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Discarded Net Material in Alaskan Waters, 1982-84

by
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ABSTRACT

From 1982 to 1984, the National Marine Fisheries Service Foreign Fisheries Observer Program conducted a study on the amounts of net material lost, discarded, or encountered by vessels in foreign and joint venture fishing in the fisheries conservation zone (FCZ) off Alaska. This study was a response to reports of the entanglement of marine mammals in trawl net material. Data were collected aboard all vessel types involved in trawling operations. One thousand and sixty-eight observer cruises provided year-round data throughout the Bering Sea/Aleutian Islands region and the western and central portions of the Gulf of Alaska.

U.S. observers monitored net mending activities and fishing operations. Amounts of net material seen discarded, lost, retrieved, or floating in the water were recorded. Any occurrences of entanglements were also recorded.

In 1982, 14% of the pieces discarded during observed net mending operations were of a size thought most likely to entangle marine mammals. In 1983 and 1984, the percentages were 31% and 17%, respectively. From the fall of 1982 through the end of 1984, observers reported 1,551 pieces of net material brought up in trawl catches; 229 pieces (15%) were thought to have been taken from midwater. Forty-six of the pieces from midwater were of a mesh size or surface area thought most likely to entangle marine mammals. Most of the net material was encountered on the ocean bottom, where endangerment to marine mammals is unlikely. However, after these and other pieces have been captured in trawling operations, most of them are discarded back into the ocean. While discarded pieces are still in the surface or midwater areas they may endanger marine mammals.

In 1983, foreign and joint venture trawling operations lost approximately 70 nets or large portions of nets. In 1984, the number increased to approximately 90.

In 1982, U.S. observers reported no sightings of entangled marine mammals or birds. In 1983, four pinnipeds and one gull were reported entangled. One pinniped was dead. In 1984, four pinnipeds and one cetacean were reported entangled; two of the pinnipeds and the cetacean were dead.

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INTRODUCTION

In recent years, there has been growing concern over the amount of marine debris in the world's oceans, and its impact on the marine species which ingest or may become entangled in the debris (Shomura and Yoshida, 1985). Merrell (1980) estimated that approximately 1,664 metric tons (t) of plastic litter is lost or discarded each year in Alaskan waters. This litter is primarily comprised of fragments of trawl web (Merrell, 1985). Fiscus and Kozloff (1972) and Fowler (1982a,b) have reported on the entanglement of northern fur seals (Callorhinus ursinus) in net material (and also packing bands) lost or discarded from vessels engaged in trawling operations. Fowler's (1982a,b) reports led to a study conducted by the National Marine Fisheries Service (NMFS) Foreign Fisheries Observer Program whereby U.S. observers monitored the loss, discard, and encounter of net material by vessels engaged in foreign and joint venture fishing operations in the fisheries conservation zone (FCZ) off Alaska.

The following information is included to provide some background as to the extent of the fishery involved. Uchida (1985) estimates that there are approximately 170,000 km of gill net, 2,000 km of purse seine, 5,000 km of trawl net, and 8,900 km of miscellaneous net gear available to net fisheries operating in the North Pacific. Data collected by U.S. observers and reported in this paper are primarily from the trawl fishery; however, observers also recorded sightings of floating gill net and other net fragments. The level of fishing effort is another important factor in determining the potential amount of trawl webbing that could be lost or discarded, and thus become a potential source of entanglement to marine mammals, birds, fish, and other organisms. The estimated total number of trawlers (foreign and joint venture) that operated off Alaska in 1983 and 1984 (the two complete years for which

observer net loss data were available for this study) remained above 300 vessels each year (311 in 1983, 314 in 1984) (Low et al. 1985). The foreign and joint venture fisheries operating within the U.S. FCZ in Alaska landed 1.6 million t of groundfish in 1983, and 1.9 million t in 1984 (Berger et al. 1985).

The Magnuson Fishery Conservation and Management Act of 1976 (Magnuson Act) requires foreign vessels fishing or conducting joint venture operations within the 200-mile U.S. FCZ to carry a U.S. observer. A program was established at the Northwest and Alaska Fisheries Center to train and place these observers. Data collected by the observers can be used by scientists for a variety of management and research needs (French et al., 1982). One of the areas in which the program has recently been involved concerns the effect that trawl operations may have on marine mammals. Beginning in the fall of 1982 and continuing through 1985, the observers recorded information on the amount of net material lost or discarded in the foreign and joint venture fisheries. Data presented in this paper provide a summary of the information collected from 1982 through 1984.

The original intent of the study was primarily to determine the type of information observers could be expected to collect on lost or discarded netting. The purpose of this paper is to: 1) summarize and evaluate the information collected and 2) make recommendations and develop a plan for future data collections which would provide the information needed to ascertain the impact of the trawl fishery on marine mammal populations.

METHODS

U.S. fisheries observers stationed aboard foreign vessels recorded the amount of net material discarded or lost during foreign or joint venture

fishing activities. Each observer monitored net mending operations whenever possible, and used a standard form (Fig. 1) to record the results. The instructions included with this form (Appendix A) provided observers with a general background as to why information on netting lost or discarded at sea was of interest to scientists. The form itself was divided into three sections which are described as follows. Within each International North Pacific Fisheries Commission (INPFC) area (Fig. 2), information was collected on the number of net mending operations that were monitored, the number of pieces of netting that were discarded during each operation, and the observer's best estimate of the average number of net mending operations per week that occurred aboard the vessel. These operations were monitored in such a way as to minimize the effect an observer's presence might have on the amount of material being discarded. When a piece of netting was discarded, the observer was asked to note the approximate amount of material (in square meters) and from what part of the net (codend, belly, or wing) it came.

Fishing operations were monitored, and each observer was asked to collect any information concerning lost or discarded trawl nets (whole net assemblies or major portions) or codends. Also, net material seen in the catch was noted and the number of pieces, amount of netting (in square meters), approximate mesh size,. and apparent position of the mesh (bottom or midwater) when taken were recorded. Observers were also asked to note the final disposition of the material (e.g., burned, stored, or discarded).

Observers collected data on the approximate amount of any floating net material sighted. Any occurrence of marine mammals or birds entangled by man-made objects was also reported. Instances of a propeller being fouled by webbing were noted. The color of the nets used on the vessel and the color of the net material used in mending were recorded.

This being a pilot project, observers were encouraged to expand on the data requested by including their comments on the back of the form. These comments were invaluable in presenting a clearer picture as to what was actually seen. This was most helpful in our attempts to tabulate the data.

In an attempt to better educate the captains and crews of foreign vessels as to the effects of net debris, each observer brought aboard a poster describing the effects of debris on marine life. This poster was presented to the captain upon the observer's arrival aboard the vessel, along with a request that it be prominently displayed in an area frequented by the entire crew.

In summarizing these observations, we frequently use the term "observer cruise". An observer cruise is defined as an occurrence of an observer being stationed aboard a fishing vessel. The length of this cruise may vary from as little as 2-3 days to as much as 3 months, but the average length of a cruise is about 1 month. Most observers are stationed aboard two different vessels (two cruises) during their tour of service.

Table 1 gives a definition of the codes associated with the surface area (m^2) and mesh size of the net material observed. These codes are used throughout the tables presented in this paper. The surface area categories were determined based on the categories set up in section 2 of the discarded netting form (Fig. 1). To simplify the reporting procedure, three categories (<O.l m^2; 0.1 m^2 -0.5 m^2; and >0.5 m2) were used instead of the four categories used on the form. We feel that pieces of net material in area category A (which are mostly strands) are unlikely to entangle marine mammals, and that larger pieces of netting are more likely to cause entanglement. Scordino (1985) reports that strings made up only 2-5% of the entangling debris found on seals on St. Paul Island for the years 1981-84. Calkins (1985) in a study on Steller sea lions (Eumetopias jubatus), regarded net material < 1.0 m^2 as not causing entanglement.

The three mesh size categories were determined based on whether the piece most likely came from the cod end (< 100 mm), belly (100-250 mm), or wing section (>250 mm) of the trawl net. Fowler (1984) reports that items most frequently found on entangled fur seals (81%) were from 200-250 mm stretched mesh, and that 96.5% of the items were from 150-300 mm stretched mesh. Recent studies on the Pribilof Islands have shown that fur seal pups become entagled in mesh size as small as 150 mm (Fowler[1/]). Loughlin[2/] has observed that because Steller sea lions are much larger than fur seals, mesh size will likely affect only pups and yearlings. The amount of net material is of much greater importance than mesh size in determining the likelihood of sea lion entanglement. In reporting the results of this study, we are regarding net material of area category C and area-mesh size categories Bb as being most likely to entangle marine mammals, net material in area category A as being least likely to cause entanglement of marine mammals, and net material of area-mesh size categories Ba and Bc as presenting some entanglement problems for marine mammals.

