

Incidental Catch of Marine Mammals by Foreign Fishing Vessels, 1978-81

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Introduction

Passage of the Marine Mammal Protection Act (MMPA) of 1972 established a moratorium on the taking of marine mammals. Exceptions to the moratorium included the incidental taking of marine mammals in commercial fishing operations for which a General Permit system was established by the U.S. National Marine Fisheries Service (NMFS). Amendments to the MMPA in 1981 authorized the Secretary of Commerce to waive the permit requirement in certain instances. However, General Permits allowing the incidental take of marine mammals have been issued by

ABSTRACT—U.S. fishery observers were placed aboard 10 percent of the foreign fishing vessels in the U.S. fishery conservation zone in the northeastern north Pacific Ocean and Bering Sea during 1978-81 and collected data on marine mammals incidentally taken by the vessels. Of the total 298 marine mammals observed incidentally taken, 81 were released alive and 217 were dead. Species taken in low numbers included northern fur seal, harbor seal, northern elephant seal, ribbon seal, walrus, and Dall's porpoise. Northern sea lions were the prevalent species taken and accounted for 90 percent of the total. Tooth samples from 78 dead northern sea lions yielded a range of ages for males and females of between 1 and 16 years, most being 9 years or less. The total estimated annual sea lion take between 1978 and 1981 averaged 724 animals. Thus the total sea lion population of well over 200,000 animals was most likely not significantly affected. The majority of the take occurs between late autumn and early spring, a period when sea lions are not concentrated on rookeries. Japan and the Soviet Union accounted for the majority of incidentally caught marine mammals.

the NMFS to domestic fishermen since 1974 and to foreign fishermen, under jurisdiction of the Magnuson Fishery Conservation and Management Act (MFCMA) of 1976, since 1977. The issuance of General Permits to foreign vessels was restricted to those operating within the U.S. 200-mile fishery conservation zone (FCZ). The incidental taking of marine mammals produces the need to estimate regularly the number and location of marine mammals incidentally caught in the course of commercial fishing operations, with the objective of determining the overall impact of this take on marine mammal stocks.

Since implementation of the MFCMA, the United States has placed fishery observers aboard foreign trawl and long-line fishing vessels in the FCZ to collect data which are used by the United States to estimate the foreign commercial catch, provide information on the various stocks of fish, and report compliance with U.S. fishing regulations (French et al., 1982). For example, in 1977 and 1978 combined, 122 fisheries observers sampled caught fish on 128 foreign vessels in the eastern Bering Sea and Aleutian Islands region (Nelson et al., 1981). Observer coverage averaged 10 percent between 1978 and 1981 in the area covered in this paper. A description of the sampling methods used in different regions by U.S. observers may be found in Nelson et al. (1981), Wall et al. (1981), and French et al. (1981).

Although the primary objective of

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fishery observers was to collect fishery data, they have also collected data on marine mammals caught incidental to fishing operations, including species, number observed caught, sex, morphological measurements, location, and, since 1979, the collection of canine teeth when appropriate.

All foreign vessels fishing within the FCZ are required to have a General Permit and, as a stipulation of the permit, to report all marine mammals caught while in the FCZ. The reporting by vessels may not be reliable, however, since there is no assurance that they are reporting all the animals caught by them. The identification of animals caught and reported may also be subject to question since the ships' personnel are not trained to identify marine mammals properly. Also, not all foreign vessels have observers on board, which reduces the number of observer-reported animals in proportion to the total number of incidentally taken marine mammals. Reports by U.S. observers onboard foreign vessels are more reliable, but these include only the animals actually seen by the individual observer and consequently do not include all of the animals taken.

