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NOAA Technical Memorandum NMFS-AFSC-82

Data Report: 1996 Gulf of Alaska Bottom Trawl Survey

by
M. H. Martin

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center

October 1997

NOAA Technical Memorandum NMFS

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PREFACE

This data report is one of three types of standard reports presenting data from the 1996 Gulf of Alaska groundfish survey conducted by the National Marine Fisheries Service (NMFS). The three standard reports are:

1) **Cruise Report** outlines the survey objectives, documents itinerary, personnel, and vessels employed and summarizes major accomplishments.

2) **Report to Industry** is a fishing log consisting of raw haul and catch data for each haul made during the survey, catch summaries for the major species, catch per unit effort by haul, and gear specifications and diagrams.

3) **Data Report** (this document), contains detailed descriptions of the survey planning and operation, species distribution and abundance charts, length frequency plots, tables of estimated biomass, catch per unit effort, average weight and length estimates, length frequency plots, length-weight regression parameters, list of identified species, survey strata specifications and charts, and trawl descriptions and diagrams.

ABSTRACT

The fifth triennial groundfish assessment survey of the Gulf of Alaska was conducted during the summer of 1996 by the Alaska Fisheries Science Center's Resource Assessment and Conservation Engineering (RACE) Division. The survey area covered the continental shelf and upper continental slope to 500 m in the Gulf of Alaska from Islands of Four Mountains (170°W long.) to Dixon Entrance (132°40'W long.). The survey was conducted aboard three chartered trawlers, the F/V Dominator, F/V Golden Dawn, and F/V Vesteraalen. A total of 804 survey stations was successfully sampled using standard RACE Division Nor'eastern high-opening bottom trawl nets with rubber bobbin roller gear.

The primary survey objectives were to define the distribution and estimate the relative abundance of the principal groundfish and commercially important invertebrate species within the survey area and to collect data on biological parameters useful to groundfish researchers and managers including age, growth, length-weight relationships, feeding habits, and size, sex, and age composition. The survey also collected ancillary data requested by other research groups.

At least 140 fish species and 202 invertebrate species were captured in survey tows (Appendix C). Arrowtooth flounder (Atheresthes stomias), Pacific ocean perch (Sebastes alutus), walleye pollock (Theragra chalcogramma), Pacific halibut (Hippoglossus stenolepis) and Pacific cod (Gadus macrocephalus) were the most abundant species within the survey area. Atka mackerel (Pleurogrammus monopterygius), flathead sole (Hippoglossoides elassodon) and

sharpchin rockfish (Sebastes zacentrus) were locally abundant in some areas. Survey results are presented including estimates of catch per unit effort and biomass, species distribution, length frequency distribution, and length-weight relationships for commercially important species encountered during the survey.

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INTRODUCTION

The fifth triennial groundfish survey of the Gulf of Alaska was conducted during the summer of 1996 by the National Marine Fisheries Service's (NMFS) Alaska Fisheries Science Center (AFSC). Survey design and operations were the responsibilities of scientists from the AFSC's Resource Assessment and Conservation Engineering (RACE) Division in Seattle, Washington.

This report presents the survey results for the principal fish species in each of the five GOA International North Pacific Fisheries Commission (INPFC) statistical areas: Shumagin, Chirikof, Kodiak, Yakutat, and Southeastern. The purpose of this report is to provide fishery resource managers with results of the 1996 Gulf of Alaska groundfish survey, and to supplement the status of stocks resource assessment and allocation process. This report presents the 1996 survey results only and makes no comparisons with previous Gulf of Alaska surveys.

The survey objectives were to:

1) Delineate the distributions of major groundfish and commercially important invertebrate species inhabiting the continental shelf and upper continental slope of the Gulf of Alaska in water depths to 500 m.

2) Collect data to estimate the abundance of the major groundfish species.

3) Collect data on specific biological parameters of general interest to researchers and resource managers including :

- size, sex and age composition
- growth, length-weight relationships
- food habits.

4) Collect accurate net mensuration data for all survey nets and vessels.

5) Collect data for special research projects including:

- an arrowtooth flounder trophic interaction study
- a stable isotope research collection
- a special coral collection
- a snailfish taxonomy study
- contributions to the at-sea observer teaching collection
- rockfish maturity studies in the western Gulf of Alaska
- a Pacific ocean perch genetic study in the eastern Gulf of Alaska.

METHODS

Survey Area

The Gulf of Alaska forms the northeastern border of the Pacific Ocean and consists of complex bathymetric features ranging from jagged, mountainous pinnacles to flat, muddy areas. These features provide a variety of habitats resulting in a complex ecosystem mosaic (Fig. 1). Prevailing rough bottom conditions in many areas require the standard use of rubber bobbin roller gear for all bottom trawling operations. The 1996 Gulf of Alaska survey included the entire continental shelf and upper portion of the continental slope to the 500 m depth contour.

The total survey area was approximately 299,936 km² (87,446 square nautical miles (nmi²), Table 1). The shelf, comprising more than 90% of the total Gulf of Alaska survey area, extends approximately 220 km (120 nmi) off Cook Inlet and narrows to 40 km (22 nmi) off Dixon Entrance and 20 km (11 nmi) off the Islands of Four Mountains. Approximately 80% of the shelf is shallower than 200 m. The remaining shelf area is bisected by several gullies, 100-500 m in depth, extending from the upper slope to the inner shore. The outer shelf is bordered by the continental slope, a region approximately 20 km in width, which descends steeply into the abyssal Aleutian Trench in the western and central Gulf of Alaska and the Alaska Plain in the eastern gulf. The survey assessed only that portion of the slope shallower than 500 m, an area of approximately 15,000 km² (8,000 nmi²). Several areas were removed from the survey area in the 1996 survey including several unnavigable bays and coastal areas and the generally untrawlable areas in the Sandman Reef and Pavlov Islands areas in the Shumagin INPFC area (Appendix A).

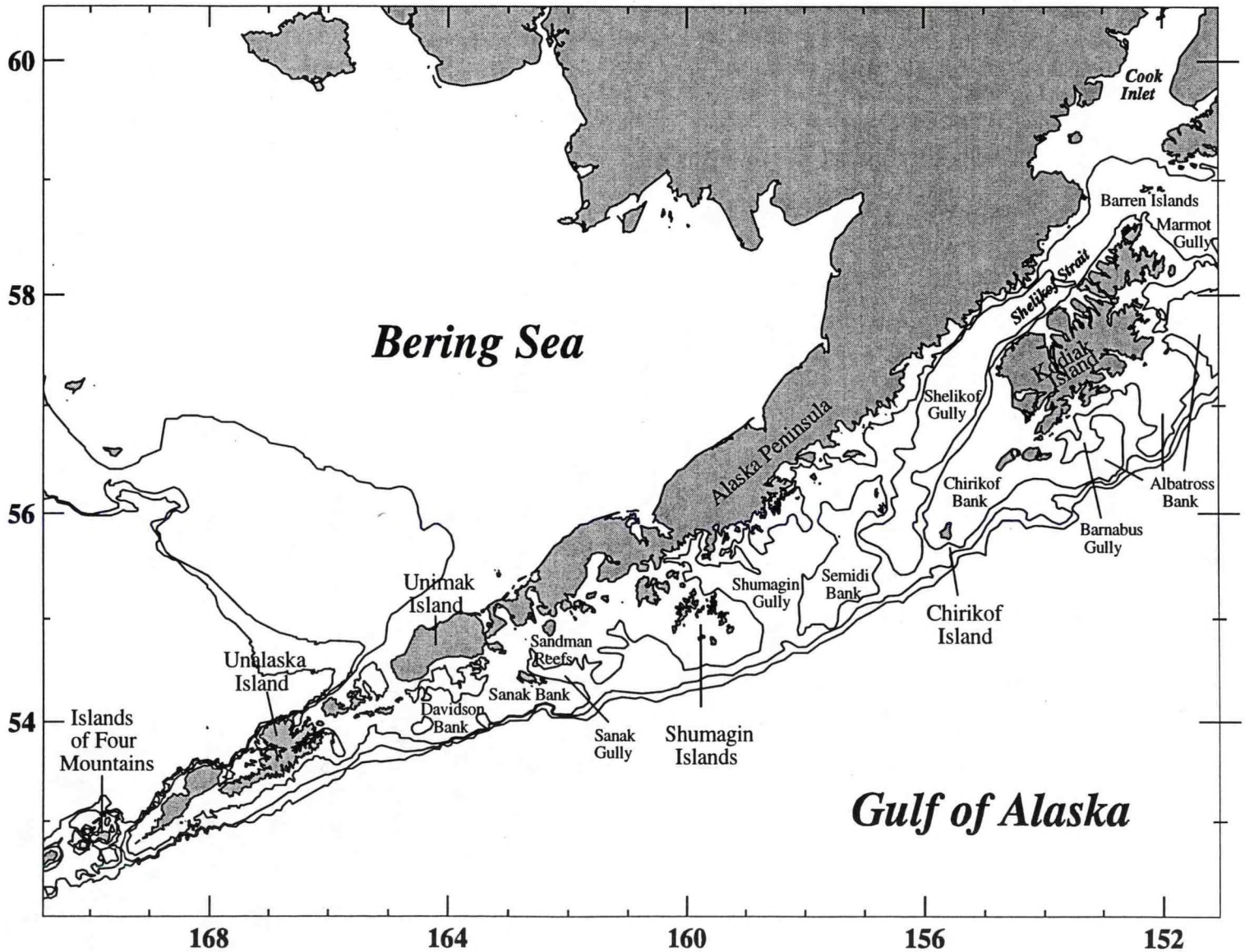

Figure 1.--Bathymetric and geographic features of the survey area for the 1996 Gulf of Alaska triennial groundfish survey.

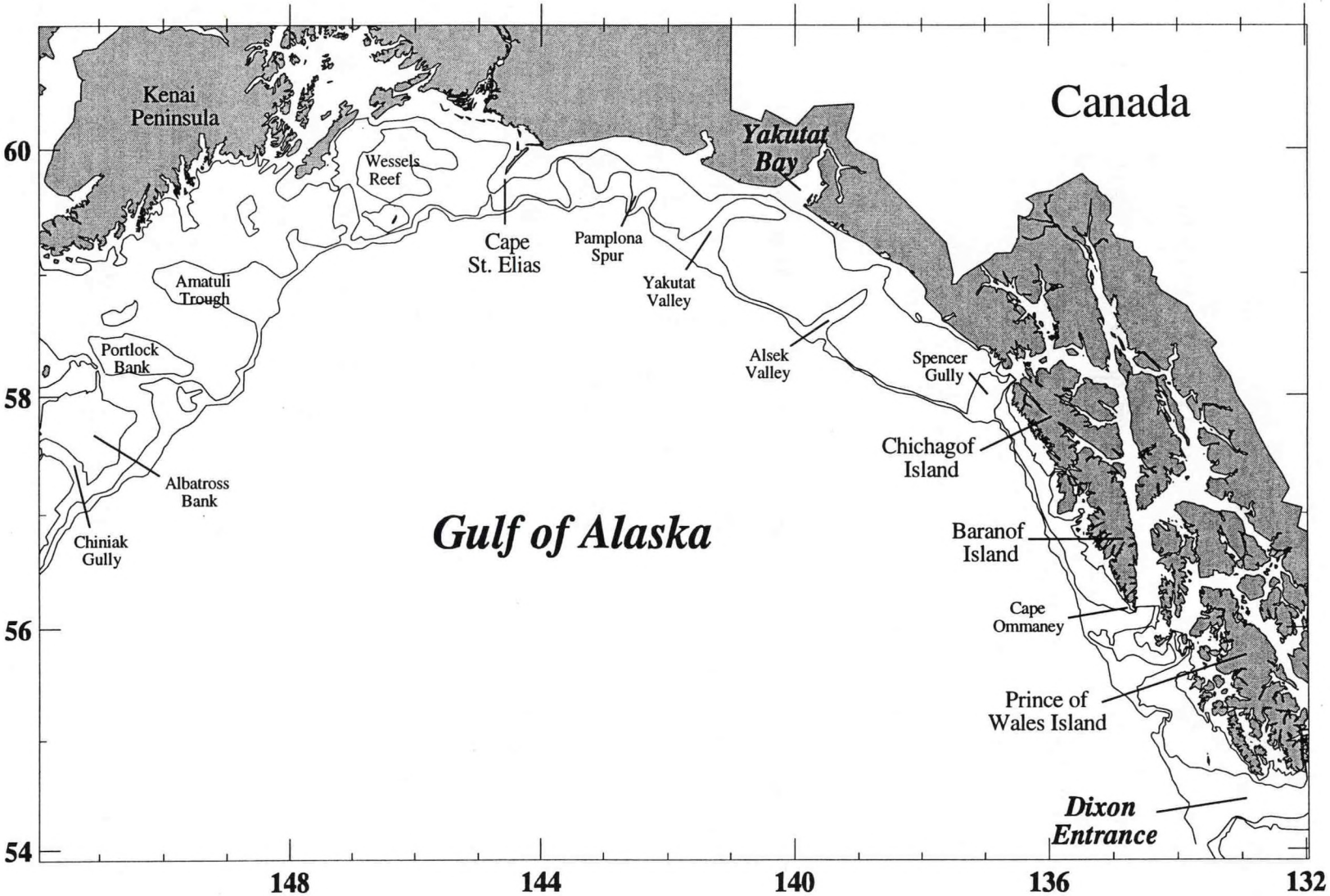

Figure 1.--Continued.

About 32% (96,255 km²) of the total survey area is within the Kodiak INPFC area (Table 1). The portion of the survey area contained within the Chirikof INPFC area and the Shumagin INPFC area are approximately equal at about 20% (63,038 km²) and 21% (61,148 km²), respectively, while the Yakutat INPFC survey area makes up about 18% (53,694 km²). The Southeastern INPFC survey area comprised the smallest portion with less than 9% of the total survey area (25,801 km²).

Vessels

All three charter vessels used were house-forward stern trawlers with stern ramps, forward and aft net storage reels (mounted aft over the stern ramp and forward of the working deck), telescoping deck cranes, propeller nozzles, and paired, controlled-tension hydraulic trawl winches with 1,280 m to 1,460 m of 2.54 cm diameter steel cable. The F/V Vesteraalen is 38 m in overall length (LOA) and is powered by a single, 1,700 continuous horsepower (HP) main engine. The F/V Dominator is also 38 m LOA with a 1,300 HP main engine. The F/V Golden Dawn is 45 m LOA and is propelled by a 2,000 HP main engine. Electronic equipment on all vessels included Global Positioning Systems (GPS) and LORAN C receivers with video position plotters, at least two radars, single sideband and VHF transmitter-receivers, color video fish-finders, paper recorder depth sounders, and auto-pilots.

Captains Tim Cosgrove and Craig Jenssen operated the F/V Vesteraalen and the F/V Dominator, respectively, for the entire cruise period. Captains Steven Berets and Gary Hansen

operated the F/V Golden Dawn for the first and second halves of the cruise, respectively.

Fishing Gear

All vessels used standard RACE Division poly-Nor'eastern high-opening bottom trawls rigged with rubber bobbin roller gear (Appendix B). Gear specifications included: a 27.2 m headrope with twenty-one 30 cm diameter floats, and a 24.3 m chain "fishing line" attached to a 24.9 m, 0.95 cm diameter galvanized wire footrope. The roller gear was 24.2 m long and constructed of 1.91 cm diameter galvanized wire rope, 36 cm rubber bobbins separated by 10 cm rubber disks. In addition, 5.9 m wire rope extensions with 10 cm and 20 cm rubber disks were used to span each lower flying wing section.

Trawls were constructed of 12.7 cm stretched-mesh polyethylene web with a 3.2 cm mesh nylon liner in the codend. Net rigging consisted of triple 54.84 m, 1.59 cm diameter galvanized wire rope dandylines. The dandylines were rigged with 22.9 cm, 45.7 cm, and 60.7 cm chain extensions to the headrope, side, and bottom wing attachments, respectively. Steel V-doors (1.83 m × 2.74 m) weighing approximately 800 kg each were used. The fishing dimensions of the trawls were measured aboard each vessel using Scanmar acoustic net mensuration equipment.

Survey Design

The 1996 triennial survey used a stratified random sampling pattern consistent with previous triennial surveys (Martin and Clausen 1995, Stark and Clausen 1995, Munro and Hoff

1995). The Gulf of Alaska was divided into 49 strata categorized by water depth, type of geographical area (e.g., banks, gullies, and slopes) and INPFC statistical area boundaries (Appendix B).

Sample allocations for each stratum were determined by calculating the sample allocations for each of the important groundfish species using a Neyman optimum allocation strategy (Cochran 1977) with data from the previous four triennial surveys. The mean number of samples was then calculated for each stratum with each species weighted by its mean catch per unit effort (CPUE) for the entire Gulf of Alaska. Each stratum was required to have at least three samples and the maximum sample density was limited to a maximum of 2.5 times the mean sample density to constrain the potential influence of a single species on the overall results. The number of samples in each stratum was adjusted according to the mean percentage of bad performance tows within that stratum over the past four surveys to give the total number of stations to be allocated for each stratum. The number of stations allocated above were randomly selected without replacement from a grid composed of cells of 25 km in area (based on lines of latitude and longitude) which covered the entire survey area. The stations for each stratum were divided evenly among the three vessels to allow a comparison of relative fishing efficiencies between vessels.

Stations were prioritized within each stratum to provide three potential levels of systematically controlled sampling density. Station prioritization was necessary to allow for the possible loss of survey days due to bad weather, mechanical breakdowns, difficulty in finding

trawlable bottom, etc. Each of the selected stations was assigned a priority based on the possibilities of completing either 600, 900, or 1,200 total successful stations. Priority One stations were allocated from the minimum potential sampling level of 600 total stations and comprised at least 50% of the stations in each stratum. Each stratum's remaining stations were divided equally between Priority Two and Priority Three sampling densities, corresponding to the successful completion of 900 or 1,200 stations, respectively. The Priority One stations were always attempted. Priority Two and Three stations were attempted according to the prevailing rate of successful station sampling and the remaining survey vessel time. The selected gridpoints were considered to define the center of 5 by 5 km areas, defined as grid-areas. Within each selected grid-area, the bottom was searched using echosounder returns to find sufficient trawlable bottom to obtain a successful 15 minute tow, not necessarily trawling at the actual gridpoint. If trawlable bottom could not be found in the immediate area of the selected gridpoint, a search for a suitable location within the grid-area was commenced. If, in the judgment of the field party chief, no trawlable grounds could be found within the grid-area within 2 hours, a nearby alternate station was selected from a list of successful tows completed during previous triennial groundfish surveys. If sufficient trawlable bottom was encountered while transiting to the alternate site, this location was selected for the sample.

Data Collection Techniques

The goal of each sample (tow) was to maintain the vessel speed at 3 knots while maintaining the net in fishing configuration for 15 minutes. Occasionally, tows of shorter duration were necessary to prevent net damage or when echosounder and Scanmar information suggested the potential for an exceptionally large catch. The time and location (estimated by global positioning system [GPS]) of the vessel were recorded every 6 seconds during each tow. Pressure at depth, water temperature, and time were recorded every 6 seconds during most tows using a MicroBT data logger (Richard Brancker Research Ltd.) placed on the headrope of the net. The vertical and horizontal net openings were monitored with Scanmar net sonde units. Scanmar data were generally not collected for tows over rough bottom. The surface water temperature was measured at most stations with a bucket thermometer. To reduce potential fishing power differences between the survey vessels, standardized trawling and gear handling methods were practiced including the use of scope ratio tables (trawl warp relative to bottom depth) and maintaining a 3 nmi/hour trawling speed.

A trawl sample was considered successful if horizontal and vertical net openings remained within the normal range, the roller gear maintained consistent contact with the bottom, the net suffered no or little damage during the tow, and there were no conflicts with derelict fishing gear. Trawl samples were considered unsuccessful when the field party chief deemed that the sample result was affected by trawl damage or an unstable trawl configuration or if the duration of the tow was less than 10 minutes.

