

HALIBUT BYCATCH IN DOMESTIC GROUND FISH FISHERIES
IN THE CENTRAL GULF OF ALASKA, 1987-1989

By

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Regional Information Report¹ No. 4K89-19

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

July 1989

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ACKNOWLEDGEMENTS

We thank the many observers who have participated in ADF&G's program, and Marvis Beasley and Beth Pagliero for their assistance in data processing.

We especially thank the International Pacific Halibut Commission and the Alaska Fisheries Development Foundation for their financial assistance to ADF&G's observer program in 1988-89, a time when observer coverage of the domestic groundfish fleet plummeted as the fleet expanded. Their cooperation and assistance, together with that from the Kodiak Groundfish Advisory Committee, has been appreciated.

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ABSTRACT

Results of ADF&G's groundfish observer program indicate that the bycatch of halibut in the newly emerging domestic fisheries is pervasive in both longline and bottom trawl fisheries. Preliminary bycatch rates in domestic longline fisheries (40% in sablefish fishery, 22% in Pacific cod fishery, 14% in halibut fishery) appear to be far greater than those which occurred in previous Joint-Venture fisheries. The bycatch rate was lower in bottom trawl fisheries (4%), but the harvest by this gear was larger. Taken together, the bottom trawl and longline fisheries in 1988 probably exceeded the halibut mortality cap of 2000 mt set for the Gulf of Alaska.

Halibut bycatch in bottom trawl fisheries tended to vary seasonally, with highest bycatch rates occurring from August to January (average 6.7%) and lowest rates from February to July (average 2.4%).

Halibut handling, injury, and mortality were also assessed in the domestic fisheries. For bottom trawl fisheries, the halibut remained on deck an average of 31 minutes before being returned to sea; mortality was estimated at 6.6% and, of the remainder, 29% were adversely affected by handling. For longline fisheries, halibut remained out of the water an average of only 2.6 minutes; mortality was estimated at 5%, and an additional 6% were adversely affected by handling.

INTRODUCTION

Alaska's groundfish fisheries have nearly completed the transition from a foreign to a domestic enterprise. In 1989, 96% of all groundfish harvested in the Gulf of Alaska (232,000 mt) will be caught and processed by domestic operations (DAP).

The expansion of the domestic fisheries has unfortunately been coupled by a precipitous decline in the collection of biological and fishery performance information needed to manage the groundfish fisheries. In particular, the onboard observer program, which previously monitored 100% of all foreign vessels fishing in U.S. waters, has dropped to about 1% coverage of the DAP because domestic vessels are not required to take observers aboard.

One consequence of the lack of observer coverage is that incidental catches of prohibited species (Pacific halibut, salmon, herring, crab) are largely unknown in domestic fisheries. These "bycatch" species are fully utilized in other fisheries and cannot be retained by groundfish fishermen.

The Alaska Department of Fish and Game (ADF&G) has operated a small program of observers for DAP groundfish fisheries, primarily focusing on shore-based vessels in the Central Gulf of Alaska (Fig. 1). The purpose of this report is to summarize this information with regard to the incidental catch of Pacific halibut.

GROUNDFISH CATCHES IN THE CENTRAL GULF OF ALASKA

In 1988, 151,100 mt of groundfish were harvested by all gear groups in the Gulf of Alaska (GOA). Most of the catch (73%) was taken in the Central GOA regulatory area between 147° and 159° W longitude (Fig. 2).

Within the Central GOA, over half of the harvest (54%) was landed at Kodiak by shore-based vessels, the remainder was caught by offshore catcher-processors. In recent years, groundfish deliveries to Kodiak have almost doubled yearly (Fig. 3). In terms of tonnage, most deliveries to Kodiak processors have been from bottom and midwater trawlers (87%) compared to longliners (12%) and other gear types (1%) (Craig and Watson 1989).

Seasonal groundfish catches in the Central GOA tended to be greatest in spring and fall but vary by species (Fig. 4).

COMPARISON OF BYCATCH UNITS USED BY ADF&G AND NMFS

Although ADF&G's observer methodology is compatible with that of the National Marine Fisheries Service (NMFS), ADF&G's calculations of bycatch rates in domestic fisheries differs from that used by NMFS:

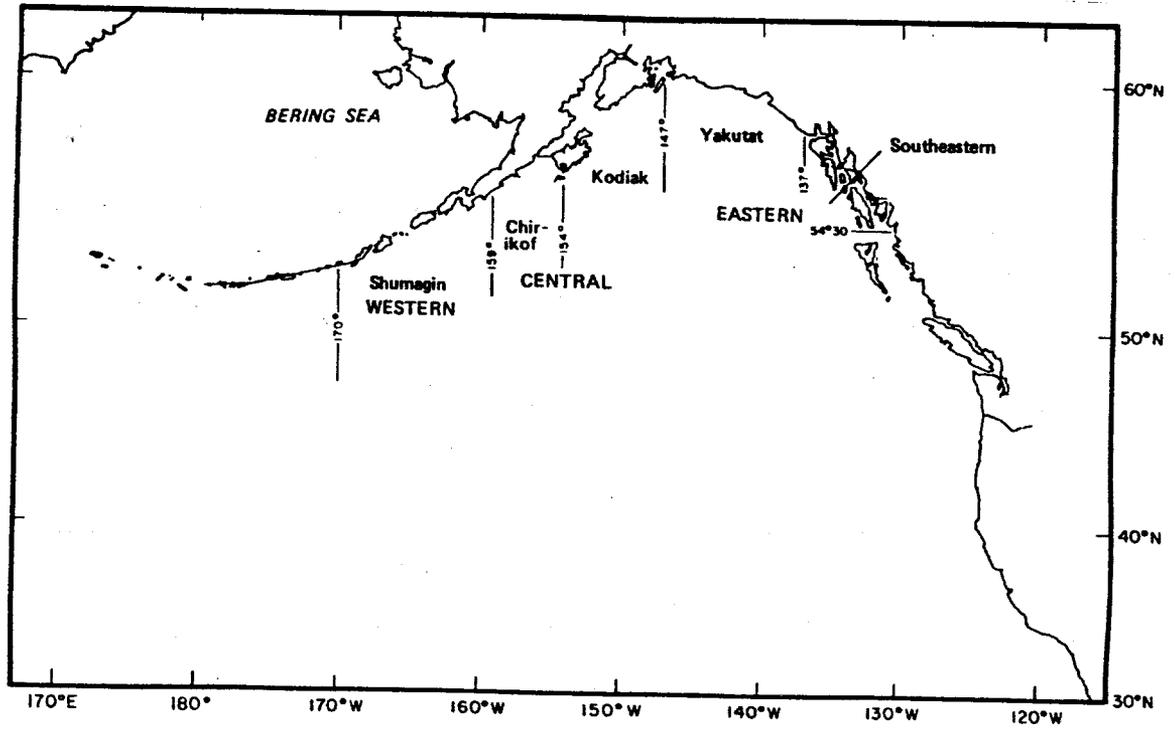


Figure 1. Groundfish management areas in the Gulf of Alaska.

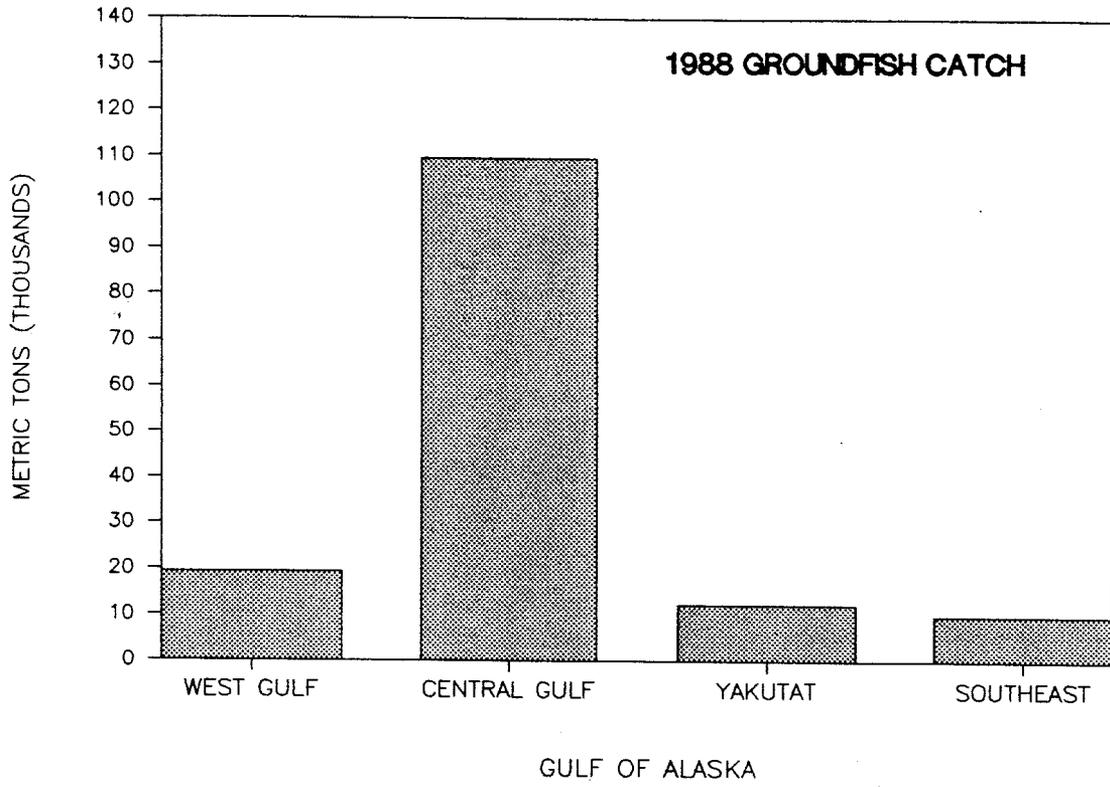


Figure 2. Regional catches of DAP groundfish in the Gulf of Alaska, all gear types. Source: PacFIN.

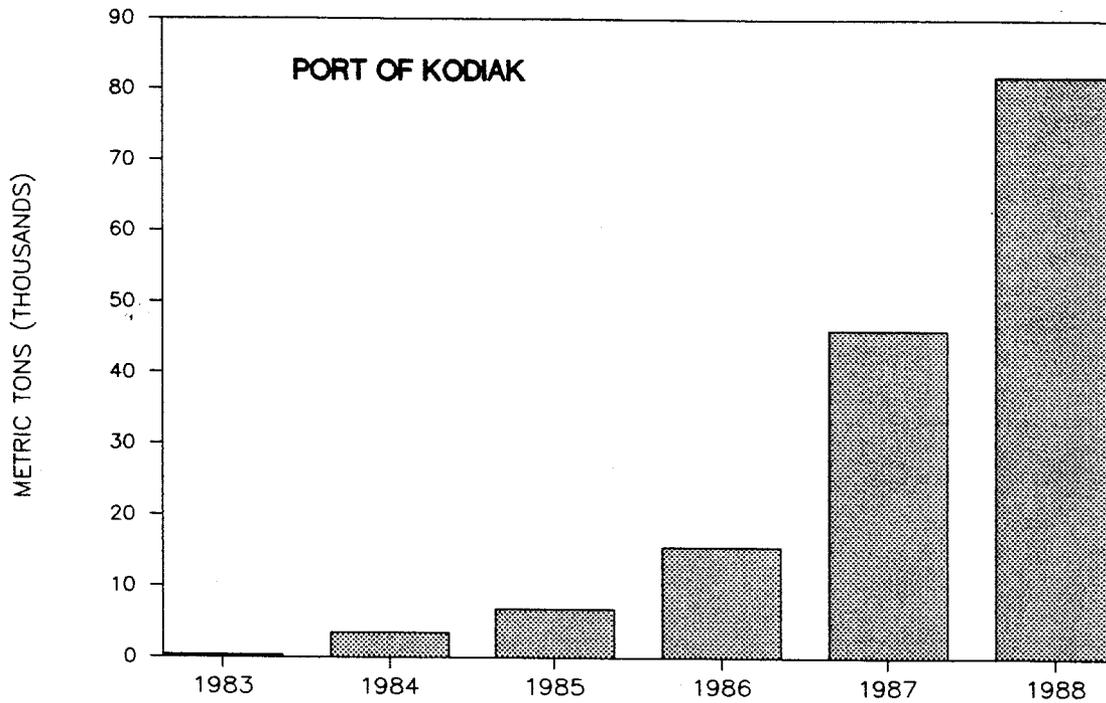


Figure 3. Groundfish deliveries by domestic shore-based vessels to the Port of Kodiak. Halibut are not included. Source: ADF&G annual shellfish reports; NMFS and ADF&G fishticket databases through 12/15/1988.

1988 CENTRAL GULF OF ALASKA

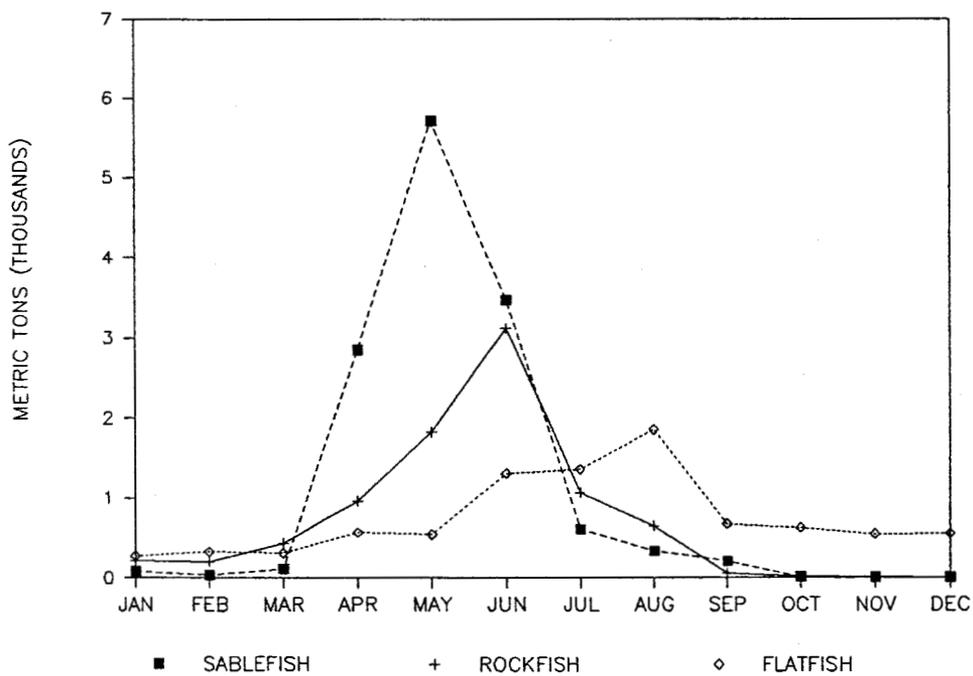
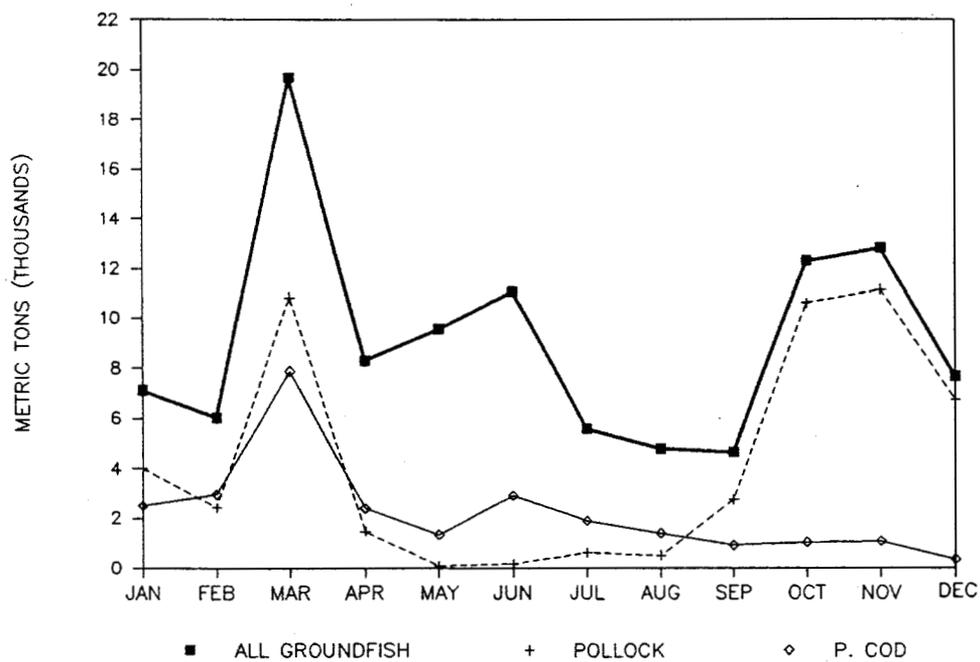


Figure 4. Monthly catches of groundfish species in the Central Gulf of Alaska, 1988. Source: PacFIN.

Agency	Bycatch Unit	Definition
ADF&G	kg/mt landed weight	kg of halibut caught per metric ton of landed catch (whole fish, all species, including landed discards if listed) as reported on the ADF&G fish ticket.
NMFS	kg/mt total catch weight	kg of halibut caught per metric ton of total catch of all species brought aboard ship (prior to any at-sea discards of fish)

Where, $\text{Total catch} = \text{Landed catch} + \text{discards}$

Because NMFS was able to put observers on virtually every foreign and joint venture fishing vessel operating in U.S. waters, the bycatch of halibut could be determined in a straightforward manner by summing each vessel's catch. For the domestic fleet, however, there is far less than 100% observer coverage, thus the bycatch rate on observed vessels must be expanded to the unobserved vessels in order to calculate the total halibut catch. Because the total catch is not recorded on unobserved vessels, the only available means to do this is through the ADF&G fish ticket record of the unobserved vessel's landed catch. By knowing the bycatch per ton of landed weight for the observed vessels, the bycatch rate can be expanded to the landed weight of the unobserved vessels.

