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MARINE MAMMAL - FISHERIES INTERACTION STUDY, ANNUAL REPORT FOR THE PERIOD OF JULY 1, 1979 - JUNE 30, 1980

BY

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Marine Mammal - Fisheries Interaction Study, Annual Report for the Period of July 1, 1979 - June 30, 1980

by

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INTRODUCTION

This report is submitted as part of the contract requirements of the Marine Mammal-Fisheries Interaction Study, NASO Contract No. 79-ABC-00149. The study is designed to estimate the direct interaction of marine mammals with all commercial and recreational fisheries of California. The objectives are:

a. The survey will cover established commercial and recreational fisheries in the State of California.

b. Data to be collected shall include but is not limited to: i. incidence of marine mammal interactions with the fishery, ii. incidental marine mammal mortality and injury associated with fishing gear and operations, iii. depredation of catch and damage to gear, or fishing sites, iv. gear types underutilized due directly to marine mammal activity, v. incidence of injury and mortality to marine mammals from lost, untended, or "ghost fishing" gear.

c. The study area shall be bordered on the north by the California-Oregon border and on the south by the California-Mexico border. The seaward limits of the survey shall be determined by the locations of the various fishing grounds utilized by domestic fishing vessels in California waters.

All data sheets collected in the 1979-1980 period are presently being edited for submission to key-punch operators and no complete analysis for any of the fisheries is available at this time. One series of data, the

salmon commercial and recreational fishery for May, 1980, has been submitted for key-punching.

To satisfy the requirements of the contract, however, the field data have been hand collated and most of the data are presented in tabular form for general evaluation of marine mammal interaction for each fishery. Tentative, draft copies of sampling effort by month and port are included (Tables 2 through 13). Preliminary computations of the number of salmon and value of the commercial catch removed by California sea lions are given for May 1980 (Table 1) as an example of the type of information that will be available for all fisheries at the end of the second year. At the time this study is terminated, the two years of data will be ready for immediate computer analysis.

A second year's coverage of certain fisheries was required for several reasons. It was not possible to initiate coverage of all fisheries at the onset of the program due to the problems caused by the State's hiring freeze which affected contract programs as well as State funded studies. It was not until January 1980 that a full complement of personnel was available for routine coverage. The State, to partially compensate for loss of sampling effort, contributed five months seasonal help funds during the last half of the first year's study.

Other reasons for incomplete coverage in the first year were problems of receiving insufficient cooperation from the fishermen, unexpected possible fishery - marine mammal interactions which were added to the program, increased costs of operation due to inflation, and the necessity of hiring temporary help through the Pacific Marine Fisheries Commission which increased the overhead expenditures.

GENERAL RESULTS

The primary approach of this survey is to cover all fisheries in which interaction with marine mammals was known or reported to occur. Several fisheries will not be covered in the second year because either no or significantly little interaction was observed. These are: the pier fishery, the shoreline hook-and line sport fishery, the bottomfish skiff fishery, the partyboat bottomfish fishery north of Morro Bay, the lamprey fishery of the Eel and Klamath rivers, the night and surf smelt fisheries, the bottom trawl fishery, and the albacore troll fishery.

The objectives include estimates of the loss in fish and damage to gear in the fisheries as well as an estimate of the loss of marine mammals during the fishery operations. Estimates of fish loss and gear damage will be computed for all fisheries but accurate estimates of marine mammal take may not be available for all fisheries. There is considerable concern on the part of gill and trammel net fishermen and salmon trollers that such information may eventually curtail their operations and sufficient at-sea trips on these vessels (those that would purposely take an animal) may not be possible. Some information on marine mammal kills is being gathered either first hand or by report and the take is actually less than original reports indicated. Project samplers are now being taken to sea by more fishermen now that we are better known. One of the positive attitudes on the part of the fishermen is that they wish us to help them solve the problem of loss of fish and damage to gear by marine mammals. Past and present take of marine mammals by the fishermen has not solved the problem and possibly new approaches can be tried when the problem is better defined. We have emphasized this purpose with the fishermen and are

receiving more cooperation and interest in our study.

Even with the increased cooperation of fishermen, there may not be sufficient field days in which to gather significant mammal take data because of the infrequency of take in nets or by shooting or scaring by the salmon trollers and squid and anchovy net fishermen. Consequently, we are attempting to compensate for insufficient at-sea data by collecting interview data. These two series (at-sea and interview) are being gathered for all fisheries and will be tested for reliability.

Information gathered on other Department of Fish and Game marine fisheries projects will be useful. Personnel in the Anadromous Fisheries Branch, Department of Fish and Game, and the Intercept Study (NMFS grant to Pacific Marine Fisheries Comm.) are collecting both interview and at-sea data.

There are five fisheries in which significant loss of fish and/or damage to gear occurs and increased emphasis will be placed on these in the second year. They are: the gill and trammel net fisheries (both ocean and Klamath River), commercial salmon trolling, the Pacific herring gill net fisheries in Crescent City harbor and Tomales, Humboldt and San Francisco Bays, the dip net squid fishery of southern California, and the anchovy and mackerel round-haul net fisheries of southern California.

With completion of the remaining fisheries needing increased sampling in the second year, the results of the study will yield important data for OSP evaluation as required by the MMPA as well as supply State and federal agencies with information leading to possible return of management to the State of California.

REPORT BY FISHERY

Salmon Fishery

Commercial Catch

There are differences between the 1979 and 1980 commercial fishing conditions. There are fewer fish available in 1980, there are added restrictions to the fishery, and, if the albacore season is better in 1980 than in 1979, more of the larger "trip" boats will not remain in the salmon fishery as they did in 1979. Nevertheless, a total year's sample has been made and the general results indicate a slightly less loss than estimated by the pilot study conducted in Monterey in the 1960's which indicated a 4-5 percent loss.

