INFORMATIONAL LEAFLET NO. 258

LONGLINE FISHERIES MONITORING IN THE EASTERN GULF OF ALASKA,
1980 - 1985

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November 1986

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October 1986

1 This project was partially funded by the Alaska Region of the National Marine Fisheries Service under contract numbers 81-ABC-00269 and 83-ABC-00324

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ABSTRACT

The Alaska Department of Fish and Game has sampled landings from the commercial longline fisheries in the eastern Gulf of Alaska since 1978. Skipper interviews have been conducted for sablefish *(Anoplopoma fimbria)* fisheries since 1980 and for rockfish (*Sebastes* spp.) fisheries since 1982.

Sablefish landings have increased in all management areas of the eastern Gulf since 1981. Catch per unit of effort (CPUE in kg/hook) calculated from skipper interviews increased between 1980 and 1985. However, the percentage of fish in the large size market category (over 2.25 kg dressed wt.) declined over the same period. Possible reasons for these changes are discussed. Two hook types were compared. Circle hooks may be nearly twice as efficient as "J" hooks. Fisheries monitoring results were contradictory to the results of independent stock assessment surveys conducted by other agencies.

Rockfish samplers monitored biological parameters as well as fisheries performance. The number of species landed in the major fisheries increased between 1982 and 1985, although two species dominated the landings. Of five species sampled length frequency was significantly different over time for two species in the Sitka area, and length frequency was significantly different for all species between ports of landing. Only one species sampled in the Ketchikan landings and two in the Sitka landings had equal sex ratios. The CPUE increased in the Sitka fishery from 1982 to 1985 but declined in the Ketchikan fishery between 1984 and 1985. Between 1982 and 1985 the Sitka fleet moved progressively further from the original areas fished indicating a decline in CPUE in the original areas. Aging results indicate yelloweye rockfish are much older than previously thought. Differences were noted in the age distribution samples from different areas.

Interpretation of results from both fisheries is discussed in detail. Because of numerous variables, fisheries performance alone may not be a valid indicator of stock condition. An integrated approach for determining stock condition is promoted.

KEY WORDS: fisheries monitoring, rockfish *(Sebastes* spp.*)*, sablefish *(Anoplopoma fimbria)*, Southeastern Alaska, CPUE, species composition, AWL.

INTRODUCTION

Domestic longline fisheries in the eastern Gulf of Alaska have been monitored by personnel of the Alaska Department of Fish and Game (ADF&G) Commercial Fisheries Division as part of an on-going research and management program in this area since 1978. Besides collecting detailed catch and effort statistics from the landed catch, the ADF&G samples landings of sablefish *(Anoplopoma fimbria)* and rockfish *(Sebastes* spp.*)* to obtain species composition and biological data and conducts skipper interview and logbook programs to obtain detailed catch, area, and effort data from these fisheries. The port sampling programs are entirely voluntary and rely on the cooperation of the fishermen and processors for their success.

This report summarizes the results of domestic longline fisheries monitoring in the eastern Gulf of Alaska from 1980 through 1985. It is comprised of two sections. Each section presents a detailed description of the monitoring activity of one of the two primary groundfish fisheries in the region, the sablefish and the rockfish longline fisheries.

Description of Area

Through Title 16 of the Alaska Statutes and based on regulations established by the Alaska Board of Fisheries, the Region I (Southeastern and Yakutat Areas) Groundfish Project Leader has in-season management responsibility for State waters from Dixon Entrance (54° 40′ N. lat) north and westward to Cape Suckling (143° 55′ W. long.). The project also has had responsiblity for monitoring domestic landings from the Exclusive Economic Zone (EEZ) in the eastern Gulf of Alaska through funding contracts with the National Marine Fisheries Service (NMFS) and the North Pacific Fisheries Management Council (NPFMC). Sablefish and rockfish fisheries along the outer coast of Southeastern Alaska were managed in-season in cooperation with the NMFS.

The eastern Gulf is divided into seven ADF&G management areas for the purpose of reporting catch and effort for all species and for sablefish and rockfish management. The Southeastern Area is divided into two inside management areas, Northern Southeast Inside (NSEI) and Southern Southeast Inside (SSEI) and three outside areas, Northern Southeast Outside (NSEO), Central Southeast Outside (CSEO), and Southern Southeast Outside (SSEO). The Yakutat Area is divided into two management areas, East Yakutat (EYAK) and West Yakutat (WYAK) separated at 140° west longitude (Figure 1). Fisheries monitoring is extremely complex because of the vast size of the area, which extends nearly 950 kilometers, from Dixon Entrance to Cape Suckling and also because there are twelve active ports of landing scattered throughout Region I.

Description of the Fishery

Total domestic groundfish landings in the eastern Gulf of Alaska have increased from less than 3,000 t in 1980 to over 8,400 t in 1985 with an ex-vessel value increase from $1.7 million to over $11.5 million during that same period. The domestic fisheries in the eastern Gulf are primarily longline fisheries for high-value species such as sablefish and rockfish with minimal trawl landings of flatfish (Pleuronectidae) and rockfish. Other

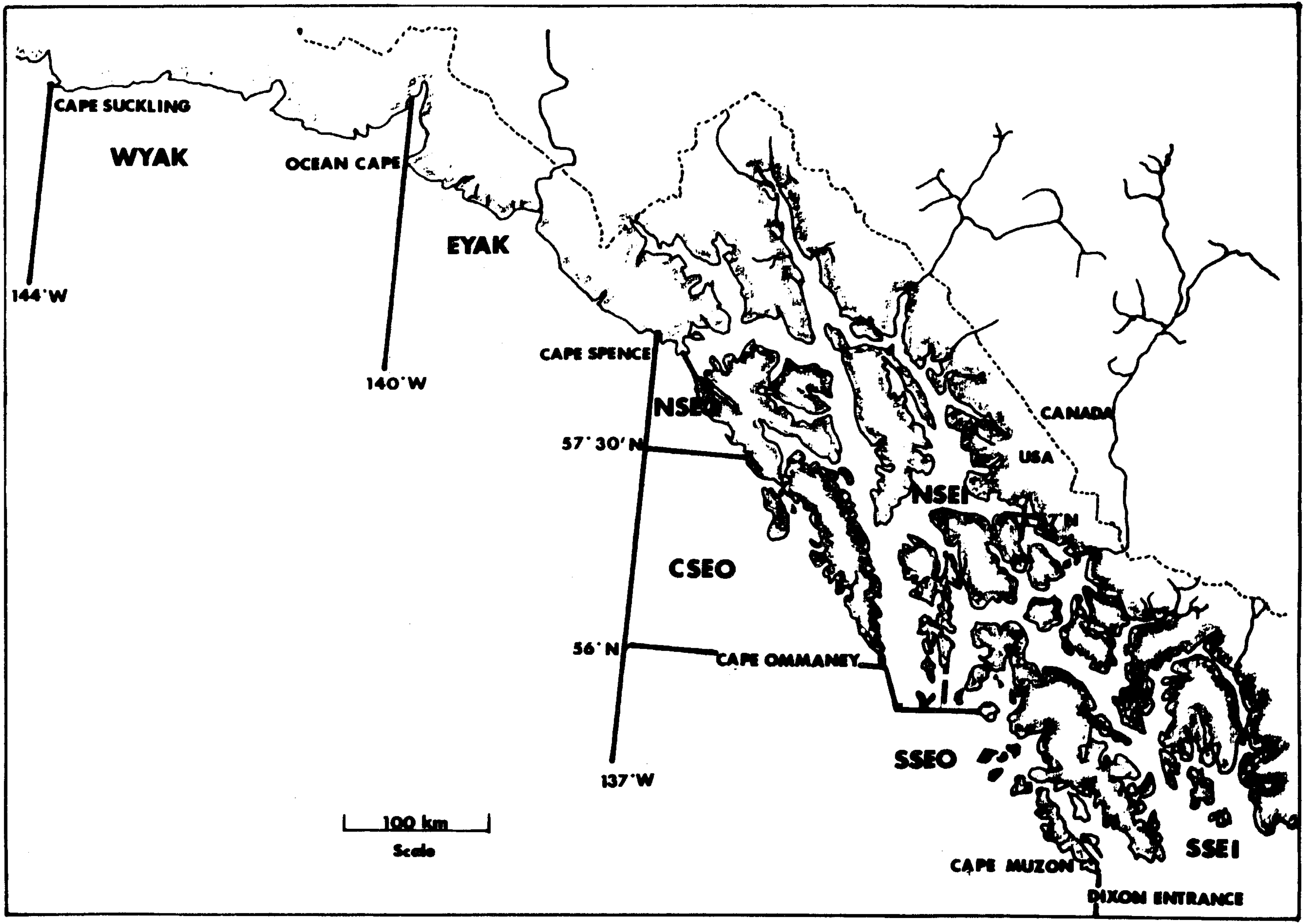


Figure 1. The eastern Gulf of Alaska coastline showing Alaska Department of Fish and Game Region I boundaries and groundfish management boundaries.

species such as Pacific cod (*Gadus macrocephalus*) and lingcod (*Ophiodon elongatus*) are also landed but represent only a small fraction of the total landings and value of the fishery.

Project Personnel

Project biologists and seasonal fisheries technicians sampled landings in Sitka, Ketchikan, Petersburg, Juneau, Pelican, and Hoonah with periods of employment varying depending on available funding, sampling priorities, and anticipated levels of fishing effort.

Attempts to utilize samplers for onboard observer work in the longline fisheries failed due to the reluctance of skippers to accomodate the available observers. Reasons given include the small size and limited space on board many of the rockfish vessels and the intensity of the short sablefish seasons which require full crews and increase the risk of injury to non-fishing personnel. Because of the problem with placing observers aboard longline vessels, longline fisheries monitoring was restricted to shore-based landings during the reporting period.

SABLEFISH FISHERIES MONITORING

Sablefish fisheries are among the oldest in the State with catch records dating back to the early 1900's (Bracken 1983). Domestic sablefish landings in the eastern Gulf have increased steadily since the foreign fisheries withdrew from the offshore areas of Southeastern and east Yakutat in 1978. The fishery continues to grow with the 1985 eastern Gulf landings totaling nearly 6,400 t and an ex-vessel value of $9.6 million; making it one of the largest single-species fisheries in the region. Sablefish fisheries are intensely managed in both State and Federal waters with seasons becoming progressively shorter as the fishing effort intensifies.

The ADF&G has relied on fisheries monitoring to determine comparative catch per unit of effort (CPUE) and has used this data to establish annual harvest levels within the guideline harvest ranges set by regulation for State waters since 1979. Data from the offshore fisheries is summarized and presented to the NPFMC and NMFS to be used in conjunction with other indexes of abundance to determine status of sablefish stocks in the EEZ.

Methods

Monitoring of the eastern Gulf sablefish fisheries relies on seasonal port samplers and permanent staff biologists who are stationed in the primary ports of landing in the Southeastern Area (Figure 2) during the sablefish seasons. The number and location of samplers used varies from year to year depending on available funding and anticipated number of deliveries to each port of landing.

