

# MARINE MAMMALS IN RELATION TO COMMERCIAL FISHERIES IN ALASKA\*

by

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A variety of mammals inhabit the seas adjacent to Alaska. Seven species of pinnipeds and more than a dozen species of whales and porpoises are common to abundant. Certain of these mammals have been harvested in the past, both for commercial and subsistence purposes, though at present only the fur seal and walrus have much commercial value to Americans. The walrus, ringed seal, bearded seal, and to a lesser extent the harbor seal and ribbon seal, are still utilized domestically by Alaskan natives. In addition, the natives harvest many belugas, some bowhead whales, and an occasional California grey whale. The Japanese in recent years have intensified their whale fishery in the Aleutian Island region, but no American whaling enterprise currently exists in these northern waters. Beyond these direct benefits afforded mankind by marine mammals, their aesthetic quality rates appreciation that will increase directly as better tourist transport is developed. Were fish not of such enormous importance, we might let the matter stand here, but the actual situation is that some marine mammals are, to varying extents, detrimental in their relationships to commercial fisheries. I would like to review our knowledge of these relationships. For the most part, the information is based on investigations conducted during the past few years by the Alaska Department of Fish and Game.

It might be well to point out that the problem of predation and depredations by marine mammals has several aspects. An objective biologist is primarily concerned with purely biological considerations. Commercial fishermen stress negative economic factors, that is, the value of fish lost; natives stress the opposite -- the value realized from harvesting the mammals. Much of the public sees only the aesthetic value. These differing interests aggravate the original problem, because the best conceived predation control program is certain to have no small amount of heartfelt criticism directed at it. This is not to imply that criticism of present programs may not be legitimate in some cases. Rather it accentuates the need for more facts so that all elements of the problem can be confidently balanced.

Because marine mammals are, by virtue of their environment, closely associated with fish, it may be well to comment briefly even on the more unlikely predators. The baleen whales, for example, are seldom thought of as fish predators or competitors, yet many of them share a Euphausiid diet with salmon in their ocean rearing areas. Some of them also eat fish, though in this connection, the little piked whale may be the only species worthy of note. It frequently concentrates in areas where herring are abundant, and from observations in the Sitka Sound area, I am satisfied that it does indeed forage on these fish. The influence of the baleen whales on fish production is presently an academic consideration, and might best be left at that.

Porpoises are fish eaters, though the character of their diet remains little known. There are a few references in the literature which indicate that they feed

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on herring. The two specimens that I have examined, a harbor porpoise from Bristol Bay and a Dall porpoise from Taku Inlet also contained herring. Due to their small size, it seems doubtful that porpoises could make serious inroads in any fish stock unless they become far more abundant than they are today.

The last cetacean that I shall mention is the beluga. This small toothed whale, some 12 to 15 feet in length, has a holarctic distribution. In the western arctic, it is mostly migratory, wintering in the Bering Sea and spending the summer months in the Arctic Ocean. However, there are substantial numbers of these animals that fail to show this migratory behavior: they spend the summer months in Cook Inlet and the larger estuaries of Bristol Bay, Hooper Bay, Norton and Kotzebue Sounds. Their occurrence in these areas during the time of salmon migrations has created speculation that predation on these fish may take place.

The Department of Fish and Game initiated an investigation of the beluga in Bristol Bay during the spring of 1954. Since then, some work has been done on this problem each year. The results of the first two seasons investigations have been reported in the Department's Annual Reports, but it may be interesting to review them here.

In the Kvichak and Nushagak estuaries during 1954 and 1955, 116 belugas were collected to determine the kind and quantity of food consumed. From the stomach contents of these specimens, from estimates of the number of belugas present, and approximate knowledge of the size and timing of fish migrations, it was possible to derive a reasonably good understanding of the predation picture. The belugas fed primarily on smelt from the time of the spring ice breakup until the onset of the downstream red salmon migration in late May -- a period of two weeks or slightly more. During the passage of the red salmon smolts through the lower Kvichak River, which required about 20 days both in 1954 and 1955, these fish displaced smelt as the dominant item in the beluga's diet. Thirty beluga stomachs examined during the course of the downstream salmon migration contained an average of 685 red salmon smolts; the maximum number in one stomach was 2,798. In the last half of June, mature salmon first appeared in Kvichak and Nushagak Bays enroute to their natal streams. Belugas then fed almost exclusively on mature fish until at least mid-August when our collecting ceased. As many as 16 adult salmon were found in one stomach. In addition, minor numbers of other food types, including blennies, flounders, sculpin, smelt, and shrimp were usually represented. These smaller forms are apparently of much importance to calf and yearling belugas, which feed little, if at all, on adult salmon.

