenarios. The median number of 2SW females increased in the scenario with 0.25 times the base hatchery discount rate and decreased overall in the scenarios with 0.5, 1, 2, and 4 times the base (Table 6.10.1.1; Figure 6.10.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.10.1.2; Figure 6.10.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar in each scenario and decreased more as the hatchery discount increased.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.10.1.3; Figure 6.10.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 in all generations (Table 6.10.1.4; Figure 6.10.1.3).

6.10.2 Recovery

Adult abundance increased in all five Recovery scenarios, whereas adult distribution differed between scenarios. The median number of 2SW females increased in all scenarios and was the highest in the scenario with the lowest hatchery discount (i.e., 0.25 times the base) (Table 6.10.2.1; Figure 6.10.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.10.2.2; Figure

6.10.2.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar in each scenario, with the proportion decreasing as the hatchery discount increased.

The number of smolts killed differed between Recovery scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage increased overall in the scenarios with 0.25, 0.5, and 1 times the base hatchery discount rate and decreased overall in the scenarios with 2 and 4 times the base (Table 6.10.2.3; Figure 6.10.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations (Table 6.10.2.4; Figure 6.10.2.3).

6.11 Number of Smolts Stocked

In the base hatchery input, 550,000 smolts were stocked annually. This value was used as the base input for the number of smolts stocked, and sensitivities were run at values of 0.25, 0.5, 2, and 4 times the base value (i.e., 137,500, 275,000, 1,100,000, and 2,200,000, respectively).

6.11.1 Base Case

Adult abundance and distribution differed between Base Case scenarios. The median number of 2SW females decreased overall in the scenarios with 0.25, 0.5, 1, and 2 times the base number of smolts stocked and increased in the scenario with 4 times the base (Table 6.11.1.1; Figure 6.11.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 in all scenarios (Table 6.11.1.2; Figure 6.11.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were the lowest in the scenario with 0.25 times the base number of smolts stocked and increased as the number of smolts stocked increased.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.11.1.3; Figure 6.11.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.11 in all generations and scenarios (Table 6.11.1.4; Figure 6.11.1.3).

6.11.2 Recovery

Adult abundance increased overall in all five Recovery scenarios, whereas adult distribution differed between scenarios. The median number of 2SW females increased in all scenarios and was the highest in the scenario with 4 times the base number of smolts stocked (Table 6.11.2.1; Figure 6.11.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 in all scenarios (Table 6.11.2.2; Figure 6.11.2.2). In the scenarios with 0.25, 0.5, 1, and 2 times the base number of smolts stocked, the proportion of iterations for the Upper Penobscot and Piscataquis declined from generation 1 to generation 2 and increased in subsequent generations. In the scenario with 4 times the base number of smolts stocked, the proportion of iterations for the Upper Penobscot and Piscataquis equaled one in all generations.

The number and proportion of smolts killed differed between Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased from generation 1 to generation 2 and then increased in subsequent generations in the scenarios with 0.25, 0.5, and 1 times the base number of smolts stocked (Table 6.11.2.3; Figure 6.11.2.3). The median total number of 2SW females increased in the scenarios with 2 and 4 times the base. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased from 0.11 to 0.10 in the scenarios with 0.25 and 0.5 times the base number of smolts stocked and remained constant at 0.11 for all generations in the scenarios with 1, 2, and 4 times the base (Table 6.11.2.4; Figure 6.11.2.3).

6.12 Stocking Distribution

Smolts were distributed throughout the Penobscot River watershed according to the mean proportion stocked in each PU during 2003–2012 (Table 3.4.1). This distribution of stocked smolts was used as the base input, and sensitivities were run with all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam. In the scenario with all smolts stocked in the Piscataquis River, smolts were stocked in PUs 4, 5, and 6 according to the proportion of habitat units in each PU (i.e., 66%, 0.4%, and 33.6%, respectively). In the scenario with all smolts stocked equally among PUs, no smolts were stocked in PU 1. In the scenario with all smolts stocked below Veazie Dam, smolts were stocked in PUs 13 and 14 according to the proportion of habitat units in each PU (i.e., 21.3% and 78.7%, respectively).

6.12.1 Base Case

Adult abundance decreased overall in all five Base Case scenarios, whereas adult distribution differed between scenarios. The median number of 2SW females decreased overall in all scenarios, but the number of 2SW females was highest in the scenario with all smolts stocked below Veazie dam (Table 6.12.1.1; Figure 6.12.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 in all scenarios (Table 6.12.1.2; Figure 6.12.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis decreased from generation 1 to generation 3 and varied without trend in subsequent generations in all scenarios. The proportion of iterations in the Piscataquis was higher than the proportion of iterations in the Upper Penobscot in the scenario where all smolts were stocked in the Piscataquis. The proportion of iterations in the Upper Penobscot was higher than the proportion of iterations in the Piscataquis in the scenario where all smolts were stocked in PU 2. The proportion of iterations in the Upper Penobscot and Piscataquis were similar to each other in the other three scenarios and were highest in the base scenario.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed differed between scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 in all scenarios (Table 6.12.1.3; Figure 6.12.1.3). The number of smolts killed was lowest in the scenario where all smolts were stocked below Veazie Dam and was highest in the scenario where all smolts were stocked in PU 2. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest (0.13) in the scenario where all smolts were stocked in PU 2, lowest (0.06 in generations 2–10) in the scenario where all smolts were stocked below Veazie Dam, and equaled 0.10 or 0.11 in all generations for the other three scenarios (Table 6.12.1.4; Figure 6.12.1.3).

6.12.2 Recovery

Adult abundance increased overall in all five Recovery scenarios, whereas adult distribution differed between scenarios. The median number of 2SW females increased in all scenarios and was the highest in the scenario where all smolts were stocked below Veazie Dam (Table 6.12.2.1; Figure 6.12.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 in all scenarios (Table 6.12.2.2; Figure 6.12.2.2). The proportion of iterations for the Upper Penobscot and Piscataquis declined from generation 1 to generation 2 and increased in subsequent generations. The proportion of iterations was closest to one in the base scenario.

The number and proportion of smolts killed differed between Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased from generation 1 to generation 2 and then increased in subsequent generations in all scenarios (Table 6.12.2.3; Figure 6.12.2.3). The number of smolts killed increased overall in the scenario where all smolts were stocked in the Piscataquis and in the base scenario and decreased overall in the other three scenarios. The number of smolts killed was the lowest in the scenario with all smolts stocked below Veazie Dam. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest (0.13) in the scenario where all smolts were stocked in PU 2, lowest (0.09 in generations 2–10) in the scenario where all smolts were stocked below Veazie Dam, and equaled 0.10 or 0.11 in all generations for the other three scenarios (Table 6.12.2.4; Figure 6.12.2.3).

6.13 Straying

A set of logical rules was developed to assist with estimating PU-specific homing rates and straying patterns by using specific study results combined with the Expert Panel opinions and local knowledge (Table 3.10.1). These rules were used as the base input, and alternate sets of rules were developed to run sensitivities. The first alternate set of rules (RulesX1) was developed using study results, fishway trap data, and Expert Panel opinions, but local knowledge was excluded (Table 6.13.1). The second alternate set of rules (RulesX2) was the RulesX1 table applied to itself to further distribute straying fish (Table 6.13.2). In the third alternate set of rules (100% home), all adults returned to their natal PU (Table 6.13.3). In the fourth alternate set of rules (=straying), all returning adults strayed to other PUs equally (Table 6.13.4).

6.13.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios and were not sensitive to straying in the Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 and varied without trend in subsequent generations (Table 6.13.1.1; Figure 6.13.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.13.1.2; Figure

6.13.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations for all scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to straying in the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.13.1.3; Figure 6.13.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations and scenarios (Table 6.13.1.4; Figure 6.13.1.3).

6.13.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 (Table 6.13.2.1; Figure 6.13.2.1). Adult abundance was highest in the base scenario and lowest in the scenario with 100% homing. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.13.2.2; Figure 6.13.2.2).

The number of smolts killed differed between the Recovery scenarios, whereas the proportion of smolts killed remained constant between the scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage declined from generation 1 to generation 2 and increased in subsequent generations in all straying scenarios except 100% home, where the number of smolts killed varied without trend in generations 2–10 (Table 6.13.2.3; Figure 6.13.2.3). The number of smolts killed decreased overall in the RulesX1 and RulesX2 scenarios, whereas the number of smolts killed increased overall in the base and =straying scenarios. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations and scenarios (Table 6.13.2.4; Figure 6.13.2.3).

6.14 Proportion Dying

The fate of adult Atlantic salmon that were unsuccessful at passing an individual dam was determined by the Expert Panel, and one fate was that a proportion of the fish die (Table 3.12.1). The Expert Panel's decision on the proportion of fish that die was used as the base input, and sensitivities were run at alternate values (i.e., 0, 0.012, 0.024, and 0.048). The alternate proportions of fish dying were applied only to dams where the base proportion dying input was greater than zero (Table 3.12.1). The proportion of fish remaining downstream was adjusted accordingly so that the proportion dying, the proportion returning to sea, and the proportion remaining downstream still summed to one.

6.14.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios, and these results were not sensitive to the proportion of fish dying in the Base Case scenarios. The median number of 2SW females declined to approximately the same value from generation 1 to generation 2 and varied without trend in subsequent generations in all scenarios (Table 6.14.1.1;

Figure 6.14.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.14.1.2; Figure 6.14.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations in all scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the proportion of fish dying in the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.14.1.3; Figure 6.14.1.3). The numbers of smolts killed were similar among scenarios. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations and scenarios (Table 6.14.1.4; Figure 6.14.1.3).

6.14.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. Adult abundance and distribution were not sensitive to the proportion of fish dying in the Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 at approximately the same abundance in all scenarios (Table 6.14.2.1; Figure 6.14.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.14.2.2; Figure 6.14.2.2).

The number of smolts killed increased overall in all five Recovery scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the proportion of fish dying in the Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and increased in subsequent generations to approximately the same level in all scenarios by generation 10 (Table 6.14.2.3; Figure 6.14.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was equal to 0.10 or 0.11 for all generations and scenarios (Table 6.14.2.4; Figure 6.14.2.3).

6.15 Proportion Returning to Sea

Another fate of adult Atlantic salmon that were unsuccessful at passing an individual dam was that a proportion of the fish return to the ocean un-spawned. The proportion of fish returning to sea at each dam was determined by the Expert Panel, and this decision was used as the base input (Table 3.12.1). Sensitivities were run at values of 0, 0.5, 2, and 4 times the base value. The proportion of fish remaining downstream was adjusted accordingly so that the proportion dying, the proportion returning to sea, and the proportion remaining downstream still summed to one.

6.15.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 and varied without trend in subsequent generations in all scenarios (Table 6.15.1.1; Figure 6.15.1.1). Abundance was the lowest in the scenario with 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.15.1.2; Figure 6.15.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations in all scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.15.1.3; Figure 6.15.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations and scenarios (Table 6.15.1.4; Figure 6.15.1.3).

6.15.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 in all scenarios (Table 6.15.2.1; Figure 6.15.2.1). Abundance was highest in the scenario with 0 times the base proportion returning to sea and lowest in the scenario with 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.15.2.2; Figure 6.15.2.2).

The number of smolts killed increased overall in all five Recovery scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and increased in subsequent generations (Table 6.15.2.3; Figure 6.15.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was equal to 0.10 or 0.11 for all generations and scenarios (Table 6.15.2.4; Figure 6.15.2.3).

6.16 Proportion Remaining Downstream

The third, and final, possible fate of adult Atlantic salmon that were unsuccessful at passing an individual dam in the DIA Model was that a proportion of the fish go elsewhere, specifically to a downstream PU, to spawn. The proportion of fish spawning in a downstream PU was determined by the Expert Panel, and this decision was used as the base input (Table 3.12.1). Sensitivities were run with all adults that were unsuccessful at passing an individual dam spawning in the PU immediately below that dam (Table 6.16.1) and with the adults evenly distributed between all PUs below the dam that was not passed (Table 6.16.2).

6.16.1 Base Case

Adult abundance and distribution decreased in all three Base Case scenarios, and these results were not sensitive to the proportion of fish remaining downstream in the Base Case scenarios. The median number of 2SW females declined to approximately the same value from generation 1 to generation 2 and varied without trend in subsequent generations in all scenarios (Table 6.16.1.1; Figure 6.16.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.16.1.2; Figure

6.16.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations in all scenarios.

The number of smolts killed decreased in all three Base Case scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the proportion of fish remaining downstream in the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.16.1.3; Figure 6.16.1.3). The numbers of smolts killed were similar among scenarios. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations and scenarios (Table 6.16.1.4; Figure 6.16.1.3).

6.16.2 Recovery

Adult abundance increased and adult distribution remained near one in all three Recovery scenarios. Adult abundance and distribution were not sensitive to the proportion of fish remaining downstream in the Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 at approximately the same abundance in all scenarios (Table 6.16.2.1; Figure 6.16.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.16.2.2; Figure 6.16.2.2).

The number of smolts killed increased overall in all three Recovery scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the proportion of fish dying in the Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and increased in subsequent generations (Table 6.16.2.3; Figure 6.16.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was equal to 0.10 or 0.11 for all generations and scenarios (Table 6.16.2.4; Figure 6.16.2.3).

6.17 Downstream Dam Passage Survival Rates

Downstream dam passage survival rates of smolts were estimated by Alden (Amaral et al. 2012). These rates were used as the base input values, except for Upper Dover Dam, which equaled 92.15% (see Section 3.6.1). Sensitivities were run at -10%, -5%, +5%, and +10% of the base survival rates, with survival capped at one. These data adjustments were applied to each dam, except Dover Upper Dam.

6.17.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 and varied without trend in subsequent generations (Table 6.17.1.1; Figure 6.17.1.1). Abundance was lowest in the scenario with downstream dam passage survival rates decreased by 10% and highest in the scenario with these rates increased by 10%. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.17.1.2; Figure 6.17.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis declined from generation 1 to 3 and varied without trend in subsequent generations. The proportion of iterations in the Upper Penobscot and Piscataquis were lowest in the scenario with downstream dam passage survival rates decreased by 10% and highest in the scenario with these rates increased by 10%.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant in each of the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.17.1.3; Figure 6.17.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant for all generations in each scenario but varied among scenarios (Table 6.17.1.4; Figure 6.17.1.3). The number and proportions of smolts killed were highest in the scenario with downstream dam passage survival rates decreased by 10% and lowest in the scenario with these rates increased by 10%.

6.17.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 in all scenarios (Table 6.17.2.1; Figure 6.17.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.17.2.2; Figure 6.17.2.2). The adult abundance and distribution were lowest in the scenario with downstream dam passage survival rates decreased by 10% and highest in the scenario with these rates increased by 10%.

The number of smolts killed differed between Recovery scenarios, whereas the proportion of smolts killed remained constant in each of the Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased overall in the scenario with survival rates decreased by 10% but increased overall in the other four Recovery scenarios (Table 6.17.2.3; Figure 6.17.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant for all generations in each scenario but varied among scenarios (Table 6.17.2.4; Figure 6.17.2.3). The number and proportions of smolts killed were highest in the scenario with downstream dam passage survival rates decreased by 10% and lowest in the scenario with these rates increased by 10%.

6.18 Upstream Dam Passage Survival Rates

Upstream dam passage survival rate distributions of adults were estimated using telemetry studies or previous model estimates (Table 3.11.1.1). Sensitivities were run at -10%, -5%, +5%, and +10% of the base survival rates, with survival capped at one. Four dams (i.e., Medway, Milo, Sebec, and Orono) do not have any upstream passage, and so upstream passage values at these dams were set to zero in both the base input and the sensitivity runs.

6.18.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios, and these results were not sensitive to upstream dam passage survival rates in the Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 and varied without trend in subsequent generations (Table 6.18.1.1; Figure 6.18.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.18.1.2; Figure 6.18.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis declined from generation 1 to 3 and varied without trend in subsequent generations. The proportion of iterations in the Upper Penobscot and Piscataquis were lowest in the scenario with upstream dam passage survival rates decreased by 10% and highest in the scenario with these rates increased by 10%.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the upstream dam passage survival rates in the Base Case scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.18.1.3; Figure 6.18.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations and scenarios (Table 6.18.1.4; Figure 6.18.1.3).

6.18.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios. Adult abundance and distribution were not sensitive to upstream dam passage survival rates in the Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 in all scenarios (Table 6.18.2.1; Figure 6.18.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.18.2.2; Figure 6.18.2.2). The adult abundance and distribution were lowest in the scenario with upstream dam passage survival rates decreased by 10% and highest in the scenario with these rates increased by 10%.

The number of smolts killed differed between Recovery scenarios, whereas the proportion of smolts killed remained constant. The number and proportion of smolts killed were not sensitive to the upstream dam passage survival rates in the Recovery scenarios. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased overall in the scenarios with survival rates decreased by 5 and 10% but increased overall in the other three Recovery scenarios (Table 6.18.2.3; Figure 6.18.2.3). The number of smolts killed was lowest in the scenario with downstream dam passage survival rates decreased by 10% and highest in the scenario with these rates increased by 10%. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations and scenarios (Table 6.18.2.4; Figure 6.18.2.3).

6.19 Indirect Latent Mortality

An indirect latent mortality rate of 10% per dam was applied, and this rate was used as the base input. Sensitivities were run at values of 2.5%, 5%, 20%, and 40% indirect latent mortality per dam.

6.19.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 and varied without trend in subsequent generations (Table 6.19.1.1; Figure 6.19.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas (Table 6.19.1.2; Figure 6.19.1.2). The proportion of iterations remained at one for the Lower Penobscot in generations 2–10 for the scenarios with 2.5%, 5%, 10%, and 20% indirect latent mortality per dam but declined to below 0.10 in the scenario with 40% indirect latent mortality per dam. The proportion of iterations for the Upper Penobscot and Piscataquis declined from generation 1 to 3 and varied without trend in subsequent generations. Adult abundance and distribution were highest in the scenario with 2.5% indirect latent mortality per dam and lowest (zero or close to zero in generations 2–10) in the scenario with 40% indirect latent mortality per dam.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.19.1.3; Figure 6.19.1.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant at 0.11 for all generations and scenarios (Table 6.19.1.4; Figure 6.19.1.3).

6.19.2 Recovery

Adult abundance and distribution differed between the Recovery scenarios. The median number of 2SW females increased overall in the scenarios with 2.5%, 5%, 10% and 20% indirect latent mortality per dam but decreased to zero in the scenario with 40% indirect latent mortality per dam (Table 6.19.2.1; Figure 6.19.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations and areas in the scenarios with 2.5%, 5%, and 10% indirect latent mortality per dam, decreased from generation 1 to generation 2 and increased in subsequent generations in the scenario with 20% indirect latent mortality per dam, and decreased to zero or close to zero in the scenario with 40% indirect latent mortality per dam (Table 6.19.2.2; Figure 6.19.2.2).

The number of smolts killed differed between Recovery scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage increased overall in the scenarios with 2.5%, 5%, and 10% indirect latent morality per dam but decreased overall in the scenarios with 20% and 40% indirect latent mortality per dam (Table 6.19.2.3; Figure 6.19.2.3). The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations and scenarios (Table 6.19.2.4; Figure 6.19.2.3).

6.20 Downstream Path Choice

Smolts originating upriver of the Stillwater Branch have the option of migrating to the ocean via the Stillwater Branch or the mainstem. Telemetry data were used to develop a distribution for smolt use of the Stillwater Branch (Figure 3.6.3.2), and this was used as the base input. Sensitivities were run at 0.25, 0.5, 2, and 4 times the base. Downstream path choice for the Stillwater Branch was capped at one.

6.20.1 Base Case

Adult abundance and distribution decreased in all five Base Case scenarios, and these results were not sensitive to downstream path choice in the Base Case scenarios. The median number of 2SW females declined to approximately the same value from generation 1 to generation 2 and varied without trend in subsequent generations in all scenarios (Table 6.20.1.1; Figure 6.20.1.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 (Table 6.20.1.2; Figure 6.20.1.2). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations in all scenarios.

The number of smolts killed decreased in all five Base Case scenarios, whereas the proportion of smolts killed remained constant in each scenario. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was highest in generation 1, declined from generation 1 to generation 2, and varied without trend in generations 2–10 (Table 6.20.1.3; Figure 6.20.1.3). The number of smolts killed was highest in the scenario with 0.25 times the base Stillwater Branch use rate and lowest in the scenario with 4 times the base Stillwater use rate. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant for all generations at either 0.10 (in the scenarios with 2 and 4 times the base) or 0.11 (in the scenarios with 0.25, 0.5, and 1 times the base) (Table 6.20.1.4; Figure 6.20.1.3).

6.20.2 Recovery

Adult abundance increased and adult distribution remained near one in all five Recovery scenarios, and these results were not sensitive to downstream path choice in the Recovery scenarios. The median number of 2SW females increased from generation 1 and reached a plateau by generation 10 at approximately the same abundance in all scenarios (Table 6.20.2.1; Figure 6.20.2.1). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Table 6.20.2.2; Figure 6.20.2.2).

The number of smolts killed increased overall in all five Recovery scenarios, whereas the proportion of smolts killed remained constant in each scenario. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2, and increased in subsequent generations (Table 6.20.2.3; Figure 6.20.2.3). The number of smolts killed was highest in the scenario with 0.25 times the base Stillwater Branch use rate and lowest in the scenario with 4 times the Stillwater Branch use rate. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant for all generations at either 0.10 (in the scenarios with 2 and 4 times the base) or 0.11 (in the scenarios with 0.25, 0.5, and 1 times the base) (Table 6.20.2.4; Figure 6.20.2.3).

6.21 Freshwater and Marine Survival Rates With the Hatchery Turned On or Off

A series of sensitivities were run with a range of freshwater and marine survival rates. Scenarios with five freshwater survival rates (0.25, 0.5, 1, 2, and 4 times the base case egg to smolt survival) were run with five marine survival rates (0.25, 0.5, 1, 2, and 4 times the base case). Each freshwater and marine survival rate combination was run with stocking of hatchery-reared smolts turned on and turned off in the DIA Model.

6.21.1 Hatchery On

Adult abundance and distribution increased as freshwater and marine survival increased with the hatchery component of the model turned on. The median number of 2SW females decreased from generation 1 to generation 2 and varied without trend in subsequent generations when the marine survival rate was low (Tables 6.21.1.1 – 6.21.1.3; Figures 6.21.1.1 – 6.21.1.3). The number of 2SW females increased above the starting abundance of 587 fish by generation 10 in the scenarios with the marine survival increased by 2 times the base and freshwater survival increased by 2 and 4 times the base and in all scenarios with marine survival increased by 4 times the base (Tables 6.21.1.4 – 6.21.1.5; Figures 6.21.1.4 – 6.21.1.5). The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at or near one for the Lower Penobscot in generations 2–10 for all combinations of freshwater and marine survival rates (Tables 6.21.1.6 – 6.21.1.10; Figures 6.21.1.6 – 6.21.1.10). The proportion of iterations in the Upper Penobscot and Piscataquis declined from generation 1 to generation 3 and varied without trend in subsequent generations when the marine survival rate was low, but the proportion of iterations in these areas was close to or equal to one in all generations in scenarios when the freshwater survival rate was 1, 2, or 4 times the base and marine survival was 4 times the base.

The trend in the number of smolts killed differed based on the freshwater and marine survival rates with the hatchery turned on, but the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage generally increased as freshwater and marine survival increased (Tables 6.21.1.11 – 6.21.1.15; Figures 6.21.1.11 – 6.21.1.15). The number of smolts killed decreased overall in scenarios when marine and freshwater survival rates were low and increased overall only in scenarios with 4 times the base marine survival rate and 1, 2, and 4 times the freshwater survival rate. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage remained constant for all generations (0.10 and 0.11 in the scenario with 2 times the marine survival base case rate and 4 times the freshwater survival base case rate and the scenarios with 4 times the marine survival base case rate and 1, 2, and 4 times the freshwater base case rate; 0.11 for all other combinations of marine and freshwater survival rates) (Tables 6.21.1.16 – 6.21.1.20; Figures 6.21.1.11 – 6.21.1.15).

6.21.2 Hatchery Off

Adult abundance and distribution increased as freshwater and marine survival increased with the hatchery component of the model turned off. The median number of 2SW females decreased to zero or near zero when the marine or freshwater survival rates were low (Tables 6.21.2.1 – 6.21.2.5; Figures 6.21.2.1 – 6.21.2.5). The number of 2SW females increased above the starting abundance of 587 fish by generation 10 in the scenarios with the marine survival increased by 2 times the base and freshwater survival increased by 4 times the base and with marine survival increased by 4 times the base and freshwater survival increased by 2 and 4 times the base. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas for all combinations of freshwater and marine survival rates (Tables 6.21.2.6 – 6.21.2.10; Figures 6.21.2.6 – 6.21.2.10). The proportion of iterations in all three areas decreased to zero or near zero by generation 10 in scenarios with low marine or freshwater survival rates but equaled one or close to one in all generations in scenarios with 2 times the base marine survival and 4 times the base freshwater survival rates and 4 times the base marine survival rate and 2 and 4 times the base freshwater survival rates.

The number and proportion of smolts killed decreased overall in all scenarios with a range of freshwater and marine survival rates and the hatchery turned off. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased to zero or near zero in scenarios with low marine or freshwater survival rates (Tables 6.21.2.11 – 6.21.2.15; Figures 6.21.2.11 – 6.21.2.15). The number of smolts killed began to increase by generation 10 in scenarios with 2 times the base marine survival and 4 times the base freshwater survival rates and 4 times the base marine survival rate and 2 and 4 times the base freshwater survival rates. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage decreased to zero in scenarios with low marine or freshwater survival rates (Tables 6.21.2.16 – 6.21.2.20; Figures 6.21.2.11 – 6.21.2.15). The decrease in the proportion of smolts killed was less in scenarios with increased marine and freshwater survival rates.

6.22 Median and Mean Marine Survival Rates for Different Time Series

Estimates of the median 2SW female marine survival rates during 1971–2010 were fitted to an inverse gaussian distribution with μ = 0.006265, shape parameter λ = 0.0068723, and a shift of 0.00000813424 (Figure 3.9.4). This distribution was used as the base input, and five alternate distributions were used to run sensitivities. The distributions for the base and sensitivities were developed using the same process, but different data were used in each distribution (i.e., mean or median, different time series). The first alternate distribution was median estimates of 2SW female marine survival rates during 1971–1990 fitted to an inverse gaussian distribution with μ = 0.012056, shape parameter λ = 0.080705, and a shift of -0.0020676. The second alternate distribution was median estimates of 2SW female marine survival rates during 1991–2010 fitted to an inverse gaussian distribution with μ = 0.003916, shape parameter λ = 0.0480996, and a shift of -0.0013579. The third alternate distribution was mean estimates of 2SW female marine survival rates during 1971–2010 fitted to an inverse gaussian distribution with μ = 0.0070894, shape parameter λ = 0.0077758, and a shift of 0.00000954211. The fourth alternate distribution was mean estimates of 2SW female marine survival rates during 1971–1990 fitted to an inverse gaussian distribution with μ = 0.013649, shape parameter λ = 0.091492, and a shift of -0.0023463. The fifth alternate distribution was mean estimates of 2SW female marine survival rates during 1991–2010 fitted to an inverse gaussian distribution with μ = 0.0044284, shape parameter λ = 0.0543302, and a shift of -0.0015336. A Base Case scenario was run with each of the above distributions and the base case freshwater survival rate input, and a Recovery scenario was run with each of the above distributions increased by four times and the freshwater survival base case increased by two times.

6.22.1 Base Case

Adult abundance and distribution differed between the Base Case scenarios. The median number of 2SW females declined from generation 1 to generation 2 in all median and mean scenarios, varied without trend in generations 2–10 in the median and mean scenarios using 1991–2010 and 1971–2010 data, and increased in generations 2–10 in the median and mean scenarios using 1971–1990 data (Tables 6.22.1.1 and 6.22.1.2; Figures 6.22.1.1 and 6.22.1.2). The number of 2SW females was highest in the scenario using the mean 2SW female marine survival rates from 1971 to 1990 and lowest in the scenario using the median 2SW female marine survival rates from 1991 to 2010, although the number of 2SW females killed was similar between median and mean scenarios that used marine survival rates from the same time period. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one in generation 1 for all three areas and remained at one for the Lower Penobscot in generations 2–10 for all scenarios (Tables 6.22.1.3 and 6.22.1.4; Figures 6.22.1.3 and 6.22.1.4). The proportion of iterations for the Upper Penobscot and Piscataquis were similar, declining from generation 1 to 3 and varying without trend in subsequent generations for all scenarios. The proportion of iterations for the Upper Penobscot and Piscataquis were closest to one in the scenario using the mean 2SW female marine survival rates from 1971 to 1990 and closest to zero in the scenario using the median 2SW female marine survival rates from 1991 to 2010, although the proportion of iterations was similar between median and mean scenarios that used marine survival rates from the same time period.

The number of smolts killed decreased in all of the median and mean Base Case scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage was the highest in generation 1, declined from generation 1 to generation 2 or 3, and varied without trend in subsequent generations (Tables 6.22.1.5 and 6.22.1.6; Figures 6.22.1.5 and 6.22.1.6). The number of smolts killed was highest in the scenario using the mean 2SW female marine survival rates from 1971 to 1990 and lowest in the scenario using the median 2SW female marine survival rates from 1991 to 2010, although the number of smolts killed was similar between median and mean scenarios that used marine survival rates from the same time period. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.11 for all generations and scenarios (Tables 6.22.1.7 and 6.22.1.8; Figures 6.22.1.5 and 6.22.1.6).

6.22.2 Recovery

Adult abundance increased overall and adult distribution remained near one in all of the median and mean Recovery scenarios. The median number of 2SW females increased after generation 1 or 2 and reached a plateau by generation 10 (Tables 6.22.2.1 and 6.22.2.2; Figures

6.22.2.1 and 6.22.2.2). The number of 2SW females was highest in the scenario using the mean 2SW female marine survival rates from 1971 to 1990 and lowest in the scenario using the median 2SW female marine survival rates from 1991 to 2010, although the number of 2SW females was similar between median and mean scenarios that used marine survival rates from the same time period. The proportion of iterations when at least one 2SW female was located in each Penobscot River watershed area equaled one or close to one in all generations, areas, and scenarios (Tables 6.22.2.3 and 6.22.2.4; Figures 6.22.2.3 and 6.22.2.4).

The number of smolts killed differed between the Recovery scenarios, whereas the proportion of smolts killed remained constant. The median total number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage increased overall in the median and mean scenarios using the mean 2SW female marine survival rates from 1971 to 1990 and 1971 to 2010 but decreased overall in the median and mean scenarios using the mean 2SW female marine survival rates from 1991 to 2010 (Tables 6.22.2.5 and 6.22.2.6; Figures 6.22.2.5 and 6.22.2.6). The number of smolts killed was highest in the scenario using the mean 2SW female marine survival rates from 1971 to 1990 and lowest in the scenario using the median 2SW female marine survival rates from 1991 to 2010, although the number of smolts killed was similar between median and mean scenarios that used marine survival rates from the same time period. The median total proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage equaled 0.10 or 0.11 for all generations and scenarios (Tables 6.22.2.7 and 6.22.2.8; Figures 6.22.2.5 and 6.22.2.6).

6.23 Summary

Model diagnostics were used to decide the appropriate number of iterations and whether or not the results of model runs using that number of iterations were stable. Five thousand iterations was determined to be the appropriate number of model iterations, and the variation in the results of DIA Model runs using 5,000 iterations was considered acceptable.

Sensitivity of model inputs were examined using the percent difference of 2SW female abundance in generation 10 (Table 6.23.1). The percent difference was calculated as the difference in the median number of 2SW females in generation 10 when the input was changed, compared to the median number of 2SW females in generation 10 when all inputs were set at their base estimates. Highly sensitive model inputs caused the median number of 2SW females to deviate by more than the percent change from the base (e.g., if the base input was multiplied by two, a highly sensitive input would cause more than a 100% difference) (Essington 2003). Linearly sensitive model inputs caused the median number of 2SW females to deviate by the percent change from the base (e.g., if the base input was multiplied by two, a linearly sensitive input would cause a 100% difference). Insensitive model inputs caused the median number of 2SW females to deviate by less than the percent change from the base (e.g., if the base input was multiplied by two, an insensitive input would cause less than a 100% difference). Several sensitivities (hatchery stocking, stocking distribution, straying, proportion dying, proportion remaining downstream, and marine survival using mean and median-based estimates with different time series) could not be classified using this system because the base model was changed in a manner that did not allow for direct quantitative comparison.

A few of the model inputs were highly sensitive, but the majority of the inputs were insensitive. Marine survival and downstream dam survival were highly sensitive in all Base Case and Recovery scenarios, the number of smolts stocked was highly sensitive in all Base Case scenarios, and the hatchery discount was highly sensitive when this input was decreased from the base value in Base Case and Recovery scenarios. The sensitivity of the model to these inputs means a demographic response could reasonably be expected if one of these dynamics changed due to management intervention (e.g., downstream dam passage survival rate) or a shift in the natural range (e.g., marine survival). Other model inputs that could be compared quantitatively were insensitive.

The sensitivities that could not be classified as highly sensitive, linearly sensitive, or insensitive were compared to each other (Table 6.23.1). The percent differences in the sensitivities for hatchery stocking, stocking distribution, and marine survival using mean and median-based estimates with different time were relatively high compared to percent differences of straying, the proportion dying, and the proportion remaining downstream.

7 CONCLUSIONS

Marine survival and downstream dam passage survival rates had the greatest impact of all DIA Model inputs. These findings are consistent with expectations expressed by the NRC (2004), who reviewed the status of Atlantic salmon in Maine. The model was highly sensitive to the estimates of marine survival and downstream dam passage survival in all Base Case and Recovery scenarios. Model results showed that the population of Atlantic salmon in the Penobscot River watershed declined when marine survival was low and all 15 hydroelectric dams were present in the watershed. Persistence of the modeled Atlantic salmon population at low levels was sustained by the stocking of hatchery-reared smolts. When marine survival and freshwater survival rates were increased, the abundance and distribution of adult Atlantic salmon abundance increased even when no smolts were stocked.

The locations of dams also had a large affect on the modeled population of Atlantic salmon. Mainstem dams on the Penobscot River were more detrimental to Atlantic salmon than dams in tributaries. Adult abundance and distribution throughout the watershed were higher in scenarios with mainstem dams turned off and dams in tributaries turned on than in scenarios with mainstem dams turned on and dams in tributaries turned off, even though the former scenario has fewer dams turned off (i.e., 100% survival during fish passage) in the model. This result likely occurred because mainstem dams impacted access to the rest of the watershed.

Several model inputs were difficult to estimate due to insufficient data from the Penobscot River. Even though Atlantic salmon are well-studied, especially Penobscot River Atlantic salmon, more data from this population would be beneficial for input value estimates. Marine survival, the hatchery discount, and indirect latent mortality were three such inputs, and the possibility exists that the estimates of mortality incorporated by these three inputs overlap. Marine survival estimates for 2SW females may include a significant portion of the mortality accounted for in the discount of hatchery smolt survival and the indirect latent mortality of fish that passed multiple dams. One benefit of the DIA Model is the flexibility to change input parameters. The hatchery discount and indirect latent mortality rates could be easily lowered if future studies suggest that this is appropriate.

Model inputs that could be improved include egg to smolt survival rate, marine survival distribution, and flow distribution for downstream dam passage. Egg to smolt survival rate was estimated using values from the literature, but a distribution developed from a time series of Penobscot River monitoring data would be preferable. A monitoring program of egg deposition by reach could be initiated to provide data for this model input. The marine survival distribution was corrected to attempt to represent a 'true' marine survival distribution for the Penobscot River, but a time series of post-smolt abundance at Verona and number of adult returns at

Verona would be better. The flow allocation provided by Alden (Amaral et al. 2012) was based on their best estimate of the probability of flow at certain levels, but the flow patterns in real life may or may not mirror the Alden estimates. A long, continuous time series of flow data from gauges at each dam would be ideal for this data input. The model inputs are considered the best available information for each input. To continuously improve model performance and realism, inputs should be updated as new information becomes available.

One peculiar model result that may have been caused by model input values was the large decrease in adult abundance, adult distribution, and the number of smolts killed from generation 1 to generation 2 in the Base Case model runs. A possible reason for this decrease could be because the numbers of adults in generations 1 and 2 were not counted at the same point in their life stage. The starting population size for generation 1 in all model runs was the mean annual number of 2SW female spawners at Veazie Dam during 2002–2011. The number of adults in generation 2 (and subsequent generations) was the total number of adults throughout the Penobscot River watershed that reached a PU and spawned after accounting for homing, straying, and upstream dam passage dynamics. These dynamics could have resulted in increased mortality of adult spawners in generation 2 and subsequent smolts, which was not reflected in the number of adults used to seed the model in generation 1. The seeding locations in the model in generation 1 also resulted in a more widely dispersed population through the drainage than normally occurs, resulting in longer migrations because a proportion of the adults, and subsequently smolts, were located farther from the mouth of the Penobscot River and, therefore, had to pass more dams to reach the ocean and home to their natal PU. Migrating longer distances and over multiple dams increased the mortality to which fish were subjected. Although the decrease from generation 1 to generation 2 may not be realistic, the DIA Model is not meant to be a predictive tool but should instead be used to evaluate the relative changes in the Penobscot River population of Atlantic salmon as input values are modified.

The DIA Model can be updated and developed further as new information becomes available. To date, the DIA Model has been used to evaluate the impacts of several hydroelectric dams on the Atlantic salmon population in the Penobscot River (NMFS 2012), and other analyses are possible. For instance, the DIA Model can be used to estimate which of the 15 modeled hydroelectric dams has the most impact on Atlantic salmon productivity, to describe the relative impacts of dams versus marine survival on the Atlantic salmon population at the southern end of the species range, and to address a variety of ecologically-related hypotheses associated with Atlantic salmon, dams, and fresh- and saltwater survival.

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Table 1.1. Chronology of Penobscot Dam Impact Analysis (DIA) Model.

Date	Meeting Content
September 2009	Kick-off meeting with NEFSC and NERO staff in Woods Hole, MA.
November 2009	Workgroup meeting in Orono, ME to discuss development of DIA Model.
December 2009	Workgroup meeting in Woods Hole, MA to discuss development of DIA Model.
December 2009	Workgroup conference call.
January 2010	Workgroup conference call.
February 2010	Workgroup meeting in Portland, ME to discuss DIA Model development.
March 2010	Workgroup conference call.
March 2010	Development of Survival Distribution Statement of Work.
April 2010	Workgroup conference call.
April 2010	Survival Distribution Request for Proposals issued by NERO.
July 2010	Workgroup meeting in Woods Hole, MA to review Survival Distribution proposals.
September 2010	Survival Distribution project awarded to Alden Research Laboratory, Inc.
October 2010	Workgroup meeting in Woods Hole, MA.
October 2010	Kick-off meeting with Alden Research Laboratory, Inc. in Woods Hole, MA.
October 2010	Workgroup conference call.
December 2010	Phase I check in conference call with Alden Research Laboratory, Inc.
December 2010	Expert Panel meeting in Orono, ME.
December 2010	Workgroup conference call.
January 2011	Model introduction meeting with U.S. Fish and Wildlife Service in Orono, ME.
January 2011	Phase I meeting with Alden Research Laboratory, Inc. in Orono, ME.
February 2011	Alden Research Laboratory, Inc. submits draft Phase I report.
February 2011	Conference call with Alden Research Laboratory, Inc.
March 2011	Workgroup conference call.
April 2011	Workgroup conference call.
May 2011	Workgroup conference call.
June 2011	Work group meeting in Gloucester, MA.
June 2011	Phase II meeting in Gloucester, MA with Alden Research Laboratory, Inc.
July 2011	Workgroup conference call.
August 2011	Workgroup conference call.
September 2011	Alden Research Laboratory, Inc. submits draft Phase II report.
September 2011	Workgroup conference call.
November 2011	Workgroup conference call.
December 2011	Progress meeting in Orono, ME with Alden Research Laboratory, Inc.
February 2012	Workgroup conference call.
March 2012	Workgroup conference call.
April 2012	Workgroup conference call.
May 2012	Workgroup conference call.
May 2012	Workgroup meeting in Orono, ME.
June 2012	Northeast Fisheries Science Center produces final model outputs.
June 2012	Workgroup conference call.
July 2012	Workgroup conference call.
August 2012	Workgroup conference call.
September 2012	Alden Research Laboratory, Inc. submits Phase III final report.

Table 3.1.1. Descriptions of production unit (PU) boundaries in the Penobscot River watershed with corresponding metrics of total network length, longest segment length, and partial segment length used within the Dam Impact Analysis Model. Total network length represents the sum of all perennial stream kilometers within a particular PU. Longest segment length represents the longest straight path distance that a fish could swim in a given PU. All smolts were subjected to natural mortality for half the distance of the longest segment length when migrating through their natal PU. Partial segment length corresponds to the distance that smolts would be subjected to natural mortality when traversing from one PU to another (i.e., not starting from their natal PU). Partial segment lengths in parentheses indicate situations where smolts can enter a PU from two different locations and, therefore, could be subjected to different levels of natural mortality based on different distances travelled.

PU	Downstream Boundaries	Upstream Boundaries	Total Network Length (km)	Longest Segment Length (km)	Partial Segment Length (km)
1	Medway	West Branch headwaters	4,358	309	NA
2	Mattaceunk	East Branch headwaters, Medway	1,842	139	13
3	West Enfield	Mattawamkeag River headwaters, Mattaceunk	3,068	208	50
4	Howland	Pleasant River headwaters, Milo, Brown's Mills	873	125	42 (65)
5	Brown's Mills	Dover Upper	25	10	10
6	Dover Upper	Piscataquis River headwaters	906	78	NA
7	Milo	Sebec	46	12	12
8	Sebec	Sebec River headwaters	675	59	NA
9	Stillwater, Milford	Howland Dam, West Enfield Dam, Lowell Dam	1,147	65	54
10	Great Works	Milford	2	2	2
11	Orono	Stillwater	7	4	4
12	Veazie	Great Works, Orono	156	49	7
13	Frankfort	Marsh Stream headwaters	437	54	NA
14	Verona Island	Kenduskeag Stream headwaters, Frankfort, Veazie	2,575	121	10 (41)
15	Lowell	Passadumkeag River headwaters	207	49	NA

Table 3.1.2. Number of Atlantic salmon habitat units available within the Penobscot River, the number of habitat units accessible to Atlantic salmon and used within the DIA Model, the proportional production potential (i.e., proportion of the total habitat units used) used for seeding adults into the model, and the production potential cap (i.e., habitat units used multiplied by ten) used for limiting the number of smolts produced to a maximum projected productivity level for each production unit.

PU	Habitat Units Available (in 100 m^2)	Habitat Units Used (in 100 m^2)	Proportional Production Potential	Production Potential Cap
1	84,287	0	0	0
2	44,250	44,250	0.2053	442,505
3	56,450	56,450	0.2619	564,495
4	42,849	42,849	0.1988	428,486
5	284	284	0.0013	2,839
6	21,782	21,782	0.1011	217,819
7	1,733	0	0	0
8	13,922	0	0	0
9	17,860	17,860	0.0829	178,599
10	4	4	0.0001	40
11	940	0	0	0
12	5,925	5,925	0.0275	59,247
13	4,801	4,801	0.0223	48,013
14	17,727	17,727	0.0822	177,271
15	3,601	3,601	0.0167	36,010

Table 3.3.1. Egg to fry survival values from the literature (post-Legault 2004), assuming 8 months for standardization of survival rates. None of these entries were used to further describe egg to fry survival. See Legault (2004) for additional references considered.

Author	Region	Origin	# Years of Data	Duration (months)	Reported Percent Survival Mean	Reported Percent Survival Lower	Reported Percent Survival Upper	Converted Percent Survival Mean	Converted Percent Survival Lower	Converted Percent Survival Upper
Dumas & Marty 2006	France	hatchery	1	3	32.30	NA	NA	4.91	NA	NA
Dumas & Marty 2006	France	hatchery	1	3	83.60	NA	NA	62.02	NA	NA
Dumas & Marty 2006	France	hatchery	1	3	73.90	NA	NA	44.64	NA	NA
Dumas & Marty 2006	France	hatchery	1	3				37.19	4.91	62.02
Flanagan et al. 2008	New Brunswick	hatchery	2	7	1.33	0.00	4.00	0.72	0.00	2.53
Flanagan et al. 2008	New Brunswick	hatchery	2	7	12.50	3.00	48.00	9.29	1.82	43.22

Table 3.3.2. Fry to parr0+ survival values from the literature (post-Legault 2004), assuming 2 months for standardization of survival rates. Highlighted entries were used to describe fry to parr0+ survival. See Legault (2004) for additional references considered.

Author	Region	Origin	# Years of Data	Duration (months)	Reported Percent Survival Mean	Reported Percent Survival Lower	Reported Percent Survival Upper	Converted Percent Survival Mean	Converted Percent Survival Lower	Converted Percent Survival Upper
Aprahamian et al. 2004	England	hatchery		3.5	23.42	7.80	41.30	43.63	23.28	60.33
Aprahamian et al. 2004	England	hatchery	1	3.5	22.50	NA	NA	42.64	NA	NA
Aprahamian et al. 2004	England	hatchery		3.5	14.62	1.20	26.20	33.33	7.99	46.52
Aprahamian et al. 2004	England	hatchery	2	3.5	30.15	27.40	32.90	50.40	47.72	52.98
Aprahamian et al. 2004, average	England	hatchery	3	3.5	20.54	1.20	41.30	40.48	7.99	60.33
Coghlan & Ringler 2004	New York	hatchery	1	1	7.00	NA	NA	0.49	NA	NA
Coghlan & Ringler 2004	New York	hatchery	1	2	2.00	NA	8.00	2.00	NA	8.00
Coghlan et al. 2007	New York	hatchery	1	2	NA	1.00	66.00	NA	1.00	66.00
Raffenberg & Parrish 2003	Vermont	hatchery	unk	unk	NA	2.00	50.00	NA	2.00	50.00
Millard 2005	New York	hatchery	1	3.5	24.00	4.00	38.00	44.24	15.89	57.53
Millard 2005	New York	hatchery	1	3.5	6.00	1.00	22.00	20.04	7.20	42.10
Millard 2005	New York	hatchery	1	3.5	37.00	28.00	63.00	56.66	48.32	76.80
Millard 2005, average	New York	hatchery	1	3.5				40.31	7.20	76.80

Table 3.3.3. Parr0+ to parr1+ survival values from the literature (post-Legault 2004), assuming 12 months for standardization of survival rates. Highlighted entries were used to describe parr0+ to parr1+ survival. See Legault (2004) for additional references considered.

			# Years	Duration	Reported Percent Survival			Converted Percent Survival		
Author	**Region**	**Origin**	**of Data**	**(months)**	**Mean**	**Lower**	**Upper**	**Mean**	**Lower**	**Upper**
Letcher et al. 2002	Massachusetts	hatchery	1	8	0.56	NA	NA	0.04	NA	NA
Letcher et al. 2002	Massachusetts	hatchery	1	5	0.71	NA	NA	0.00	NA	NA
Aprahamian et al. 2004	England	hatchery	2	12.67	26.32	19.90	34.10	28.25	21.67	36.10

Table 3.3.4. Parr1+ to smolt survival values from the literature (post-Legault 2004), assuming 9 months for standardization of survival rates. This entry was not used to further describe parr1+ to smolt survival. See Legault (2004) for additional references considered.

			# Years	Duration	Reported Percent Survival			Converted Percent Survival		
Author	**Region**	**Origin**	**of Data**	**(months)**	**Mean**	**Lower**	**Upper**	**Mean**	**Lower**	**Upper**
Letcher et al. 2002	Massachusetts	hatchery	2		0.34	0.21	0.46	0.10	NA	NA

Table 3.3.5. Summary of life stage survival rates used to develop the egg to smolt survival distribution.

Life Stage		Survival (%)		
Begin	**End**	**Min**	**Max**	**Mean**
Egg	Fry	15	35	25.0
Fry	Parr 0+	31	60	45.5
Parr 0+	Parr 1+	13	56	34.5
Parr 1+	Smolt	17	50	33.5
Egg	Smolt	0.10	5.88	1.31

Table 3.4.1. Mean percentage and number of hatchery-reared smolts stocked into each production unit (PU) from 2003-2012.

PU	Smolts Stocked (%)	Number of Smolts Stocked
1	0	0
2	0	0
3	17.2	94,628
4	34.6	190,076
5	0	0
6	0	0
7	0	0
8	0	0
9	31.7	174,495
10	0	0
11	0	0
12	14.2	78,109
13	0	0
14	2.3	12,692
15	0	0
Total	100	550,000

Table 3.6.1.1. Differences in the mean, minimum, and maximum smolt survival between updated estimates and estimates used for analyses in this document for four hydroelectric dams. Smolt survival estimate differences are due to an update in the flow allocation to the Stillwater Branch of the Penobscot River.

	Smolt Survival		
Dam	**Mean**	**Minimum**	**Maximum**
Great Works	-0.004	0	-0.002
Milford	0	0	0
Orono	-0.006	-0.006	-0.002
Stillwater	-0.001	-0.024	0

Table 3.6.2.1. Correlation analysis results of mean annual flow data during 1935 – 2010 at five monitoring sites (identified by their seven digit US geological Survey gauge number) within the Penobscot River drainage. Only April – June flow data was used to correspond to the timing of the Atlantic salmon smolt migration in the Penobscot River.

	1029500	**1030500**	**1031500**	**1034500**	**1034000**
1029500	1.000	0.918	0.831	0.959	0.882
1030500	0.918	1.000	0.834	0.931	0.869
1031500	0.831	0.834	1.000	0.888	0.981
1034500	0.959	0.931	0.888	1.000	0.922
1034000	0.882	0.869	0.981	0.922	1.000

Table 3.8.1. Survival rates of wild- and hatchery-origin fish and the ratio of wild versus hatchery survival from the literature. Highlighted entries were used to describe the hatchery discount. Multiple survival rates for one study indicate results from different parts of study design (e.g., multiple rivers or ages, different recapture location).

Author	Region	Start	End	Wild Survival Rate	Hatchery Survival Rate	Wild:Hatchery Survival Ratio
Crozier and Kennedy 1993	Northern Ireland	1973	1990	0.0820	0.0100	8.2
Crozier and Kennedy 1993	Northern Ireland	1973	1990	0.0820	0.0230	3.6
Crozier and Kennedy 1993*	Northern Ireland	1973	1990	0.0110	0.0010	7.3
Crozier and Kennedy 1993	Northern Ireland	1983	1990	0.3250	0.0720	4.5
Crozier and Kennedy 1993	Northern Ireland	1983	1990	0.3250	0.1280	2.5
De Leaniz et al. 1989	Spain	1985	1988	NA	NA	NA
De Leaniz et al. 1989	Spain	1985	1988	NA	NA	NA
Einum and Fleming 2001	Multiple	NA	NA	NA	NA	NA
Fleming et al. 1997	Norway	NA	NA	NA	NA	NA
Jokikokko et al. 2006	Finland	1986	1992	0.0843	0.0580	1.5
Jokikokko et al. 2006	Finland	1986	1992	0.0843	0.0375	2.2
Jokikokko et al. 2006	Finland	1986	1992	NA	NA	1.0
Jokikokko et al. 2006	Finland	1986	1992	NA	NA	2.1
Jokikokko et al. 2006	Finland	1986	1992	NA	NA	2.1
Jokikokko et al. 2006	Finland	1986	1992	NA	NA	1.0
Jokikokko et al. 2006	Finland	1986	1992	NA	NA	3.5
Jokikokko et al. 2006	Finland	1986	1992	NA	NA	3.4
Jonsson 1997	Multiple	NA	NA	NA	NA	2.0
Jonsson and Fleming 1993	Multiple	NA	NA	0.0690	0.0280	2.5
Jonsson and Fleming 1993	Multiple	NA	NA	0.0690	0.0070	9.9
Jonsson and Fleming 1993	Multiple	NA	NA	0.0690	0.0320	2.2
Jonsson et al. 1991	Norway	1975	1989	0.0580	0.0320	1.8
Jonsson et al. 1991	Norway	1975	1989	0.0290	0.0120	2.4
Jonsson et al. 1991	Norway	1975	1989	0.0020	0.0020	1.0

Author	Region	Start	End	Wild Survival Rate	Hatchery Survival Rate	Wild:Hatchery Survival Ratio
Jonsson et al. 2003	Norway	1981	1999	0.0710	0.0290	2.4
Jonsson et al. 2003	Norway	1981	1999	0.0710	0.0270	2.6
Jonsson et al. 2003	Norway	1981	1999	0.0180	0.0040	4.5
Jonsson et al. 2003	Norway	1981	1999	0.0180	0.0020	9.0
Jonsson et al. 2003	Norway	1981	1999	0.0890	0.0330	2.7
Jonsson et al. 2003	Norway	1981	1999	0.0890	0.0290	3.1
Jutila et al. 2003	Finland	1991	1993	0.1043	0.0713	1.5
Kallio-Nyberg et al. 2004	Finland	1972	1998	0.3300	0.2600	1.3
Kallio-Nyberg et al. 2011	Finland	1986	2007	0.0379	0.0208	1.8
Kallio-Nyberg et al. 2011	Finland	1986	2007	0.0379	0.0182	2.1
Peyronnet et al. 2008	Ireland	1980	2000	0.1598	0.0569	2.8
Peyronnet et al. 2008	Ireland	1980	2000	0.2089	0.0989	2.1
Peyronnet et al. 2008	Ireland	1980	2000	0.1107	0.0434	2.6
Salminen et al. 2007	Finland	1988	1999	NA	NA	NA
Saloniemi et al. 2004	Finland	1991	1993	0.1290	0.1095	1.2

*Reported wild:hatchery survival ratio was different than calculated value from wild and hatchery survival rates. Reported ratio was used instead of calculated value.

Table 3.10.1. Homing rates and straying patterns by production unit (PU) for the Dam Impact Analysis Model, based on an assessment of previous behavioral studies, fishway trap data, Expert Panel recommendations, and local knowledge. The Natal PU (rows) identifies where a fish was reared and the Final Destination PU (columns) identifies where a fish will attempt to migrate. Homing rates are bolded and listed in the diagonal row. Grey cells indicate no straying from that Natal PU into the Final Destination PU.

Natal PU	Final Destination PU 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**0.900**	0.080	0.009	0.005	0	0	0	0	0.005	0	0	0	0	0	0.001
2	0.070	**0.900**	0.009	0.010	0	0	0	0	0.010	0	0	0	0	0	0.001
3	0	0.010	**0.900**	0.050	0.010	0.010	0	0	0.010	0	0	0	0	0	0.010
4	0	0	0.010	**0.900**	0.001	0.049	0.020	0.020	0	0	0	0	0	0	0
5	0	0	0	0.010	**0.900**	0.080	0.004	0.004	0.002	0	0	0	0	0	0
6	0	0	0	0.080	0.01	**0.900**	0.005	0.005	0	0	0	0	0	0	0
7	0	0	0	0.020	0	0	**0.900**	0.080	0	0	0	0	0	0	0
8	0	0	0	0.020	0	0	0.080	**0.900**	0	0	0	0	0	0	0
9	0	0.010	0.040	0.080	0	0	0	0	**0.700**	0.050	0.010	0.010	0	0	0.100
10	0.020	0.020	0.060	0.060	0	0	0	0	0.100	**0.700**	0.010	0.010	0.010	0	0.010
11	0.010	0.020	0.040	0.020	0	0	0	0	0.100	0.050	**0.700**	0.020	0.020	0.010	0.010
12	0	0	0.020	0.020	0	0	0	0	0.200	0.020	0.020	**0.700**	0.010	0.010	0
13	0	0	0.040	0.020	0	0	0	0	0.030	0	0	0	**0.900**	0.010	0
14	0	0	0.030	0.060	0	0	0	0	0.080	0.020	0.010	0.100	0	**0.700**	0
15	0	0.010	0.010	0	0	0	0	0	0.060	0.010	0.010	0	0	0	**0.900**

Table 3.11.1.1. Upstream passage for 15 hydroelectric dams included in the Dam Impact Analysis Model, including the mean, standard deviation, minimum, and maximum values.

Hydroelectric Dam	Mean	Standard Deviation	Minimum	Maximum
Medway	0	0	0	0
Mattaceunk	0.9200	0.0325	0.8875	0.9525
West Enfield	0.9200	0.0325	0.8875	0.9525
Dover Upper	0.9200	0.0325	0.8875	0.9525
Brown's Mills	0.9200	0.0325	0.8875	0.9525
Sebec	0	0	0	0
Milo	0	0	0	0
Howland	0.9200	0.0325	0.8875	0.9525
Lowell	0.9200	0.0325	0.8875	0.9525
Milford	0.8993	0.0958	0.6670	1.0000
Stillwater	0.9200	0.0325	0.8875	0.9525
Great Works	0.6730	0.2783	0.1190	0.9440
Orono	0	0	0	0
Veazie	0.6485	0.1907	0.4210	0.9840
Frankfort	0.9200	0.0325	0.8875	0.9525

Table 3.12.1. Details regarding the fate of adult spawners that do not successful migrate above each of the 15 hydroelectric facilities modeled within the Dam Impact Analysis Model. Unsuccessful fish will: 1) die, 2) return to the sea and not spawn or 3) will be redirected to a downstream PU according to the proportions detailed under the Destination PU.

				Destination PU														
Dam Failed to Pass	**Proportion Dying**	**Proportion Returning to Sea**	**Proportion Remaining Downstream**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Medway	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mattaceunk	0.01	0	0.99	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
West Enfield	0.02	0	0.98	0	0	0	0.6	0	0	0	0	0.4	0	0	0	0	0	0
Upper Dover	0.02	0	0.98	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Brown's Mills	0.02	0	0.98	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Sebec	0	0	1	0	0	0	0.1	0	0	0.9	0	0	0	0	0	0	0	0
Milo	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Howland	0.02	0	0.98	0	0	0.4	0	0	0	0	0	0.6	0	0	0	0	0	0
Lowell	0.01	0	0.99	0	0	0.01	0.01	0	0	0	0	0.98	0	0	0	0	0	0
Milford	0.01	0	0.99	0	0	0	0	0	0	0	0	0	0	0	0.8	0	0.2	0
Stillwater	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Great Works	0.02	0.1	0.88	0	0	0	0	0	0	0	0	0	0	0	0.8	0	0.2	0
Orono	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Veazie	0.03	0.15	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.9	0
Frankfort	0.02	0.1	0.88	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.9	0

Table 3.12.2. Justification used for determining the percentages of Atlantic salmon adult spawners that die or return to sea and do not spawn for each of the 15 hydroelectric facilities modeled within the Dam Impact Analysis Model. The percentages are applied to fish that do not successfully pass each facility. The remaining fish are redirected to a downstream PU to spawn.

Dam	Total Dead (%)	Justification	Total Out to Sea (%)	Justification
Medway	0	no passage	0	
Mattaceunk	1	baseline	0	
West Enfield	2	baseline, high percentage of fall back	0	
Dover Upper	2	baseline, poaching	0	
Brown's Mills	2	baseline, stalling, and lack of thermal refugia	0	
Sebec	0	no passage	0	
Milo	0	no passage	0	
Howland	2	baseline, high percentage of fall back	0	
Lowell	1	baseline	0	
Stillwater	0	no passage	0	
Milford	1	baseline	0	
Great Works	2	baseline, stalling, and lack of thermal refugia	10	proximity to ocean
Orono	0	no passage	0	
Veazie	3	baseline, seal predation, handling	15	proximity to ocean, handling
Frankfort	2	baseline, seal predation	10	proximity to ocean

Table 4.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the Base Case and Recovery scenarios.

	Base Case			Recovery		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	587	587	587	587	587	587
2	51	124	329	525	1,057	2,091
3	51	122	323	909	1,891	3,925
4	51	119	344	1,242	2,483	4,813
5	52	118	324	1,408	2,730	5,286
6	51	120	329	1,496	2,859	5,454
7	50	119	330	1,478	2,924	5,508
8	52	121	327	1,538	2,894	5,528
9	51	121	329	1,518	2,894	5,607
10	52	119	324	1,531	2,941	5,660

Table 4.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 under the Base Case and Recovery scenarios.

	Base Case			Recovery		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.52	1.00	0.96	0.96	1.00
3	0.49	0.50	1.00	0.98	0.98	1.00
4	0.48	0.49	1.00	0.99	0.99	1.00
5	0.48	0.48	1.00	0.99	0.99	1.00
6	0.48	0.49	1.00	0.99	0.99	1.00
7	0.48	0.49	1.00	0.99	0.99	1.00
8	0.48	0.48	1.00	0.99	0.99	1.00
9	0.48	0.49	1.00	0.99	0.99	1.00
10	0.48	0.49	1.00	0.99	0.99	1.00

Table 4.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the Base Case and Recovery scenarios.

	Base Case			Recovery		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	165,841	178,926	197,361	181,207	198,544	219,982
2	150,923	162,374	178,497	166,953	187,430	219,594
3	150,879	161,515	176,614	171,055	192,816	228,268
4	150,632	162,103	178,765	174,162	198,402	236,743
5	150,815	161,933	177,300	175,577	201,414	240,414
6	150,898	161,633	178,287	176,644	200,124	238,869
7	150,609	161,468	177,244	175,734	200,952	242,706
8	151,036	162,202	178,661	176,368	201,284	239,874
9	150,745	161,823	177,234	176,467	202,536	242,691
10	150,916	161,774	177,611	176,594	201,486	243,378

Table 4.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the Base Case and Recovery scenarios.

	Base Case			Recovery		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.10	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12

Table 5.1. Hydroelectric dams turned on or off in five Dam Impact Analysis Model scenarios. The “X” indicates the dam is turned off (i.e., 100% survival). In the two columns furthest to the right, the “X” also indicates whether a dam is located on the mainstem of the Penobscot River or on a tributary to the Penobscot River.

Dam	Dams on	PRRP	Dams off	Mainstem off, Tributaries on	Mainstem on, Tributaries off
Medway					*
Mattaceunk			X	X	
West Enfield			X	X	
Dover Upper			X		X
Brown's Mills			X		X
Sebec			X		X
Milo			X		X
Howland		X	X		X
Lowell			X		X
Milford			X	X	
Stillwater			X		X
Great Works		X	X	X	
Orono			X		X
Veazie		X	X	X	
Frankfort			X		X

*Medway Dam is considered a tributary dam, but was turned on due to the lack of of downstream and upstream passage.

Table 5.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 1 - Dams on			Part 1 - PRRP			Part 1 - Dams off			Part 1 - Main off/Trib on			Part 1 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	51	124	339	96	304	703	170	428	936	130	363	816	61	153	408
3	52	121	330	85	300	718	164	445	990	120	362	818	60	145	408
4	51	120	337	86	308	704	165	447	992	118	363	842	60	147	412
5	50	118	322	92	301	699	166	452	1,034	124	358	834	62	148	408
6	51	120	329	90	298	705	166	450	1,008	114	359	838	61	149	400
7	50	120	321	93	285	709	161	451	1,022	121	354	826	59	148	406
8	51	122	326	93	300	699	171	437	1,007	119	355	831	59	152	402
9	50	118	333	88	305	707	172	452	990	121	348	823	62	152	396
10	50	122	324	89	298	703	173	453	994	118	360	840	62	147	399

Table 5.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 1 - Dams on			Part 1 - PRRP			Part 1 - Dams off			Part 1 - Main off/Trib on			Part 1 - Main on/Trib off		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.52	1.00	0.88	0.88	1.00	0.94	0.94	1.00	0.91	0.92	1.00	0.59	0.59	1.00
3	0.48	0.49	1.00	0.87	0.87	1.00	0.93	0.93	1.00	0.89	0.90	1.00	0.54	0.55	1.00
4	0.48	0.48	1.00	0.87	0.87	1.00	0.93	0.93	1.00	0.90	0.90	1.00	0.54	0.55	1.00
5	0.48	0.48	1.00	0.87	0.88	1.00	0.93	0.93	1.00	0.90	0.90	1.00	0.54	0.55	1.00
6	0.48	0.49	1.00	0.87	0.87	1.00	0.93	0.93	1.00	0.90	0.90	1.00	0.54	0.55	1.00
7	0.48	0.49	1.00	0.87	0.88	1.00	0.93	0.93	1.00	0.90	0.90	1.00	0.53	0.54	1.00
8	0.48	0.49	1.00	0.87	0.88	1.00	0.93	0.93	1.00	0.90	0.90	1.00	0.54	0.54	1.00
9	0.48	0.48	1.00	0.87	0.87	1.00	0.93	0.93	1.00	0.89	0.90	1.00	0.54	0.55	1.00
10	0.48	0.48	1.00	0.87	0.88	1.00	0.93	0.93	1.00	0.90	0.90	1.00	0.54	0.55	1.00

Table 5.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 1 - Dams on			Part 1 - PRRP			Part 1 - Dams off			Part 1 - Main off/Trib on			Part 1 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	166,139	178,671	196,125	58,756	61,305	64,826	0	0	0	32,922	35,101	37,012	136,002	150,516	171,652
2	150,702	161,952	178,509	52,788	54,766	59,175	0	0	0	30,877	33,196	35,867	124,653	138,305	156,493
3	150,499	161,394	176,913	52,716	54,630	58,793	0	0	0	30,872	33,158	35,719	123,521	136,236	155,134
4	150,490	161,768	177,536	52,734	54,649	58,595	0	0	0	30,980	33,230	35,866	124,208	137,030	155,571
5	150,368	160,911	177,378	52,670	54,551	58,750	0	0	0	30,912	33,192	35,805	123,645	136,527	156,652
6	150,380	161,464	177,434	52,703	54,477	58,644	0	0	0	30,756	33,159	35,907	124,305	137,043	156,153
7	150,576	161,867	178,069	52,744	54,562	58,694	0	0	0	30,817	33,165	35,811	123,541	136,922	155,274
8	150,547	161,541	177,444	52,735	54,534	58,584	0	0	0	30,909	33,250	35,881	123,821	137,158	155,962
9	150,676	161,682	178,163	52,721	54,634	58,567	0	0	0	30,891	33,226	35,844	123,906	136,957	156,378
10	150,835	162,048	177,507	52,716	54,580	58,658	0	0	0	30,910	33,224	35,891	123,929	137,349	157,101

Table 5.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 1 - Dams on			Part 1 - PRRP			Part 1 - Dams off			Part 1 - Main off/Trib on			Part 1 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.03	0.03	0.04	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
2	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
3	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
4	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
5	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
6	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
7	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
8	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
9	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10
10	0.10	0.11	0.12	0.03	0.03	0.03	0.00	0.00	0.00	0.02	0.02	0.02	0.08	0.09	0.10

Table 5.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 2 - Dams on			Part 2 - PRRP			Part 2 - Dams off			Part 2 - Main off/Trib on			Part 2 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	22	42	79	39	73	141	57	108	208	49	91	178	27	51	101
3	1	5	14	4	9	24	9	20	48	6	14	37	2	7	18
4	0	1	2	0	0	4	0	3	10	0	2	7	0	1	2
5	0	0	0	0	0	0	0	0	2	0	0	1	0	0	1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 2 - Dams on			Part 2 - PRRP			Part 2 - Dams off			Part 2 - Main off/Trib on			Part 2 - Main on/Trib off		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.98	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	1.00
3	0.25	0.28	0.93	0.83	0.90	0.81	0.95	0.94	0.82	0.96	0.89	0.83	0.28	0.38	0.93
4	0.03	0.05	0.59	0.29	0.46	0.39	0.63	0.61	0.38	0.63	0.44	0.40	0.03	0.07	0.62
5	0.00	0.01	0.23	0.05	0.14	0.15	0.27	0.27	0.13	0.28	0.13	0.13	0.00	0.01	0.26
6	0.00	0.00	0.07	0.01	0.03	0.04	0.09	0.10	0.03	0.10	0.03	0.04	0.00	0.00	0.08
7	0.00	0.00	0.02	0.00	0.00	0.01	0.03	0.03	0.01	0.03	0.01	0.01	0.00	0.00	0.02
8	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 2 - Dams on			Part 2 - PRRP			Part 2 - Dams off			Part 2 - Main off/Trib on			Part 2 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	13,269	18,003	24,447	6,767	9,215	12,343	0	0	0	2,939	3,983	5,365	10,833	14,846	19,994
2	256	533	1,106	427	863	1,768	0	0	0	249	512	1,043	273	560	1,170
3	0	16	88	25	91	246	0	0	0	21	56	192	0	21	104
4	0	0	0	0	0	26	0	0	0	0	6	28	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

	Part 2 - Dams on			Part 2 - PRRP			Part 2 - Dams off			Part 2 - Main off/Trib on			Part 2 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.05	0.05	0.06	0.00	0.00	0.00	0.02	0.02	0.02	0.07	0.08	0.09
2	0.10	0.11	0.12	0.04	0.05	0.05	0.00	0.00	0.00	0.02	0.02	0.02	0.07	0.08	0.09
3	0.00	0.09	0.10	0.03	0.04	0.04	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.07	0.08
4	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5.3.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

	Part 3 - Dams on			Part 3 - PRRP			Part 3 - Dams off			Part 3 - Main off/Trib on			Part 3 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	182	340	642	311	590	1,116	469	866	1,668	399	741	1,419	225	410	801
3	160	368	904	273	667	1,643	544	1,310	3,276	404	975	2,391	193	492	1,181
4	169	486	1,285	279	789	2,322	662	1,953	5,893	446	1,312	3,830	212	612	1,627
5	186	611	1,614	270	974	2,950	833	2,879	9,216	479	1,758	5,685	245	780	2,045
6	215	731	1,880	301	1,122	3,769	1,104	4,096	11,976	563	2,228	7,621	287	936	2,338
7	253	831	2,061	336	1,372	4,200	1,432	5,375	14,274	664	2,890	9,452	320	1,040	2,500
8	274	936	2,228	374	1,552	4,774	1,752	6,622	16,559	794	3,529	10,680	364	1,141	2,632
9	302	985	2,412	394	1,692	5,095	2,260	7,557	18,079	915	4,065	11,272	402	1,176	2,749
10	313	1,055	2,434	454	1,811	5,348	2,603	8,385	19,219	1,033	4,443	11,860	428	1,252	2,752

Table 5.3.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

	Part 3 - Dams on			Part 3 - PRRP			Part 3 - Dams off			Part 3 - Main off/Trib on			Part 3 - Main on/Trib off		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
4	0.95	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.98	1.00
5	0.94	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.98	1.00
6	0.93	0.96	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	1.00
7	0.94	0.96	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	1.00
8	0.95	0.97	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	1.00
9	0.94	0.96	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	1.00
10	0.95	0.96	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.98	1.00

Table 5.3.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

	Part 3 - Dams on			Part 3 - PRRP			Part 3 - Dams off			Part 3 - Main off/Trib on			Part 3 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	26,504	36,130	48,697	13,508	18,406	24,896	0	0	0	5,895	7,920	10,756	21,632	29,897	40,323
2	3,953	8,195	16,852	6,723	13,466	28,150	0	0	0	4,070	8,077	16,434	4,111	8,766	17,963
3	1,832	4,495	11,517	4,683	11,721	31,452	0	0	0	3,838	9,813	24,375	1,925	5,068	12,511
4	1,541	4,581	13,301	3,881	11,727	37,850	0	0	0	3,823	12,218	36,980	1,625	4,972	13,356
5	1,605	5,488	15,559	3,535	13,111	45,204	0	0	0	4,444	15,956	53,936	1,685	5,522	15,149
6	1,851	6,567	17,330	3,610	14,494	54,940	0	0	0	5,147	20,150	71,674	1,873	6,632	16,433
7	2,122	7,496	19,087	3,812	17,002	60,694	0	0	0	5,947	25,540	80,134	2,072	6,916	17,987
8	2,359	8,165	20,405	4,055	19,289	72,385	0	0	0	6,660	31,020	90,009	2,257	7,695	19,064
9	2,487	8,971	21,333	4,470	21,076	76,106	0	0	0	7,777	35,313	96,184	2,507	7,933	19,324
10	2,641	9,605	21,680	4,940	22,769	80,684	0	0	0	9,152	38,795	98,556	2,617	8,364	20,261

Table 5.3.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

	Part 3 - Dams on			Part 3 - PRRP			Part 3 - Dams off			Part 3 - Main off/Trib on			Part 3 - Main on/Trib off		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.05	0.05	0.06	0.00	0.00	0.00	0.02	0.02	0.02	0.07	0.08	0.09
2	0.10	0.11	0.12	0.04	0.05	0.05	0.00	0.00	0.00	0.02	0.02	0.02	0.07	0.08	0.09
3	0.10	0.10	0.11	0.04	0.04	0.04	0.00	0.00	0.00	0.02	0.02	0.02	0.07	0.07	0.08
4	0.10	0.10	0.11	0.03	0.04	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08
5	0.10	0.10	0.11	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08
6	0.09	0.10	0.11	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08
7	0.10	0.10	0.11	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08
8	0.09	0.10	0.11	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08
9	0.09	0.10	0.11	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08
10	0.09	0.10	0.11	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.07	0.08

Table 5.3.1.1. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with all dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0	4,031	3,258	818	1,490	0	0	2,452	209	5,303	1,126	8,706	1,301	6,624	150
2	0	472	529	80	163	0	0	503	73	1,081	219	1,718	256	2,557	265
3	0	73	141	16	30	0	0	193	29	502	102	804	118	1,983	373
4	0	0	93	0	0	0	0	168	21	480	97	769	114	2,188	492
5	0	0	96	0	0	0	0	192	21	554	110	902	128	2,641	641
6	0	0	116	0	0	0	0	234	24	672	132	1,071	154	3,035	777
7	0	0	129	0	0	0	0	257	26	745	148	1,184	174	3,397	910
8	0	0	143	0	0	0	0	286	29	814	163	1,301	192	3,723	1,046
9	0	0	161	0	0	0	0	311	31	898	179	1,445	211	4,067	1,139
10	0	0	168	0	0	0	0	335	33	959	188	1,534	222	4,265	1,251

Table 5.3.1.2. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with all dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0.00	0.21	0.08	0.08	0.15	0.00	0.00	0.09	0.13	0.08	0.08	0.15	0.10	0.11	0.06
2	0.00	0.20	0.08	0.08	0.15	0.00	0.00	0.09	0.13	0.08	0.08	0.15	0.10	0.11	0.06
3	0.00	0.19	0.08	0.08	0.13	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.11	0.06
4	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.11	0.06
5	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.11	0.06
6	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.10	0.06
7	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.11	0.06
8	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.11	0.06
9	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.10	0.06
10	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09	0.12	0.08	0.08	0.15	0.10	0.10	0.06

Table 5.3.1.3. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with implementation of the PRRP. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0	4,006	3,257	819	1,486	0	0	0	203	5,481	1,172	0	1,349	0	153
2	0	2,036	2,165	464	947	0	0	0	267	4,953	999	0	1,162	0	162
3	0	1,078	1,603	327	693	0	0	0	325	5,083	1,017	0	1,184	0	190
4	0	612	1,293	281	609	0	0	0	417	5,532	1,127	0	1,334	0	226
5	0	370	1,152	285	625	0	0	0	550	6,525	1,332	0	1,549	0	277
6	0	263	1,065	299	649	0	0	0	672	7,720	1,534	0	1,774	0	332
7	0	229	1,107	340	747	0	0	0	871	8,973	1,736	0	2,038	0	400
8	0	218	1,189	375	795	0	0	0	1,048	10,173	2,004	0	2,334	0	461
9	0	217	1,255	406	860	0	0	0	1,148	11,036	2,220	0	2,598	0	513
10	0	222	1,343	445	915	0	0	0	1,221	11,894	2,329	0	2,701	0	582

Table 5.3.1.4. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with implementation of the PRRP. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0.00	0.20	0.08	0.08	0.15	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
2	0.00	0.20	0.08	0.08	0.15	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
3	0.00	0.20	0.08	0.08	0.15	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
4	0.00	0.20	0.08	0.08	0.15	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
5	0.00	0.20	0.08	0.08	0.15	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
6	0.00	0.20	0.08	0.08	0.14	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
7	0.00	0.19	0.08	0.08	0.14	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
8	0.00	0.19	0.08	0.08	0.14	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
9	0.00	0.19	0.08	0.08	0.14	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06
10	0.00	0.19	0.08	0.08	0.14	0.00	0.00	0.00	0.13	0.08	0.08	0.00	0.10	0.00	0.06

Table 5.3.1.5. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with mainstem dams turned off and tributary dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0	0	0	815	1,491	0	0	2,456	206	0	1,233	0	1,416	0	152
2	0	0	0	467	937	0	0	2,638	369	0	1,545	0	1,796	0	166
3	0	0	0	346	777	0	0	3,106	626	0	2,073	0	2,411	0	185
4	0	0	0	322	781	0	0	3,754	948	0	2,783	0	3,202	0	213
5	0	0	0	347	889	0	0	4,696	1,402	0	3,652	0	4,265	0	244
6	0	0	0	419	1,111	0	0	5,912	1,840	0	4,601	0	5,393	0	278
7	0	0	0	508	1,310	0	0	7,231	1,997	0	5,794	0	6,861	0	329
8	0	0	0	630	1,529	0	0	8,865	2,419	0	7,068	0	8,353	0	379
9	0	0	0	726	1,776	0	0	10,108	2,631	0	7,671	0	9,266	0	414
10	0	0	0	835	1,955	0	0	11,264	2,961	0	8,704	0	10,276	0	475

Table 5.3.1.6. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with mainstem dams turned off and tributary dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
2	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
3	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
4	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
5	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
6	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
7	0.00	0.00	0.00	0.08	0.14	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
8	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
9	0.00	0.00	0.00	0.08	0.15	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06
10	0.00	0.00	0.00	0.08	0.14	0.00	0.00	0.09	0.13	0.00	0.08	0.00	0.10	0.00	0.06

Table 5.3.1.7. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0	3,769	3,020	0	0	0	0	0	0	5,768	0	9,297	0	7,507	0
2	0	493	546	0	0	0	0	0	0	1,529	0	2,449	0	3,358	0
3	0	84	159	0	0	0	0	0	0	745	0	1,201	0	2,675	0
4	0	20	113	0	0	0	0	0	0	684	0	1,084	0	2,887	0
5	0	0	124	0	0	0	0	0	0	737	0	1,200	0	3,206	0
6	0	0	152	0	0	0	0	0	0	897	0	1,422	0	3,842	0
7	0	0	165	0	0	0	0	0	0	950	0	1,547	0	4,171	0
8	0	0	179	0	0	0	0	0	0	1,033	0	1,658	0	4,569	0
9	0	0	190	0	0	0	0	0	0	1,070	0	1,737	0	4,738	0
10	0	0	202	0	0	0	0	0	0	1,149	0	1,849	0	4,920	0

Table 5.3.1.8. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the scenario with mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

Gen	Medway	Mattaceunk	West Enfield	Dover Upper	Brown's Mills	Sebec	Milo	Howland	Lowell	Milford	Stillwater	Great Works	Orono	Veazie	Frankfort
1	0.00	0.21	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00
2	0.00	0.20	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00
3	0.00	0.19	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00
4	0.00	0.14	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00
5	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00
6	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.10	0.00
7	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00
8	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.10	0.00
9	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.10	0.00
10	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.00	0.11	0.00

Table 6.1. Overview of model diagnostics and sensitivity analyses used to evaluate the Dam Impact Analysis Model, including a description of the analysis or input, how the input was varied, and values tested in the Base Case and Recovery scenarios. Model diagnostics and sensitivity analyses are divided into sections based on how model inputs were varied.

Description	Vary By	Base Case					Recovery				
Number of iterations	number	100	500	1000	5000	10000	100	500	1000	5000	10000
Model stability	number	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Production potential cap	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Eggs per female	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Egg to smolt survival	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
In-river mortality	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Marine survival	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Initial number of adults	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Hatchery discount	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Number of smolts stocked	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Proportion returning to sea	multiplier	0	0.5	base	2	4	0	0.5	base	2	4
Indirect latent mortality	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Downstream path choice	multiplier	0.25	0.5	base	2	4	0.25	0.5	base	2	4
Egg to smolt survival (hatchery on)											
Marine survival * 0.25	multiplier	0.25	0.5	1	2	4					
Marine survival * 0.5	multiplier	0.25	0.5	1	2	4					
Marine survival * 1	multiplier	0.25	0.5	1	2	4					
Marine survival * 2	multiplier	0.25	0.5	1	2	4					
Marine survival * 4	multiplier	0.25	0.5	1	2	4					
Egg to smolt survival (hatchery off)											
Marine survival * 0.25	multiplier	0.25	0.5	1	2	4					
Marine survival * 0.5	multiplier	0.25	0.5	1	2	4					
Marine survival * 1	multiplier	0.25	0.5	1	2	4					
Marine survival * 2	multiplier	0.25	0.5	1	2	4					
Marine survival * 4	multiplier	0.25	0.5	1	2	4					
Downstream dam survival	percent	-10%	-5%	base	5%	10%	-10%	-5%	base	5%	10%
Upstream dam survival	percent	-10%	-5%	base	5%	10%	-10%	-5%	base	5%	10%
Hatchery stocking	varying approaches	off	on 1st 25 yrs	on 2nd 25 yrs	base		off	on 1st 25 yrs	on 2nd 25 yrs	base	
Stocking distribution	varying approaches	all in Pisc	all in PU 2	base	equal in all PUs	all below VZ	all in Pisc	all in PU 2	base	equal in all PUs	all below VZ
Straying	varying approaches	RulesX1	RulesX2	base	100% home	=straying	RulesX1	RulesX2	base	100% home	=straying
Proportion dying	proportion	0	0.012	base	0.024	0.048	0	0.012	base	0.024	0.048
Proportion remaining downstream	varying approaches	below impassable dam	evenly dist below	base			below impassable dam	evenly dist below	base		
Marine survival											
Mean based	varying approaches	1971-1990	1991-2010	1971-2010			1971-1990	1991-2010	1971-2010		
Median based	varying approaches	1971-1990	1991-2010	base			1971-1990	1991-2010	base		

Table 6.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Base Case scenario.

	Base Case - 100			Base Case - 500			Base Case - 1000			Base Case - 5000			Base Case - 10000		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	48	119	291	50	131	299	50	118	325	51	124	329	50	122	339
3	51	116	299	46	122	317	47	125	338	51	122	323	49	120	330
4	53	124	346	47	121	357	53	121	325	51	119	344	51	122	323
5	49	122	339	53	127	319	49	120	327	52	118	324	51	120	331
6	48	106	352	47	117	352	52	124	315	51	120	329	50	120	329
7	54	123	293	51	121	341	49	122	321	50	119	330	51	122	328
8	44	137	324	50	119	326	48	121	328	52	121	327	51	120	330
9	57	140	281	51	122	329	53	121	325	51	121	329	50	121	330
10	54	146	303	50	122	312	52	117	326	52	119	324	50	122	321

Table 6.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Base Case scenario.

	Base Case - 100			Base Case - 500			Base Case - 1000			Base Case - 5000			Base Case - 10000		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.51	0.52	1.00	0.52	0.52	1.00	0.52	0.53	1.00	0.52	0.52	1.00	0.52	0.52	1.00
3	0.47	0.47	1.00	0.49	0.50	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.48	0.49	1.00
4	0.51	0.51	1.00	0.46	0.47	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.48	1.00
5	0.50	0.50	1.00	0.49	0.50	1.00	0.49	0.50	1.00	0.48	0.48	1.00	0.48	0.49	1.00
6	0.49	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.48	1.00
7	0.50	0.51	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
8	0.46	0.48	1.00	0.48	0.50	1.00	0.49	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00
9	0.49	0.50	1.00	0.48	0.48	1.00	0.47	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
10	0.55	0.55	1.00	0.50	0.50	1.00	0.49	0.51	1.00	0.48	0.49	1.00	0.48	0.49	1.00

Table 6.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Base Case scenario.

	Base Case - 100			Base Case - 500			Base Case - 1000			Base Case - 5000			Base Case - 10000		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	164,296	181,579	201,119	165,515	178,156	194,670	165,305	178,508	198,313	165,841	178,926	197,361	165,655	178,765	196,693
2	149,316	158,524	183,677	150,538	160,776	175,736	150,646	162,343	179,291	150,923	162,374	178,497	150,851	162,134	178,131
3	150,583	162,712	179,133	150,049	162,114	177,729	150,568	161,742	177,688	150,879	161,515	176,614	150,453	161,267	177,467
4	148,991	164,631	178,792	150,341	160,898	176,676	149,970	161,556	177,861	150,632	162,103	178,765	150,804	161,741	177,356
5	152,608	166,983	183,094	151,605	162,127	177,383	150,272	162,474	176,295	150,815	161,933	177,300	150,665	161,599	177,763
6	151,410	162,426	176,864	152,007	163,191	177,391	150,408	160,750	177,067	150,898	161,633	178,287	150,608	162,020	178,267
7	148,458	159,190	171,438	150,140	161,754	178,539	150,766	161,122	176,309	150,609	161,468	177,244	150,602	161,638	177,717
8	156,389	166,170	178,270	152,450	162,345	177,864	150,771	161,891	179,074	151,036	162,202	178,661	150,833	161,906	177,670
9	149,291	161,062	177,554	149,689	160,082	177,142	151,074	160,930	176,769	150,745	161,823	177,234	150,850	161,959	177,662
10	151,505	161,711	172,115	150,002	162,760	177,240	150,199	160,657	177,230	150,916	161,774	177,611	150,659	161,921	178,418

Table 6.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Base Case scenario.

	Base Case - 100			Base Case - 500			Base Case - 1000			Base Case - 5000			Base Case - 10000		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.11	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.1.5. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Recovery scenario.

	Recovery - 100			Recovery - 500			Recovery - 1000			Recovery - 5000			Recovery - 10000		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	528	1,086	2,000	549	1,027	2,125	514	1,025	2,131	525	1,057	2,091	521	1,043	2,098
3	874	2,057	3,865	906	1,815	4,131	950	1,886	3,783	909	1,891	3,925	927	1,922	3,850
4	1,080	2,293	4,396	1,158	2,624	5,113	1,223	2,442	4,966	1,242	2,483	4,813	1,249	2,480	4,848
5	1,273	2,779	5,647	1,391	2,616	5,057	1,393	2,725	5,228	1,408	2,730	5,286	1,400	2,723	5,228
6	1,680	2,820	4,734	1,455	2,786	5,404	1,556	2,837	5,368	1,496	2,859	5,454	1,497	2,845	5,455
7	1,479	2,965	5,442	1,386	2,874	5,364	1,528	2,874	5,675	1,478	2,924	5,508	1,501	2,880	5,552
8	1,373	2,713	6,240	1,489	2,730	5,601	1,456	2,926	5,566	1,538	2,894	5,528	1,523	2,917	5,576
9	1,529	3,019	5,209	1,580	2,882	5,360	1,481	2,914	5,553	1,518	2,894	5,607	1,518	2,920	5,576
10	1,588	2,856	5,487	1,472	2,965	5,731	1,532	2,865	5,720	1,531	2,941	5,660	1,526	2,916	5,525

Table 6.1.6. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Recovery scenario.

	Recovery - 100			Recovery - 500			Recovery - 1000			Recovery - 5000			Recovery - 10000		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.95	0.95	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00
3	0.98	0.98	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00
4	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00
5	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.1.7. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Recovery scenario.

	Recovery - 100			Recovery - 500			Recovery - 1000			Recovery - 5000			Recovery - 10000		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	186,728	197,382	225,988	180,718	198,075	217,142	181,456	199,438	219,414	181,207	198,544	219,982	180,967	198,149	220,630
2	165,379	192,416	227,715	166,187	186,830	216,403	166,415	187,385	219,581	166,953	187,430	219,594	166,649	188,136	220,666
3	170,352	195,301	229,819	171,038	193,587	231,832	171,545	193,528	225,195	171,055	192,816	228,268	170,799	193,109	228,835
4	175,061	193,130	241,535	173,003	198,872	240,449	174,296	196,982	236,311	174,162	198,402	236,743	173,809	197,835	235,693
5	175,820	199,110	227,703	173,511	200,685	240,098	176,597	198,651	237,064	175,577	201,414	240,414	174,936	199,026	238,784
6	180,068	197,126	240,943	175,183	201,780	239,626	179,328	203,794	241,721	176,644	200,124	238,869	176,313	201,241	240,914
7	179,011	201,412	236,854	174,810	199,394	239,665	176,175	203,189	239,400	175,734	200,952	242,706	176,706	201,253	242,435
8	182,028	206,381	253,974	175,356	199,293	243,710	177,115	202,271	239,218	176,368	201,284	239,874	176,727	201,919	241,450
9	172,442	201,709	232,023	175,084	202,508	242,171	178,903	201,601	238,775	176,467	202,536	242,691	176,133	200,938	242,716
10	177,349	200,455	227,702	176,172	203,717	241,273	178,014	202,286	239,632	176,594	201,486	243,378	176,167	201,416	241,642

Table 6.1.8. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Recovery scenario.

	Recovery - 100			Recovery - 500			Recovery - 1000			Recovery - 5000			Recovery - 10000		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.11	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.11	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12
9	0.10	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
10	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for five model runs with 5,000 iterations under the Base Case scenario.

	Base Case - run1			Base Case - run2			Base Case - run3			Base Case - run4			Base Case - run5		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	51	122	331	50	123	335	50	124	332	51	120	333	50	121	341
3	50	119	332	51	120	323	52	119	329	51	120	323	50	118	325
4	50	121	324	50	121	329	51	120	330	50	121	324	51	121	335
5	50	124	324	50	118	332	51	122	340	50	121	319	50	120	322
6	50	118	328	50	120	330	53	122	327	51	118	330	50	125	329
7	50	121	336	49	125	333	52	121	332	50	122	337	52	121	329
8	51	125	327	52	117	323	51	119	323	52	121	326	49	118	333
9	51	121	329	51	118	327	51	120	334	51	120	323	49	121	322
10	51	119	318	50	120	333	50	121	330	50	121	334	51	121	340

Table 6.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for five model runs with 5,000 iterations under the Base Case scenario.

	Base Case - run1			Base Case - run2			Base Case - run3			Base Case - run4			Base Case - run5		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.53	1.00	0.52	0.52	1.00	0.52	0.53	1.00	0.52	0.52	1.00	0.51	0.52	1.00
3	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
4	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
5	0.49	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.49	0.49	1.00
6	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
7	0.48	0.49	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00
8	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
9	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
10	0.48	0.48	1.00	0.47	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00

Table 6.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for five model runs with 5,000 iterations under the Base Case scenario.

	Base Case - run1			Base Case - run2			Base Case - run3			Base Case - run4			Base Case - run5		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	166,173	179,021	196,785	165,506	178,660	196,505	165,879	179,049	197,053	165,774	178,876	197,043	165,770	179,033	196,827
2	150,875	161,977	178,456	151,339	162,584	177,991	150,704	161,823	177,496	151,036	161,896	178,220	150,915	162,237	177,980
3	150,716	161,807	177,932	150,596	161,654	177,790	151,000	162,091	178,832	150,385	161,861	178,346	150,614	161,541	176,745
4	150,526	162,190	178,771	150,871	162,131	178,384	150,061	161,280	177,007	150,480	161,737	178,044	150,803	161,557	177,270
5	150,503	161,804	177,633	150,658	162,077	177,672	151,253	162,100	176,937	150,723	161,745	177,308	150,501	161,958	178,113
6	150,970	161,635	177,953	150,765	161,642	177,662	150,608	161,835	177,593	150,609	160,774	176,283	150,756	162,103	177,304
7	150,607	161,356	177,831	150,910	162,146	177,758	150,266	161,826	178,195	151,067	162,026	178,652	150,667	162,070	177,705
8	150,847	161,760	177,531	150,425	161,502	177,367	151,017	161,575	177,528	150,828	161,889	177,572	150,820	161,122	176,536
9	150,943	161,923	177,939	149,852	161,020	177,164	151,067	162,010	178,227	150,463	161,804	178,102	150,408	161,328	177,286
10	150,758	161,944	178,390	150,535	162,080	177,441	150,696	161,910	177,283	150,326	161,516	177,348	150,928	161,735	178,016

Table 6.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for five model runs with 5,000 iterations under the Base Case scenario.

	Base Case - run1			Base Case - run2			Base Case - run3			Base Case - run4			Base Case - run5		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.2.5. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for five model runs with 5,000 iterations under the Recovery scenario.

	Recovery - run1			Recovery - run2			Recovery - run3			Recovery - run4			Recovery - run5		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	513	1,076	2,125	512	1,057	2,130	521	1,067	2,119	526	1,059	2,133	516	1,071	2,134
3	918	1,913	3,890	913	1,927	3,889	916	1,932	3,865	922	1,901	3,878	945	1,921	3,938
4	1,227	2,458	4,895	1,251	2,480	4,925	1,246	2,455	4,896	1,240	2,475	4,848	1,254	2,461	4,836
5	1,412	2,701	5,295	1,431	2,729	5,279	1,425	2,732	5,181	1,402	2,735	5,250	1,383	2,735	5,354
6	1,480	2,835	5,419	1,491	2,837	5,488	1,464	2,840	5,482	1,486	2,836	5,443	1,459	2,853	5,485
7	1,517	2,919	5,555	1,510	2,914	5,483	1,512	2,864	5,600	1,511	2,875	5,562	1,494	2,906	5,590
8	1,530	2,947	5,588	1,518	2,890	5,643	1,527	2,884	5,565	1,523	2,901	5,566	1,504	2,912	5,621
9	1,510	2,959	5,661	1,517	2,909	5,492	1,556	2,942	5,597	1,515	2,924	5,530	1,550	2,890	5,559
10	1,549	2,896	5,447	1,523	2,893	5,526	1,506	2,974	5,568	1,565	2,886	5,557	1,528	2,909	5,533

Table 6.2.6. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for five model runs with 5,000 iterations under the Recovery scenario.

	Recovery - run1			Recovery - run2			Recovery - run3			Recovery - run4			Recovery - run5		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.97	1.00
3	0.98	0.98	1.00	0.98	0.98	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.97	0.98	1.00
4	0.98	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.2.7. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for five model runs with 5,000 iterations under the Recovery scenario.

	Recovery - run1			Recovery - run2			Recovery - run3			Recovery - run4			Recovery - run5		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	181,101	197,608	219,497	180,902	198,025	219,617	181,060	199,110	221,318	180,906	197,820	219,464	180,990	198,041	221,277
2	166,972	188,420	219,069	167,160	188,645	219,146	168,046	188,636	219,811	166,507	188,495	220,674	166,872	187,510	219,394
3	170,941	193,325	229,017	170,020	193,656	229,038	170,809	193,314	227,605	170,581	194,085	229,950	171,324	193,705	227,995
4	173,496	198,590	237,312	174,908	198,769	235,324	174,160	197,774	235,905	174,490	199,432	236,038	173,864	197,441	235,737
5	175,100	198,824	238,896	176,108	199,721	239,934	176,300	199,200	239,863	175,718	200,559	240,375	175,203	200,283	240,054
6	174,869	200,607	240,419	176,299	201,327	241,661	175,963	200,318	241,353	176,042	200,449	242,051	176,826	201,362	242,245
7	176,700	201,554	242,242	176,547	201,229	240,953	176,506	202,284	242,484	175,750	202,205	241,914	176,257	201,464	241,844
8	176,907	201,199	243,516	176,275	201,261	241,307	175,813	201,510	241,985	176,645	201,329	241,416	176,069	201,412	241,946
9	175,765	201,940	241,985	176,324	201,680	243,368	176,227	202,173	243,140	176,128	200,619	239,896	176,735	201,704	241,473
10	176,436	202,584	239,674	176,899	201,169	243,039	176,240	200,673	242,116	176,232	201,532	241,854	175,768	201,496	240,204

Table 6.2.8. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for five model runs with 5,000 iterations under the Recovery scenario.

