

Telemetry

Atlantic salmon have a complex life history, spending 1-3 years in freshwater and then undertaking a strenuous migration into the marine environment. There they spend an additional 1-3 years at sea before returning to their natal rivers to spawn. Although Atlantic salmon face many challenges during their freshwater phase (both natural and human-caused), their migration to the marine environment is even more rigorous.



Not to scale

The parr-to-smolt transformation (smoltification) results in river adaptations giving way to seawater readiness.

Before juveniles are able to enter the marine environment, they must undergo dramatic physiological changes. As smolts leave the river, they encounter unfamiliar environmental conditions and a new complex of *piscivorous* (fish-eating) predators including seals, waterbirds and fish.



One challenge some smolts face as they migrate to sea is passing through hydroelectric facilities. Above, NEST contractor Graham Goulette prepares to release a smolt captured in a rotary screw trap downriver of the Veazie Dam (in background) after collecting biological data such as length and weight.



Seals and double-crested cormorants (pictured here drying off on rocks in Penobscot Bay) are two predators smolts may encounter as they emigrate from coastal rivers into the marine environment.

Ultrasonic telemetry provides a tool by which the Northeast Salmon Team (NEST) can monitor the movement of Atlantic salmon smolts as they migrate through the discrete ecological zones (riverine, estuarine, and nearshore marine) of Maine's coastal systems.

This technology allows NEST researchers to better understand what factors influence smolt behavior (e.g. timing and duration of migration and route of travel) and where high levels of mortality occur. Telemetry also enables NEST researchers to quantify the affects of different mitigation techniques employed towards Atlantic salmon recovery efforts (such as stocking hatchery reared individuals at different life stages).

NEST has used telemetry as an assessment tool to study emigrating Atlantic salmon smolts since 1997. While the initial telemetry study focused on native Atlantic salmon populations in the Narraguagus River, NEST has since expanded its scope to include the Penobscot, Pleasant and Dennys Rivers, different age classes and origins of smolts, as well as new telemetry technologies.

Snapshot of NEST Telemetry



Surgically implanting pingers in smolts

A smolt receives a V9P-type tag



So how does the NEST carry out research using telemetry? A sample of hatchery or *naturally* reared (resulting from natural reproduction or fry stocking) smolts undergo a surgical procedure in which a Vemco ultrasonic tag, or “pinger,” is implanted within their abdominal cavity. Tagged hatchery reared smolts are released according to documented periods of migration for the river of study while naturally reared smolts are generally released shortly after surgery. A network of fixed location ultrasonic telemetry receivers (VR2's) are deployed in "arrays" (single units or series that cover cross-sections of a river, estuary or bay) throughout the discrete ecological zones which tagged smolts pass (left). The pingers transmit a signal that each VR2 decodes and date/time-stamps when tagged individuals pass within its detection range (zero to 800 meters, depending on environmental conditions). Some types of pingers (e.g. the V9P) are also capable of transmitting depth data to the VR2's. NEST scientists can use the data retrieved from VR2s that detect these V9P pingers to identify the depth at which smolts migrate into estuaries and bays and also calibrate the depth at which nets are fished during NEST's postsmolt trawl survey.



Vessel contractor Michael Ormsby and NEST contractor Graham Goulette retrieve a VR2 receiver from an array in Penboscot Bay. After retrieval, data collected by the VR2 is downloaded (right) and used to gain a better understanding of emigrating smolt behavior and mortality.