RESULTS

Observations of Net Mending Operations

No reasonable estimates could be made of the number of weekly net mending operations performed by the foreign fishing vessels. Observers reported that net mending operations frequently occurred immediately following the retrieval of the net (a time when observers are in the factory). For this reason, many observers refrained from estimating the number of net mending operations per

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1/ C. W. Fowler, Northwest and Alaska Fisheries Center, NMFS, NOAA, Bldg. 4, BIN C15700, 7600 Sand Point Way NE, Seattle, WA 98115, pers. commun. 1986.

2/ T. R. Loughlin, Northwest and Alaska Fisheries Center, NMFS, NOAA, Bldg. 4, BIN C15700, 7600 Sand Point Way NE, Seattle, WA 98115, pers. commun. 1986.

week. In addition, several observer reports indicated that the crew appeared to only mend their nets if a large tear occurred; other reports told of repairs being made after every haul. Observers who did attempt to calculate average net mending operations per week reported a wide range of results.

The ability to calculate the number of net mending operations per week would have allowed the calculation of the total number of net mending operations per year. Instead, we have produced a table (Table 2) showing the number of days foreign trawlers spent inside the U.S. FCZ off Alaska (35,841 days in 1982, 35,268 days in 1983, 24,316 days in 1984). These numbers do not necessarily reflect the number of net mending operations per year, but are provided as a means of indicating changes in the level of fishing activity from 1982-1984.

Tables 3-5 summarize the net mending observations made by U.S. fisheries observers aboard foreign fishing vessels inside the U.S. FCZ during 1982-84. Area category, number of pieces, and mesh size category are given for each vessel class and INPFC area, along with the total number of cruises, the number of cruises yielding information, and the number of net mending operations that were monitored. Net mending operations are further summarized in Tables 6-7. In 1982, 709 observer cruises occurred on vessels not participating in joint venture operations, and 135 of these cruises yielded net mending data. No net mending data were collected during the other observer cruises. No joint venture cruises were monitored for net mending operations in 1982 because all joint venture observers had already boarded their vessels prior to the start of this study. Seven hundred and thirty-three net mending operations were monitored, during which 319 pieces of net material were discarded (Table 7). Two hundred and fifty-five pieces (80%) were of area category A. These pieces were primarily loose strands of twine or pieces with a mesh size less

than 100 mm. As stated above, pieces of net material in this area category appear to have a minimal chance of entangling marine mammals. Forty-five pieces (14%) were either of area category C or area-mesh size categories Bb (the categories of net material thought most likely to entangle marine mammals). Nineteen pieces (6%) were of area-mesh size categories Ba or Bc.

In 1983, 961 observer cruises occurred of which 428 provided net mending data. Observers monitored 2,401 net mending operations and saw 1,024 pieces of net material being discarded. Six hundred and three pieces (59%) were of area category A. Three hundred and twenty-two pieces (31%) were net material of a mesh size or area thought most likely to entangle marine mammals. Ninety-nine pieces (10%) were of area-mesh size categories Ba or Bc.

In 1984, 1,190 observer cruises occurred, 505 of which yielded net mending data. Observers monitored 3,428 net mending operations and recorded 1,375 pieces of discarded net material. Nine hundred and ninety-eight pieces (73%) were of a size thought least likely to entangle marine mammals (area category A), and 235 pieces (17%) were of a mesh size or area thought most likely to entangle marine mammals. One hundred and forty-two pieces (10%) were of area-mesh size categories Ba or Bc.

Observations of Netting Occurring in Trawl Catches

Tables 8-12 and Figure 2 summarize the occurrences of loose net material brought up in the catches reported by U.S. fisheries observers. These tables report the number of pieces of net material and their areas (m^2) along with the number of observer cruises from which this information was collected. This information was tabulated by INPFC area and vessel class. Other data listed include the mesh size category of the net material; where in the water column the observer felt this net material was caught; and information concerning the disposal of the netting (e.g., discarded, stored, or burned).

As noted above, we have information concerning how many observer cruises contained information on webbing brought up in catches of fish. Unfortunately, we do not have a record of how many hauls were monitored for the occurrence of webbing. If we had this information, or some other measure of effort (i.e., duration of the hauls sampled), we could use these catch and effort data to make estimates of the amount of loose net material recovered annually in trawl operations in Alaskan waters. Even without the effort data, Tables 8-12 are useful in showing the relative sizes of the pieces caught, and how they were disposed of by the vessels.

In 1982, 335 pieces of net material were reported to have been caught; 231 of the pieces (69%) were of area category A. Forty-one pieces were burned and 11 pieces were stored aboard the vessel. One hundred and forty-three pieces (43%) were discarded, including a large section of gill net (40-m^2); the rest (140 pieces, 42%) were unaccounted for. Two hundred and thirty-eight pieces (71%) were taken from the ocean bottom, and 96 pieces (29%) were thought captured in midwater. The large section of gill net was caught on the surface. Of the pieces caught in midwater, nine were of a size thought to most likely cause entanglement of marine mammals. Of the pieces later discarded by the vessels, 33 were of the area-mesh size categories thought most likely to entangle marine mammals.

In 1983, 679 pieces of net material were reported to have been caught; 484 of the pieces (71%) were of 'area category A. Twenty-two pieces were burned and 12 pieces were stored. Five hundred and thirty-seven pieces (79%) were discarded, including 2 complete trawl nets, 1 seine net, and 1 codend. Ninety-seven pieces were not discarded, but whether they were burned or stored is not known. Eleven pieces were unaccounted for. Six hundred and twenty pieces (91%) were taken from the ocean bottom and 59 pieces (9%) were

thought to have been encountered in midwater. Fifteen of the pieces caught midwater were of the area-mesh size categories thought most likely to entangle marine mammals. Of the pieces later discarded by the vessels, 64 were of the area-mesh size categories thought most likely to cause entanglement of marine mammals.

In 1984, observers reported the catch of 537 pieces of net material; 311 of the pieces (58%) were of area category A. Fifty pieces were burned and 21 pieces were stored. Three hundred and thirty-five pieces (62%) were discarded, including two gill nets, one complete trawl net, and two crab pots. Pieces not discarded but otherwise unaccounted for totalled 119, including two codends and two gill nets. Twelve pieces were unaccounted for, including one complete trawl net, one gill net, and two codends. Four hundred and sixty-two pieces (86%) were caught on the ocean bottom, 74 pieces (14%) were thought taken in midwater, and one gill net was retrieved on the surface. Twenty-two of the pieces caught in midwater were of the area-mesh size categories thought most likely to entangle marine mammals. One hundred and thirteen of the pieces later discarded by the vessels were of the area-mesh size categories thought most likely to cause entanglement of marine mammals.

Observers reported several methods employed by vessels to dispose of netting other than by discarding the pieces. Some ships (Japanese, especially) kept 55-gallon drums on deck and incinerated small scraps of webbing. On other vessels, it was common practice to store net pieces for future reuse in mending or reinforcing trawl nets. Several reports from Korean vessels indicate that much of the netting is saved for resale when they reach their home port. Less frequently, observers report the transfer of netting to cargo vessels where the ultimate disposition of the netting is unknown.

Observations of the Number of Lost or Discarded Trawl Nets

Tables 13-16 summarize the numbers of lost or discarded nets as reported by U.S. fisheries observers. In 1982, four trawl nets and two codends were recorded as lost or discarded. In 1983, 4.75 trawl nets, 2 wing sections of a trawl net, and 32.5 codends were recorded as lost or discarded. In 1984, one-third of a trawl net, 3 belly sections of a trawl net, 1 wing section of a trawl net, and 69 codends were recorded as lost or discarded. The loss of all or part of a net is a major event aboard a fishing vessel, and we expect that if an observer was aboard, he or she would certainly be aware of the loss. For this reason, we are fairly confident that the numbers given in Tables 13-16 are accurate. For joint venture operations, we feel that the actual amount of net loss would be higher than that reported by observers. Even though most of the codends are lost during transfer between the U.S. catcher boats and the foreign vessels, observers are not on board the catcher boats, and any net loss during trawling operations would not come to the observer's attention.

Because this study began in the middle of 1982, it is difficult to relate reported net loss in 1982 to the entire fishery. For 1983 and 1984, however, we expanded the reported net loss to the entire fishery based on percent observer coverage of each vessel type. In 1983, 51 codends, 10 trawl nets, and 3.5 wing panels from trawl nets were estimated lost. In 1984, we estimate the loss to be 82 codends, two-fifths of a trawl net, 1.25 wing panels of a trawl net, and 3.67 belly sections from trawl nets. Observers did not report whether the lost codends sank or floated, but one observer revealed that an empty codend lost during transfer back to the catcher boat sank immediately. The net was quickly located on the bottom with their echosounder and the crew seemed quite confident that it would stay there and

that they could retrieve it later. Net material that were lost but later retrieved are not included in Tables 13-16.

