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Trawl Survey of Groundfish Resources
off the Aleutian Islands,
July-August 1980

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and
Thomas K. Wilderbuer

January 1982

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16. ABSTRACT During the summer of 1980, the National Marine Fisheries Service, in cooperation with the Japan Fisheries Agency, conducted a resource assessment survey of the groundfish resources of the Aleutian Islands area. The report includes information on the distribution, abundance, available biomass, and size composition of 19 commercially important groundfish and crab species. It was found that several groundfish species presently occur at levels of abundance which are adequate to support commercial exploitation. Some species were abundant throughout most of the area surveyed while others were abundant in only one or two areas. The continental shelf and upper slope on the Pacific side of the Aleutian chain contained 63.8% of the available biomass, while the Bering side contained 36.1% with the largest portion of the biomass on both sides (56%) being located in the 55 to 108 fm depth interval. Walleye pollock was the dominant species in the survey area with Pacific cod and Pacific ocean perch the second the third highest estimated available biomass. (Author modified)				
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TRAWL SURVEY OF GROUND FISH RESOURCES OFF
THE ALEUTIAN ISLANDS, JULY-AUGUST 1980

by

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ABSTRACT

During the summer of 1980, the National Marine Fisheries Service, in cooperation with the Japan Fisheries Agency, conducted a resource assessment survey of the groundfish resources of the Aleutian Islands area.

This report summarizes the survey data collected by the U.S. chartered commercial fishing vessels Half Moon Bay and Ocean Harvester and includes information on the distribution, abundance, available biomass, and size composition of 19 commercially important groundfish and crab species found off the Aleutian Islands.

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INTRODUCTION

Between 3 July and 20 August 1980, the National Marine Fisheries Service's (NMFS) Northwest and Alaska Fisheries Center, in cooperation with the Japan Fisheries Agency, conducted a cooperative resource assessment survey throughout the Aleutian Island chain from Unimak Pass to Agattu Island to assess the fishery potential and biological condition of the groundfish resources.

Although NMFS has conducted **similar** groundfish assessment surveys in the Gulf of Alaska since 1975 and Bering Sea since 1964, this survey marked the first comprehensive U.S. assessment of groundfish resources in the Aleutians and includes only the data collected by the U.S. vessels.

This report, which is intended primarily for industry use, was prepared to support development of a growing U.S. groundfish trawl fishery in the western Alaska region. Catch rate data by species, area and depth zones along the Pacific and Bering Sea sides of the Aleutian chain are presented with associated data on the size composition of **commercially** valuable species captured. In addition, several tows were completed which targeted on near bottom or mid-**water** fish concentrations that were detected acoustically. Results of these encounter response tows are presented separately.

BACKGROUND

The first otter trawl fishery in the Aleutian Islands commenced in 1963 when twelve Soviet BMRT type vessels fished along the entire chain from August to December primarily for Pacific ocean perch (Chitwood 1969). During 1964 from five to twenty Soviet vessels operated and landed nearly 61,000 **metric** tons (t) of Pacific ocean perch. In 1965, Soviet fishing effort increased when twenty to thirty BMRT's and ten SRT type side trawlers joined the fishery and landed nearly 71,000 t. Up to twenty BMRT's fished from May through

November during 1966 but by December all vessels had departed the Aleutian Islands and moved to the Gulf of Alaska. The trends of the Soviet fishery from 1966 to 1977 are impossible to follow, as catch data from the Aleutian Islands were included in the Bering Sea catch statistics.

During 1964, the Japanese entered the Aleutian Island trawl fishery with up to seven factory stern trawlers and two small otter trawlers fishing primarily on Pacific ocean perch. The fishery effort increased during 1965 and in 1966 fourteen factory trawlers, two small otter trawlers and two factory ships accompanied by eleven trawlers, operated in the Aleutian area. Pacific ocean perch remained the primary species taken south of the eastern Aleutian Islands and along the central and western Aleutians. During 1966, the Japanese developed an intensive walleye pollock fishery along the 100 fathom contour north of the Fox Islands.

Exploratory fishing operations in the Aleutian Islands during 1966 by the Republic of Korea (South Korea) indicated their interest in entering the Aleutian Island trawl fishery. During 1980, Taiwan, Federal Republic of Germany (West Germany), and Poland fished the Aleutian Islands for the first time along with the United States operating individually in joint-venture fisheries both with South Korea and the Soviet Union.

Detailed catch statistics by the International North Pacific Fisheries Commission (INPFC) blocks of one-half degree latitude and one degree longitude are available for the Aleutian statistical area (west of 170° W longitude) for all nations from 1978 to 1980. The total foreign otter trawl catch increased from 65,468 t in 1978 to 110,133 in 1980 (Table 1). Japan was the principal fishing nation and landed from 61 to 75% of the total foreign trawl catch. The Soviet catch accounted for 28 and 37% of the total landings in 1978 and 1979 but dropped to less than 1% in 1980 when their permits and quotas were

Table 1.--Total foreign groundfish trawl catch from the Aleutians (INPFC) area by years.

Country	Year		
	1978	1979	1980
-----metric tons-----			
USSR	24,374	23,445	961
Japan	39,961	58,871	82,937
South Korea	1,133	906	20,248
Taiwan	0	0	29
West Germany	0	0	39
Poland	<u>0</u>	<u>0</u>	<u>5,919</u>
Total	65,468	83,222	110,133

not issued. South Korea, which landed between 1 and 2% of the total foreign catch in 1978 and 1979, increased its catch to 18% in 1980. Taiwan, West Germany, and Poland fished only during 1980 when the three nations landed 5% of the total catch.

The total catch by species for the Aleutian Islands from 1978 to 1980, is presented in Tables 2-4. During 1978 and 1979, Atka mackerel was the dominant species with catches of 23,418 and 21,279 t, respectively. Although the 1980 reduction of Soviet fishing effort was partially replaced by the South Korean effort, the total catch of Atka mackerel dropped to 15,534 t. Pacific ocean perch catches remained stable in 1978-79 (5,300 and 5,500 t) and decreased to 4,000 t in 1980, while walleye pollock catches were lower in 1978-79 (6,280 and 9,440 t) and increased significantly to 58,056 t in 1980.

In the Shumagin International North Pacific Fishery Commission (INPFC) statistical area, the foreign trawl landing totaled 43,435 t in 1978, decreased to 36,331 t in 1979 and increased to 57,125 t in 1980 (Tables 5-8). Since 1978 the largest portion of the total catch is taken by South Korea, 77% in 1978, 70% in 1979 and 55% in 1980. Soviet catches, which were very small in 1978-79, increased to 18,405 t in 1980; Poland's catch increased from 284 t in 1979 to 5,971 in 1980. Walleye pollock was the dominant species accounting for 72% of the total trawl catch in 1978 and over 80% in 1979 and 1980. The total foreign landings of pollock were just over 30,000 t in 1978-79 but increased to 46,596 t in 1980.

The Japanese groundfish trawl catch statistics are complete from 1964 to 1979 and provide information on their catch trends during that period (Table 9). Pacific ocean perch dominated the Japanese catches from 1964 to 1966 when they landed over 20,000 t each year. With the exception of catch increases in 1968 and 1974, Pacific ocean perch-catches have decreased to only 413 t in 1978 and 844 t in 1979. Nearly 171,000 t were landed from 1964 to 1979.

Table 2.--Aleutian (INPFC) area trawl catch by species and foreign nation in 1978.

Species	Nation			Total
	USSR	Japan	South Korea	
	-----metric tons-----			
Yellowfin sole	0	741	1	742
Other flounders	29	9,083	0	9,112
Pacific ocean perch	167	4,830	271	5,268
Sablefish	0	241	23	264
Pacific cod	140	2,258	6	2,404
Walleye pollock	1,264	4,952	64	6,280
Atka mackerel	22,612	806	0	23,418
Squid	19	2,086	31	2,136
Other species	<u>143</u>	<u>14,964</u>	<u>737</u>	<u>15,844</u>
Total	24,374	39,961	1,133	65,468

Table 3.--Aleutian (INPFC) area trawl catch by species and foreign nation in 1979.

Species	Nation			Total
	USSR	Japan	South Korea	
-----metric tons-----				
Yellowfin sole	0	1,195	11	1,206
Other flounders	9	15,817	4	15,830
Pacific ocean perch	18	5,299	159	5,476
Sablefish	0	146	0	146
Pacific cod	396	4,259	16	4,671
Walleye pollock	1,135	8,127	178	9,440
Atka mackerel	20,269	1,010	0	21,279
Squid	1	2,207	5	2,213
Other species	<u>1,617</u>	<u>20,811</u>	<u>533</u>	<u>22,961</u>
Total	23,445	58,871	906	83,222

Table 4.--Aleutian (INPFC) area trawl catch by species and foreign nation in 1980.

Species	Nation						Total
	USSR	Japan	South Korea	Taiwan	Poland	West Germany	
	-----metric tons-----						
Yellowfin sole	0	399	17	0	34	0	450
Turbots ^{1/}	1	7,045	110	0	4	0	7,160
Other flounders	3	4,648	77	0	15	0	4,743
Pacific ocean perch ^{2/}	5	3,627	356	7	1	4	4,000
Other rockfish	2	1,995	36	0	<u>3/</u>	0	2,033
Sablefish	0	94	18	8	<u>3/</u>	0	120
Pacific cod	4	2,685	53	1	3	5	2,751
Walleye pollock	1	45,951	6,256	12	5,806	30	58,056
Atka mackerel	937	1,391	13,175	0	31	0	15,534
Squid	0	2,328	0	1	4	0	2,333
Other species	<u>8</u>	<u>12,774</u>	<u>150</u>	<u>0</u>	<u>21</u>	<u>0</u>	<u>12,953</u>
Total	961	82,937	20,248	29	5,919	39	110,133

1/ Turbots include arrowtooth flounder and Greenland turbot.

2/ In 1980, the Pacific ocean perch catch data included sharpchin, rougheye, short-raker, and northern rockfish.

3/ Less than 0.5 t.

Table 5.--Total foreign groundfish trawl catch from the Shumagin (INPFC) area by years.

Country	Year		
	1978	1979	1980
	-----metric tons-----		
USSR	2,866	249	18,405
Japan	7,166	4,938	1,555
South Korea	33,403	25,484	31,194
Poland	0	284	5,971
Mexico	<u>0</u>	<u>5,376</u>	<u>0</u>
Total	43,435	36,331	57,125

Table 6. --Shumagin (INPFC) area trawl catch by species and foreign nation in 1978.

Species	Nation			Total
	USSR	Japan	South Korea	
	-----metric tons-----			
Flounder	0	2,123	270	2,393
Pacific ocean perch	193	416	3,021	3,630
Other rockfish	0	116	602	718
Sablefish	0	13	9	22
Pacific cod	995	260	1,361	2,616
Walleye pollock	1,494	3,490	26,268	31,252
Atka mackerel	184	243	61	488
Squid	0	17	130	147
Other species	<u>0</u>	<u>488</u>	<u>1,681</u>	<u>2,169</u>
Total	2,866	7,166	33,403	43,435

Table 7.--Shumagin (INPFC) area trawl catch by species and foreign nation 1979.

Species	Nation					Total
	USSR	Japan	South Korea	Mexico	Poland	
	-----metric tons-----					
Flounder	26	2,130	557	17	15	2,745
Pacific ocean perch	30	627	188	67	2	914
Other rockfish	<u>1/</u>	24	12	4	0	40
Sablefish	3	33	0	28	8	72
Pacific cod	6	116	788	100	9	1,019
Walleye pollock	170	1,354	23,312	5,121	249	30,206
Atka mackerel	5	313	81	11	<u>1/</u>	410
Squid	<u>1/</u>	37	84	4	9	134
Other species	<u>9</u>	<u>304</u>	<u>462</u>	<u>42</u>	<u>0</u>	<u>817</u>
Total	249	4,938	25,484	5,394	292	36,357

1/ Less than 0.5 t.

Table 8. --Shumagin (INPFC) area trawl catch by species and foreign nation 1980.

Species	Nation				Total
	USSR	Japan	South Korea	Poland	
	-----metric tons-----				
Flounder	975	260	1,710	0	2,945
Pacific ocean perch	290	139	343	29	801
Other rockfish	2	4	41	3	50
Sablefish	127	29	284	0	440
Pacific cod	361	666	1,626	9	2,662
Walleye pollock	15,495	334	24,918	5,849	46,596
Atka mackerel	899	34	736	48	1,717
Squid	1	7	104	0	112
Other species	<u>254</u>	<u>83</u>	<u>1,451</u>	<u>38</u>	<u>1,826</u>
Total	18,404	1,556	31,213	5,976	57,149

Table 9.--Japanese groundfish trawl landings (in metric tons) by species and years from Unimak Pass to Attu Island.

Year	Species													Total
	Pacific Ocean perch	Other rock-fish	Walleye pollock	Pacific cod	Sable-fish	Atka mackerel	Arrow-tooth flounder	Turbot	Rock sole	Flat-head sole	Yellow-fin sole	Squid	Other species	
1964	24,001	--	25,386	992	1,823	--	14,543	--	120	570	88	--	711	68,234
1965	35,523	--	10,303	1,798	1,486	--	2,525	--	1,201	217	1,016	--	1,243	55,312
1966	22,200	--	27,341	3,416	2,733	--	4,164	--	1,433	1,170	5,786	--	1,052	69,295
1967	10,509	--	111,221	8,093	1,833	--	6,626	--	490	1,382	2,594	--	401	143,149
1968	17,387	--	119,478	10,467	581	--	4,818	--	92	1,209	333	--	413	154,778
1969	9,255	--	97,896	13,086	1,625	--	5,612	--	336	2,613	311	--	791	131,525
1970	10,161	--	2,916	16,858	1,999	--	2,903	--	189	1,275	658	--	3,221	40,180
1971	9,056	--	7,631	7,750	2,374	--	822	--	3,089	2,050	6,341	--	4,459	43,572
1972	4,568	--	86,271	6,635	1,649	--	493	--	26,367	344	5,633	--	6,738	138,698
1973	5,231	--	145,609	6,018	1,650	--	642	--	6,928	1,293	16,757	--	8,556	192,684
1974	9,999	--	721	7,832	1,707	--	1,265	--	3,815	2,605	382	--	8,952	37,278
1975	5,331	--	68,382	7,842	1,151	--	70	--	678	850	453	--	8,968	93,725
1976	5,340	--	175,895	6,780	1,516	--	48	--	506	329	161	--	8,024	198,599
1977	935	2,473	3,951	1,268	78	383	1,434	1,219	23	12	38	1,030	5,549	18,393
1978	413	1,440	2,536	1,105	37	205	845	2,473	483	88	132	792	4,620	15,169
1979	<u>844</u>	<u>4,362</u>	<u>4,397</u>	<u>2,052</u>	<u>69</u>	<u>444</u>	<u>4,198</u>	<u>2,725</u>	<u>555</u>	<u>156</u>	<u>543</u>	<u>4,537</u>	<u>7,102</u>	<u>31,984</u>
Total	170,753	8,275	889,934	101,992	22,311	1,032	51,008	6,417	46,305	16,163	41,226	6,359	70,800	1,432,575

Although the Japanese groundfish trawl fishery originally developed on Pacific ocean perch, walleye pollock has been the dominant **species** with nearly 890,000 t being landed from 1964 to 1979. The catch trend has been cyclic in nature, peaking at over 119,000 t in 1968, nearly 146,000 t in 1973, and nearly 176,000 t in 1976. The third **most** important species in the Japanese landings was Pacific cod which totaled nearly 102,000 t from 1964 to 1979. Yearly landings increased from 992 t in 1964 to a peak landing of nearly 17,000 t in 1970, then generally decreased to a low of 1,100 t in 1978. Flatfish species do not appear to be targeted except in certain years. Rock sole landings were generally low, less than 7,000 t except in 1972 when over 26,000 t was landed. Yellowfin sole were also less than 7,000 t with the exception of 1973 when nearly 17,000 t were landed.

VESSELS, GEAR, AND SURVEY METHODS

The survey was conducted from the chartered trawler/crabbers Half Moon Bay and Ocean Harvester. Both vessels have recently been engaged in groundfish trawl fisheries and were operated by experienced trawl skippers. The Half Moon Bay, 108 ft in length and 850 hp, and Ocean Harvester, 108 ft in length and 1,125 hp, are house-forward, West Coast design vessels of steel construction and equipped with state-of-the-art trawl winches carrying 800-1,000 fm of 3/4 or 7/8 in diameter trawl warp and tandem or **triple** stern mounted net reels. Their suite of electronic fish finding and navigation equipment includes fishing echo sounders with bottom locks and scale expansion, third wire netsonde **systems** for midwater trawling, dual auto tracking LORAN C units, and LORAN plotters.

Bottom trawling was conducted with the 90/105 ft Noreastern trawls (Figure 1) equipped with 18 in diameter rubber bobbins for **use** on hard or

NOREASTERN

B = BAR
M = MESH
P = POINT
AB = ALL BAR

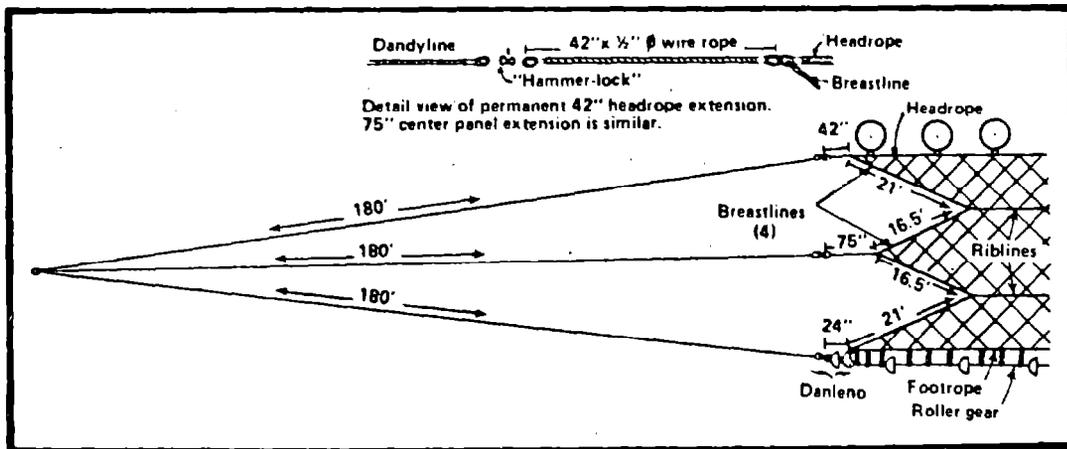
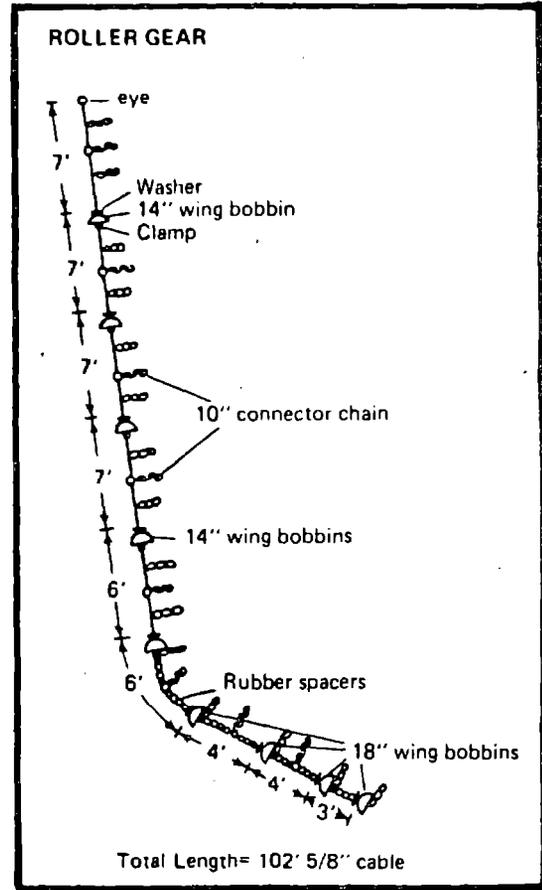
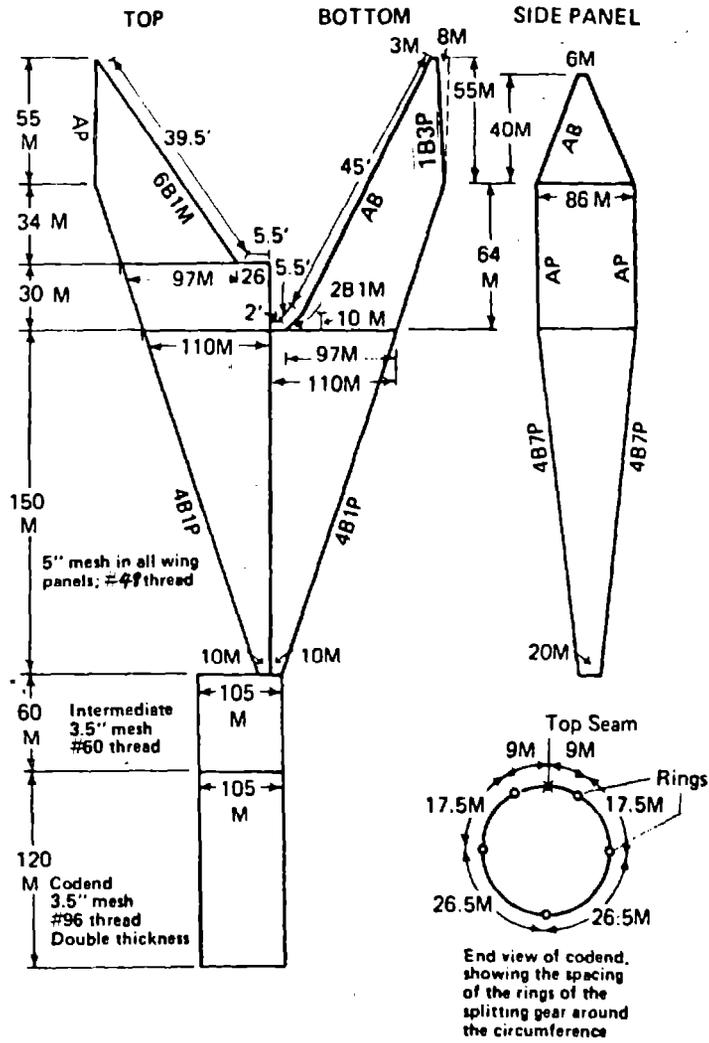


Figure 1-Diagrammatic drawing of the 90/105' Noreastern trawl.

irregular substrates. The Noreastern trawls were rigged with triple 30 fm dandyline with an 18 in chain extension on the headrope dandyline and spread with 6 x 9 ft steel V doors weighing approximately 1,800 lb each. Midwater trawling was conducted with No. 1000 Alaska diamond trawls rigged with 30 fm dandyline, 250-lb tom weights and spread with the same 6 x 9 ft steel V doors used in bottom trawling (Figure 2). The Alaska diamond trawl fished by the Ocean Harvester was damaged beyond shipboard repair about halfway through the survey and was replaced with a similar sized midwater trawl spread by 5 ft x 11 ft midwater trawl doors.

The Aleutian groundfish survey was conducted between Unimak Pass and Agattu Island, a distance of approximately 830 nautical miles (nmi). Throughout this area, operations were conducted on both Pacific and Bering Sea sides of the Aleutians in depths from 25-380 fm. The Half Moon Bay surveyed the westward areas from Agattu Island to Amukta Pass during 3 July to 18 August. The Ocean Harvester surveyed the Eastern Aleutian area between Amukta Pass and Unimak Pass from 30 July to 20 August.

The survey was divided into sampling units which were 30 minutes of longitude wide; thus, each unit was about 20 nmi wide in an east-west direction. Within each unit bottom tows were attempted in each depth zone of 1-54 fm, 55-108 fm, 109-162 fm, 163-273 fm, 274-382 fm, and 383-492 fm.

The U.S. vessels Half Moon Bay and Ocean Harvester conducted sampling in the odd numbered sampling units while the Japanese research vessel Hatsue Maru conducted sampling in the even number units; During the process of completing these tows, additional encounter-response tows were completed on heavy concentrations of fish when encountered either near bottom or in midwater. All fishing was conducted during daylight hours and the net was towed for, 30 minutes, unless hauled early due to bad bottom conditions. Each catch was

DIAMOND TRAWL

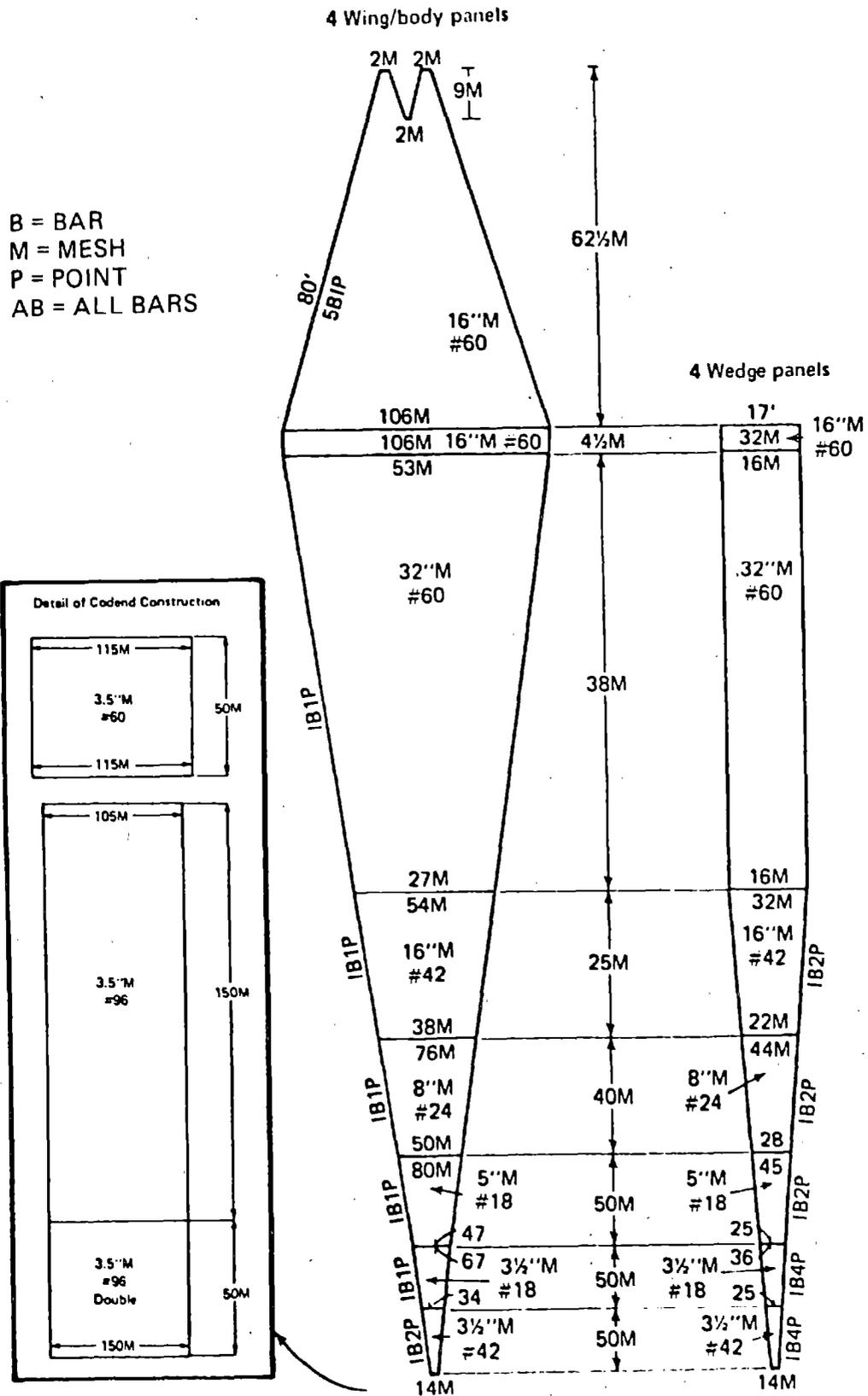


Figure Z--Diagrammatic drawing of the Alaska Diamond midwater trawl.

sorted by species, weighed to determine catch rates, and samples processed to determine the size distributions of commercially valuable species.