	Recovery - run1			Recovery - run2			Recovery - run3			Recovery - run4			Recovery - run5		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.10	0.12

Table 6.3.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Base Case scenario.

	Base Case - 2.5			Base Case - 5			Base Case - base			Base Case - 20			Base Case - 40		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	51	124	340	51	119	342	51	124	329	50	122	337	51	121	331
3	49	116	316	50	120	329	51	122	323	51	119	316	51	117	324
4	49	121	322	51	122	330	51	119	344	50	119	330	51	120	337
5	50	118	319	50	120	320	52	118	324	51	121	329	51	119	330
6	50	118	323	51	118	325	51	120	329	51	119	326	51	125	330
7	49	119	320	50	121	332	50	119	330	51	124	334	50	122	333
8	49	116	321	50	116	329	52	121	327	51	123	331	51	121	326
9	50	119	317	51	121	327	51	121	329	51	122	329	49	123	325
10	50	117	329	51	122	325	52	119	324	53	121	329	50	119	339

Table 6.3.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Base Case scenario.

	Base Case - 2.5			Base Case - 5			Base Case - base			Base Case - 20			Base Case - 40		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.52	1.00	0.52	0.52	1.00	0.52	0.52	1.00	0.51	0.52	1.00	0.52	0.52	1.00
3	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.48	0.48	1.00	0.48	0.49	1.00
4	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
5	0.47	0.48	1.00	0.48	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.48	1.00
6	0.48	0.48	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00
7	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
8	0.47	0.48	1.00	0.47	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00
9	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
10	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00

Table 6.3.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Base Case scenario.

	Base Case - 2.5			Base Case - 5			Base Case - base			Base Case - 20			Base Case - 40		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	166,481	179,491	197,304	165,662	178,991	195,984	165,841	178,926	197,361	165,759	178,771	195,549	166,097	178,792	196,655
2	150,807	162,112	178,252	150,695	161,955	178,173	150,923	162,374	178,497	150,788	161,656	177,836	150,844	162,033	177,994
3	150,413	161,661	176,635	150,517	161,164	177,121	150,879	161,515	176,614	150,402	161,873	177,900	150,761	162,080	178,558
4	150,549	161,960	177,923	150,503	161,369	177,714	150,632	162,103	178,765	150,660	161,720	177,324	150,927	162,151	177,603
5	150,834	161,756	177,533	150,897	162,200	178,599	150,815	161,933	177,300	150,639	162,069	177,915	150,737	161,907	178,540
6	150,739	161,815	177,480	150,795	161,766	177,418	150,898	161,633	178,287	150,755	161,587	177,435	150,883	161,875	177,130
7	150,305	161,098	177,575	150,689	161,653	177,398	150,609	161,468	177,244	150,728	161,386	177,579	151,045	162,091	177,614
8	150,593	161,345	177,902	150,701	161,614	177,387	151,036	162,202	178,661	150,782	161,809	177,523	150,773	161,613	178,588
9	150,567	161,259	177,506	150,727	161,873	177,520	150,745	161,823	177,234	150,681	162,291	178,258	150,793	162,394	178,570
10	150,729	161,227	177,024	150,710	161,592	178,018	150,916	161,774	177,611	150,942	162,235	178,420	151,099	161,888	178,012

Table 6.3.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Base Case scenario.

	Base Case - 2.5			Base Case - 5			Base Case - base			Base Case - 20			Base Case - 40		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.3.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Recovery scenario.

	Recovery - 2.5			Recovery - 5			Recovery - base			Recovery - 20			Recovery - 40		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	513	1,044	2,104	525	1,063	2,093	525	1,057	2,091	515	1,060	2,117	525	1,047	2,119
3	695	1,392	2,690	836	1,672	3,241	909	1,891	3,925	966	2,068	4,227	989	2,066	4,508
4	733	1,439	2,747	967	1,849	3,669	1,242	2,483	4,813	1,448	3,097	6,210	1,528	3,420	7,373
5	741	1,456	2,748	1,007	1,963	3,766	1,408	2,730	5,286	1,862	3,734	7,379	2,168	4,801	10,206
6	717	1,441	2,870	1,031	1,966	3,772	1,496	2,859	5,454	2,089	4,171	8,190	2,708	5,780	12,140
7	728	1,490	2,780	1,033	1,983	3,809	1,478	2,924	5,508	2,184	4,381	8,529	3,062	6,609	13,282
8	740	1,472	2,772	1,032	1,987	3,846	1,538	2,894	5,528	2,274	4,480	8,656	3,407	7,035	13,893
9	747	1,443	2,801	1,014	1,974	3,746	1,518	2,894	5,607	2,306	4,557	8,576	3,471	7,208	14,381
10	746	1,445	2,790	1,017	2,015	3,754	1,531	2,941	5,660	2,319	4,624	8,850	3,641	7,334	14,361

Table 6.3.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Recovery scenario.

	Recovery - 2.5			Recovery - 5			Recovery - base			Recovery - 20			Recovery - 40		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.97	1.00	0.96	0.96	1.00
3	0.97	0.97	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00
4	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
5	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
8	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
9	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	1.00	1.00	1.00	1.00	1.00
10	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00

Table 6.3.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Recovery scenario.

	Recovery - 2.5			Recovery - 5			Recovery - base			Recovery - 20			Recovery - 40		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	180,992	197,515	219,759	181,163	197,541	219,303	181,207	198,544	219,982	180,531	197,738	219,156	180,738	198,139	219,990
2	164,989	185,093	215,108	165,878	186,342	217,361	166,953	187,430	219,594	167,356	189,045	222,003	168,124	189,054	223,102
3	165,541	185,404	213,152	168,604	189,675	221,337	171,055	192,816	228,268	173,018	198,256	235,961	173,740	199,944	244,777
4	166,480	186,197	213,370	169,578	190,542	224,232	174,162	198,402	236,743	178,210	205,110	251,372	179,130	211,651	265,452
5	166,370	186,397	214,260	169,919	192,277	226,521	175,577	201,414	240,414	181,699	211,282	260,221	187,368	223,596	286,431
6	166,403	186,712	214,520	169,685	191,397	226,052	176,644	200,124	238,869	183,087	212,845	265,915	191,169	231,558	304,537
7	166,549	185,692	214,571	170,365	192,662	227,429	175,734	200,952	242,706	184,724	216,101	268,170	195,758	238,645	312,349
8	166,476	186,191	213,927	170,693	192,370	224,413	176,368	201,284	239,874	185,631	216,250	269,532	196,732	239,283	314,437
9	166,551	185,561	214,269	170,231	191,312	225,538	176,467	202,536	242,691	185,628	217,039	269,055	197,762	242,553	318,195
10	166,455	185,820	213,638	170,371	192,207	226,374	176,594	201,486	243,378	186,972	217,816	272,728	200,219	243,731	321,162

Table 6.3.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Recovery scenario.

	Recovery - 2.5			Recovery - 5			Recovery - base			Recovery - 20			Recovery - 40		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.10	0.11
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.11
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11

Table 6.4.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	39	97	274	44	102	297	51	124	329	66	159	421	100	247	572
3	38	96	268	43	104	288	51	122	323	66	160	434	107	256	638
4	38	95	273	43	105	274	51	119	344	68	164	436	120	285	675
5	40	94	269	43	104	300	52	118	324	70	172	434	122	296	702
6	40	94	264	42	104	279	51	120	329	68	168	434	124	302	725
7	39	95	277	42	103	286	50	119	330	72	170	438	128	305	722
8	39	95	262	43	102	290	52	121	327	70	166	436	130	301	727
9	39	96	269	43	102	296	51	121	329	71	165	440	130	307	735
10	39	97	267	43	104	288	52	119	324	70	172	443	126	306	714

Table 6.4.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.47	0.48	1.00	0.48	0.49	1.00	0.52	0.52	1.00	0.57	0.58	1.00	0.69	0.69	1.00
3	0.45	0.46	1.00	0.46	0.47	1.00	0.49	0.50	1.00	0.53	0.53	1.00	0.59	0.60	1.00
4	0.46	0.47	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.60	0.61	1.00
5	0.45	0.46	1.00	0.47	0.47	1.00	0.48	0.48	1.00	0.52	0.53	1.00	0.60	0.60	1.00
6	0.46	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.54	1.00	0.61	0.61	1.00
7	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.61	0.62	1.00
8	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.48	1.00	0.52	0.53	1.00	0.61	0.61	1.00
9	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.61	0.62	1.00
10	0.46	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.61	0.61	1.00

Table 6.4.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	153,111	163,942	180,216	157,982	169,452	186,371	165,841	178,926	197,361	181,046	197,573	219,673	209,686	234,497	266,430
2	148,821	159,469	175,318	149,409	159,886	175,526	150,923	162,374	178,497	153,284	165,728	183,881	156,285	172,480	196,796
3	148,625	159,254	174,727	149,747	160,391	175,948	150,879	161,515	176,614	152,451	163,983	182,076	155,205	169,577	191,945
4	149,457	160,028	175,200	149,721	160,670	176,433	150,632	162,103	178,765	152,581	164,591	182,427	155,668	170,185	192,271
5	149,587	159,974	175,246	150,227	160,666	176,446	150,815	161,933	177,300	152,470	164,628	181,818	155,736	170,469	191,689
6	149,187	159,311	174,608	149,638	160,519	176,055	150,898	161,633	178,287	152,055	163,864	181,903	155,406	169,350	190,318
7	149,996	160,136	175,668	149,806	160,541	175,774	150,609	161,468	177,244	151,810	163,599	181,960	155,914	170,486	191,142
8	148,809	159,347	173,641	149,817	160,285	176,019	151,036	162,202	178,661	152,068	164,207	182,260	155,676	170,316	191,107
9	149,074	159,374	174,670	149,623	160,171	175,249	150,745	161,823	177,234	152,455	164,230	181,944	155,916	170,175	191,446
10	148,929	159,148	174,414	149,310	159,768	174,779	150,916	161,774	177,611	151,784	164,040	180,960	155,486	170,485	192,504

Table 6.4.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.4.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	345	789	1,609	408	868	1,795	525	1,057	2,091	722	1,453	2,724	1,090	2,170	4,098
3	463	1,010	2,072	622	1,309	2,739	909	1,891	3,925	1,485	2,906	5,566	2,280	4,216	7,997
4	526	1,101	2,271	770	1,588	3,253	1,242	2,483	4,813	1,876	3,559	6,700	2,574	4,785	8,790
5	526	1,131	2,321	826	1,746	3,487	1,408	2,730	5,286	2,028	3,754	6,953	2,672	4,953	8,992
6	533	1,161	2,391	885	1,802	3,608	1,496	2,859	5,454	2,085	3,759	7,016	2,659	4,949	9,222
7	536	1,167	2,376	892	1,867	3,748	1,478	2,924	5,508	2,107	3,840	7,015	2,716	4,982	9,205
8	539	1,154	2,402	888	1,869	3,738	1,538	2,894	5,528	2,075	3,821	7,244	2,690	4,926	9,276
9	544	1,161	2,401	907	1,852	3,701	1,518	2,894	5,607	2,078	3,843	7,152	2,690	4,998	9,097
10	541	1,177	2,402	916	1,880	3,791	1,531	2,941	5,660	2,090	3,805	7,139	2,692	4,971	9,292

Table 6.4.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.93	0.93	1.00	0.94	0.94	1.00	0.96	0.96	1.00	0.98	0.98	1.00	0.99	0.99	1.00
3	0.94	0.94	1.00	0.96	0.96	1.00	0.98	0.98	1.00	0.99	0.99	1.00	1.00	1.00	1.00
4	0.94	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	0.94	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 6.4.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	157,431	168,823	185,548	165,479	178,894	196,976	181,207	198,544	219,982	209,612	234,267	266,327	263,490	308,167	364,538
2	154,207	166,251	183,911	158,428	173,339	194,766	166,953	187,430	219,594	185,821	220,635	290,235	232,493	319,638	494,237
3	154,516	167,545	184,437	160,145	176,265	199,296	171,055	192,816	228,268	193,975	237,309	318,710	256,353	369,680	541,056
4	155,279	167,922	185,959	161,229	178,214	201,252	174,162	198,402	236,743	201,470	248,579	336,861	274,928	393,372	561,158
5	154,971	167,802	186,696	161,404	177,589	200,164	175,577	201,414	240,414	203,775	253,399	341,755	279,964	397,855	564,116
6	155,082	167,527	186,557	162,331	178,662	202,185	176,644	200,124	238,869	203,800	252,258	346,228	278,910	407,523	569,395
7	155,294	168,620	186,220	162,420	178,977	202,269	175,734	200,952	242,706	205,618	254,856	341,061	282,581	414,766	573,742
8	155,135	167,764	186,595	162,664	178,911	202,085	176,368	201,284	239,874	204,144	255,617	348,217	282,190	412,303	573,768
9	155,478	168,268	185,895	162,221	178,806	203,112	176,467	202,536	242,691	205,480	256,812	350,812	280,335	411,734	576,167
10	155,597	168,944	186,394	162,321	178,390	202,660	176,594	201,486	243,378	204,914	255,487	347,992	281,992	417,285	574,638

Table 6.4.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12

Table 6.5.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	39	94	275	43	103	292	51	124	329	66	160	419	98	248	591
3	39	95	275	43	101	291	51	122	323	66	161	427	107	270	636
4	39	94	266	43	104	288	51	119	344	68	167	442	117	278	696
5	39	95	265	43	103	292	52	118	324	71	169	423	121	295	709
6	39	93	268	42	102	293	51	120	329	70	166	443	125	295	734
7	39	92	268	43	104	282	50	119	330	71	167	436	124	307	726
8	39	94	273	43	104	281	52	121	327	70	167	444	125	310	734
9	40	93	273	43	105	280	51	121	329	71	170	433	125	305	736
10	39	95	258	43	102	286	52	119	324	69	169	437	127	299	727

Table 6.5.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.52	1.00	0.59	0.59	1.00	0.67	0.67	1.00
3	0.46	0.46	1.00	0.46	0.47	1.00	0.49	0.50	1.00	0.52	0.53	1.00	0.61	0.61	1.00
4	0.44	0.45	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.53	0.54	1.00	0.60	0.61	1.00
5	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.48	1.00	0.52	0.53	1.00	0.61	0.62	1.00
6	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.61	0.62	1.00
7	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.60	0.61	1.00
8	0.45	0.46	1.00	0.47	0.47	1.00	0.48	0.48	1.00	0.52	0.53	1.00	0.60	0.61	1.00
9	0.45	0.46	1.00	0.47	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.61	0.62	1.00
10	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.53	0.53	1.00	0.60	0.61	1.00

Table 6.5.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	153,307	164,201	179,465	157,698	169,494	185,307	165,841	178,926	197,361	180,763	197,372	220,436	210,394	234,860	265,712
2	149,888	160,356	176,422	150,038	160,761	176,103	150,923	162,374	178,497	152,879	165,057	183,207	157,501	173,268	197,401
3	149,402	159,920	174,777	149,202	159,642	175,219	150,879	161,515	176,614	152,073	164,168	181,283	155,648	170,390	192,315
4	149,735	160,385	175,741	150,038	160,984	176,332	150,632	162,103	178,765	152,442	163,801	181,159	155,423	170,326	190,612
5	149,775	159,795	175,263	150,167	160,502	176,668	150,815	161,933	177,300	152,239	163,826	181,780	155,203	169,695	190,660
6	149,275	159,362	175,096	149,429	160,202	175,879	150,898	161,633	178,287	152,712	164,674	182,013	155,641	170,782	192,314
7	149,340	159,846	175,137	150,089	160,827	177,016	150,609	161,468	177,244	152,119	164,180	181,494	155,547	170,692	191,975
8	149,153	159,498	175,012	149,854	160,925	176,277	151,036	162,202	178,661	152,528	164,706	182,947	155,355	170,688	191,584
9	149,483	160,167	175,498	149,933	160,561	176,027	150,745	161,823	177,234	151,957	164,480	182,524	156,030	170,546	191,484
10	148,951	160,151	175,627	149,814	159,578	175,496	150,916	161,774	177,611	152,375	164,369	182,228	155,624	170,220	191,296

Table 6.5.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.5.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	320	739	1,525	341	782	1,644	405	877	1,811	525	1,057	2,091	732	1,441	2,719
3	397	843	1,753	469	1,020	2,057	606	1,299	2,690	909	1,891	3,925	1,502	2,909	5,743
4	406	887	1,835	523	1,096	2,233	762	1,618	3,214	1,242	2,483	4,813	1,906	3,509	6,875
5	415	883	1,803	528	1,147	2,372	865	1,685	3,570	1,408	2,730	5,286	2,029	3,696	7,065
6	404	872	1,825	533	1,162	2,405	891	1,807	3,615	1,496	2,859	5,454	2,059	3,779	7,199
7	407	884	1,793	543	1,162	2,415	905	1,875	3,662	1,478	2,924	5,508	2,065	3,861	7,060
8	396	893	1,830	545	1,164	2,363	893	1,876	3,713	1,538	2,894	5,528	2,085	3,790	7,269
9	405	881	1,847	536	1,189	2,429	906	1,873	3,801	1,518	2,894	5,607	2,075	3,842	7,243
10	392	898	1,848	542	1,168	2,452	917	1,853	3,755	1,531	2,941	5,660	2,079	3,828	7,170

Table 6.5.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.91	0.91	1.00	0.92	0.93	1.00	0.94	0.94	1.00	0.96	0.96	1.00	0.99	0.99	1.00
3	0.92	0.92	1.00	0.94	0.94	1.00	0.96	0.96	1.00	0.98	0.98	1.00	0.99	0.99	1.00
4	0.92	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
5	0.93	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
6	0.93	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
7	0.93	0.93	1.00	0.95	0.96	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
8	0.92	0.93	1.00	0.95	0.95	1.00	0.98	0.98	1.00	0.99	0.99	1.00	1.00	1.00	1.00
9	0.93	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
10	0.92	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00

Table 6.5.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	152,947	163,476	179,474	157,152	168,935	185,761	165,873	179,053	197,148	181,207	198,544	219,982	209,001	234,625	265,299
2	151,510	163,124	179,436	154,041	166,447	184,136	158,606	174,162	195,431	166,953	187,430	219,594	186,371	221,947	287,195
3	152,016	163,215	178,868	154,298	166,899	185,179	160,021	176,048	197,963	171,055	192,816	228,268	192,817	235,716	321,585
4	152,438	164,204	179,536	154,802	168,117	186,627	161,136	177,247	201,385	174,162	198,402	236,743	199,978	247,814	334,429
5	152,431	164,202	180,836	155,668	168,329	185,866	161,922	178,296	202,382	175,577	201,414	240,414	202,561	252,510	340,237
6	152,190	162,910	179,157	154,801	167,984	185,944	162,466	178,591	201,066	176,644	200,124	238,869	205,273	254,663	344,049
7	152,014	163,443	179,792	154,900	168,399	186,502	161,989	178,857	203,356	175,734	200,952	242,706	204,212	254,355	347,591
8	151,685	163,294	179,350	155,114	167,528	185,811	162,166	178,872	202,691	176,368	201,284	239,874	205,363	255,787	347,404
9	151,568	162,981	179,327	154,930	167,558	185,566	162,082	178,806	201,591	176,467	202,536	242,691	204,705	252,093	342,865
10	152,127	163,424	179,604	155,320	168,708	187,364	162,410	178,468	202,639	176,594	201,486	243,378	206,300	253,587	349,017

Table 6.5.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12

Table 6.6.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	51	127	350	52	127	347	51	124	329	50	119	320	45	108	290
3	51	125	336	52	125	333	51	122	323	48	113	311	44	105	285
4	51	122	333	52	123	335	51	119	344	49	114	319	46	106	282
5	53	126	336	52	123	337	52	118	324	47	115	320	45	105	273
6	52	130	335	53	127	330	51	120	329	49	114	318	46	105	285
7	52	126	355	52	125	333	50	119	330	48	118	318	46	103	281
8	53	126	332	52	122	337	52	121	327	49	117	316	45	107	281
9	53	122	347	51	123	334	51	121	329	48	116	316	46	105	289
10	52	123	342	51	124	334	52	119	324	49	120	312	44	105	287

Table 6.6.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.53	1.00	0.52	0.53	1.00	0.52	0.52	1.00	0.51	0.51	1.00	0.47	0.48	1.00
3	0.49	0.49	1.00	0.50	0.51	1.00	0.49	0.50	1.00	0.47	0.48	1.00	0.43	0.44	1.00
4	0.49	0.50	1.00	0.49	0.50	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.44	0.45	1.00
5	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.47	0.48	1.00	0.44	0.45	1.00
6	0.49	0.50	1.00	0.49	0.50	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.44	0.45	1.00
7	0.49	0.50	1.00	0.49	0.50	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.44	0.45	1.00
8	0.49	0.49	1.00	0.49	0.50	1.00	0.48	0.48	1.00	0.47	0.48	1.00	0.45	0.45	1.00
9	0.49	0.50	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.47	0.47	1.00	0.44	0.45	1.00
10	0.48	0.49	1.00	0.49	0.50	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.44	0.45	1.00

Table 6.6.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	168,087	181,854	200,231	167,796	181,294	199,309	165,841	178,926	197,361	162,455	175,208	192,462	155,610	167,822	185,003
2	153,137	164,500	180,302	152,826	163,877	180,201	150,923	162,374	178,497	147,951	159,137	174,393	141,601	152,550	167,887
3	153,158	164,512	180,843	152,269	163,782	179,288	150,879	161,515	176,614	147,591	158,240	174,168	141,499	151,991	166,631
4	153,219	164,308	180,820	151,878	163,475	179,990	150,632	162,103	178,765	147,471	158,149	173,461	141,673	152,151	168,015
5	153,369	164,486	180,101	151,686	162,596	178,858	150,815	161,933	177,300	147,436	158,534	173,478	141,470	151,633	166,517
6	152,872	164,002	180,475	152,447	163,448	179,676	150,898	161,633	178,287	147,305	158,040	173,937	141,560	152,058	167,035
7	153,765	164,844	180,791	152,431	163,132	179,385	150,609	161,468	177,244	147,410	157,967	173,816	141,427	151,983	166,365
8	152,864	163,607	180,505	152,244	163,936	179,666	151,036	162,202	178,661	147,467	158,469	174,496	141,690	151,898	166,947
9	152,852	164,340	181,096	152,136	163,561	180,374	150,745	161,823	177,234	147,772	158,278	174,434	141,433	152,013	167,186
10	152,748	164,072	180,413	152,665	163,406	179,361	150,916	161,774	177,611	147,533	158,030	173,210	141,640	152,120	167,759

Table 6.6.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.6.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	523	1,105	2,157	520	1,079	2,168	525	1,057	2,091	501	1,030	2,063	458	949	1,902
3	954	1,956	4,014	966	1,955	3,914	909	1,891	3,925	878	1,833	3,781	804	1,711	3,430
4	1,309	2,521	4,892	1,295	2,528	4,979	1,242	2,483	4,813	1,223	2,341	4,671	1,083	2,230	4,376
5	1,436	2,793	5,471	1,442	2,743	5,290	1,408	2,730	5,286	1,382	2,653	5,106	1,266	2,475	4,804
6	1,517	2,935	5,561	1,506	2,939	5,502	1,496	2,859	5,454	1,451	2,782	5,264	1,347	2,550	4,991
7	1,560	2,942	5,695	1,539	2,966	5,593	1,478	2,924	5,508	1,444	2,832	5,423	1,330	2,573	5,038
8	1,556	2,994	5,783	1,557	2,937	5,683	1,538	2,894	5,528	1,469	2,806	5,412	1,358	2,610	5,042
9	1,546	3,004	5,754	1,547	2,983	5,716	1,518	2,894	5,607	1,484	2,838	5,458	1,340	2,673	5,069
10	1,587	2,996	5,651	1,538	2,951	5,681	1,531	2,941	5,660	1,482	2,793	5,372	1,413	2,607	5,056

Table 6.6.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	**Upper**	**Piscataquis**	**Lower**	**Upper**	**Piscataquis**	**Lower**	**Upper**	**Piscataquis**	**Lower**	**Upper**	**Piscataquis**	**Lower**	**Upper**	**Piscataquis**	**Lower**
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.97	0.97	1.00	0.97	0.97	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.95	0.95	1.00
3	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.97	0.98	1.00	0.97	0.97	1.00
4	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.99	1.00	0.98	0.98	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.6.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	183,994	200,552	223,498	182,987	200,103	222,068	181,207	198,544	219,982	177,266	194,015	215,954	170,141	186,153	206,431
2	170,320	192,471	223,389	169,550	190,636	222,456	166,953	187,430	219,594	163,385	183,872	214,799	155,807	173,997	201,805
3	174,287	198,068	236,010	173,148	195,873	233,652	171,055	192,816	228,268	166,405	188,672	223,861	159,164	179,380	211,553
4	176,358	202,233	243,135	175,535	199,812	241,050	174,162	198,402	236,743	169,828	191,753	226,624	161,291	182,304	215,966
5	178,955	204,164	246,740	176,612	201,180	243,375	175,577	201,414	240,414	171,190	195,133	232,514	162,737	184,473	219,124
6	179,116	205,034	246,058	177,939	203,446	244,511	176,644	200,124	238,869	171,786	195,426	234,034	164,041	184,576	219,208
7	179,611	205,556	248,133	178,914	204,401	246,113	175,734	200,952	242,706	173,468	196,125	233,833	163,680	185,515	220,883
8	179,399	204,951	248,492	178,006	203,328	245,593	176,368	201,284	239,874	171,627	195,953	234,599	164,530	185,145	221,157
9	179,437	205,427	249,839	178,445	204,153	246,236	176,467	202,536	242,691	172,349	196,744	233,634	164,176	186,287	223,376
10	180,307	206,299	249,131	179,021	203,932	245,158	176,594	201,486	243,378	173,129	196,473	233,972	164,678	186,579	221,655

Table 6.6.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12
5	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
8	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.7.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	10	22	45	22	47	111	51	124	329	139	367	836	405	880	1,768
3	9	17	37	19	42	96	51	122	323	167	437	987	615	1,310	2,659
4	9	17	36	19	40	96	51	119	344	185	467	1,026	770	1,590	3,253
5	8	18	37	19	42	95	52	118	324	191	482	1,064	850	1,748	3,525
6	9	17	36	18	41	98	51	120	329	196	485	1,090	873	1,844	3,711
7	9	17	37	19	40	95	50	119	330	190	486	1,086	899	1,829	3,733
8	8	18	38	19	40	94	52	121	327	193	491	1,076	913	1,857	3,785
9	9	17	37	19	41	93	51	121	329	195	499	1,090	910	1,879	3,805
10	9	17	37	19	41	95	52	119	324	199	493	1,094	915	1,869	3,724

Table 6.7.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.08	0.08	1.00	0.25	0.25	1.00	0.52	0.52	1.00	0.78	0.78	1.00	0.94	0.94	1.00
3	0.06	0.06	1.00	0.21	0.21	1.00	0.49	0.50	1.00	0.78	0.79	1.00	0.96	0.96	1.00
4	0.06	0.06	1.00	0.21	0.22	1.00	0.48	0.49	1.00	0.78	0.79	1.00	0.97	0.97	1.00
5	0.06	0.06	1.00	0.21	0.22	1.00	0.48	0.48	1.00	0.79	0.80	1.00	0.97	0.97	1.00
6	0.07	0.07	1.00	0.21	0.21	1.00	0.48	0.49	1.00	0.80	0.80	1.00	0.97	0.97	1.00
7	0.06	0.06	1.00	0.22	0.22	1.00	0.48	0.49	1.00	0.80	0.80	1.00	0.97	0.97	1.00
8	0.06	0.06	1.00	0.21	0.21	1.00	0.48	0.48	1.00	0.80	0.80	1.00	0.97	0.97	1.00
9	0.06	0.06	1.00	0.21	0.21	1.00	0.48	0.49	1.00	0.80	0.81	1.00	0.97	0.98	1.00
10	0.06	0.07	1.00	0.21	0.21	1.00	0.48	0.49	1.00	0.80	0.80	1.00	0.97	0.98	1.00

Table 6.7.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	165,391	178,899	197,254	166,269	178,864	197,362	165,841	178,926	197,361	165,975	178,912	196,889	166,240	179,316	195,777
2	149,147	159,542	175,141	149,594	160,077	175,643	150,923	162,374	178,497	153,741	166,649	184,067	158,498	173,745	195,470
3	149,362	159,495	174,835	149,044	159,740	174,367	150,879	161,515	176,614	153,795	166,171	183,842	160,183	175,858	198,518
4	149,165	159,545	175,262	149,573	160,271	175,477	150,632	162,103	178,765	154,005	166,203	185,061	161,111	177,338	200,007
5	149,275	159,952	174,768	149,310	159,990	175,743	150,815	161,933	177,300	153,692	166,306	183,792	161,885	178,057	201,583
6	149,741	159,476	174,550	149,052	159,542	174,738	150,898	161,633	178,287	153,489	166,087	183,825	161,758	178,104	201,694
7	149,275	159,765	173,959	149,285	159,918	175,331	150,609	161,468	177,244	154,258	166,733	184,772	162,386	178,616	202,539
8	149,260	159,942	175,639	149,633	160,276	175,128	151,036	162,202	178,661	153,955	166,320	184,180	162,047	178,958	203,608
9	148,885	159,072	174,323	148,994	159,302	174,790	150,745	161,823	177,234	154,212	166,984	184,213	161,977	178,720	202,651
10	148,936	159,260	174,125	149,105	159,148	174,832	150,916	161,774	177,611	153,824	166,135	183,702	161,839	178,563	202,839

Table 6.7.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.7.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	13	27	57	28	59	145	67	161	403	188	461	980	525	1,057	2,091
3	10	20	42	24	50	116	65	159	423	249	625	1,322	909	1,891	3,925
4	9	19	40	22	48	108	68	165	433	299	706	1,526	1,242	2,483	4,813
5	9	18	40	23	49	109	70	168	429	334	752	1,624	1,408	2,730	5,286
6	9	18	39	23	48	109	70	166	443	340	796	1,673	1,496	2,859	5,454
7	9	19	40	22	46	106	69	177	437	358	793	1,737	1,478	2,924	5,508
8	9	19	40	22	47	113	70	169	455	347	806	1,748	1,538	2,894	5,528
9	9	19	40	23	48	111	70	172	441	345	812	1,758	1,518	2,894	5,607
10	9	18	41	23	48	113	69	170	434	352	816	1,735	1,531	2,941	5,660

Table 6.7.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.10	0.11	1.00	0.30	0.31	1.00	0.58	0.59	1.00	0.83	0.84	1.00	0.96	0.96	1.00
3	0.06	0.07	1.00	0.23	0.23	1.00	0.52	0.53	1.00	0.83	0.83	1.00	0.98	0.98	1.00
4	0.06	0.07	1.00	0.22	0.23	1.00	0.51	0.52	1.00	0.85	0.85	1.00	0.99	0.99	1.00
5	0.06	0.07	1.00	0.22	0.22	1.00	0.53	0.53	1.00	0.86	0.86	1.00	0.99	0.99	1.00
6	0.06	0.06	1.00	0.22	0.23	1.00	0.53	0.54	1.00	0.86	0.87	1.00	0.99	0.99	1.00
7	0.07	0.07	1.00	0.22	0.22	1.00	0.53	0.53	1.00	0.86	0.86	1.00	0.99	0.99	1.00
8	0.06	0.06	1.00	0.22	0.23	1.00	0.53	0.53	1.00	0.85	0.86	1.00	0.99	0.99	1.00
9	0.06	0.06	1.00	0.22	0.22	1.00	0.53	0.53	1.00	0.86	0.86	1.00	0.99	0.99	1.00
10	0.06	0.06	1.00	0.22	0.23	1.00	0.52	0.52	1.00	0.86	0.86	1.00	0.99	0.99	1.00

Table 6.7.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	181,617	198,597	220,603	181,128	198,070	220,582	181,417	198,034	220,876	180,981	197,761	220,025	181,207	198,544	219,982
2	149,493	159,928	175,829	150,265	161,224	177,400	152,613	165,078	183,715	157,912	173,483	196,057	166,953	187,430	219,594
3	149,094	159,260	174,864	149,809	160,976	176,050	152,374	164,263	182,857	158,418	173,777	195,473	171,055	192,816	228,268
4	149,609	160,166	174,590	149,720	160,380	175,791	152,621	164,740	182,406	158,458	174,279	196,552	174,162	198,402	236,743
5	149,356	159,964	175,177	150,024	160,954	177,002	152,271	164,249	181,806	159,696	175,660	198,673	175,577	201,414	240,414
6	149,397	159,934	174,903	149,461	160,568	176,072	152,221	164,307	181,902	159,237	174,838	197,955	176,644	200,124	238,869
7	149,140	159,394	175,037	149,819	160,548	176,394	152,072	163,669	181,372	159,560	174,949	198,020	175,734	200,952	242,706
8	149,165	159,471	174,641	150,031	161,063	176,573	152,281	164,403	182,157	159,496	175,556	197,373	176,368	201,284	239,874
9	149,012	159,898	174,857	150,049	160,907	176,877	152,118	163,996	181,604	159,560	176,193	199,666	176,467	202,536	242,691
10	148,945	159,125	174,321	149,677	160,148	176,416	152,037	164,505	182,286	159,533	175,409	199,752	176,594	201,486	243,378

Table 6.7.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.8.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Base Case scenario.

	Base Case - 147			Base Case - 294			Base Case - base(587)			Base Case - 1174			Base Case - 2348		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	147	147	147	294	294	294	587	587	587	1,174	1,174	1,174	2,348	2,348	2,348
2	39	97	268	43	104	291	51	124	329	67	163	426	99	249	583
3	48	117	323	48	119	322	51	122	323	54	128	344	59	140	374
4	50	120	323	51	121	334	51	119	344	50	121	337	52	123	330
5	51	119	319	52	121	321	52	118	324	50	122	331	51	120	329
6	51	122	329	49	120	339	51	120	329	50	119	332	51	119	329
7	51	124	329	51	119	329	50	119	330	51	123	332	52	120	333
8	50	121	325	51	119	326	52	121	327	52	121	320	51	120	332
9	50	122	332	50	120	332	51	121	329	51	121	326	51	121	326
10	50	121	331	51	121	333	52	119	324	51	119	328	52	122	324

Table 6.8.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Base Case scenario.

	Base Case - 147			Base Case - 294			Base Case - base(587)			Base Case - 1174			Base Case - 2348		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.52	1.00	0.58	0.59	1.00	0.68	0.68	1.00
3	0.48	0.49	1.00	0.47	0.48	1.00	0.49	0.50	1.00	0.49	0.50	1.00	0.51	0.51	1.00
4	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.49	0.49	1.00
5	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00
6	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
7	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
8	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00
9	0.49	0.50	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
10	0.49	0.50	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00

Table 6.8.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Base Case scenario.

	Base Case - 147			Base Case - 294			Base Case - base(587)			Base Case - 1174			Base Case - 2348		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	152,897	164,511	180,119	157,270	169,030	184,989	165,841	178,926	197,361	180,352	197,380	220,160	209,373	236,070	268,772
2	150,796	161,592	177,869	150,555	161,491	177,739	150,923	162,374	178,497	151,510	162,622	179,010	152,184	164,461	181,498
3	150,834	161,817	177,623	150,972	161,613	177,661	150,879	161,515	176,614	151,052	161,943	177,470	150,505	161,869	178,343
4	150,223	161,712	178,026	150,727	162,188	177,470	150,632	162,103	178,765	150,068	161,570	178,444	150,277	161,543	177,519
5	150,981	162,079	178,792	150,487	161,428	177,669	150,815	161,933	177,300	150,848	161,773	177,756	150,916	162,318	177,779
6	150,806	162,094	178,018	150,798	161,444	177,734	150,898	161,633	178,287	150,725	161,575	176,958	150,584	161,679	177,632
7	150,859	162,122	178,037	150,708	161,668	177,351	150,609	161,468	177,244	150,738	161,730	177,830	150,767	161,690	177,465
8	150,223	160,911	177,678	150,934	161,746	177,773	151,036	162,202	178,661	150,833	161,620	178,268	150,388	161,506	177,513
9	150,545	161,720	177,507	150,962	162,348	178,803	150,745	161,823	177,234	150,456	161,550	177,276	150,867	162,182	177,902
10	150,574	161,578	178,048	150,821	161,473	178,223	150,916	161,774	177,611	150,534	160,909	177,212	151,197	162,624	178,261

Table 6.8.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Base Case scenario.

	Base Case - 147			Base Case - 294			Base Case - base(587)			Base Case - 1174			Base Case - 2348		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12

Table 6.8.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Recovery scenario.

	Recovery - 147			Recovery - 294			Recovery - base(587)			Recovery - 1174			Recovery - 2348		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	147	147	147	294	294	294	587	587	587	1,174	1,174	1,174	2,348	2,348	2,348
2	347	802	1,613	408	883	1,783	525	1,057	2,091	724	1,421	2,764	1,112	2,111	4,070
3	794	1,659	3,393	853	1,743	3,502	909	1,891	3,925	1,091	2,185	4,355	1,313	2,629	5,198
4	1,151	2,360	4,671	1,223	2,387	4,569	1,242	2,483	4,813	1,309	2,611	5,099	1,441	2,777	5,435
5	1,378	2,673	5,220	1,406	2,718	5,207	1,408	2,730	5,286	1,446	2,807	5,290	1,484	2,894	5,434
6	1,464	2,828	5,446	1,488	2,874	5,343	1,496	2,859	5,454	1,487	2,856	5,532	1,535	2,892	5,548
7	1,498	2,860	5,473	1,483	2,870	5,538	1,478	2,924	5,508	1,549	2,867	5,633	1,523	2,885	5,478
8	1,540	2,905	5,470	1,513	2,883	5,571	1,538	2,894	5,528	1,532	2,899	5,570	1,552	2,880	5,547
9	1,509	2,910	5,558	1,527	2,900	5,568	1,518	2,894	5,607	1,540	2,899	5,478	1,538	2,934	5,555
10	1,514	2,943	5,514	1,525	2,968	5,553	1,531	2,941	5,660	1,529	2,964	5,493	1,534	2,905	5,560

Table 6.8.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Recovery scenario.

	Recovery - 147			Recovery - 294			Recovery - base(587)			Recovery - 1174			Recovery - 2348		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.92	0.92	1.00	0.94	0.94	1.00	0.96	0.96	1.00	0.98	0.98	1.00	1.00	1.00	1.00
3	0.97	0.97	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00
4	0.98	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	1.00	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.8.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Recovery scenario.

	Recovery - 147			Recovery - 294			Recovery - base(587)			Recovery - 1174			Recovery - 2348		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	157,547	168,672	185,114	165,411	178,381	195,560	181,207	198,544	219,982	209,582	235,014	267,620	263,318	308,063	363,701
2	164,183	181,712	209,105	164,356	183,465	213,123	166,953	187,430	219,594	171,141	195,117	233,837	179,554	211,373	259,138
3	169,217	190,313	224,258	170,171	191,681	226,355	171,055	192,816	228,268	173,012	196,832	233,650	176,070	202,154	243,458
4	172,140	196,093	234,300	172,961	196,070	233,825	174,162	198,402	236,743	173,956	199,156	241,470	176,343	201,090	240,261
5	174,781	199,986	239,082	174,608	200,282	240,369	175,577	201,414	240,414	175,572	200,138	239,582	176,416	201,133	240,236
6	175,166	201,349	239,830	176,466	200,272	239,480	176,644	200,124	238,869	175,315	200,191	241,042	176,561	200,318	241,291
7	176,207	200,994	241,983	176,263	200,990	240,567	175,734	200,952	242,706	176,873	201,814	240,871	176,701	200,975	242,460
8	176,711	202,353	243,386	176,073	201,054	240,817	176,368	201,284	239,874	176,207	201,118	241,885	176,721	202,030	240,706
9	175,580	200,698	243,670	175,648	199,991	240,578	176,467	202,536	242,691	176,208	201,437	241,706	176,868	201,852	240,893
10	176,582	201,652	241,881	177,058	201,630	240,748	176,594	201,486	243,378	177,369	201,740	243,243	175,910	202,459	244,713

Table 6.8.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Recovery scenario.

	Recovery - 147			Recovery - 294			Recovery - base(587)			Recovery - 1174			Recovery - 2348		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12
6	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
7	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
9	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.9.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Base Case scenario.

	Base Case - off			Base Case - on 1st 25 yr			Base Case - on 2nd 25 yr			Base Case - base (on)		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587
2	22	42	81	51	121	331	22	43	82	51	124	329
3	1	5	14	51	121	317	1	5	14	51	122	323
4	0	1	2	51	118	331	0	1	2	51	119	344
5	0	0	0	51	121	324	0	0	0	52	118	324
6	0	0	0	135	247	468	0	0	0	51	120	329
7	0	0	0	14	34	85	34	87	258	50	119	330
8	0	0	0	1	5	16	48	115	319	52	121	327
9	0	0	0	0	1	2	49	117	335	51	121	329
10	0	0	0	0	0	1	50	121	334	52	119	324

Table 6.9.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Base Case scenario.

	Base Case - off			Base Case - on 1st 25 yr			Base Case - on 2nd 25 yr			Base Case - base (on)		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.98	0.96	1.00	0.52	0.53	1.00	0.98	0.96	1.00	0.52	0.52	1.00
3	0.24	0.28	0.93	0.48	0.49	1.00	0.25	0.29	0.93	0.49	0.50	1.00
4	0.03	0.05	0.58	0.47	0.48	1.00	0.02	0.04	0.59	0.48	0.49	1.00
5	0.01	0.01	0.23	0.48	0.49	1.00	0.00	0.01	0.23	0.48	0.48	1.00
6	0.00	0.00	0.07	1.00	1.00	1.00	0.00	0.00	0.06	0.48	0.49	1.00
7	0.00	0.00	0.02	0.61	0.76	1.00	0.45	0.46	1.00	0.48	0.49	1.00
8	0.00	0.00	0.01	0.17	0.26	0.92	0.48	0.49	1.00	0.48	0.48	1.00
9	0.00	0.00	0.00	0.04	0.07	0.59	0.47	0.48	1.00	0.48	0.49	1.00
10	0.00	0.00	0.00	0.01	0.02	0.26	0.49	0.49	1.00	0.48	0.49	1.00

Table 6.9.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Base Case scenario.

	Base Case - off			Base Case - on 1st 25 yr			Base Case - on 2nd 25 yr			Base Case - base (on)		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	13,407	18,066	24,300	165,964	178,837	197,064	13,359	18,034	24,503	165,841	178,926	197,361
2	258	539	1,124	151,529	162,054	177,903	261	538	1,125	150,923	162,374	178,497
3	0	15	90	150,946	161,893	176,942	0	15	93	150,879	161,515	176,614
4	0	0	0	150,766	162,030	178,116	0	0	0	150,632	162,103	178,765
5	0	0	0	150,335	161,464	177,657	0	0	0	150,815	161,933	177,300
6	0	0	0	1,359	2,781	5,719	148,382	159,136	174,178	150,898	161,633	178,287
7	0	0	0	76	220	590	150,183	161,674	177,149	150,609	161,468	177,244
8	0	0	0	0	15	87	150,482	161,720	176,539	151,036	162,202	178,661
9	0	0	0	0	0	0	150,529	161,905	178,460	150,745	161,823	177,234
10	0	0	0	0	0	0	150,606	161,697	177,396	150,916	161,774	177,611

Table 6.9.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Base Case scenario.

	Base Case - off			Base Case - on 1st 25 yr			Base Case - on 2nd 25 yr			Base Case - base (on)		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.00	0.09	0.10	0.10	0.11	0.12	0.00	0.09	0.10	0.10	0.11	0.12
4	0.00	0.00	0.00	0.10	0.11	0.12	0.00	0.00	0.00	0.10	0.11	0.12
5	0.00	0.00	0.00	0.10	0.11	0.12	0.00	0.00	0.00	0.10	0.11	0.12
6	0.00	0.00	0.00	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.00	0.00	0.00	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12
8	0.00	0.00	0.00	0.00	0.09	0.11	0.10	0.11	0.12	0.10	0.11	0.12
9	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.11	0.12	0.10	0.11	0.12
10	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.9.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Recovery scenario.

	Recovery - off			Recovery - on 1st 25 yr			Recovery - on 2nd 25 yr			Recovery - base (on)		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587
2	183	334	651	527	1,057	2,095	182	341	650	525	1,057	2,091
3	152	375	915	929	1,905	3,897	152	376	932	909	1,891	3,925
4	161	474	1,333	1,278	2,540	4,809	164	471	1,343	1,242	2,483	4,813
5	188	618	1,616	1,432	2,780	5,300	187	599	1,652	1,408	2,730	5,286
6	213	759	1,869	1,615	2,990	5,627	155	583	1,700	1,496	2,859	5,454
7	247	842	2,110	1,133	2,198	4,158	748	1,623	3,329	1,478	2,924	5,508
8	267	930	2,250	938	1,856	3,618	1,150	2,316	4,627	1,538	2,894	5,528
9	303	967	2,372	822	1,690	3,409	1,384	2,639	5,127	1,518	2,894	5,607
10	315	1,015	2,395	760	1,591	3,154	1,479	2,815	5,335	1,531	2,941	5,660

Table 6.9.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Recovery scenario.

	Recovery - off			Recovery - on 1st 25 yr			Recovery - on 2nd 25 yr			Recovery - base (on)		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	0.97	0.97	1.00	1.00	1.00	1.00	0.96	0.96	1.00
3	0.98	0.99	1.00	0.98	0.98	1.00	0.98	0.99	1.00	0.98	0.98	1.00
4	0.95	0.97	1.00	0.98	0.98	1.00	0.95	0.97	1.00	0.99	0.99	1.00
5	0.94	0.96	1.00	0.99	0.99	1.00	0.94	0.97	1.00	0.99	0.99	1.00
6	0.94	0.96	1.00	1.00	1.00	1.00	0.55	0.56	1.00	0.99	0.99	1.00
7	0.94	0.96	1.00	1.00	1.00	1.00	0.96	0.96	1.00	0.99	0.99	1.00
8	0.94	0.96	1.00	1.00	1.00	1.00	0.98	0.98	1.00	0.99	0.99	1.00
9	0.94	0.96	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.94	0.96	1.00	0.99	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.9.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Recovery scenario.

	Recovery - off			Recovery - on 1st 25 yr			Recovery - on 2nd 25 yr			Recovery - base (on)		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	26,699	35,883	48,632	180,695	197,508	219,608	26,443	36,251	48,738	181,207	198,544	219,982
2	3,948	8,092	17,721	166,577	187,474	219,552	3,868	8,401	16,995	166,953	187,430	219,594
3	1,785	4,566	11,734	171,119	193,924	227,432	1,739	4,558	11,690	171,055	192,816	228,268
4	1,456	4,605	13,266	173,929	198,049	235,466	1,479	4,598	13,547	174,162	198,402	236,743
5	1,583	5,560	15,498	175,502	199,391	239,260	1,579	5,456	15,799	175,577	201,414	240,414
6	1,834	6,801	17,337	20,786	38,433	75,962	154,207	167,248	186,565	176,644	200,124	238,869
7	2,075	7,413	19,376	11,728	22,637	44,071	167,295	187,399	218,381	175,734	200,952	242,706
8	2,177	8,374	20,095	8,856	18,173	33,947	171,508	194,802	232,690	176,368	201,284	239,874
9	2,466	8,820	21,434	7,397	16,107	30,883	175,492	199,573	239,042	176,467	202,536	242,691
10	2,709	9,561	21,907	6,498	15,041	28,473	175,650	200,339	239,189	176,594	201,486	243,378

Table 6.9.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Recovery scenario.

	Recovery - off			Recovery - on 1st 25 yr			Recovery - on 2nd 25 yr			Recovery - base (on)		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.10	0.11	0.10	0.11	0.12
4	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.10	0.11	0.10	0.11	0.12
5	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.10	0.11	0.10	0.11	0.12
6	0.10	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12
8	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12
9	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12
10	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.10.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	324	744	1,507	117	317	737	51	124	329	28	59	145	19	37	80
3	380	838	1,702	131	350	807	51	122	323	23	51	117	12	25	53
4	397	863	1,737	135	363	806	51	119	344	22	47	111	11	23	48
5	405	873	1,759	142	362	802	52	118	324	22	49	110	10	22	46
6	390	861	1,796	134	356	819	51	120	329	22	47	111	10	22	46
7	401	880	1,774	135	355	822	50	119	330	22	48	111	10	22	46
8	410	849	1,780	137	366	824	52	121	327	22	47	111	10	22	46
9	390	862	1,740	137	360	805	51	121	329	23	47	112	11	22	46
10	397	867	1,755	138	363	810	52	119	324	22	47	111	11	22	45

Table 6.10.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.92	0.92	1.00	0.75	0.76	1.00	0.52	0.52	1.00	0.30	0.30	1.00	0.16	0.16	1.00
3	0.93	0.93	1.00	0.74	0.75	1.00	0.49	0.50	1.00	0.23	0.23	1.00	0.07	0.08	1.00
4	0.92	0.93	1.00	0.76	0.76	1.00	0.48	0.49	1.00	0.21	0.22	1.00	0.07	0.07	1.00
5	0.92	0.93	1.00	0.76	0.77	1.00	0.48	0.48	1.00	0.22	0.23	1.00	0.07	0.07	1.00
6	0.92	0.93	1.00	0.75	0.76	1.00	0.48	0.49	1.00	0.22	0.23	1.00	0.07	0.07	1.00
7	0.92	0.92	1.00	0.75	0.76	1.00	0.48	0.49	1.00	0.22	0.23	1.00	0.07	0.07	1.00
8	0.92	0.93	1.00	0.76	0.76	1.00	0.48	0.48	1.00	0.22	0.22	1.00	0.06	0.07	1.00
9	0.93	0.93	1.00	0.76	0.77	1.00	0.48	0.49	1.00	0.21	0.22	1.00	0.07	0.07	1.00
10	0.93	0.93	1.00	0.75	0.75	1.00	0.48	0.49	1.00	0.22	0.22	1.00	0.07	0.07	1.00

Table 6.10.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	165,365	178,703	197,079	165,999	178,556	196,582	165,841	178,926	197,361	166,289	179,221	197,220	165,603	178,839	197,219
2	157,706	171,764	191,918	152,999	165,388	182,792	150,923	162,374	178,497	150,070	160,620	175,768	149,154	159,860	175,524
3	157,784	172,287	193,212	153,158	165,131	183,335	150,879	161,515	176,614	149,693	159,954	175,357	149,322	159,737	174,695
4	157,420	171,572	192,396	153,400	165,881	183,300	150,632	162,103	178,765	149,646	160,311	175,617	148,503	158,885	174,742
5	157,938	172,169	193,577	153,168	165,305	182,971	150,815	161,933	177,300	149,609	160,018	175,327	149,161	159,609	175,604
6	157,941	172,206	192,513	153,294	165,680	182,887	150,898	161,633	178,287	149,662	159,542	174,444	149,113	159,352	174,171
7	158,041	172,743	192,629	153,090	165,683	182,862	150,609	161,468	177,244	149,822	160,481	175,620	148,732	158,902	174,193
8	158,154	172,854	193,398	153,837	166,152	183,608	151,036	162,202	178,661	149,660	160,193	175,511	148,884	159,257	174,404
9	157,517	172,359	193,488	153,452	165,558	182,239	150,745	161,823	177,234	149,312	160,188	175,478	148,484	158,850	175,213
10	157,978	172,211	192,969	153,459	165,787	183,690	150,916	161,774	177,611	149,417	159,970	176,198	148,871	159,667	175,554

Table 6.10.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.10.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	1,877	3,526	6,736	968	1,894	3,721	525	1,057	2,091	281	644	1,323	171	424	916
3	3,103	5,762	10,972	1,747	3,367	6,412	909	1,891	3,925	461	1,080	2,340	225	626	1,535
4	3,344	6,292	11,803	2,071	3,949	7,502	1,242	2,483	4,813	678	1,526	3,137	330	893	2,125
5	3,464	6,330	11,983	2,200	4,117	7,771	1,408	2,730	5,286	842	1,817	3,611	440	1,124	2,497
6	3,509	6,436	11,707	2,292	4,191	7,822	1,496	2,859	5,454	926	1,948	3,899	526	1,285	2,839
7	3,514	6,394	11,981	2,241	4,171	7,886	1,478	2,924	5,508	986	2,019	4,034	576	1,413	3,078
8	3,501	6,357	11,917	2,257	4,160	7,913	1,538	2,894	5,528	1,019	2,071	4,076	648	1,449	3,081
9	3,496	6,452	11,892	2,254	4,245	7,908	1,518	2,894	5,607	1,039	2,064	4,156	661	1,533	3,255
10	3,503	6,455	11,898	2,264	4,243	7,904	1,531	2,941	5,660	1,058	2,109	4,186	694	1,581	3,262

Table 6.10.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	0.99	0.99	1.00	0.96	0.96	1.00	0.90	0.90	1.00	0.80	0.80	1.00
3	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	1.00	0.90	0.90	1.00	0.74	0.74	1.00
4	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.92	0.93	1.00	0.78	0.79	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.94	0.95	1.00	0.82	0.83	1.00
6	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.95	0.95	1.00	0.84	0.84	1.00
7	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.95	0.95	1.00	0.85	0.86	1.00
8	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.96	0.96	1.00	0.87	0.87	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.96	0.96	1.00	0.88	0.88	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.96	0.96	1.00	0.87	0.87	1.00

Table 6.10.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	181,067	198,090	220,504	180,974	198,270	221,056	181,207	198,544	219,982	181,178	198,427	220,336	181,231	197,740	220,049
2	193,621	235,848	315,133	178,505	205,722	252,370	166,953	187,430	219,594	160,911	178,178	203,868	157,574	172,066	193,831
3	205,419	256,617	348,233	184,937	217,117	273,408	171,055	192,816	228,268	162,782	179,199	206,092	157,318	172,219	193,138
4	210,390	262,588	351,977	187,974	221,950	280,880	174,162	198,402	236,743	164,519	182,951	210,077	157,615	173,956	197,029
5	209,072	263,480	355,769	189,097	222,899	286,954	175,577	201,414	240,414	165,305	184,289	212,356	158,939	174,965	198,038
6	209,711	263,452	355,818	189,913	223,391	283,662	176,644	200,124	238,869	167,238	186,040	215,607	159,620	177,157	200,699
7	210,051	264,119	356,858	189,426	224,758	285,891	175,734	200,952	242,706	166,920	187,060	217,041	160,798	177,765	201,480
8	210,123	265,923	359,667	189,444	224,644	287,472	176,368	201,284	239,874	167,143	186,848	217,510	161,726	177,725	203,510
9	210,433	265,151	361,232	188,980	225,057	287,932	176,467	202,536	242,691	167,926	187,483	216,775	161,851	178,410	203,785
10	210,608	264,157	353,760	188,958	224,366	285,240	176,594	201,486	243,378	168,112	188,347	217,938	162,250	180,153	205,031

Table 6.10.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
7	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.11.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	19	37	79	27	60	144	51	124	329	120	319	721	327	731	1,516
3	12	25	51	24	49	117	51	122	323	129	349	782	393	824	1,748
4	11	22	48	23	48	109	51	119	344	133	368	801	383	867	1,755
5	11	22	46	22	48	110	52	118	324	137	367	817	389	875	1,799
6	11	22	46	22	48	109	51	120	329	136	357	820	396	863	1,776
7	10	22	46	22	48	109	50	119	330	138	359	833	409	877	1,749
8	11	21	45	22	46	113	52	121	327	136	357	808	407	861	1,758
9	10	22	46	22	47	112	51	121	329	136	361	825	404	870	1,783
10	11	22	46	21	47	112	52	119	324	137	367	804	389	870	1,785

Table 6.11.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.16	0.16	1.00	0.30	0.30	1.00	0.52	0.52	1.00	0.75	0.76	1.00	0.91	0.91	1.00
3	0.07	0.08	1.00	0.23	0.23	1.00	0.49	0.50	1.00	0.75	0.76	1.00	0.92	0.92	1.00
4	0.06	0.07	1.00	0.22	0.23	1.00	0.48	0.49	1.00	0.75	0.76	1.00	0.92	0.93	1.00
5	0.06	0.07	1.00	0.22	0.23	1.00	0.48	0.48	1.00	0.76	0.76	1.00	0.92	0.92	1.00
6	0.07	0.07	1.00	0.22	0.23	1.00	0.48	0.49	1.00	0.75	0.76	1.00	0.93	0.93	1.00
7	0.07	0.07	1.00	0.22	0.22	1.00	0.48	0.49	1.00	0.76	0.77	1.00	0.93	0.93	1.00
8	0.07	0.07	1.00	0.22	0.23	1.00	0.48	0.48	1.00	0.75	0.76	1.00	0.93	0.93	1.00
9	0.07	0.07	1.00	0.22	0.22	1.00	0.48	0.49	1.00	0.75	0.76	1.00	0.92	0.93	1.00
10	0.07	0.07	1.00	0.22	0.22	1.00	0.48	0.49	1.00	0.75	0.76	1.00	0.93	0.93	1.00

Table 6.11.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	52,447	58,663	66,557	90,503	98,929	110,096	165,841	178,926	197,361	315,266	337,480	369,994	613,771	656,846	716,789
2	37,385	40,180	44,232	75,302	80,699	88,904	150,923	162,374	178,497	302,438	324,746	355,701	606,797	651,212	714,989
3	37,393	39,889	43,786	74,890	80,161	88,102	150,879	161,515	176,614	303,353	326,912	359,220	608,682	651,757	717,704
4	37,425	40,031	43,822	75,268	80,614	88,490	150,632	162,103	178,765	303,145	325,840	358,520	607,944	654,580	720,626
5	37,370	40,194	44,107	74,995	80,789	88,333	150,815	161,933	177,300	302,954	325,373	358,031	607,628	653,823	719,290
6	37,313	40,019	43,995	74,986	80,652	88,357	150,898	161,633	178,287	302,442	324,316	355,908	607,555	652,512	719,547
7	37,273	39,973	43,809	74,969	80,317	87,504	150,609	161,468	177,244	302,709	324,418	356,975	607,010	652,238	716,696
8	37,377	40,069	44,010	74,700	80,509	88,371	151,036	162,202	178,661	302,963	325,007	359,588	606,462	652,664	718,012
9	37,321	39,909	43,765	74,977	80,250	87,980	150,745	161,823	177,234	303,362	325,112	356,554	609,600	651,963	716,238
10	37,393	39,951	43,822	74,956	80,566	88,506	150,916	161,774	177,611	303,121	325,348	357,710	608,739	655,180	718,771

Table 6.11.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.11.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	174	428	929	288	637	1,305	525	1,057	2,091	954	1,874	3,741	1,885	3,555	6,968
3	237	620	1,513	446	1,092	2,372	909	1,891	3,925	1,716	3,325	6,597	3,113	5,811	10,912
4	339	890	2,128	662	1,494	3,216	1,242	2,483	4,813	2,100	3,908	7,457	3,443	6,284	11,690
5	453	1,135	2,527	832	1,802	3,658	1,408	2,730	5,286	2,213	4,055	7,798	3,471	6,416	11,888
6	554	1,323	2,774	939	1,940	3,845	1,496	2,859	5,454	2,267	4,161	7,869	3,457	6,455	12,101
7	637	1,433	2,987	988	2,005	4,064	1,478	2,924	5,508	2,276	4,167	7,859	3,489	6,493	12,000
8	666	1,521	3,186	1,035	2,087	4,181	1,538	2,894	5,528	2,265	4,129	7,902	3,456	6,496	12,019
9	694	1,544	3,272	1,016	2,076	4,202	1,518	2,894	5,607	2,260	4,160	7,906	3,539	6,520	11,791
10	708	1,570	3,253	1,042	2,113	4,187	1,531	2,941	5,660	2,261	4,218	8,028	3,477	6,383	11,830

Table 6.11.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.80	0.80	1.00	0.90	0.90	1.00	0.96	0.96	1.00	0.99	0.99	1.00	1.00	1.00	1.00
3	0.74	0.75	1.00	0.89	0.90	1.00	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	0.79	0.79	1.00	0.92	0.93	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	0.83	0.83	1.00	0.93	0.94	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	0.85	0.86	1.00	0.95	0.95	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	0.87	0.87	1.00	0.95	0.95	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	0.87	0.87	1.00	0.96	0.96	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	0.88	0.88	1.00	0.95	0.96	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	0.88	0.88	1.00	0.96	0.96	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 6.11.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	66,294	76,800	90,552	104,967	117,463	134,139	181,207	198,544	219,982	332,519	357,745	394,440	632,841	676,546	740,803
2	42,154	49,195	62,318	84,336	95,604	115,045	166,953	187,430	219,594	332,418	371,021	429,684	660,074	732,012	834,667
3	41,390	48,185	61,195	84,544	97,501	117,649	171,055	192,816	228,268	339,069	381,813	448,125	674,450	751,918	864,879
4	42,536	50,113	63,826	86,332	100,508	122,456	174,162	198,402	236,743	344,416	389,432	454,240	678,342	758,920	870,301
5	42,846	51,531	67,269	87,812	102,461	126,191	175,577	201,414	240,414	345,136	388,794	458,346	679,923	760,949	870,663
6	43,879	53,080	69,174	89,526	104,626	127,963	176,644	200,124	238,869	343,086	388,719	459,964	679,956	758,601	877,164
7	45,064	54,498	71,394	89,143	104,871	129,460	175,734	200,952	242,706	345,842	390,714	458,828	678,265	756,041	873,365
8	45,056	55,179	72,671	89,820	105,112	130,283	176,368	201,284	239,874	345,441	389,321	458,803	679,233	761,494	874,070
9	45,263	55,557	74,177	90,084	104,731	130,935	176,467	202,536	242,691	345,435	390,098	457,810	679,031	760,905	868,326
10	45,664	55,384	73,677	90,059	104,966	131,323	176,594	201,486	243,378	345,356	389,375	457,772	677,369	762,334	873,159

Table 6.11.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.12.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Base Case scenario.

	Base Case - all in Pisc			Base Case - all in PU 2			Base Case - base			Base Case - equal in all PUs			Base Case - all below VZ		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	32	72	190	27	59	147	51	124	329	65	135	334	208	393	798
3	27	62	157	22	48	114	51	122	323	67	138	328	251	459	926
4	27	60	155	21	46	107	51	119	344	69	142	335	253	478	943
5	26	60	155	21	47	108	52	118	324	70	143	338	259	479	937
6	26	60	154	21	46	110	51	120	329	69	144	335	254	479	958
7	27	61	154	21	47	111	50	119	330	70	141	345	256	484	936
8	27	59	151	22	47	109	52	121	327	68	142	341	257	480	947
9	27	60	150	21	47	111	51	121	329	70	140	339	256	483	950
10	27	61	152	21	46	110	52	119	324	69	139	347	254	481	962

Table 6.12.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Base Case scenario.

	Base Case - all in Pisc			Base Case - all in PU 2			Base Case - base			Base Case - equal in all PUs			Base Case - all below VZ		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.36	0.39	1.00	0.33	0.30	1.00	0.52	0.52	1.00	0.44	0.44	1.00	0.33	0.33	1.00
3	0.25	0.33	1.00	0.25	0.23	1.00	0.49	0.50	1.00	0.38	0.39	1.00	0.31	0.32	1.00
4	0.24	0.33	1.00	0.25	0.22	1.00	0.48	0.49	1.00	0.39	0.39	1.00	0.32	0.33	1.00
5	0.24	0.32	1.00	0.25	0.22	1.00	0.48	0.48	1.00	0.38	0.39	1.00	0.32	0.32	1.00
6	0.23	0.33	1.00	0.25	0.22	1.00	0.48	0.49	1.00	0.38	0.38	1.00	0.32	0.33	1.00
7	0.24	0.33	1.00	0.25	0.22	1.00	0.48	0.49	1.00	0.38	0.39	1.00	0.31	0.32	1.00
8	0.23	0.32	1.00	0.25	0.22	1.00	0.48	0.48	1.00	0.38	0.39	1.00	0.32	0.32	1.00
9	0.23	0.32	1.00	0.25	0.22	1.00	0.48	0.49	1.00	0.39	0.39	1.00	0.32	0.33	1.00
10	0.24	0.32	1.00	0.25	0.22	1.00	0.48	0.49	1.00	0.38	0.38	1.00	0.32	0.33	1.00

Table 6.12.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Base Case scenario.

	Base Case - all in Pisc			Base Case - all in PU 2			Base Case - base			Base Case - equal in all PUs			Base Case - all below VZ		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	222,805	239,303	262,636	255,824	280,102	300,659	165,841	178,926	197,361	176,739	190,776	208,235	21,610	26,224	32,276
2	206,591	219,916	241,186	239,235	262,117	281,627	150,923	162,374	178,497	161,363	172,972	189,922	6,916	9,394	11,290
3	206,603	220,704	241,619	238,627	261,656	280,725	150,879	161,515	176,614	161,009	172,565	188,778	6,963	9,578	11,394
4	206,349	220,485	242,885	238,535	261,905	281,134	150,632	162,103	178,765	160,210	172,376	188,915	6,990	9,852	11,446
5	206,299	220,156	241,841	239,078	260,270	280,136	150,815	161,933	177,300	160,498	171,969	188,342	6,987	9,830	11,450
6	206,037	220,183	241,683	239,298	261,645	281,208	150,898	161,633	178,287	160,864	172,502	189,577	6,995	9,783	11,471
7	205,949	220,342	241,240	239,033	262,324	281,212	150,609	161,468	177,244	160,892	172,295	188,594	6,987	9,459	11,429
8	206,301	220,826	242,780	239,166	260,611	280,416	151,036	162,202	178,661	160,852	172,313	188,824	6,998	9,542	11,457
9	206,438	220,636	242,931	238,877	261,315	280,850	150,745	161,823	177,234	161,102	173,110	189,208	6,998	9,721	11,454
10	206,040	219,994	241,537	240,029	260,901	280,939	150,916	161,774	177,611	160,823	172,634	187,636	6,983	9,414	11,423

Table 6.12.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Base Case scenario.

	Base Case - all in Pisc			Base Case - all in PU 2			Base Case - base			Base Case - equal in all PUs			Base Case - all below VZ		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.09	0.09	0.10
2	0.10	0.10	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.13	0.06	0.06	0.09
3	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.06	0.06	0.09
4	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.06	0.06	0.09
5	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.06	0.06	0.09
6	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.13	0.06	0.06	0.09
7	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.06	0.06	0.09
8	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.06	0.06	0.09
9	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.13	0.06	0.06	0.09
10	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.06	0.06	0.09

Table 6.12.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Recovery scenario.

	Recovery - all in Pisc			Recovery - all in PU 2			Recovery - base			Recovery - equal in all PUs			Recovery - all below VZ		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	354	760	1,515	295	645	1,326	525	1,057	2,091	524	1,075	2,112	1,008	1,995	3,986
3	580	1,288	2,690	442	1,079	2,310	909	1,891	3,925	954	1,965	3,950	1,864	3,565	6,571
4	830	1,770	3,567	643	1,474	3,150	1,242	2,483	4,813	1,283	2,519	4,807	2,119	3,834	7,216
5	990	2,068	4,073	813	1,739	3,551	1,408	2,730	5,286	1,398	2,734	5,136	2,124	3,950	7,484
6	1,104	2,217	4,255	899	1,894	3,861	1,496	2,859	5,454	1,465	2,782	5,285	2,182	4,014	7,460
7	1,155	2,282	4,521	968	1,983	3,952	1,478	2,924	5,508	1,505	2,827	5,417	2,123	4,004	7,368
8	1,182	2,303	4,529	998	2,053	4,009	1,538	2,894	5,528	1,485	2,873	5,366	2,158	4,012	7,497
9	1,185	2,342	4,635	1,022	2,060	4,125	1,518	2,894	5,607	1,511	2,814	5,396	2,189	4,007	7,382
10	1,189	2,324	4,685	1,024	2,090	4,107	1,531	2,941	5,660	1,510	2,855	5,454	2,171	4,029	7,638

Table 6.12.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Recovery scenario.

	Recovery - all in Pisc			Recovery - all in PU 2			Recovery - base			Recovery - equal in all PUs			Recovery - all below VZ		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.92	0.93	1.00	0.91	0.90	1.00	0.96	0.96	1.00	0.94	0.94	1.00	0.91	0.91	1.00
3	0.91	0.94	1.00	0.91	0.89	1.00	0.98	0.98	1.00	0.96	0.96	1.00	0.96	0.96	1.00
4	0.94	0.95	1.00	0.93	0.92	1.00	0.99	0.99	1.00	0.97	0.98	1.00	0.97	0.98	1.00
5	0.95	0.97	1.00	0.94	0.93	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.98	0.98	1.00
6	0.96	0.97	1.00	0.95	0.94	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.97	0.98	1.00
7	0.96	0.97	1.00	0.96	0.95	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.98	0.98	1.00
8	0.97	0.98	1.00	0.96	0.96	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.98	0.98	1.00
9	0.97	0.98	1.00	0.96	0.95	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.98	0.98	1.00
10	0.96	0.97	1.00	0.96	0.96	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.98	0.98	1.00

Table 6.12.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Recovery scenario.

	Recovery - all in Pisc			Recovery - all in PU 2			Recovery - base			Recovery - equal in all PUs			Recovery - all below VZ		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	238,335	257,927	285,908	271,711	298,167	323,743	181,207	198,544	219,982	191,771	209,396	230,691	34,659	44,421	56,669
2	222,263	245,437	280,566	256,476	282,612	310,639	166,953	187,430	219,594	175,615	195,393	222,023	14,098	23,445	39,198
3	223,809	249,022	283,935	256,745	284,237	314,129	171,055	192,816	228,268	179,625	198,970	227,587	18,458	28,480	46,163
4	226,808	252,368	291,019	260,764	288,626	320,786	174,162	198,402	236,743	182,164	203,619	234,833	20,753	31,278	52,026
5	228,488	255,223	293,742	263,442	290,512	323,783	175,577	201,414	240,414	183,168	205,190	235,832	21,050	32,514	53,796
6	229,191	257,310	297,398	262,801	291,733	325,826	176,644	200,124	238,869	183,805	205,958	237,064	21,671	33,314	54,799
7	230,418	257,186	297,823	262,421	291,480	326,540	175,734	200,952	242,706	183,452	205,934	238,854	21,439	33,414	54,924
8	230,198	258,014	298,353	265,121	291,922	326,876	176,368	201,284	239,874	182,959	205,769	238,829	21,204	33,013	55,865
9	230,401	256,376	296,544	263,545	291,965	328,254	176,467	202,536	242,691	184,424	206,237	237,707	21,208	33,117	56,319
10	231,194	259,232	301,109	264,171	293,519	328,503	176,594	201,486	243,378	184,130	206,317	239,419	21,411	33,391	55,035

Table 6.12.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Recovery scenario.

	Recovery - all in Pisc			Recovery - all in PU 2			Recovery - base			Recovery - equal in all PUs			Recovery - all below VZ		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.09	0.10	0.11
2	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
3	0.10	0.10	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
4	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
5	0.10	0.10	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
6	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
7	0.10	0.10	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
8	0.10	0.10	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
9	0.10	0.10	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.08	0.09	0.10
10	0.10	0.11	0.12	0.11	0.13	0.14	0.10	0.11	0.12	0.10	0.11	0.12	0.09	0.09	0.10

Table 6.13.1. Alternate homing rates and straying patterns by production unit (PU) for the Dam Impact Analysis Model, based on an assessment of previous behavioral studies, fishway trap data, and Expert Panel recommendations, but local knowledge was excluded (RulesX1). The Natal PU (rows) identifies where a fish was reared and the Final Destination PU (columns) identifies where a fish will attempt to migrate. Homing rates are bolded and listed in the diagonal row. Grey cells indicate no straying from that Natal PU into the Final Destination PU.

	Final Destination PU														
Natal PU	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	**0.900**	0.090	0.010	0	0	0	0	0	0	0	0	0	0	0	0
2	0.045	**0.900**	0.045	0	0	0	0	0	0.010	0	0	0	0	0	0
3	0	0.045	**0.900**	0.045	0	0	0	0	0.010	0	0	0	0	0	0
4	0	0	0.045	**0.900**	0	0.045	0	0	0.010	0	0	0	0	0	0
5	0	0	0	0.050	**0.900**	0.050	0	0	0	0	0	0	0	0	0
6	0	0	0	0.090	0	**0.900**	0	0	0.010	0	0	0	0	0	0
7	0	0	0	0.045	0	0	**0.900**	0.045	0.010	0	0	0	0	0	0
8	0	0	0	0.010	0	0	0.090	**0.900**	0	0	0	0	0	0	0
9	0	0	0.090	0.090	0	0	0	0	**0.700**	0.030	0	0	0	0	0.090
10	0	0	0	0	0	0	0	0	0.270	**0.700**	0	0.030	0	0	0
11	0	0	0	0	0	0	0	0	0.270	0.030	**0.700**	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0.270	0	**0.700**	0	0.030	0
13	0	0	0	0	0	0	0	0	0	0	0	0.050	**0.900**	0.050	0
14	0	0	0	0	0	0	0	0	0	0	0	0.270	0.030	**0.700**	0
15	0	0	0	0	0	0	0	0	0.100	0	0	0	0	0	**0.900**

Table 6.13.2. Alternate homing rates and straying patterns by production unit (PU) for the Dam Impact Analysis Model, based on applying the RulesX1 table to itself to further distribute straying fish (RulesX2). The Natal PU (rows) identifies where a fish was reared and the Final Destination PU (columns) identifies where a fish will attempt to migrate. Homing rates are bolded and listed in the diagonal row. Grey cells indicate no straying from that Natal PU into the Final Destination PU.

	Final Destination PU														
Natal PU	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	**0.904**	0.081	0.013	0.000	0	0	0	0	0.001	0	0	0	0	0	0
2	0.041	**0.906**	0.042	0.003	0	0	0	0	0.007	0.000	0	0	0	0	0.001
3	0.002	0.041	**0.905**	0.041	0	0.002	0	0	0.008	0.000	0	0	0	0	0.001
4	0	0.002	0.041	**0.907**	0	0.041	0	0	0.008	0.000	0	0	0	0	0.001
5	0	0	0.002	0.050	**0.900**	0.047	0	0	0.001	0	0	0	0	0	0
6	0	0	0.005	0.082	0	**0.904**	0	0	0.008	0.000	0	0	0	0	0.001
7	0	0	0.003	0.042	0.002	0	**0.904**	0.041	0.007	0.000	0	0	0	0	0.001
8	0	0	0.000	0.013	0	0.000	0.081	**0.904**	0.001	0	0	0	0	0	0
9	0	0.004	0.085	0.085	0	0.004	0	0	**0.719**	0.021	0	0.001	0	0	0.081
10	0	0	0.024	0.024	0	0	0	0	0.189	**0.716**	0	0.021	0	0.001	0.024
11	0	0	0.024	0.024	0	0	0	0	0.197	0.029	**0.700**	0.001	0	0	0.024
12	0	0	0	0	0	0	0	0	0.073	0.189	0	**0.716**	0.001	0.021	0
13	0	0	0	0	0	0	0	0	0	0.014	0	0.049	**0.902**	0.037	0
14	0	0	0	0	0	0	0	0	0	0.073	0	0.191	0.027	**0.710**	0
15	0	0.009	0.009	0	0	0	0	0	0.070	0.003	0	0	0	0	**0.909**

Table 6.13.3. Alternate homing rates and straying patterns by production unit (PU) for the Dam Impact Analysis Model, where all adults return to their natal PU (100% home). The Natal PU (rows) identifies where a fish was reared and the Final Destination PU (columns) identifies where a fish will attempt to migrate. Homing rates are bolded and listed in the diagonal row. Grey cells indicate no straying from that Natal PU into the Final Destination PU.

	Final Destination PU														
Natal PU	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	**1.000**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	**1.000**	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	**1.000**	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	**1.000**	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	**1.000**	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	**1.000**	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	**1.000**	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	**1.000**	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	**1.000**	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	**1.000**	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	**1.000**	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	**1.000**	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	**1.000**	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.000**	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.000**

Table 6.13.4. Alternate homing rates and straying patterns by production unit (PU) for the Dam Impact Analysis Model, where all returning adults stray equally to other PUs (=straying). The Natal PU (rows) identifies where a fish was reared and the Final Destination PU (columns) identifies where a fish will attempt to migrate. Homing rates are bolded and listed in the diagonal row. Grey cells indicate no straying from that Natal PU into the Final Destination PU.

	Final Destination PU														
Natal PU	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
2	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
3	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
4	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
5	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
6	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
7	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
8	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071	0.071
9	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071	0.071
10	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071	0.071
11	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071	0.071
12	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071	0.071
13	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071	0.071
14	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**	0.071
15	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	**0**

Table 6.13.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Base Case scenario.

	Base Case - RulesX1			Base Case - RulesX2			Base Case - base			Base Case - 100% home			Base Case - =straying		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	53	123	339	51	125	335	51	124	329	53	124	335	57	131	338
3	52	120	324	51	121	322	51	122	323	51	119	335	53	124	334
4	52	121	332	52	120	322	51	119	344	52	120	326	54	123	332
5	51	122	326	51	121	329	52	118	324	50	120	328	54	124	328
6	51	122	333	51	118	332	51	120	329	52	122	332	54	123	325
7	53	121	324	51	119	330	50	119	330	52	121	323	54	121	332
8	52	119	328	50	120	339	52	121	327	51	123	334	54	126	328
9	54	121	327	51	120	326	51	121	329	51	123	335	54	123	329
10	53	124	323	52	119	321	52	119	324	51	123	322	53	124	325

Table 6.13.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Base Case scenario.

	Base Case - RulesX1			Base Case - RulesX2			Base Case - base			Base Case - 100% home			Base Case - =straying		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.50	0.51	1.00	0.51	0.52	1.00	0.52	0.52	1.00	0.51	0.52	1.00	0.48	0.48	1.00
3	0.47	0.48	1.00	0.47	0.48	1.00	0.49	0.50	1.00	0.47	0.48	1.00	0.46	0.46	1.00
4	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.47	0.47	1.00
5	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.48	1.00	0.47	0.47	1.00
6	0.48	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.47	0.47	1.00
7	0.48	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.46	0.46	1.00
8	0.47	0.48	1.00	0.47	0.48	1.00	0.48	0.48	1.00	0.47	0.48	1.00	0.47	0.47	1.00
9	0.47	0.48	1.00	0.47	0.47	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.47	1.00
10	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.47	0.47	1.00

Table 6.13.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Base Case scenario.

	Base Case - RulesX1			Base Case - RulesX2			Base Case - base			Base Case - 100% home			Base Case - =straying		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	165,902	179,096	196,955	165,967	178,868	196,533	165,841	178,926	197,361	165,939	179,200	197,855	165,491	178,387	196,732
2	151,123	162,997	179,091	150,986	162,184	177,798	150,923	162,374	178,497	151,035	162,019	178,972	150,824	161,876	178,444
3	151,280	162,742	178,759	151,065	162,112	178,351	150,879	161,515	176,614	150,953	161,952	177,810	150,907	161,721	178,169
4	150,850	161,898	178,680	151,198	162,089	177,354	150,632	162,103	178,765	151,024	162,236	178,468	151,086	161,967	178,097
5	150,959	161,981	177,425	150,884	161,622	177,758	150,815	161,933	177,300	150,600	162,029	178,304	150,684	161,727	178,064
6	150,837	161,823	177,989	150,608	161,688	178,523	150,898	161,633	178,287	150,924	162,614	178,175	150,961	161,851	177,767
7	151,212	161,833	178,603	150,573	161,997	178,365	150,609	161,468	177,244	150,927	161,816	177,903	150,729	161,763	178,391
8	151,047	161,731	177,730	151,447	162,758	178,843	151,036	162,202	178,661	150,644	161,665	177,230	151,158	162,211	177,581
9	151,225	162,380	178,773	150,744	162,079	178,689	150,745	161,823	177,234	150,819	161,930	177,775	150,757	161,677	177,284
10	151,130	161,989	178,353	151,039	162,360	178,153	150,916	161,774	177,611	150,703	161,664	177,633	150,640	161,741	177,777

Table 6.13.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Base Case scenario.

	Base Case - RulesX1			Base Case - RulesX2			Base Case - base			Base Case - 100% home			Base Case - =straying		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.13.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Recovery scenario.

	Recovery - RulesX1			Recovery - RulesX2			Recovery - base			Recovery - 100% home			Recovery - =straying		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	523	1,053	2,096	515	1,065	2,124	525	1,057	2,091	524	1,063	2,092	536	1,066	2,077
3	932	1,865	3,717	914	1,855	3,754	909	1,891	3,925	898	1,882	3,801	900	1,880	3,762
4	1,145	2,290	4,432	1,125	2,282	4,503	1,242	2,483	4,813	1,120	2,156	4,234	1,147	2,338	4,681
5	1,209	2,373	4,596	1,223	2,396	4,697	1,408	2,730	5,286	1,161	2,274	4,463	1,273	2,569	4,995
6	1,262	2,444	4,681	1,249	2,404	4,703	1,496	2,859	5,454	1,169	2,279	4,440	1,329	2,658	5,177
7	1,267	2,427	4,697	1,289	2,489	4,722	1,478	2,924	5,508	1,176	2,241	4,534	1,375	2,652	5,114
8	1,298	2,465	4,582	1,272	2,466	4,769	1,538	2,894	5,528	1,168	2,299	4,470	1,380	2,683	5,242
9	1,272	2,478	4,727	1,273	2,466	4,759	1,518	2,894	5,607	1,166	2,334	4,488	1,375	2,703	5,230
10	1,252	2,479	4,742	1,297	2,468	4,705	1,531	2,941	5,660	1,188	2,330	4,505	1,370	2,742	5,288

Table 6.13.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Recovery scenario.

	Recovery - RulesX1			Recovery - RulesX2			Recovery - base			Recovery - 100% home			Recovery - =straying		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00
3	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.97	0.97	1.00	0.98	0.98	1.00
4	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.99	1.00	0.99	0.99	1.00

Table 6.13.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Recovery scenario.

	Recovery - RulesX1			Recovery - RulesX2			Recovery - base			Recovery - 100% home			Recovery - =straying		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	181,567	198,742	220,748	181,433	198,258	219,757	181,207	198,544	219,982	181,530	198,446	220,344	182,058	198,722	219,903
2	168,352	190,399	224,269	169,056	191,428	225,980	166,953	187,430	219,594	169,030	190,548	219,838	167,217	186,899	216,545
3	172,342	193,351	223,850	172,372	194,439	227,261	171,055	192,816	228,268	170,458	190,145	219,077	176,136	203,688	249,670
4	172,649	193,835	225,757	174,616	197,207	229,107	174,162	198,402	236,743	171,570	191,686	218,756	181,938	212,104	263,543
5	174,332	195,521	227,063	175,350	197,107	228,643	175,577	201,414	240,414	171,198	191,258	219,271	184,561	214,694	270,014
6	174,539	195,561	227,605	175,783	198,847	231,457	176,644	200,124	238,869	171,513	190,940	218,543	184,218	218,318	275,167
7	173,559	195,886	228,124	175,778	198,412	229,755	175,734	200,952	242,706	172,265	191,229	219,097	185,208	217,861	272,754
8	174,805	195,170	226,626	175,433	197,493	230,335	176,368	201,284	239,874	171,932	191,575	219,289	185,719	218,943	276,066
9	175,053	196,088	229,547	176,730	198,699	230,419	176,467	202,536	242,691	171,400	190,903	219,499	185,681	218,812	275,689
10	173,419	195,785	229,240	175,351	197,638	230,300	176,594	201,486	243,378	172,185	191,229	219,437	185,607	218,986	277,836

Table 6.13.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Recovery scenario.

	Recovery - RulesX1			Recovery - RulesX2			Recovery - base			Recovery - 100% home			Recovery - =straying		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
4	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
7	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.14.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Base Case scenario.

	Base Case - 0			Base Case - 0.012			Base Case - base			Base Case - 0.024			Base Case - 0.048		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	53	123	343	50	125	347	51	124	329	51	124	335	49	121	328
3	52	125	334	50	122	327	51	122	323	51	116	319	50	116	324
4	52	125	340	51	121	339	51	119	344	50	121	329	49	120	332
5	52	127	341	52	123	332	52	118	324	52	120	327	50	117	329
6	52	124	335	52	124	327	51	120	329	51	121	326	49	119	326
7	53	125	336	53	122	329	50	119	330	51	123	325	50	119	318
8	52	124	349	52	123	340	52	121	327	50	120	328	49	118	333
9	54	126	332	51	123	333	51	121	329	51	122	328	50	119	326
10	51	126	339	52	125	334	52	119	324	51	120	330	50	120	331

Table 6.14.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Base Case scenario.

	Base Case - 0			Base Case - 0.012			Base Case - base			Base Case - 0.024			Base Case - 0.048		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.52	1.00	0.52	0.52	1.00	0.52	0.52	1.00	0.51	0.52	1.00	0.52	0.53	1.00
3	0.48	0.49	1.00	0.48	0.48	1.00	0.49	0.50	1.00	0.47	0.48	1.00	0.48	0.49	1.00
4	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00	0.49	0.49	1.00
5	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.47	0.48	1.00	0.47	0.48	1.00
6	0.47	0.48	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.48	0.49	1.00
7	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
8	0.49	0.50	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00
9	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00
10	0.48	0.49	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00

Table 6.14.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Base Case scenario.

	Base Case - 0			Base Case - 0.012			Base Case - base			Base Case - 0.024			Base Case - 0.048		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	165,752	178,394	196,438	165,604	178,612	197,210	165,841	178,926	197,361	165,024	178,993	197,799	165,387	178,203	196,293
2	150,885	162,263	178,997	150,727	161,992	178,075	150,923	162,374	178,497	151,009	162,123	178,041	151,045	162,443	178,726
3	151,037	161,471	176,966	150,761	161,639	176,887	150,879	161,515	176,614	150,658	162,131	178,348	150,762	161,991	177,889
4	150,760	162,029	178,932	150,560	161,854	178,059	150,632	162,103	178,765	150,739	162,000	178,091	151,122	162,161	178,714
5	150,823	161,677	177,772	150,714	161,652	177,544	150,815	161,933	177,300	151,113	162,386	178,670	150,126	160,928	177,054
6	150,581	161,852	178,007	150,414	161,839	176,894	150,898	161,633	178,287	150,088	161,417	176,770	150,415	161,521	177,157
7	150,966	162,385	178,053	150,830	161,933	177,819	150,609	161,468	177,244	150,574	161,835	178,033	150,657	161,953	177,251
8	150,255	161,397	177,595	150,360	161,659	177,738	151,036	162,202	178,661	150,962	162,061	177,750	150,785	161,469	177,386
9	150,341	161,554	178,176	150,647	161,886	178,781	150,745	161,823	177,234	150,790	161,417	177,309	151,155	161,619	177,048
10	150,773	161,840	178,426	150,564	161,738	177,818	150,916	161,774	177,611	150,778	161,485	177,777	150,864	162,096	178,537

Table 6.14.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Base Case scenario.

	Base Case - 0			Base Case - 0.012			Base Case - base			Base Case - 0.024			Base Case - 0.048		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.14.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Recovery scenario.

	Recovery - 0			Recovery - 0.012			Recovery - base			Recovery - 0.024			Recovery - 0.048		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	520	1,105	2,098	511	1,071	2,116	525	1,057	2,091	507	1,063	2,115	510	1,057	2,072
3	958	1,933	4,002	954	1,932	3,922	909	1,891	3,925	916	1,897	3,904	920	1,891	3,800
4	1,277	2,481	4,957	1,271	2,514	4,829	1,242	2,483	4,813	1,242	2,528	4,914	1,216	2,475	4,792
5	1,445	2,781	5,331	1,421	2,741	5,338	1,408	2,730	5,286	1,423	2,772	5,241	1,377	2,757	5,177
6	1,514	2,872	5,494	1,496	2,831	5,506	1,496	2,859	5,454	1,474	2,835	5,407	1,468	2,795	5,416
7	1,525	2,902	5,582	1,525	2,952	5,560	1,478	2,924	5,508	1,512	2,940	5,546	1,465	2,896	5,521
8	1,564	2,944	5,588	1,524	2,937	5,529	1,538	2,894	5,528	1,527	2,891	5,593	1,484	2,870	5,481
9	1,553	2,953	5,533	1,518	2,910	5,526	1,518	2,894	5,607	1,520	2,917	5,600	1,500	2,890	5,530
10	1,546	2,926	5,692	1,534	2,892	5,702	1,531	2,941	5,660	1,532	2,939	5,500	1,489	2,868	5,561

Table 6.14.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Recovery scenario.

	Recovery - 0			Recovery - 0.012			Recovery - base			Recovery - 0.024			Recovery - 0.048		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.96	0.96	1.00	0.96	0.97	1.00	0.96	0.96	1.00	0.96	0.97	1.00	0.97	0.97	1.00
3	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.97	0.98	1.00
4	0.99	0.99	1.00	0.98	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.99	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.14.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Recovery scenario.

	Recovery - 0			Recovery - 0.012			Recovery - base			Recovery - 0.024			Recovery - 0.048		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	181,072	197,460	220,030	181,691	199,628	221,021	181,207	198,544	219,982	180,944	197,546	220,175	181,323	198,496	221,471
2	167,546	188,158	219,692	167,084	187,644	219,544	166,953	187,430	219,594	166,812	187,385	218,862	167,298	187,760	220,358
3	170,522	192,988	228,935	170,256	192,862	227,991	171,055	192,816	228,268	171,478	194,540	229,120	170,633	193,393	229,596
4	173,533	198,027	236,215	173,542	198,867	236,267	174,162	198,402	236,743	173,756	198,433	236,410	173,488	198,110	235,801
5	175,190	199,355	240,244	174,958	199,802	239,132	175,577	201,414	240,414	174,807	199,974	240,151	175,173	199,584	238,418
6	176,548	200,489	240,749	176,206	200,431	241,601	176,644	200,124	238,869	174,990	200,058	240,704	175,893	200,781	240,291
7	175,712	201,242	239,775	176,033	201,158	240,205	175,734	200,952	242,706	175,872	201,364	240,550	175,898	201,049	242,400
8	176,994	201,053	239,888	175,936	201,900	242,749	176,368	201,284	239,874	176,740	201,786	244,142	175,836	201,071	240,836
9	176,300	201,240	238,929	176,529	201,400	244,738	176,467	202,536	242,691	177,221	202,014	240,249	176,707	202,849	243,431
10	176,548	201,288	240,672	175,641	200,396	241,086	176,594	201,486	243,378	176,851	202,289	241,453	176,314	200,849	241,274

Table 6.14.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Recovery scenario.

	Recovery - 0			Recovery - 0.012			Recovery - base			Recovery - 0.024			Recovery - 0.048		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12
7	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.15.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Base Case scenario.

	Base Case - 0			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	58	135	367	54	130	349	51	124	329	43	107	306	29	76	245
3	59	136	371	54	129	342	51	122	323	41	101	297	27	66	217
4	60	137	368	54	130	345	51	119	344	44	103	285	25	66	224
5	59	141	361	57	128	349	52	118	324	43	102	292	26	65	213
6	59	141	362	56	129	357	51	120	329	42	102	295	26	63	219
7	60	138	365	55	128	347	50	119	330	42	106	294	26	65	221
8	59	138	365	55	128	351	52	121	327	42	103	292	26	64	218
9	59	142	379	57	130	347	51	121	329	41	102	288	26	63	216
10	61	139	369	56	131	345	52	119	324	43	102	291	26	64	221

Table 6.15.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Base Case scenario.

	Base Case - 0			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.53	1.00	0.52	0.53	1.00	0.52	0.52	1.00	0.52	0.53	1.00	0.53	0.53	1.00
3	0.48	0.48	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.47	0.48	1.00	0.47	0.48	1.00
4	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00
5	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.47	0.47	1.00
6	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00
7	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00
8	0.48	0.49	1.00	0.49	0.50	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.47	0.48	1.00
9	0.48	0.49	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.47	0.48	1.00
10	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.47	0.48	1.00

Table 6.15.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Base Case scenario.

	Base Case - 0			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	165,377	177,973	195,208	165,747	178,458	196,637	165,841	178,926	197,361	166,192	178,997	197,518	166,081	179,398	196,688
2	150,959	162,270	178,387	150,903	162,206	178,875	150,923	162,374	178,497	150,570	161,722	177,676	150,636	162,152	178,378
3	150,480	161,611	177,959	150,485	161,775	176,924	150,879	161,515	176,614	150,611	161,248	176,481	150,614	161,480	177,759
4	151,028	161,933	178,795	150,872	162,438	178,042	150,632	162,103	178,765	150,829	161,963	177,765	150,447	161,924	177,267
5	150,435	161,297	178,221	150,659	161,786	177,014	150,815	161,933	177,300	150,392	161,385	177,528	150,599	161,704	177,224
6	150,998	162,226	179,259	151,020	161,856	177,947	150,898	161,633	178,287	150,368	161,463	177,639	150,889	161,635	176,985
7	150,616	161,597	177,544	150,214	161,614	178,323	150,609	161,468	177,244	150,440	161,099	177,086	150,278	161,306	176,763
8	151,134	161,784	177,643	150,649	162,043	178,775	151,036	162,202	178,661	150,852	161,595	178,082	150,338	161,461	177,707
9	150,568	161,794	178,244	150,777	161,891	176,932	150,745	161,823	177,234	150,880	162,137	177,894	150,391	161,267	178,143
10	150,971	161,848	177,432	150,445	161,555	177,698	150,916	161,774	177,611	151,064	161,739	177,627	150,607	161,247	177,623

Table 6.15.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Base Case scenario.

	Base Case - 0			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.15.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Recovery scenario.

	Recovery - 0			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	559	1,143	2,236	531	1,117	2,171	525	1,057	2,091	471	984	1,987	383	809	1,660
3	1,020	2,084	4,218	970	2,021	3,955	909	1,891	3,925	848	1,674	3,477	616	1,363	2,753
4	1,372	2,684	5,125	1,321	2,543	5,109	1,242	2,483	4,813	1,116	2,247	4,492	827	1,754	3,622
5	1,527	2,938	5,584	1,484	2,855	5,475	1,408	2,730	5,286	1,299	2,515	4,883	986	2,007	3,979
6	1,584	3,082	5,865	1,545	2,877	5,664	1,496	2,859	5,454	1,353	2,626	5,129	1,087	2,152	4,251
7	1,603	3,104	5,919	1,543	2,994	5,665	1,478	2,924	5,508	1,355	2,697	5,213	1,122	2,212	4,381
8	1,639	3,112	5,827	1,564	2,999	5,724	1,538	2,894	5,528	1,420	2,671	5,304	1,126	2,242	4,393
9	1,630	3,134	5,897	1,578	3,004	5,738	1,518	2,894	5,607	1,410	2,724	5,191	1,140	2,323	4,362
10	1,638	3,101	5,848	1,597	2,997	5,663	1,531	2,941	5,660	1,395	2,730	5,201	1,177	2,299	4,435

Table 6.15.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Recovery scenario.

	Recovery - 0			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.97	0.97	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00
3	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.97	0.97	1.00
4	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.98	0.98	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.15.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Recovery scenario.

