Seal Bounties in Maine and Massachusetts, 1888 to 1962

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Abstract - Maine and Massachusetts paid bounties on seals during the 19th and 20th centuries. To determine the number of seals killed for bounty, we examined historical records of bounty claims, and used geographic information systems and multiple linear regression to find predictors of places where large numbers of bounties were paid. We found records of 24,831 bounties paid in Maine (1891–1945) and 15,690 in Massachusetts (1888–1962). Considering possible fraud, missing data, and seals struck and lost, this suggests that 72,284 to 135,498 seals were killed in the bounty hunt, probably enough to account for regional declines in seal populations. Larger numbers of bounties were paid where there were more seals and a higher human population.

Introduction

The Gulf of Maine is a semi-enclosed marine ecosystem bounded by the coastlines of Maine, New Hampshire, and Massachusetts to the south and west, the Canadian Maritime provinces to the north, and by underwater banks to the south and east (National Geographic 1999, US Fish and Wildlife Service 2007). Two pinniped species, *Phoca vitulina* L. (Harbor Seal) and *Halichoerus grypus* Fabricius (Gray Seal), are year-round residents in the Gulf of Maine (Katona et al. 1993) and were exploited for meat and pelts even prior to European contact (Spiess and Lewis 2001). More recently, these seals have been killed accidentally as by-catch in commercial fisheries or deliberately as nuisances or for illegal trade (Baird 2001, Daley 2004, Jacobs and Terhune 2000).

From the late 19th to the mid-20th centuries, the states of Maine and Massachusetts paid bounties for the destruction of seals. In Maine, bounty laws were in effect from 1891 to 1905 and from 1937 to 1945 (Lelli and Harris 2006). Although the bounty laws made no distinction among seal species, legislative history and contemporary accounts suggest that Harbor Seals were the primary target (Allen 1942a, 1942b; Bounty on … 1888; Lelli and Harris 2006) although Gray Seals were also killed (Andrews and Mott 1967, Rough 1995, Seal's tails … 1905). There were also bounties and culls of Harbor and Gray Seals in Atlantic Canada during the 20th century (Baird 2001, Lavigueur and Hammill 1993).

Seals gained protection from hunting and killing in isolated pockets of Maine as far back as 1872 (An Act… 1872), but nationwide protection was

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not afforded for another hundred years (Marine Mammal Protection [MMPA] Act 1972). Since passage of the MMPA in 1972, it has been illegal to harass, hunt, capture, or kill seals and other marine mammals throughout the United States. The following year, the first census of Harbor and Gray Seals to cover the entire coast of Maine counted only 5796 Harbor Seals and about 30 Gray Seals (Richardson 1973). By 2001, the number of Harbor Seals counted on the Maine and New Hampshire coast had increased to 38,014 (the total population estimated from the count was nearly one hundred thousand), and Gray Seal numbers had grown to 1731 (Gilbert et al. 2005). Thus, the number of seals has increased many-fold in the Gulf of Maine since the New England seal bounties ended and the MMPA was passed.

It is widely assumed that the number of seals killed for bounty in the Gulf of Maine caused a substantial reduction in population size, and that seal populations have rebounded with the end of these bounties because hunting pressure was relieved and protection legislation was instituted (Katona et al. 1993, Payne and Schneider 1984, Stellwagen … 1993, Waring et al. 2007). This is certainly logical to infer from the steady increases in the Harbor Seal and Gray Seal populations since the end of the bounties and the enactment of the MMPA (Baird 2001, Gilbert et al. 2005, Richardson 1973). However, because there are no tallies of the number of bounties paid for seals in New England, it is not possible to say whether or not there were enough seals killed for bounty to account for the low population numbers at the end of the bounty period. This is particularly true given the fact that there were (and are) other sources of seal mortality. Natural causes of seal mortality include disease, storms, abandonment of pups, and predation (Katona et al. 1993). Human causes include shooting (without bounty), harassment, fishing gear entanglement, boat strikes, and loss or degradation of habitat (Baird 2001, Jacobs and Terhune 2000).