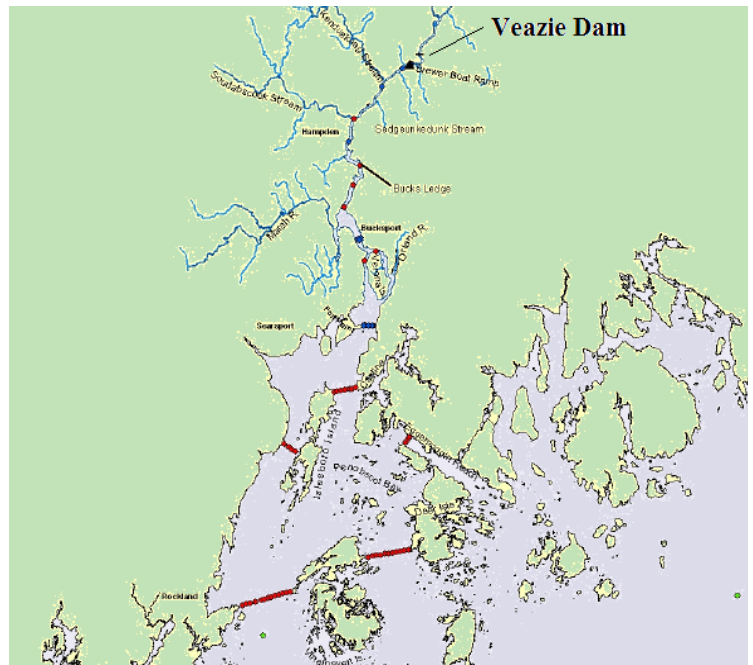


NEST has used telemetry on Maine's largest River, the Penobscot, since 2005 to assess the effect of different rearing environments on smolt migration timing and survivorship. As part of a NEST-funded collaborative study with a local private research company (MariCal), a portion of smolts reared at the U.S. Fish and Wildlife Service (USFWS) Green Lake National Fish Hatchery (GLNFH) underwent Mari-cal's SeaReady™ process, which preconditions them for entry into saltwater. In 2006, hatchery reared (SeaReady™ and non-treated) and naturally reared individuals were tagged with pingers and released together to assess these different rearing strategies on smolt behavior and survival.

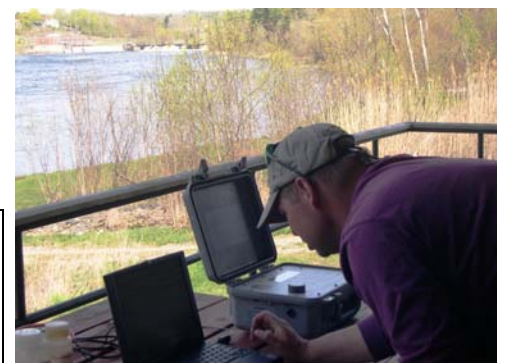
NEST has been using telemetry to gain a better understanding of smolt behavior and sources of mortality within the Narraguagus River system since 1997. From 2004-2005, NEST researchers coupled telemetry and a cormorant exclusion study to assess if and how the non-lethal harassment of double-crested cormorants affected emigrating smolt survivorship.