	Recovery - 0			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	181,571	198,431	220,867	180,597	198,294	220,822	181,207	198,544	219,982	181,537	198,553	220,688	181,045	198,031	219,777
2	168,083	188,159	219,778	167,158	188,402	219,562	166,953	187,430	219,594	167,635	188,214	220,849	167,157	187,493	220,462
3	171,140	193,588	230,702	171,011	193,695	230,706	171,055	192,816	228,268	170,758	192,247	228,290	168,522	191,140	225,940
4	174,043	198,552	237,208	175,101	197,651	235,638	174,162	198,402	236,743	172,694	196,543	234,427	172,993	195,290	231,502
5	175,627	200,441	239,230	175,622	199,936	238,920	175,577	201,414	240,414	175,525	199,815	237,472	173,985	197,505	235,858
6	175,841	201,253	241,098	175,499	200,937	240,342	176,644	200,124	238,869	175,549	200,511	240,866	174,085	198,698	239,764
7	176,163	201,139	240,537	177,021	200,564	242,344	175,734	200,952	242,706	175,857	201,639	241,825	174,423	199,533	240,596
8	176,781	202,102	241,803	176,469	202,192	242,734	176,368	201,284	239,874	176,434	200,771	241,574	174,444	198,765	238,196
9	176,830	202,176	243,152	177,179	202,751	241,159	176,467	202,536	242,691	175,879	201,069	241,568	175,364	200,826	239,437
10	177,796	202,652	243,223	175,876	201,365	241,255	176,594	201,486	243,378	176,141	202,080	242,551	174,883	199,770	238,339

Table 6.15.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Recovery scenario.

	Recovery - 0			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.16.1. Alternate distribution of the proportion of adult Atlantic salmon remaining in a downstream production unit (PU) after unsuccessfully attempting to pass an individual dam, where all adults spawn in the PU immediately below the dam that was not passed. Grey cells indicate that none of the adults that failed to pass that dam spawned in that Destination PU.

				Destination PU														
Dam Failed to Pass	Proportion Dying	Proportion Returning to Sea	Proportion Remaining Downstream	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Medway	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mattaceunk	0.01	0	0.99	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
West Enfield	0.02	0	0.98	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Upper Dover	0.02	0	0.98	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Brown's Mills	0.02	0	0.98	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Sebec	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Milo	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Howland	0.02	0	0.98	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Lowell	0.01	0	0.99	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Milford	0.01	0	0.99	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Stillwater	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Great Works	0.02	0.1	0.88	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Orono	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Veazie	0.03	0.15	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Frankfort	0.02	0.1	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Table 6.16.2. Alternate distribution of the proportion of adult Atlantic salmon remaining in a downstream production unit (PU) after unsuccessfully attempting to pass an individual dam, where adults were evenly distributed and spawned in all PUs below the dam that was not passed. Grey cells indicate that none of the adults that failed to pass that dam spawned in that Destination PU.

				Destination PU														
Dam Failed to Pass	Proportion Dying	Proportion Returning to Sea	Proportion Remaining Downstream	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Medway	0	0	1	0	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
Mattaceunk	0.01	0	0.99	0	0	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
West Enfield	0.02	0	0.98	0	0	0	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Upper Dover	0.02	0	0.98	0	0.077	0.077	0.077	0.077		0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Brown's Mills	0.02	0	0.98	0	0.083	0.083	0.083	0	0	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Sebec	0	0	1	0	0.077	0.077	0.077	0.077	0.077	0.077		0.077	0.077	0.077	0.077	0.077	0.077	0.077
Milo	0	0	1	0	0.083	0.083	0.083	0.083	0.083	0	0	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Howland	0.02	0	0.98	0	0.111	0.111	0	0	0	0	0	0.111	0.111	0.111	0.111	0.111	0.111	0.111
Lowell	0.01	0	0.99	0	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0
Milford	0.01	0	0.99	0	0	0	0	0	0	0	0	0	0.200	0.200	0.200	0.200	0.200	0
Stillwater	0	0	1	0	0	0	0	0	0	0	0	0	0	0.250	0.250	0.250	0.250	0
Great Works	0.02	0.1	0.88	0	0	0	0	0	0	0	0	0	0	0.250	0.250	0.250	0.250	0
Orono	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.333	0.333	0.333	0
Veazie	0.03	0.15	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0.500	0.500	0
Frankfort	0.02	0.1	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	1.000	0

Table 6.16.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units (PUs) in generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the PU immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Base Case scenario.

	Base Case - below impassable dam			Base Case - evenly dist below			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587
2	50	125	341	51	122	341	51	124	329
3	48	118	318	50	119	320	51	122	323
4	51	119	326	51	123	318	51	119	344
5	50	122	333	52	120	326	52	118	324
6	50	119	319	51	123	323	51	120	329
7	50	121	320	51	120	318	50	119	330
8	51	117	324	52	121	326	52	121	327
9	51	120	335	51	120	317	51	121	329
10	50	121	322	51	120	318	52	119	324

Table 6.16.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Base Case scenario.

	Base Case - below impassable dam			Base Case - evenly dist below			Base Case - base		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.52	1.00	0.52	0.52	1.00	0.52	0.52	1.00
3	0.48	0.48	1.00	0.47	0.48	1.00	0.49	0.50	1.00
4	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00
5	0.49	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00
6	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00
7	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00
8	0.47	0.48	1.00	0.47	0.48	1.00	0.48	0.48	1.00
9	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00
10	0.48	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00

Table 6.16.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Base Case scenario.

	Base Case - below impassable dam			Base Case - evenly dist below			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	165,627	178,716	196,063	165,678	178,806	196,351	165,841	178,926	197,361
2	150,796	162,284	178,349	151,302	162,456	177,756	150,923	162,374	178,497
3	150,308	161,199	177,897	150,951	162,115	177,244	150,879	161,515	176,614
4	150,551	161,864	177,464	151,503	161,744	177,090	150,632	162,103	178,765
5	150,430	161,250	176,781	150,769	161,450	177,676	150,815	161,933	177,300
6	150,314	161,929	178,230	151,236	162,340	177,853	150,898	161,633	178,287
7	150,435	161,643	176,431	150,718	162,139	178,190	150,609	161,468	177,244
8	150,458	161,846	177,914	151,314	162,259	177,988	151,036	162,202	178,661
9	150,674	161,377	177,463	150,517	161,749	177,203	150,745	161,823	177,234
10	150,490	161,508	177,326	150,853	161,577	177,082	150,916	161,774	177,611

Table 6.16.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Base Case scenario.

	Base Case - below impassable dam			Base Case - evenly dist below			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.16.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units (PUs) in generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the PU immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Recovery scenario.

	Recovery - below impassable dam			Recovery - evenly dist below			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587
2	517	1,072	2,098	521	1,057	2,111	525	1,057	2,091
3	903	1,889	3,689	877	1,839	3,818	909	1,891	3,925
4	1,197	2,328	4,605	1,179	2,353	4,727	1,242	2,483	4,813
5	1,334	2,577	5,085	1,336	2,604	5,152	1,408	2,730	5,286
6	1,402	2,711	5,184	1,413	2,782	5,353	1,496	2,859	5,454
7	1,411	2,744	5,336	1,432	2,816	5,434	1,478	2,924	5,508
8	1,449	2,772	5,274	1,450	2,798	5,406	1,538	2,894	5,528
9	1,468	2,784	5,303	1,468	2,832	5,447	1,518	2,894	5,607
10	1,447	2,782	5,313	1,464	2,808	5,481	1,531	2,941	5,660

Table 6.16.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Recovery scenario.

	Recovery - below impassable dam			Recovery - evenly dist below			Recovery - base		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00
3	0.98	0.98	1.00	0.97	0.97	1.00	0.98	0.98	1.00
4	0.99	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.16.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Recovery scenario.

	Recovery - below impassable dam			Recovery - evenly dist below			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	180,140	197,473	219,373	180,927	198,705	220,918	181,207	198,544	219,982
2	166,468	187,114	218,538	167,572	187,204	218,325	166,953	187,430	219,594
3	169,746	192,316	227,078	170,625	191,797	225,340	171,055	192,816	228,268
4	172,173	197,178	233,269	172,606	195,852	232,101	174,162	198,402	236,743
5	173,242	198,564	237,494	174,026	197,949	235,626	175,577	201,414	240,414
6	174,784	200,379	240,936	174,185	198,039	237,752	176,644	200,124	238,869
7	174,412	199,158	241,251	176,581	199,957	237,603	175,734	200,952	242,706
8	174,598	199,550	240,380	175,006	199,056	237,190	176,368	201,284	239,874
9	174,676	198,789	238,563	174,334	199,055	238,671	176,467	202,536	242,691
10	175,312	200,394	239,276	174,652	199,408	237,992	176,594	201,486	243,378

Table 6.16.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Recovery scenario.

	Recovery - below impassable dam			Recovery - evenly dist below			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12

Table 6.17.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	37	82	217	44	98	274	51	124	329	60	153	409	73	190	476
3	36	81	199	43	96	259	51	122	323	61	150	411	71	186	465
4	37	82	207	41	96	260	51	119	344	59	149	409	71	179	492
5	36	81	206	43	98	266	52	118	324	60	157	411	73	184	475
6	36	80	201	43	98	264	51	120	329	61	152	391	74	188	473
7	36	82	204	43	100	267	50	119	330	60	147	409	73	184	484
8	37	79	212	43	96	263	52	121	327	60	145	404	72	183	484
9	37	82	213	43	98	270	51	121	329	61	147	410	72	189	482
10	37	82	208	43	101	262	52	119	324	62	149	411	72	181	482

Table 6.17.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.39	0.40	1.00	0.46	0.47	1.00	0.52	0.52	1.00	0.58	0.59	1.00	0.64	0.64	1.00
3	0.35	0.36	1.00	0.42	0.43	1.00	0.49	0.50	1.00	0.55	0.56	1.00	0.60	0.60	1.00
4	0.36	0.37	1.00	0.41	0.42	1.00	0.48	0.49	1.00	0.54	0.55	1.00	0.59	0.59	1.00
5	0.36	0.37	1.00	0.42	0.42	1.00	0.48	0.48	1.00	0.55	0.56	1.00	0.60	0.61	1.00
6	0.35	0.36	1.00	0.42	0.43	1.00	0.48	0.49	1.00	0.55	0.56	1.00	0.60	0.61	1.00
7	0.36	0.37	1.00	0.42	0.43	1.00	0.48	0.49	1.00	0.54	0.55	1.00	0.59	0.60	1.00
8	0.36	0.37	1.00	0.42	0.43	1.00	0.48	0.48	1.00	0.53	0.54	1.00	0.60	0.61	1.00
9	0.37	0.38	1.00	0.42	0.42	1.00	0.48	0.49	1.00	0.54	0.55	1.00	0.60	0.61	1.00
10	0.36	0.37	1.00	0.42	0.43	1.00	0.48	0.49	1.00	0.55	0.55	1.00	0.60	0.61	1.00

Table 6.17.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	278,617	290,461	305,709	226,156	238,252	254,548	165,841	178,926	197,361	95,972	110,200	130,903	25,874	41,299	63,406
2	255,190	263,267	274,611	205,982	215,707	229,378	150,923	162,374	178,497	87,586	100,310	118,935	22,319	35,590	56,627
3	254,464	262,503	274,123	205,966	215,525	229,513	150,879	161,515	176,614	86,938	99,466	117,911	22,735	36,481	56,682
4	254,660	262,483	273,705	205,894	215,143	228,359	150,632	162,103	178,765	87,286	100,271	118,345	23,121	37,159	57,147
5	254,678	262,656	273,991	206,327	215,700	229,646	150,815	161,933	177,300	87,346	100,193	119,452	22,808	36,890	55,879
6	254,700	262,677	273,820	206,072	215,297	228,022	150,898	161,633	178,287	87,104	100,169	117,890	22,592	36,133	55,621
7	254,448	262,611	274,653	206,048	215,882	229,722	150,609	161,468	177,244	87,408	100,103	119,076	22,961	37,102	56,478
8	254,637	262,985	274,518	206,116	215,843	229,803	151,036	162,202	178,661	87,022	100,024	119,302	22,889	36,018	55,498
9	254,482	262,470	274,213	206,318	215,675	229,709	150,745	161,823	177,234	87,544	100,608	119,896	22,847	36,899	57,529
10	254,687	262,563	273,405	206,001	214,970	228,989	150,916	161,774	177,611	87,254	100,325	118,045	22,897	36,307	55,601

Table 6.17.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
2	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
3	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
4	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
5	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
6	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
7	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
8	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
9	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
10	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03

Table 6.17.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	351	755	1,556	433	906	1,794	525	1,057	2,091	617	1,261	2,433	720	1,458	2,788
3	635	1,388	2,815	785	1,619	3,345	909	1,891	3,925	1,114	2,262	4,452	1,296	2,636	5,153
4	915	1,898	3,714	1,075	2,148	4,148	1,242	2,483	4,813	1,450	2,869	5,585	1,706	3,235	6,303
5	1,055	2,146	4,102	1,230	2,410	4,575	1,408	2,730	5,286	1,641	3,150	5,950	1,822	3,579	6,794
6	1,148	2,205	4,422	1,325	2,495	4,809	1,496	2,859	5,454	1,688	3,240	6,130	1,902	3,648	6,903
7	1,165	2,301	4,461	1,323	2,564	4,918	1,478	2,924	5,508	1,720	3,253	6,295	1,952	3,638	6,956
8	1,178	2,326	4,492	1,321	2,604	4,965	1,538	2,894	5,528	1,762	3,337	6,180	1,970	3,711	6,964
9	1,201	2,316	4,450	1,332	2,607	4,975	1,518	2,894	5,607	1,747	3,327	6,282	1,964	3,704	7,075
10	1,190	2,340	4,500	1,372	2,606	4,904	1,531	2,941	5,660	1,740	3,278	6,276	2,001	3,722	7,110

Table 6.17.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.92	0.92	1.00	0.94	0.95	1.00	0.96	0.96	1.00	0.98	0.98	1.00	0.98	0.99	1.00
3	0.95	0.95	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00
4	0.96	0.96	1.00	0.97	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
5	0.97	0.97	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	1.00	1.00	1.00	1.00	1.00
6	0.97	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	0.98	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
8	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
9	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
10	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00

Table 6.17.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	301,315	319,580	342,255	244,747	262,309	285,145	181,207	198,544	219,982	106,308	123,526	147,154	28,373	45,062	69,748
2	270,712	289,823	320,229	223,271	243,660	275,496	166,953	187,430	219,594	100,917	121,643	150,022	27,946	45,518	73,448
3	274,423	297,320	331,432	226,393	249,682	285,501	171,055	192,816	228,268	103,757	125,291	157,364	28,967	47,980	75,954
4	278,244	302,590	341,845	231,050	254,277	293,185	174,162	198,402	236,743	105,945	128,487	163,809	30,453	48,446	78,113
5	280,775	305,537	344,960	232,185	258,496	299,045	175,577	201,414	240,414	106,415	128,902	166,820	30,266	48,766	79,485
6	281,941	307,287	348,590	233,160	259,210	300,107	176,644	200,124	238,869	106,455	129,056	166,787	29,587	50,050	80,276
7	282,780	307,724	349,126	233,852	259,098	300,826	175,734	200,952	242,706	107,479	129,971	167,567	29,365	49,581	79,088
8	284,238	309,388	350,066	234,575	259,800	301,859	176,368	201,284	239,874	107,010	131,070	168,338	29,782	49,836	80,426
9	283,612	308,404	349,889	234,594	258,904	300,804	176,467	202,536	242,691	107,972	131,008	167,460	30,538	49,512	80,260
10	283,296	309,190	350,013	235,287	260,440	300,739	176,594	201,486	243,378	107,444	131,591	167,497	30,156	49,811	79,343

Table 6.17.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
2	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
3	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
4	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
5	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
6	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
7	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
8	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.10	0.12	0.05	0.06	0.07	0.01	0.02	0.03
9	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03
10	0.19	0.19	0.20	0.14	0.15	0.16	0.10	0.11	0.12	0.05	0.06	0.07	0.01	0.02	0.03

Table 6.18.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	56	128	337	52	125	333	51	124	329	47	122	337	42	118	349
3	57	127	328	55	122	330	51	122	323	46	117	324	43	113	329
4	56	131	336	55	122	327	51	119	344	46	118	330	42	111	325
5	57	132	336	56	125	331	52	118	324	46	117	325	41	111	319
6	56	127	336	55	125	328	51	120	329	46	117	336	40	113	331
7	58	128	332	56	122	323	50	119	330	47	117	335	41	112	334
8	59	127	331	54	126	329	52	121	327	47	118	332	41	113	327
9	58	127	337	54	124	331	51	121	329	47	117	327	42	113	325
10	58	128	329	54	123	329	52	119	324	46	115	328	43	112	330

Table 6.18.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.47	0.48	1.00	0.49	0.50	1.00	0.52	0.52	1.00	0.54	0.55	1.00	0.57	0.58	1.00
3	0.44	0.45	1.00	0.46	0.46	1.00	0.49	0.50	1.00	0.50	0.51	1.00	0.53	0.54	1.00
4	0.43	0.44	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.51	0.52	1.00	0.53	0.54	1.00
5	0.44	0.45	1.00	0.46	0.47	1.00	0.48	0.48	1.00	0.51	0.52	1.00	0.54	0.55	1.00
6	0.44	0.45	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.52	1.00	0.53	0.54	1.00
7	0.44	0.45	1.00	0.45	0.46	1.00	0.48	0.49	1.00	0.51	0.51	1.00	0.53	0.54	1.00
8	0.43	0.43	1.00	0.46	0.47	1.00	0.48	0.48	1.00	0.50	0.51	1.00	0.53	0.54	1.00
9	0.44	0.45	1.00	0.47	0.47	1.00	0.48	0.49	1.00	0.51	0.52	1.00	0.54	0.54	1.00
10	0.44	0.44	1.00	0.45	0.46	1.00	0.48	0.49	1.00	0.50	0.51	1.00	0.53	0.54	1.00

Table 6.18.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	165,661	178,762	197,246	165,847	179,023	195,975	165,841	178,926	197,361	166,018	179,473	197,291	166,177	179,238	197,078
2	150,508	161,982	178,322	150,929	161,455	177,332	150,923	162,374	178,497	151,484	162,822	178,291	151,544	162,477	179,369
3	149,989	160,397	176,256	150,569	161,480	177,260	150,879	161,515	176,614	150,742	162,002	178,962	150,885	162,057	178,149
4	150,394	161,189	176,943	150,736	161,885	176,732	150,632	162,103	178,765	150,970	162,113	178,233	151,196	162,398	178,871
5	150,112	161,191	176,853	150,131	161,471	177,405	150,815	161,933	177,300	150,884	162,049	177,691	151,176	162,847	179,595
6	150,726	161,508	177,507	150,287	161,293	177,106	150,898	161,633	178,287	151,092	162,294	177,846	151,288	162,684	179,436
7	149,834	160,870	176,615	150,749	161,341	177,252	150,609	161,468	177,244	151,122	162,587	179,135	151,324	162,687	179,136
8	150,461	161,212	177,147	150,558	161,580	176,887	151,036	162,202	178,661	150,792	161,925	178,117	150,922	162,612	179,008
9	150,151	161,184	177,482	150,478	161,324	177,040	150,745	161,823	177,234	150,733	161,252	177,276	151,275	162,639	179,884
10	150,203	160,820	177,256	150,381	161,771	177,652	150,916	161,774	177,611	151,370	162,224	177,354	151,250	162,583	178,749

Table 6.18.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

	Base Case -10%			Base Case -5%			Base Case - base			Base Case +5%			Base Case +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.18.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	512	1,051	2,074	514	1,070	2,067	525	1,057	2,091	510	1,067	2,147	530	1,114	2,127
3	950	1,926	3,861	940	1,924	3,823	909	1,891	3,925	927	1,913	3,750	892	1,884	3,820
4	1,206	2,457	4,837	1,260	2,450	4,844	1,242	2,483	4,813	1,265	2,495	4,904	1,227	2,492	4,955
5	1,380	2,649	4,956	1,400	2,686	5,223	1,408	2,730	5,286	1,407	2,773	5,452	1,411	2,813	5,563
6	1,440	2,743	5,139	1,457	2,861	5,310	1,496	2,859	5,454	1,499	2,916	5,560	1,527	2,961	5,850
7	1,459	2,764	5,220	1,471	2,838	5,350	1,478	2,924	5,508	1,528	2,965	5,688	1,552	3,013	5,937
8	1,445	2,818	5,287	1,478	2,870	5,457	1,538	2,894	5,528	1,558	2,974	5,736	1,570	3,131	5,997
9	1,458	2,754	5,276	1,495	2,804	5,457	1,518	2,894	5,607	1,537	2,948	5,771	1,600	3,112	6,055
10	1,455	2,772	5,287	1,468	2,831	5,468	1,531	2,941	5,660	1,571	2,974	5,744	1,581	3,097	6,158

Table 6.18.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.95	0.95	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.97	0.97	1.00	0.97	0.97	1.00
3	0.97	0.97	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00
4	0.98	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
5	0.98	0.98	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.98	0.98	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.18.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	180,678	198,223	220,148	181,515	198,792	220,273	181,207	198,544	219,982	181,102	197,570	219,115	180,659	198,506	220,392
2	163,924	182,852	209,270	165,030	183,588	212,134	166,953	187,430	219,594	169,788	191,498	225,792	171,548	196,905	239,238
3	167,197	186,789	215,569	168,462	189,589	222,221	171,055	192,816	228,268	174,242	198,548	240,573	176,501	205,933	256,191
4	169,131	188,812	218,916	171,595	193,784	227,701	174,162	198,402	236,743	176,576	203,629	249,706	181,832	213,587	271,285
5	169,554	190,036	220,599	173,033	194,962	228,773	175,577	201,414	240,414	178,735	206,890	252,587	183,079	218,211	279,148
6	170,334	190,743	222,169	173,572	195,854	230,217	176,644	200,124	238,869	180,214	209,162	257,573	185,944	219,125	282,715
7	170,692	191,823	222,383	173,405	195,884	229,579	175,734	200,952	242,706	180,039	209,530	257,311	185,233	219,098	284,802
8	171,309	191,728	221,068	172,436	195,350	230,842	176,368	201,284	239,874	179,903	209,703	259,817	185,977	220,897	288,514
9	171,507	190,667	221,556	173,732	195,264	229,517	176,467	202,536	242,691	179,884	209,853	260,658	186,005	221,084	286,549
10	171,188	190,558	222,141	173,214	195,355	232,079	176,594	201,486	243,378	180,293	209,479	257,636	186,554	221,569	285,627

Table 6.18.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

	Recovery -10%			Recovery -5%			Recovery - base			Recovery +5%			Recovery +10%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
8	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
10	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.19.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Base Case scenario.

	Base Case - 2.5%			Base Case - 5%			Base Case - base			Base Case - 20%			Base Case - 40%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	75	190	501	65	170	443	51	124	329	28	58	138	0	0	0
3	72	192	491	64	163	431	51	122	323	28	59	143	0	0	0
4	74	190	483	66	160	439	51	119	344	28	58	135	0	0	0
5	74	194	484	65	163	434	52	118	324	28	59	135	0	0	0
6	74	185	483	66	164	438	51	120	329	28	59	135	0	0	0
7	74	187	497	67	164	443	50	119	330	28	59	137	0	0	0
8	75	192	495	64	165	436	52	121	327	28	58	138	0	0	0
9	73	187	491	64	164	440	51	121	329	28	59	135	0	0	0
10	72	193	497	66	168	428	52	119	324	28	59	139	0	0	0

Table 6.19.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Base Case scenario.

	Base Case - 2.5%			Base Case - 5%			Base Case - base			Base Case - 20%			Base Case - 40%		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.64	0.64	1.00	0.61	0.61	1.00	0.52	0.52	1.00	0.27	0.28	1.00	0.00	0.00	0.19
3	0.61	0.62	1.00	0.58	0.58	1.00	0.49	0.50	1.00	0.25	0.26	1.00	0.00	0.00	0.09
4	0.61	0.62	1.00	0.56	0.56	1.00	0.48	0.49	1.00	0.24	0.25	1.00	0.00	0.00	0.08
5	0.61	0.62	1.00	0.57	0.57	1.00	0.48	0.48	1.00	0.25	0.26	1.00	0.00	0.00	0.08
6	0.60	0.61	1.00	0.57	0.58	1.00	0.48	0.49	1.00	0.25	0.26	1.00	0.00	0.00	0.09
7	0.60	0.61	1.00	0.57	0.57	1.00	0.48	0.49	1.00	0.26	0.26	1.00	0.00	0.00	0.08
8	0.61	0.62	1.00	0.56	0.57	1.00	0.48	0.48	1.00	0.25	0.25	1.00	0.00	0.00	0.08
9	0.60	0.61	1.00	0.56	0.57	1.00	0.48	0.49	1.00	0.24	0.25	1.00	0.00	0.00	0.08
10	0.61	0.61	1.00	0.57	0.58	1.00	0.48	0.49	1.00	0.26	0.27	1.00	0.00	0.00	0.09

Table 6.19.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Base Case scenario.

	Base Case - 2.5%			Base Case - 5%			Base Case - base			Base Case - 20%			Base Case - 40%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	166,042	179,187	196,955	165,594	178,772	196,613	165,841	178,926	197,361	165,478	178,822	197,219	165,511	179,256	197,164
2	152,478	164,586	181,179	151,065	162,721	179,512	150,923	162,374	178,497	149,382	159,710	175,010	148,722	159,407	174,457
3	151,133	162,789	179,167	151,871	163,080	179,478	150,879	161,515	176,614	149,818	160,197	175,390	149,268	158,982	174,302
4	151,786	163,291	180,179	151,461	162,351	178,590	150,632	162,103	178,765	149,375	160,339	176,195	149,228	159,620	174,804
5	152,034	162,994	179,763	151,373	162,593	179,626	150,815	161,933	177,300	149,166	159,361	174,646	148,787	159,255	174,445
6	151,254	162,628	179,992	151,453	162,496	178,760	150,898	161,633	178,287	149,571	160,491	175,843	148,846	159,424	175,228
7	151,023	162,939	179,948	151,693	162,825	179,320	150,609	161,468	177,244	149,397	160,401	176,347	149,234	159,626	175,273
8	151,739	162,920	179,716	151,730	162,759	179,633	151,036	162,202	178,661	149,578	160,034	175,091	148,697	159,618	174,743
9	151,722	163,237	179,600	151,365	162,736	179,359	150,745	161,823	177,234	149,401	160,073	175,580	148,248	159,343	174,527
10	151,942	163,770	180,117	151,096	162,392	179,219	150,916	161,774	177,611	149,093	159,603	174,732	148,566	159,012	174,123

Table 6.19.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Base Case scenario.

	Base Case - 2.5%			Base Case - 5%			Base Case - base			Base Case - 20%			Base Case - 40%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.19.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Recovery scenario.

	Recovery - 2.5%			Recovery - 5%			Recovery - base			Recovery - 20%			Recovery - 40%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	736	1,487	2,826	667	1,331	2,637	525	1,057	2,091	214	513	1,100	0	0	0
3	1,357	2,631	5,178	1,193	2,345	4,874	909	1,891	3,925	440	1,005	2,118	0	0	0
4	1,702	3,373	6,559	1,543	3,077	5,995	1,242	2,483	4,813	667	1,480	2,966	0	0	0
5	1,893	3,577	6,976	1,735	3,272	6,417	1,408	2,730	5,286	816	1,725	3,413	0	0	0
6	1,937	3,718	7,098	1,800	3,415	6,555	1,496	2,859	5,454	908	1,819	3,668	0	0	0
7	1,991	3,722	7,142	1,812	3,402	6,565	1,478	2,924	5,508	966	1,945	3,780	0	0	0
8	1,992	3,801	7,142	1,813	3,470	6,631	1,538	2,894	5,528	977	1,953	3,792	0	0	0
9	1,990	3,810	7,234	1,812	3,480	6,590	1,518	2,894	5,607	974	1,972	3,951	0	0	0
10	1,980	3,789	7,162	1,812	3,521	6,638	1,531	2,941	5,660	1,012	1,977	3,829	0	0	0

Table 6.19.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Recovery scenario.

	Recovery - 2.5%			Recovery - 5%			Recovery - base			Recovery - 20%			Recovery - 40%		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.99	0.99	1.00	0.98	0.98	1.00	0.96	0.96	1.00	0.82	0.82	1.00	0.00	0.00	0.29
3	0.99	0.99	1.00	0.99	0.99	1.00	0.98	0.98	1.00	0.88	0.89	1.00	0.00	0.00	0.13
4	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.92	0.92	1.00	0.00	0.00	0.08
5	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.94	0.94	1.00	0.00	0.00	0.06
6	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.95	0.95	1.00	0.00	0.00	0.05
7	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.95	0.95	1.00	0.00	0.00	0.04
8	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.95	0.95	1.00	0.00	0.00	0.03
9	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.96	0.96	1.00	0.00	0.00	0.03
10	1.00	1.00	1.00	0.99	1.00	1.00	0.99	0.99	1.00	0.96	0.96	1.00	0.00	0.00	0.03

Table 6.19.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Recovery scenario.

	Recovery - 2.5%			Recovery - 5%			Recovery - base			Recovery - 20%			Recovery - 40%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	180,918	197,959	220,414	181,455	198,089	220,048	181,207	198,544	219,982	181,226	198,543	220,478	180,933	198,077	219,670
2	173,577	199,341	239,671	171,411	194,830	233,775	166,953	187,430	219,594	157,529	172,252	193,849	148,692	159,392	174,685
3	178,669	206,903	255,156	175,955	202,793	247,858	171,055	192,816	228,268	160,845	176,611	199,403	148,066	158,724	173,717
4	182,559	213,860	267,266	180,190	209,561	255,984	174,162	198,402	236,743	162,552	179,685	205,012	147,987	158,839	174,626
5	184,465	215,476	274,971	181,905	210,758	263,456	175,577	201,414	240,414	164,440	182,089	207,455	147,694	158,420	173,622
6	185,708	217,937	276,482	182,325	212,300	262,233	176,644	200,124	238,869	165,289	182,338	210,214	147,495	158,377	173,746
7	185,777	217,709	275,623	181,496	212,034	262,348	175,734	200,952	242,706	166,208	183,503	208,695	146,835	157,898	172,752
8	185,746	218,153	274,200	182,175	212,573	266,948	176,368	201,284	239,874	166,175	184,215	209,199	145,860	157,151	172,030
9	184,556	218,907	278,867	182,552	212,350	264,036	176,467	202,536	242,691	164,973	183,266	209,034	145,436	156,969	173,381
10	185,842	217,766	278,408	182,328	211,315	261,963	176,594	201,486	243,378	165,429	183,241	210,193	145,142	156,772	171,811

Table 6.19.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Recovery scenario.

	Recovery - 2.5%			Recovery - 5%			Recovery - base			Recovery - 20%			Recovery - 40%		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.20.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	50	119	333	50	123	330	51	124	329	52	124	342	52	126	346
3	50	117	327	50	119	320	51	122	323	50	118	332	53	126	340
4	51	120	323	50	117	328	51	119	344	50	121	337	52	125	339
5	51	118	325	50	121	328	52	118	324	52	122	338	52	127	342
6	51	118	322	50	120	323	51	120	329	52	123	337	53	125	346
7	49	119	333	51	118	331	50	119	330	52	125	330	54	126	349
8	50	121	321	51	118	323	52	121	327	51	125	338	52	123	344
9	51	118	327	51	120	324	51	121	329	53	126	331	53	128	343
10	50	120	322	50	121	332	52	119	324	52	122	337	53	125	348

Table 6.20.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.52	0.52	1.00	0.51	0.52	1.00	0.52	0.52	1.00	0.52	0.53	1.00	0.54	0.54	1.00
3	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.49	0.50	1.00	0.50	0.50	1.00
4	0.49	0.49	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.49	1.00
5	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.49	0.50	1.00
6	0.48	0.49	1.00	0.49	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.49	0.50	1.00
7	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.50	0.51	1.00
8	0.48	0.49	1.00	0.48	0.48	1.00	0.48	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00
9	0.48	0.49	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.50	1.00	0.49	0.50	1.00
10	0.47	0.48	1.00	0.48	0.49	1.00	0.48	0.49	1.00	0.49	0.49	1.00	0.49	0.50	1.00

Table 6.20.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	168,916	182,313	200,795	167,809	181,248	199,384	165,841	178,926	197,361	161,712	174,828	192,912	154,335	166,159	183,583
2	153,869	165,192	180,588	152,610	164,165	180,357	150,923	162,374	178,497	147,200	157,753	174,518	140,178	149,786	166,964
3	153,261	164,894	180,271	152,782	164,414	180,342	150,879	161,515	176,614	147,141	157,659	174,114	139,617	149,286	165,613
4	153,410	164,965	180,484	152,163	163,717	179,894	150,632	162,103	178,765	146,949	157,785	174,568	140,030	149,410	165,862
5	152,962	164,165	180,529	152,172	163,904	180,170	150,815	161,933	177,300	147,146	157,991	174,235	140,089	149,834	166,609
6	153,613	165,096	181,125	152,072	163,463	179,341	150,898	161,633	178,287	147,346	157,904	174,285	139,828	149,428	165,259
7	153,322	165,106	180,286	152,630	163,386	179,758	150,609	161,468	177,244	146,852	157,358	172,846	140,024	150,161	166,412
8	153,132	164,790	180,510	152,694	164,090	179,453	151,036	162,202	178,661	146,854	157,615	173,156	139,964	149,647	164,724
9	153,752	165,144	181,010	152,225	163,432	180,061	150,745	161,823	177,234	147,437	158,235	174,009	140,058	149,647	165,484
10	153,234	164,438	180,056	152,488	163,856	179,616	150,916	161,774	177,611	147,348	158,326	174,302	139,761	149,754	165,614

Table 6.20.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Base Case scenario.

	Base Case - 0.25			Base Case - 0.5			Base Case - base			Base Case - 2			Base Case - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11

Table 6.20.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	504	1,073	2,082	516	1,054	2,112	525	1,057	2,091	525	1,080	2,146	528	1,099	2,182
3	936	1,899	3,719	943	1,921	3,854	909	1,891	3,925	929	1,954	3,928	947	1,944	3,992
4	1,237	2,461	4,771	1,257	2,484	4,871	1,242	2,483	4,813	1,259	2,502	4,860	1,295	2,553	4,937
5	1,417	2,733	5,142	1,424	2,740	5,195	1,408	2,730	5,286	1,401	2,756	5,453	1,451	2,833	5,414
6	1,479	2,818	5,409	1,477	2,865	5,376	1,496	2,859	5,454	1,497	2,853	5,427	1,538	2,887	5,629
7	1,483	2,879	5,546	1,484	2,886	5,531	1,478	2,924	5,508	1,539	2,892	5,471	1,553	2,996	5,662
8	1,506	2,881	5,627	1,506	2,844	5,531	1,538	2,894	5,528	1,516	2,927	5,643	1,568	2,956	5,690
9	1,504	2,844	5,641	1,520	2,873	5,513	1,518	2,894	5,607	1,551	2,984	5,651	1,564	3,024	5,764
10	1,539	2,883	5,494	1,502	2,901	5,538	1,531	2,941	5,660	1,540	2,968	5,603	1,547	2,979	5,703

Table 6.20.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.96	0.96	1.00	0.96	0.96	1.00	0.96	0.96	1.00	0.97	0.97	1.00	0.97	0.97	1.00
3	0.98	0.98	1.00	0.97	0.97	1.00	0.98	0.98	1.00	0.98	0.98	1.00	0.98	0.98	1.00
4	0.99	0.99	1.00	0.98	0.98	1.00	0.99	0.99	1.00	0.98	0.99	1.00	0.99	0.99	1.00
5	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
6	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
7	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
8	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
9	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00
10	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00

Table 6.20.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	184,090	201,335	223,031	182,619	199,743	221,442	181,207	198,544	219,982	176,514	192,978	215,977	168,937	184,018	207,303
2	169,652	190,789	221,780	169,239	190,617	222,332	166,953	187,430	219,594	163,678	184,264	216,052	155,713	176,754	209,306
3	173,517	196,937	232,753	173,423	195,947	232,210	171,055	192,816	228,268	167,811	190,250	224,497	159,136	180,805	218,620
4	176,876	201,303	239,832	175,743	200,146	238,209	174,162	198,402	236,743	170,259	194,039	233,336	162,590	186,218	224,977
5	178,287	202,661	243,003	176,937	201,902	241,775	175,577	201,414	240,414	171,695	196,248	236,792	164,460	187,987	228,801
6	179,325	204,090	244,229	178,482	203,063	243,028	176,644	200,124	238,869	172,176	196,961	238,493	165,564	189,340	229,961
7	179,678	204,545	244,692	178,706	203,429	244,034	175,734	200,952	242,706	172,342	197,293	236,179	165,269	190,023	230,568
8	179,679	205,327	244,892	178,845	203,654	244,885	176,368	201,284	239,874	172,037	197,273	239,056	164,894	189,384	229,787
9	179,400	204,912	245,845	178,801	203,136	243,622	176,467	202,536	242,691	172,456	197,101	238,213	164,666	190,767	232,850
10	179,461	204,387	245,398	178,680	204,428	246,969	176,594	201,486	243,378	172,585	198,645	239,213	165,063	190,350	231,885

Table 6.20.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Recovery scenario.

	Recovery - 0.25			Recovery - 0.5			Recovery - base			Recovery - 2			Recovery - 4		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.09	0.10	0.11
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.10	0.11	0.09	0.10	0.11
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.11	0.09	0.10	0.11

Table 6.21.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned on.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	8	17	37	9	18	40	10	22	46	13	27	56	19	37	80
3	8	16	36	8	16	35	9	18	37	9	20	41	12	25	52
4	8	16	35	8	16	35	8	17	37	9	19	40	11	23	48
5	8	16	36	8	16	36	9	17	36	9	19	40	11	22	46
6	8	16	36	8	16	36	9	17	37	9	18	40	11	22	46
7	8	16	35	8	16	35	8	18	37	9	19	40	10	22	46
8	8	16	35	8	16	36	9	17	38	9	19	40	10	22	46
9	8	16	36	8	16	35	9	17	37	9	19	40	11	21	46
10	8	16	34	8	16	36	9	17	37	9	19	40	11	22	46

Table 6.21.1.2. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned on.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	17	38	88	18	40	96	22	47	112	28	60	146	40	85	226
3	17	36	83	17	38	86	19	42	95	23	50	114	33	71	169
4	16	36	85	17	38	89	19	41	97	22	48	113	32	67	153
5	16	36	85	17	38	88	19	40	93	22	47	115	31	65	155
6	16	36	86	17	38	88	19	41	94	22	48	111	31	66	151
7	16	36	84	17	38	88	19	41	94	22	46	108	30	66	151
8	16	36	86	17	39	88	18	40	94	22	48	111	31	65	151
9	16	36	83	17	37	89	19	40	96	22	47	112	31	64	150
10	16	36	86	17	38	88	19	41	93	23	48	109	30	63	153

Table 6.21.1.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned on.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	40	94	277	44	105	291	51	122	347	66	163	420	96	250	586
3	39	93	272	43	103	285	49	121	331	67	160	420	107	265	637
4	39	96	269	43	102	286	50	118	324	70	164	424	117	285	680
5	40	94	270	43	106	282	50	119	329	70	171	433	121	293	713
6	38	96	273	43	103	288	48	125	332	69	168	431	124	302	717
7	40	95	273	43	104	280	51	118	333	68	172	438	128	302	727
8	40	93	267	43	104	287	50	121	329	69	169	446	125	305	746
9	40	93	270	43	102	280	50	118	339	69	168	455	130	302	729
10	39	94	269	43	102	280	49	123	319	70	172	430	131	299	737

Table 6.21.1.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned on.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	106	293	695	117	316	742	140	364	827	186	465	992	282	643	1,317
3	110	317	715	134	355	793	166	431	982	247	616	1,336	433	973	2,047
4	112	312	725	139	362	815	186	455	1,039	303	715	1,524	557	1,181	2,371
5	116	310	715	136	364	816	191	475	1,063	331	769	1,637	607	1,264	2,459
6	115	316	733	139	356	820	194	479	1,065	342	795	1,679	636	1,308	2,588
7	116	310	740	138	361	813	200	492	1,073	349	816	1,716	657	1,314	2,545
8	116	311	712	141	363	819	187	493	1,082	349	815	1,725	646	1,344	2,585
9	115	315	723	135	358	840	189	497	1,087	353	806	1,752	658	1,323	2,574
10	113	320	720	138	369	831	189	492	1,103	355	830	1,737	652	1,342	2,659

Table 6.21.1.5. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned on.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	326	735	1,534	351	804	1,610	406	887	1,795	526	1,052	2,087	739	1,425	2,779
3	386	835	1,778	467	1,002	2,103	618	1,332	2,690	930	1,908	3,807	1,501	2,875	5,707
4	395	896	1,830	516	1,098	2,276	757	1,561	3,284	1,243	2,489	4,817	1,898	3,510	6,741
5	408	886	1,837	547	1,129	2,309	824	1,752	3,485	1,414	2,707	5,231	2,021	3,698	6,938
6	409	876	1,852	534	1,163	2,381	866	1,816	3,655	1,478	2,867	5,417	2,030	3,799	7,121
7	399	883	1,823	546	1,157	2,380	901	1,897	3,687	1,523	2,822	5,506	2,087	3,782	7,092
8	411	891	1,842	534	1,156	2,353	906	1,853	3,757	1,508	2,877	5,558	2,053	3,930	7,157
9	425	890	1,822	550	1,174	2,412	899	1,851	3,748	1,510	2,902	5,612	2,091	3,859	7,157
10	418	890	1,787	561	1,174	2,394	931	1,907	3,708	1,493	2,961	5,548	2,070	3,884	7,117

Table 6.21.1.6. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned on.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.06	0.07	1.00	0.07	0.07	1.00	0.09	0.09	1.00	0.11	0.11	1.00	0.16	0.16	1.00
3	0.06	0.06	0.99	0.06	0.06	1.00	0.06	0.06	1.00	0.06	0.06	1.00	0.07	0.07	1.00
4	0.06	0.06	0.99	0.06	0.06	1.00	0.06	0.07	1.00	0.07	0.07	1.00	0.07	0.07	1.00
5	0.06	0.06	0.99	0.06	0.06	1.00	0.06	0.06	1.00	0.06	0.07	1.00	0.07	0.07	1.00
6	0.06	0.06	0.99	0.07	0.07	0.99	0.06	0.06	0.99	0.06	0.06	1.00	0.06	0.07	1.00
7	0.06	0.06	0.99	0.06	0.06	0.99	0.06	0.06	1.00	0.07	0.07	1.00	0.07	0.07	1.00
8	0.06	0.06	0.99	0.06	0.07	1.00	0.06	0.07	1.00	0.06	0.07	1.00	0.07	0.07	1.00
9	0.06	0.06	0.99	0.06	0.07	0.99	0.06	0.07	1.00	0.06	0.06	1.00	0.07	0.07	1.00
10	0.06	0.06	0.99	0.06	0.06	0.99	0.06	0.06	1.00	0.06	0.07	1.00	0.07	0.07	1.00

Table 6.21.1.7. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned on.

	Marine 0.5x - FW - 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.21	0.22	1.00	0.23	0.23	1.00	0.25	0.26	1.00	0.30	0.31	1.00	0.39	0.40	1.00
3	0.20	0.21	1.00	0.20	0.20	1.00	0.21	0.21	1.00	0.22	0.23	1.00	0.26	0.27	1.00
4	0.20	0.21	1.00	0.21	0.22	1.00	0.21	0.22	1.00	0.22	0.23	1.00	0.25	0.26	1.00
5	0.21	0.21	1.00	0.20	0.21	1.00	0.21	0.21	1.00	0.23	0.23	1.00	0.25	0.26	1.00
6	0.20	0.21	1.00	0.21	0.21	1.00	0.21	0.21	1.00	0.22	0.22	1.00	0.25	0.25	1.00
7	0.19	0.20	1.00	0.21	0.21	1.00	0.21	0.22	1.00	0.22	0.23	1.00	0.25	0.25	1.00
8	0.21	0.21	1.00	0.21	0.21	1.00	0.21	0.22	1.00	0.22	0.23	1.00	0.25	0.25	1.00
9	0.20	0.21	1.00	0.21	0.21	1.00	0.21	0.22	1.00	0.22	0.23	1.00	0.24	0.25	1.00
10	0.21	0.22	1.00	0.20	0.21	1.00	0.20	0.21	1.00	0.22	0.22	1.00	0.25	0.25	1.00

Table 6.21.1.8. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned on.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.46	0.47	1.00	0.48	0.49	1.00	0.51	0.52	1.00	0.58	0.59	1.00	0.68	0.68	1.00
3	0.45	0.46	1.00	0.45	0.46	1.00	0.49	0.49	1.00	0.52	0.53	1.00	0.60	0.61	1.00
4	0.45	0.46	1.00	0.46	0.46	1.00	0.47	0.48	1.00	0.52	0.53	1.00	0.60	0.61	1.00
5	0.45	0.45	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.60	0.61	1.00
6	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.62	0.62	1.00
7	0.45	0.46	1.00	0.46	0.47	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.61	0.62	1.00
8	0.44	0.45	1.00	0.47	0.48	1.00	0.48	0.49	1.00	0.52	0.53	1.00	0.60	0.61	1.00
9	0.45	0.46	1.00	0.46	0.47	1.00	0.47	0.48	1.00	0.52	0.53	1.00	0.61	0.62	1.00
10	0.45	0.46	1.00	0.46	0.47	1.00	0.49	0.50	1.00	0.52	0.53	1.00	0.61	0.61	1.00

Table 6.21.1.9. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned on.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.73	0.73	1.00	0.75	0.75	1.00	0.78	0.79	1.00	0.83	0.84	1.00	0.89	0.89	1.00
3	0.73	0.73	1.00	0.75	0.76	1.00	0.78	0.79	1.00	0.83	0.83	1.00	0.89	0.89	1.00
4	0.73	0.74	1.00	0.75	0.76	1.00	0.79	0.79	1.00	0.84	0.85	1.00	0.90	0.91	1.00
5	0.73	0.74	1.00	0.75	0.76	1.00	0.80	0.80	1.00	0.85	0.86	1.00	0.92	0.93	1.00
6	0.74	0.74	1.00	0.76	0.76	1.00	0.80	0.81	1.00	0.86	0.86	1.00	0.93	0.93	1.00
7	0.73	0.74	1.00	0.76	0.77	1.00	0.80	0.80	1.00	0.86	0.86	1.00	0.93	0.93	1.00
8	0.74	0.75	1.00	0.76	0.76	1.00	0.80	0.80	1.00	0.86	0.87	1.00	0.93	0.93	1.00
9	0.73	0.74	1.00	0.76	0.77	1.00	0.79	0.80	1.00	0.86	0.86	1.00	0.93	0.93	1.00
10	0.73	0.74	1.00	0.75	0.76	1.00	0.79	0.80	1.00	0.86	0.86	1.00	0.92	0.93	1.00

Table 6.21.1.10. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned on.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.91	0.91	1.00	0.92	0.93	1.00	0.94	0.94	1.00	0.96	0.96	1.00	0.98	0.98	1.00
3	0.92	0.93	1.00	0.94	0.94	1.00	0.96	0.96	1.00	0.98	0.98	1.00	0.99	0.99	1.00
4	0.93	0.93	1.00	0.94	0.95	1.00	0.96	0.97	1.00	0.99	0.99	1.00	0.99	1.00	1.00
5	0.93	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
6	0.93	0.93	1.00	0.94	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
7	0.93	0.93	1.00	0.94	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
8	0.93	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
9	0.93	0.93	1.00	0.94	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00
10	0.93	0.93	1.00	0.95	0.95	1.00	0.97	0.97	1.00	0.99	0.99	1.00	1.00	1.00	1.00

Table 6.21.1.11. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned on.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	152,925	164,137	179,577	157,120	168,521	184,924	165,811	178,984	196,161	181,168	198,161	220,216	209,994	235,121	267,968
2	148,695	158,711	174,192	148,826	159,208	175,007	149,147	159,486	174,288	149,472	159,984	175,456	149,845	160,475	175,756
3	148,918	159,426	174,330	149,223	159,509	174,287	148,807	158,998	174,294	149,034	159,354	173,713	149,102	159,486	175,002
4	149,091	160,112	174,850	149,520	160,142	175,852	148,990	159,279	174,523	149,146	159,628	175,303	149,851	159,897	174,406
5	149,047	159,752	175,315	148,624	159,450	175,030	149,001	159,785	174,604	148,856	159,598	174,265	149,194	159,424	175,190
6	148,799	159,246	174,899	148,748	158,883	173,893	148,990	159,070	174,304	149,273	160,327	175,252	149,355	159,344	174,814
7	148,946	159,275	174,272	148,811	159,001	173,347	149,044	159,364	175,031	149,411	159,623	174,906	149,020	159,852	175,050
8	148,533	158,996	173,815	148,640	159,014	174,433	149,009	159,657	174,484	148,746	159,450	175,021	148,988	159,995	176,131
9	148,811	159,668	174,702	149,246	159,389	174,791	148,902	159,528	174,365	149,060	159,037	174,677	149,428	159,618	174,983
10	148,892	159,325	174,453	148,722	159,438	174,606	148,936	159,020	175,220	148,915	159,543	173,461	149,502	160,146	174,929

Table 6.21.1.12. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.5, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned on.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	153,304	163,877	179,245	158,042	169,534	185,881	166,041	179,027	197,393	180,784	197,201	219,672	209,943	235,171	268,177
2	149,246	159,894	174,768	149,394	159,503	175,301	149,925	160,719	175,977	150,522	161,693	177,928	152,280	164,780	183,473
3	149,306	159,706	175,016	148,972	159,874	174,794	149,597	160,205	174,982	150,093	160,713	177,570	150,899	162,791	179,763
4	148,922	159,217	173,698	148,900	159,557	175,466	149,216	160,080	175,563	149,721	160,323	176,034	150,792	161,782	178,095
5	149,031	159,621	174,962	148,837	159,216	175,165	149,329	159,488	174,503	150,073	161,000	176,543	150,648	162,083	179,717
6	149,220	159,300	174,094	149,168	159,398	174,791	149,851	159,972	173,858	150,155	160,984	177,245	150,663	162,038	179,165
7	148,889	159,036	174,277	148,705	159,435	174,993	149,300	160,151	174,845	149,990	160,666	176,697	150,492	161,717	178,431
8	148,988	159,433	174,229	148,784	159,373	174,917	149,893	160,387	175,963	149,874	160,673	176,889	151,048	162,034	179,852
9	149,058	159,353	174,508	148,980	159,194	173,800	149,654	160,012	175,444	149,467	160,589	176,629	150,510	162,158	178,495
10	148,977	159,208	174,281	149,319	160,162	175,287	149,306	160,011	175,503	149,495	160,241	175,851	150,760	161,795	177,934

Table 6.21.1.13. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned on.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	153,467	164,155	179,245	157,815	169,434	186,171	166,114	179,459	197,956	180,664	198,396	219,697	209,433	234,881	267,916
2	149,624	159,632	174,946	150,061	160,776	176,217	150,692	162,029	178,243	153,002	165,405	183,649	156,664	172,645	196,257
3	149,312	160,037	175,860	149,953	160,831	175,831	150,402	161,693	177,856	151,738	164,298	181,898	155,389	170,235	192,148
4	149,716	160,017	175,077	149,782	159,877	175,716	150,110	161,332	177,712	152,055	164,251	181,845	155,387	169,939	191,688
5	149,490	159,838	175,232	149,804	160,501	176,021	150,460	161,583	177,364	151,615	163,976	181,101	155,854	170,273	191,126
6	149,230	159,797	175,461	149,879	160,651	176,692	151,207	162,616	178,756	151,612	163,934	181,261	155,944	170,473	191,516
7	149,144	159,475	175,041	149,918	160,684	176,514	150,849	161,758	177,266	152,482	164,585	181,181	156,081	171,135	192,299
8	149,245	159,505	175,064	149,974	160,572	176,223	150,873	162,065	177,615	151,977	164,106	180,781	155,550	170,849	192,119
9	149,113	159,698	174,233	149,886	160,718	176,286	150,820	161,690	177,543	152,139	164,455	181,128	155,479	170,375	191,650
10	149,319	159,980	175,331	150,121	160,444	176,016	150,981	161,998	177,942	152,920	164,921	182,030	155,397	170,812	192,309

Table 6.21.1.14. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned on.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	152,855	163,857	179,503	158,099	169,615	185,987	165,413	178,621	195,739	181,113	198,511	219,934	209,320	234,894	267,120
2	150,265	161,031	176,889	151,166	162,372	178,704	153,527	166,134	184,031	158,222	174,275	195,609	166,934	189,401	226,805
3	150,337	161,247	177,218	151,453	162,513	178,498	153,794	166,694	184,725	158,009	173,851	196,643	167,467	190,434	226,466
4	150,532	160,693	176,969	151,317	162,731	179,506	153,500	166,580	183,169	158,898	174,402	196,460	169,979	192,751	229,049
5	150,079	161,159	176,583	151,573	163,058	180,107	153,828	166,226	184,314	158,911	174,973	197,648	170,142	193,858	232,267
6	149,903	160,479	175,611	151,333	162,870	179,230	153,618	166,142	184,237	159,821	175,550	198,885	171,130	194,999	233,577
7	150,231	161,085	176,811	151,787	163,148	179,226	153,970	166,802	184,721	159,575	175,259	198,449	171,157	194,156	231,302
8	150,330	161,535	177,384	151,988	163,248	179,176	153,909	166,397	185,045	159,879	175,653	199,293	171,729	194,997	233,616
9	150,364	161,183	176,818	151,488	162,468	178,664	153,674	166,443	185,146	159,460	175,105	197,426	171,393	196,362	234,653
10	150,122	161,070	175,870	151,699	162,863	179,030	153,788	166,611	185,223	160,039	176,339	198,826	171,505	195,483	234,095

Table 6.21.1.15. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned on.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	153,529	163,966	179,449	157,612	169,209	185,517	165,827	178,804	196,344	181,799	198,411	221,074	210,303	235,890	268,922
2	151,972	162,905	178,787	154,388	166,916	184,401	159,308	174,313	196,426	166,457	186,724	218,390	186,238	222,260	285,357
3	152,249	163,298	179,641	154,373	167,303	185,019	160,597	175,762	199,512	170,867	193,135	228,109	194,539	236,410	320,891
4	152,342	163,429	179,906	155,532	168,395	186,511	161,057	177,831	200,768	174,137	197,942	234,326	200,528	247,313	337,063
5	152,092	163,184	178,788	154,948	167,340	185,726	162,169	177,489	200,131	174,917	199,967	240,369	204,280	251,999	341,167
6	152,384	164,464	181,102	155,131	167,608	185,218	161,447	177,566	201,701	176,600	200,631	243,134	204,364	254,782	344,849
7	152,222	163,094	179,180	155,142	167,742	185,718	161,395	177,700	201,046	176,651	201,662	241,617	203,858	256,089	350,040
8	151,566	163,085	178,493	155,698	168,237	186,123	162,200	178,420	202,183	176,285	200,727	242,662	204,840	256,789	352,567
9	151,843	163,050	179,718	154,836	167,553	185,769	162,749	178,873	203,654	176,970	201,051	241,883	204,049	257,826	350,898
10	152,183	163,470	180,244	155,104	167,895	185,916	161,806	178,833	202,688	175,484	199,732	244,370	204,614	256,659	347,664

Table 6.21.1.16. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned on.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.21.1.17. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned on.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.21.1.18. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned on.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.21.1.19. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned on.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12

Table 6.21.1.20. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned on.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.10	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.10	0.12	0.10	0.11	0.12

Table 6.21.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned off.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	0	3	5	3	5	9	5	10	20	11	20	40	22	42	81
3	0	0	0	0	0	0	0	0	1	0	1	2	1	5	14
4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.21.2.2. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned off.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	3	5	9	5	10	20	11	20	40	22	42	81	45	84	166
3	0	0	0	0	0	1	0	1	2	1	5	14	9	23	58
4	0	0	0	0	0	0	0	0	0	0	1	2	1	7	23
5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	8
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.21.2.3. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned off.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	5	10	20	11	20	41	22	41	81	45	84	164	90	171	328
3	0	0	1	0	1	2	1	5	14	9	23	57	38	93	232
4	0	0	0	0	0	0	0	1	2	1	7	22	20	61	172
5	0	0	0	0	0	0	0	0	0	1	1	8	11	40	132
6	0	0	0	0	0	0	0	0	0	0	1	2	6	26	97
7	0	0	0	0	0	0	0	0	0	0	0	1	2	17	75
8	0	0	0	0	0	0	0	0	0	0	0	0	1	11	59
9	0	0	0	0	0	0	0	0	0	0	0	0	1	7	44
10	0	0	0	0	0	0	0	0	0	0	0	0	0	3	33

Table 6.21.2.4. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned off.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	11	21	40	22	42	81	46	84	158	89	173	324	186	339	643
3	0	1	2	1	5	14	9	22	57	37	92	234	149	361	873
4	0	0	0	0	1	2	1	7	22	20	59	182	157	435	1,074
5	0	0	0	0	0	0	1	1	8	11	39	136	167	486	1,202
6	0	0	0	0	0	0	0	1	2	6	26	104	178	531	1,177
7	0	0	0	0	0	0	0	0	1	2	18	83	199	548	1,244
8	0	0	0	0	0	0	0	0	0	1	11	64	202	571	1,267
9	0	0	0	0	0	0	0	0	0	1	7	45	211	584	1,305
10	0	0	0	0	0	0	0	0	0	0	3	36	220	592	1,289

Table 6.21.2.5. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned off.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
2	22	43	80	44	84	165	89	171	322	178	336	666	373	670	1,294
3	1	5	14	9	23	57	39	92	232	152	370	920	618	1,326	2,834
4	0	1	2	1	7	22	20	60	176	160	463	1,344	960	1,976	3,869
5	0	0	0	1	1	8	11	40	141	181	606	1,630	1,192	2,225	4,303
6	0	0	0	0	1	2	6	28	106	210	726	1,887	1,294	2,412	4,599
7	0	0	0	0	0	1	2	18	83	226	844	2,149	1,360	2,477	4,585
8	0	0	0	0	0	0	1	11	65	256	906	2,217	1,393	2,540	4,676
9	0	0	0	0	0	0	1	7	50	283	948	2,408	1,409	2,556	4,763
10	0	0	0	0	0	0	0	4	38	328	1,019	2,443	1,406	2,547	4,803

Table 6.21.2.6. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned off.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.40	0.33	0.58	0.62	0.56	0.83	0.80	0.74	0.96	0.92	0.89	0.99	0.98	0.96	1.00
3	0.00	0.00	0.01	0.00	0.00	0.08	0.01	0.01	0.32	0.06	0.07	0.69	0.24	0.28	0.93
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.02	0.04	0.58
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.23
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6.21.2.7. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned off.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.62	0.55	0.83	0.79	0.74	0.96	0.92	0.89	0.99	0.98	0.96	1.00	0.99	0.99	1.00
3	0.00	0.00	0.09	0.01	0.01	0.33	0.05	0.06	0.69	0.25	0.29	0.93	0.60	0.65	0.99
4	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.16	0.02	0.04	0.59	0.24	0.32	0.93
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.23	0.11	0.17	0.76
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.05	0.08	0.54
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.35
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.21
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.12
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07

Table 6.21.2.8. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned off.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.80	0.75	0.96	0.92	0.88	1.00	0.98	0.96	1.00	0.99	0.99	1.00	1.00	1.00	1.00
3	0.00	0.00	0.33	0.05	0.06	0.70	0.25	0.29	0.93	0.60	0.65	0.99	0.88	0.91	1.00
4	0.00	0.00	0.01	0.00	0.00	0.15	0.03	0.05	0.58	0.23	0.32	0.93	0.68	0.76	1.00
5	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.22	0.11	0.17	0.76	0.56	0.66	0.99
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.05	0.08	0.54	0.48	0.58	0.96
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.35	0.41	0.50	0.92
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.22	0.35	0.43	0.87
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.13	0.31	0.38	0.80
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.27	0.33	0.74

Table 6.21.2.9. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned off.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.92	0.88	0.99	0.98	0.96	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.05	0.06	0.70	0.25	0.28	0.93	0.59	0.65	0.99	0.88	0.91	1.00	0.98	0.99	1.00
4	0.00	0.00	0.15	0.03	0.05	0.58	0.23	0.31	0.93	0.68	0.77	1.00	0.95	0.97	1.00
5	0.00	0.00	0.01	0.00	0.01	0.24	0.11	0.16	0.75	0.56	0.65	0.99	0.94	0.96	1.00
6	0.00	0.00	0.00	0.00	0.00	0.07	0.05	0.08	0.53	0.48	0.57	0.96	0.94	0.96	1.00
7	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.35	0.42	0.50	0.92	0.93	0.96	1.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.21	0.36	0.44	0.86	0.93	0.96	1.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.12	0.32	0.39	0.81	0.93	0.96	1.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.27	0.34	0.74	0.94	0.96	1.00

Table 6.21.2.10. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned off.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.97	0.96	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.26	0.29	0.93	0.60	0.65	0.99	0.88	0.91	1.00	0.98	0.99	1.00	1.00	1.00	1.00
4	0.03	0.05	0.59	0.24	0.32	0.93	0.69	0.77	1.00	0.95	0.98	1.00	1.00	1.00	1.00
5	0.00	0.01	0.24	0.11	0.17	0.75	0.57	0.67	0.99	0.94	0.97	1.00	1.00	1.00	1.00
6	0.00	0.00	0.07	0.05	0.09	0.54	0.49	0.58	0.96	0.94	0.97	1.00	1.00	1.00	1.00
7	0.00	0.00	0.02	0.02	0.04	0.37	0.42	0.51	0.92	0.94	0.96	1.00	1.00	1.00	1.00
8	0.00	0.00	0.00	0.01	0.02	0.22	0.37	0.45	0.87	0.94	0.96	1.00	1.00	1.00	1.00
9	0.00	0.00	0.00	0.00	0.01	0.12	0.32	0.39	0.81	0.94	0.96	1.00	1.00	1.00	1.00
10	0.00	0.00	0.00	0.00	0.00	0.07	0.28	0.35	0.75	0.94	0.96	1.00	1.00	1.00	1.00

Table 6.21.2.11. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned off.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	3,298	4,511	6,094	6,603	9,035	12,180	13,262	17,988	24,305	26,459	36,076	48,546	52,800	71,546	97,743
2	0	2	18	0	32	79	53	142	296	256	541	1,119	1,050	2,185	4,334
3	0	0	0	0	0	0	0	0	0	0	0	13	0	60	358
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.21.2.12. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.5, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned off.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	3,299	4,526	6,086	6,614	8,993	12,213	13,221	17,879	24,455	26,214	36,045	48,607	52,960	72,315	96,859
2	0	15	40	25	73	149	130	281	567	503	1,078	2,229	2,031	4,141	8,788
3	0	0	0	0	0	0	0	0	7	0	29	185	161	580	1,582
4	0	0	0	0	0	0	0	0	0	0	0	0	0	93	484
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.21.2.13. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned off.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	3,294	4,520	6,092	6,644	9,042	12,216	13,247	18,022	24,282	26,613	35,808	48,702	53,003	72,108	97,210
2	13	34	74	65	137	279	257	537	1,117	1,005	2,123	4,381	3,958	8,233	17,308
3	0	0	0	0	0	3	0	16	88	84	287	776	880	2,257	5,713
4	0	0	0	0	0	0	0	0	0	0	49	238	369	1,206	3,454
5	0	0	0	0	0	0	0	0	0	0	0	67	186	743	2,578
6	0	0	0	0	0	0	0	0	0	0	0	0	62	493	1,912
7	0	0	0	0	0	0	0	0	0	0	0	0	0	312	1,425
8	0	0	0	0	0	0	0	0	0	0	0	0	0	185	1,134
9	0	0	0	0	0	0	0	0	0	0	0	0	0	78	884
10	0	0	0	0	0	0	0	0	0	0	0	0	0	24	631

Table 6.21.2.14. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned off.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	3,279	4,527	6,080	6,651	9,048	12,112	13,274	18,043	24,189	26,593	36,035	48,673	53,317	72,007	97,211
2	31	70	140	129	270	551	512	1,050	2,160	1,956	4,098	8,627	8,015	16,259	33,317
3	0	0	2	0	7	45	40	142	379	445	1,139	3,009	3,549	8,701	20,795
4	0	0	0	0	0	0	0	24	116	189	585	1,836	2,751	8,423	20,124
5	0	0	0	0	0	0	0	0	33	86	376	1,358	2,911	9,321	21,666
6	0	0	0	0	0	0	0	0	0	29	243	1,074	3,076	9,514	22,151
7	0	0	0	0	0	0	0	0	0	0	161	796	3,282	10,201	22,212
8	0	0	0	0	0	0	0	0	0	0	95	602	3,355	10,568	23,389
9	0	0	0	0	0	0	0	0	0	0	44	441	3,491	10,604	23,313
10	0	0	0	0	0	0	0	0	0	0	16	350	3,792	11,077	23,768

Table 6.21.2.15. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned off.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	3,303	4,492	6,111	6,616	9,002	12,086	13,221	18,093	24,419	26,493	36,019	48,858	52,832	72,225	97,367
2	64	134	281	250	530	1,109	997	2,069	4,331	3,867	8,219	17,834	15,315	30,964	64,133
3	0	4	23	20	74	194	227	562	1,497	1,721	4,446	11,764	12,900	27,798	57,666
4	0	0	0	0	12	62	98	304	908	1,440	4,436	13,459	16,771	32,797	67,097
5	0	0	0	0	0	18	45	197	691	1,577	5,480	15,630	19,434	37,053	76,752
6	0	0	0	0	0	0	16	131	521	1,695	6,473	17,781	21,495	40,511	81,933
7	0	0	0	0	0	0	0	86	404	1,954	7,431	19,478	23,150	42,526	85,842
8	0	0	0	0	0	0	0	48	329	2,191	8,061	20,447	23,424	43,697	88,099
9	0	0	0	0	0	0	0	23	236	2,428	8,818	21,148	23,555	43,590	90,261
10	0	0	0	0	0	0	0	8	191	2,693	9,259	21,401	23,524	43,653	90,084

Table 6.21.2.16. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned off.

	Marine 0.25x - FW 0.25x			Marine 0.25x - FW 0.5x			Marine 0.25x - FW 1x			Marine 0.25x - FW 2x			Marine 0.25x - FW 4x		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.00	0.07	0.10	0.00	0.10	0.11	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.10
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6.21.2.17. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned off.

	Marine 0.5x - FW 0.25x			Marine 0.5x - FW 0.5x			Marine 0.5x - FW 1x			Marine 0.5x - FW 2x			Marine 0.5x - FW 4x		
Gen	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**	**25%**	**median**	**75%**
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.00	0.10	0.11	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.10	0.09	0.10	0.11
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6.21.2.18. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned off.

	Marine 1x - FW 0.25x			Marine 1x - FW 0.5x			Marine 1x - FW 1x			Marine 1x - FW 2x			Marine 1x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.09	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.10	0.10
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.10
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.10

Table 6.21.2.19. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned off.

	Marine 2x - FW 0.25x			Marine 2x - FW 0.5x			Marine 2x - FW 1x			Marine 2x - FW 2x			Marine 2x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.10	0.11	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.00	0.00	0.08	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.11
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.10	0.10	0.10	0.10	0.11
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.10	0.10	0.10	0.11
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.09	0.10	0.11
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.10	0.09	0.10	0.11

Table 6.21.2.20. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned off.

	Marine 4x - FW 0.25x			Marine 4x - FW 0.5x			Marine 4x - FW 1x			Marine 4x - FW 2x			Marine 4x - FW 4x		
Gen	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.11
4	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.11
5	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.11
6	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.11
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.11
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.09	0.10	0.11	0.10	0.10	0.11
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.10	0.09	0.10	0.11	0.10	0.10	0.11

Table 6.22.1.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587
2	204	385	648	29	51	89	51	124	329
3	233	431	730	24	44	76	51	122	323
4	250	459	766	23	44	75	51	119	344
5	253	465	771	23	43	75	52	118	324
6	253	470	793	23	43	76	51	120	329
7	258	479	789	23	44	75	50	119	330
8	259	472	791	24	43	75	52	121	327
9	263	475	790	23	43	75	51	121	329
10	258	481	791	23	43	76	52	119	324

Table 6.22.1.2. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587
2	247	458	770	34	61	106	58	150	396
3	301	539	877	29	52	90	61	150	411
4	318	576	961	28	50	88	62	152	420
5	337	603	964	27	51	89	62	150	401
6	337	602	982	27	52	90	61	156	397
7	341	604	992	28	52	91	63	155	407
8	343	614	991	28	52	91	63	153	408
9	345	605	992	28	51	91	62	150	415
10	349	605	998	28	52	89	63	155	406

Table 6.22.1.3. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.87	0.87	1.00	0.18	0.19	1.00	0.52	0.52	1.00
3	0.86	0.87	1.00	0.13	0.13	1.00	0.49	0.50	1.00
4	0.86	0.87	1.00	0.13	0.14	1.00	0.48	0.49	1.00
5	0.86	0.87	1.00	0.13	0.14	1.00	0.48	0.48	1.00
6	0.86	0.86	1.00	0.13	0.14	1.00	0.48	0.49	1.00
7	0.87	0.87	1.00	0.13	0.14	1.00	0.48	0.49	1.00
8	0.87	0.88	1.00	0.12	0.13	1.00	0.48	0.48	1.00
9	0.87	0.87	1.00	0.13	0.13	1.00	0.48	0.49	1.00
10	0.86	0.87	1.00	0.13	0.14	1.00	0.48	0.49	1.00

Table 6.22.1.4. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.90	0.90	1.00	0.24	0.25	1.00	0.57	0.57	1.00
3	0.90	0.90	1.00	0.18	0.19	1.00	0.53	0.54	1.00
4	0.90	0.91	1.00	0.18	0.19	1.00	0.54	0.55	1.00
5	0.91	0.92	1.00	0.19	0.19	1.00	0.53	0.54	1.00
6	0.91	0.91	1.00	0.18	0.19	1.00	0.53	0.54	1.00
7	0.91	0.92	1.00	0.19	0.20	1.00	0.54	0.55	1.00
8	0.91	0.92	1.00	0.18	0.19	1.00	0.54	0.55	1.00
9	0.91	0.92	1.00	0.18	0.18	1.00	0.54	0.54	1.00
10	0.91	0.92	1.00	0.19	0.19	1.00	0.54	0.55	1.00

Table 6.22.1.5. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	166,044	179,148	196,470	165,530	178,744	196,478	165,841	178,926	197,361
2	153,433	165,138	181,792	149,541	160,311	175,946	150,923	162,374	178,497
3	153,201	164,831	181,022	149,070	160,074	175,203	150,879	161,515	176,614
4	153,222	164,817	180,499	149,207	159,528	175,338	150,632	162,103	178,765
5	153,086	164,537	182,208	149,222	159,390	174,720	150,815	161,933	177,300
6	152,713	164,517	180,972	148,311	159,130	174,058	150,898	161,633	178,287
7	153,433	165,328	181,830	148,806	159,349	174,947	150,609	161,468	177,244
8	153,877	165,334	181,049	149,290	159,408	175,298	151,036	162,202	178,661
9	153,296	165,042	182,475	149,228	159,626	174,231	150,745	161,823	177,234
10	152,716	164,799	180,946	148,735	159,292	175,382	150,916	161,774	177,611

Table 6.22.1.6. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	165,707	179,003	196,659	166,213	178,805	196,734	165,775	178,837	197,370
2	153,967	165,327	183,067	149,340	159,804	175,401	151,373	162,642	178,173
3	154,131	166,147	182,982	148,847	159,036	174,268	150,999	162,159	178,473
4	154,351	166,166	183,234	148,781	159,514	174,835	151,059	162,404	178,640
5	154,385	166,347	183,192	148,758	159,830	175,736	150,841	162,195	178,108
6	154,178	166,144	183,138	148,851	159,388	175,397	151,127	162,501	178,026
7	154,606	166,460	183,811	149,118	159,575	175,288	151,065	162,305	178,846
8	154,295	166,688	183,102	149,297	159,825	175,229	151,430	162,520	178,050
9	154,521	165,817	182,004	149,188	159,370	174,703	151,244	162,714	178,962
10	154,521	166,490	182,710	149,023	159,614	174,877	151,201	162,261	178,839

Table 6.22.1.7. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.22.1.8. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

	Base Case - 1971-1990			Base Case - 1991-2010			Base Case - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.22.2.1. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587
2	1,537	2,363	3,536	296	520	799	525	1,057	2,091
3	3,801	5,865	8,682	383	659	1,060	909	1,891	3,925
4	5,271	7,577	10,736	454	783	1,241	1,242	2,483	4,813
5	5,611	8,033	11,311	493	862	1,353	1,408	2,730	5,286
6	5,796	8,213	11,674	536	905	1,434	1,496	2,859	5,454
7	5,833	8,267	11,677	557	939	1,468	1,478	2,924	5,508
8	5,811	8,289	11,687	565	948	1,490	1,538	2,894	5,528
9	5,828	8,341	11,663	564	966	1,509	1,518	2,894	5,607
10	5,800	8,281	11,698	560	952	1,525	1,531	2,941	5,660

Table 6.22.2.2. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of two sea-winter females across all Penobscot River production units in generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	587	587	587	587	587	587	587	587	587
2	1,733	2,708	4,074	361	598	929	607	1,233	2,410
3	4,620	7,062	10,285	488	829	1,309	1,124	2,368	4,699
4	6,216	8,969	12,598	600	1,020	1,589	1,586	3,006	5,751
5	6,661	9,471	13,516	667	1,124	1,785	1,752	3,377	6,403
6	6,706	9,733	13,787	725	1,193	1,848	1,832	3,433	6,544
7	6,864	9,834	13,708	752	1,227	1,879	1,846	3,465	6,601
8	6,898	9,825	13,576	757	1,251	1,909	1,861	3,479	6,606
9	6,810	9,901	13,933	777	1,264	1,957	1,889	3,527	6,733
10	6,853	9,797	13,907	772	1,264	1,940	1,901	3,555	6,706

Table 6.22.2.3. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	0.92	0.93	1.00	0.96	0.96	1.00
3	1.00	1.00	1.00	0.92	0.92	1.00	0.98	0.98	1.00
4	1.00	1.00	1.00	0.92	0.93	1.00	0.99	0.99	1.00
5	1.00	1.00	1.00	0.94	0.94	1.00	0.99	0.99	1.00
6	1.00	1.00	1.00	0.94	0.95	1.00	0.99	0.99	1.00
7	1.00	1.00	1.00	0.95	0.95	1.00	0.99	0.99	1.00
8	1.00	1.00	1.00	0.94	0.94	1.00	0.99	0.99	1.00
9	1.00	1.00	1.00	0.94	0.95	1.00	0.99	0.99	1.00
10	1.00	1.00	1.00	0.94	0.95	1.00	0.99	0.99	1.00

Table 6.22.2.4. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are listed for generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower	Upper	Piscataquis	Lower
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	0.94	0.95	1.00	0.97	0.97	1.00
3	1.00	1.00	1.00	0.94	0.95	1.00	0.98	0.98	1.00
4	1.00	1.00	1.00	0.95	0.96	1.00	0.99	0.99	1.00
5	1.00	1.00	1.00	0.96	0.96	1.00	1.00	1.00	1.00
6	1.00	1.00	1.00	0.97	0.97	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	0.97	0.97	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	0.97	0.97	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	0.97	0.97	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	0.97	0.97	1.00	1.00	1.00	1.00

Table 6.22.2.5. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	180,954	198,039	221,185	181,033	198,306	219,755	181,207	198,544	219,982
2	186,030	213,947	254,918	158,212	172,343	191,174	166,953	187,430	219,594
3	200,421	236,359	293,067	158,423	172,089	191,549	171,055	192,816	228,268
4	210,418	249,911	317,452	159,476	173,413	191,942	174,162	198,402	236,743
5	213,316	257,526	324,725	159,522	174,192	193,520	175,577	201,414	240,414
6	216,114	262,357	330,804	160,036	173,995	193,695	176,644	200,124	238,869
7	215,514	262,641	332,898	160,550	175,162	194,216	175,734	200,952	242,706
8	217,834	263,772	331,084	159,989	174,523	193,769	176,368	201,284	239,874
9	217,500	263,541	335,082	160,906	175,705	194,808	176,467	202,536	242,691
10	216,375	263,236	335,618	160,445	174,519	193,691	176,594	201,486	243,378

Table 6.22.2.6. Twenty-fifth percentile, median, and seventy-fifth percentile of the number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	181,065	198,574	220,414	180,718	198,108	219,513	179,894	197,737	219,643
2	189,857	218,000	260,815	160,084	174,543	194,637	169,279	191,666	225,604
3	208,977	250,134	312,374	159,995	174,933	195,311	174,371	198,105	237,956
4	219,168	268,201	340,024	161,615	176,589	198,262	178,237	203,448	245,124
5	226,179	277,709	349,594	162,593	178,191	199,651	180,725	207,275	255,006
6	227,516	280,465	359,707	163,024	177,829	198,152	180,690	208,244	254,667
7	227,709	283,705	364,948	162,858	178,241	199,919	181,286	207,963	255,285
8	228,692	284,675	363,103	162,699	177,854	198,152	179,942	207,203	253,480
9	227,783	285,933	369,843	163,499	178,688	198,959	181,187	207,593	255,073
10	229,927	285,076	363,204	163,899	178,673	199,734	180,747	208,261	255,599

Table 6.22.2.7. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.22.2.8. Twenty-fifth percentile, median, and seventy-fifth percentile of the proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams. Values are listed for generations (Gen) 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

	Recovery - 1971-1990			Recovery - 1991-2010			Recovery - base		
Gen	25%	median	75%	25%	median	75%	25%	median	75%
1	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
2	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
3	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.10	0.12
4	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
5	0.10	0.10	0.12	0.10	0.11	0.12	0.10	0.11	0.12
6	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
7	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
8	0.10	0.10	0.12	0.10	0.10	0.12	0.10	0.10	0.12
9	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12
10	0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.11	0.12

Table 6.23.1. Percent difference from the base median number of two sea-winter (2SW) females in generation 10 for Base Case and Recovery scenarios. Sensitivity analyses are divided into three sections based on how model inputs were varied and can be compared among each section. The sensitivity runs in the third section cannot be quantitatively compared. Bold values indicate the model input was highly sensitive (i.e., the median number of 2SW females deviated by more than the percent change from the base) in that scenario. The raw data were reported when the base value equaled zero (i.e., in the egg to smolt survival (hatchery off) runs). These values are denoted by the absence of a percent sign (%). See Table 6.1 for values tested in sensitivity runs.

Description	Base Case					Recovery				
Production potential cap	-2%	3%	0%	2%	0%	-51%	-31%	0%	57%	149%
Eggs per female	-18%	-13%	0%	45%	157%	-60%	-36%	0%	29%	69%
Egg to smolt survival	-20%	-14%	0%	42%	151%	-52%	-37%	0%	59%	107%
In-river mortality	3%	4%	0%	1%	-12%	2%	0%	0%	-5%	-11%
Marine survival	**-86%**	**-66%**	0%	**314%**	**1471%**	**-89%**	**-72%**	0%	**380%**	**1630%**
Initial number of adults	2%	2%	0%	0%	3%	0%	1%	0%	1%	-1%
Hatchery discount	**629%**	**205%**	0%	-61%	-82%	**119%**	44%	0%	-28%	-46%
Number of smolts stocked	**-82%**	**-61%**	0%	**208%**	**631%**	-47%	-28%	0%	43%	117%
Proportion returning to sea	17%	10%	0%	-14%	-46%	5%	2%	0%	-7%	-22%
Indirect latent mortality	62%	41%	0%	-50%	-100%	29%	20%	0%	-33%	-100%
Downstream path choice	1%	2%	0%	3%	5%	-2%	-1%	0%	1%	1%
Egg to smolt survival (hatchery on)										
Marine survival * 0.25	-6%	-6%	0%	12%	29%					
Marine survival * 0.5	-12%	-7%	0%	17%	54%					
Marine survival * 1	-24%	-17%	0%	40%	143%					
Marine survival * 2	-35%	-25%	0%	69%	173%					
Marine survival * 4	-53%	-38%	0%	55%	104%					
Egg to smolt survival (hatchery off)										
Marine survival * 0.25	0	0	0	0	0					
Marine survival * 0.5	0	0	0	0	0					
Marine survival * 1	0	0	0	0	3					
Marine survival * 2	0	0	0	3	592					
Marine survival * 4	**-100%**	**-100%**	0%	**25375%**	**63575%**					
Downstream dam survival	**-31%**	**-15%**	0%	**25%**	**52%**	**-20%**	**-11%**	0%	**11%**	**27%**
Upstream dam survival	8%	3%	0%	-3%	-6%	-6%	-4%	0%	1%	5%
Hatchery stocking	-100%	-100%	2%	0%		-65%	-46%	-4%	0%	
Stocking distribution	-49%	-61%	0%	17%	304%	-21%	-29%	0%	-3%	37%
Straying	4%	0%	0%	3%	4%	-16%	-16%	0%	-21%	-7%
Proportion dying	6%	5%	0%	1%	1%	-1%	-2%	0%	0%	-2%
Proportion remaining downstream	2%	1%	0%			-5%	-5%	0%		
Marine survival										
Mean based	290%	-66%	0%			176%	-64%	0%		
Median based	304%	-64%	0%			182%	-68%	0%		

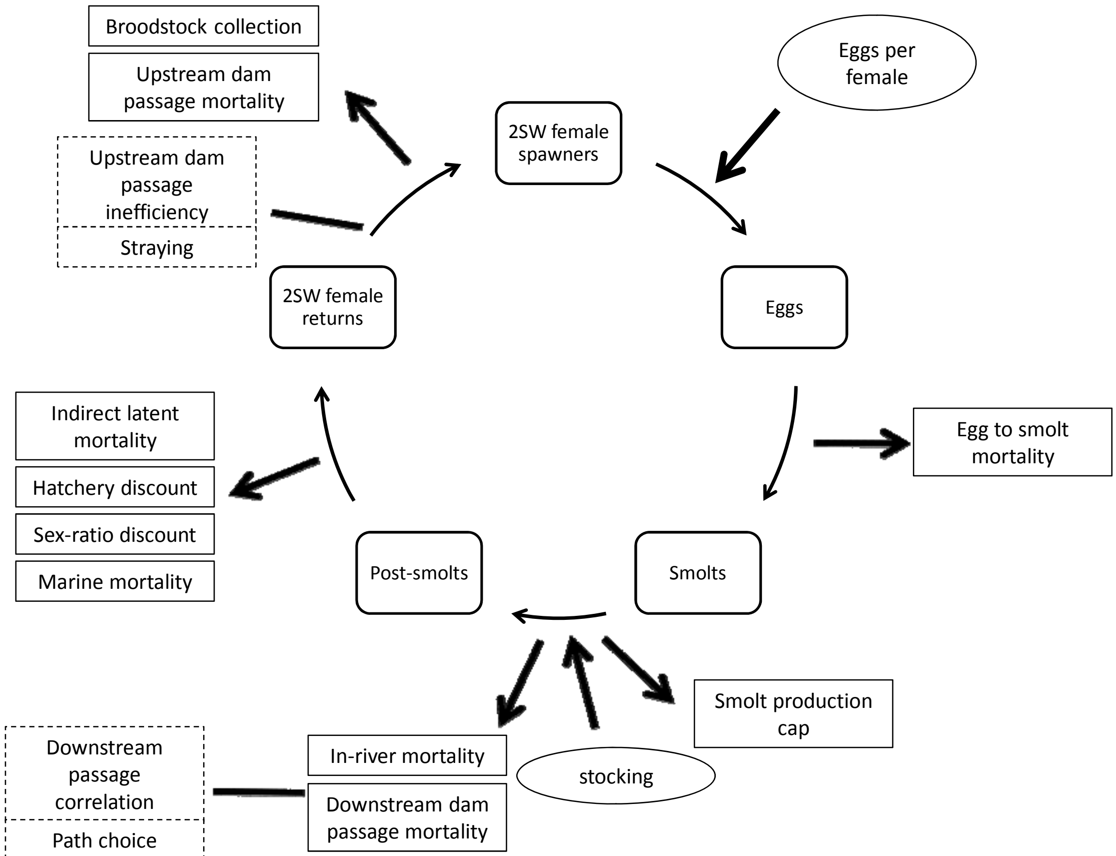

Figure 2.1. Schematic of the processes detailed within the DIA Model. Rounded rectangles indicate life cycle stages, ovals indicate additions to the population, and rectangles indicate subtractions from the population. Dashed rectangles are neither additions to nor subtractions to the population, but represent dynamics incorporated into the model. All model runs simulated ten five-year generations (50 years) and consisted of 5,000 iterations.

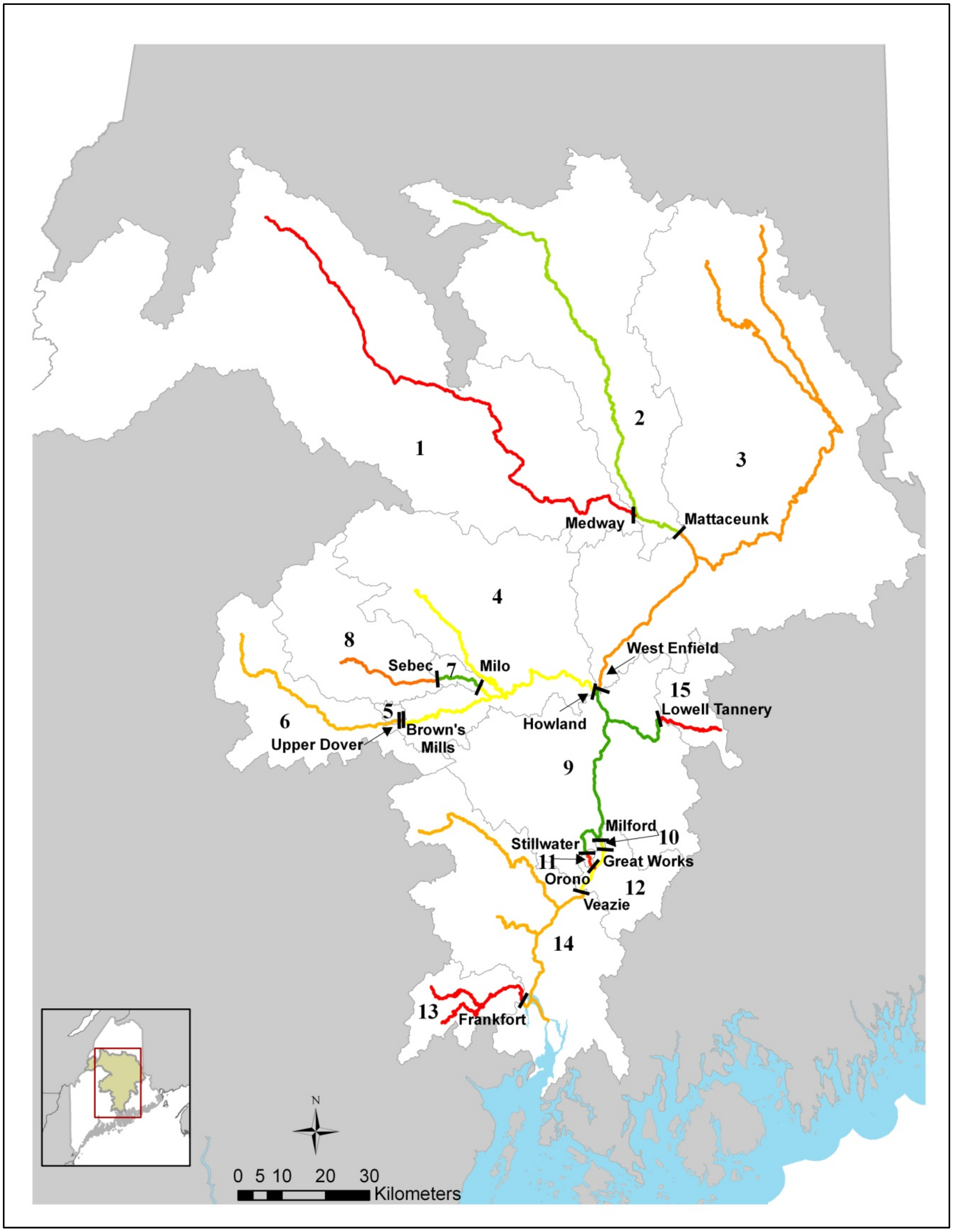

Figure 2.2. The Penobscot River watershed and major tributaries divided into 15 production units. Locations of the 15 hydroelectric dams included in the Dam Impact Analysis Model are denoted by dashes and the name of each dam. The map inset is the Penobscot River watershed within the state of Maine.

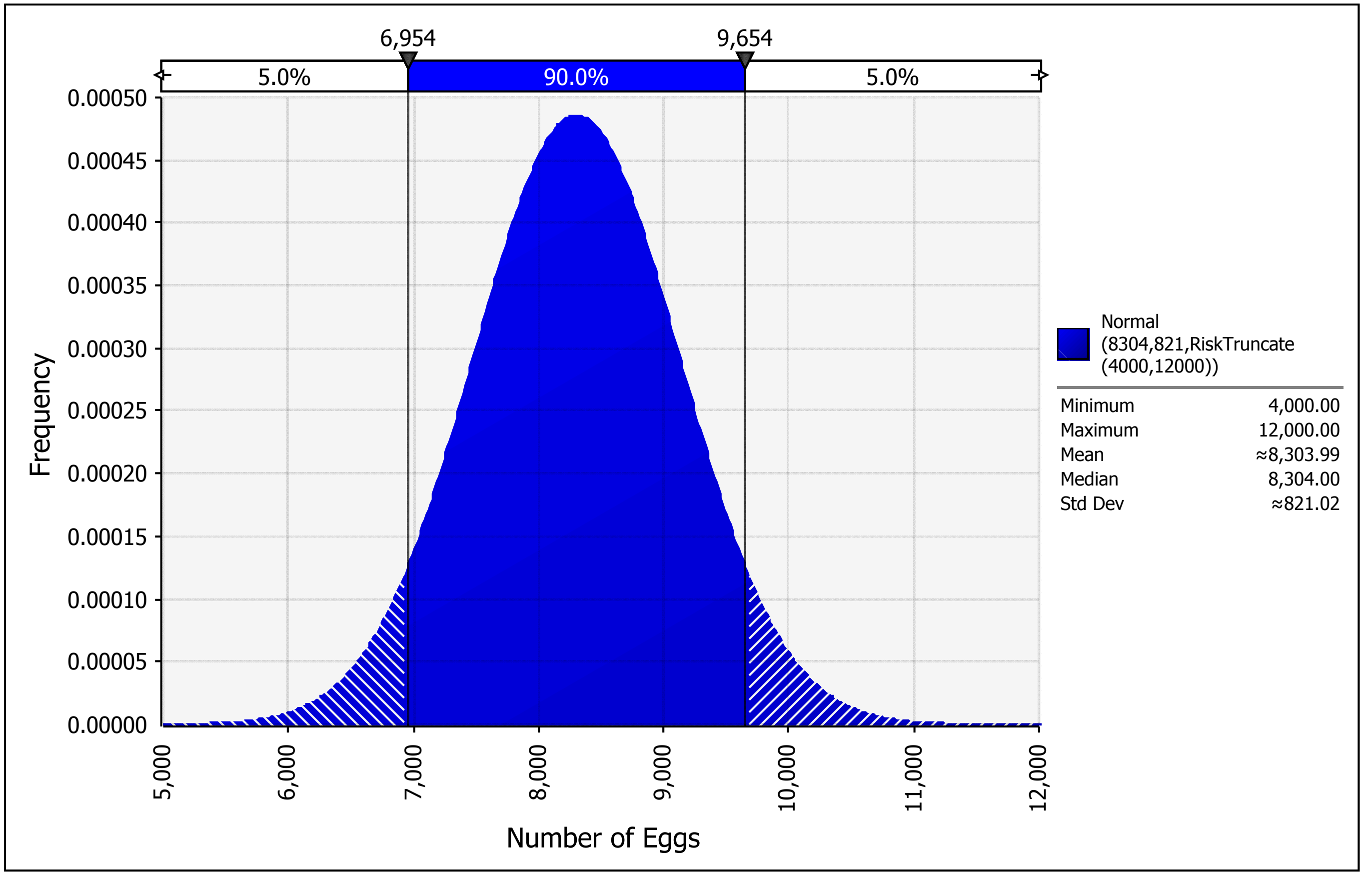

Figure 3.2.1. Simulated distribution of eggs produced per adult female Atlantic salmon generated from mean annual fecundity estimates for Penobscot River sea-run female Atlantic salmon spawned at Craig Brook National Fish Hatchery during 1997–2010.

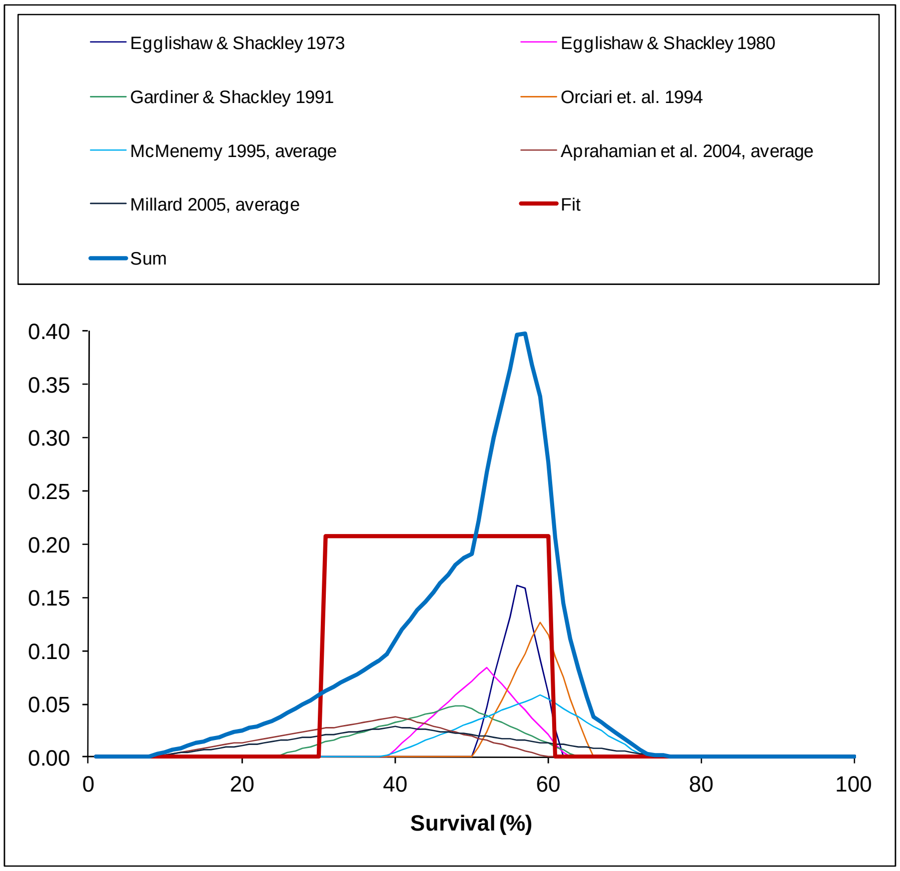

Figure 3.3.1. Fry to parr0+ survival estimates from seven studies, the calculated sum of these values, and the resulting uniform distribution (denoted Fit).