Observations of Floating Net Debris and Entanglement

Table 17 summarizes the U.S. foreign fisheries observer reports of floating net material. In 1982, two pieces of floating net material were seen. In 1983, 18 pieces were seen, including a trawl net with floats and 3 gill nets (one of which was retrieved and burned). In 1984, 12 pieces of floating net material were reported. Table 18 summarizes the recording by U.S. foreign fisheries observers of marine mammals or birds entangled in net material. No occurrences were reported in 1982. In 1983, four sea lions and one gull were observed entangled. Three of the sea lions and the gull appeared unaffected by the material. One sea lion was dead, but no information is available as to the cause of death. In 1984, two sea lions, two northern fur seals, and one humpback whale were reported entangled. One fur seal was free-swimming; one fur seal was drowned but was reported to have been close to death by starvation; one sea lion was dead; and one sea lion was seen following the codend unentangled but with constricting material around the neck. The humpback whale was entangled in a crabpot buoy line and was dead.

Summary of Results

Foreign fishing vessels using trawl gear spent 35,841 days collectively inside the U.S. FCZ off Alaska in 1982, 35,268 days in 1983, and 24,316 days in 1984. Observers recorded net mending data for 135 cruises in 1982 and reported that 14% of the pieces being discarded were thought most likely to entangle marine mammals; In 1983, the numbers were: 428 cruises provided net mending data and 31% of the pieces were potentially entangling to marine

mammals. In 1984, 505 cruises yielded net mending data and 17% of the pieces being discarded were thought most likely to entangle marine mammals.

In 1982, 335 pieces of net material were recorded in trawl catches, of which 96 pieces were caught in midwater and 1 piece on the surface; Nine of the pieces encountered in midwater and the one piece on the surface were of a mesh size or area likely to entangle marine mammals. At least 143 of the pieces brought up in trawl catches were later discarded (usually without being cut up, bundled, or altered in any way), 33 of them of a mesh size or area likely to entangle marine mammals. In 1983, 679 pieces were recorded caught, 59 in midwater. Fifteen of the pieces caught in midwater were of a mesh size or area likely to entangle marine mammals. At least 537 pieces were discarded, 64 of them of a mesh size or area likely to entangle marine mammals. In 1984, 537 pieces were recorded caught, 74 in midwater and 1 on the surface. Twenty-two of the pieces caught in midwater and the piece caught on the surface were of a mesh size or area likely to entangle marine mammals. At least 335 pieces were later discarded, 113 of them of a mesh size or area likely to entangle marine mammals.

We estimate that in 1983, foreign and joint venture operations lost 70 nets or large portions of nets. In 1984, the number increased to approximately 90.

During the 3-year study, observers reported 32 pieces of floating net material. They sighted no entangled animals in 1982, four sea lions and one gull in 1983 (one sea lion being dead), and two sea lions (one dead), two northern fur seals (one dead), and a humpback whale (dead) in 1984.

DISCUSSION

We feel that the net material information collected by U.S. observers working under contract for NMFS has been very useful. Although this information has not allowed us to provide an estimate of the amounts of material being discarded, lost, or retrieved, we have been able to detect some trends and to identify areas of concern.

In addition to the yearly decrease in the number of vessel days inside the U.S. FCZ (Table 2), it appears that the number of pieces 'of net material being discarded per net mending operation is also decreasing (Table 7). If this is occurring, it may in part be a result of the increased U.S. observer coverage of the foreign fishing vessels and the fact that in 1983 and 1984 three vessels were cited and later fined $5,000 apiece for discarded netting violations. These violations were reported by U.S. fisheries. observers. Beginning in 1985, the U.S. observers became more vocal about net material being discarded during-net-mending operations. The observer program is continuing its efforts to discourage the practice of discarding net material.

A continuing pattern in net material brought up in the trawling operations may be of some concern. Most of 'the net material is being encountered on the ocean bottom, where it appears to have minimal opportunity to entangle marine mammals. However, after these pieces have been captured in trawling operations, most of them are discarded back into the ocean. In fact, many more pieces of potentially entangling net material were seen being discarded into the water column then were seen taken out of the midwater and surface areas. In addition, these pieces are usually discarded immediately after the haul, a time when sea lions are apt to be in close proximity to the vessel; Though it is reasonable to assume that pieces brought up from the ocean bottom will

eventually return to the bottom after being discarded, while they are on the surface or are floating midwater they pose a hazard to marine mammals.

In March of 1977 (as part of the Magnuson Act), a regulationprohibiting the discard of fishing gear into the fisheries conservation zone went into effect. Since that time, nine cases regarding discarded netting have been resolved. The first six cases resulted in warnings being issued. The next three vessels cited each paid a fine of $5,000. At present, five discarded netting violation cases have been sent to NOAA General Counsel, and four other cases `are currently under investigation by the NMFS Law Enforcement Division, Alaska Region. Table 19 reports the penalty schedules for pollution violations made by foreign vessels. The amount of the fine is based on tonnage size and the number of occurrences of the violation. The fine is also based on any previous violations or fines issued to the same vessel. If the cases currently pending result in fines being imposed, these enforcement actions and the current level of observer coverage should help deter the' discard of netting from either net mending operations or material brought up in the trawl operations.

Tables 13-15 show a large increase in the number of lost or discarded codends from 1982 to 1984. This is due to the increase in joint venture activities. Most of these codends are being lost in the transfer from the U.S. catcher boats to the foreign processing vessel. As joint venture activities and the associated occurrence of lost codends continues to increase, this could be a potential problem and should be addressed. The United States fishermen would like to reduce this occurrence since the loss of codends is very costly to vessel operations. If, in fact, these codends do sink immediately and stay on the ocean bottom, they may not cause a problem for marine mammals. If, however, they do not sink (or if they sink in an area with a

bottom shallow enough to be accessible to marine mammals (<200 m)), a problem could exist. These codends are frequently full of fish and may attract marine mammals. : They-also are of an area likely to cause entanglement. More work needs to be done in this area to determine whathappens to the lost codends.

A revised form (Fig. 3) has been developed to enable more detailed and complete information to be obtained and stored in a computerized data base and to allow the calculation of the amount of net material brought up in the hauls. Instructions on filling out the revised form are included in Appendix B. Under this system, U.S. observers would continue to collect information on lost or discarded codends or net material, floating net material or entangled marine mammals or birds, and net material brought up in the catch. This information would be returned to Seattle and entered on a data base structured by fishing vessel class and nationality and by INPFC area of the observance. This data base would be related to the primary observer data base which contains the total number of hauls made by the vessel, the number sampled by the observer, the total tonnage of fish landed by the vessel, and the tonnage sampled by the observer. This reporting system would allow, 1) the extrapolation of the amount of netting found in the entire haul and lost or discarded during the haul, 2) the presentation of an overall view of the amount of material being lost in Alaskan waters and the amount already there, and 3) 'summarization of the amounts of net material in each area (m^2) and mesh size category.

The U.S. Observer Program will continue its efforts to discourage the illegalpractice of discarding net material. The U.S. observers will record any observed occurrences of discarded netting, and report the position, surface area (m^2), mesh size, and number of pieces for possible enforcement action. Occurrences of net material being brought up in the hauls and then discarded

should be recorded in the same manner. This information will continue to be submitted to the NMFS Law Enforcement Division, Alaska or Northwest Region. Fines and diligent reporting by U.S. observers should help -reduce the amount of discarded net material by foreign vessels operating in U.S. waters.

LITERATURE CITED

Berger, J., J. Wall, and R. Nelson Jr. 1985. Summary of U.S. observer sampling of foreign and joint-venture fisheries in the northeast--Pacific Ocean and eastern. Bering Sea, 1984. (Document submitted to-'the annual meeting of the International North Pacific Fisheries Commission, Tokyo, Japan, October 1985. 224 p.) Northwest and, Alaska Fisheries Center, National Marine Fish. Serv., NOAA, Building 4, Bin C15700, 7600 Sand Point Way N.-E., Seattle, WA 98115.

Calkins, D.C. 1985. Steller sea lion entanglement in marine debris. In R. S. Shomura and H. O. Yoshida (editors), Proceedings of the Workshop -on the Fate and Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, p. 308-314. U.S. Dep. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., -NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-54.

Fiscus, C. H., and P. Kozloff. 1972. Fur seals and fish netting. Appendix E. In Fur seal investigations, 1971, p. 124-132. Unpubl. rep.,, Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA,98115

Fowler., C. W. 1982a; 'Interactions of-northern fur seals and commercial fisheries. Trans. N. Am. Wildl. Nat. Res. Conf. 47:278-292.

1982b. Entanglement as an explanation for the decline in northern fur seals of the Pribiloff Islands. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA 98115, 24 p. (Background paper submitted to the 25th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, 13-16 April 1982, held in Ottawa, Canada.)