Collection and Processing of Samples

Catches weighing less than approximately 1,100 kg were emptied directly onto a sorting table, sorted to species, and weighed to the nearest 0.1 kg using a platform scale. Species groups weighing less than 2 kg were generally weighed to the nearest 2 g on a Marel digital read-out scale. Larger catches were weighed with a dynamometer or the weight was estimated volumetrically. A representative subsample that approximated the sampling table capacity was then obtained following the procedures described by Hughes (1976) to reduce subsampling bias caused by species and size stratification within the codend. The entire catch was sampled for major groundfish species that occurred in limited numbers and were easily differentiated to species. Pacific halibut were immediately measured and released. Halibut weights were estimated from the length data. Numbers and weights of all species were estimated for each haul. Northern rock sole (Lepidopsetta cf.sp. bilineata), southern rock sole (Lepidopsetta bilineata), light dusky rockfish (Sebastes cf.sp. ciliatus) and dark dusky rockfish (Sebastes ciliatus) were identified to species for the first time in the 1996 survey. In previous surveys, both northern and southern rock sole were identified as "rock sole" and both light and dark dusky rockfish were identified as "dusky rockfish".

Additional data collection was concentrated on fish species of high commercial value or abundance in the survey area. A random subsample of 100 to 300 individuals (target subsample size was species-dependent) of each of these species identified in the catch was sorted by sex and individual fork lengths (FL) were measured using Polycorder (Omnidata) data loggers with

barcode reading capabilities and barcoded length strips. Fish that could not be readily sexed were classified as unsexed and measured. Age structures were collected from randomly selected individuals of the target species. Fork length was estimated to the nearest 1 cm interval, and weight was estimated to the nearest 2-10 g (scale accuracy depended on the weight of the specimen) with a Marel digital read-out scale. To ensure that adequate samples for all commonly observed year classes were collected, the age specimen collections were stratified by sex and 1 cm FL intervals. Every attempt was made to distribute the age specimen collections over the entire survey area.

Stomach samples for selected species were collected throughout the western and central portions of the survey by biologists from the AFSC's Trophic Interactions Program aboard the F/V Golden Dawn. Ancillary data and specimens were collected for several other research projects including an arrowtooth flounder trophic interaction study, a stable isotope study, a special coral collection, a snailfish (family Cyclopteridae) taxonomy study, contributions to the at-sea observer teaching collection, rockfish maturity studies in the Western Gulf of Alaska, and a Pacific ocean perch genetic study in the eastern Gulf of Alaska.

Data Analysis

Biomass estimates were calculated using the area-swept method (Alverson and Pereyra 1969). The area swept was estimated by multiplying the estimated distance towed by the estimated mean net spread for each tow. The distance towed was estimated by computing the distance traveled over ground by the vessel between the estimated time when the footrope came

into contact with the bottom (on-bottom) and the estimated time when the center of the footrope left the bottom (off-bottom). The distance traveled by the vessel was estimated by smoothing the GPS location data to eliminate the dither introduced by selective availability, the largest source of error in the GPS system, and measuring the distance along this line. The mean net spread was estimated by averaging the smoothed net spread readings from the Scanmar units between on-bottom and off-bottom. Net spreads for tows for which there were no Scanmar data were estimated using a stepwise generalized additive model using net number, net height (when available), mean speed over ground (when available), depth, total catch and the actual scope/expected scope ratio as variables. For each species, a CPUE was calculated for each tow by dividing catch weight (in kg) by the area swept by the trawl (in km^2). A mean CPUE for each stratum was calculated as the mean of the individual tow CPUEs (including zero catches) within that stratum. Mean CPUEs of combined strata were calculated as the component strata CPUE means weighted by strata area. Biomass estimates were calculated by multiplying each stratum mean CPUE by the stratum area and summing the results to obtain estimates by INPFC statistical areas and depth intervals. The 95% confidence interval was calculated for each species biomass estimate. A detailed description of the analytical procedures is presented in Wakabayashi et al. (1985).

Population length compositions were estimated by expanding the length-frequency data to the total catch for each species by length and sex category at each station (Wakabayashi et al. 1985). The stratum population within a sex-length category was calculated by multiplying the

stratum population by the proportion of fish in that category from the summed station data. Population size composition estimates were summed over strata to create estimates by area.

Length-weight data collected from individual fish were used to estimate length-weight relationships based on a nonlinear least squares regression algorithm. The length-weight relationship was expressed as :

$$\text{Weight}_{(\text{grams})} = a * \text{Length}_{(\text{mm})}^{b}$$

where W=weight (grams), L=length (mm), a=coefficient, and b=exponent.

Data Limitations

Due to the multi-species nature of this survey, there are some limitations in its ability to estimate fish abundance. Obviously, populations whose entire depth range is not covered by the survey are not fully sampled (e.g., sablefish, shortspine thornyhead). Populations that extend into areas untrawlable with the survey gear are not fully represented (e.g., many rockfish species). Populations of species that exhibit a highly contagious distribution pattern (e.g., Atka mackerel and Pacific ocean perch) or are highly restricted in the amount of available habitat in the Gulf of Alaska (e.g., yellowfin sole and starry flounder) would be better sampled with a different survey design. For these reasons, survey estimates of abundance are considered more reliable for species that are widely and more uniformly distributed.

Estimates of population size within the survey area are routinely represented as absolute biomass estimates. These estimates make the assumption that 100% of the fish within the path of

the trawl are captured. In fact, the situation is much more complex. As with any fishing gear, the survey trawl exhibits some size selectivity. Fish small enough to pass through the net mesh are not sampled well. Some larger fish may be able to outswim the trawl, at least for a short time. Fish are herded into the path of the trawl by the doors and the bridles in front of the trawl. Some fish escape under the footrope of the net. The rate of herding and escapement depend upon several factors including the species and water temperature; This is an active area of research at the AFSC. Given these limitations, survey abundance estimates are probably best seen as relative measures of abundance.

RESULTS

Tows were attempted at a total of 868 stations (72% of the allocated stations), and 804 of these (93%) were considered successful tows and included in the biomass and size composition analysis (Table 1). Scanmar net spread data were successfully collected for 777 tows (90%). Headrope depth and temperature data were successfully collected for a total of 770 tows (89%). Bottom temperatures ranged from 3.2° to 11.7°C. Sea surface temperatures were collected at a total of 781 stations (90%) and ranged from 4.2° to 16.1°C.

Table 1.--Number of allocated, attempted, and successfully completed stations and sampling density for the 1996 Gulf of Alaska triennial groundfish survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of stations Allocated	Attempted	Successful	Area (km^2)	Sampling density (stations/1,000 km^2)
Shumagin	1 - 100	123	109	102	41,151	2.48
	101 - 200	72	65	60	14,678	4.09
	201 - 300	26	24	22	2,788	7.89
	301 - 500	19	18	16	2,531	6.32
	All depths	240	216	200	61,148	3.27
Chirikof	1 - 100	108	81	69	26,036	2.65
	101 - 200	104	72	68	23,851	2.85
	201 - 300	49	34	31	11,547	2.68
	301 - 500	17	15	13	1,604	8.1
	All depths	278	202	181	63,038	2.87
Kodiak	1 - 100	143	64	59	38,518	1.53
	101 - 200	202	114	109	43,334	2.52
	201 - 300	52	35	31	11,491	2.7
	301 - 500	20	12	11	2,912	3.78
	All depths	417	225	210	96,255	2.18
Yakutat	1 - 100	41	34	33	16,513	2
	101 - 200	62	54	50	29,383	1.7
	201 - 300	33	29	27	5,170	5.22
	301 - 500	12	7	6	2,628	2.28
	All depths	148	124	116	53,694	2.16
Southeastern	1 - 100	12	8	7	6,547	1.07
	101 - 200	57	52	50	11,085	4.51
	201 - 300	32	29	28	5,053	5.54
	301 - 500	15	12	12	3,117	3.85
	All depths	116	101	97	25,801	3.76
All areas	1 - 100	427	296	270	128,765	2.1
	101 - 200	497	357	337	122,331	2.75
	201 - 300	192	151	139	36,049	3.86
	301 - 500	83	64	58	12,792	4.53
	All depths	1199	868	804	299,936	2.68

Catch Results by Area

At least 140 fish species from 33 families were captured during the 1996 survey. Appendix C presents lists of fish (Appendix C-1) and invertebrate (Appendix C-2) species encountered during the survey. Relative abundance estimates, reported as CPUE, are presented in Table 2 for the 20 most abundant groundfish species in each of the five INPFC areas.

Over the entire survey area, arrowtooth flounder was the most abundant groundfish encountered during the survey (Table 2). Arrowtooth flounder had the highest CPUE of any species in three of the five INPFC areas covered by the survey. It was second in terms of CPUE in the other two areas. Pacific ocean perch, walleye pollock, Pacific halibut and Pacific cod were also very important components of the gulf-wide species composition.

In the Shumagin INPFC area, Atka mackerel had the highest CPUE of any species, mostly due to one extremely large tow. Arrowtooth flounder, Pacific cod and walleye pollock were the next most abundant groundfish species and CPUEs were also high for Pacific halibut, Pacific ocean perch, and flathead sole. In the Chirikof INPFC area, arrowtooth flounder was the dominant species in survey catches with a mean CPUE that was the highest area-wide CPUE observed in the survey. Walleye pollock, Pacific ocean perch, Pacific halibut and Pacific cod were also important components of the species composition. In the Kodiak INPFC area, arrowtooth flounder and Pacific ocean perch were the two most abundant species. Pacific halibut, walleye pollock and Pacific cod also had notably high CPUEs. In the Yakutat INPFC

area, arrowtooth flounder was the dominant species with a mean CPUE almost four times higher than the next most abundant species, Pacific ocean perch. In the Southeastern INPFC area, Pacific ocean perch, arrowtooth flounder, sharpchin rockfish and walleye pollock predominated in the catches. Pacific ocean perch had a CPUE about 2.5 times the next highest CPUE (arrowtooth flounder).

Table 2.-- Mean CPUE (kg/km^2) for the 20 most abundant groundfish in each International North Pacific Fisheries Commission area during the 1996 triennial Gulf of Alaska bottom trawl survey.

Shumagin Area		Chirikof Area		Kodiak Area	
Species	CPUE	Species	CPUE	Species	CPUE
Atka mackerel	5,300	arrowtooth flounder	7,269	arrowtooth flounder	6,729
arrowtooth flounder	3,107	walleye pollock	4,026	Pacific ocean perch	3,215
Pacific cod	2,885	Pacific ocean perch	2,170	Pacific halibut	2,607
walleye pollock	2,489	Pacific halibut	2,052	walleye pollock	2,090
Pacific halibut	1,729	Pacific cod	1,972	Pacific cod	2,006
Pacific ocean perch	1,423	flathead sole	731	sablefish	812
flathead sole	1,024	northern rockfish	595	flathead sole	726
northern rock sole	963	skate unident.	424	southern rock sole	542
southern rock sole	727	rex sole	342	light dusky rockfish	355
giant grenadier	524	southern rock sole	319	northern rockfish	298
yellowfin sole	459	sablefish	290	skate unident.	277
northern rockfish	431	light dusky rockfish	283	Dover sole	243
starry flounder	249	Dover sole	163	rex sole	198
skate unident.	233	rougheye rockfish	146	eulachon	197
rex sole	145	northern rock sole	137	rougheye rockfish	180
sablefish	125	yellowfin sole	133	lingcod	125
shortspine	123	Pacific sleeper shark	116	shortspine thornyhead	122
yellow Irish lord	111	giant grenadier	105	butter sole	107
butter sole	96	eulachon	95	Pacific sleeper shark	101
light dusky rockfish	55	shortspine thornyhead	94	yellowfin sole	89
Number of hauls	200	Number of hauls	181	Number of hauls	210

Yakutat Area		Southeastern Area		All Areas	
Species	CPUE	Species	CPUE	Species	CPUE
arrowtooth flounder	3,489	Pacific ocean perch	5,765	arrowtooth flounder	5,128
Pacific ocean perch	883	arrowtooth flounder	2,165	Pacific ocean perch	2,435
Dover sole	521	sharpchin rockfish	1,559	walleye pollock	2,213
spiny dogfish	421	walleye pollock	1,413	Pacific halibut	1,773
sablefish	419	Pacific halibut	934	Pacific cod	1,677
Pacific halibut	418	silvergray rockfish	701	Atka mackerel	1,082
walleye pollock	343	redstripe rockfish	525	flathead sole	645
sharpchin rockfish	331	harlequin rockfish	510	sablefish	452
shortspine	255	spotted ratfish	432	southern rock sole	398
light dusky rockfish	249	Dover sole	403	northern rockfish	310
flathead sole	222	shortspine thornyhead	370	skate unident.	258
rex sole	173	sablefish	363	northern rock sole	247
skate unident.	148	rex sole	345	Dover sole	245
lingcod	136	rougheye rockfish	278	light dusky rockfish	233
rougheye rockfish	110	Pacific cod	253	rex sole	226
shortraker rockfish	79	shortraker rockfish	132	sharpchin rockfish	202
eulachon	73	flathead sole	124	shortspine thornyhead	162
Pacific cod	62	Pacific tomcod	120	giant grenadier	161
salmon shark	58	lingcod	104	yellowfin sole	151
Pacific sleeper shark	53	english sole	104	rougheye rockfish	143
Number of hauls	116	Number of hauls	97	Number of hauls	804

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Catch Results by Species

For each species of great commercial interest or abundance, the following items are presented:

1. A brief synopsis of the data collected.
2. A table presenting the number of hauls, the number of hauls with catch, CPUE, estimated biomass, and mean length and weight of that species by INPFC area and depth.
3. A figure showing the distribution and relative abundance of that species.
4. A figure showing the estimated size composition of the population for that species.
5. A figure showing the length-weight relationship from the individual length and weight data collected.
6. CPUE and biomass estimates by stratum for that species.

For other species that were locally abundant (other flatfish and other rockfish), only items 1, 2, and 6 above are presented.

The scientific names used generally follow the fifth edition of the Common and Scientific Names of Fishes from the United States and Canada (Robins et al. 1991). The only exceptions to this are in the Order Pleuronectiformes (flatfish) scientific names. The names used throughout this report reflect recent reexamination of the phylogeny of this family (Cooper and Chapleau 1996, Ivankov 1996, Rass 1996, Berendzen 1997).

Arrowtooth flounder (Atherestes stomias)

Arrowtooth flounder had the highest CPUE of any species in the 1996 survey (Table 3), and its biomass was over twice that of the next most abundant species. Arrowtooth flounder were distributed throughout the survey area (Fig. 2), occurring in all 49 strata (Table 4) and at more than 92% of the sampled stations, including about 98% of the stations at depths greater than 100 m (Table 3). Approximately 47% of the estimated arrowtooth flounder biomass was found between 101 and 200 m in the Chirikof and Kodiak INPFC areas (approximately 22% of the total area). The highest CPUEs were associated with larger gullies and the shallower areas on the continental slope, especially Shelikof Edge, Albatross Gullies, Sanak Gully, and Chirikof Outer Shelf (Table 4). Large catches were also recorded in shallow water (less than 100 m) south of Kodiak Island (Albatross Shallows stratum). Arrowtooth flounder had the highest estimated biomass of any species in three of the five INPFC areas surveyed and was second in estimated biomass in the other two areas. Length data were collected for more than 56,000 arrowtooth flounder. Both mean length and mean weight increased with depth in all areas. The largest fish in terms of mean size were found in the Kodiak area in all depths, and mean fish size generally decreased to the east and to the west. Length modes were generally found between 40 and 45 cm FL for males and between 55 and 60 cm FL for females (Fig. 3). Length modes were also seen at 21-22 cm FL for both sexes in the shallowest strata in the Shumagin and Kodiak areas (Fig. 3). The length-weight relationship for arrowtooth flounder specimens collected during the survey is depicted in Figure 4.

Table 3.--Number of survey hauls, number of hauls with arrowtooth flounder, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	88	1,885	77,583	0.57	35.5
	101 - 200	60	57	8,048	118,129	0.75	41.3
	201 - 300	22	22	1,618	4,510	1.04	46.1
	301 - 500	16	15	796	2,014	1.60	53.6
	All depths	200	182	3,107	202,236	0.68	38.8
Chirikof	1 - 100	69	49	4,272	111,214	0.67	37.9
	101 - 200	68	68	13,276	316,653	0.87	42.8
	201 - 300	31	31	5,543	63,999	1.13	47.3
	301 - 500	13	13	1,776	2,849	1.77	54.6
	All depths	181	161	7,269	494,715	0.84	41.9
Kodiak	1 - 100	59	50	5,129	197,549	1.05	44.6
	101 - 200	109	107	10,573	458,188	0.99	45.1
	201 - 300	31	31	2,202	25,308	1.23	48.5
	301 - 500	11	9	656	1,909	1.83	55.4
	All depths	210	197	6,729	682,954	1.02	45.1
Yakutat	1 - 100	33	28	3,487	57,582	0.75	40.6
	101 - 200	50	50	4,160	122,232	0.68	39.7
	201 - 300	27	27	2,428	12,552	0.96	44.8
	301 - 500	6	6	2,545	6,688	1.72	54.8
	All depths	116	111	3,489	199,054	0.73	40.4
Southeastern	1 - 100	7	3	504	3,300	0.76	39.5
	101 - 200	50	49	4,016	44,517	0.59	36.7
	201 - 300	28	27	1,159	5,856	0.83	40.9
	301 - 500	12	11	2,258	7,039	1.53	54.6
	All depths	97	90	2,165	60,712	0.66	38.1
All areas	1 - 100	270	218	3,473	447,228	0.78	39.9
	101 - 200	337	331	8,663	1,059,719	0.85	42.6
	201 - 300	139	138	3,113	112,225	1.10	46.7
	301 - 500	58	54	1,603	20,499	1.65	54.6
	All depths	804	741	5,128	1,639,671	0.85	42.1

All areas biomass, 95% confidence interval: 1,410,088 - 1,869,254 metric tons (t).