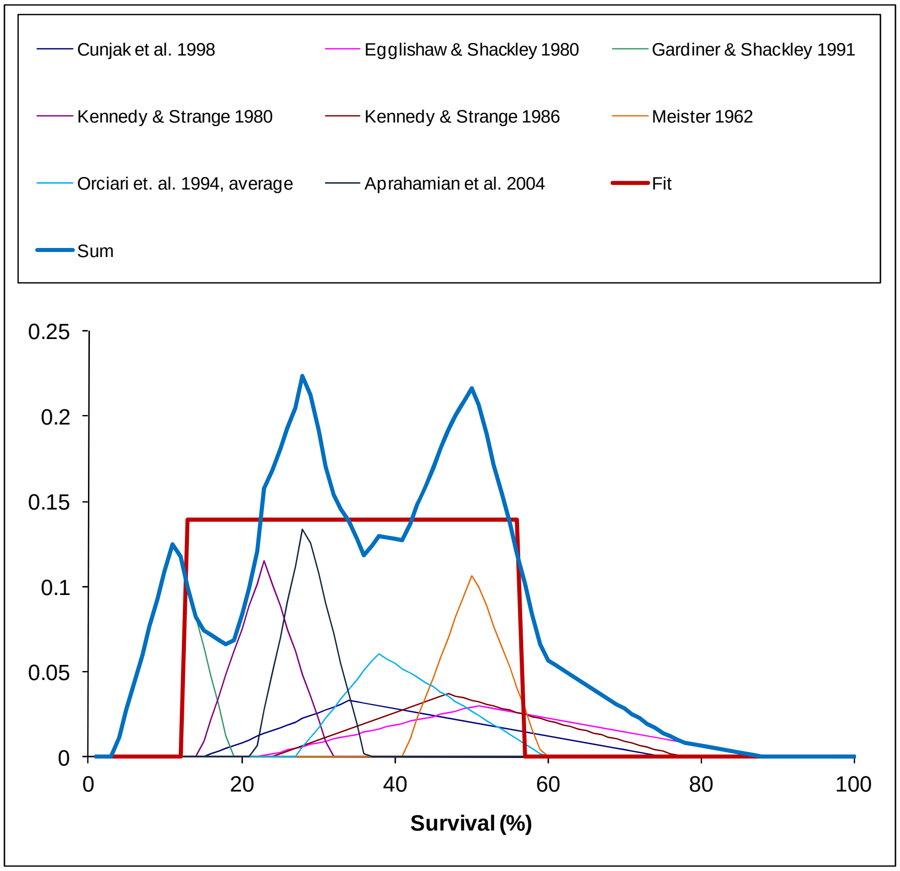

Figure 3.3.2. Parr0+ to parr1+ survival estimates from eight studies, the calculated sum of these values, and the resulting uniform distribution (denoted Fit).

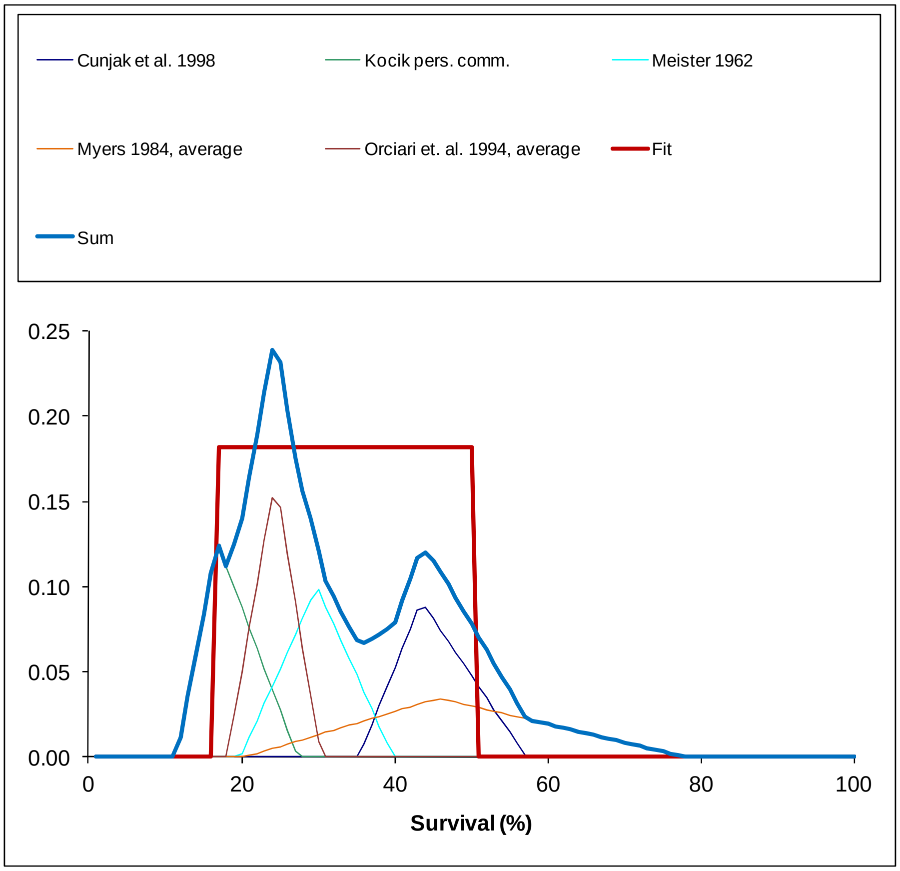

Figure 3.3.3. Parr1+ to smolt survival estimates from five studies, the calculated sum of these values, and the resulting uniform distribution (denoted Fit).

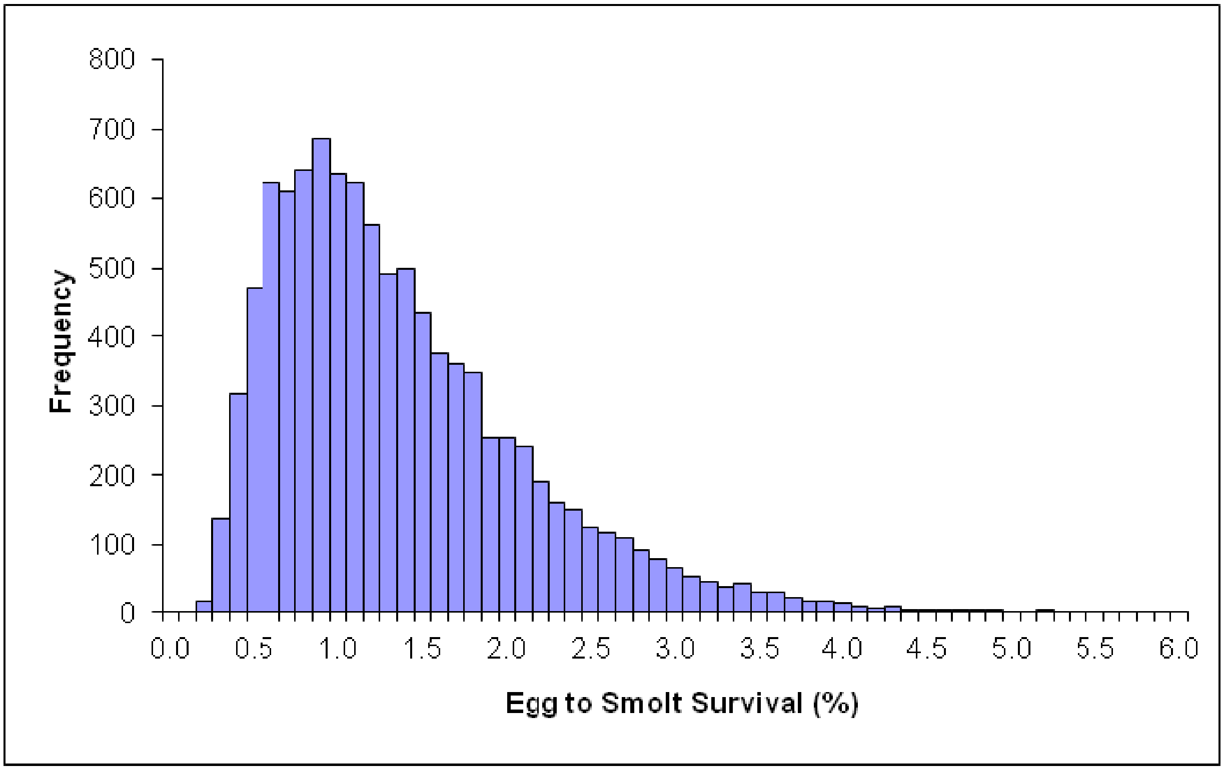

Figure 3.3.4. Histogram of 10,000 egg to smolt survival rates calculated by randomly selecting a survival value from each of the uniform distributions associated with the four juvenile life stage transitions.

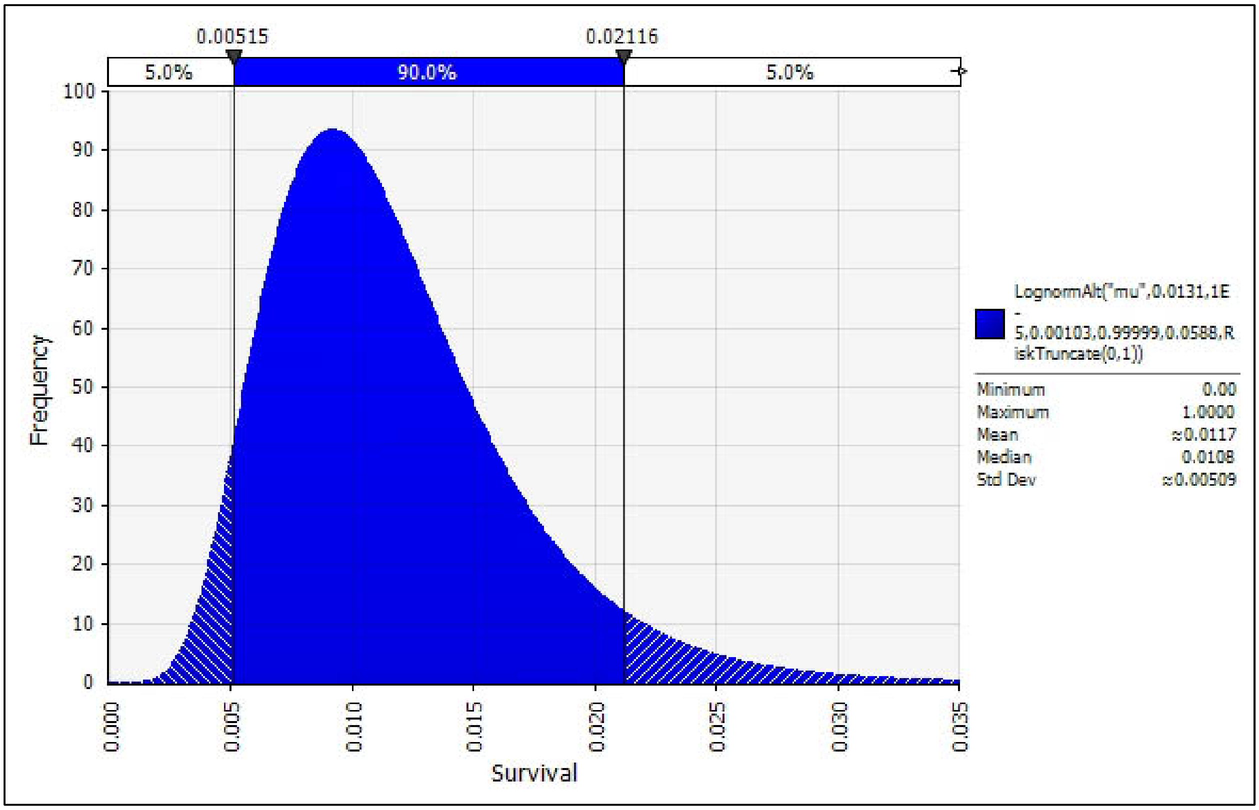

Figure 3.3.5. Fitted distribution of egg to smolt survival used in all Dam Impact Analysis Model simulations.

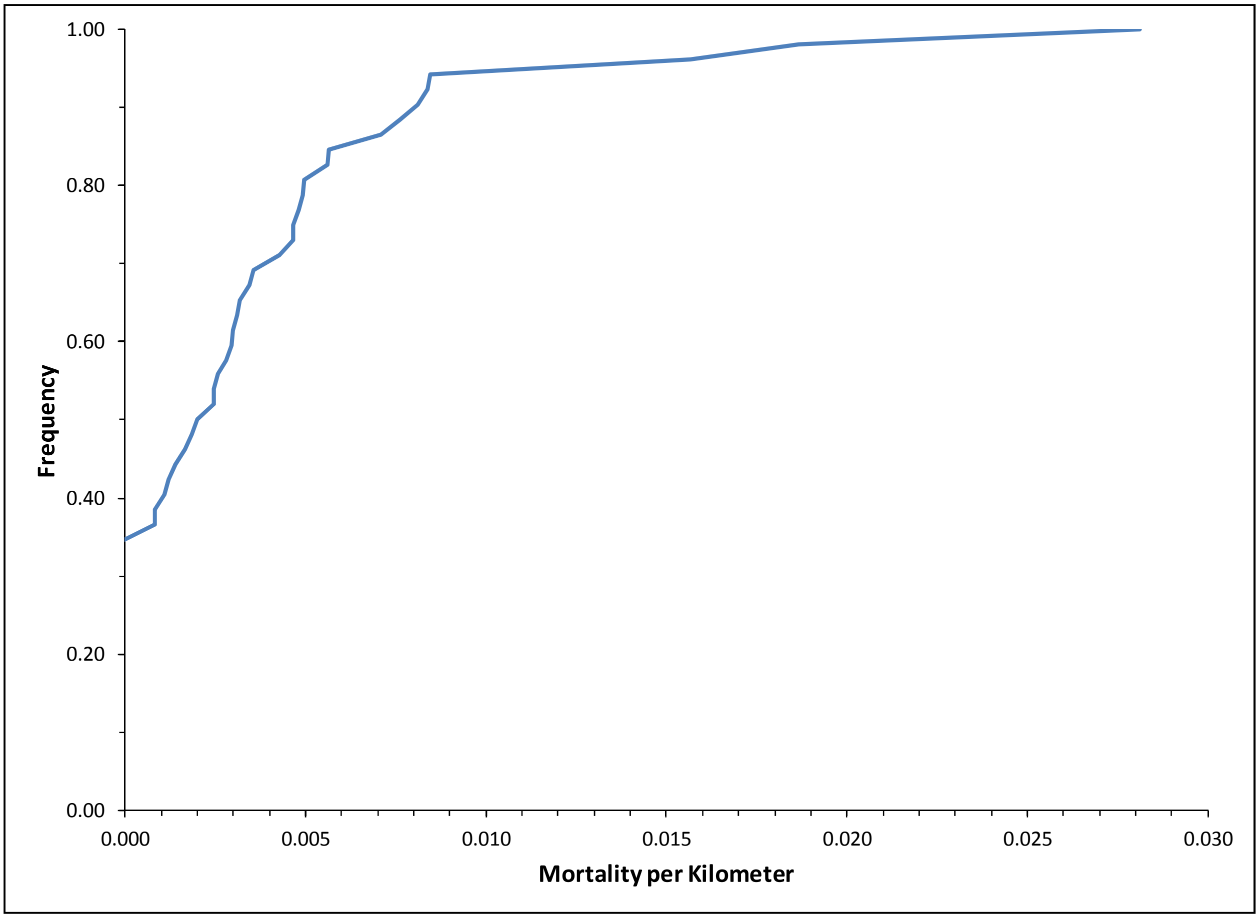

Figure 3.5.1. Cumulative frequency distribution of mortality per km for smolts migrating through the Penobscot River generated from 53 estimates over four years of study (2005, 2006, 2009, and 2010) in the Penobscot River.

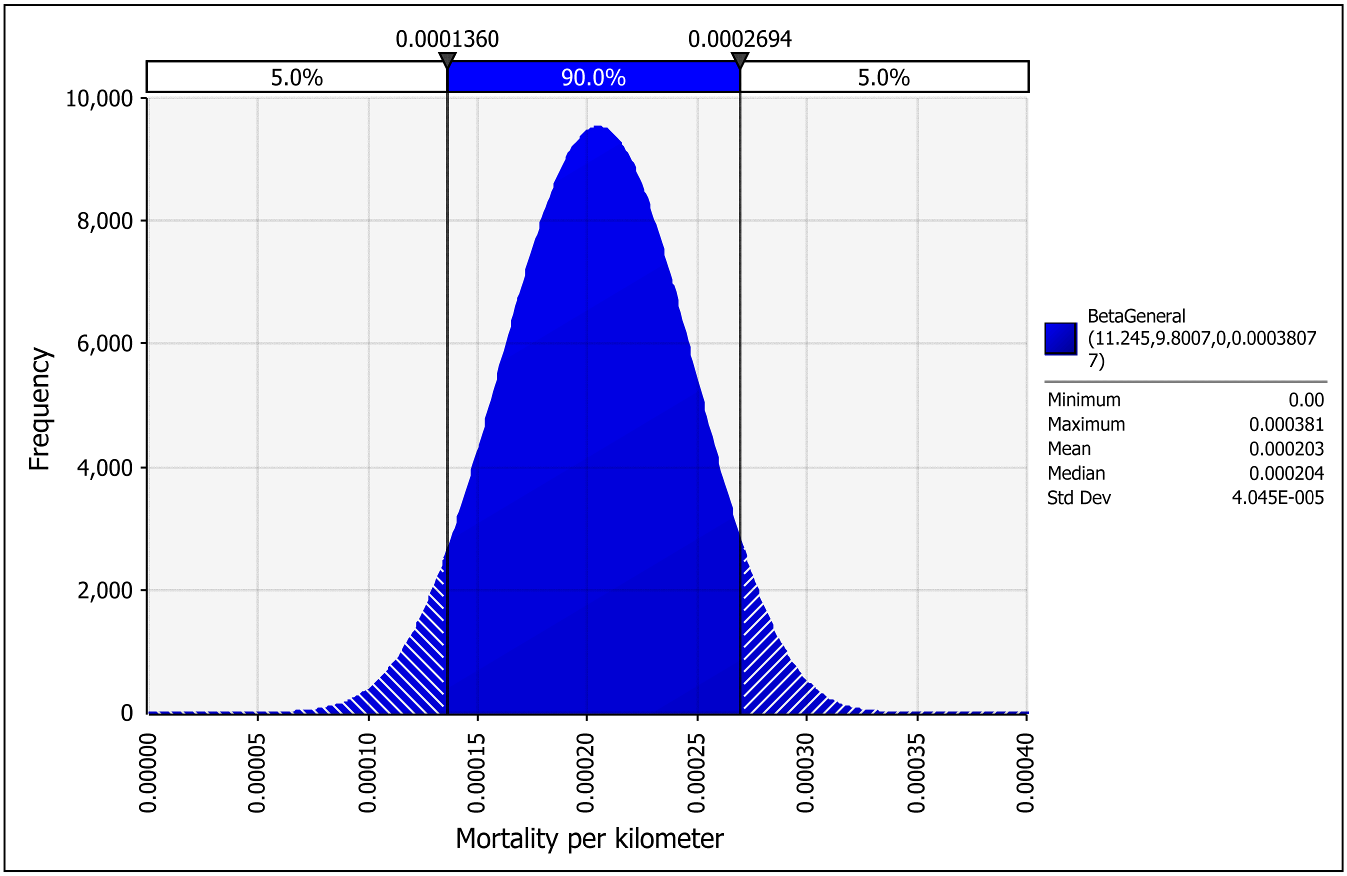

Figure 3.5.2. Simulated distribution of mortality per km for Penobscot River smolts migrating from their rearing habitat to the ocean. Mortality estimates did not include dam-related mortality and were generated through a sub-model which used random draws from a cumulative distribution made from field data gathered during telemetry studies on the Penobscot River. Estimates from the random draws were applied on a production unit- and iteration-specific level to estimate the number of smolts that would reach the ocean and to calculate an overall mortality per km estimate.

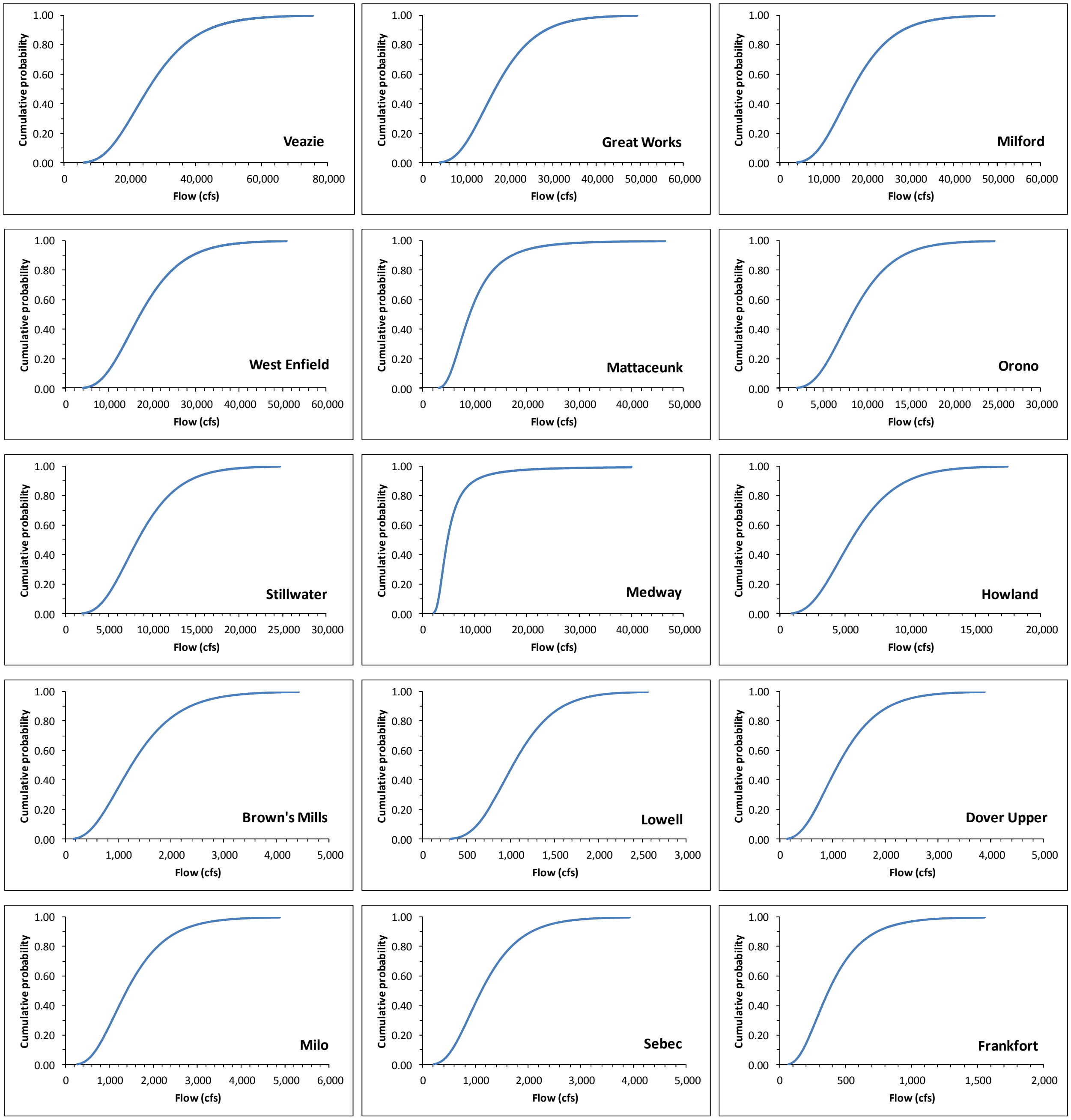

Figure 3.6.1.1. Cumulative flow probability functions for the month of May provided by Alden Research Laboratory, Inc. for 15 FERC-regulated hydroelectric facilities on the Penobscot River. Note the facility-specific x-axes for all graphs and that the minimum and maximum predicted flow is identified by the beginning and ending of the data series.

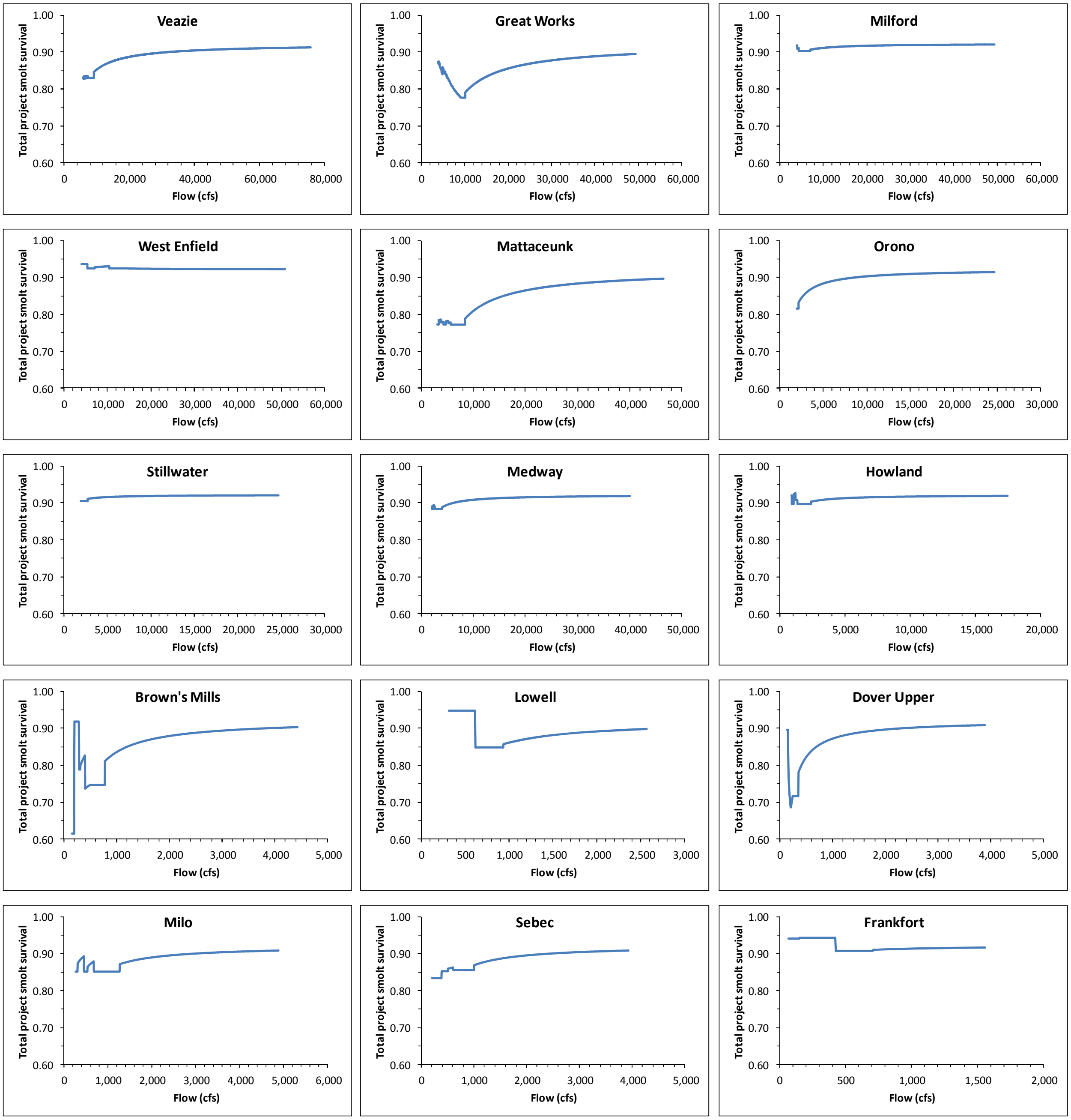

Figure 3.6.1.2. Total project smolt survival by flow for the month of May provided by Alden Research Laboratory, Inc. for 15 FERC-regulated hydroelectric facilities on the Penobscot River. Survival at low flows is typically variable as operational changes with increasing flows (e.g., engaging additional turbines) alter the proportion of flow passing via the turbines versus the spillway and downstream bypass and, therefore, alter the proportion of smolts passing via the turbine, where mortality and injury rates are often higher than alternative passage routes. Note the facility-specific x-axes for all graphs, the y-axes are set from 0.6 to 1.0, and that the minimum and maximum predicted flow is identified by the beginning and ending of the data series.

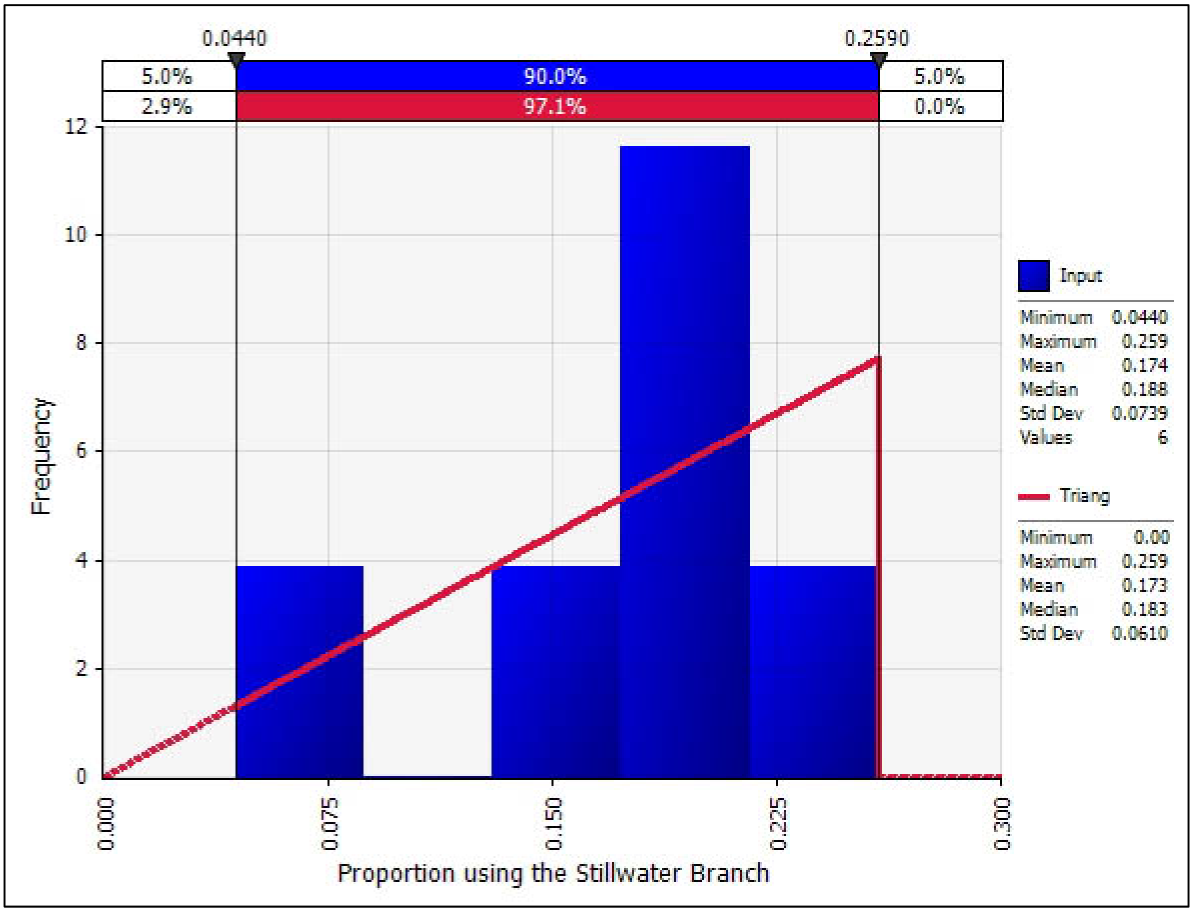

Figure 3.6.3.1. Estimates of Stillwater Branch use based on four years of telemetry studies (2005, 2006, 2009, and 2010) within the Penobscot River and the corresponding triangular distribution used to partition downstream migrating smolts according to downstream migrating path.

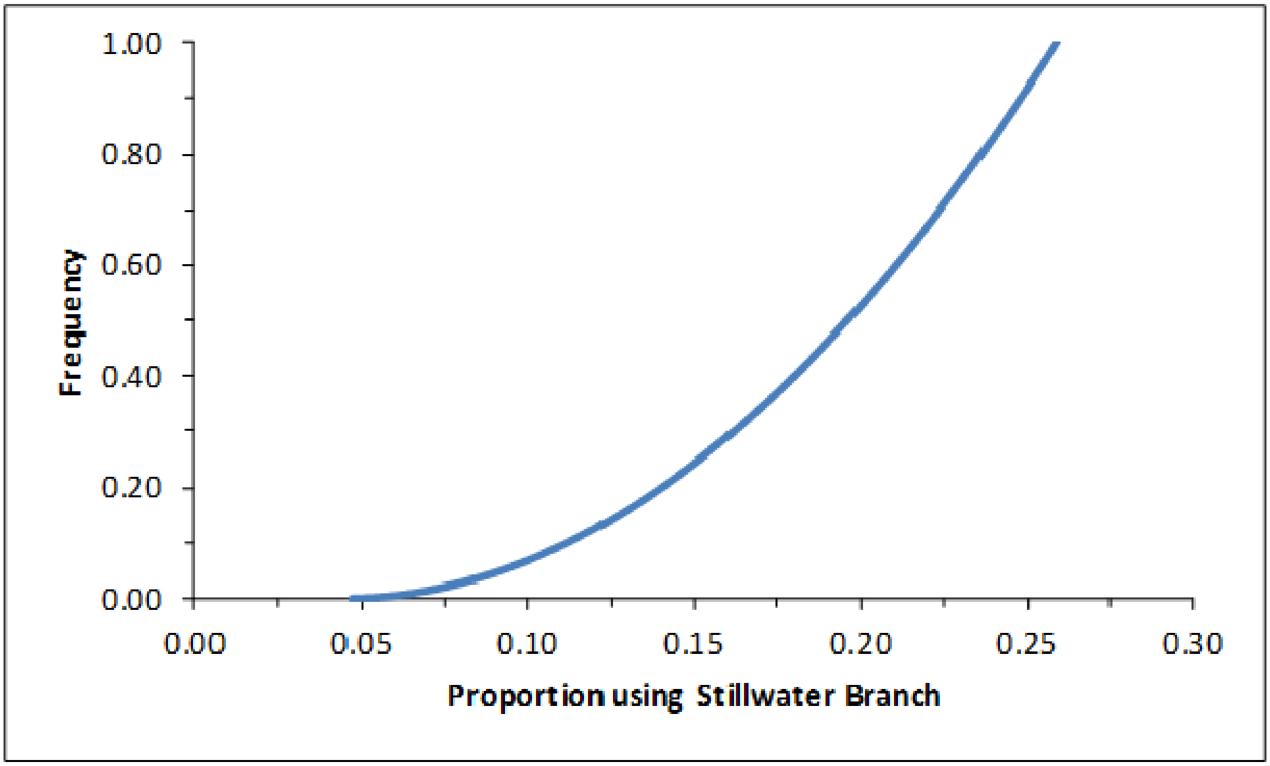

Figure 3.6.3.2. Cumulative frequency distribution of Stillwater Branch use based on 5,000 random draws from the triangular distribution developed from four years of telemetry studies within the Penobscot River.

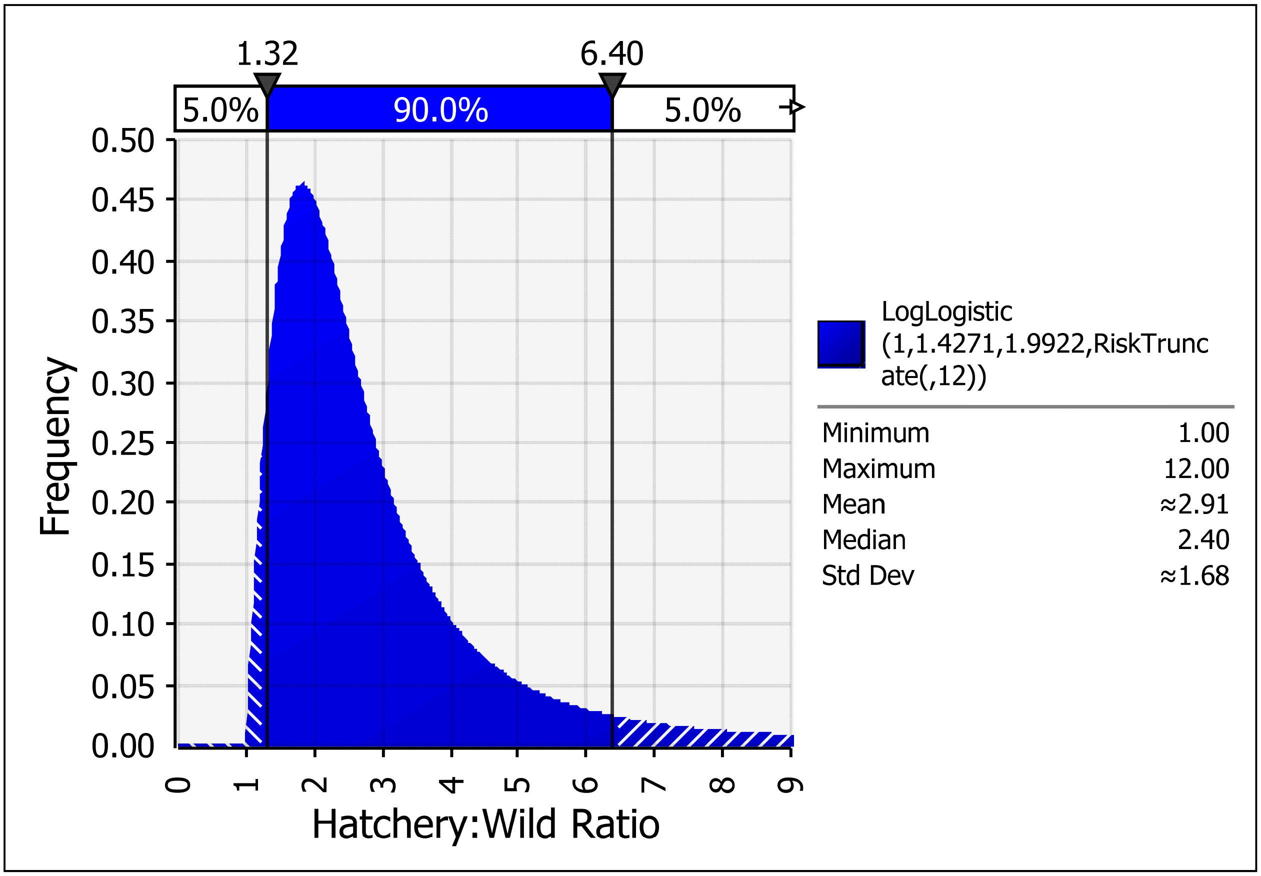

Figure 3.8.1. Fitted distribution of hatchery discount values. A total of 17 data points were obtained from the literature, describing Atlantic salmon smolt to adult survival rates for both hatchery- and wild-origin Atlantic salmon. Year- and iteration-specific draws from this distribution were made and the hatchery discount values were applied to the hatchery smolts at Verona to estimate the number of wild-equivalent smolts.

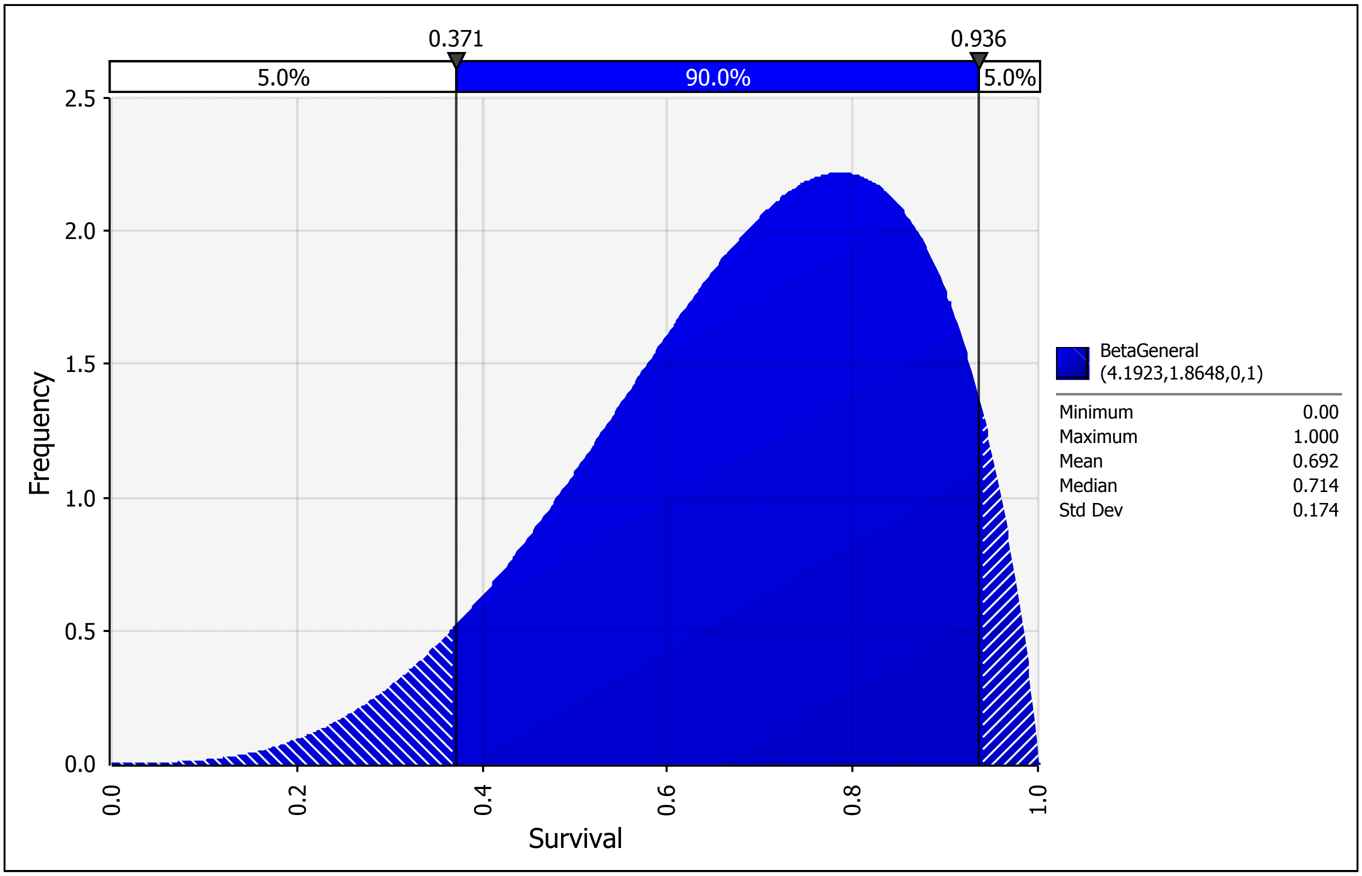

Figure 3.9.1. Fitted distribution of freshwater survival (stocking to Verona Island) generated from 17 data points from five years (2005, 2006, 2009, 2010 and 2011) of telemetry studies on hatchery and wild fish released at six sites in the Penobscot River.

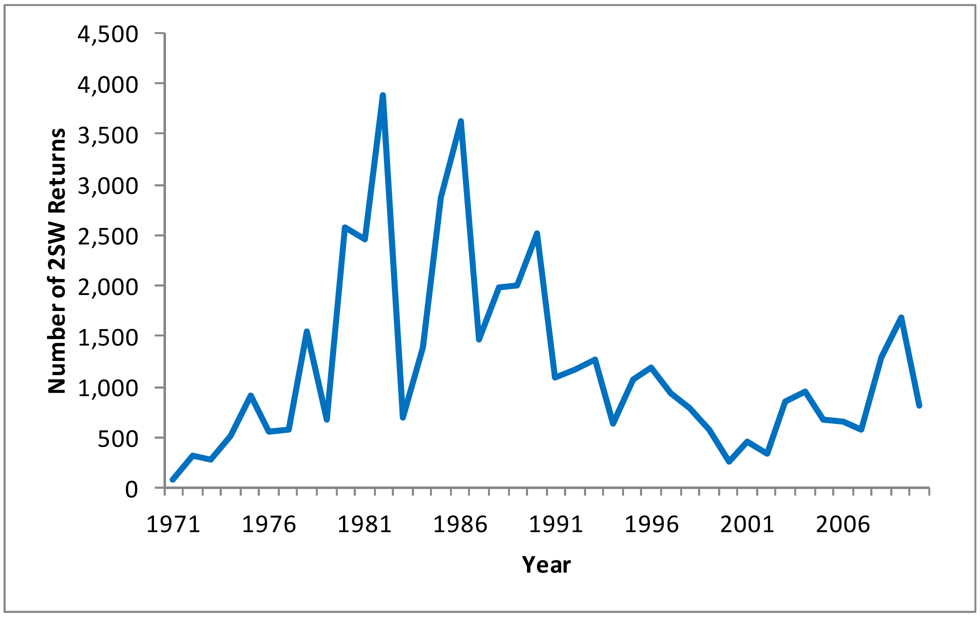

Figure 3.9.2. Number of Penobscot River two sea-winter (2SW) adults returning in the years 1971–2010.

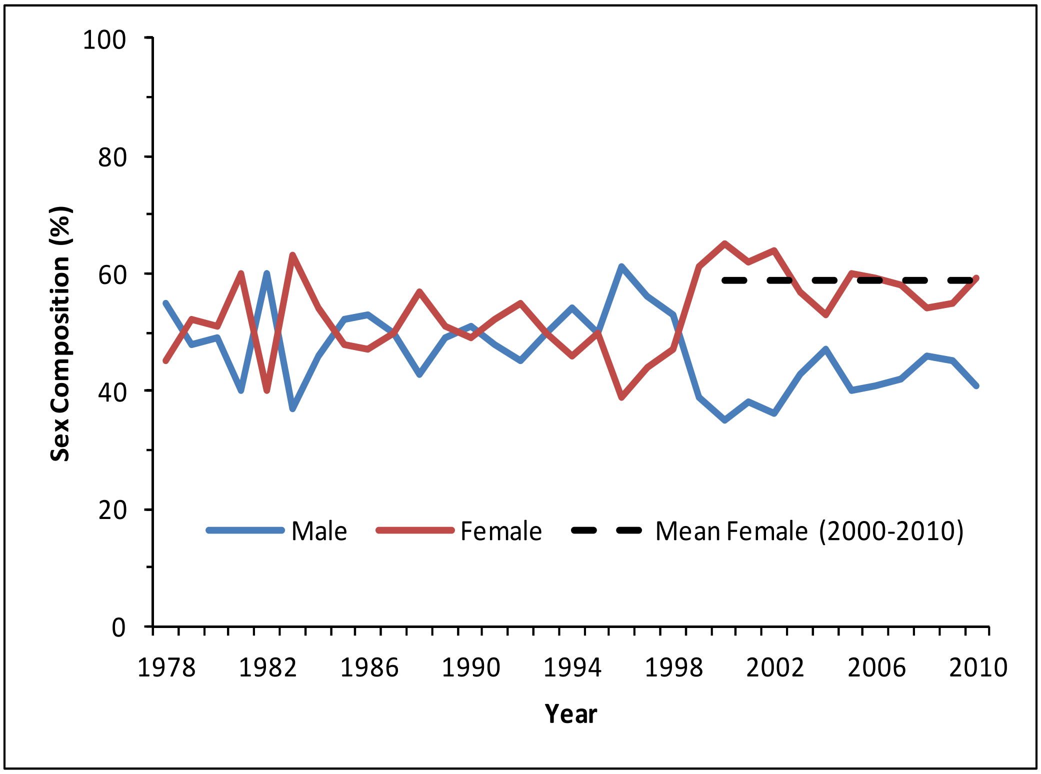

Figure 3.9.3. Sex composition of Penobscot River two sea-winter adult returns during 1978–2010. The 1978–1999 data represented determinations made in the field throughout the migratory season, whereas 2000–2010 data were corrected at the hatchery prior to spawning.

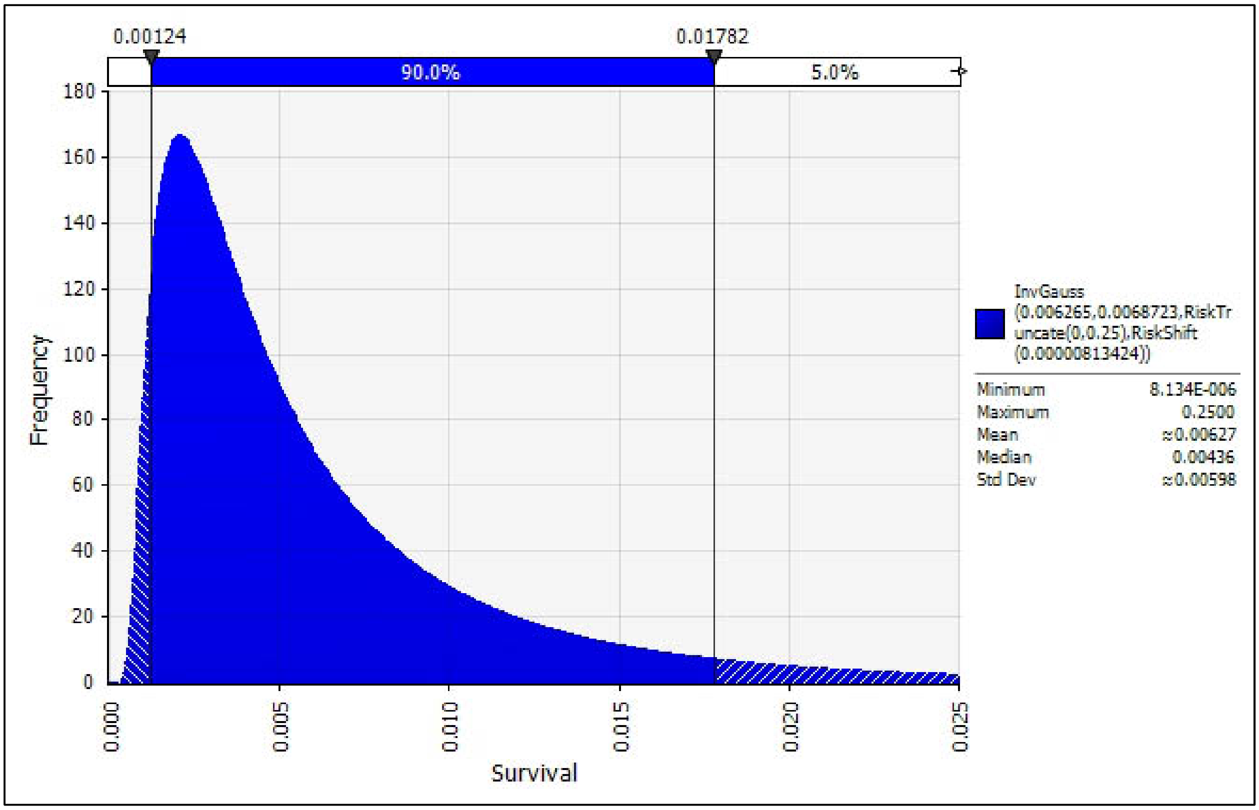

Figure 3.9.4. Fitted 2SW female marine survival distribution generated by dividing the number of 2SW adult returns (1971–2010), adjusted for the proportion female, by the number of stocked smolts (1969–2008) contributing to those returns, adjusted for the number of females stocked and freshwater mortality.

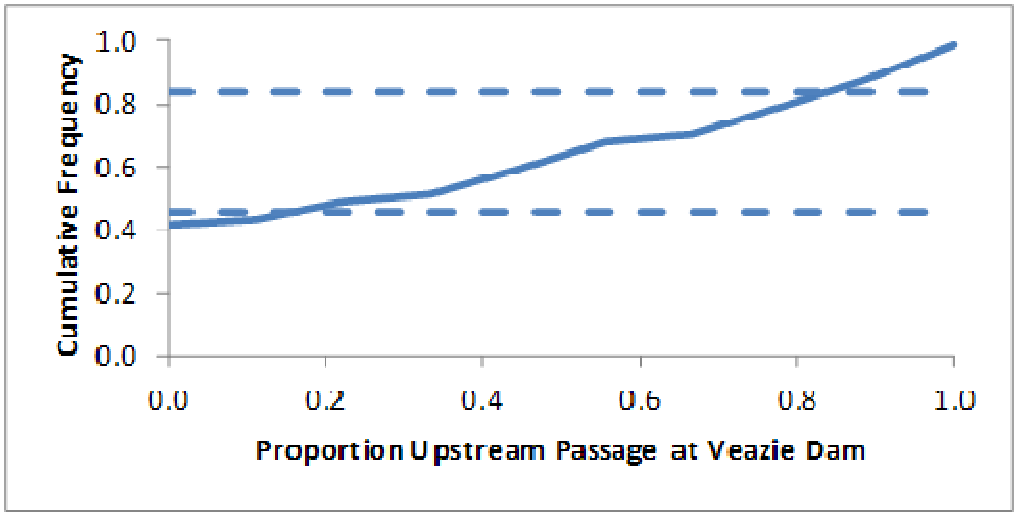

Figure 3.11.1.1. Cumulative distribution of upstream dam passage (with $\mu \pm \sigma$ minimum and maximum values indicated by the dashed lines) for Veazie Dam.

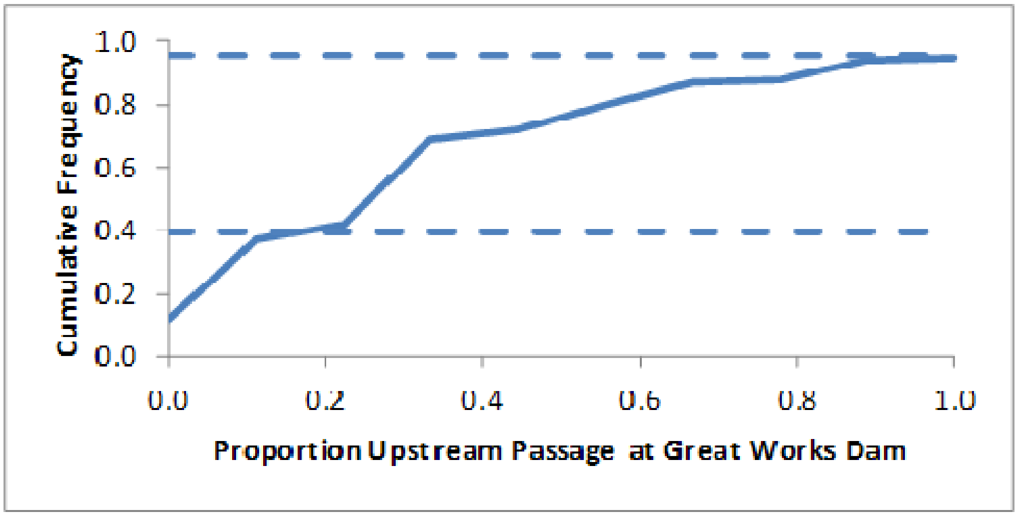

Figure 3.11.1.2. Cumulative distribution of upstream dam passage (with $\mu \pm \sigma$ minimum and maximum values indicated by the dashed lines) for Great Works Dam.

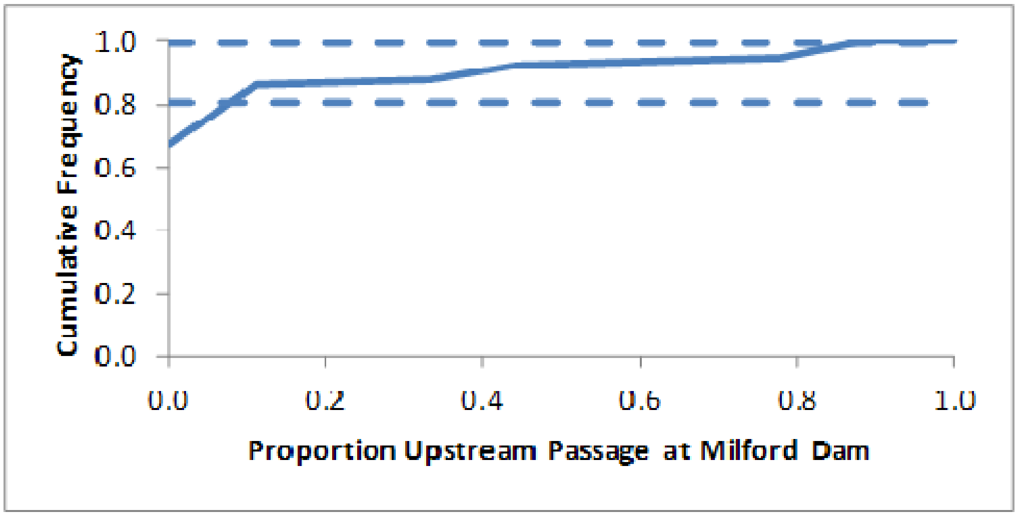

Figure 3.11.1.3. Cumulative distribution of upstream dam passage (with $\mu \pm \sigma$ minimum and maximum values indicated by the dashed lines) for Milford Dam.

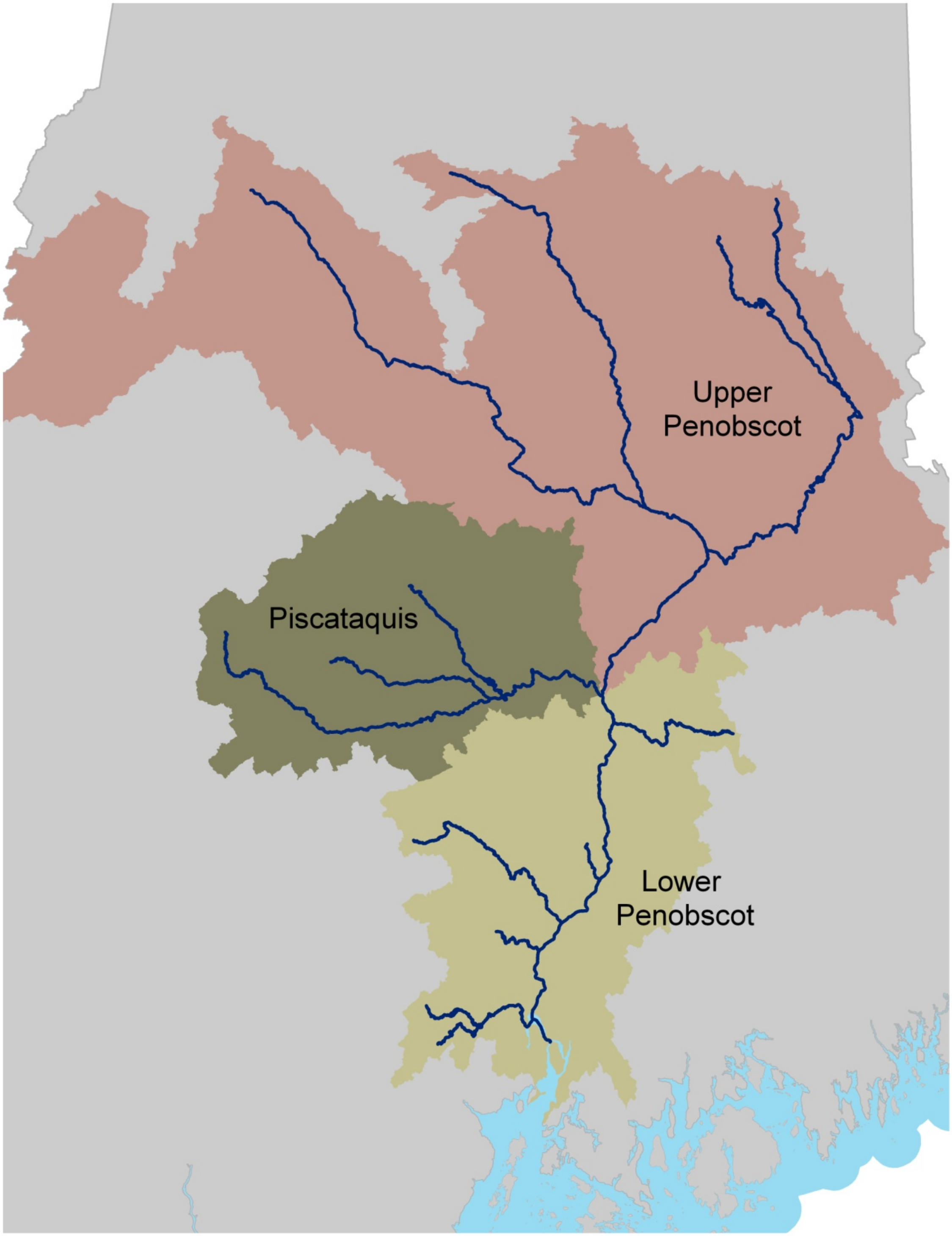

Figure 4.1. The Penobscot River watershed and major tributaries divided into three areas: the Upper Penobscot area includes the portion of the watershed above West Enfield Dam, the Piscataquis area includes the Piscataquis River watershed, and the Lower Penobscot area includes the portion of the watershed below West Enfield Dam.

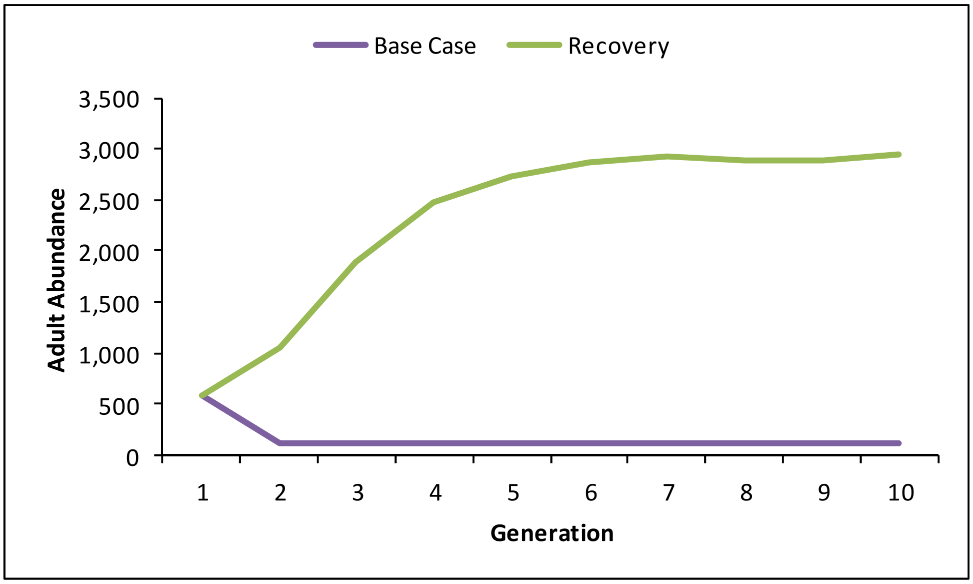

Figure 4.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the Base Case and Recovery scenarios.

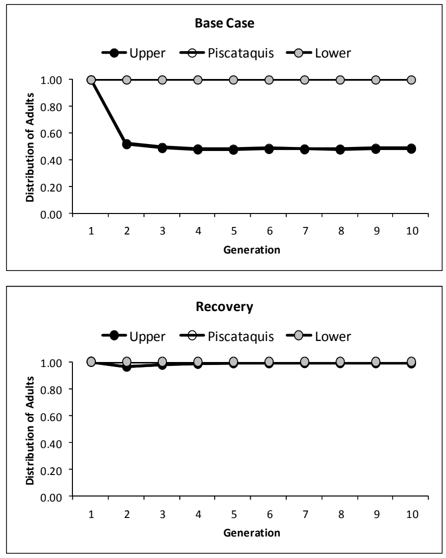

Figure 4.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 under the Base Case and Recovery scenarios.

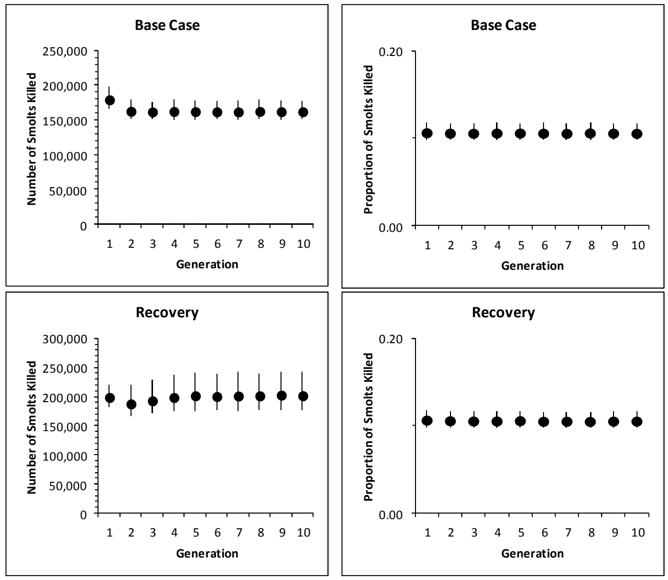

Figure 4.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the Base Case and Recovery scenarios (top and bottom panels, respectively).

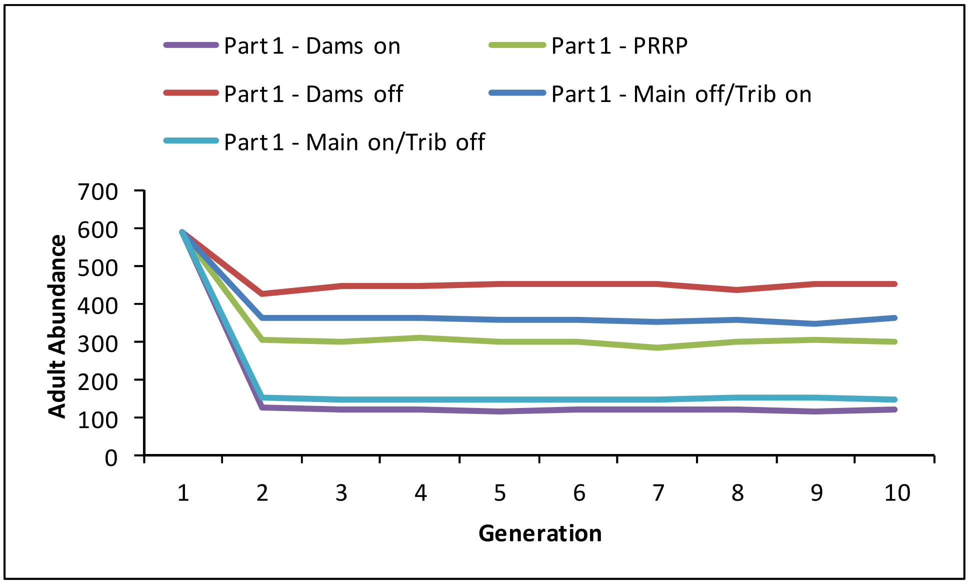

Figure 5.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

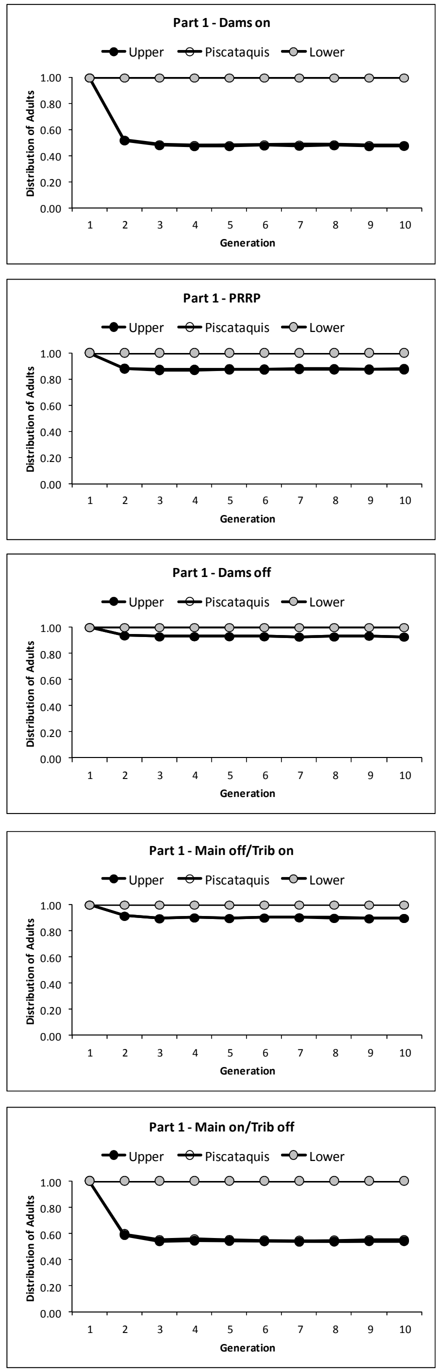

Figure 5.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off (top to bottom, respectively). Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

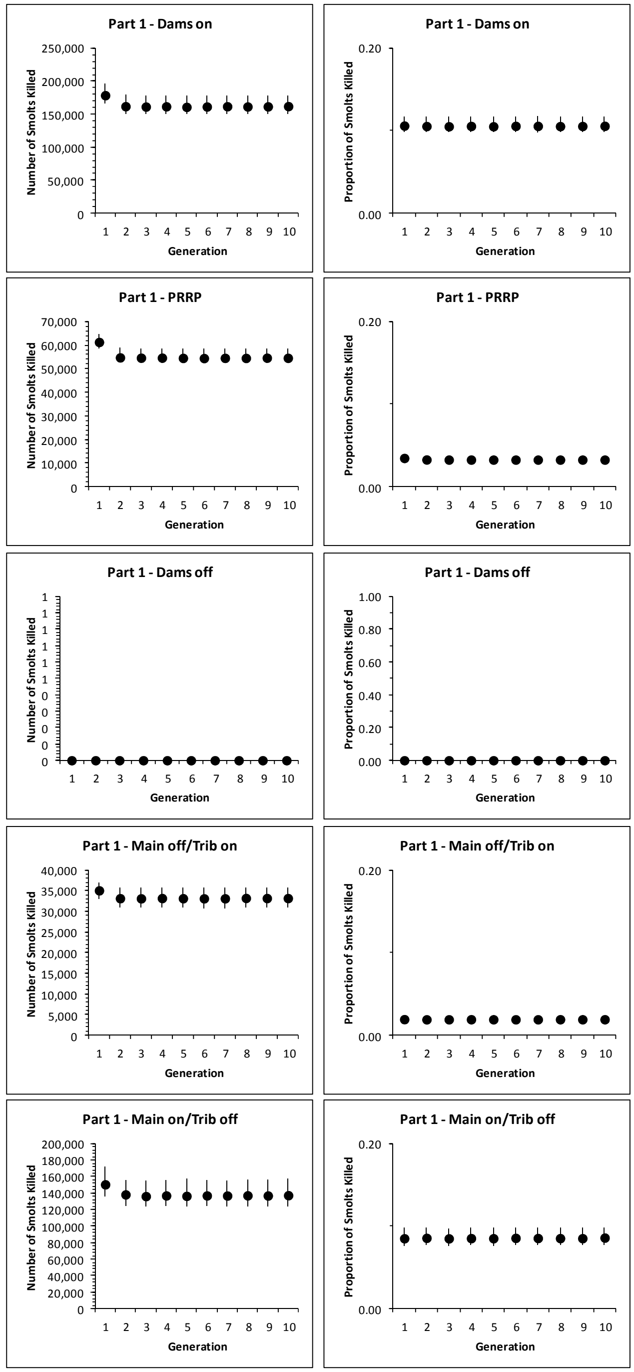

Figure 5.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off (top to bottom, respectively). Hatchery stocking was turned on and freshwater and marine survival rates were set at the base case values in all scenarios.

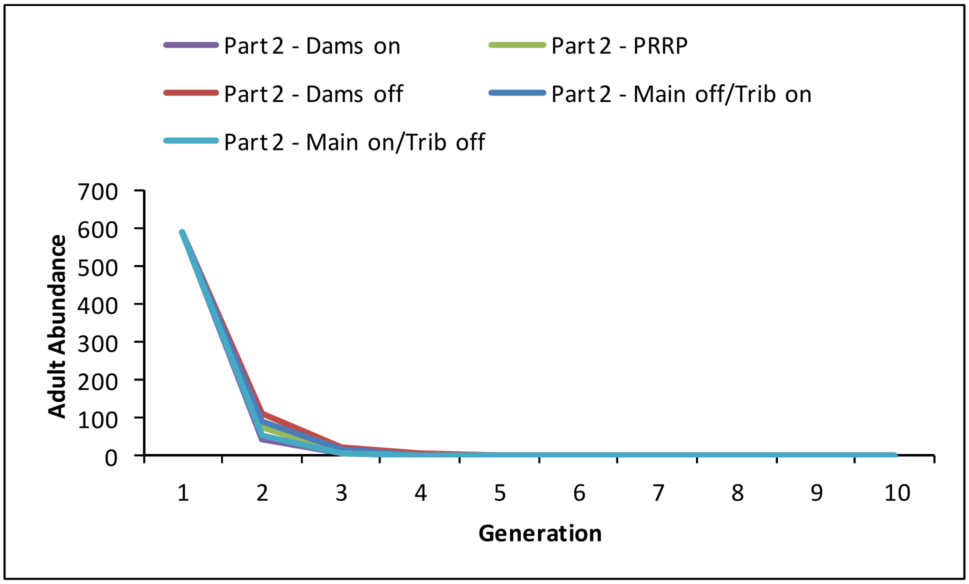

Figure 5.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

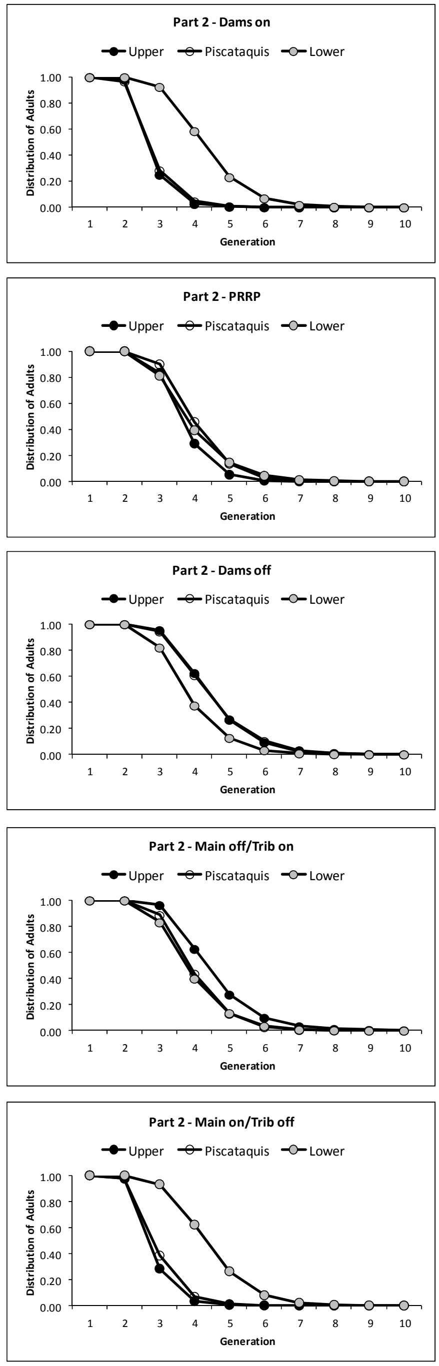

Figure 5.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off (top to bottom, respectively). Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

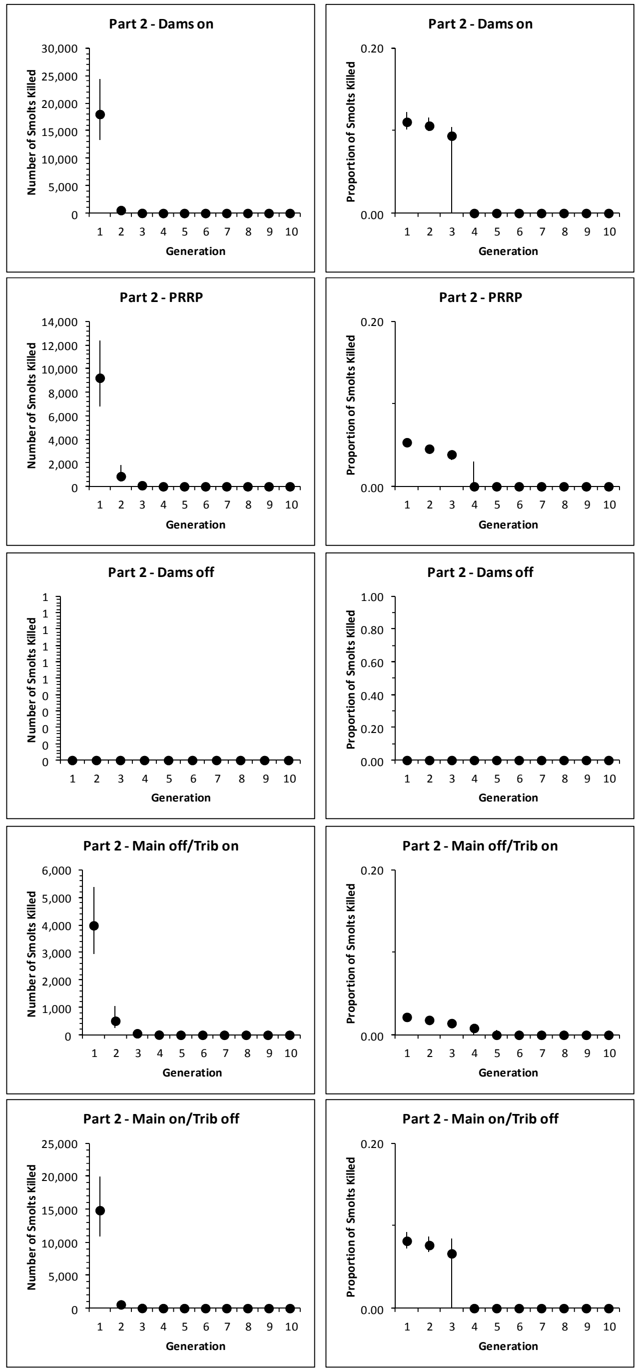

Figure 5.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off (top to bottom, respectively). Hatchery stocking was turned off and freshwater and marine survival rates were set at the base case values in all scenarios.

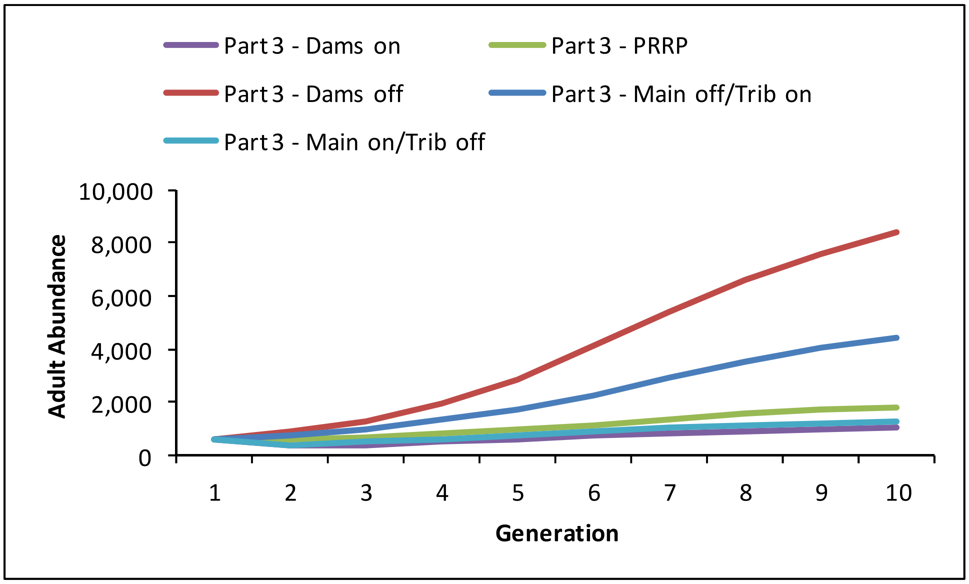

Figure 5.3.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

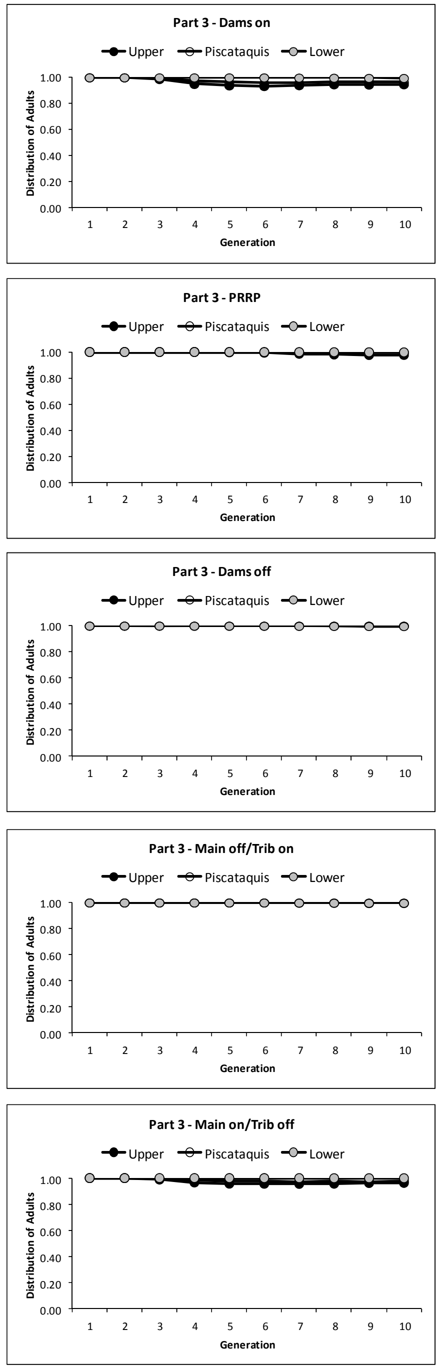

Figure 5.3.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off (top to bottom, respectively). Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

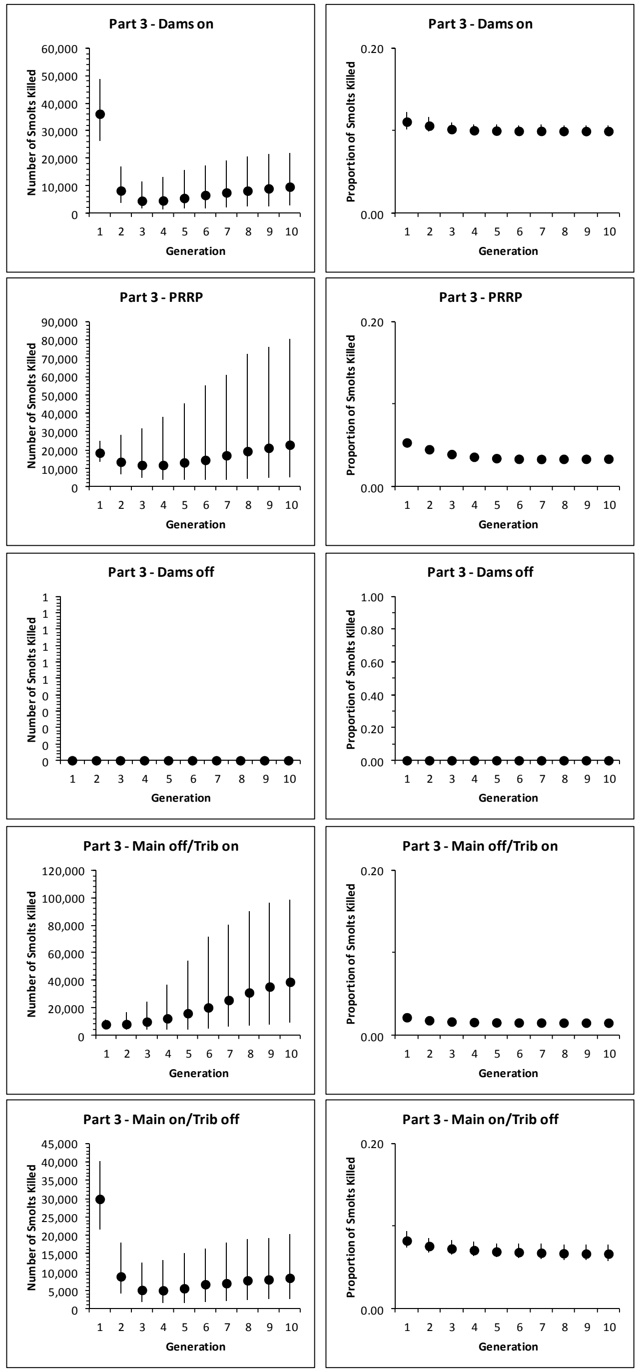

Figure 5.3.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios with all dams turned on, implementation of the PRRP, all dams turned off, mainstem dams turned off and tributary dams turned on, and mainstem dams turned on and tributary dams turned off (top to bottom, respectively). Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value in all scenarios.