DATA PRESENTATION

The survey area was subdivided into four geographic subareas: 1. Agattu Island to Little Sitkin Island, 2. Little Sitkin Island to Great Sitkin Island, 3. Great Sitkin Island to Yunaska Island, and 4. Yunaska Island to Unimak Pass. Each subarea was further divided into 1) Pacific Ocean and 2) Bering Sea side of the Aleutian Islands chain (Figure 3).

The locations of the sampling stations are presented graphically and include: 1) successfully completed standard survey stations (Table 10); 2) stations where the trawl snagged and resulted in gear damage and the station was considered unsuccessful (Table 11); 3) stations where the midwater trawl was used to identify species aggregation which could not be sampled with other trawls due to untrawlable bottom and position in the water column (Table 12); and 4) stations where the 90/105 Noreastern trawl was used to obtain measures of abundance and species composition of fish aggregations encountered during the normal survey operations (encounter response sampling; Table 13). A fishing log which provides all pertinent data on individual stations and the resulting catches is available through the RACE Division of the Northwest and Alaska Fisheries Center, Seattle, Washington.

For this report, catch rates were calculated and species compositions were determined by areas, and by depth intervals within areas: only the data from the standard survey stations are included. Catch rates presented are averages for each area or depth interval and, as such, will be lower than what would be expected under commercial exploitation.

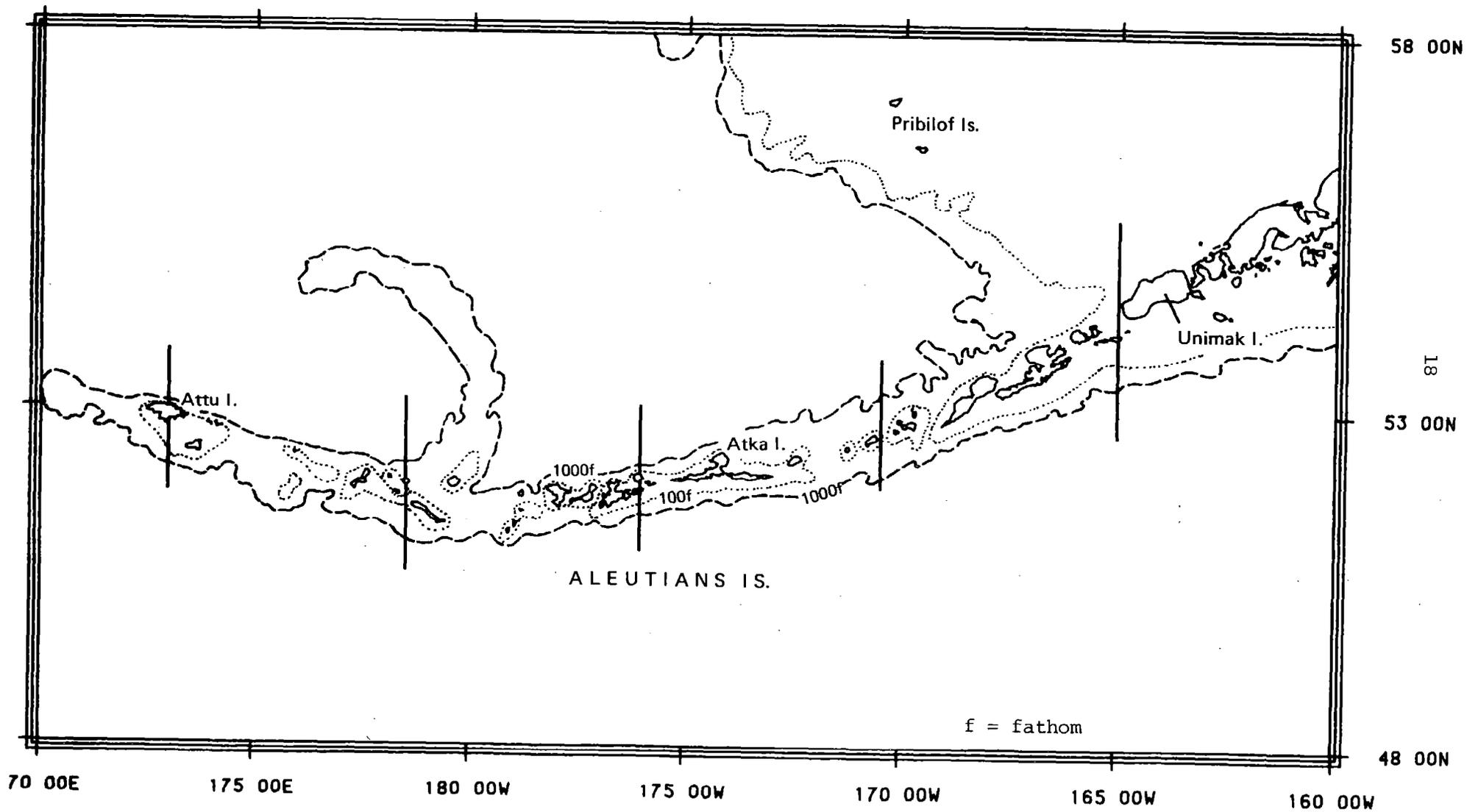


Figure 3. --Area of survey operations and subdivisions for data analysis and presentation.

Table 10.--Number of successfully completed stations made with Noreastern trawl by area and depth intervals.

Survey area	Depth Intervals (fm)					
	1-100 30-54	101-200 55-108	201-300 109-164	301-500 165-273	501-700 274-382	1-700
Ugatta to Little Sitkin Island						
Bering	1	2	1	3	0	7
Pacific	1	10	4	6	0	21
Little Sitkin to Great Sitkin Island						
Bering	2	5	2	4	0	13
Pacific	2	13	8	8	0	31
Great Sitkin to Unaska Island						
Bering	1	9	7	2	1	20
Pacific	0	7	5	5	2	19
Unaska Island to Unimak Pass						
Bering	8	7	3	3	1	22
Pacific	<u>8</u>	<u>9</u>	<u>3</u>	<u>4</u>	<u>3</u>	<u>27</u>
Total	23	62	33	35	7	160

Table 11.--List of stations where snags and/or gear damage occurred during the 1980 survey of the Aleutian Islands.

Vessel					
Ocean Harvester			Half Moon Bay		
13	39		1	25	82
22	40		3	38	90
25			4	46	110
34			5	56	111
37			17	66	121
38				74	124
					128

Table 12.--List of stations sampled with the Alaska diamond No. 1000 mid-water trawl during the 1980 Aleutian Island survey.

Vessel					
Ocean Harvester			Half Moon Bay		
	6			30	
	33			40	
	41			43	
	47			123	

Table 13.--List of stations conducted to delineate concentrations of fish or shellfish encountered during the 1980 Aleutian Island survey (Encounter Response Sampling).

Vessel					
Ocean Harvester			Half Moon Bay		
18	64	72		84	
30	65	83		91	
31	68	84		92	
53	69	85		125	
54	70	86		127	
62	71	88		129	

Estimates of exploitable biomass were calculated using the area swept technique (Alverson and Pereyra 1969) by depth interval and areas. These **biomass** estimates in most cases should be considered conservative as they were calculated assuming that the trawl was 100% efficient and included only the size ranges which were retained **by** the trawl.

Length-frequency data are presented graphically using a reverse accumulative frequency technique (Figure 4) for males and females combined to represent the size composition for a given species within a depth interval or area. To interpret these graphs select a particular length on the horizontal axis (X axis) of the graph and follow a perpendicular line **up to** the size **composition** curve. At this point of intersection follow a line parallel with the X (-length) axis to the point of intersection with the vertical (percent) axis (Y axis) and this indicates the percentage of the fish greater than the size selected on the length axis. In the sample provided, 80% of the walleye pollock were greater than 40 **cm** in length.

RESULTS OF THE GROUND FISH SURVEY

The survey area, Unimak Pass to Agattu Island is generally characterized by having an extremely narrow continental shelf and upper continental **slope** which drops steeply into deep basins both on the Bering and Pacific sides. The major exception is the Unimak Pass to Yunaska Island area where the shelf is considerably wider. Softer and **more** regular bottom in this area allowed fishing operations to be conducted in all depth intervals from 25 to 382 fm. In the Yunaska to Agattu Island region, the substratum was harder and rougher, which particularly hampered fishing operations in shallow water. Deep water fishing greater than 274 fm west of Seguam Pass was curtailed due to hard-sharp corals which caused considerable gear damage.

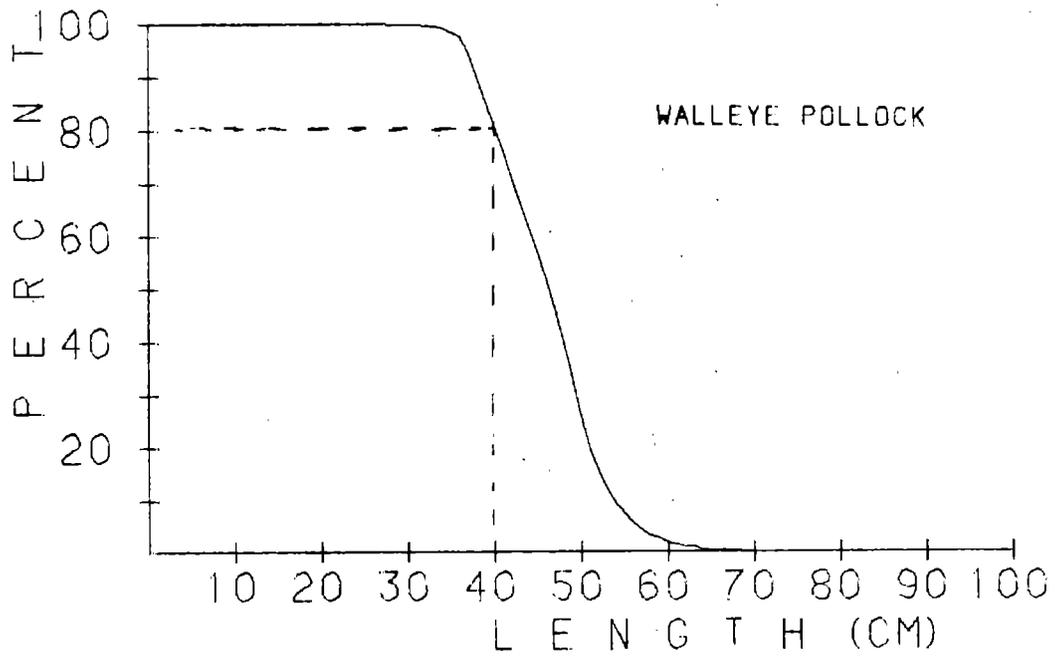


Figure 4. --Example of fish size composition data presented in this paper.'

During the 1980 survey, 218 sampling stations were attempted from Unimak Pass to Agattu Island, 129 by the Half Moon Bay and 89 by the Ocean Harvester. Twenty-six stations were unsuccessful due to hang-ups and/or gear damage. Of the 192 successful stations, 160 were standard survey stations completed with the 90/105 Noreastern trawl. Eight midwater stations with the Alaska Diamond No. 1000 and 24 stations with the Noreastern trawl were made in response to species aggregations encountered during the normal survey operations.

Agattu Island to Little Sitkin Island

Pacific Side

Station location, species composition and catch rates for commercially important species by depth intervals are presented in Figures 5-9 and Table 14. Over the entire depth range sampled, Atka mackerel was the dominant species averaging 334 lb/h with over 99% of the available biomass occurring in the 55-109 fm depth interval. Atka mackerel ranged from 23 to 41 cm in length and averaged 34.6 cm with approximately 84% of the stock encountered being 30 cm or larger (Figure 10).

Although Pacific cod were captured in all depth intervals sampled, they occurred predominately in the 55-109 fm depth interval where the catch rate averaged 459 lb/h and which contained 93% of the cod biomass. Cod in this area ranged from 31-102 cm in length and averaged 62.9 cm with about 76% of the individuals being greater than 50 cm.

Northern rockfish averaged 83 lb/h and were found in highest abundance in the 55-109 fm depth interval where the catch rate averaged 206 lb/h. Over 99% of the biomass of northern rockfish was encountered in this depth interval where this species ranged from 26 to 40 cm in length and averaged 31.5 cm with approximately 65% of the individuals being 30 cm or larger.

BERING SIDE

Sponge
200 lbs/hr

Invertebrate unident.
186 lbs/hr

Green sea urchin
33 lbs/hr

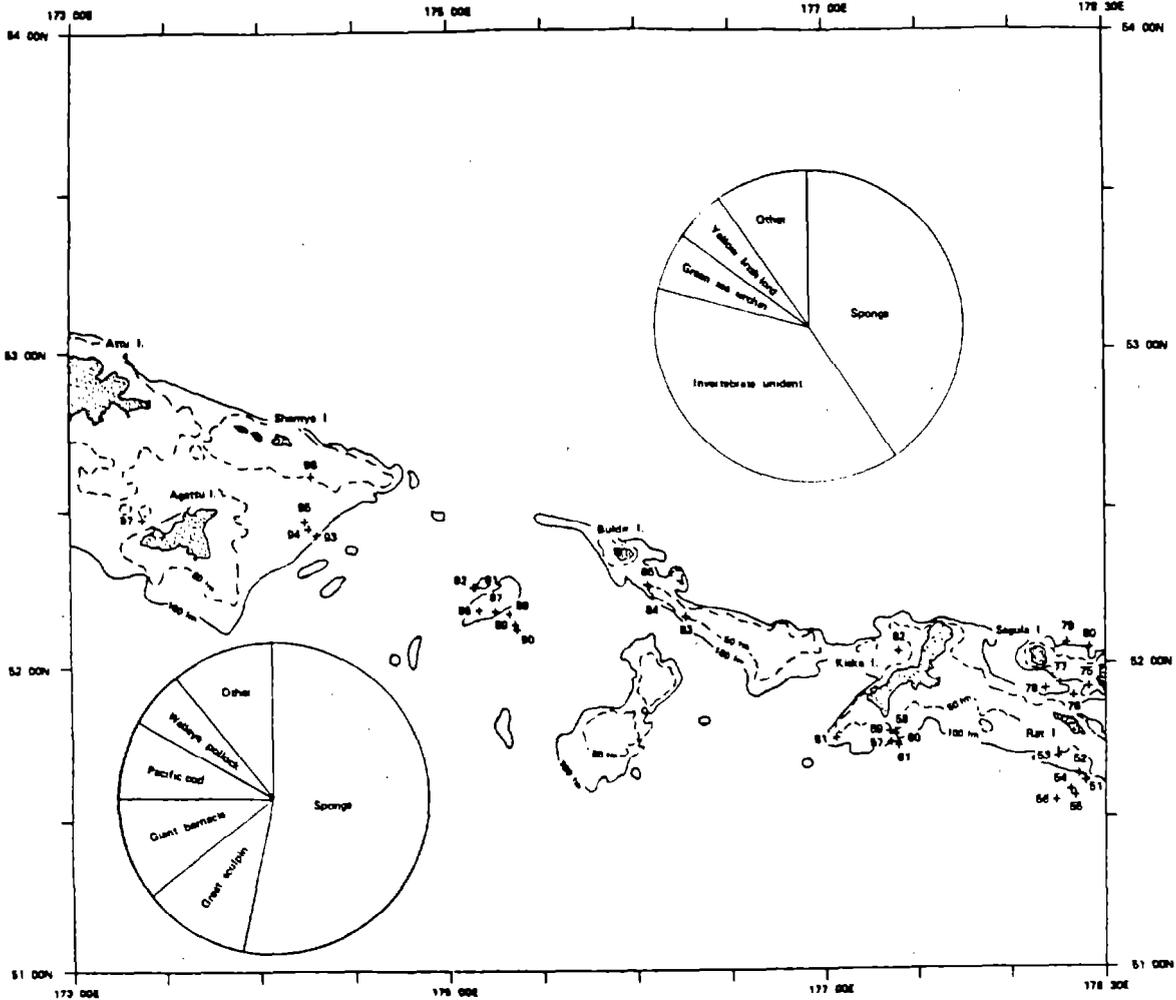
Yellow Irish lord
28 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Sponge
322 lbs/hr

Great sculpin
68 lbs/hr

Giant barnacle
68 lbs/hr

Pacific cod
45 lbs/hr

Walleye pollock
37 lbs/hr

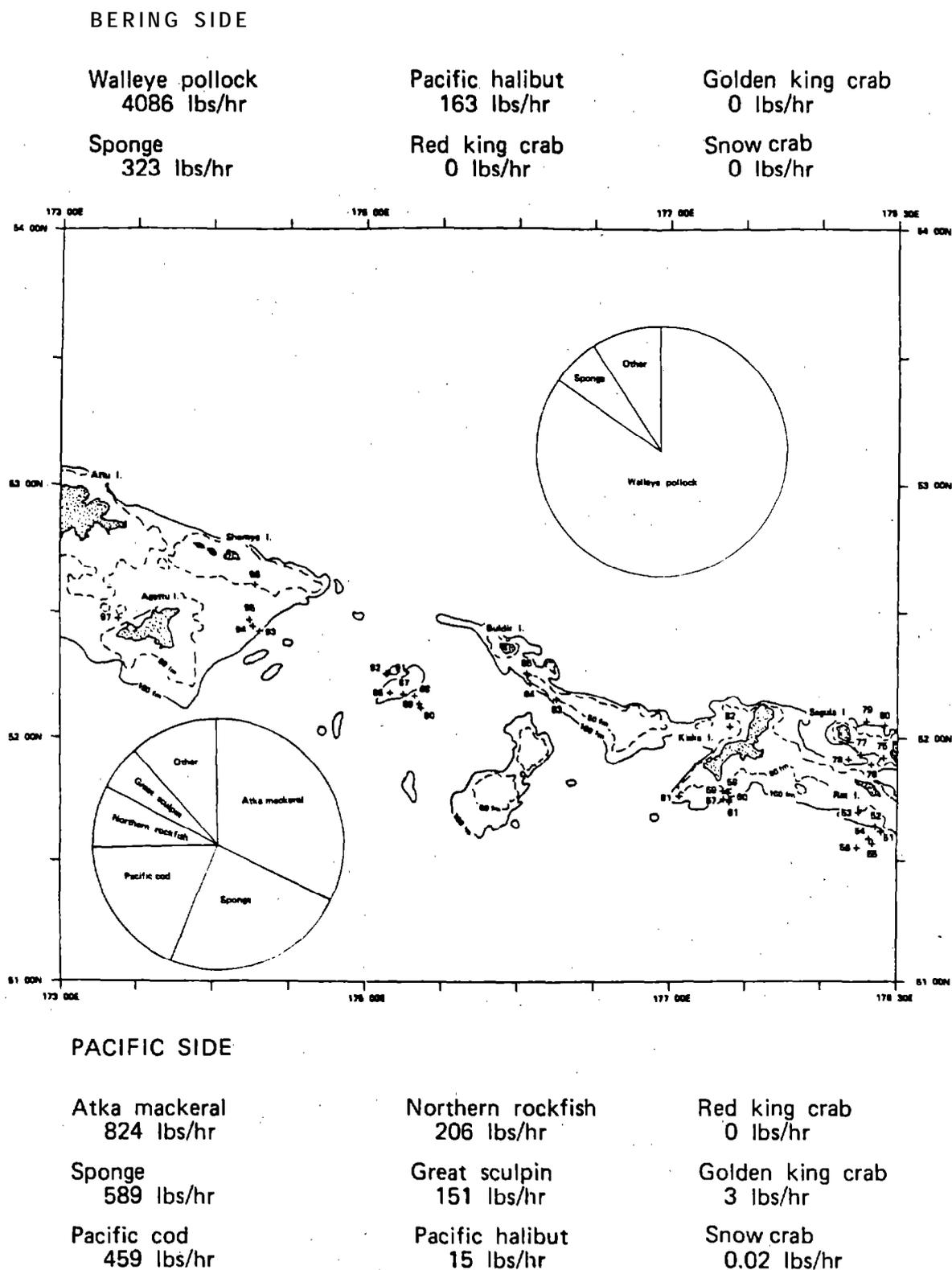
Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0 lbs/hr

Snow crab
0.2 lbs/hr

Figure 5. --Species composition and catch rates of fish and invertebrates in the 1-53 fathom depth interval from Agattu to Little Sitkin Island.



BERING SIDE

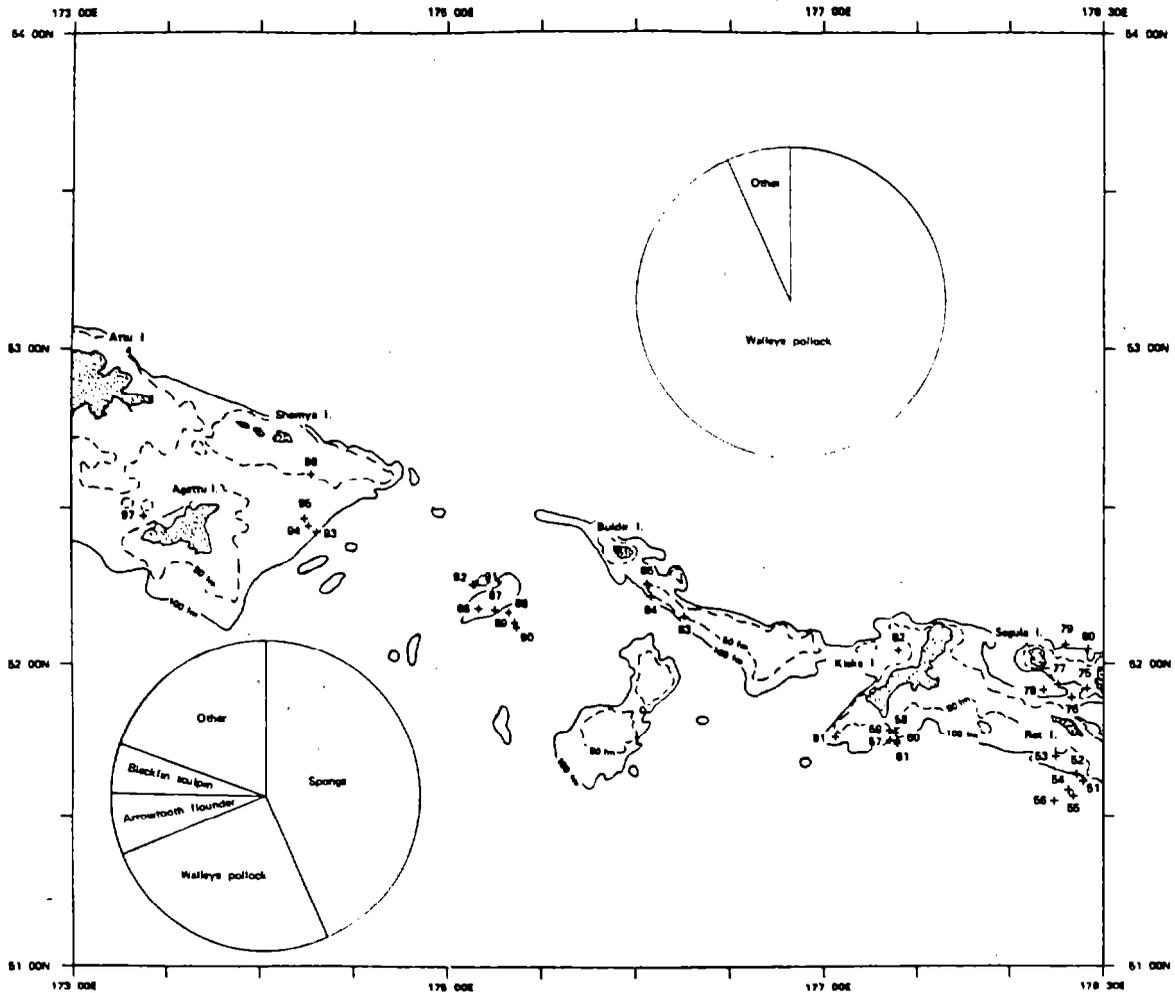
Walleye pollock
11,836 lbs/hr

Red king crab
0 lbs/hr

Snow crab
0 lbs/hr

Pacific halibut
0 lbs/hr

Golden king crab
320 lbs/hr



PACIFIC SIDE

Sponge
214 lbs/hr

Blackfin sculpin
27 lbs/hr

Golden king crab
4 lbs/hr

Walleye pollock
121 lbs/hr

Pacific halibut
12 lbs/hr

Snow crab
0 lbs/hr

Arrowtooth flounder
32 lbs/hr

Red king crab
0 lbs/hr

Figure 7. --Species composition and catch rates of fish and invertebrates in the 109-164 fathom depth interval from Agattu to Little Sitkin Island.