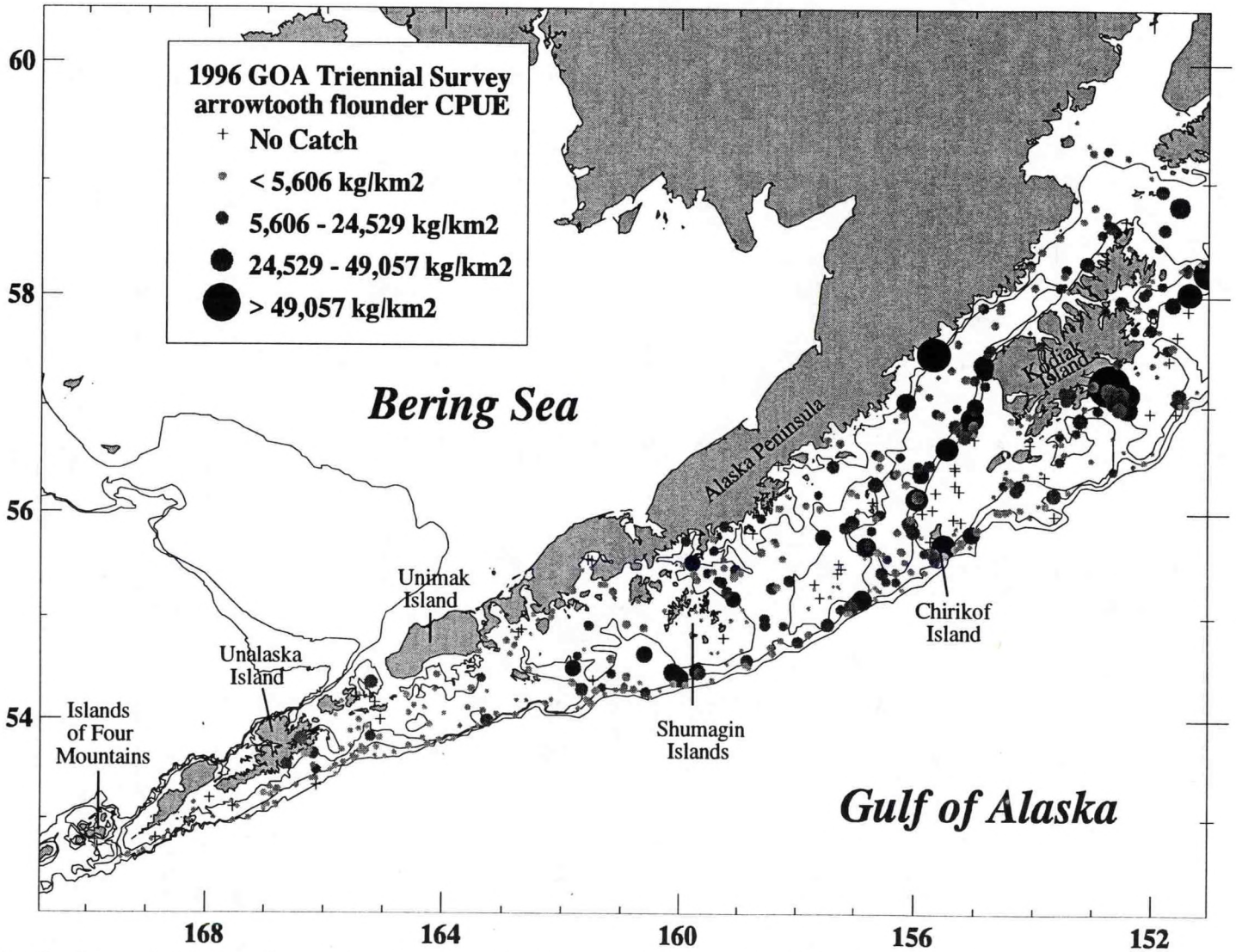
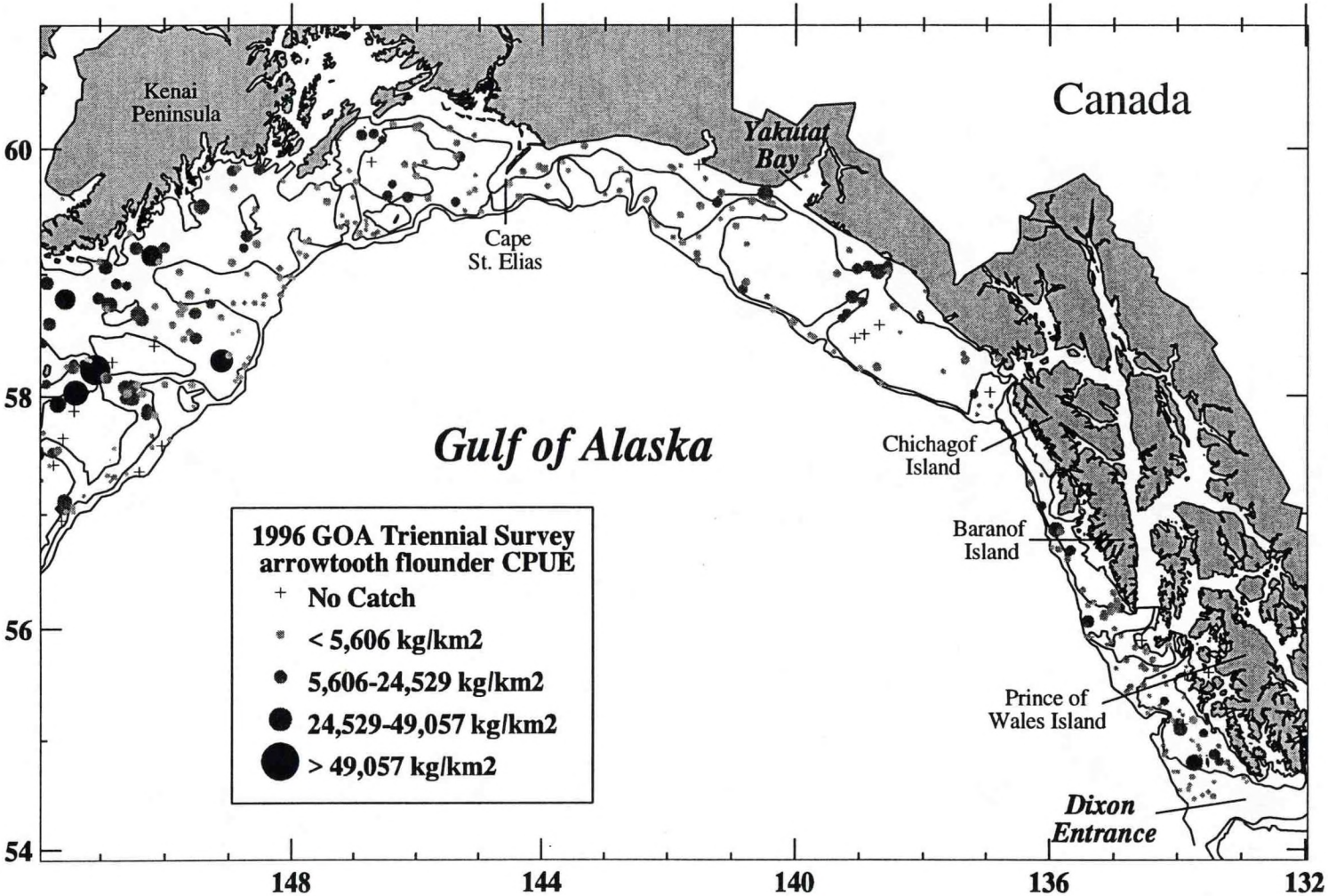


Figure 2.--Distribution and relative abundance of arrowtooth flounder from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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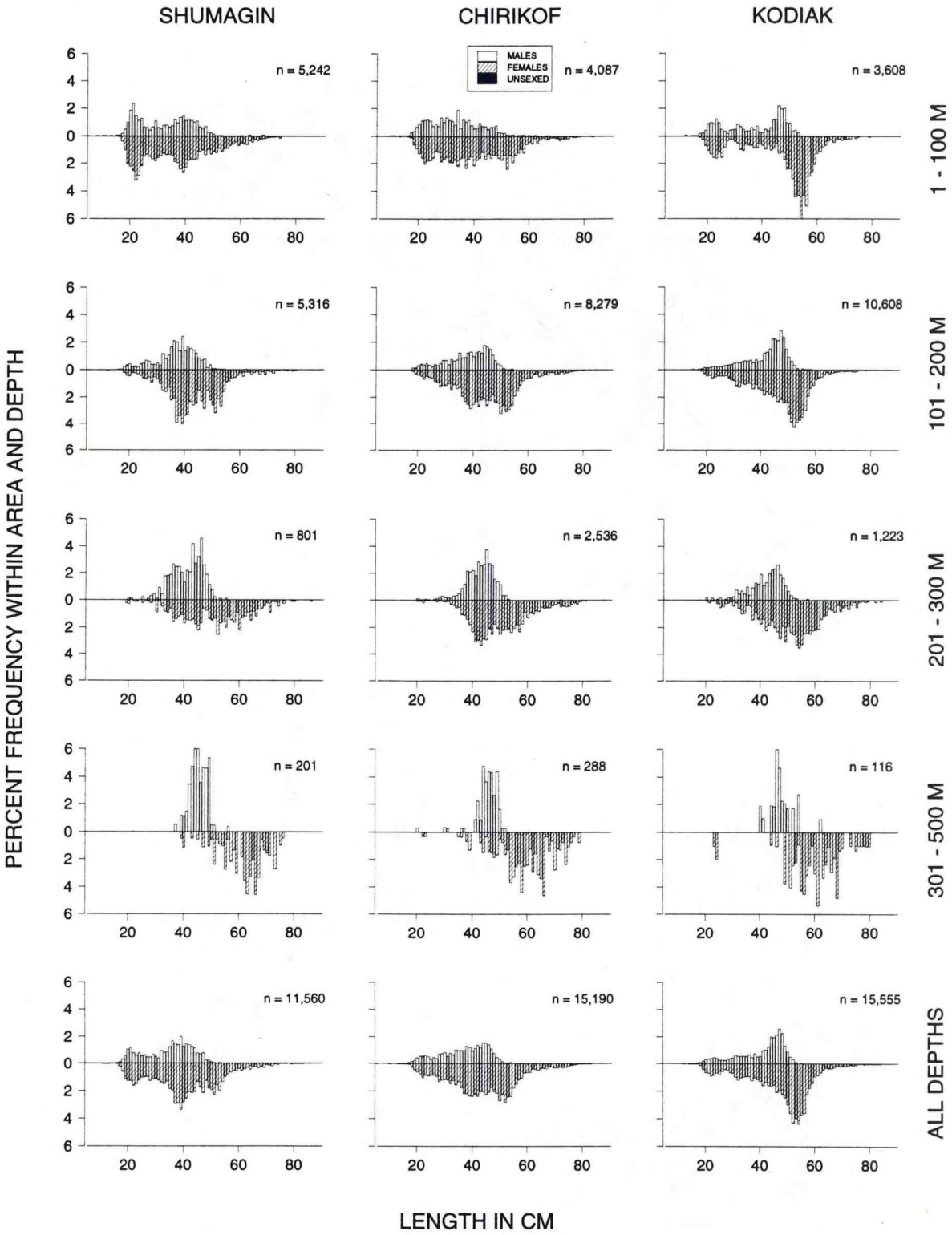

Figure 3.--Size composition of the estimated arrowtooth flounder population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

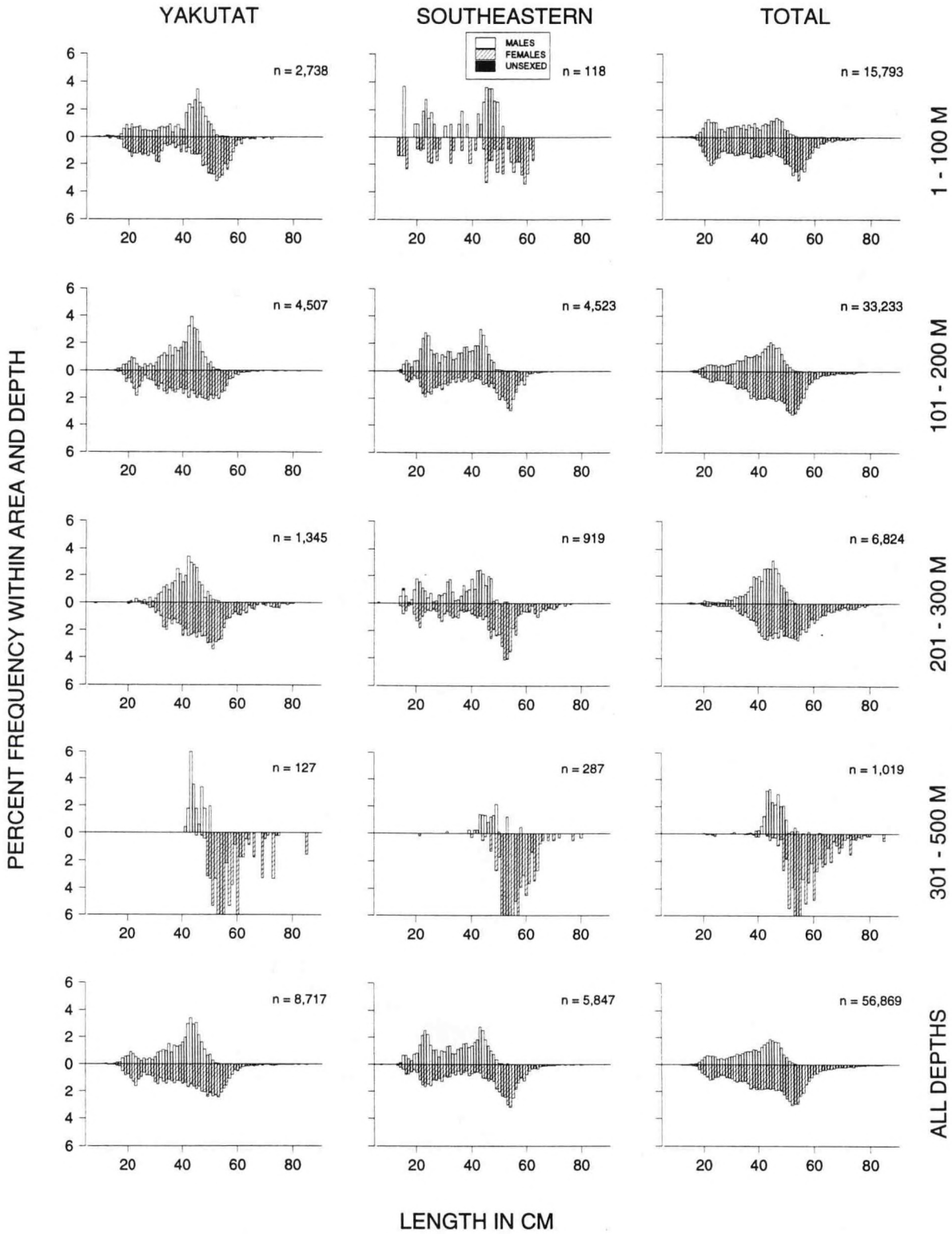

Figure 3.--Continued.

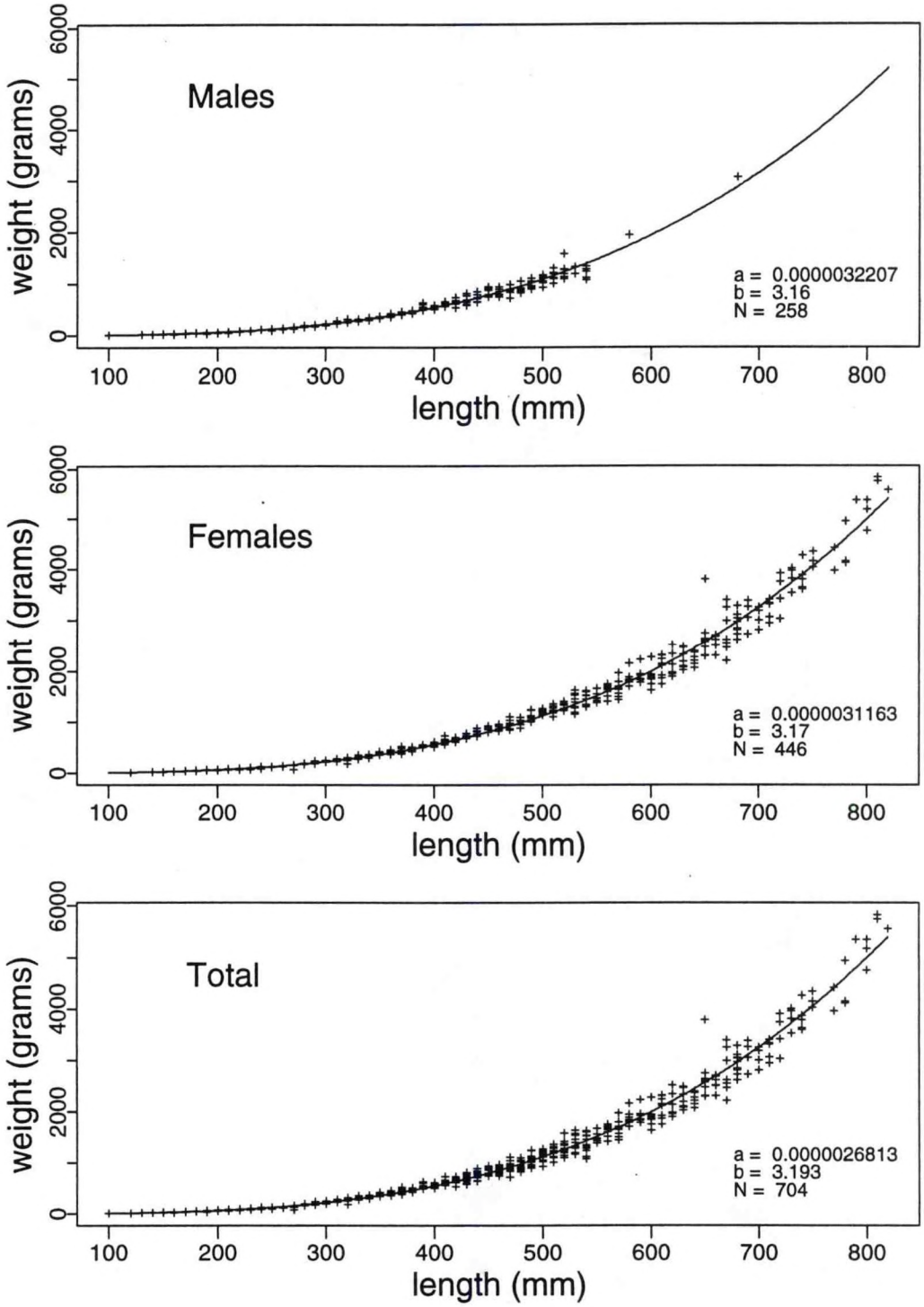

Figure 4.--Length-weight relationship for arrowtooth flounder specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $\text{Weight}_{(grams)} = a * \text{Length}_{(mm)}^{b}$.

Table 4.--Catch per unit effort by stratum for arrowtooth flounder sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	101-200	Shelikof Edge	28	28	21,026	162,638	86,852	238,424
Kodiak	101-200	Albatross Gullies	32	32	17,413	137,779	79,981	195,577
Kodiak	1-100	Albatross Shallows	24	23	13,799	79,572	0	171,427
Shumagin	101-200	Sanak Gully	6	6	12,665	53,790	311	107,270
Chirikof	101-200	Chirikof Outer Shelf	24	24	12,404	62,157	30,743	93,571
Kodiak	101-200	Kenai Flats	17	17	10,871	131,297	61,977	200,616
Shumagin	101-200	West Shumagin Gully	13	13	10,076	22,957	11,379	34,535
Kodiak	101-200	Barren Islands	15	15	9,361	102,797	36,876	168,717
Kodiak	101-200	Portlock Flats	21	21	9,359	68,665	26,379	110,951
Chirikof	101-200	East Shumagin Gully	16	16	8,272	91,858	52,857	130,860
Yakutat	101-200	Yakutat Flats	9	9	7,039	63,579	11,608	115,550
Chirikof	1-100	Chirikof Bank	35	23	5,956	64,278	13,820	114,737
Kodiak	1-100	Northern Kodiak Shallows	6	6	5,937	13,060	0	32,027
Chirikof	201-300	Lower Shelikof Gully	22	22	5,729	57,391	40,010	74,773
Southeastern	101-200	Baranof-Chichagof Shelf	14	14	5,561	23,336	9,646	37,027
Kodiak	1-100	Albatross Banks	19	12	5,132	79,057	0	195,479
Shumagin	101-200	Shumagin Outer Shelf	41	38	5,076	41,382	17,292	65,472
Chirikof	1-100	Upper Alaska Peninsula	16	14	4,763	37,823	0	77,642
Chirikof	201-300	Chirikof Slope	9	9	4,324	6,608	0	14,516
Kodiak	201-300	Upper Shelikof Gully	6	6	3,960	12,707	8,243	17,171
Yakutat	301-500	Yakutat Slope	1	1	3,758	5,715		
Yakutat	1-100	Yakutat Shallows	22	18	3,574	35,553	11,210	59,896
Kodiak	101-200	Kodiak Outer Shelf	24	22	3,512	17,650	2,853	32,446
Yakutat	101-200	Middleton Shelf	23	23	3,504	25,744	14,005	37,483
Yakutat	1-100	Middleton Shallows	11	10	3,355	22,029	9,785	34,273
Yakutat	201-300	Yakutat Gullies	11	11	3,120	9,493	4,126	14,860
Southeastern	101-200	Prince of Wales Shelf	36	35	3,075	21,181	7,357	35,004
Yakutat	101-200	Yakataga Shelf	8	8	2,797	14,758	2,313	27,203
Southeastern	301-500	Southeastern Deep Gullies	8	7	2,741	6,426	0	16,325
Shumagin	1-100	Fox Islands	28	22	2,718	22,271	5,439	39,102
Yakutat	101-200	Fairweather Shelf	10	10	2,349	18,151	4,996	31,306
Kodiak	1-100	Lower Cook Inlet	6	6	2,165	21,406	0	47,519
Shumagin	1-100	Davidson Bank	25	25	2,038	27,885	8,868	46,902
Chirikof	301-500	Chirikof Slope	13	13	1,776	2,849	1,268	4,430
Shumagin	201-300	Shumagin Slope	22	22	1,618	4,510	2,212	6,809
Kodiak	201-300	Kenai Gullies	20	20	1,573	10,476	6,509	14,444
Yakutat	201-300	Yakutat Slope	16	16	1,438	3,059	1,524	4,594
Southeastern	201-300	Baranof-Chichagof Slope	5	5	1,432	1,611	464	2,759
Shumagin	1-100	Shumagin Bank	23	20	1,427	17,689	4,261	31,118
Shumagin	1-100	Lower Alaska Peninsula	26	21	1,416	9,738	3,511	15,964
Kodiak	201-300	Kodiak Slope	5	5	1,310	2,125	530	3,721
Chirikof	1-100	Semidi Bank	18	12	1,248	9,113	0	20,024
Southeastern	201-300	Prince of Wales Slope/Gullies	23	22	1,081	4,245	2,523	5,966
Yakutat	301-500	Yakutat Gullies	5	5	879	973	0	2,215
Kodiak	1-100	Kenai Peninsula	4	3	847	4,454	0	9,960
Shumagin	301-500	Shumagin Slope	16	15	796	2,014	517	3,512
Southeastern	301-500	Southeastern Slope	4	4	793	613	0	1,987
Kodiak	301-500	Kodiak Slope	11	9	656	1,909	556	3,262
Southeastern	1-100	Southeastern Shallows	7	3	504	3,300	0	8,731

Pacific halibut (Hippoglossus stenolepis)

Pacific halibut were consistently found at all surveyed depths less than 400 m, but approximately 74% of the biomass was estimated to be located between 1 and 100 m (Table 5). Halibut were encountered at 93% of the stations sampled in this depth range. The largest CPUEs occurred in the shallow areas southeast of Kodiak Island (Albatross Banks) and Montague Island (Fig. 5) and on the large flat banks in the Chirikof area (Semidi Bank and Chirikof Bank). Albatross Banks accounted for about 24% of the total biomass estimate, but only 5% of the total survey area. Over half of the estimate for Albatross Banks was due to one tow (> 2,400 kg), the largest halibut catch of the survey. Pacific halibut were the fourth most abundant groundfish in the survey area (Table 1). Mean length and weight generally increased with depth throughout the survey area (Table 6). Halibut were sexed on one boat only, therefore the majority of the halibut caught were unsexed over the course of the survey (Fig. 6). Length modes for halibut were generally between 55 and 65 cm in the areas of highest abundance. Fish greater than 135 cm FL (less than 1% of the total population size composition) were excluded from Figure 6 to improve its readability.