Evaluation of the data led to the following conclusions: Loss of downstream migrating red salmon in the Kvichak River during 1954 and 1955 amounted to at least 3,000,000 fish each year. Just what 3,000,000 smolts represent in terms of adult fish is unknown, though if one guessed that 5% of them would return, then it would amount to some 150,000 mature individuals. During the past two seasons, that is 1956 and 1957, the loss of downstream migrants was considerably less due to the extremely small number of fish that descended the Kvichak River. Belugas were nevertheless present, and percentage-wise predation losses may have been larger than in preceding years. In this regard, predation on smelt is noteworthy, for the presence of these fish acts to hold the belugas in areas where they subsequently forage on salmon.

Predation losses of adult red salmon in Nushagak and Kvichak Bays were about 80,000 fish, equal to 2.7% of the total run in 1954, and 40,000 fish or 1.0% of

the run in 1955. In the last two seasons, the absolute losses were probably higher while the percentage losses were lower due to much larger runs of fish.

Other species of salmon are preyed upon to a lesser extent; the loss of all other salmon combined is approximately equal to that of reds alone.

Translating predation losses into dollars is one method, though, of course, not always the best method of assessing their significance. In the present case, it would be reasonable to place the monetary value of salmon taken by belugas during 1954 and 1955 at nearly \$200,000 each year. This estimate is based on prices paid to fishermen in those years, and values the smolt loss the same way, considering that each 100 smolts equal 5 adult fish. Because predation appears to fluctuate within narrow limits as compared to fluctuations in fish number, its biological significance undoubtedly varies much from year to year.

The results of this research are considered to indicate the need for predation control, especially if this could be effectively accomplished without large-scale destruction of the belugas. An important reason for not destroying belugas unnecessarily is their importance in Eskimo economies further north along the coast -- chiefly from Hooper Bay to Wainwright. As yet, we do not know how much interchange there may be between local populations, though there appears to be little movement during the summer.

In the spring of both 1956 and 1957, the Department of Fish and Game attempted to reduce predation on red salmon downstream migrants by simply chasing the belugas out of the lower Kvichak River with a speedboat. We feel that this action was successful in materially reducing predation, though it obviously was not the solution to the problem, because during stormy weather and the hours of darkness the belugas unfailingly moved back into the confines of the lower river where most predation occurred. Another control method, which, however, has not yet been tested, is the use of sonic repellants. That is, if one could transmit the calls of frightened or wounded belugas, it might repel other belugas. Perhaps better would be the sounds of killer whales. We have succeeded in recording a small amount of the sound emitted by belugas, but have not yet tested the response of other animals to it.

Continuation of the beluga investigation is planned, with emphasis being placed on finding ways of reducing predation.

Considering now the Pinnipeds in relation to our commercial fisheries. Animals of the hair seal group, family Phocidae, have long held prominence as fish predators, with usually little effort being made to distinguish between the various species of seals, to say nothing of their differing food habits. Included in the category of hair seals is the bearded seal, the ribbon seal, the ringed seal and the harbor seal.

The bearded seal is primarily associated with the arctic ice pack; it occurs uncommonly in areas where commercial fishing is practiced. In any case, it does not eat fish, but subsists almost entirely on crustaceans and other marine invertebrates. It is important as a source of food to the Eskimos, and as a predator of fish, it must be completely discounted.

The ribbon seal, wholly a pelagic animal, is so rare that it must likewise be dismissed as a predator of no importance.

The ringed seal is mostly confined to the vicinity of the arctic ice, though fair numbers of them do spend the summer south of the Bering Strait. They are practically unknown east of the Alaska Peninsula and are even rare in Bristol Bay except during the winter season. They are primarily crustacean eaters, though they do eat small fish as tom cod, flounders and sculpins. Certainly their role as a predator on commercial fishes is insignificant.