To explore the possible impact of seal bounties in New England on Harbor Seal populations in the Gulf of Maine, we undertook historical research to determine the number of bounties paid for seals in Maine and Massachusetts during each year when bounty legislation was in place. We then considered the factors that might make the actual number of animals killed either lower or higher than the number of bounties paid, and used this analysis to estimate the maximum and minimum number of seals that may have been killed for bounty.

Bounty legislation generally required that the bounty be paid relatively close to the location where the animal was actually killed (Lelli and Harris 2006). Thus, it was also possible for us to conduct a rough spatial analysis to determine how the seal bounties were distributed along the coast. This analysis allowed us to explore factors that predict high numbers of bounties being paid in a particular area.

Methods

Determination of bounty periods

We have previously found that seal bounty legislation was in place in Maine from 1891 to 1905 and from 1937 to 1945 (Lelli and Harris 2006). To determine the dates when similar legislation was in place in other states that have coastline on the Gulf of Maine, we examined the statutes and legislative history of the states of New Hampshire and Massachusetts.

Data sources for number of bounties paid

For Massachusetts, we obtained records of expenditures from county treasurers' reports of seal bounties they reimbursed to towns from 1888 to 1908. These reports were available for the coastal counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, and Suffolk. Treasurers' reports for the County of Dukes for 1888 and 1889, and for the County of Nantucket from 1888 to 1897, were not available. However, in Dukes County, where no payments were recorded at the county level during those years, there is evidence that seal bounty payments were made by at least one town within the County. We examined the Annual Reports of the Finances of this town (Edgartown, MA) by the Auditor of Accounts for the years 1889 to 1908 to determine the number of seal bounties paid.

We collected data for seal bounties paid in Massachusetts from 1919 to 1959 from the following state government sources: Annual Reports of the Division of Fisheries and Game (1919 to 1931), Report of the Marine Fisheries (1932), Annual Reports of the Division of Fisheries and Game (1933 to 1938), Annual Reports of the Commissioner of Conservation (1939 to 1953), and Annual Reports of the Commissioner of Natural Resources (1954 to 1959). There were no statewide records of seal bounties paid in Massachusetts between 1959 and 1962 even though the bounty law was still in force.

We accessed the State of Maine Treasury General Accounts ledgers for data on Maine seal bounty payments between 1892 and 1894. For the years 1895 to 1900, we drew data from the Maine General Accounts as well as the Annual Reports of the Treasurer of the State of Maine.

The second Maine bounty was in effect from 1937 to 1945. However, data on the amount paid for bounties was only available for 1937 through 1940. The state Treasury General Accounts ledger provided data for bounty payments for 1937. For 1938 to 1940, we obtained bounty payment records from the Eleventh and Twelfth Biennial Reports of the Department of Sea and Shore Fisheries. No state records of seal bounties paid in Maine were available for the period from 1941 to 1945. To explore whether bounties were being paid directly by the towns without reimbursement from the state during this period, we checked the annual reports of seven Maine towns (Tremont, Jonesport, Stonington, Boothbay Harbor, Dennysville, Yarmouth, and Freeport) that paid the most bounties from 1939 to 1940 and found no records of any seal bounties paid by these towns that were not accounted for in the Department's Biennial Reports.

Fraudulent claims could cause the number of seal bounties paid to be an over-count of the number of seals actually killed. Therefore, we searched for reports of seal bounty fraud in the regional newspapers of the bounty periods located in the major historical archives of Maine and Massachusetts.

Data analysis

We summed the numbers of bounties paid by year (temporally) and by the towns in which the bounties were paid (spatially). Using geographic information system software (ArcGIS, ESRI; http://www.esri.com), we employed our spatial results to construct a cartographic representation of the distribution of the number of seal bounties paid in New England and generated the other variables needed for an analysis of the factors predicting the number of bounties paid in various parts of the coast. For this process, we made use of base maps of Maine's towns and the Maine coast at mean high water obtained from the Maine Office of Geographic Information Systems website (http://megis.maine.gov/) as well as base maps of Massachusetts towns obtained from the Massachusetts Office of Geographic and Environmental Information website (http://www.mass.gov/mgis/).