1984. Entanglement in fishery debris as a contributing factor in the decline of northern fur seals on the Pribilof Islands. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA 98115, 33 p. (backgroud paper submitted to the 27th Annual Meetimg of the Standing Scientific Committee of the North Pacific Fur Seal Commission, 9-13 April 1984, held in Moscow, U.S.S.R.)

French, R., R. Nelson Jr., and J. Wall. 1982. Role of the United States observer program in management of foreign fisheries in the northeast Pacific Ocean and eastern Bering Sea. N. Am. J. Fish. Manage. 2:122-131.

Low, L.-L., R. E. Nelson Jr., and R. E. Narita. 1985. Net loss from trawl fisheries off Alaska. In R. S. Shomura and H. 0. Yoshida (editors), Proceedings of the Workshop on the Fate and Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, p. 130-153. U.S. Dep. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-54.

Merrell, T. R. Jr. 1980. Accumulation of plastic litter on beaches of Amchitka Island, Alaska. Mar. Environ. Res. 3:171-184.

1985. Fish nets and other plastic litter on Alaska beaches. In R. S. Shomura and H. O. Yoshida (editors); Proceedings of the Workshop on the Fate and Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, p. 160-182. U.S. Dep. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-54.

Scordino, J. 1985. Studies on fur seal entanglement, 1981-84, St. Paul Island, Alaska. In R. S. Shomura and H. 0. Yoshida (editors), Proceedings of the Workshop on the Fate and Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, p. 278-29.0,, U.S. Dep. Commer.; Natl. Oceanic Atmos. Admin., Nat-l. Mar. Fish. Serv., NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-54.

Shomura, R. S., and H. O. Yoshida (editors). 1985. Proceedings of the Workshop on the FatGand Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, p. 3-l2. U.S. Dep. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-54.

Uchida, R. N. 1985. The types and estimated amounts of fish net deployed in the North Pacific. In R. S. Shomura and H. 0. Yoshida (editors), Proceedings of the Workshop on the Fate and Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, p. 37-108. U.S. Dep. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., NOAA Tech. Memo; NOAA-TM-NMFS-SWFC-54.

Observer Name:_____

Cruise No._____ Vessel Code_____ Ship Name:_____

Estimate of amount of discarded netting by area:

	AREA____	AREA____	AREA____
No. of net-mending operations monitored	_____	_____	_____
Average no. of pieces discarded/net-mending operation	___/___ =	___/___ =	___/___ =
Average no. of net-mending operations/week	___/___ =	___/___ =	___/___ =

Approximate size composition of the discarded pieces of netting that you observed while monitoring net-mending:

(record the number of pieces observed in each category.)	cod-end mesh	belly mesh	wing mesh
No. less than 0.1 m^2 (1 ft^2)	_____	_____	_____
No. 0.1 m^2 to 0.37 m^2 (1 ft^2 to 4 ft^2)	_____	_____	_____
No. 0.37 m^2 to 0.836 m^2 (4 ft^2 to 9 ft^2)	_____	_____	_____
No. larger than 0.836 m^2 (9 ft^2)	_____	_____	_____

Please answer the following questions, using the back where necessary.

1. To your knowledge during the period you were aboard, did your ship lose any trawl nets or discard any badly torn codends?
   Yes_____ No_____ (If yes, describe the circumstances.)

2. Did you observe any pieces of webbing in the catches?
   Yes_____ No_____ (If yes, describe the size of the pieces, the approximate mesh size, and whether you think the mesh was taken on the bottom or mid-water.)

3. Did you see any evidence of floating net material, observe a marine mammal with entangling matter, or hear of a propeller fouled by webbing?
   Yes_____ No_____ (If yes, please comment.)

4. What were the colors of the nets used on this vessel, and was the material used in mending of the same color?

Please place comments on any of the above on the back of this sheet.

Figure 1.--Discard netting form used from 1982 to 1985.

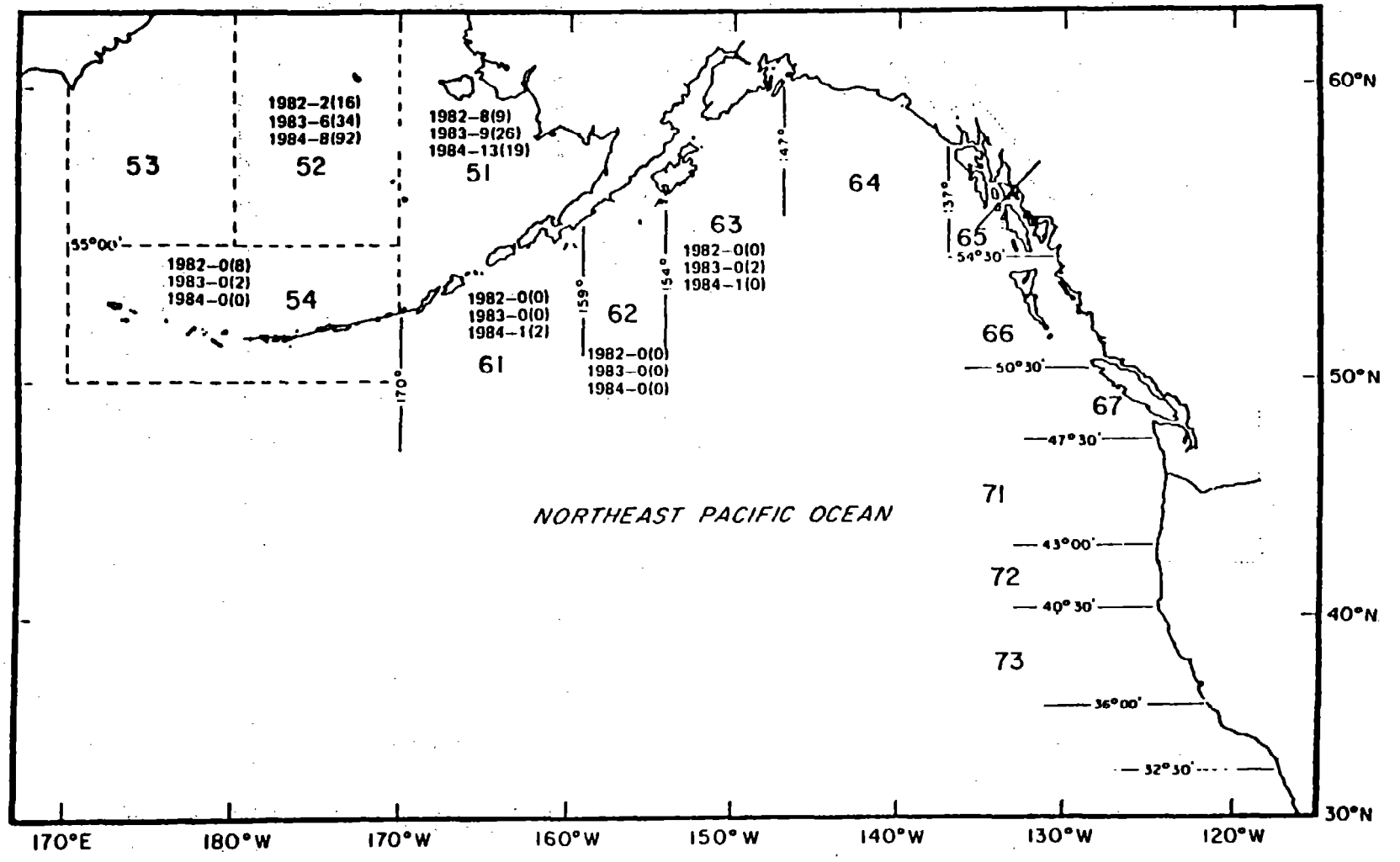

Figure 2.--Figure of pieces of potentially entangling net material recovered (discarded) in the surface and midwater column in catches brought aboard foreign fishing vessels in International North Pacific Fisheries Commission areas of the Bering Sea, Aleutian Islands, and Gulf of Alaska.

OBSERVATIONS OF DISCARDED NETTING/MARINE MAMMAL ENTAGLEMENT

Page____ of____

	Cruise no.				Vessel code			Year		
1	3	4	5	6	7	8	9	10	11	12
•										

Observation code (column 1)
1 = Netting found in sampled portion of haul
2 = Netting found in portion of haul not sampled
3 = Observed floating netting
4 = Lost or discarded net material
5 = Entangled marine mammal or bird

Site code (column 15)
A = $< 0.1\ m^2$
B = $0.1\ m^2 - 1.0\ m^2$
C = $> 1.0\ m^2$
D = Cod end
E = Trawl net
F = Unknown

Mesh code (column 16)
C = Cod end
B = Belly
W = Wing
S = Strand
E = Entire net
U = Unknown

Water column code (column 21)
S = Surface
M = Midwater
B = Bottom
U = Unknown
N = Not applicable

Disposition code (column 22)
B = Burned L = Lost
S = Stored O = Other
D = Discarded
U = Unknown
N = Not applicable

Observation code	Date				Location										Number				Water column code	Disposition code	Comments
	Month		Day		Latitude (N)				E/M	Longitude				Site	Mesh						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Figure 3.--New (1987) discard netting form.