Table 5.--Number of survey hauls, number of hauls with Pacific halibut, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	100	2,297	94,539	3.65	59.7
	101 - 200	60	53	1,169	17,159	5.68	72.9
	201 - 300	22	10	235	656	8.17	79.0
	301 - 500	16	5	81	206	6.93	80.5
	All depths	200	168	1,729	112,560	3.87	61.2
Chirikof	1 - 100	69	68	3,619	94,237	3.51	60.3
	101 - 200	68	57	1,551	36,997	7.19	80.0
	201 - 300	31	20	593	6,847	9.55	89.6
	301 - 500	13	3	980	1,572	20.09	113.0
	All depths	181	148	2,052	139,653	4.26	64.1
Kodiak	1 - 100	59	55	5,732	220,793	3.32	61.6
	101 - 200	109	82	864	37,423	8.28	84.7
	201 - 300	31	15	521	5,987	13.07	94.7
	301 - 500	11	3	146	424	14.04	98.4
	All depths	210	155	2,607	264,627	3.70	63.3
Yakutat	1 - 100	33	23	465	7,677	5.83	70.0
	101 - 200	50	21	390	11,446	4.21	69.5
	201 - 300	27	16	633	3,276	12.82	94.1
	301 - 500	6	3	556	1,459	16.86	106.2
	All depths	116	63	418	23,858	5.45	71.8
Southeastern	1 - 100	7	4	530	3,467	7.07	67.1
	101 - 200	50	37	1,885	20,895	5.83	74.5
	201 - 300	28	12	362	1,829	11.60	93.1
	301 - 500	12	0	---	---	---	---
	All depths	97	53	934	26,191	6.19	74.3
All areas	1 - 100	270	250	3,267	420,713	3.48	61.0
	101 - 200	337	250	1,013	123,920	6.53	77.4
	201 - 300	139	73	516	18,595	11.15	91.5
	301 - 500	58	14	286	3,661	16.29	104.1
	All depths	804	587	1,773	566,889	3.99	63.6

All areas biomass, 95% confidence interval: 383,511 - 750,267 metric tons (t).

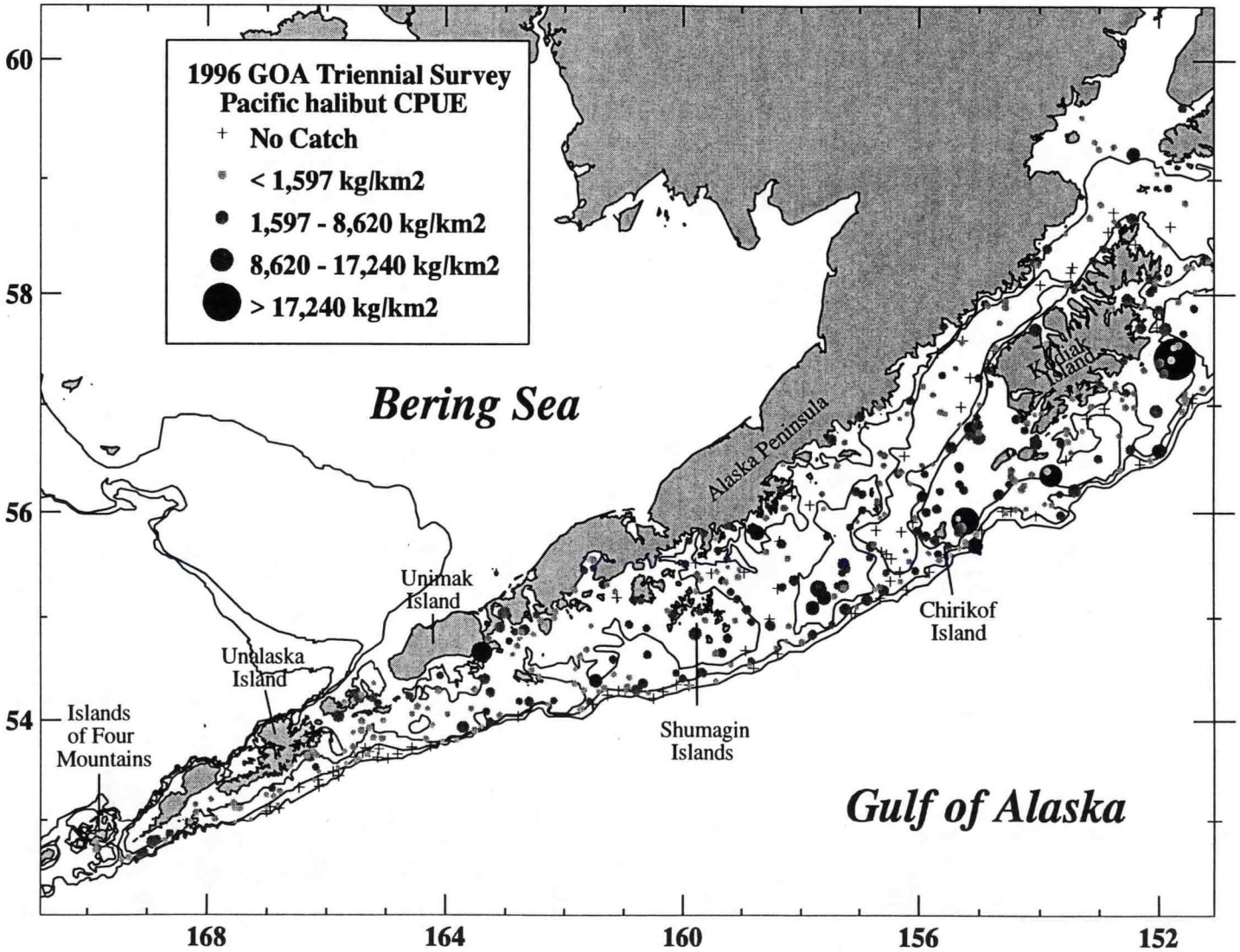

Figure 5.--Distribution and relative abundance of Pacific halibut from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

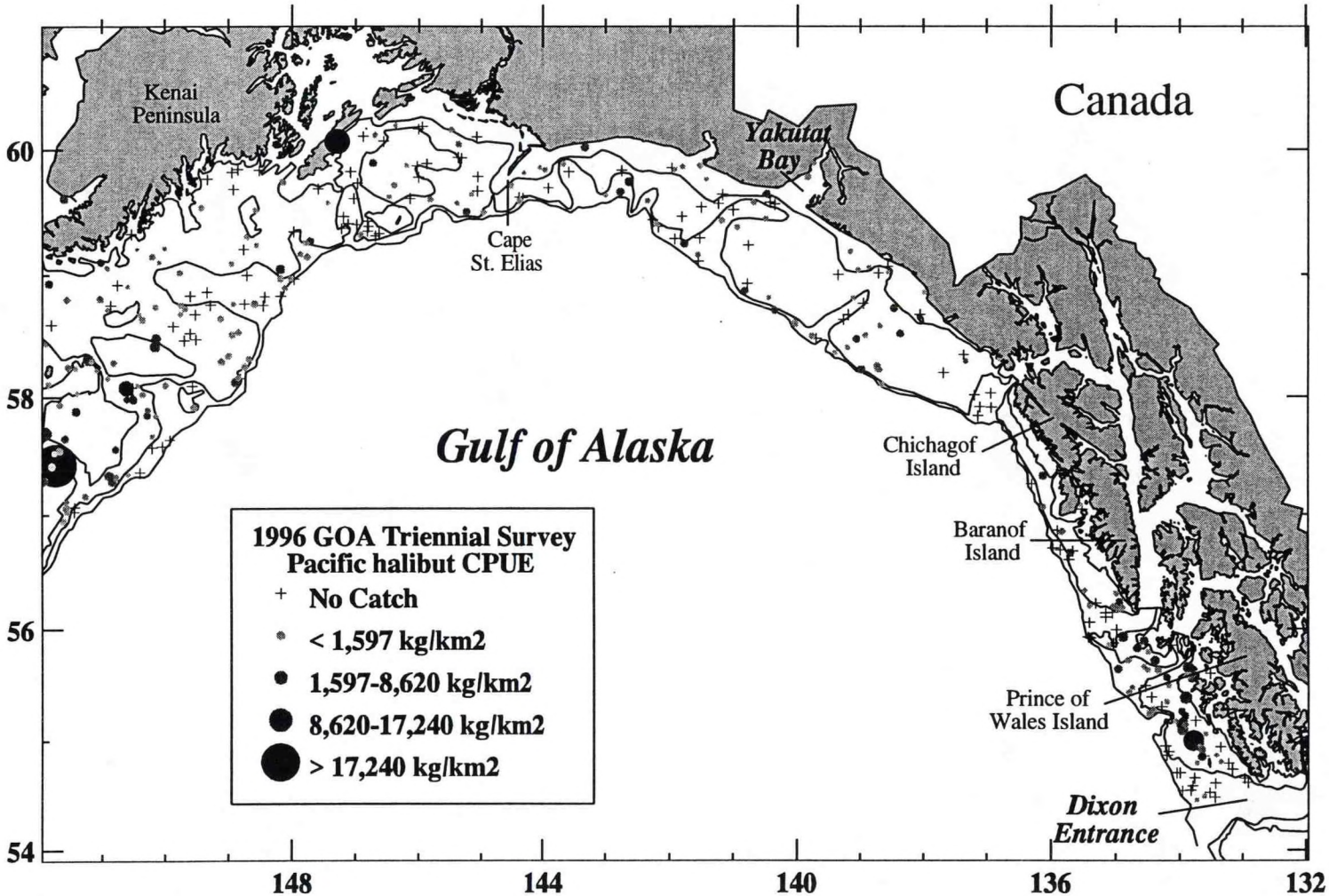

Figure 5.--Continued.

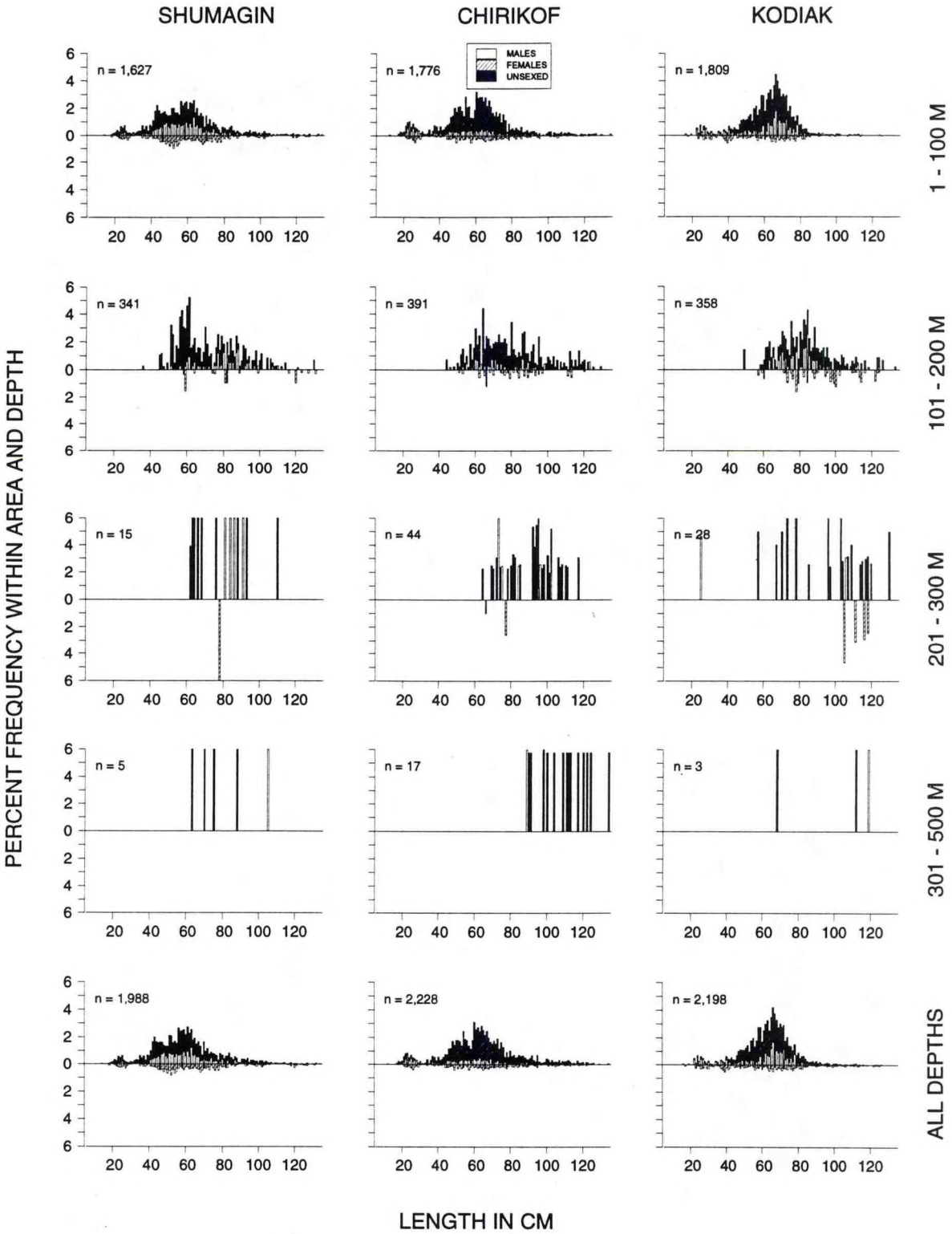

Figure 6.--Size composition of the estimated Pacific halibut population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

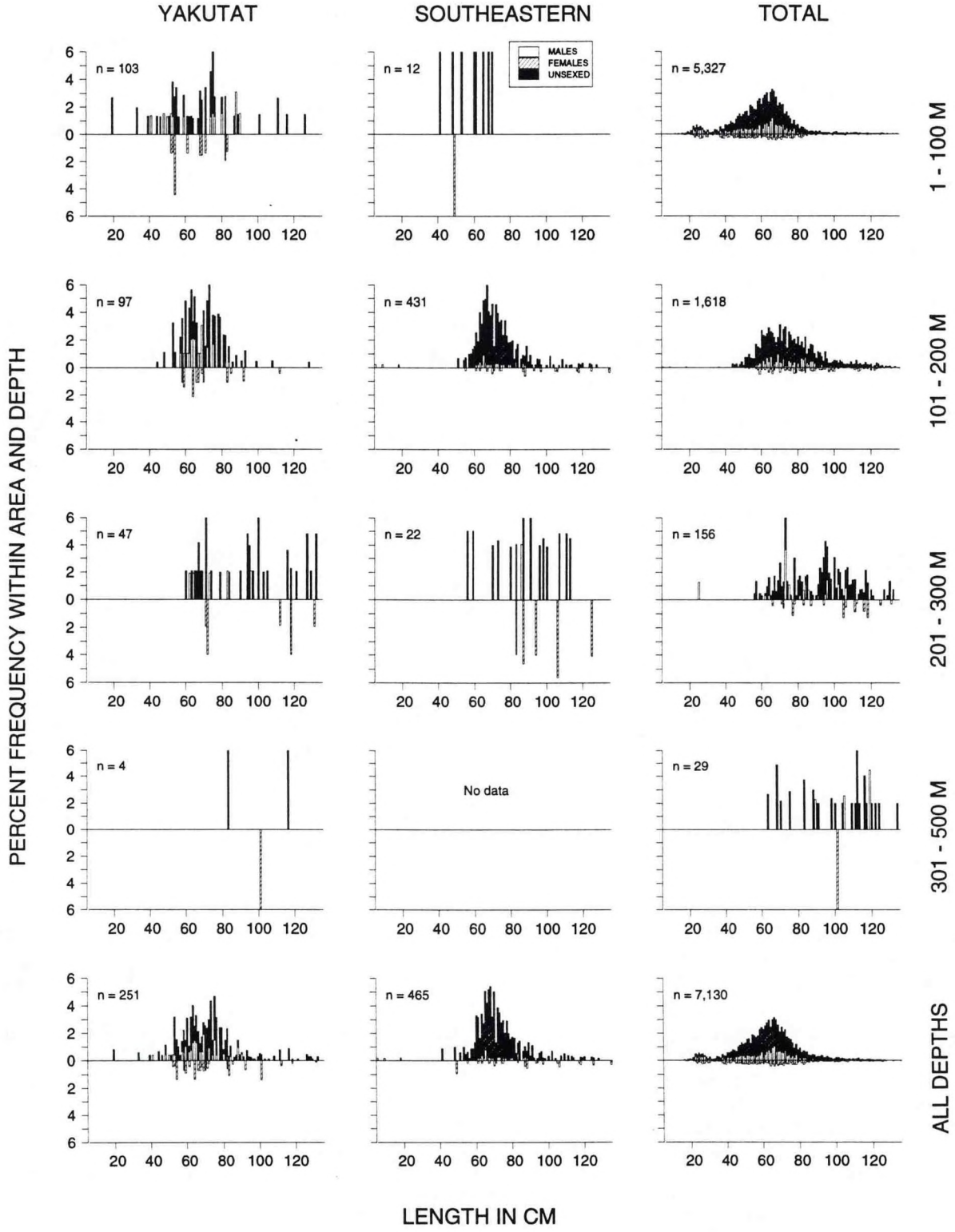

Figure 6.--Continued.