The primary responsibility of the port samplers is to contact as many vessel operators as possible to obtain detailed information on their fishing operation using a "skipper interview" form (Appendix 1). The form provides summarized data on the type and amount of gear used, the exact fishing

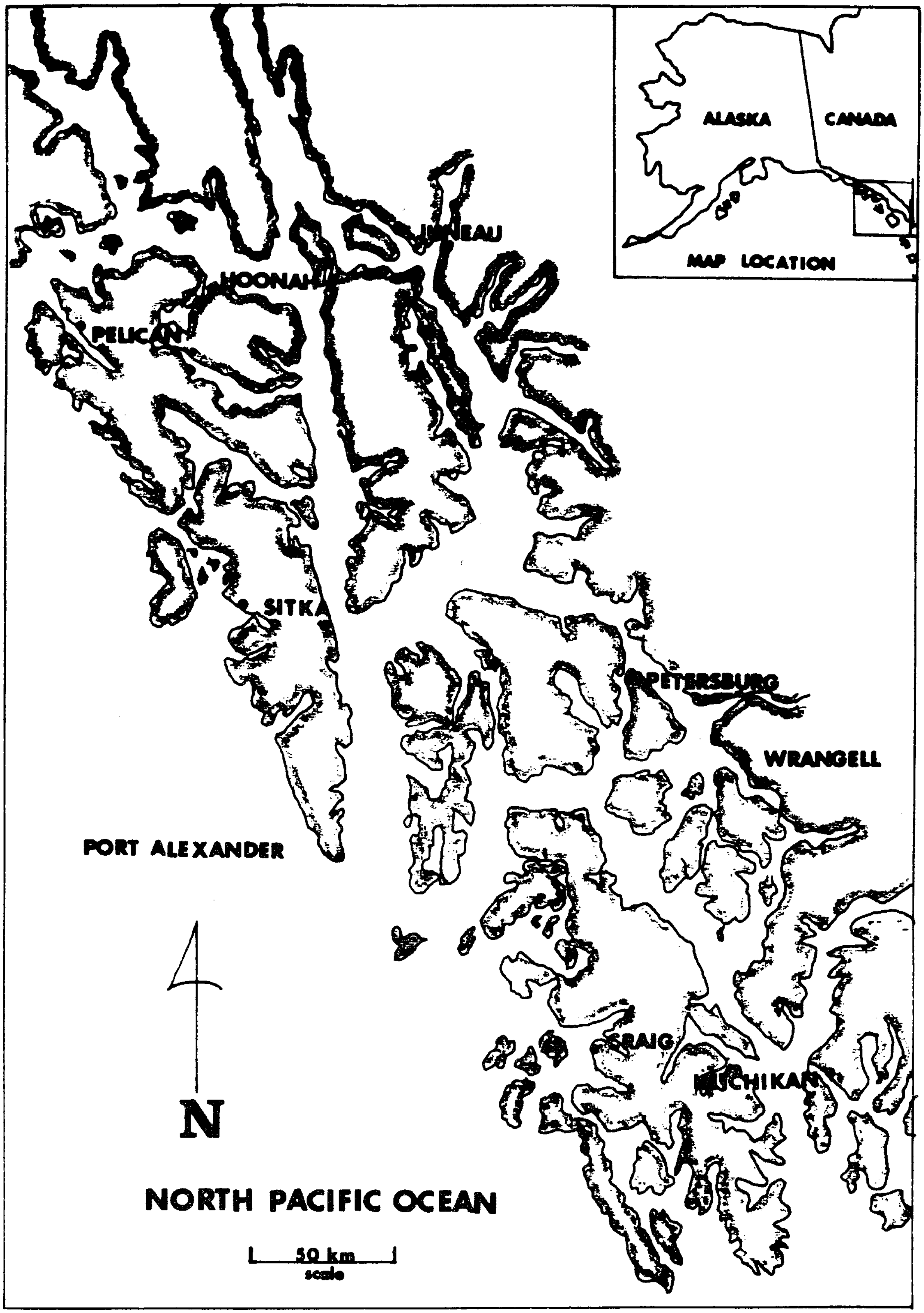


Figure 2. Southeastern Alaska showing primary ports of landing.

location, amount of time fished, number of fish caught, average depth fished, bait type, and other factors that may have influenced catch. These data are combined with total weight for that trip from the fish ticket (Appendix 2) which is a documentation of each landing required by regulation. The data is entered on microcomputers in Petersburg and Sitka using a RBASE 5000 database management program. The database is then queried to determine total pounds landed and number of hooks deployed by management area by year for the sampled portion of the fleet. The data is then converted to kilograms per hook as an indicator of CPUE for the fishery assuming that the interviewed vessels are repesentative of the total fleet. The landed weight of sablefish from the sampled portion of the fleet is compared to the total weight landed for each management area to determine the percentage of total landings sampled.

Port samplers are also responsible for collecting ADF&G supplied logbooks from participating skippers. Although both skipper interviews and logbooks provide information on fisheries performance, the logbook program was not initiated until mid-1983 and thus provides a rather limited database for this fishery. Also, even though logbooks provide more detailed set by set catch information as opposed to the trip summary data obtained from the interviews, a much higher percentage of the fleet was interviewed during the 1980 to 1985 project period. In the rare instances where logbooks were collected and an interview was not conducted, the logbook data was summarized by trip and entered into the system on an interview form. Therefore, to provide consistency over the sampling period, all data was converted to a trip summary format for data entry.

During 1983 many of the sablefish vessels converted from "J" or straight-shanked hooks to circle hooks (Figure 3). The 1982 through 1984 interviews data was examined to compare CPUE between the two hook types for the NSEI and NSEO management areas, the two areas where a sufficient sample size of both hook types was reported. The skippers which, in 1983, first converted to circle hooks could have been more innovative and efficient fishermen. Therefore, to isolate this possibility from changes in CPUE related directly to hook type, the vessels which converted to circle hooks in 1983 were combined into a 'core' fleet. Their CPUE, before and after converting to circle hooks, was compared as was the CPUE for all vessels combined.

Port samplers collected length and weight samples from the landed catch from 1980 through 1983 even though virtually all sablefish landed were headed and eviscerated at sea. This program was discontinued in 1984 when it was determined that, because of the significant variability in sablefish growth rates as shown in other studies the length and weight samples from landed fish provided no meaningful information for fisheries management. However, since sablefish are normally reported by market size category on the fish tickets, the fish ticket database was examined to determine the percentage of fish landed over five pounds (2.25 kg) dressed weight for each management area since 1980. This size category separation was chosen because fish over five pounds (2.25 kg) are worth considerably more to the industry, and based on samples collected during ADF&G research cruises, this size also represents the approximate breakpoint between mature and immature female sablefish.

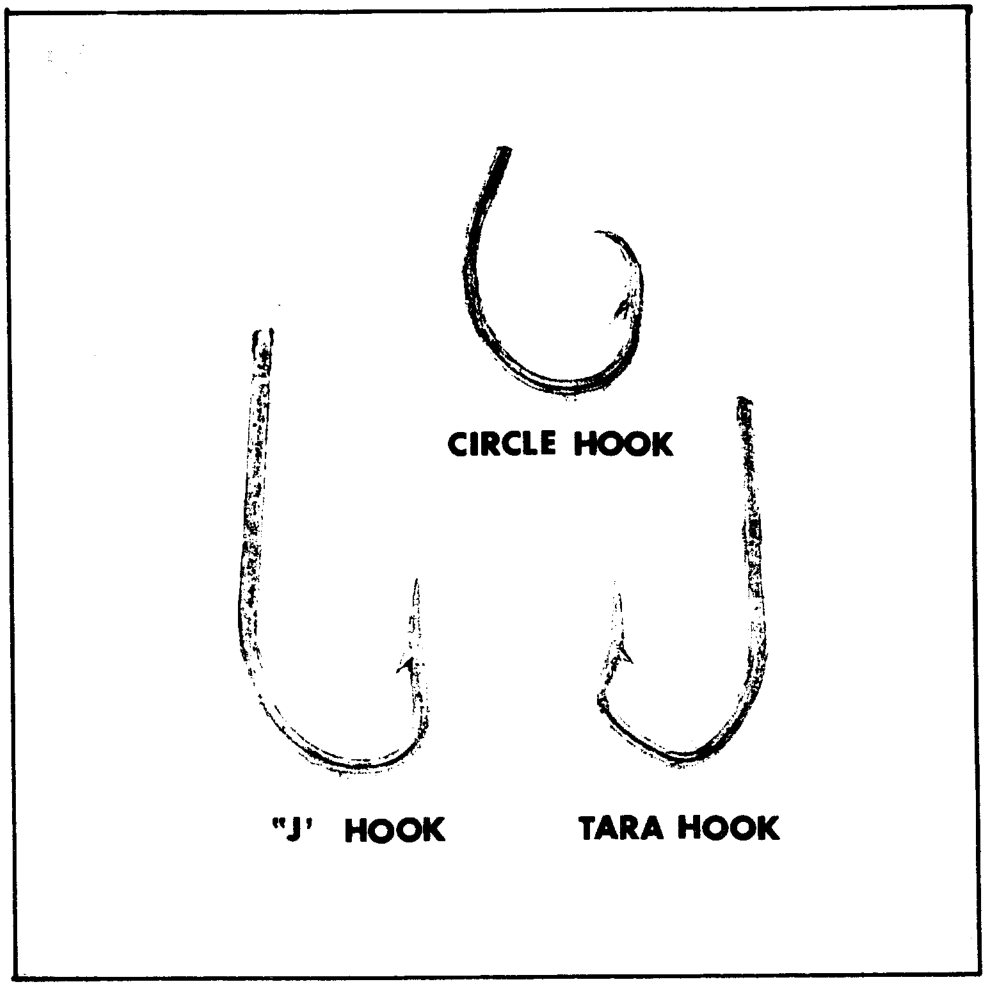


Figure 3. Primary hook types used in the Gulf of Alaska sablefish and rockfish longline fisheries.

Port samplers also collect sablefish tags from the fishery. Tags were sorted by agency and, where detailed recapture information was lacking, skipper interview, logbook, and/or fish ticket data were utilized to determine date and location of recapture. Tags originating from other agencies were then mailed to the tag return contact person for that agency. The ADF&G tag return information was entered on a microcomputer in Petersburg using the RBASE 5000 database management program. Preliminary results of ADF&G sablefish tagging studies were reported in Bracken (1982 and 1983). Results available prior to July 1984 from ADF&G and other agency tagging studies have been combined and included in a report which will be submitted to the International North Pacific Fisheries Commission (INPFC).

Obtaining age samples (otoliths) from the sablefish fishery is difficult since, the fish are headed at sea. However, beginning in 1985 a voluntary catch sampling program was initiated for which vessel operators were requested to bring in the heads from a portion of their sablefish catch. Skippers were requested to save the heads from the last day's fishing. If available, 100 heads per trip were sampled at dockside. During 1985 a total of 1140 sablefish otolith pairs were sampled from heads brought in from three management areas. These structures were then sent to the ADF&G age reading lab in Kodiak. Age determination for these otoliths has not been completed because of budgetary restrictions. Results of sablefish age reading from otoliths collected during indexing and tagging studies during 1979 through 1983 is reported in Funk and Bracken (1983).

Results

A total of 638 skipper interviews were conducted between 1980 and 1985. Landings from two management areas, NSEI and NSEO, received the most interview effort because of the higher number of landings from these areas, the availability of samplers during the time these areas were fished, and the greater need for detailed data to manage these areas. Interviewed landings ranged from 0.3% to 79% of the total landings in the NSEI management area and from 2% to 45% of the total landings in the NSEO management area (Table 1). Most interviews were conducted in Sitka followed in decreasing order by Petersburg, Pelican, Juneau, and other Southeastern ports (Table 2). The Seattle "interviews" are primarily trip summaries from logbooks turned in by skippers who delivered in Washington State.

Of the 638 interviews taken, 583 contained the information necessary to calculate CPUE (kg/hook). The CPUE increased in all areas over time regardless of sample size (Table 3); however, only the Northern Southeast Inside and Outside Management Areas were considered to have had enough samples over the entire time period for an adequate comparison of the CPUE trends (Figure 4). Note that while CPUE increases over time for both areas, the CPUE from the NSEI area is consistently higher than from the NSEO area.

Hook Type CPUE Comparisons:

Gear changes in a fishery have been shown to have dramatic effects on CPUE. Williams and McCaughran, (1985) reported that circle hooks outfished "J" hooks for halibut by 220% in experiments conducted in Southeastern Alaska in

Table 1. Percentage of usable weight (kilograms) from skipper interviews compared to total weight landed in the Northern Southeast Inside (NSEI) Management Area and Outside Management Area sablefish fisheries, 1980-1985.

	MANAGEMENT AREA					
	NORTHERN SOUTHEAST INSIDE AREA			OUTSIDE AREAS[1]		
YEAR	SAMPLED WEIGHT	TOTAL WEIGHT	PERCENT SAMPLED	SAMPLED WEIGHT	TOTAL WEIGHT	PERCENT SAMPLED
1980	303,537	393,236	77.0%	45,065	990,825	5.0%
1981	973	303,585	0.3%	128,500	883,995	15.0%
1982	287,379	362,251	79.0%	19,434	873,866	2.0%
1983	348,237	530,214	66.0%	519,926	1,238,600	42.0%
1984	284,303	573,919	50.0%	252,567	1,648,598	15.0%
1985	521,980	911,543	57.0%	524,922	1,157,041	45.0%

[1] Includes all outside Southeast Alaska areas since no area distinction was made for landings from the outside areas prior to 1984.