The earliest count of the number of seals in the Gulf of Maine was undertaken in 1973 and covered only the Maine coast (Richardson 1973). This work divided the coast into 15 zones and reported the number of seals observed in each zone. To determine the factors that predict the number of bounties paid, we adopted these zones as the areal unit of analysis. We developed a GIS layer that divides the coast into zones based on the verbal descriptions of the zone boundaries in the original paper. Then we aggregated the bounty numbers by zones and used this number as the dependent variable in our analysis.

For independent variables (predictors of the number of bounties paid), we considered the possibility that the number of seals killed in a zone might have been influenced by the number of seals that were present or the number of people who lived nearby. Therefore, we used the GIS to determine the following possible predictors of the number of seal bounties paid: 1) the number of Harbor Seals present in each zone at the earliest available count (1973), and 2) the human population living in the towns bordering the coast of each zone in 1950 (the earliest date for which town-level detail is available on Maine census data).

Because not all the zones defined for the 1973 count are the same size, we also considered the possibility that larger zones would have more live seals, more seal bounties, and more people living nearby simply because they were larger. To address this, we used our GIS to determine the following independent variables in our analysis: 1) the point-to-point distance from one end of each zone to the other, and 2) the length of the shoreline in each zone. This analysis does not take into consideration the fact that variations in coastal morphology in the Gulf of Maine may impact available seal haul-out space in ways not captured by zone length or even shoreline length. However, we have no way to quantify this impact.

We then conducted multiple linear regression analysis using the SAS Statistics Software package (http://www.sas.com/technologies/analytics/statistics/index.html) to determine which of the four independent variables significantly predicted the number of seal bounties paid. We used Pearson correlation coefficients to examine correlations among independent variables and also tested for significant interactions among the independent variables. A P-value < 0.05 was considered significant.

Results

Seal bounty laws

We found no evidence of a state-level bounty in New Hampshire from legislative history or any references to a bounty in New Hampshire in the literature. We did, however, find that Massachusetts paid bounties on seals from 1888 to 1908 and from 1919 to 1962. Thus, while seal bounties were paid in Maine during two periods totaling 24 years between 1891 and 1945, Massachusetts paid bounties on seals during two periods totaling 55 years between 1888 and 1962.

When the first seal bounty law was established in Massachusetts in 1888, it covered the entire Commonwealth and authorized the clerk of the town where the seal was killed to pay claimants a one-dollar-per-seal-tail reward. The clerks were then reimbursed annually from the county treasury (An Act … 1888). The bounty was increased to three dollars per seal (tail) in 1892 (An Act … 1892) and repealed in 1908 (An Act … 1908). The second Massachusetts seal bounty was enacted in 1919. It covered the entire state and provided two dollars per seal in exchange for the whole skin and nose. Town clerks were reimbursed for seal bounties they paid as well as a fifty-cent-per-bounty fee for their services (An Act … 1919). In 1933, the legislature increased the bounty payment to five dollars per seal (whole skin and nose, no change in fee). Bounties were paid to claimants by town treasurers, who were reimbursed from the county treasury (An Act… 1933). The second bounty was repealed in 1962 (An Act … 1962).

We have previously provided an extensive review of the history of Maine seal bounty laws (Lelli and Harris 2006). Briefly, the Maine legislature enacted a first bounty on seals in 1891 that was limited to the waters of the Penobscot River and Bay. To collect fifty cents, a person presented a seal's nose to the treasurer of the town in which the seal was killed within thirty days of making the kill (An Act … 1891). Towns were then reimbursed from the State treasury. In 1895, the bounty was expanded to the entire state and the amount was increased from fifty cents to one dollar (An Act … 1895). This bounty was repealed in 1905 (An Act … 1905). A second Maine bounty, enacted in 1937, was restricted to the two most northeastern counties of Hancock and Washington. Bounty hunters had to reside in the two designated counties and could claim the one-dollar-per-seal-nose reward in their town of residence within two days of making the kill (An Act … 1937). In 1939, the bounty was extended to all coastal counties except the southernmost

county of York (An Act … 1939). The second Maine bounty was repealed in 1945 (An Act … 1945).