BERING SIDE

Walleye pollock
436 lbs/hr

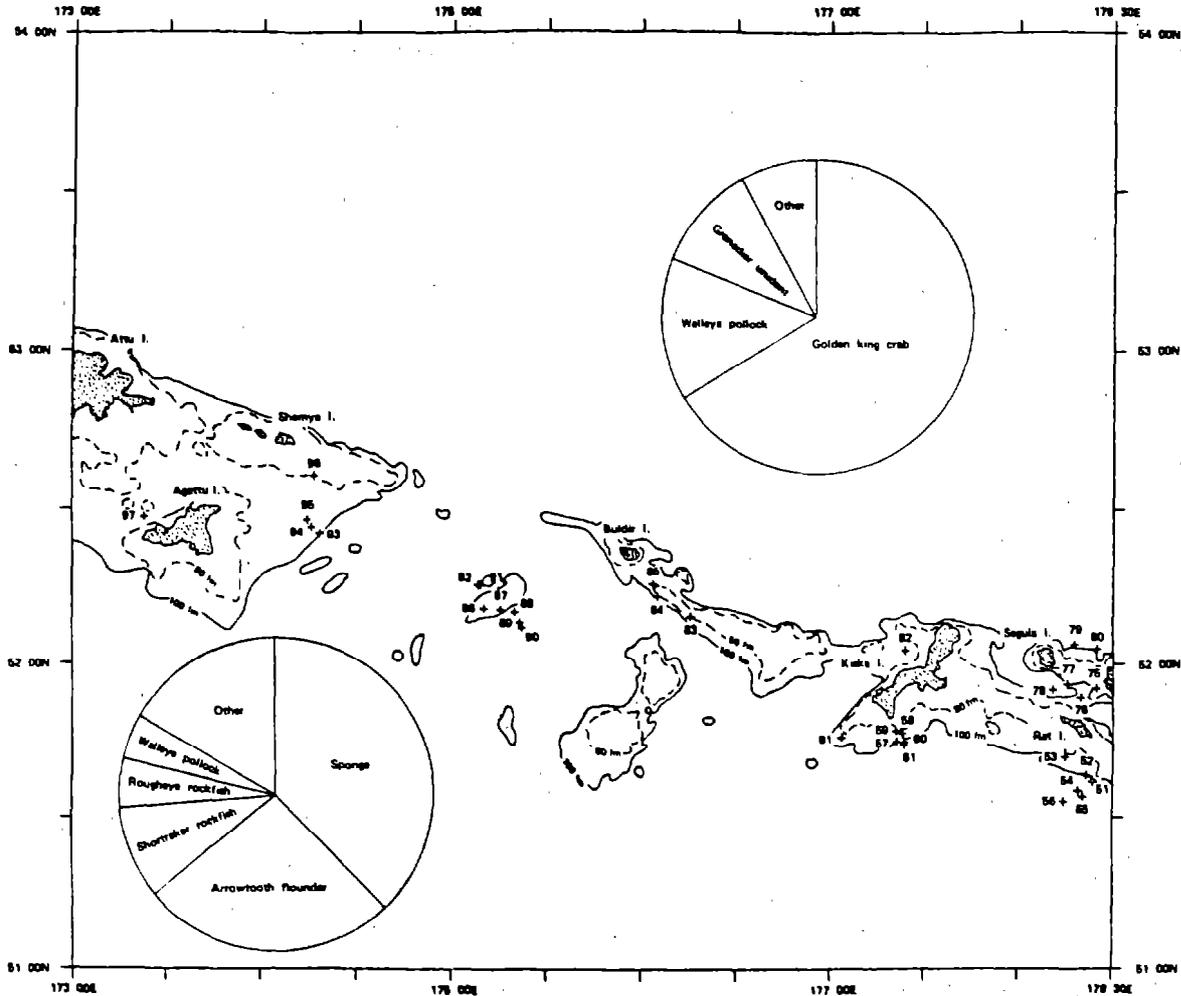
Grenadier unident.
326 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
1930 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Sponge
253 lbs/hr

Arrowtooth flounder
180 lbs/hr

Shortraker rockfish
61 lbs/hr

Rougheye rockfish
38 lbs/hr

Walleye pollock
36 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
1 lbs/hr

Golden king crab
14 lbs/hr

Snow crab
0 lbs/hr

Figure 8.--Species composition and catch rates of fish and invertebrates in the 165-273 fathom depth interval from Agattu to Little Sitkin Island.

BERING SIDE

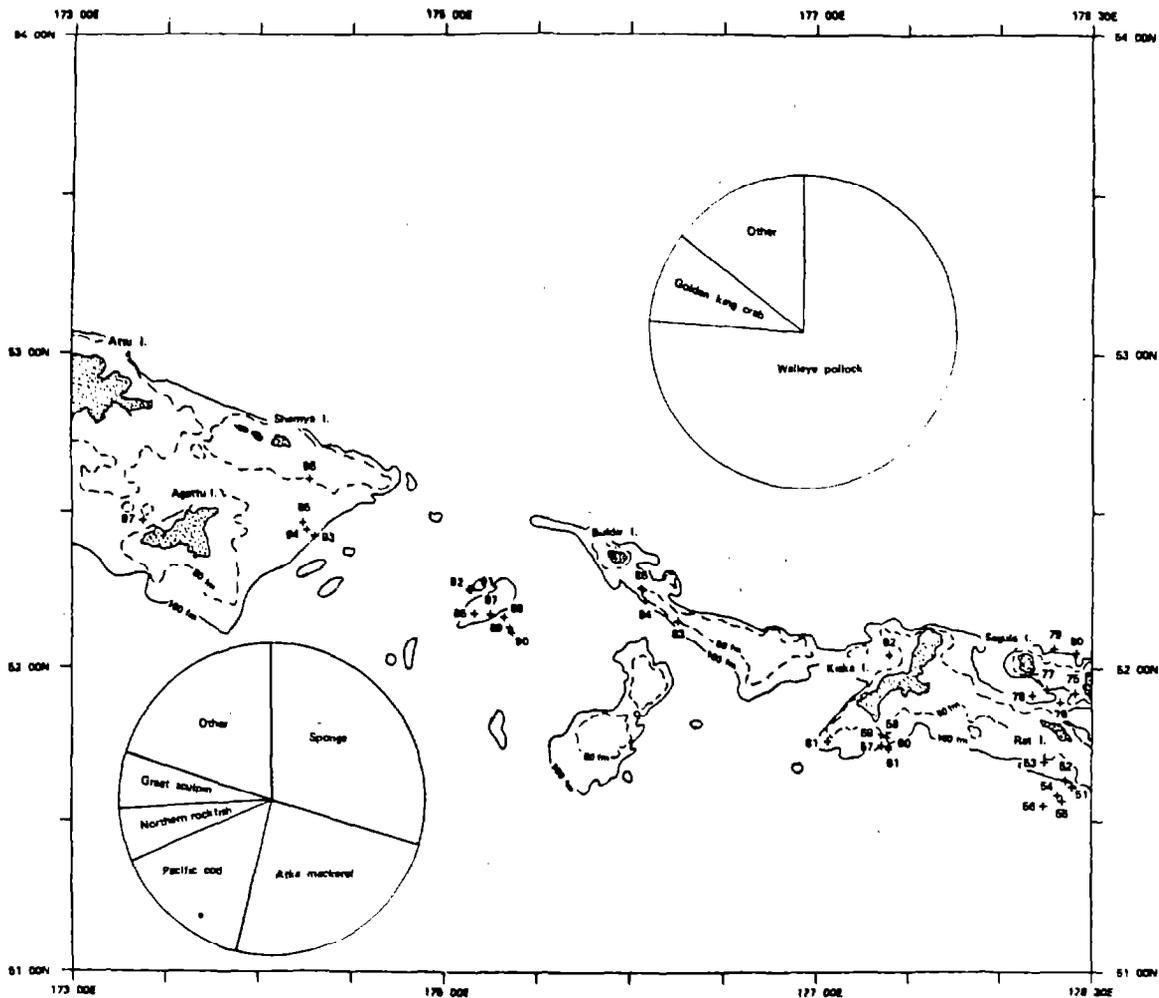
Walleye pollock
3175 lbs/hr

Red king crab
0 lbs/hr

Snow crab
0 lbs/hr

Pacific halibut
63 lbs/hr

Golden king crab
396 lbs/hr



PACIFIC SIDE

Sponge
404 lbs/hr

Northern rockfish
83 lbs/hr

Red king crab
0.2 lbs/hr

Atka mackerel
334 lbs/hr

Great sculpin
81 lbs/hr

Golden king crab
4 lbs/hr

Pacific cod
199 lbs/hr

Pacific halibut
7 lbs/hr

Snow crab
0.06 lbs/hr

Figure 9.--Species composition and catch rates of fish and invertebrates in the 1-382 fathom depth interval from Agattu to Little Sitkin Island.

Table 14.--Mean catch and **estimates** of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Agattu to Little Sitkin I. -- Pacific Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54 (1,081)		55-108 (1,535)		109-164 (446)		165-273 (738)		274-382 (929)		1-382 (4,729)	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder	2.0	46	8.0	258	32.5	304	179.5	2,778	-	-	42.5	3,386
Greenland turbot	-	-	-	-	-	-	20.7	320	-	-	4.0	320
Pacific halibut	-	-	14.7	474	12.0	113					7.4	587
Flathead sole	10.0	226	4.7	151							4.7	377
Dover sole												
Rex sole							0.6	9			0.1	9
Rock sole	10.0	226	93.0	2,993	0.5	5					40.5	3,224
Sablefish							4.3	67			0.8	67
Giant grenadier												
Pacific cod	45.0	1,020	459.3	14,782	7.8	73	0.7	10			199.4	15,885
Walleye pollock	37.0	838	49.8	1,602	121.0	1,131	35.7	552			51.8	4,123
Atka mackerel	4.0	90	824.1	26,523	0.2	2					334.1	26,615
Shortspine thornyhead	1.0	22			13.0	122	31.7	490			8.0	634
Rougeye rockfish			1.2	38	0.5	5	38.0	588			7.9	631
Pacific ocean perch			3.2	103	14.6	137	4.0	62			3.8	302
Northern rockfish			205.9	6,626			0.3	5			83.2	6,631
Shorthead rockfish			1.5	48			61.0	944			12.5	992
Red king crab							1.2	18			0.2	18
Golden king crab			3.2	104	3.6	34	14.2	219			4.5	357

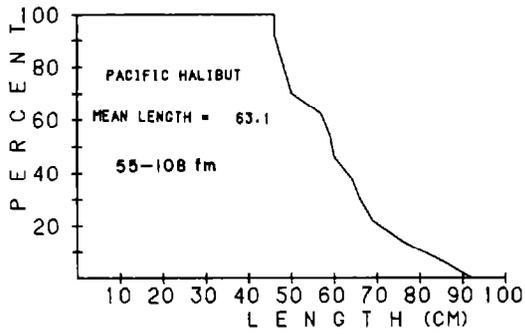
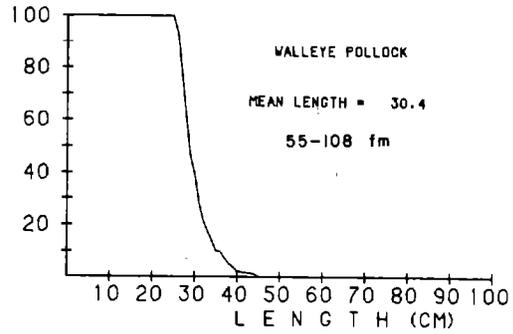
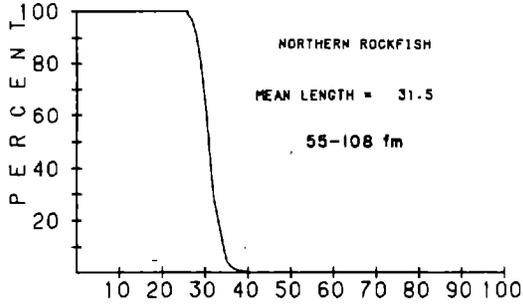
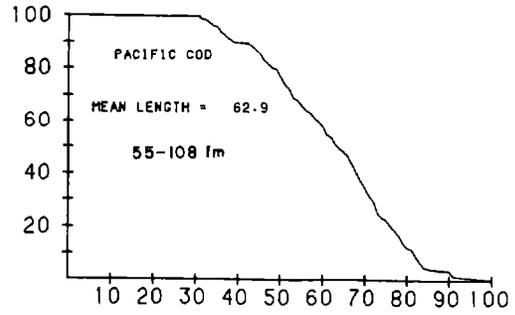
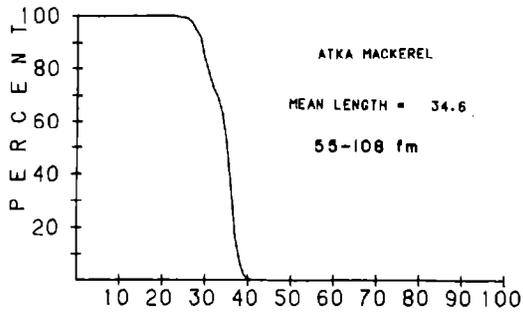


Figure 10.--Size composition of Atka mackerel, Pacific cod, northern rockfish, walleye pollock and Pacific halibut, in the Agattu to Little Sitkin Island area - Pacific side.

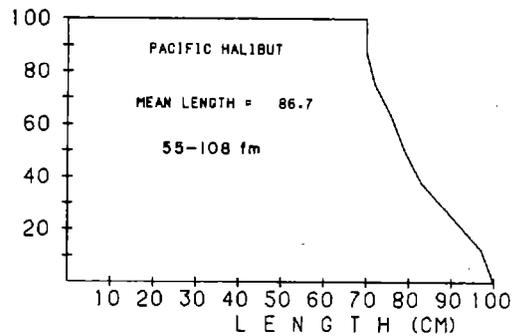
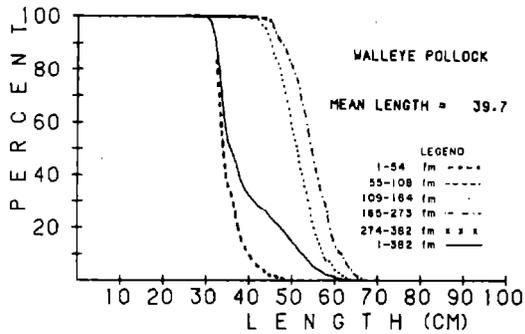


Figure 11.--Size composition of walleye pollock and Pacific halibut in the Agattu to Little Sitkin Island area - Bering side.

Walleye pollock were also captured in all depth intervals sampled; however, their highest abundance occurred in the 109-164 fm depth interval where the catch rate averaged 121 lb/h and which accounted for 39% of the available biomass in this area. Pollock ranged from 25 to 45 cm and averaged only 30.4 cm in length with only 15% of the individual being 35 cm or larger.

Two flatfish, the arrowtooth flounder and rock sole occurred in abundance in this area. Arrowtooth flounder were captured in all depth intervals sampled and were most abundant in the deepest depth interval where the catch rate averaged 180 lb/hr and which held 82% of the available biomass encountered. Rock sole were captured in depth intervals from 30 to 164 fm and were most abundant in the 55 to 108 fm depth interval which held 93% of the available biomass. Pacific halibut, which occurred at very low catch rates, ranged in length from 45 to 92 cm and averaged 63.1 cm.

Bering Side

In this area only seven stations were sampled in the extreme eastern portion, from Kiska Island to Little Sitkin Island (Figures 5-9, Table 15).

Walleye pollock was the dominant species encountered averaging 3,175 lb/h. Abundance was highest in the 109 to 164 fm (11,836 lb/h) and 55 to 108 fm (4,086 lb/h) depth intervals which together contained 97% of the estimated biomass. Size composition of walleye pollock varied by depth with the larger pollock occurring in deeper water. In the 109 to 164 and 165 to 273 fm depth intervals, pollock ranged from 40 to 67 and 42 to 68 cm in length and averaged 51.8 and 55.3 cm, respectively, with 100% of the pollock being greater than 35 cm (Figure 11). In the shallower depth interval, 55 to 108 fm, pollock ranged from 29 to 50 cm and averaged 35.7 cm.

Table 15.--Mean catch and estimates of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Agattu to Little Sitkin I.--Bering Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54 (146)		55-108 (187)		109-164 (62)		165-273 (89)		274-382 (84)		1-382 (568)	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder					28.0	34	24.0	41			8.0	75
Greenland turbot							9.0	15			1.7	15
Pacific halibut			163.2	586							63.1	586
Flathead sole												
Dover sole												
Rex sole							0.3	1			0.1	1
Rock sole	6.0	17	60.0	215	20.0	24	0.7	1			27.7	257
Sablefish							0.7	1			0.1	1
Giant grenadier												
Pacific cod			106.0	381	92.0	110	2.0	3			53.1	494
Walleye pollock			4,086.3	14,671	11,836.0	14,090	436.0	745			3,175.2	29,506
Atka mackerel			0.3	1							0.1	1
Shortspine thornyhead			0.2	1			4.9	8			1.0	9
Rougheye rockfish					128.0	152	29.3	50			21.8	202
Pacific ocean perch					104.0	124	21.0	36			17.1	160
Northern rockfish												
Shortraker rockfish					56.0	66	59.7	102			18.1	168
Red king crab												
Golden king crab					320.0	381	85.0	145			405.0	526

Other species occurring in abundance in at least one depth interval were Pacific halibut, 163 lb/h in 55 to 108 fm; Pacific cod, 106 lb/h in 55 to 198 fm; rougheye rockfish, 128 lb/hr in 109 to 164 fm; and Pacific ocean perch, 104 lb/h in 109 to 164 fm. Pacific halibut ranged from 70 to 127 cm in length and averaged 86.7 cm.

Little Sitkin Island to Great Sitkin Island

Pacific Side

Walleye pollock was the most abundant species in this area averaging 2,381 lb/hr (Figures 12-16, Table 16). Highest abundance occurred in the depth intervals 109 to 164 fm (9,050 lb/h) and 55 to 108 fm (2,561 lb/h). These two depth intervals accounted for over 99% of the available biomass.

Pollock in the 55 to 108 fm depth interval ranged from 20 to 66 and averaged only 32.4 cm in length while the pollock in the 109 to 164 fm depth interval were considerably larger, ranging from 30 to 67 and averaging 44.3 cm (Figure 16). Atka mackerel, 945 lb/h; Pacific cod, 539 lb/h; and Pacific ocean perch, 372 lb/h, also occurred at high catch rates. Atka mackerel were most abundant in the 55 to 108 fm depth interval where the catch rate averaged 3,251 lb/h and which accounted for 98% of the total available biomass encountered. The size composition of Atka mackerel was similar in both the 55 to 108 fm and 109 to 164 fm depth intervals with the exception of the smaller individuals, less than 30 cm, which occurred only in the deeper depth interval (Figure 17). Pacific cod were captured in all depth intervals sampled: however, they were most abundant in the 55 to 108 fm interval where the catch rate averaged 1,593 lb/h and which accounted for 84% of the available biomass. Pacific cod ranged from 31 to 95 and averaged 61.8 cm in length with 76% of the fish being 50 cm or larger. Pacific ocean perch were most abundant in

BERING SIDE

Sponge
205 lbs/hr

Pacific halibut
2 lbs/hr

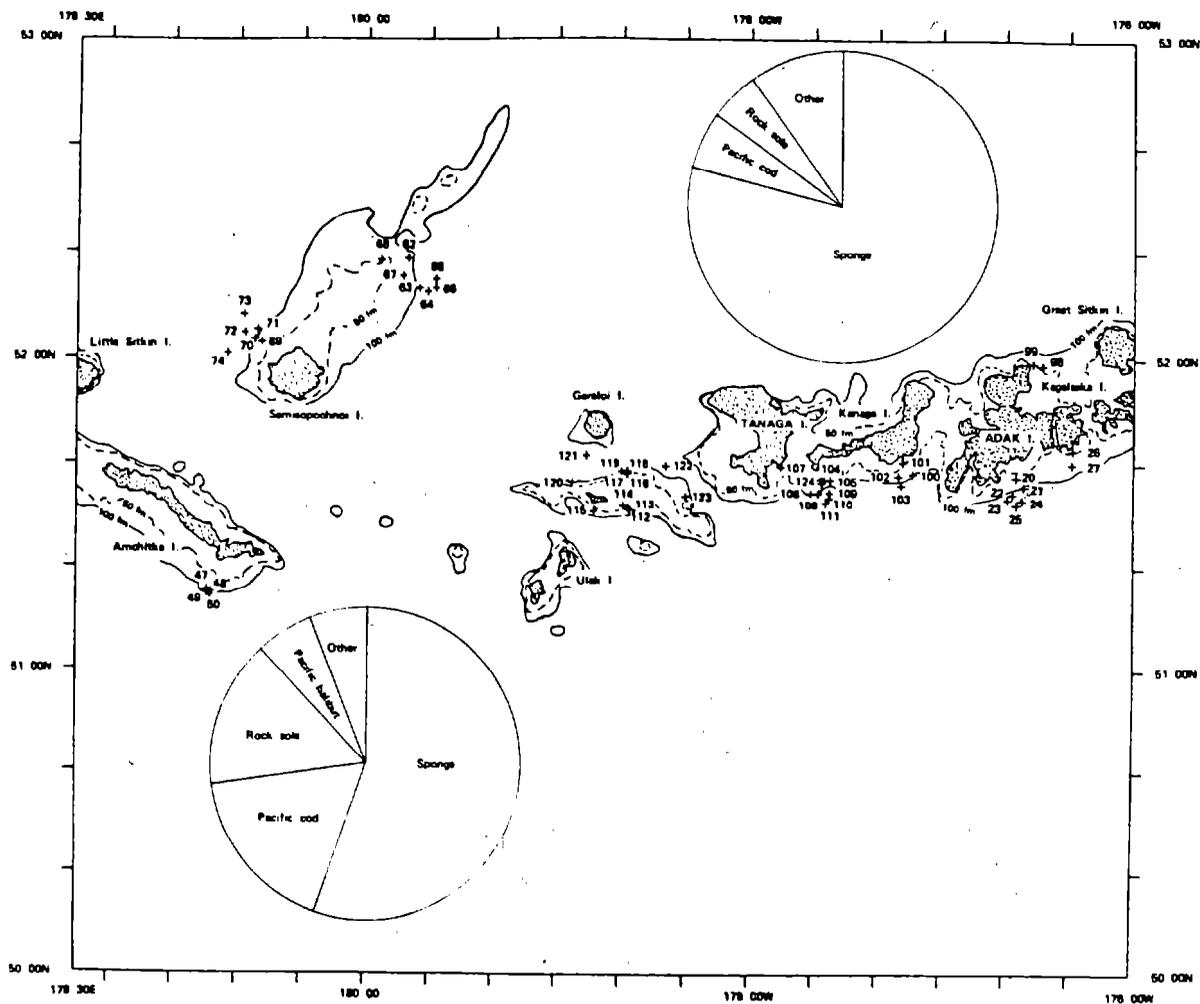
Snow crab
0 lbs/hr

Pacific cod
17 lbs/hr

Red king crab
0 lbs/hr

Rock sole
15 lbs/hr

Golden king crab
0 lbs/hr



PACIFIC SIDE

Sponge
179 lbs/hr

Pacific halibut
21 lbs/hr

Snow crab
0 lbs/hr

Pacific cod
56 lbs/hr

Red king crab
0 lbs/hr

Rock sole
50 lbs/hr

Golden king crab
0 lbs/hr

Figure 12.--Species composition and catch rates of fish and invertebrates in the 1-54 fathom depth interval from Little Sitkin to Great Sitkin Island.

BERING SIDE

Sponge
1097 lbs/hr

Walleye pollock
325 lbs/hr

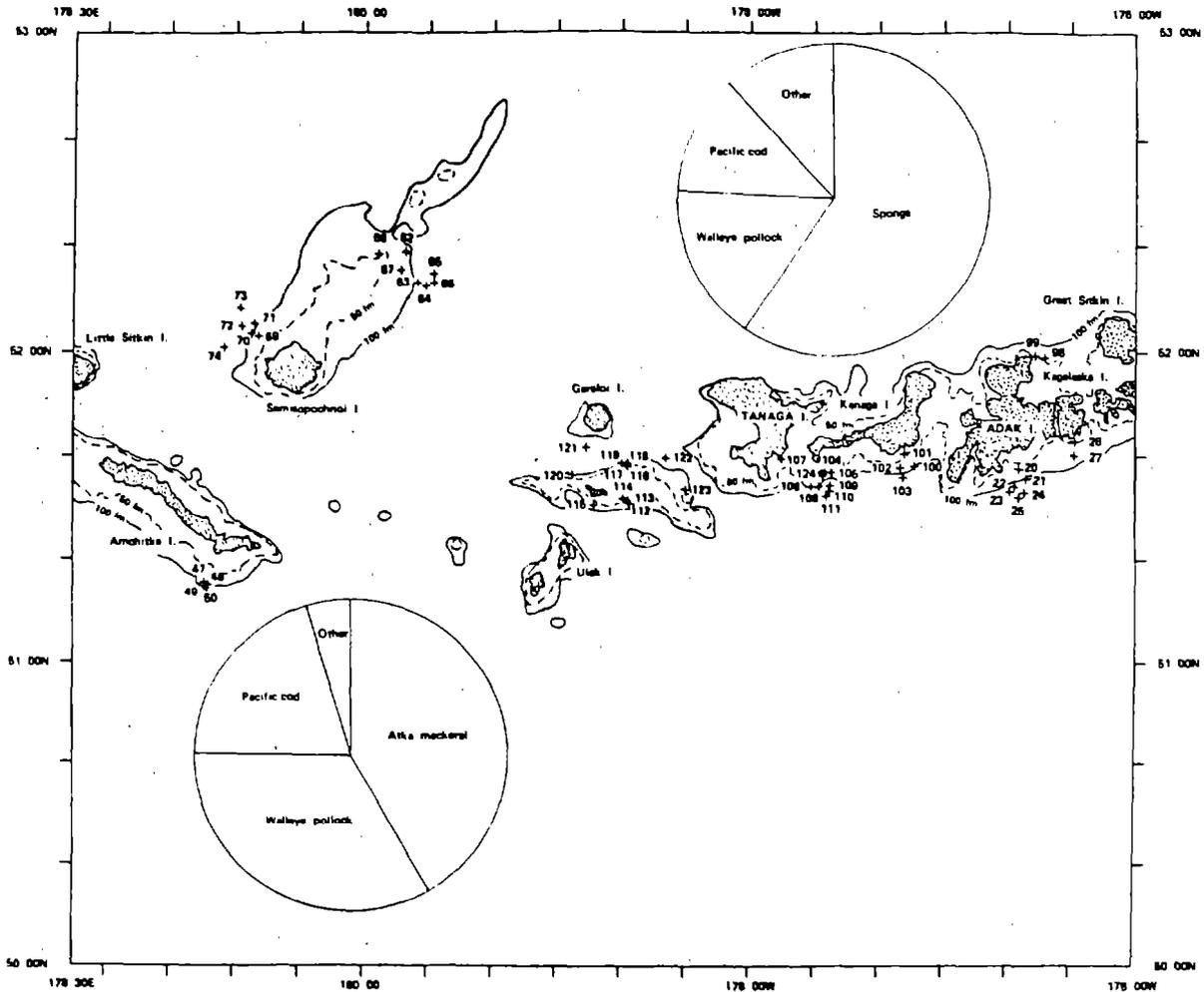
Pacific cod
206 lbs/hr

Pacific halibut
42 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Atka mackerel
3251 lbs/hr

Walleye pollock
2561 lbs/hr

Pacific cod
1593 lbs/hr

Pacific halibut
58 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0.6 lbs/hr

Snow crab
0.4 lbs/hr

Figure 13.--Species composition and catch rates of fish and invertebrates in the 55-108 fathom depth interval from Little Sitkin to Great Sitkin Island.