Another difference in the potential interaction between 1979 and 1980 may occur in the fall of 1980 when the California sea lions return to the salmon fishing areas. This is the return of the exceptionally large number of yearlings observed in the central and northern California nearshore waters in the spring of 1980. Most of these yearlings migrated south of Monterey during the commercial salmon closure in June 1980 and are expected to return to the area in August. When these yearlings were present in large numbers in Monterey Bay in May, they were not involved in fishery interaction as were the large subadult and adult California sea lions. Particular effort will be made to observe the behavior of these young animals this fall in the squid, gill net, and salmon fisheries of central California. To demonstrate the disproportionate large number of this cohort in the migratory male Zalophus population, a count of Zalophus on the Monterey breakwater during the peak migration to the south in June numbered 1400 animals, 67 percent of which were yearlings. This

compared to 20 percent yearlings counted in 1979 at the same area during the southern migration by project personnel. David Ainley, Point Reyes Bird Observatory, pers. commun., has noted a larger percentage of juvenile California sea lions hauling out at the Farallon Islands over the past three years. Alan Baldridge, Hopkins Marine Station, pers. commun., made counts at the Monterey Breakwater in 1968 and noted the percentage of juvenile plus subadult sea lions was only about 40 percent of the total present.

Project data for May 1980 were used to demonstrate the type of analysis that will be available for each month of the fishery for the two year period (Table 1). Estimates of the total catch by numbers were obtained from the Anadromous Fisheries Branch and the total loss of fish and commercial size fish due to sea lion predation were computed. The average loss to marine mammals for the entire area from Monterey to Crescent City was 3.6 percent, or 8634 fish. When this estimate is adjusted by the percentage of short fish returned (shakers), the loss of commercial sized fish was 2.49 percent or 5905 fish. The average size fish was about 10 pounds and the average price to the fisherman was at about $2.20 per pound amounting to a $130,000 loss during May 1980. This is a minimal loss because a certain percentage of the shakers taken by sea lions would have been caught at a later date when they became legal size, gear loss was also not included in this tentative estimate, and all the catch figures were not as yet received. The total value of salmon landed in California during May was about $5,000,000.

It has not been possible to obtain sufficient at-sea trips. Cooperation of fishermen has been poor because of many factors, and in Eureka and San

Francisco harbors it has been difficult to arrange for more than a few trips per month. Consequently, interview data were collected at all landing concessions by project and Anadromous Branch samplers in an attempt to gain more information on marine mammal interaction. In all, 113 trips were taken at-sea (Table 2) yielding an overall (not weighted by port catch) loss of 2.4 percent compared to a project interview sample of 1506 boats yielding a 3.2 percent loss (Table 3). The data recorded by Anadromous Branch samplers have not been received as yet. An intensive test will be made in September 1980 to determine the validity of the interview data. During a 4 or 5 day period project personnel will be at-sea and all commercial landings will be monitored by project and Anadromous Branch personnel during this same interval at Moss Landing.

When aboard the 113 at-sea trips, only one sea lion was shot at, to scare it away. When listening to the marine radio, it appears that more take of animals occurs than is indicated by this one observation. All 22 of the fish observed lost at sea were taken by California sea lions. Only one loss of a fish to a Steller sea lion was reported by a fisherman. Harbor seals, northern fur seals, and elephant seals have not been reported or observed taking fish off lines in the salmon troll fishery. Gear loss estimates have not been made and will be included in the final report. Sampling will be increased on this fishery through the 1980 season.

Klamath River Indian Gill Net Fishery

This fishery is the most difficult fishery to monitor. State and federal agencies have been having a difficult time monitoring the effort and catch of the fishery due to the lack of interest on the part of many Indian fishermen. It was not until we hired an Indian guide to take our

samplers on the river in his boat that we were able to gather direct observation of nets fishing at nighttime. Even in this manner it was not possible to cover most of the river and an estimate of the interaction was not obtained in the first year. Of all the fisheries in the State, it appears that this fishery is most affected by marine mammal predation. Harbor seals (up to 200 have been counted at the mouth of the river) remove netted salmon quickly and to avoid nearly total loss the fishermen must closely attend the nets. Entanglement of harbor seals in nets was observed as well as harbor seals and California sea lions being shot near the nets. New controls by the Fish and Wildlife Service and the Bureau of Indian Affairs will establish better monitoring of the fishery in the 1980 season. Sampling procedures are being set up to tally the fish removed from a certain section of the river and cooperation has been offered to project samplers to enable us to gain valid total catch data and possibly enable us to compute the total loss due to mammal predation. One dead harbor seal has been retrieved from the net for necropsy by NMFS and a routine procedure is being set up to retrieve as many of these newly killed animals as is possible. Project samplers are now well known by most of the fishermen and increased cooperation with the netters is expected. Sampling will be increased in fall of 1980.

Recreational Catch

Seventy-two salmon partyboat trips at-sea were taken (Table 4) with no fish loss to marine mammals occurring in the fall 1979 period but with some loss recorded during spring of 1980. Project personnel interviewed 157 partyboats as they were unloading with a loss of 1.35 percent reported (Table 5). The entire loss was in the spring 1980 period. When comparing

only San Francisco at-sea data (54 boats, 827 legal fish, and 6 lost to mammals) with interview data (134 boats, 1709 legal fish, and 13 lost to mammals), the percentage loss to mammals was 0.75 and 0.72 percent respectively. Other comparisons of partyboat at-sea and interview data also indicate the interview data are accurate. Losses to mammals in the partyboat catch appear to be entirely in the San Francisco and Monterey Bay areas. About 41 percent of the salmon hooked by partyboat fishermen were undersized yielding a tentative 0.4 to 0.8 percent loss to sea lions.

There is even less interaction in the skiff salmon fishery. An overall loss of 0.5 percent was recorded from interviews of 823 skiffs (Table 6). Accounting for shaker loss, only about 0.3 percent of the legal skiff catch was lost to sea lions. The only loss recorded throughout the area from Crescent City to Monterey was at Moss Landing in February and April of 1980. When the data are weighted by port, the loss in the skiff fishery is expected to be less than 0.3 percent. The salmon skiff fishery will be sampled only incidentally in fall of 1980 requiring less sampling effort.