Table 2. Number of sablefish interviews conducted by port of landing in Southeastern Alaska, 1980-1985.

PORT	YEAR 1980	1981	1982	1983	1984	1985	TOTAL
SITKA	39	24	24	108	81	130	406
PETERSBURG	28	1	16	22	14	38	119
PELICAN	6	0	2	8	3	27	46
JUNEAU	10	0	8	8	0	0	26
KETCHIKAN	0	0	0	0	0	36	36
SEATTLE	1	0	0	0	0	1	2
WRANGELL	0	0	0	0	0	1	1
METLAKATLA	0	0	0	0	0	2	2
TOTAL	84	25	50	146	98	235	638

Table 3. Catch per unit of effort (kg/hook) in the eastern Gulf of Alaska sablefish fisheries by management area, 1980-1985.

MANAGEMENT AREA	YEAR	NUMBER SAMPLED	KILOGRAMS SAMPLED	HOOKS SAMPLED	KG/HOOK
NSEI	1980	74	303,537	2,362,451	0.13
	1981	1	973	3,500	0.28
	1982	44	287,379	1,289,423	0.22
	1983	52	348,237	1,135,285	0.31
	1984	36	284,303	844,093	0.34
	1985	70	521,980	1,060,540	0.49
NSEO[1]	1980	9	34,568	281,660	0.12
	1981	23	116,057	999,900	0.12
	1982	2	19,434	203,000	0.10
	1983	77	452,703	2,423,338	0.19
	1984	41	252,567	1,032,610	0.24
	1985	84	524,922	1,564,617	0.34
SSEO	1980	1	10,497	57,840	0.18
	1981	1	12,444	45,000	0.28
	1983	4	67,223	315,660	0.21
	1984	4	44,389	161,140	0.28
	1985	4	39,603	111,808	0.35
SSEI	1983	5	22,434	116,160	0.19
	1985	33	92,135	432,610	0.21
EYAK	1982	3	10,259	141,650	0.07
	1983	4	23,229	160,925	0.14
	1985	3	25,912	71,000	0.36
WYAK	1982	1	8,594	70,000	0.12
	1984	2	21,627	93,840	0.23
	1985	5	67,995	239,660	0.28

[1] Includes the Central Southeast Outside area which was established in 1985.

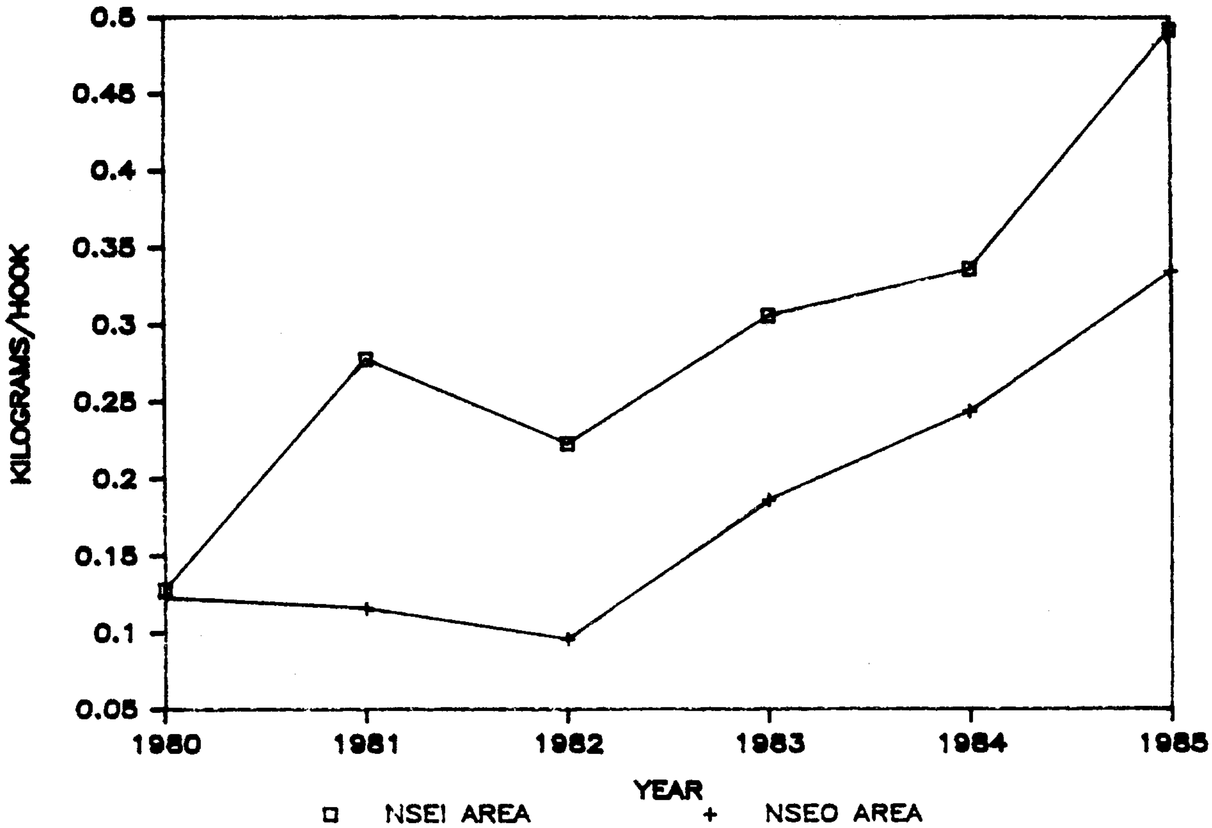


Figure 4. CPUE expressed in kilograms per hook in the Northern Southeast Inside (NSEI) management area and Outside management area sablefish fisheries, 1980-1985.

1984. In 1983 a portion of the sablefish fleet converted from the use of the conventional "J" hook to circle hooks. The results were reportedly so dramatic that by 1984 only 6% of the interviewed vessels utilized "J" hooks (Table 4). The conversion from universal use of "J" hooks through 1981 to nearly total use of circle hooks by 1985 is shown in Figure 5. It is assumed that the interviewed vessels are representative of the total fleet. Tara hooks, which are a Japanese cod hook and quite similar in configuration to the "J" hook, were first used in the fishery in 1982, one year prior to the introduction of circle hooks. Although tara hooks were said to be superior to "J" hooks, they were also replaced by circle hooks; and the use of tara hooks never exceeded 20% of the sampled landings. Because of the relatively limited use, the sample size of tara hooks in any one management area is not considered adequate to test its efficiency against the other hook types from the interview data. To our knowledge no other hook efficiency comparisons have been made with tara hooks.

The interview database was examined to determine the difference in CPUE for the "J" hooks and circle hooks for the NSEI and NSEO management areas during 1983. Total landed weight and number of hooks deployed for each hook type where hook type was reported on the interview form. Increases in CPUE of 94% and 91% were noted for circle hooks in the NSEO and NSEI areas respectively (Table 5). The median CPUE values for the two hook types were tested for statistical significant difference using the Wilcoxon test. The difference was found to be significant at the 99% level indicating that the increase in circle hook CPUE is highly significant. To determine the effect on observed CPUE for 1983 and to attempt to make that data comparable with the 1984 and 1985 data, the weight landed by "J" hooks was multiplied by the observed increase in circle hook CPUE during 1983. The resulting weight was then divided by the total number of both "J" and circle hooks deployed to calculate an adjusted CPUE for that year. The converted CPUE is considerably higher than the average CPUE for both the NSEO and NSEI management areas (Figure 6). The database was examined to determine if the substantial difference in observed CPUE between hook types was the result of the improved efficiency of the circle hooks or the result of better fishing performance for the vessels which first converted to circle hooks in 1983. To do this, the performance of vessels which first converted to circle hooks in 1983 was compared to the remainder of the fleet using the same hook types, "J" hooks in 1982 and circle hooks in 1984. The sample size was considered adequate to make comparisons for the NSEI area in 1982 and both the NSEI and NSEO areas in 1984. The results indicate that the vessels which first converted to circle hooks in 1983 had CPUE values of 22% to 29% higher than the average for vessels using the same hook type in the year prior to and subsequent to the year of conversion (Table 6). This suggests that the fishermen which converted to circle hooks when the new hooks first became available could be expected to obtain somewhat higher CPUE levels than average regardless of gear type. Because of the small sample size, these results should not be considered conclusive. However, it is important to note that even when the higher expected fishing performance of the vessels which converted to circle hooks in 1983, the circle hook CPUE for 1983 is still 62% to 72% higher than for "J" hooks.

Table 4. Number of skipper interviews conducted by hook type in the eastern Gulf of Alaska sablefish fisheries, 1980-1985.

YEAR	NUMBER OF OCCURRENCES						TOTAL SAMPLED
	"J" HOOKS		CIRCLE HOOKS		TARA HOOKS		
	N	(%)	N	(%)	N	(%)	
1980	84	100	0	0	0	0	84
1981	25	100	0	0	0	0	25
1982	8	80	0	0	2	20	10
1983	93	65	29	20	19	13	144
1984	5	6	66	74	18	20	89
1985	5	2	205	93	11	5	221

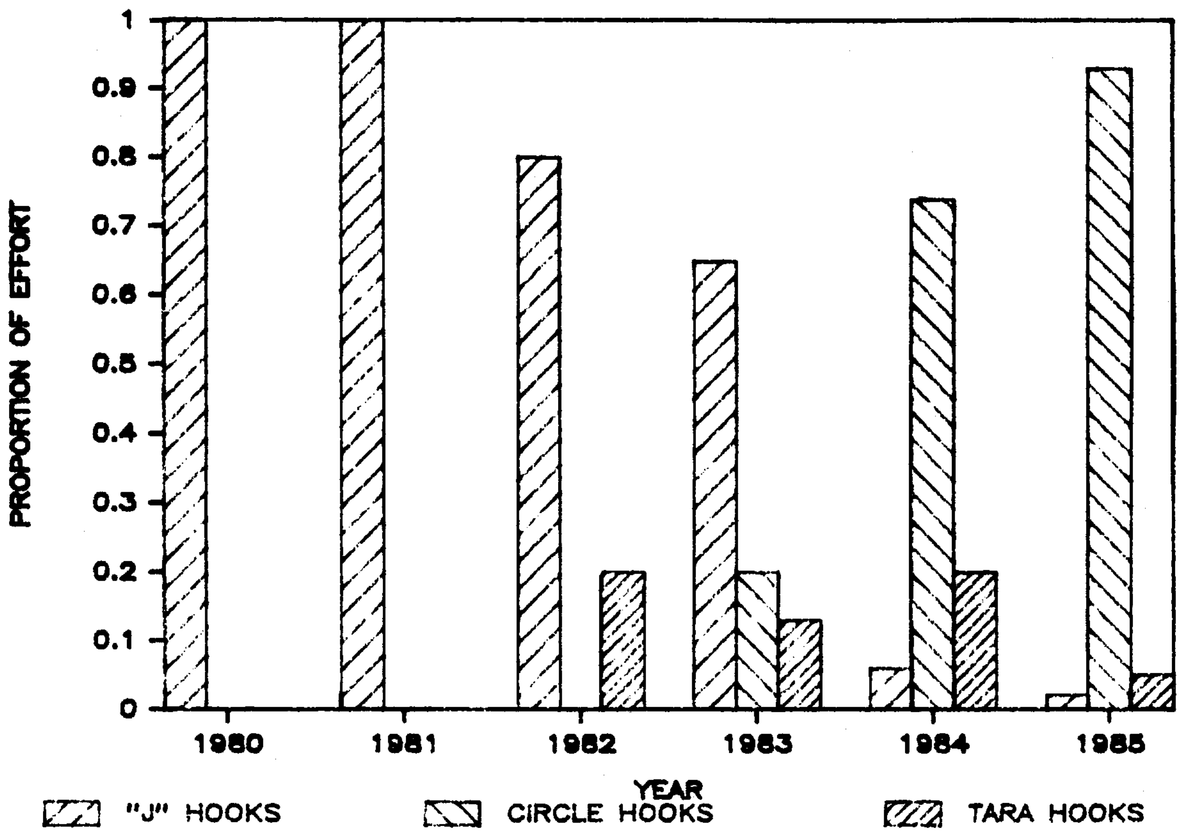


Figure 5. Proportion of effort by hook type from interviews conducted by Alaska Department of Fish and Game from the eastern Gulf of Alaska sablefish fisheries, 1980-1985.