RESULTS

A. BOTTOM TRAWL FISHERIES

Characteristics of Observed Vessels and Fisheries

All bottom trawlers observed in the Kodiak area during the period of study (1987-1989) were shore-based vessels typically 80-120' in length (range 55-150').

Most vessels fished on the east side of Kodiak Island within 50-70 n. miles of town (Fig. 5). The productive Barnabas area (statistical areas 525702 and 515700) received 41% of the fishing effort, with the remainder spread out evenly in 22 other statistical areas generally within 100 n. miles of town. Fishing trips by bottom trawlers generally lasted 3-4 days but ranged from day-trips to one week.

We compared towing locations during two time periods when the bycatch of halibut differed (discussed later): February-July, and August-January. The number of tows and their locations were generally similar during both time periods,

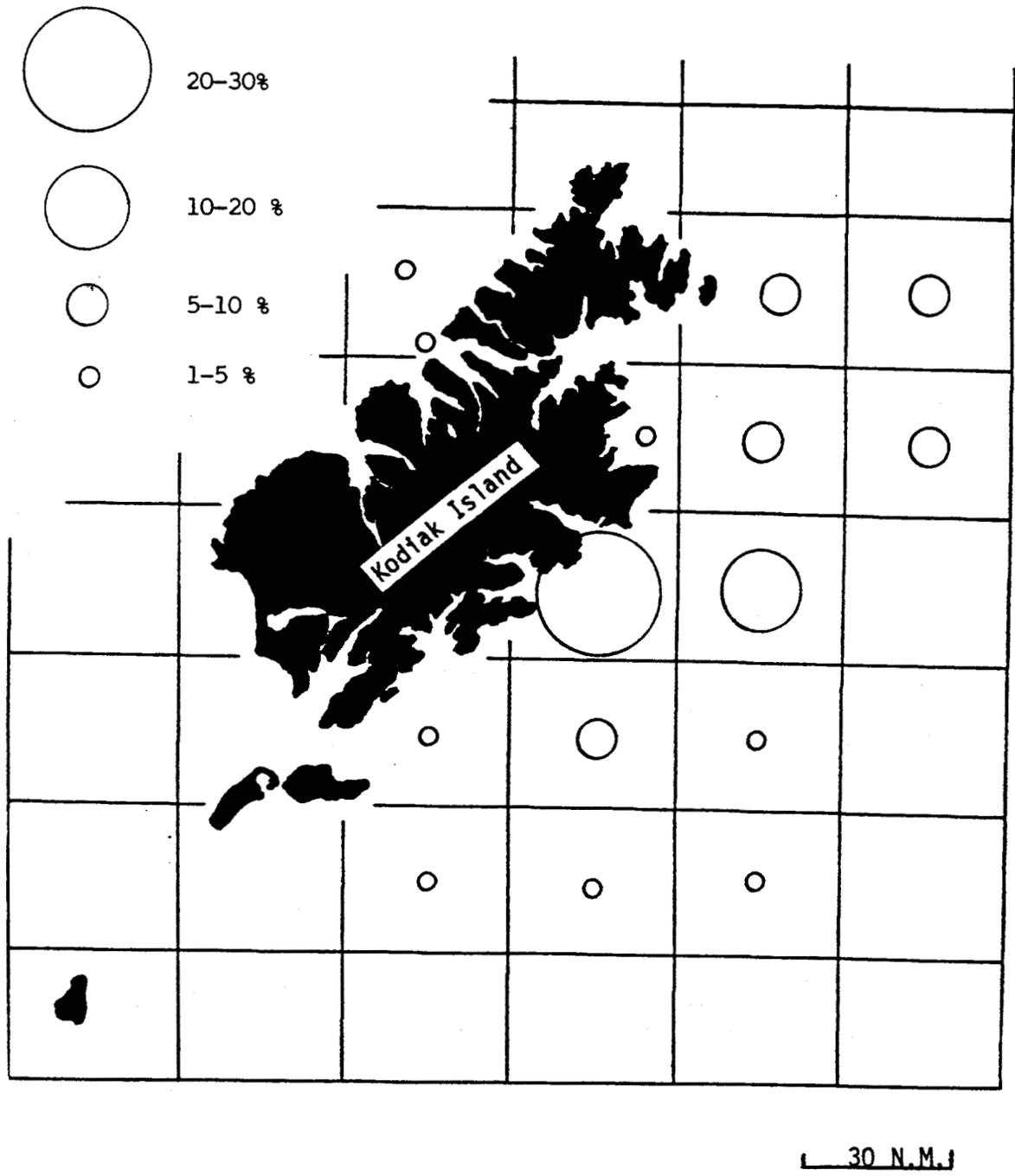


Figure 5. Statistical areas fished by observed DAP bottom trawlers in the Kodiak area (1987-89). Percentages refer to the number of observed trawl tows (n = 685) in each statistical area.

although the percentage of tows differed by an average of 5% in individual statistical areas (Fig. 6).

Bottom trawlers towed their nets primarily at depths of 40-100 fathoms (Fig. 7). Tow depth was examined by month to detect possible seasonal patterns, but no large-scale trends were apparent (Fig. 8).

Size of Halibut Caught

Most halibut caught by bottom trawl were small fish ranging in length 30-90 cm (Fig. 9), which corresponds to halibut weights of 0.6-19.8 lb. Halibut taken by trawl gear tended to be smaller than those caught by longline gear. Average weights of halibut in separate bottom trawl fisheries were: 7.0 lb (Pacific cod fishery), 9.0 lb (pollock fishery), 9.2 lb (all bottom trawl fisheries combined), 11.4 lb (shallow-water flatfish fisheries), and 20.4 lb (deepwater flatfish fisheries).

Seasonal Trends in Halibut Size and CPUE

The average size of halibut caught by domestic bottom trawlers tended to change with season. During each year of study, the largest fish (average weight 20-40 lb) were taken in mid to late summer; thereafter, sizes declined, with the smallest fish (average 4-6 lb) taken in late winter and early spring (Fig. 10).

The pattern of these changes was similar between years, as shown in Figure 11 which plots multi-year data over a single annual cycle. While there was considerable trip-by-trip variation in the average size of halibut caught, the average size per month changed in a remarkably smooth manner.

The relative biomass of halibut, or biomass CPUE (kg caught/trawl hour), parallels the decline in average size of fish. Relative biomass was highest in late summer/early winter and lowest from February to July (Fig. 12). In this comparison (and others below), a trend line was drawn by eye.

Halibut relative abundance or numerical CPUE (number caught/trawl hour) indicates the reverse trend, with a relatively low abundance of halibut in summer and higher abundance in winter (Fig. 13).

In general, the relative abundance of halibut was not closely correlated with size of fish (Fig. 14). However, in those cases where the CPUE was highest, the fish were small (5 lb), and conversely, when the largest halibut were caught (30-40 lb), few were taken in bottom trawls.

Overall relationships between halibut size, relative abundance and season are summarized in Figure 15. These data support the general observation that large halibut migrate into shallower water in summer and are thus susceptible to being caught in trawl fisheries, although few large halibut are taken at that time by the fishery, probably because they can avoid capture by the trawls. Numerical CPUE thus presents a very relative picture of seasonal abundance of large halibut. After summer, the steady decline in fish size indicates that the large halibut moved off the trawling grounds and into deeper water.

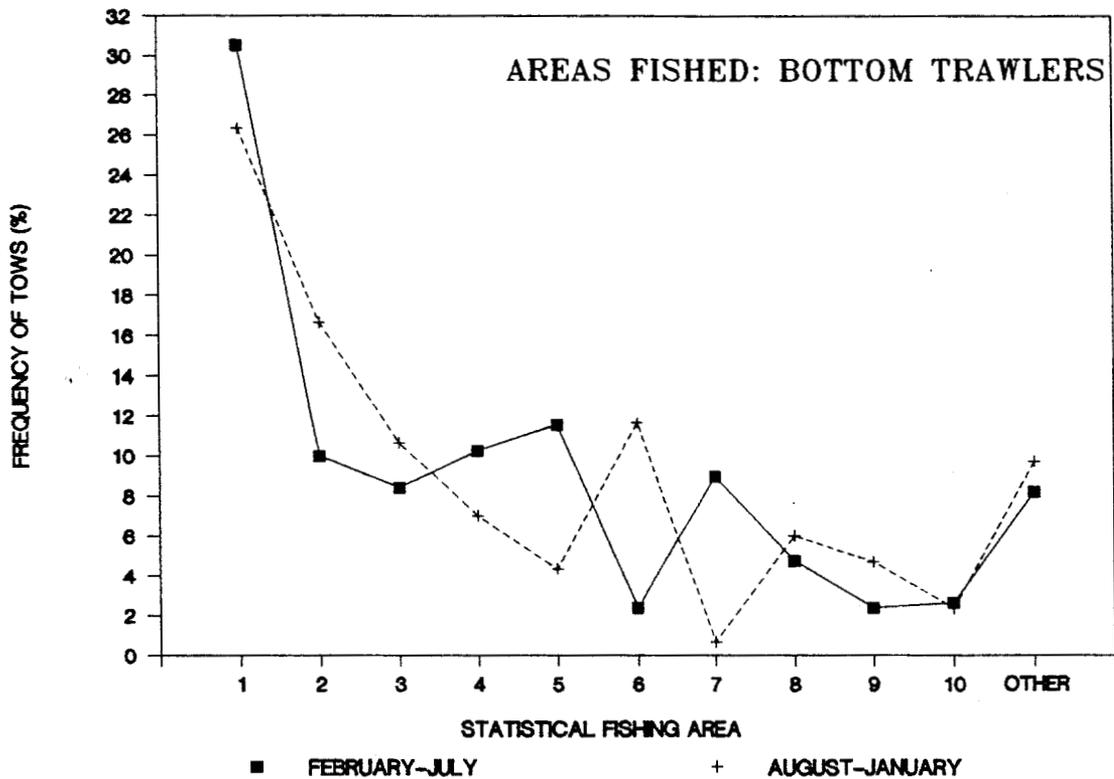


Figure 6. Comparison of statistical areas fished by DAP bottom trawlers in the Kodiak area (1987-89) during two time periods. Statistical areas: 1 (525702), 2 (515700), 3 (515730), 4 (525630), 5 (505800), 6 (515802), 7 (505700), 8 (505730), 9 (515630), 10 (495800).

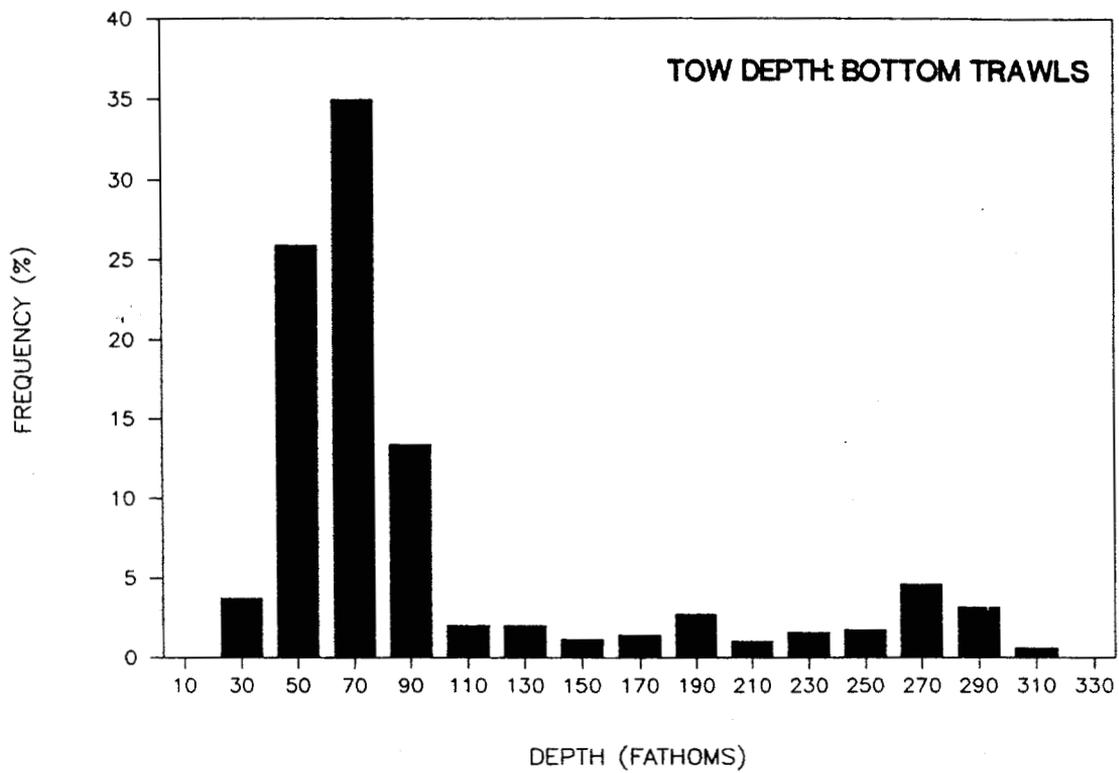


Figure 7. Tow depths for observed DAP bottom trawls in the Kodiak area (1987-89). Graph scale shows midpoints at 20 fm intervals. N = 685 tows.

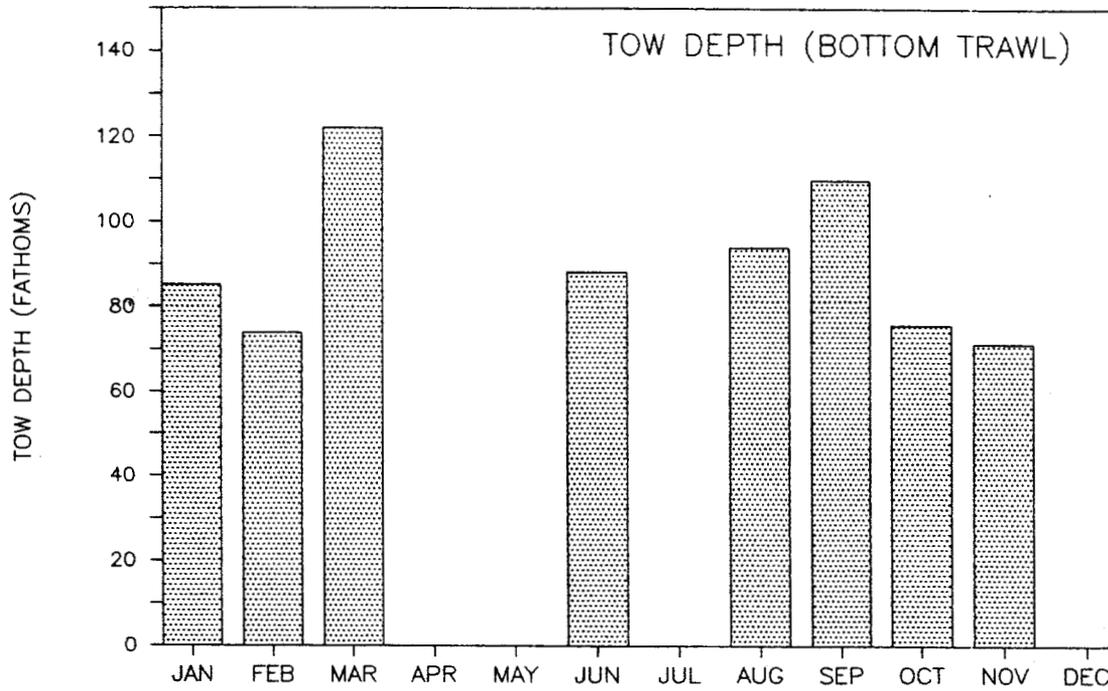


Figure 8. Monthly averages of observed tow depths for DAP bottom trawls in the Kodiak area (1987-89). Not shown are months where the number of tows was less than 15.