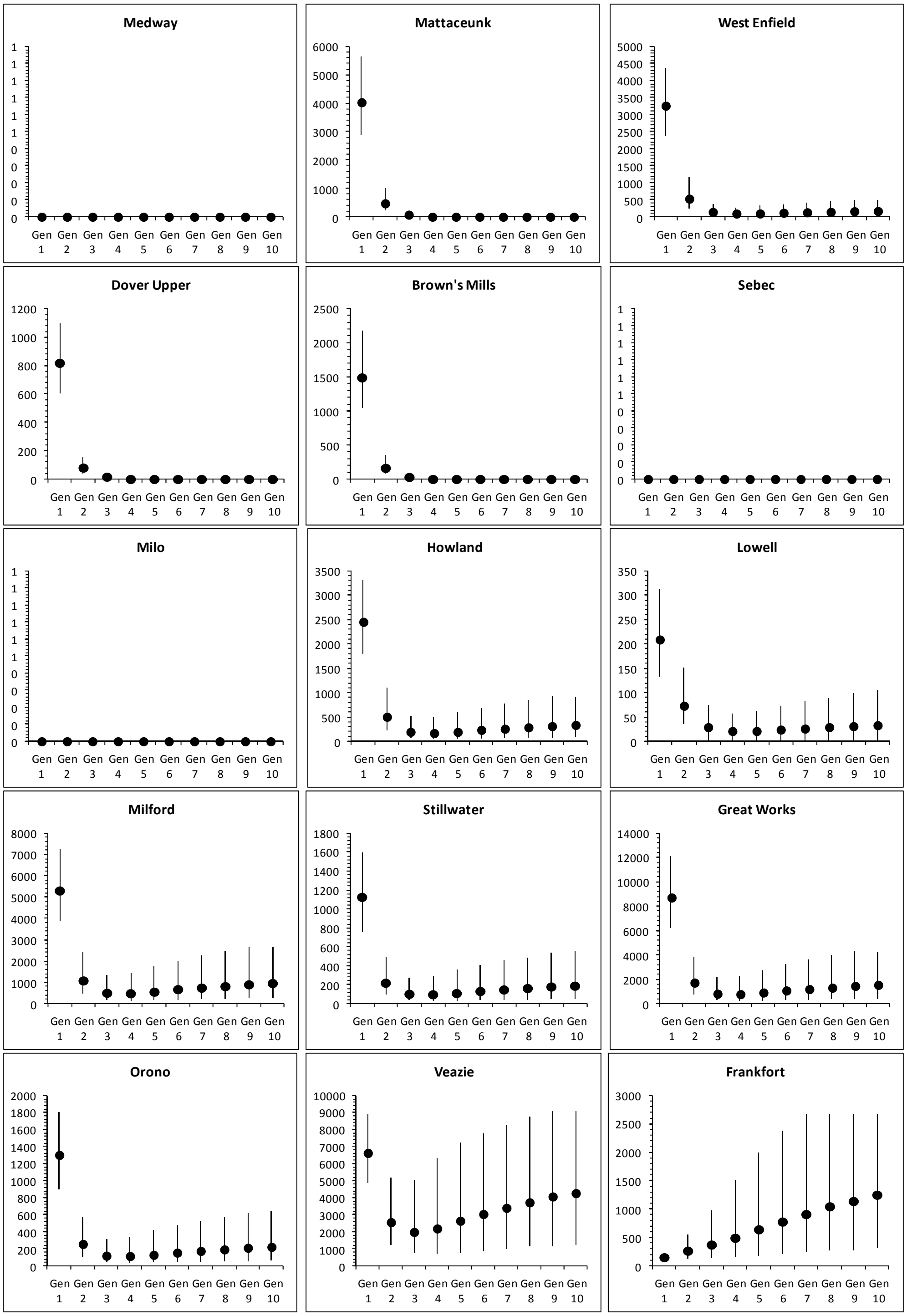

Figure 5.3.1.1. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with all dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

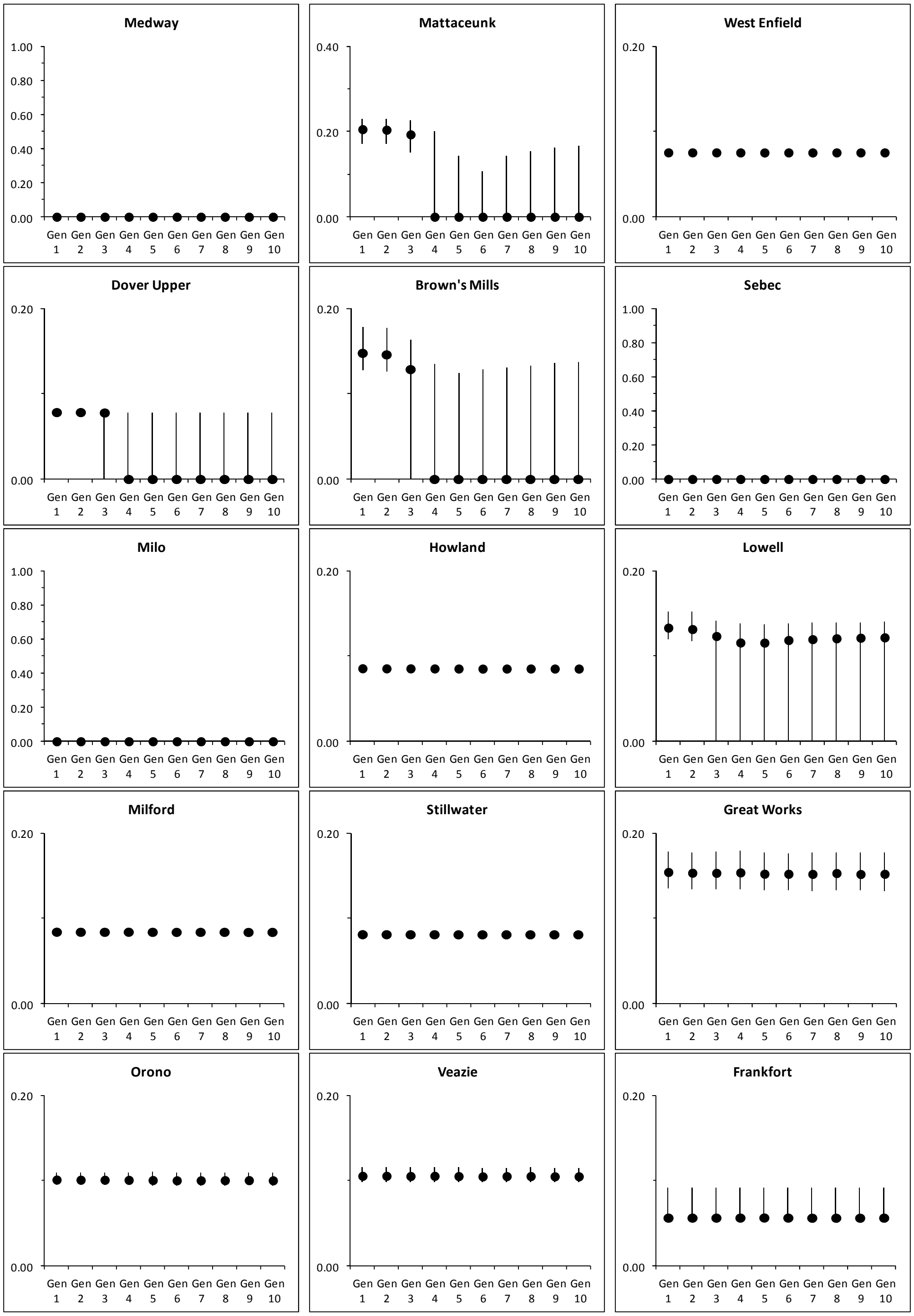

Figure 5.3.1.2. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with all dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

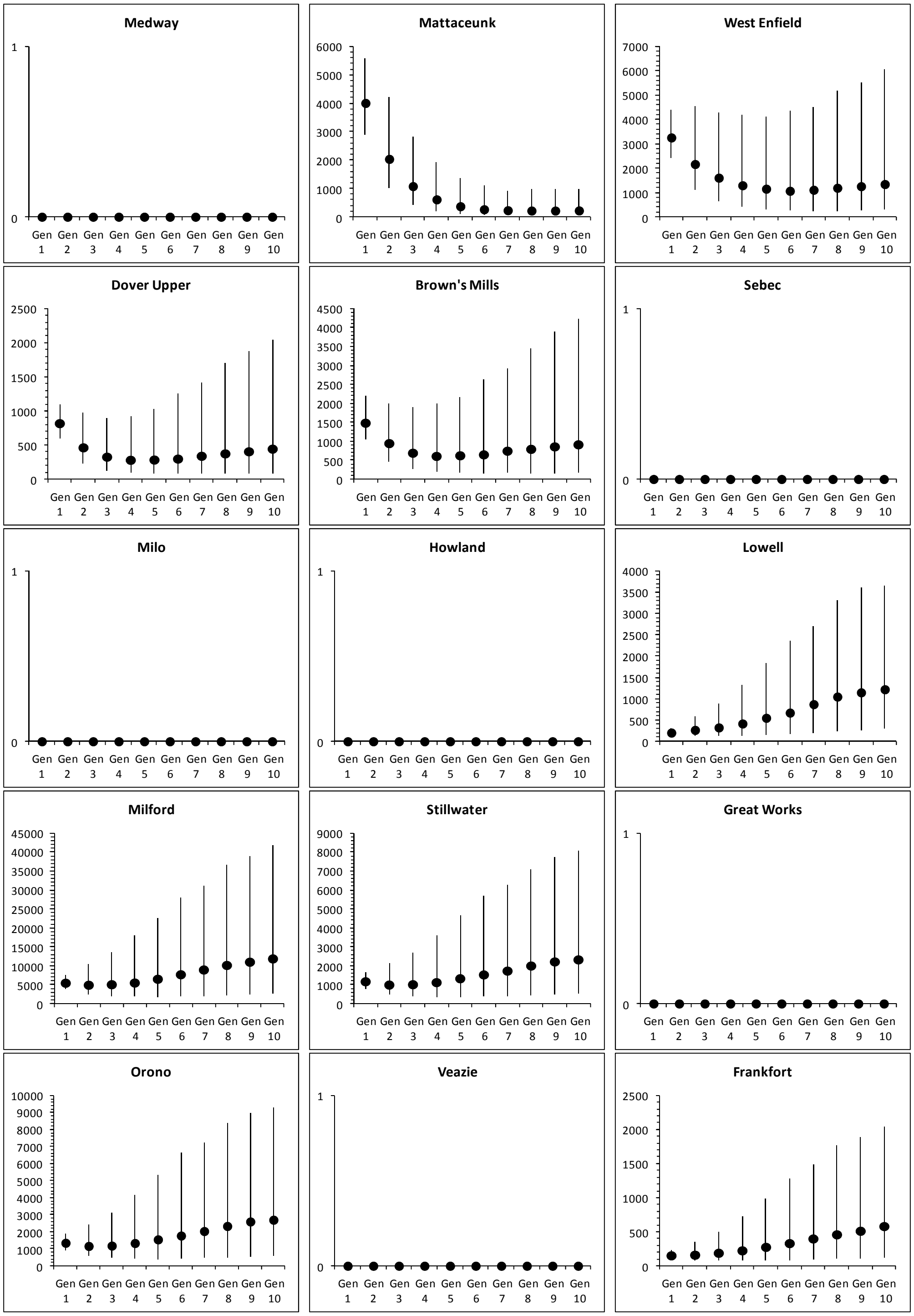

Figure 5.3.1.3. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with implementation of the PRRP. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

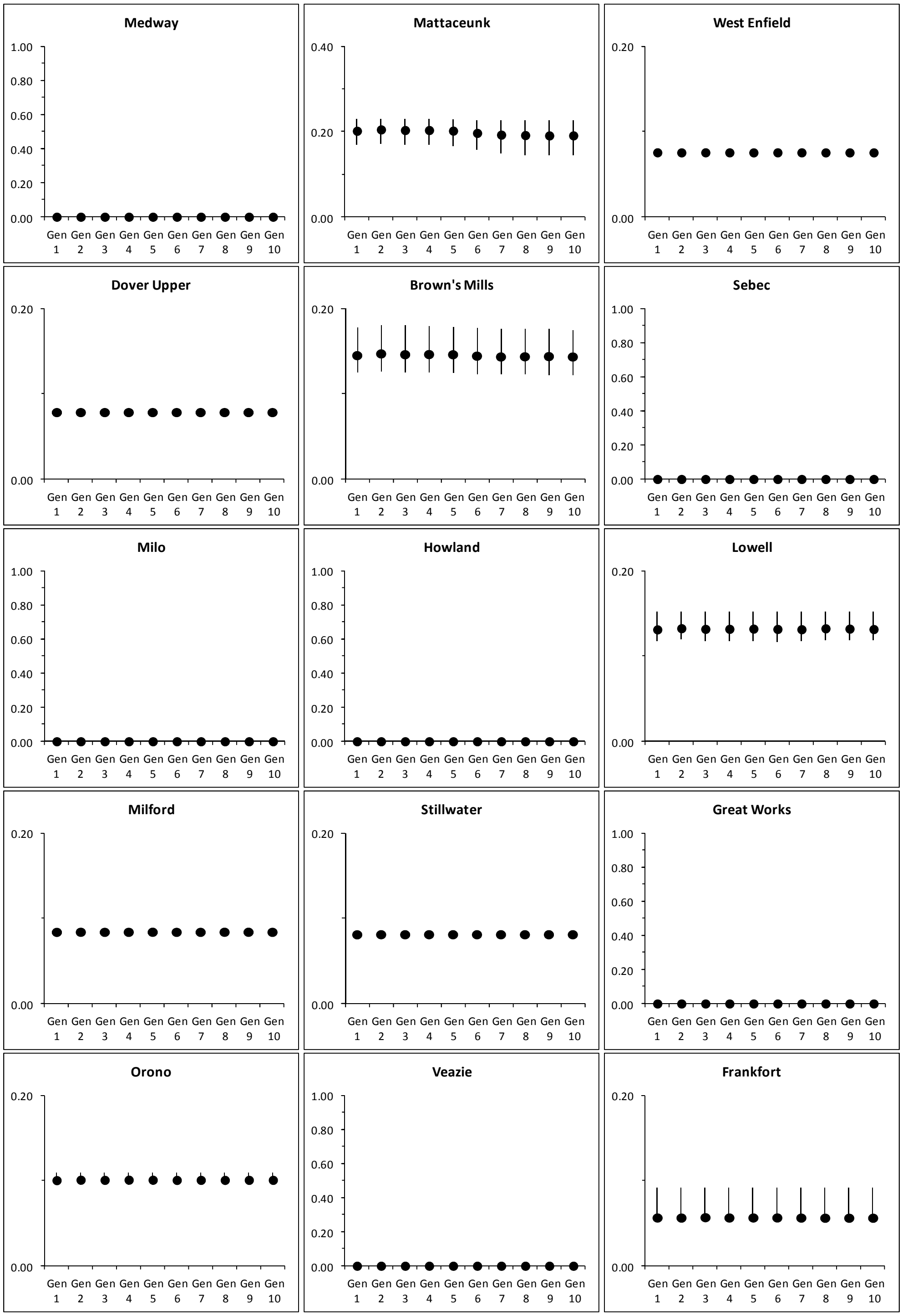

Figure 5.3.1.4. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with implementation of the PRRP. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

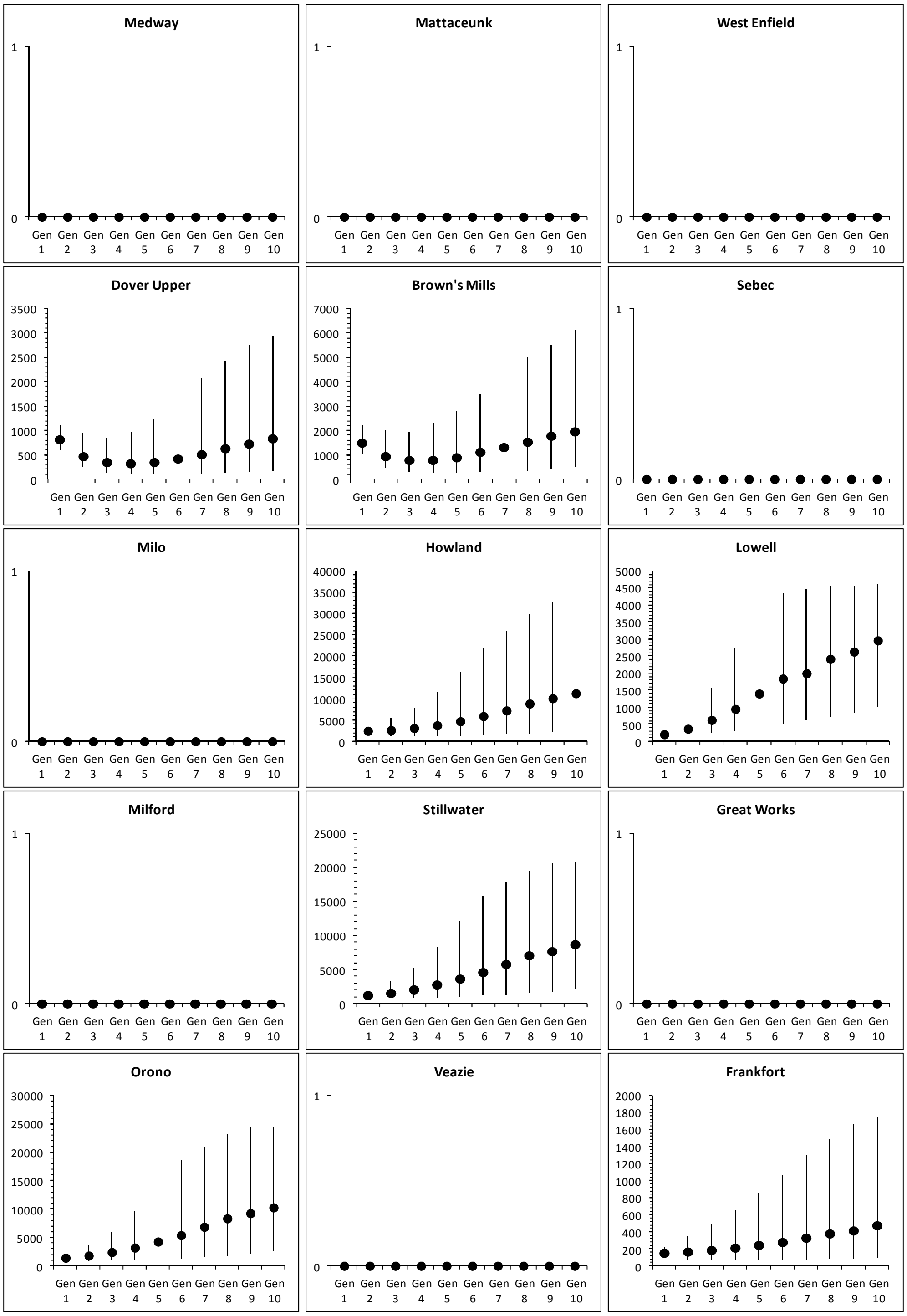

Figure 5.3.1.5. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with mainstem dams turned off and tributary dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

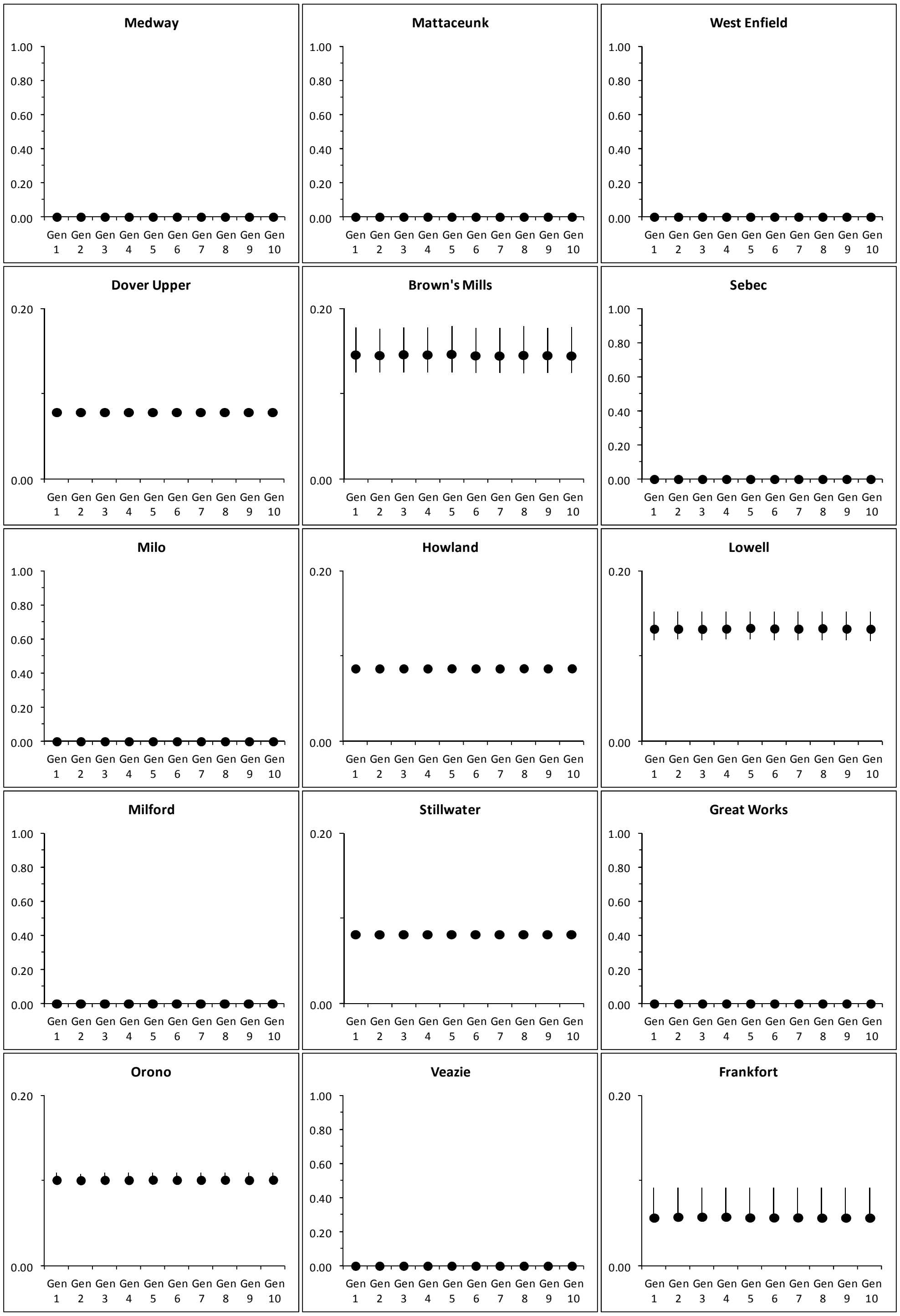

Figure 5.3.1.6. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with mainstem dams turned off and tributary dams turned on. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

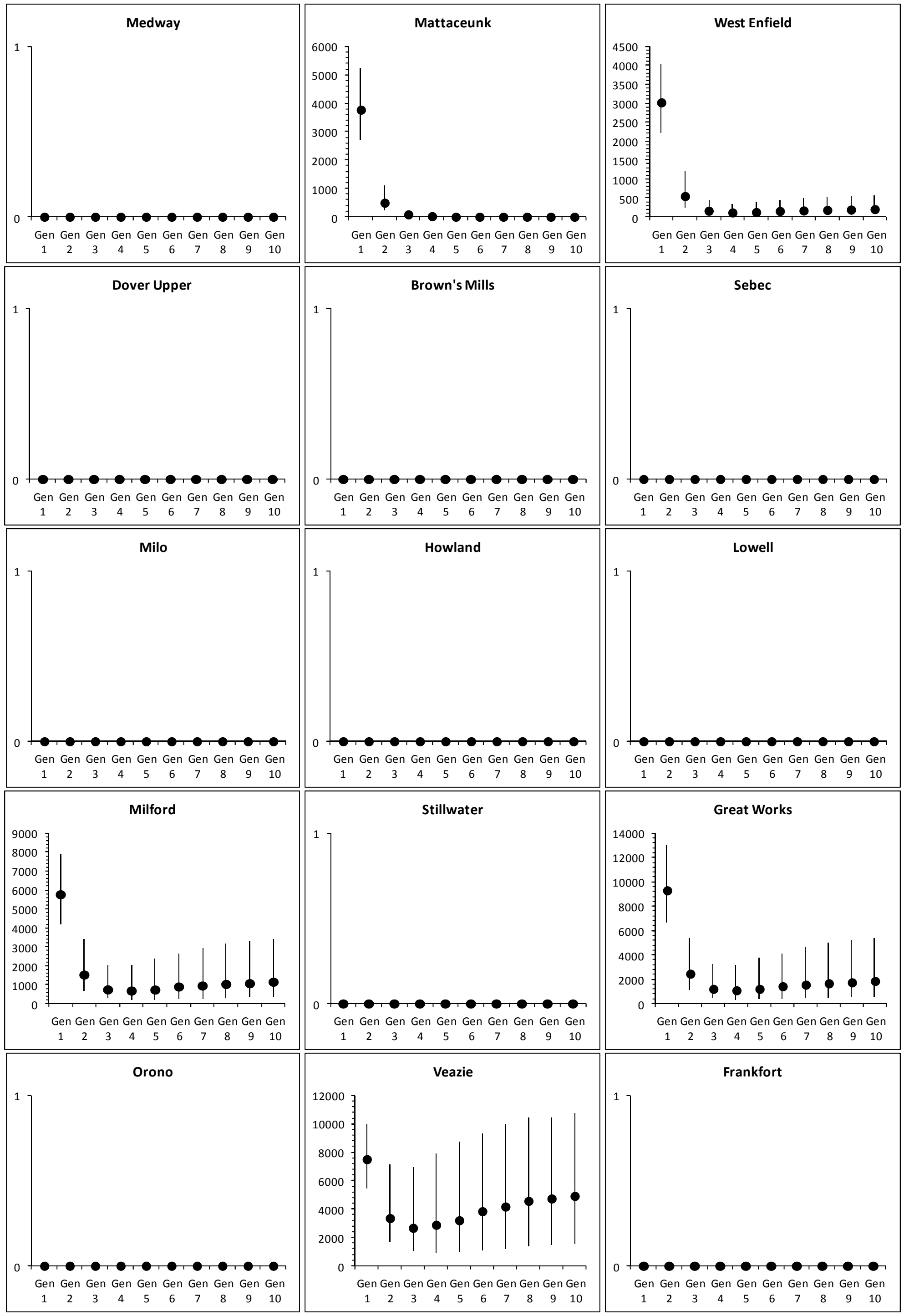

Figure 5.3.1.7. Median number of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

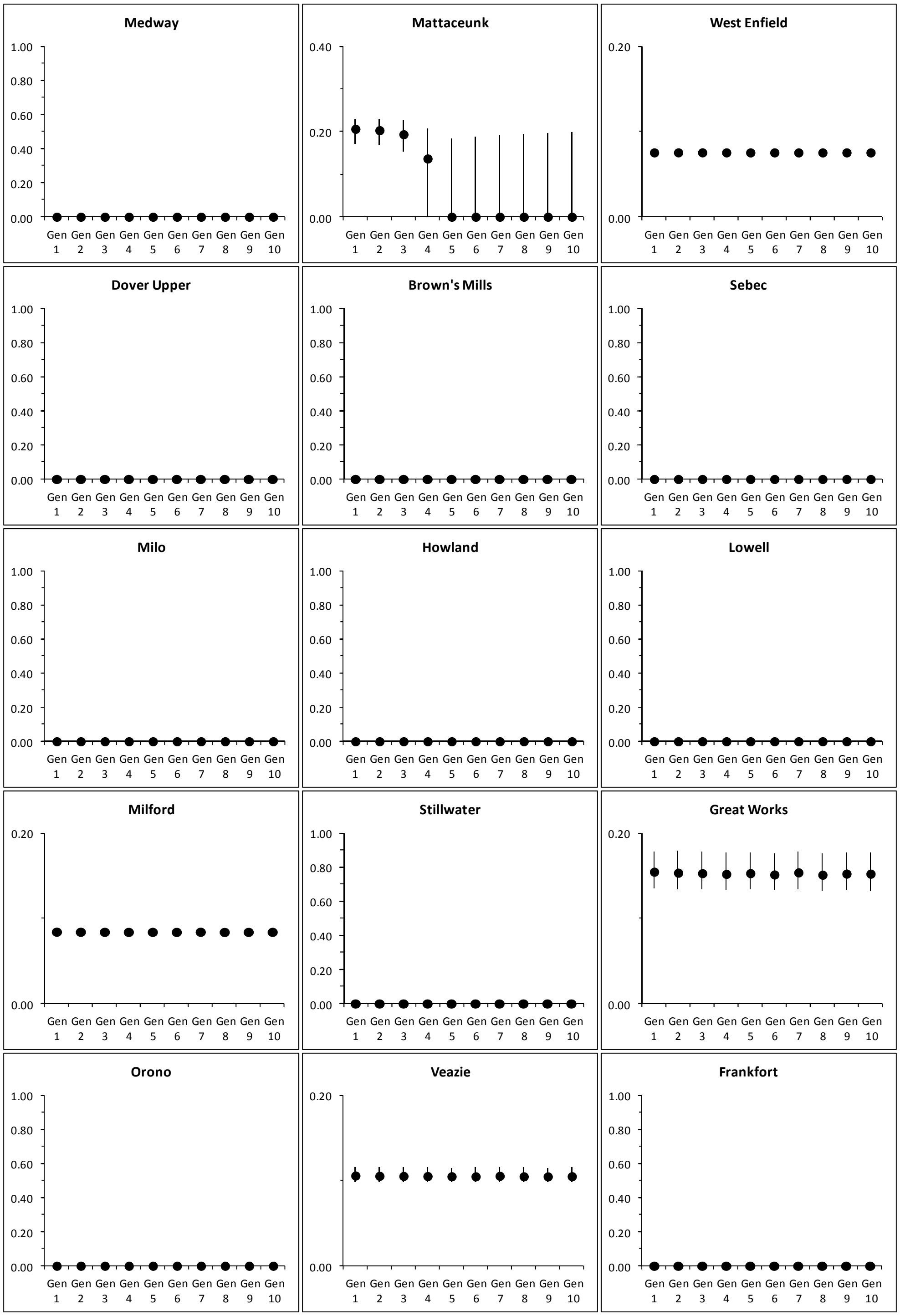

Figure 5.3.1.8. Median proportion of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage at each one of the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the scenario with mainstem dams turned on and tributary dams turned off. Hatchery stocking was turned off, the freshwater survival rate was increased by two times the base case value, and the marine survival rate was increased by 4 times the base case value.

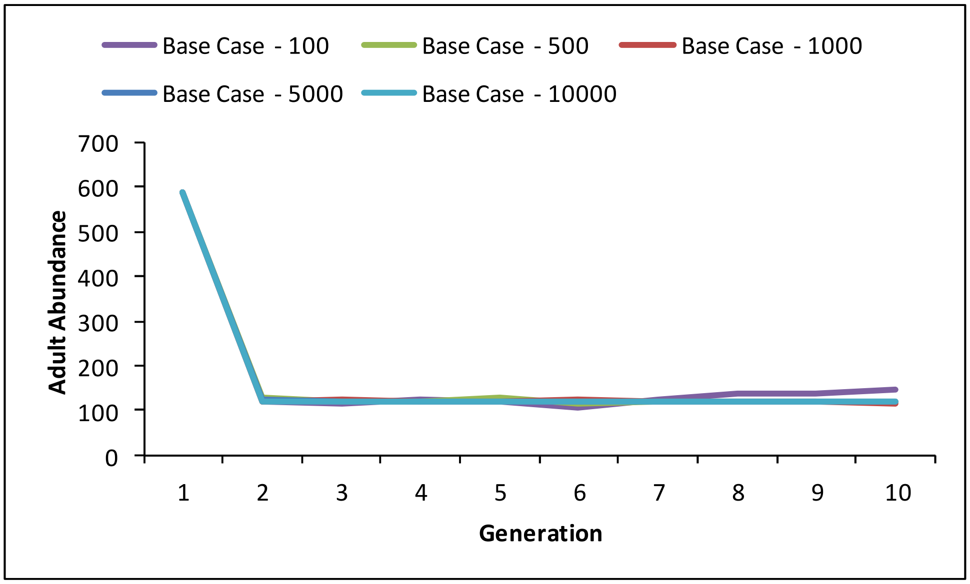

Figure 6.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Base Case scenario.

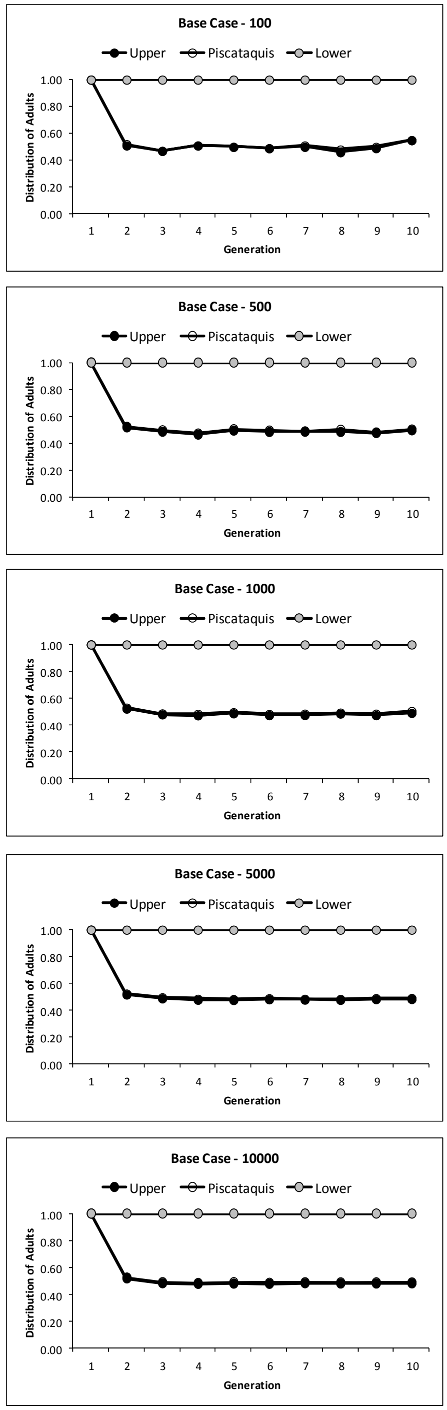

Figure 6.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations (top to bottom, respectively) under the Base Case scenario.

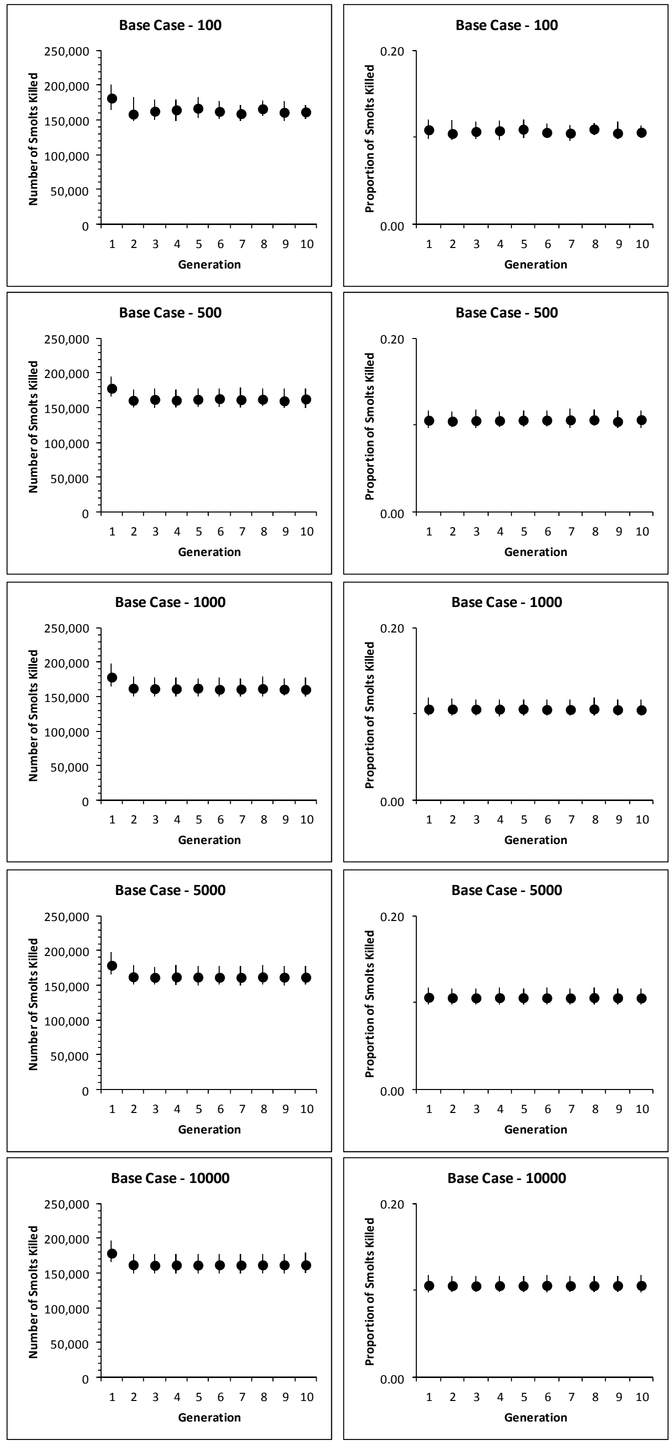

Figure 6.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 100, 500, 1,000, 5,000, and 10,000 model iterations (top to bottom, respectively) under the Base Case scenario.

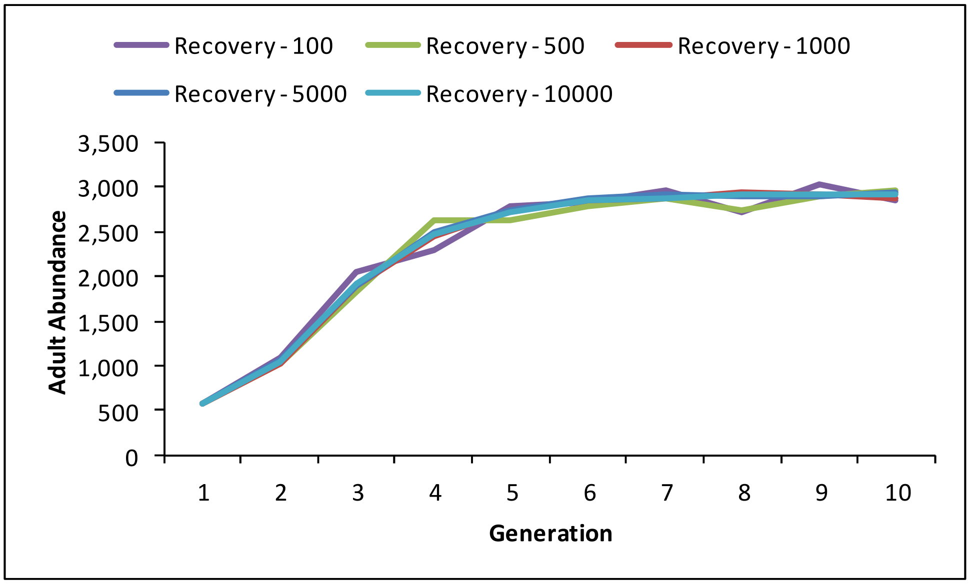

Figure 6.1.4. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations under the Recovery scenario.

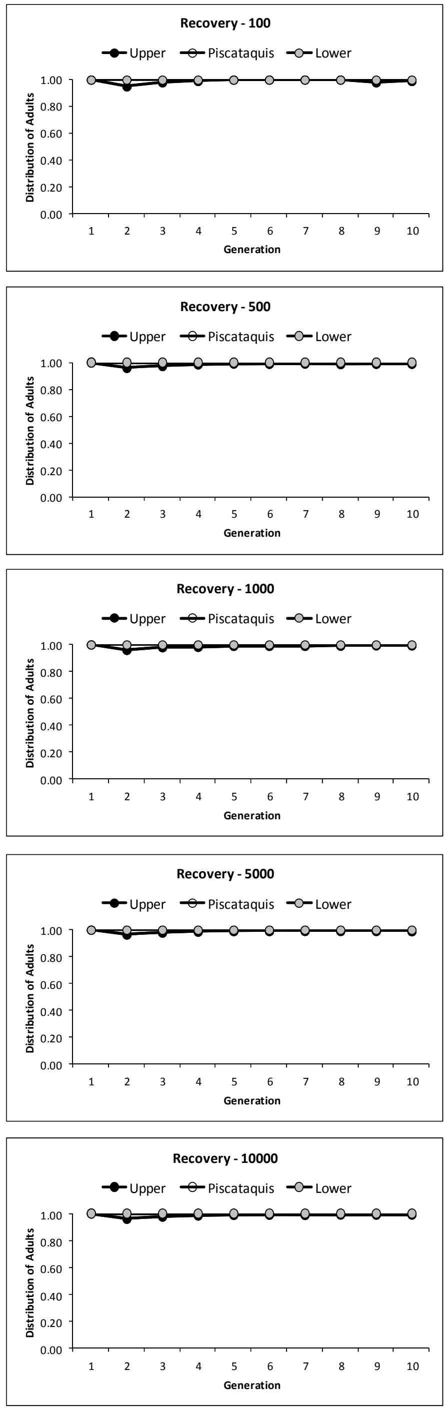

Figure 6.1.5. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 100, 500, 1,000, 5,000, and 10,000 model iterations (top to bottom, respectively) under the Recovery scenario.

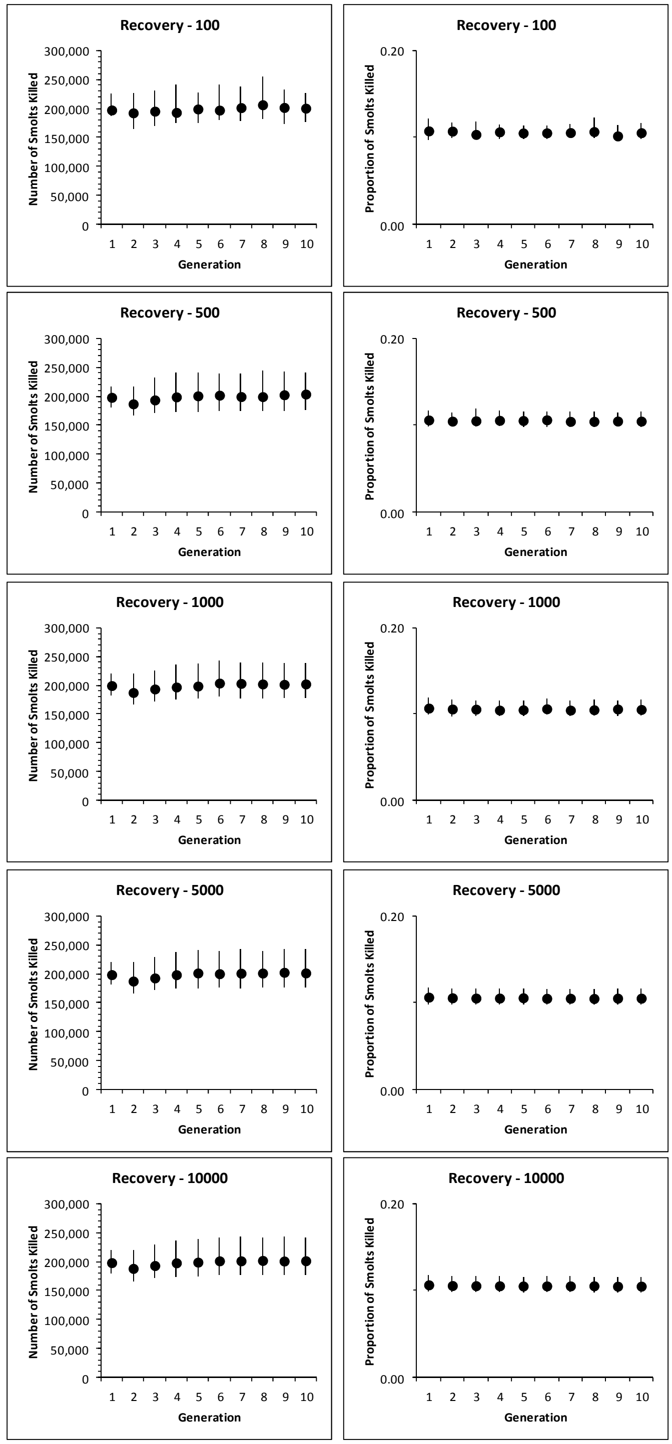

Figure 6.1.6. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 100, 500, 1,000, 5,000, and 10,000 model iterations (top to bottom, respectively) under the Recovery scenario.

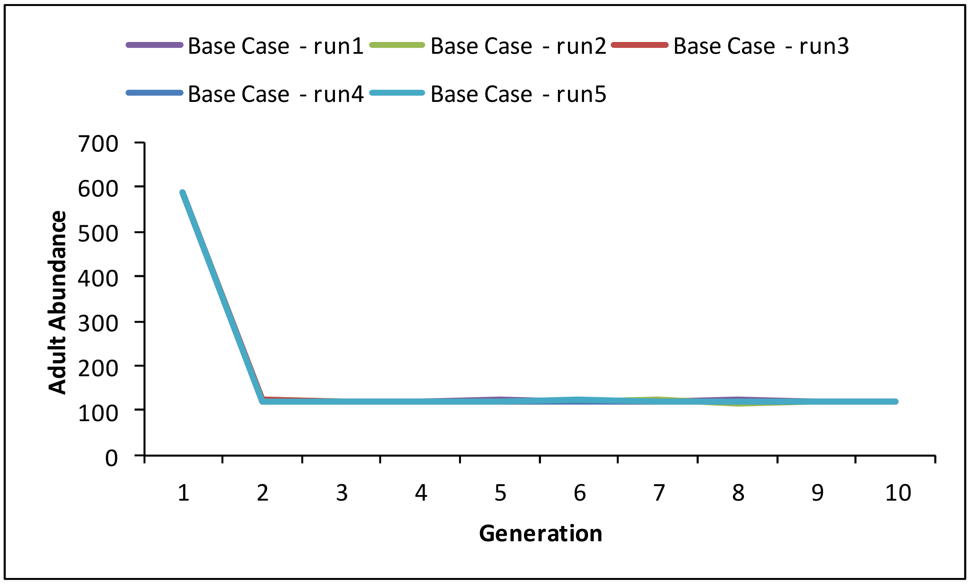

Figure 6.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for five model runs with 5,000 iterations under the Base Case scenario.

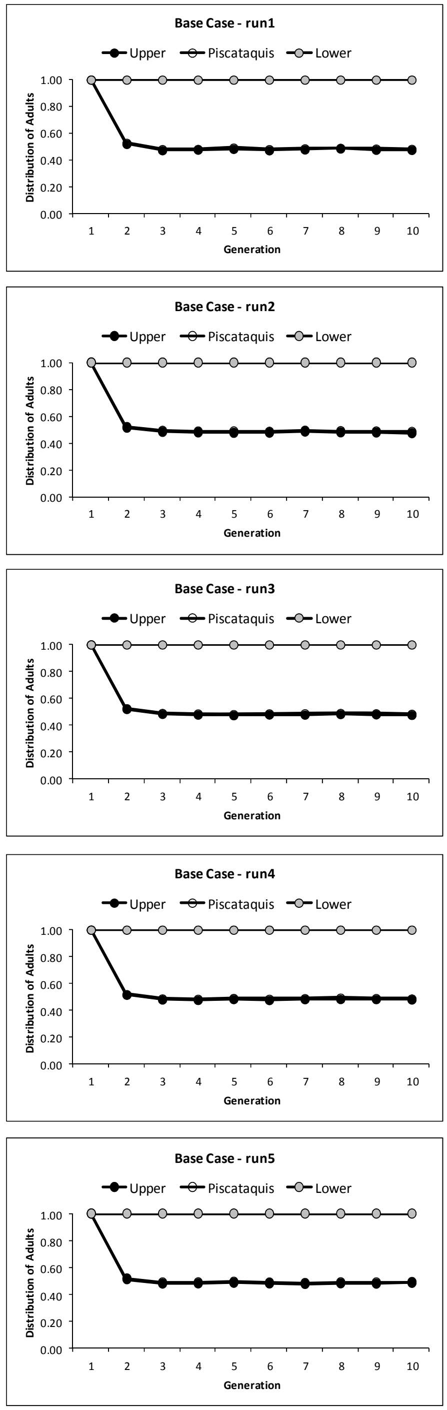

Figure 6.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for five model runs with 5,000 iterations (top to bottom, respectively) under the Base Case scenario.

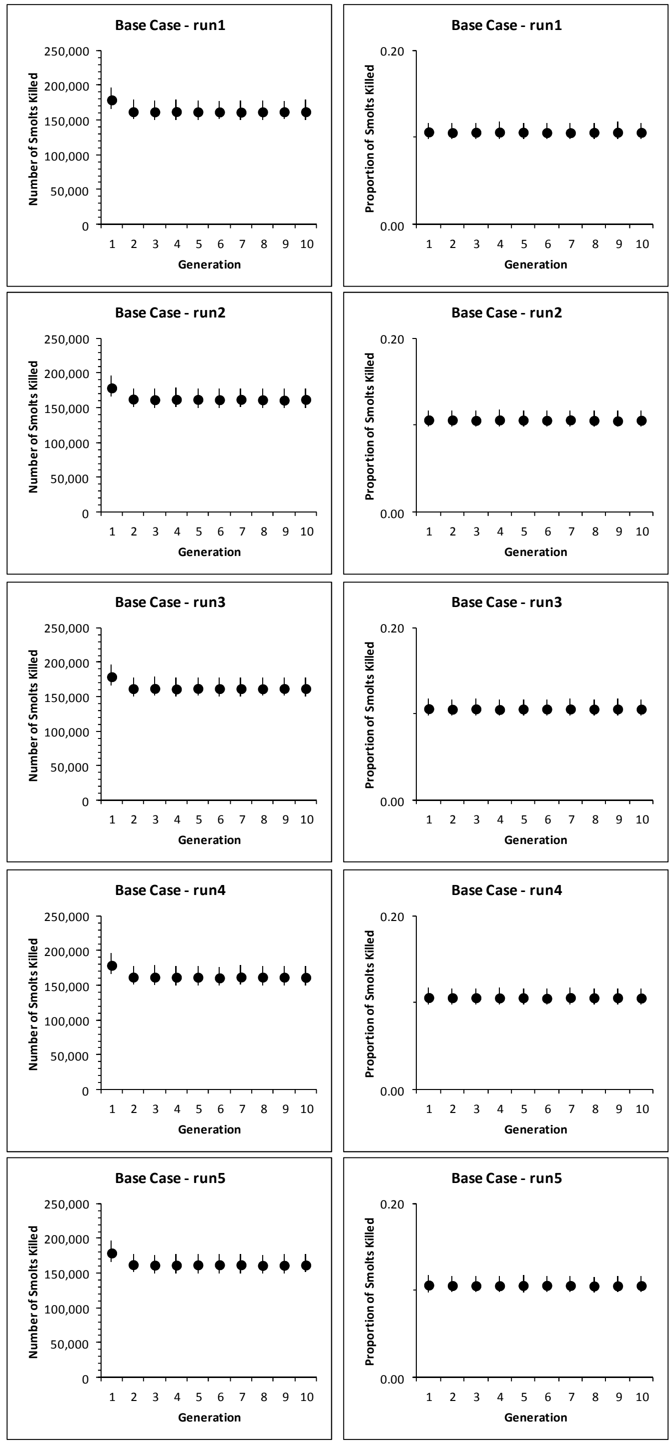

Figure 6.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for five model runs with 5,000 iterations (top to bottom, respectively) under the Base Case scenario.

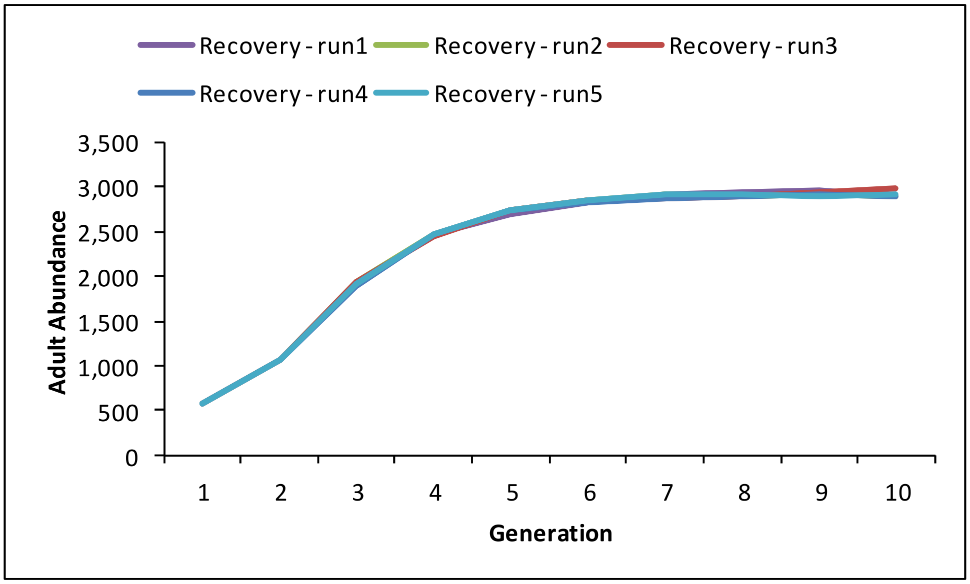

Figure 6.2.4. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for five model runs with 5,000 iterations under the Recovery scenario.

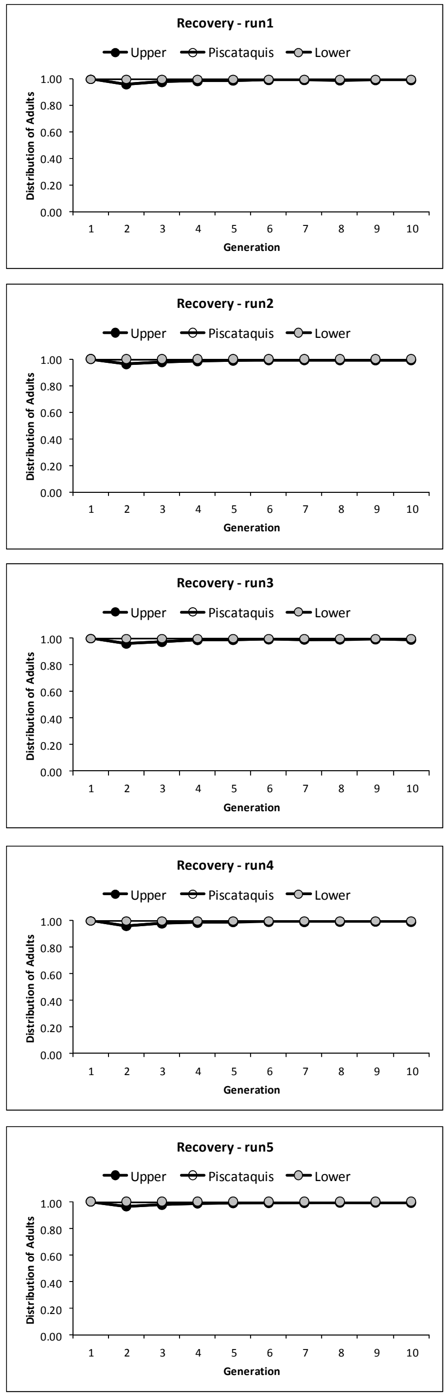

Figure 6.2.5. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for five model runs with 5,000 iterations (top to bottom, respectively) under the Recovery scenario.

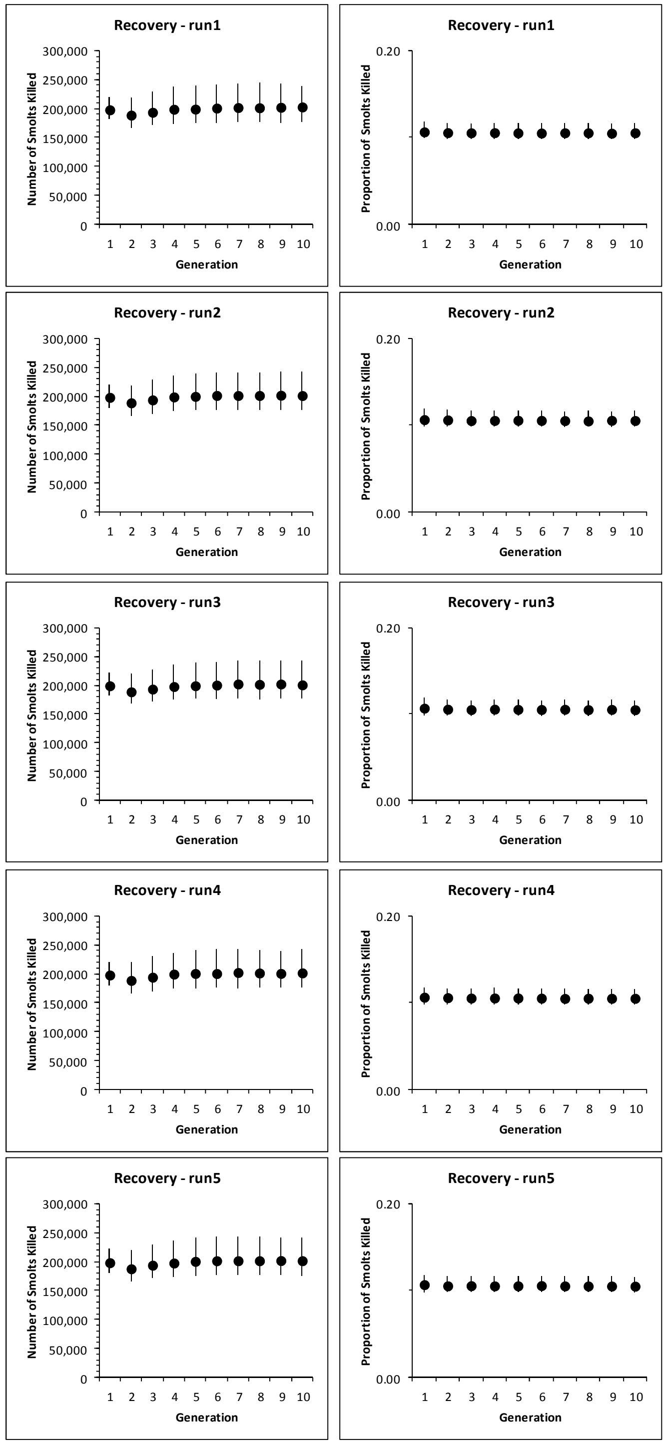

Figure 6.2.6. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for five model runs with 5,000 iterations (top to bottom, respectively) under the Recovery scenario.

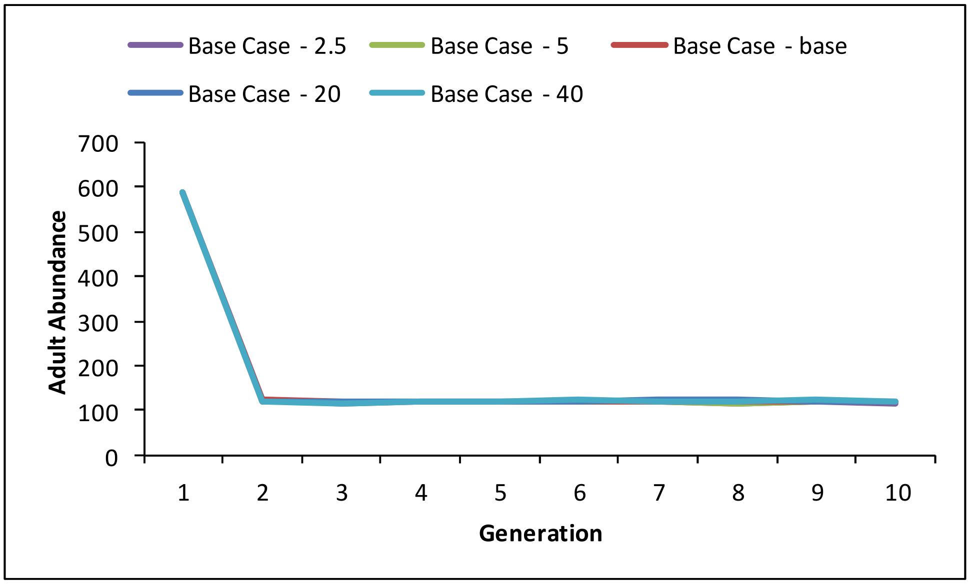

Figure 6.3.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Base Case scenario.

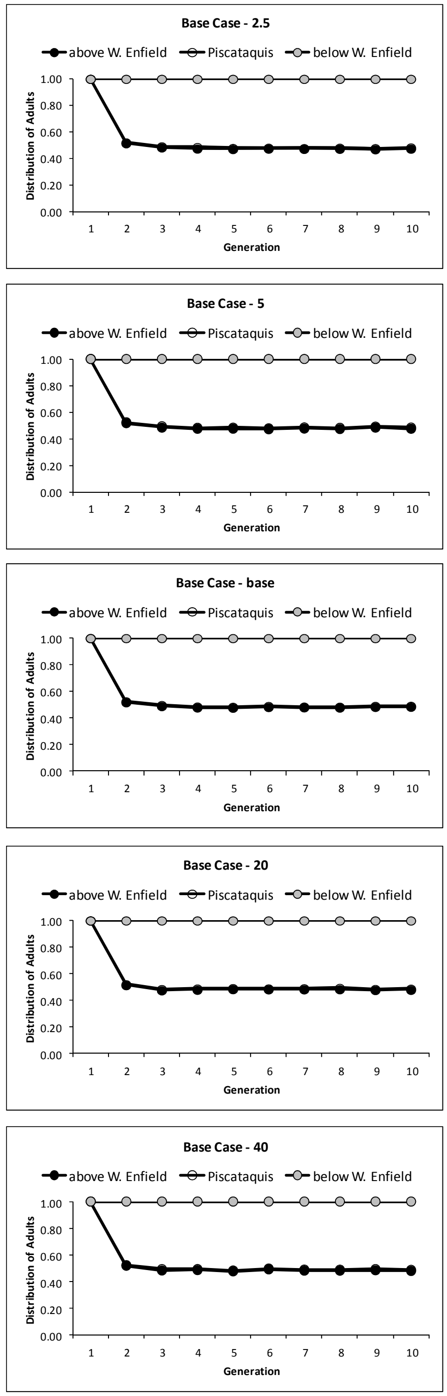

Figure 6.3.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, top to bottom, respectively) under the Base Case scenario.

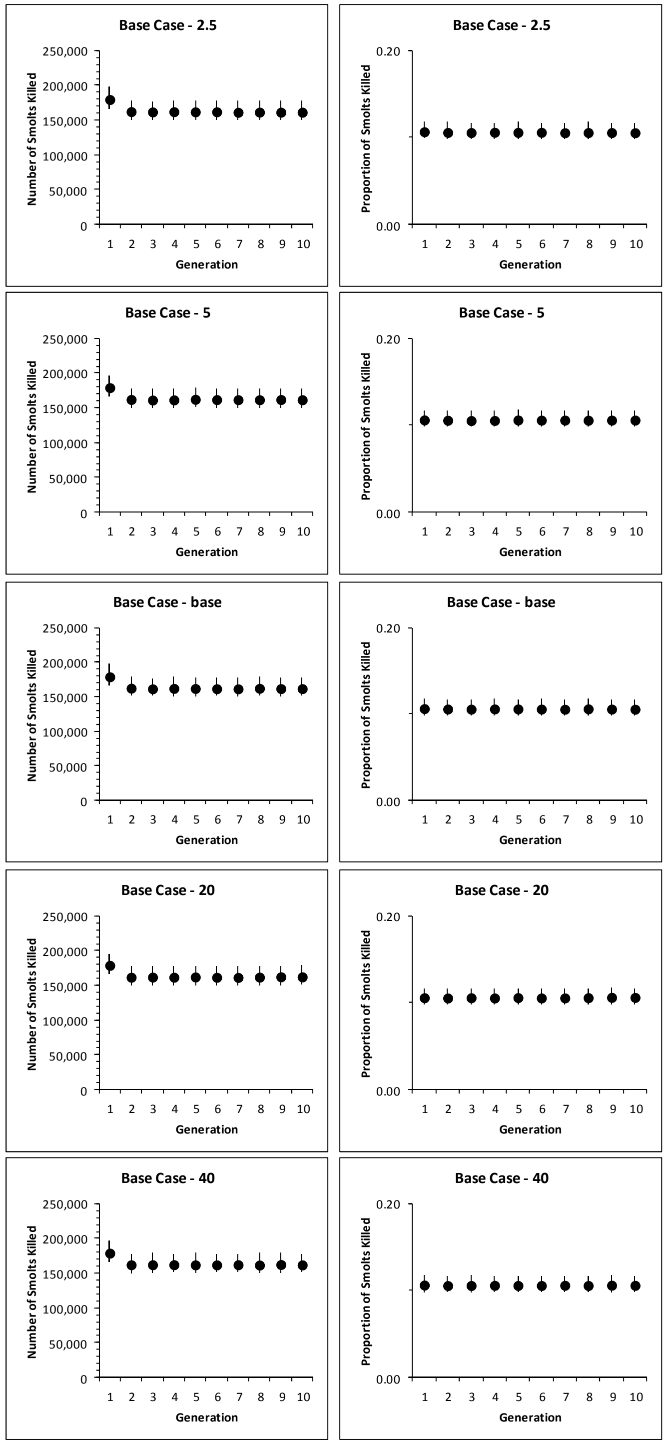

Figure 6.3.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, top to bottom, respectively) under the Base Case scenario.

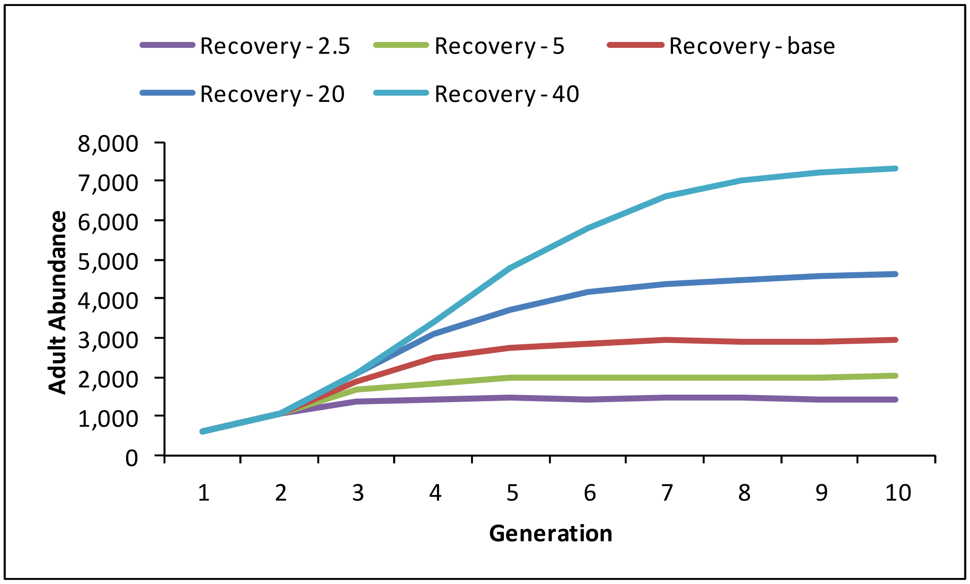

Figure 6.3.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, respectively) under the Recovery scenario.

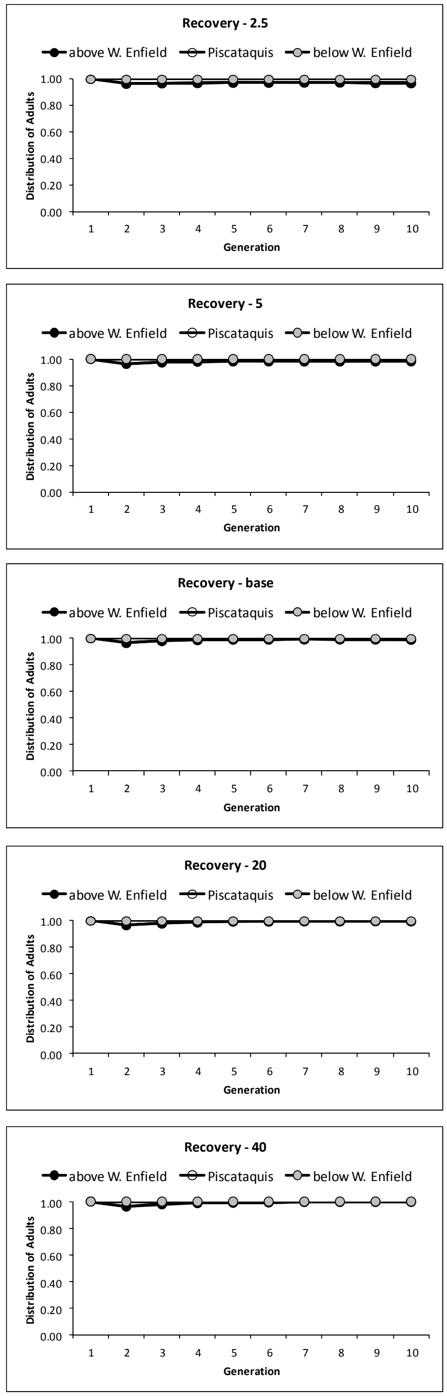

Figure 6.3.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, top to bottom, respectively) under the Recovery scenario.

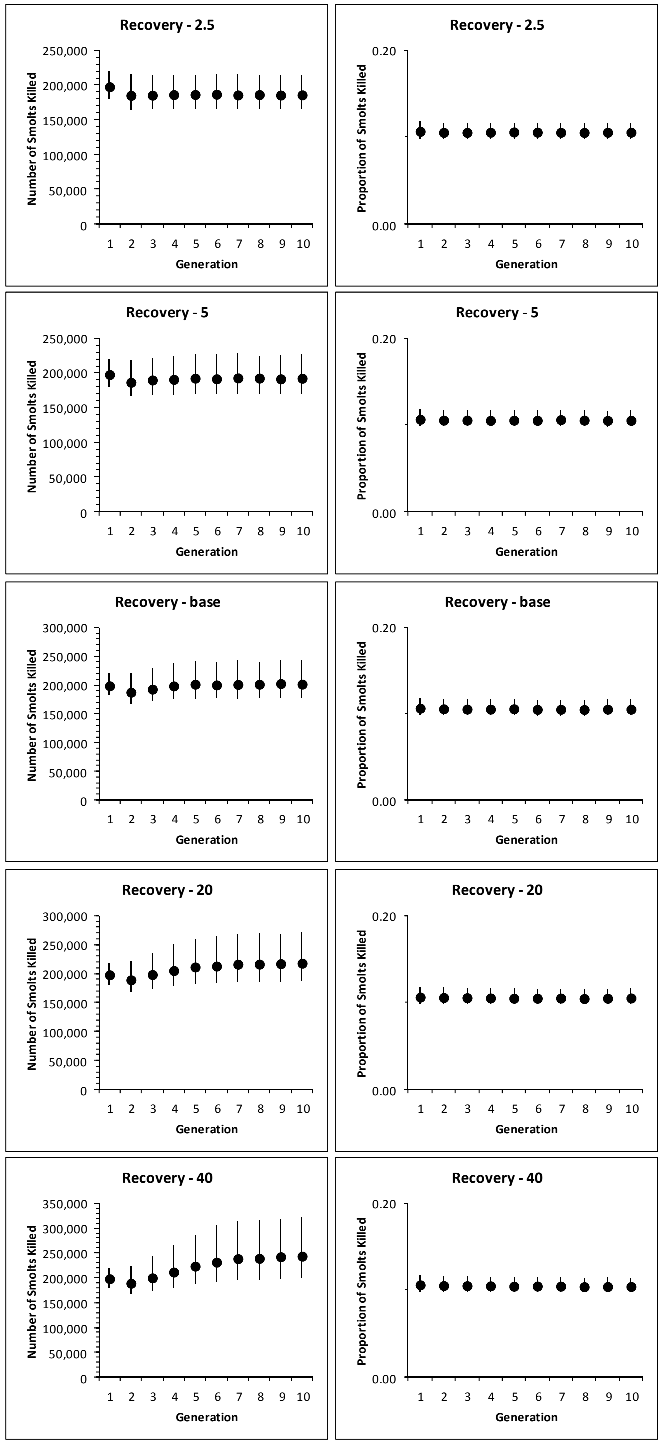

Figure 6.3.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base production potential cap (i.e., 2.5, 5, 10, 20, and 40 smolts per 100 m^2, top to bottom, respectively) under the Recovery scenario.

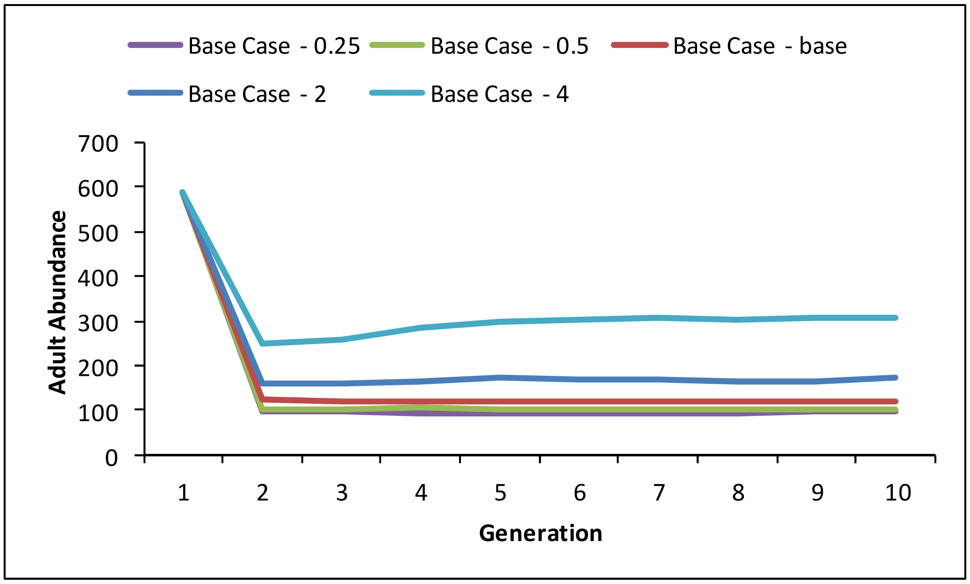

Figure 6.4.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Base Case scenario.

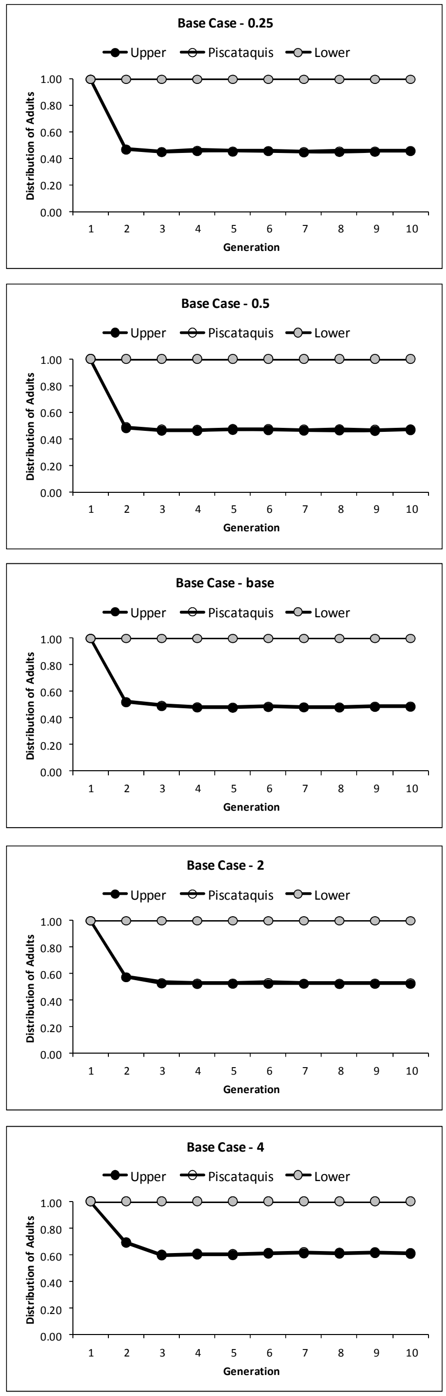

Figure 6.4.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate (top to bottom, respectively) under the Base Case scenario.

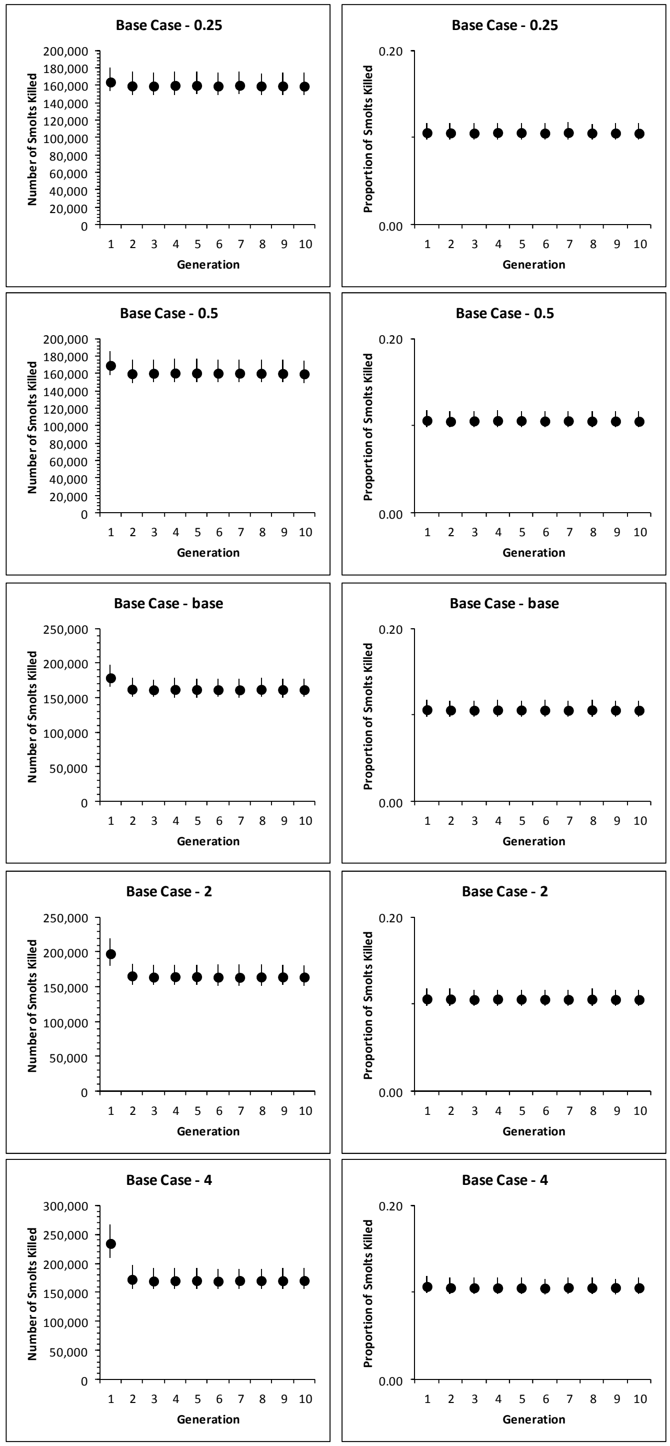

Figure 6.4.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate (top to bottom, respectively) under the Base Case scenario.

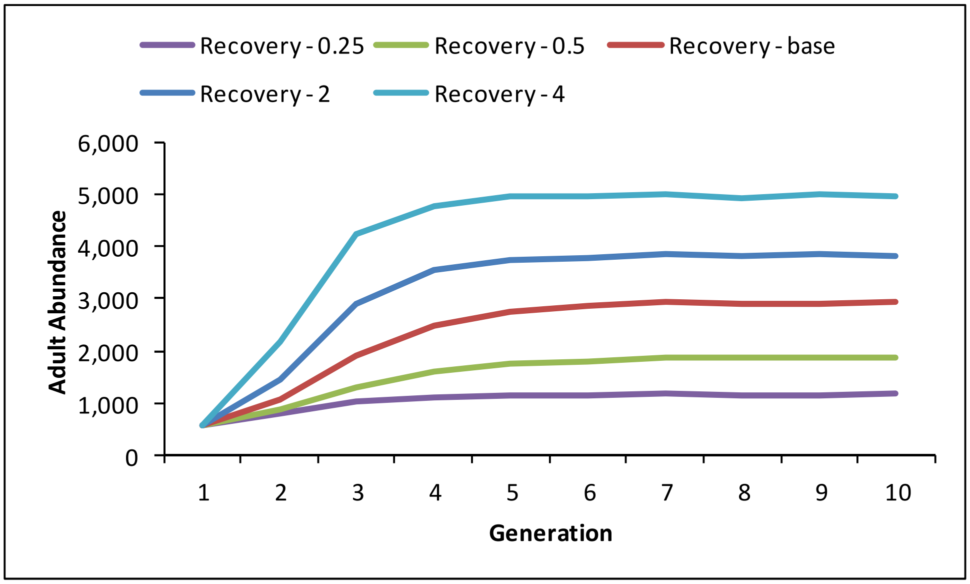

Figure 6.4.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate under the Recovery scenario.

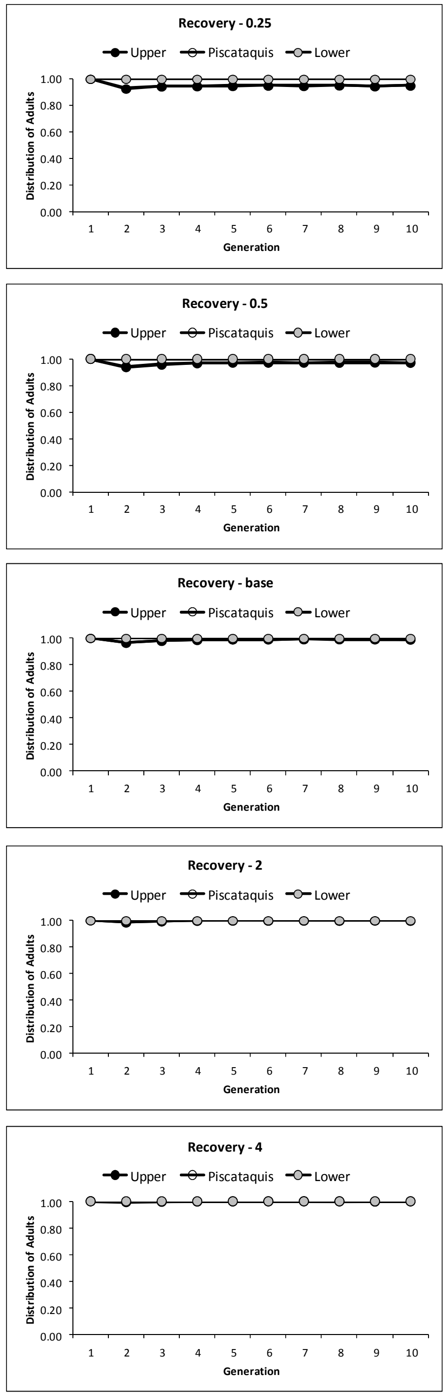

Figure 6.4.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate (top to bottom, respectively) under the Recovery scenario.

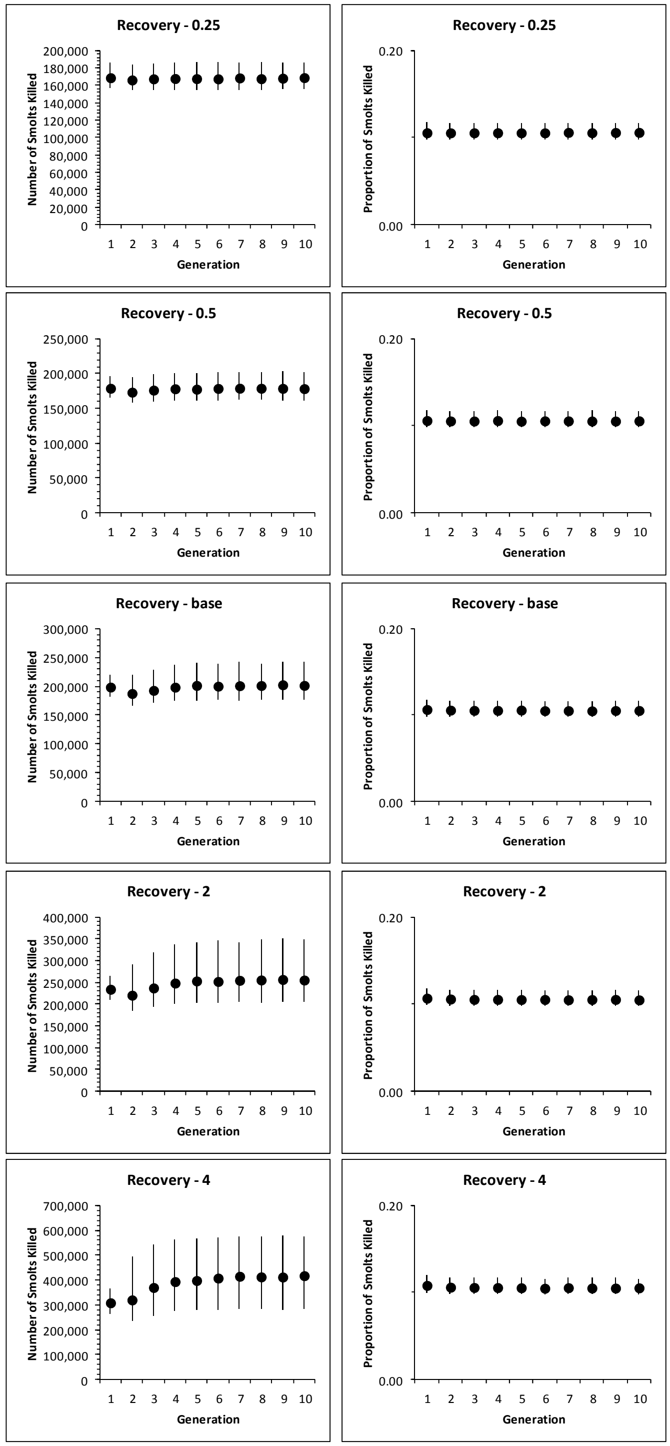

Figure 6.4.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base eggs per female rate (top to bottom, respectively) under the Recovery scenario.

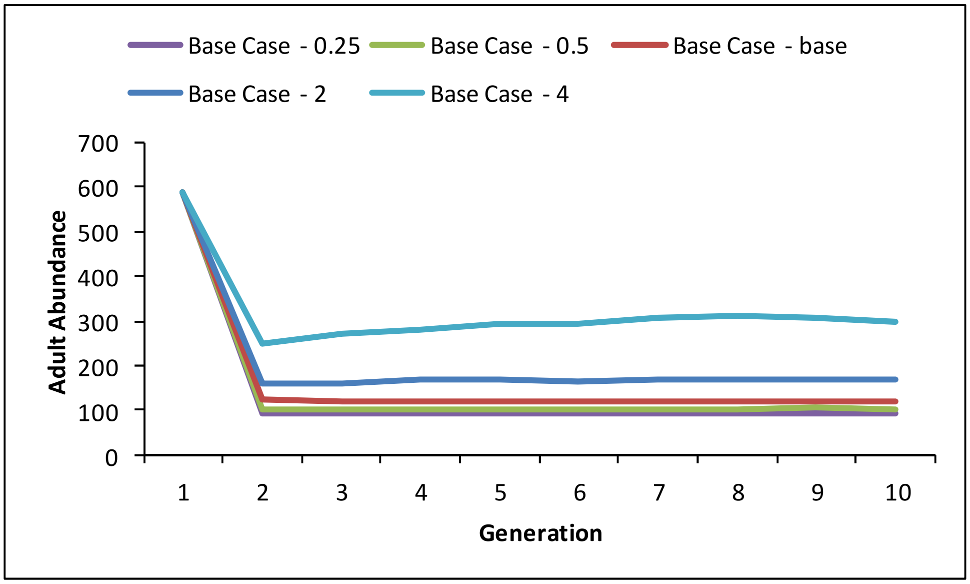

Figure 6.5.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Base Case scenario.

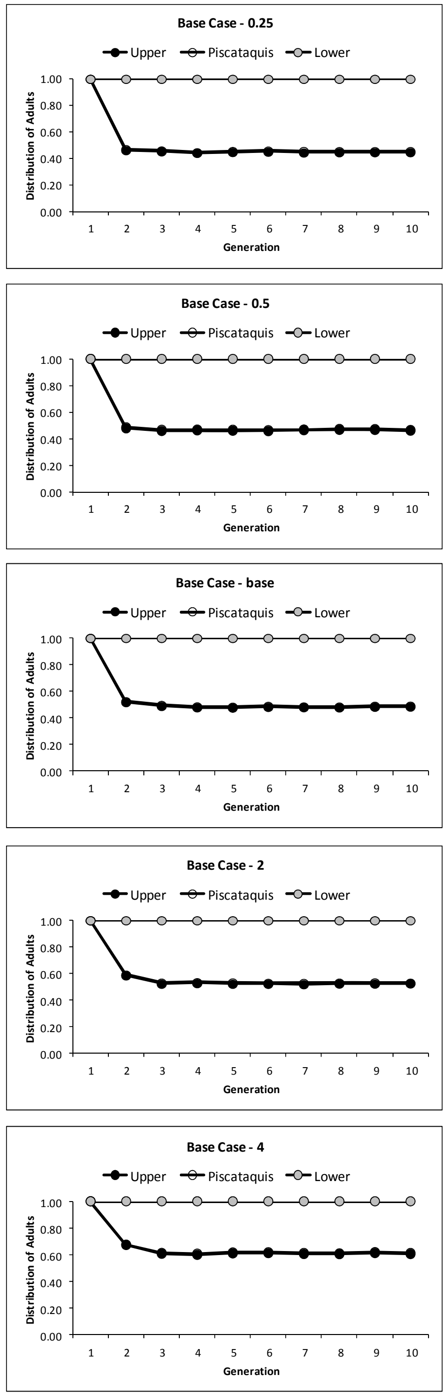

Figure 6.5.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate (top to bottom, respectively) under the Base Case scenario.

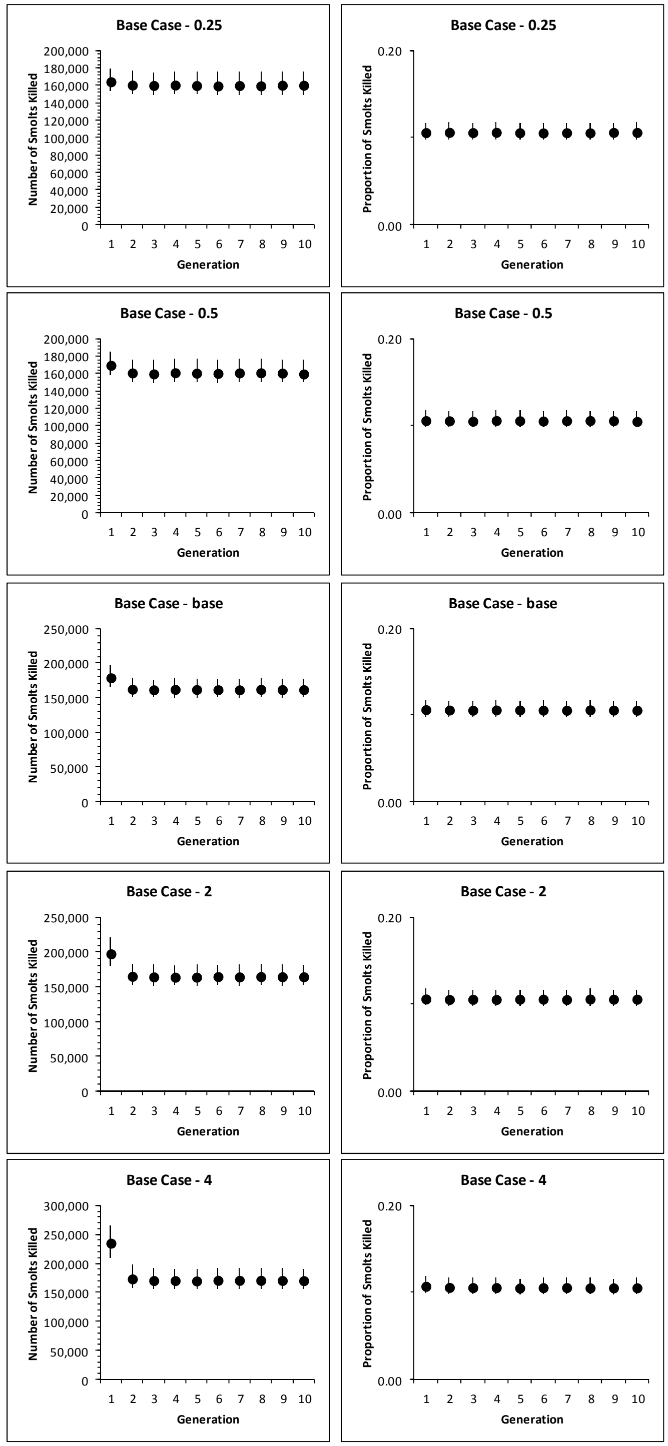

Figure 6.5.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate (top to bottom, respectively) under the Base Case scenario.

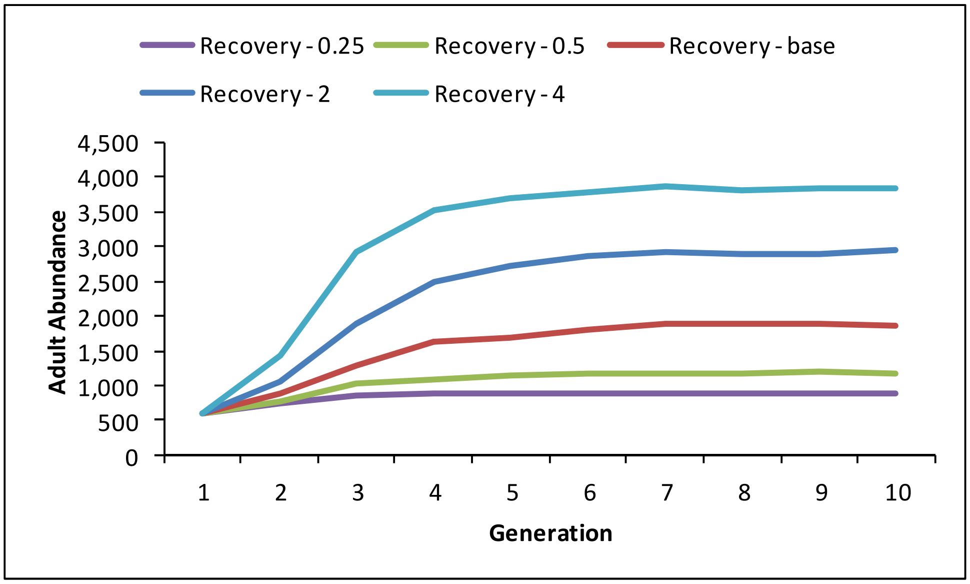

Figure 6.5.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate under the Recovery scenario.

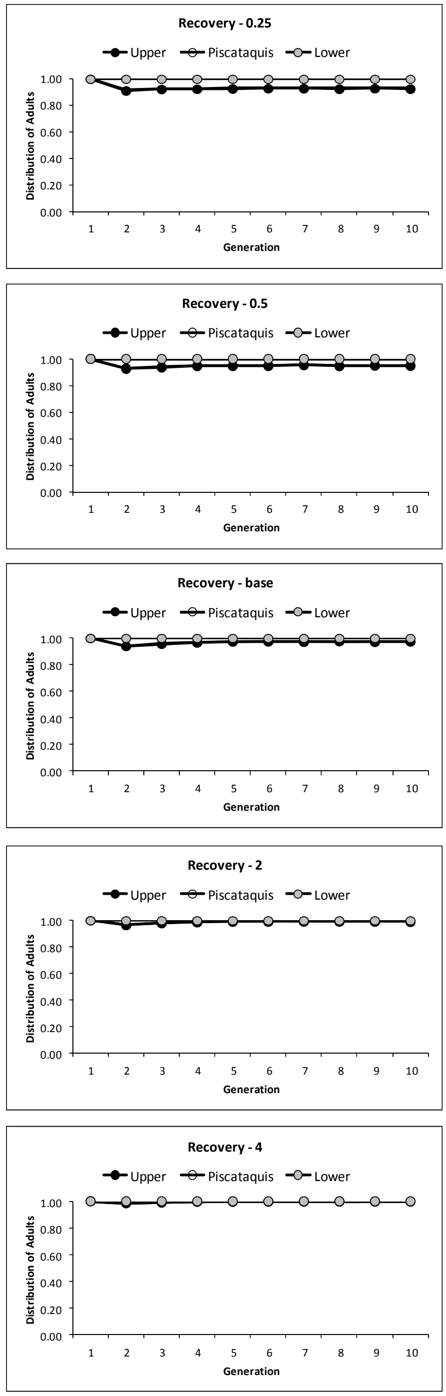

Figure 6.5.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate (top to bottom, respectively) under the Recovery scenario.

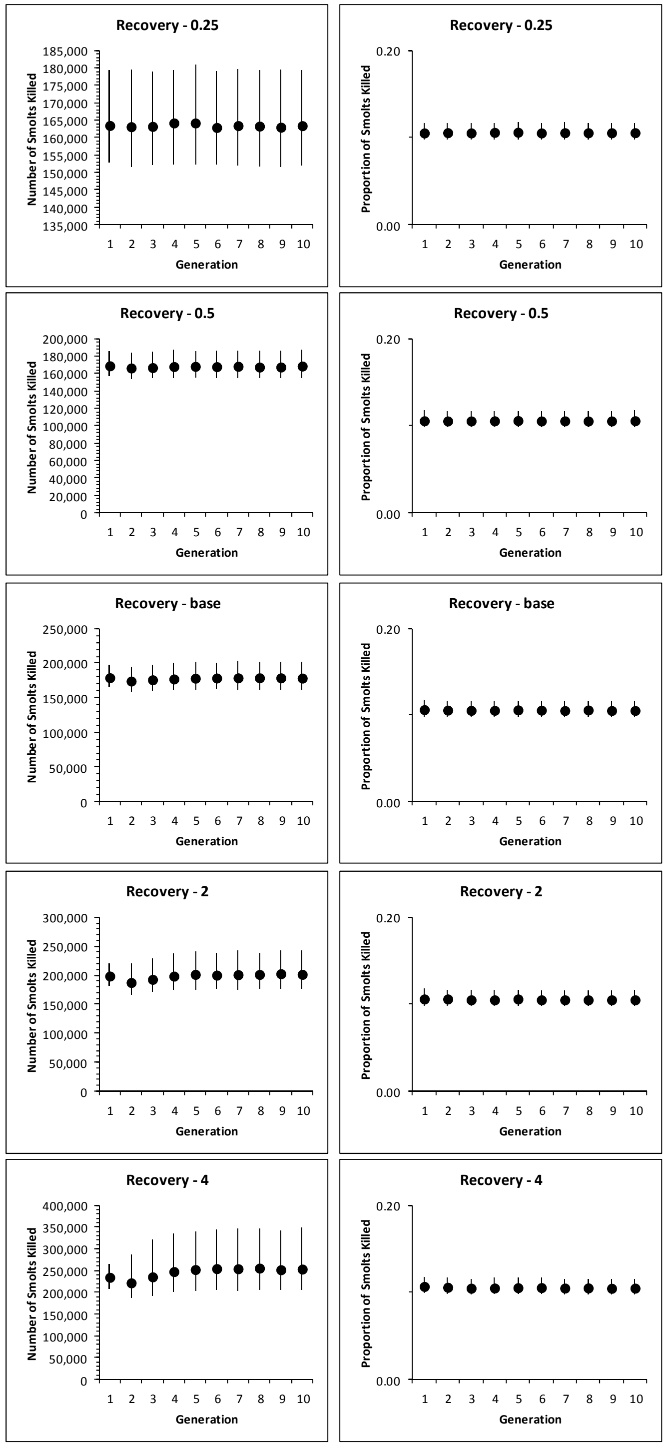

Figure 6.5.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base egg to smolt survival rate (top to bottom, respectively) under the Recovery scenario.

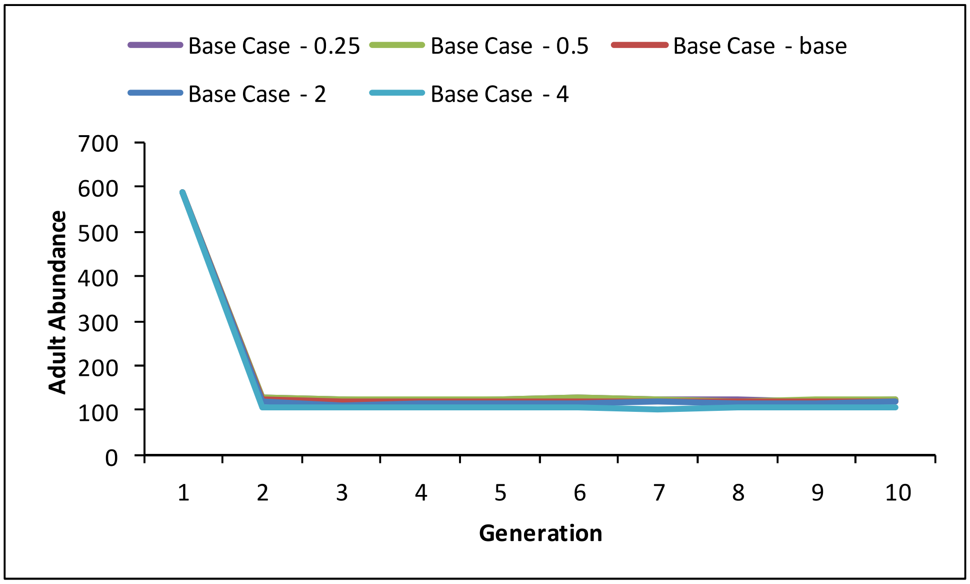

Figure 6.6.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Base Case scenario.

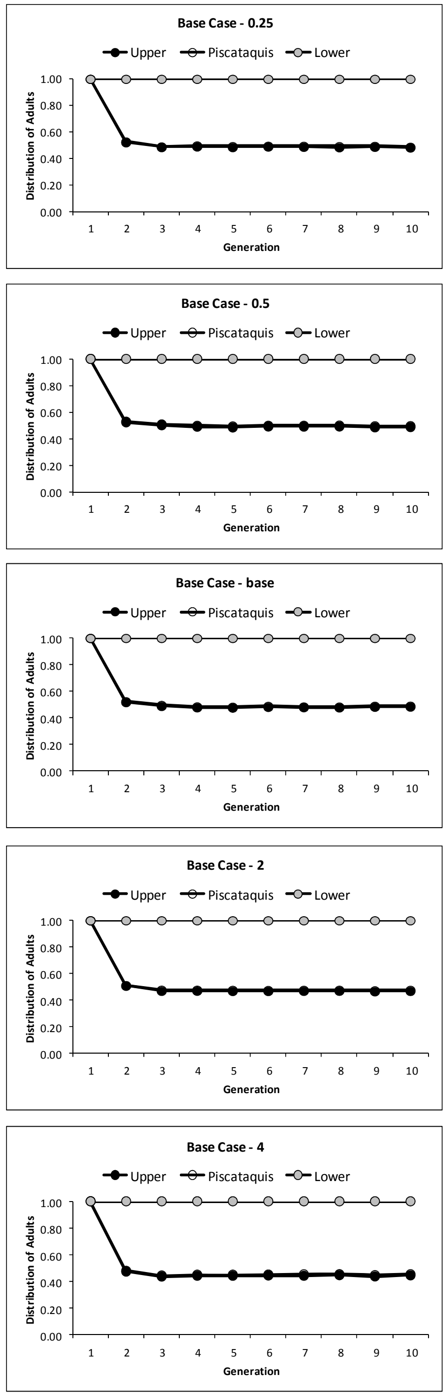

Figure 6.6.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate (top to bottom, respectively) under the Base Case scenario.

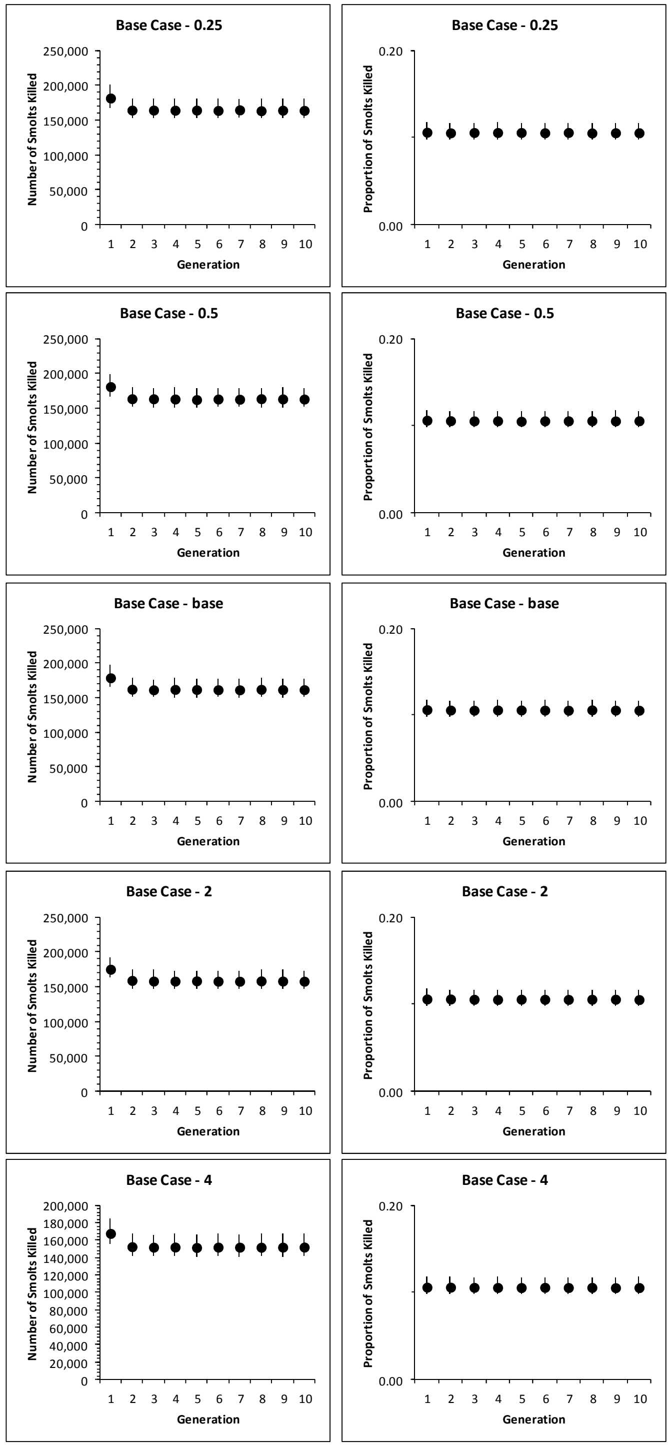

Figure 6.6.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate (top to bottom, respectively) under the Base Case scenario.