The last animal in the hair seal group is the harbor seal, which occurs along the entire coast of Alaska. It frequently ascends rivers for many miles, and there is even a small resident population in Lake Illiamna. This appears to be almost entirely a fish eating mammal; our collections show that several species of smelt are seasonally important in its diet, though it also eats flounders, herring, cod, rockfish, etc. Salmon also are eaten, though most of these seem to be taken from gill nets, rather than being caught as free swimming fish.

It would be safe to say that harbor seals are harmless to our commercial fisheries, except where gill nets are employed. In the latter circumstance, they frequently destroy such quantities of salmon that control is clearly warranted.

I would like now to speak of seal control activities in Alaska. First, a Territorial bounty of three dollars is paid on all four species of seal just mentioned. I do not have, nor is there available, information on the percentage of each species represented in claims for bounties. No doubt most claims involve harbor seals, though a large number of ringed seals are unquestionably bountied. Probably relatively few bearded seals and ribbon seals are bountied because they are not subject to being killed in large numbers due to their pelagic habits.

As already mentioned, only the harbor seal is destructive to commercial fisheries, but even in this case, the animals are seldom killed for bounty at times and in places that would benefit fishermen. It is clearly evident after thirty years of seal bounty payment in Alaska that this system is not capable of depressing seal numbers except perhaps temporarily in restricted localities. It must be concluded, therefore, that no good return, insofar as commercial fisheries are concerned, is realized from the present seal bounty system.

The Alaska Department of Fish and Game has had an active harbor seal control program for seven years. Seals are killed only in important gill net fisheries just prior to and during the fishing season. In the Stikine and Taku River fisheries, expert riflemen are employed to shoot seals. On the Copper River flats, seals are destroyed by depth bombing with dynamite. This method is hazardous, but extremely effective; it has accounted for 27,000 seals in seven years. The animals have been reduced to a small fraction of their former numbers, and their depredations have dwindled accordingly. However, even this huge removal of seals has had only local influence on their numbers. One need go only 100 or 150 miles either east or west to still find herds numbering 1000 or more individuals.

The cost per seal killed by our rifle hunters is about three dollars; those killed by dynamite cost considerably less. Fishermen in the localities where seal control is conducted unanimously acclaim its good results. We are aware that there is little residual benefit from this control work, except perhaps in the Copper River area. The expenditures must be justified by the fish saved during the period of control. Our experience has shown that in gill net fisheries where seal depredations are excessive, local intensive control during the fishing season can be economically rewarding. General control, spread in space and time as with the

bounty system is useless. It expends money and animal life to no good purpose.

The eared seals, that is, the fur seal and sea lion, remain to be considered. I am not qualified to say much about the fur seal for my knowledge of this animal has been gained almost entirely from reading. The reports that have been published do not suggest that the fur seal is harmful to any existing commercial fisheries. On the Commander Islands salmon spawn in streams in close proximity to fur seal rookeries indicating that a very long close association has existed without serious detriment to the fish. Salmon have on occasion been found in fur seal stomachs, but their occurrence is uncommon. The Japanese, however, have recently reported heavy losses of salmon to these predators in their high-seas gill net fishery. But the fur seals themselves are a valuable resource and predation by them would have to be extremely destructive to warrant serious concern.

Now the sea lion. This mammal is abundant in most parts of Alaska and its presence is especially well known in our most important fishing areas. Its depredation in our fisheries cannot be dismissed lightly and the problem is aggravated by our ignorance of even such things as the animal's basic life history characteristics. In contrast to the fur seal, which has been studied more or less intensively for over half a century, the sea lion has been paid scant attention until very recent years. Knowledge of its breeding biology, food habits and population status is only now being acquired and such information is certainly requisite to a satisfactory understanding of the sea lion's role as a predator. About ten years ago the Fish and Wildlife Service began a study of the sea lion with emphasis on its depredations. The work achieved was of much value, but unfortunately it was terminated long before conclusive results were obtained. Fish and Wildlife Service biologists have since published worthwhile bits of information, though the major contribution of this Service has been the lending of financial support (mostly Saltonstall-Kennedy funds) to other agencies for the conduct of sea lion research. The Fishery Products Laboratory in Ketchikan, the Fisheries Research Institute of the University of Washington and the Alaska Department of Fish and Game have all shared these benefits. Since July 1956, the Territory has supported, unassisted, the investigation by the Department of Fish and Game.