BERING SIDE

Sponge
2324 lbs/hr

Walleye pollock
978 lbs/hr

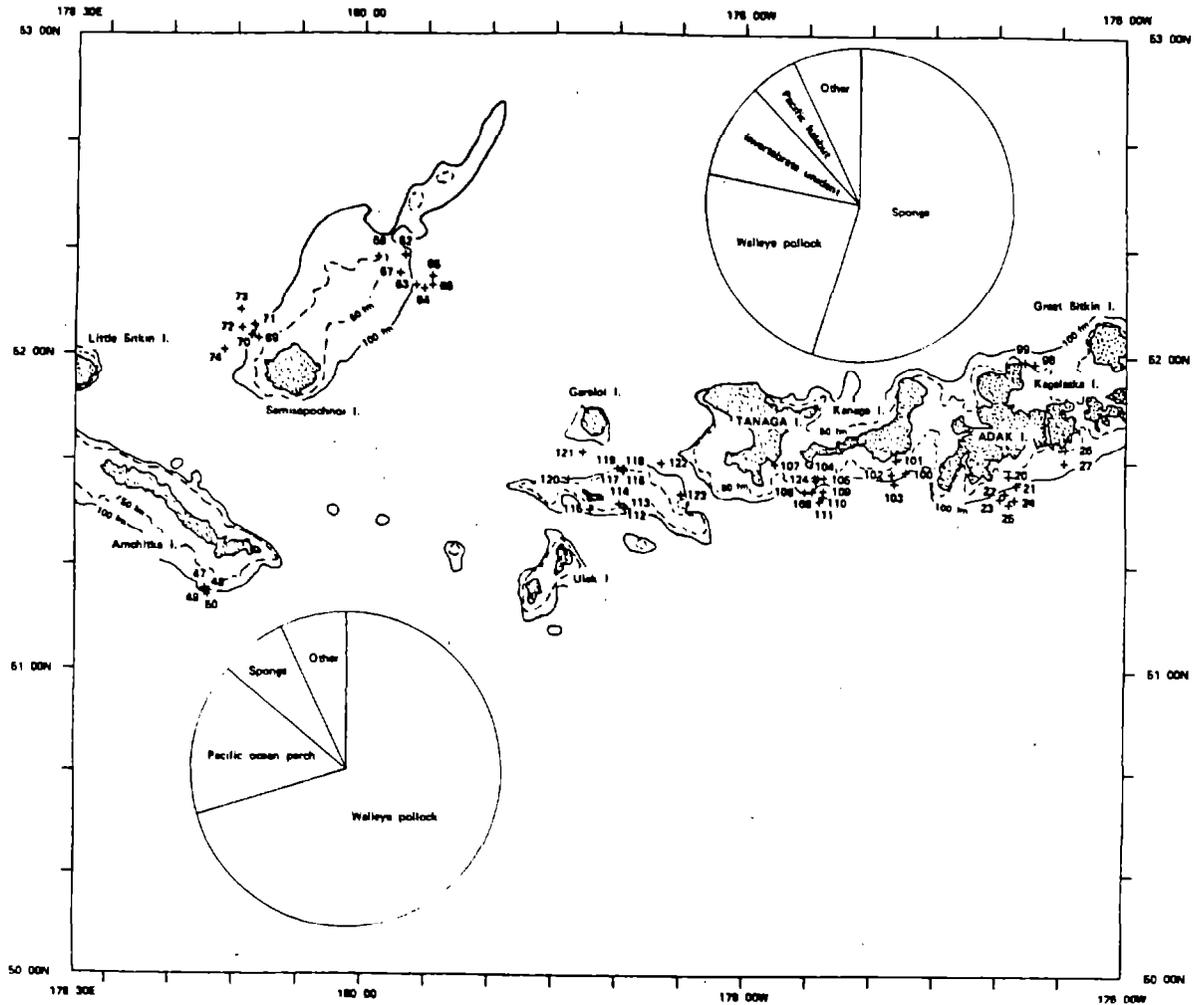
Invertebrate unident.
430 lbs/hr

Pacific halibut
215 lbs/hr

Red king crab
6 lbs/hr

Golden king crab
4 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Walleye pollock
9049 lbs/hr

Pacific ocean perch
2038 lbs/hr

Sponge
840 lbs/hr

Pacific halibut
25 lbs/hr

Red king crab
13 lbs/hr

Golden king crab
18 lbs/hr

Snow crab
0 lbs/hr

Figure 14.--Species composition and catch rates of fish and invertebrates in the 109-164 fathom depth interval from Little Sitkin to Great Sitkin Island.

BERING SIDE

Sponge
214 lbs/hr

Arrowtooth flounder
112 lbs/hr

Golden king crab
0 lbs/hr

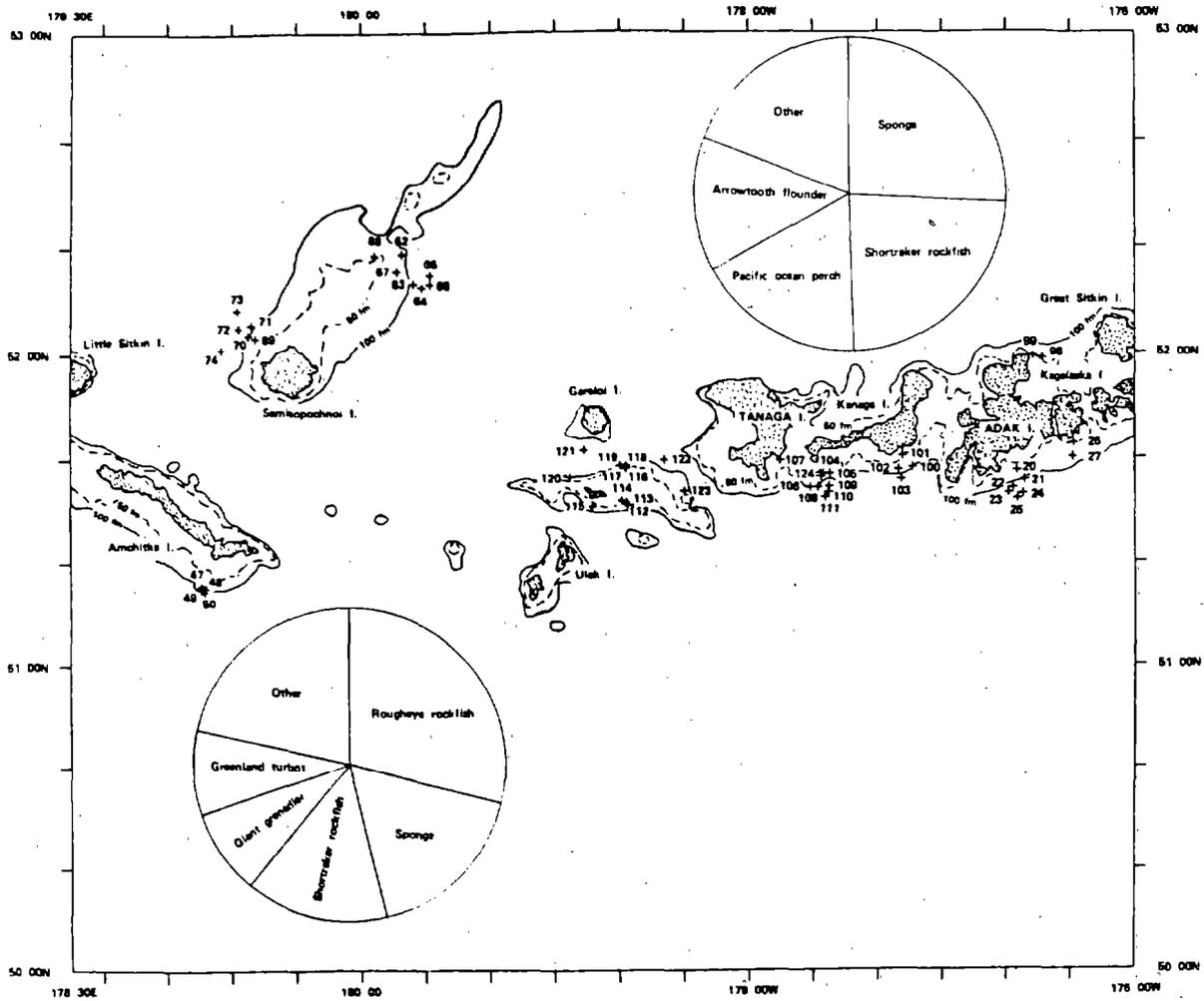
Shortraker rockfish
194 lbs/hr

Pacific halibut
0 lbs/hr

Snow crab
0 lbs/hr

Pacific ocean perch
150 lbs/hr

Red king crab
0 lbs/hr



PACIFIC SIDE

Rougheye rockfish
219 lbs/hr

Giant grenadier
65 lbs/hr

Red king crab
0 lbs/hr

Sponge
132 lbs/hr

Greenland turbot
64 lbs/hr

Golden king crab
13 lbs/hr

Shortraker rockfish
110 lbs/hr

Pacific halibut
0 lbs/hr

Snow crab
0 lbs/hr

Figure 15.--Species composition and catch rates of fish and invertebrates in the 165-273 fathom depth interval from Little Sitkin to Great Sitkin Island.

BERING SIDE

Sponge
720 lbs/hr

Pacific halibut
40 lbs/hr

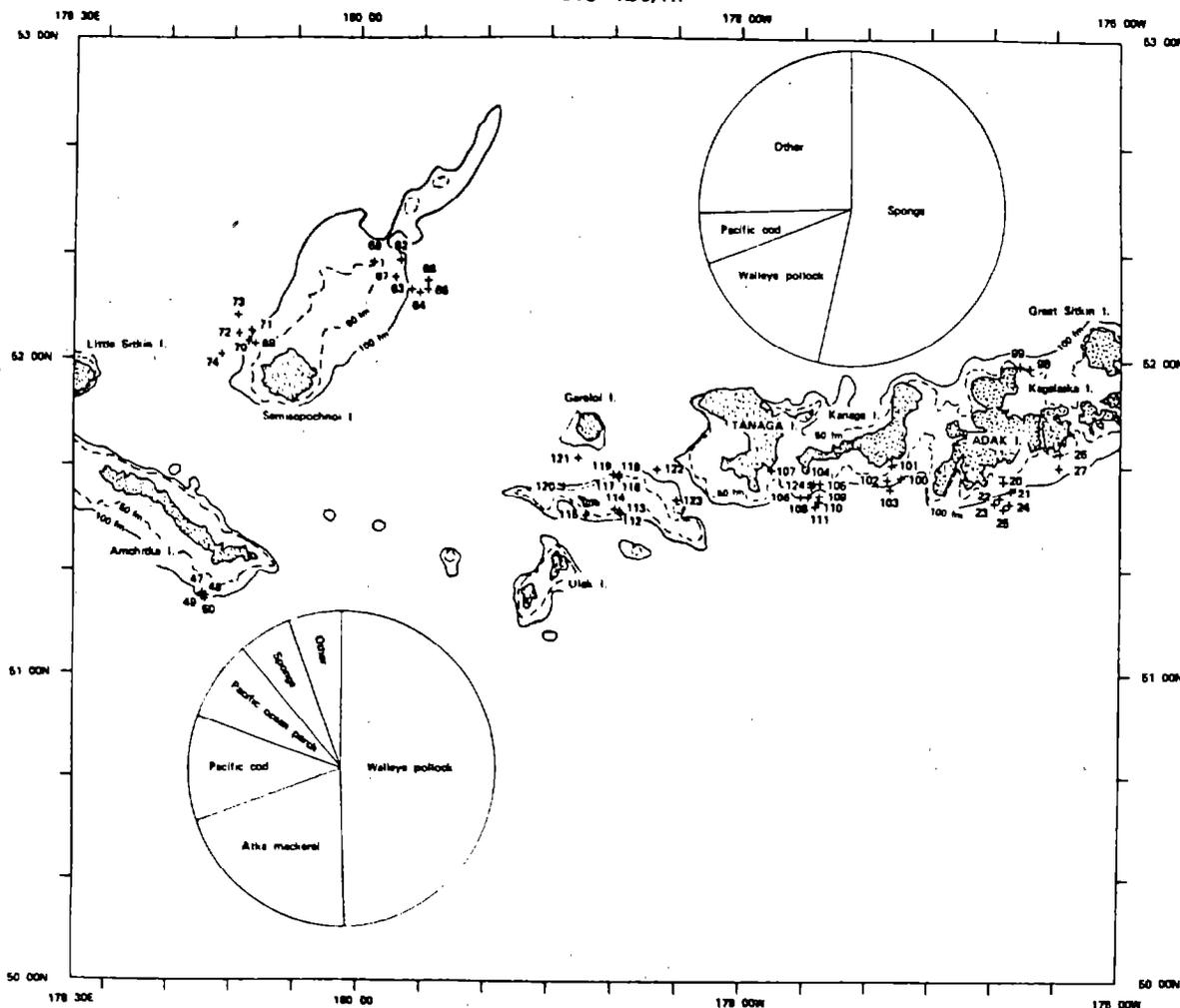
Snow crab
0.4 lbs/hr

Walleye pollock
215 lbs/hr

Red king crab
0.8 lbs/hr

Pacific cod
69 lbs/hr

Golden king crab
0.5 lbs/hr



PACIFIC SIDE

Walleye pollock
2381 lbs/hr

Pacific ocean perch
372 lbs/hr

Red king crab
2 lbs/hr

Atka mackerel
945 lbs/hr

Sponge
272 lbs/hr

Golden king crab
6 lbs/hr

Pacific cod
539 lbs/hr

Pacific halibut
28 lbs/hr

Snow crab
0.1 lbs/hr

Figure 16.--Species composition and catch rates of fish and invertebrates in the 1-382 fathom depth interval from Little Sitkin to Great Sitkin Island.

Table 16.--Mean catch and estimates of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Little Sitkin to Great Sitkin I.--Pacific Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54		55-108		109-164		165-273		274-382		1-382	
	(575)	(498)	(319)	(360)	(370)	(2,122)	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder	5.8	69	35.1	361	107.9	710	13.8	102			34.4	1,242
Greenland turbot							64.1	476			13.2	476
Pacific halibut	20.7	245	57.1	586	25.0	165					27.6	996
Flathead sole			0.1	1							0.1	1
Dover sole							0.2	2			0.1	2
Rex sole							8.8	65			1.8	65
Rock sole	50.3	597	37.4	384	15.1	99					29.9	1,080
Sablefish			0.3	3	25.2	166	32.9	244			11.4	413
Giant grenadier							65.0	482			13.4	482
Pacific cod	56.0	664	1,593.9	16,369	369.0	2,427	2.8	21			539.2	19,481
Walleye pollock	5.8	69	2,561.1	26,302	9,049.6	59,531	17.7	131			2,381.3	86,033
Atka mackerel			3,250.6	33,382	116.5	766					945.2	34,148
Shortspine thornyhead					0.2	2	8.1	60			1.7	62
Rougheye rockfish					3.9	26	218.8	1,624			45.7	1,650
Pacific ocean perch			0.5	5	2,039.0	13,413	1.2	9			371.6	13,427
Northern rockfish			2.7	28	8.3	54					2.8	82
Shortraker rockfish					10.5	69	110.7	822			24.7	891
Red king crab					13.3	88					2.4	88
Golden king crab			0.6	6	17.5	115	13.9	103			6.2	224

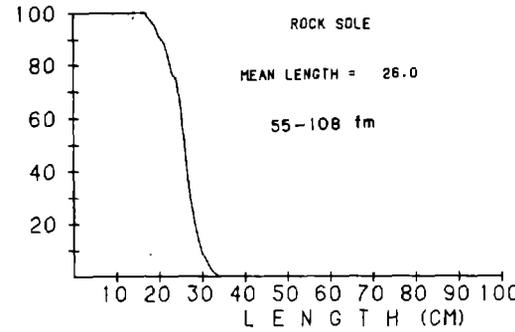
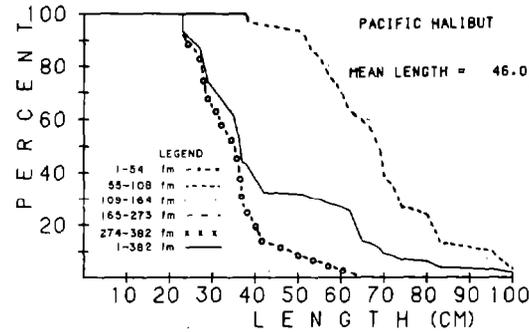
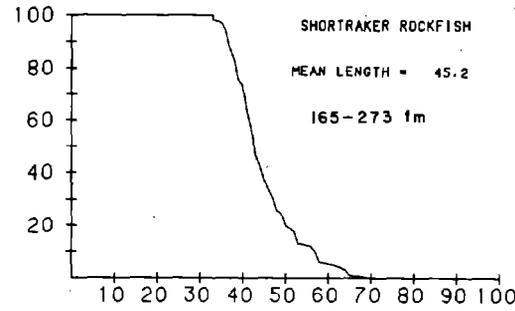
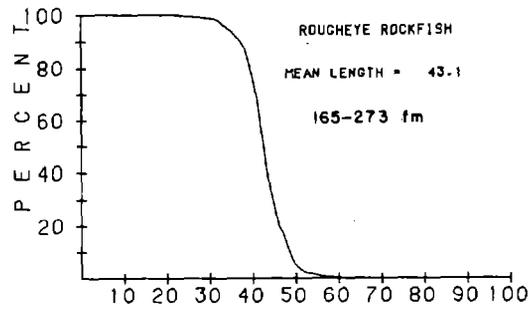
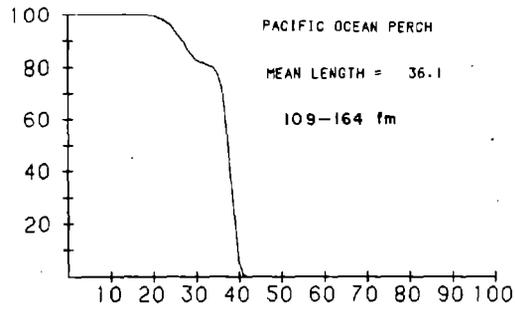
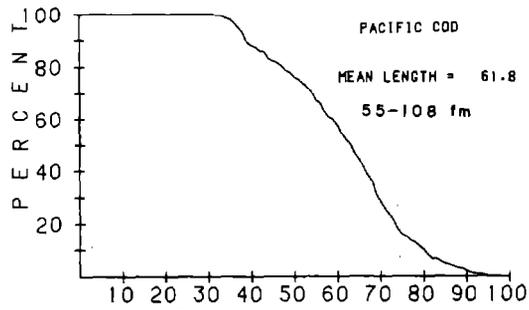
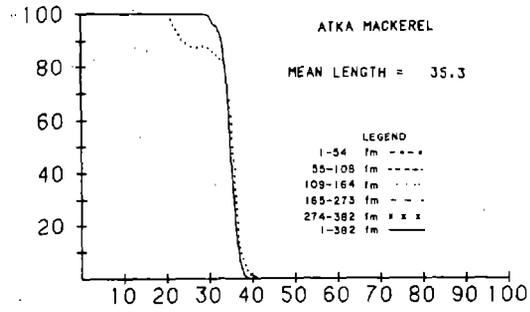
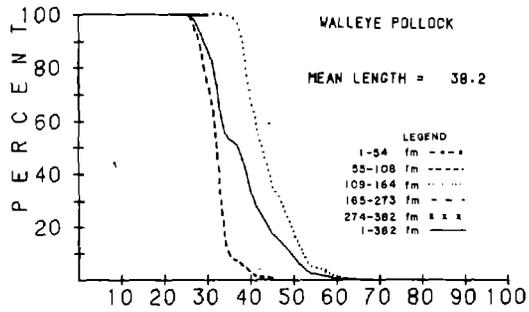


Figure 17. --Size composition of walleye pollock, Atka mackerel, Pacific cod, Pacific ocean perch, rougheye rockfish, shortraker rockfish, Pacific halibut and rock sole in the Little Sitkin to Great Sitkin Island area - Pacific side.

the 109 to 164 fm depth interval where the catch averaged 2,039 lb/h. In this depth interval they ranged from 17 to 42 and averaged 36.1 cm in length with 78% of the fish being 35 cm or larger (Figure 16). Other species which occurred at abundance levels greater than 100 lb/h in at least 1 depth interval were arrowtooth flounder, 109 to 164 fm; roughey rockfish, 165 to 273 fm; and shortraker rockfish, 165 to 273 fm. Roughey rockfish in this area ranged in size from 23 to 61 and averaged 43.1 cm in length while shortraker rockfish ranged from 33 to 70 and averaged 45.2 cm. Although they did not occur at high abundance size composition, data were collected for Pacific halibut and rock sole. The average size of Pacific halibut increased from 37.8 in 1 to 54 fm to 71.5 cm in 55 to 108 fm. Rock sole in the 55 to 108 fm depth interval were quite small, averaging only 26.0 cm.

Bering Side

Walleye pollock was the most abundant species in this area and was the only species with a mean overall catch rate greater than 100 lb/h (Figures 12-16, Table 17). Walleye pollock were most abundant in the 109 to 164 fm, 978 lb/h, and 55 to 108 fm, 325 lb/h depth intervals which contained over 99% of the available biomass. In the shallower depth interval, walleye pollock ranged from 28 to 46 and averaged 32.3 cm in length, while individuals in the 109 to 164 depth interval ranged from 30 to 59 cm and averaged 43.5 cm (Figure 18). In the shallower depth interval, only 5% of the specimens captured were 35 cm or larger, while in the deeper depth interval about 98% of the specimens were greater than 35 cm in length. Pacific cod were most abundant in the 55 to 108 fm depth interval where the catch rate averaged 206 lb/h. Cod in this depth interval ranged from 30 to 89 cm and averaged 47.3 cm in length with 25% of the specimens being larger than 50 cm. Shortraker rockfish, 194 lb/h; Pacific

Table 17.--Mean catch and estimates of exploitable **biomass** by depth interval, for dominant species in the Aleutian Region (Little Sitkin to Great Sitkin I.--Bering Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54		55-108		109-164		165-273		274-382		1-382	
	(678)		(519)		(265)		(538)		(792)		(2,792)	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder	1.0	14	10.8	118	18.0	100	111.5	1,258			35.5	1,490
Greenland turbot			0.4	4			37.2	420			10.1	424
Pacific halibut	1.6	22	42.3	460	215.0	1,194					40.0	1,676
Flathead sole	4.0	57	5.6	61							2.8	118
Dover sole							2.5	28			0.7	28
Rex sole			0.1	1							0.1	1
Rock sole	15.0	214	56.5	614	12.6	70	0.2	3			21.5	901
Sablefish							5.8	65			1.5	65
Giant grenadier							5.0	57			1.3	57
Pacific cod	17.0	242	205.8	2,239	78.0	434					69.5	2,915
Walleye pollock			325.2	3,538	978.0	5,434	2.5	28			214.6	9,000
Atka mackerel			25.0	272	1.0	6					6.6	278
Shortspine thornyhead	3.0	42	0.4	4	4.0	22	15.0	170			5.7	238
Rougheye rockfish					2.0	11	7.2	82			2.2	93
Pacific ocean perch			0.1	1			149.5	1,686			40.2	1,687
Northern rockfish												
Shortraker rockfish			0.8	9			193.8	2,186			52.3	2,195
Red king crab					6.0	34					0.8	34
Golden king crab					4.0	22					0.5	22

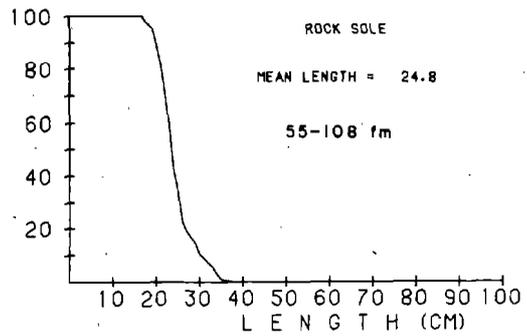
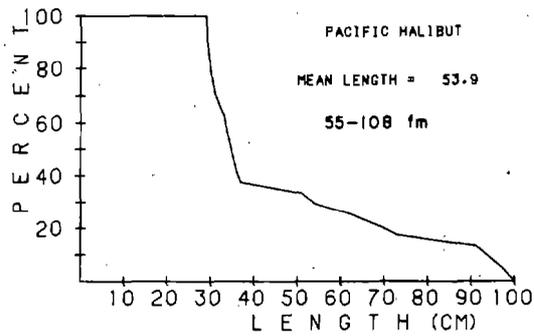
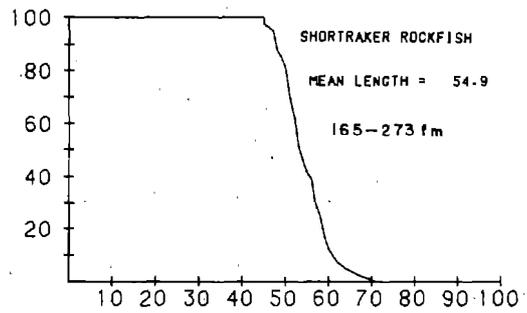
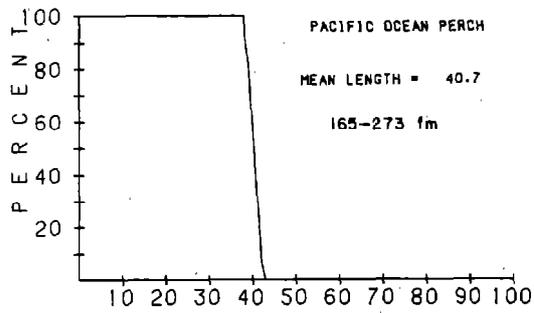
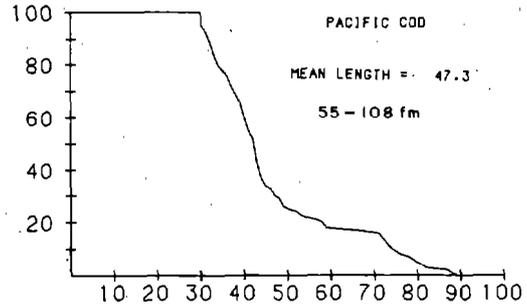
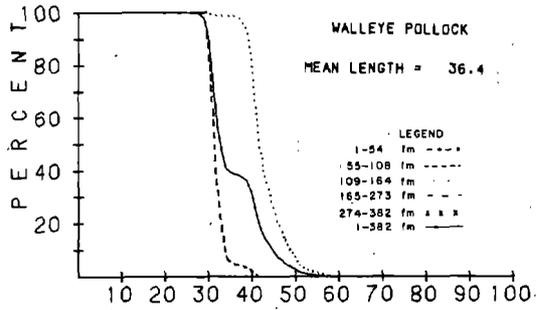


Figure 18. --Size composition of walleye pollock, Pacific cod, Pacific ocean perch, shortraker, rockfish, Pacific halibut and, rock sole in the Little Sitkin to Great Sitkin Island area - Bering side.

ocean perch, 150 lb/h; and arrowtooth flounder, 112 lb/h, **were** most abundant in the 165 to 273 fm interval. Pacific ocean perch in this area and depth interval ranged from 38 to 43 cm (average 40.7 cm) with all individuals being greater than 35 cm, while shortraker rockfish ranged from 45 to 71 cm and averaged 54.9 cm. Size composition data were also collected for Pacific halibut which ranged from 29 to 97 cm (average 53.9 cm) and rock sole which ranged from 17 to 37 cm (average 24.8 cm).

Great Sitkin Island to Yunaska Island

Pacific Side

Walleye pollock, 551 lb/h, was the most abundant species in this area (Figures 19-24, Table 18). Pollock were captured in three depth zones from 55 to 273 fm, but was **most** abundant in the 55 to 109 fm interval where the catch rate averaged 1,338 lb/h and which accounted for 93% of the available biomass. Walleye pollock in this area were large, averaging 47.9, 52.2 and 50.0 **cm** in the 55 to 108, 109 to 164 and 164 to 273 fm depth intervals, respectively (Figure 25). Smaller pollock, less than 35 **cm** were found only in shallower depth interval 55 to 108; however, even in this interval, over 90% of the individuals captured were greater than 35 **cm**.