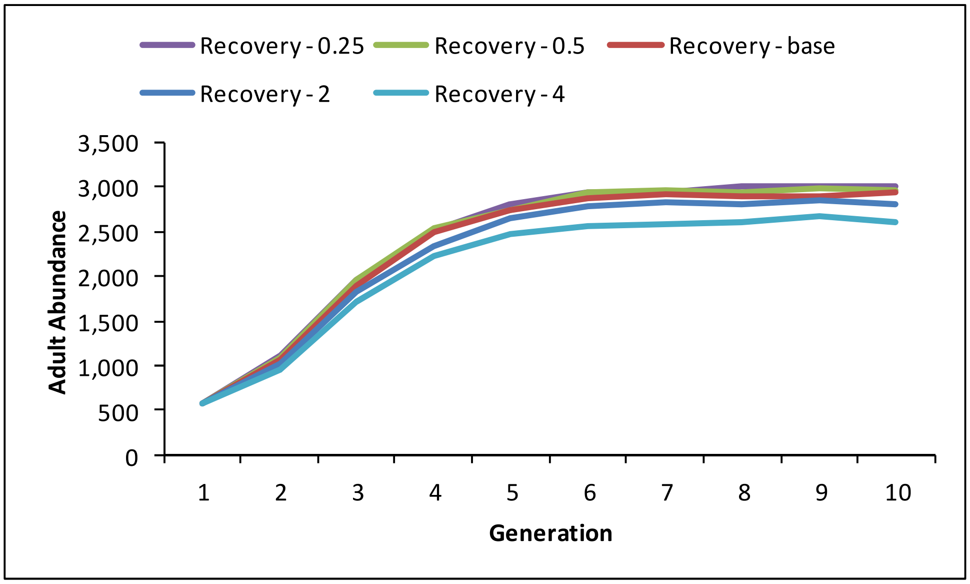

Figure 6.6.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate under the Recovery scenario.

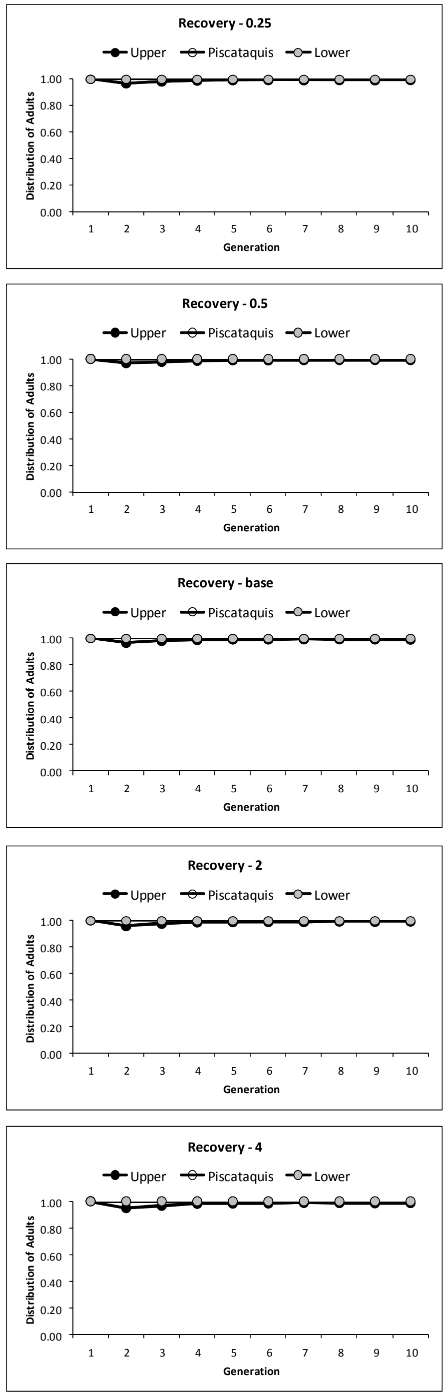

Figure 6.6.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate (top to bottom, respectively) under the Recovery scenario.

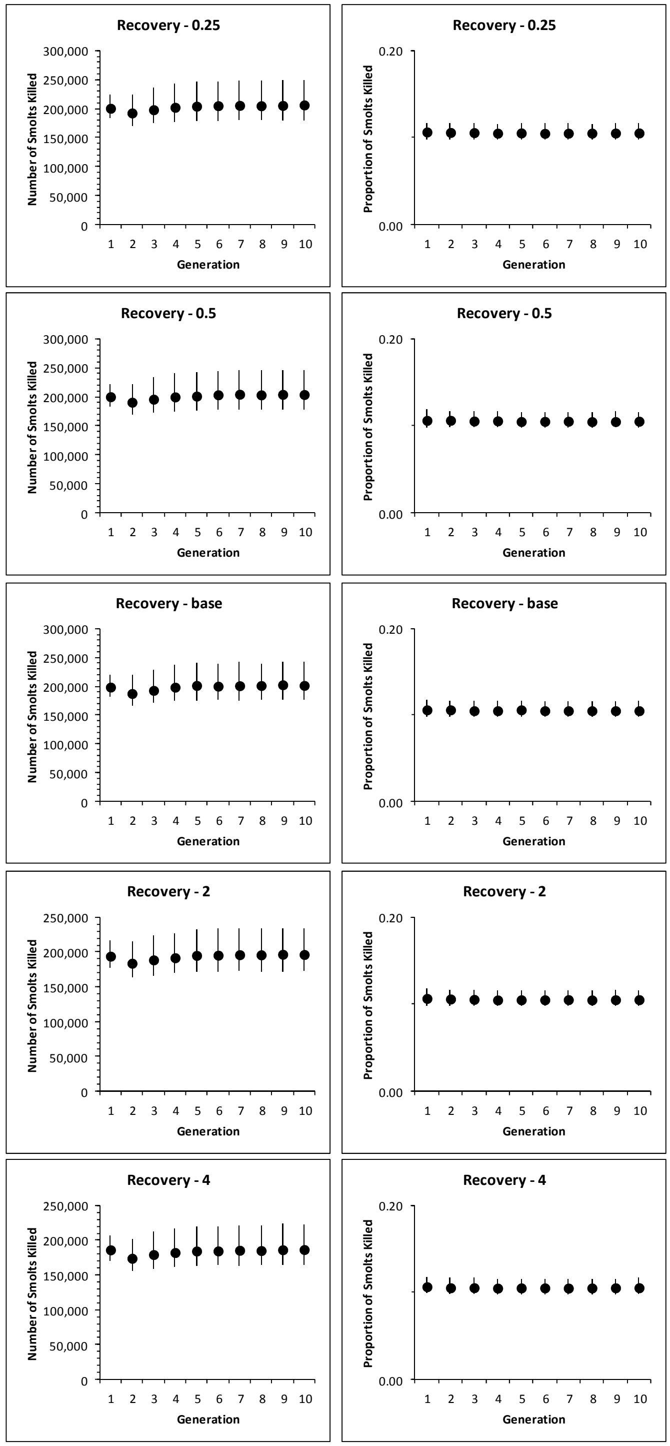

Figure 6.6.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base in-river mortality rate (top to bottom, respectively) under the Recovery scenario.

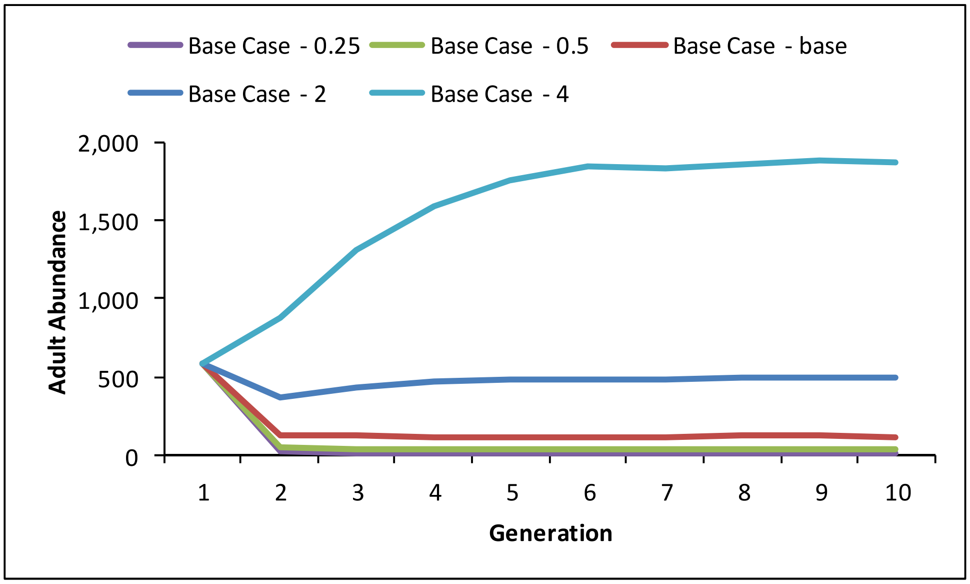

Figure 6.7.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Base Case scenario.

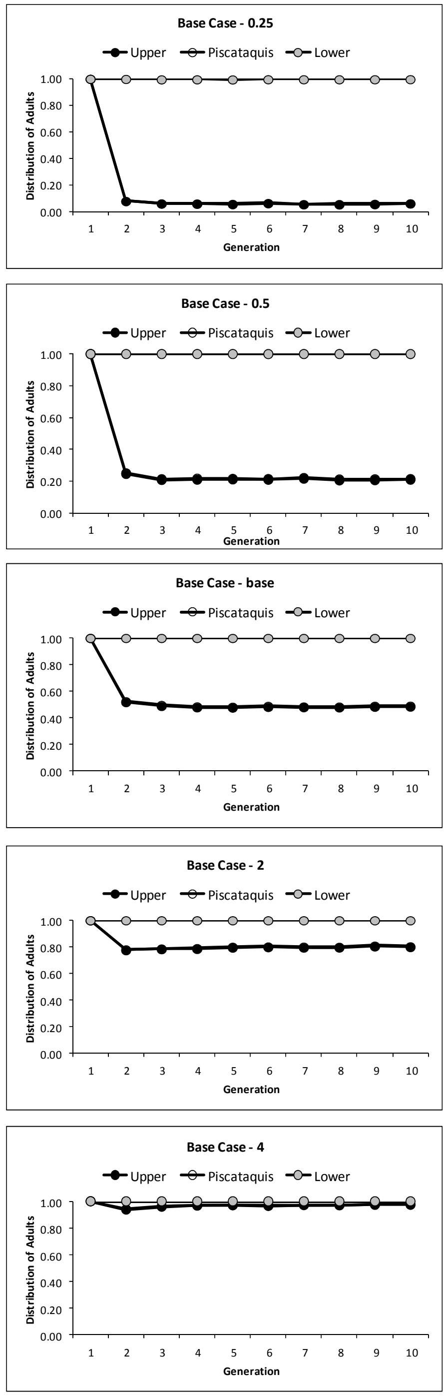

Figure 6.7.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate (top to bottom, respectively) under the Base Case scenario.

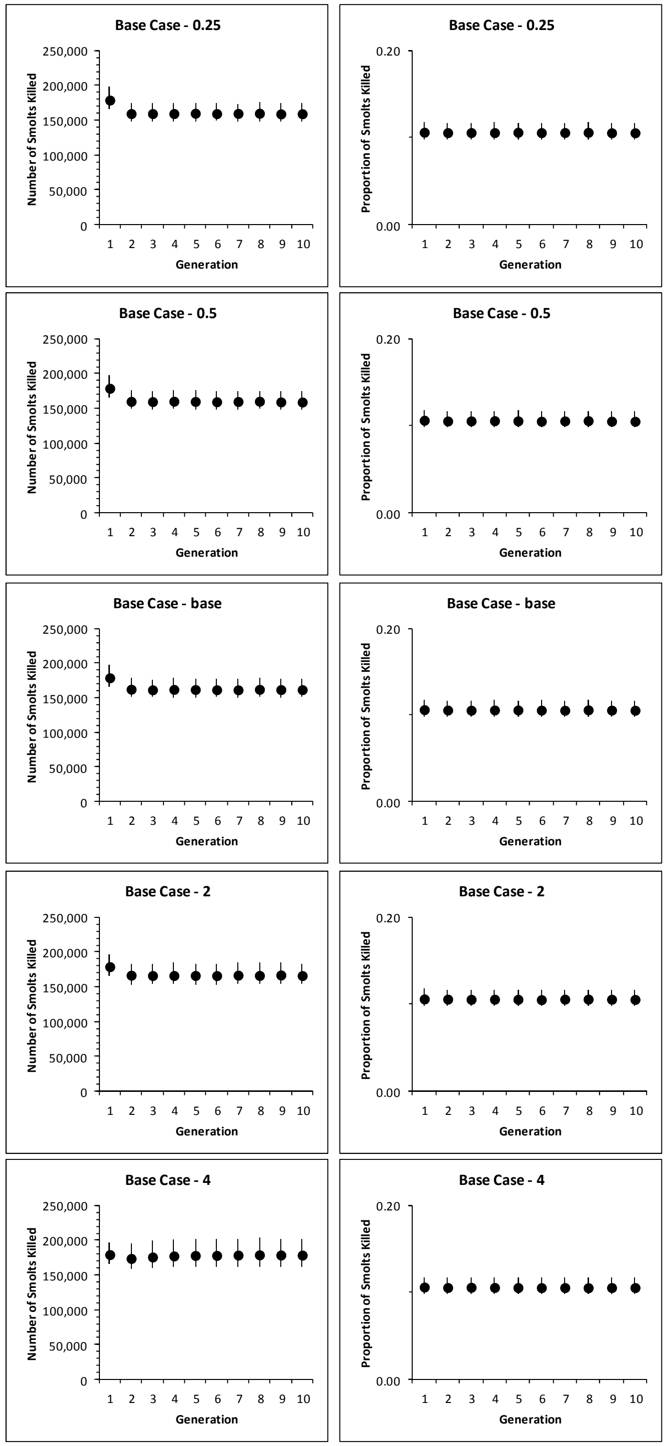

Figure 6.7.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate (top to bottom, respectively) under the Base Case scenario.

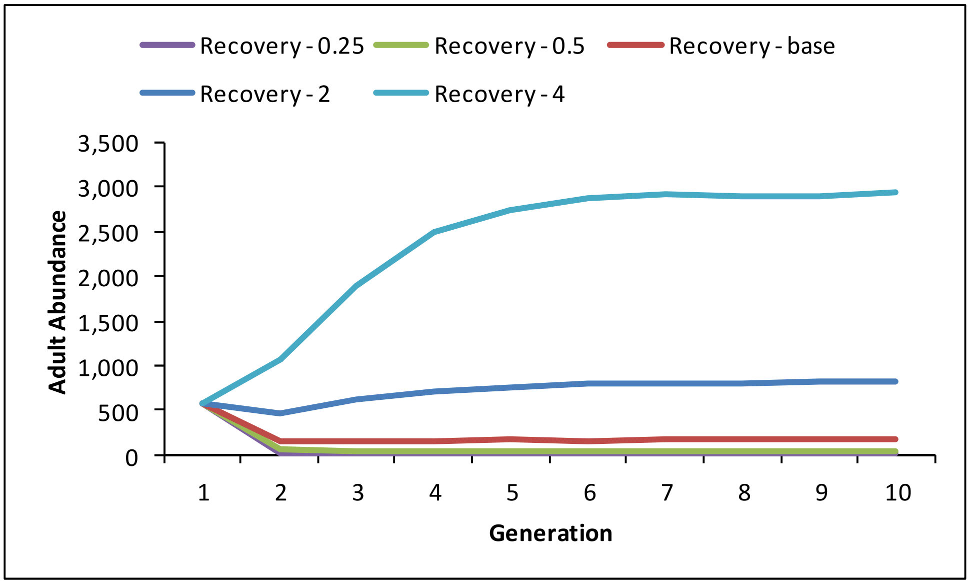

Figure 6.7.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate under the Recovery scenario.

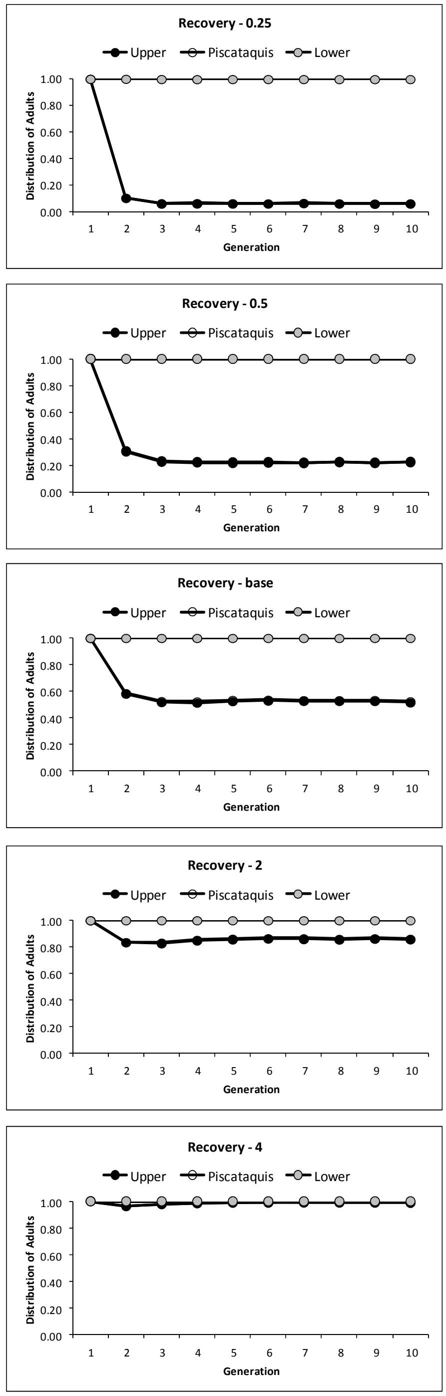

Figure 6.7.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate (top to bottom, respectively) under the Recovery scenario.

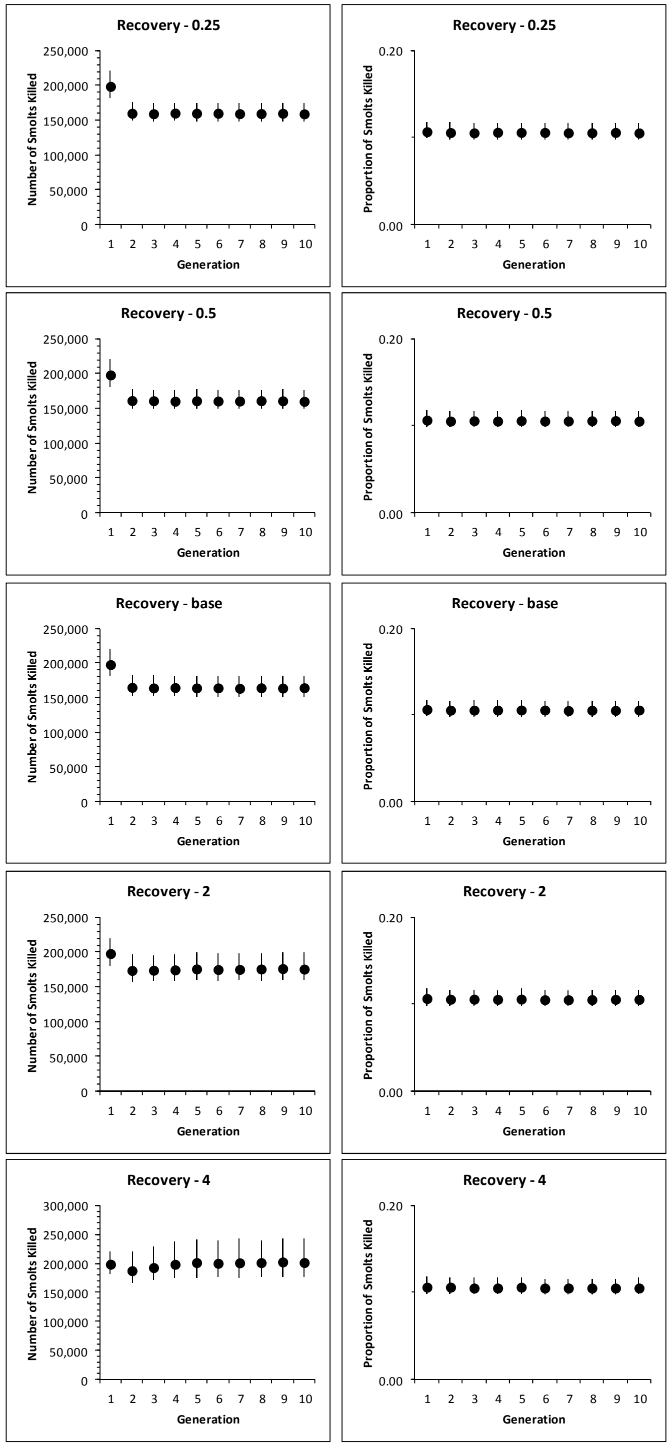

Figure 6.7.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base marine survival rate (top to bottom, respectively) under the Recovery scenario.

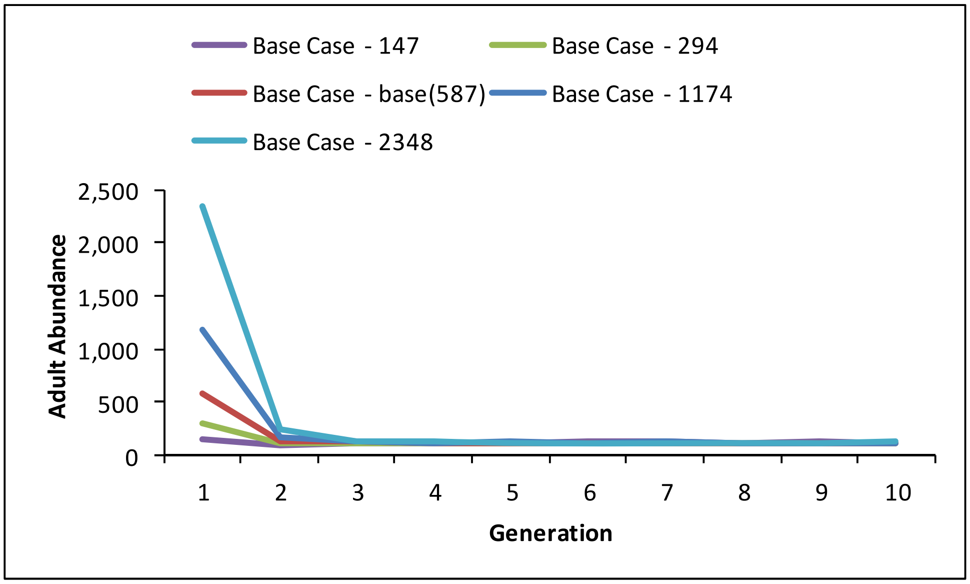

Figure 6.8.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Base Case scenario.

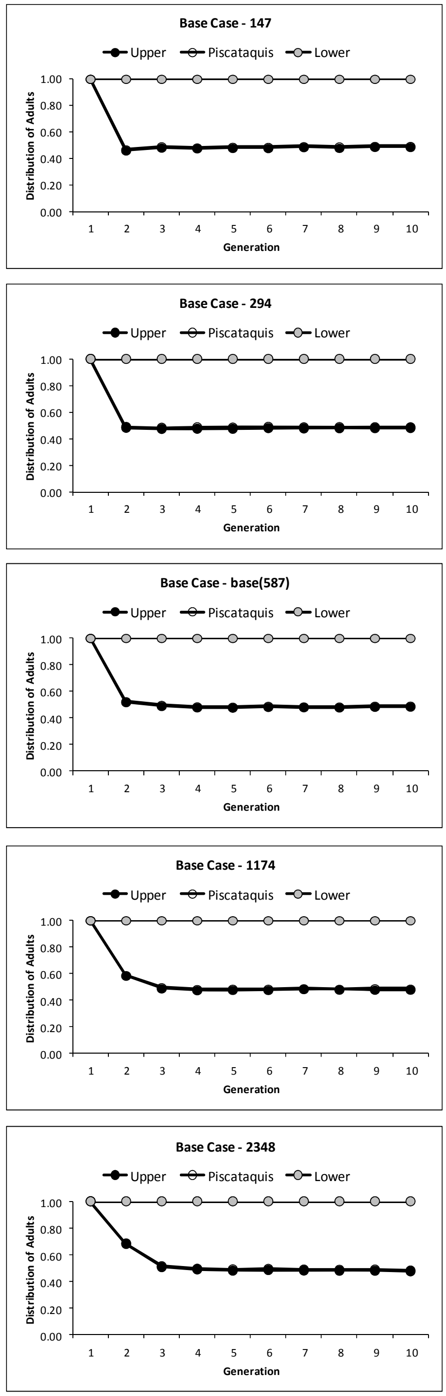

Figure 6.8.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, top to bottom, respectively) under the Base Case scenario.

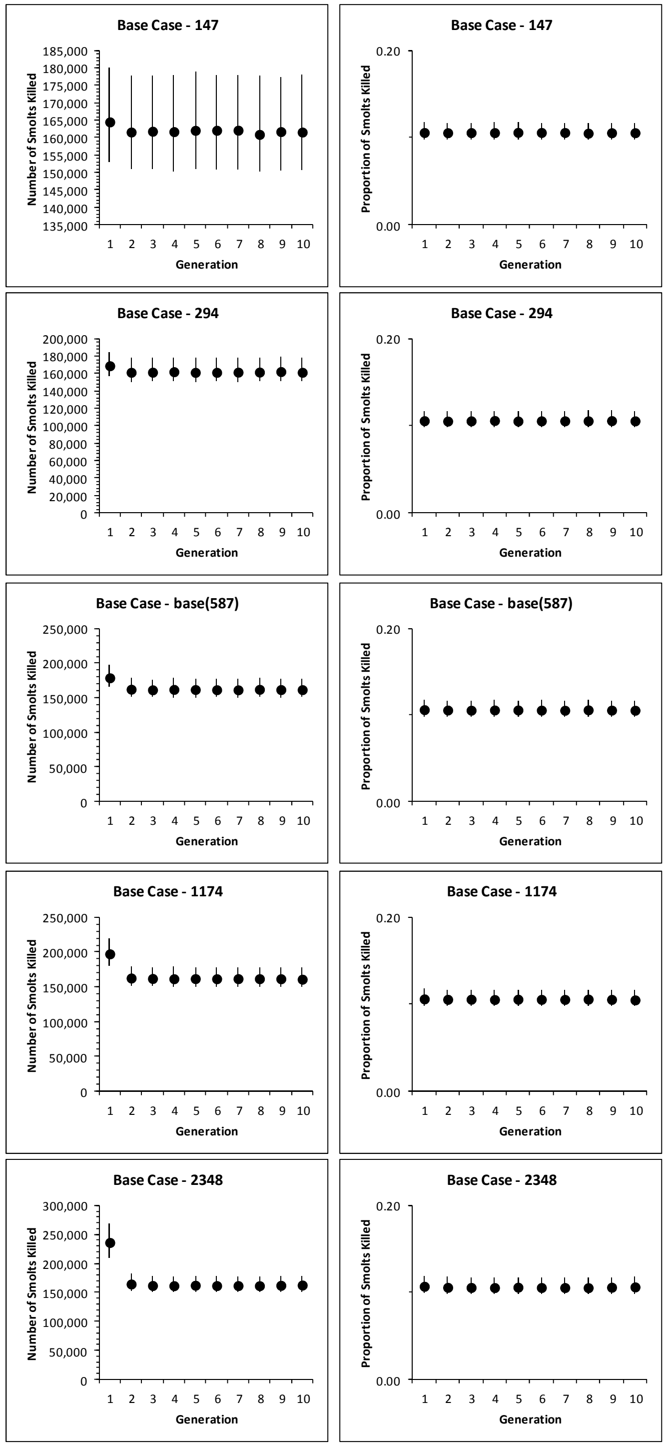

Figure 6.8.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, top to bottom, respectively) under the Base Case scenario.

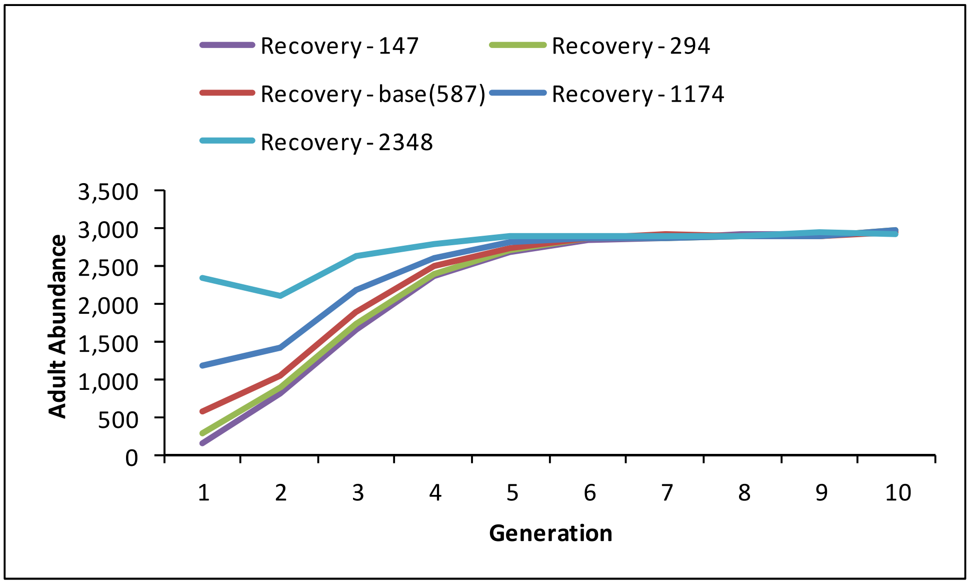

Figure 6.8.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, respectively) under the Recovery scenario.

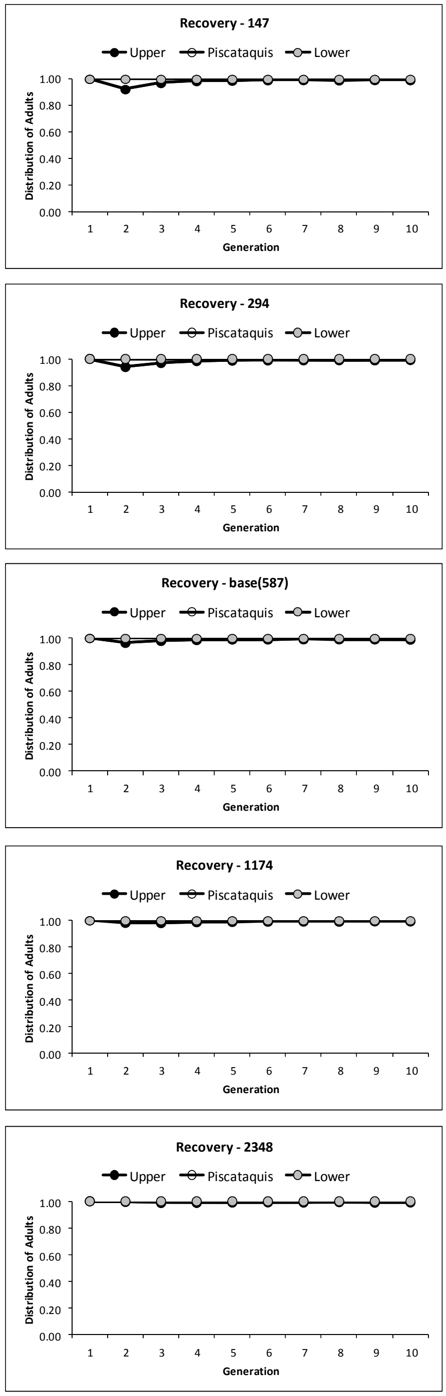

Figure 6.8.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, top to bottom, respectively) under the Recovery scenario.

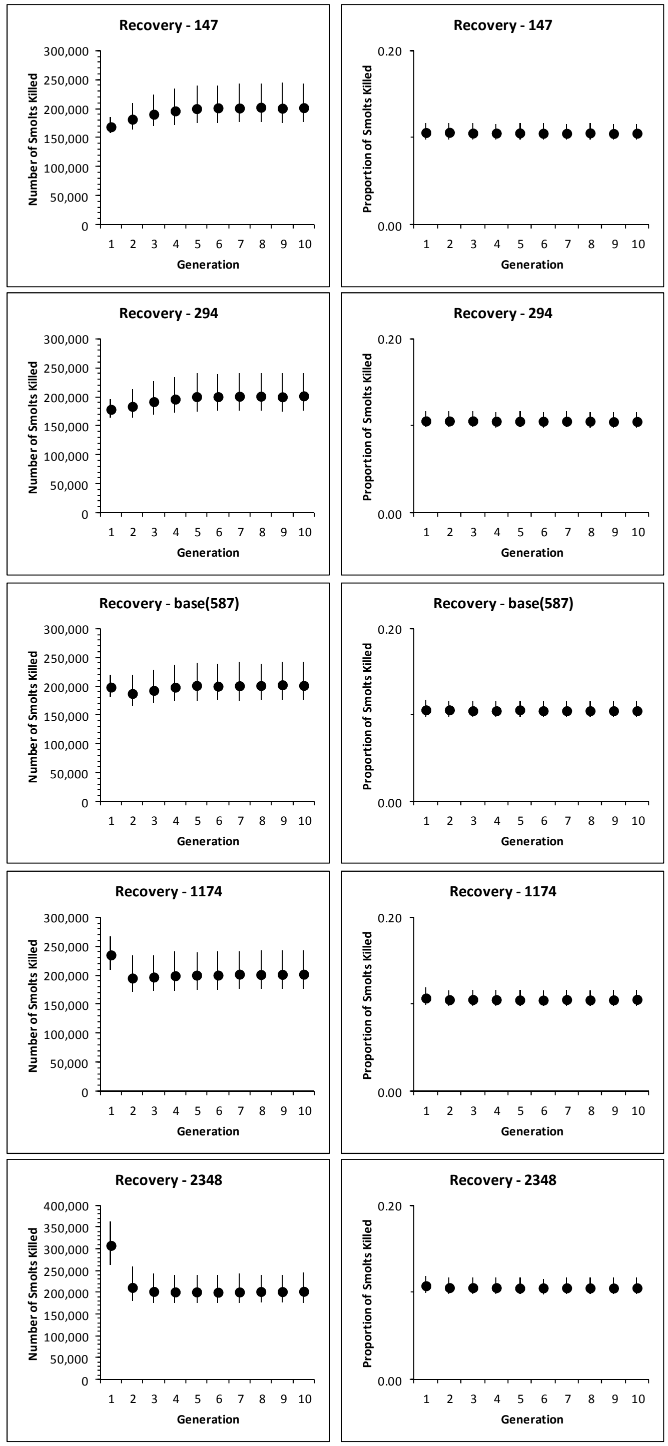

Figure 6.8.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base initial adult abundance (i.e., 147, 294, 587, 1,174, and 2,348, top to bottom, respectively) under the Recovery scenario.

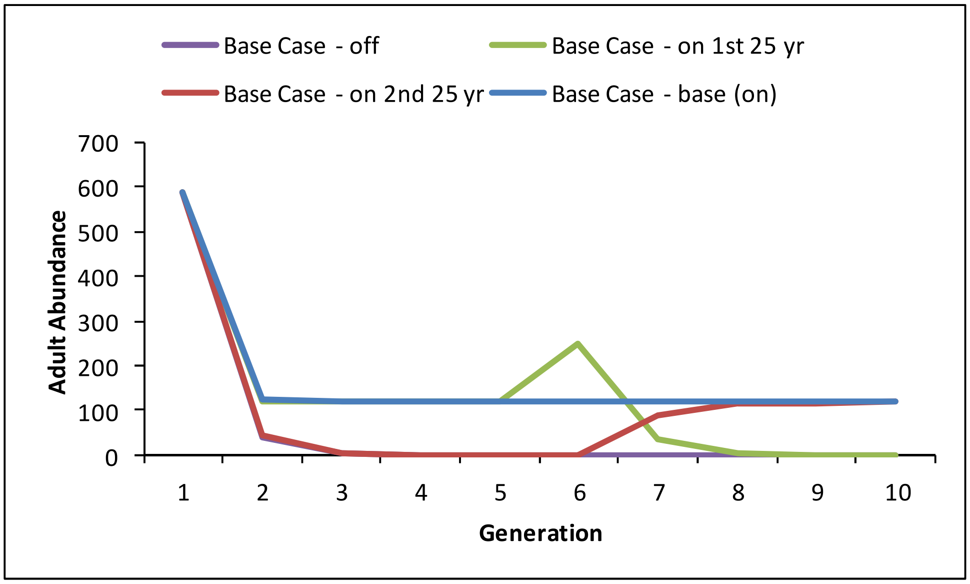

Figure 6.9.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Base Case scenario.

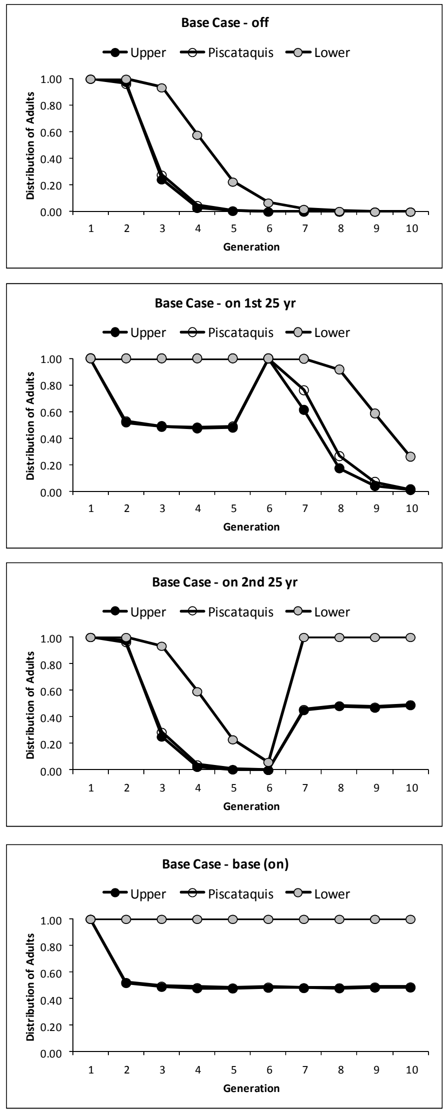

Figure 6.9.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) (top to bottom, respectively) under the Base Case scenario.

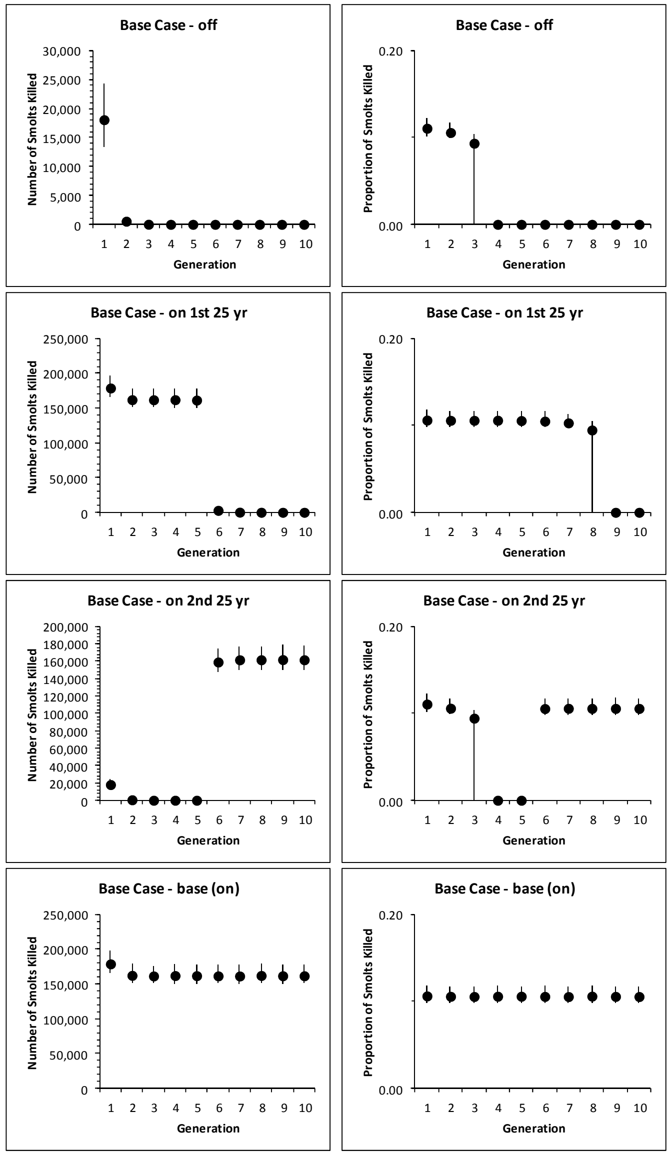

Figure 6.9.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) (top to bottom, respectively) under the Base Case scenario.

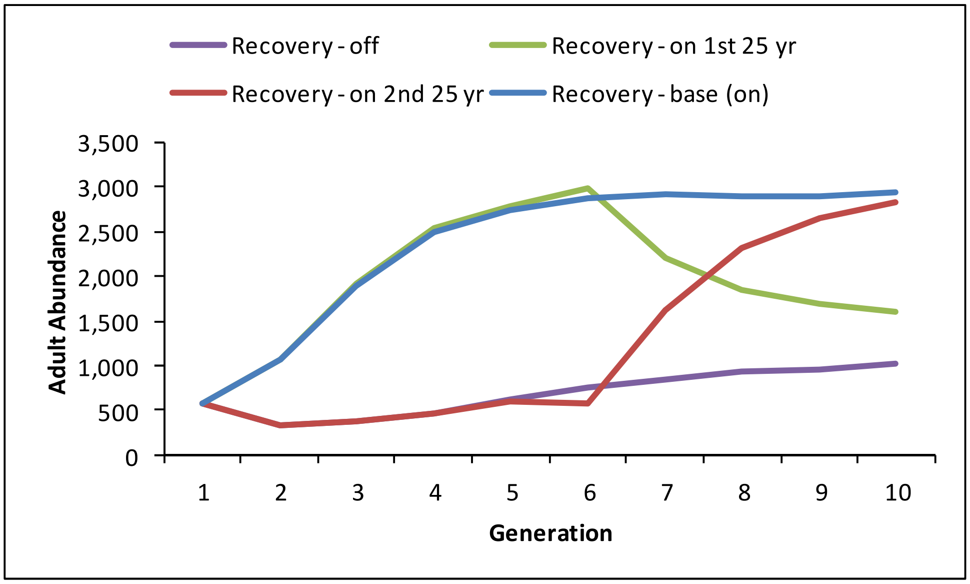

Figure 6.9.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) under the Recovery scenario.

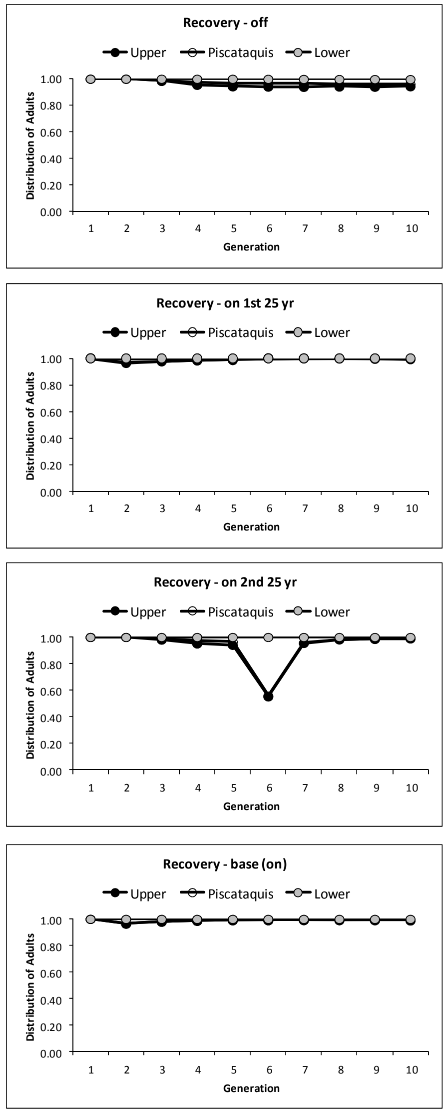

Figure 6.9.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) (top to bottom, respectively) under the Recovery scenario.

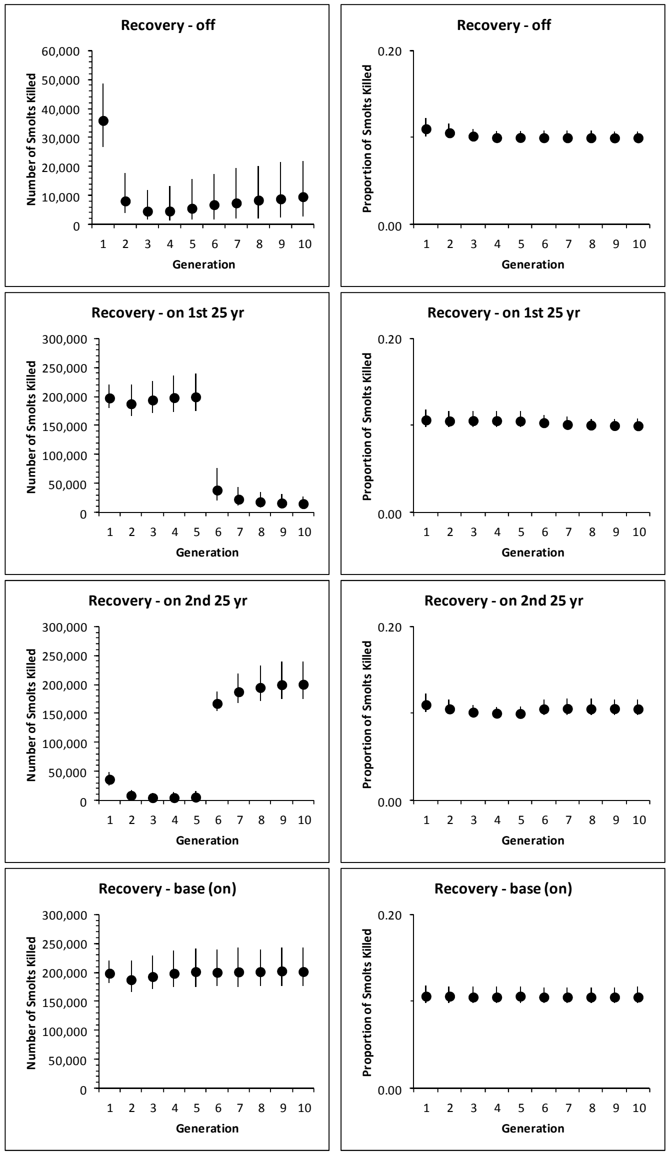

Figure 6.9.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the hatchery off, the hatchery on for the first 25 years, the hatchery on for the second 25 years, and the hatchery on (base) (top to bottom, respectively) under the Recovery scenario.

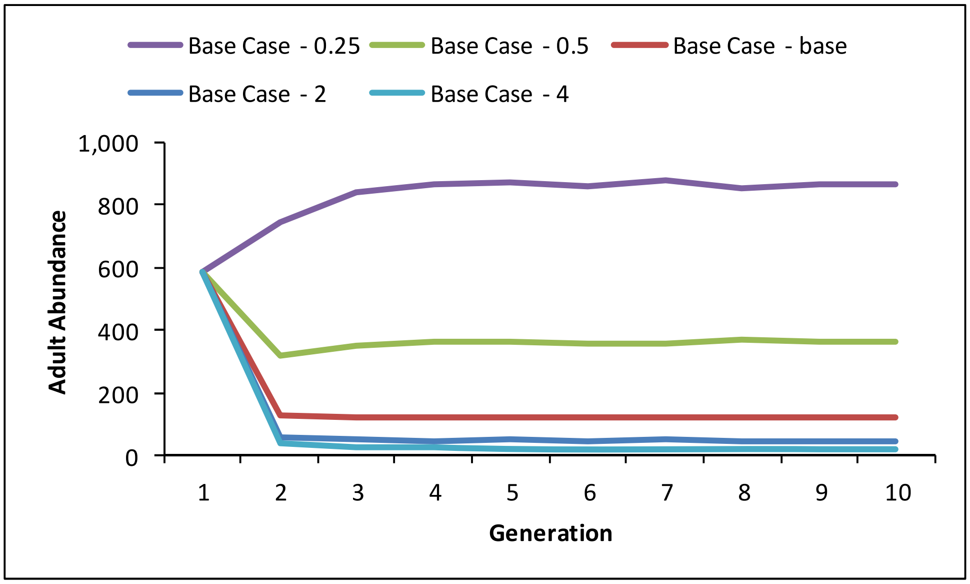

Figure 6.10.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Base Case scenario.

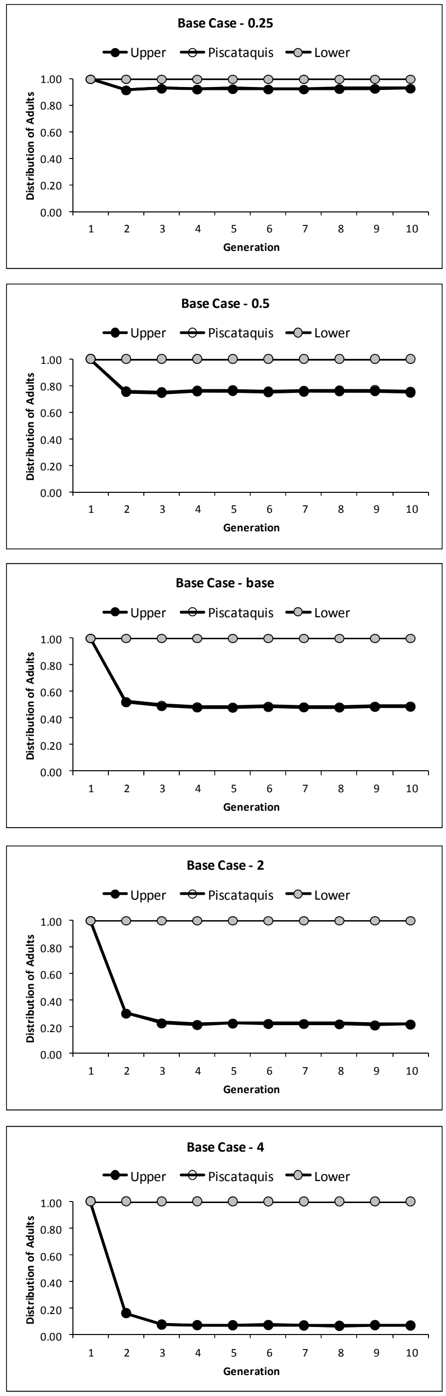

Figure 6.10.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate (top to bottom, respectively) under the Base Case scenario.

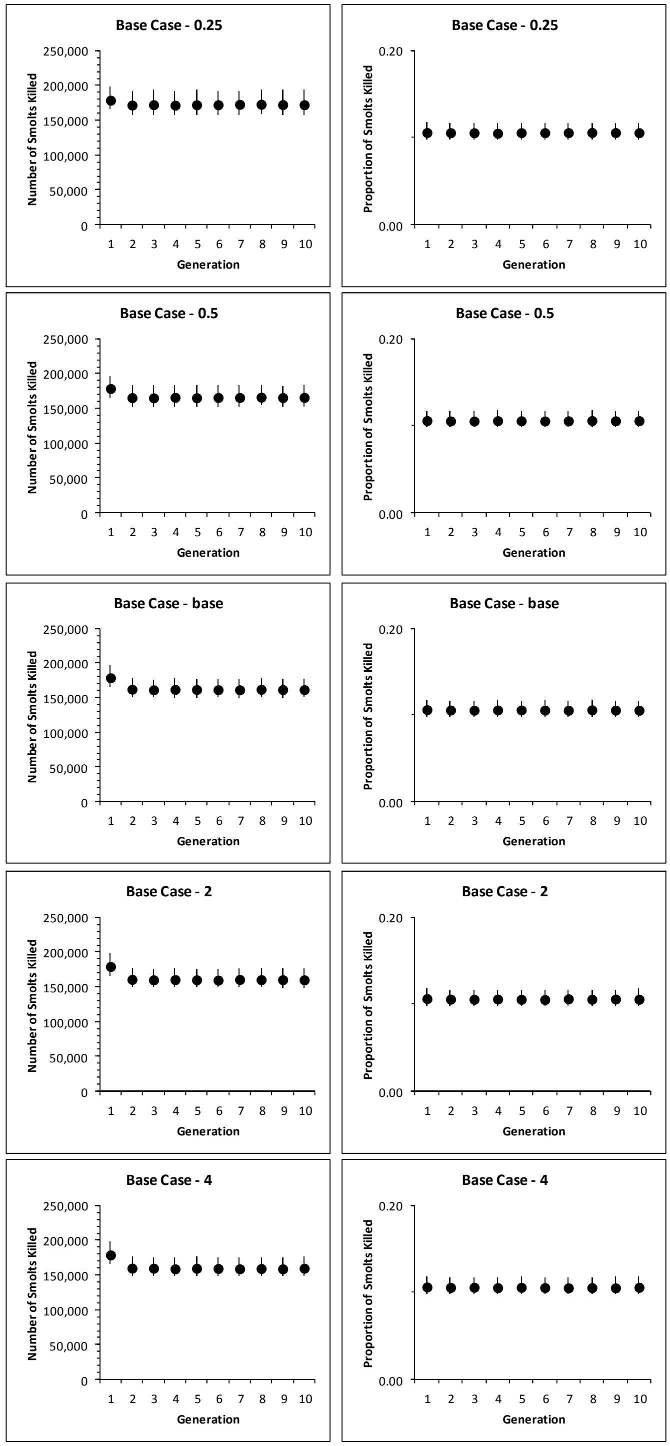

Figure 6.10.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate (top to bottom, respectively) under the Base Case scenario.

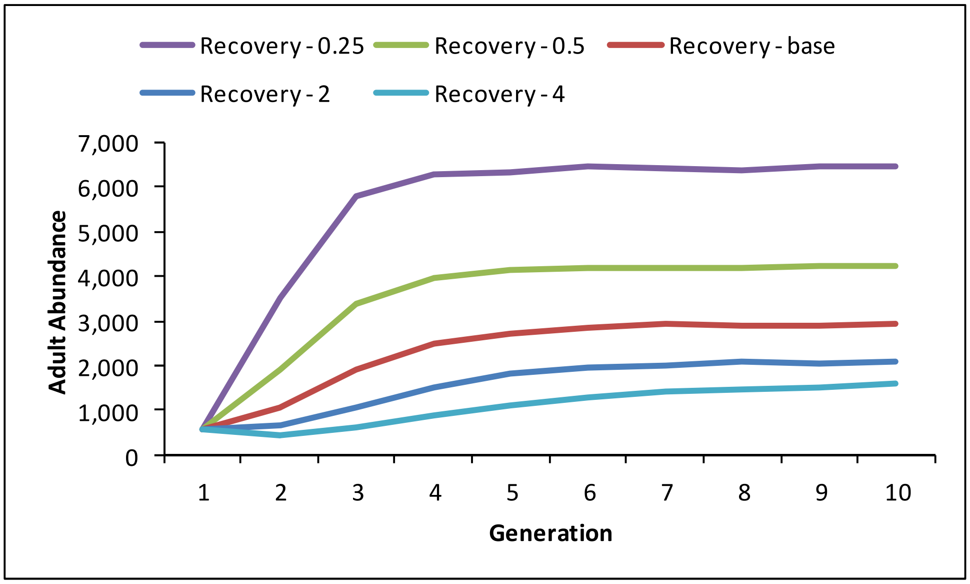

Figure 6.10.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate under the Recovery scenario.

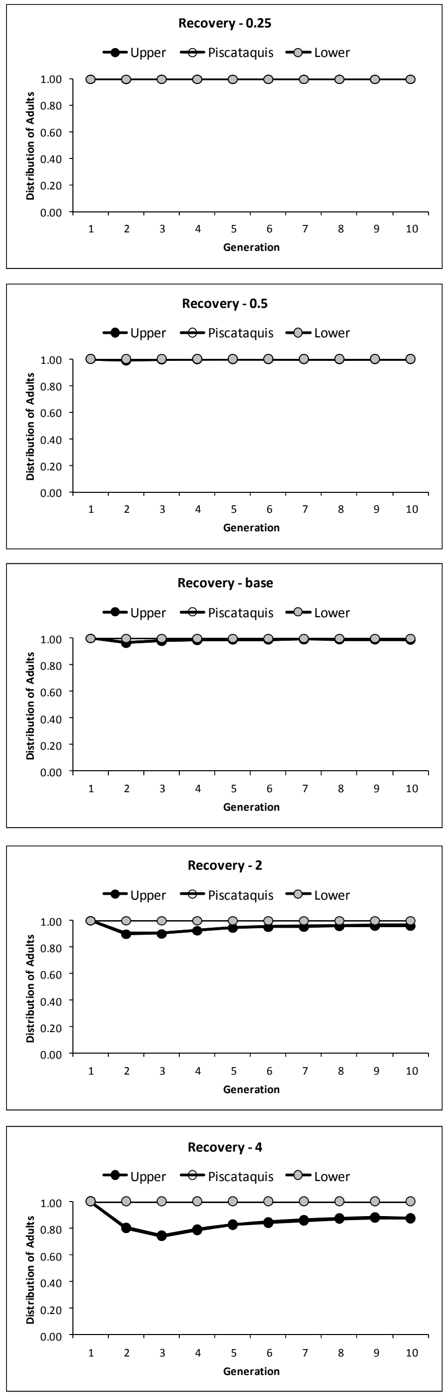

Figure 6.10.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate (top to bottom, respectively) under the Recovery scenario.

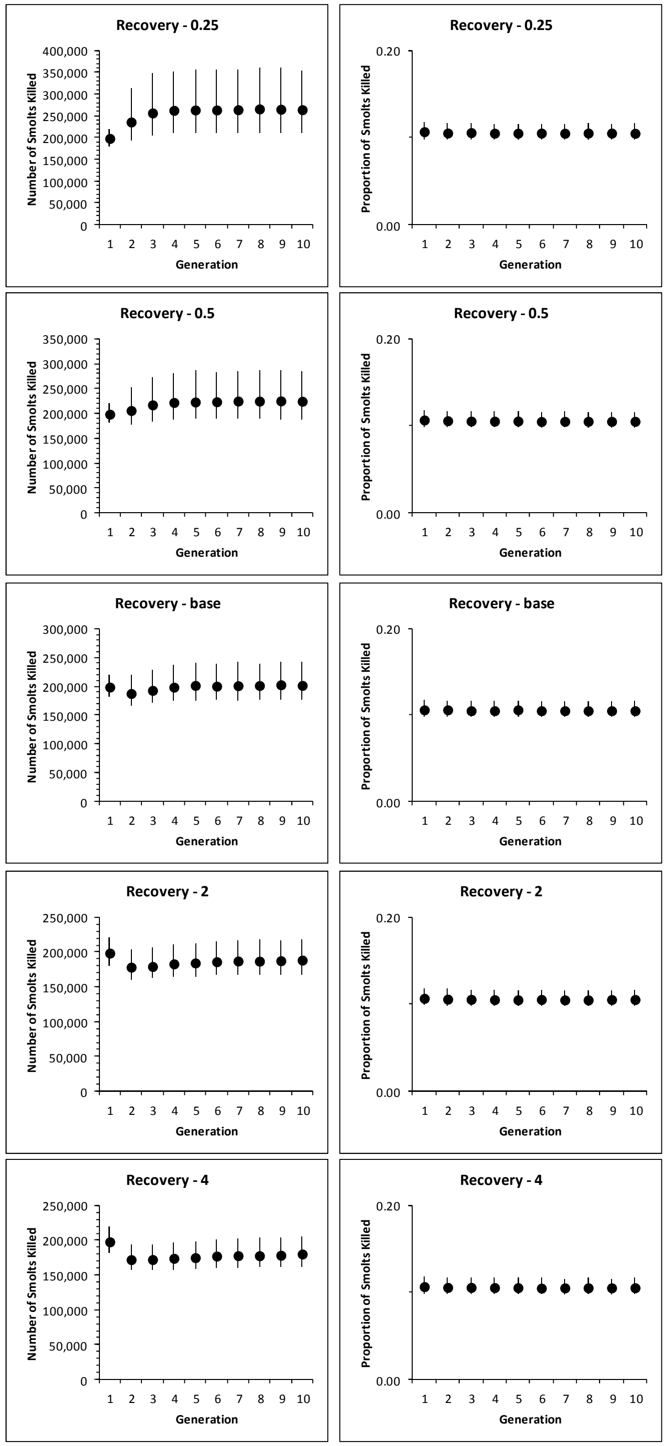

Figure 6.10.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base hatchery discount rate (top to bottom, respectively) under the Recovery scenario.

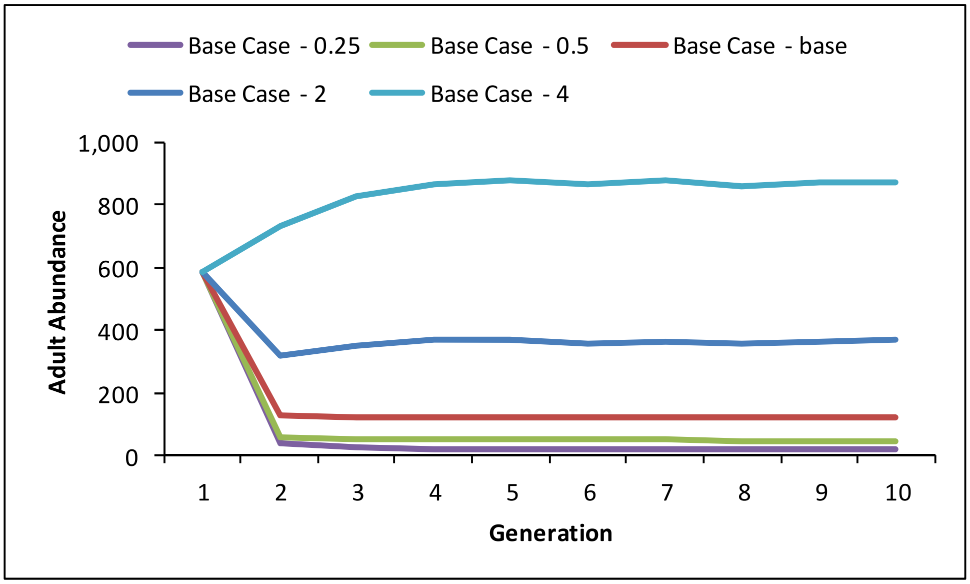

Figure 6.11.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Base Case scenario.

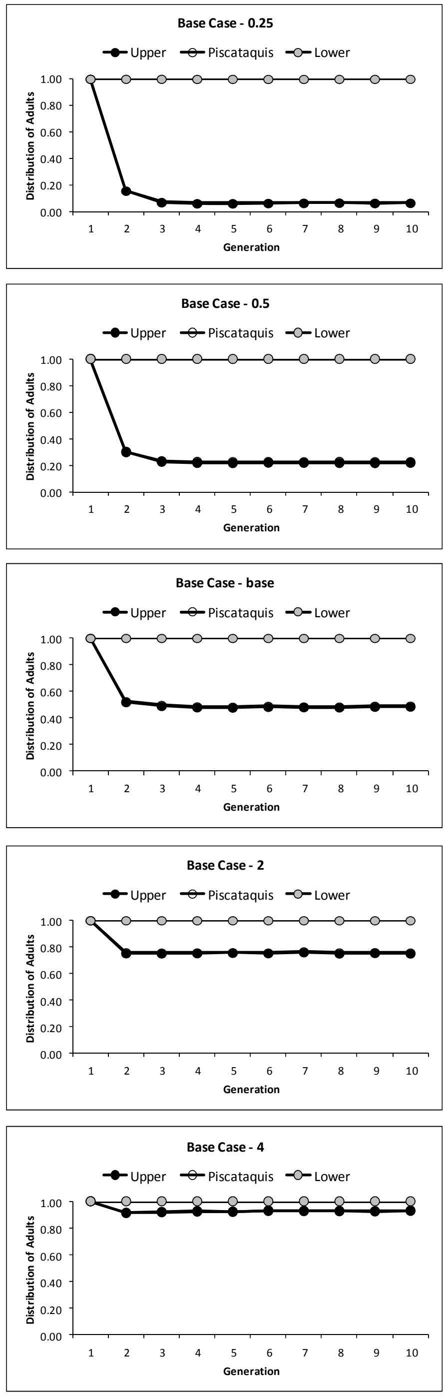

Figure 6.11.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked (top to bottom, respectively) under the Base Case scenario.

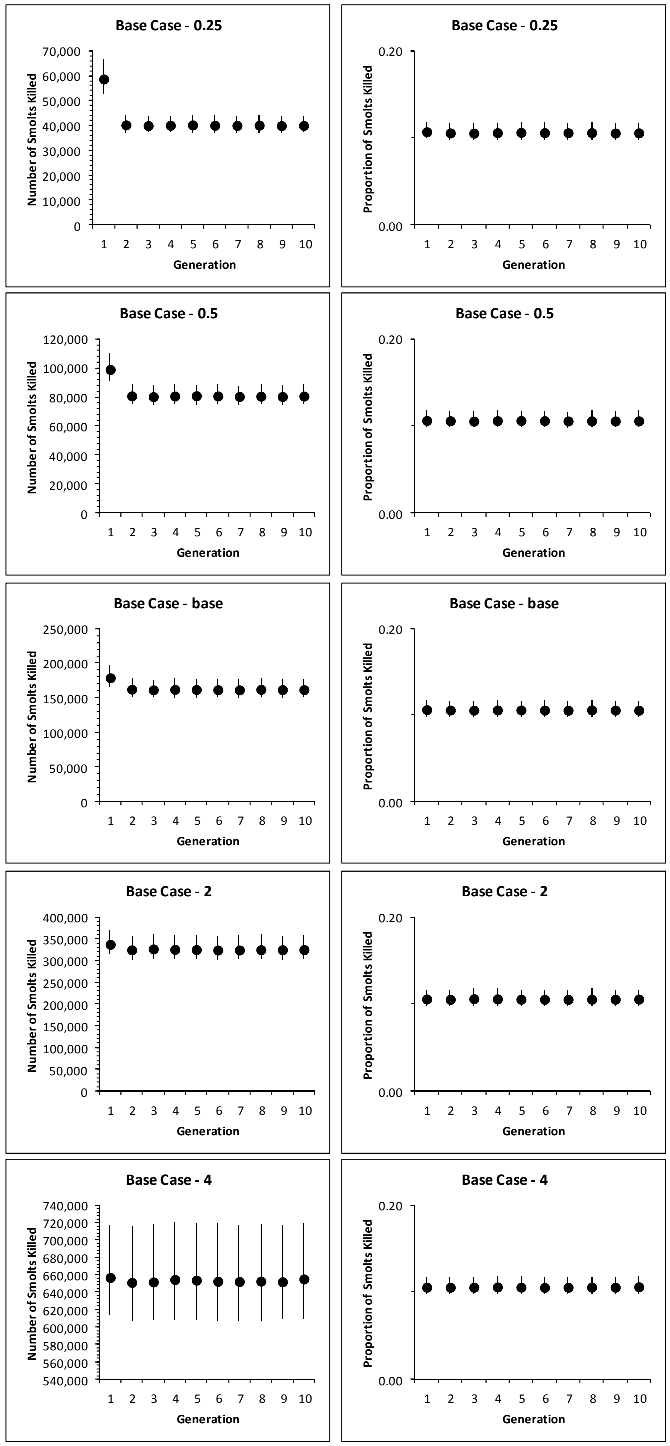

Figure 6.11.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked (top to bottom, respectively) under the Base Case scenario.

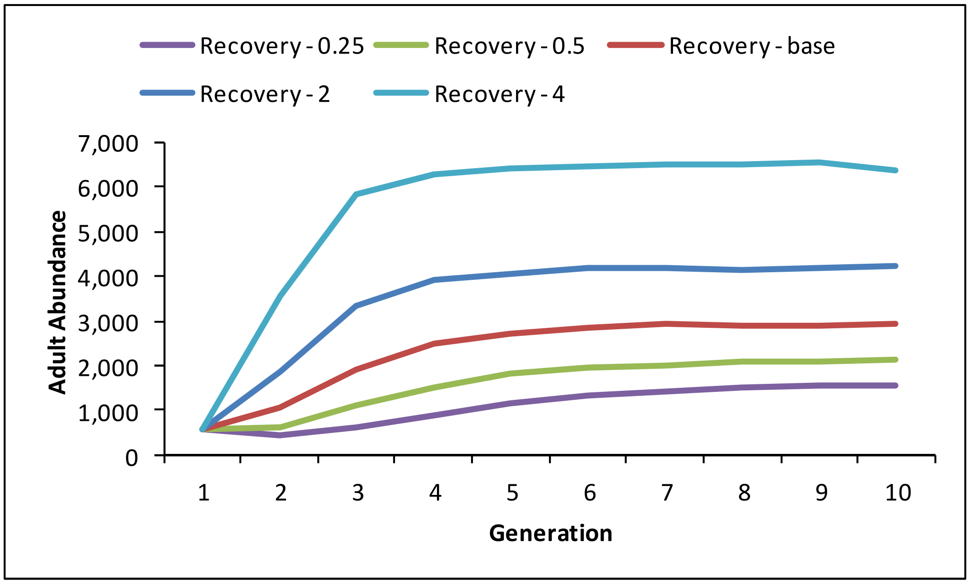

Figure 6.11.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked under the Recovery scenario.

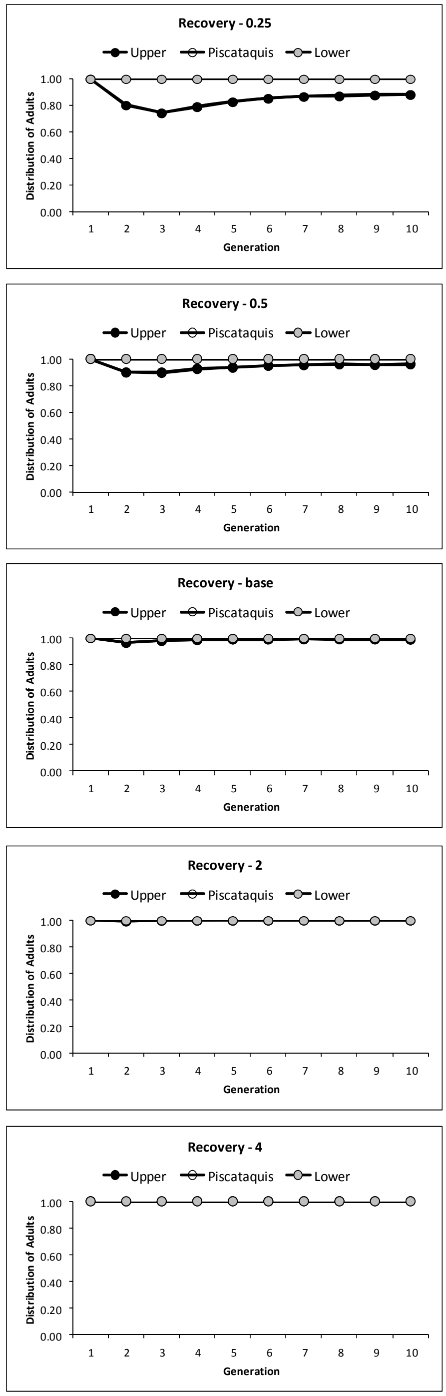

Figure 6.11.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked (top to bottom, respectively) under the Recovery scenario.

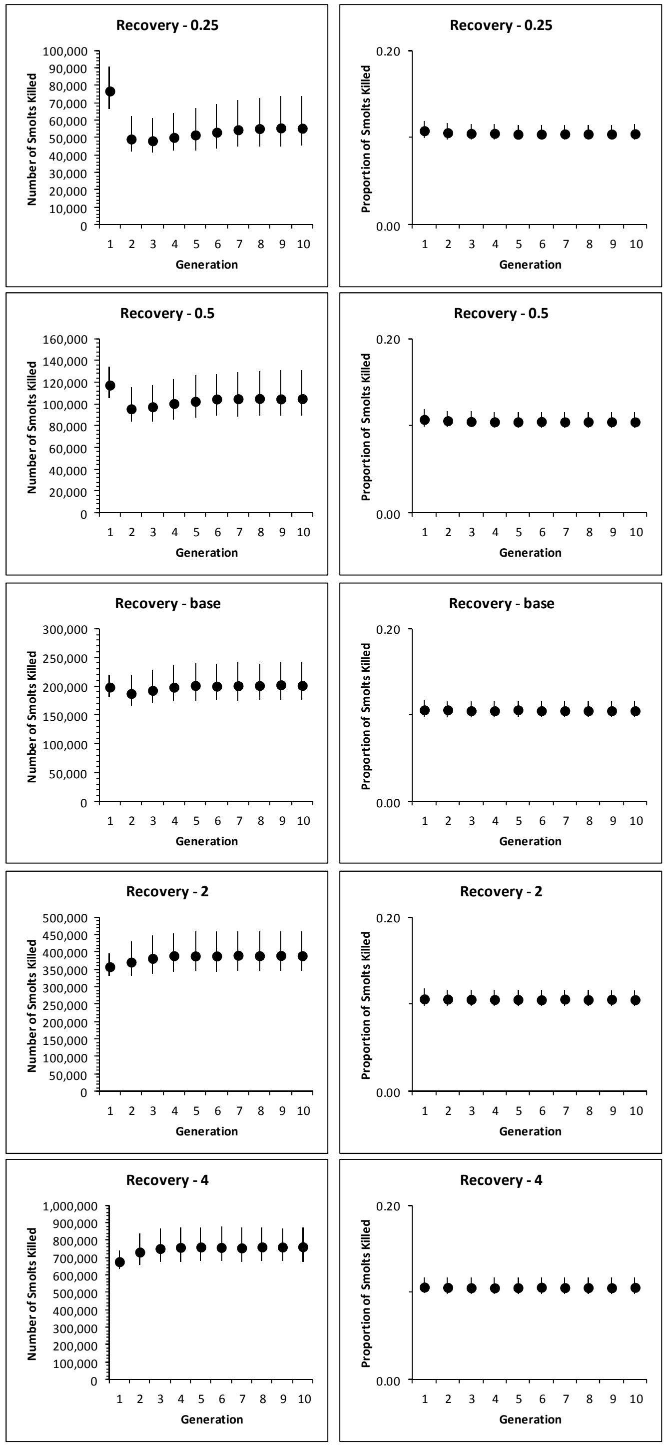

Figure 6.11.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base number of smolts stocked (top to bottom, respectively) under the Recovery scenario.

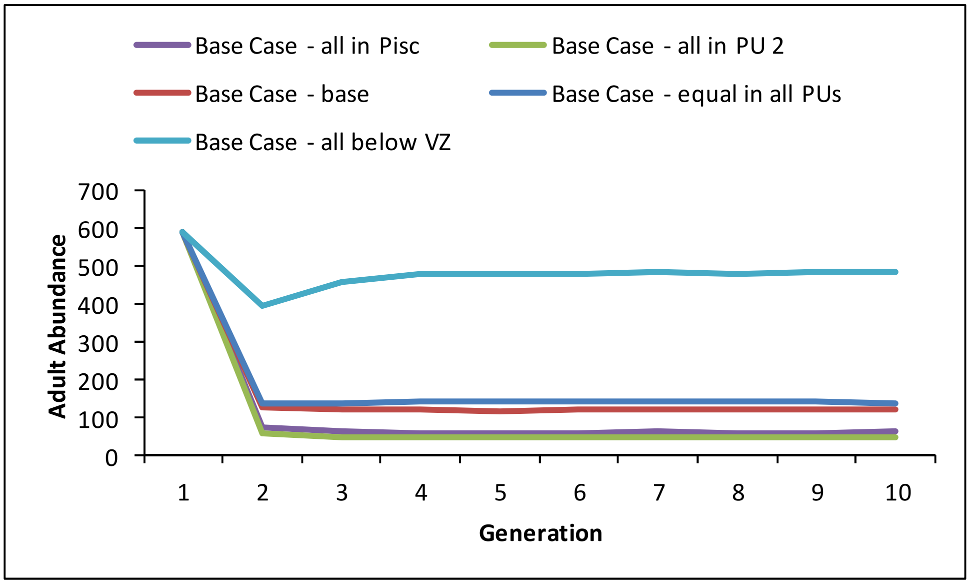

Figure 6.12.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Base Case scenario.

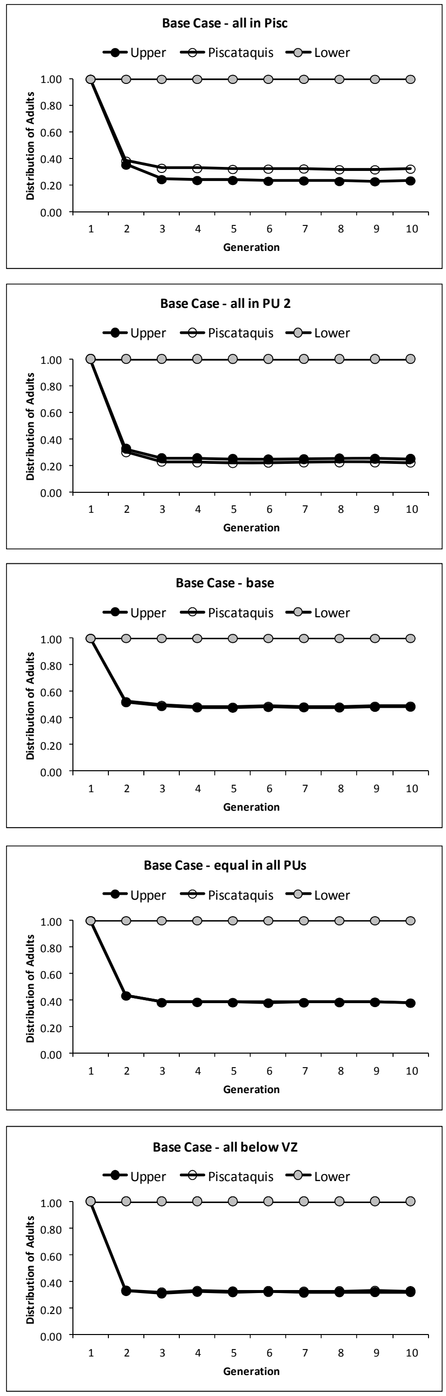

Figure 6.12.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam (top to bottom, respectively) under the Base Case scenario.

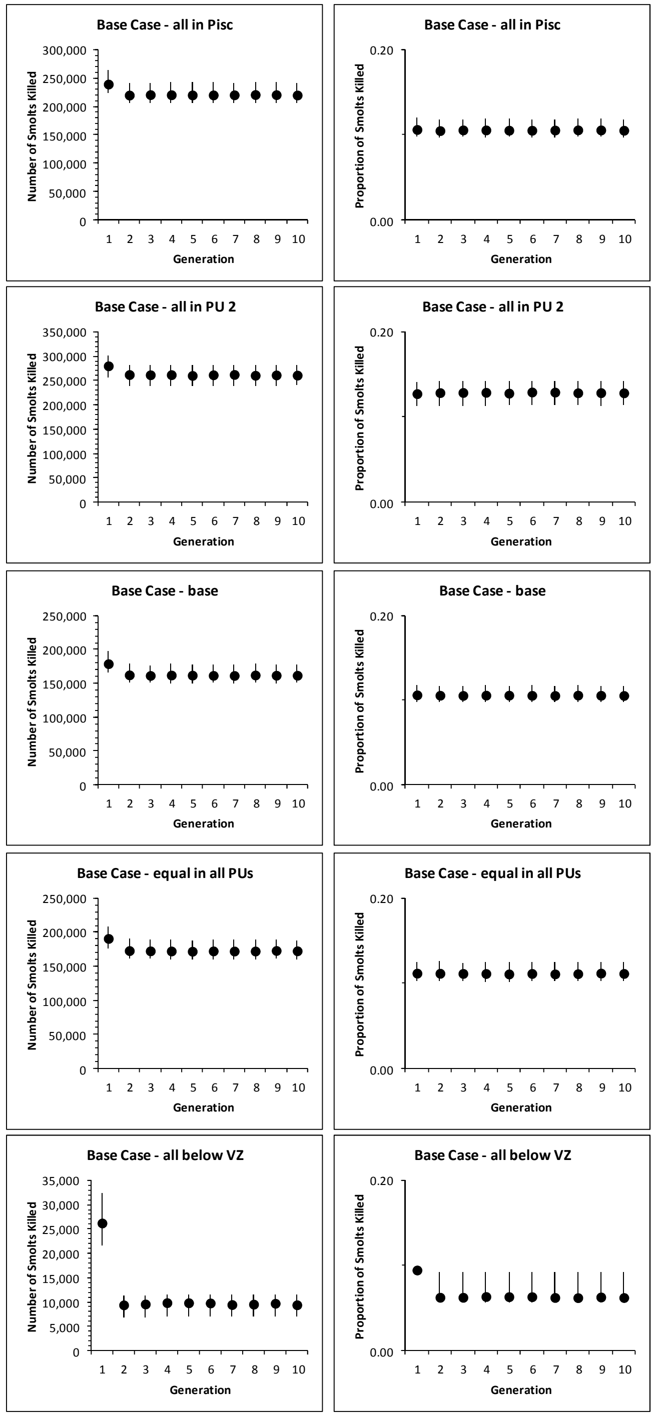

Figure 6.12.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam (top to bottom, respectively) under the Base Case scenario.

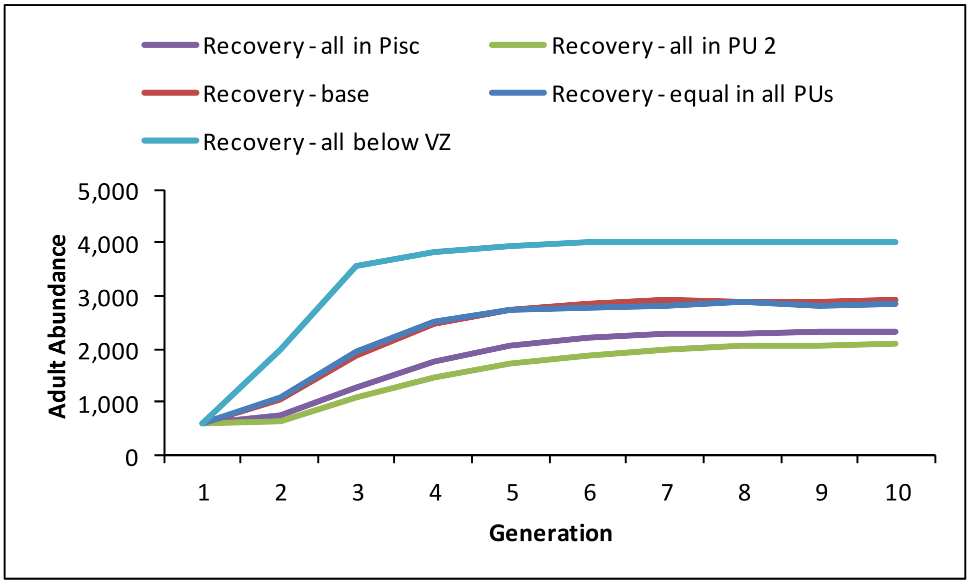

Figure 6.12.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam under the Recovery scenario.

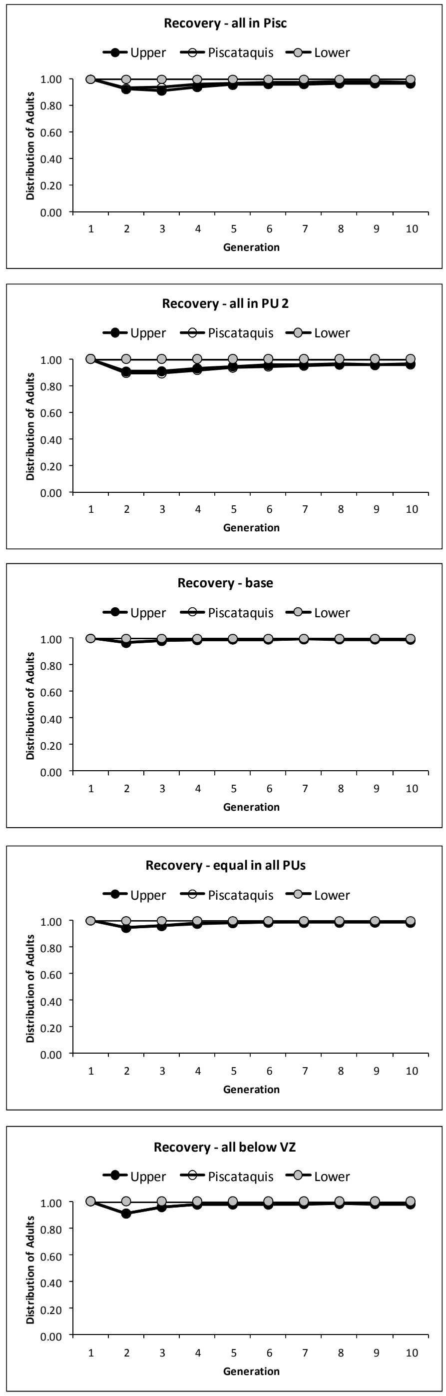

Figure 6.12.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam (top to bottom, respectively) under the Recovery scenario.

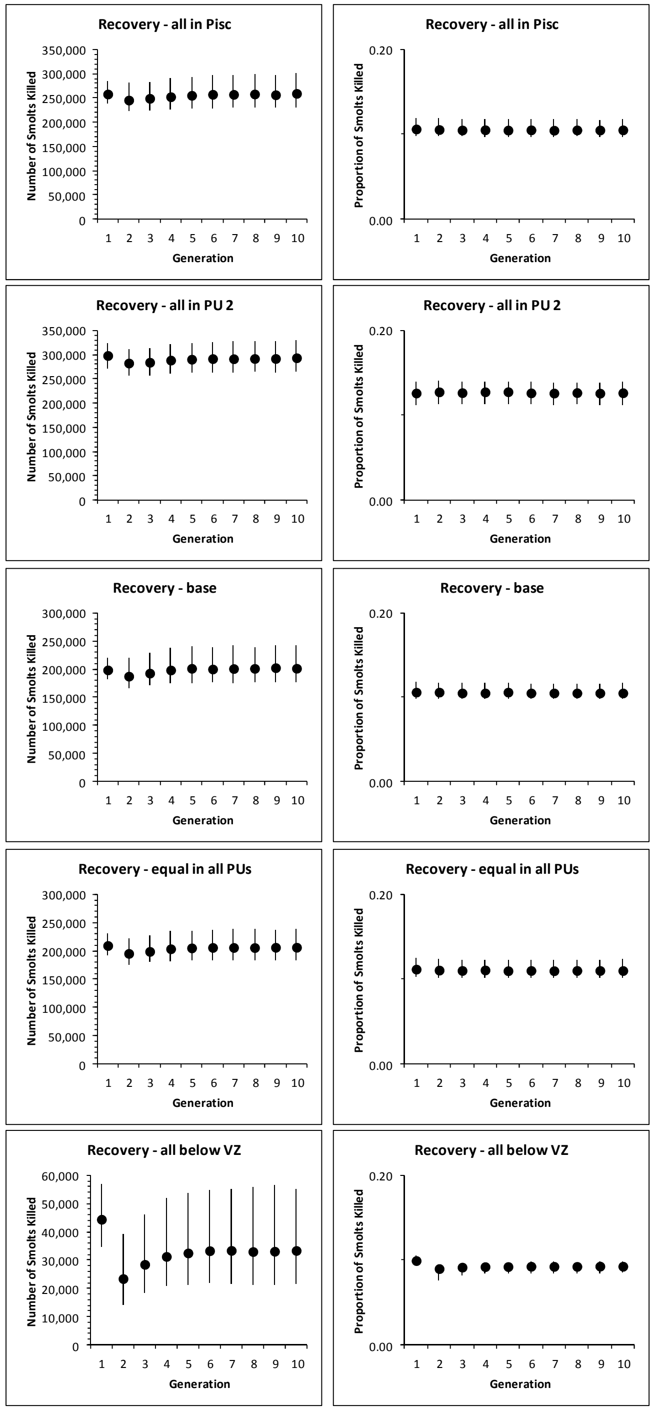

Figure 6.12.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for all smolts stocked in the Piscataquis River, all smolts stocked in PU 2, smolts stocked using the base distribution, smolts stocked equally among PUs, and all smolts stocked below Veazie Dam (top to bottom, respectively) under the Recovery scenario.

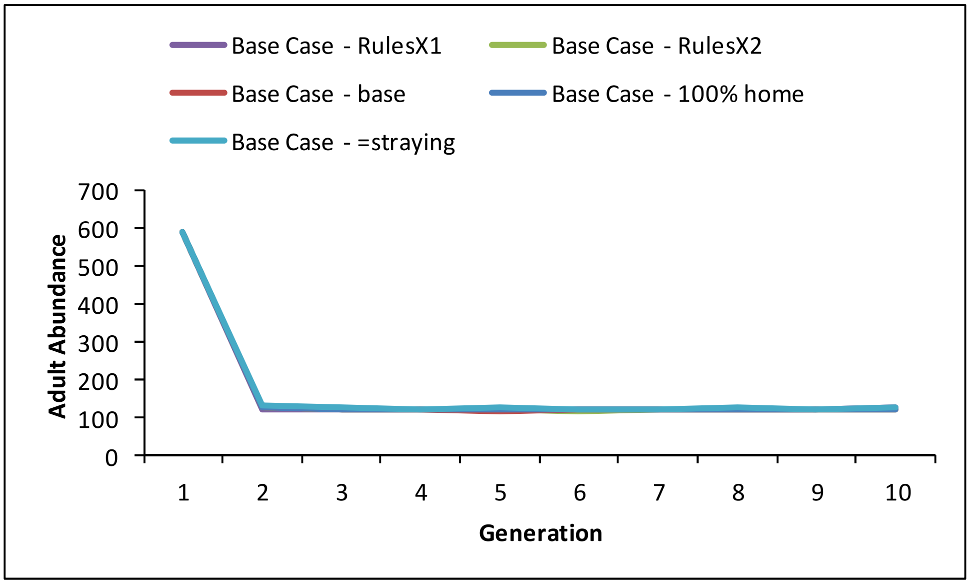

Figure 6.13.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Base Case scenario.

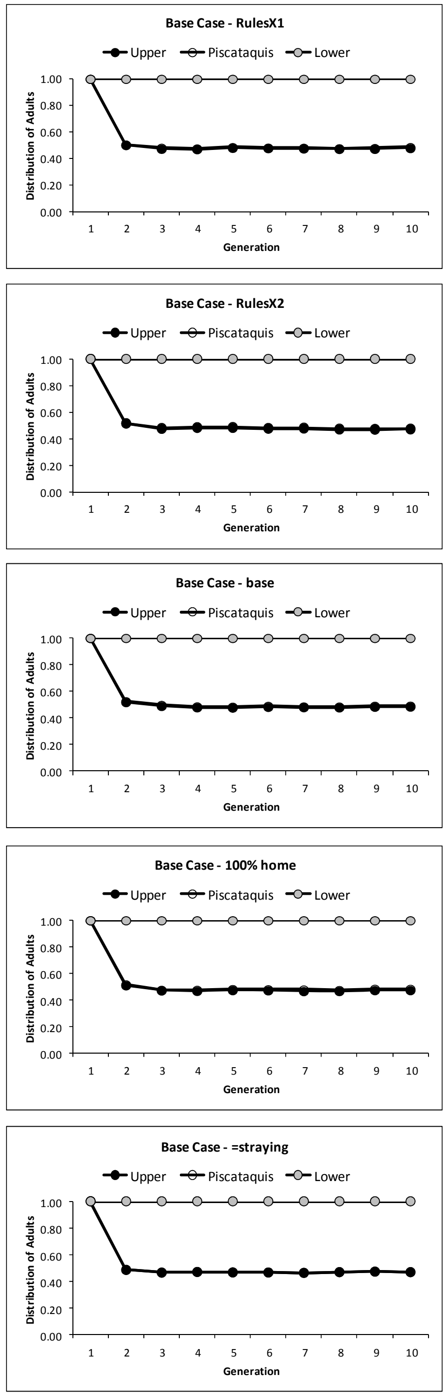

Figure 6.13.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying (top to bottom, respectively) under the Base Case scenario.

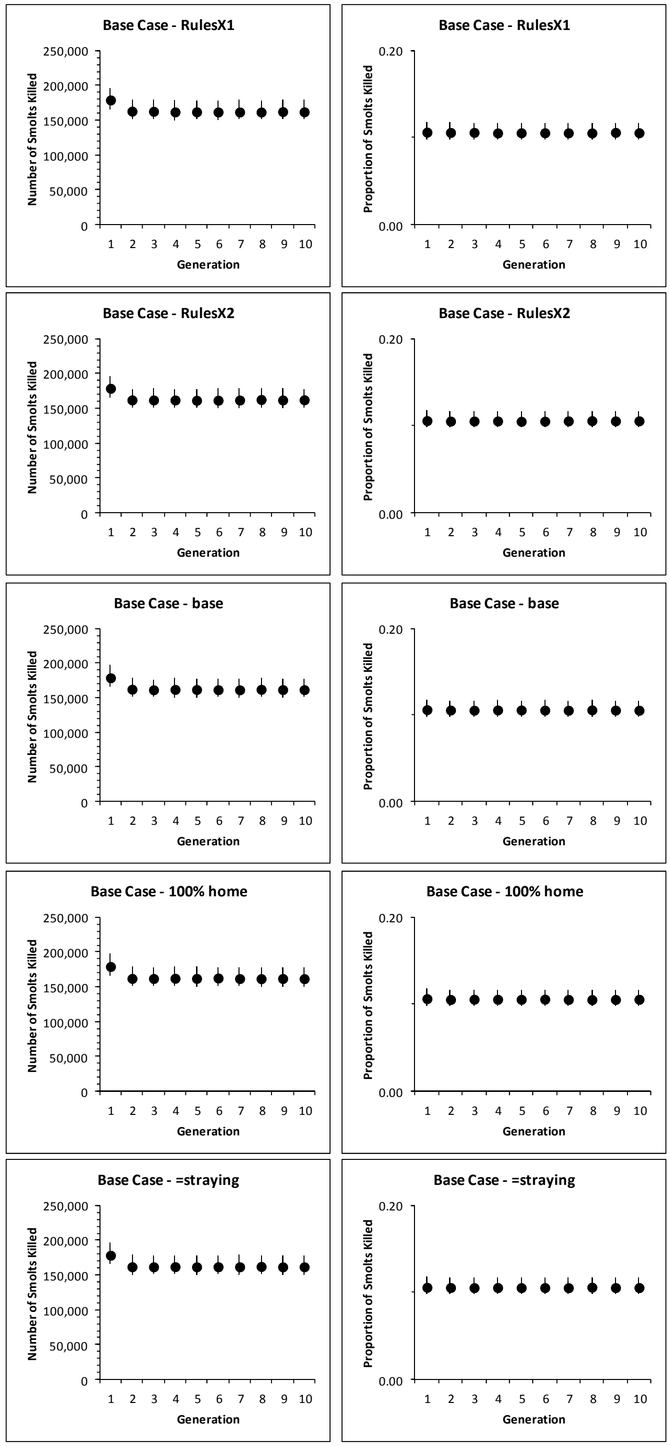

Figure 6.13.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying (top to bottom, respectively) under the Base Case scenario.