Table 1 .--Definition of area and mesh 'size categories of observed net material.

Area category	Size of Pieces	Remarks
A	<0.1 m^2	
B	0.1 m^2 - 0.5 m^2	(potentially entangling for pinnipeds in conjunction with a mesh size of 100-250 mm)
C	>0.5 m^2	(potentially entangling for pinnipeds)
Mesh size category		
a	< 100 mm	(codend mesh)
b	100 mm - 250 mm	(belly mesh) (potentially entangling for pinnipeds in conjunction with an area >.1 m^2)
c	> 250 mm	(wing mesh)

Table 2.--Vessel days of foreign vessels using trawl gear in the U.S. fisheries conservation zone off Alaska.[1/]

Year	INPFC area[2/]	Vessel days
1982	51	10,253
	52	13,091
	54	7,877
	61	1,499
	62	1,951
	63	1,170
	Total	35,841
1983	51	10,054
	52	13,124
	54	7,261
	61	1,456
	62	1,849
	63	1,524
	Total	35,268
1984	51	10,062
	52	6,985
	54	3,184
	61	760
	62	1,671
	63	1,654
	Total	24,316

1/ A vessel day is a day spent by a foreign fishing vessel inside the U.S. fishery conservation zone.

2/ Refer to Figure 2 for the designation of the International North Pacific Fisheries Commission areas.

Table 3.--Net mending operations monitored aboard foreign fishing vessels in the U.S. fisheries conservation zone off Alaska, 1982[1/].

Vessel class	INPFC[2/] area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Small trawler	51	60/14	61	A /10	strands
				A / 3	a
				C / 1	b
	52	185/30	133	A / 3	a
				A /19	b
				A /18	c
				B /10	b
				B /13	c
				C /12	b
				C / 4	c
	54	87/ 6	17	A /20	strands
	61	35/ 9	45	A /15	strands
				B / 1	c
				C / 1	c
	62	31/11	79	A /15	strands
				A / 3	a
	63	25/10	76	A /15	strands
				B / 1	a
				B / 2	c
				C / 1	a
				C / 5	b
				C / 3	c

Table 3.--Continued.

Vessel class	INPFC[2]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Surimi trawler	51	32/ 8	116	A /75	c
				C / 1	a
	52	32/ 8	51	A / 5	b
	61	6/ 0			
	62	6/ 2	18	0	
	63	2/ 0			
Freezer trawler	51	79/14	59	A / 5	strands
				A / 1	a
				A / 2	b
				B / 2	b
				B / 2	c
	52	17/ 4	9	A / 2	b
				A / 3	c
				B / 1	b
	54	26/ 5	13	A / 2	b
				C / 1	b

Table 3.--Continued.

Vessel class	INPFC[2/] area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Freezer trawler	61	32/ 2	7	Unknown	
	62	29/ 9	32	A /10	a
				A /26	b
				A / 1	c
	63	13/ 3	17	A / 2	b
				B / 3	b
Surimi mothership	51	8/ 0			
	52	2/ 0			
Freezer mothership	51	2/ 0			

[1/] Net mending operations were not observed aboard joint venture vessels until 1983.

[2/] International North Pacific Fisheries Commission.

Table 4.--Net mending operationsmonitored aboard foreign fishing vessels in the U.S. fisheries conservation zone off Alaska, 1983.

Vessel class	INPFC[1]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Small trawler	51	118/ 57	340	A / 17	a
				A / 38	b
				A / 16	c
				B / 10	a
				B / 26	b
				B / 10	c
				C / 12	a
				C / 22	b
				C / 21	c
	52	275/155	727	A / 80	strands
				A / 53	a
				A /145	b
				A / 78	c
				B / 21	a
				B / 49	b
				B / 31	c
				C / 3	a
				C / 43	b
				C / 58	c
	54	99/ 33	97	A / 6	a
				A / 9	b
				A / 13	c
				B / 10	b
				B / 9	c
				C / 1	a
				C / 8	b
				C / 32	c

Table 4.--Continued.

Vessel class	INPFC[1]/ area-	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Small trawler	61	34/ 17	57	A / 5	strands
				A / 5	c
				B / 1	a
				B / 2	b
	62	32/ 15	37	A / 5	strands
				A / 1	c
				C / 4	b
	63	31/ 16	176	A / 2	b
				A / 3	c
				B / 3	b
				B / 1	c
				C / 1	a
				C / 3	c
Surimi trawler	51	21/ 5	47	C / 1	a
	52	32/ 17	251	A / 1	b
				B / 3	c
				C / 1	c
	61	5/ 2	17	0	
	62	5/ 2	25	A / 6	strands
	63	2/ 1	3	0	

Table 4.--Continued.

Vessel class	INPFC1/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Freezer trawler	51	109/ 34	219	A / 9	strands
				A / 7	a
				A / 3	b
				B / 2	b
	52	7/ 1	1	0	
	54	14/ 7	29	B / 1	a
				C / 1	a
				C / 1	b
				C / 11	c
	61	48/ 19	46	A / 20	strands
				A / 1	b
				C / 2	c
	62	30/ 11	76	A / 4	b
				A / 1	c
				B / 1	b
	63	9/ 7	28	0	

Table 4.--Continued.

Vessel class	INPFC[1/] area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Surimi mothership	51	9/ 4	12	0	
	52	4/ 2	2	0	
Freezer mothership	51	1/ 1	60	0	
JV mothership	51	30/ 9	86	A / 20 B / 7 C / 4	a a a
	54	3/ 0			
	61	5/ 2	7	A / 10	strands
	62	23/ 7	40	A / 35 B / 5	a a
	63	15/ 4	18	A / 10	strands

[1/] International North Pacific Fisheries Commission.

Table 5.--Net mending operations monitored aboard foreign fishing vessels in the U.S. fisheries conservation zone off Alaska, 1984.

Vessel class	INPFC[1]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Small trawler	51	76/ 49	301	A / 15	Strands
				A / 13	a
				A / 20	b
				A / 4	c
				B / 7	b
				B / 1	c
				C / 1	a
	52	306/119	704	A / 65	Strands
				A / 66	a
				A / 33	b
				A / 97	c
				B / 45	a
				B / 13	b
				B / 10	c
				C / 46	a
				C / 4	b
				C / 4	c
	54	119/ 53	131	A / 14	a
				A / 3	b
				A / 4	c
				B / 12	a
				B / 11	b
				B / 5	c
				C / 3	a
				C / 5	b

Table 5.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Small trawler	61	17/ 5	14	A / 5	b
				A / 2	c
				B / 1	a
				B / 2	b
				B / 1	c
				C / 1	c
	62	12/ 4	28	A / 20	strands
				A / 10	a
				A / 27	b
				B / 4	a
				B / 5	b
				C / 2	c
	63	13/ 5	25	A / 10	a
				A / 24	b
				B / 3	a
				B / 5	b
				C / 2	c
Side trawler	51	1/ 1	4	0	

Table 5.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Surimi trawler	51	13/ 12	232	A / 45	strands
				A / 4	a
				A / 5	b
				A / 1	c
	52	32/ 25	285	A / 2	a
				A / 4	b
				A / 1	c
				B / 8	a
				B / 6	b
				C / 3	a
				C / 10	b
				C / 28	c
	54	3/ 0			
	61	7/ 3	78	0	
	62	5/ 4	34	0	
	63	4/ 3	19	0	
Freezer trawler	51	149/ 83	727	A / 25	strands
				A /162	a
				A / 40	b
				A / 32	c
				B / 7	a
				B / 25	b
				B / 12	c
				C / 3	a
				C / 2	b
				C / 7	c

Table 5.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Freezer trawler	52	53/ 16	78	A / 12	strands
				A / 19	a
				A / 14	b
				A / 5	c
				B / 5	a
				B / 15	b
				B / 1	c
	54	27/ 14	60	A / 10	strands
				B / 2	b
				C / 1	a
	61	43/ 12	35	A / 10	strands
				A / 9	a
	62	30/ 8	53	A / 24	a
				A / 24	b
				A / 10	c
				B / 4	a
				B / 6	b
				B / 1	c
				C / 2	a
	63	19/ 3	9	A / 3	a
				B / 1	a
				C / 2	a

Table 5.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises/number monitored	Number of operations monitored	Area category/ number of pieces discarded (see Table 1)	Mesh size category (see Table 1)
Surimi mothership	51	1/ 0			
	52	7/ 2	14	0	
Freezer mothership	51	1/ 0			
	52	1/ 0			
JV mothership	51	84/ 39	290	A / 5	strands
				A / 28	a
				B / 4	a
				C / 4	a
	52	8/ 3	18	0	
	54	28/ 13	186	A / 26	a
				B / 6	a
				C / 5	a
	61	36/ 7	35	A / 15	a
				B / 1	a
	62	49/ 14	41	A / 12	a
				B / 8	a
				C / 3	a
	63	46/ 8	27	A / 19	a
				B / 2	a

[1]/International North Pacific Fisheries Commission.