Table 6.--Catch per unit effort by stratum for Pacific halibut sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	1-100	Albatross Banks	19	19	8,735	134,548	0	289,792
Kodiak	1-100	Kenai Peninsula	4	3	8,541	44,931	0	179,845
Chirikof	1-100	Semidi Bank	18	18	4,064	29,680	15,377	43,983
Chirikof	1-100	Chirikof Bank	35	35	3,999	43,158	18,641	67,675
Kodiak	1-100	Northern Kodiak Shallows	6	6	2,844	6,256	0	12,805
Chirikof	1-100	Upper Alaska Peninsula	16	15	2,695	21,399	9,198	33,600
Shumagin	1-100	Davidson Bank	25	25	2,552	34,923	10,823	59,023
Southeastern	101-200	Prince of Wales Shelf	36	27	2,494	17,180	6,983	27,376
Kodiak	1-100	Lower Cook Inlet	6	6	2,437	24,091	0	57,289
Shumagin	1-100	Shumagin Bank	23	21	2,402	29,788	17,361	42,216
Kodiak	101-200	Kodiak Outer Shelf	24	23	2,177	10,940	5,752	16,128
Shumagin	1-100	Lower Alaska Peninsula	26	26	2,038	14,017	9,567	18,467
Shumagin	1-100	Fox Islands	28	28	1,930	15,811	9,516	22,107
Kodiak	1-100	Albatross Shallows	24	21	1,902	10,967	6,565	15,370
Chirikof	101-200	Chirikof Outer Shelf	24	22	1,775	8,894	5,222	12,567
Chirikof	101-200	East Shumagin Gully	16	11	1,567	17,398	7,557	27,240
Chirikof	101-200	Shelikof Edge	28	24	1,384	10,705	5,829	15,582
Shumagin	101-200	Shumagin Outer Shelf	41	36	1,249	10,182	7,300	13,063
Kodiak	101-200	Albatross Gullies	32	26	1,233	9,754	4,036	15,472
Shumagin	101-200	West Shumagin Gully	13	11	1,082	2,466	1,218	3,714
Shumagin	101-200	Sanak Gully	6	6	1,062	4,511	684	8,339
Chirikof	301-500	Chirikof Slope	13	3	980	1,572	0	4,750
Kodiak	101-200	Barren Islands	15	10	885	9,721	3,541	15,901
Southeastern	101-200	Baranof-Chichagof Shelf	14	10	885	3,715	1,928	5,503
Yakutat	101-200	Fairweather Shelf	10	7	871	6,733	2,054	11,413
Yakutat	201-300	Yakutat Slope	16	11	810	1,724	836	2,611
Kodiak	201-300	Kodiak Slope	5	3	732	1,188	0	2,662
Kodiak	201-300	Upper Shelikof Gully	6	4	684	2,195	46	4,344
Chirikof	201-300	Lower Shelikof Gully	22	14	642	6,433	2,857	10,010
Yakutat	301-500	Yakutat Gullies	5	2	614	679	0	2,026
Kodiak	101-200	Portlock Flats	21	13	604	4,433	1,694	7,171
Yakutat	1-100	Yakutat Shallows	22	18	539	5,359	2,321	8,397
Southeastern	1-100	Southeastern Shallows	7	4	530	3,467	0	9,379
Yakutat	301-500	Yakutat Slope	1	1	513	780		
Yakutat	201-300	Yakutat Gullies	11	5	510	1,552	0	3,381
Southeastern	201-300	Prince of Wales Slope/Gullies	23	11	432	1,696	570	2,822
Kodiak	201-300	Kenai Gullies	20	8	391	2,604	883	4,326
Yakutat	1-100	Middleton Shallows	11	5	353	2,318	0	5,065
Yakutat	101-200	Yakutat Flats	9	5	298	2,689	0	6,550
Yakutat	101-200	Middleton Shelf	23	9	276	2,024	493	3,556
Chirikof	201-300	Chirikof Slope	9	6	271	414	113	714
Shumagin	201-300	Shumagin Slope	22	10	235	656	177	1,135
Kodiak	101-200	Kenai Flats	17	10	213	2,575	656	4,493
Kodiak	301-500	Kodiak Slope	11	3	146	424	0	1,001
Southeastern	201-300	Baranof-Chichagof Slope	5	1	118	133	0	502
Shumagin	301-500	Shumagin Slope	16	5	81	206	0	414

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Flathead sole (Hippoglossoides elassodon)

Flathead sole CPUEs were highest in samples from shallow water (less than 100 m), especially south of the lower Alaska Peninsula and in the waters surrounding Kodiak Island (Fig. 7 and Tables 7 and 8). These strata accounted for about 27% of the total estimated biomass while comprising less than 5% of the total survey area. Smaller yet less variable catches of flathead sole were found in the major gully areas west of about 152°W longitude (Fig. 7). The male length frequency data in the areas of high abundance generally showed a frequency mode between 30 and 35 cm FL, while the female mode was much more variable exhibiting modes ranging from 25 to 40 cm FL (Fig. 8). The largest fish were consistently found at the deeper depths, but fish captured at depths less than 100 m were generally larger than those captured between 100 and 200 m. (Table 7). The length-weight relationship for flathead sole specimens collected during the survey is depicted in Figure 9.

Table 7.--Number of survey hauls, number of hauls with flathead sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	64	1,276	52,495	0.35	31.6
	101 - 200	60	29	953	13,977	0.22	27.4
	201 - 300	22	13	63	174	0.28	30.6
	301 - 500	16	2	16	41	0.40	35.3
	All depths	200	108	1,024	66,687	0.31	30.3
Chirikof	1 - 100	69	34	895	23,303	0.31	30.5
	101 - 200	68	54	950	22,671	0.29	30.4
	201 - 300	31	25	329	3,802	0.38	34.1
	301 - 500	13	1	2	3	0.58	42.0
	All depths	181	114	731	49,779	0.31	30.7
Kodiak	1 - 100	59	28	877	33,795	0.29	29.5
	101 - 200	109	67	861	37,297	0.32	31.1
	201 - 300	31	19	229	2,628	0.35	32.7
	301 - 500	11	0	---	---	---	---
	All depths	210	114	726	73,720	0.30	30.4
Yakutat	1 - 100	33	25	456	7,532	0.33	30.0
	101 - 200	50	34	153	4,489	0.23	27.3
	201 - 300	27	10	126	653	0.25	27.8
	301 - 500	6	1	2	6	0.66	40.0
	All depths	116	70	222	12,680	0.28	28.7
Southeastern	1 - 100	7	4	509	3,330	0.26	28.6
	101 - 200	50	7	11	119	0.22	27.8
	201 - 300	28	2	4	21	0.23	27.8
	301 - 500	12	0	---	---	---	---
	All depths	97	13	124	3,470	0.26	28.6
All areas	1 - 100	270	155	935	120,455	0.32	30.5
	101 - 200	337	191	642	78,553	0.28	29.8
	201 - 300	139	69	202	7,278	0.35	32.7
	301 - 500	58	4	4	50	0.42	35.9
	All depths	804	419	645	206,336	0.30	30.3

All areas biomass, 95% confidence interval: 169,347 - 243,325 metric tons (t).

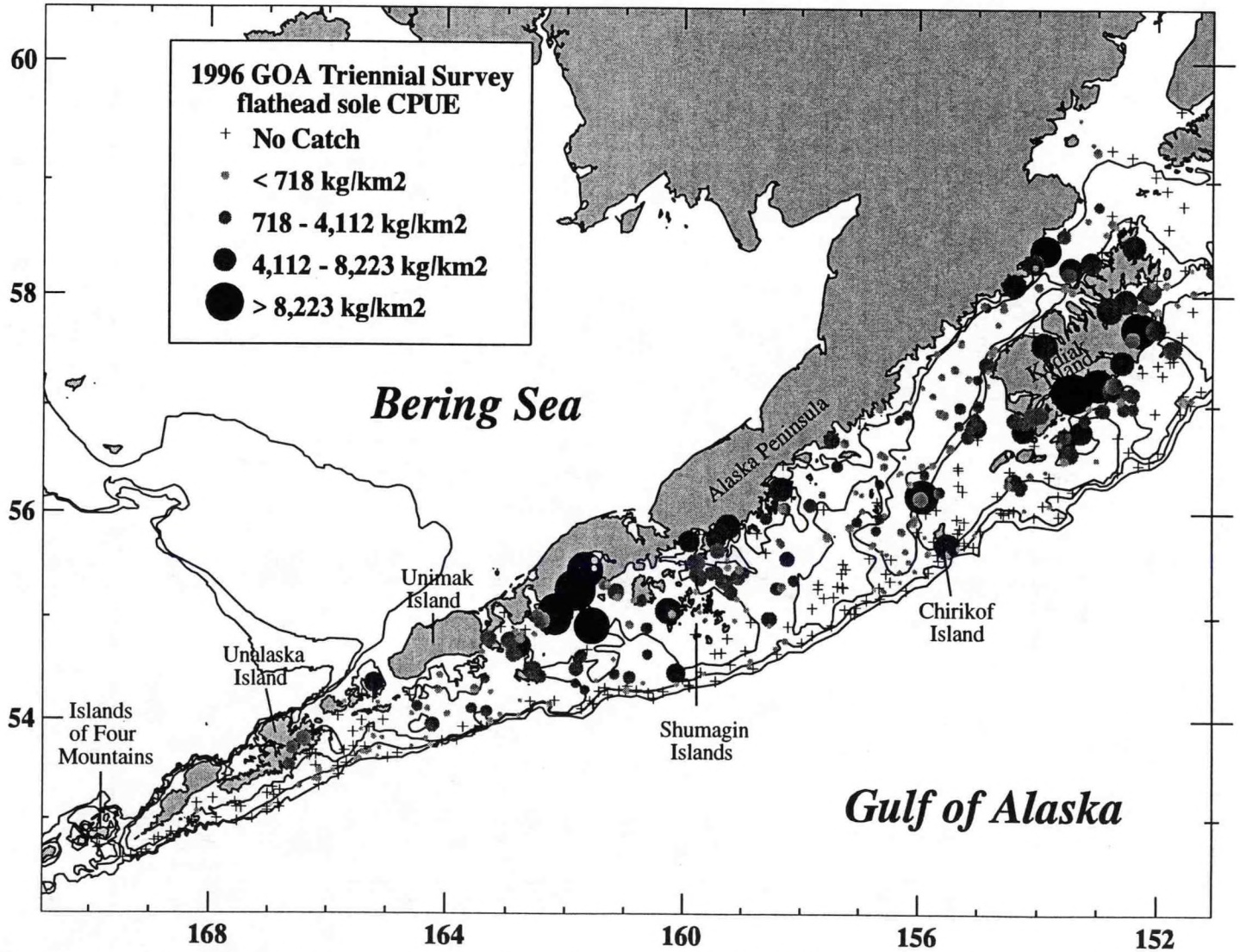


Figure 7.--Distribution and relative abundance of flathead sole from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

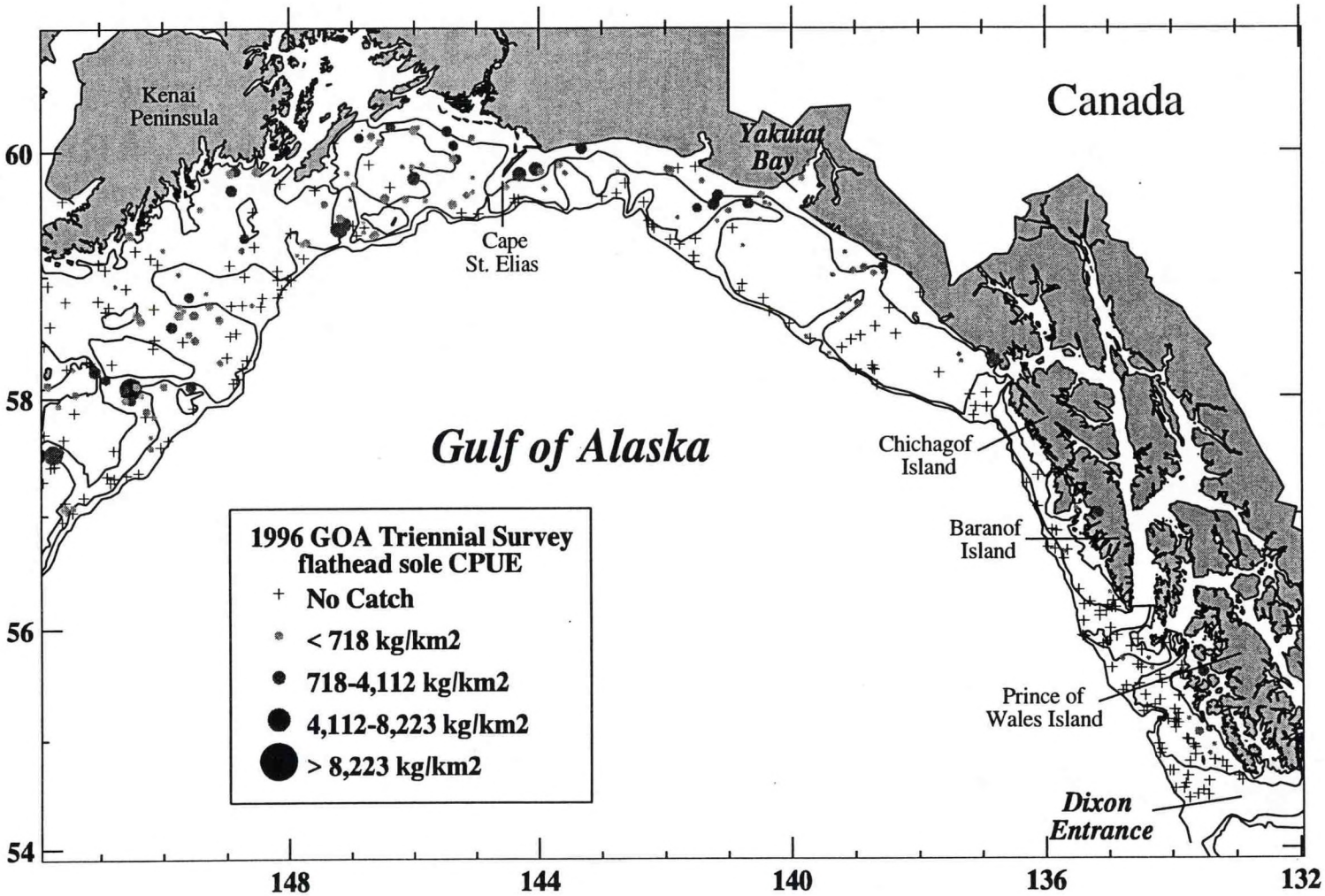


Figure 7.--Continued.

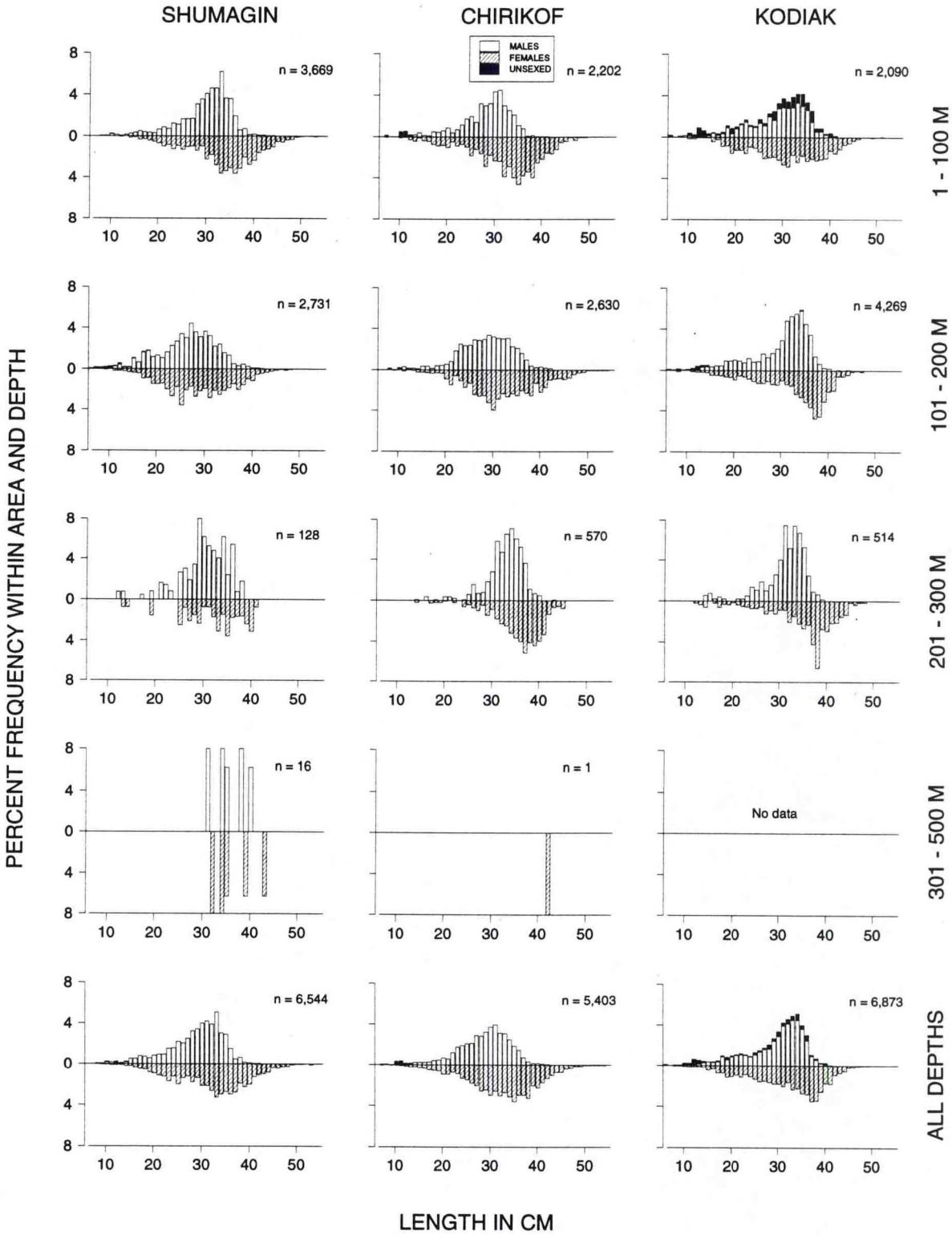


Figure 8.--Size composition of the estimated flathead sole population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

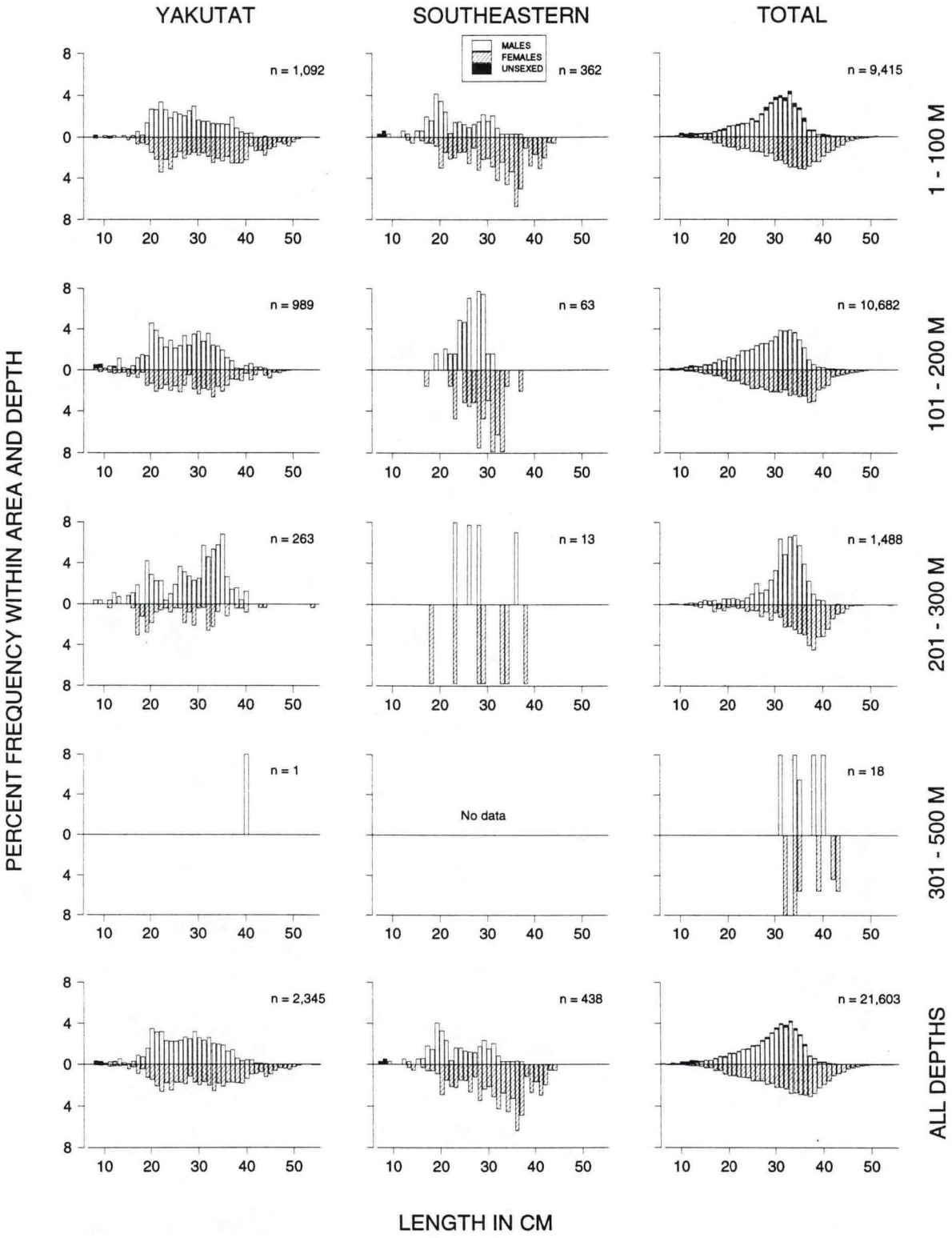


Figure 8.--Continued.