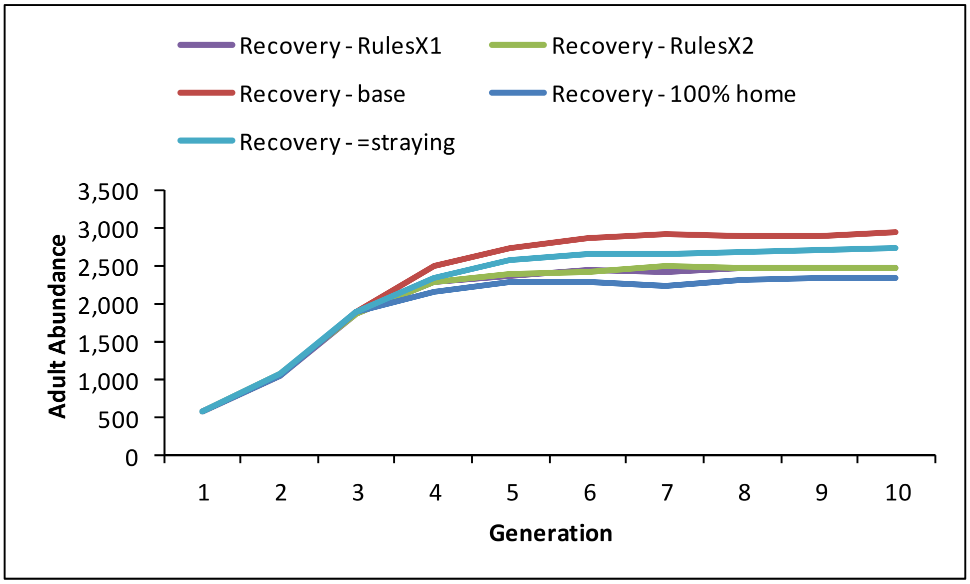

Figure 6.13.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying under the Recovery scenario.

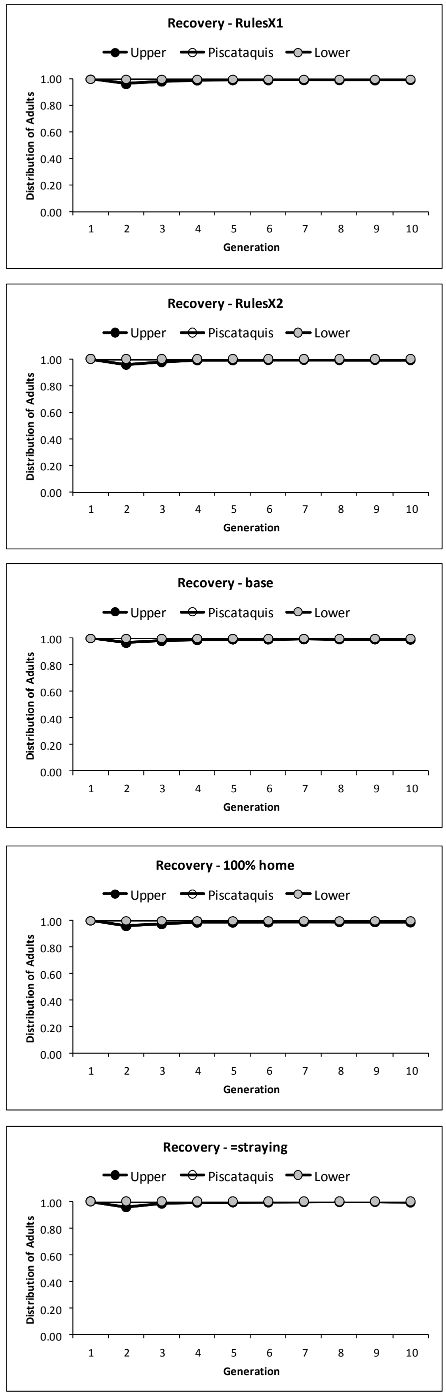

Figure 6.13.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying (top to bottom, respectively) under the Recovery scenario.

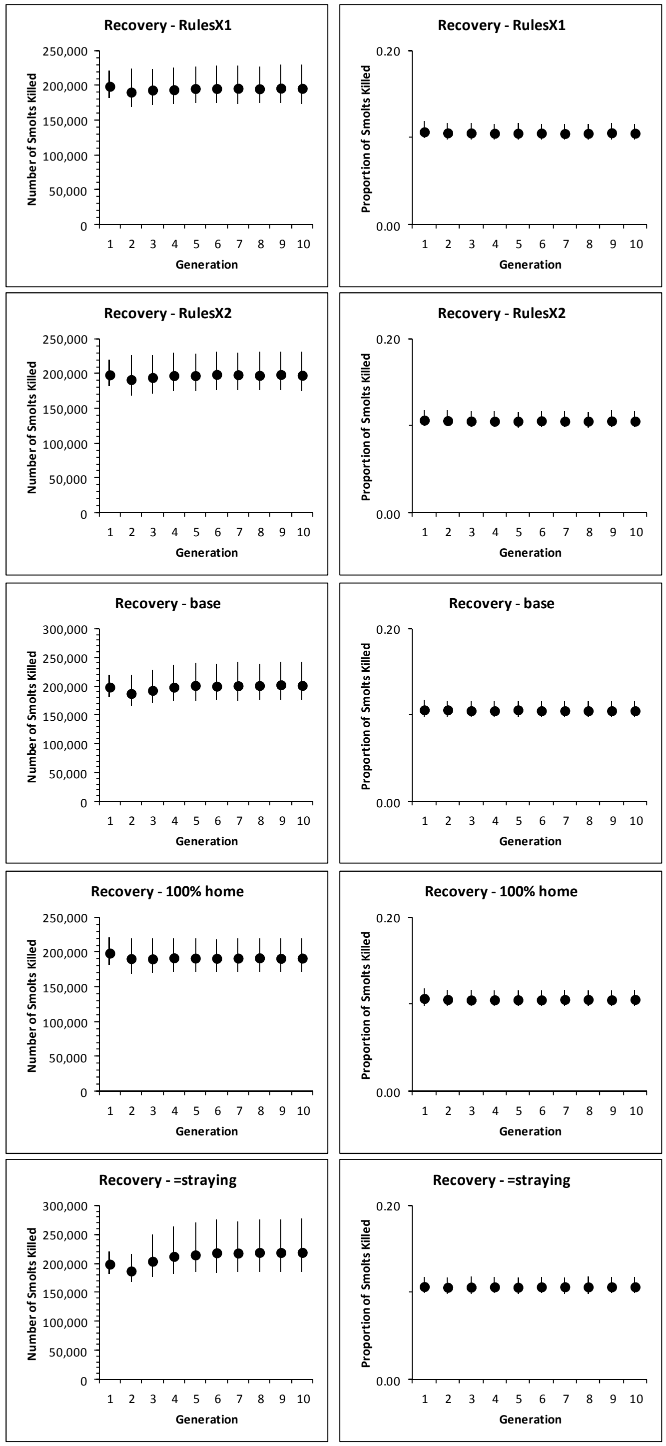

Figure 6.13.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the straying scenarios RulesX1, RulesX2, the base, 100% home, and =straying (top to bottom, respectively) under the Recovery scenario.

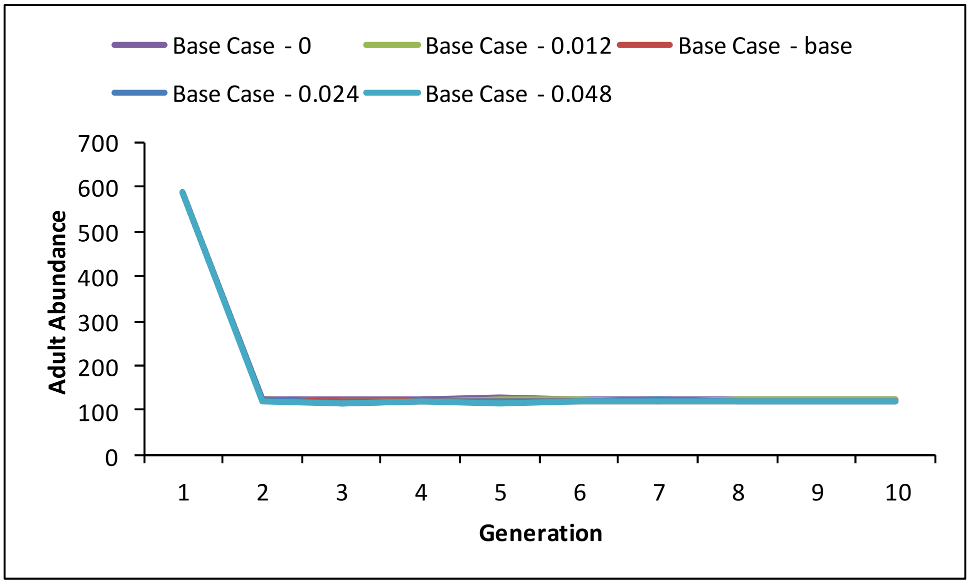

Figure 6.14.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Base Case scenario.

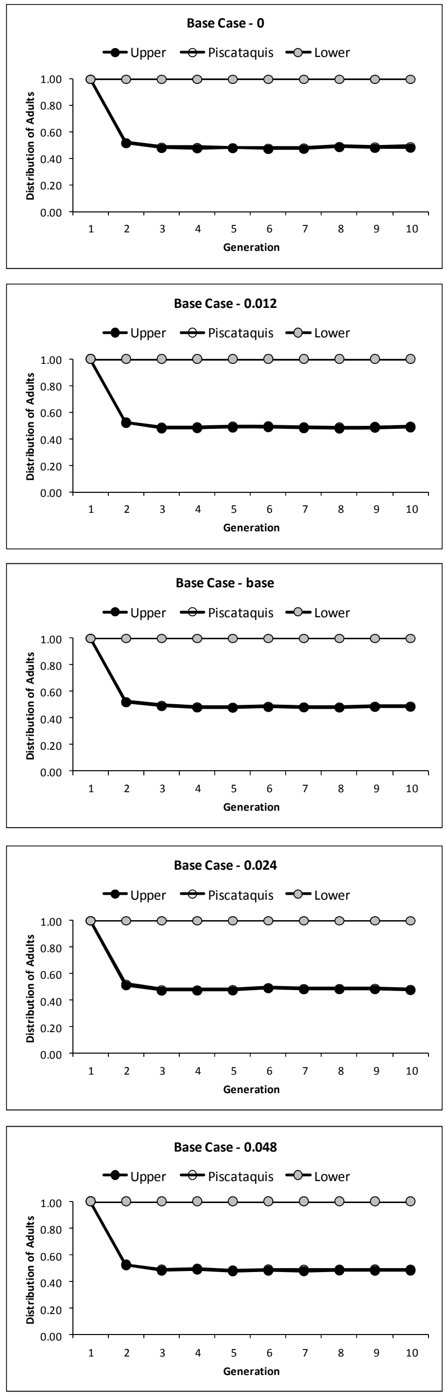

Figure 6.14.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 (top to bottom, respectively) under the Base Case scenario.

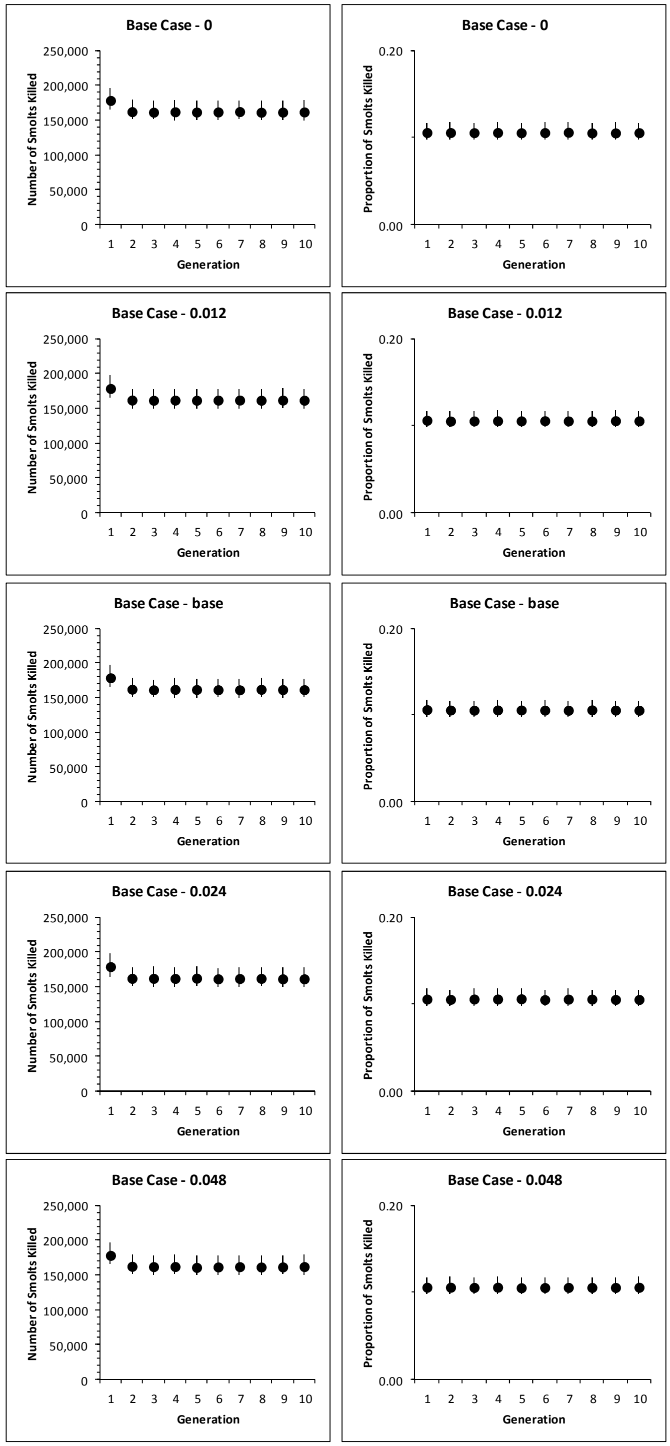

Figure 6.14.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 (top to bottom, respectively) under the Base Case scenario.

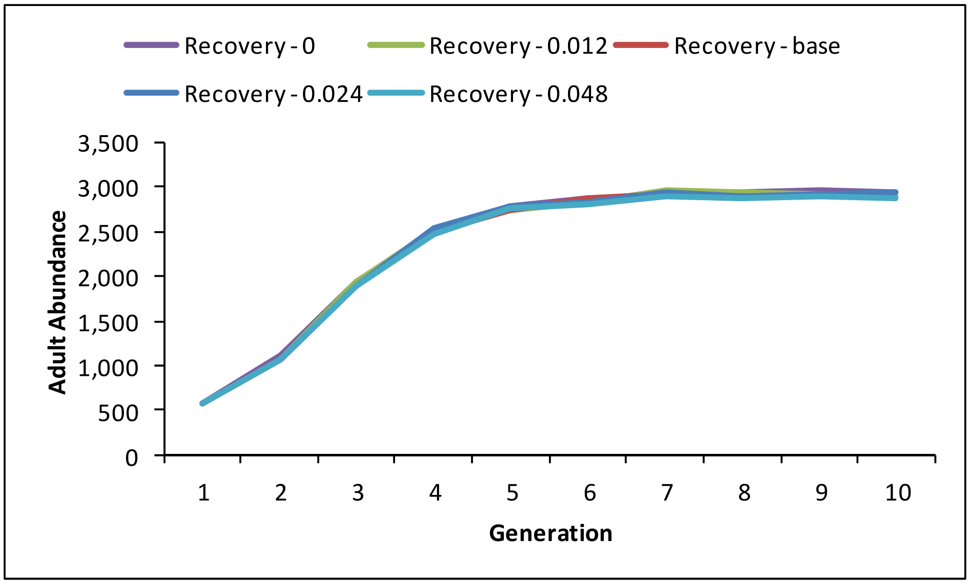

Figure 6.14.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 under the Recovery scenario.

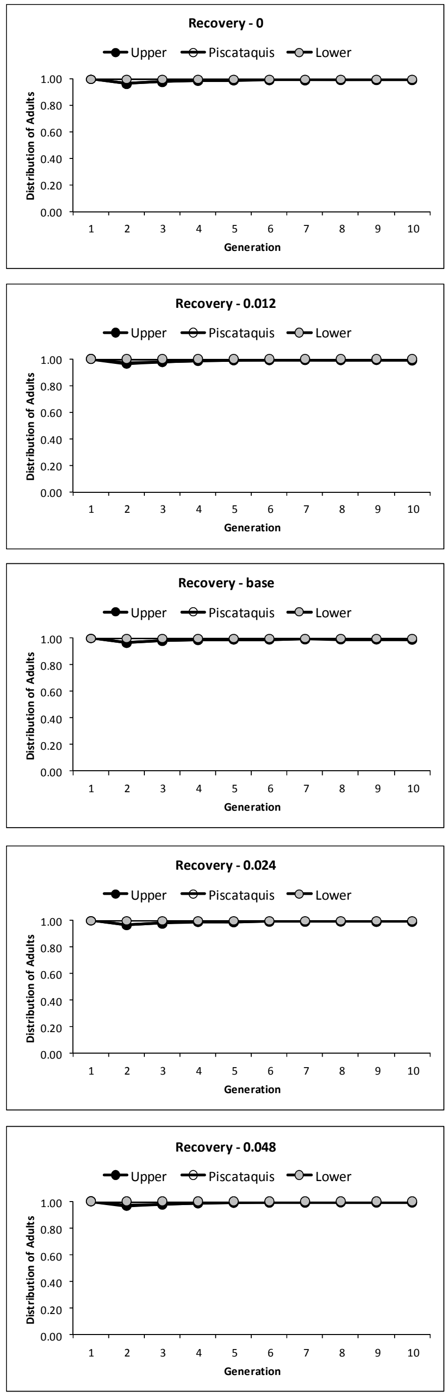

Figure 6.14.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 (top to bottom, respectively) under the Recovery scenario.

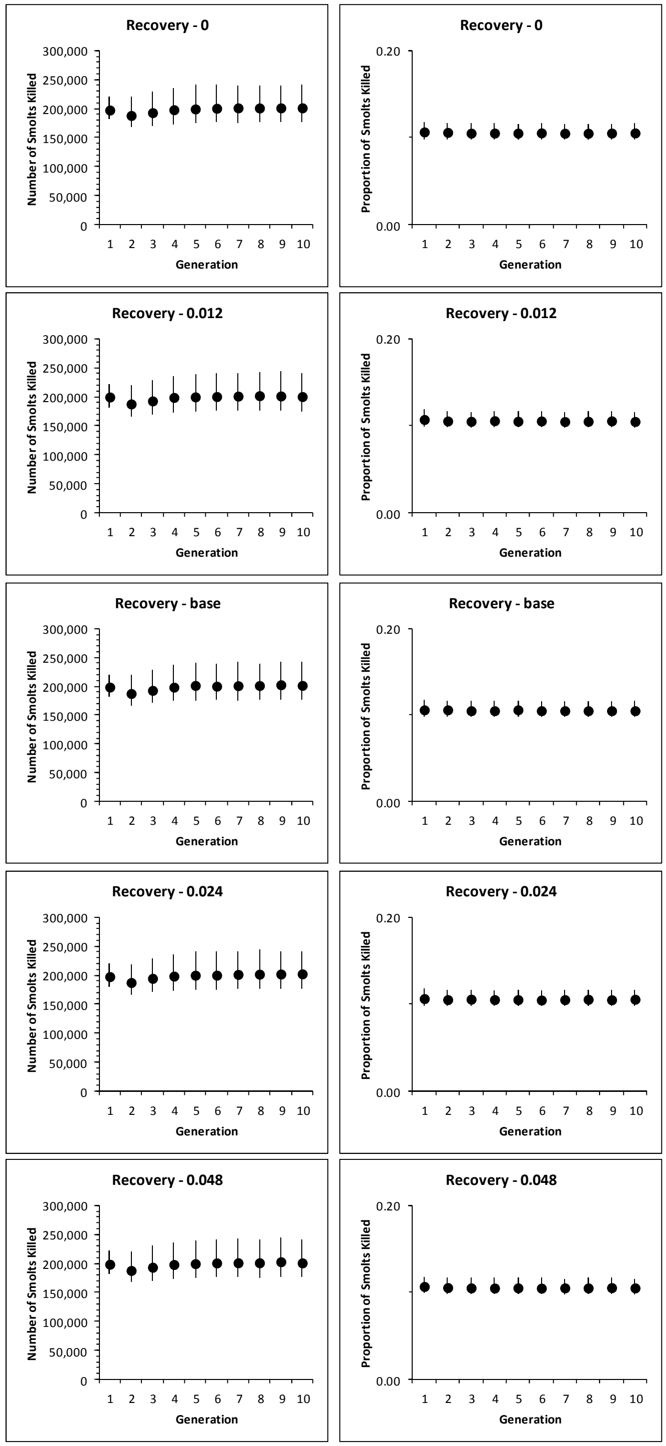

Figure 6.14.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for the proportion of adults that die after unsuccessfully passing a dam equal to 0, 0.012, the base, 0.024, and 0.048 (top to bottom, respectively) under the Recovery scenario.

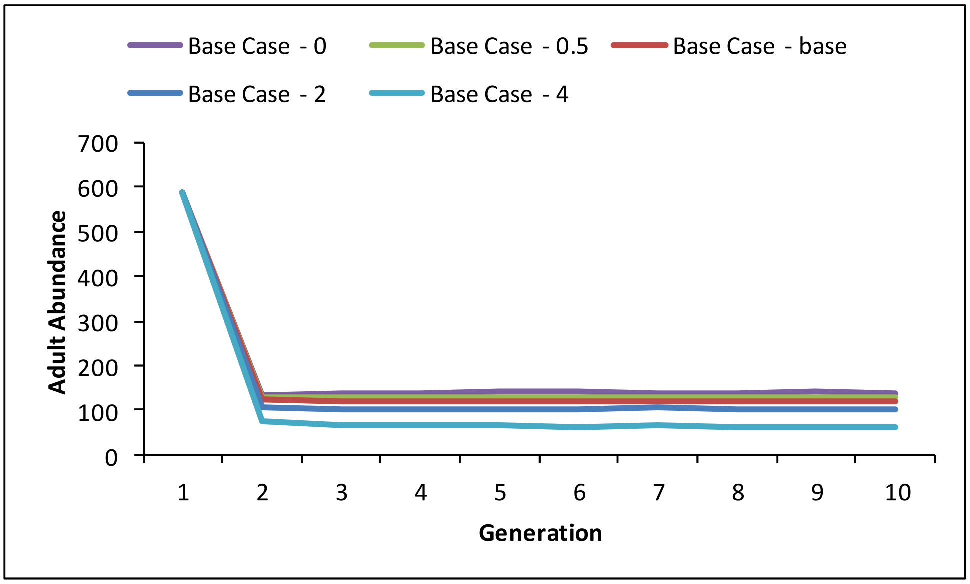

Figure 6.15.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Base Case scenario.

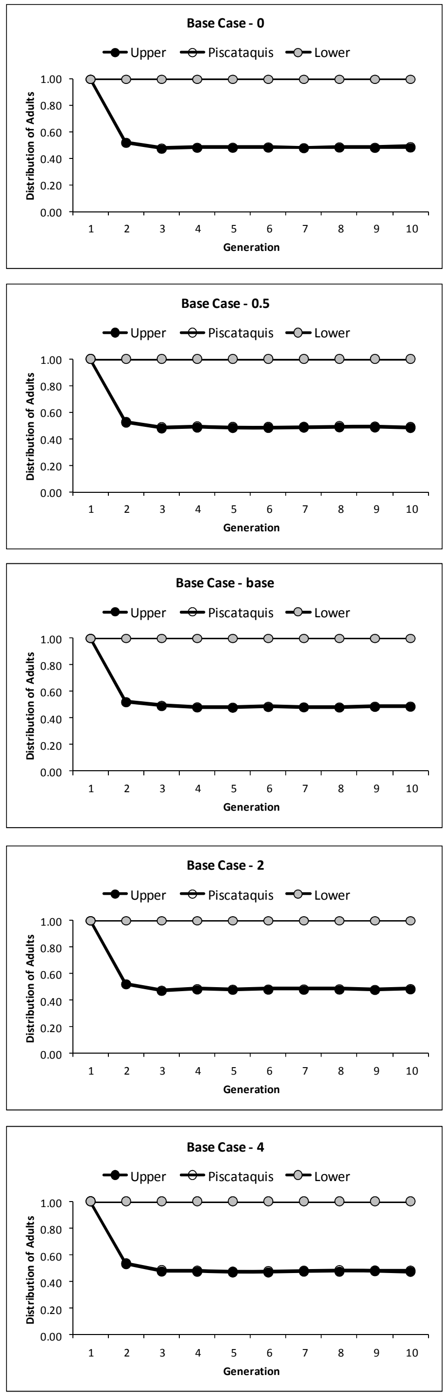

Figure 6.15.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam (top to bottom, respectively) under the Base Case scenario.

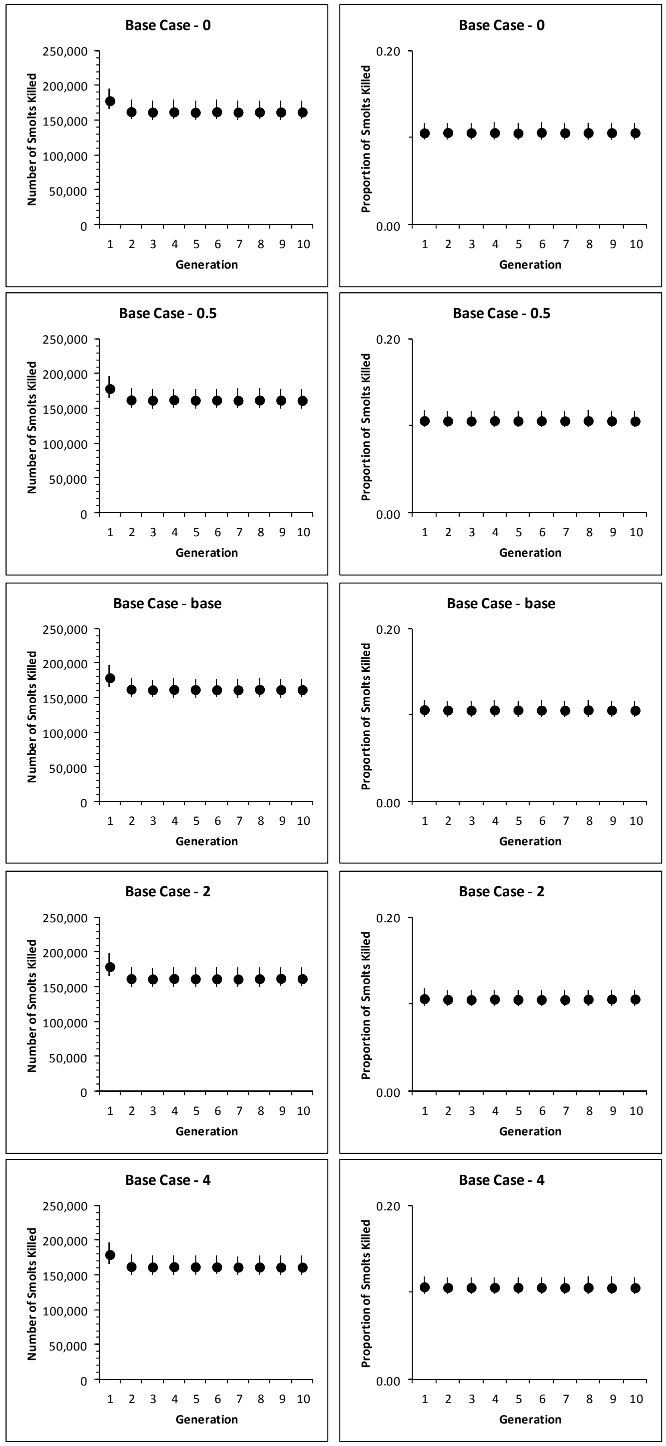

Figure 6.15.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam (top to bottom, respectively) under the Base Case scenario.

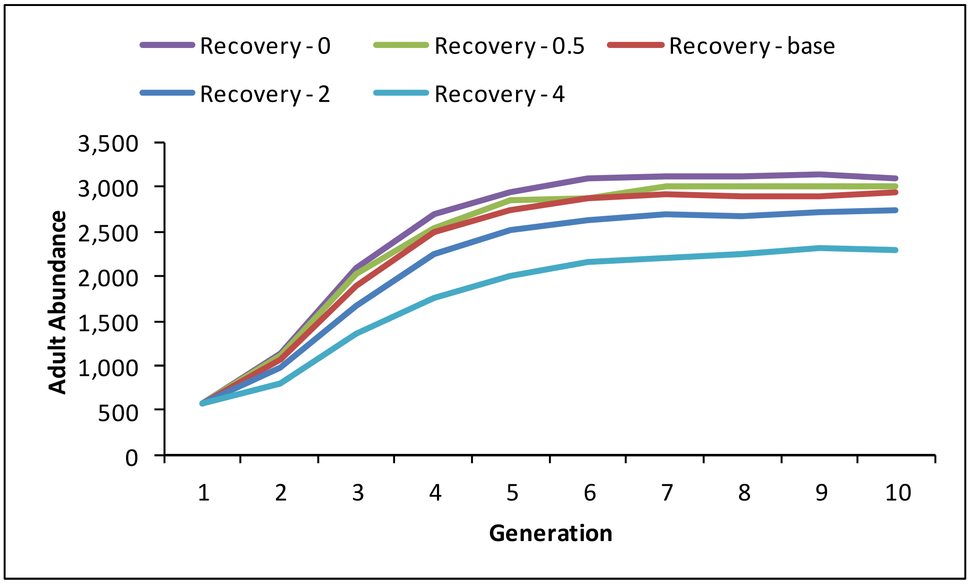

Figure 6.15.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam under the Recovery scenario.

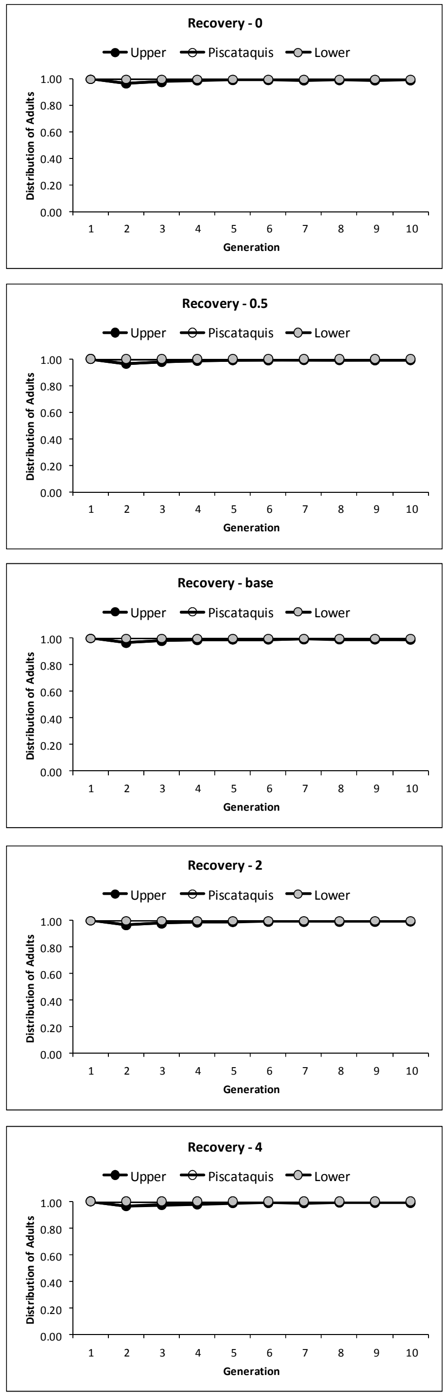

Figure 6.15.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam (top to bottom, respectively) under the Recovery scenario.

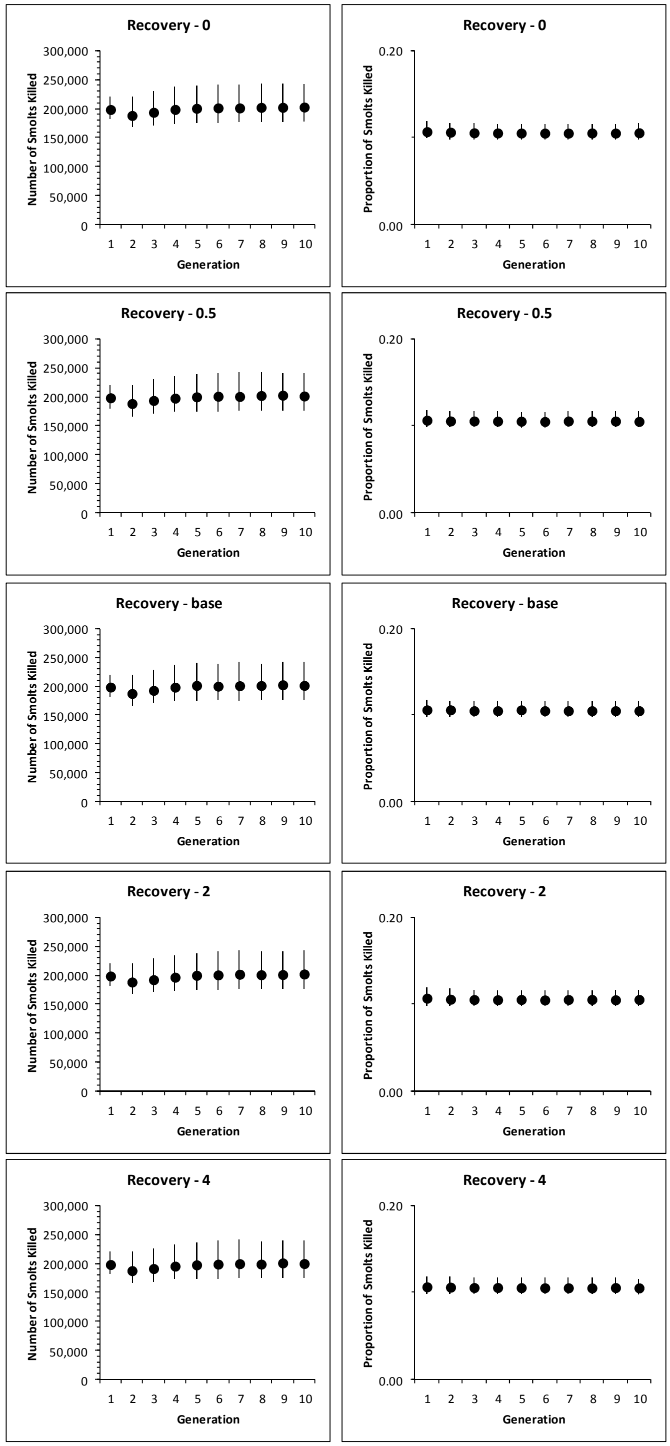

Figure 6.15.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0, 0.5, 1 (base), 2, and 4 times the base proportion of adults that return to sea after unsuccessfully passing a dam (top to bottom, respectively) under the Recovery scenario.

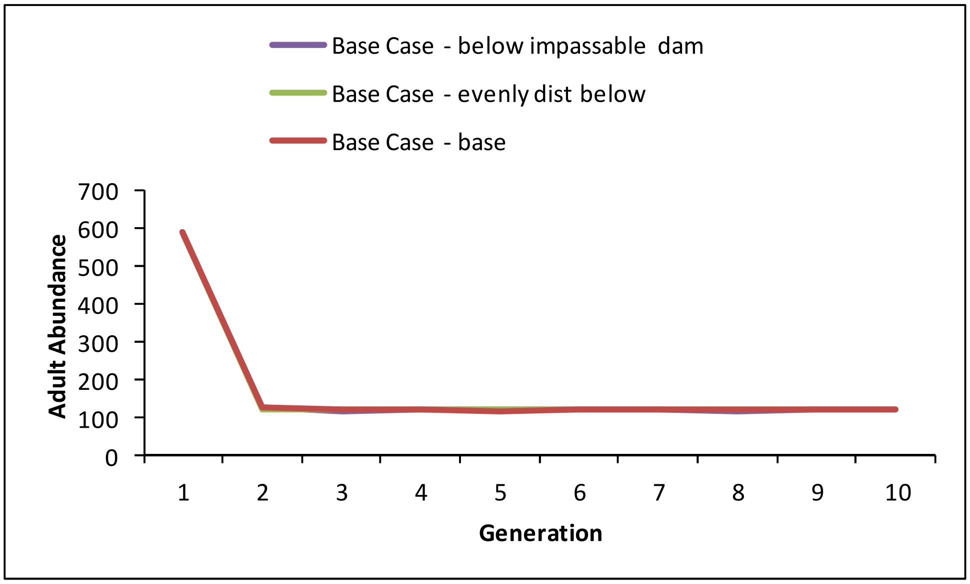

Figure 6.16.1.1. Median number of two sea-winter females across all Penobscot River production units (PUs) in generations 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the PU immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Base Case scenario.

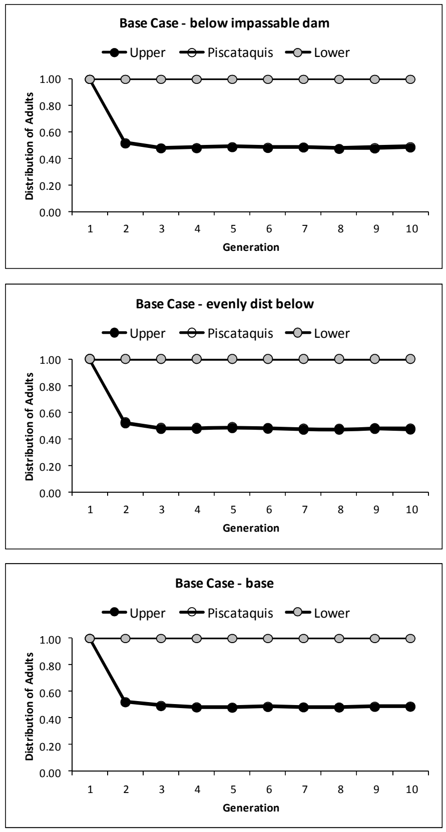

Figure 6.16.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base (top to bottom, respectively) under the Base Case scenario.

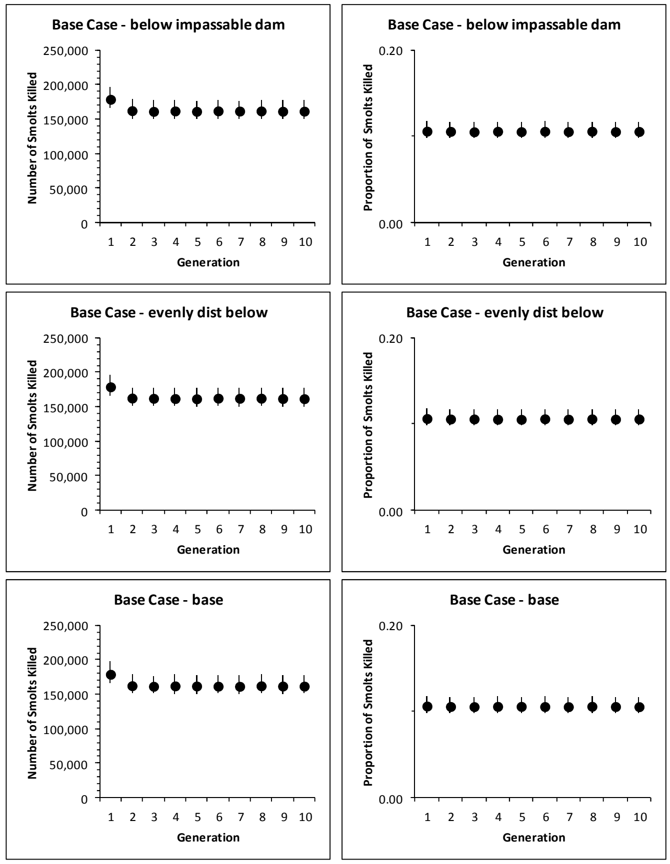

Figure 6.16.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base (top to bottom, respectively) under the Base Case scenario.

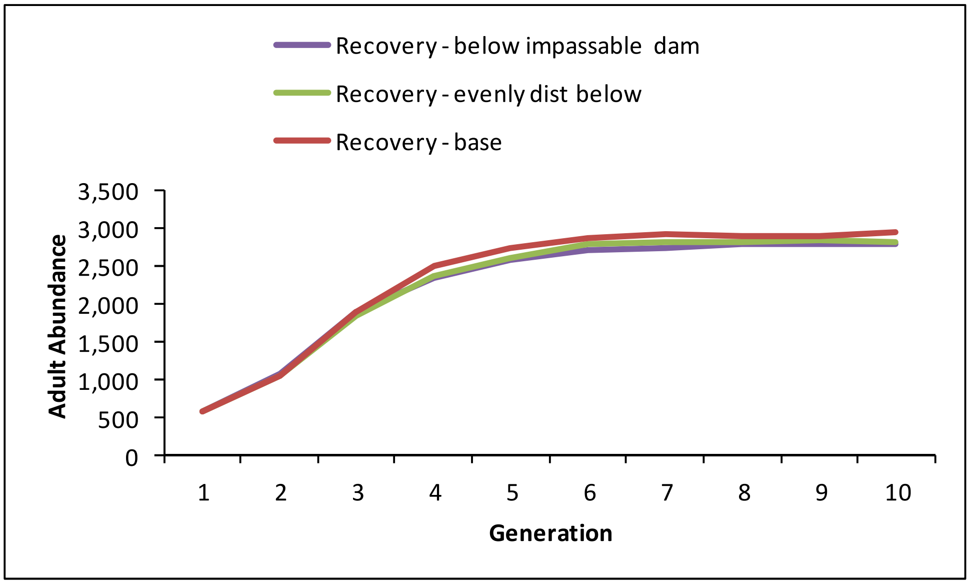

Figure 6.16.2.1. Median number of two sea-winter females across all Penobscot River production units (PUs) in generations 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the PU immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base under the Recovery scenario.

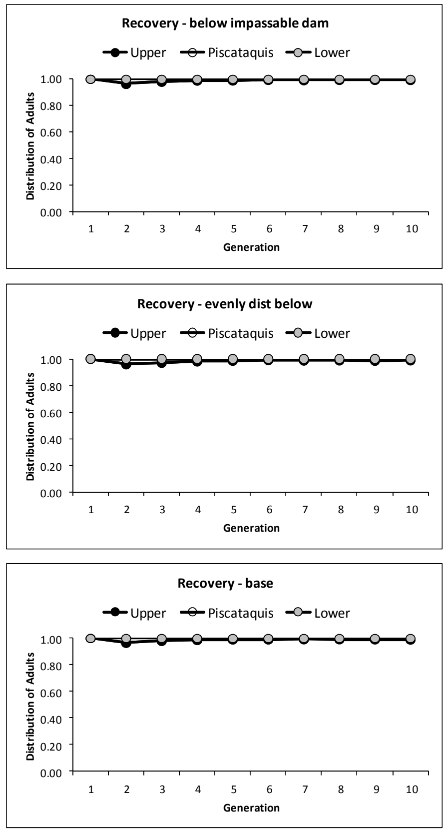

Figure 6.16.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base (top to bottom, respectively) under the Recovery scenario.

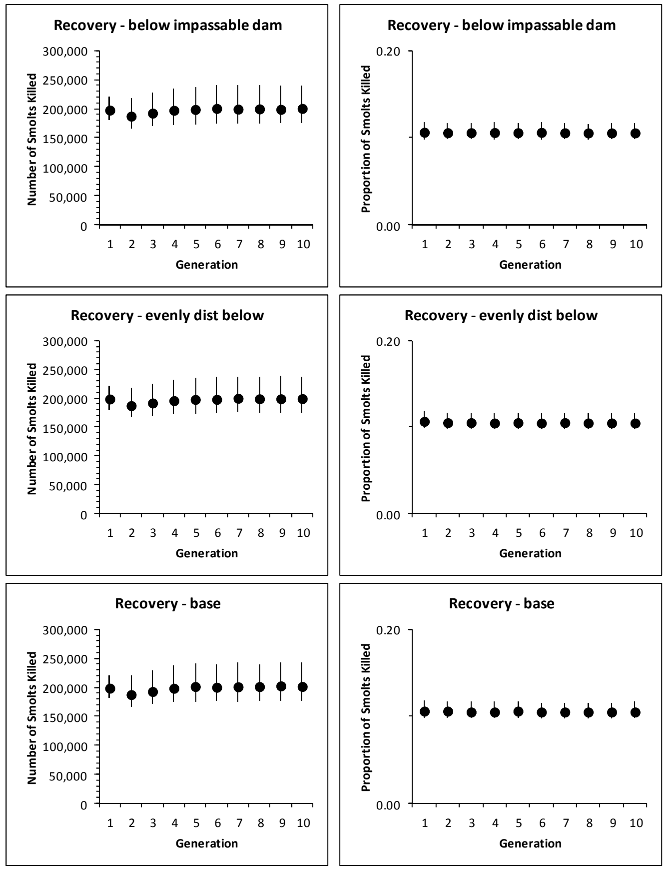

Figure 6.16.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for all adults that unsuccessfully attempt to pass an individual dam spawning in the production unit (PU) immediately below the impassable dam, for adults being evenly distributed in all PUs below the impassable dam, and the base (top to bottom, respectively) under the Recovery scenario.

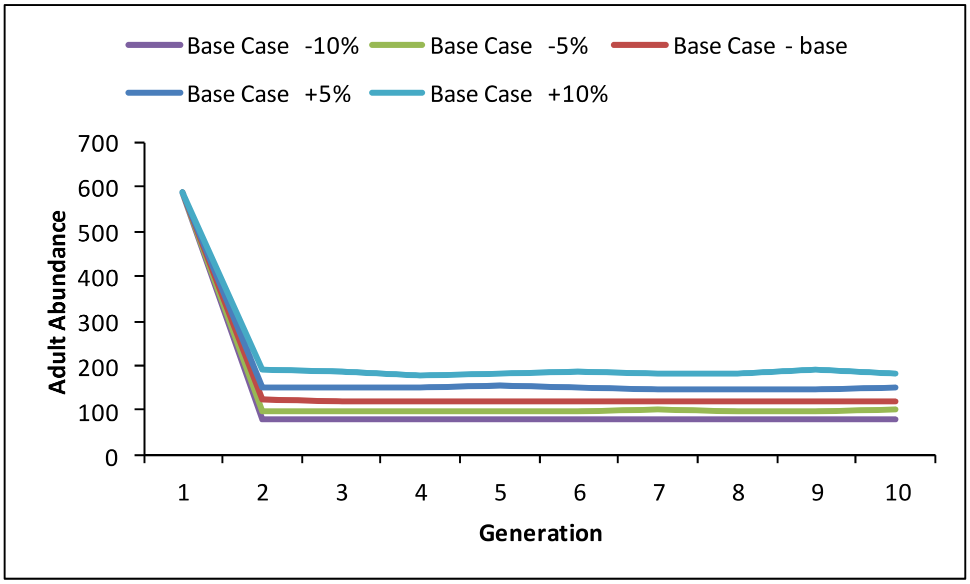

Figure 6.17.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

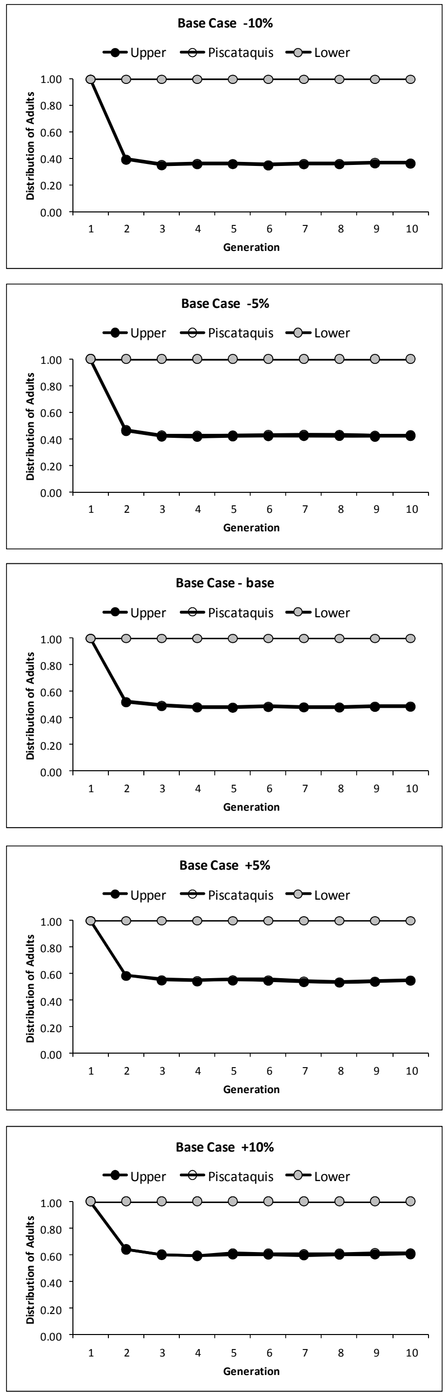

Figure 6.17.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Base Case scenario.

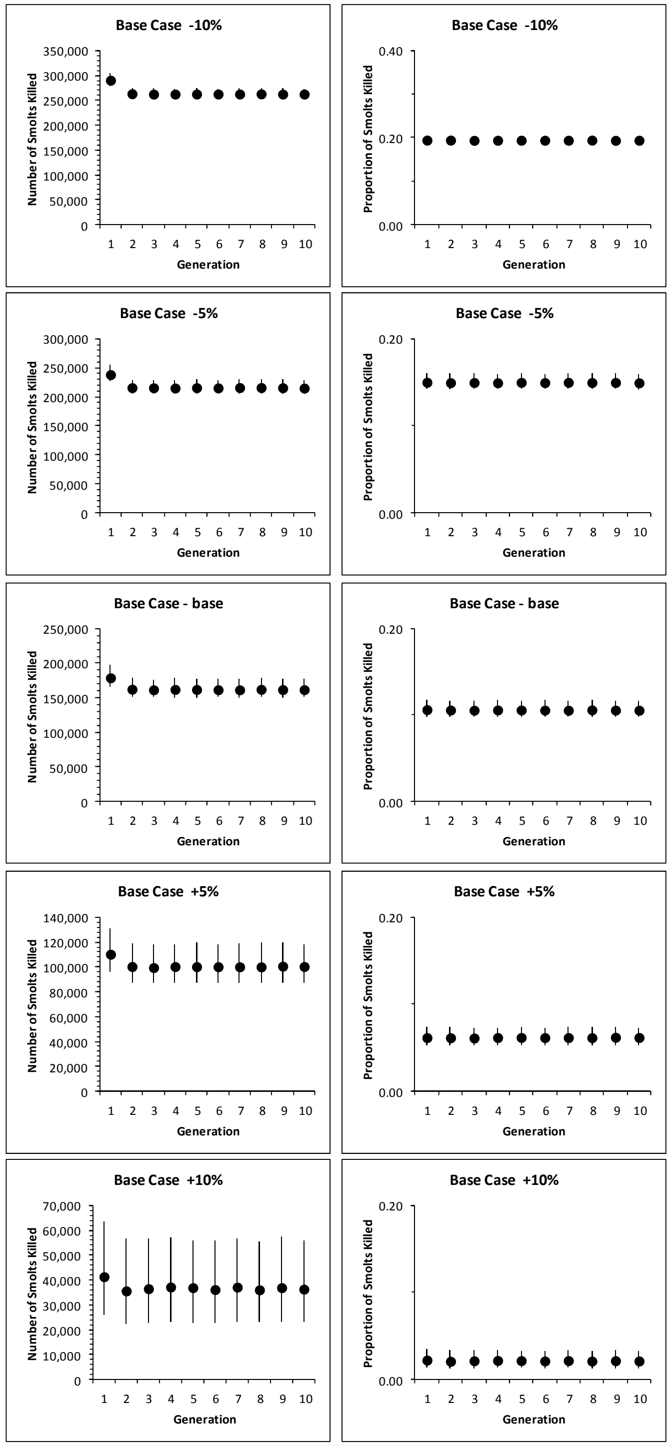

Figure 6.17.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Base Case scenario.

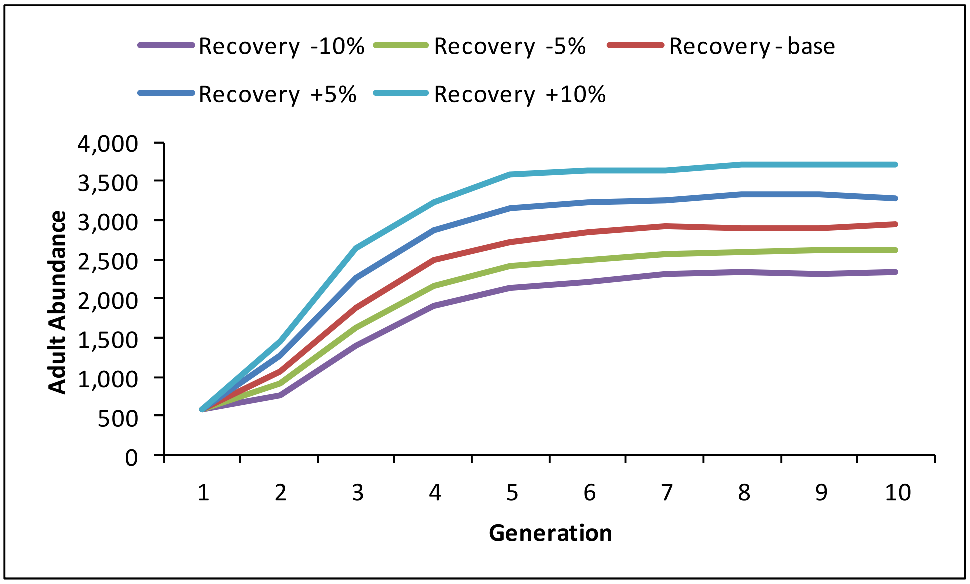

Figure 6.17.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

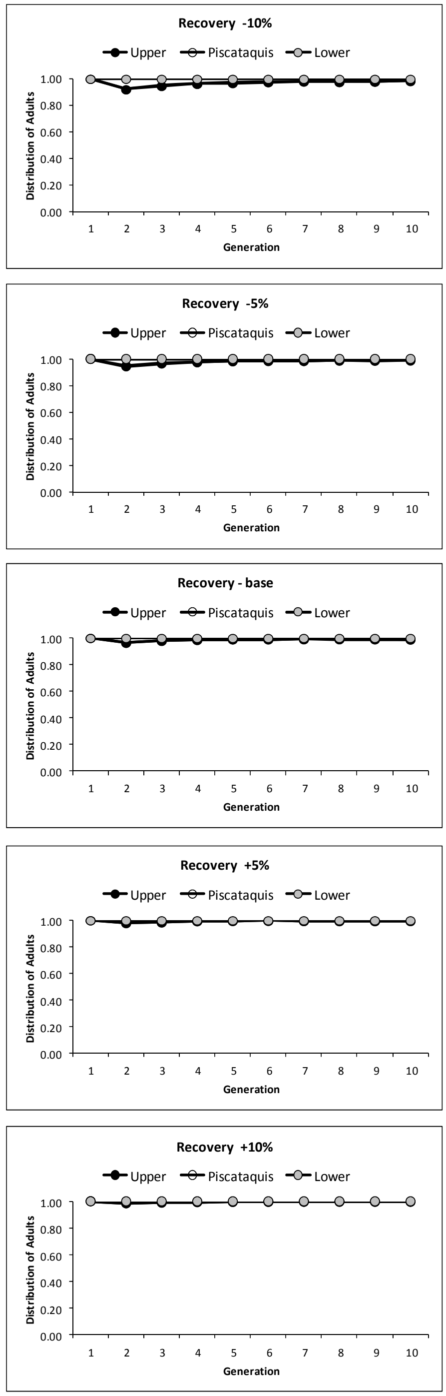

Figure 6.17.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Recovery scenario.

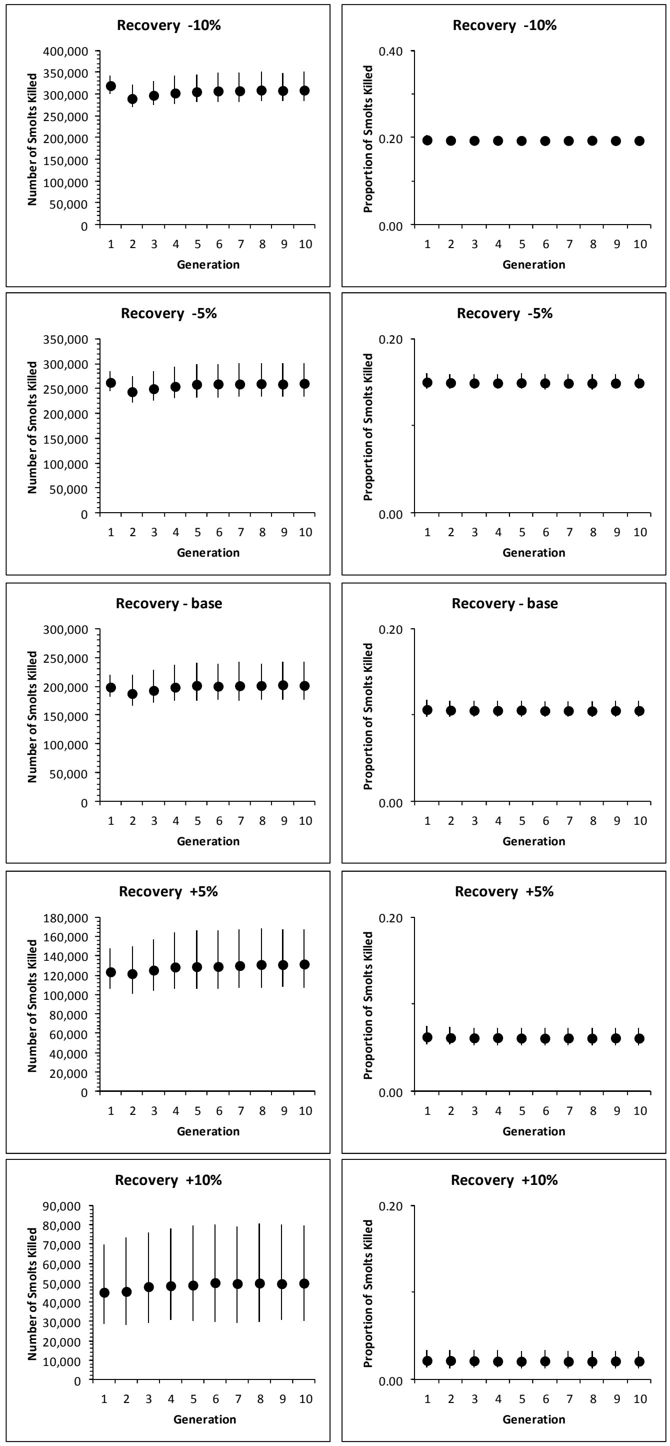

Figure 6.17.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for downstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Recovery scenario.

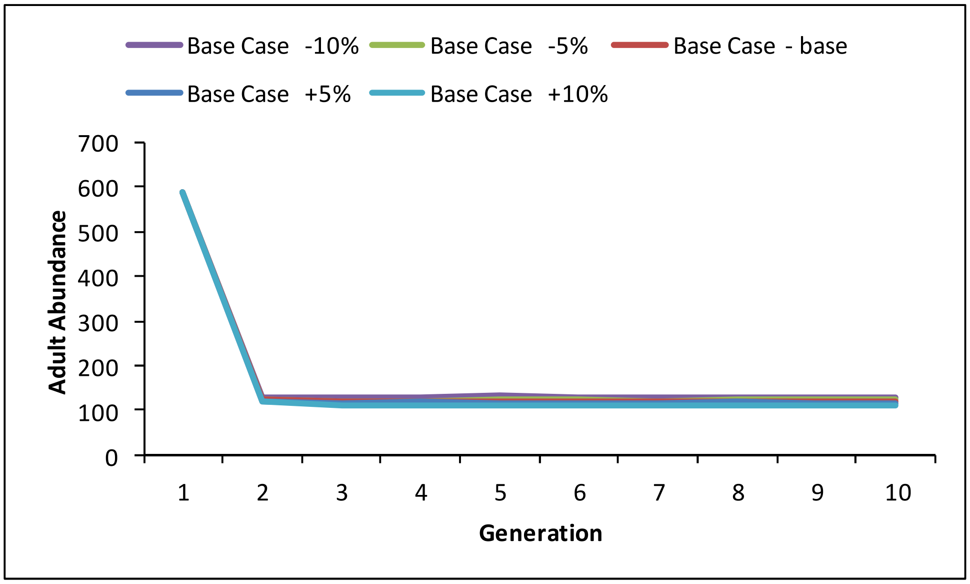

Figure 6.18.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Base Case scenario.

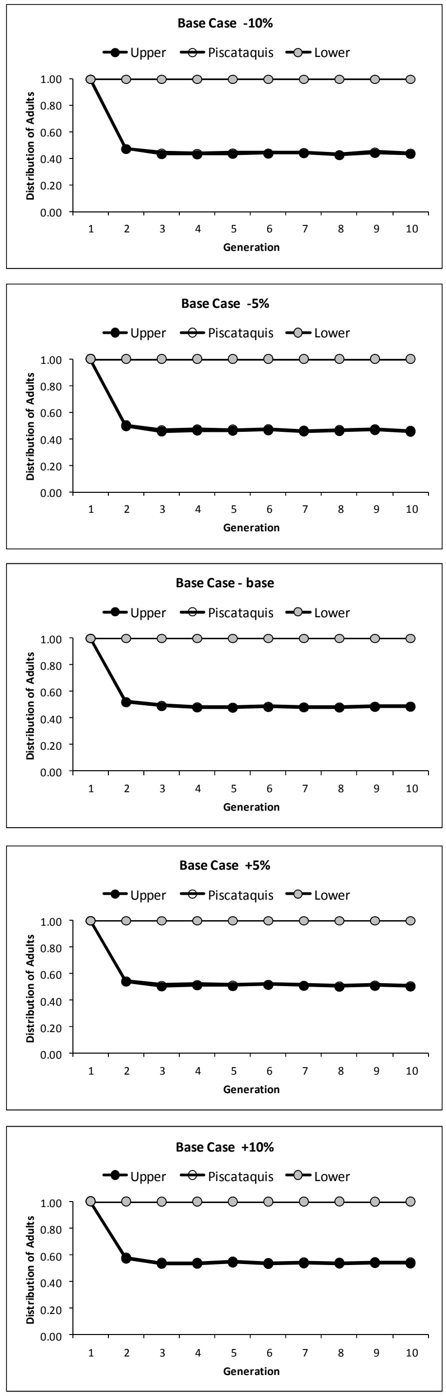

Figure 6.18.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Base Case scenario.

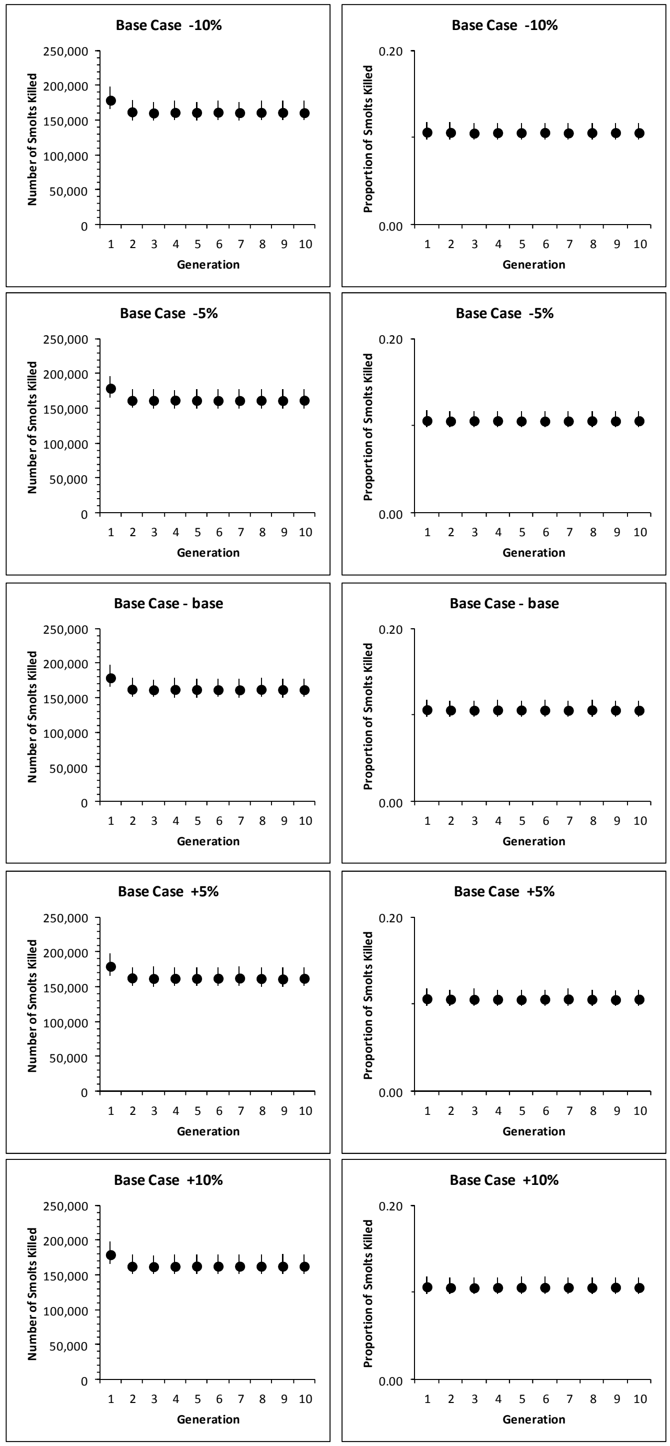

Figure 6.18.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Base Case scenario.

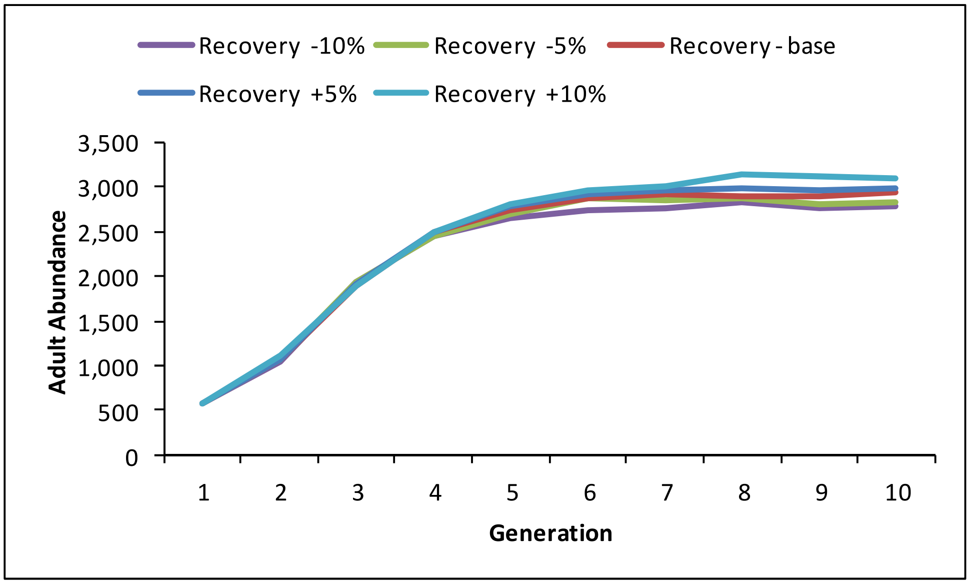

Figure 6.18.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) under the Recovery scenario.

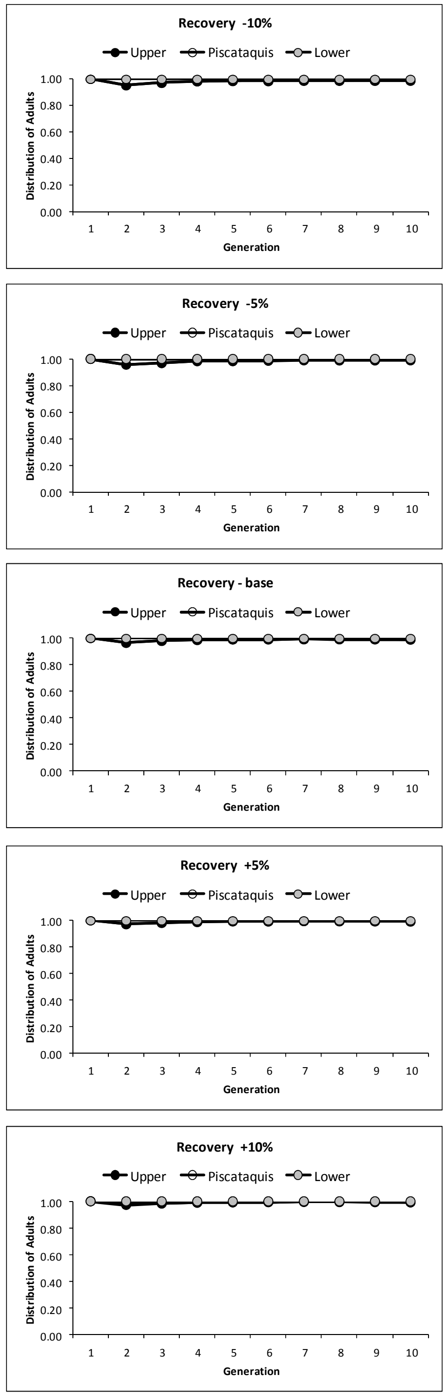

Figure 6.18.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Recovery scenario.

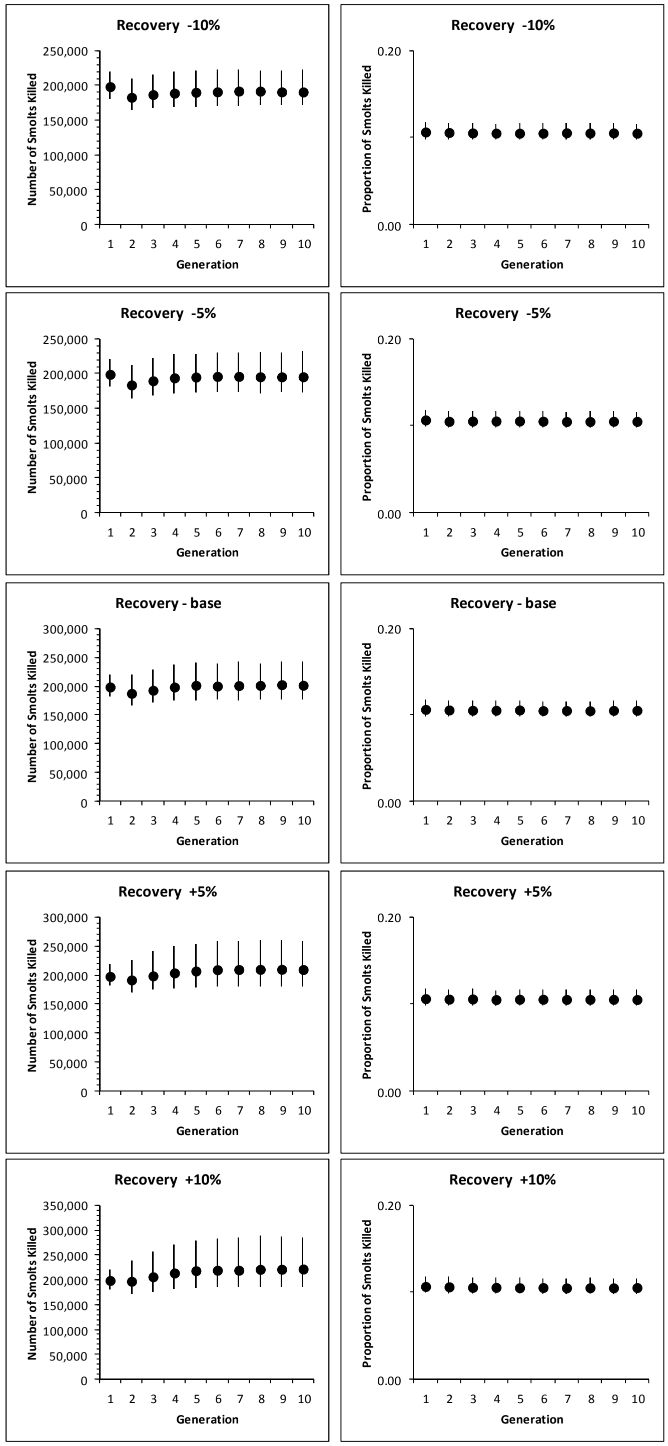

Figure 6.18.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for upstream dam passage survival rates decreased by 10%, decreased by 5%, set at the base, increased by 5%, and increased by 10% (with survival capped at one) (top to bottom, respectively) under the Recovery scenario.

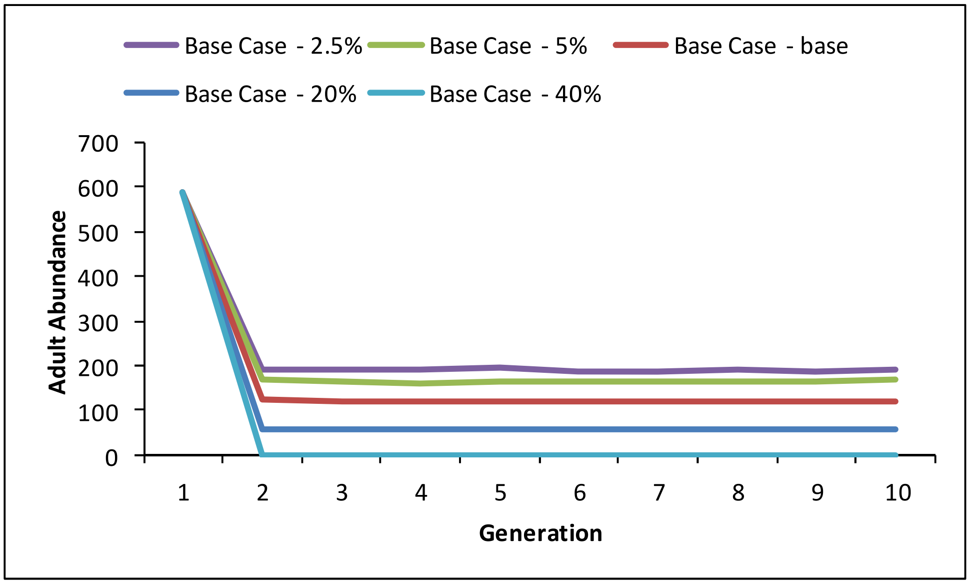

Figure 6.19.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Base Case scenario.

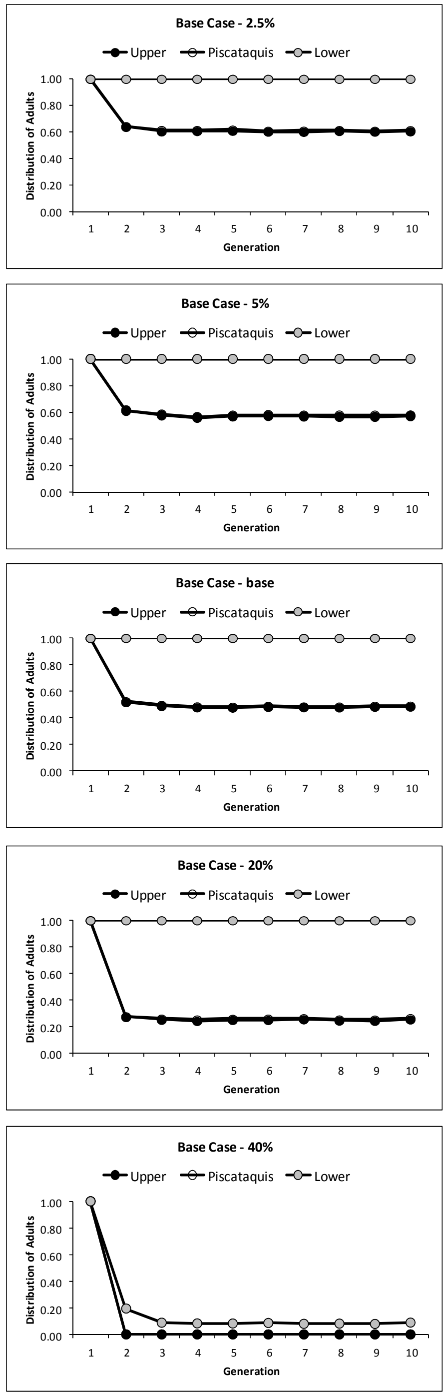

Figure 6.19.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, top to bottom, respectively) under the Base Case scenario.

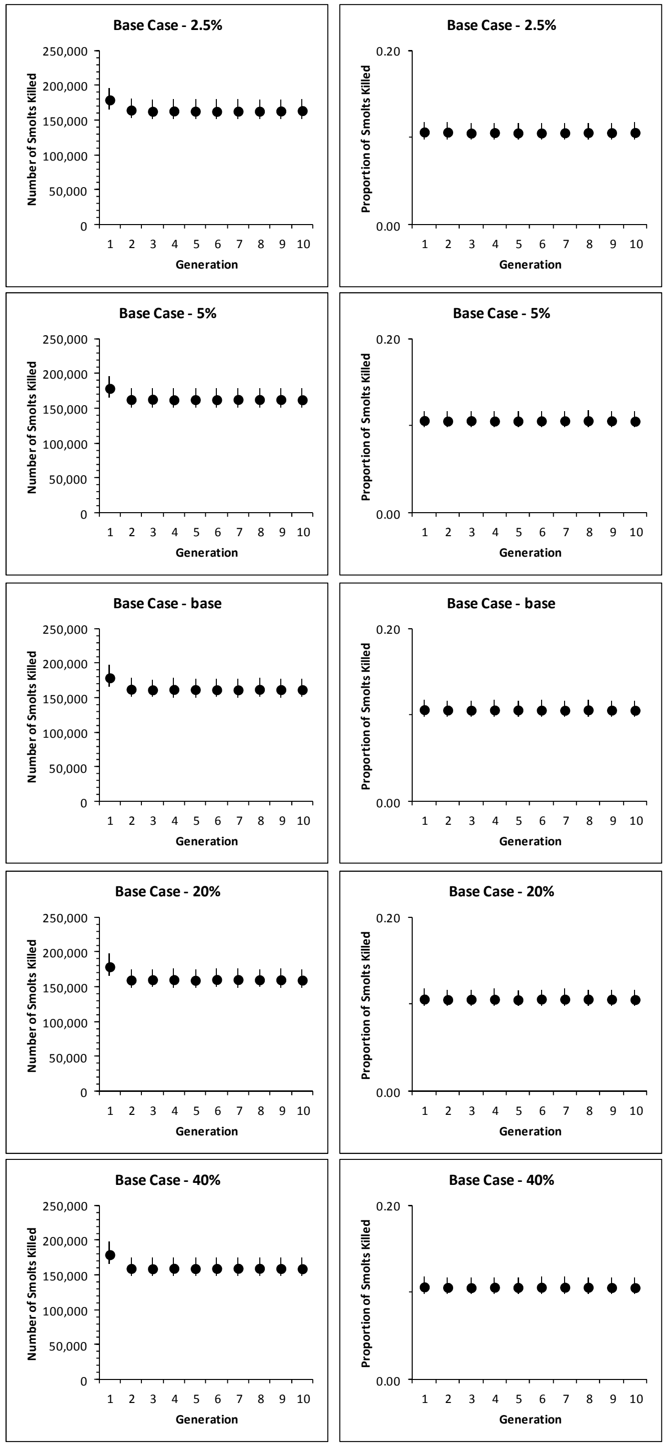

Figure 6.19.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, top to bottom, respectively) under the Base Case scenario.

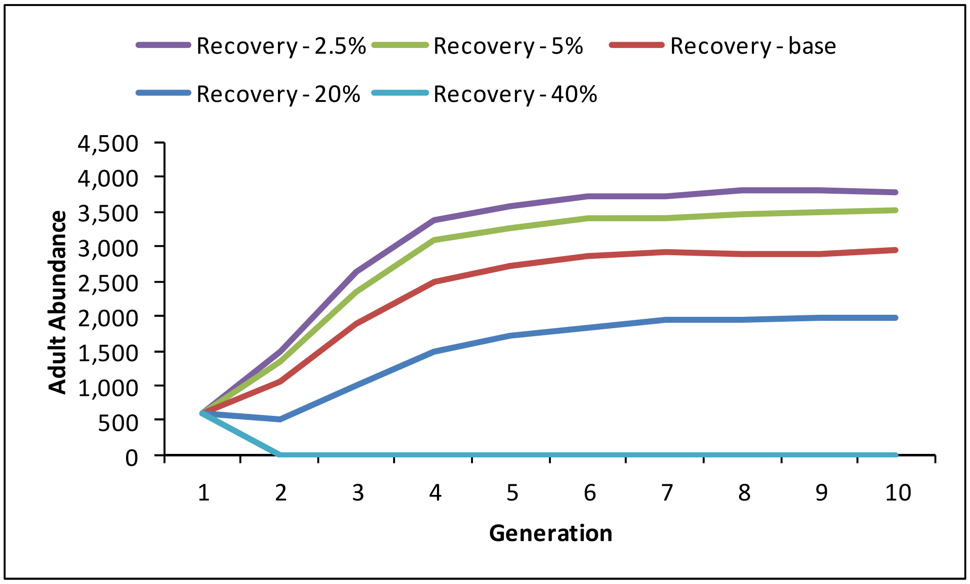

Figure 6.19.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, respectively) under the Recovery scenario.

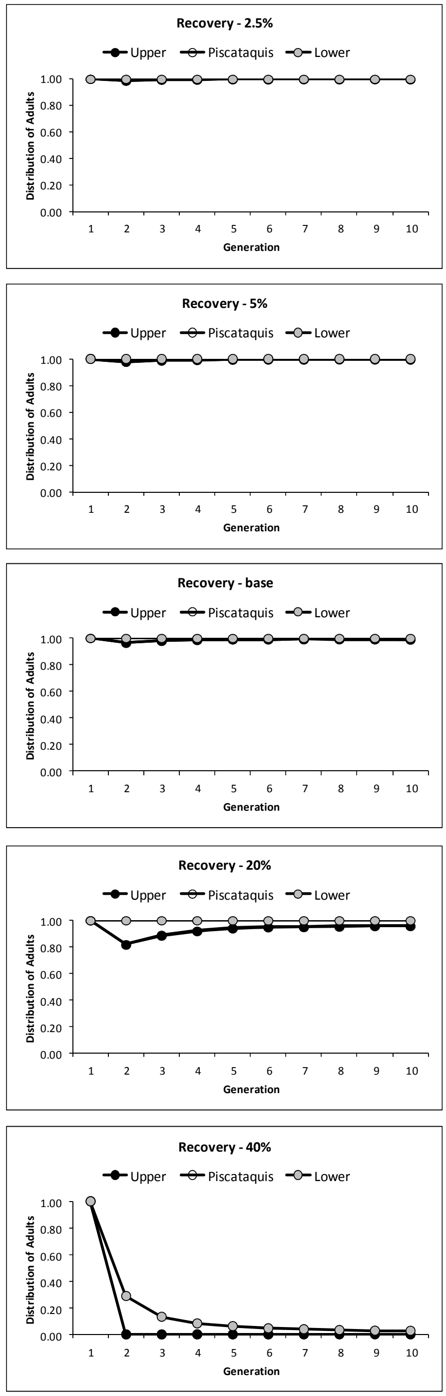

Figure 6.19.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, top to bottom, respectively) under the Recovery scenario.

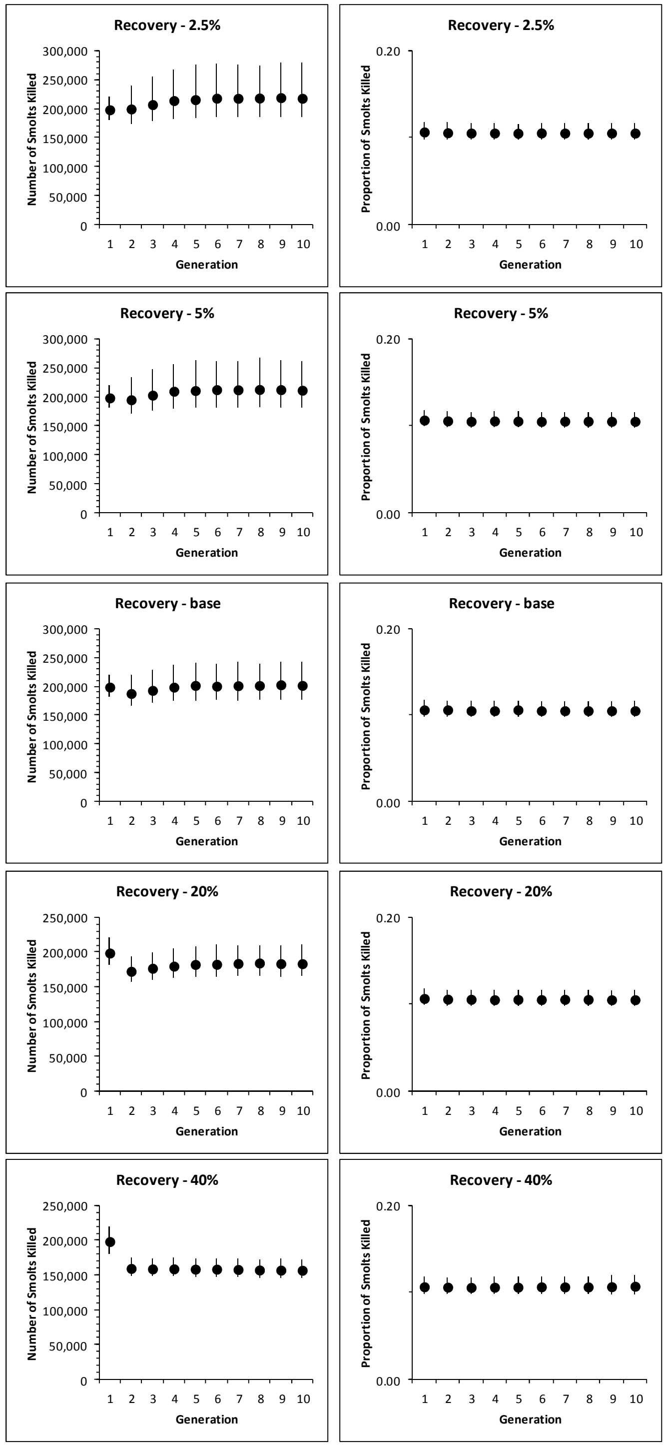

Figure 6.19.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base indirect latent mortality rate (i.e., 2.5%, 5%, 10%, 20%, and 40% per dam, top to bottom, respectively) under the Recovery scenario.

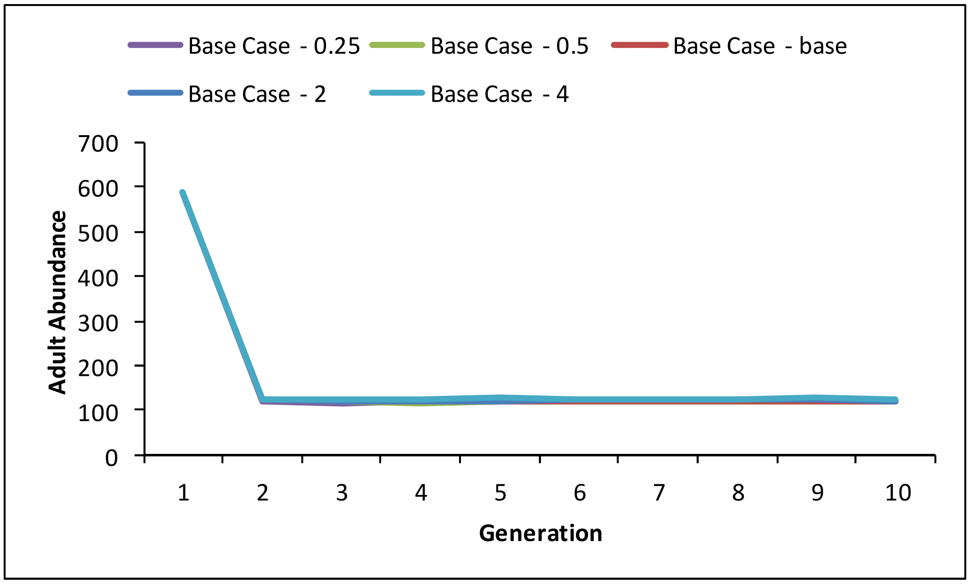

Figure 6.20.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Base Case scenario.

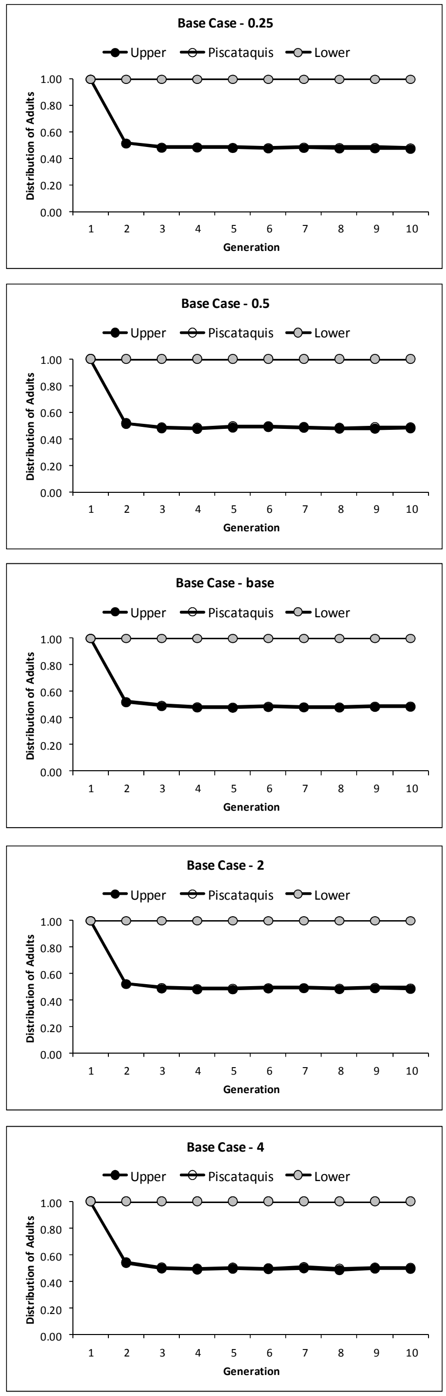

Figure 6.20.1.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) (top to bottom, respectively) under the Base Case scenario.

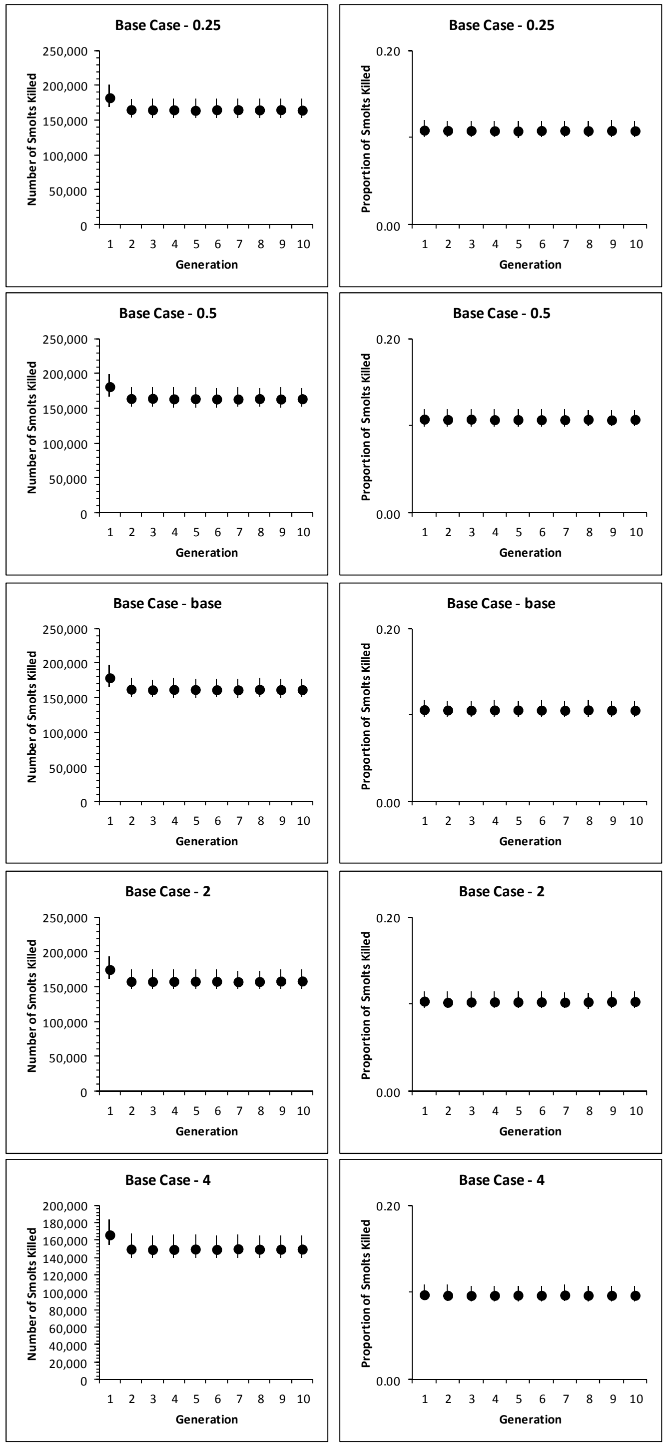

Figure 6.20.1.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) (top to bottom, respectively) under the Base Case scenario.

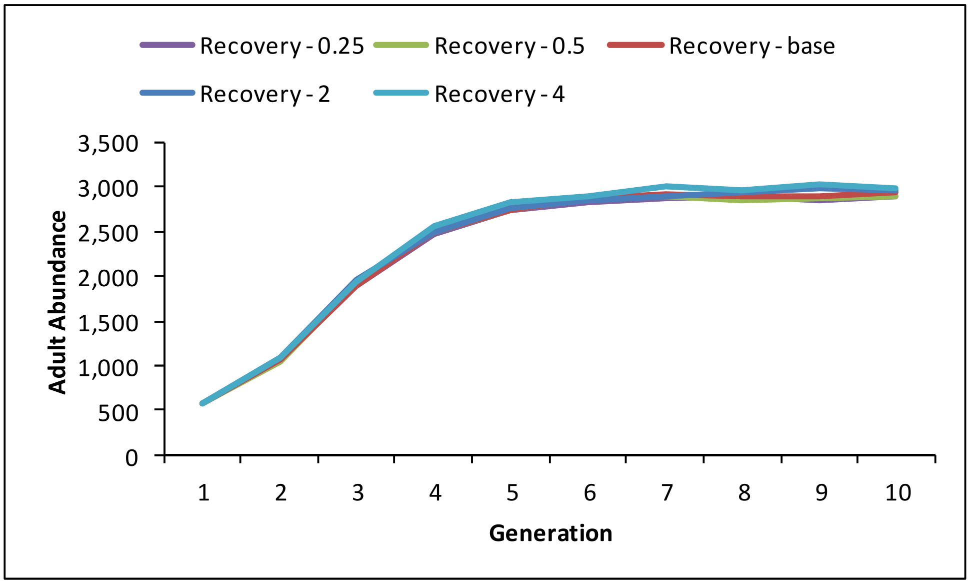

Figure 6.20.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) under the Recovery scenario.