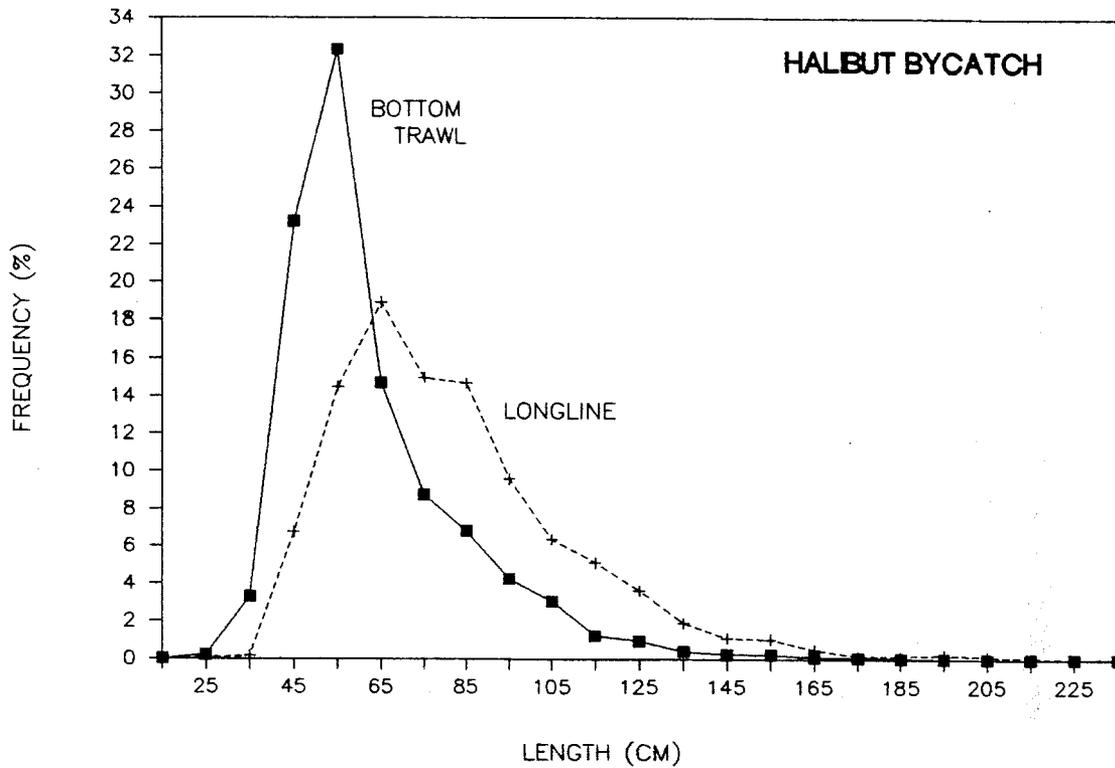


Figure 9. Size of halibut caught by observed bottom trawl and longline vessels. The data represent measurements of 36,650 halibut in combined bottom trawl fisheries, and 8,289 halibut in longline fisheries for sablefish and Pacific cod. Graph scale shows midpoint at 10 cm intervals.

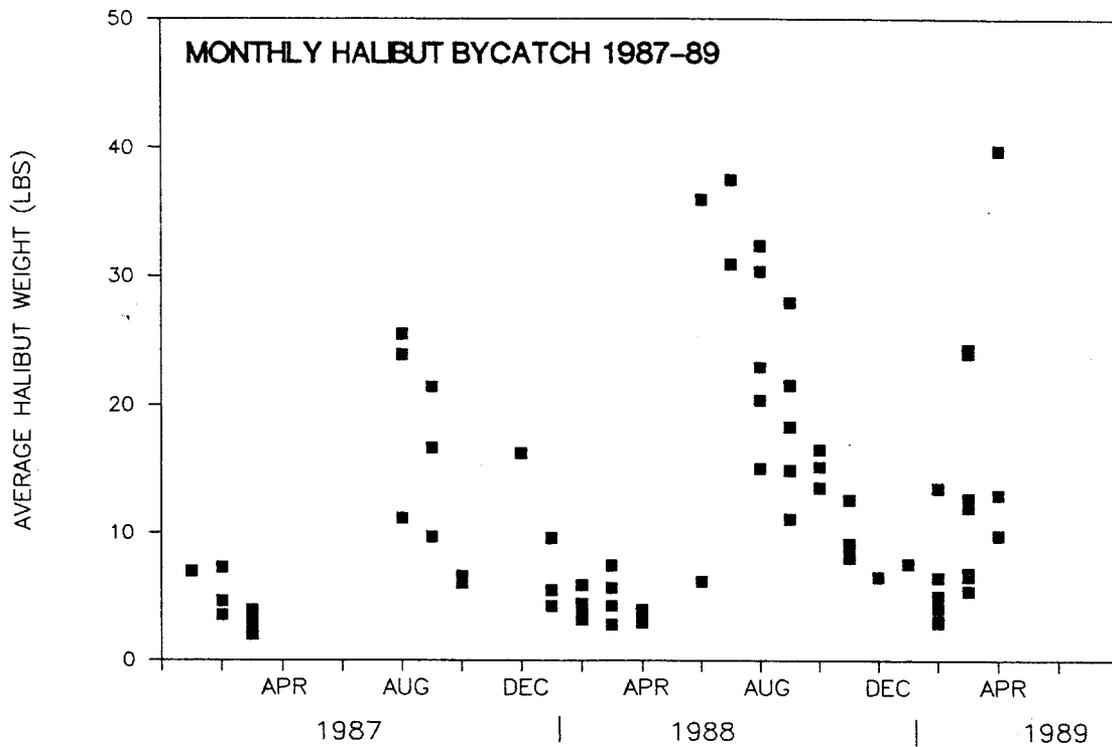


Figure 10. Average weight of halibut taken as bycatch on 79 DAP bottom trawler trips, Jan. 1987 to May 1989, Kodiak Island area. Each symbol represents the average size of halibut taken in combined trawls from a single vessel trip, regardless of target species in directed fisheries.

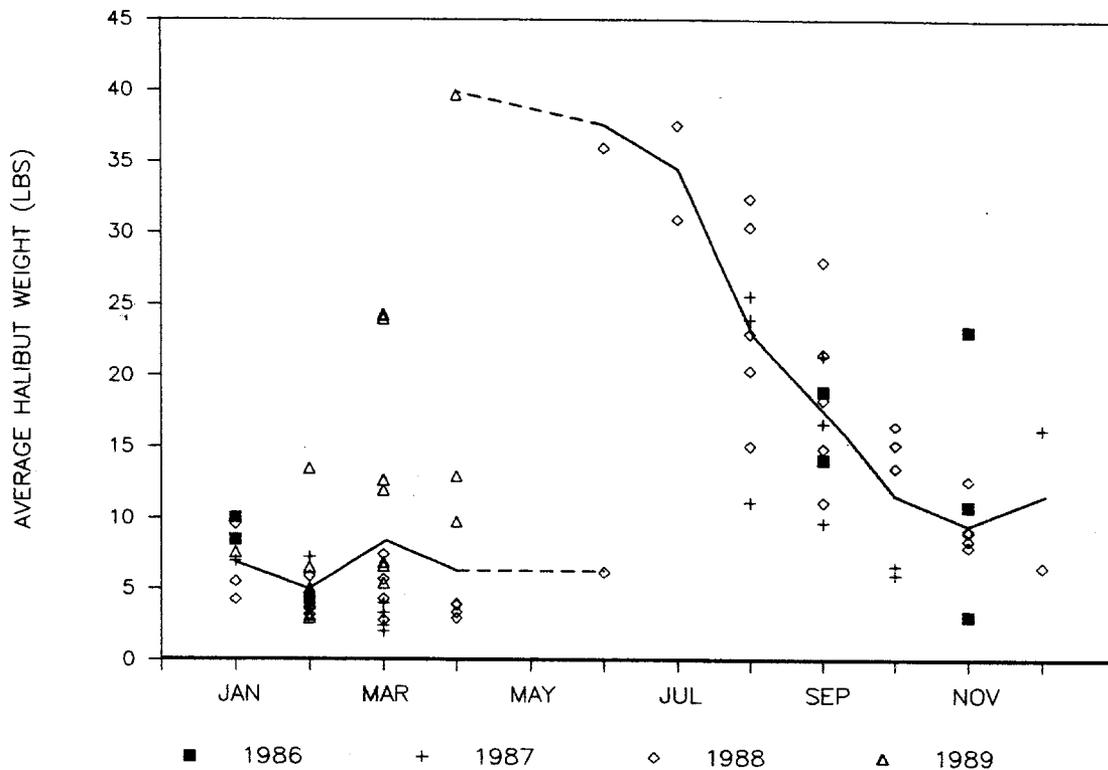


Figure 11. Monthly changes in the average weight of halibut taken as bycatch in 79 DAP bottom trawl trips, Kodiak Island area. Multi-year data (1986-1989) have been superimposed over a single annual cycle. Each symbol represents the average size of halibut taken in combined trawls from a single vessel trip, regardless of target species in directed fisheries. The line represents the average monthly value for all vessel trips, except that no trips were taken in May (dashed line).

HALIBUT CPUE (KG/HR)

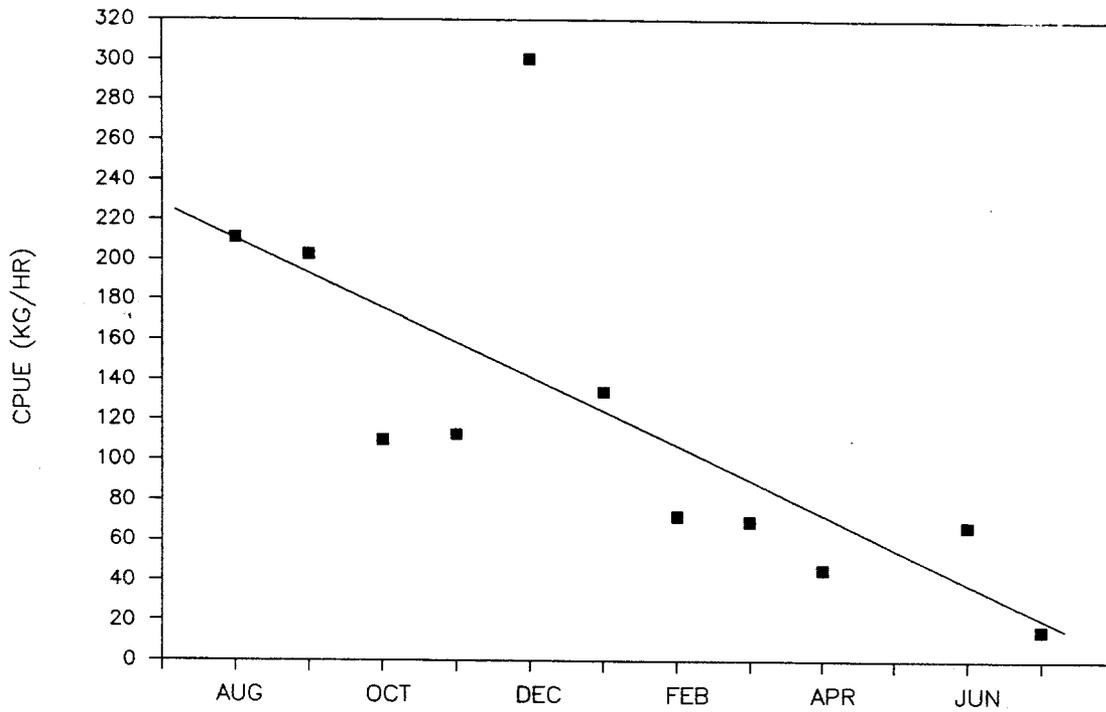


Figure 12. Monthly variation in halibut CPUE (kg/hr trawled) in DAP bottom trawl fisheries in the Kodiak area. Symbols represent monthly averages for 79 vessel trips taken over the period Jan. 1987 to May 1989, without regard to target species in the directed fisheries.

HALIBUT CPUE

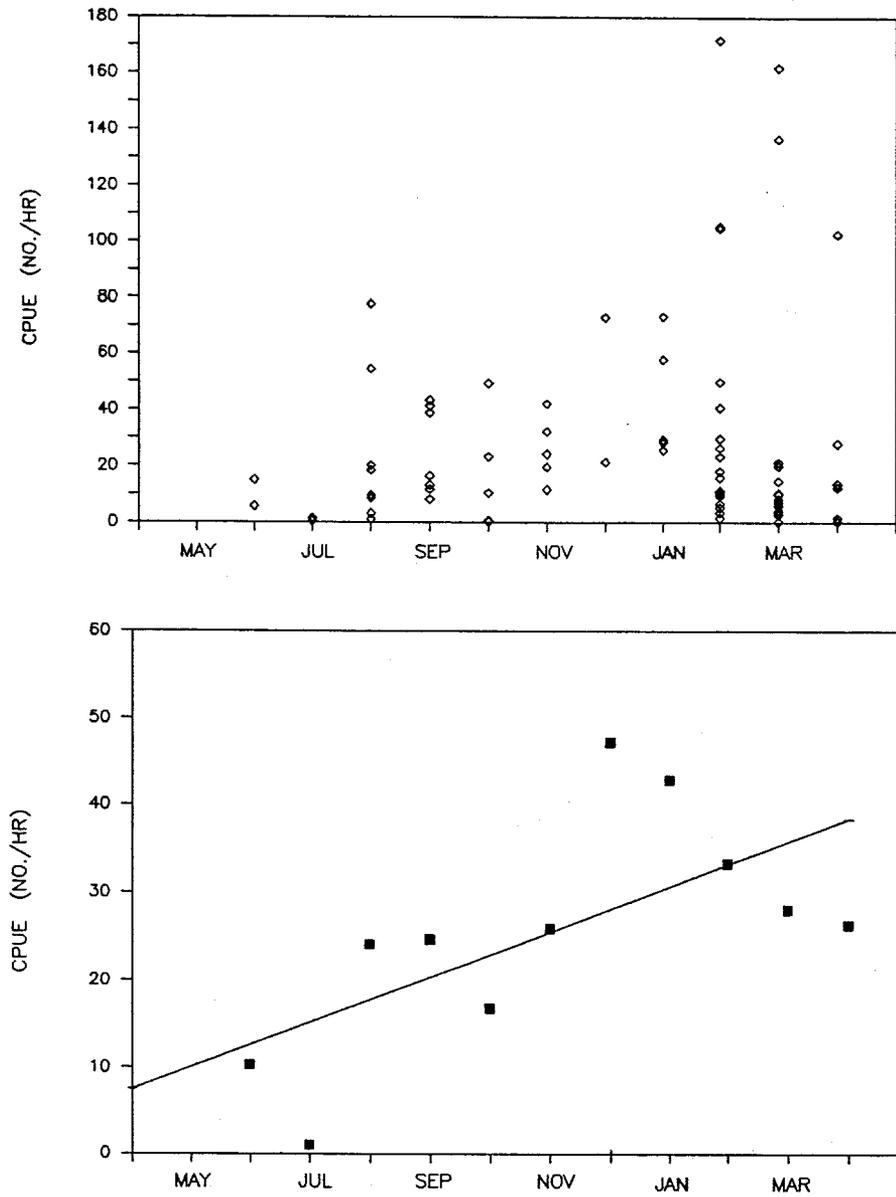


Figure 13. (Top) Annual variation in halibut CPUE (no./hr trawled) for 79 vessel trips. Each symbol represents the average size of halibut taken in combined trawls from a single trip. (Bottom) Monthly averages for all trips combined, regardless of year (1987-1989) or target species in directed fisheries. Note differences in Y-axis scale.

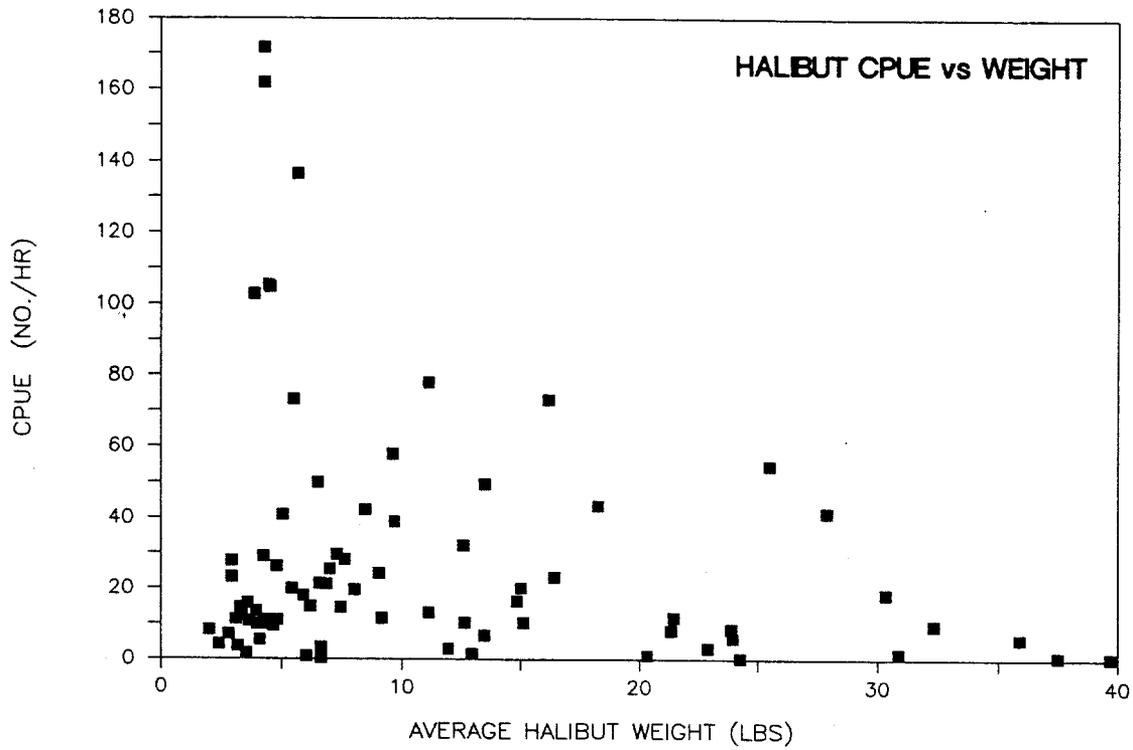


Figure 14. Comparison between CPUE (no./hr) and average weight of halibut caught as bycatch in DAP bottom trawl fisheries. Each symbol represents the average size of halibut taken in combined trawls from a single trip.