Recreational Bottomfish Catch

Partyboat Fishery

In 13 at-sea trips and 30 interview samples no interaction was observed or recorded in the central California area (Table 7). All the skippers contacted stated they were never "bothered" in central California and sampling was terminated in May 1980. Southern California partyboat skippers have reported interaction and our sampling has revealed about 2.5 percent of the catch was removed by sea lions (Table 8). There was more interaction reported from partyboat skippers fishing in Baja California waters (south of the Coronado Islands) with about 6.4 percent loss

reported in interviews. These estimates do not include gear loss or tally of the number of times the boats had to be moved to new locations to avoid sea lion harassment. More at-sea samples will be obtained in southern California in the second year at San Diego, Long Beach and Santa Barbara.

Skiff Catch

Skiff fishermen in pursuit of bottomfish were sampled by project personnel from Trinidad to Monterey (Table 9) with no interaction with marine mammals reported for the 350 skiffs interviewed. Intercept personnel data (not included in this report) also show no interaction throughout the State and consequently this fishery will not be monitored in the second year.

Commercial Bottomfish Fishery

Skiff Catch

As in the sport skiff catch little or no marine mammal interaction takes place (Table 10). In 41 interviews in central and northern California, no interaction was reported and most skippers claim they are never bothered. Sampling will be discontinued north of Pt. Conception in the second year.

In southern California a loss to sea lions was recorded in one sample from Long Beach and a limited sampling will be undertaken, but at a reduced level. The skiff commercial fisheries are in quest of more species of fish and in different habitats in southern California and there may be more potential for interaction with residential and migratory marine mammals.

Longline Catch

Nine longline boats were interviewed in San Diego and two in Monterey

with one minor interaction reported at San Diego. Apparently the fishery is too deep for pinnipeds. Occasional sampling will be undertaken when routinely covering the fishing port areas. If more interaction is revealed, at-sea samples may be considered.

Bottom Otter Trawl Fishery

Two trips were taken at-sea with no interaction observed. There was one Department of Fish and Game experimental trawl in which a California sea lion was entrapped and killed when the net was approaching the surface. Commercial trawlers have also reported this happening, but rarely. A commercial trawler at Moss Landing reported one young California sea lion killed in this manner in May 1980. Interviews will be continued on a limited basis.

Fish Traps

Four fish trap fishermen were interviewed at San Diego with no interaction reported. No routine sampling will be conducted on this fishery in the second year but occasional interviews will be made to determine possible trap damage that was reported happening in the past by several fishermen. A report by Department personnel in the Monterey Office revealed the entrapment and death of a harbor seal in a fish trap in Carmel Bay at depths greater than previously recorded for this species.

Gill and Trammel Net Fisheries

The loss of gear and fish in this fishery can be high in some instances. Boats operating out of San Diego fishing in Baja California waters recorded the highest loss (Table 11) with 12.5 percent of the catch reported taken by sea lions compared with approximately 2.2 percent of the catch lost in California waters. The principal species taken by

sea lions are white sea bass, California halibut, yellowtail (Seriola), and barracuda. Net damage was not collated for this report but at times it may be more than the value of fish lost, such as whole nets being destroyed by whales. Thirty-nine at-sea samples were collected resulting in a 0.7 percent loss of fish, all of which was recorded in southern California (Table 12). Cooperation of the fishermen is improving as is indicated by the number of southern California at-sea trips increasing from only 2 to 4 in the first three months of 1980 to 6 to 10 per month at the end of the fiscal year.

Increased effort will be expended on this fishery for the remainder of the study, especially in southern California and in Monterey Bay. Two marine mammals, an elephant seal and a California sea lion, were entangled in the nets in the at-sea sample, and five entanglements were reported in the interview sample, three in Baja California waters and two in southern California. There is a new gill net fishery in Monterey Bay involving 23 additional gill net boats that will be closely monitored. Reports by Department of Fish and Game Marine Wardens reveal that marine mammals are being taken in these nets. A routine program of being present twice weekly in a Department boat when the nets are being retrieved is being initiated.

Damage to nets is difficult to determine both as to cause and in the cost of repairs. Damage can be observed when a grey whale entangles an entire net or when small bites are made in herring gill nets by pinnipeds. Observers have noted holes in nets which were accompanied with abrasive wear to lines near the net. This damage can most likely be attributed to sharks. When a large hole appears in a net being retrieved and there is no rough wear on adjacent webbing and lines and the set was not on a rocky

reef, it can be assumed the hole was made by a mammal. Fishermen interpret these holes as such, but there is no proof that a mammal was the cause. Analysis of data will include an estimate of the reported damage to nets with the understanding that the data are empirically weak and represent maximum damage costs.

Herring Fishery

This fishery was difficult to monitor because of the unexpected nature of the net operations. The fishery is both night and day for the gill nets as well as the lampara and purse seine nets, however, most of the round haul catch was during the night. The gill nets are usually not attended thus it was not feasible to obtain rides on the boats to observe possible interactions except in Humboldt Bay and Crescent City. All the observations at Tomales Bay and in San Francisco Bay were from shore during the daylight hours. Several hundred gill nets were observed over a five day period and over 30 sets of lampara nets were observed in San Francisco Bay with no marine mammals entangled. The loss to the fishery will be difficult to determine. Hours of observing California sea lions and occasionally harbor seals foraging on the fish in the nets were tallied but the data have not been analysed to determine the extent of the loss. The loss is heavier when the runs are light with, at times, all the fish removed from the nets if the fisherman leaves the net in the water because there is not enough catch to warrant retrieving the net. This fishery will be more intensively surveyed in the December to February period. New information gathered will include a count of the number of pinnipeds present in the immediate area to determine the maximum potential amount of fish that could be removed from the nets assuming all they would be

eating were herring taken from the nets. An average daily consumption of captive animals can be used as a base for daily consumption of herring. In Tomales and San Francisco Bays most of the interaction is with California sea lions whereas harbor seals are observed in Humboldt Bay. The Crescent City harbor interaction is with California sea lions. The fishermen were not too concerned about the fish removed from the nets, in fact, in Humboldt and Tomales Bays the fishermen watch the behavior of the pinnipeds to locate new runs entering the fishing area. They are troubled by the tears and holes in the nets made when mammals bite part of the mesh along with the fish. Estimates of net damage will be available for the 1980-81 season.