Interestingly, between 1872 and 1959 in Maine, there were also times and places where it was unlawful to kill seals. Seal protection laws were supported by conservationists, animal welfare supporters, owners of hotels and resorts and other tourist-related businesses, and owners of homes on the Maine coast (Lelli and Harris 2006). For example, from 1940 to 1945, it was unlawful to hunt, shoot at, or kill a seal within two miles of Green Island, Maine (An Act … 1940). We did not find any comparable seal protection laws in Massachusetts or New Hampshire between 1800 and 1962. Massachusetts did enact a law protecting Gray Seals in 1965 (Gray Seal … 1965), and in 1969, New Hampshire adopted a law making it unlawful for any person (except for licensed lobsters and commercial fishers) to take or to attempt to take any species of seal at any time (An Act … 1969).

Number and location of bounties paid

In Massachusetts, we found records of 9689 seal bounties paid during the first bounty (1888 to 1908) and 6001 during the second bounty (1919 to 1962). In Maine, we counted 22,916 seal bounties during the first bounty (1891 to 1905) and 1915 during the second bounty (1937 to 1945). Thus, we counted a total of 40,521 seal bounties paid in Maine and Massachusetts from 1888 to 1962. The largest number of seal bounties paid in any given year by state was 5606 in Maine in 1904 and 1591 in Massachusetts in 1907 (Fig. 1). While the Maine bounty was in effect until 1945, the last year for which there was evidence that bounties were actually paid was 1940. In Massachusetts, where a bounty was in effect until 1962, there are no records

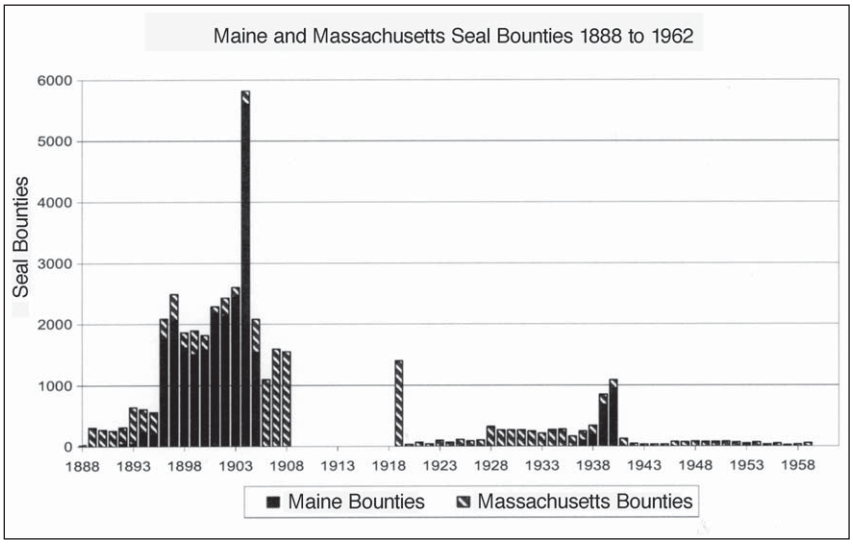

Figure 1. Yearly totals of seal bounties paid in Maine and Massachusetts from 1888 to 1962.

of bounties paid after 1959, and the last year in which more than 100 bounties were paid was 1941 (Fig. 1). Thus, seal bounties were essentially ended in New England by the early 1940s. Seal bounties were paid in 112 Maine towns between 1891 and 1905, but in only 65 towns between 1937 and 1945. In Massachusetts, bounties were paid in 38 towns between 1888 and 1908 and in 60 towns between 1919 and 1962 (Fig. 2).

Inaccurate and missing data

Seal bounty records were kept by dozens of people using different accounting methods. County and municipal clerks and treasurers did not always report the same information. Here, the only bounties counted are from records that clearly specified that the payment was for killing seals. Other seal bounty payments may be concealed in general categories such as "miscellaneous expenditures," "bounty on animals," and "nuisance mammals."