HALIBUT ABUNDANCE AND SIZE

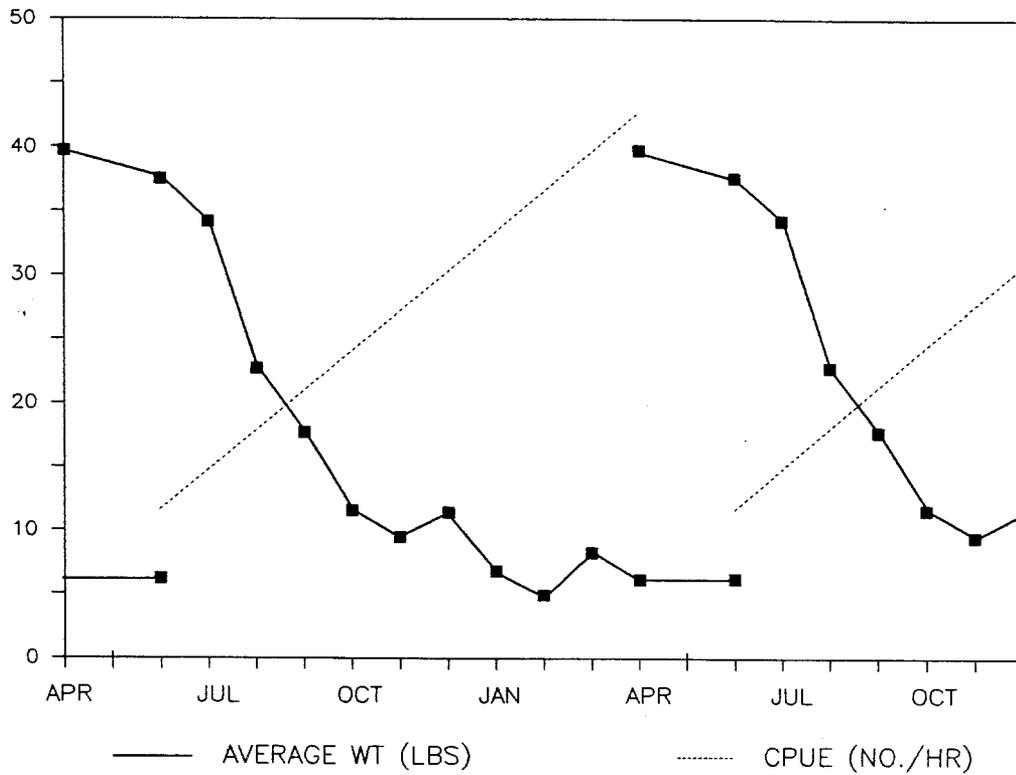


Figure 15. Monthly comparison between halibut CPUE (no./hr trawled) and average halibut weight for fish taken as bycatch in DAP bottom trawl fisheries, Kodiak Island area. Lines represent monthly averages for all vessel trips over the period Jan. 1987 to May 1989, without regard to target species in directed bottom trawl fisheries.

The data also indicate a reverse pattern of abundance for small halibut. In this case, CPUE values (no./hr) for small halibut probably reflect actual levels of abundance more closely than for large halibut because the smaller fish are less able to avoid the trawl gear. Their numbers on the fishing grounds were high in winter and low in summer, although sampling effort in summer has also been low. Several possibilities might account for the low CPUE of small halibut in summer: (1) the fish remained on the trawling grounds but resided in areas not fished by the fleet in summer, (2) the fish remained on the trawling grounds but moved into areas unsuitable for trawling operations, or (3) the fish migrated off the trawling grounds, presumably shoreward into either shallow areas or areas closed by regulation to bottom trawling (portions of Kodiak Island's coastal waters from 0-3 mi and some federal waters farther offshore are closed to bottom trawling year-round). The first two hypotheses do not seem likely because there was little apparent seasonal pattern of either areas fished or depths fished, as previously discussed.

There is some evidence, based on data obtained with small-mesh trawl nets, for the shoreward movement of small halibut into shallower or protected waters. Blackburn (1979) reports that small halibut (mean size 45 cm) were present in two Kodiak bays (Ugak, Alitak) and that they were more abundant in summer (15-17 kg/hr) than in winter (3-4.5 kg/hr). Similarly, Watson (1989) found small halibut, including those in the 4-11 lb category that disappeared from trawl bycatch in summer, in August-October during a research survey of coastal waters and bays around Kodiak Island (Fig. 16).

A possible onshore/offshore migration pattern for large and small halibut is shown in Figure 17.

Bycatch of Halibut in Bottom Trawls

Because of the recent surge of domestic vessels participating in the groundfish fishery, together with the low coverage of these vessels by observers, it has usually been necessary to present bycatch data that have been aggregated over multiple years in order to increase sample sizes. The observer database is only now large enough to allow preliminary comparisons of bycatch rates between years, seasons, and target species of the directed fisheries.

The bycatch rate used by management agencies and in this report is based on weight (kg/mt) rather than numbers (no./mt). The percentage of halibut bycatch in a fishery is equal to the bycatch rate of halibut (kg/mt) divided by 10.

Annual Summaries

A summary of halibut bycatch rates for domestic bottom trawlers, in the Kodiak area is listed in Table 1. Bycatch rates from January 1987 to May 1989 varied from 3.9-5.7%, depending on the year or combination of years examined. In these cases, all vessel trips were combined, without regard to the target species each vessel was seeking.

Halibut bycatch rates were more variable when the data were separated by target species (Table 1). Lowest rates (2.2-2.8%) were observed in the Pacific cod and deepwater flatfish (rex and Dover sole) categories. Highest rates were seen in

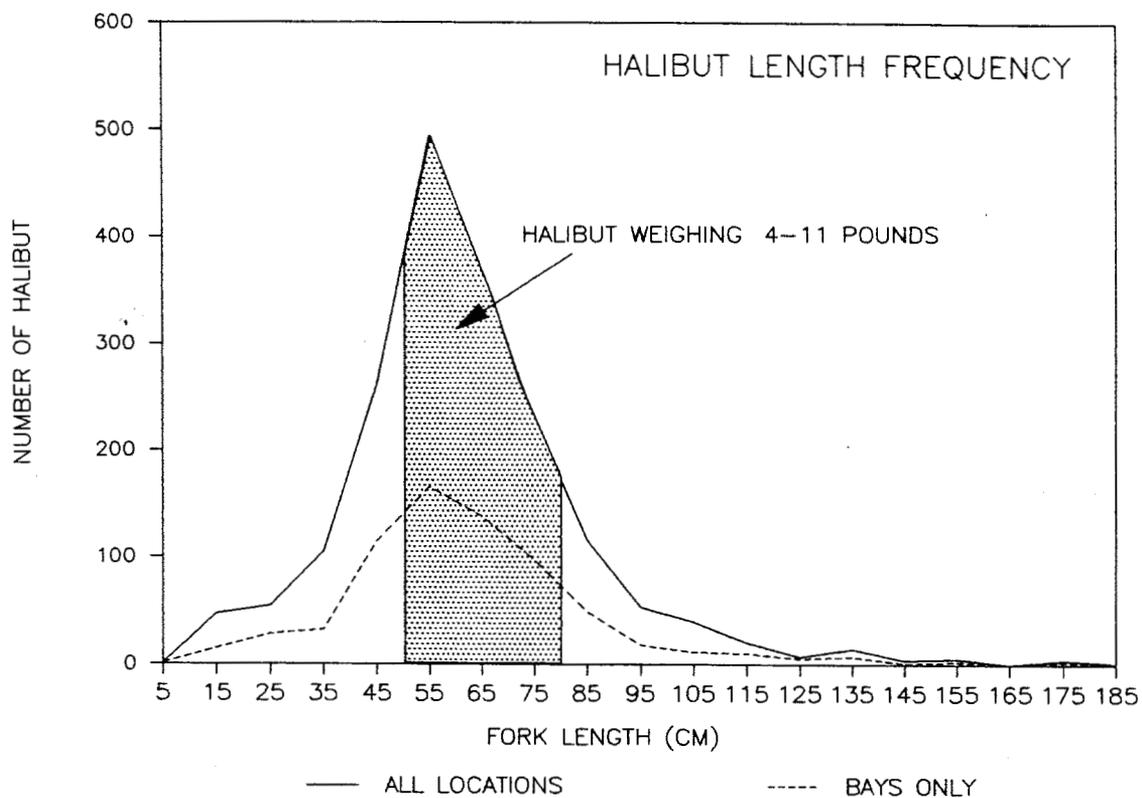


Figure 16. Length frequencies of halibut taken in ADF&G's research survey for crab and groundfish in coastal waters around Kodiak Island, July-October 1988. The bottom trawl used was a 400-mesh eastern otter trawl.

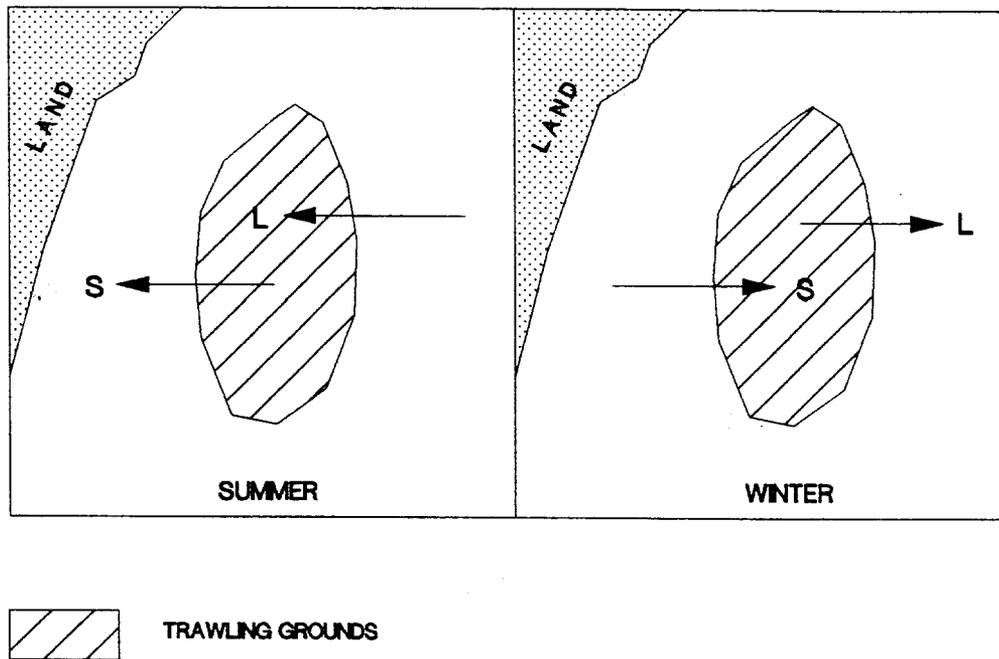


Figure 17. Hypothesized onshore/offshore component of halibut movements through Kodiak's trawling grounds.
 S = small halibut (average weight 4-6 lb);
 L = large halibut (average weight 20-40 lb).

Table 1. Halibut bycatch rates in domestic bottom trawl fisheries on the east side of Kodiak Island, 1987-89. Sample size refers to observed vessel trips. mt = metric ton.
Source: ADF&G observer database, 1 May 1989.

Years	Bottom Trawl Target Species	Sample Size		Bycatch Rates		
		hauls	trips	no./mt	kg/mt	% ^a
1987	combined	146	16	6.8	39.1	3.9
1988	combined	307	44	14.1	57.1	5.7
1987-88 ^b	combined	376	52	10.9	45.3	4.5 ^f
1987-89 ^c	combined	595	84	9.5	39.5	4.0
1987-89 ^c	Pacific cod	274	43	9.0	28.4	2.8
1987-89 ^c	deep flatfish ^d	117	22	2.4	22.3	2.2
1987-89 ^c	shal. flatfish ^e	35	9	14.6	74.2	7.4
1987-89 ^c	pollock	122	22	14.3	58.6	5.9
1987-89 ^c	pollock/P.cod	31	7	10.8	92.1	9.2

^aTotal weight of halibut bycatch divided by the total landed catch as reported on the fishticket for each vessel trip.

^bJan 1987 to 30 Sept 1988

^cJan 1987 to 1 May 1989

^dRex and Dover sole

^eRock sole, flathead sole, butter sole, and starry flounder

^fValue used by NPFMC to set 1989 halibut bycatch rate for DAP vessels in the Gulf of Alaska.

the pollock/P.cod and shallow-water flatfish (rock, flathead and butter sole, and starry flounder) categories.

Appendices 1-6 list more detailed information about the species composition of the total catches in these groundfish fisheries, and the statistical fishing areas in which the data were collected.

Seasonal Variation

Halibut bycatch rates for bottom trawlers appear highly variable when viewed either over a multi-year period or over a single annual cycle with all years combined (Fig. 18). Bycatch rates seem relatively low in early summer, but that is due in part to the low sampling effort then.

A seasonal trend is apparent, however, when the monthly averages of bycatch are compared (Fig. 19). Halibut bycatch was highest (4.4-8.5%) from late summer (August) to mid winter (January). This would seem to represent the time when small halibut were moving into the fishing grounds (thereby reducing the average weight of fish present) and, at the same time, any remaining large or medium-size fish were leaving for deeper water (Fig. 15). From February to July, bycatch rates were lower (0.7-3.7%). Although catches of small halibut were high during this period, their small size contributed to lowering the bycatch rate. Another important factor probably contributing to the lowering of the halibut bycatch at this time is that some target species (Pacific cod, pollock) are winter/spring spawners, at which time they form spawning aggregations that can be fished with less bycatch. And, although large halibut were moving into the trawling area in springtime, their number or catchability was low.

All of these trends are brought together in Figure 20. The bycatch rate, relative biomass (kg/hr), and average size of halibut (pounds) are highest in late summer/early fall and decrease thereafter, despite increases in the relative abundance of the fish (no./hr) because the increase is comprised of smaller halibut.

Bycatch Per Vessel Trip

The halibut bycatch for each observed vessel trip in the bottom trawl fishery ranged from 0.03-29.5%, with a mean of 4.0% during the period Jan. 1987 to May 1989 (Fig. 21).

Halibut Mortality, Injury and Condition

Observers on bottom trawlers examined the halibut bycatch to assess the condition and handling of the fish. The observers randomly pre-selected 73 individual hauls (on 33 different vessels) for this purpose during September 1988 to April 1989. The tows averaged 34 halibut (range 1 - 437) whose average size was 69.3 cm.

This task involved the observer's full attention to account for all halibut, including those buried underneath other fish, so it necessitated that the observer not sample the haul as he would otherwise do. Three basic observations were made on individual halibut:

HALIBUT BYCATCH RATE 1987-89

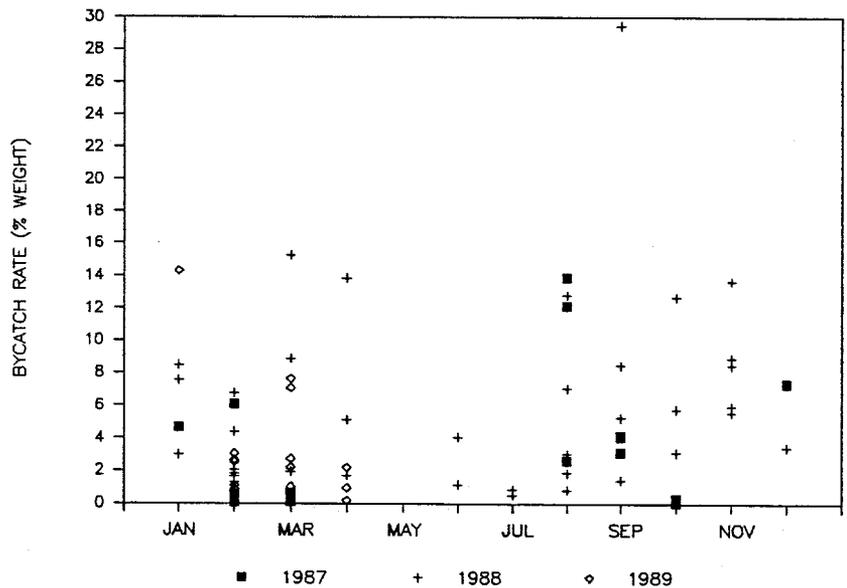
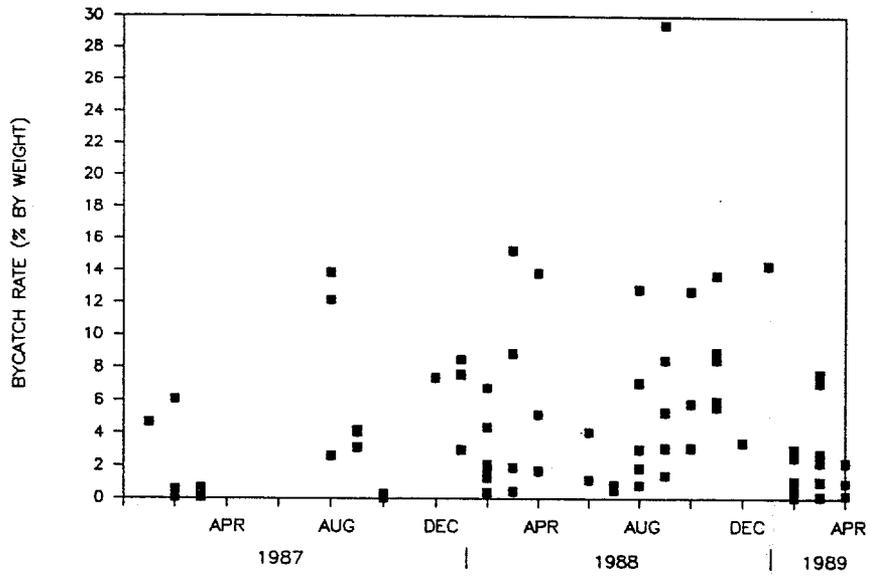


Figure 18. (Top) Annual variation in halibut bycatch rates (% by weight) for individual vessel trips in DAP bottom trawl fisheries from Jan. 1987 to May 1989 in the Kodiak Island area. (Bottom) Monthly variation whereby multi-year data have been superimposed over a single annual cycle. For both graphs, each symbol represents the bycatch rate of halibut taken in combined trawls from a single vessel trip, regardless of target species in directed fisheries.