Squid Fishery

The southern California and Monterey Bay squid fisheries are quite different and each requires unique sampling procedures. The Monterey Bay fishery is by lampara boats working mostly at night but occasionally during the early morning period up to 0900 hours. The spawning squid concentrate in shallow sandy bottom areas off Seaside, Monterey, and Pacific Grove. The lampara fishermen will look for the glow caused by the moving squid at night, pass over the school with a depth sounder and then set the net. During the daylight hours, only depth recorder flashes and tracings are observed and sets are made where the squid are thought to be. The sampling procedure has been to observe the operation from a Department boat. In this way, several sets can be monitored at the same time. In Monterey Bay, 45 boats each making several sets were observed in 1979-1980 and no marine mammals were observed in the fishing area (Table 13). Fishermen have reported that sea lions have been taken in the nets but they almost always jump over the cork lines when the net is drawn close

to the boat. This was observed several times by project personnel in the lampara herring fishery in San Francisco Bay. The 1980 fall run of squid in Monterey Bay will be monitored with emphasis placed on nighttime sampling. Sampling will be increased in the fall 1980 period.

In southern California the fishery is primarily at Catalina Island and is done by dip netting the squid attracted to the boat by lights suspended over the side. The problems here are no direct eating of fish at the lights but, according to the fishermen, frightening of squid away from the dip net area. The marine mammals involved are the California sea lion and pilot whales. Two at-sea trips were made in 1979 (Table 13) and 19 interviews were made. In one interview the fisherman claimed he lost 18 tons of squid due to frightening away from the light. It will be difficult to determine this reported loss empirically. The fishermen are concerned about how much squid pilot whales eat which is a possible indirect interaction but not one covered in this study and one which would be very difficult to determine. It has been reported that squid fishermen use the presence of pilot whales as an indicator of the location of squid concentrations. In light of this, aerial censuses will be made of the immediate area before, during, and after the squid season to reveal increased concentration of marine mammals in the squid spawning area, with emphasis on the pilot whale.

Two at-sea trips have been taken, and as our objectives are being understood, more at-sea trips are expected this coming winter season. Increased effort from shore as well as from fishing vessels will be made to observe more of the total operation.

Round Haul Nets for Anchovy and Mackerel

Three at-sea and six interview samples were obtained on the anchovy and mackerel fisheries with no interaction with marine mammals observed or reported. Some of the fishermen have reported that "seals" occasionally jump inside the nets and scare the fish but so far this has not been observed. The potential for scaring of fish and take of marine mammals remains high in this fishery and more effort will be put in going out on boats. Monitoring of anchovy bait haul boats as well as mackerel and anchovy commercial round haul operations will be increased in 1980-1981.

Miscellaneous Fisheries

Mid-Depth Trawl

Three interviews were made of fishermen at Eureka utilizing new mid-depth trawls for Pacific hake. No interaction was reported. Interview monitoring will be continued on this fishery to determine if at-sea trips are necessary.

Pier and Jetty Recreational Fishing

In 1979, 40 days were spent at 23 different piers and jetties to observe actions of marine mammals. No marine mammals interactions were observed and even though some fishermen claim sea lions scare the fish away no evidence is available to substantiate such interaction. Sampling has been discontinued on this fishery.

Jack Pole Fishery

This is a pole and hook-and-line fishery for surface pelagic fish such as bonito. The two interviews made on this fishery were at San Diego on boats that had fished in Baja California waters. The fishermen claim fish are frightened by sea lions but there is also some loss of

fish and gear. Interviews will be continued.

Steelhead River Fishing from Skiffs

Skiffs fishing in the Albion and Navarro Rivers of northern California were observed on 2 days. The five boats observed caught 8 fish and no interaction was observed. Sampling intensity will remain the same.

Lobster Traps

Two lobster fishermen were interviewed at San Diego. They claim that occasionally a sea lion will injure the nets when mackerel bait is used, especially when fishing at San Clemente Island.

Swordfish Spearing

One at-sea trip was made to determine if there may be a problem. No interaction was observed but the fisherman stated that occasionally porpoise riding the bow will scare swordfish before they can be speared. If the Kapilof bill passes the State Legislature, there may be increased opportunity for project observers to make at-sea trips on the gill net boats that fish both sharks and swordfish. Increased sampling will be necessary in this case.

River Observations

In addition to the salmon gill net fishery in the Klamath River, several other fisheries exist in and at the mouths of rivers that have been monitored to determine possible interaction. The rivers covered in the first year were, from north to south, the Smith, Klamath, Eel, Noyo, Big, Albion, Navarro, and Garcia Rivers. The fisheries in some of these rivers are the salmon shore fishery, surfperch fishing near the mouths, surf and night smelt fishing at the mouths, the eulachon fishery, the lamprey fishery, and crab sport fishery.

In none of these fisheries was any direct interaction observed on 37 days of sampling involving all rivers. The lamprey fishery in the Eel and Klamath Rivers involved the most direct proximity of the fishermen and California sea lions, but only "scaring" of the lamprey by a sea lion would have been a problem. There was no eulachon spawning run to observe this year. Harbor seals move about in the river systems throughout the year and nearly constant reporting of harassment by seals is reported by recreational fishermen. In all cases these reported interactions have not been substantiated. There was a report of a river otter taking a surfperch from a fish cage holder in the Albion River, and river otters have been observed feeding on Dungeness crabs in the river mouth area. Continued observations of these fisheries will be continued but only during expected maximum usage for a particular fishery such as a eulachon run next spring, if one should take place in the northernmost rivers.