Table 5. Comparison of CPUE using "J" and circle hooks in the Northern Southeast Inside Management Area and Outside Management Area sablefish fisheries, 1983.

AREA	"J" HOOK CPUE[1]	"J" HOOK (N)	CIRCLE HOOK CPUE[1]	CIRCLE HOOK (N)	PERCENT DIFFERENCE	AVERAGE CPUE[1]	ADJUST CPUE[2]
NSEO	0.16	(54)	0.31	(14)	94%	0.19	0.29
NSEI	0.26	(30)	0.50	(12)	91%	0.31	0.46

[1]CPUE expressed in kilograms dressed weight landed per hook fished.
[2]CPUE adjusted to reflect value if all vessels had fished circle hooks.

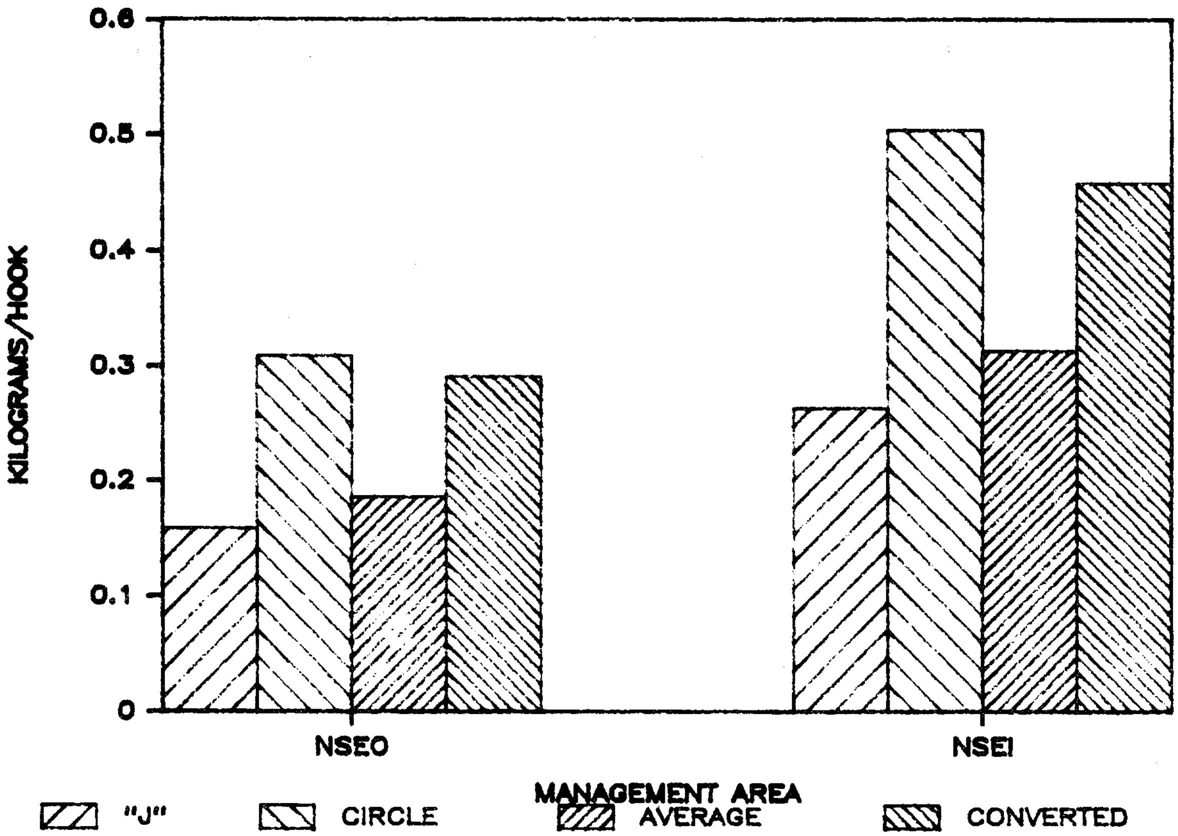


Figure 6. CPUE expressed in kilograms per hook from the 1983 Northern Southeast Inside (NSEI) Management Area and Outside (NSEO) Management Area sablefish fisheries showing values for "J" hooks and circle hooks, average CPUE for all hook types, and the expected CPUE if only circle hooks were used.

Table 6. The difference in CPUE of vessels which converted to circle hooks in 1983 compared to the remainder of the fleet using like gear in 1982 and 1984 in the Northern Southeast Outside and Inside Management Areas.

	YEAR					
	1982			1984		
MGMT AREA	CORE FLEET[1]	TOTAL FLEET[2]	PERCENT DIFFERENCE	CORE FLEET[1]	TOTAL FLEET[2]	PERCENT DIFFERENCE
NSEO	-INSUFFICIENT DATA-			.30 kg/h	.25 kg/h	22%
NSEI	.30 kg/h	.22 kg/h	29%	.42 kg/h	.34 kg/h	26%

[1]Vessels which converted to circle hooks in 1983
[2]Total fleet which fished "J" hooks in 1982 and circle hooks in 1984.

The fish ticket database was examined to determine trends in the percentage of large fish (over 2.25 kg dressed weight) landed from each management area. The general trend was for a decline in average size in each of the management areas over time (Table 7). The highest percentage of large fish consistently came from the NSEI management area. The declining trend in the percentage of large fish tapered off in the NSEI area between 1984 and 1985 while the percentage of large fish landed from other areas continued to decline (Figure 7.)

Discussion

Sablefish landings and CPUE (kg/hook) increased substantially in all management areas between 1980 and 1985. However, with the exception of the NSEI and NSEO management areas, the observed increase in CPUE should not be considered conclusive due to the small sample size. During the same period the percentage of large fish (2.25 kg dressed weight or larger) decreased in all management areas. The interpretation of these results would be incomplete without a discussion of the changes in markets, changes in gear, and biological factors that influence trends in fish size and catchability.

In 1982 and 1983 the market demand changed from predominantly "western cut" sablefish to "eastern cut" fish. For the eastern cut fish the pectoral girdle is removed along with the head while it is retained on the western cut fish. The difference in weight between the two cuts, as determined by samples from research cruises, is approximately 5 to 7%. Also, the market began accepting smaller fish in 1984. Prior to 1984, fish under three pounds (1.35 kg) dressed weight were rarely landed; whereas fish size categories down to two pounds (0.9 kg) were frequently recorded on fishtickets in 1984 and 1985. These changes are important to note because market demand can significantly affect both CPUE and percentage of large fish landed.

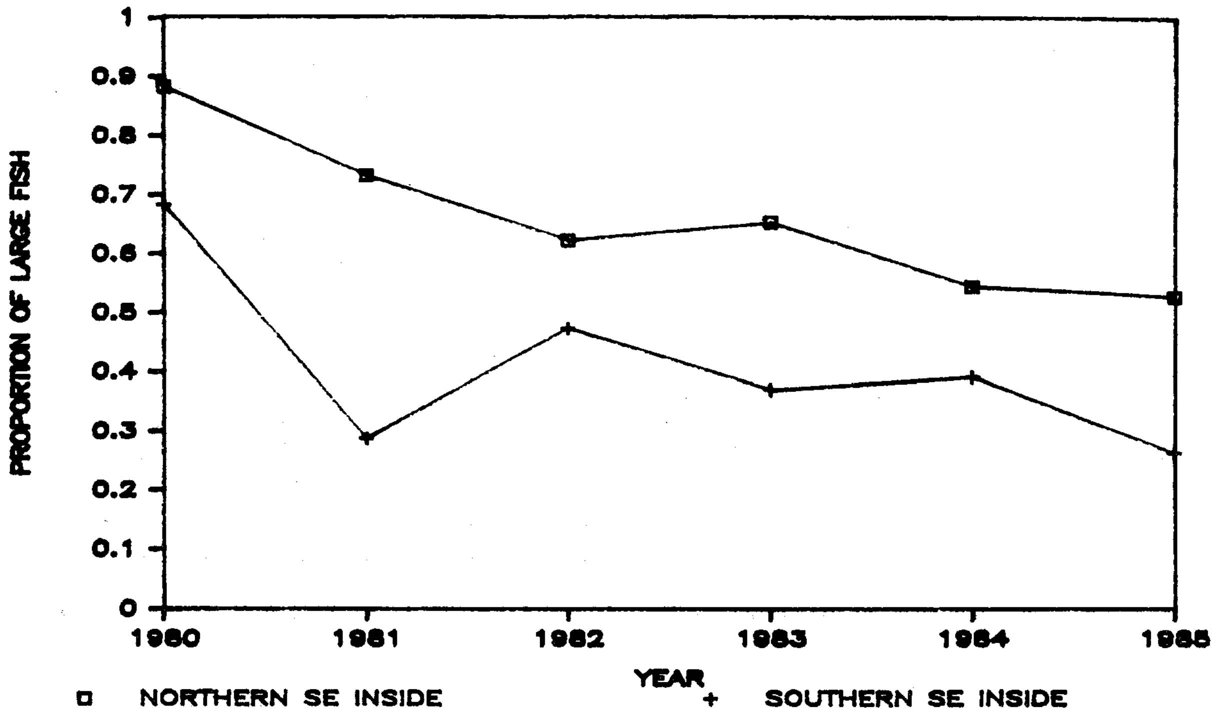
A reduction in the acceptable market size will undoubtedly result in an observed reduction in the percentage of fish over five pounds (2.25 kg) dressed weight compared to the total landed weight. Likewise, the conversion from western to eastern cut effects the percentage of large fish landed since additional weight is lost in the eastern cut placing more fish in the lower size categories. Conversely, the market acceptability of smaller fish will tend to increase the observed CPUE from the fishery, which is based on the landed weight per hook and does not take into account the discard at sea. Fish that were discarded prior to 1984 became part of the landed catch during the last two years of the study and, thus, were included in the CPUE calculation for those years.

The introduction of circle hooks to the fishery beginning in 1983 undoubtedly had an impact on the observed CPUE increase between 1982 and 1984. However, by 1984 most of the fleet had converted to circle hooks. The increase in CPUE between 1984 and 1985 cannot be attributed to gear changes. Experiments comparing hook types and spacing need to be conducted in order to

Table 7. Percentage of large sablefish (over 2.27 kg dressed weight) by management area from the eastern Gulf of Alaska sablefish fisheries, 1980-1985.

YEAR	MANAGEMENT AREA				
	NSEI	OUTSIDE[1]	SSEI	EYAK	NYAK
1980	88.3%	68.4%	68.5%	64.9%	0.0%
1981	73.3%	64.0%	28.8%	75.3%	0.0%
1982	62.3%	61.6%	47.4%	63.4%	63.0%
1983	65.2%	55.2%	37.0%	60.7%	53.6%
1984	54.4%	50.6%	39.2%	55.9%	57.3%
1985	52.7%	42.5%	26.3%	47.3%	38.8%

[1] The "outside" area includes the NSEO, SSEO, and CSEO management areas.