HALIBUT BYCATCH

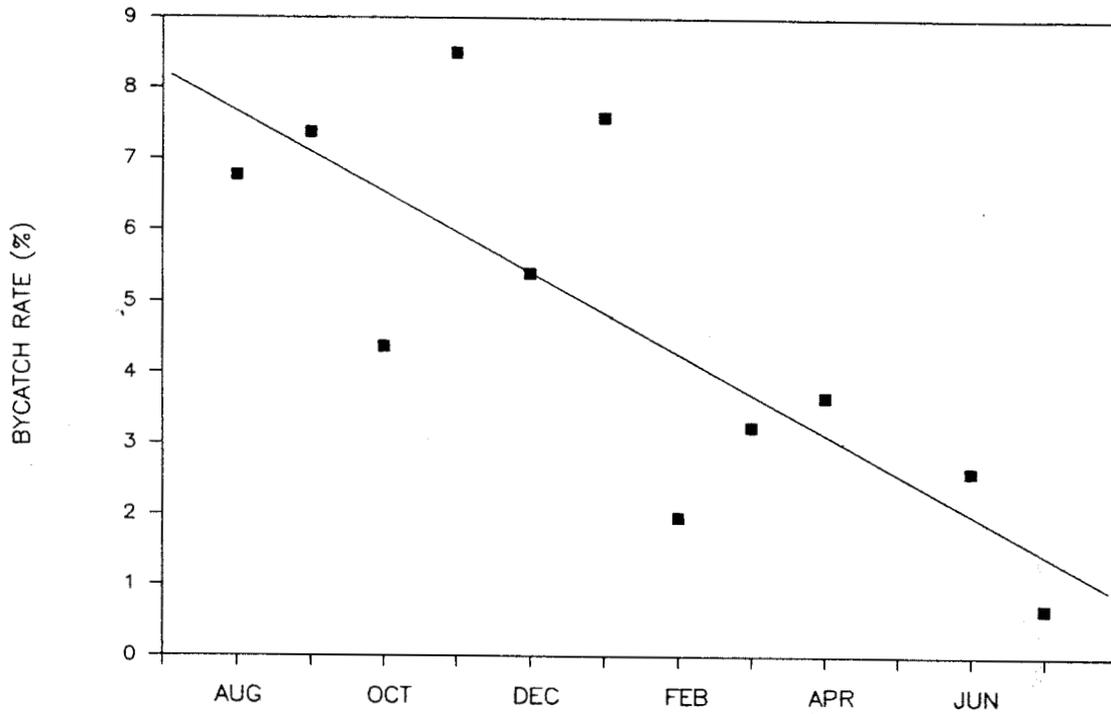


Figure 19. Monthly variation in halibut bycatch rate (% by weight) for DAP shore-based bottom trawl fisheries in the Kodiak Island area. Symbols represent monthly averages for all vessel trips over a multi-year period (1987-89), without regard to target species in directed bottom trawl fisheries.

HALIBUT BYCATCH TRENDS

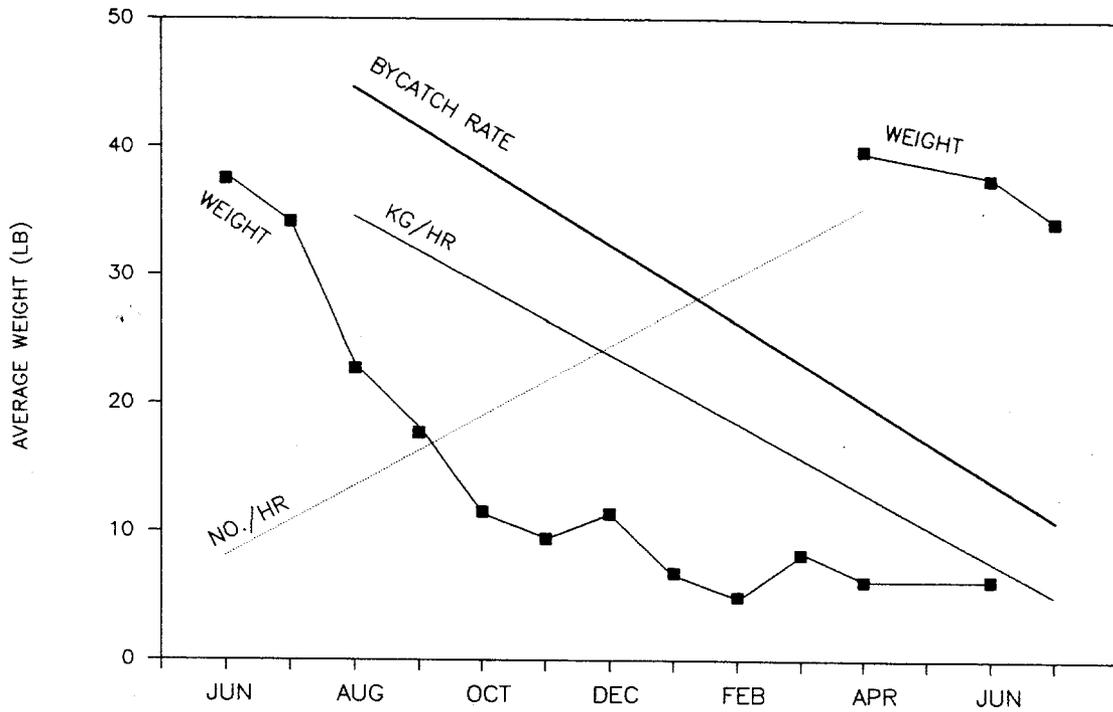


Figure 20. Summary graph of monthly trends in halibut bycatch in domestic bottom trawl fisheries for shore-based vessels.

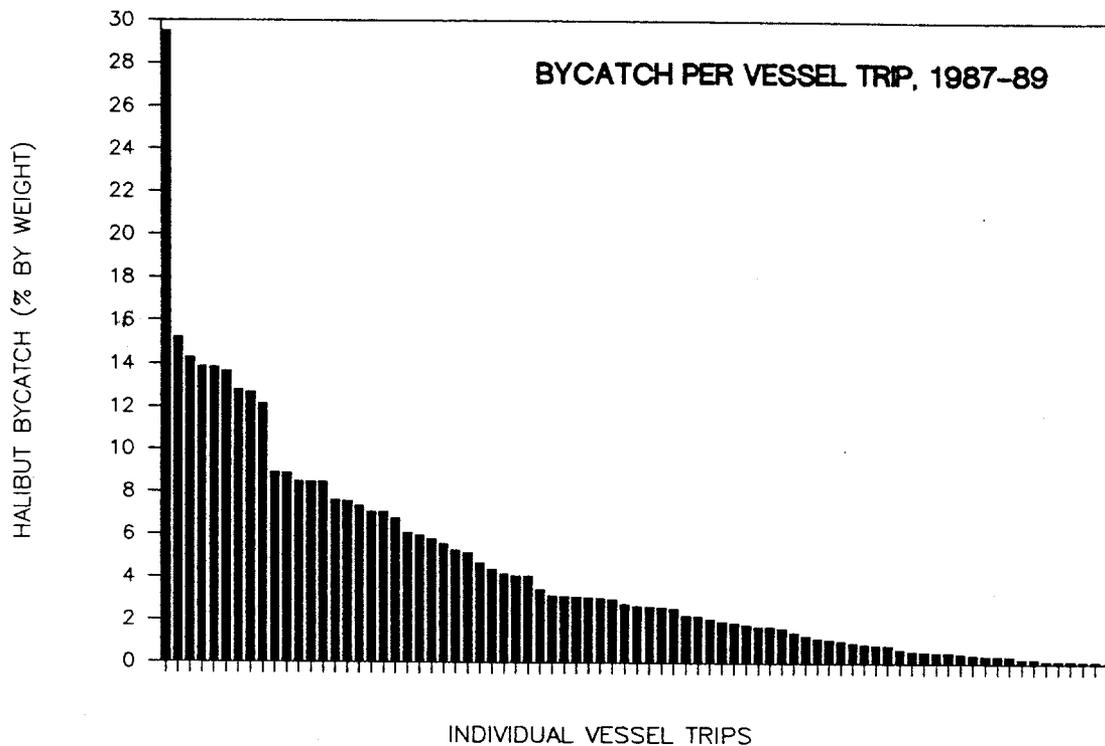


Figure 21. Halibut bycatch rates (% by weight) for 79 individual vessel trips by DAP shore-based bottom trawlers in the Kodiak area, without regard to year (1987-89) or target species in the directed fisheries.

- a. Did fish appear to be alive or dead?
- b. Was the fish injured?
- c. How was the fish handled?

The observer was instructed to remain unobtrusive so that he might record the way halibut were handled as if the observer was not present. A methodological problem arose, however. In order for the observer to closely examine the fish for injuries, the observer could not be unobtrusive -- he had to go where the halibut was or have the halibut passed to him, thereby altering what the fishermen did with the fish. In other cases, some fishermen always passed the halibut over to the observer because the fisherman thought that was what the observer was there for in the first place. This problem only affected the documentation of the way the fish was handled; consequently, handling data are presented separately for those fish that were and were not closely checked for injuries.

In general, the observers felt that their observations were probably a good approximation of the way the fishermen would normally handle the fish if no observer had been present. The fishermen had established work routines and were generally too busy getting the target species properly stored than to be continuously thinking about the observer's presence.

On-Deck Handling

After the codend of a pre-selected bottom trawl was emptied onto the deck, the catch was sorted -- target fish were put into the ship's hold and bycatch species were discarded over the side. The observer categorized the handling of halibut based on a quick subjective assessment as follows:

- | | |
|-----------------|--|
| Rough handling | - fish were grabbed only by the caudal peduncle and flipped overboard, or thrown across the deck. The impact of this handling on the survival of the fish is unknown. |
| Pewed | - the pew (pugh, peugh) stick was driven into flesh of the fish as the fish was flipped (pewed) overboard. |
| Pew-pushed | - the pew stick was hooked on the halibut's mouth parts, jaw, or opercular cover, and the fish was pushed or pulled across the deck to a scupper hole for release. |
| Moderate impact | - not pewed or roughly handled as described above. This category was termed "moderate" because these fish had nonetheless been caught, towed, and left on deck for a period of time. |

As previously mentioned, there was a considerable difference in the fisherman's handling behavior depending on whether or not the halibut was given to the observer for a close examination of injuries. When given to the observer, 3.4% of the halibut (n = 1437) were roughly handled or pewed compared to 26.7% (n = 866) when the fishermen released the fish directly. Most of the latter fish were "roughly handled" (Fig. 22). "Pew-pushed" is not included in the "pew" category because the injury to the halibut is considerably less than when the fish is actually pewed.

Time on Deck

The average time that the halibut remained on deck before being returned to sea was 31 min (range 1 - 120 min, n = 2466). In general, 48% of the halibut bycatch was returned to sea within the first 20 min after the net was hauled out of the water, but 18% were still lying on deck after 1 hour (Fig. 23).

There was a slight tendency for large halibut to be released overboard sooner than small halibut: sub-legal halibut (< 32 in) remained on deck about 5 min longer than legal size halibut (> 32 in).

There was no significant correlation between the halibut's average time on deck with either the total number of halibut caught or the total weight of the trawl haul. Similarly, there was no significant correlation between the total weight of the trawl haul and halibut condition (ie, injuries, rough handling, and mortality).

Injuries and Mortality

Halibut caught in bottom trawls were assessed as being either alive or dead, and those alive were examined for new and old injuries. The assessment of mortality was subjective -- the fish appeared obviously dead (without any movement or other sign of life and often appeared washed-out in color), but rigorous criteria were not used. Injuries were generally cuts that were categorized as either fresh wounds (new) or scarred-over wounds (old). Note that all fish were examined for mortality (n = 2466) but not injury (n = 1437).

In total, 6.6% of the trawl-caught halibut examined by the observers were dead. This "on-deck" mortality assessment compares favorably with other published "on-deck" mortality rates for trawl-caught halibut in domestic fishries: 5-25% (Bell 1956), 20% (Hoag 1975), 21% (Blackburn and Schmidt 1988).

Of the alive halibut, 2.3% had new injuries. An additional 4.3% had old injuries, not inflicted by their present capture. Most of the injuries detected were old injuries to the halibut's mouth parts (Fig. 24).

However, as previously mentioned, about 27% of the halibut not closely examined by the observer also sustained pew injuries or rough handling when they were returned to sea (Fig. 22).

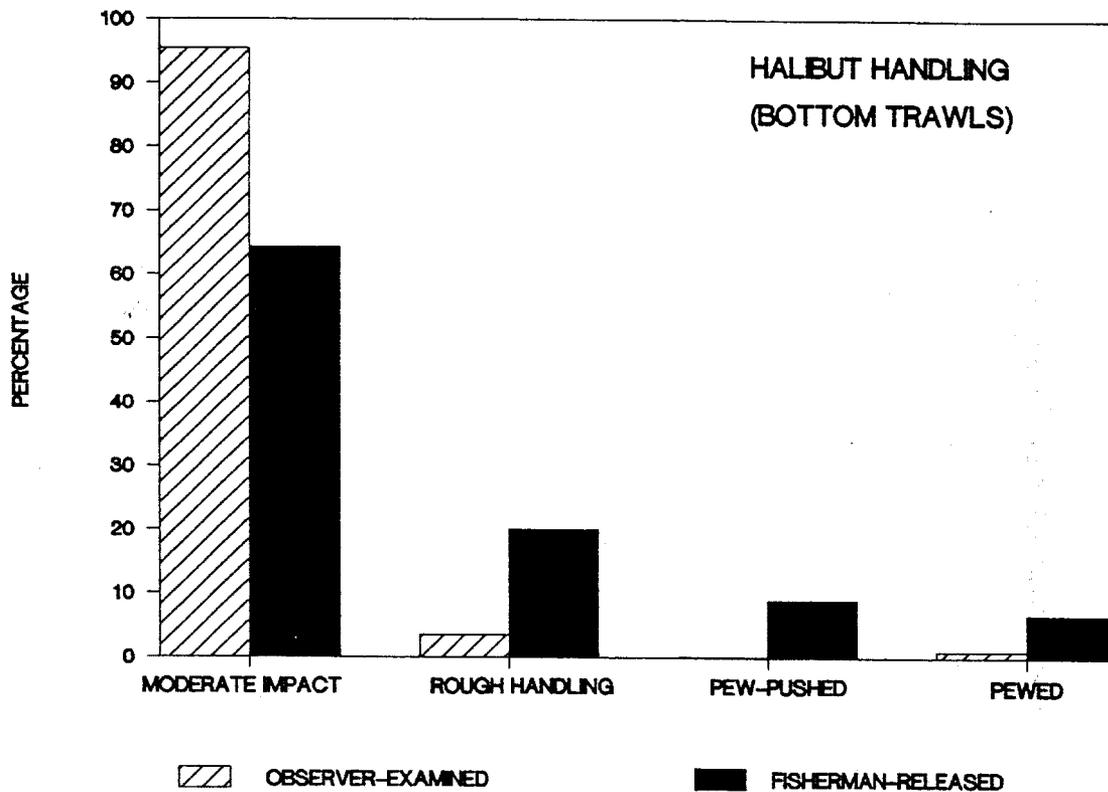


Figure 22. Handling and release method for halibut caught in DAP shore-based bottom trawl fisheries, 1988-89. Data are presented separately for halibut that were directly released overboard by the fishermen (n = 1437 halibut), and those that were passed over to the observer for a closer examination (n = 866).

HALIBUT TIME ON DECK BEFORE RELEASE

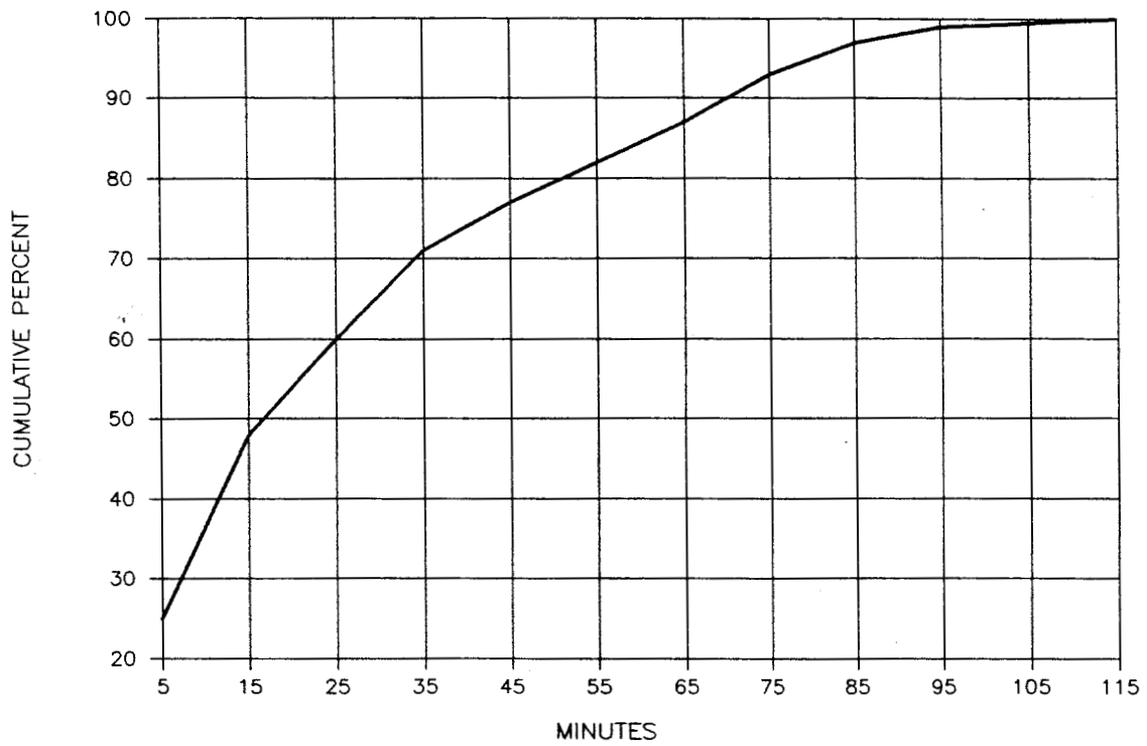


Figure 23. Time that halibut remained on deck after capture by domestic shore-based bottom trawlers. N = 2466 halibut. Graph scale shows midpoints at 10 min intervals.