RECOMMENDATIONS

Specific changes of emphasis have been noted under each fishery section and will not be repeated here. The major emphasis in the second year will be to gather information to determine the extent of take of marine mammals. Determination of OSP levels of each of the mammals populations is important to evaluate the number of animals that should be allowed under the permit to take by commercial fishermen.

The need for estimates of mammals present in the interaction areas has become quite evident in the first year's study. Evaluation of fishery data would have been more meaningful if the number of animals present were known. The Klamath River problems are related to residential harbor seals with seasonal movements of California and Steller sea lions entering

the river system. Weekly counts have been made of marine mammals in this area and we have been able to determine that it is the harbor seal that is the major problem. Emphasis will be made to estimate numbers of mammals present in the herring fishery areas of central and northern California and near the squid fishery areas of southern California. As this report was being revised for final editing, another aspect of California sea lion predation on commercial salmon hooked by trollers has been realized. During the spring southern migration of Zalophus, the animals concentrate close to shore and move almost enmasse including both adult and subadult animals. In Monterey Bay interaction with the commercial fleet was high, about 8% loss, in May and June. At the peak of the southern migration, over 1400 California sea lions were counted at the Monterey breakwater. During the northern migration, only about 50 to 80 California sea lions have occupied the Monterey breakwater, but in September the loss of salmon taken by sea lions to the commercial fishermen was about the same as in May and June when many more animals were present. This points out the need to develop more intensive assessment and populations dynamics studies to properly relate the interaction of mammals with the fisheries. More accurate and seasonal censuses are also essential for OSP determinations as required by the Marine Mammal Protection Act of 1972, especially for species that are taken during fishing operations. In the second year of the interaction study as much time as can be spared will be given to censusing mammals in the key interaction zones. Department of Fish and Game airplanes and boats will be available at no cost to the contractor. Zalophus is the one species that appears in all fisheries where there is interaction although Phoca is the problem animal of the Klamath River.

The major emphasis on take of marine mammals in fishery operations will be the Monterey Bay gill net fishery.

A testing of the accuracy of interview data in the salmon fishery is important inasmuch as it was not possible to arrive at valid estimates of loss through at-sea observations. Interview data of the other fisheries such as the gill net and round haul net fisheries have been important, however, more at-sea trips are essential to accurately monitor these fisheries. To accomplish this, two months of seasonal time has been transferred from the central and northern California area to southern California in the second year.

Local pinniped censuses will be necessary to evaluate the potential interaction of the herring and squid fisheries. Department airplanes and boats will be available at no cost to the study for this purpose. The computer analysis will be utilized only for the fisheries in which there is sufficient information collected to warrant statistical computations. These will include the salmon, herring, and gill net fisheries. The final report will be readily available soon after the end of the data collection period.

TABLE 1.
California Commercial Salmon Catch and Loss to Mammals for May, 1980.

	Sampling Data				Total Catch and Estimated Loss			
	No. boats* sampled	No. fish sampled	Fish lost to sea lions	Percent loss to sea lions	Total salmon catch	Total est. no. fish lost	Percent shakers	No. commercial sized fish lost to sea lions
Crescent City	93	1318	88	6.259	18,948	1186	40.87	701
Eureka	165	12,052	194	1.584	91,448	1449	12.77	1264
Fort Bragg	187	5197	409	7.296	18,817	1373	23.93	1044
San Francisco	272	3502	148	4.055	71,343	2893	39.48	1751
Monterey	343	2021	122	5.693	30,438	1733	33.91	1145
Totals	1060	24,090	961	3.603	230,994	8634	31.61	5905
Percent of total catch or effort	7.7	10.43		3.603				2.49 (Dollar value lost: $130,000)

* Deliveries or landings

TABLE 2

Commercial Salmon At-Sea Sampling, July 1979 - June 1980.

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total	% Loss
1979						
July						
Crescent City	2	105	0	0	0	
Eureka-Trin.	4	70	0	0	0	
Fort Bragg	8	155	0	0	0	
Bodega Bay	4	43	0	0	0	
Monterey Bay	16	33	0	0	0	
Total July	34	406	0	0	0	0.0
August						
Crescent City	3	15	0	0	0	
Eureka-Trin.	1	22	0	0	0	
Fort Bragg	8	95	1	1	2	
Bodega Bay	5	2	0	0	0	
Princeton-Drakes B.	4	21	1	1	2	
Monterey Bay	13	19	0	0	0	
Total August	34	174	2	2	4	2.3
September						
Crescent City	1	13	0	0	0	
Eureka-Trin.	2	1	0	0	0	
Fort Bragg	4	32	0	1	1	
Monterey	4	4	0	0	0	
Total September	11	50	0	1	1	2.0
1980						
May						
Crescent City	4	21	7	0	7	
Trinidad	1	1	0	0	0	
Eureka	5	89	3	4	7	
Fort Bragg	10	66	2	0	2	
Bodega Bay	7	42	0	1	1	
Berk.-Saus	2	9	0	0	0	
Santa Cruz	2	6	0	0	0	
Moss Landing	3	9	0	0	0	
Total May	34	243	12	5	17	6.1
Grand Total 1979-1980	113	873	14	8	22	2.4

TABLE 3

Commercial Salmon Interview Sampling, July 1979 - June 1980.