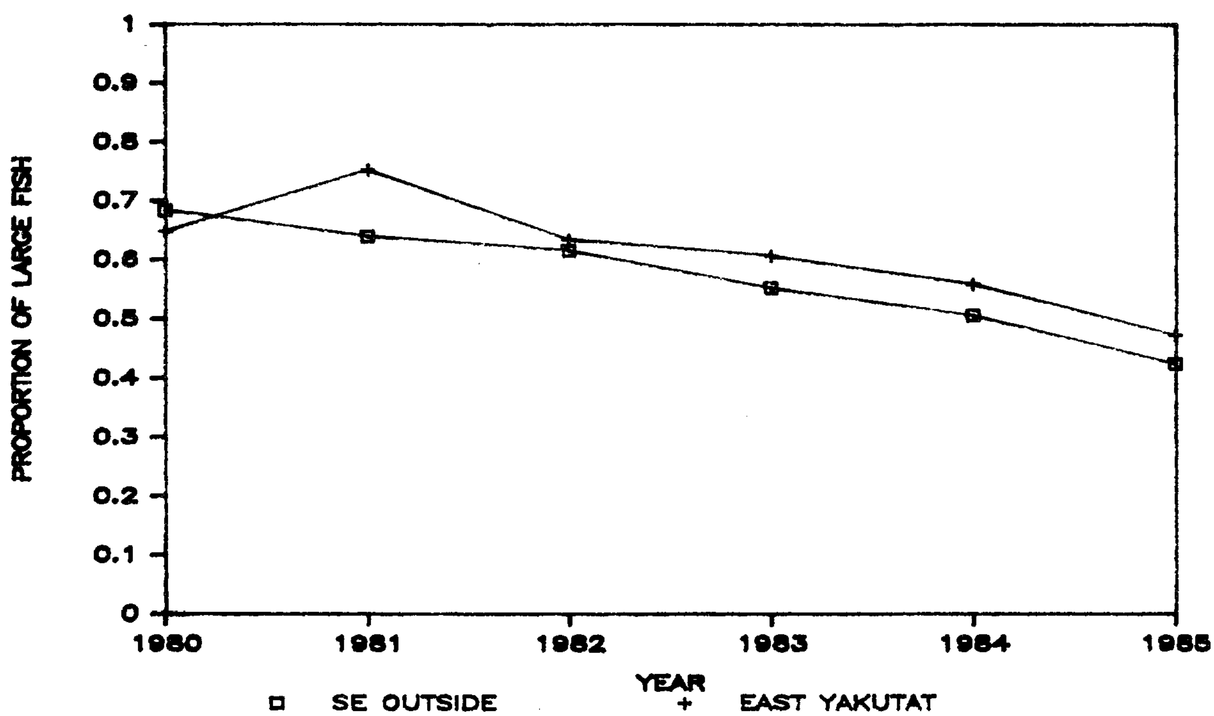


Figure 7. Proportion of sablefish over 5 pounds (2.27 kg) dressed weight from four eastern Gulf of Alaska management areas, 1980-1985.

obtain the information necessary to standardize CPUE over time. Without this information CPUE results over the entire study period can be considered speculative.

A strong 1977 year class of sablefish has been reported in the eastern Gulf of Alaska by a number of authors (Balsiger and Alton 1981, Sasaki 1982, McFarlane and Beamish 1983, Bracken 1983, Funk and Bracken 1984, and Fujioka 1986). During 1980 and 1981 the 1977 year class of sablefish began recruiting to the deep-water fishery. It is conceivable that the presence of this cohort in the fishery could have actually resulted in a decrease in the calculated CPUE of landed fish during those years. The fish in this year class did not begin to reach the marketable size category (at that time) in any significant number prior to 1982 and were generally discarded at sea. Assuming that some gear saturation occurred because of the large influx of small fish, the observed CPUE of landed fish would have been reduced. As the fish reached the marketable size category beginning in 1982, a notable increase in CPUE could have been expected. Gear saturation and discard prior to 1982 and increasing retention of this cohort beginning in 1982 could account for at least some of the observed increase in the CPUE within the sablefish fisheries between 1982 and 1984.

Two independent indexing studies, the NMFS pot indexing study and the joint Japan-U.S. longline indexing study have been conducted offshore of Southeastern Alaska since 1978. The results of the joint survey, most recently reported by Sasaki (1985) and Fujioka (1986), indicate a downward trend in relative population weight (RPW) in the Southeastern area between 1981 and 1983, with a tapering off of the downward trend between 1983 and 1984, and a notable increase in 1985 (Figure 8).

The sharp increase in RPW observed in the Southeastern area in 1981 is probably the result of recruitment of the 1977 year class. Some researchers have shown evidence of substantial westward movement of juvenile sablefish out of the eastern Gulf to the Central and Western Gulf (Bracken 1982 and 1983; Beamish and McFarlane 1983). This could at least partially explain the sharp increase in RPW in 1981 followed by a gradual decline through 1984. Further evidence of a westward population shift is presented by the fact that the RPW increased substantially in more westward areas of the Gulf beginning a year later in 1982 as the RPW continued to decline in the Southeastern area (Sasaki 1985).

Clausen (1986) reported on results of the NMFS pot indexing study. The relative abundance of sablefish remained nearly constant in the two northern pot indexing sites, Cape Ommaney and Cape Cross, between 1981 and 1984 for medium (fork length 57-66 cm) and large (fork length > 66 cm) fish. There was a noticable increase for both size categories in 1985.

Bracken (1982) postulated that the westward movement of a substantial portion of the juvenile fish across the Gulf would be followed by a compensatory movement of fish back into the eastern Gulf after the fish reached maturity. This could at least partially explain the increase in RPW

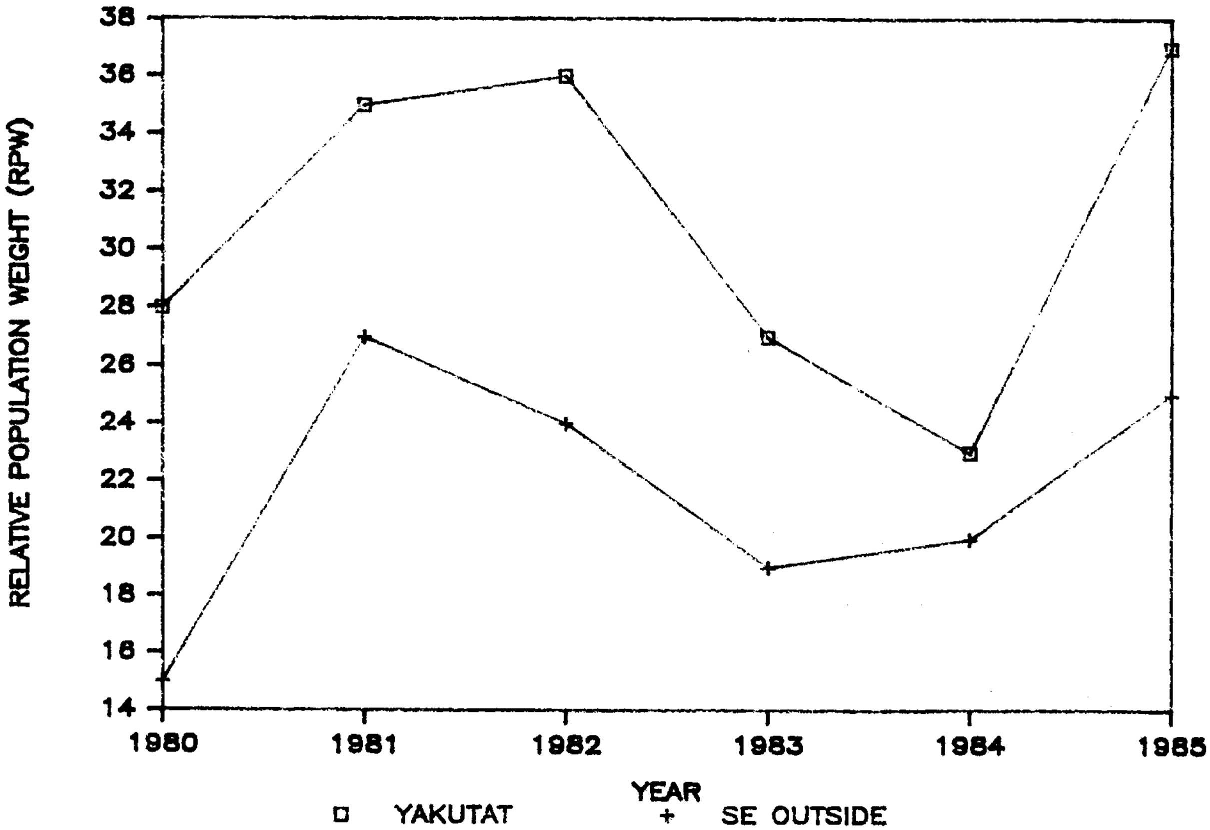


Figure 8. Relative population weight (RPW) from the joint U.S.-Japan sablefish longline survey, 1980-1985 (Fujioka 1986).

noted in 1985 in the joint longline survey for the eastern Gulf and the increase in abundance of medium and large fish observed in the 1985 pot indexing survey in the Southeastern area.

It is important to note that the near constant value of relative sablefish abundance observed in the pot indexing survey and declining value of relative sablefish abundance in the longline survey through 1984 contradict the constant increase in fishery CPUE observed in the NSEO area between 1982 and 1985. This information suggests that factors other than abundance influence fishery performance, and that fisheries CPUE by itself may not be a valid indicator of sablefish stock abundance.

ROCKFISH FISHERIES MONITORING

The rockfish setline fisheries represent the second most important groundfish fishery in terms of catch and value within the eastern Gulf of Alaska. Domestic landings from the eastern Gulf have increased from less than 160 t in 1980 to nearly 1,500 t, worth approximately $1.6 million, in 1985. Because of the rapid increase in harvest and the resulting short time series of data, rockfish management is considered to be the greatest challenge facing the ADF&G groundfish staff at this time. The rockfish group is very complex with nearly forty species categorized into three assemblages throughout the Gulf (Bracken and Ito 1986). Many of these species are extremely long-lived (Leaman and Beamish 1984). Also, the eastern Gulf fishery occurs in both state waters and the EEZ thus requiring cooperative management between the State and Federal governments.

The ADF&G recognized the potential of this resource as the fishery began to expand in the late 1970's. Beginning in 1980 the ADF&G contracted with Alaska Coastal Research to conduct baseline studies in the nearshore waters along the outer coast. Results are published in Rosenthal et al. (1981 and 1982).

The ADF&G groundfish staff began sampling commercial rockfish landings in Sitka in the fall of 1982 with the employment of a port sampler primarily for that purpose. Her work has been supplemented periodically with seasonal samplers during peak periods of fishing effort. Considerable sampling effort also occurred in the Ketchikan area during the fall of 1984 and the winter and spring of 1985. A total of 373 interviews and 220 biological samples were obtained from rockfish landings between 1982 and 1985 (Table 8). Results of sampling in Petersburg from 1983 through 985 are not included in this report because of the relatively low level of fishing effort and the small sample size obtained. This section of the report presents the results of rockfish port sampling in Sitka and Ketchikan from 1982 through 1985.

Methods

The rockfish port sampling program is divided into two primary tasks: skipper interviews (including logbook distribution and retrieval) and biological sampling of the landed catch.

Table 8. Number of landings sampled and interviews taken by port of landings in the Southeastern Alaska rockfish fisheries, 1982-1985.

YEAR	SITKA		KETCHIKAN		PETERSBURG		TOTAL	
	INTERVIEWS	SAMPLES	INTERVIEW	SAMPLES	INTERVIEW	SAMPLES	INTERVIEW	SAMPLES
1982	30	38	--	--	--	--	30	38
1983	37	34	--	--	3	2	40	36
1984	99	70	31	34	14	12	144	116
1985	65	42	90	55	4	3	159	100
TOTAL:	231	114	121	89	21	17	373	220

Skipper interviews are conducted for as many deliveries as possible. Information is recorded when available on area set, distance fished from shore, gear type, days fished, depths fished, target species, number of hooks fished, hook type, hook size and spacing, number of target fish caught and discarded, and incidental catch. Because the number of target species caught is rarely available due to the mixed species nature of the fishery, CPUE (kg/hook) was calculated for all landed fish by combining effort data from the interview and weight data from the fish ticket.

The landed catch is also sampled for biological data. Results are recorded on a specialized sampling form (Appendix 3). Species composition, fork length, weight, sex and stage of maturity data are recorded from an unbiased sample of the catch. The size of the sample taken depends on the unloading procedure and work space available (this varies considerably between processors and vessels).

The objectives of the biological sampling are as follows:

1. determine the species compostion of the landed catch;

2. determine basic biological parameters of the landed catch such as length, weight, and age by species;

3. monitor changes in size composition by area over time; and

4. monitor gonad conditions to identify spawning cycles.

Whenever possible, otoliths are taken from specimens for age and growth studies. Ovary samples have been collected from yelloweye rockfish *(S. ruberrimus)* to determine fecundity. Current biological investigations by ADF&G include determining the relationship between age and fecundity, age structure of the landed catch, growth, and movements of fish. These studies are on-going and data analysis is not yet complete. An informational leaflet on the spawning cycles of southeast rockfish is currently in preparation for publication.

Rockfish interview and sampling data were entered into a microcomputer in Sitka. Analyses are completed using the microcomputer and the State of Alaska IBM mainframe computer in Juneau.

Results

Eleven species were landed in the Sitka area rockfish fishery during 1982, 15 in 1983, 20 in 1984, and 23 in 1985 (Table 9). Changes in species composition of the landed catch during that time period were influenced by increases in market flexibility as well as changes in fishing ground. Yelloweye rockfish remain the primary commercial species with quillback rockfish second in importance. As new markets developed other species have become important as well. Small fishes such as china, rosethorn, and tiger are important in the U. S. oriental market. Also, in 1985 markets for the formerly undesirable pelagic species (dusky, black, yellowtail, silvergray) were developed.