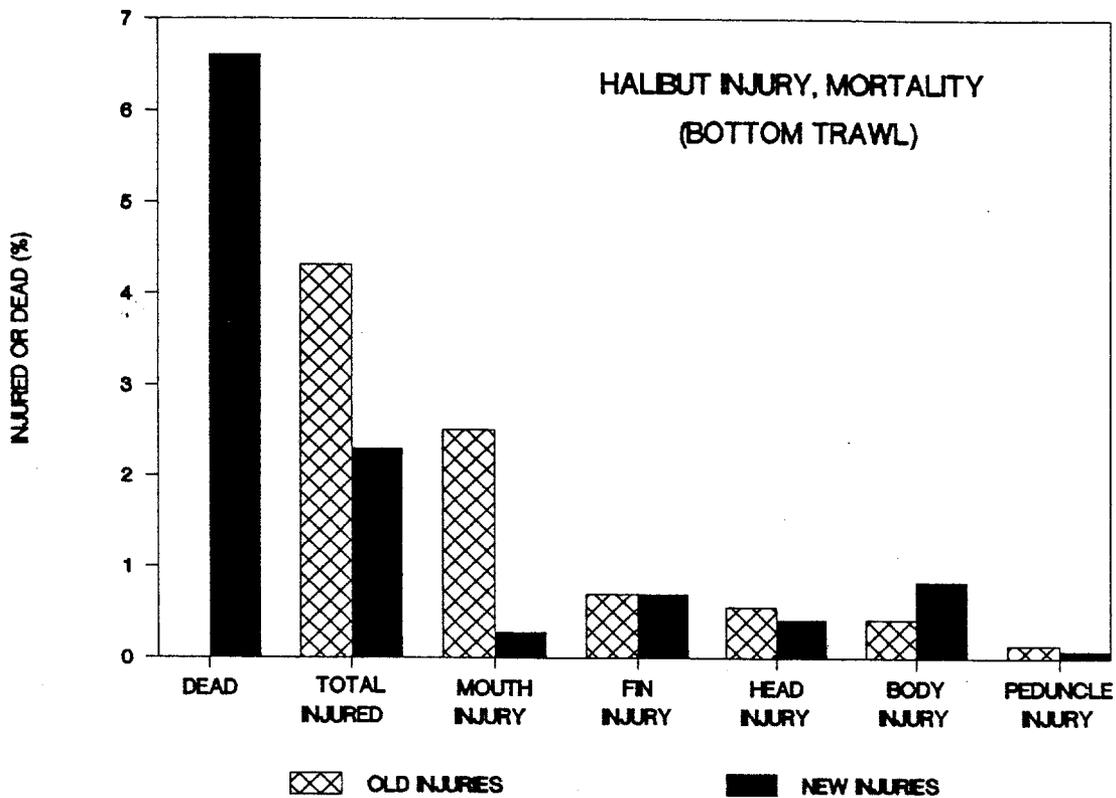


Figure 24. Injuries and mortality of halibut caught in DAP shore-based bottom trawl fisheries, 1988-89. Sample sizes for injuries (n = 1437) and mortality (n = 2466) differed.

Summary: Handling, Injury, Mortality

Halibut caught by shore-based domestic bottom trawlers remained on deck an average of 31 min before being returned to sea. Mortality was estimated at 6.6%, and of the remainder, 29% were negatively affected by the capture (2.3% had new injuries, 20% were roughly handled, and 6.7% were pewed when returned to sea). In sum, 34% of all observed trawl-caught halibut were either dead or negatively impacted.

The fate of these fish after release was not determined. The impact of new injuries, rough handling, and pewing on the survivability of the halibut is not known. What proportion of the halibut judged to be "dead" were actually alive is also not known but is probably small. In a previous tagging study (Hoag 1975), only 1% of trawl-caught halibut that were judged to be dead were recaptured alive at a later date.

The actual total mortality due to all of these factors is therefore not known but is assumed by IPHC to be 50% due to results of a tagging study conducted by Hoag (1975).

B. LONGLINE GEAR

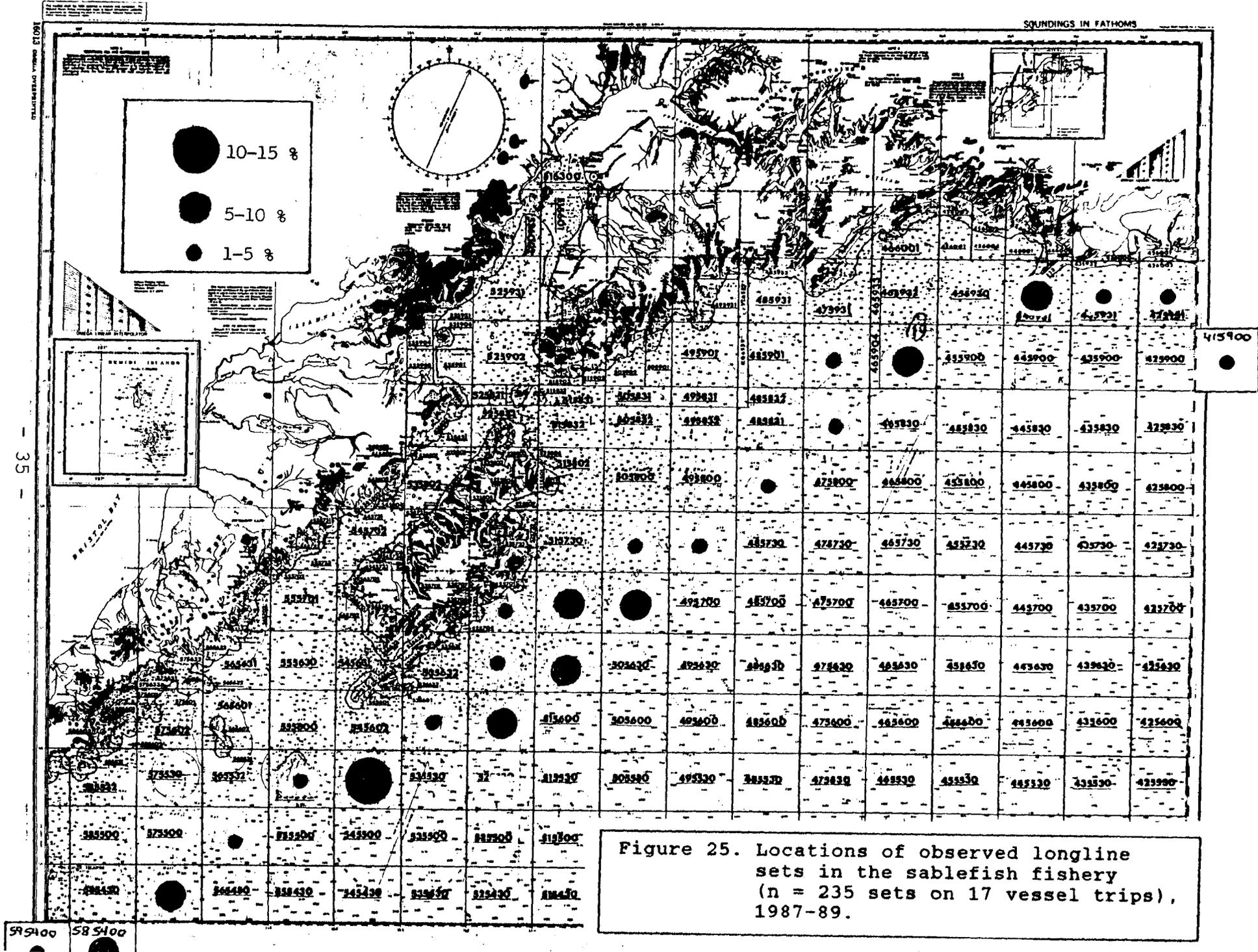
Domestic longline fisheries in the Central Gulf of Alaska include fisheries for sablefish (black cod), Pacific cod, and halibut. During 1987-89, ADF&G observers monitored catches on 17 sablefish vessel trips, 7 Pacific cod vessel trips, and 5 halibut vessel trips. A total of 23 different vessels and 311 longline sets were monitored by the observers.

The data presented in this section are preliminary due to small sample sizes, but the information is noteworthy because it suggests that the bycatch rate of halibut in domestic longline fisheries is considerably higher than that which occurred in previous Joint-Venture fisheries.

Characteristics of Observed Vessels and Fisheries

Longline vessels observed in the Central Gulf of Alaska included both shore-based vessels and catcher-processors. These vessels were typically 40-110 feet in length (range 28-115'). Fishing trips lasted from 1-day openings for halibut to 9-day trips on longline vessels fishing for sablefish.

The areas and depths fished by the observed vessels varied according to the target fishery. The sablefish fishery occurred offshore along the continental shelf break, generally in 220-420 fm of water (Figs. 25 and 26). The Pacific cod fishery occurred in shallower water (40-80 fm) along the east side of Kodiak Island (Figs. 26 and 27). The small sample size for the halibut fishery also occurred in relatively shallow water (20-60 fm) on Kodiak's east side (Figs. 26 and 28).



595100 585100

DEPTH OF LONGLINE SETS

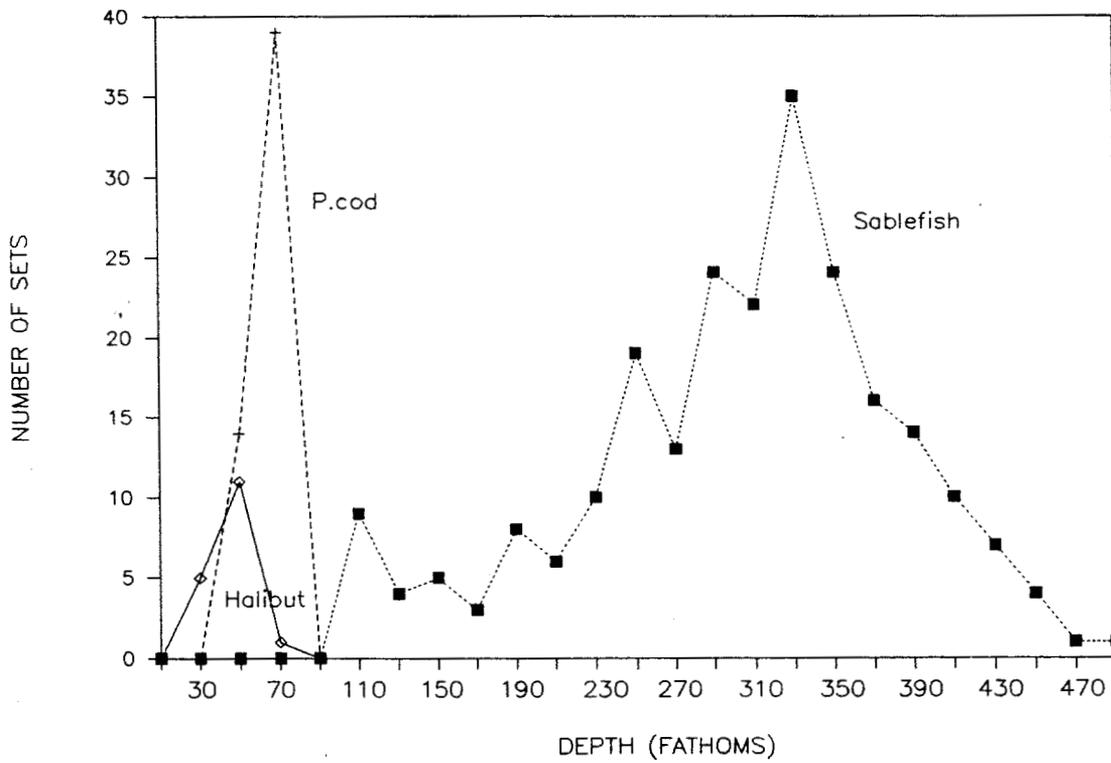


Figure 26. Depth distribution of observed longline sets for sablefish (n = 235 sets), Pacific cod (n = 59 sets), and halibut (n = 17 sets). Graph scale shows midpoints at 20 fm intervals.

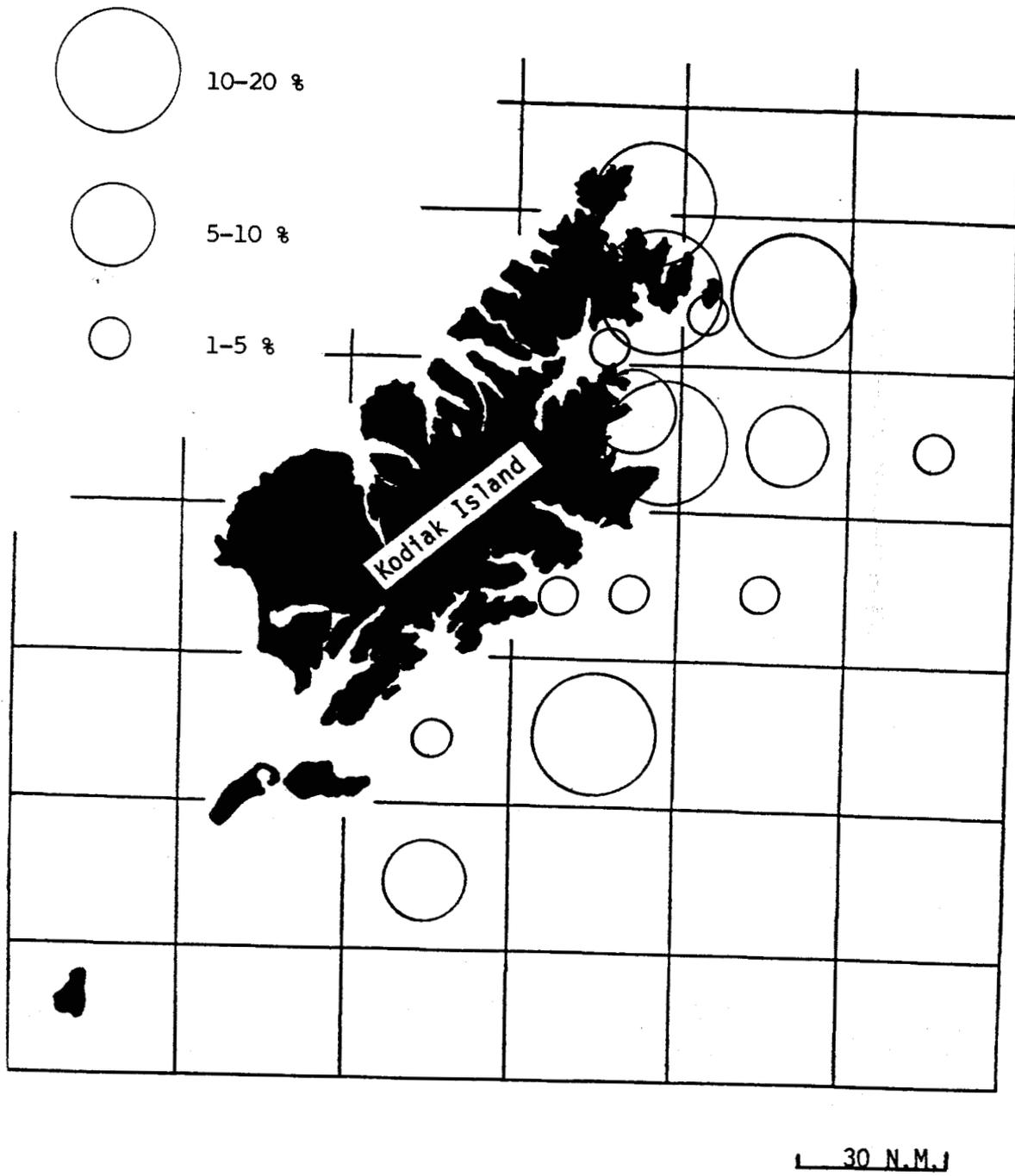


Figure 27. Locations of observed longline sets in the Pacific cod fishery (n = 59 sets on 7 vessels trips), 1988-89.