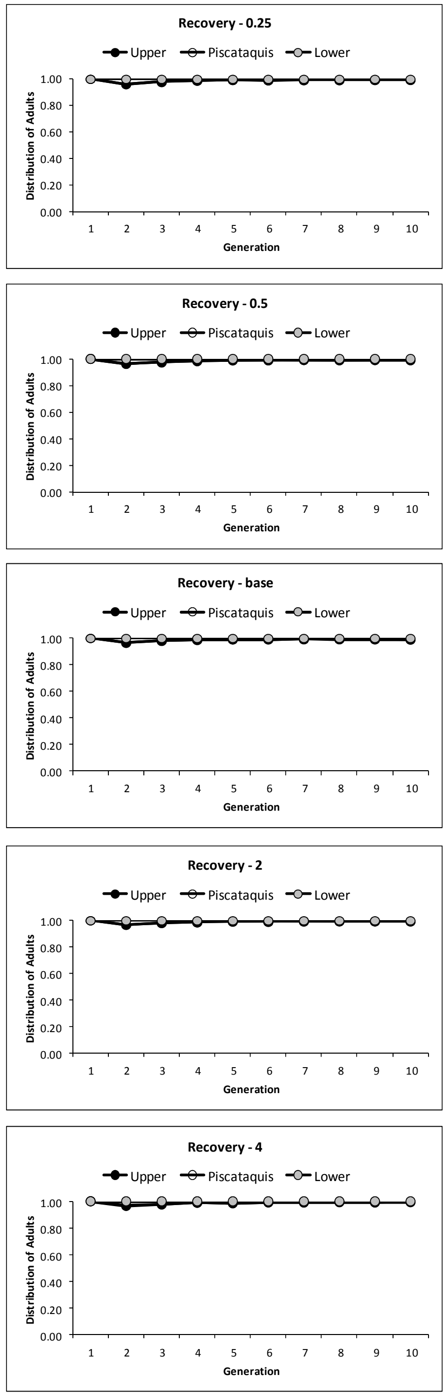

Figure 6.20.2.2. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) (top to bottom, respectively) under the Recovery scenario.

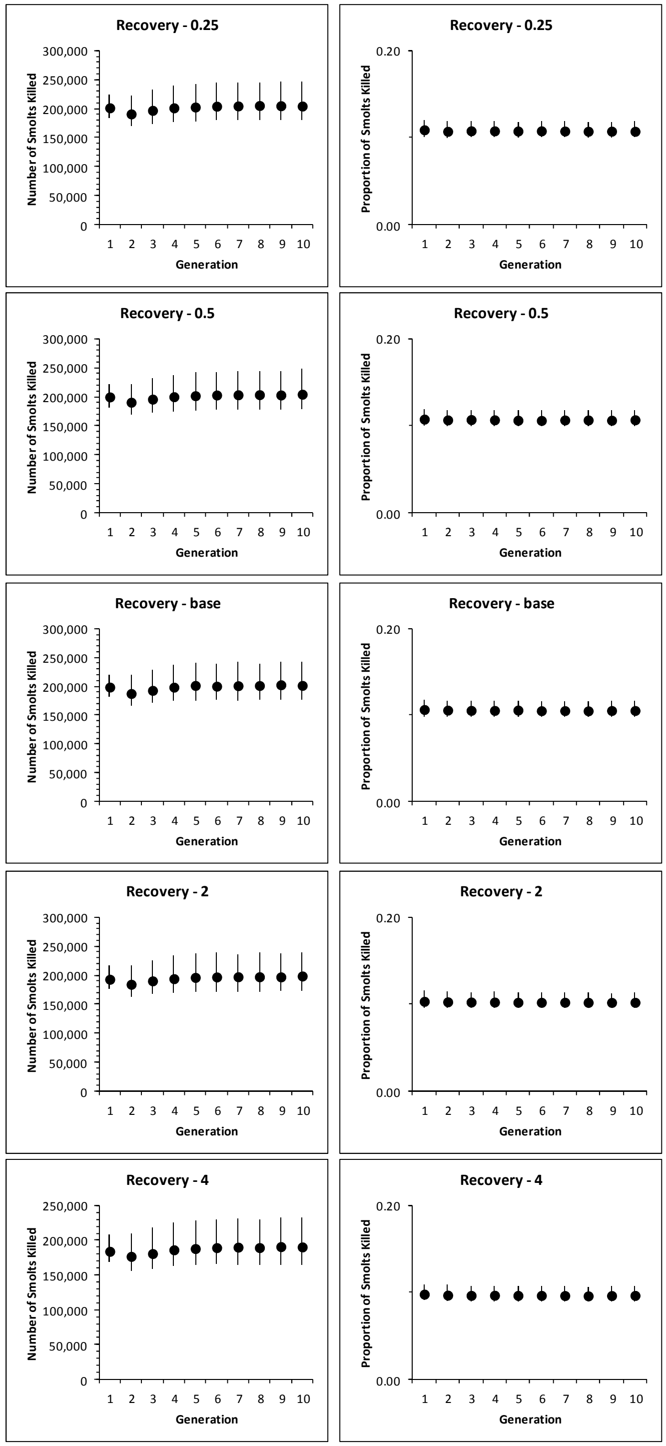

Figure 6.20.2.3. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for downstream path choice rates for the Stillwater Branch of 0.25, 0.5, 1 (base), 2, and 4 times the base (with Stillwater Branch use capped at one) (top to bottom, respectively) under the Recovery scenario.

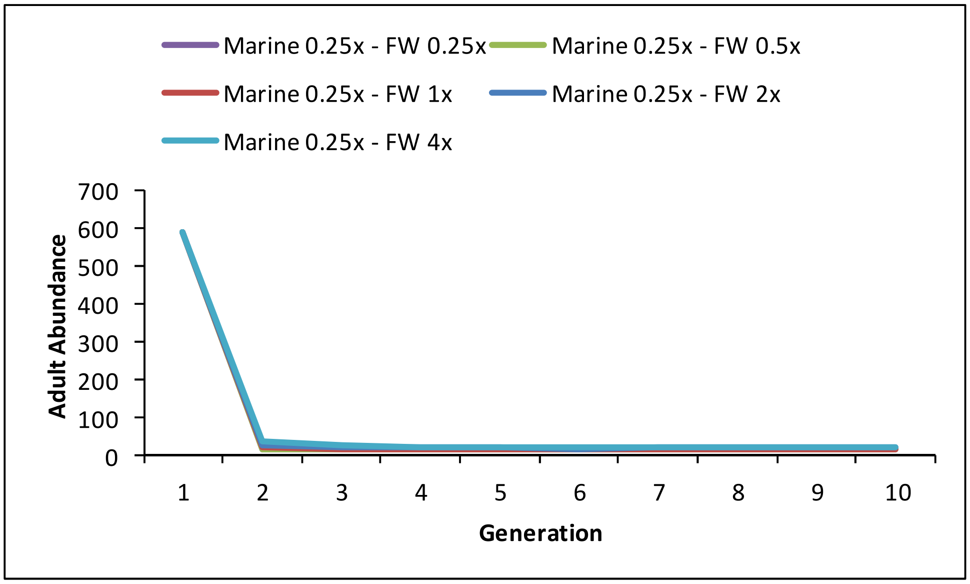

Figure 6.21.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned on.

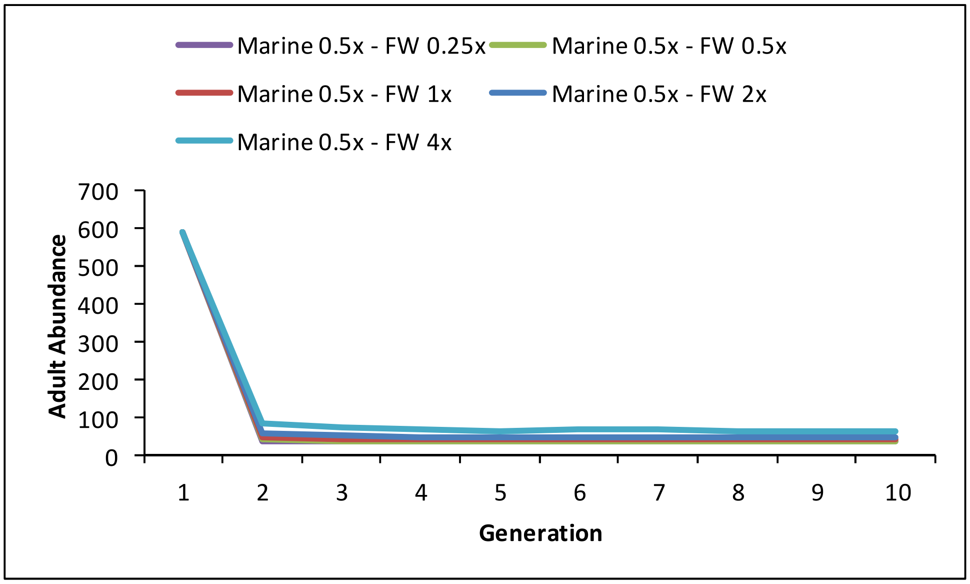

Figure 6.21.1.2. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned on.

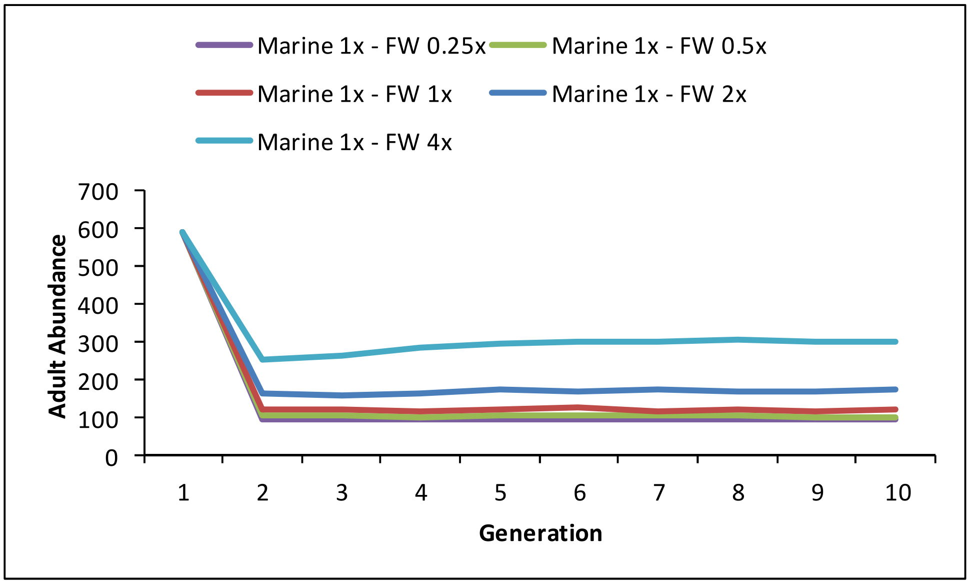

Figure 6.21.1.3. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned on.

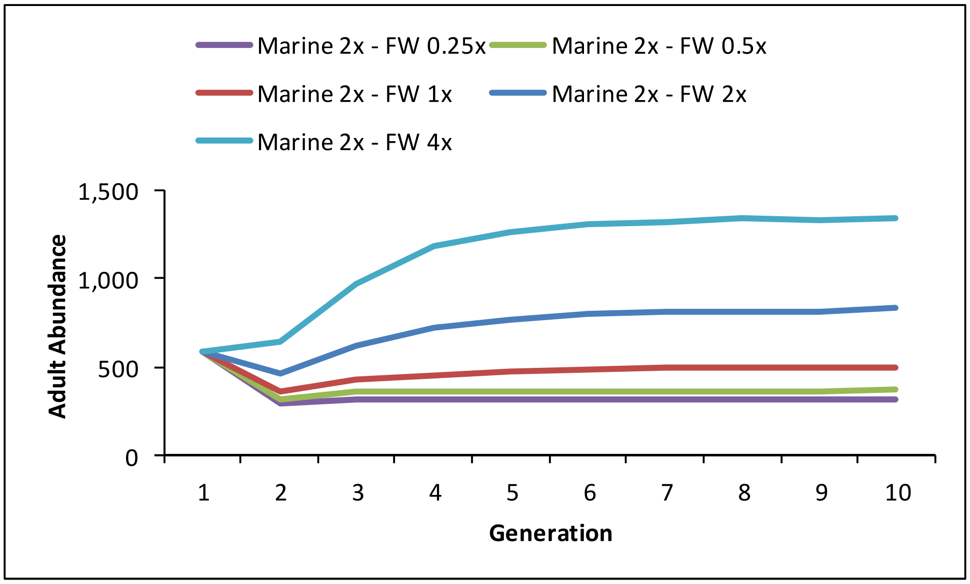

Figure 6.21.1.4. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned on.

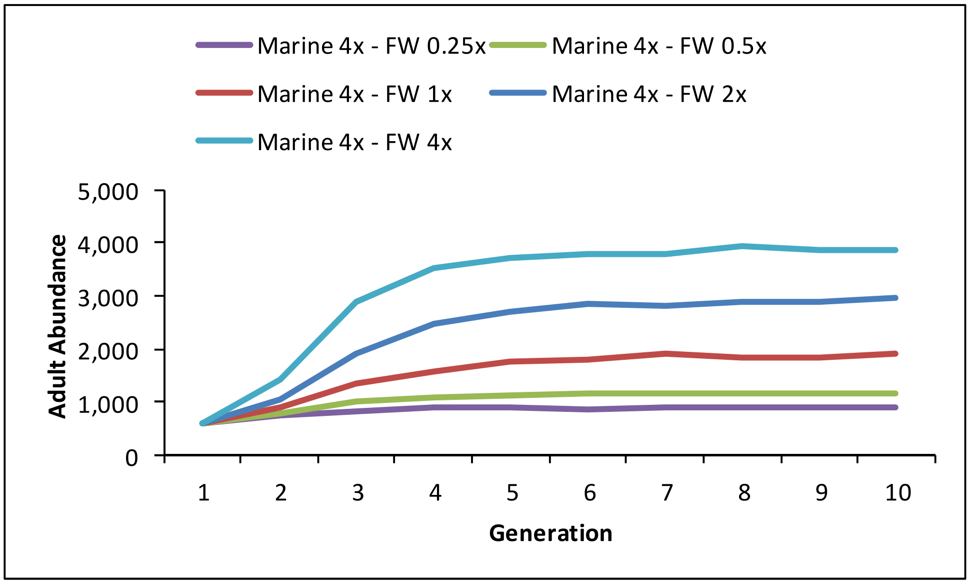

Figure 6.21.1.5. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned on.

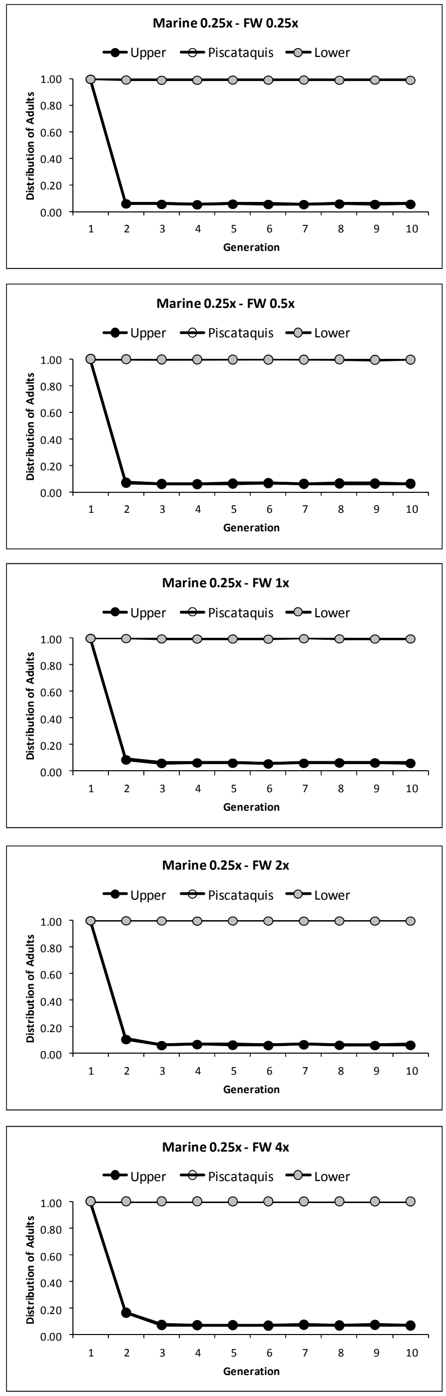

Figure 6.21.1.6. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.25 times the base case marine survival rate and the hatchery turned on.

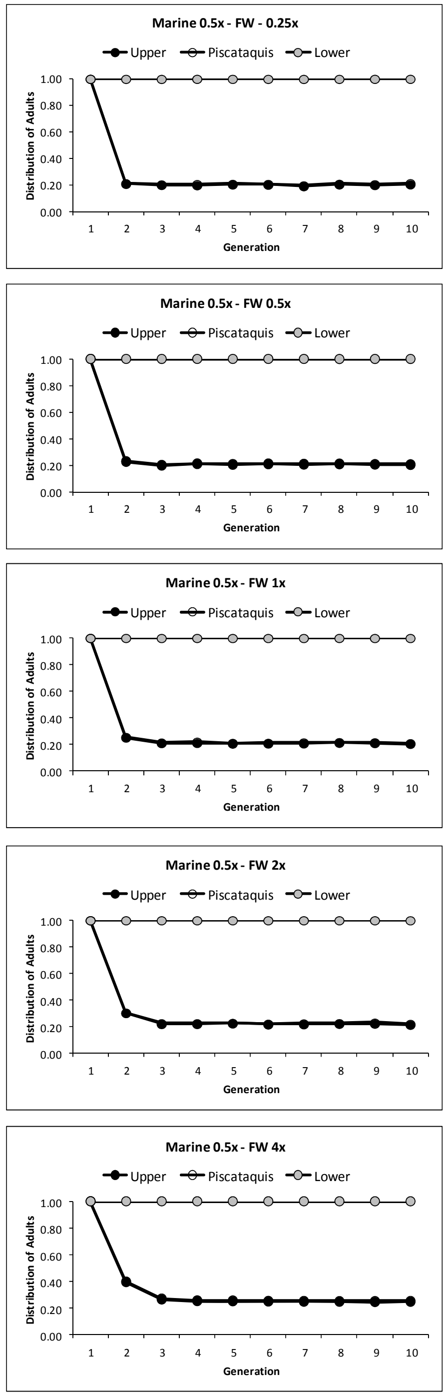

Figure 6.21.1.7. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.5 times the base case marine survival rate and the hatchery turned on.

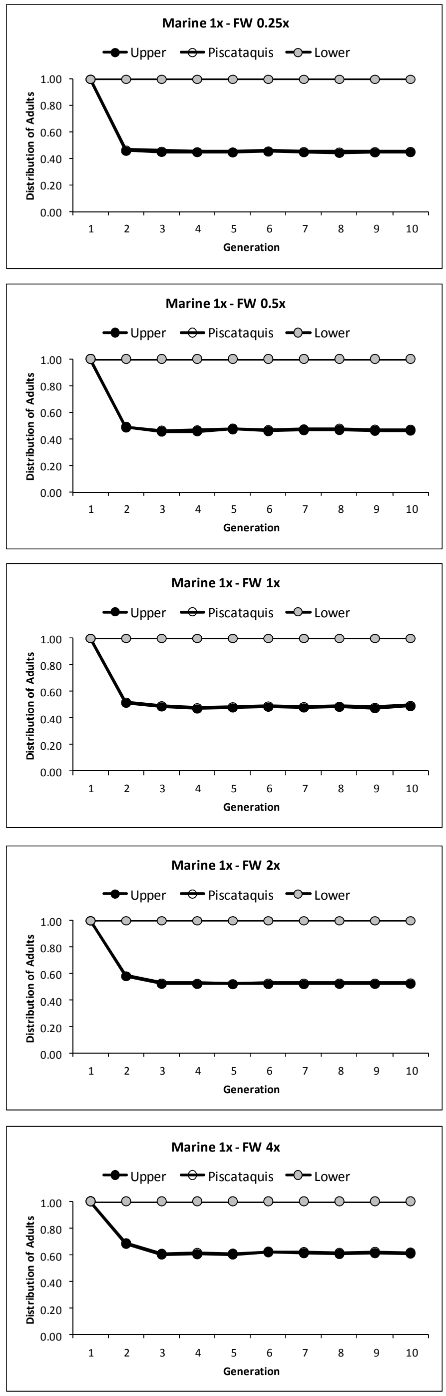

Figure 6.21.1.8. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 1 times the base case marine survival rate and the hatchery turned on.

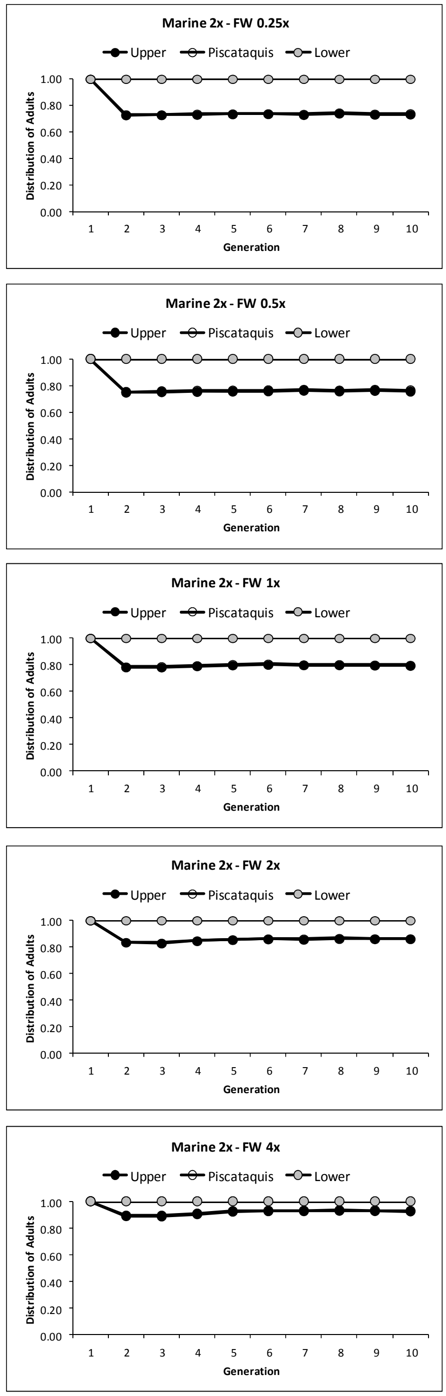

Figure 6.21.1.9. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 2 times the base case marine survival rate and the hatchery turned on.

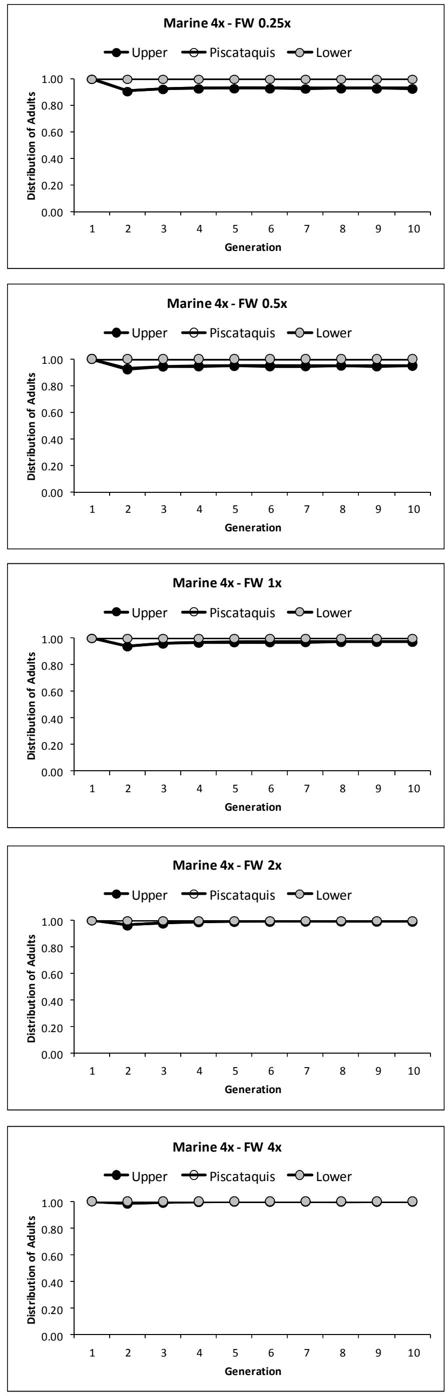

Figure 6.21.1.10. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 4 times the base case marine survival rate and the hatchery turned on.

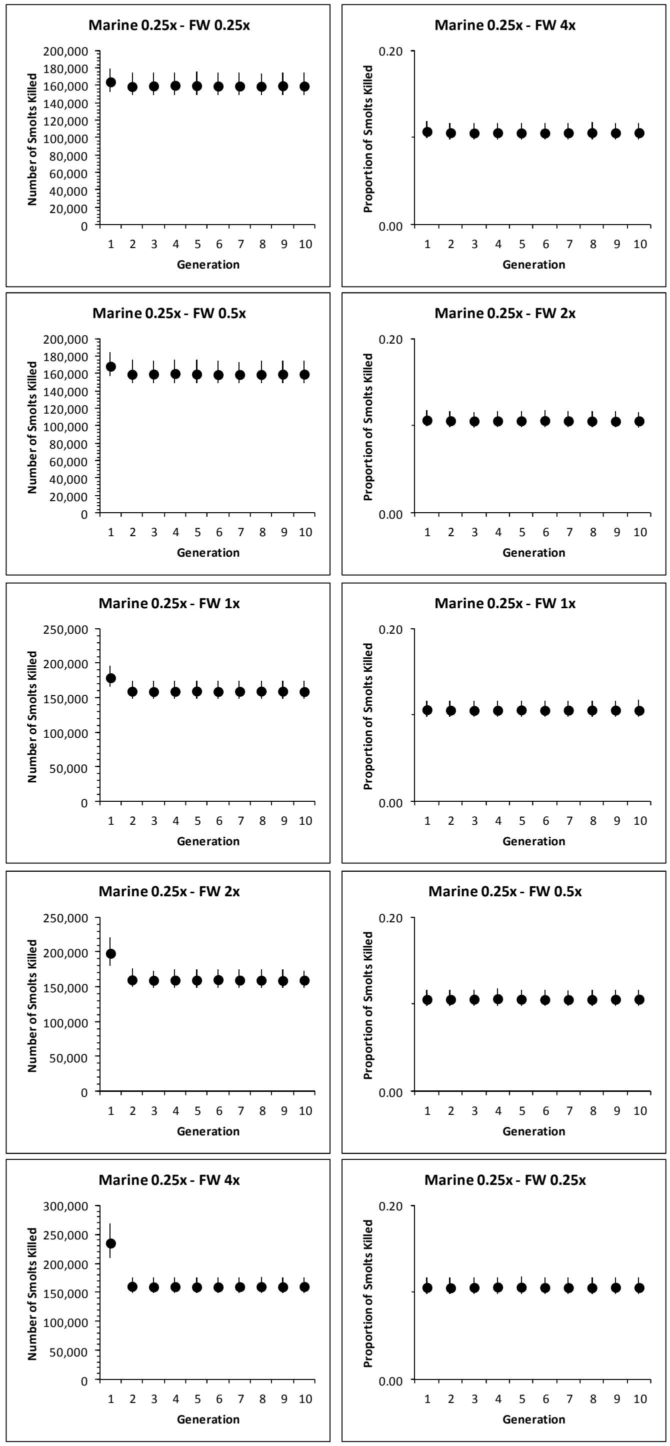

Figure 6.21.1.11. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.25 times the base case marine survival rate and the hatchery turned on.

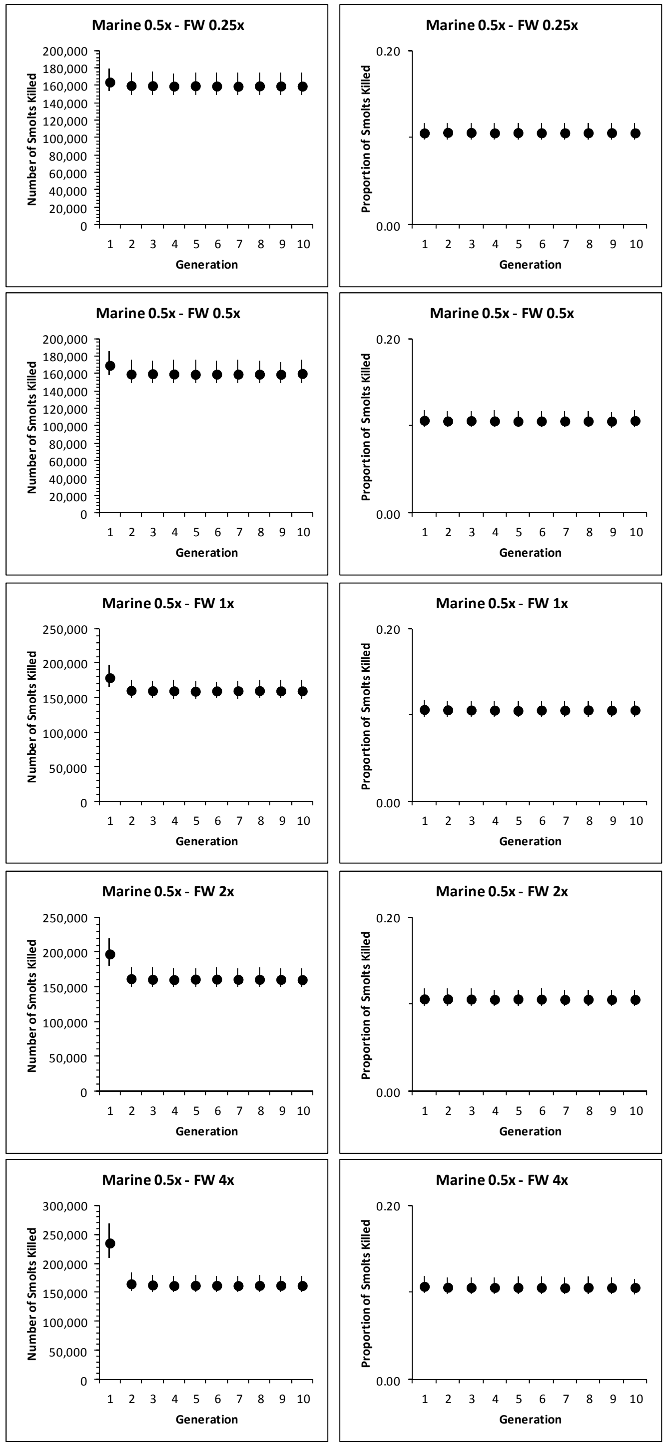

Figure 6.21.1.12. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.5 times the base case marine survival rate and the hatchery turned on.

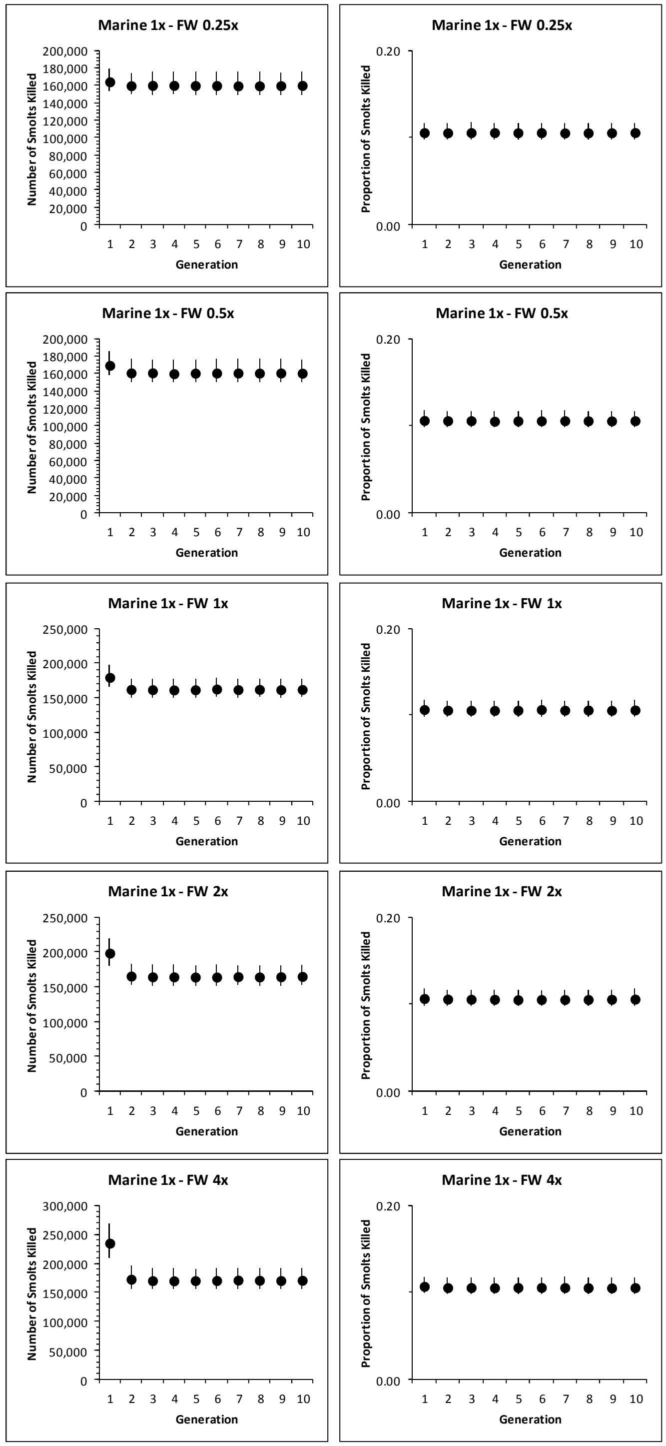

Figure 6.21.1.13. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 1 times the base case marine survival rate and the hatchery turned on.

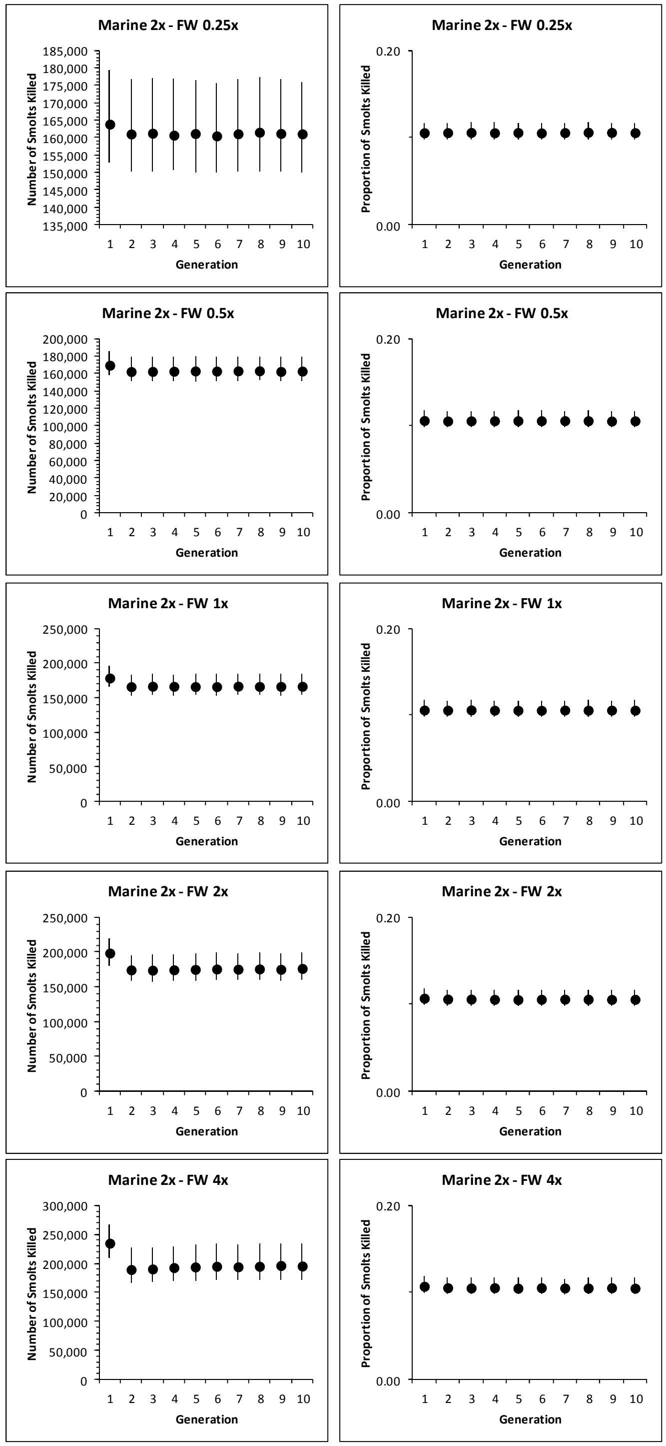

Figure 6.21.1.14. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 2 times the base case marine survival rate and the hatchery turned on.

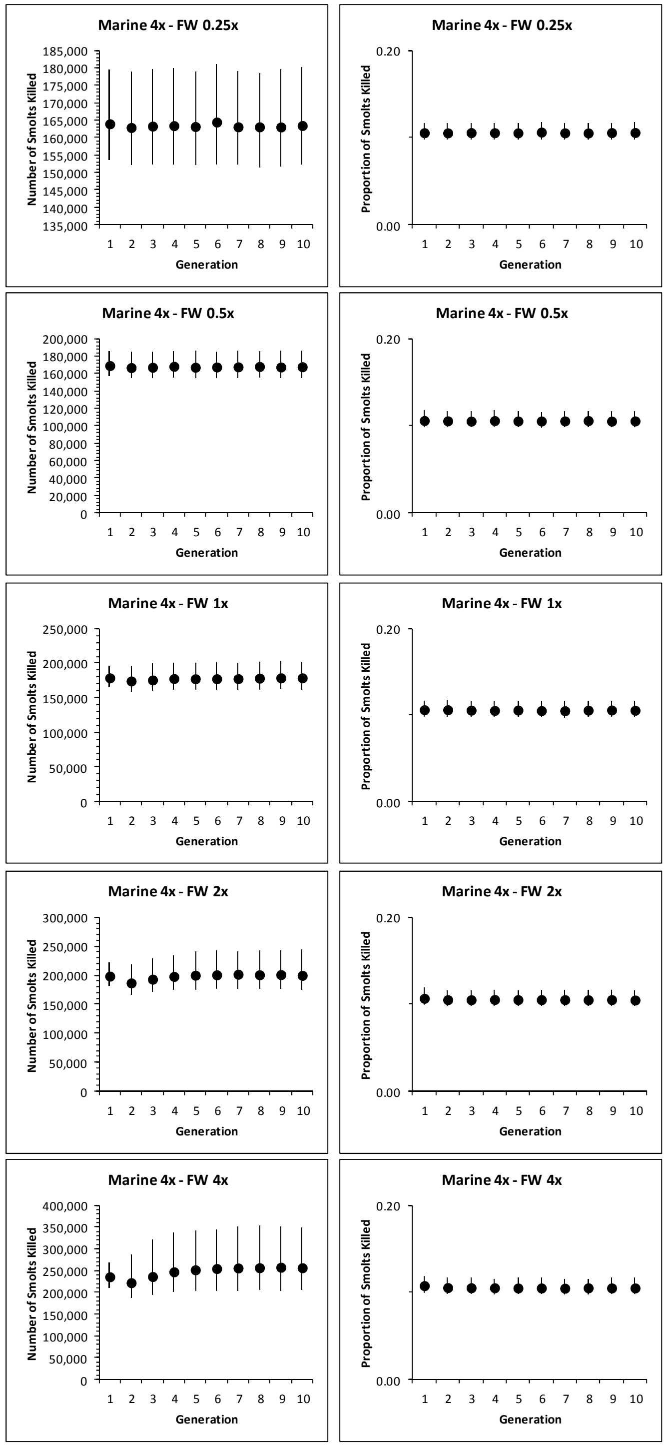

Figure 6.21.1.15. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 4 times the base case marine survival rate and the hatchery turned on.

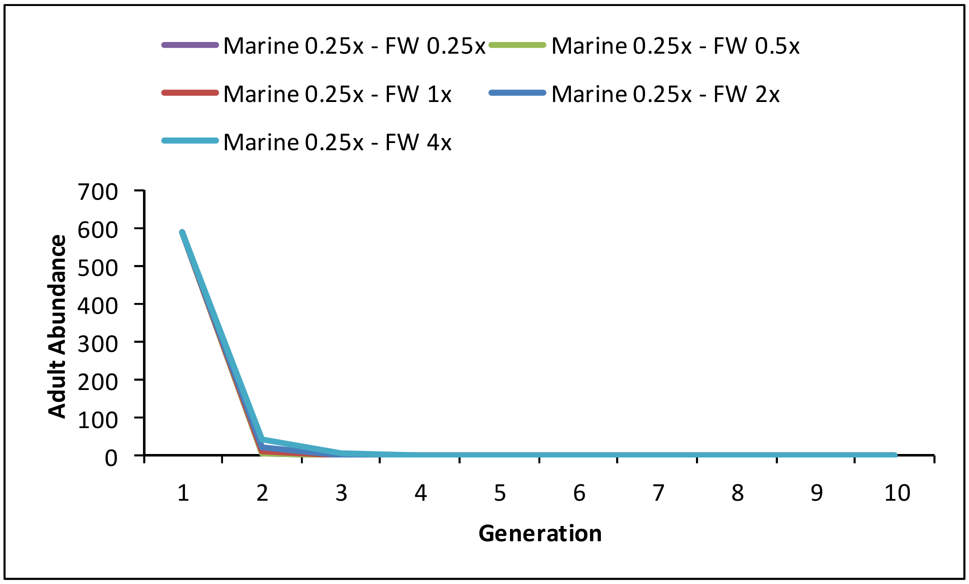

Figure 6.21.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.25 times the base case marine survival rate and the hatchery turned off.

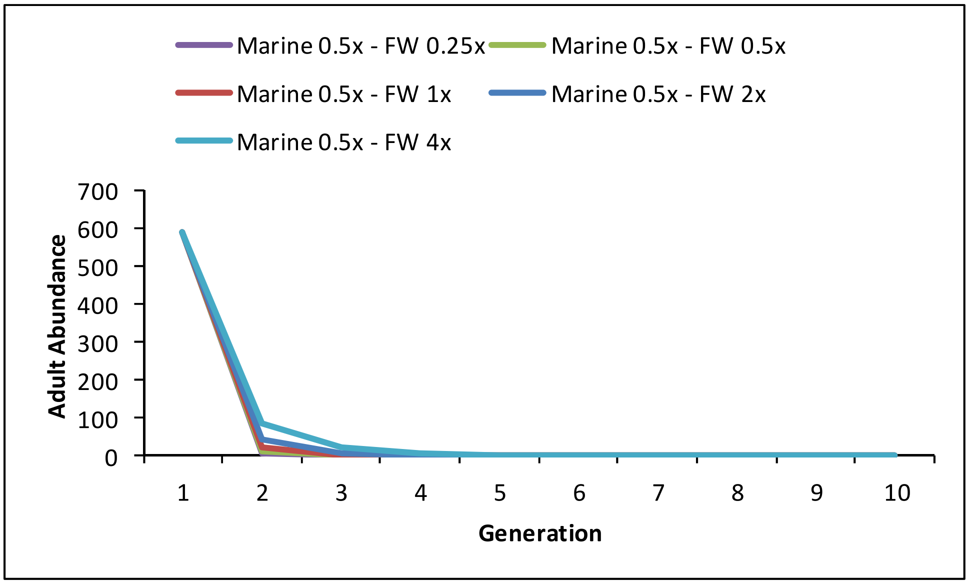

Figure 6.21.2.2. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 0.5 times the base case marine survival rate and the hatchery turned off.

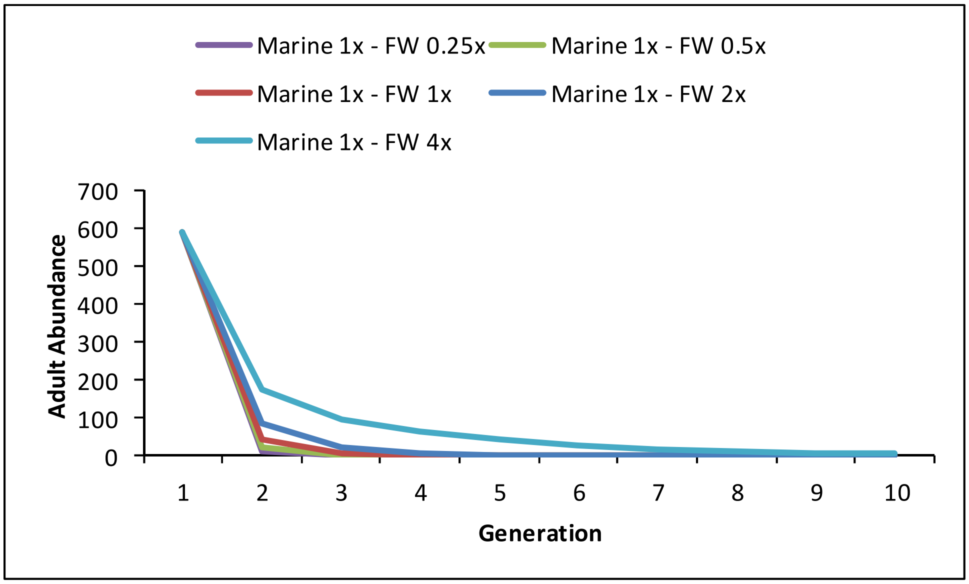

Figure 6.21.2.3. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 1 times the base case marine survival rate and the hatchery turned off.

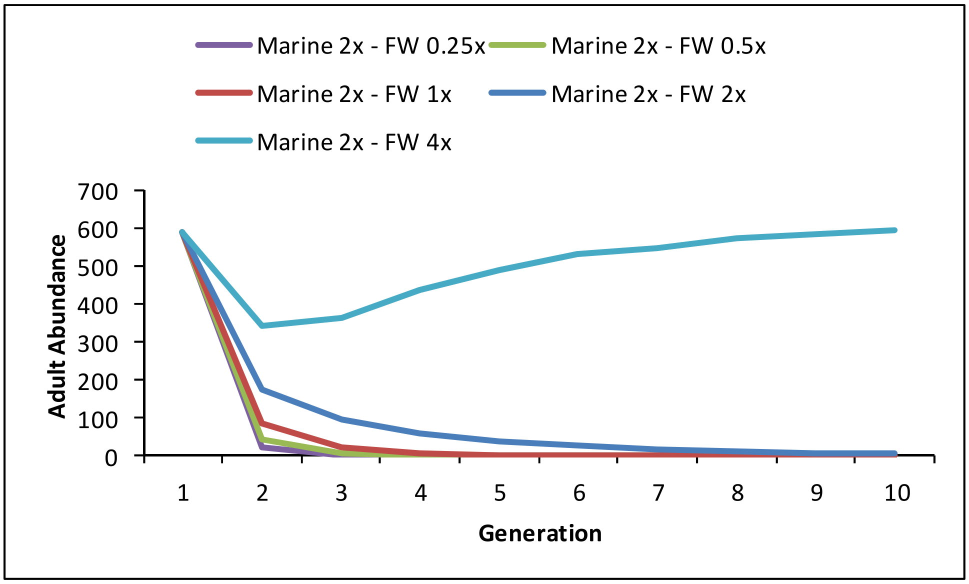

Figure 6.21.2.4. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 2 times the base case marine survival rate and the hatchery turned off.

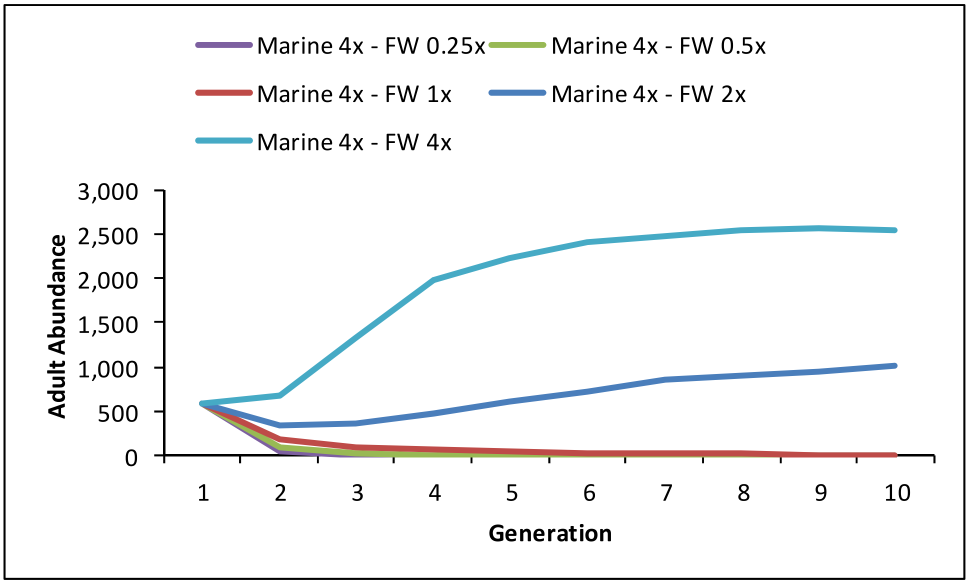

Figure 6.21.2.5. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate with 4 times the base case marine survival rate and the hatchery turned off.

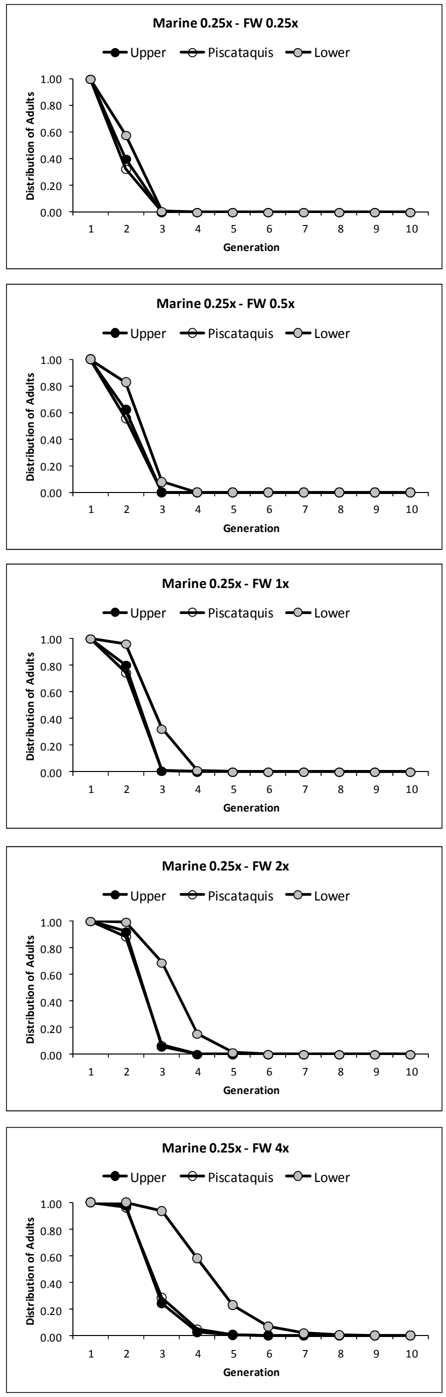

Figure 6.21.2.6. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.25 times the base case marine survival rate and the hatchery turned off.

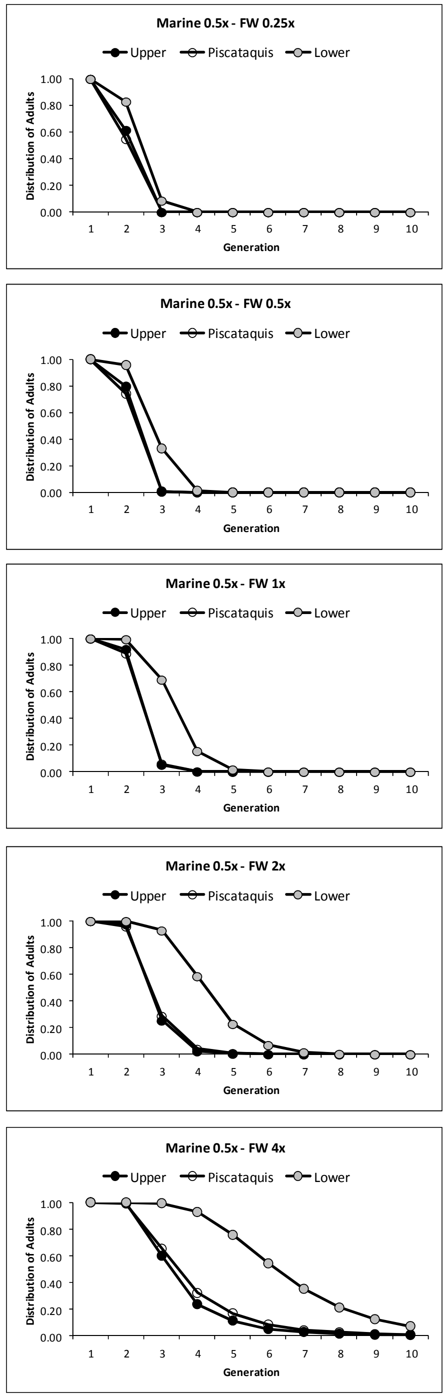

Figure 6.21.2.7. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.5 times the base case marine survival rate and the hatchery turned off.

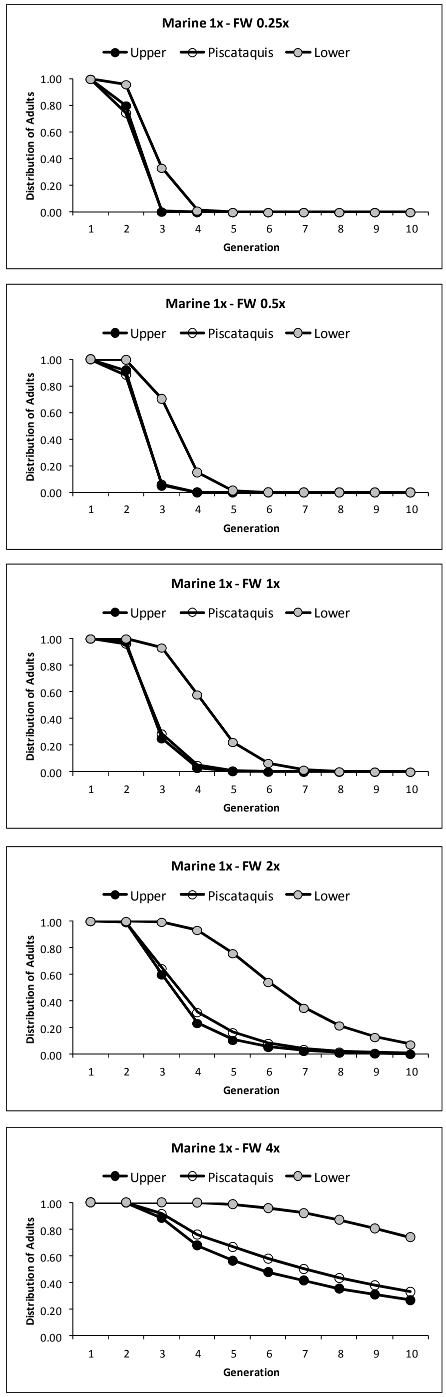

Figure 6.21.2.8. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 1 times the base case marine survival rate and the hatchery turned off.

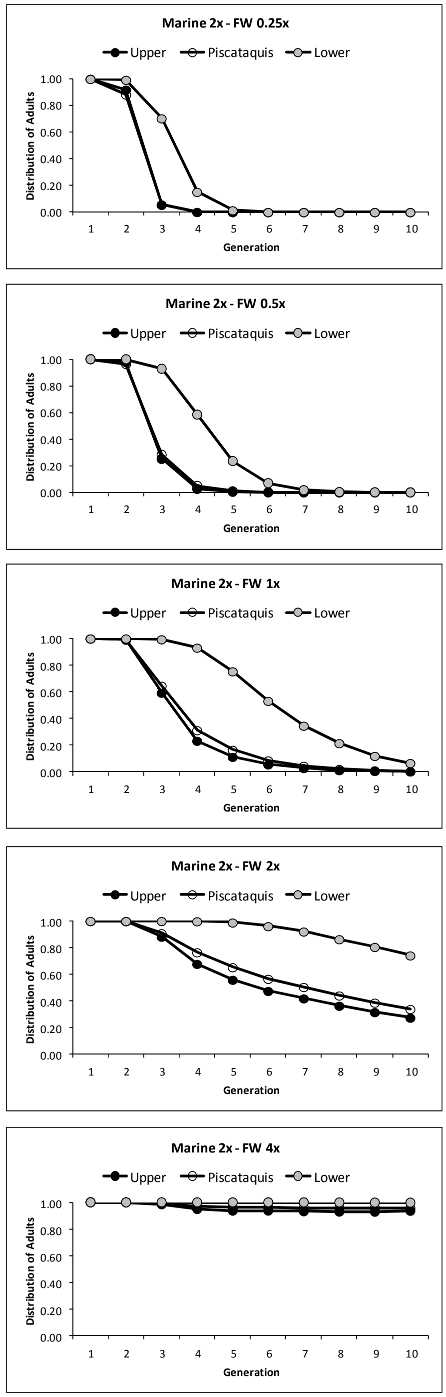

Figure 6.21.2.9. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 2 times the base case marine survival rate and the hatchery turned off.

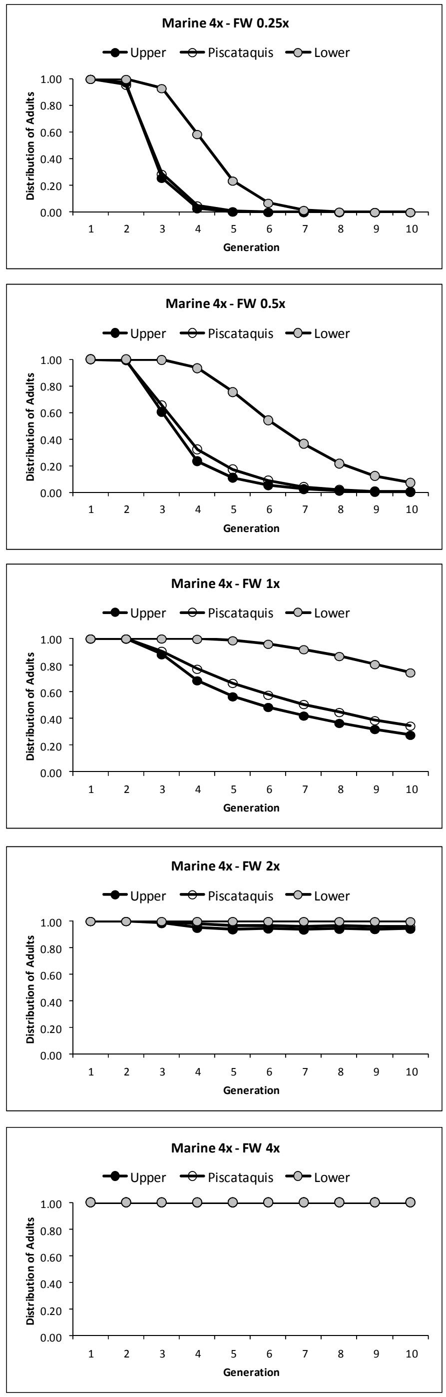

Figure 6.21.2.10. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 4 times the base case marine survival rate and the hatchery turned off.

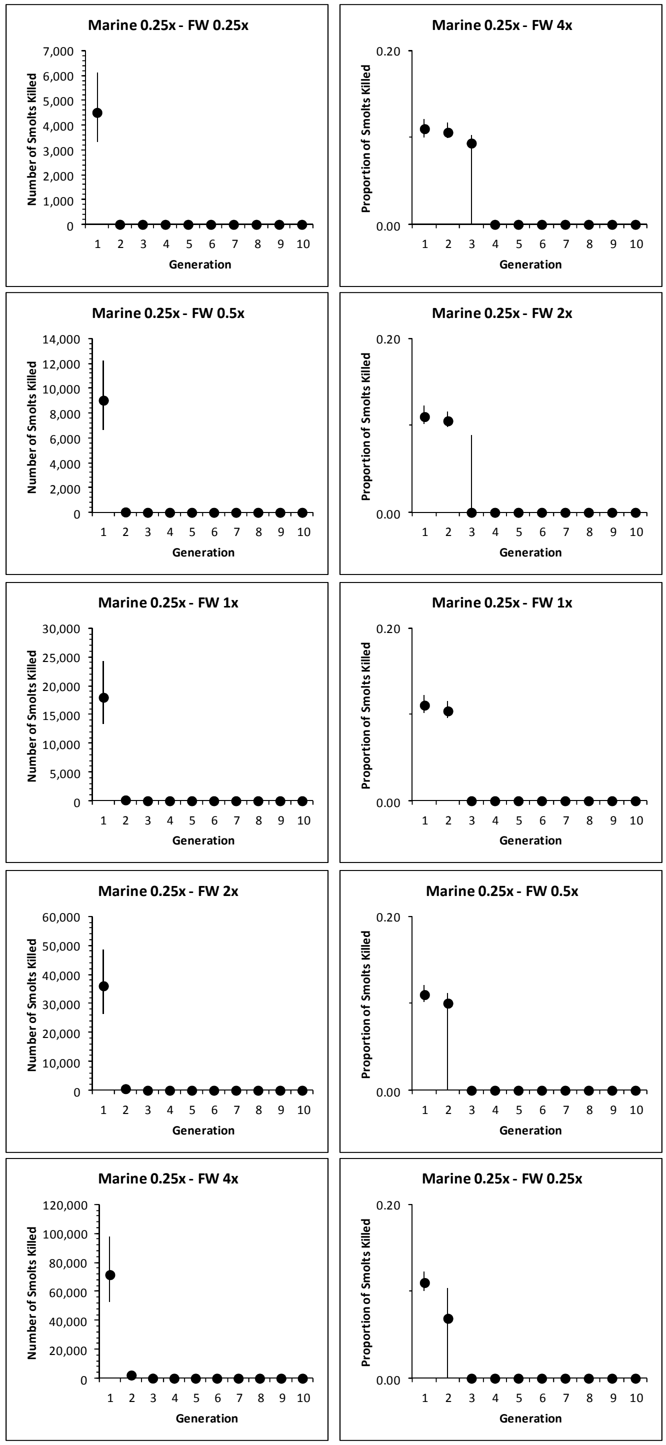

Figure 6.21.2.11. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.25 times the base case marine survival rate and the hatchery turned off.

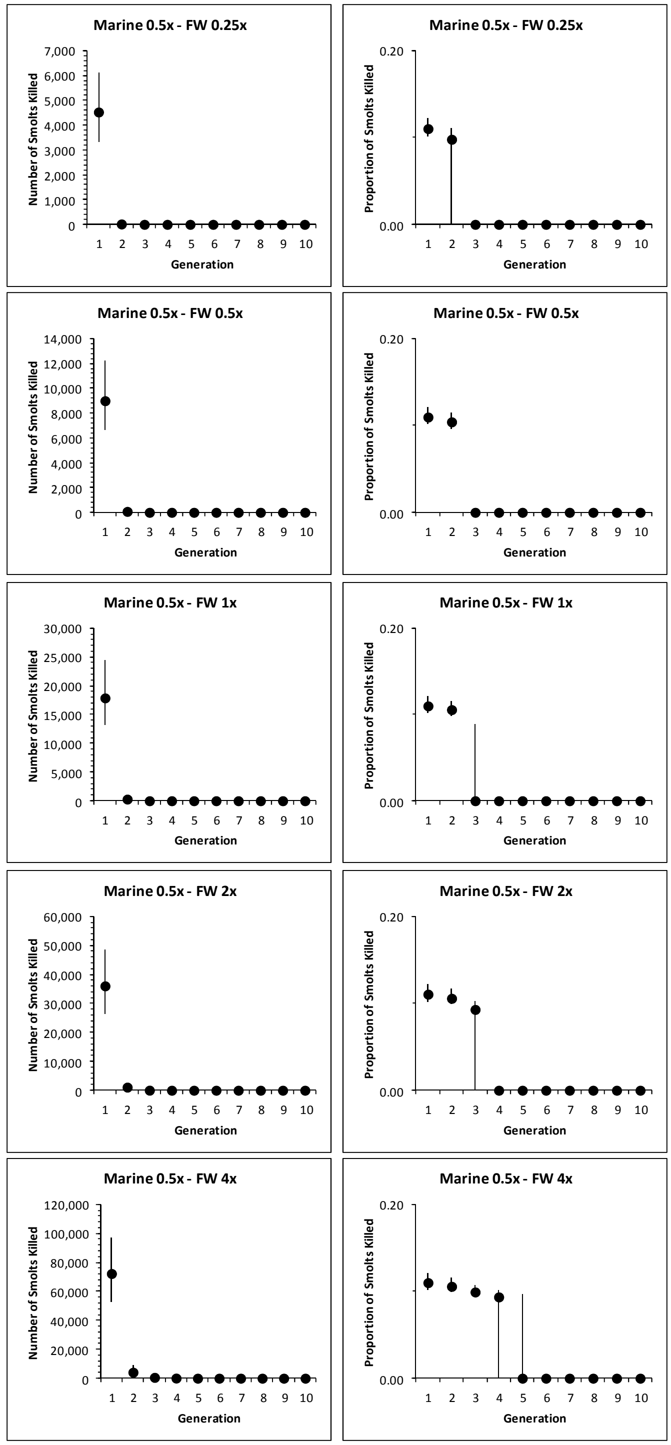

Figure 6.21.2.12. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 0.5 times the base case marine survival rate and the hatchery turned off.

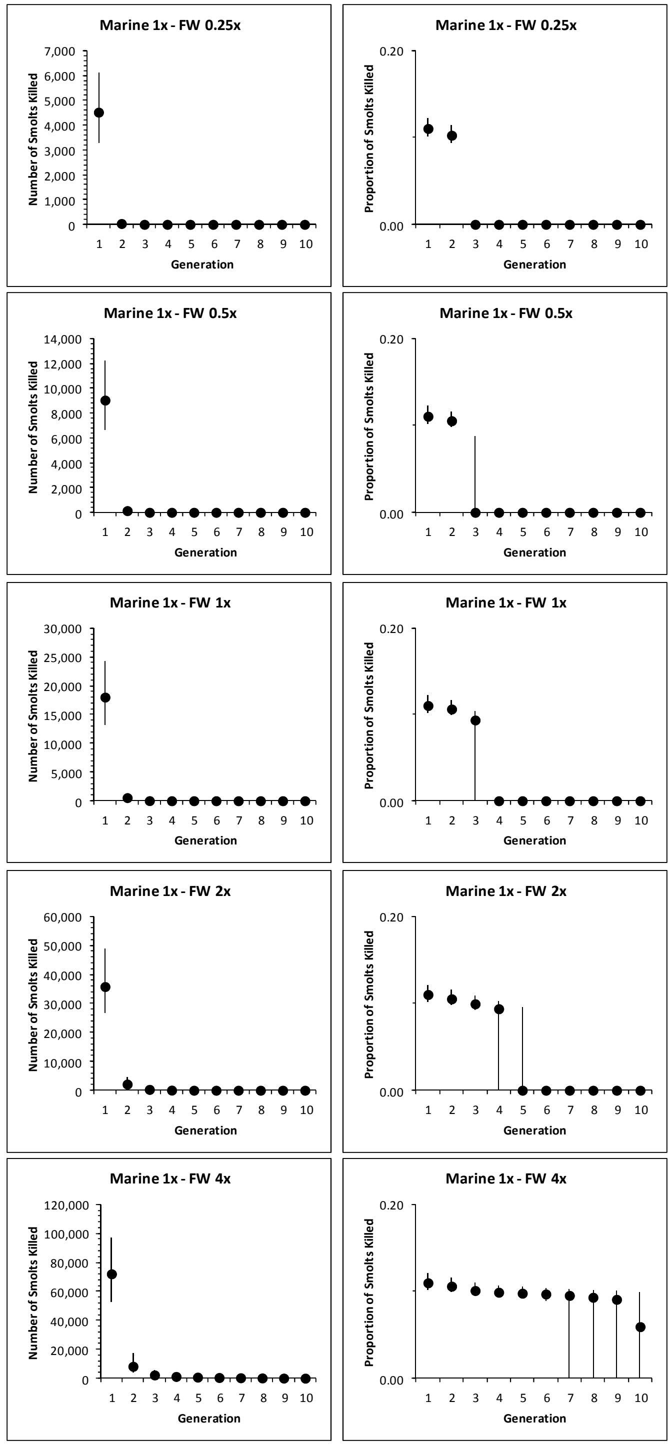

Figure 6.21.2.13. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 1 times the base case marine survival rate and the hatchery turned off.

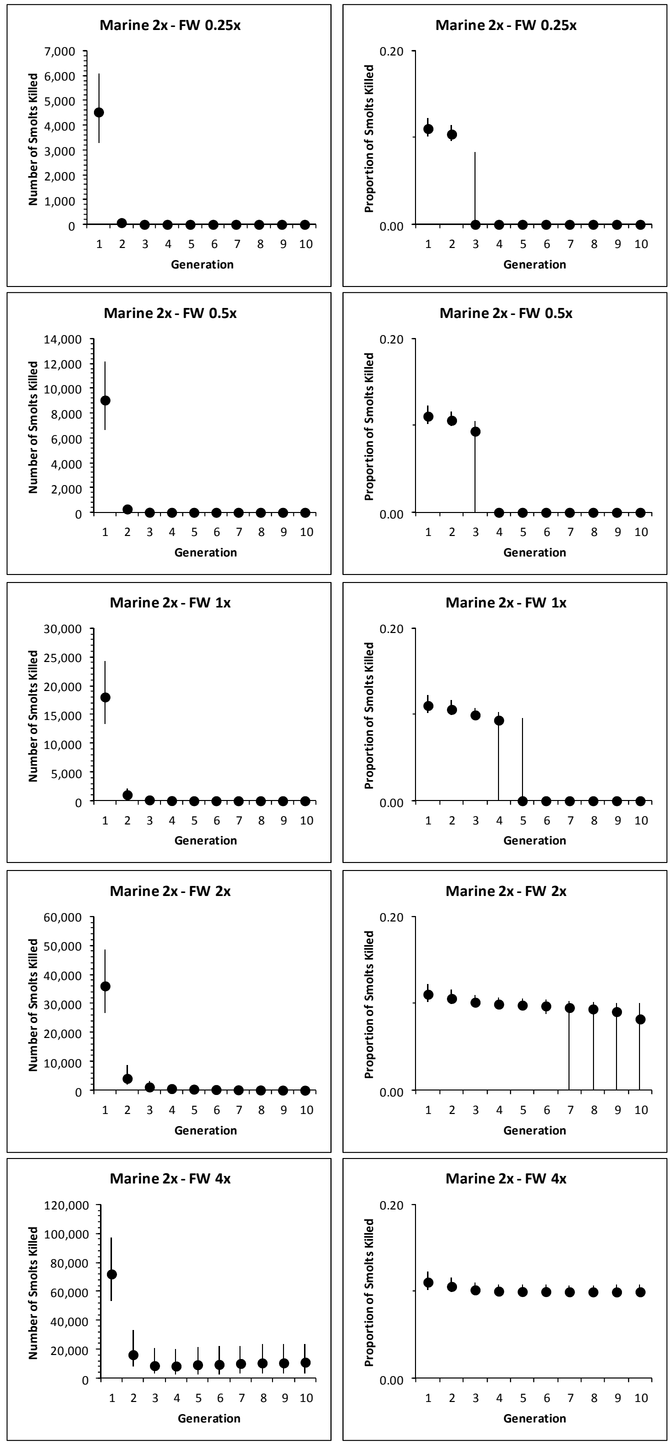

Figure 6.21.2.14. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 2 times the base case marine survival rate and the hatchery turned off.

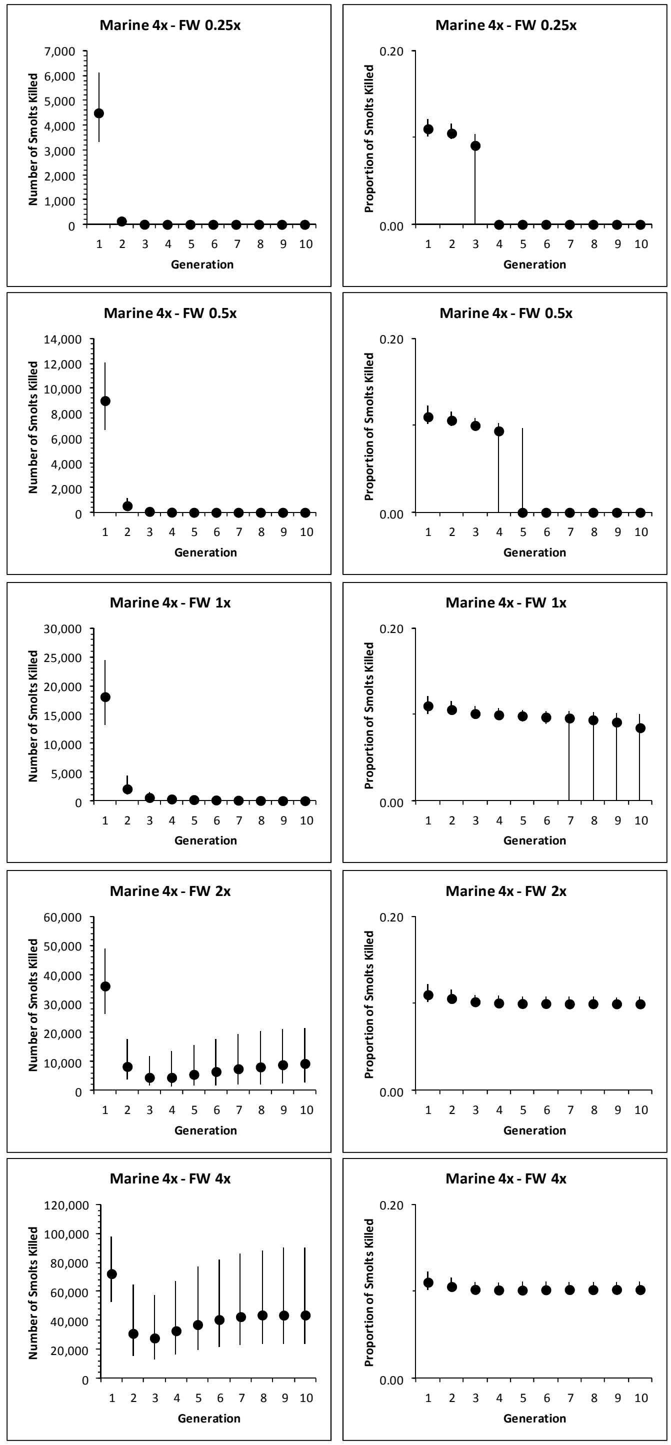

Figure 6.21.2.15. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for 0.25, 0.5, 1 (base), 2, and 4 times the base case freshwater survival rate (top to bottom, respectively) with 4 times the base case marine survival rate and the hatchery turned off.

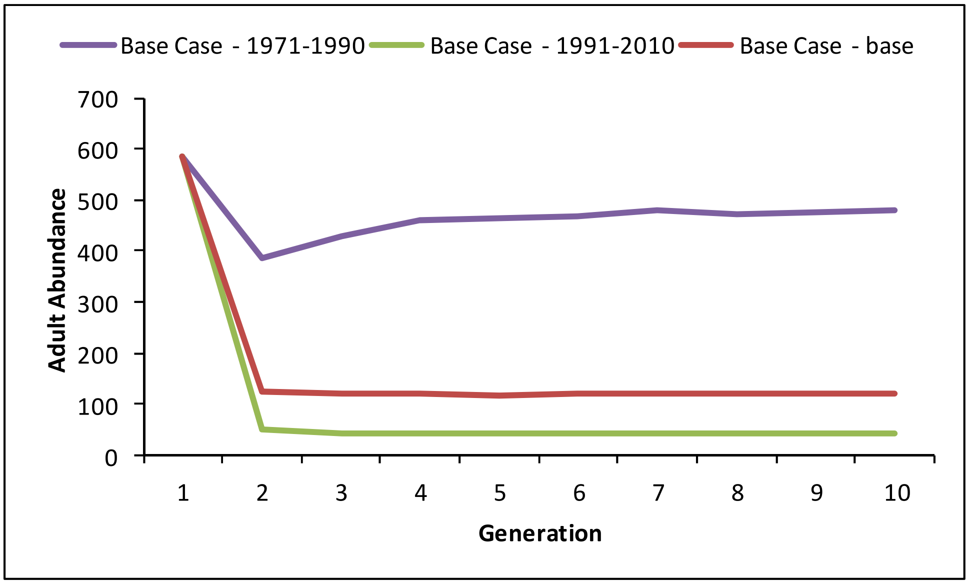

Figure 6.22.1.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

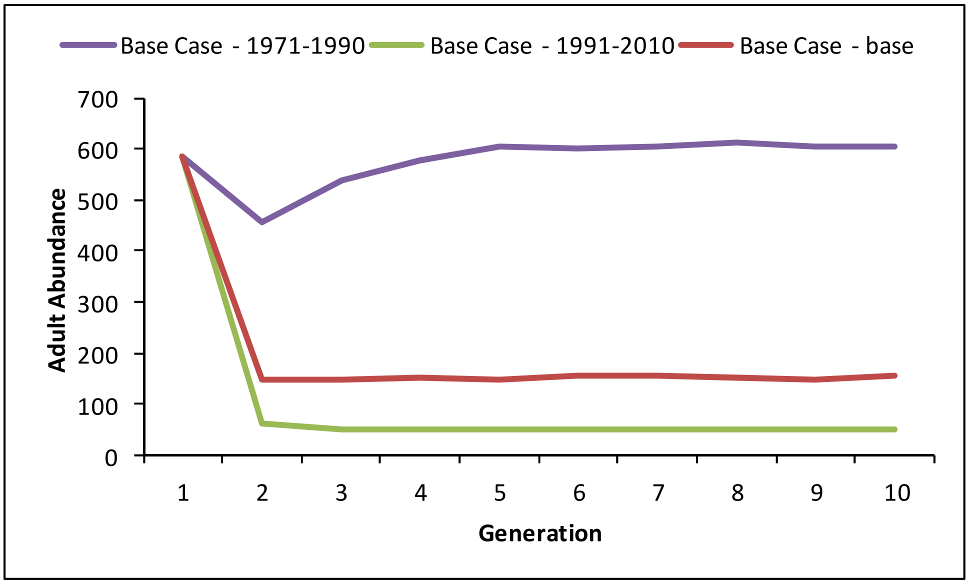

Figure 6.22.1.2. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Base Case scenario.

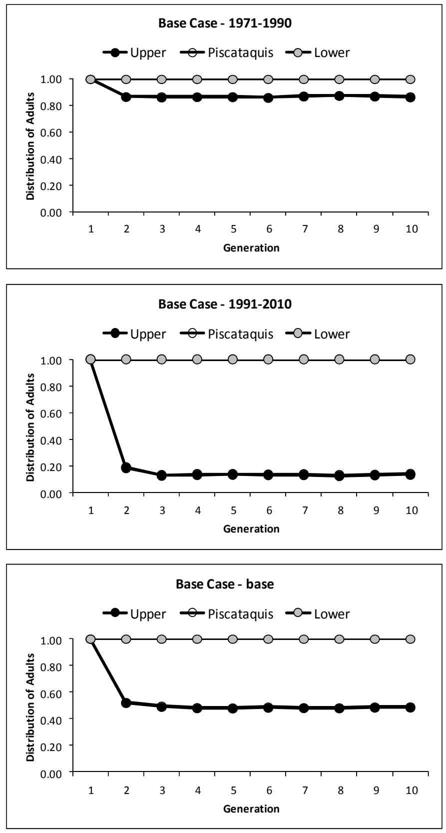

Figure 6.22.1.3. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Base Case scenario.

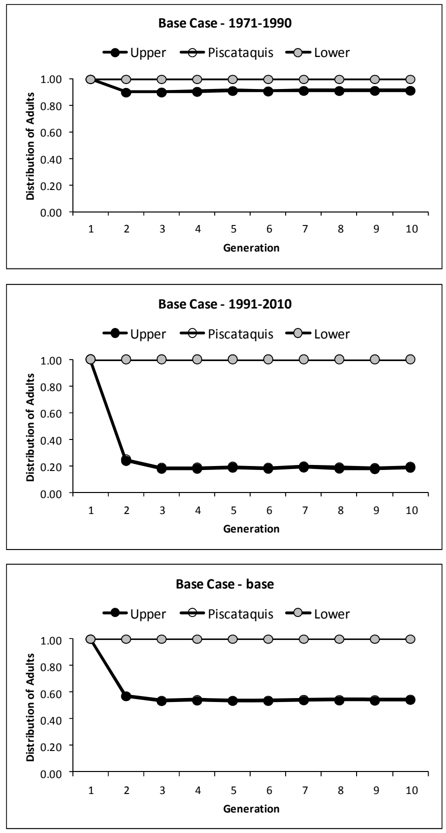

Figure 6.22.1.4. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Base Case scenario.

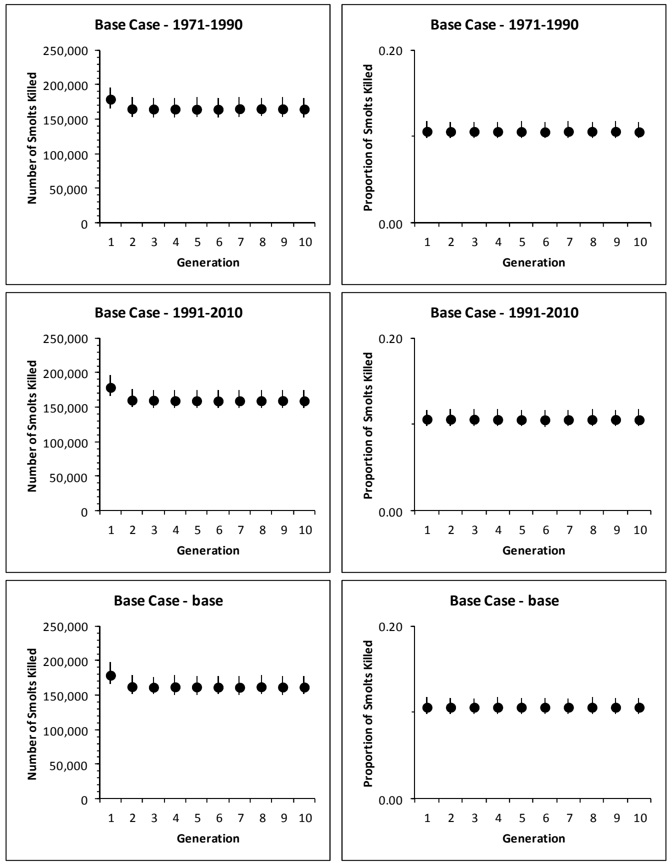

Figure 6.22.1.5. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Base Case scenario.

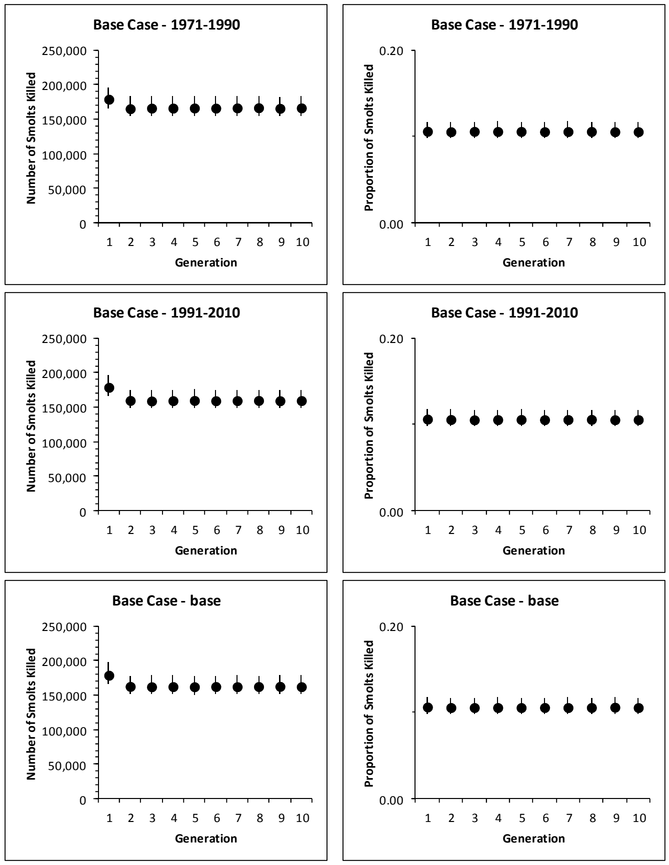

Figure 6.22.1.6. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Base Case scenario.

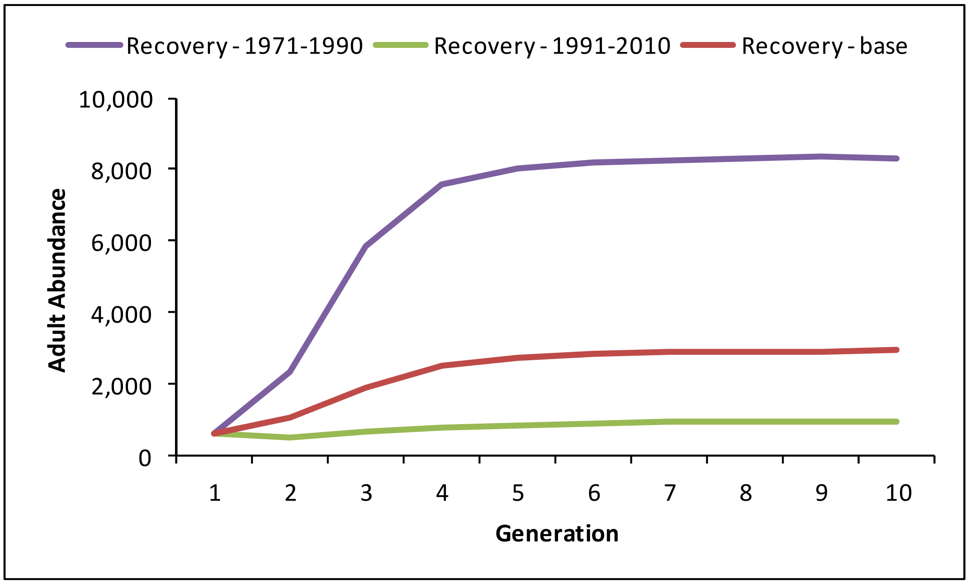

Figure 6.22.2.1. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

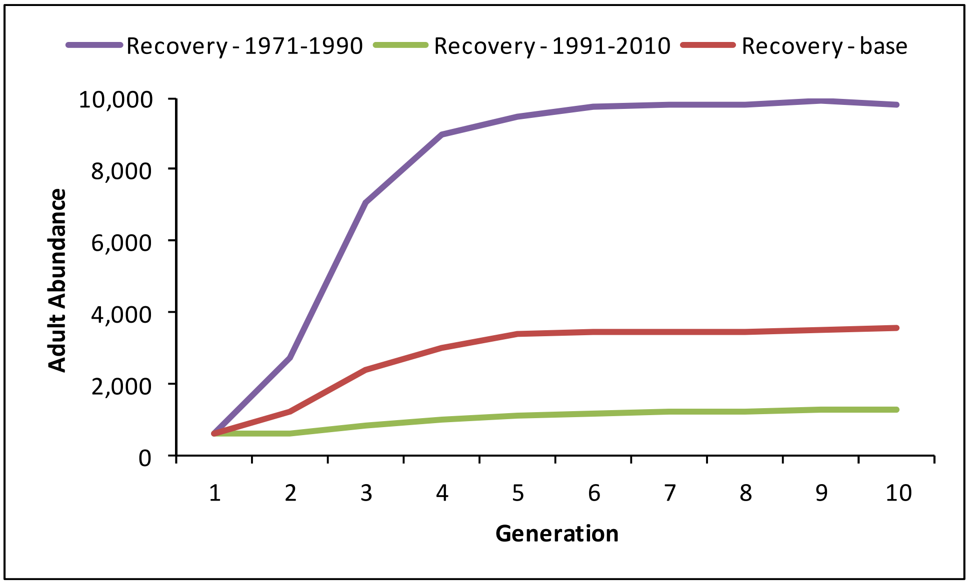

Figure 6.22.2.2. Median number of two sea-winter females across all Penobscot River production units in generations 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

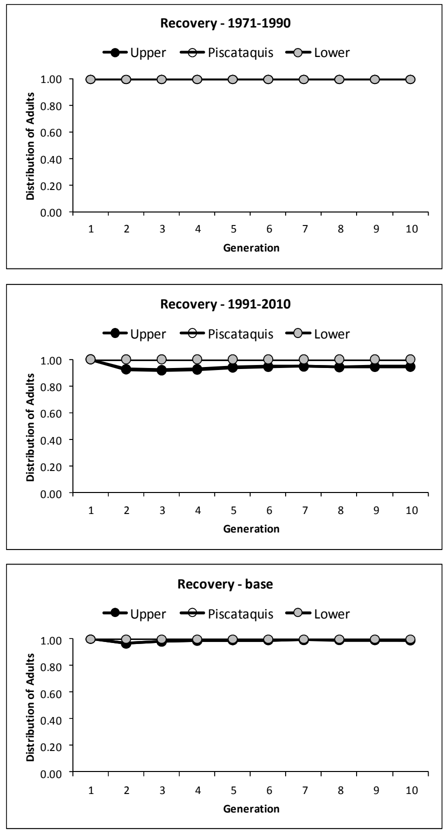

Figure 6.22.2.3. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) under the Recovery scenario.

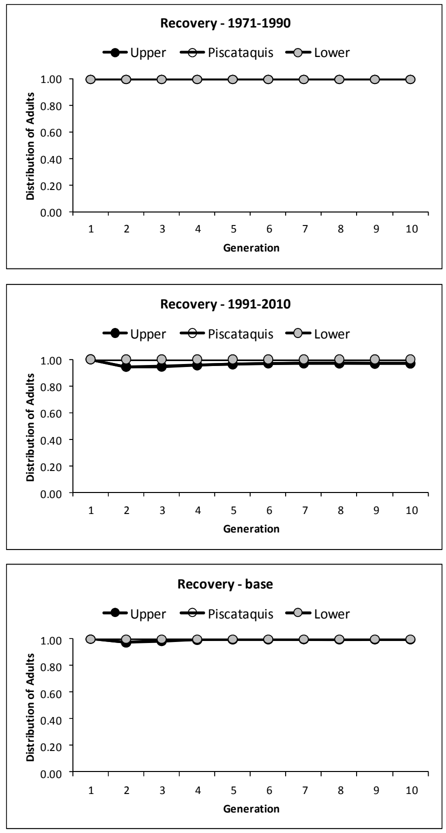

Figure 6.22.2.4. Proportion of iterations when at least one two sea-winter female was present in three areas of the Penobscot River watershed: the Upper Penobscot (i.e., above West Enfield Dam), the Piscataquis (i.e., the Piscataquis River watershed), and the Lower Penobscot (i.e., below the West Enfield Dam). Values are shown for generations 1–10 for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Recovery scenario.

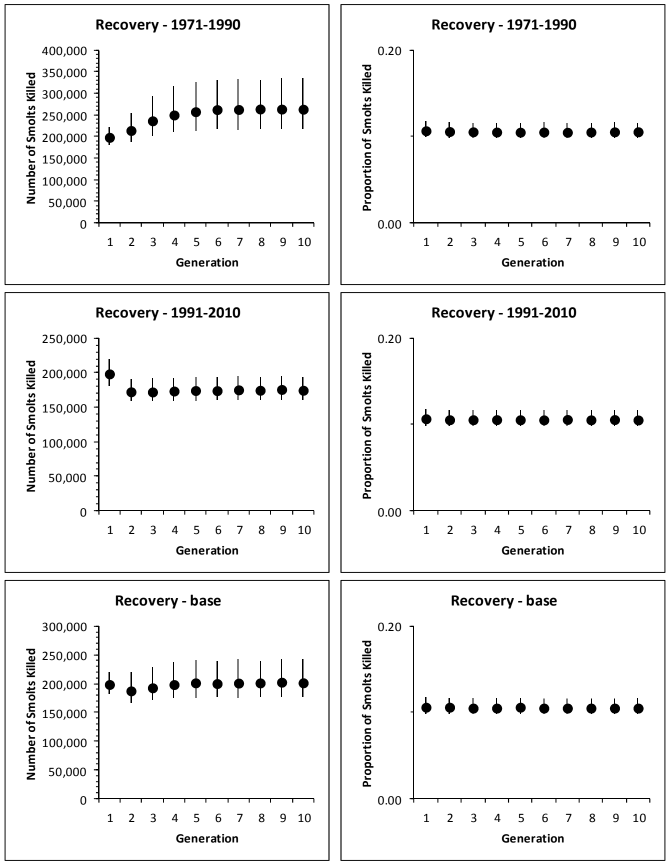

Figure 6.22.2.5. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios using median two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Recovery scenario.

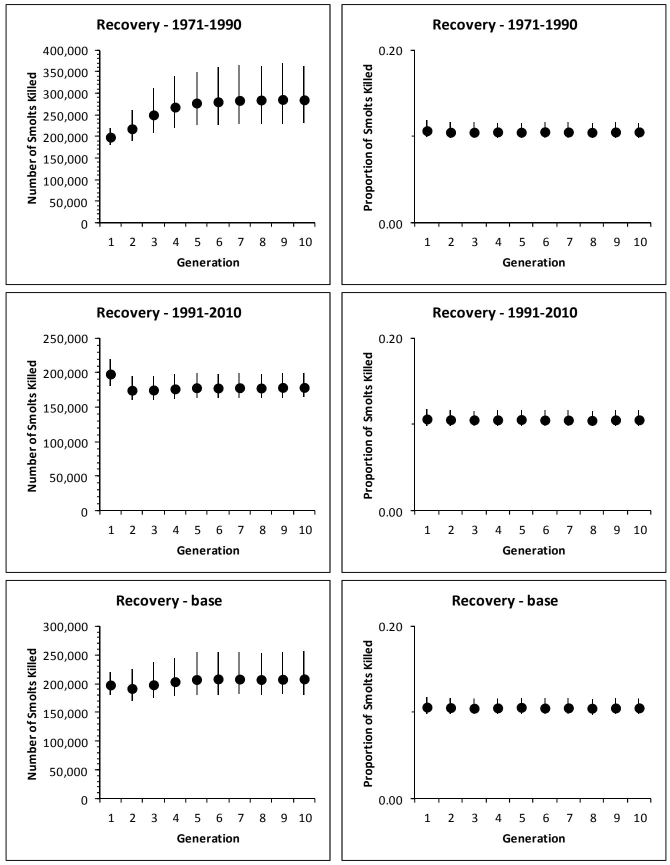

Figure 6.22.2.6. Median number (panels on the left) and median proportion (panels on the right) of smolts killed during emigration due to direct and indirect cumulative mortality associated with dam passage across the 15 modeled hydroelectric dams in generations 1–10. Medians (circles) and twenty-fifth to the seventy-fifth percentiles (lines) are shown for scenarios using mean two sea-winter female marine survival rates during 1971–1990, 1991–2010, and 1971–2010 (base) (top to bottom, respectively) under the Recovery scenario.

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