Table 9. Species composition of rockfish *(Sebastes* spp.*)* port samples from landings in Sitka, 1982-1985.

Scientific Name	Common Name	1982 N	1982 PERCENT	1983 N	1983 PERCENT	1984 N	1984 PERCENT	1985 N	1985 PERCENT
S. aleutianus	rougheye	0	0.00	28	1.32	58	0.98	13	0.56
S. alutus	pop							3	
S. babcocki	red banded	0	0.00	14	0.66	26	0.44	18	0.77
S. borealis	shortraker	0	0.00	0	0.00	0	0.00	39	1.67
S. brevispinis	silvergray	31	1.14	70	3.29	232	3.93	62	2.66
S. caurinus	copper	0	0.00	7	0.33	10	0.17	6	0.26
S. ciliatus	dusky	19	0.70	43	2.02	121	2.05	31	1.33
S. crameri	darkblotch	0	0.00	0	0.00	1	0.02	1	0.04
S. elongatus	greenstripe	4	0.15	0	0.00	5	0.08	3	0.13
S. flavidus	yellowtail	37	1.36	25	1.18	54	0.91	15	0.64
S. helvomaculatus	rosethorn	84	3.08	126	5.93	379	6.42	242	10.38
S. maliger	quillback	798	29.23	356	16.75	945	16.01	341	14.63
S. melanops	black	53	1.94	62	2.92	236	4.00	85	3.65
S. mystinus	blue							3	
S. nebulosus	china	101	3.70	39	1.84	89	1.51	41	1.76
S. nigrocinctus	tiger	56	2.05	24	1.13	110	1.86	46	1.97
S. paucispinis	bocaccio	2	0.07	1	0.05	2	0.03	2	0.09
S. pinniger	canary	92	3.37	118	5.55	390	6.61	181	7.76
S. proriger	redstripe	21	0.77	3	0.14	28	0.47	2	0.09
S. reedi	yellowmouth							5	
S. ruberrimus	yelloweye	1432	52.45	1209	56.89	3208	54.35	1183	50.75
S. variegatus	harlequin	0	0.00	0	0.00	5	0.08	5	0.21
S. zacentrus	sharpchin	0	0.00	0	0.00	4	0.07	4	0.17
TOTAL		2730		2125		5903		2331	

In most cases, all of these species were caught prior to 1985 but discarded at sea because of a lack of market demand. One exception is the occurrence of deepwater species, in particular rougheye *(S. aleutianus)*, shortraker *(S. borealis)*, and redbanded *(S. babcocki)*. These species first occured as a major component of the rockfish harvest in the 1985 landings. Once markets accepted these species as the more highly desired "red rockfish", market category, vessels moved to new grounds in deeper water to target on them. This shift to deeper areas is believed to have alleviated some of the fishing pressure in the more heavily fished nearshore areas.

Yelloweye and quillback *(S. maliger)* also dominated the Ketchikan area rockfish landings (Table 10). Numbers of fish landed appear to be about equal for these two species, although yelloweye is predominate in terms of total weight landed because of their larger size. Fourteen rockfish species were landed in 1984, and 21 species were landed in Ketchikan during 1985. Many of these species accounted for only a few occurrences.

Size Distribution:

Length distribution statistics for Sitka samples are listed in Table 11. Five species of rockfish, quillback, yelloweye, black *(S. melanops)*, canary *(S. pinniger)*, and rosethorn *(S. helvomaculatus)*, were examined for differences in length frequency distribution between years. The average size of rosethorn and canary rockfish varied between years with larger average sizes occuring in 1985 in each case. The frequency of occurrence for both of these species greatly increased in the landed catch in 1985, thus the 1985 data is presumed to better represent the actual length distribution of the expoitable population. No difference in length were observed between sexes for any of the species tested.

Length distribution statistics for Ketchikan samples are listed in Table 12. All the tested species appeared to have different length frequency distribution between Ketchikan and Sitka with a consistently larger mean size in the Ketchikan landings than in the Sitka landings.

Length/Weight:

The length/weight relationships for two species, yelloweye and quillback were examined from the Sitka landings. An obvious difference in the length/weight relationship was noted for females during the spawning season when compared to resting females for the two species tested (Table 13). Ovaries of adult fish account for a much larger proportion of total body weight during the spawning season than at other stages of development. More data is needed to determine the length/weight relationships for other species.

Sex Ratios:

Differences from 50:50 sex ratios were tested using the normal approximation of the binomial test. Of the five rockfish species tested in the Ketchikan samples only one species, rosethorn, exhibited a 50:50 sex ratio (Table 14). However, in the Sitka samples two species, rosethorn and quillback, both displayed equal sex ratios (Table 15).

Table 10. Species composition of rockfish *(Sebastes* spp.*)* port samples from landings in Ketchikan, 1984-1985.

Scientific Name	Common Name	YEAR 1984 N	1984 PERCENT	1985 N	1985 PERCENT
S. aleutianus	rougheye	0	0.00	161	2.23
S. babcocki	red banded	3	0.09	252	3.50
S. borealis	shortraker	0	0.00	41	0.57
S. brevispinis	silvergray	65	2.04	222	3.08
S. caurinus	copper		0.00	53	0.74
S. ciliatus	dusky	12	0.38	45	0.62
S. crameri	darkblotch		0.00	1	0.01
S. elongatus	greenstripe	1	0.03	18	0.25
S. flavidus	yellowtail	26	0.82	24	0.33
S. helvomaculatus	rosethorn	4	0.13	65	0.90
S. maliger	quillback	1100	34.49	3063	42.48
S. melanops	black	90	2.82	81	1.12
S. nebulosus	china	15	0.47	80	1.11
S. nigrocinctus	tiger	6	0.19	98	1.36
S. paucispinis	bocaccio	1	0.03	22	0.31
S. pinniger	canary	250	7.84	176	2.44
S. proriger	redstripe	2	0.06	13	0.18
S. reedi	yellowmouth		0.00	1	0.01
S. ruberrimus	yelloweye	1614	50.61	2779	38.54
S. zacentrus	sharpchin		0.00	15	0.21
TOTAL		3189		7210	

Table 11. Length frequency statistics from rockfish *(Sebastes* spp.*)* port samples taken in Sitka, 1982-1985.

	YEAR															
	1982				1983				1984				1985			
SPECIES	COUNT	MAX	MIN	AVG	COUNT	MAX	MIN	AVG	COUNT	MAX	MIN	AVG	COUNT	MAX	MIN	AVG
S. melanops	53	56	34	47	59	63	38	50	236	68	35	49	80	60	30	49
S. ruberrimus	1432	76	22	50	1129	77	24	52	2957	78	21	51	1100	76	25	51
S. pinniger	92	58	29	47	115	62	38	48	390	60	36	48	153	60	39	51
S. maliger	798	58	24	36	350	47	25	37	945	48	22	34	299	49	23	37
S. nigrocinctus	56	46	26	37	24	46	33	39	110	51	26	38	39	46	25	28
S. nebulosus	101	43	26	32	38	41	27	33	90	43	24	34	41	43	27	34
S. helvomaculatus					123	35	22	28	379	39	22	30	206	39	23	30
S. aleutianus													13	56	29	38
S. borealis																
S. babcocki	40	51	24	38	13	52	31	45	26	51	25	50	39	57	28	46
S. ciliatus	19	43	27	35	41	47	33	39	121	48	27	41	31	48	33	42
S. flavidus	37	58	30	41	24	54	33	44	54	53	30	42	14	49	68	45
S. entomelas					12	52	38	43								
S. brevispinis	31	70	30	47	66	69	30	48	222	65	25	45	52	69	34	43
S. proriger	21	52	22	33	3	34	30	31	28	41	30	34	5	41	32	35
S. caurinus													6	40	29	33
S. elongatus													3	32	32	32

Table 12. Length frequency statistics from rockfish *(Sebastes* spp.*)* port samples taken in Ketchikan, 1984-1985.

	YEAR							
	1984				1985			
SPECIES	COUNT	MAX	MIN	AVG	COUNT	MAX	MIN	AVG
S. melanops	90	58	39	51	81	61	31	51
S. ruberrimus	1614	77	20	56	2779	80	24	54
S. pinniger	250	69	27	51	176	58	35	47
S. maliger	1100	47	27	38	3063	54	34	38
S. nigrocinctus	6	40	32	37	98	46	28	40
S. nebulosus	15	41	31	35	80	43	27	35
S. helvomaculatus	4	34	31	32	65	38	27	32
S. aleutianus					161	85	27	38
S. borealis					41	95	42	64
S. babcocki	3	41	108	36	252	56	23	41
S. ciliatus	12	49	32	42	45	48	34	39
S. flavidus	26	58	34	46	24	56	39	46
S. entomelas								
S. brevispinis	65	64	32	46	222	71	30	48
S. proriger	2	40	38	39	13	44	32	37
S. caurinus					53	43	26	35
S. elongatus	1			31	18	36	27	32
S. zacentrus					15	37	28	33
S. reedi					1			37

Table 13. Length/weight relationship from the equation $W=aL^b$ by sex for yelloweye *(S. ruberrimus)* and quillback *(S. maliger)* rockfish from commercial landings in Sitka, 1983-1984.

Species	sex	a	b	N
S. ruberrimus	male	.000023827	2.932887377	169
	female	.000015348	3.056191748	108
	ripe female	.000004348	3.396210000	63
S. maliger	male	.000165805	2.418765352	69
	female	.000036458	2.828220293	25
	ripe female	.000007426	3.281341578	19

Table 14. Normal approximations of the binomial test, differences from 50:50 sex ratios for rockfish *(Sebastes* spp.*)* samples taken in Ketchikan, 1985.

SPECIES	MALES	FEMALES	T STAT	Z STAT
S. ruberrimus	1276	1482	2758	3.914457
S. melanops	46	37	83	1.231139
S. maliger	1976	1616	3592	6.694282
S. pinniger	111	65	176	4.796349
S. helvomaculatus	30	32	62	0.123031

Table 15. Normal approximations of the binomial test, differences from 50:50 sex ratios for rockfish (*Sebastes* spp.) samples taken in Sitka, 1985.

SPECIES	MALES	FEMALES	T STAT	Z STAT
S. ruberrimus	501	621	1122	3.573129
S. melanops	54	31	85	2.704039
S. maliger	169	23	45	0
S. pinniger	133	48	181	7.240379
S. helvomaculatus	111	128	239	1.0377582

Catch per Unit Effort:

Rockfish CPUE (kg/hook) was determined from skipper interviews and logbooks. The Sitka data exhibits a gradual increase in CPUE over time (Figure 9). However, at least some of this observed increase is artificial. During 1982 most of the hooks deployed in the fishery were "J" hooks (Figure 3). By 1984, however, most vessel operators had converted to the more efficient circle hooks. Therefore, only the CPUE values between 1984 and 1985 can be directly compared without adjusting the data to reflect the increased efficiency of circle hooks in the later years.

In contrast to the Sitka data, the Ketchikan CPUE data shows a sharp decline in CPUE from 1984 to 1985 (Figure 9). It is unclear at this time whether the observed decline in CPUE in the Ketchikan area is the result of declining stocks or the result of other factors. Additional sampling effort is needed to better understand the dynamics of the fishery.

Distribution of the Fleet:

Interpretation of CPUE data is difficult for many reasons, one of which is fleet mobility. However, changes in distance fished from port are considered to be an indication skipper's to maintain a viable fishery on a particular fishing grounds over time. The distribution of the rockfish fleet was monitored to determine how closely they fished to the port of landing from 1981 through 1984. In 1981 most of the fishing effort in the Sitka area was directed at the grounds adjacent to Sitka Sound. In 1982 there was a shift outward from these grounds to encompass grounds to the south of Sitka. By 1983 very little effort was expended on the original grounds, and effort extended into the SSEO and NSEI management areas as far as 130 to 160 km away from Sitka. This trend continued into 1984 (Figure 10).