Table 6.--Summary of discarded net material by mesh size and and surface area categories during net mending operations actually monitored by U.S. observers 1982-84.

Year	Mesh size (see Table 1)	Surface area A	Surface area B	Surface area C	Total
1982	strands	80	0	0	80
	a	20	1	2	23
	b	58	16	19	93
	c	97	18	8	123
	Total	255	35	29	319
1983	strands	145	0	0	145
	a	138	45	23	206
	b	203	93	78	374
	c	117	54	128	299
	Total	603	192	229	1,024
1984	strands	207	0	0	207
	a	436	111	73	620
	b	199	97	21	317
	c	156	31	44	231
	Total	998	239	138	1,375
1982-84	strands	432	0	0	432
	a	594	157	98	849
	b	460	206	118	784
	c	370	103	180	653
	Total	1,856	466	396	2,718

Table 7.--Pieces of netting observed being discarded during net mending operations, 1982-84.

Year	INPFC[1]/ area	Number of operations monitored	Number of pieces discarded	Number of potentially entangling pieces discarded
1982	51	236	102	4
	52	193	90	27
	54	30	23	1
	61	52	17	1
	62	129	55	0
	63	93	32	12
	Total	733	319	45
1983	51	764	225	88
	52	981	566	154
	54	126	102	64
	61	127	46	4
	62	178	62	5
	63	225	23	7
	Total	2,401	1,024	322
1984	51	1,554	472	49
	52	1,099	516	129
	54	377	107	27
	61	162	47	3
	62	156	162	18
	63	80	71	9
	Total	3,428	1,375	235

[1]/ International North Pacific Fisheries Commission.

Table 8.--Webbing brought up in catches aboard foreign fishing vessels in the U.S. fisheries conservation zone off Alaska, 1982[1/]

Vessel class	INPFC[2/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	51	60	A / 1	bottom	a	1	
			B / 1	mid	a	0	burned
			B / 6	mid	c	6	
			B / 4	mid	unknown	4	
			B / 2	bottom	unknown	0	burned
			B / 2	bottom	c	2	
			C / 3	bottom	a	2	1 stored
			C / 4	bottom	b	4	
			C / 3	mid	a	1	2 burned
			C / 1	surface	unknown	1	5x8 m gill net
	52	185	A / 30	bottom	a, scraps	30	
			A / 4	bottom	b	4	
			B / 30	bottom	unknown	30	
			B / 5	bottom	b	5	
			C / 1	bottom	a	1	
			C / 7	bottom	unknown	7	
			C / 1	bottom	b	1	
			C / 2	mid	b	2	
	54	87	A / 30	bottom	strands	30	
			B / 4	bottom	b	4	
			B / 1	bottom	unknown	1	
			C / 4	bottom	unknown	4	

Table 8.--Continued.

Vessel class	INPFC[2/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	61	35	B / 1	bottom	unknown	0	burned
			C / 3	bottom	b	0	burned
	62	31	A / 30	bottom	strands	0	burned
	63	25	B / 1	bottom	a	1	
Surimi trawler	51	32	A / 30	mid	a,b,c	unknown	
			A / 30	bottom	a,b,c	unknown	
			C / 1	bottom	trawl net	0	burned
	52	32	A / 30	mid	a,b,c	unknown	
			A / 30	bottom	a,b,c	unknown	
	61	6	0				
	62	6	B / 1	bottom	a	0	burned
	63	2	0				

Table 8.--Continued.

Vessel class	INPFC[2/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Freezer trawler	51	79	A / 10	mid	a,b,c	unknown	
			B / 1	mid	c	0	stored
			B / 1	bottom	a	1	
			B / 1	bottom	b	1	
			B / 1	bottom	c	unknown	
			C / 1	mid	a	0	stored
			C / 3	mid	c	0	stored
			C / 2	bottom	b	0	stored
			C / 2	bottom	c	unknown	
	52	17	C / 1	bottom	b	unknown	
	54	26	A / 5	mid	a	unknown	
	61	32	0				
	62	29	A / 1	bottom	c	unknown	
			B / 1	bottom	b	0	stored
			C / 2	bottom	b	0	stored
	63	13	0				

1/ Joint venture vessels were not monitored until 1983.
2/ International North Pacific Fisheries Commission.

Table 9.--Webbing brought up in catches aboard foreign fishing vessels in the U.S. fishery conservation zone off Alaska, 1983.

Vessel class	INPFC[1]/ area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	51	118	A / 1	mid	unknown	1	gill net scrap
			A /100	bottom	a	100	net fragments
			B / 1	mid	unknown	0	stored
			B / 7	bottom	a	1	
			B / 7	bottom	b	1	
			B / 7	bottom	c	5	inc. 2 entire codends-1 discarded
			C / 4	bottom	a	2	
			C / 1	mid	b	0	
			C / 18	bottom	b	7	
			C / 1	mid	c	1	
			C / 11	bottom	c	6	

Table 9.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	52	275	A /50	bottom	strands	50	
			A / 5	bottom	b	5	
			A / 1	bottom	c	1	
			B / 2	mid	a	1	
			B / 4	bottom	a	4	
			B /19	bottom	b	14	
			B / 2	mid	c	2	
			B /12	bottom	c	9	
			C / 1	mid	a	1	
			C /11	bottom	a	8	
			C / 2	mid	b	0	burned
			C / 1	mid	c	0	
			C /11	bottom	c	8	
			C / 5	bottom	entire trawl nets	2	
			C / 1	bottom	seine net	1	

Table 9.--Continued.

Vessel class	INPFC[1/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	54	99	A / 3	bottom	a	2	
			A / 1	bottom	b	1	
			B / 1	bottom	b	1	
			B / 3	bottom	c	unknown	
			C / 1	bottom	a,b,c	1	large bundle of misc. netting
	61	34	A / 5	bottom	strands	5	
			C / 3	bottom	b	0	
	62	32	C / 1	bottom	b	0	
			C / 3	bottom	c	0	
			C / 1	bottom	entire trawl net	0	
	63	31	B / 3	bottom	b	1	
			C / 2	bottom	a	0	
			C / 3	bottom	b	1	
			C / 1	bottom	c	0	

Table 9.--Continued.

Vessel class	INPFC[1/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Surimi trawler	51	21	C / 3	mid	a	0	
			C / 2	bottom	a	0	
			C / 2	mid	b	2	
	52	32	A /50	bottom	strands	50	
			A / 1	bottom	b	0	
			B / 3	mid	a	0	
			B / 2	bottom	a	0	
			B / 1	mid	b	0	
			C / 2	bottom	a	0	
			C / 1	bottom	b	0	
			C / 1	mid	c	0	
			C / 2	bottom	c	0	
			C / 1	bottom	gill net	0	
			C / 1	bottom	trawl net	0	
	61	5	0				
	62	5	B / 1	bottom	b	0	
	63	2	0				

Table 9.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Freezer trawler	51	109	A / 50	bottom	strands	50	
			A / 5	bottom	b	unknown	
			B / 3	bottom	a	0	stored
			B / 2	bottom	c	0	stored
			C / 1	bottom	a	0	stored
			C / 2	bottom	b	2	
			C / 1	bottom	c	0	stored
			C / 2	bottom	entire trawl nets	0	stored
	52	7	0				
	54	14	0				
	61	48	A /100	bottom	strands	100	
			C / 1	bottom	b	unknown	
	62	30	A / 70	bottom	strands	70	
			A / 1	bottom	b	1	
			B / 2	bottom	a	0	stored
	63	9	A / 5	bottom	strands	5	
			C / 2	bottom	b	unknown	

Table 9.--Continued.

Vessel class	INPFC[1/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Surimi mothership	51	9	A / 5	mid	strands	5	
	52	4	0				
Freezer mothership	51	1	C / 1	mid	b	0	
JV mothership	51	30	A /10	mid	strands	4	
			A / 1	bottom	a	1	
			C / 1	mid	b	0	
			C / 5	bottom	b	5	
	54	3	0				
	61	5	A /10	mid	strands	0	burned
	62	23	A /10	mid	strands	0	burned
	63	15	0				

1/ International North Pacific Fisheries Commission.