Furthermore, we were unable to locate some historical records. It is very difficult to believe that no seals were killed for bounty in Dukes and Nantucket counties during the first Massachusetts bounty program, yet no records of bounty payments exist for these counties. Indeed, Andrews and

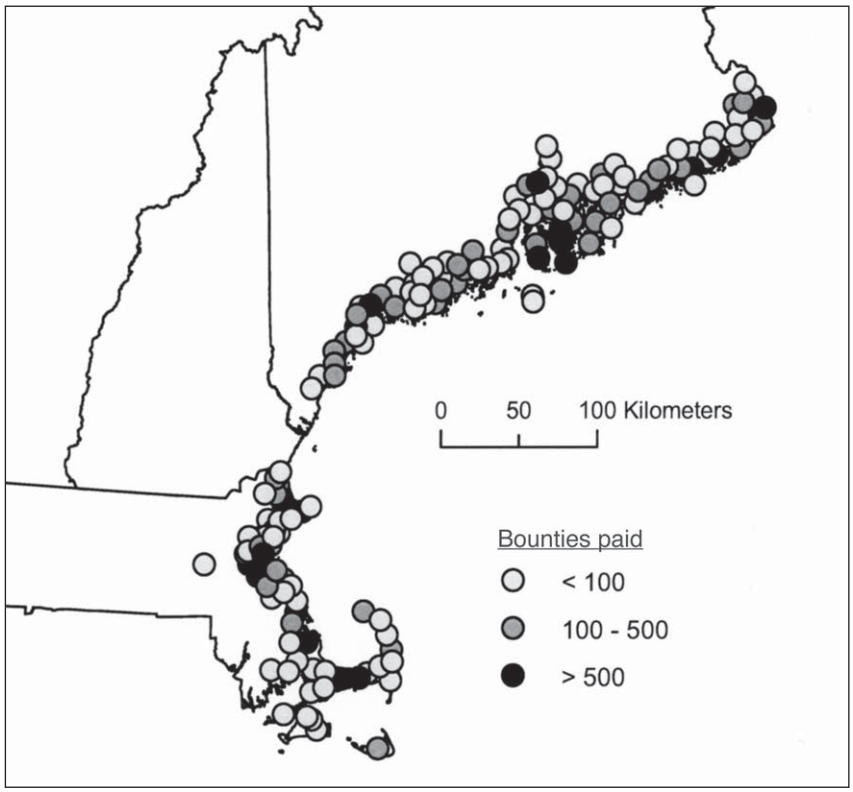

Figure 2: Spatial distribution of the number of seal bounties paid in Maine and Massachusetts from 1888 to 1962.

Mott (1967) reported that about 40 Gray Seals were killed in Nantucket during the 1940s and 1950s. However, given the anecdotal nature of the Andrews report and the absence of any evidence of bounties paid in Dukes, we are unable to estimate the actual number of seals killed in these counties. There are also no records of bounties paid for entire years when the laws were in effect, including 1941 to 1945 in Maine and 1960 to 1962 in Massachusetts (Fig. 1). For the purpose of estimating the total number of seals killed, we assumed that the number of seals killed for bounty in each of the missing years was between zero (which assumes that no seals were killed) and the number paid in the last year for which records exist (which would be the case if the killing of seals continued at a constant rate during those years). This number is 950 for Maine in 1940 and 55 for Massachusetts in 1959.

Fraudulent bounty claims

Historical evidence suggests that fraud occurred in the seal bounty program. Apparently, not only could a person make more than one tail out of a seal hide that was good enough to fool a town clerk, it was also possible to make many fake noses out of a single seal. In January 1904, several men were charged with making fraudulent seal bounty claims in Portland, ME. Two of the men reportedly submitted 86 fake noses in one day, and another man allegedly admitted that he had collected $1000 with fake noses from the City the previous year (Barry 1979, Norton 1930, Rough 1968). Shortly after the Portland, ME seal bounty scandal, a similar scam was discovered in Massachusetts. In January 1908, several men from Maine were accused of submitting false claims for bounties in Lynn, Salem, Gloucester, Quincy, Norfolk, and Nahant, MA the previous year. One of them reportedly said that he had killed the seals in Maine and brought the tails to Massachusetts (which would have been illegal). However, newspapers also reported that the men manufactured as many as 150 tails out of one pelt (Thought they … 1908). Massachusetts repealed its bounty law later that year (An Act … 1908).