The expansion or shift to new grounds is related to the increased number of vessels competing on the grounds and the subsequent declines in local stocks because of this increased effort. According to some fishermen, it was no longer possible to maintain a viable fishery on the same grounds. In the early years of the fishery the few participating fishermen practiced a sort of self imposed grounds rotation, fishing an area for a trip and then letting it rest until some later time. However, as the effort increased there were no unfished grounds to rotate back to, and the effort shifted to less fished areas progressively further from the port of landing. This is particularly significant since the market dictates that the fish must be no more than four days old when landed. This means that the fishermen are spending a greater percentage of their fishing trip traveling to and from port. During 1985 there was a shift back into the traditional fishing grounds, primarily by new entrants into the fishery. However, many Sitka vessels were still fishing further from port; and the areas of exploitation began to overlap as the same fishing grounds were utilized by vessels from Petersburg, Wrangell, and Ketchikan.

Age Distribution:

The application of a new method for estimating age suggests that rockfish may be older than previosly thought. Prior to 1982 rockfish were generally

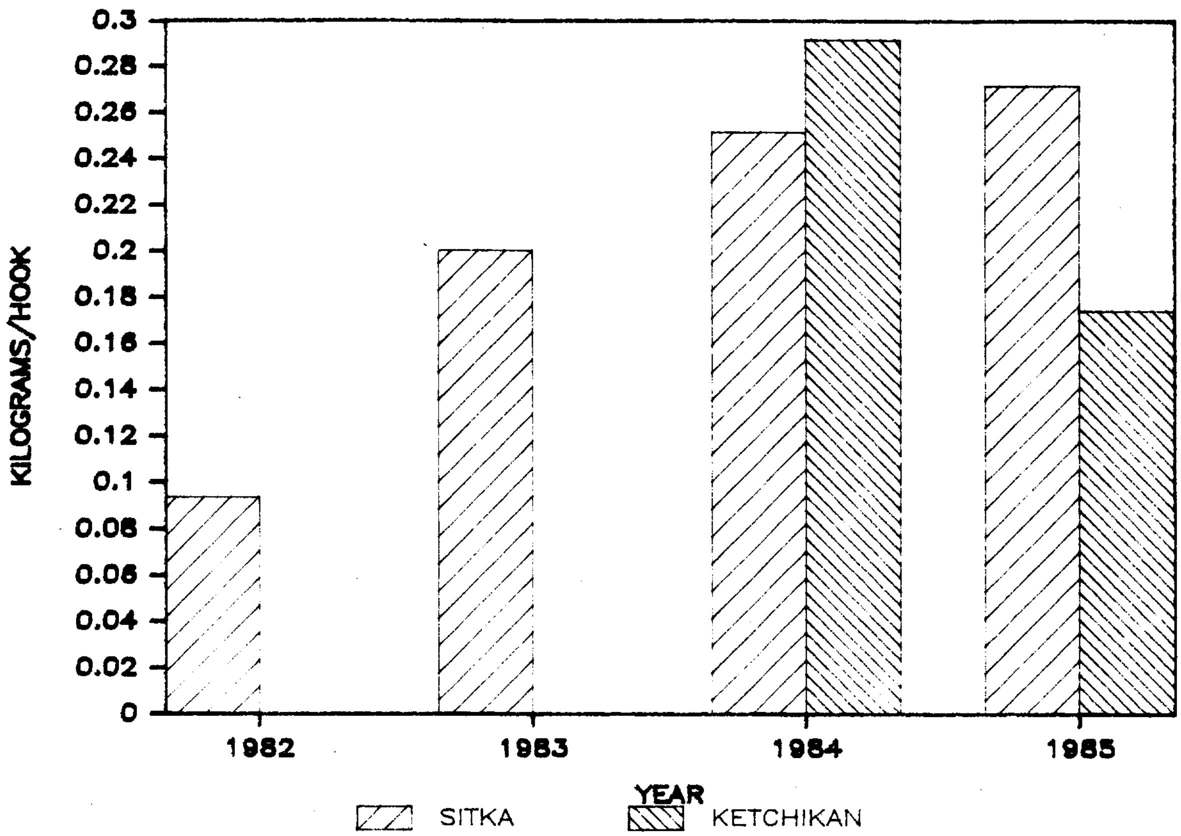


Figure 9. Catch per unit of effort (CPUE) in kilograms per hook in the two major Southeastern Alaska rockfish fisheries, 1982-1984.

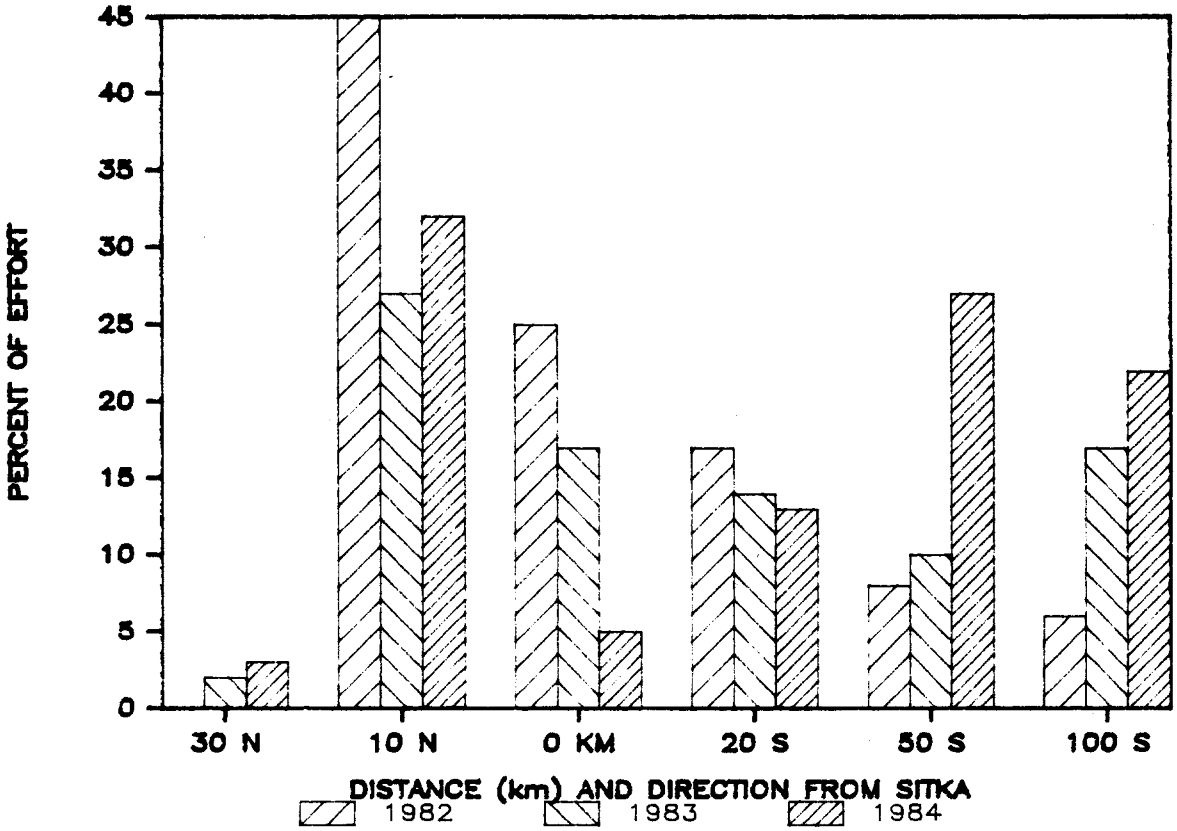


Figure 10. Distribution of the Sitka area rockfish fleet shown in percent of effort by fishing grounds and distance (km) from the home port, 1982-1984.

aged using surface readings of otoliths. Since that time, however, the break-and-burn technique [developed by Chilton and Beamish (1982)] has been used extensively for long lived species and yields higher estimates of age for several species of rockfish, particularly for older specimens.

The application of different aging techniques makes the interpretation of the earlier age data (1981-1982) difficult. Samples of yelloweye rockfish taken in the Sitka area in 1981 were aged using the surface reading method. The mean age estimate was 20 years with a range of 7 to 63 years (Rosenthal et al. 1982). The ADF&G age reading lab in Kodiak, on the other hand, used the break-and-burn technique to age a sample of yelloweye otoliths from the commercial fisheries taken in the same area in 1984. Mean age of this sample was 44 years with a range of 15 to 105 years. Differences in age determination and sampling methods make direct comparison of these data invalid.

Age data from 1984 also showed differences in age composition by area. Fish sampled in the Ketchikan area during 1984 had a more normal age distribution than the Sitka sample and a much higher mean age of 60 years. Age distributions of yelloweye rockfish sampled during 1984 and aged using the break-and-burn technique are shown in Figure 11. These data should be considered preliminary, and differences in markets and possibly differences in sampling methods between ports must be considered before any conclusions can be made. A more detailed description of yelloweye age and growth is presented in O'Connell and Funk (in press).

Discussion

Results from rockfish port sampling programs highlight the problems associated with relying solely on fishery statistics for monitoring stock changes. Although biological data collected from port sampling is valuable as a database for future comparisons, many factors make analysis of these data difficult. Rockfish assemblages change over depth as do size and age distributions within species. Many trips occur over broad depth ranges. Sets may be made in depths from 20 to 120 fathoms within the same trip if the processor demands several species and/or will accept a range of sizes within a species. Market demands play a large role in determining what is landed both in terms of species composition and size distribution within a species. Weather, tides, and skipper experience also affect where and how a vessel will fish. Since habitat and depth fished greatly influence both species and size composition, area fished affects both the type and number of species landed and the CPUE. Small changes in fishing location may cause cause significant changes in catch within and between trips.

Comparison of sampling results between Sitka and Ketchikan are difficult for many of the same reasons. There are apparently geographic differences in species composition between the two areas as the Ketchikan area appears to be the northern limit of some species. Market again plays a large role in area differences. Although mean size of several species is generally larger in the Ketchikan catch, at least some of this can be explained by market. Many of the smaller fish are still discarded in the Ketchikan fishery. Conversely, some of these size differences may be real as the Ketchikan stock has not sustained as long or as intensive a fishery. Changes in size

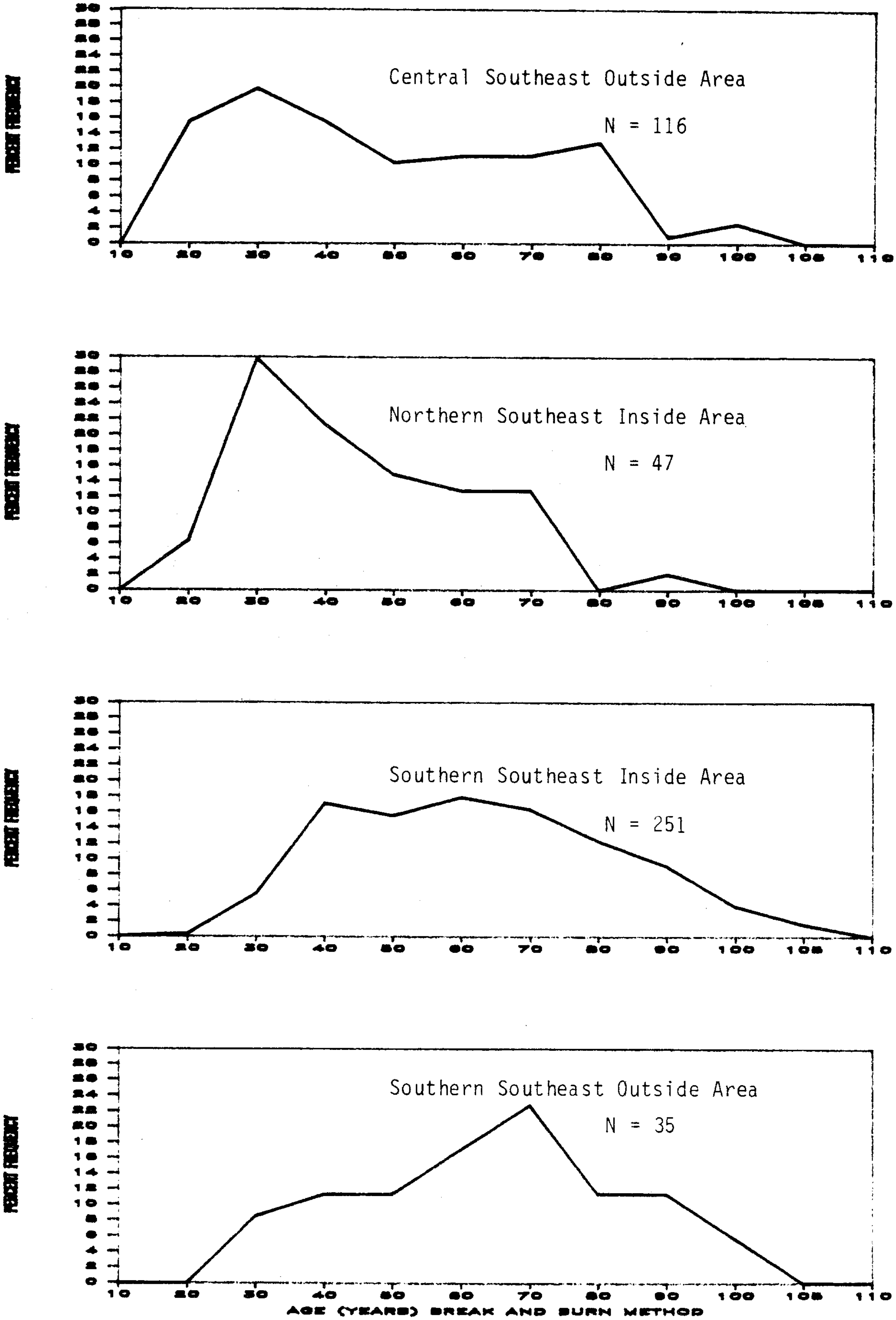


Figure 11. Age distribution of yelloweye rockfish sampled from the shore-based commercial catch in four areas of the eastern Gulf of Alaska.

distribution within the Ketchikan fishery should be closely monitored to see what effects continued fishing pressure has on these stocks.