Fishery observers have been placed on foreign vessels for many years and have reported the incidental take of marine mammals since 1972; however, the methods used for collecting data and the reporting requirements have progressively improved. The more rigorous reporting scheme now in use is partly due to requirements in the MMPA and MFCMA, stipulating that the Federal Government manage fishery stocks and marine mammal stocks together, resulting in the need to report and record accurately the incidental take of marine

mammals. In the observer scheme used prior to the MFCMA, observers reported some, but not all, marine mammals taken in hauls observed by crew members. Most fish sampling was done in the hold where marine mammals might not be seen, and not all marine mammals taken and observed by fishery observers were reported. During the period 1972-76, about 800 marine mammal mortalities (mostly sea lions) were estimated annually from fishery observer reports, similar to the average take for the period 1978-81. But, because of the loose reporting requirements during the former period, the total annual estimated take is regarded by us as equivocal and underestimated. In our view the former data were too rough to provide accurate estimates, and the present observer scheme provides a better indication of the incidental take of marine mammals in the foreign fishery.

The purpose of this paper is to summarize the incidental take of marine mammals as reported by U.S. observers on foreign fishing vessels in the northeastern north Pacific Ocean and eastern Bering Sea FCZ from 1978 to 1981. Marine mammals reported by U.S. observers on foreign vessels which were part of a joint venture are not included here since those animals were caught by U.S. fishermen. We include a description of the species caught, their sex, number, age (when available), location, the type of fishery involved, and nation-

ality of the vessel in which the take occurred.

Marine Mammal Species Summary

During the period 1978-81 a total of 298 marine mammals were observed by U.S. fisheries observers incidentally taken by foreign vessels fishing within the north Pacific Ocean and Bering Sea FCZ (Table 1). Of these, 81 were caught and released alive; the remaining 217 either died as a result of the fishing operation or were dead when taken by the fishery. Northern (Steller) sea lions, *Eumetopias jubatus*, were the prevalent species taken, representing 90 percent (268 animals) of those caught. Northern fur seals, *Callorhinus ursinus*, were the next most abundant pinniped caught, representing 3 percent of the total (9 animals). Infrequently, harbor seals, *Phoca vitulina*; ribbon seals, *Phoca fasciata*; northern elephant seals, *Mirounga angustirostris*; and walrus, *Odobenus rosmarus*, were caught, but in very low numbers (Table 1). Six Dall's porpoise, *Phocoenoides dalli*, were caught and were the prevalent cetacean identified; eight unidentified cetaceans were also caught.

The northern sea lion's breeding range is centered in the Aleutian Islands and Gulf of Alaska (Calkins and Pitcher, 1982; Loughlin et al., in press). Not surprisingly, in those areas of the southeastern Bering Sea and Gulf of Alaska where intense foreign commercial fish-

ing occurs, high incidental take of sea lions is prevalent (Fig. 1). Another reason for the high incidental take of sea lions, which unlike other marine mammals that tend to shun fishing vessels, is their propensity to follow fishing vessels to feed on fish discarded during processing or to interfere with the net and other gear during the fishing operation. The occurrence of sea lions near fishing vessels far out at sea seems to have been observed only since the expansion of foreign commercial fishing activity in the north Pacific Ocean and Bering Sea, although sea lions were regularly seen on halibut grounds when vessels were present¹. Few large groups of sea lions were seen further than 10-15 miles offshore during extensive pelagic fur seal studies in the 1950's and 1960's (Fiscus and Baines, 1966).

Since 1979, fishery observers have opportunistically collected sea lion teeth which were given to us for age determination by counting dental annuli (Fiscus, 1961; Spalding, 1964). The reader should be cautioned that the data based on collected teeth may be biased, since not all animals caught and killed are represented in the tooth samples, and smaller animals (young and females) may be overrepresented because observers and vessel crews may prefer to sample the smaller animals that are easier to handle on deck. In 1979, teeth from 26 sea lions were collected by fishery observers representing 82 percent of the sea lions seen and which died that year in the foreign commercial fishery (Table 1). In 1980, teeth were collected from 37 sea lions, representing 80 percent of those that died; and in 1981 teeth were collected from 15 sea lions, representing 48 percent of those that died. Of the 26 sea lions collected in 1979, 12 were females; in 1980, 18 of 37 were females; and in 1981 6 of 15 were females. The age of all males and females ranged from 1 year to 16 years, with 92 percent aged 9 years or younger.