Predictors of bounty numbers

Because the earliest count of numbers of live seals was done on the Maine coast only, our analysis of factors predicting high numbers of bounties paid covered only this area and used the 15 zones described in the original article (Richardson 1973) as the unit of areal analysis. In multiple linear regression analysis, we found that higher numbers of bounties paid was predicted for coast zones that had more seals ($P = 0.002$) and a higher human population ($P = 0.001$). A model that includes these two variables explained 73% of the variability in the number of bounties paid. These two independent variables did not correlate significantly with each other; however, their interaction was a significant predictor of the number of bounties paid. Adding this interaction to the model increased the r-squared value to 75%. Neither the point-to-point distance from one end of each zone to the other ($P = 0.48$) nor the length of coastline in the zone ($P = 0.15$) significantly predicted the number of bounties paid.

Discussion

While the count of the number of bounties paid reported here provides a starting point for determining the impact of bounties on Gulf of Maine seal populations, several factors could make the number of seals killed either higher or lower than the number of bounties paid. These factors include inaccurate or missing historical records, struck and lost animals, and fraud in bounty claims.

Fraud

When the Massachusetts seal bounty was first enacted, at least one legislator anticipated fraud and opposed the bill for that reason (Seals' tails and flippers… 1888) ("the flippers of seals are so similar to the tails that the bounty would be paid five times for each seal …"). When bounty programs were enacted, they were designed to discourage fraud. Bounties were generally small amounts of money paid to local citizens. For example, of the twelve individuals who collected seal bounties during 1940 in the Town of Stonington, ME, eight of them collected five dollars or less and the highest paid person collected 17 dollars (Town of Stonington 1940). Thus it was unlikely for individuals to commit widespread fraud.

Contemporaneous newspaper accounts show, however, that fraud was suspected in both Maine and Massachusetts in the first decade of the 20th century (see above). The sharp spike in the number of Maine seal bounties paid in 1904 (5606 bounties) compared to the previous year (2448) (Fig. 1) suggests that fraudulent claims may have been paid for a number of seal noses manufactured out of a single hide. Much of the increase is accounted for by Portland, ME, where accusations of fraud were made (Barry 1979). There, bounty claims increased from 208 in 1903 to 2632 in 1904. For the purpose of estimating the total number of seals killed, we assumed that the actual number of seals killed in Portland during 1904 was between zero (which would be the case if all Portland bounties paid in 1904 were fraudulent) and 2632 (if none of those paid were fraudulent).

Fraud may also account for the rise in bounties collected in Massachusetts from 1906 to 1908. However, there is evidence that at least some fraud in Massachusetts was due to killing seals in Maine and collecting the bounty in Massachusetts (Thought they… 1908). This type of fraud does not produce an over-count of seals killed in the Gulf of Maine as a whole (although it would impact our spatial analysis). Furthermore, at least two of the Massachusetts towns where fraud was suspected (Lynn and Norfolk) paid no bounties between 1906 and 1908. This absence of payment suggests that fraudulent bounty claims were not all paid. For the purpose of estimating the total number of seals killed, we assumed that the actual number of seals killed in the seven Massachusetts towns where fraud was suspected from 1906 to 1908 was between zero and 1477 (the number of bounties paid). It is also noteworthy that the number of bounties paid in Boston, MA jumped from 136 in 1906 to 406 in 1907 and then to 1491 in 1908. However, we

could find no confirmation of fraud involving the seal bounty claims in Boston. When the Massachusetts bounty was re-established in 1919, a person was required to present the whole skin and nose of the seal in exchange for the bounty (An Act … 1919), making fraud much more difficult.