Table 10.--Webbing brought up in catches aboard foreign fishing vessels in the U.S. fishery conservation zone off Alaska, 1984.

Vessel class	INPFC[1]/ area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	51	76	A / 1	bottom	a	1	
			A /50	bottom	b	50	
			B / 3	bottom	a	1	
			B / 5	bottom	b	3	
			B / 2	bottom	c	2	
			C / 1	mid	a	0	
			C / 6	bottom	a	2	
			C /10	bottom	b	6	
			C / 3	mid	c	0	
			C / 4	bottom	c	1	
			C / 1	bottom	crab pot netting	1	
			C / 1	mid	gill net	1	
			C / 1	mid	entire trawl net	1	

Table 10.--Continued.

Vessel class	INPFC[1/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	52	306	A /200	bottom	fragments	150	
			A / 1	bottom	b	0	
			A / 5	bottom	c	3	
			B / 1	mid	a	1	
			B / 6	bottom	a	3	
			B / 70	bottom	b	60	
			B / 1	mid	c	1	
			B / 2	bottom	c	2	
			B / 3	bottom	crab pot netting	3	
			B / 1	bottom	gill net portion	1	
			C / 1	mid	a	1	
			C / 8	bottom	a	6	
			C / 1	mid	b	0	
			C / 26	bottom	b	18	
			C / 6	bottom	c	1	
			C / 1	mid	gill net	1	
			C / 1	bottom	entire trawl net	unknown	
			C / 1	bottom	small otter trawl	1	cut up and bundled for disposal
			C / 2	bottom	crab pot netting	2	

Table 10.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Small trawler	54	119	A / 2	bottom	a	2	
	61	17	C / 2	bottom	a	2	
			C / 1	mid	c	0	stored
	62	12	0				
	63	13	A /50	mid	a	0	burned
			C / 1	bottom	b	unknown	
Side trawler	51	1	0				
Surimi trawler	51	13	B / 1	mid	b	0	
			C / 1	bottom	crab pot netting	1	
	52	32	B / 1	bottom	b	0	
			C / 1	mid	a	0	
			C / 1	mid	gill net	unknown	
			C / 2	mid	b	0	
			C / 1	bottom	c	0	
			C / 2	bottom	crab pots	2	
	54	3	0				
	61	7	0				
	62	5	0				
	63	4	C / 1	bottom	a	0	entire cod end

Table 10.--Continued.

Vessel class	INPFC[1]/ area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Freezer trawler	51	149	A / 2	bottom	a	2	
			B / 6	bottom	b	0	stored
			B / 3	bottom	c	unknown	
			C / 2	mid	a	unknown	
			C / 2	mid	a	2	entire codends
			C / 1	mid	b	unknown	
			C / 9	bottom	b	0	stored
			C / 4	bottom	c	0	stored
			C / 1	mid	c	0	stored
			C / 1	bottom	entire trawl net	1	cut into pieces & dumped, pieces floated
			C / 1	bottom	gill net	0	
	52	53	C / 1	surface	gill net	0	
			C / 2	bottom	a	0	
	54	27	C / 1	bottom	a	unknown	entire codend
	61	43	0				
	62	30	C / 1	bottom	a	0	
			C / 1	bottom	a	0	entire codend
			C / 3	bottom	b	0	
	63	19	C / 1	mid	a	0	

Table 10.--Continued.

Vessel class	INPFC[1/] area	Number of cruises observed	Area category/ number of pieces (See Table 1)	Water column	Mesh size category (See Table 1)	Number discarded	Notes
Surimi mothership	51	1	B / 1	bottom	a	0	
	52	7	0				
Freezer mothership	51	1	0				
	52	1	0				
JV mothership	51	84	C / 1	bottom	a	unknown	
			C / 1	bottom	a	unknown	entire codend
	52	8	0				
	54	28	0				
	61	36	0				
	62	49	0				
	63	46	0				

[1/] International North Pacific Fisheries Commission.

Table 11 .--Summary of the mesh size and net area of observed webbing brought up in catches aboard foreign fishing vessels in the U.S. fishery conservation zone off Alaska.

Year	Water column	Mesh size (See Table 1)	Net area A	B	C	Total
1982	mid	strands	0	0	0	0
		a	5	1	4	10
		b	0	0	2	2
		c[1/]	70	7	3	80
		unknown	0	4	0	4
		Total	75	12	9	96
1982	bottom	strands	60	0	0	60
		a	31	3	4	38
		b	4	11	13	28
		c[1/]	61	3	3	67
		unknown	0	34	11	45
		Total	156	51	31	238
1982	Total	strands	60	0	0	60
		a	36	4	8	48
		b	4	11	15	30
		c[1/]	131	10	6	147
		unknown	0	38	12	50
		Total	231	63	41 [2/]	335 [2/]
1983	mid	strands	35	0	0	35
		a	0	5	4	9
		b	0	1	7	8
		c	0	2	3	5
		unknown	1	1	0	2
		Total	36	9	14	59
1983	bottom	strands	330	0	0	330
		a	104	18	22	144
		b	13	31	36	80
		c[1/]	1	24	41	66
		unknown	0	0	0	0
		Total	448	73	99	620
1983	Total	strands	365	0	0	365
		a	104	23	26	153
		b	13	32	43	88
		c[1/]	1	26	44	71
		unknown	1	1	0	2
		Total	484	82	113	679

Table 11 .--Continued.

Year	Water column	Mesh size (See Table 1)	Net area A	B	C	Total
1984	mid	strands	0	0	0	0
		a	50	1	8	59
		b	0	1	4	5
		c[1]/	0	1	9	10
		unknown	0	0	0	0
		Total	50	3	21	74
1984	bottom	strands	200	0	0	200
		a	5	10	24	39
		b	51	82	49	182
		c[1]/	5	11	25	41
		unknown	0	0	0	0
		Total	261	103	98	462
1984	Total	strands	200	0	0	200
		a	55	11	32	98
		b	51	83	53	187
		c[1]/	5	12	35	52
		unknown	0	0	0	0
		Total	311	106	120 2/	537 2/
1982-84	Total	strands	625	0	0	625
		a	195	38	66	299
		b	68	126	111	305
		c[1]/	137	48	85	270
		unknown	1	39	12	52
		Total	1,026	251	274 3/	1,551 3/

1/includes multiple mesh sizes.

2/includes one piece of netting taken on the surface of net area "C" and unknown mesh size.

3/includes two pieces of netting taken on the surface of net area "C" and unknown mesh size.

Table 12.--Summary of observed webbing brought up in catches aboard foreign fishing vessels in the U.S. fishery conservation zone.

Year	INPFC area[1/]	Water column	No. of pieces	No. of pieces potentially entangling	No. of pieces known discarded	No. of potentially entangling pieces known discarded
By Year						
1982	-	-	335	51	143	33
1983	-	-	679	144	537	64
1984	-	-	537	203	335	113
By Year and Water Column						
1982	-	surface	1	1	1	1
		mid	96	9	13	3
		bottom	238	41	129	29
1983	-	surface	0	0	0	0
		mid	59	15	17	4
		bottom	620	129	520	60
1984	-	surface	1	1	0	0
		mid	74	22	8	6
		bottom	462	180	327	107
By Year, INPFC[1/] Area, and Water Column						
1982	51	surface	1	1	1	1
		mid	59	7	11	1
		bottom	50	12	11	7
	52	mid	32	2	2	2
		bottom	109	15	78	14
	54	mid	5	0	0	0
		bottom	39	8	39	8
	61	mid	0	0	0	0
		bottom	4	3	0	0
	62	mid	0	0	0	0
		bottom	35	3	0	0
	63	mid	0	0	0	0
		bottom	1	0	1	0

Table 12.--Continued.

Year	INPFC area [1]	Water column	No. of pieces	No. of pieces potentially entangling	No. of pieces known discarded	No. of potentially entangling pieces known discarded
By Year, INPFC [1] Area, and Water Column						
1983	51	mid	26	9	13	3
		bottom	228	53	280	23
	52	mid	13	6	4	1
		bottom	180	54	152	33
	54	mid	0	0	0	0
		bottom	9	2	5	2
	61	mid	0	0	0	0
		bottom	109	4	105	0
	62	mid	10	0	0	0
		bottom	78	5	71	0
	63	mid	0	0	0	0
		bottom	16	11	7	2
1984	51	mid	13	13	4	4
		bottom	112	50	71	15
	52	surface	1	1	0	0
		mid	9	7	4	2
		bottom	338	120	252	90
	54	mid	0	0	0	0
		bottom	3	1	2	0
	61	mid	1	1	0	0
		bottom	2	2	2	2
	62	mid	0	0	0	0
		bottom	5	5	0	0
	63	mid	51	1	0	0
		bottom	2	2	0	0

[1] International North Pacific Fisheries Commission.