Northern rockfish were second in abundance in this area with an average catch rate of 399 lb/h, and were found principally in the 55 to 109 fm depth interval where the catch rate averaged 1,047 lb/h and which held over 99% of the available biomass. Northern rockfish ranged from 27 to 41 **cm** in length (average 35.0 cm). Next in abundance was Atka mackerel which averaged 123 lb/h over all depth intervals. Atka mackerel occurred primarily in the 55 to 108 **fm** depth interval, 322 lb/h where over 99% of the available biomass occurred and ranged from 25 to 40 cm (average 36.0 **cm**). Pacific cod which

BERING SIDE

Rock sole
226 lbs/hr

Pacific halibut
51 lbs/hr

Golden king crab
0 lbs/hr

Pacific cod
121 lbs/hr

Red king crab
0 lbs/hr

Snow crab
0.4 lbs/hr

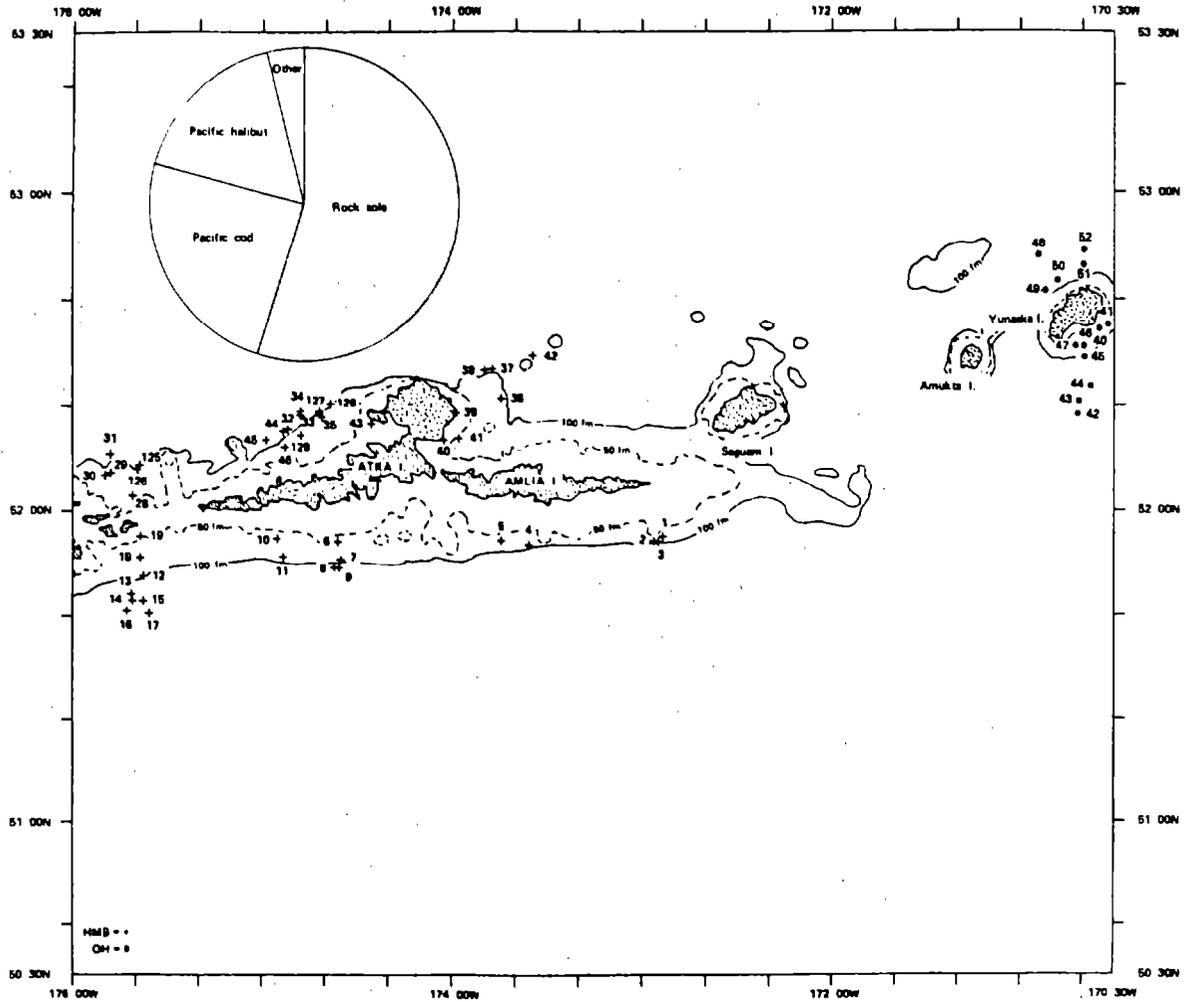


Figure 19. --Species composition and catch rates of fish and invertebrates in the 1-54 fathom depth interval from Great Sitkin to Yunaska Island.

BERING SIDE

Pacific ocean perch
1824 lbs/hr

Sponge
513 lbs/hr

Golden king crab
13 lbs/hr

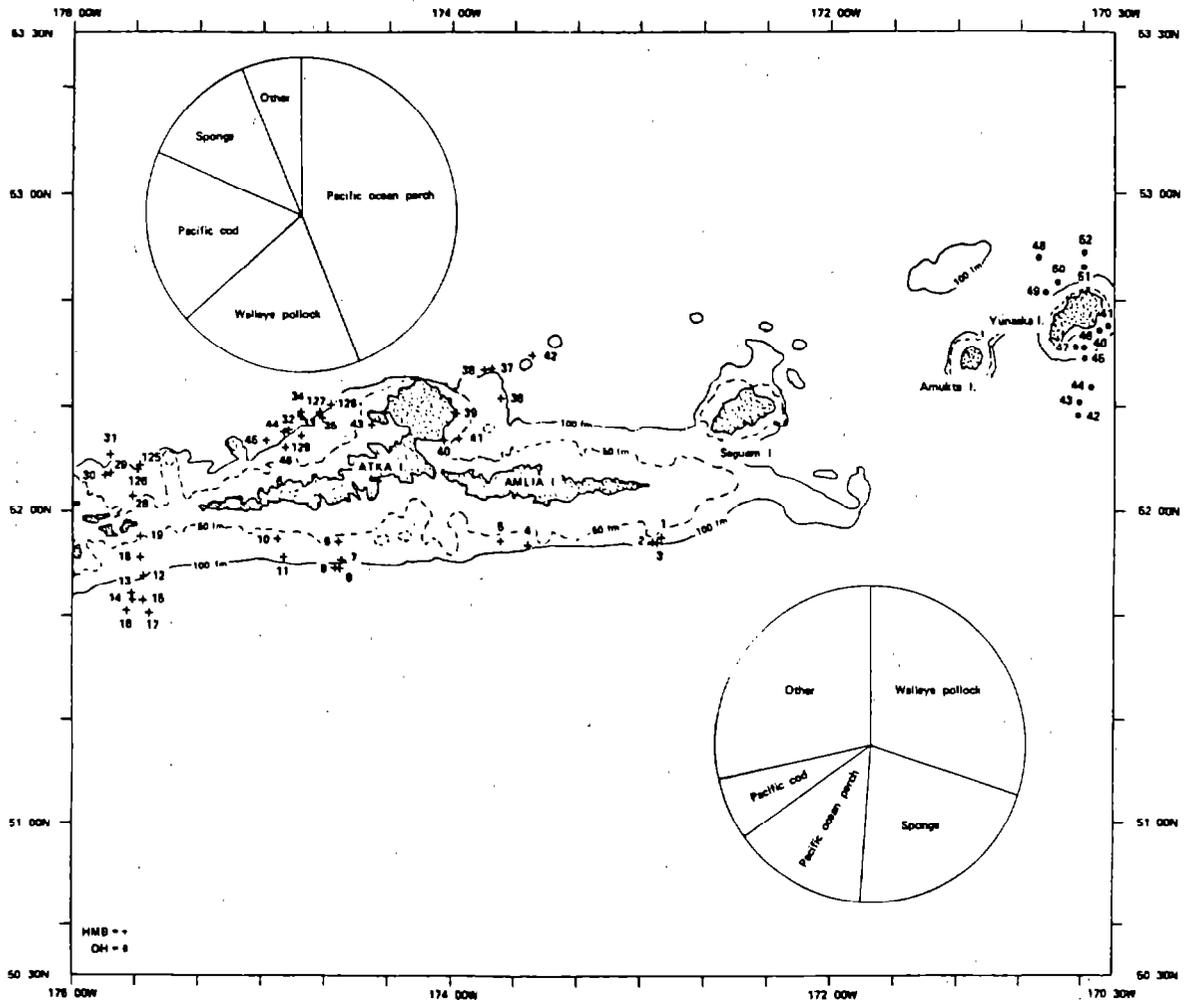
Walleye pollock
785 lbs/hr

Pacific halibut
11 lbs/hr

Snow crab
0.6 lbs/hr

Pacific cod
761 lbs/hr

Red king crab
0 lbs/hr



PACIFIC SIDE

Walleye pollock
165 lbs/hr

Pacific cod
32 lbs/hr

Golden king crab
2 lbs/hr

Sponge
117 lbs/hr

Pacific halibut
16 lbs/hr

Snow crab
0.08 lbs/hr

Pacific ocean perch
78 lbs/hr

Red king crab
0 lbs/hr

Figure 21.--Species composition and catch rates of fish and invertebrates in the 109-164 fathom depth interval from Great Sitkin to Yunaska Island.

BERING SIDE

Pacific ocean perch
1434 lbs/hr

Pacific halibut
0 lbs/hr

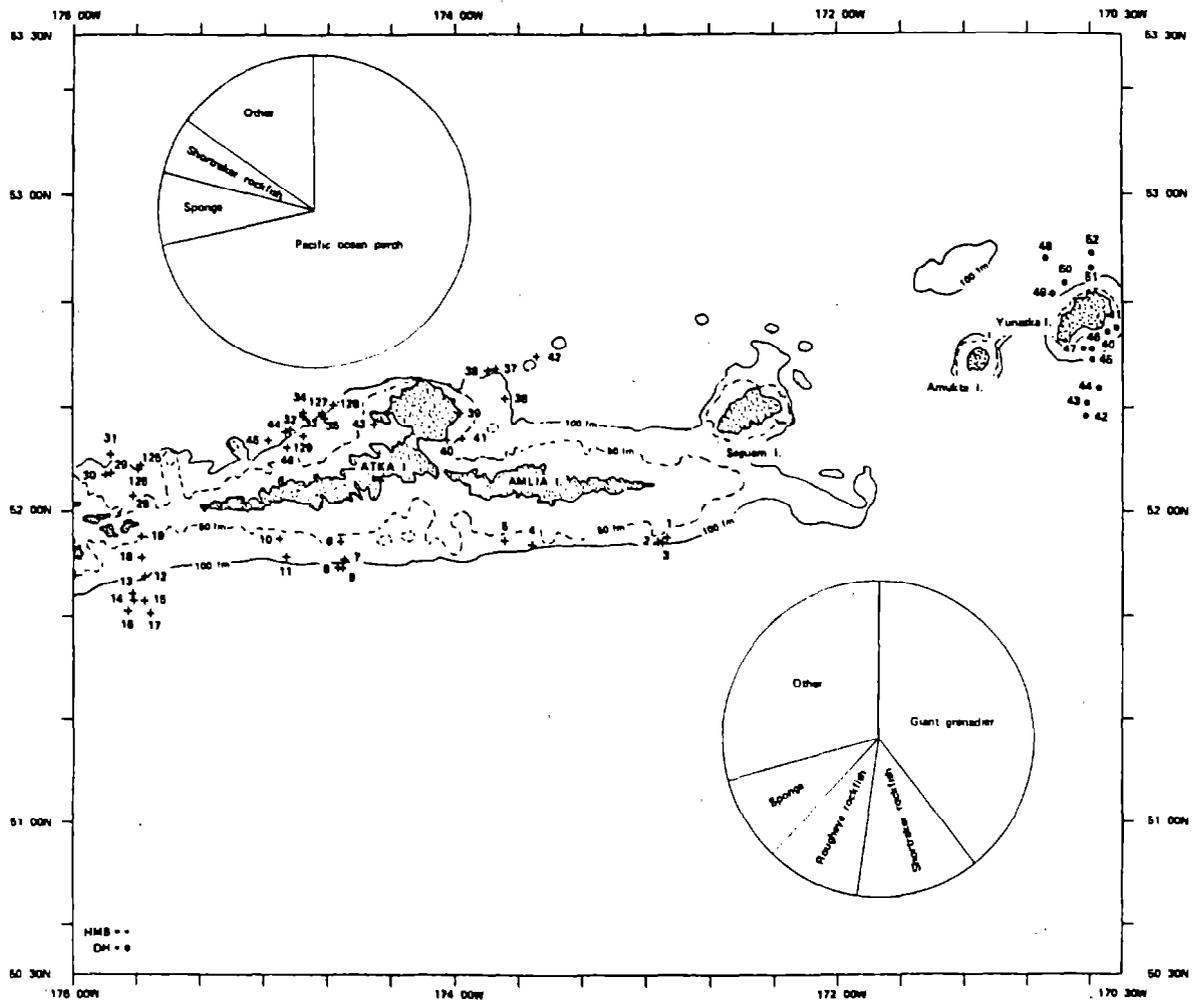
Snow crab
0 lbs/hr

Sponge
148 lbs/hr

Red king crab
0 lbs/hr

Shortraker rockfish
120 lbs/hr

Golden king crab
8 lbs/hr



PACIFIC SIDE

Giant grenadier
141 lbs/hr

Sponge
32 lbs/hr

Golden king crab
3 lbs/hr

Shortraker rockfish
46 lbs/hr

Pacific halibut
0 lbs/hr

Snow crab
0 lbs/hr

Rougheye rockfish
36 lbs/hr

Red king crab
0 lbs/hr

Figure 22.--Species composition and catch rates of fish and invertebrates in the 165-273 fathom depth interval from Great Sitkin to Yunaska Island.

BERING SIDE

Giant grenadier
260 lbs/hr

Pacific halibut
0 lbs/hr

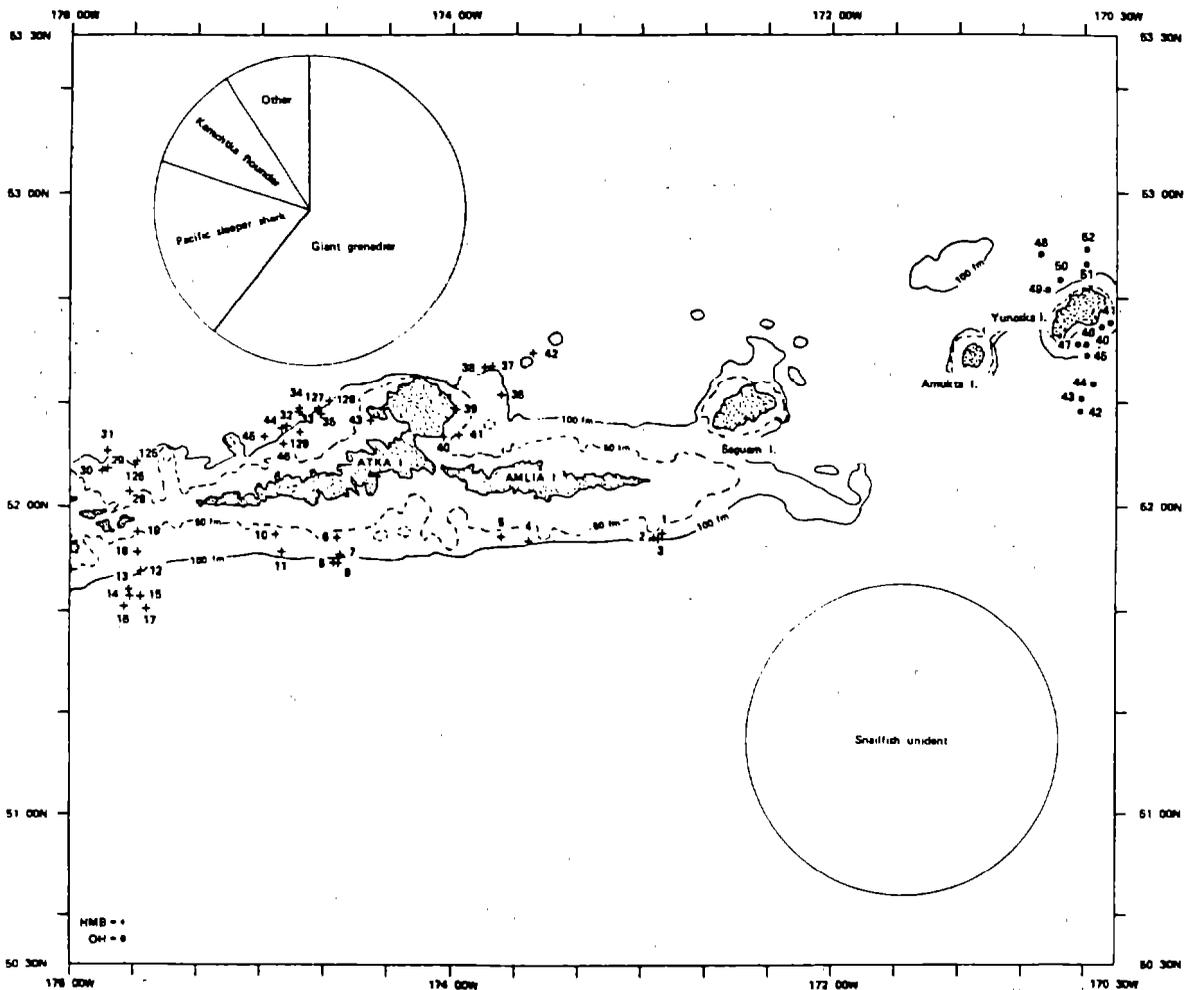
Snow crab
0 lbs/hr

Pacific sleeper shark
86 lbs/hr

Red king crab
0 lbs/hr

Kamchatka flounder
48 lbs/hr

Golden king crab
8 lbs/hr



PACIFIC SIDE

Snailfish unident.
0.2 lbs/hr

Red king crab
0 lbs/hr

Snow crab
0 lbs/hr

Pacific halibut
0 lbs/hr

Golden king crab
0 lbs/hr

Figure 23.--Species composition and catch rates of fish and invertebrates in the 274-382 fathom depth interval from Great Sitkin to Yunaska Island.

BERING SIDE

Pacific ocean perch
572 lbs/hr

Sponge
126 lbs/hr

Golden king crab
5 lbs/hr

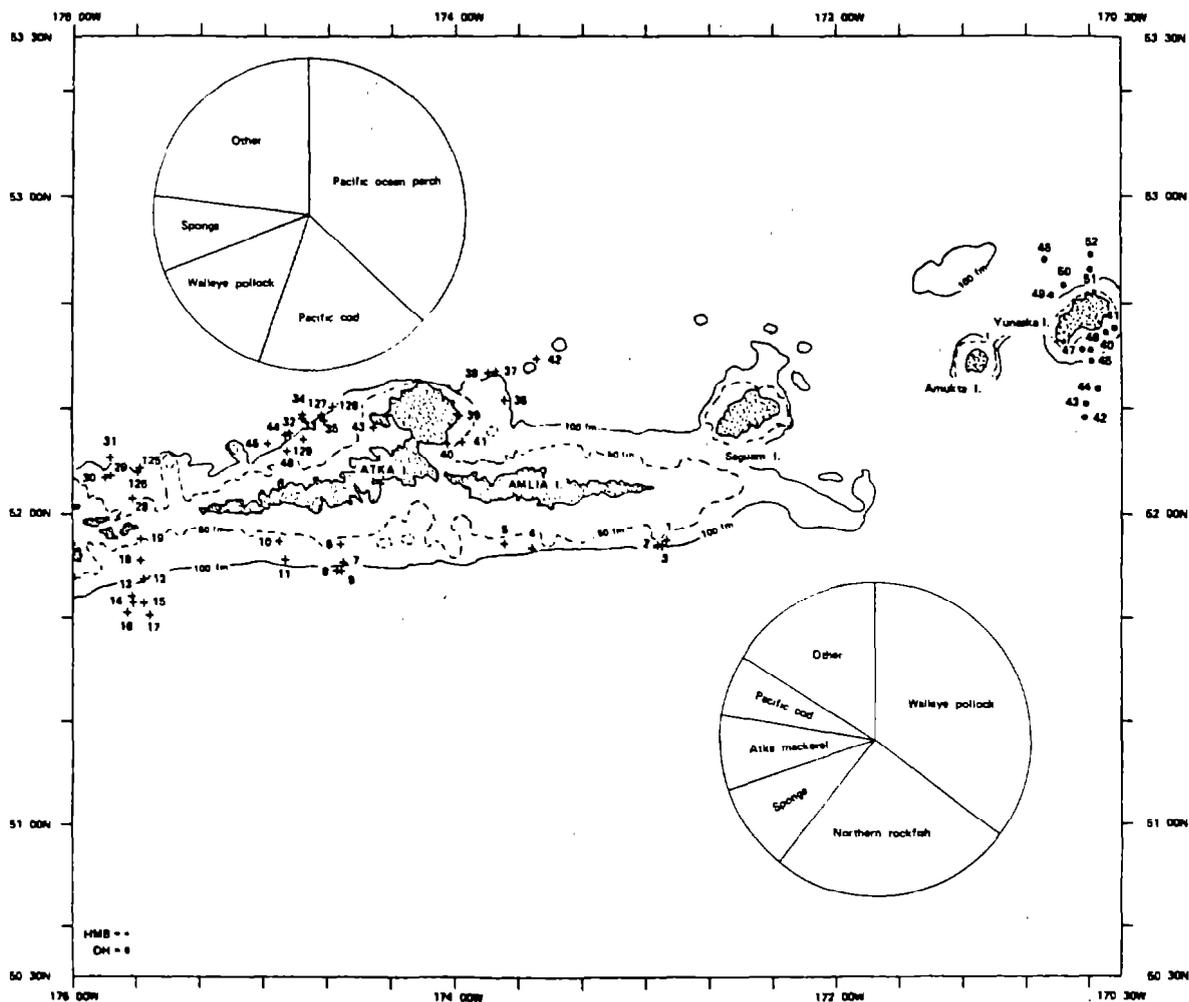
Pacific cod
274 lbs/hr

Pacific halibut
15 lbs/hr

Snow crab
2 lbs/hr

Walleye pollock
207 lbs/hr

Red king crab
5 lbs/hr



PACIFIC SIDE

Walleye pollock
550 lbs/hr

Atka mackerel
123 lbs/hr

Red king crab
1 lbs/hr

Northern rockfish
399 lbs/hr

Pacific cod
97 lbs/hr

Golden king crab
2 lbs/hr

Sponge
136 lbs/hr

Pacific halibut
45 lbs/hr

Snow crab
0.04 lbs/hr

Figure 24. --Species composition and catch rates of fish and invertebrates in the 1-382 fathom depth interval from Great Sitkin to Yunaska Island.

Table 18.--Mean catch and estimates of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Great Sitkin to Yunaska I.--Pacific Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54 (952)		55-108 (1,136)		109-164 (685)		165-273 (737)		274-382 (421)		1-382 (3,931)	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder			21.6	578	25.4	410	15.5	269			17.9	1,257
Greenland turbot							5.5	95			1.4	95
Pacific halibut			107.5	2,874	16.0	258					44.7	3,132
Flathead sole					0.4	6					0.1	6
Dover sole												
Rex sole			2.0	54	0.7	11	5.6	97			2.3	162
Rock sole			45.0	1,202	10.0	161	9.3	162			21.8	1,525
Sablefish			0.5	13	16.6	267	17.0	294			8.2	574
Giant grenadier							140.8	2,442			34.8	2,442
Pacific cod			234.0	6,253	32.0	516	2.7	46			97.2	6,815
Walleye pollock			1,338.3	35,768	165.0	2,659	8.8	153			550.5	38,580
Atka mackerel			322.1	8,610	1.6	26					123.2	8,636
Shortspine thornyhead					2.0	32	3.0	52			1.2	84
Rougheye rockfish					5.2	84	36.0	624			10.1	708
Pacific ocean perch			36.3	971	78.0	1,257	10.0	174			34.3	2,402
Northern rockfish			1,046.7	27,974	1.0	17	0.2	3			399.4	27,994
Shortraker rockfish					2.0	32	46.2	801			11.9	833
Red king crab			3.5	92							1.3	92
Golden king crab			1.5	39	2.0	32	2.7	46			1.7	117

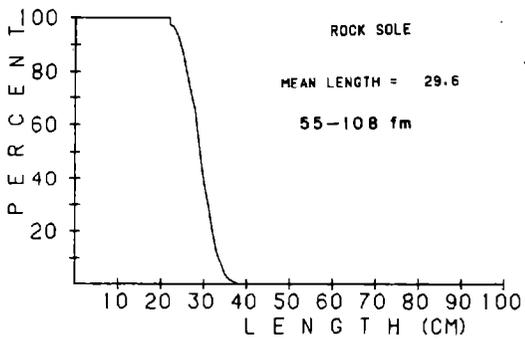
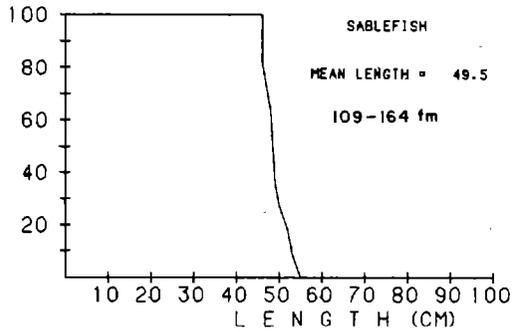
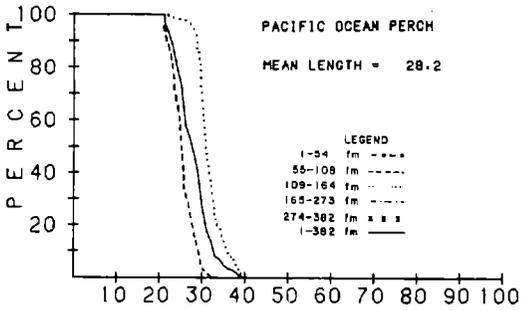
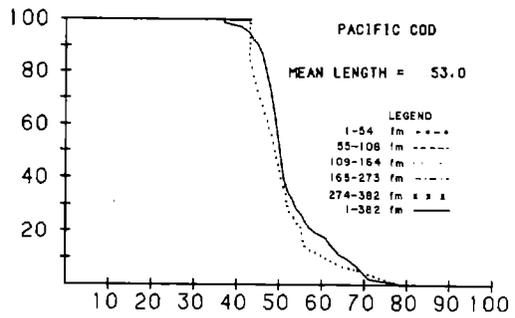
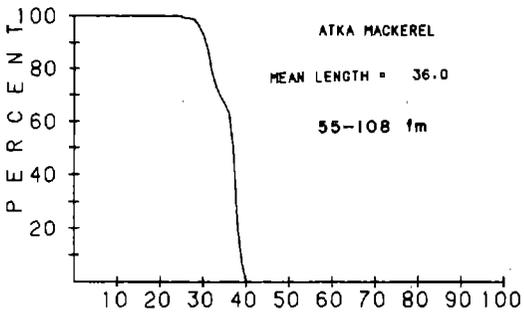
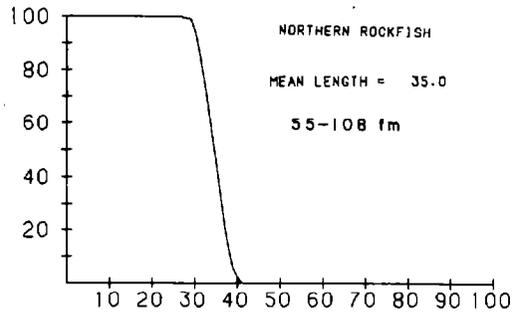
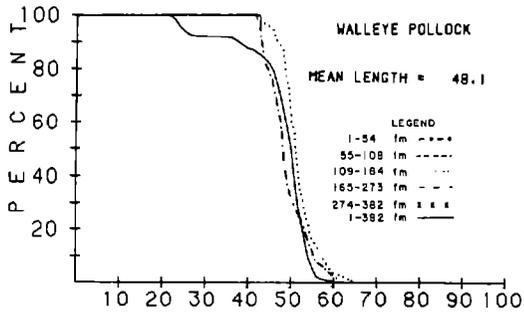


Figure 25.--Size composition of walleye pollock, northern rockfish, Atka mackerel, Pacific cod, Pacific ocean perch, sablefish and rock sole in the Great Sitkin to Yunaska Island area - Pacific side.

occurred in all depth intervals sampled, averaged 97 lb/h; however, highest abundance was found in the 55 to 108 fm interval, 234 lb/h, which accounted for 92% of the available biomass. Pacific cod ranged from 31 to 95 cm (average 53.1 cm) in the 55 to 108 fm interval and from 37 to 79 cm (average 52.0 cm) in 109 to 164 fm with 52 and 43% of the specimens being larger than 50 cm. Other species which occurred in abundances of 100 lb/h or more, in one depth interval, included giant grendier (rattails), 141 lb/h in 165 to 273 fm, and Pacific halibut, 108 lb/h in 55 to 108 fm. Pacific halibut ranged in size from 35 to 119 cm (average 80.7 cm). Length frequency data were collected for Pacific ocean perch, sablefish, and rock sole. The average size of Pacific ocean perch increased with depth averaging 25.9 cm in 55 to 108 fm and 31.8 cm in 109 to 164 fm. Pacific ocean perch in this area were small with all individuals in the 55 to 108 fm depth interval being less than 35 cm and only 12% of the specimens in the 109 to 164 fm depth interval being 35 cm or larger. Sablefish ranged from 46 to 55 cm (average 49.5 cm), while rock sole ranged from 22 to 38 cm (average 29.6 cm).