Struck and lost animals

The term "struck and lost" refers to animals that are wounded during a hunt, but either escape or are lost during landing (North Atlantic Marine Mammal Commission 2006). This phenomenon is another source of uncertainty in establishing the actual number of seals killed based on records of bounties paid. Fishers surveyed by the Maine Department of Sea and Shore Fisheries in 1946 complained about the problem of struck and lost. One fisher argued that the bounty should be increased to four dollars because, "anyone will shoot three and get one" (Seal Damage Reports 1947), a struck and lost rate of 67%. Modern estimates of struck-and-loss rates for seals vary widely and depend, to some extent, on variables such as hunting method, fat content of the seal, and salinity of surface water (Reeves et al. 1998). Low rates (up to 10%) are sometimes associated with *Pagophilus groenlandicus* Erxleben (Harp Seals) and *Phoca hispida* Schreber (Ringed Seals) killed and retrieved on fast ice (Lavigne 1999, Reeves et al. 1998). However, the fraction of bedlamers (juvenile Harp Seals older than beaters) and adult Harp Seals struck and lost in the Northwest Atlantic has been estimated at 20% (hunted on ice) to 50% (shot in the water) (Lavigne 1999). The struck-and-loss rate for walruses harvested by Native Alaskans between 1952 and 1972 was estimated at 42% (Fay et al. 1994). Loss rates of 70% for Harp Seals killed in the arctic spring and summer seal hunt are also reported (Sergeant 1991, cited in Lavigne 1999), while 50% is given as a conservative estimate for older seals shot in the water (Sjare and Stenson 2002).

With few exceptions, the people who collected seal bounties in Maine and Massachusetts were fishers and not professional sealers. Both skill and determination were needed to shoot a seal, mortally wound it, and gaff it before it sank. Seals were hunted in open water from small boats because seals struck on land or tidal ledges generally lunged back into the water (Hallett 1947). However, seals struck in the water may sink, particularly when their body fat is low. This fact suggests that Harbor Seal pups may have been disproportionately lost and that the struck-and-lost rate probably varied by season. Furthermore, unlike professional and subsistence seal hunters in the studies cited above, New England fishers were motivated to kill seals primarily because seals were perceived to be competitors for fish. Collecting the bounty was a bonus, not the person's livelihood, and the carcass itself had no value. A fisher had less to gain than a commercial or subsistence sealer if retrieval of the seal carcass was difficult or dangerous. Based on these considerations, we estimate that the struck-and-lost rates in the Maine and Massachusetts seal bounty hunts may have been 50% to 67%, in line with contemporaneous estimates and in the middle to high end of the range described for the modern Harp Seal hunt.

Estimation of number of seals actually killed

Correcting our count of bounties in the historical record (40,251) for missing data yields low and high estimates of the number of bounties paid of 40,251 and 45,166 respectively. Correcting this value for fraud yields low and high estimates of the number of seals represented by the body parts presented to town clerks of 36,142 and 45,166 respectively. Finally, applying a struck-and-lost rate of between 50% (low estimate) and 67% (high estimate) suggests that between 72,284 and 135,498 seals were actually killed as part of the bounty hunt in Maine and Massachusetts.

Without knowing the number of seals present in the Gulf of Maine during the bounty years, it is difficult to determine exactly how this level of killing would have impacted seal populations. However, there were only 5796 Harbor Seals and about 30 Gray Seals counted on the Maine coast in 1973 (Richardson 1973), when seal populations had 28 years to recover from the Maine bounty and 11 years to recover from the Massachusetts bounty. More recent counts of Harbor Seals on the Maine coast have been found to underestimate the actual population by an average factor of 2.58 (Gilbert et al. 2005). However, even with this correction, the number of seals killed in the Maine and Massachusetts bounties from the late 19th to the mid-20th centuries may have been an order of magnitude greater than the number that remained after the bounties were repealed. It is difficult to imagine that this level of killing did not reduce seal populations.

Impact of bounty on seal populations

Seals consume a range of marine organisms including fin fish (teleosts) and invertebrates (Reidman 1990). As is the case for terrestrial carnivores, seals come into conflict with humans when they compete with people for prey resources, and bounty programs have historically been designed to reduce this conflict by reducing the number of animals or eliminating them entirely (Treves and Karanth 2003). Reducing the number of seals to reduce their impact on commercially important fish stocks remains the rationale for hunts and culls of seals in Canada (Fisheries Resource Management-Atlantic 2003) and Norway (Ministry of Fisheries 2003) to this day. Thus, it is not surprising that the legislative history of the New England seal bounties shows that they too were instituted to reduce the impact of seals on fisheries (Maine Commissioners of Sea and Shore Fisheries 1934).