Year, month, and port	Number boats sampled	No. Fish caught	Lost to Mammals Pos.	Prob.	Total	% Loss
1979						
July						
Crescent City	5	34	0	0	0	0.0
Trinidad	43	575	0	5	5	0.9
Eureka	40	249	4	5	9	3.5
Shelter Cove	10	93	0	0	0	0.0
Fort Bragg	13	119	0	0	0	0.0
Bodega Bay	49	279	0	0	0	0.0
San Francisco Bay	7	670	0	0	0	0.0
Princeton	10	581	0	0	0	0.0
Santa Cruz	44	62	0	0	0	0.0
Moss Landing	8	17	0	0	0	0.0
Total July	229	4921	4	10	14	0.3
August						
Crescent City	14	98	0	0	0	0.0
Trinidad	19	44	0	0	0	0.0
Eureka	10	19	0	0	0	0.0
Fort Bragg	28	138	0	0	0	0.0
Point Arena	4	7	1	0	1	12.5
Bodega Bay	85	285	3	0	3	1.0
San Francisco	5	13	2	0	2	13.3
Princeton	3	0	0	0	0	0.0
Santa Cruz	16	23	0	1	1	4.2
Moss Landing	29	39	0	0	0	0.0
Total August	213	666	6	1	7	1.0
September						
Eureka	10	197	0	0	0	0.0
Shelter Cove	7	40	1	0	1	2.4
Fort Bragg	9	539	28	2	30	5.3
Bodega Bay	4	5	0	0	0	0.0
Princeton	1	0	0	0	0	0.0
Santa Cruz	7	5	2	0	2	0.0
Total September	38	786	31	2	33	4.0

TABLE 3. Continued

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total	% Loss
1980						
May						
Crescent City	89	1297	67	14	81	5.9
Trinidad	12	16	0	0	0	0.0
Eureka	147	11,946	75	112	187	1.5
Fort Bragg	177	5131	244	163	407	7.4
Bodega Bay	201	2025	88	13	101	4.8
San Francisco Bay	40	1244	17	22	39	3.0
Princeton	22	182	5	2	7	3.7
Santa Cruz	106	229	14	4	18	7.3
Moss Landing	188	1583	73	13	86	5.2
Monterey	44	194	17	1	18	8.5
Total May	1026	23,847	600	344	944	3.8
Grand Total	1506	30,220	641	357	998	3.2

TABLE 4

At-Sea Salmon Partyboat Sampling, July 1979 - June 1980.

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total
1979					
July					
Crescent City	1	2	0	0	0
Eureka	4	28	0	0	0
Fort Bragg	4	21	0	0	0
San Francisco	7	149	0	0	0
Total July	16	200	0	0	0
August					
Crescent City	1	2	0	0	0
Eureka	2	11	0	0	0
Fort Bragg	3	21	0	0	0
Bodega Bay	1	15	0	0	0
San Francisco	5	63	0	0	0
Total August	12	112	0	0	0
September					
Fort Bragg	1	3	0	0	0
Bodega Bay	1	3	0	0	0
San Francisco	10	220	0	0	0
Total September	12	226	0	0	0
1980					
March					
San Francisco	8	81	2	0	2
April					
San Francisco	16	202	1	0	1
May					
San Francisco	4	43	1	1	2
June					
San Francisco	4	69	1	0	1
Grand Total	72	933	5	1	6
			(0.64% loss)		

TABLE 5. Partyboat Salmon Interview, July 1979 - June 1980 (Sample Size = 14.8% of Total Est. Catch).

Year, month, and port	Number boats sampled	No. fish landed	Lost to Mammals Pos.	Prob.	Total
1979					
July					
San Francisco	5	64	0	0	0
August					
San Francisco	10	160	0	0	0
1980					
February					
San Francisco	8	220	0	0	0
Monterey Bay	5	14	2	1	3
Total February	13	234	2	1	3
March					
San Francisco	38	378	5	0	5
Monterey Bay	10	86	6	2	8
Total March	48	464	11	2	13
April					
San Francisco	43	574	5	2	7
Monterey Bay	8	25	1	0	1
Total April	51	599	6	2	8
May					
San Francisco	12	92	0	0	0
June					
San Francisco	18	221	1	0	1
Grand Total	157	1834	20 (Loss = 1.35% total fish; approx. 0.8% legal sized fish)	5	25

TABLE 6. Sport Skiff Salmon Interview, July 1979 - June 1980.

Year, month, and port	Number boats sampled	No. fish landed	Lost to Mammals Pos.	Prob.	Total
1979					
July					
Crescent City	2	2	0	0	0
Trinidad	5	13	0	0	0
Eureka	7	12	0	0	0
Shelter Cove	6	10	0	0	0
Fort Bragg	25	56	0	0	0
Bodega Bay	11	38	0	0	0
Princeton	10	15	0	0	0
Santa Cruz	19	8	0	0	0
Moss Landing	2	0	0	0	0
Total July	87	154	0	0	0
August					
Trinidad	24	15	0	0	0
Eureka	2	0	0	0	0
Fort Bragg	27	17	0	0	0
Bodega Bay	65	48	0	0	0
Princeton	58	15	0	0	0
Santa Cruz	14	0	0	0	0
Moss Landing	1	0	0	0	0
Total August	191	95	0	0	0
September					
Fort Bragg	15	3	0	0	0
Bodega Bay	3	5	0	0	0
Princeton	9	0	0	0	0
Total September	27	8	0	0	0
1980					
February					
Bodega Bay	3	2	0	0	0
San Francisco Bay	6	39	0	0	0
Moss Landing	48	69	3	0	3
Total February	57	110	3	0	3

TABLE 6. Continued

Year, month, and port	Number boats sampled	No. fish landed	Lost to Mammals Pos.	Prob.	Total
March					
San Francisco Bay	9	10	0	0	0
Princeton	23	23	0	0	0
Santa Cruz	25	31	0	0	0
Moss Landing	56	49	0	0	0
Monterey	15	18	0	0	0
Total March	128	131	0	0	0
April					
Santa Cruz	16	50	0	0	0
Moss Landing	55	60	2	0	2
Total April	71	110	2	0	2
May					
Bodega Bay	1	1	0	0	0
Santa Cruz	22	7	0	0	0
Moss Landing	48	26	0	0	0
Total May	71	34	0	0	0
June					
Crescent City	26	62	0	0	0
Trinidad	12	16	0	0	0
Fort Bragg	45	144	0	0	0
Santa Cruz	40	47	0	0	0
Moss Landing	48	62	0	0	0
Monterey	20	24	0	0	0
Total June	191	355	0	0	0
Grand Total	323	1000	5 (Loss = 0.5%)	0	5

TABLE 7. Central California At-Sea and Interview Bottomfish Partyboat Sampling, July 1979 - June 1980.