Bering Side

Pacific ocean perch was the most abundant species in this area with an average catch rate of 572 lb/h (Figures 19-24, Table 19). Pacific ocean perch were abundant in both the 109 to 164 fm, 1,824 lb/hr, and 165 to 273 fm, 1,434 lb/h, depth intervals which accounted for 98% of the available biomass. The average length of Pacific ocean perch increased with depth, averaging 33.9 cm in 55 to 100 fm, 34.6 cm in 107 to 164 fm, and 37.4 cm in 165 to 273 fm (Figure 26). In the deeper depth interval about 86% of the Pacific ocean perch encountered were 35 cm or larger while only 45% were larger than 35 cm in the middle depth and 36% in the shallow depth interval.

Table 19.--Mean catch and estimates of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Great Sitkin to Yunaska I.--Bering Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54		55-108		109-164		165-273		274-382		1-382	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
	(620)		(886)		(520)		(710)		(774)		(3,510)	
Arrowtooth flounder	0.4	5	169.0	2,954	30.8	316	13.2	186			50.0	3,461
Greenland turbot					4.1	42	90.0	1,261	12.0	183	21.5	1,486
Pacific halibut	51.0	624	16.8	294	11.4	118					15.0	1,036
Flathead sole			29.7	518	1.1	12	26.9	377			13.1	907
Dover sole												
Rex sole			0.9	16							0.2	16
Rock sole	226.0	2,764	58.9	1,030	10.6	109					56.4	3,903
Sablefish					0.3	3					0.1	3
Giant grenadier									260.0	3,970	57.3	3,970
Pacific cod	121.0	1,480	528.6	9,239	760.6	7,802	33.0	462			274.1	18,983
Walleye pollock			334.1	5,840	784.7	8,050	32.5	455			207.1	14,345
Atka mackerel												
Shortspine thornyhead												
Rougheye rockfish					7.4	76	18.4	258			4.8	334
Pacific ocean perch			46.1	806	1,824.0	18,713	1,434.2	20,090			572.0	39,609
Northern rockfish	0.4	5	2.1	37	20.0	205					3.6	247
Shortraker rockfish			3.0	53	11.1	114	120.0	1,681			26.7	1,848
Red king crab			20.4	358							5.2	358
Golden king crab					12.9	133	8.0	112	8.0	122	5.3	367

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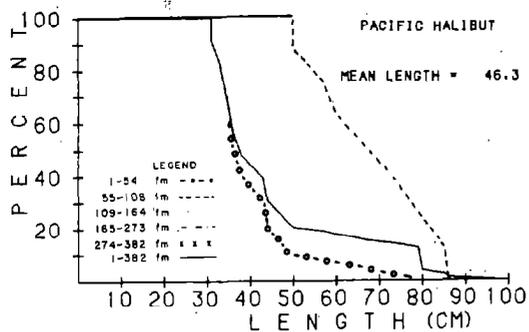
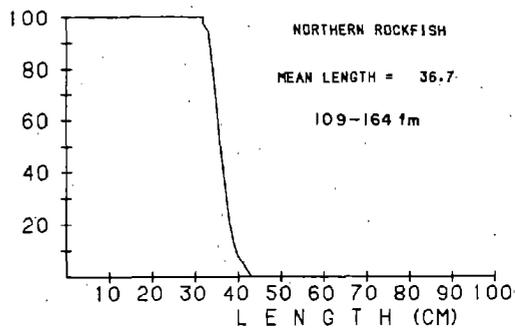
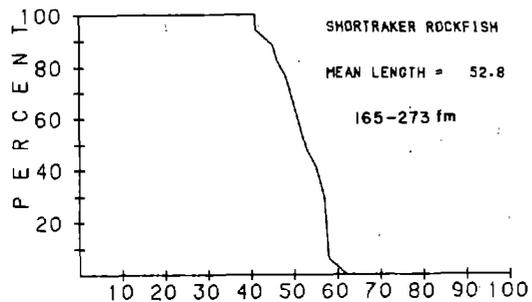
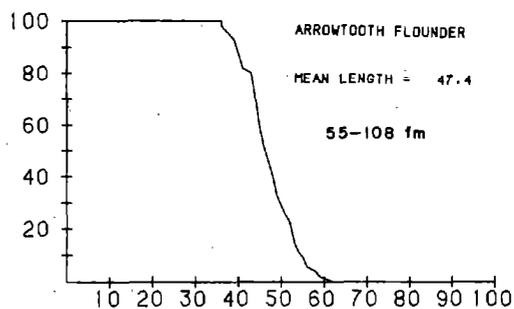
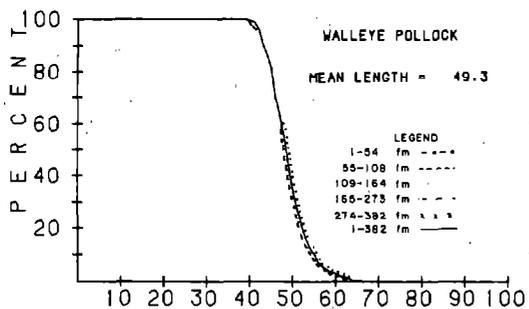
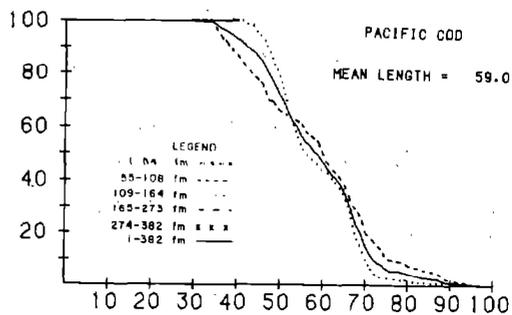
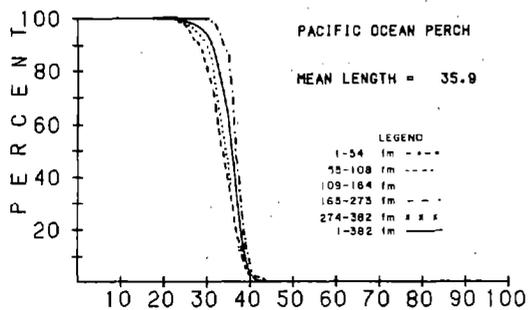


Figure 26. --Size composition of Pacific ocean perch, Pacific cod, walleye pollock, arrowtooth flounder, shortraker rockfish, northern rockfish and Pacific halibut in the Great Sitkin to Yunaska Island area - Bering side.

Pacific cod was the second most abundant species, averaging 274 lb/h, followed by walleye pollock, averaging 207 lb/h. Pacific cod were caught primarily in the 55 to 164 fm depth interval which accounted for 90% of the available biomass. Pacific cod in 55 to 108 fm ranged from 30 to 97 cm (average 59.2 cm) and from 41 to 88 cm (average 58.8 cm) in 109 to 164 fm. In the 55 to 108 fm depth interval 66% of the cod were 50 cm or larger and 77% in 109 to 164 fm. Walleye pollock occurred in highest abundance in 109 to 164 fm, 785 lb/h, and 55 to 108 fm, 334 lb/h. These two depth intervals also accounted for 97% of the available biomass. Walleye pollock were large in both the 55 to 108 and 109 to 164 fm depth intervals, where they ranged, respectively, from 38 to 70 cm (average 48.9 cm) and 40 to 64 cm (average 49.6 cm).

Other species which were abundant in at least one depth interval included giant grenadier (rattail), 260 lb/h, 274 to 382 fm; arrowtooth flounder; 169 lb/h, 55 to 108 fm; rock sole, 226 lb/h in 30 to 54 fm; and shortraker rockfish, 120 lb/h in 165 to 273 fm. Arrowtooth flounder in the 55 to 108 fm depth ranged from 36 to 62 cm (average 47.4 cm) and shortraker rockfish ranged from 41 to 62 cm (average 52.8 cm) while giant grenadier ranged from 86 to 114 cm (average 97.6 cm). Length frequency data were also taken from northern rockfish which ranged from 32 to 43 cm (average 36.7 cm) in the 109 to 164 fm depth interval and Pacific halibut for which the average size increased from 42.4 cm in 1 to 54 fm to 69.8 cm in 55 to 108.

Yunaska Island to Unimak Pass

Pacific Side

Pacific ocean perch, 1,405 lb/h, and walleye pollock, 1,060 lb/h (average catch rates), were the two dominant species in this area (Figures 27-32,

BERING SIDE

Pacific cod
1825 lbs/hr

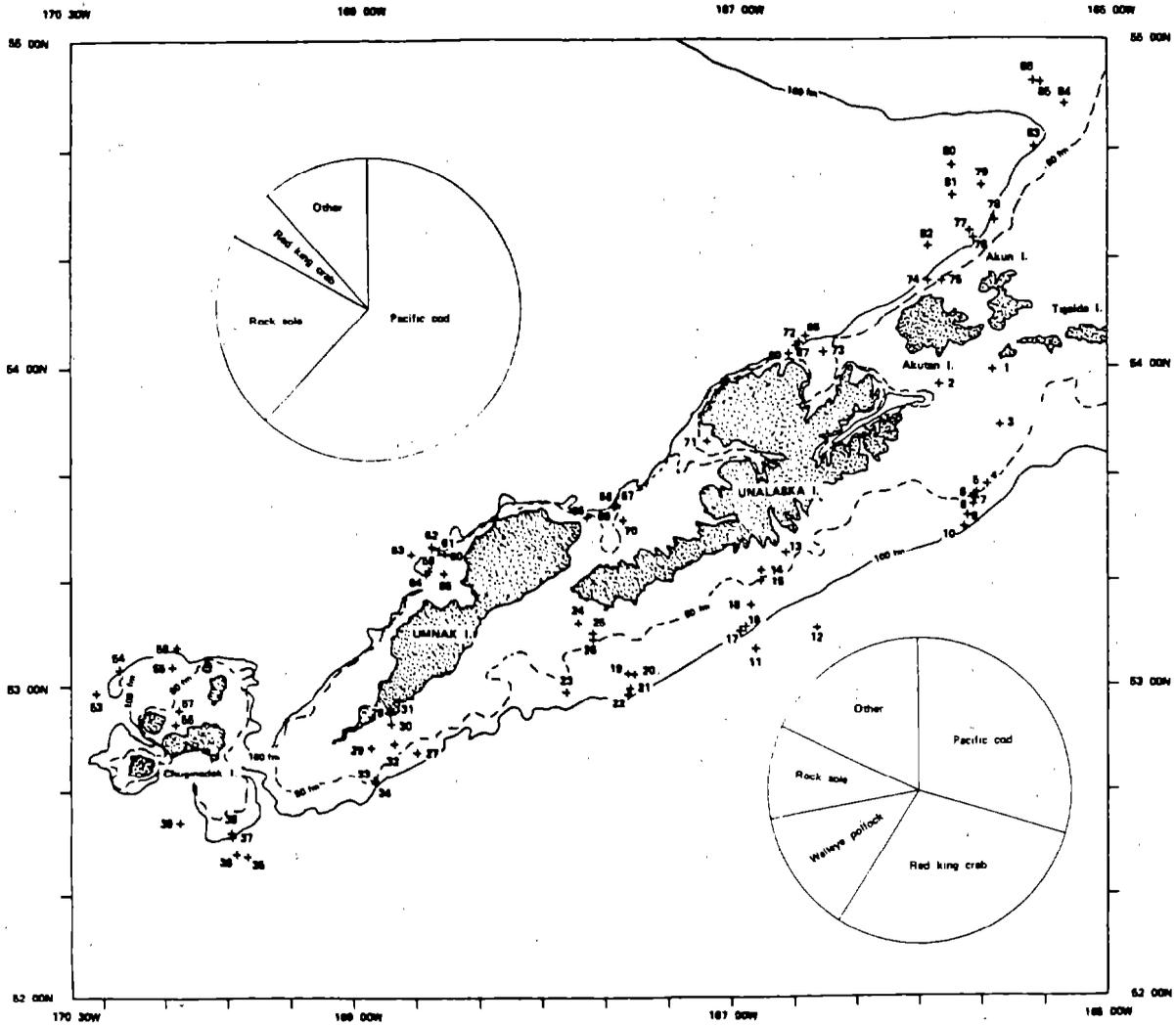
Pacific halibut
26 lbs/hr

Golden king crab
0 lbs/hr

Rock sole
597 lbs/hr

Red king crab
154 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Pacific cod
836 lbs/hr

Pacific halibut
97 lbs/hr

Snow crab
0 lbs/hr

Walleye pollock
383 lbs/hr

Red king crab
813 lbs/hr

Rock sole
288 lbs/hr

Golden king crab
0 lbs/hr

Figure 27. --Species composition and catch rates of fish and invertebrates in the 1-54 fathom depth interval from Yunaska Island to Unimak Pass.

BERING SIDE

Pacific cod
3185 lbs/hr

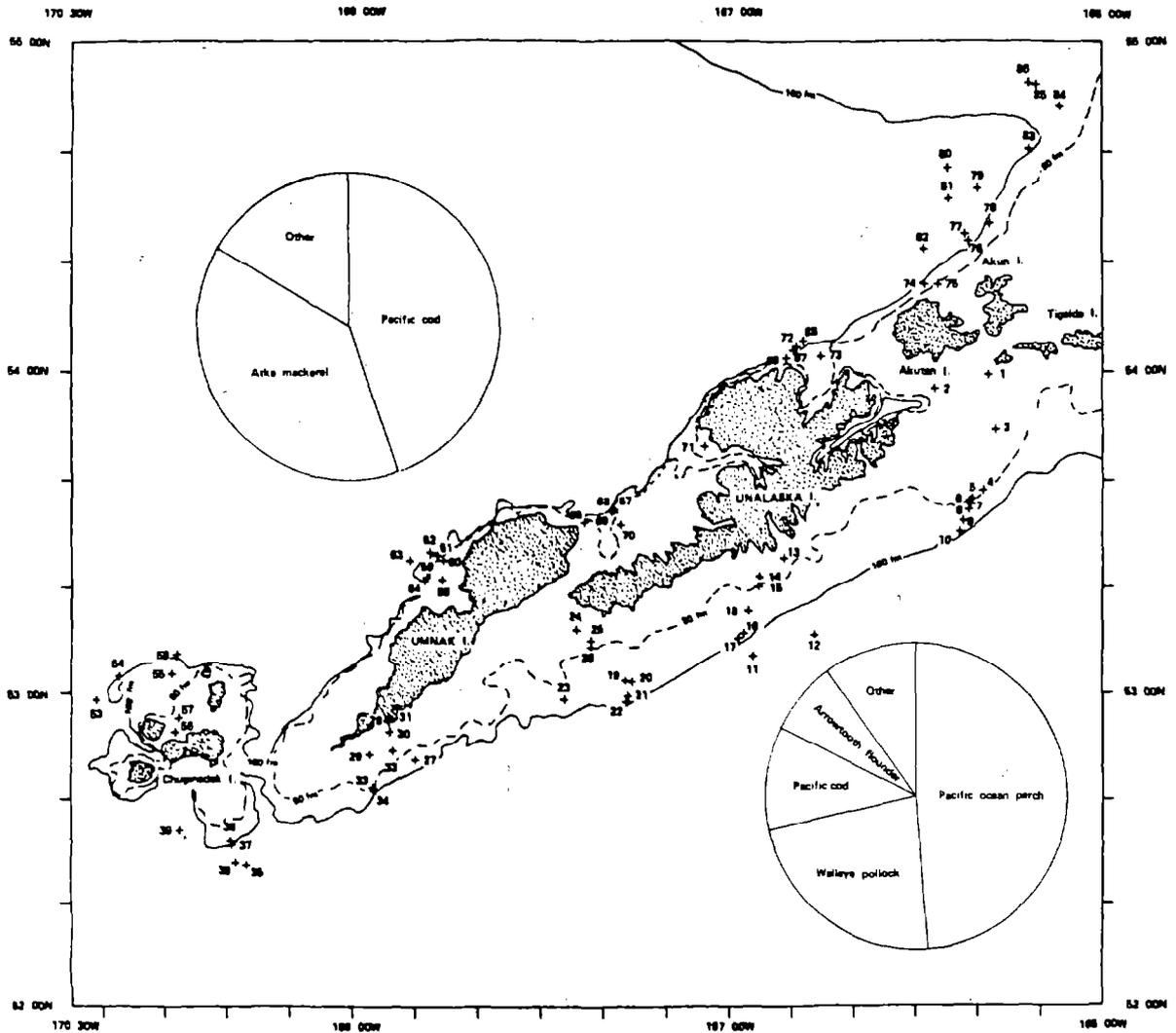
Atka mackerel
2791 lbs/hr

Pacific halibut
203 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0 lbs/hr

Snow crab
0.03 lbs/hr



PACIFIC SIDE

Pacific ocean perch
4037 lbs/hr

Walleye pollock
1925 lbs/hr

Pacific cod
877 lbs/hr

Arrowtooth flounder
633 lbs/hr

Pacific halibut
35 lbs/hr

Red king crab
6 lbs/hr

Golden king crab
0 lbs/hr

Snow crab
1 lbs/hr

Figure 28. --Species composition and catch rates of fish and invertebrates in the 55-108 fathom depth interval from Yunaska Island to Unimak Pass.

BERING SIDE

Pacific ocean perch
1363 lbs/hr

Walleye pollock
1117 lbs/hr

Pacific cod
765 lbs/hr

Sablefish
668 lbs/hr

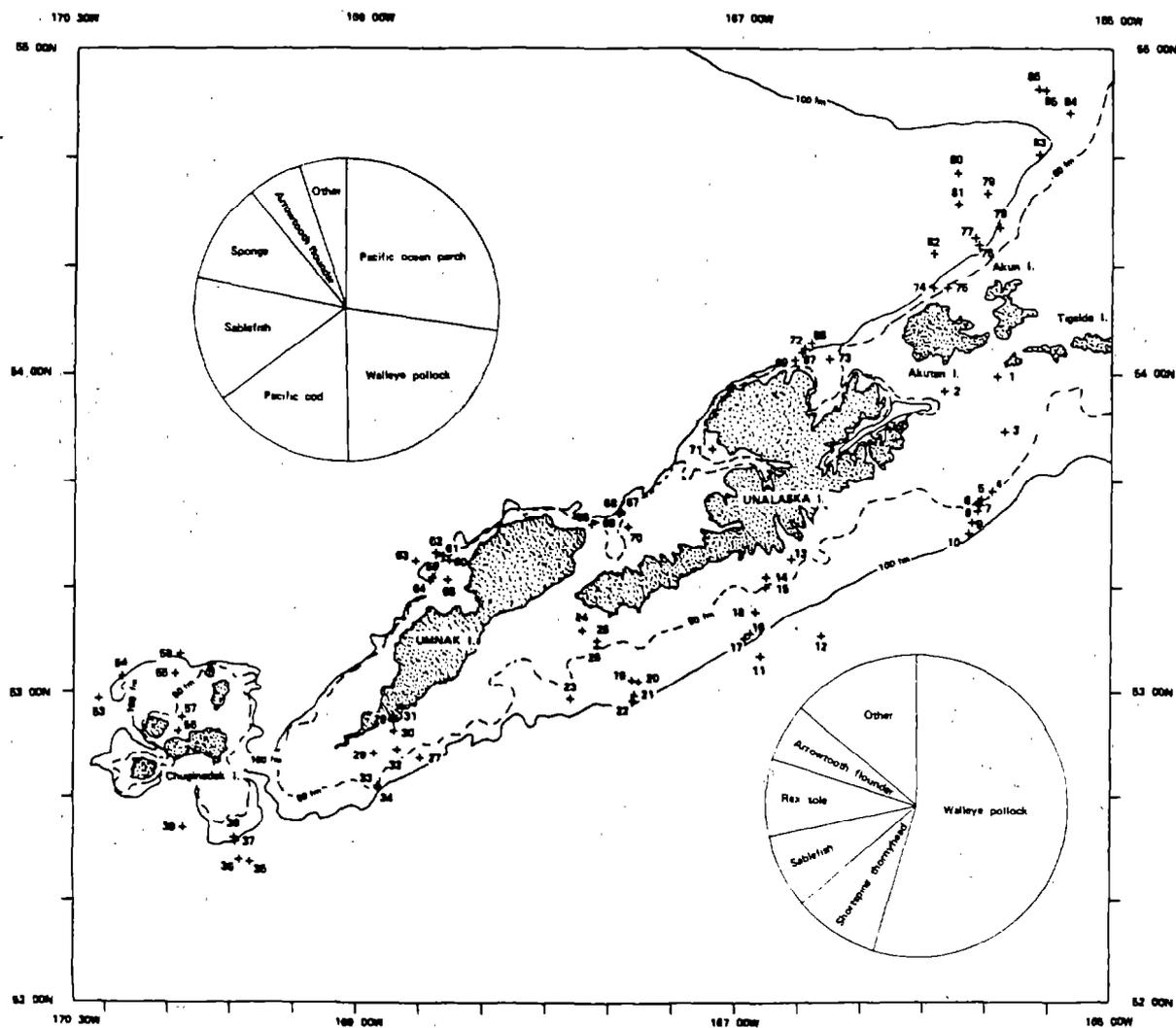
Sponge
542 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
24 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Walleye pollock
1473 lbs/hr

Shortspine thornyhead
237 lbs/hr

Sablefish
226 lbs/hr

Rex sole
215 lbs/hr

Arrowtooth flounder
170 lbs/hr

Pacific halibut
1 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0 lbs/hr

Snow crab
0 lbs/hr

Figure 29.--Species composition and catch rates of fish and invertebrates in the 109-164 fathom depth interval from Yunaska Island to Unimak Pass.

BERING SIDE

Greenland turbot
554 lbs/hr

Walleye pollock
409 lbs/hr

Sablefish
159 lbs/hr

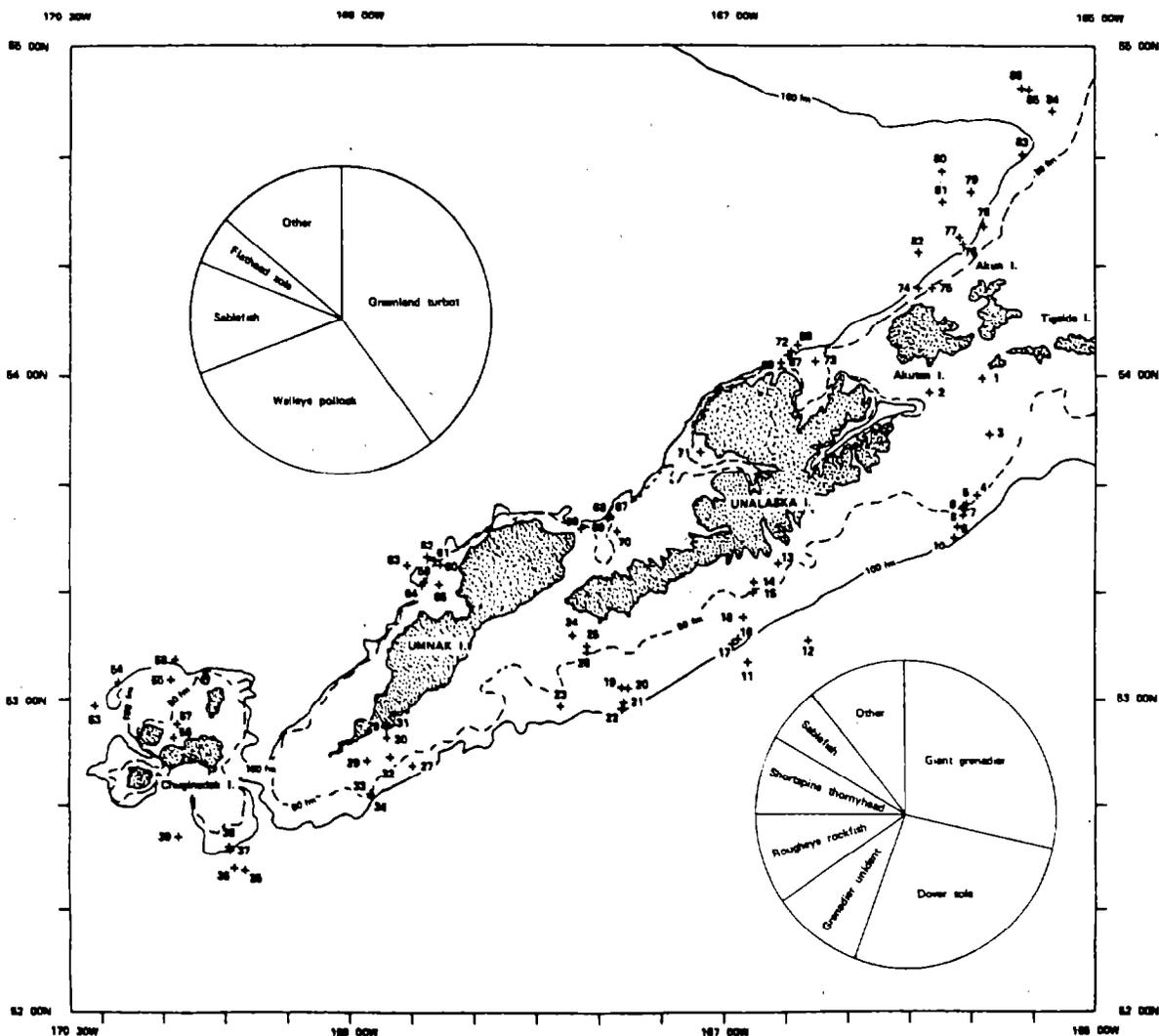
Flathead sole
83 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
1 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Giant grenadier
1266 lbs/hr

Dover sole
1256 lbs/hr

Grenadier unident.
446 lbs/hr

Rougheye rockfish
430 lbs/hr

Shortspine thornyhead
358 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
24 lbs/hr

Snow crab
0 lbs/hr

Figure 30.--Species composition and catch rates of fish and invertebrates in the 165-273 fathom depth interval from Yunaska Island to Unimak Pass.