Often CPUE is used as an an indicator of stock abundance and condition. However, because of the high mobility of the fleet, differences in species composition by depth, and changes in market demands, commercial CPUE does not appear to be a good indicator of stock condition for the rockfish setline fishery.

Gear changed from the exclusive use of "J" hooks in 1982 to virtually 100% use of circle hooks by 1984. Efficiency of circle hooks has not been determined for this fishery but has been determined to be as much as 200% greater than "J" hooks in the halibut fishery (Williams and McCaughran, 1985) and, as discussed earlier, fom 62% to 94% higher for sablefish fisheries. Because of fleet movement, local reductions in CPUE may be marked. While the local fleet was small, fishermen rotated between fishing grounds leaving grounds to rest for long periods without fishing pressure. This practice is no longer possible as more vessels have entered the fishery and most productive areas are fished continuously.

As stated previously, rockfish (with the exception of quillbacks) exhibit a positive correlation of increasing size with depth; therefore, the depth fished influences CPUE, with lower CPUE generally encountered in shallower depths.

Market conditions also influence CPUE. Market conditions, which change substantially throughout a season, dictate the desired target species and size of fish. These shifts result in dramatic CPUE fluctuations. For example, if the current market demand is for small yelloweye and quillback or conversely for large yelloweye, a significant change in observed CPUE will result. Prior to 1983 very few skippers kept all rockfish caught. However, beginning in 1983 there has been increased pressure on processors by fishermen to buy "all or nothing". An observed increase in CPUE during 1983 and 1984 may merely reflect an increase in the landed catch rather than an increase in total catch, and in fact because of the way CPUE is calculated, a decline in abundance of some species could be easily masked by increased marketability of more species. Efficiency is improving as new fishing methods and better electronic equipment are introduced to the rockfish fishery. Technological improvement, in addition to the increased experience of many skippers, is certain to affect CPUE.

The final problem with using fishery generated CPUE may be in the accuracy of the data. As a rule, rockfish fishermen use snap-on gear and find it difficult to keep an accurate count of the number of hooks deployed. Most numbers furnished are an estimate of the actual effort. Without onboard sampling there is no way to determine the extent or consistency of errors within the reported effort.

Because of the problems in calculating and interpreting CPUE data collected from the fishery, it is likely that by the time a statistically significant decline in CPUE is observed utilizing only fisheries data, stocks will have declined beyond the point of short term recovery (Francis 1984).

pressure on rockfish stocks in other areas was reviewed. This information, combined with data suggesting a decline in CPUE in portions of the CSEO area was a determining factor in the decision to set a guideline harvest limit for nearshore rockfish in this area. A quota level was set jointly by the Alaska Board of Fisheries and the NPFMC at the 1984 peak harvest of 600 mt in order to slow growth of the fishery, to allow staff biologists additional time to determine the sustainable yield from the area, and to explore management options in more detail without destroying the economic viability of the fishery.

Declines in both effort and landings were observed in the Sitka area fishery in 1985. However, the reasons for this appear to be influenced by economics and weather rather than from substantial declines in stock condition. Weather during the early months of 1985 hampered fishing efforts, and the high price of sablefish and halibut influenced many fishermen to change to those fisheries. Summer months are traditionally slow for rockfish markets in Southeastern Alaska. These factors combined to keep the 1985 catch below the 1984 harvest level.

Because of the shortening length of the sablefish fishery and the generally better early season weather conditions in 1986, an increase in rockfish effort is expected for the 1986 season. It is also anticipated that more species will be included in the list of "desirable" fishes as new markets develop.

Effort is continuing to increase in the Ketchikan fishery with a growth rate similar to that observed in the early Sitka fishery. That fishery must be more closely monitored if signs of over-exploitation are to be detected. Unfortunately, because of budget constraints, there is now no rockfish fisheries monitoring in the Ketchikan area.

Although port sampling provides a relatively low cost method of fisheries monitoring, it is vital that this data be supplemented with on-board sampling and independent stock assessment surveys. On-board sampling is needed to determine differences in depth and area fished as well as to determine the actual level of fishing effort. Stock assessment studies are needed to provide unbiased data on annual changes in abundance, species composition, and size within the rockfish populations as these factors are masked in the fisheries monitoring data because of market fluctuations, mobility of the fleet, and changes in gear technology.

CONCLUSIONS

Domestic longline monitoring studies in the eastern Gulf have provided valuable information on distribution of effort, CPUE, and gear technology from both the sablefish and rockfish fisheries, as well as species composition and substantial biological data from the rockfish fisheries that would not otherwise be available. Fisheries CPUE has been used as the primary indicator of stock abundance in the inside sablefish fisheries since 1979 and has been combined with other data sources as an indicator of stock condition in offshore waters. The results of rockfish fisheries monitoring in the Sitka area provided the basis for regulatory changes and the establishment of a catch quota for the rockfish fishery. However, the results of this study indicate that, due largely to the dynamic and diverse nature of these fisheries, fisheries monitoring alone is not an adequate indicator of stock condition. Independent stock assessment studies are needed in all management areas for rockfish and in the inside areas for sablefish. On-board sampling of the rockfish fishery is also needed to obtained detailed information on depth fished, discard, and effort levels. Gear efficiency experiments are needed in both fisheries to provide a measure for standardizing CPUE between hook types and between snap-on and fixed gear.

Conversely, fisheries monitoring documents the changes in gear technology, market conditions, composition of the catch, and distribution of effort. Without these data fisheries managers have a poor understanding of how a fishery should be adjusted in response to changes in abundance as determined through stock assessment surveys. To adequately manage the sablefish and rockfish fisheries, managers require a combination of dockside and onboard monitoring and independent stock assessment programs. Without an extensive integrated database, the risk of overexploiting these valuable long lived species is greatly increased.

ACKNOWLEDGMENTS

The authors would like to thank all of the port samplers who worked so diligently, often in inclement weather and at odd hours to obtain the information used in this report. Among them, Jerry Koerner in Ketchikan, Beverly Richardson in Petersburg, and Linnea Neuman in Sitka deserve special recognition. Beverly also assisted with the graphics for the report. Fritz Funk, ADF&G Juneau, provided invaluable support setting up the groundfish computer network and helping with the screen forms and database systems used to enter and retrieve data. Rexanne Eide, ADF&G Petersburg, typed figure labels and the table and figure lists. Gary Gunstrom and Phil Rigby, ADF&G Juneau, edited the draft version of the report. Without the contract funding provided by both the NMFS and NPFMC, monitoring of fisheries in the EEZ could not have been accomplished. And finally, since the port sampling program and logbooks programs are voluntary, the fishermen and processors who provided us with information and allowed us to use their facilities deserve thanks for their cooperation.

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APPENDICES

APPENDIX I

LONGLINE VESSEL INTERVIEW FORM

Vessel Name ______________________ ADF&G Number __________

Date ___/___/_85 (mm dd yy) Port ____ Processor __________

Current Fishery ____ (CP/JV/SJ/DS) Target Species ______ Days Fished __________

Next Fishery ____ (CP/JV/SJ/DS) Next Target Species ______ Next Trip Start ___/___ (mm dd)

Logbook Aboard ____ (JV/LL/TR/NO) Logbook Pages Collected ___ (Y/N) Logbook Distributed ____ (JV/LL/TR/NO)

GEAR DESCRIPTION

Gear LL

Bait (Herring, Squid, Octopus) ___

Hook Size __________

Hooks per Skate __________

Snap-on, Fixed ___

Hook Type (Circle, J, Tara, Mixed) __

Hook Spacing (feet) __________

Total Skates/Trip __________

Total Hooks/Trip __________

CATCH & SAMPLING SUMMARY

Spec. Mgmnt Area	Stat Area	% Effort in Area	Avg. Depth (fms)	Species	Number	Pounds	Dress Code	No. Otoliths

---

Data Quality ____ (1-5: 1=excellent, 5=poor) Sampler Initials ______

Comments: ____

(14-Feb-85)

PURCHASER

ALASKA DEPARTMENT OF FISH & GAME
GROUNDFISH TICKET

APPENDIX II

DO NOT WRITE IN THIS SPACE

G85 021801

Vessel Name ______________________

Fishery →
Name →
Permit Number →

5 AAC 39.130 (B)(9) REQUIRES IMPRINTING OF THE CFEC PERMIT CARD HERE

ADF&G NO. ↔ [ ]

Date Fishing Began ← ____________

Proc. Code ____________________

Company ____________________

Date Landed ← ____________

PORT OF LANDING

DELIVERY CONDITION CODES
- ENTER FOR EACH SPECIES IN COLUMNS 4 & 11 BELOW -

1 = WHOLE FOODFISH	6 = SALTED AND SPLIT
2 = WHOLE BAIT	7 = WESTERN CUT
3 = BLED	8 = EASTERN CUT
4 = GUTTED ONLY	9 = FILLETS
5 = GUTTED AND HEADED	10 = LANDED DISCARD

PRINT TYPE OF GEAR USED

SPECIES	STAT AREA	Code	COND CODE	POUNDS	PRICE	AMOUNT	SPECIES	STAT AREA	Code	COND CODE	POUNDS	PRICE	AMOUNT
SABLEFISH		710					PACIFIC OCEAN PERCH		141				
							BLACK ROCKFISH		142				
							IDIOT ROCKFISH		143				
							RED SNAPPER - YELLOWEYE		145				
							CANARY ROCKFISH		146				
FLATHEAD SOLE		122					QUILLBACK ROCKFISH		147				
ROCK SOLE		123					CHINA ROCKFISH		149				
DOVER SOLE		124					ROSETHORN ROCKFISH		150				
REX SOLE		125					DUSKY ROCKFISH		154				
YELLOWFIN SOLE		127					RED ROCKFISH UNSPECIFIED		140				
STARRY FLOUNDER		129					ROCKFISH - UNSPECIFIED		139				
ALASKA PLAICE		133					LINGCOD		130				
FLOUNDER UNSPECIFIED		120					SCULPIN		160				
PACIFIC COD		110					SKATE		700				
POLLOCK		270					SHARK		689				

Fisherman's Signature * ______________________ Fish Received by ______________________

FISH DELIVERED HEREBY WERE CAUGHT IN COMPLIANCE WITH STATE LICENSING LAWS AND STATE LABOR LAWS AND REGULATIONS

11-218 (REV. 8/84) ⓟ

NOT NEGOTIABLE

APPENDIX III

CONFIDENTIAL

STAT AREA	SUB	SAMPLE DATE MO	DAY	YR	VESSEL NAME	ADF&G NO	GEAR	PROC

SPECIES	LENGTH CM	WEIGHT	SEX	MATURITY	SPECIES	LENGTH CM	WEIGHT	SEX	MATURITY