Year, month, and port	Number boats sampled	No. fish caught	No. fish lost to marine mammals
AT-SEA			
1979			
July			
Bodega Bay	1	(not tallied for this report)	0
Farallon Islands	1	"	0
Año Nuevo Island	3	"	0
Santa Cruz	1	"	0
Total July	6	"	0
August			
Bodega Bay	1	"	0
Farallon Islands	1	"	0
Año Nuevo Island	2	"	0
Total August	4	"	0
September			
Bodega Bay	1	"	0
Farallon Islands	1	"	0
Año Nuevo Island	1	"	0
Total September	3	"	0
Total At-Sea	13	"	0
INTERVIEW			
1979			
December			
Princeton	8	1066	0
March			
San Francisco Bay	1	0	0
Princeton	5	630	0
Monterey	4	401	0
Total March	10	1031	0

TABLE 7. Continued

Year, month, and port	Number boats sampled	No. fish caught	No. fish lost to marine mammals
April			
San Francisco Bay	1	0	0
Monterey	1	75	0
Total April	2	75	0
Total Interview	20	2172	0

TABLE 8. Southern California Bottomfish Partyboat Interview Sampling Data, July 1979 - June 1980.

Year, month and port	Number boats sampled	No. fish landed	No. fish lost to marine mammals	% Loss
FISH CAUGHT IN BAJA CALIFORNIA WATERS (San Diego landings)				
1979				
November	5	3908	35	
December	1	248	0	
1980				
January	4	2238	8	
February	2	285	0	
Total Baja California	12	6679	43	6.4
FISH CAUGHT IN CALIFORNIA WATERS (Including Coronado Islands)				
1979				
November				
San Diego	6	775	0	0.0
December				
San Diego	3	197	50	20.2
1980				
January				
San Diego	4	480	0	0.0
February				
San Diego	20	3576	89	2.4
March				
San Diego	6	1037	35	
Long Beach	3	838	4	
Total March	9	1875	39	2.0

TABLE 8. Continued

Year, month, and port	Number boats sampled	No. fish landed	No. fish lost to marine mammals	% Loss
April				
San Diego	1	22	0	
Long Beach	1	52	1	
Total April	2	74	1	1.3
June				
San Diego	2	67	30	
Long Beach	5	768	0	
Total June	7	835	30	3.5
Total California Waters	54	8097	209	2.5

TABLE 9. Bottomfish Sport Skiff Catch, July 1, 1979 to June 1980.

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total	% Loss
1979						
July						
Trinidad	1	(not tallied for this report)	0	0	0	0
Fort Bragg	5	"	0	0	0	0
Princeton	9	"	0	0	0	0
Santa Cruz	26	"	0	0	0	0
Moss Landing	2	"	0	0	0	0
Monterey	4	"	0	0	0	0
Total July	47	"	0	0	0	0
August						
Trinidad	2	"	0	0	0	0
Fort Bragg	3	"	0	0	0	0
Bodega Bay	7	"	0	0	0	0
Princeton	57	"	0	0	0	0
Santa Cruz	11	"	0	0	0	0
Moss Landing	15	"	0	0	0	0
Total August	95	"	0	0	0	0
September						
Fort Bragg	3	"	0	0	0	0
Bodega Bay	6	"	0	0	0	0
Princeton	28	"	0	0	0	0
Santa Cruz	12	"	0	0	0	0
Total September	49	"	0	0	0	0
December						
Fort Bragg	6	67	0	0	0	0
Princeton	20	65	0	0	0	0
Total December	26	132	0	0	0	0
1980						
February						
Moss Landing	2	0	0	0	0	0

TABLE 9. Continued

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total	% Loss
1980						
March						
Berk.-Saus.	17	90	0	0	0	0
Princeton	36	307	0	0	0	0
Santa Cruz	14	21	0	0	0	0
Moss Landing	5	37	0	0	0	0
Monterey	2	0	0	0	0	0
Total March	74	455	0	0	0	0
April						
Moss Landing	2	4	0	0	0	0
May						
Santa Cruz	13	46	0	0	0	0
Moss Landing	1	2	0	0	0	0
Monterey	1	4	0	0	0	0
Total May	15	52	0	0	0	0
June						
Crescent City	2	31	0	0	0	0
Santa Cruz	22	338	0	0	0	0
Moss Landing	4	163	0	0	0	0
Monterey	12	189	0	0	0	0
Total June	40	721	0	0	0	0
Grand Total	350	1364 (for 159 boats)	0	0	0	0.0%

TABLE 10

Commercial Bottomfishing from Skiff, July 1979 - June 1980.

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total
1979					
July					
Princeton	7	(not tallied for this report)	0	0	0
Santa Cruz	6	"	0	0	0
Monterey	5	"	0	0	0
Total July	18	"	0	0	0
August					
Trinidad	3	"	0	0	0
Princeton	4	"	0	0	0
Santa Cruz	3	"	0	0	0
Moss Landing	3	"	0	0	0
Total August	13	"	0	0	0
September					
Princeton	1	"	0	0	0
Santa Cruz	3	"	0	0	0
Total September	4	"	0	0	0
1980					
January					
Oceanside	1	151	0	0	0
February					
Monterey	1	340	0	0	0
March					
San Francisco	1	30	0	0	0
Princeton	1	0	0	0	0
Santa Cruz	2	57	0	0	0
Total March	4	578	0	0	0
May					
Monterey	1	32	0	0	0

TABLE 10. Continued

Year, month, and port	Number boats sampled	No. fish caught	Lost to Mammals Pos.	Prob.	Total
June					
Long Beach	1	666	13	0	13
Grand Total	43	1767 (for 8 boats)	13	0	13

TABLE 11. Gill and Trammel Net Interview, July 1979 - June 1980.