The fact that there were far more bounties paid in the first than in the second seal bounty period in both Maine and Massachusetts (Fig. 1) suggests that the number of seals in the Gulf of Maine fell during the late 19th and early 20th centuries. Indeed, Harbor Seals may have been locally extirpated (or nearly so) from some areas of the Massachusetts coast, only to return decades after the end of the bounties (Katona et al. 1993, Payne and Selzer 1989). We have also found that higher numbers of bounties were paid along parts of the Maine coast that had more seals and a higher human population. Thus, to the extent that the purpose of the bounty was to reduce the number of seals with the objective of reducing fisheries interactions (human-seal

conflicts), the New England seal bounties could be seen as accomplishing their goal.

Two factors complicate this point of view, however. First, the negative attitudes of fishers toward seals seemed to change very little over the course of the seal bounty periods when seal populations (and presumably fisheries interactions) were probably falling dramatically (Lelli and Harris 2006). Indeed, the negative attitudes of fishers toward seals in Maine are remarkably similar to those expressed toward *Phoca hispida saimensis* Nordquist (Saimaa Ringed Seals) in Finland (Tonder and Jurvelius 2004) and *Monachus monachus* Hermann (Mediterranean Monk Seals) in Greece (Glain et al. 2001), two species of critically endangered pinnipeds. Thus, there may be no level of seal population reduction, short of total extirpation, sufficient to change fishers' attitudes toward these animals. It is also important to note that during and after the seal bounty periods in Maine and Massachusetts, the indiscriminate and unregulated killing of seals was allowed nearly everywhere in the Gulf of Maine until seals gained legal protection via the Marine Mammal Protection Act (MMPA) (Gilbert et al. 2005, Lelli and Harris 2006, Payne and Selzer 1989). Thus, the rebound in seal numbers probably resulted from both the cessation of the bounty and passage of the MMPA.

Study limitations

This study suffers from several important limitations. First, it does not include data from Canadian bounties and hunts, which certainly impacted seal populations in the Gulf of Maine. Second, we cannot rule out the possibility that some municipalities in New England may have paid bounties on seals prior to the enactment of state bounties, although we found no evidence for such payments. Finally, while the multivariable analysis of the predictors of the number of bounties paid used the earliest available town-level census data and seal counts, these numbers reflect conditions near the end (in the case of the 1950 census numbers) or soon after the end of (in the case of the 1973 seal counts) the bounty. Earlier data for these variables may have yielded different results. Nonetheless, both of these variables were significant predictors of the number of seal bounties paid.

Conclusions

We have compiled records of 40,251 seal bounties paid in Maine and Massachusetts between 1888 and 1962. These records probably represent between 72,284 and 135,498 seals actually killed as part of the bounty hunt, numbers that may have had a substantial impact on seal populations in the Gulf of Maine. We have also found that larger numbers of bounties were paid in areas that had more seals and higher human population. To the extent that the purpose of seal bounties was to reduce the number of animals where the population is largest and where conflicts between seals and humans (primarily fishers) are most likely, it could be argued that the seal bounties were successful at achieving their objective. However, it is also true that fishers

never ceased complaining about the impact of seals on their livelihood, no matter how low the seal population fell (Conkling 1999, Seal Damage… 1947) and that the bounties were repealed because the costs (including the perceived negative impact on tourism as well as animal welfare and conservation concerns) were felt to outweigh the benefits (Lelli and Harris 2006).

It is also vital to remember that the unregulated hunting of seals was permitted throughout our study period. Thus, when considering the impact of bounties on seal populations, we must remember that a national moratorium on the killing and harassment of all marine mammals, including seals (MMPA) was adopted not long after the last bounty law was repealed. It is through both of these changes in management strategy—repeal of bounty laws and the passage of protective legislation—that Harbor and Gray Seal populations in the Gulf of Maine have begun the process of recovery over the last three decades.

Acknowledgments

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