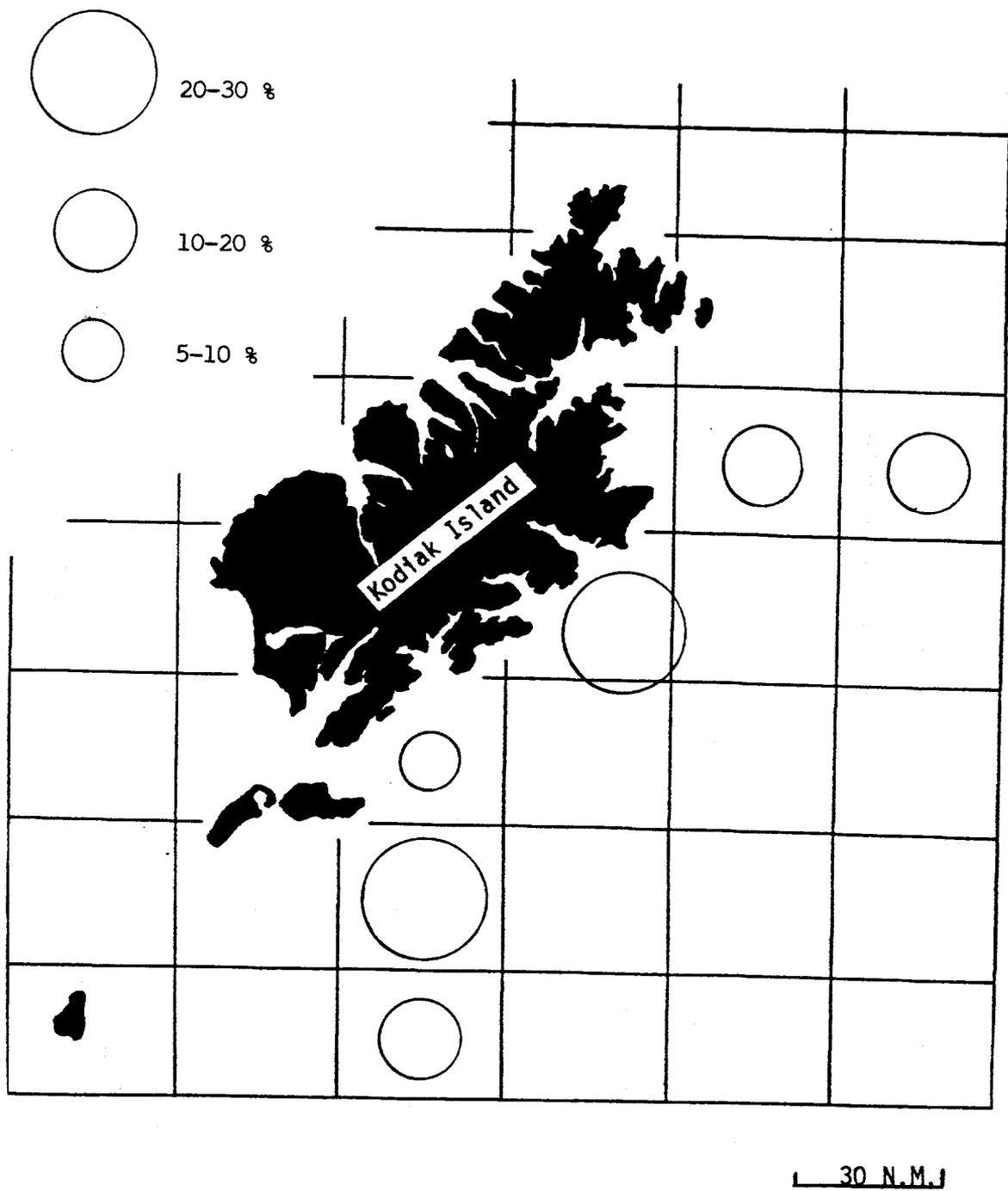


Figure 28. Locations of observed longline sets in the halibut fishery (n = 13 sets on 5 vessel trips), 1989.

Size of Halibut Caught

Halibut taken as bycatch in longline fisheries tended to be larger than those taken by bottom trawl gear (Fig. 9); however, the size of halibut taken in the Pacific cod longline fishery was similar to that taken by bottom trawl gear (Fig. 29). The sablefish fishery caught larger halibut similar in size to those in the directed halibut fishery. The "bycatch" of halibut in the halibut fishery refers to the capture of small fish (< 32 in) that cannot be retained by the fishermen.

Average weights of halibut taken in these fisheries were:

<u>Fishery</u>	<u>Ave. halibut weight (lb)</u>
bottom trawl	9.2
longline	
Halibut	8.4 ^a
P. cod	14.2
Sablefish	25.2

^aundersize halibut (< 32 in)

Bycatch of Halibut in Longline Fisheries

Unlike the trawl fisheries, there is not a clear definition of what constitutes halibut bycatch for longline fisheries. Some halibut can be seen falling off the hooks several feet below the sea surface, others are released by the fishermen along the side of the vessel before the fish come onboard, and still others are released after they land on deck. Therefore, in order to standardize methodology, ADF&G observers used the following criteria: if the halibut breaks the water surface as the longline is retrieved, then the fish is counted as "bycatch".

Although halibut accounted for about 6-8% of the number of fish caught in observed longline fisheries, the bycatch rate was much higher because it is based on the weight of halibut caught. Bycatch rates of halibut for observed longline vessels were 40% in the sablefish fishery, 22% in the Pacific cod fishery, and 14% in the halibut fishery (Table 2).

More details about the observed catches in these fisheries are presented in Appendices 7-9.

Halibut Mortality, Injury and Condition

In 1988-89, observers examined the condition and handling of halibut bycatch in 57 pre-selected longline sets on 12 different longline vessels. Due to small sample sizes, the data have been combined for all longline fisheries. For general comments about the observer's methods, see the previous section on bottom trawl fisheries.

HALIBUT CAUGHT BY LONGLINE

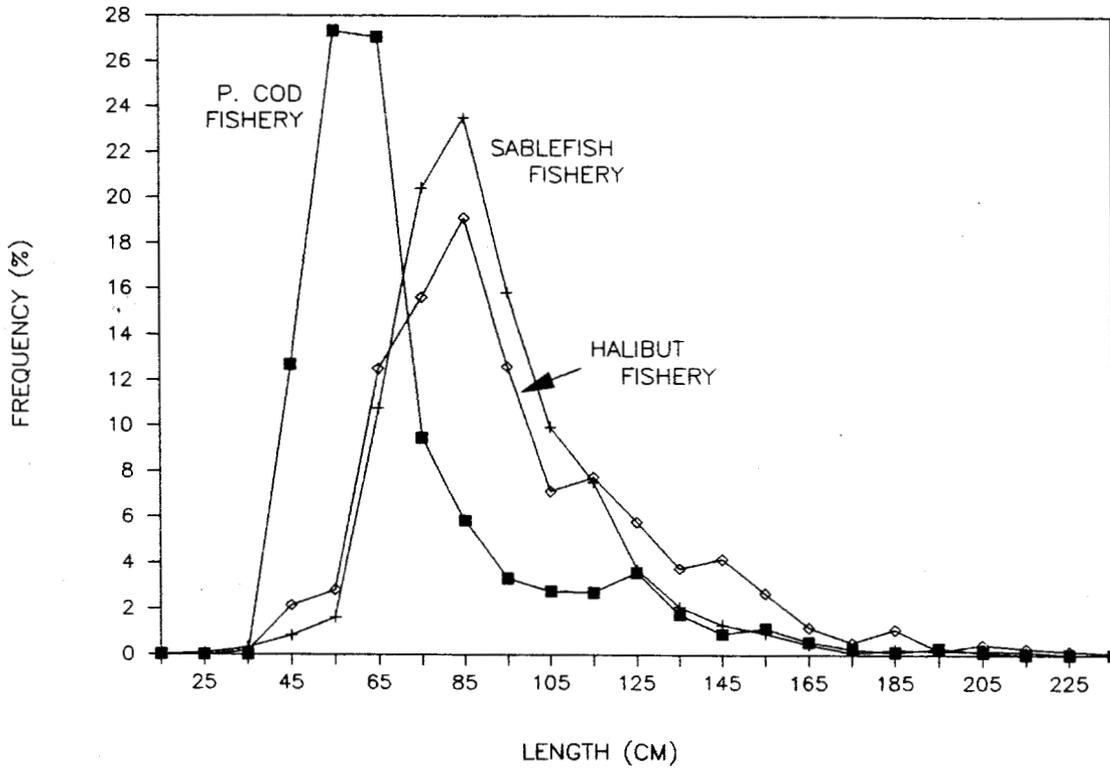


Figure 29. Size of halibut caught in longline fisheries for sablefish (n = 6403 halibut), Pacific cod (n = 1886), and halibut (n = 3930). Note that in the halibut fishery, both undersize fish (bycatch) and commercial-size fish are represented above.

Table 2. Halibut bycatch rates in domestic longline fisheries in the Central Gulf of Alaska, 1987-89. Sample size refers to observed vessel trips. mt = metric ton. Source: ADF&G observer database, June 1989.

Year	Longline Target Species	Sample Size		Bycatch Rates		
		sets	trips	no./mt	kg/mt	% ^a
1987-89	sablefish	225	17	34.8	398.0	40.0
1989	sablefish	120	9	28.1	345.1	34.5
1987-89	Pacific cod	52	7	34.1	219.8	22.0
1989	halibut	13	5	37.4	143.1	14.3

^a total weight of halibut bycatch divided by the total landed catch as reported on the fishticket or, in the absence of a fishticket, divided by the estimated retained catch for each vessel trip.

Handling

Most halibut (84.4%) were released at the ship's rail before the fish were brought aboard the vessel. These fish were released primarily by shaking the fish off the hook (Fig. 30). Only 4.1% of the observed catch was ripped off the hook by means of gaffing or automated hook stripper.

The release of fish at the ship's rail is reflected in the brief average time that the halibut remain out of the water: 2.6 minutes. Most (84.4%) were released in about 5-10 seconds, and 97% were released within 5 min (Fig. 31).

The condition of these fish was assessed in two ways. First, some observers used only dead/alive categories when assessing 885 halibut and judged that 3.7% were dead (dead fish were generally easily identified due to being scavenged by amphipods). Second, a more detailed assessment was used for another 574 halibut (after Hoag 1975):

<u>Condition</u>	<u>Description</u>
Excellent	- vigorous body movements when released: immediate swift diving or vigorous swimming motion upon re-entry to water; minor external injuries, if any.
Good	- feeble body movements when released; short recovery then weak diving or swimming motion upon re-entry to water; minor external injuries, if any.
Fair	- no body movements when released; slow righting and long recovery upon re-entry to water, little if any swimming motion. Visible movement of operculum or mouth; minor external injuries.
Poor	- no body movements when released; no righting mechanism upon re-entry to water, may be minor fin or operculum twitch; body may be abraded; severe injuries.
Dead	- no body movement when released; body limp or stiff, color pale or covered with sand fleas (amphipods).

Using these categories, 88% were judged to be in good or excellent condition and 6.8% were dead (Fig. 32). The overall mortality rate for the two assessments is approximately 5%.

With respect to injuries, all longline-caught halibut had hook wounds in the mouth, and 6.3% had additional injuries such as torn jaws, gaff wounds, or cuts (Fig. 33).

In summary, halibut caught by domestic longline vessels were quickly returned to sea after capture -- the average time that the fish were out of the water was

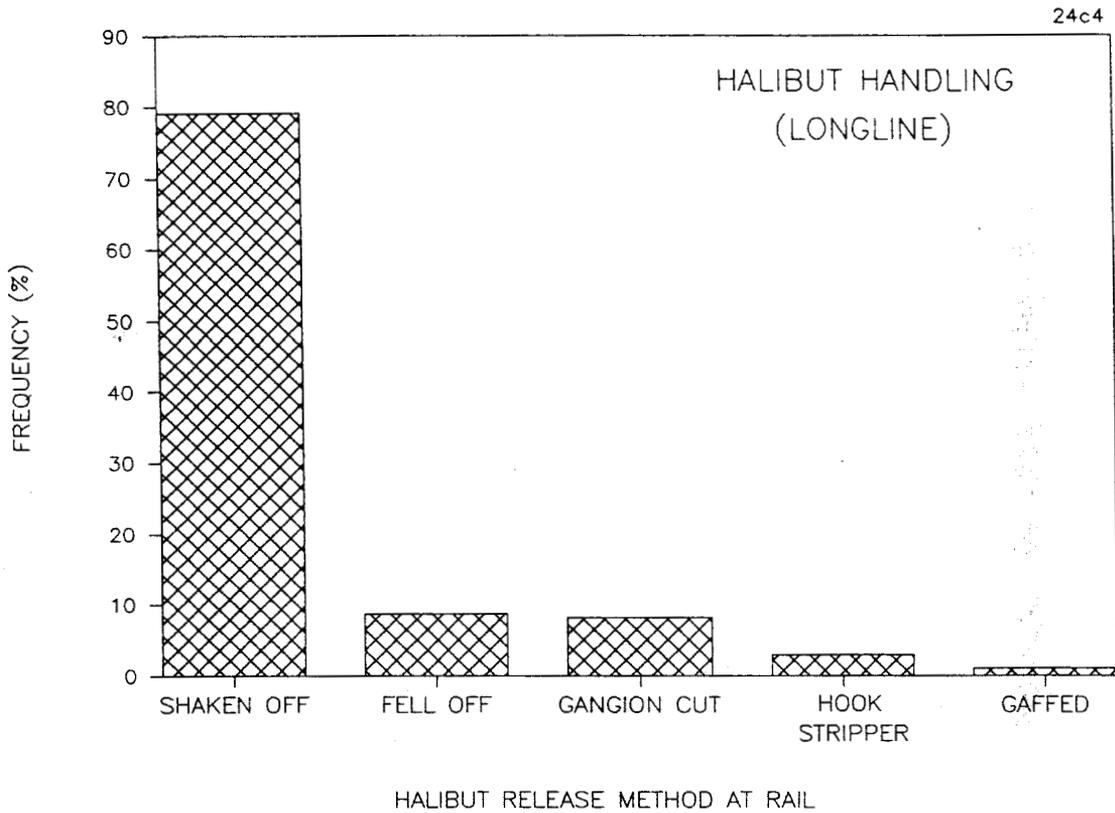


Figure 30. Halibut handling and release method on DAP longline vessels, 1989. Data have been combined for all target species in longline fisheries (n = 1459 halibut).

HALIBUT BYCATCH (LONGLINE)

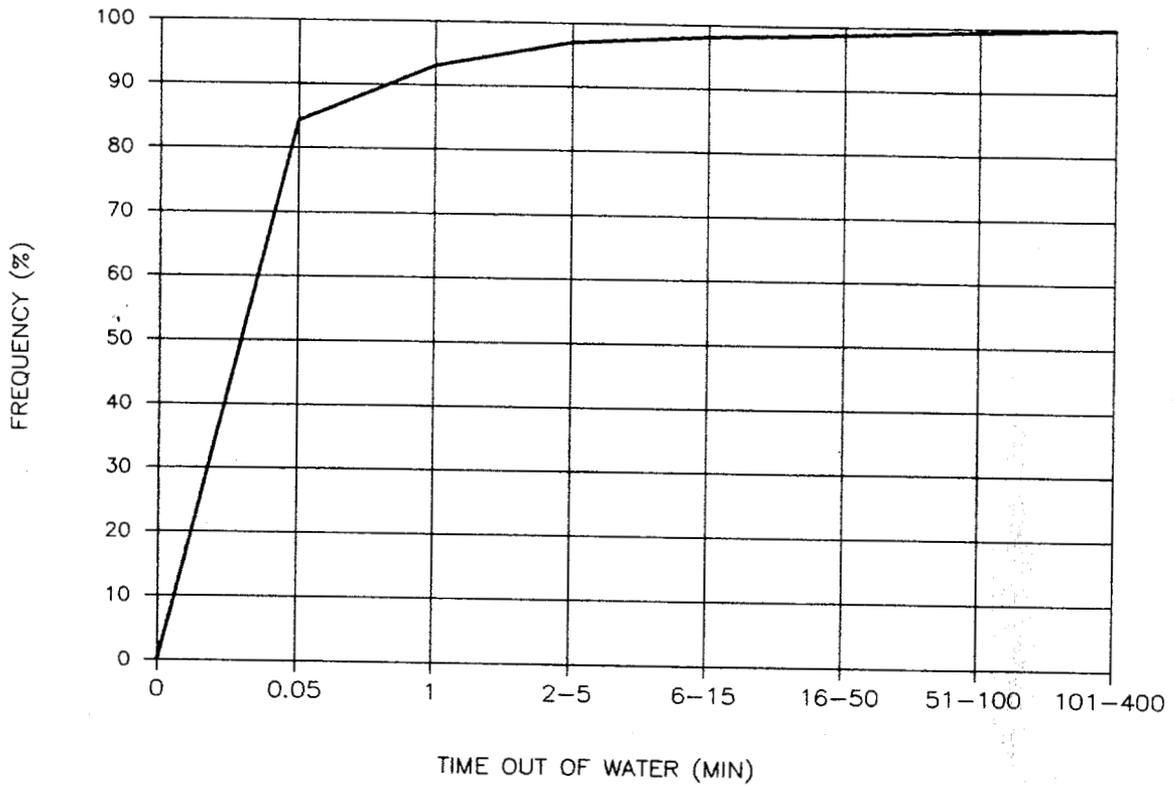


Figure 31. Time that halibut remained out of the water after capture by domestic longline vessels, 1989. Data have been combined for all target species in longline fisheries (n = 1459 halibut). Graph shows variable time intervals.