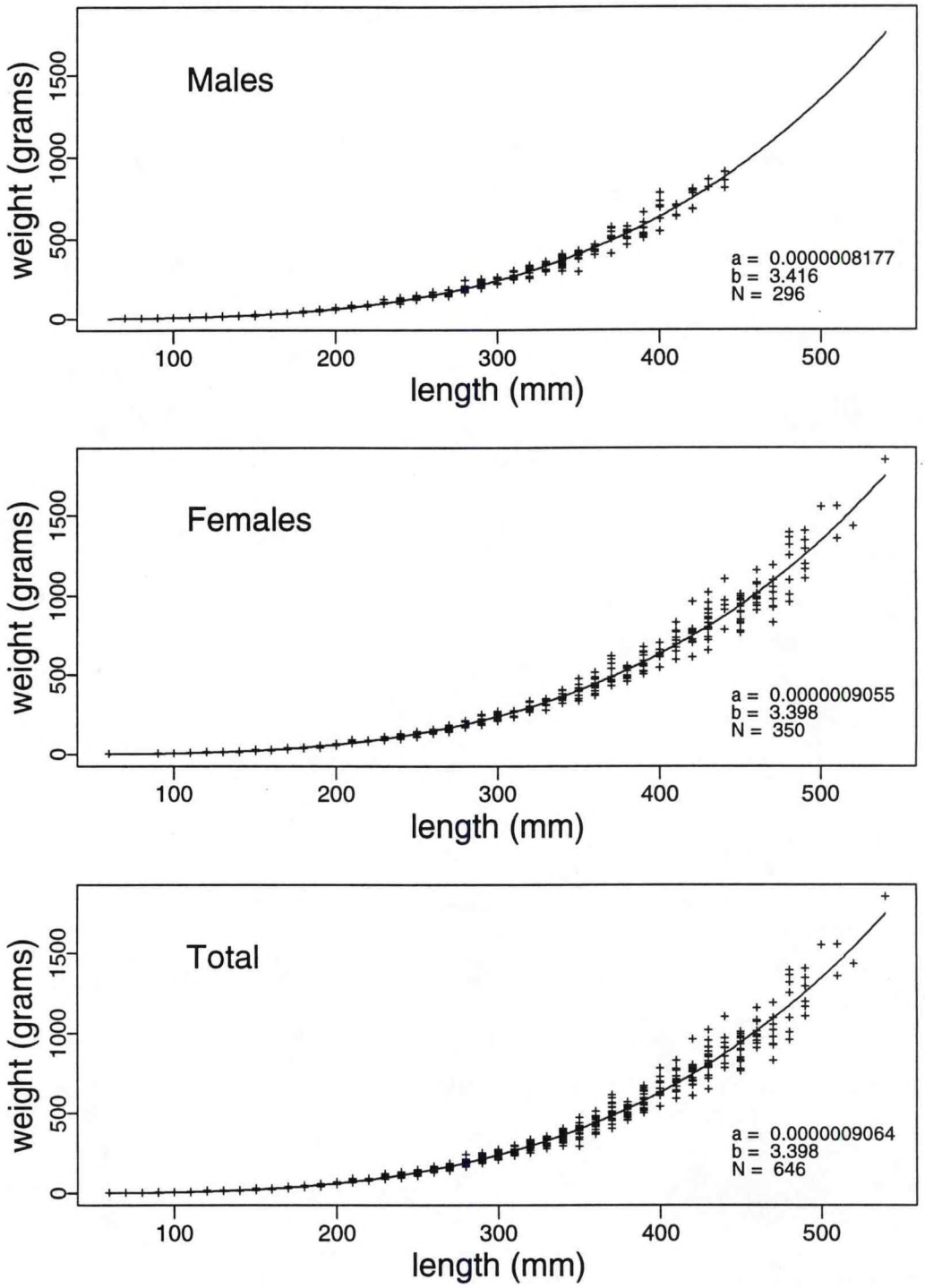


Figure 9.--Length-weight relationship for flathead sole specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $\text{Weight}_{(grams)} = a * \text{Length}_{(mm)}^{b}$.

Table 8.--Catch per unit effort by stratum for flathead sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km²)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	1-100	Albatross Shallows	24	15	4,079	23,523	10,096	36,950
Shumagin	1-100	Lower Alaska Peninsula	26	20	3,672	25,253	9,495	41,011
Kodiak	1-100	Northern Kodiak Shallows	6	4	3,535	7,775	0	16,581
Shumagin	101-200	West Shumagin Gully	13	13	2,080	4,739	2,771	6,708
Shumagin	101-200	Sanak Gully	6	6	1,915	8,133	3,567	12,700
Kodiak	101-200	Albatross Gullies	32	30	1,805	14,278	9,237	19,319
Chirikof	1-100	Upper Alaska Peninsula	16	12	1,612	12,799	3,061	22,537
Kodiak	101-200	Barren Islands	15	8	1,530	16,806	0	34,957
Shumagin	1-100	Shumagin Bank	23	16	1,331	16,503	0	34,904
Chirikof	101-200	Shelikof Edge	28	26	1,101	8,516	1,407	15,624
Chirikof	101-200	East Shumagin Gully	16	14	1,089	12,096	6,574	17,619
Chirikof	1-100	Chirikof Bank	35	18	942	10,171	4,363	15,979
Shumagin	1-100	Davidson Bank	25	20	566	7,748	3,466	12,029
Southeastern	1-100	Southeastern Shallows	7	4	509	3,330	0	7,173
Yakutat	1-100	Middleton Shallows	11	9	482	3,162	691	5,634
Yakutat	1-100	Yakutat Shallows	22	16	439	4,370	1,591	7,148
Chirikof	101-200	Chirikof Outer Shelf	24	14	411	2,059	0	5,231
Chirikof	201-300	Lower Shelikof Gully	22	21	371	3,719	2,098	5,340
Shumagin	1-100	Fox Islands	28	8	365	2,991	0	6,186
Yakutat	101-200	Middleton Shelf	23	20	301	2,211	1,208	3,213
Kodiak	101-200	Kenai Flats	17	10	293	3,537	1,012	6,061
Kodiak	201-300	Upper Shelikof Gully	6	6	293	942	287	1,596
Yakutat	101-200	Yakataga Shelf	8	7	287	1,513	0	3,713
Kodiak	101-200	Portlock Flats	21	12	257	1,887	848	2,925
Kodiak	201-300	Kenai Gullies	20	11	238	1,583	105	3,062
Yakutat	201-300	Yakutat Gullies	11	8	213	648	0	1,323
Kodiak	1-100	Kenai Peninsula	4	1	157	828	0	3,464
Kodiak	101-200	Kodiak Outer Shelf	24	7	157	789	0	1,877
Shumagin	101-200	Shumagin Outer Shelf	41	10	136	1,105	0	2,822
Kodiak	1-100	Lower Cook Inlet	6	3	110	1,085	0	3,676
Yakutat	101-200	Yakutat Flats	9	5	80	721	0	1,656
Shumagin	201-300	Shumagin Slope	22	13	63	174	69	280
Kodiak	201-300	Kodiak Slope	5	2	63	103	0	279
Chirikof	201-300	Chirikof Slope	9	4	55	83	0	185
Chirikof	1-100	Semidi Bank	18	4	46	333	0	759
Kodiak	1-100	Albatross Banks	19	5	38	584	0	1,264
Southeastern	101-200	Prince of Wales Shelf	36	5	16	112	0	313
Shumagin	301-500	Shumagin Slope	16	2	16	41	0	123
Yakutat	101-200	Fairweather Shelf	10	2	6	44	0	112
Southeastern	201-300	Prince of Wales Slope/Gullies	23	2	5	21	0	59
Yakutat	301-500	Yakutat Gullies	5	1	5	6	0	21
Southeastern	101-200	Baranof-Chichagof Shelf	14	2	2	7	0	18
Yakutat	201-300	Yakutat Slope	16	2	2	5	0	13
Chirikof	301-500	Chirikof Slope	13	1	2	3	0	10

Southern rock sole (Lepidopsetta bilineata)

Approximately 93% of the southern rock sole biomass in the survey area was estimated to be in water shallower than 100 m in the central and western Gulf of Alaska. (Tables 9 and 10; Fig. 10). About 42% of the biomass estimate came from the Kodiak INPFC area at depths less than 100 m (Table 9), approximately 12% of the survey area. The highest CPUEs of the survey were seen in the shallow water surrounding Kodiak Island and south of the Kenai Peninsula. The most consistent catches were noted on Albatross Banks, the shallow banks to the south and east of Kodiak, where every catch contained southern rock sole. Relatively high catches were also recorded in the shallow areas just to the south of the Alaska Peninsula and the shallow areas surrounding the Shumagin Islands (Fig. 10). Females were much more abundant than males, comprising about 75% of the estimated population (Fig. 11). The length frequency data showed a modal length between 30 and 35 cm FL for males and between 39 and 42 cm FL for females in high abundance areas (Fig. 11). Both mean length and mean weight generally increased with depth (Table 9). The length-weight relationship for southern rock sole specimens collected during the survey is depicted in Figure 12.

Table 9.--Number of survey hauls, number of hauls with southern rock sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	87	1,068	43,972	0.66	36.7
	101 - 200	60	31	227	3,334	0.84	38.5
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	118	727	47,306	0.67	36.8
Chirikof	1 - 100	69	55	821	21,374	0.74	36.4
	101 - 200	68	10	14	332	0.94	41.5
	201 - 300	31	1	2	15	0.77	40.0
	301 - 500	13	1	1	2	0.14	---
	All depths	181	67	319	21,723	0.74	36.5
Kodiak	1 - 100	59	50	1,385	53,368	0.68	34.9
	101 - 200	109	28	38	1,635	0.64	35.9
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	78	542	55,003	0.68	34.9
Yakutat	1 - 100	33	4	12	185	0.43	29.7
	101 - 200	50	1	15	429	0.72	37.7
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	5	11	614	0.60	34.4
Southeastern	1 - 100	7	4	333	2,180	0.34	28.8
	101 - 200	50	13	43	480	0.62	35.1
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	17	95	2,660	0.37	29.5
All areas	1 - 100	270	200	940	121,079	0.67	35.6
	101 - 200	337	83	51	6,210	0.75	37.5
	201 - 300	139	1	1	15	0.77	40.0
	301 - 500	58	1	0	2	0.14	---
	All depths	804	285	398	127,306	0.68	35.7

All areas biomass, 95% confidence interval: 100,213 - 154,399 metric tons (t).

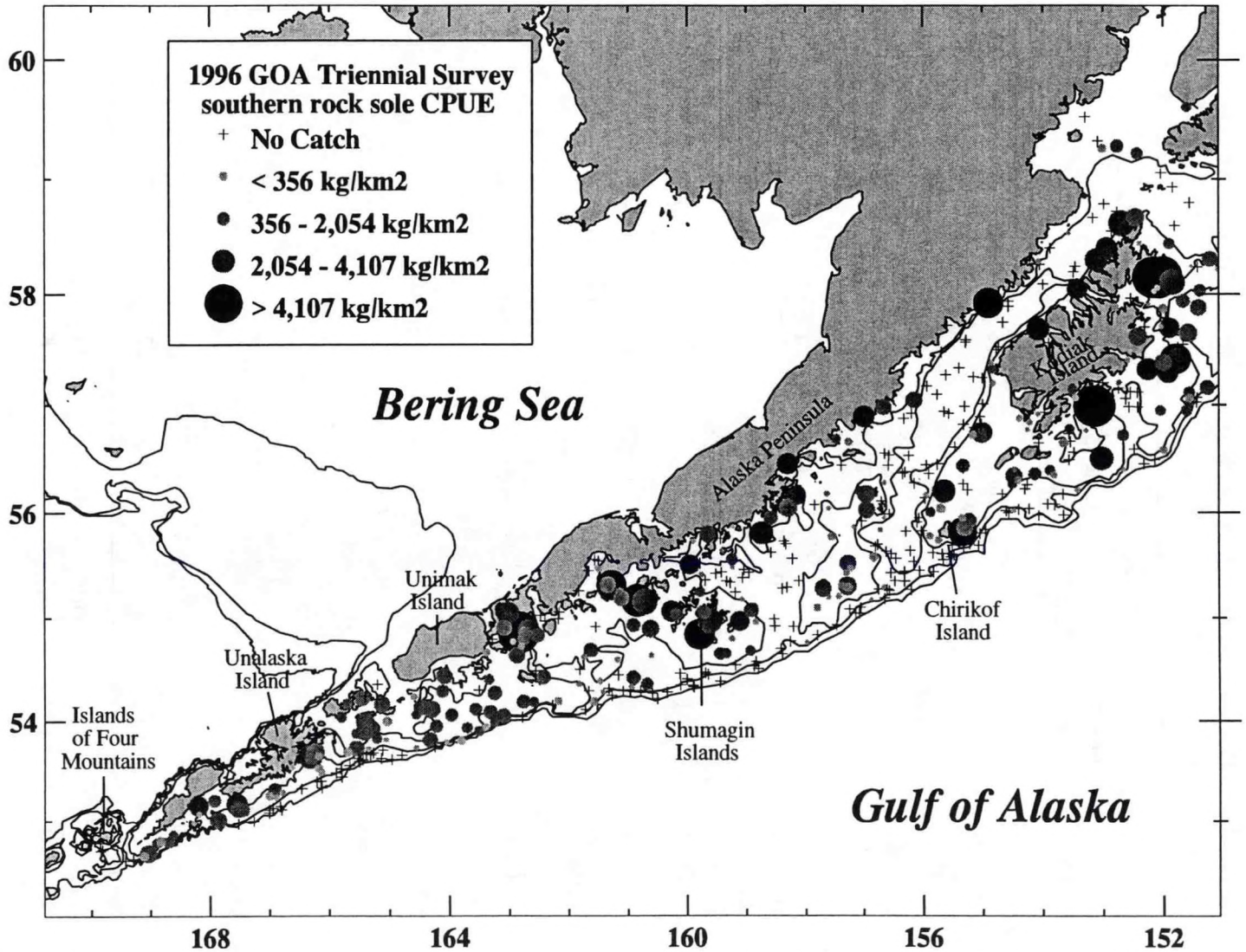


Figure 10.--Distribution and relative abundance of southern rock sole from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

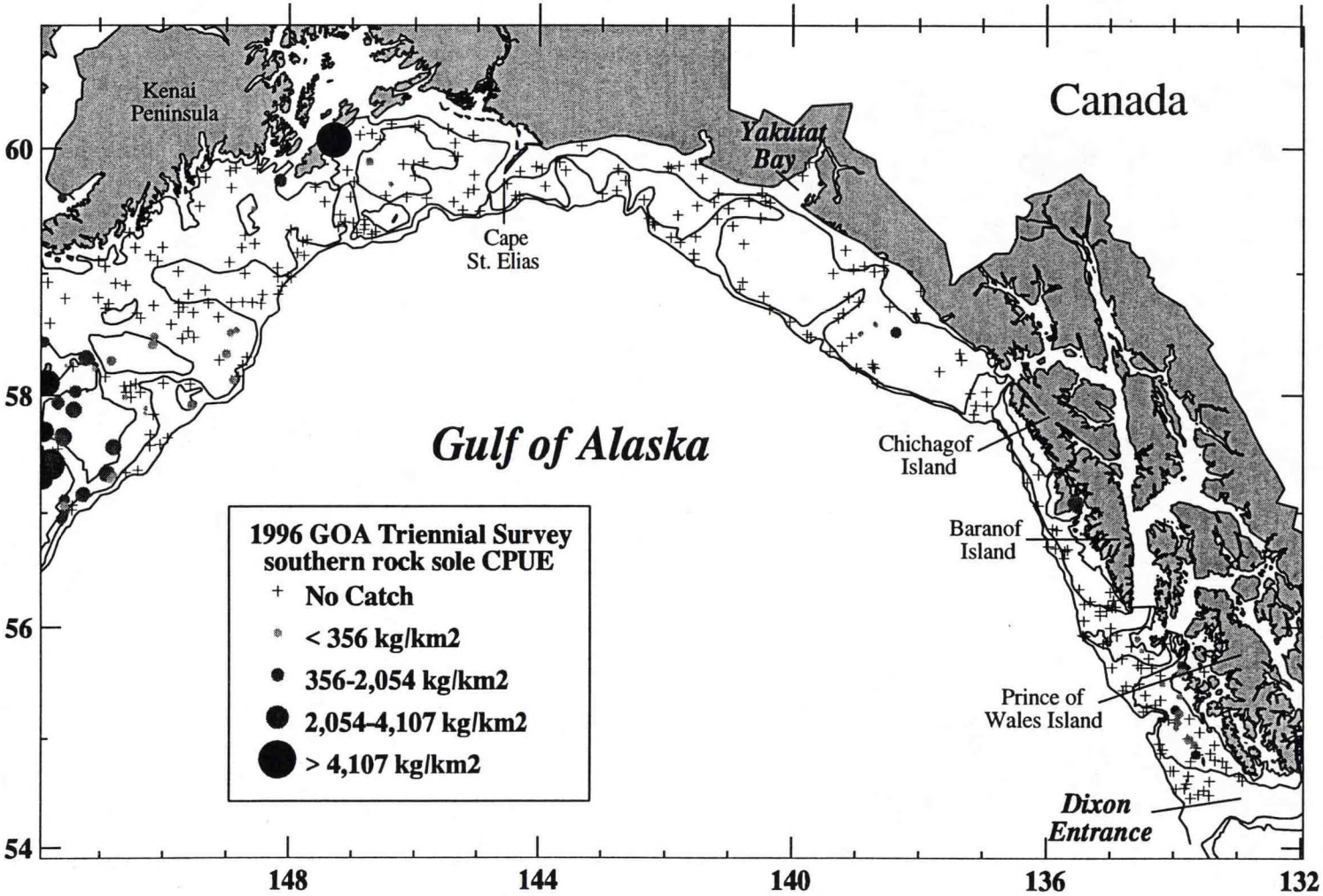


Figure 10.--Continued.