Due to the general nature of this paper, it is not possible to dwell long on the details of research though I would like to at least mention the course of the work that the Department of Fish and Game has been pursuing. At the outset, all of the rookeries from the British Columbia border to the Kenai Peninsula were located and most were photographed from the air. This survey complemented similar endeavors by the Fisheries Research Institute in the westward areas. The problem of evaluating the predation and depredations of sea lions was approached by stomach analysis of specimens collected at all times of the year and by interviewing and circularizing fishermen. The detailed study of the animal's biology and behavior was undertaken on the rookeries, most of it on Lewis Island of the Wooded Island group in the Gulf of Alaska. Our estimate of the number of sea lions occurring in the summer season from the Barren Islands, just south of the Kenai Peninsula, eastward to the Canadian border is 25,000. The results of surveys to the westward by the Fisheries Research Institute have not yet been made public though there is ample evidence that this region has at least twice the number of animals found in the east, that is, east of the Kenai. From stomachs examined thus far it appears that sea lions eat a wide variety of fish; squid are also an important food during the winter season in Southeastern Alaska. Herring were found more frequently and in greater quantity than any other food on a year around basis. Halibut, flounders, cod, rock fish, greenling, sculpins, salmon and even chitons were also found in

stomachs. As collecting continues an even wider range of food items will undoubtedly be revealed. It appears doubtful that sufficient quantities of commercial species of fish, with the possible exception of salmon, are taken while free swimming. It is perfectly certain, however, that important quantities of black cod, halibut and salmon are taken from fishing gear; mainly, trolling lines and long lines. The animals are equally a nuisance around traps where they undoubtedly destroy numbers of salmon.

With regard to depredation, questionnaires returned by fishermen provide some information. It is, of course, probable that the contents of the returned questionnaires are flavored by prejudice, at any rate, the results were as follows: First, the halibut fishery. Returns represent 253 boat days of fishing. The average loss per boat day to sea lions was 11 fish, or about 440 pounds, if they were of average size. This quantity would have a value to the fishermen of about \$88.00. Reports from salmon trollers, mostly in the outside waters of Southeastern Alaska, represent 564 boat days of fishing. The reported loss was 3 fish per boat day which would have a value of about \$6.00. I do not have information at this time on the total fishing effort and, in any event, doubt that one would be justified in projecting the above losses to cover the entire fleet during the whole of the season. Some idea of fishermen's sentiments with respect to sea lions may be gathered from their remarks. I have abstracted a few from the questionnaires: "Could be bombed", "Please thin them out a little", "Thin down as soon as possible", "Kill off at least 90% of herds", "Would like to see sea lions destroyed", "Send the Coast Guard out to destroy them", "Destroy sea lions, they are costly to fishermen", "Bomb rookeries", "Have drive to kill them off", "Shoot the bums", "Kill them all", "Recommend bounty on sea lions", "Get rid of them", "Use dynamite, guns, poison, A bombs", "Bomb or machine gun rookeries", "Government control", . . . , and one atypical comment, "Don't think they are too serious". This last fellow didn't sign his name.

Some very important knowledge concerning the biology of reproduction has recently been acquired. Contrary to general belief, sea lions do not breed annually as do fur seals. It is probable that biennial breeding is the rule. Pups nurse for well over a year which is also in sharp contrast to fur seals.

Pupping is mostly concentrated on relatively few large rookeries, for example; on Lewis Island where I counted over 2,000 animals in 1956, fewer than 100 pups were born. In 1957 about 50 pups were born. There were present each year approximately 800 cows accompanied by yearlings which must have been born elsewhere. A similar situation was found on Chiswell Island and seemed, from aerial observation, to likewise prevail on the many other small rookeries examined. So little pupping took place on these smaller intervening rookeries that it might be considered accidental. They are, however, of much importance as breeding sites. In the region east and south of the Kenai to the Canadian border, there exist only two major pupping rookeries - Forrester Island and the Barren Islands which are nearly 800 miles straight line distance apart. I do not yet know the situation to the westward where there are several extremely large rookeries; certainly the major pupping rookeries must be close together. At any rate, this type of information should be invaluable if sea lions are ever utilized commercially or it is otherwise desired to control their numbers. I consider this another example of why a thorough going investigation should be conducted preliminary to actual attempts at predation control.