Male sea lions in the Gulf of Alaska

Table 1.—Summary of incidentally taken marine mammal species observed by U.S. fisheries observers on foreign vessels in the northeastern North Pacific Ocean and eastern Bering Sea fishery conservation zone, 1978-81. Numbers represent only animals from hauls observed by the fishery observer on 10 percent of the foreign vessels.

Species	1978	1979	1980	1981	Total
Northern sea lion, <i>Eumetopias jubatus</i>	117(38) [*]	57(24)	51(5)	43(12)	268
Northern fur seal, <i>Callorhinus ursinus</i>	3	1	3	1	8
Harbor seal, <i>Phoca vitulina</i>		1			1
Northern elephant seal, <i>Mirounga angustirostris</i>		1			1
Ribbon seal, <i>Phoca fasciata</i>	1				1
Walrus, <i>Odobenus rosmarus</i>	1	1	1		3
Unidentified pinniped		2			2
Dall's porpoise, <i>Phocoenoides dalli</i>	1(1)	4		1	6
Unidentified cetacean	3	3		2	8
Total	126(39)	70(24)	55(5)	47(12)	298

^{*}Totals include animals found dead in catch, decomposed in catch, and released alive (in parentheses).

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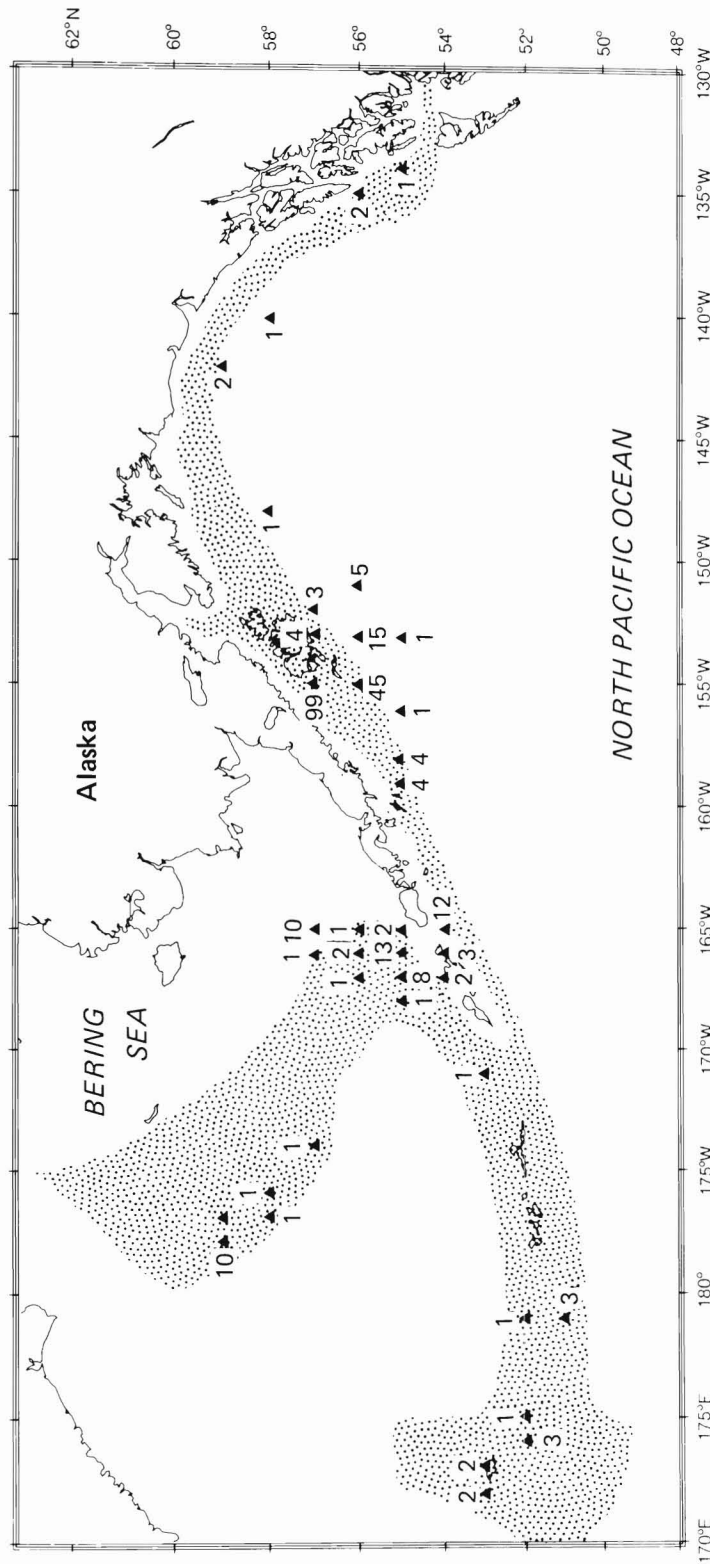