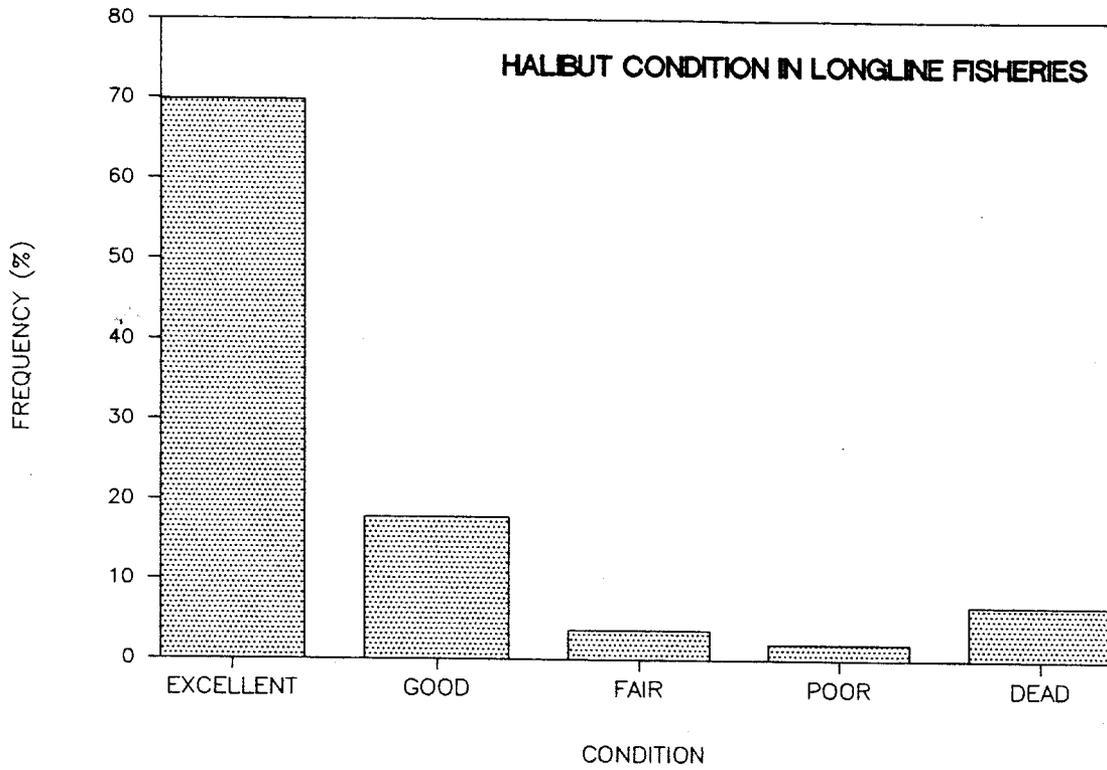


Figure 32. Condition of 574 halibut caught by DAP longline vessels, 1989. Data have been combined for all target species in longline fisheries.

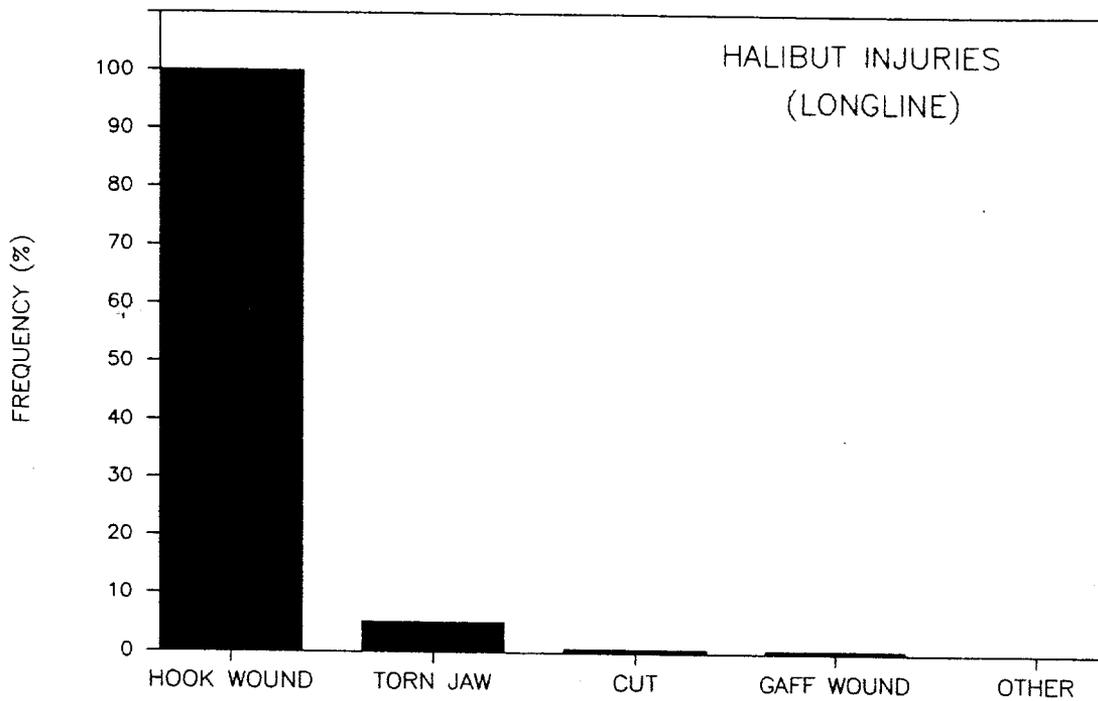


Figure 33. Injuries of 1375 halibut caught by longline vessels, 1989. Data have been combined for all target species in longline fisheries.

only 2.6 min. Mortality was estimated at 5%, and an additional 6% were adversely impacted (seriously wounded), primarily when they were released from the hook.

C. MIDWATER TRAWL FISHERIES

Although there is an extensive midwater trawl fishery for pollock in the Central Gulf of Alaska, few halibut or other demersal fish are taken by this gear. On occasion, however, midwater trawls may pick up a few halibut and crab when the trawls are towed near the bottom.

During 1987-89, observers monitored 37 midwater trawlers and examined catches in 95 tows. The bycatch rate of halibut was only 0.1 kg/mt or 0.01% of the landed pollock catch. Appendix 10 lists catch details for the observed vessels.

D. POT FISHERIES

Pot fishing for groundfish occurs on a small scale in the Central Gulf of Alaska. In 1987-88, observers monitored four pot vessels fishing for Pacific cod in the Kodiak area. All pots observed were crab pots modified to catch fish but minimize catches of halibut. Modifications were varied but included combinations of reduced size of tunnel openings, plastic "fingers" in tunnels, heavy twine tied at 8 inch intervals, etc.

The bycatch of halibut was low: 3.8 kg/mt or 0.4%. The average weight of halibut taken was 7.0 lb. Appendix 11 lists catch details for the observed vessels.

DISCUSSION

Although the data presented in this report are preliminary due to small sample sizes, the results indicate that the bycatch rate of halibut in domestic longline fisheries is significantly greater than that which occurred in previous Joint-Venture fisheries in the Gulf of Alaska:

Fishery	Halibut Bycatch Rate (%)	
	JV	Domestic
Bottom trawl	2.5-6.5 ^a	4
Longline		
Sablefish	1.2 ^b	40
Pacific cod	5-9 ^b	22

^aNPFMC, and J. Wall, NWAFC, pers. comm.

^bNPFMC

Reasons for this increase are not known but could be due to differing fishing areas, times, techniques, or gears, or changes in the abundances of either halibut or target species.

At the present time, the bycatch issue is pervasive in both domestic longline and bottom trawl fisheries. Together, these fisheries may have taken twice the halibut mortality cap of 2000 mt set by the North Pacific Fishery Management Council for the Gulf of Alaska in 1988 (Table 3).

Furthermore, the halibut fishery itself is also responsible for a significant mortality of undersize halibut (Table 3).

Attention should now be directed at (a) confirming these bycatch rates through increased observer coverage of the domestic fleet, and (b) examining the validity of the assumed mortality rates for the halibut caught by each gear type. Both of these points are currently being addressed by NPFMC and IPHC.

Table 3. Estimated halibut bycatch in domestic longline and bottom trawl fisheries in 1988, Gulf of Alaska.

GOA Domestic Fishery	^a Estimated Halibut Bycatch Rate (%)	^b Assumed Halibut Mortality Rate (%)	^c 1988 GOA Groundfish Harvest (mt)	Estimated 1988 Halibut Mortality (mt)
^d Bottom trawl	4	50	^e 70,209	1400
Longline				
Sablefish	40	25	26,297	2600
Pacific cod	22	25	3,930	200
Halibut	14	25	^f 25,351	900

^a This study.

^b IPHC

^c PacFIN (3 April 1989)

^d combined target species

^e calculated as all catches of flatfish, rockfish, and roundfish except only 25% of the pollock catch.

^f IPHC (Areas 2C, 3A and 3B)

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Appendix 1. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	2.9	9.5	39.5
Gear: Bottom Trawl	Tanner crab	0.2	5.0	2.1
Target Species: mixed	R.king crab	T	T	T
	Salmon	0.1	0.3	0.8
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 May 89	Commercial			
Vessels Observed: 32	Pacific cod	37.3		
Trips Observed: 84	Pollock	21.7		
Hauls/Sets Observed: 595	Flounder	28.3		
Total Landing: 2938.0 mt	Sablefish	4.5		
Stat. Areas Observed:	Rockfish	2.3		
495730 495800 505700	Other	2.7		
505730 505800 515600				
515630 515700 515730				
515802 515908 515935				
525600 525630 525702				
525730 525806 525807				
535602 535632 535733				
535734 535802 535803				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 3969.41 mt.

17append.1

Appendix 2. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	2.5	9.0	28.4
Gear: Bottom Trawl	Tanner crab	0.1	4.4	1.7
Target Species: P.cod	R.king crab	T	T	T
	Salmon	0.1	0.4	1.0
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 May 89	Commercial			
Vessels Observed: 25	Pacific cod	70.3		
Trips Observed: 43	Pollock	11.4		
Hauls/Sets Observed: 274	Flounder	12.4		
Total Landing: 1469.0 mt	Sablefish	1.4		
Stat. Areas Observed:	Rockfish	0.6		
505730 505800 515700	Other	1.2		
515730 515802 515908				
515935 525630 525702				
525730 535602 535632				
535733 535734 535802				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 1706.83 mt.

17append.2-6

Appendix 3. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	----
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	1.4	2.4	22.3
Gear: Bottom Trawl	Tanner crab	T	0.1	T
Target Species: Deep	R.king crab	T	T	T
flatfish	Salmon	T	T	0.1
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 May 89	Commercial			
Vessels Observed: 5	Pacific cod	1.6		
Trips Observed: 22	Pollock	3.7		
Hauls/Sets Observed: 117	Flounder	63.3		
Total Landing: 555.9 mt	Sablefish	15.6		
Stat. Areas Observed:	Rockfish	8.6		
495730 495800 505700	Other	5.8		
505730 505800 515600				
515630 515700 515802				
525600 525630 525702				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 907.27 mt.

17append.2-6

Appendix 4. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	4.2	14.6	74.2
Gear: Bottom Trawl	Tanner crab	T	0.5	0.4
Target Species: Shallow	R.king crab	0.0	0.0	0.0
flatfish	Salmon	0.1	0.3	0.9
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 May 89	Commercial			
Vessels Observed: 6	Pacific cod	11.6		
Trips Observed: 9	Pollock	14.2		
Hauls/Sets Observed: 35	Flounder	62.4		
Total Landing: 109.1 mt	Sablefish	2.4		
Stat. Areas Observed:	Rockfish	1.2		
505800 515700 515730	Other	3.9		
515802 525702 525807				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 191.9 mt.

17append.2-6

Appendix 5. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	3.7	14.3	58.6
Gear: Bottom Trawl	Tanner crab	0.3	11.0	4.8
Target Species: Pollock	R.king crab	0.0	0.0	0.0
	Salmon	0.1	0.3	0.9
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 May 89	Commercial			
Vessels Observed: 11	Pacific cod	21.0		
Trips Observed: 22	Pollock	57.0		
Hauls/Sets Observed: 122	Flounder	16.4		
Total Landing: 584.8 mt	Sablefish	0.6		
Stat. Areas Observed:	Rockfish	0.1		
495800 505730 505800	Other	0.9		
515700 515730 515802				
525630 525702 535632				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 928.8399 mt.

17append.2-6

Appendix 6. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	8.4	10.8	92.1
Gear: Bottom Trawl	Tanner crab	0.3	5.8	3.6
Target Species: Pollock +	R.king crab	0.0	0.0	0.0
P. cod	Salmon	T	0.1	0.2
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 May 89	Commercial			
Vessels Observed: 4	Pacific cod	20.4		
Trips Observed: 7	Pollock	44.1		
Hauls/Sets Observed: 31	Flounder	23.2		
Total Landing: 161.3 mt	Sablefish	1.2		
Stat. Areas Observed:	Rockfish	0.4		
505800 515700 515730	Other	1.9		
515802 525630 525702				
525806 525807				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 176.66 mt.

17append.2-6

Appendix 7. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Central Gulf Alaska	Halibut	6.0	34.8	398.0
Gear: Longline	Tanner crab	T	T	T
Target Species: Sablefish	R.king crab	0.0	0.0	0.0
	Salmon	0.0	0.0	0.0
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 28 Jun 89	Commercial			
Vessels Observed: 15	Pacific cod	0.8		
Trips Observed: 17	Pollock	T		
Hauls/Sets Observed: 225	Flounder	4.9		
Total Landing: 254.7 mt	Sablefish	57.9		
Stat. Areas Observed:	Rockfish	15.8		
415900 425931 435931	Other	14.5		
445931 465901 475830				
475900 485800 495730				
505700 505730 515630				
515700 525600 525630				
525702 535602 545530				
555532 565000 575430				
585400 595400				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 350.35 mt.

17 append.7-9

Appendix 8. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak east side	Halibut	7.6	34.1	219.8
Gear: Longline	Tanner crab	T	0.1	0.1
Target Species: Pacific	R.king crab	0.0	0.0	0.0
cod	Salmon	0.0	0.0	0.0
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 28 Jun 89	Commercial			
Vessels Observed: 6	Pacific cod	81.5		
Trips Observed: 7	Pollock	1.7		
Hauls/Sets Observed: 52	Flounder	1.0		
Total Landing: 108.3 mt	Sablefish	T		
Stat. Areas Observed:	Rockfish	0.2		
505730 515700 515730	Other	8.0		
515801 515802 525630				
525702 525732 525733				
525803 525805 525807				
535602 535632 535706				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 167.45 mt.

17 append.7-9

Appendix 9. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	Kg/mt
			No./mt	
	Prohibited			
Area: Kodiak east side	Halibut	82.8	37.4	143.1
Gear: Longline	Tanner crab	0.0	0.0	0.0
Target Species: Halibut	R.king crab	0.0	0.0	0.0
	Salmon	0.0	0.0	0.0
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 89 - 28 Jun 89	Commercial			
Vessels Observed: 5	Pacific cod	8.0		
Trips Observed: 5	Pollock	0.0		
Hauls/Sets Observed: 13	Flounder	0.1		
Total Landing: 78.5 mt	Sablefish	0.0		
Stat. Areas Observed:	Rockfish	1.1		
505730 515730 525702	Other	8.0		
535530 535602				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 71.7 mt.

17 append.7-9

Appendix 10. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	Kg/mt
	Prohibited			
Area: Kodiak area	Halibut	T	T	0.1
Gear: Midwater Trawl	Tanner crab	T	T	T
Target Species: Pollock	R.king crab	0.0	0.0	0.0
	Salmon	T	0.1	0.4
Inclusive Dates:	Herring	T	0.4	T
01 Jan 87 - 24 May 89	Commercial			
Vessels Observed: 16	Pacific cod	0.9		
Trips Observed: 37	Pollock	97.8		
Hauls/Sets Observed: 95	Flounder	0.6		
Total Landing: 2753.2 mt	Sablefish	T		
Stat. Areas Observed:	Rockfish	0.1		
515630 515700 515730	Other	0.6		
525630 525702 525731				
525732 525802 525805				
525807 535632 535802				
545732				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 2853.73 mt.

17mtrawl.m24

17append.10

Appendix 11. Bycatch rate of prohibited species and species composition in domestic commercial fisheries as observed by the Alaska Department of Fish and Game.

Catch Details	Species	1	2	
		Catch (%)	---Bycatch---	---
			No./mt	Kg/mt
	Prohibited			
Area: Kodiak area	Halibut	0.3	1.2	3.8
Gear: Pot	Tanner crab	0.1	0.4	0.1
Target Species: Pacific	R.king crab	0.0	0.0	0.0
cod	Salmon	0.0	0.0	0.0
Inclusive Dates:	Herring	0.0	0.0	0.0
01 Jan 87 - 01 Jul 89	Commercial			
Vessels Observed: 3	Pacific cod	77.3		
Trips Observed: 4	Pollock	0.1		
Hauls/Sets Observed: 58	Flounder	0.3		
Total Landing: 36.4 mt	Sablefish	T		
Stat. Areas Observed:	Rockfish	T		
525731 525805 535732	Other	21.8		
535733 535802 535803				

1. Catch (%) refers to total catch brought on deck and is based on the observed weight of fish caught or, for longline and pot gear, the number of fish caught. Species proportions in individual trawl tows (or sets of longline/pot gear) were determined by observer's samples and expanded to the total tow weight which was visually estimated by the skipper or observer.
2. Bycatch = kg or no. per metric ton of landed fish (whole fish, all species, including landed discard) as listed on the fish ticket. Longline and pot gear kg/mt was generated from the average weight of those fish which were weighed.

T = trace, less than 0.05

0.0 = no catch.

Sum of visually estimated catch = 41.43 mt.

17append.11

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