BERING SIDE

Greenland turbot
1665 lbs/hr

Twoline eelpout
1030 lbs/hr

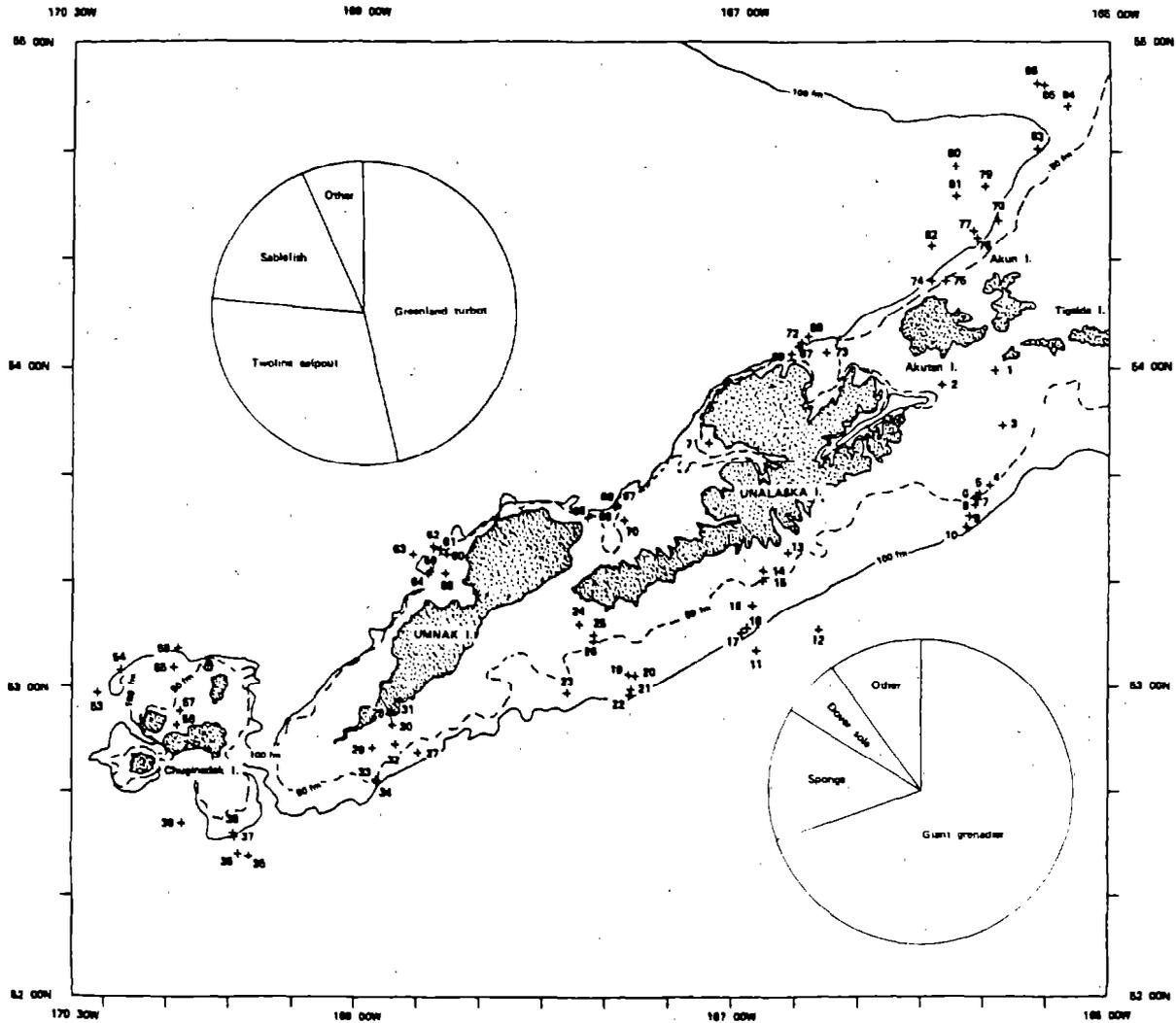
Sablefish
605 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
0.5 lbs/hr

Snow crab
0 lbs/hr



PACIFIC SIDE

Giant grenadier
2400 lbs/hr

Sponge
483 lbs/hr

Dover sole
225 lbs/hr

Pacific halibut
0 lbs/hr

Red king crab
0 lbs/hr

Golden king crab
3 lbs/hr

Snow crab
0 lbs/hr

Figure 31.--Species composition and catch rates of fish and invertebrates in the 274-382 fathom depth interval from Yunaska Island to Unimak Pass.

BERING SIDE

Pacific cod
1666 lbs/hr

Atka mackeral
774 lbs/hr

Rock sole
284 lbs/hr

Walleye pollock
276 lbs/hr

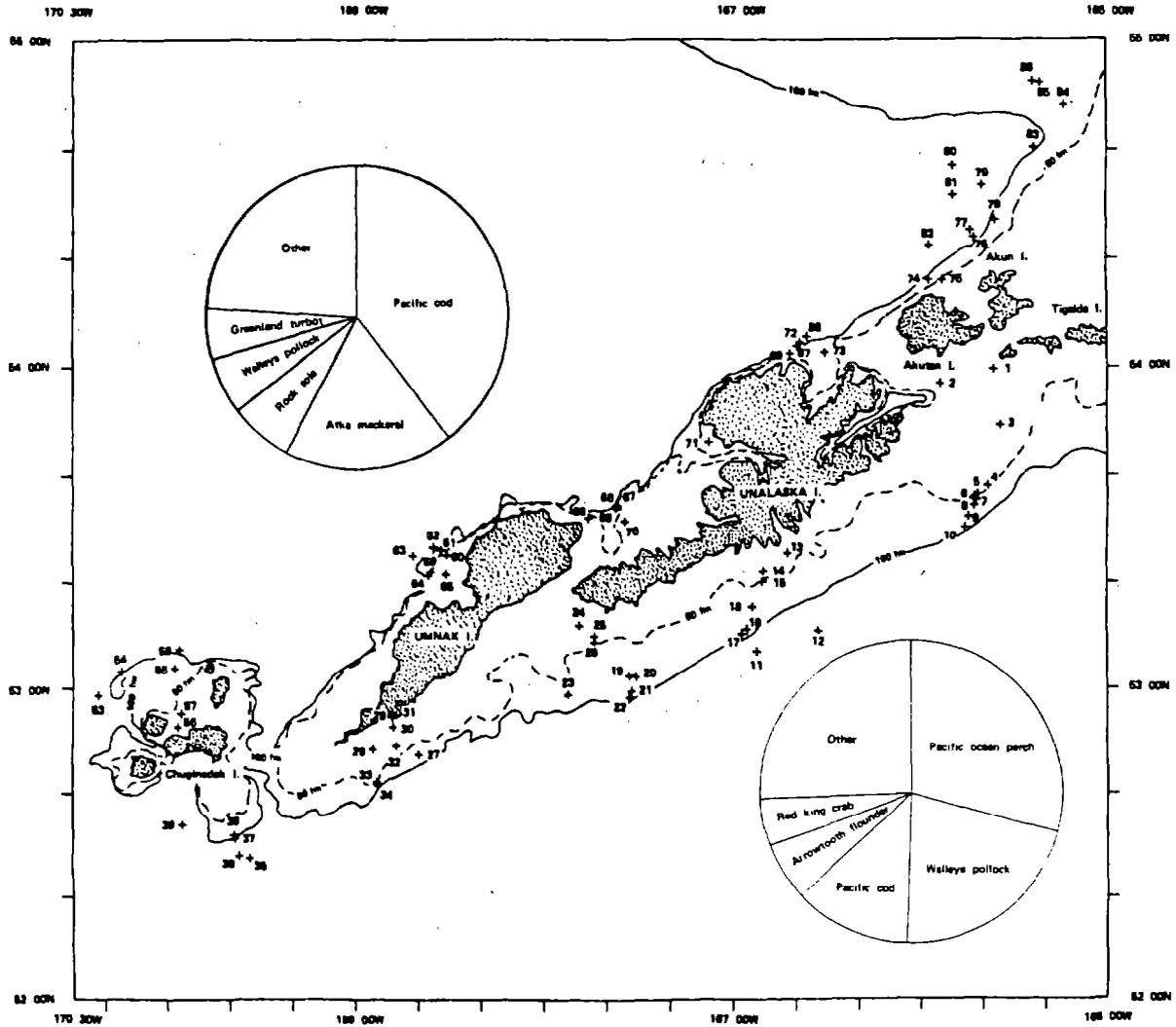
Greenland turbot
238 lbs/hr

Pacific halibut
66 lbs/hr

Red king crab
58 lbs/hr

Golden king crab
3 lbs/hr

Snow crab
0.008 lbs/hr



PACIFIC SIDE

Pacific ocean perch
1405 lbs/hr

Walleye pollock
1060 lbs/hr

Pacific cod
606 lbs/hr

Arrowtooth flounder
294 lbs/hr

Pacific halibut
45 lbs/hr

Red king crab
272 lbs/hr

Golden king crab
2 lbs/hr

Snow crab
0.3 lbs/hr

Figure 32. --Species composition and catch rates of fish and invertebrates in the 1-381 fathom depth internal from Yunaska Island to Unimak Pass.

Table 20). Pacific ocean perch were caught primarily in the 55 to 108 fm depth interval, 4,037 lb/h, which accounted for over 99% of the available biomass. This species ranged in size from 17 to 41 cm (average 33.0 cm) (Figure 33) with only 19% of the Pacific ocean perch being 35 cm or larger. Walleye pollock were captured in all depth intervals out to 273 fm; however, they were most abundant in 109 to 164 fm, 1,473 lb/h, and 55 to 108 fm, 1,925 lb/h, where these two depth intervals accounted for over 88% of the available biomass. In the 1 to 54 and 55 to 108 fm depth intervals, the size composition of walleye pollock were similar ranging from 35 to 55 cm and 35 to 69 cm and averaged 45.5 cm and 45.2 cm, respectively. However, in 109 to 164 fm depth, walleye pollock were larger ranging from 41 to 61 cm (average 50.2 cm). All pollock sampled in this area were 35 cm or larger in length.

Pacific cod, 607 lb/h average catch rate, were taken primarily in 55 to 108 fm, 878 lb/h, and 30 to 54 fm, 836 lb/h, depth intervals which accounted for 96% of the available biomass. Size composition of the cod in 1 to 54 and 109 to 164 fm were similar with individuals ranging in size from about 33 to 84 cm and 42 to 55 cm (averaging 45.3 and 47.5 cm), respectively. However, in 55 to 108 fm, the cod were considerably larger ranging from 38 to 102 cm and averaging 60.1 cm. In 55 to 108 fm, 51% of the cod were over 50 cm while in 1 to 54 and 109 to 164 fm only 8% and 3%, respectively, were 50 cm or greater. Arrowtooth flounder were most abundant in 55 to 108 fm (633 lb/h) which accounted for 75% of the available biomass. The average size of turbot increased with depth, 37.5 cm in 1 to 54 fm, 44.3 cm in 55 to 168 fm and 50.2 cm in 109 to 164 fm. In 1 to 54 fm only 27% of the arrowtooth flounder exceeded 40 cm while in 55 to 108 fm, 55% and in 109 to 164 fm, 82% exceeded 50 cm.

Table 20.--Mean catch and estimates of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Yunaska I. to Unimak Pass--Pacific Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	30-54 (1,616)		55-108 (1,686)		109-164 (870)		165-273 (429)		274-382 (257)		30-382 (4,858)	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder	117.8	3,625	633.1	20,338	169.9	2,816	48.8	399			293.6	27,178
Greenland turbot					10.7	177	55.0	450			6.8	627
Pacific halibut	97.3	2,995	35.4	1,138	0.7	11					44.8	4,144
Flathead sole	5.8	178	2.7	86	13.3	221	2.5	21			5.5	506
Dover sole			28.4	911	33.9	562	1,255.8	10,265	224.7	1,100	138.7	12,838
Rex sole	1.1	35	90.1	2,894	214.5	3,556	221.5	1,810			89.6	8,295
Rock sole	288.3	8,877	371.9	11,948	25.5	422					229.5	21,247
Sablefish			19.1	614	225.8	3,742	270.2	2,209	79.3	389	75.1	6,954
Giant grenadier							1,265.6	10,346	2,400.4	11,754	238.8	22,100 ⁶⁴
Pacific cod	835.9	25,737	877.5	28,189	133.5	2,214					606.5	56,140
Walleye pollock	383.7	11,815	1,925.4	61,852	1,472.7	24,412	2.0	16			1,059.8	98,095
Atka mackerel	40.6	1,250	0.6	19							13.7	1,269
Shortspine thornyhead			0.2	7	237.3	3,933	358.4	2,930	155.4	761	82.4	7,631
Rougheye rockfish					38.7	641	430.0	3,515			44.9	4,156
Pacific ocean perch			4,037.2	129,693	19.5	322					1,404.6	130,015
Northern rockfish	0.3	9	54.1	1,739							18.9	1,748
Shortraker rockfish									16.3	80	0.9	80
Red king crab	812.6	25,020	5.8	188							272.3	25,208
Golden king crab							24.0	196	3.3	16	2.3	212

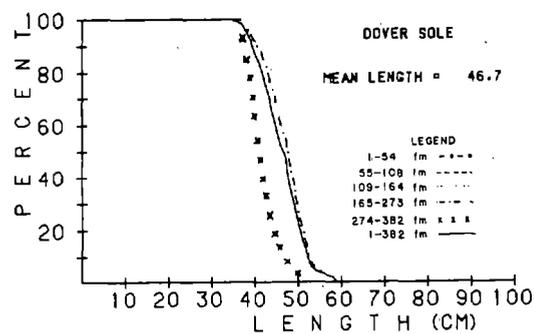
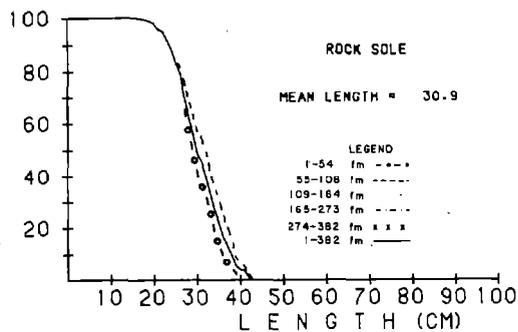
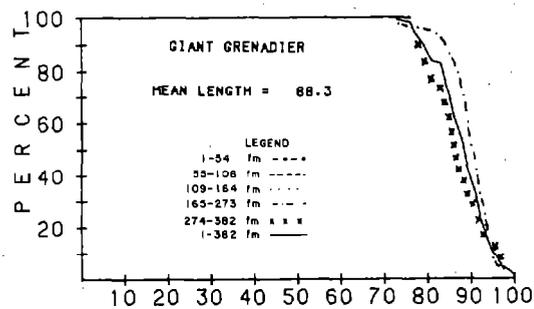
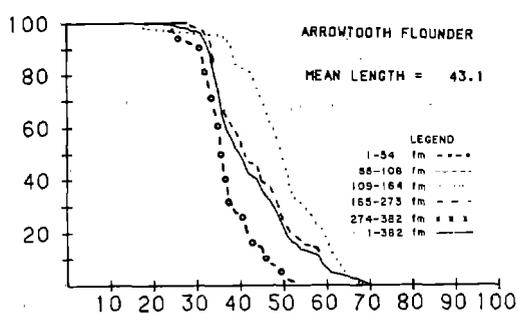
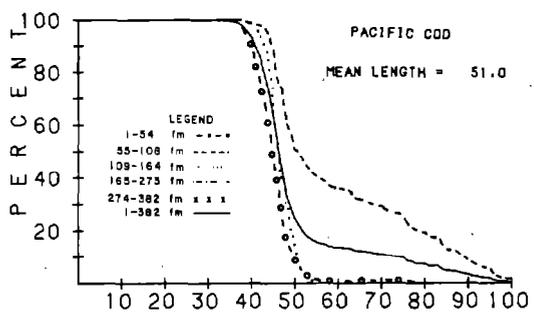
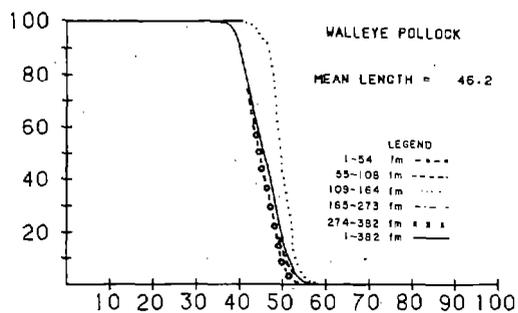
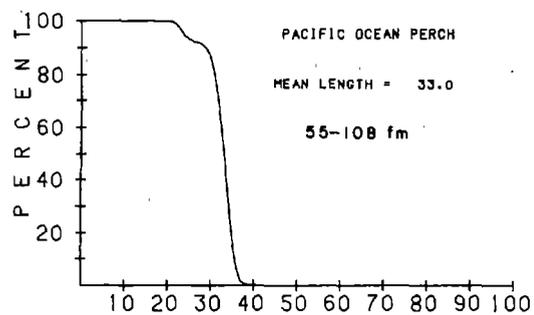


Figure 33.--Size composition of Pacific ocean perch, walleye pollock, Pacific cod, arrowtooth flounder, giant grenadier, rock sole and Dover sole in the Yunaska Island to Unimak Pass area - Pacific side.

Red king crab were abundant in this area averaging 272 lb/h with nearly all of the catch occurring in 1 to 54 fm where the catch rate averaged 813 lb/h. **Male** red king crab in this depth interval ranged in size from 104 to 188 **mm** however, the majority of the individuals were from 130 to 188 **mm**. Female red king crab ranged from 101 to 136 mm. Giant grenadier (rattails), 239 lb/h, were abundant only in the deeper depth intervals, 2,400 lb/h in 274 to 382 fm and 1,266 lb/h in 165 to 273 fm. Giant grenadier which are measured from the tip of the snout to the anus ranged in size from 73 to 101 cm and were of slightly larger average length in 164 to 273 fm than 274 to 382 fm.

Rock sole, 230 lb/h, and Dover sole, 139 lb/h, ranked next in abundance and were the only other species which averaged over 100 lb/h for all tows within this **area**-. Rock sole occurred in highest abundance in the shallower depth intervals, 30 to 54 and 55 to 108 fm, where the catch rates averaged 288 and 372 lb/h, respectively. These two depth intervals also contained 98% of the **available** biomass. Rock sole ranged from 16 to 43 **cm** and averaged 29.7 and 30.9 **cm** respectively, in the 1 to 54 and 55 to 108 fm depth intervals. Dover sole were located primarily in 165 to 273 fm, 1,256 lb/h, and 274 to 382 fm, 225 lb/h, which together contained 89% of the **available** biomass. Dover sole ranged in size from 35 to 59 cm with larger average size individuals being found in the 165 to 273 fm depth intervals.

Four species--rex sole, shortspine thornyhead (idiots), sablefish, and roughey rockfish--occurred in abundance greater than 100 lb/h in at least one depth interval. Rex sole were captured in depth intervals from 1 to 273 fm **and** were in highest abundance in 165 to 273 fm, 222 lb/h, and 109 to 164 fm, 215 lb/h. These two depth intervals contained 65% of the available biomass. Although the rex sole from the 55 to 108 and 109 to 164 fm depth intervals

have similar mean sizes, the rex sole in the 109 to 164 fm interval consisted of a larger number of both smaller and larger specimens than was found in 55 to 108 fm (Figure 34). In the 164 to 273 fm interval, the rex sole were longer, averaging 42.2 cm. The deeper depth intervals contained more large individuals, 44% greater than 35 cm in 55 to 109 fm, 58% in 109 to 164 fm, and 94% in 165 to 273 fm. Shortspine thornyheads were taken in depth intervals from 55 to 382 fm but occurred in higher abundance in deeper depths, 358 lb/h in 165 to 273 fm, 273 lb/h in 109 to 164 fm, and 155 lbs in 274 to 382 fm. Over 99% of the available biomass was located in these three depth intervals. Size composition data are available only for the 109 to 164 fm and 274 to 382 fm depth intervals where individuals ranged from 19 to 47 cm and averaged 26.9 and 30.2 cm; respectively. Sablefish were most abundant in 165 to 273 fm, 270 lb/h, and 109 to 164 fm, 226 lb/h, where 86% of the available biomass occurred. The size range of sablefish encountered with depths included 51.4 cm in 109 to 164 fm, 61.0 cm in 165 to 273 fm, and 69.3 cm in 274 to 382 fm. Only 12% of the sablefish captured in 109 to 164 fm were 55 cm or greater, while 76% were larger than 55 cm in 165 to 273 fm and 100% were larger than 55 cm in 274 to 382 fm. Rougheye rockfish were most abundant in the 165 to 273 fm depth interval, 430 lb/h, which accounted for 85% of the available biomass. Rougheye rockfish ranged from 32 to 64 cm (average 46.9 cm). Although the average size was nearly the same in both depth intervals, 47.0 cm in 165 to 273 fm and 46.4 cm in 109 to 164 fm, the size composition varied as the shallower depth interval contained both smaller and larger individuals. Length frequency data are also available for Pacific halibut, northern rockfish, and Atka mackerel. Pacific halibut had the same mean length in the 1 to 54 fm and 55 to 108 fm depth intervals; however, the halibut in the 1 to 54 fm interval consisted of both smaller and larger specimens, giving a similar mean

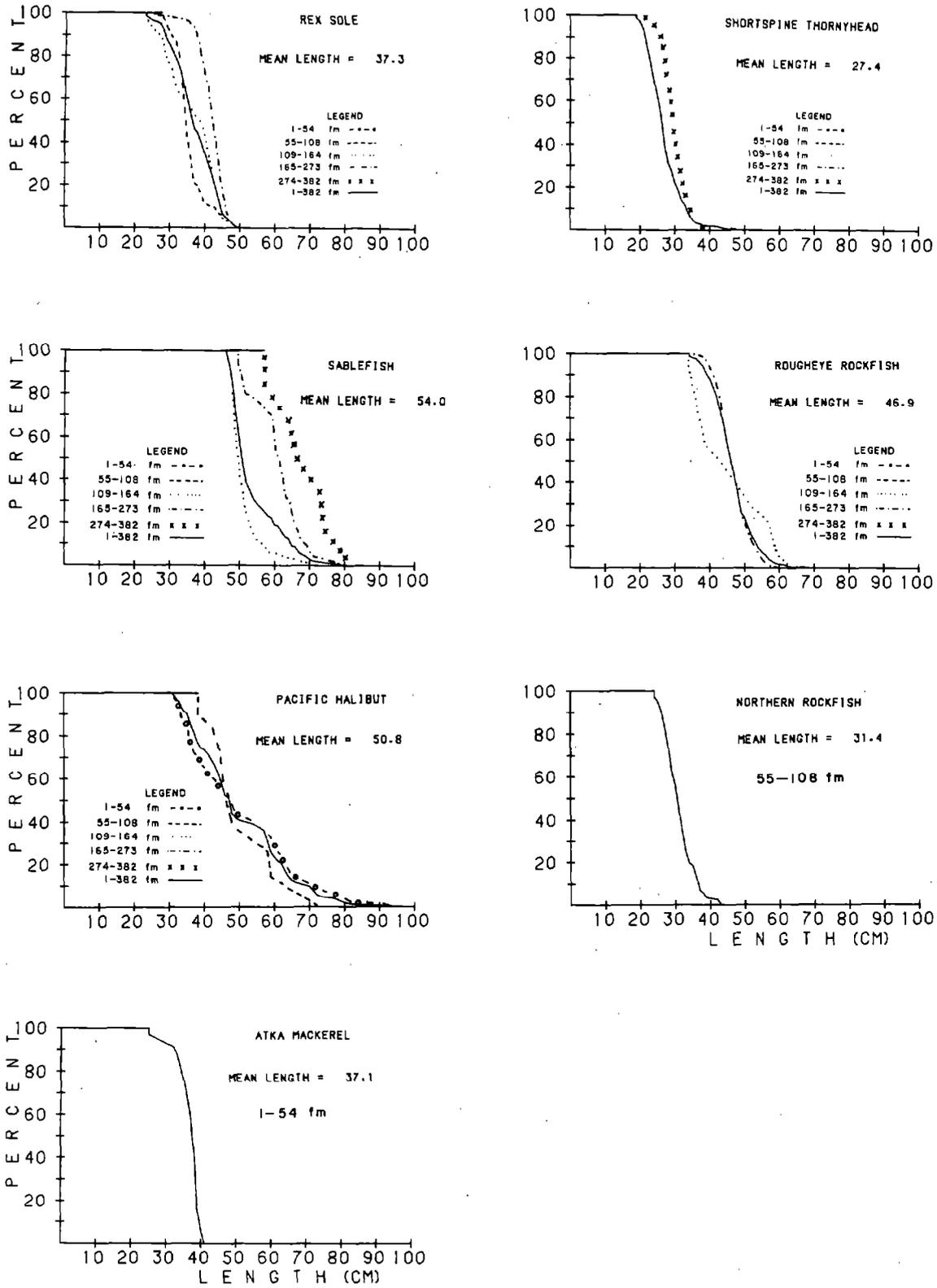


Figure 34. --Size composition of rex sole shortspine thornyhead, sablefish, rougheye rockfish, Pacific halibut, northern rockfish and Atka mackerel in the Yunaska Island to Unimak Pass area - Pacific side.

size. Northern rockfish in the 55 to 108 fm depth interval averaged 31.4 **cm** and ranged from 24.0 to 43.0 **cm** while Atka mackerel in the 1 to 54 fm depth interval averaged 37.1 and ranged from 25.0 to 41.0 **cm**

Bering Sea

In this area, Pacific cod was the dominant species encountered, averaging 1,666 lb/h (Figures 26-31, Table 21). Highest abundance was found in 55 to 108 fm, 3,185 lb/h; however, cod were also abundant in 1 to 54 fm, 1,825 lb/h, and 109 to 164 fm, 766 lb/h. These three depth intervals contained over 99% of the available biomass in this area. The size range of Pacific cod was similar in all three depth intervals: however, deeper water 109 to 164 fm held **more** larger cod over 50 **cm** (74%) than the shallower water, 50% in 55 to 108 fm, and 40% in 1 to 54 fm (Figure 35). Atka mackerel were second in abundance, 774 lb/h, and occurred in highest abundance in 55 to 108 fm, 2,791 lb/h. Over 99% of the exploitable biomass occurred in this depth interval where these species ranged from 29 to 42 **cm** (average 33.8 **cm**). With an average catch rate of 284 lb/h, rock sole ranked third, 284 lb/h, with highest abundance occurring in 1 to 54 fm, 597 lb/h, and 55 to 108 fm, 188 lb/h. Ninety-seven percent of the available biomass occurred in these two depth intervals. Rock sole ranged from 16 to 52 cm and 19 to 44 cm, respectively, with **more** smaller individuals being found in the shallower water, 1 to 54 fm. Walleye pollock was fourth in abundance, **averaging 276** lb/h; highest abundance was found in 109 to 164 fm, 1,117 lb/h. Pollock were also in good abundance in 165 to 273 fm, 409 lb/h, and 55 to 108 fm, 269 lb/h. Fifty-two percent of the available **biomass was** located in 109 to 164 fm, 27% in 55 to 108 fm, and 18% in 165 to 273 fm. The mean length of walleye pollock increased with depth from 45.3 cm in 55 to 108 fm to 48.4 **cm** in 165 to 273 fm. In the shallower water, 55 to 108 fm, 95% of

Table 21.--Mean catch and estimates of exploitable biomass by depth interval, for dominant species in the Aleutian Region (Yunaska I. to Unimak Pass--Bering Side), July-August 1980.