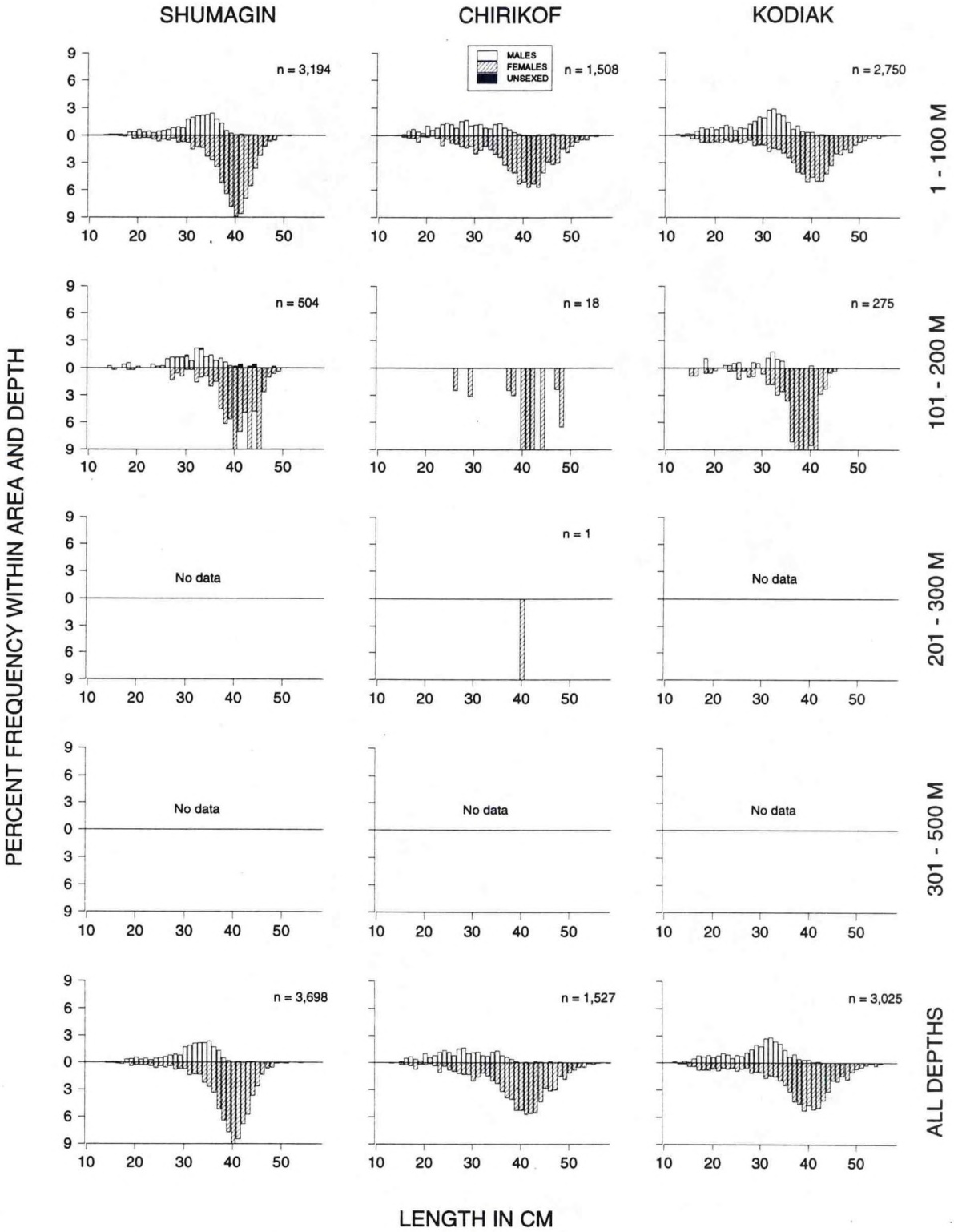
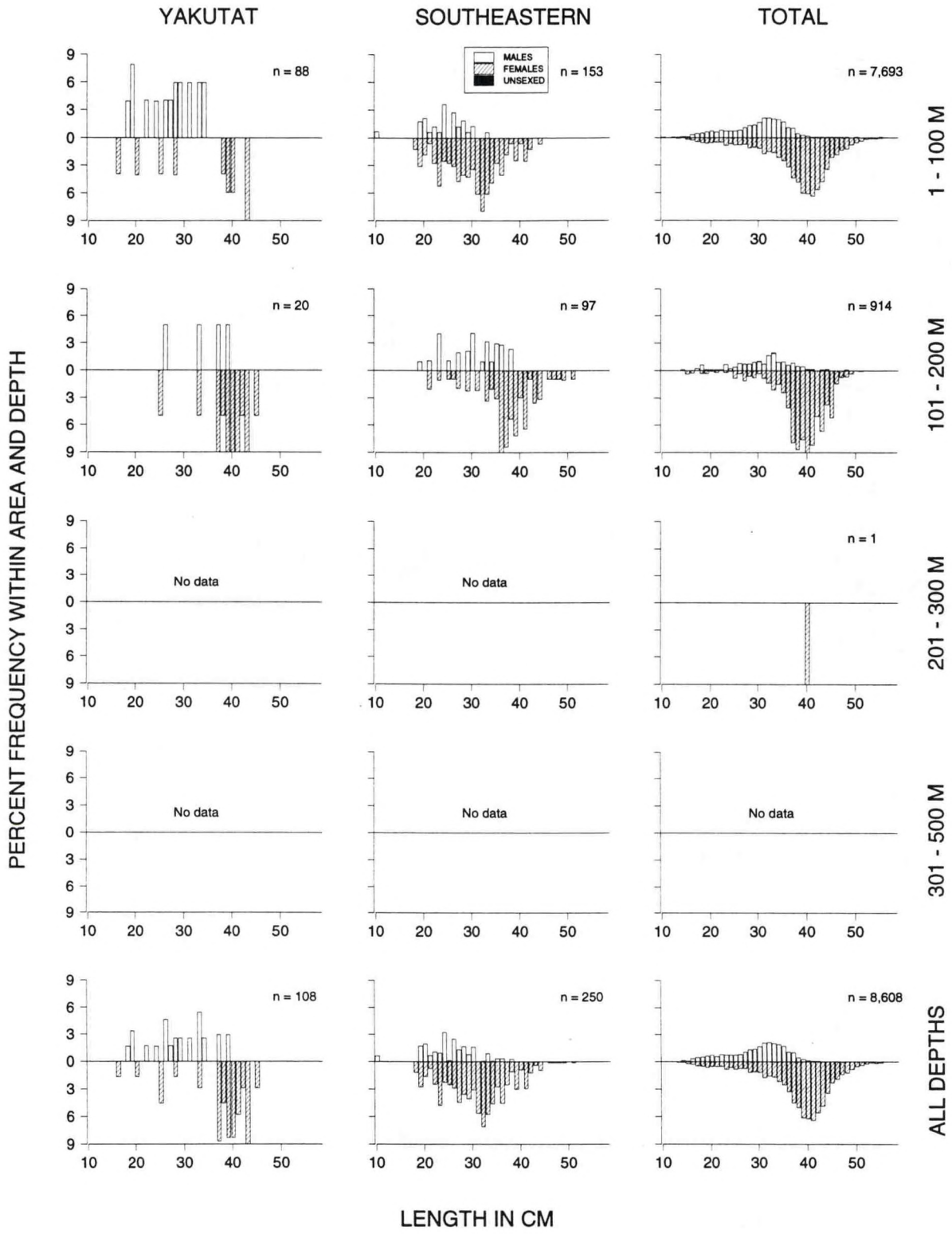


Figure 11.--Size composition of the estimated southern rock sole population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.



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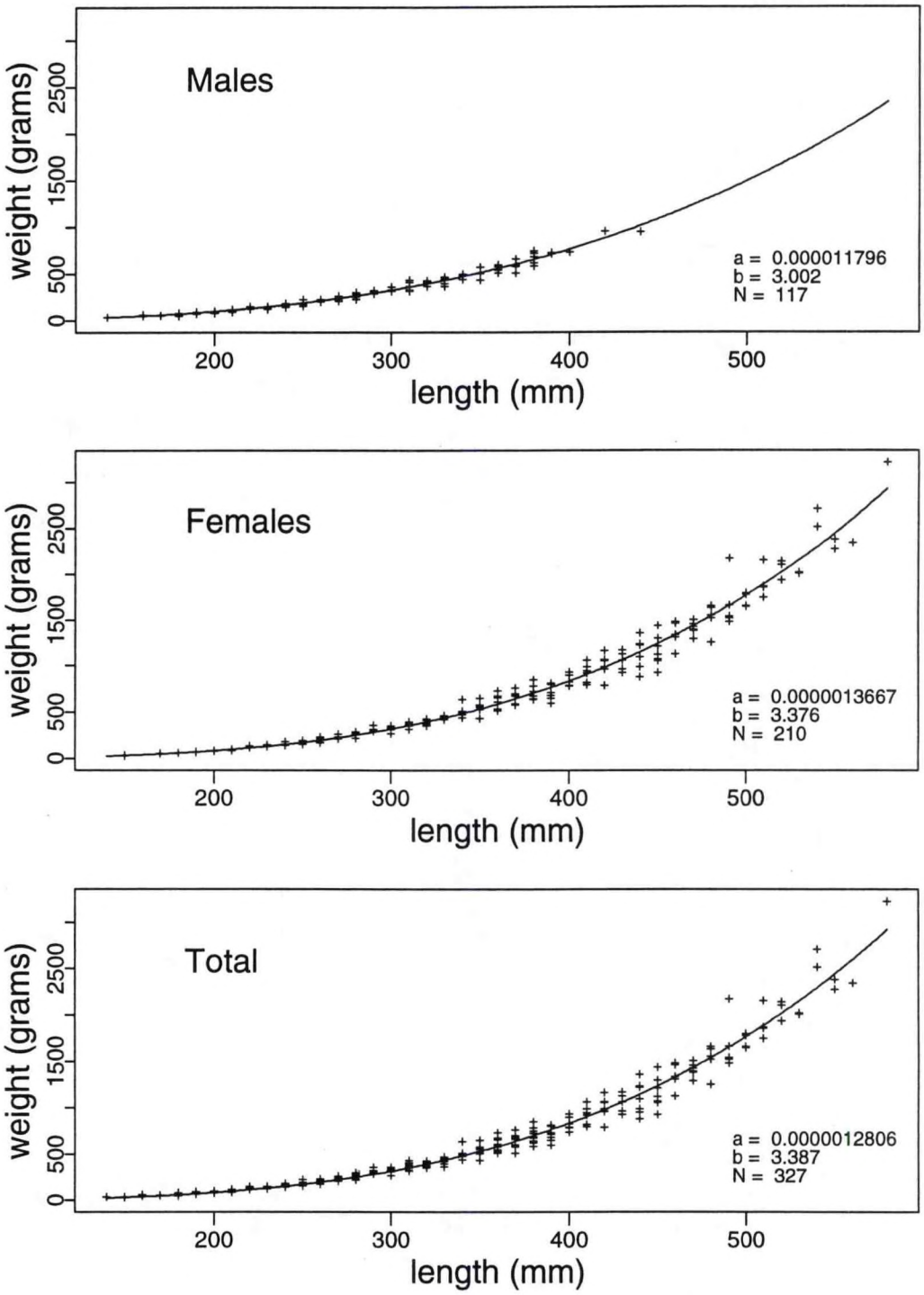


Figure 12.--Length-weight relationship for southern rock sole specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $\text{Weight}_{(grams)} = a * \text{Length}_{(mm)}^{b}$.

Table 10.--Catch per unit effort by stratum for southern rock sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	1-100	Albatross Shallows	24	19	2,032	11,718	4,035	19,401
Kodiak	1-100	Kenai Peninsula	4	3	1,924	10,120	0	37,540
Kodiak	1-100	Northern Kodiak Shallows	6	5	1,796	3,952	898	7,005
Kodiak	1-100	Albatross Banks	19	19	1,548	23,853	14,105	33,601
Shumagin	1-100	Shumagin Bank	23	22	1,497	18,559	9,622	27,496
Chirikof	1-100	Upper Alaska Peninsula	16	13	1,367	10,859	4,765	16,952
Shumagin	1-100	Lower Alaska Peninsula	26	16	1,180	8,113	2,196	14,030
Shumagin	1-100	Fox Islands	28	25	828	6,787	3,957	9,616
Shumagin	1-100	Davidson Bank	25	24	768	10,513	7,714	13,312
Chirikof	1-100	Semidi Bank	18	17	599	4,375	1,810	6,939
Chirikof	1-100	Chirikof Bank	35	25	569	6,140	2,413	9,867
Kodiak	1-100	Lower Cook Inlet	6	4	377	3,725	0	7,477
Southeastern	1-100	Southeastern Shallows	7	4	333	2,180	0	5,167
Shumagin	101-200	Shumagin Outer Shelf	41	24	296	2,413	1,190	3,636
Kodiak	101-200	Kodiak Outer Shelf	24	13	237	1,190	378	2,002
Shumagin	101-200	Sanak Gully	6	3	210	893	0	2,859
Southeastern	101-200	Prince of Wales Shelf	36	13	70	480	181	779
Yakutat	101-200	Fairweather Shelf	10	1	56	429	0	1,401
Kodiak	101-200	Portlock Flats	21	4	40	294	0	602
Chirikof	101-200	East Shumagin Gully	16	3	24	271	0	675
Yakutat	1-100	Middleton Shallows	11	2	23	150	0	439
Kodiak	101-200	Albatross Gullies	32	10	17	135	0	277
Shumagin	101-200	West Shumagin Gully	13	4	12	28	0	59
Chirikof	101-200	Shelikof Edge	28	4	6	45	0	97
Yakutat	1-100	Yakutat Shallows	22	2	4	35	0	86
Chirikof	101-200	Chirikof Outer Shelf	24	3	3	16	0	39
Chirikof	201-300	Lower Shelikof Gully	22	1	2	15	0	48
Kodiak	101-200	Barren Islands	15	1	1	16	0	51
Chirikof	301-500	Chirikof Slope	13	1	1	2	0	7

Northern rock sole (Lepidopsetta cf. sp. bilineata)

All northern rock sole were captured in the central and western Gulf of Alaska west of 150°W (Fig. 13). Approximately 79% of the total survey biomass was found in the Shumagin INPFC area in depths less than 100 m. Northern rock sole were present in about 94% of the tows in this area. The length frequency data from this area showed a modal length of between 27 and 28 cm FL for males and between 30 and 32 cm FL for females (Fig. 14). Both mean length and mean weight increased with depth in all areas (Tables 11 and 12). The length-weight relationship for northern rock sole specimens collected during the survey is depicted in Figure 15.

Table 11.-- Number of survey hauls, number of hauls with northern rock sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	96	1,479	60,847	0.36	30.3
	101 - 200	60	27	113	1,663	0.58	34.7
	201 - 300	22	4	52	144	0.76	39.9
	301 - 500	16	0	---	---	---	---
	All depths	200	127	963	62,654	0.36	30.4
Chirikof	1 - 100	69	39	354	9,224	0.47	31.6
	101 - 200	68	2	3	65	0.48	35.4
	201 - 300	31	1	0	4	0.53	38.0
	301 - 500	13	0	---	---	---	---
	All depths	181	42	137	9,293	0.47	31.7
Kodiak	1 - 100	59	25	180	6,933	0.51	31.4
	101 - 200	109	5	1	51	0.66	38.1
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	30	69	6,984	0.51	31.5
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	0	---	---	---	---
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	0	---	---	---	---
All areas	1 - 100	270	160	598	77,004	0.38	30.5
	101 - 200	337	34	15	1,779	0.58	34.8
	201 - 300	139	5	4	148	0.75	39.8
	301 - 500	58	0	---	---	---	---
	All depths	804	199	247	78,931	0.38	30.6

All areas biomass, 95% confidence interval: 59,107 - 98,755 metric tons (t).

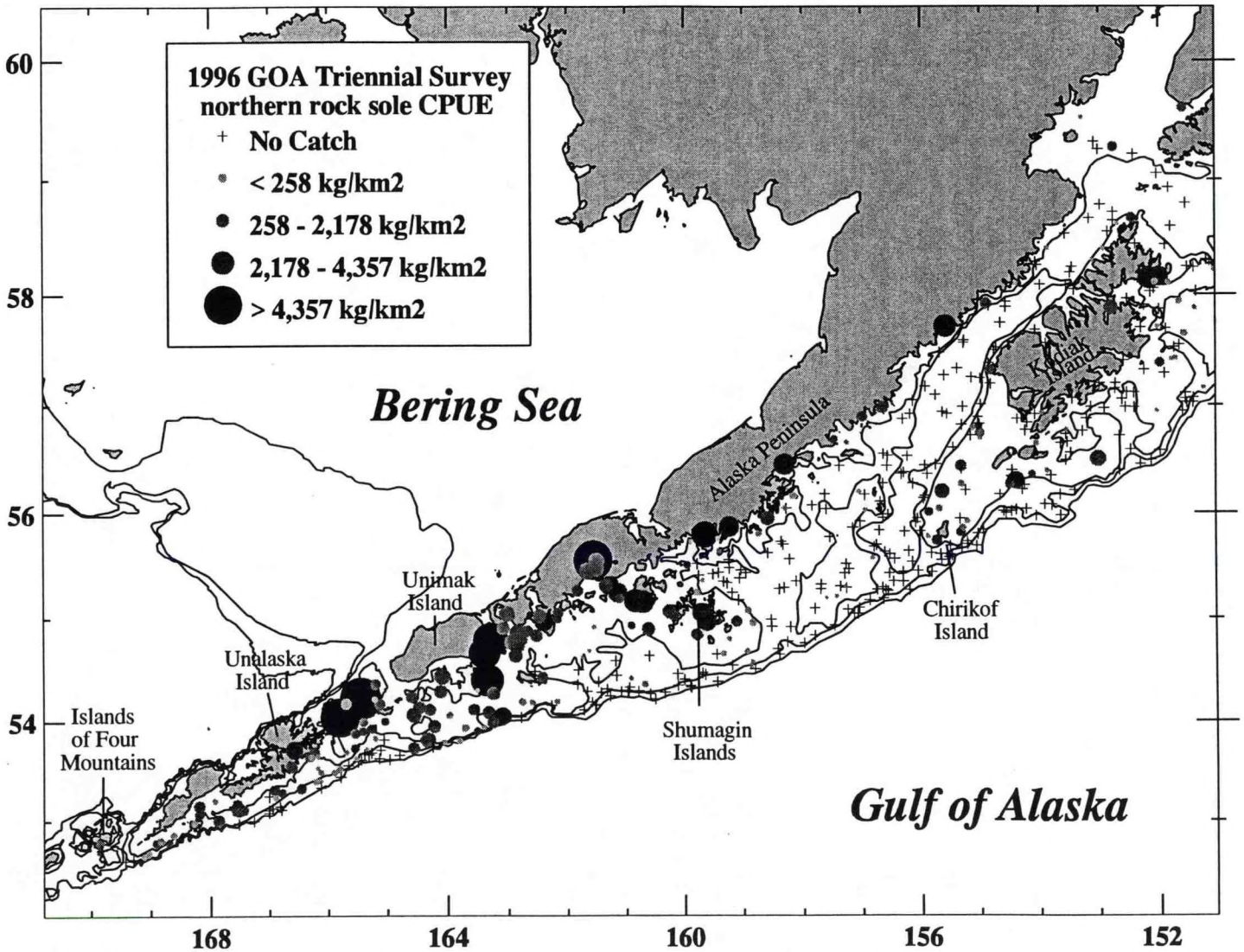
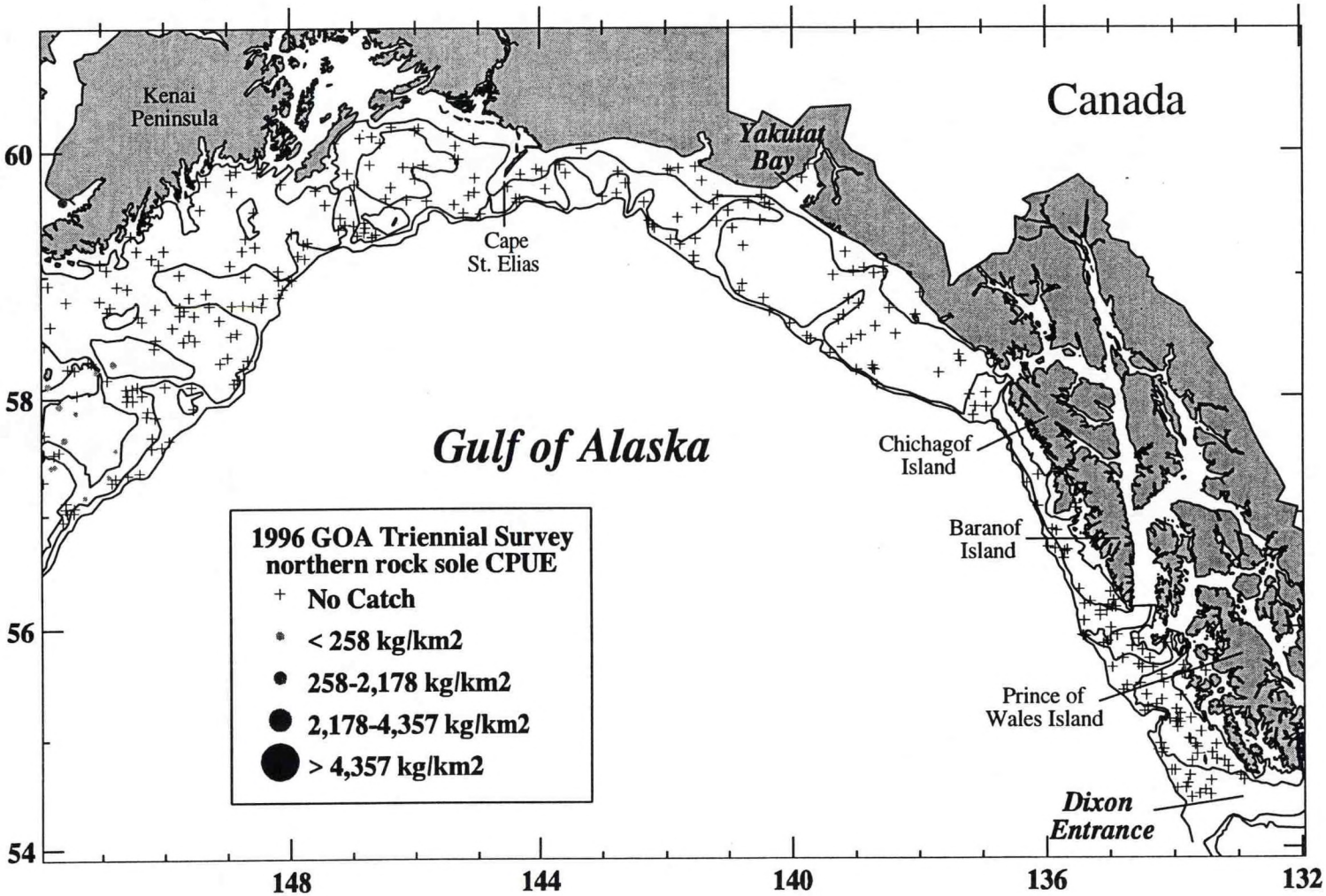