Figure 1.—Northeastern north Pacific Ocean and eastern Bering Sea showing location and number of incidentally caught marine mammals in relation to areas of heaviest commercial fishing by foreign vessels (shaded area).

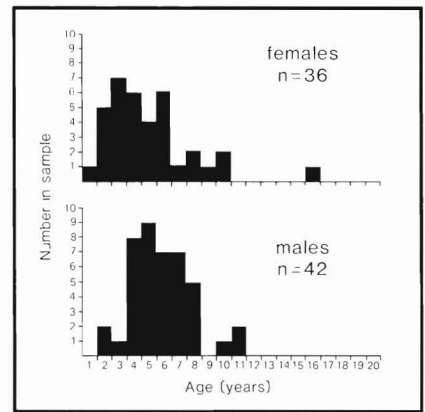


Figure 2.—Age structure of northern sea lions caught incidental to foreign fishing in the northeastern north Pacific Ocean and eastern Bering Sea, 1979-81. Only animals that had teeth removed are represented.

mature between 5 and 7 years of age, and most are able to obtain and defend territories between 9 and 13 years of age (Thorsteinson and Lensink, 1962; Pitcher and Calkins, 1981). Of the 42 males that we aged for the years 1979-81, 11 were less than 5 years of age and probably not sexually mature; 3 were 10 years of age or older and were probably old enough to obtain and defend territories; the remaining 28 ranged from 5 to 8 years of age and were probably sexually mature but too young or small to be considered territorial (Fig. 2). Therefore, of the dead male sea lions reported by observers on foreign commercial fishing vessels during 1979-81 which had teeth removed for aging, only three were probably actively reproducing males, and the others were subadult or newly matured males and not active participants in the reproducing population.

The average age of first ovulation for female sea lions in the Gulf of Alaska was 4.6 ± 0.8 years and the average age for first pregnancy was 4.9 ± 1.2 years (Pitcher and Calkins, 1981). Of the 36 incidentally caught females that we aged for the years 1979-81, 13 were 1-3 years of age. The remaining 23 ranged from 4 to 16 years of age and probably represented sexually mature animals; all but one of these were between 4 and 10 years of age. In the Gulf of Alaska, Pitcher and

Calkins (1981) found the pregnancy rate for 4-year-olds to be 81.3 percent; for 5-year-olds, 80 percent; and for 6- to 15-year-olds, 100 percent. Therefore, it seems likely that of the females taken in the foreign commercial fishery in 1979-81, only 13 (35 percent) were sexually immature while 23 (65 percent) were sexually mature. However, significant adverse impacts on the sea lion population as a whole are unlikely, given the low estimated total incidental annual take (see below). Recent minimum population estimates range from 240,000 to 290,000 individuals worldwide, of which all but about 35,000 are in Alaskan and Canadian waters (Loughlin et al., in press). However, small local populations may suffer from the loss of sexually mature female animals.