Species	Depth intervals (in fathoms) and area (in square nautical miles)											
	1-54 (1,428)		55-108 (1,057)		109-164 (486)		165-273 (456)		274-382 (387)		1-382 (3,814)	
	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t	lb/h	t
Arrowtooth flounder	65.7	1,774	164.3	3,284	292.3	2,686	68.0	586			115.5	8,330
Greenland turbot	2.2	61			12.3	114	554.0	4,777	1,665.0	12,185	237.6	17,137
Pacific halibut	26.5	715	203.1	4,060							66.2	4,775
Flathead sole	30.3	818	13.4	269	4.1	38	83.3	718			25.5	1,843
Dover sole					4.1	38					0.5	38
Rex sole	7.5	202	15.1	302	26.7	246					10.4	750
Rock sole	596.6	16,110	187.5	3,749	65.8	605	5.3	46			284.4	20,510
Sablefish	38.5	1,040	18.3	366	668.0	6,139	159.3	1,374	605.0	4,427	185.0	13,346
Giant grenadier									15.0	110	1.5	110
Pacific cod	1,825.2	49,286	3,184.6	63,652	765.5	7,034	20.0	173			1,665.9	120,145
Walleye pollock	8.5	229	269.0	5,377	1,116.5	10,261	408.7	3,524	70.0	512	276.0	19,903
Atka mackerel	0.3	6	2,791.1	55,789	0.7	6	3.3	29			774.1	55,830
Shortspine thornyhead					5.3	49	2.0	18	85.0	622	9.5	689
Rougheye rockfish					1.3	12	0.7	6			0.2	18
Pacific ocean perch			10.3	206	1,362.9	12,526	16.7	144			178.5	12,876
Northern rockfish			8.6	172	1.3	12					2.6	184
Shorttraker rockfish	2.5	67									0.9	67
Red king crab	154.2	4,166									57.8	4,166
Golden king crab					24.0	221	0.7	6	0.5	4	3.2	231

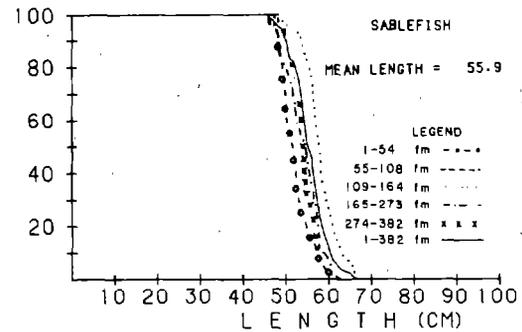
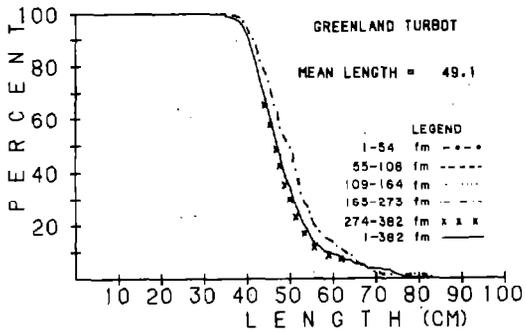
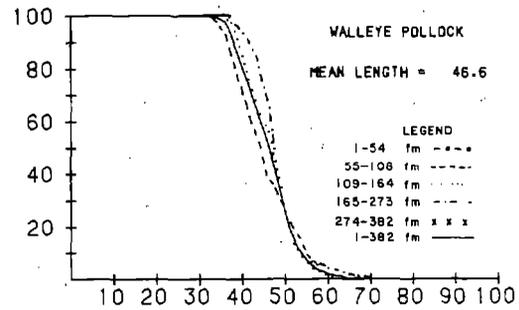
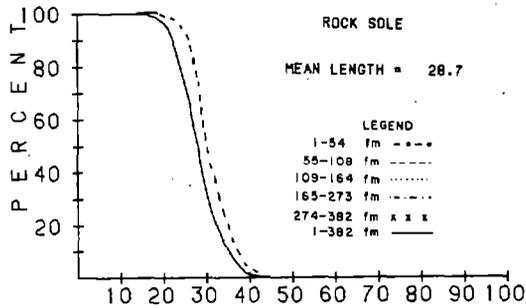
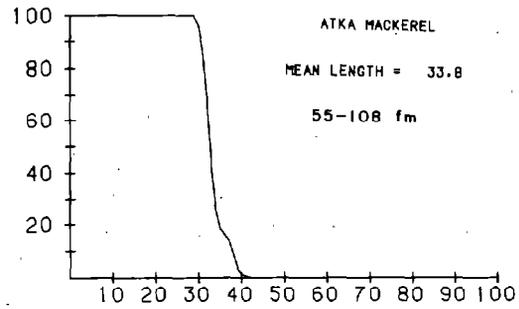
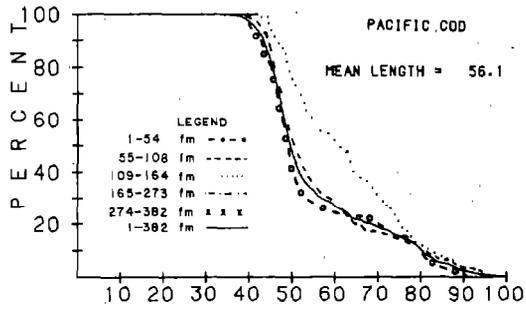


Figure 35. --Size composition of Pacific cod, Atka mackerel, rock sole, walleye pollock, Greenland turbot and sablefish in the Yunaska Island to Unimak Pass area - Bering side.

the pollock were over 35 cm while all individuals in 109 to 164 fm and 165 to 273 fm were greater than 35 cm. Greenland turbot also occurred in abundance in this area (238 lb/h), primarily in deeper water, averaging 1,665 lb/h in 274 to 382 fm and 554 lb/h in 165 to 273 fm. Nearly 99% of the available biomass was located in these two depth intervals, 71% in 274 to 382 fm and 28% in 165 to 273 fm. Greenland turbot in 165 to 273 fm ranged from 35 to 91 cm (average 51.2 cm) while in 274 to 382 fm, they ranged **from** 35 to 71 cm (average 51.2 cm) while in 274 to 382 fm, they ranged from 35 to 71 cm (average 48.5 cm). Pacific ocean perch, averaging 179 lb/h for all tows, were most abundant in 109 to 164 fm, 1,363 lb/h, where 97% of the exploited biomass occurred. Pacific ocean perch ranged in size from 24 to 41 **cm** (average 34.6 cm) (Figure 36). Sablefish, which averaged 185 lb/h over all depth intervals, occurred in highest abundance in 109 to 164 fm (668 lb/h) and 274 to 382 fm (605 lb/h) depth intervals. Together these two depth intervals contained 79% of the available biomass, 46% **in** 109 to 164 fm and 33% in 274 to 382 fm. Sablefish ranged in size from 47 to 67 **cm** with the largest averaged size fish occurring in the 109 to 164 fm interval. Arrowtooth flounder was the only remaining species which occurred at an average catch rate greater than 100 lb/h. Highest abundance was found in 109 to 164 fm, 292 lb/h, and 55 to 108 fm, 164 lb/h. Seventy-one percent of the available biomass occurred in these depth intervals, 39% in 55 to 108 fm, and 32% in 109 to 164 fm. The largest averaged sized arrowtooth flounder were found in the shallower depth interval 55 to 108 fm where 89% of the specimens were longer than 40 cm. In 109 to 164 fm and 165 to 273 fm, 65% and 75%, respectively, of the arrowtooth flounder were 40 cm or larger.

Two species, Pacific halibut and red king **crab**, were found in abundance which produced average catch rates greater than 100 lb/h in at least one depth

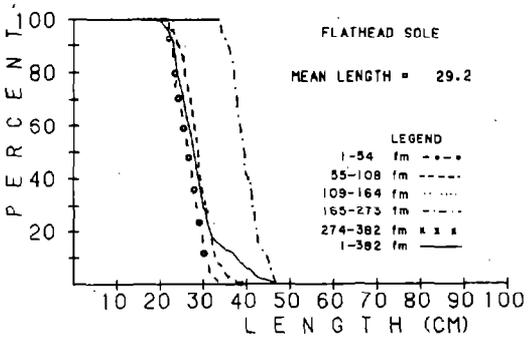
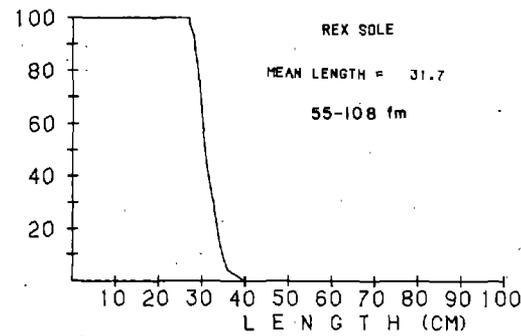
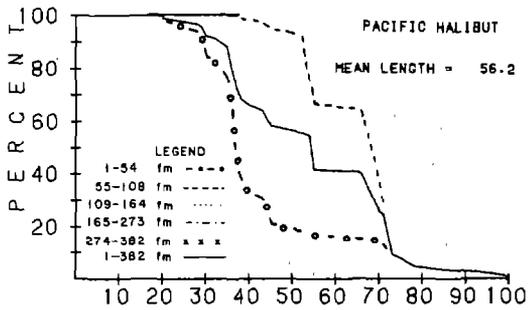
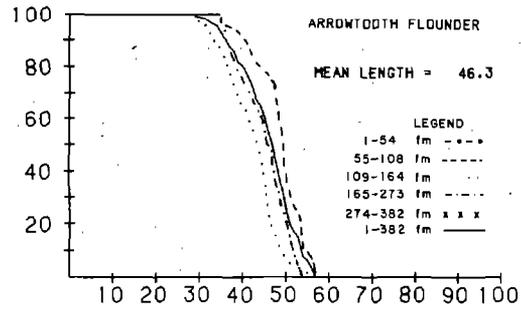
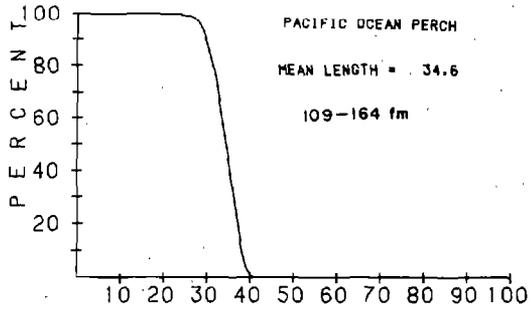


Figure 36. --Size composition of Pacific ocean perch, arrowtooth flounder, Pacific halibut, rex sole and flathead sole in the Yunaska Island to Unimak Pass area - Bering side.

interval. Pacific halibut occurred in highest abundance in 55 to 108 fm where the catches averaged 203 lb/h. Halibut in the shallow water, 1 to 54 fm, contained a much higher percentage of small fish, only 20% greater than 50 cm, than the 55 to 108 fm depth interval, where 92% greater than 50 cm were found. Red king crab were found only in the 1 to 54 fm depth interval where they averaged 154 lb/h. Males ranged from 129 to 182 mm while females ranged from 112 to 137 mm. Length frequency data are also available for rex sole and flathead sole. Rex sole in the 55 to 108 fm depth interval ranged from 27 to 49 cm (average 31.7 cm). The average size of flathead sole increased with depth from 27.1 cm in 1 to 54 fm to 29.1 cm in 55 to 108 fm and 40.3 cm in 109 to 164 fm. In 1 to 54 fm, only 15% of the flathead sole were 30 cm, or larger, while in 55 to 108 and 109 to 164 fm, 34% and 100% were 30 cm or larger, respectively.

RESULTS OF ENCOUNTER RESPONSE SAMPLING

Encounter response sampling was conducted on bottom and in midwater whenever large concentrations of groundfish were encountered by trawling or echo sounding during the regular survey sampling. Encounter response sampling is designed to provide additional information on the distribution and abundance of these fish aggregations. Attempts to provide additional data were not always successful, as it is extremely difficult to successfully target trawling efforts on fish aggregations.

Bottom Trawling

Agattu Island to Little Sitkin Island

Three encounter response stations were fished on the Pacific side of this region: two stations (Half Moon Bay No. 91 and No. 92) on Walls Plateau southwest of Buldir Island, and one on Buldir reef (Half Moon Bay No. 84)

southeast of Buldir Island. The two trawl stations on Walls Plateau in 125 and 123 fm produced extremely small catches which contained only 76.0 and 209.0 lb of fish, respectively. The single station on Buldir reef in 128 fm produced a large catch of Atka mackerel, 11,825 lb/h, and a good indication of Pacific cod, catch rate 1,425 lb/h.

Great Sitkin to Yunaska Island

Three encounter response stations were made on the Bering side, two north of Atka Island and one west of Kasatochi Island. The single station west of Kasatochi Island (Half Moon Bay No. 125) in 144 -fm caught 1,471.2 lb/h, which consisted primarily of Pacific ocean perch, 516 lb/h, and shortraker rockfish, 604 lb/h. The two stations (Half Moon Bay No. 127 and No. 129) north of Atka Island in 83 fm and 66 fm captured 2,610.4 and 1,295.2 lb/h, respectively. The deeper station primarily caught walleye pollock (1,990 lb/h) and Pacific cod (464 lb/h), while the shallower station caught only walleye pollock (1,216 lb/h).

Yunaska Island to Unimak Pass

Three encounter response stations were sampled on the Pacific side, one south of Unalaska Island, one south of Unimak Island and one in Driftwood Bay on Unimak Island. The station in Driftwood Bay (Ocean Harvester No. 31) which was made in 17 fm caught only 18 lb/h while the station immediately offshore from Driftwood Bay in 47 fm (Ocean Harvester No. 30) caught 981 lb. Principal species included rock sole (394 lb/h) and Pacific cod (294 lb/h). One station south of Unalaska Bay in 77 fm (Ocean Harvester No. 18) caught 3,378 lb/h. Principal species included Pacific cod (1,212 lb/h) walleye pollock (1,070 lb/h), arrowtooth flounder (492 lb/h), Pacific halibut (180 lb/h), and rock sole (120 lb/h).

Fifteen encounter response stations were sampled on the Bering side. Two stations (Ocean Harvester No. 53 and No. 54) were sampled northwest of Carlisle Island, the Islands of four mountains in 110 and 102 fm caught 9,368 and 3,111 lb/h, respectively. Principal species were walleye pollock, Pacific halibut (266 lb/h), and northern rockfish (164 lb/h). In the shallower water stations which produced 1,114 and 1,248 lb/h, the dominant species for the two stations were rock sole (519 lb/h), Pacific cod (481 lb/h), and Pacific halibut (110 lb/h). Four stations were sampled between Cape Idak on Unimak Island and **Cape** Kovrizhka on Unalaska Island at depths from 41 to 58 fm. Catch rate for the four stations ranged from 124 to 37,457 lb/h. The catches were dominated by Pacific cod which averaged 13,111 lb/h. Largest catches occurred in the two stations off Cape Idak which yielded catch rates of Pacific cod of 14,350 and 37,168 lb/h fished. Two stations were sampled in 61 and 160 fm off Cape Cheerful on Unalaska Island (Ocean Harvester No. 72 and No. 88). The shallower water station had an hourly catch rate for fish species of 19,636 lb and consisted primarily of Pacific cod (17,518 lb/h), northern rockfish (1,334 lb/hr), and Pacific ocean perch (653 lb/h). The deeper water station had an hourly catch rate of fish of 912 lb. Principal catch components included walleye pollock (226 lb/h), rex sole (158 lb/h), shortraker rockfish (112 lb/h), and Dover sole (102 lb/h). Four encounter response stations were sampled 40 to 50 nmi north of Akun Island in 72 to 91 fm (Ocean Harvester Nos. 83-6). Hourly catch rates for these stations ranged from 2,948 to 11,002 lb/h and averaged 6,201 lb/h. Pacific cod and walleye pollock dominate the catches averaging 3,314 and 2,651 lb/h, respectively, for the four stations.

Midwater Trawling

Whenever near or off bottom fish aggregation were located, which could not be sampled with bottom trawls because of their location in the water column or untrawlable bottom, they were sampled with midwater trawls to provide information on species identification and composition. Eight midwater tow's samples were attempted during the survey.

Little Sitkin Island to Great Sitkin Island

On the Pacific side of this area, two fish aggregations were located south of Yunaska Island. The first was located 25 fm above the sea bed over a bottom depth of 124 fm (Ocean Harvester No. 41). The resulting catch was quite small, 103 lb/h, with walleye pollock being the only fish species captured. A second aggregation was located near bottom at 96 fm over a sea bed depth of 102 fm. The catch from this tow (Ocean Harvester No. 47, 1,003 lb/h) consisted entirely of walleye pollock ranging in size from 40 to 57 cm.

On the Bering side of this area, fish aggregations were located east of Great Sitkin Island (Half Moon Bay station No. 30), in Nazan (Half Moon Bay station No. 40), and in Korovin Bay (Half Moon Bay station No. 43) on Atka Island. The aggregation east of Great Sitkin was small, scattered, and near bottom, 52 to 56 fm over a sea bed depth of 60 fm yielded only an extremely small quantity of walleye pollock (7 lb/h). In Nazan Bay, the fish aggregation found at 30 to 40 fm over a bottom depth of 85 fm was indicated as two small schools and consisted predominantly of walleye pollock (5,993 lb/h) with a few Atka mackerel (9 lb/h). In Korovin Bay, the fish aggregation was found at a depth of 50 to 70 fm, 8 to 18 fm above the sea bed. Sampling through this aggregation caught only walleye pollock (2,015 lb/h). In both Nazan and Korovin Bay, the walleye pollock were small, ranging from 21 to 31 cm.

Yunaska Island to Unimak Pass

On the Pacific side of this area, fish aggregations were sampled south of Akutan Island (Ocean Harvester station No. 6) and off Cape Udak on Unimak Island (Ocean Harvester station Nos. 33-34). South of Akutan Island, a near bottom aggregation was sampled at a bottom depth of 102 fm; however, the sampling effort was unsuccessful, catching only walleye pollock (13 lb/h). In the Cape Udak area, a large aggregation was located **at** 85 to 110 fm occurring from the sea bed to 6 to 8 fm above the sea bed. The first sampling effort in 80 fm caught Pacific ocean perch (3,032 lb/h) and small quantities of walleye pollock, northern rockfish, rougheye rockfish, sablefish and arrowtooth flounder. During the second sampling effort, the trawl contacted a sharp pinnacle tearing the belly out of the trawl. The resulting catch was very similar in composition to the previous haul, catching primarily Pacific ocean perch (1,336 lb/h).

DATA LIMITATIONS

The authors have not conducted an economic evaluation of the groundfish harvesting and processing industries for the Aleutian Island area. Conclusions concerning the occurrence of species in commercial exploitable concentrations are based solely on the magnitude of the resource and its distribution and availability. Readers should realize that the survey data may also be somewhat biased, as a result of where successful sampling was conducted, i.e., sampling was primarily conducted directly north and south of the major islands with little sampling occurring in the open passes between islands, thereby not providing an accurate estimate of the species inhabiting these areas. Also, sampling was primarily conducted from 55 to 273 fm west of Yunaska Island, thereby not providing accurate **estimates** of the **species** inhabiting these shallower and deeper depths.

SUMMARY AND CONCLUSIONS

The 1980 NMFS survey of the Aleutian Islands has provided a first over-view of the groundfish stocks in the Unimak Pass to Agattu Island region of the Aleutian Islands. Since no previous surveys have been conducted, data are not available for comparisons or measures of change and it is impossible to know if the stocks have increased or decreased in recent years. The survey has revealed, however, that several groundfish species presently occur at levels of abundance which are adequate to support commercial exploitation. Some species were abundant throughout most of the area surveyed while others were abundant in only one or two areas.

Analysis of the survey data indicated that this region contains an estimated minimal available biomass of 1,173,942 t for the 19 species of commercial fish and shellfish included in this report (Table 22). The continental shelf and upper slope on the Pacific side of the Aleutian chain contained 63.8% of the available biomass, while the Bering side contained 36.1% with the largest portion of the biomass on both sides (56%) being located in the 55 to 108 fm depth interval. The richest portion of the survey area in terms of total available biomass was the Unimak Pass to Yunaska Island area where the Pacific side contained 36.5%, 428,443 t, and the Bering side 23.9%, 280,948 t (Table 23). Although areas west of Yunaska Island contained smaller portions of the available biomass, high abundance (density greater than 180 t/nmi²) were obtained in two areas; the 55 to 108 fm and 109 to 164 fm depth intervals in the Little Sitkin Island to Great Sitkin Island - Pacific side and the 109 to 164 fm depth intervals in the Agattu Island to Little Sitkin Island area - Bering side.

Walleye pollock was the dominant species in the survey area with an estimated available biomass of 299,585 t and was primarily found in the 55 to 108 fm and 109 to 164 fm depth intervals. Although walleye pollock were found

Table 22.--Estimates of exploitable biomass (**metric tons**) by depth interval, for 19 **commercially** important species in the Aleutian Region, July-August 1980.

Species	Depth intervals (in fathoms)					
	1-54 (7,232)	55-108 (7,682)	109-164 (3,718)	165-273 (4,164)	274-382 (4,182)	1 - 3 8 2 (26,978)
Walleye pollock	12,951	154,950	125,568	5,604	512	299,585
Pacific cod	78,429	141,104	20,610	715	-	240,858
Pacific ocean perch	-	131,785	46,492	22,201	-	200,478
Atka mackerel	1,346	124,596	806	29	-	126,777
Rock sole	28,805	22,135	1,495	212	-	52,647
Arrowtooth flounder	5,533	27,891	7,376	5,619	-	46,419
Northern rockfish	14	36,576	288	8	-	36,886
Red king crab	29,186	638	122	18	-	29,964
Giant grenadier	-	-	-	13,327	15,834	29,161
Sablefish	1,040	996	10,317	4,254	4,816	21,423
Greenland turbot	61	4	333	7,814	12,368	20,580
Pacific halibut	4,601	10,472	1,859	-	-	16,932
Dover sole	-	911	600	10,295	1,100	12,906
Shortspine thornyhead	64	12	4,160	3,728	1,383	9,347
Rex sole	237	3,267	3,813	1,982	-	9,299
Rougheye rockfish	-	38	1,007	6,747	-	7,792
Shorthead rockfish	67	110	281	6,536	80	7,074
Flathead sole	1,279	1,086	277	1,116	-	3,758
Golden king crab	-	149	938	827	142	2,056
Total	163,613	656,720	226,342	91,032	36,235	1,173,942

Table 23.--Total estimated exploitable biomass of 19 commercially important species of fish and shellfish in metric tons and density in metric tons per square nautical mile by area and depth interval.

Depth interval (fathoms)	Agattu to Little Sitkin Island		Little Sitkin to Great Sitkin Island		Great Sitkin to Yunaska Island		Yunaska Island to Unimak Pass	
	t	t/nmi ²	t	t/nmi ²	t	t/nmi ²	t	t/nmi ²
Bering								
1-54	17	0.1	591	0.9	4,878	7.9	74,474	52.2
55-108	15,855	84.8	7,321	14.1	21,145	23.9	137,226	129.8
109-164	14,981	241.6	7,327	27.6	35,693	68.6	39,987	82.3
165-273	1,148	12.9	5,983	11.1	24,882	35.0	11,401	25.0
274-382	-	-	-	-	4,275	5.5	17,860	46.1
Total	32,001	66.1	21,222	10.6	90,873	25.9	280,948	73.7
Pacific								
1-54	2,468	2.3	1,644	2.9	-	-	79,541	49.2
55-108	53,702	35.0	77,427	155.5	84,428	74.3	259,616	154.0
109-164	1,926	4.3	77,631	243.4	5,768	8.4	43,029	49.4
165-273	6,062	8.2	4,141	11.5	5,248	7.1	32,157	75.0
274-382	-	-	-	-	-	-	14,100	54.9
Total	64,158	16.9 ^{1/}	160,843	91.8	95,454	37.3	428,443	88.2

1/ Does not include depth intervals not sampled.

throughout the Aleutian chain, the Pacific side contained 75% of the available biomass. The most likely area for commercial exploitation were the Unimak Pass to Yunaska Island area - Pacific side (32.7% of the estimated biomass), Little Sitkin Island to Great Sitkin Island area - Pacific side (28.7%), Great Sitkin Island to Yunaska Island - Pacific side (12.9%), and Agattu Island to Sitkin Island Bering side (9.9%).

Pacific cod had the second highest estimated available biomass, 240,858 t, and was found primarily in the 55-108 fm and 1-54 fm depth intervals. Although Pacific cod were more evenly distributed between the Bering (59%) and Pacific sides (41%) of the chain, 73% of the estimated biomass of Pacific cod was located in the Yunaska Island to Unimak Pass area, nearly 50% on the Bering side and 23% on the Pacific side. Substantial biomass estimates of from 16,000-20,000 t were made in the Little Sitkin Island to Great Sitkin Island - Pacific side, Great Sitkin Island to Yunaska Island - Bering side, and Agattu Island to Little Sitkin Island - Pacific side.

The species with the third highest estimated biomass of 200,478 t, Pacific ocean perch, occurred primarily in the 55-108 fm and 109-164 fm depth intervals and on the Pacific side **of** the Aleutian chain. Largest concentrations were found in the Unimak Pass to Yunaska Island area - Pacific side 65% and the Great Sitkin Island to Yunaska Island area - Bering side, 20%, which together contained 85% of the estimated **biomass**. Smaller, but noteworthy concentrations, 16,000 t of Pacific ocean perch were found in the Little Sitkin Island to Great Sitkin Island area - Pacific side and Yunaska Island to Unimak Pass area - Bering side.

Atka mackerel, which had the fourth largest estimated biomass, 126,777 t, was found throughout the Aleutian chain and occurred primarily in 55-108 fm.

Areas containing the largest concentrations were Yunaska Island to Unimak Pass - Bering side, 44%, Little Sitkin Island to Great Sitkin Island - Pacific side, 27%, and Agattu Island to Little Sitkin Island - Pacific side, 21%. The biomass estimate for Atka mackerel is probably high as the estimate for the Yunaska Island to Unimak Pass area - Bering side may be biased by one large catch in the very westerly edge off the area.

Rock sole, which was the fifth most abundant species by weight, had the highest available biomass estimate of the flatfish species, 52,647, t. Although the biomass estimate is considerably lower than for previously mentioned species, rock sole was found primarily in the Unimak Pass to Yunaska Island area which contained 52,195 t or 79% of the total biomass, 40.3% on the Pacific side and 38.9% on the Bering side.

Arrowtooth flounder, with the sixth highest estimated biomass, was found primarily in the Yunaska Island to Unimak Pass area - Pacific side, 27,178 t, and Bering side, 8,330 t, which together held 76.5% of the total estimated available biomass encountered during the survey.

Except for the northern rockfish which was most abundant in the Great Sitkin Island to Yunaska Island area - Pacific side, 27,974 t, and the Agattu Island to Little Sitkin Island area - Pacific side, 6,631 t, other species occurring in concentrations large enough to support commercial exploitation were found only in the Yunaska Island to Unimak Pass area. These species included: (1) red king crab - Pacific side, 25,208 t; (2) giant grenadier (rattails) - Pacific side, 22,100 t; (3) Greenland turbot - Bering side, 17,137 t, (4) Dover sole - Pacific side, 12,838 t; (5) rex sole - Pacific side, 8,295 t; and (6) sablefish - Bering side, 13,346 t and Pacific side, 6,954 t.

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