Table 13.--Lost or discarded nets from foreign fishing vessels in the U.S. fishery conservation zone off Alaska, 1982[1/].

Vessel class	INPFC area	Number and size composition
Small trawler	51	50% of 1 trawl net
	54	1 trawl net
Surimi trawler	51	2 trawl nets
Freezer trawler	51	1 codend
	54	50% of 1 trawl net
	63	1 codend

1/ Joint venture vessels were not monitored until 1983.

Table 14.--Lost or discarded nets from foreign fishing vessels in the U.S. fishery conservation zone off Alaska, 1983.

Vessel class	INPFC[1/] area	Number and size composition	Percent observer coverage	Estimated total net loss
Small trawler	51	Wing section of 1 trawl net	50.7	Wing section of 2 trawl nets
	52	3 codends 1-1/2 trawl nets	46.0	6-1/2 codends 3-1/3 trawl nets
	62	1 trawl net	57.9	1-3/4 trawl nets
Freezer trawler	51	50% of 1 codend	59.5	80% of 1 codend
	54	1 trawl net	31.1	3-1/4 trawl nets
	62	25% of 1 trawl net		40% of 1 trawl net
	63	1 wing panel of a trawl net	68.3	1-1/2 wing panels of a trawl net
Surimi mothership	52	1 trawl net	62.3	1-1/2 trawl nets
JV mothership	51	10 codends	55.7	18 codends
	54	5 codends	72.5	7 codends
	62	11 codends	75.5	14-1/2 codends
	63	3 codends	68.2	4-1/2 codends

[1/] International North Pacific Fisheries Commission.

Table 15.--Lost or discarded nets from foreign fishing vessels in the U.S. fishery conservation zone off Alaska, 1984.

Vessel class	INPFC[1/] area	Number and size composition	Percent observer coverage	Estimated total net loss
Small trawler	51	1 codend	85.1	1-1/4 codend
	52	5 codends 1 wing panel of a trawl net 1/3 of a trawl net	85.6	6 codends 1-1/4 wing panels of a trawl net 2/5 of a trawl net
	54	1 codend	67.6	1-1/2 codends
Freezer trawler	51	5 codends belly sections of 3 trawl nets	81.5	6 codends 3-2/3 belly sections
JV mothership	51	10 codends	82.3	12 codends
	52	1 codend	97.1	1 codend
	54	13 codends	80.3	16 codends
	62	26 codends	86.3	30 codends
	63	7 codends	86.7	8 codends

1/ International North Pacific Fisheries Commission.

Table 16.--Summary of lost or discarded nets (or major portions of nets) from foreign fishing vessels in the U.S. fishery conservation zone.

	Net loss				
	1982[1/]	1983		1984	
Area	Number observed	Number observed	Number estimated	Number observed	Number estimated
51	4	12	21	19	24
52	0	6	13	8	10
54	2	6	11	14	18
61	0	0	0	0	0
62	0	13	18	26	30
63	1	4	7	7	8
Total	7	41	70	74	90

[1/]No estimates are made for 1982 because only a portion of the year was monitored.

Table 17.--Observations of floating net material in the U.S. fishery conservation zone off Alaska.

INPFC[1/] area	Area category/ number of pieces (See Table 1)	Remarks
1982		
52	C / 2	
1983		
51	C / 2 B / 1	
52	C / 9 B / 1	including a whole trawl net with floats
54	C / 1 B / 2	monofilament fill net retrieved and burned
61	C / 1	gill net with floats
62	C / 1	gill net
1984		
51	C / 1	
52	C / 7	
54	C / 4	

[1/] International North Pacific Fisheries Commission.

Table 18.--Marine mammals or birds entangled in net materials as reported by U.S. fisheries observers in the U.S. fishery conservation zone off Alaska.

Year	INPFC[1/] area	Remarks
1982		None
1983	52	Steller sea lion with pink band around neck - free swimming
		Steller sea lion with cord around neck - free swimming
		Female Steller sea lion with rope around neck - free swimming
		Gull with rope around neck - flying easily
	62	Dead female sea lion brought up in haul had cord around neck cutting deeply into flesh - cause and time of death unknown
1984	51	Dead Northern fur seal with net around neck and torso - drowned. Observer reports that the mammal had been close to death by starvaion.
	52	Northern fur seal with blue net around neck - free swimming
	54	Dead sea lion brought up in haul with piece of rope around neck and scar tissue healed around rope - cause and time of death unknown
	62	Steller sea lion with constricting material around neck causing a deep wound and swelling - mammal observed following the codend
	63	Dead humpback whale entangled in crabpot buoy line

[1/] International North Pacific Fisheries Commission.

Table 19.--Penalty schedules for pollution violations (gear dispersal or abandonment) by foreign vessels.

Vessel size	Number of violations			
	1	2	3	4
	Penalty range x 1,000			
Up to 290 GRT 1/	2.5- 5	5.0-10	10-30	25
291 - 1399 GRT	5.0-10	7.5-15	15-35	
1400 GRT or more	5.0-15	7.5-20	25	

Note: The number of violations are repeated offense cases. The calculated penalty would be multiplied by additional counts. Gear disposal or abandonment is not considered a violation if the vessel claims that it is an emergency and notifies the Law Enforcement Division in Juneau at the time of the occurrence.

1/ GRT = gross registered tons.

APPENDIX A

Instructions for filling out the old (1982-85) discard netting form:

In recent years, biologists have documented a decline in the fur seal population on the Pribilof Islands in Alaska. The population decline may be partially explained by the harvest of female fur seals which occurred from 1956 to 1968. After the harvest of females ceased, however, the population did not recover and is currently declining, and other populations of this species in the western Pacific appear to be declining also.

Various hypotheses have been proposed to explain the continued decline. Fur seals are opportunistic in feeding, so lack of a given food item is not thought to be a problem. In fact, general conditions for fur seals are considered to have improved rather than declined in recent years. Some investigators have felt that entanglement in discarded netting or other fishing debris may be responsible for significant mortality. It is difficult to estimate the extent of this problem because entanglement mortalities are usually lost at sea and not washed in to beaches. Some studies have been made on the rate of accumulation of net debris on beaches, but the rate of deposition is highly dependent on the relationship of the beach to currents.

In an attempt to get a better idea of the amount of webbing floating in the ocean at any given time, observers are being asked to monitor net mending operations when possible. Observers should attempt to monitor several net mending operations per week. Try to determine how often the nets are repaired and the number and size of pieces of webbing that are discarded each time. Avoid having your presence effect the discarding of webbing--the object of this study is to determine how much is being discarded under normal ship operations. In addition, try to find out what happens to any codends that

are damaged beyond repair and make note of any nets that are lost while trawling or in delivery to a mothership or joint venture operation.

APPENDIX B

Instructions for filling out the new (1987-?) discard netting form:

1) Fill in cruise number (when known), vessel code, and year.

2) Fill out the form on an observation by observation basis. Skip a line if you change areas.

3) Each column should be filled out (except for leading zeros and in the comments section). If a particular category is not applicable (n) for the observation being recorded, or is unknown (u), the column should still be filled in using the appropriate letter code.

4) In the comments section, be sure to use only one letter per column. If you need more space, leave columns l-22 blank in the next line, put an asterisk in column 23 of this next line, and continue your comments in column 24. Follow this procedure for as many lines as needed. The comments section should include such information as codends, trawl nets, gill nets, etc. brought up in the haul; expand on the disposition of the netting (i.e., were large pieces cut up before being discarded, was netting saved for resale, etc.).

5) Record the number of pieces observed, filling out a different line for each size and mesh code. Be aware that the decimal point is included between columns 19 and 20 (example, if 4 pieces are observed, record a "4" in column 19 and a "0" in column 20; if 80% of a trawl net was observed, record a "0" in column 19 and an "8" in column 20).

6) In selecting an observation code for netting found in the haul, the sampled portion of the haul refers to the portion sampled for incidence of prohibited species and/or species composition.

7) Any observation of floating net material needs to be recorded. Comments as to its appearance should be included (i.e., tightly bundled, twisted into a long green rope, spread out over the surface, etc.).

8) If you are aware of your vessel losing or disposing of any codends or trawl nets or parts, thereof, this needs to be recorded. If your vessel is involved in joint venture operations, record the occurrence of any codend being lost during transfer or any occurrence of a trawl net being lost by the catcher boats during fishing operations. Record the position as best as possible. Briefly explain how the net was lost and if the vessel notified the U.S. Coast Guard or appropriate National Marine Fisheries Service branch of the loss and its position.

9) If you observe any entangled marine mammals, try to identify the species, the extent of entanglement, any wounds, and if the animal is alive or dead, (including cause of death), and record this information in the comments section.

Upon your return to Seattle, this data will be entered into a computerized data base along with information as to the number of hauls made and sampled, and the tonnage caught and sampled by International North Pacific Fisheries Commission area.

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