The incidental take of all marine mammals, especially sea lions, occurs primarily from late summer through early spring. Of those taken incidental to foreign fishing between 1978 and 1981, 77 percent were caught between September and April (Fig. 3). The highest monthly catch occurred in October when 12 percent of the total were taken. Only 3 percent and 4 percent of the total take were reported in May and June, respectively. A trend exists towards an inverse relationship by month between the number of sea lions incidentally taken in the foreign fishery and the number of foreign vessels in the FCZ. For the Gulf of Alaska and Bering Sea, where most of the sea lions were taken (Fig. 1), the highest number of vessels occurs during spring and summer (Fig. 3). The monthly distribution of incidental take is apparently not related directly to the number of vessels present but is more likely an indication of the number of sea lions in the area. The peak breeding season for sea lions is during June (Pitcher and Calkins, 1981) and most of the animals are on rookeries or feeding near shore during spring. The number of animals at sea is thereby reduced, lowering the likelihood of incidental take in the foreign fishery.

Foreign Vessel Summary

Vessels from Japan, South Korea, Poland, West Germany, and the Soviet

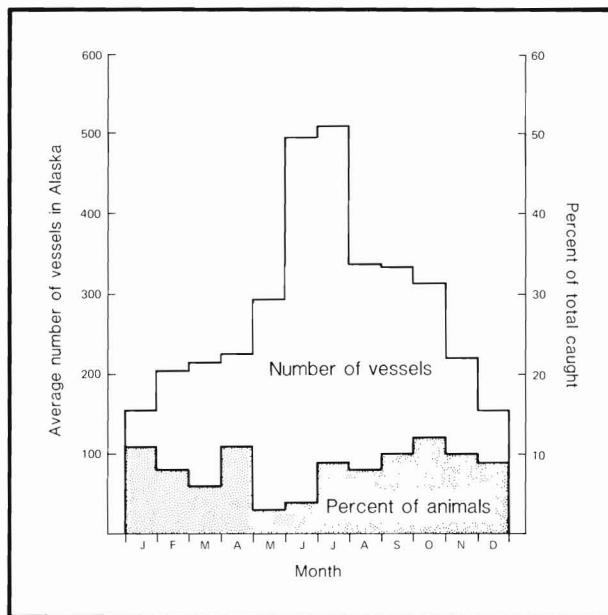


Figure 3.—Percent of sea lions taken observed by fishery observers on foreign fishing vessels by month in the northeastern north Pacific Ocean and eastern Bering Sea and the average number of foreign vessels fishing off Alaska, 1978-81. The number of vessels was obtained by the Enforcement Division, NMFS Alaska Regional Office, Juneau.

Table 2.—Number of incidentally taken marine mammal species observed by U.S. fisheries observers onboard foreign fishing vessels in the northeastern North Pacific Ocean and eastern Bering Sea FCZ by nation, 1978-81.

Species	Japan	South Korea	Poland	U.S.S.R.	West Germany	Total
Northern sea lion	197	13	4	44	10	268
Northern fur seal	4	1		3		8
Harbor seal		1				1
Northern elephant seal	1					1
Ribbon seal	1					1
Walrus	2	1				3
Unidentified pinniped	2					2
Dall's porpoise	1		2	3		6
Unidentified cetacean	4	1	1	2		8
Total observed take	212	17	7	52	10	298
Extrapolated total kill (summed from Table 3)	1,881	130	42	755	89	2,897

Union accounted for all of the U.S. observer-reported marine mammals incidentally taken during 1978-81 (Table 2). Japanese vessels took a reported 212 marine mammals, of which 197 were northern sea lions with the other species taken ranging from 1 to 4 animals. Soviet vessels accounted for the second highest recorded take, totaling 52 animals of which 44 were sea lions. South

Korean vessels took only 17, 13 of which were sea lions; West German vessels took 10 sea lions; and Polish vessels accounted for 4 sea lions, 2 Dall's porpoise, and 1 cetacean.

That vessels from Japan and the Soviet Union² account for most of the

²The Soviet Union has not been given a ground-fish allocation in the FCZ since 1980.

Table 3.—Number of marine mammals observed caught by fishery observers per metric ton (t) of groundfish by nation, 1978-81, and an extrapolation of the number expected to be killed in the fishery.