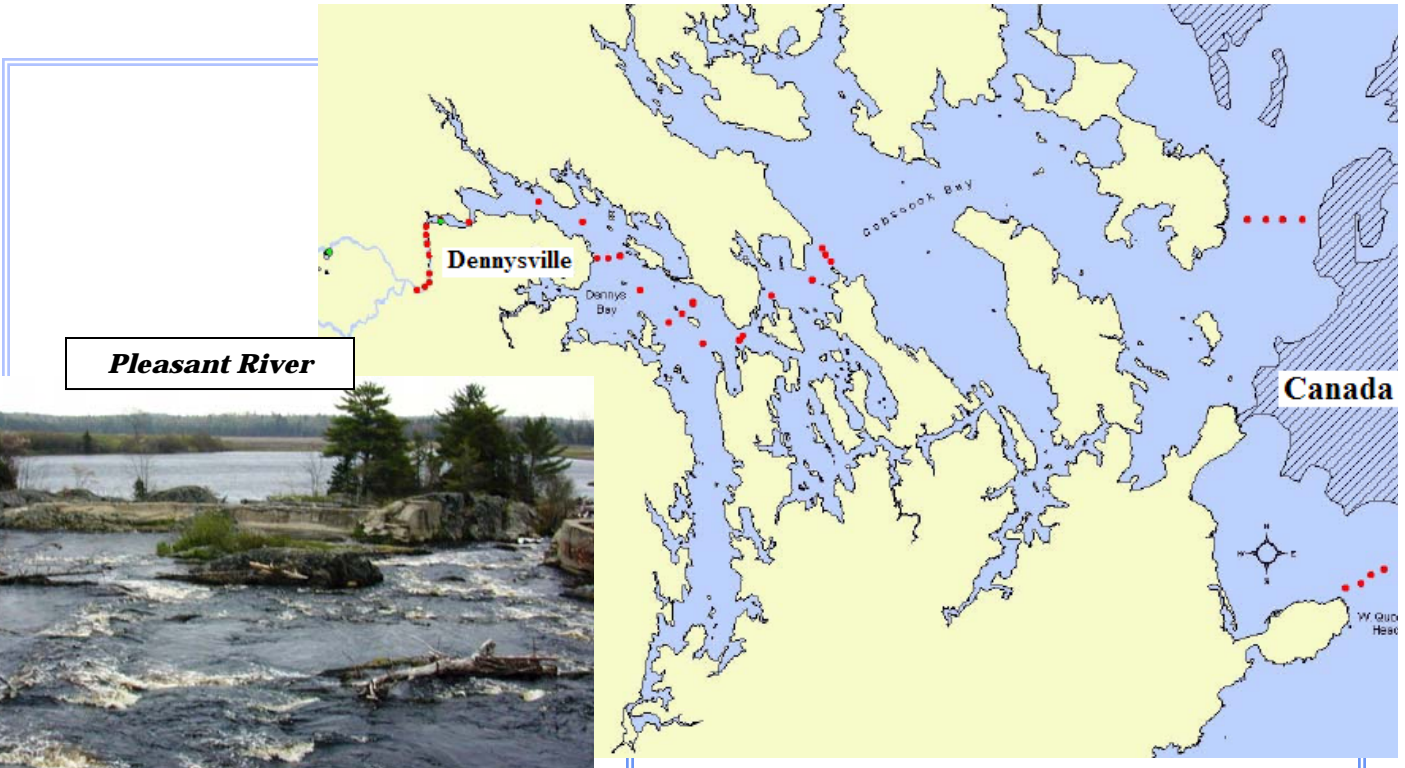


Pyrotechnics and other harassment techniques were used to disperse cormorants from their feeding areas on the lower Narraguagus River and estuary during the peak smolt migration period. Above, collaborator Adam Vashon uses a screamer.

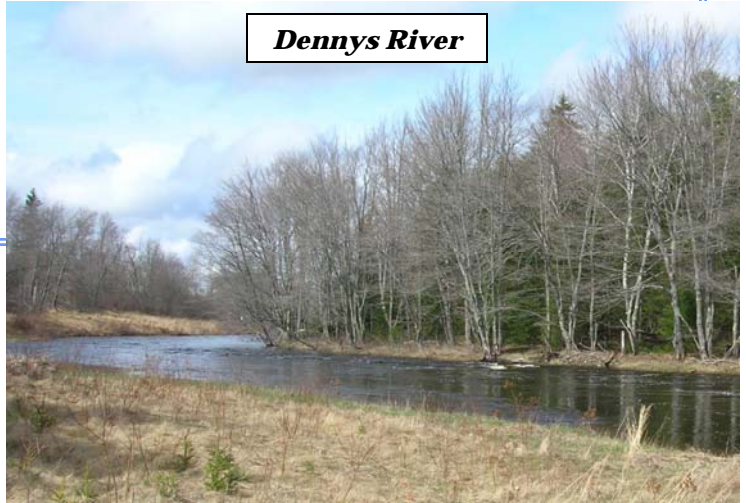


NEST contractor Ed Hastings tests pingers prior to surgically implanting them in naturally reared smolts and hatchery smolts obtained from GLNFH. Following this procedure, smolts were given time to recover and then released at the Veazie Salmon club on the bank of the Penobscot River just downstream of the Veazie Dam (right).





Pleasant River



Denny River

In 2004, a combination of 130 hatchery and naturally reared smolts were tagged and monitored as part of a telemetry study seeking to assess survivorship of emigrating smolts reared under different environmental conditions. Hatchery reared smolts were obtained from the USFWS Craig Brook National Fish Hatchery and NEST's Pleasant River rotary screw trap (pictured below) was used to collect naturally reared smolts and smolts stocked as parr two years prior (2002).



Among other things, NEST uses its rotary screw traps as a platform to collect smolts for telemetry studies.

The easternmost of NEST's study rivers (the Denny) is situated near the border of Canada (above map). From 2001-2005, NEST researchers tagged smolts reared at GLNFH and used telemetry to monitor their migration through the lower Denny River, estuary and bay.

If you find one of our VR2 units or floats adrift, please contact us: (207) 866-7109.

The NOAA's National Marine Fisheries Service (NMFS) Northeast Salmon Team (NEST) is comprised of managers from the Northeast Regional Office (NER) and scientists from the Northeast Fisheries Science Center (NEC). The NER administers NOAA's programs in the Northeastern United States to manage living marine resources for optimum use. The NEC is the research arm of NOAA Fisheries in the region and plans, develops, and manages a multidisciplinary program of basic and applied research. More Atlantic salmon information is available at www.XXXXXXXXXXXXXXX.