Year, month, and port	Number boats sampled	Est. catch in pounds	Poundage lost to marine mammals	% Loss	Mammals entangled
BOATS FISHING BAJA CALIFORNIA WATERS					
1979					
November	2	38,000	3,800	10.0	0
December	2	9,500	2,000	17.4	0
1980					
January	1	20,000	600	3.4	0
February	4	67,800	6,180	8.4	0
March	5	45,200	15,200	25.2	0
April	2	28,000	2,500	8.2	1
May	3	30,500	4,900	13.8	2
June	1	8,000	0	0.0	0
Total Baja Calif.	20	247,000	35,180	12.5	3
SOUTHERN CALIFORNIA					
1979					
November					
San Diego	5	16,600	800	4.6	0
December					
San Diego	8	26,830	400	1.5	0
January					
San Diego	9	30,151	260		0
Oceanside	1	108	0		0
Long Beach	3	41,500	400		0
Total January	13	71,759	660	0.9	0
February					
San Diego	9	11,960	405		0
Long Beach	4	31,000	6,200		0
Total February	13	42,960	6,605	13.3	0

TABLE 11. Continued.

Year, month, and port	Number boats sampled	Est. catch in pounds	Poundage lost to marine mammals	% Loss	Mammals entangled
March					
San Diego	7	8,945	750		0
Long Beach	7	51,770	10		0
Total March	14	60,715	760	1.2	0
April					
San Diego	13	65,165	575		0
Oceanside	2	100	7		0
Long Beach	12	347,463	8,018		0
Total April	27	412,728	8,600	2.0	0
May					
San Diego	14	39,390	267		2
Oceanside	3	220	10		0
Long Beach	4	102,680	15		0
Total May	21	142,290	292	0.2	2
June					
San Diego	13	33,950	100		0
Oceanside	4	2,612	0		0
Long Beach	7	20,534	448		0
Total June	24	57,096	548	1.0	0
Total Southern Calif.	125	830,978	18,665	2.2	2
CENTRAL CALIFORNIA					
1979					
August					
Princeton	2	550	1		0
Santa Cruz	1	350	0		0
Total August	3	900	1	0.1	0
September					
Monterey	1	400	0		0
Santa Cruz	1	20	0		0
Total September	2	420	0	0.0	0

TABLE 11. Continued

Year, month, and port	Number boats sampled	Est. catch in pounds	Poundage lost to marine mammals	% Loss	Mammals entangled
1980					
March					
Santa Cruz	2	80	10	11.1	0
April					
Santa Cruz	2	161	0	0.0	0
May					
Santa Cruz	4	187	32	14.6	0
Total Central Calif.	13	1,748	43	2.4	0
Total California Sample	138	832,726	18,708	2.2%	2

TABLE 12. Gill and Trammel Net At-Sea Sampling, July 1979 - June 1980.

Year, month, and port	Number boats sampled	Catch in pounds	Loss in pounds to sea lions	% Loss	Mammals entangled
SOUTHERN CALIFORNIA					
1979					
July					
San Pedro	1	80	0	0.0	0
August					
Ventura	1	50	0	0.0	0
December					
San Diego	3	105	0	0.0	0
1980					
January					
San Diego	2	160	50	23.8	0
February					
San Diego	1	350	40		0
Long Beach	1	10	0		0
Total Feburary	2	360	40	10.0	0
March					
San Diego	2	340	0		0
Long Beach	2	1,750	38		0
Total March	4	2,090	38	1.8	0
April					
San Diego	2	220	0		1
Oceanside	1	100	0		0
Long Beach	2	1,105	17		0
Santa Barbara	1	400	0		0
Total April	6	1,825	17		1

TABLE 12. Continued

Year, month, and port	Number boats sampled	Catch in pounds	Loss in pounds to sea lions	% Loss	Mammals entangled
May					
San Diego	1	60	0		0
Oceanside	1	500	20		0
Long Beach	7	27,760	80		1
Port Hueneme	1	0	0		0
Total May	10	28,320	100	0.4	1
June					
San Diego	1	22	0		0
Oceanside	1	25	0		0
Long Beach	4	3,883	0		0
Total June	6	3,930	0	0.0	0
Total Southern California	35	36,920	245	0.7	2
CENTRAL CALIFORNIA (all sampling in Monterey Bay)					
1979					
August	1	50	0		0
September	2	115	0		0
1980					
May	1	100	0		0
Total Central California	5	265	0	0.0	0
Grand Total California	39	37,185	245	0.7	2

TABLE 13. Squid Fishery Sampling, July 1979 - June 1980 (Central Calif. = Lampara Net: So. Calif. = Dip Net at Light).

Year, month, and port	Number boats sampled	Est. catch in pounds	Loss to marine mammals	Mammals entangled
AT-SEA				
CENTRAL CALIFORNIA (Monterey only)				
1979				
July	1	10	0	0
1980				
June	44	12,240	0	0
Total Central California	45	12,250	0	0
SOUTHERN CALIFORNIA				
1980				
January	1	20,000	0	0
February	1	20,000	0	0
Total Southern Calif.	2	40,000	0	0
Total At-Sea for Calif.	47	52,250	0	0
INTERVIEW				
Monterey	1	6,000	0	0
Southern California				
January	17	412,000	36,000*	0
February	2	38,000	0	0
Total Southern Calif.	19	450,000	36,000	0
Grand Total California	66	502,250	36,000	0

*Est. amount scared from light by California sea lions.