Year and nation	Groundfish		Marine mammals		
	Total t caught (A)	Observed t caught (and as % of A) (B)	No. observed dead in catch (C)	No. per observed t caught ($\times 10^{-4}$) (C/B)	Total number expected dead (A·C/B)
1978					
S. Korea	103,356	4,538 (4.4)	2	4.4	46
USSR	227,221	18,879 (8.3)	4	2.1	48
Japan	1,123,179	58,822 (5.2)	63	10.7	1,203
				Total	1,297
1979					
S. Korea	126,626	13,290 (10.5)	1	0.7	10
USSR	250,521	26,867 (10.7)	26	9.7	243
Japan	1,085,429	57,289 (5.3)	12	2.1	227
				Total	480
1980					
S. Korea	210,277	16,950 (8.1)	6	3.5	74
USSR	85,641	2,766 (3.2)	15	54.2	464
Japan	1,161,511	93,354 (8.0)	27	2.9	336
				Total	874
1981					
Poland	160,301	22,676 (14.2)	6	2.6	42
Japan	1,148,983	160,190 (13.9)	16	1.0	115
W. Germany	11,872	1,331 (11.2)	10	75.1	89
				Total	246

¹Bering Sea-Aleutian Islands, Gulf of Alaska, and east Pacific coast.

²Does not include "decomposed in catch."

marine mammals incidentally taken in the foreign fishery is not surprising, since their vessels also account for most of the foreign fishing effort in the north Pacific Ocean and Bering Sea. In our study area, Japan has had more vessels, more vessel fishing days, was allocated more groundfish, and has caught more fish than any other nation (Bakkala et al., 1979; French et al., 1982). The Soviet Union was second in most categories while Poland, West Germany, and South Korea had smaller efforts.

The primary fishery in which marine mammals were taken incidental to fishing was the eastern Bering Sea/Gulf of Alaska groundfish fishery. Bottom and midwater trawling by stern trawlers, pair trawlers, and Danish seiners were the most common types of gear used. Seines are flat nets fitted with floats on top and weights on the bottom and are pulled by one end to encircle fish. Danish seiners are used primarily below the surface to encircle fish near the bottom or at midwater depths. Trawl nets are towed along the bottom or at midwater; the cone-shaped nets are held open at the mouth by large steel doors (otter boards) (Royce, 1972; Browning, 1980).

Trawl gear is the predominant type

used by the foreign groundfish fleet in the north Pacific Ocean and Bering Sea (Bakkala et al., 1979) and accounts for most marine mammal deaths in the fishery. Presumably the marine mammals, most frequently northern sea lions, drown after they enter the net during its ascent or descent to consume the entrapped fish. Uncommonly, animals already dead and lying on the bottom were scooped up by the net and were recorded as incidentally taken animals. Smaller animals, such as some immature sea lions, harbor seals, and northern fur seals are incidentally caught in salmon and herring gill nets. Mature northern sea lions and other large marine mammals are able to break free from such frail gear and may thus cause substantial damage to the gear. Longline fisheries account for only one or two incidentally taken animals a year, although northern sea lions and killer whales, *Orcinus orca*, interact with the fishery by eating large numbers of hooked fish³.

³MMPA General Permit application to National Marine Fisheries Service by North Pacific Longline Gill Net Association, 1983

Table 3 presents an index of marine mammals taken per metric ton (t) of groundfish caught by country and an estimate of the total number of animals killed based on an extrapolation from those observed dead. The estimate of groundfish caught is based on data collected by the Northwest and Alaska Fisheries Center, NMFS. Of interest is the low number of animals incidentally killed per observed metric ton of caught fish and the variability each year in the estimated total mortalities. The amount of fish taken per haul will vary depending on the type of gear used, density and distribution of the fish, and duration of the tow; but the likelihood of killing one or more marine mammals in about every 10^4 t of fish implies that they are rarely encountered dead in the net during fishing operations. The total number of marine mammals expected to die in the foreign fishery each year ranges from 1,297 for 1978 to 246 for 1981, with an average of 724 for 1978-81. There is a declining trend in the number of animals expected to die, but the trend is not uniform. The expected marine mammal catch varies from year to year, although fishing effort occurs (as expressed in days fishing/month/country) in the same approximate location and is relatively constant. Comparison of the yearly total of metric tons of fish caught (which of course reflects the total allowable-take quota authorized under the MFCMA) supports this finding.

EMIS Recording System

As mentioned above, all foreign vessels fishing within the U.S. FCZ are required to report all marine mammals incidentally caught during fishing operations. The take is reported by the vessel operator to the nearest NMFS Regional Office, usually the NMFS Alaska Regional Office in Juneau. The incidental catch data are then entered into a computer program termed EMIS (Enforcement Management Information System) for subsequent storage and analysis. This system has been operational since 1979.

We compared the EMIS records for the period 1979-81 of incidentally

Table 4.—Numbers of incidentally caught marine mammals, 1979-81, as reported by foreign vessel operators compared to the take reported by U.S. fishery observers and the total kill extrapolated from fishery observer reports.

Type of marine mammal	1979	1980	1981	Total
Otariids	45	29	156	230
Northern sea lions	24	18	29	71
Northern fur seals	2	2		4
Other pinnipeds	5	8	9	22
Cetaceans	2	1	3	6
Total	78	58	197	333
U.S. observer totals	70	55	47	172
Extrapolated kill totals	480	874	246	1,600

caught marine mammals reported by the vessels with the records of those reported by fishery observers (Table 4). For 1979, 78 animals were reported by vessel operators, 58 in 1980, and 197 in 1981. In comparison, fishery observers reported 70, 55, and 47, respectively. The total vessel reported take for the 3 years was 333 animals versus 172 reported for the same time period by fishery observers. Northern sea lions and otariids (a general category used by vessels to report eared seals, but usually representing northern sea lions and only infrequently northern fur seals) were the prominent species reported taken by the vessels. Other pinnipeds and cetaceans were also reported taken, but in low numbers.

The takes reported by vessels and by fishery observers for 1979 and 1980 were very similar, suggesting that vessel operators were more likely to report only those animals that the fishery observer reported. That only 10 percent of the vessels had fishery observers aboard suggests that 90 percent of the vessels did not report their incidentally taken marine mammals in 1979 and 1980. But this suggestion is misleading. We compared the reports by vessel operators with those of the fishery observers for 1980 and found that of the 16 animals taken and reported by fishery observers on Soviet vessels, none were reported by vessel operators (they were not on the EMIS data base). Only two animals taken by the Soviets were on the EMIS data system. For South Korean vessels,

all 6 animals taken that were reported by observers, plus 12 others reported by the vessel operators, were on the EMIS data system. The reported take by Japanese vessels is more complicated: About 33 percent of the observer-reported takes were reported by the vessel operator. Coincidentally, Japanese vessel operators reported 34 animals taken, the same number as the observers. There appears to be no consistency by year in reporting by country or vessel, whether or not a fishery observer is on board. The reported take in 1981 of 197 animals by all foreign vessel operators (Table 4) suggests that operators were more inclined to report incidentally caught marine mammals, even if a fishery observer was not on board, although the number is still below our total projected marine mammal catch of 246 animals for 1981.

It is obvious that neither reporting system is ideal and that improvements are needed in both. The precision of the estimated total kill by the fishery-observer reporting scheme could be improved by increasing the number of observers and the percent of coverage. Amendments to the MFCMA in 1980 mandated 100 percent coverage. To achieve that, an observer fund was established which the foreign nations pay into to cover observer costs. As a result, coverage in 1982 was increased to 30 percent and planned coverage for 1983 is near 50 percent. Reporting by vessels seems to be improving as more effort is placed on obtaining the needed information, but there is no method currently available to ensure that all marine mammals that are caught are reported or that those reported are correctly identified. We believe that the best approach for estimating the annual take of incidentally caught marine mammals in the future is to rely primarily on the fishery observer reporting method and to regard the extrapolated total kills as minimum estimates. Our reliance on this method is based on the expected future increase in coverage by fishery observers, the reliability of their observations, and the suspicion that foreign vessel operators do not report incidentally caught marine mammals when fishery observers are not on board.

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