Figure 13.--Distribution and relative abundance of northern rock sole from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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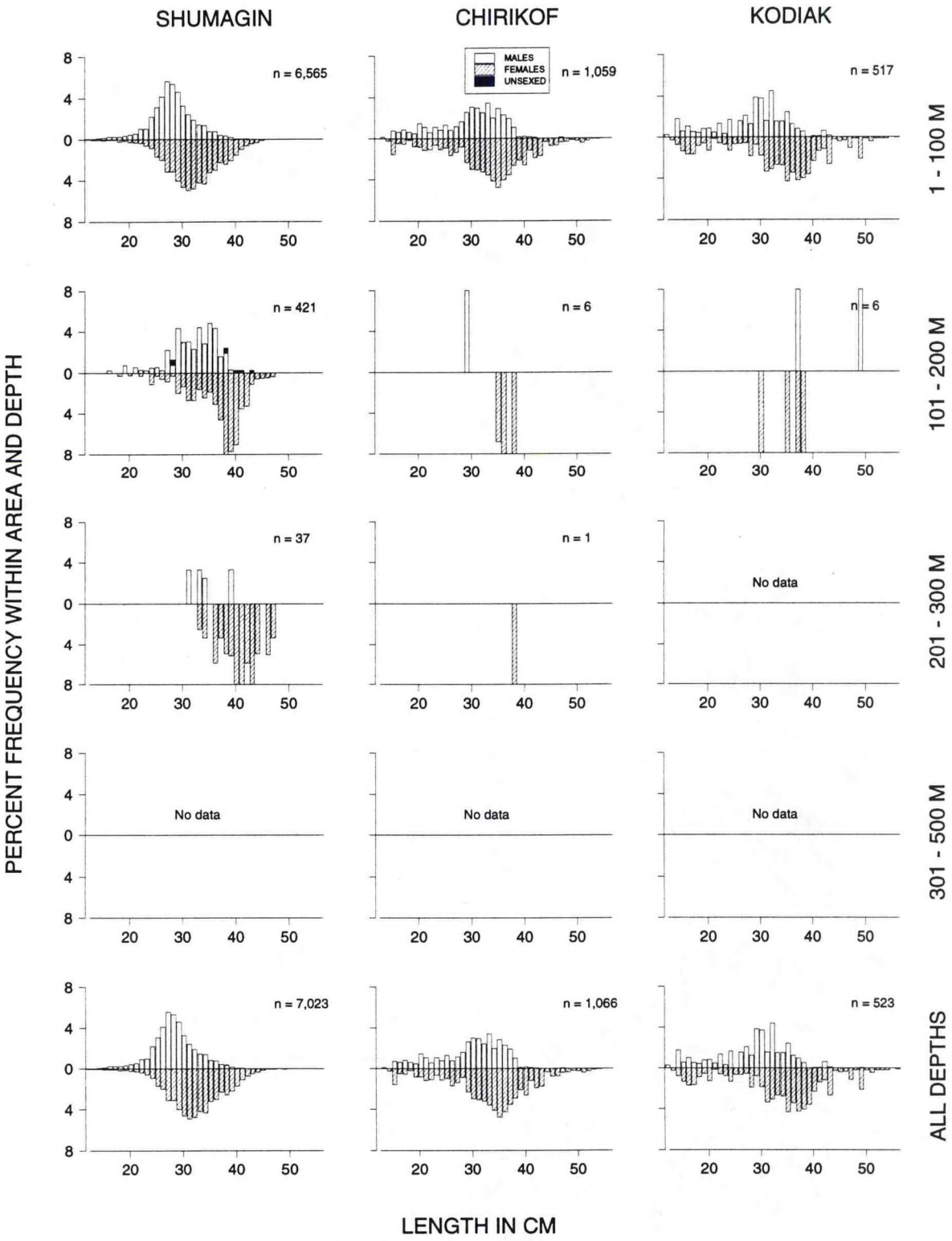


Figure 14.--Size composition of the estimated northern rock sole population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

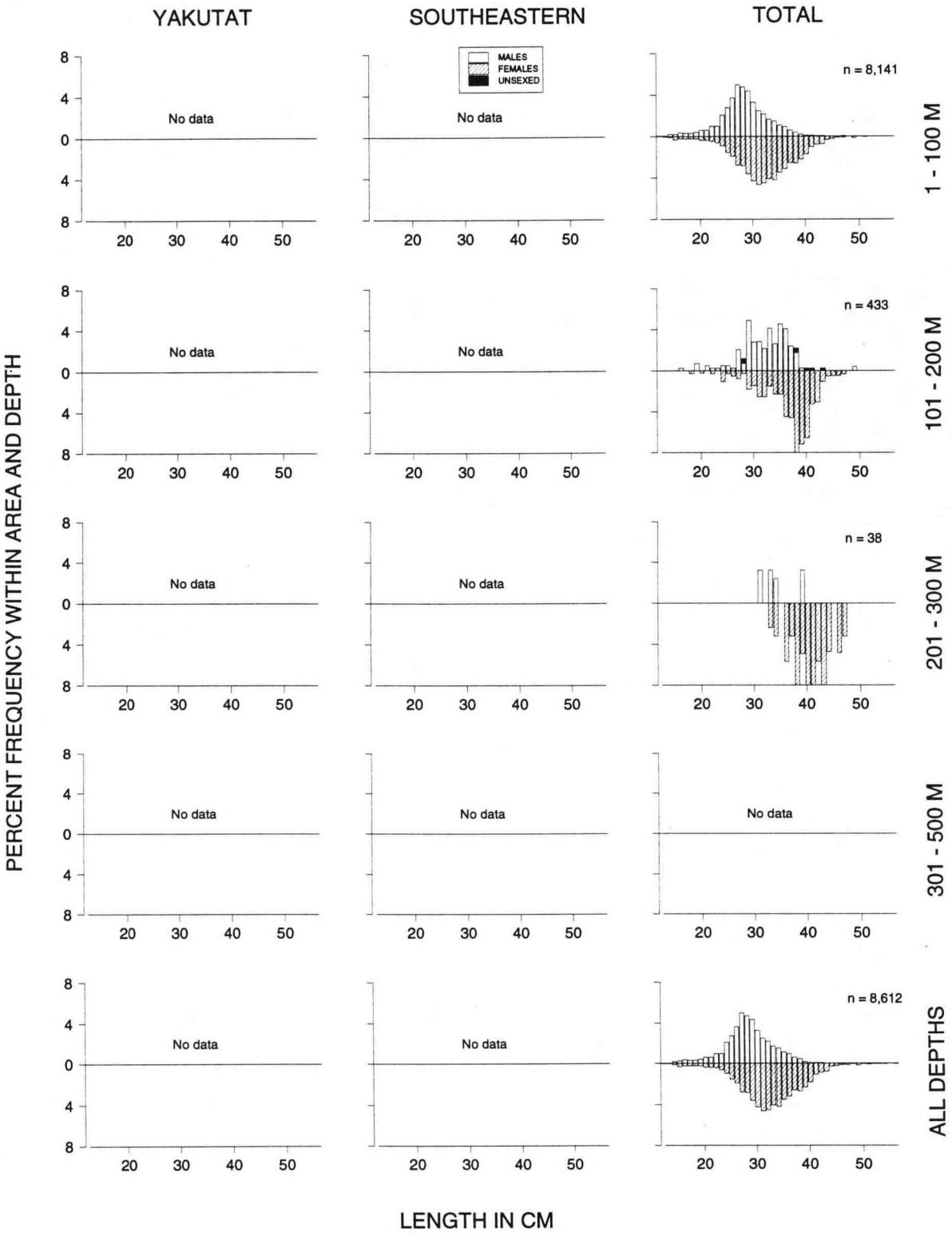


Figure 14.--Continued.

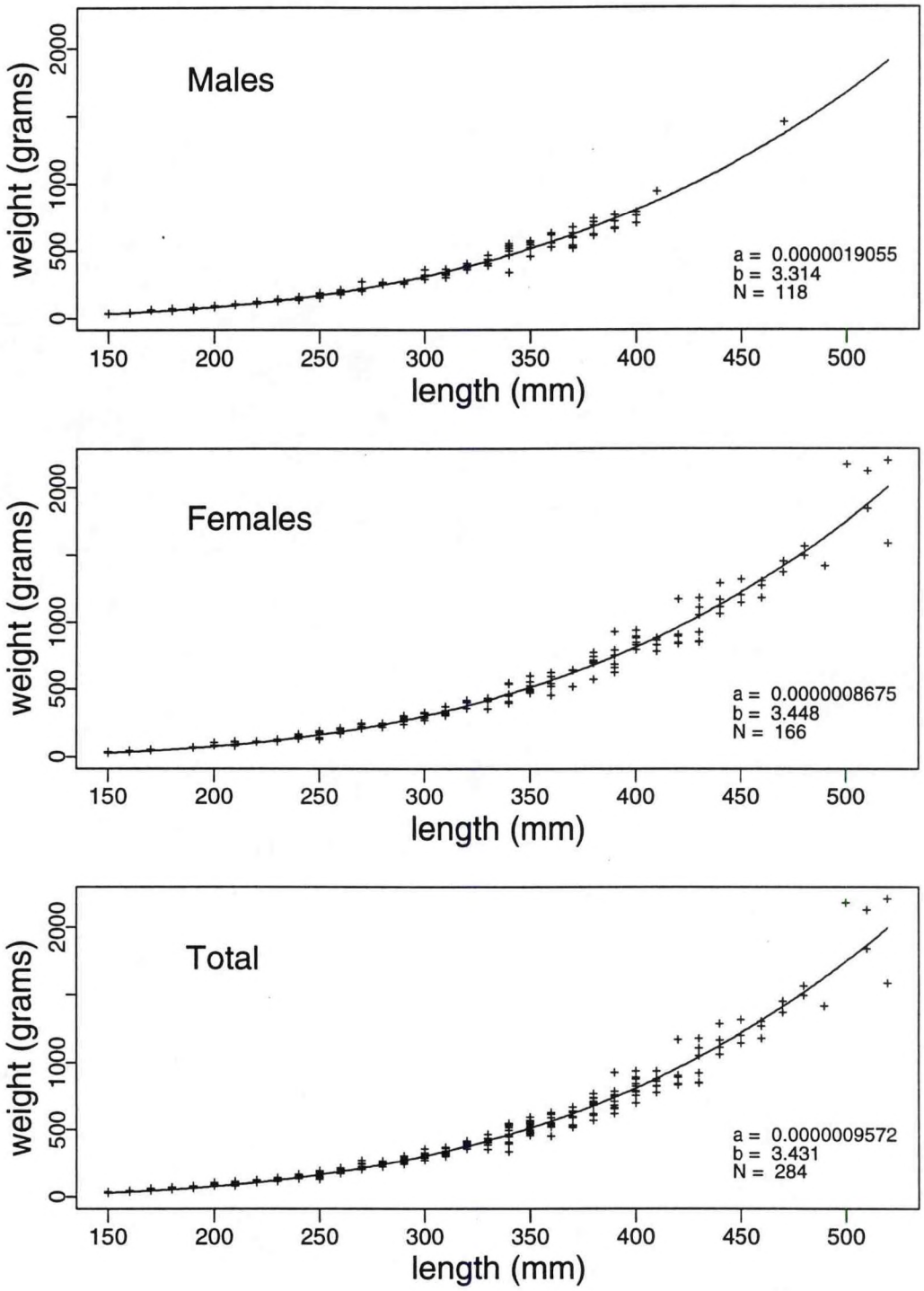


Figure 15.--Length-weight relationship for northern rock sole specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 12.--Catch per unit effort by stratum for northern rock sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Shumagin	1-100	Lower Alaska Peninsula	26	25	2,181	15,001	7,314	22,687
Shumagin	1-100	Fox Islands	28	27	1,632	13,374	2,470	24,279
Shumagin	1-100	Davidson Bank	25	24	1,433	19,607	8,159	31,055
Shumagin	1-100	Shumagin Bank	23	20	1,038	12,865	5,520	20,210
Chirikof	1-100	Upper Alaska Peninsula	16	12	782	6,208	930	11,485
Kodiak	1-100	Albatross Shallows	24	8	328	1,891	0	4,277
Chirikof	1-100	Chirikof Bank	35	21	275	2,963	1,142	4,784
Kodiak	1-100	Northern Kodiak Shallows	6	3	247	544	0	1,885
Shumagin	101-200	Shumagin Outer Shelf	41	23	198	1,616	731	2,502
Kodiak	1-100	Lower Cook Inlet	6	3	192	1,896	0	4,915
Kodiak	1-100	Albatross Banks	19	11	169	2,602	0	6,036
Shumagin	201-300	Shumagin Slope	22	4	52	144	0	326
Shumagin	101-200	Sanak Gully	6	2	9	37	0	113
Chirikof	1-100	Semidi Bank	18	6	7	53	4	102
Chirikof	101-200	East Shumagin Gully	16	1	5	60	0	189
Shumagin	101-200	West Shumagin Gully	13	2	4	10	0	26
Kodiak	101-200	Albatross Gullies	32	2	3	23	0	63
Kodiak	101-200	Barren Islands	15	1	2	17	0	52
Kodiak	101-200	Kodiak Outer Shelf	24	2	2	11	0	27
Chirikof	201-300	Chirikof Slope	9	1	2	4	0	12
Chirikof	101-200	Chirikof Outer Shelf	24	1	1	5	0	14

Rex sole (Errex zachirus)

Rex sole were widely distributed throughout the survey area, occurring in 65% of all tows and 81% of all tows greater than 100 m in depth (Table 13). They were captured in all of the strata sampled except Lower Cook Inlet, yet large catches of rex sole were rare (Table 14). The highest CPUEs for rex sole were seen on the outer continental shelf, the continental slope and the major gully areas (Fig. 16). About 60% of the total biomass of rex sole within the survey area was estimated to be between 101 and 200 m (Table 13). The total length frequency data show a mode between 33 and 35 cm FL for males and between 42 and 46 cm FL for females, although length data from individual areas and depths differed markedly (Fig. 17). For example, the mean size of female fish displayed a general decrease with depth, except in the Southeastern INPFC area. The ratio of males to females tended to increase with depth. Mean length and weight generally decreased from west to east and with depth. The length-weight relationship for rex sole specimens collected during the survey is depicted in Figure 18.

Table 13.-- Number of survey hauls, number of hauls with rex sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	20	85	3,518	0.68	41.7
	101 - 200	60	39	233	3,421	0.57	39.4
	201 - 300	22	20	661	1,844	0.53	40.2
	301 - 500	16	14	250	632	0.42	38.9
	All depths	200	93	145	9,415	0.58	40.3
Chirikof	1 - 100	69	20	150	3,908	0.58	41.0
	101 - 200	68	55	579	13,816	0.60	42.3
	201 - 300	31	26	441	5,092	0.57	42.3
	301 - 500	13	12	278	445	0.39	38.7
	All depths	181	113	342	23,261	0.58	42.0
Kodiak	1 - 100	59	17	14	520	0.29	31.5
	101 - 200	109	84	356	15,399	0.44	38.1
	201 - 300	31	23	310	3,567	0.30	34.5
	301 - 500	11	11	223	649	0.31	35.5
	All depths	210	135	198	20,135	0.39	36.9
Yakutat	1 - 100	33	22	95	1,567	0.25	31.2
	101 - 200	50	35	181	5,310	0.25	33.0
	201 - 300	27	27	411	2,125	0.24	32.8
	301 - 500	6	5	321	844	0.22	32.2
	All depths	116	89	173	9,846	0.24	32.6
Southeastern	1 - 100	7	5	131	855	0.12	25.3
	101 - 200	50	45	494	5,474	0.20	30.7
	201 - 300	28	27	378	1,911	0.21	31.5
	301 - 500	12	12	461	1,436	0.26	34.1
	All depths	97	89	345	9,676	0.20	30.4
All areas	1 - 100	270	84	81	10,368	0.38	34.1
	101 - 200	337	258	355	43,420	0.38	36.3
	201 - 300	139	123	403	14,539	0.34	35.6
	301 - 500	58	54	313	4,006	0.28	34.7
	All depths	804	519	226	72,333	0.37	35.7

All areas biomass, 95% confidence interval: 61,716 - 82,950 metric tons (t).

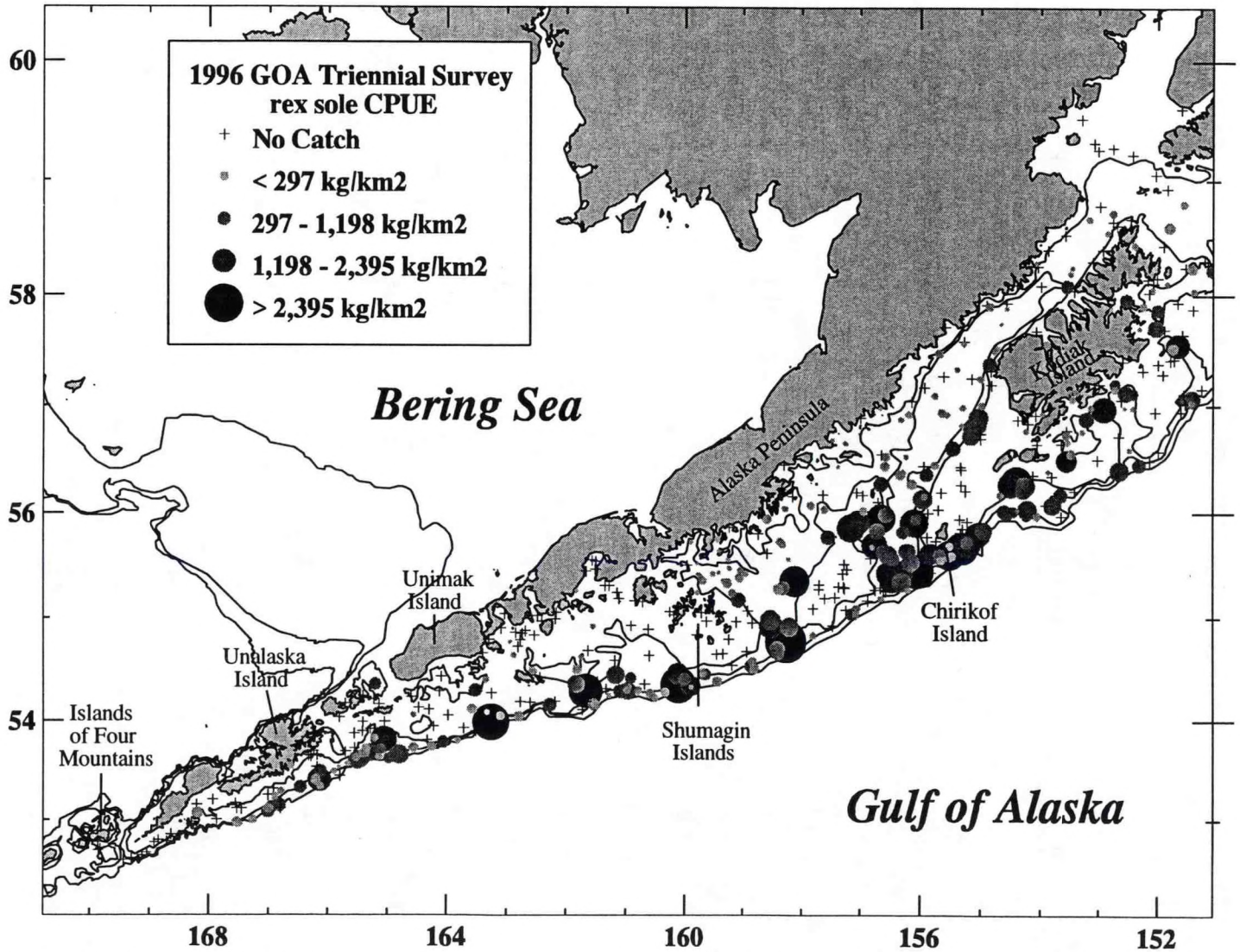
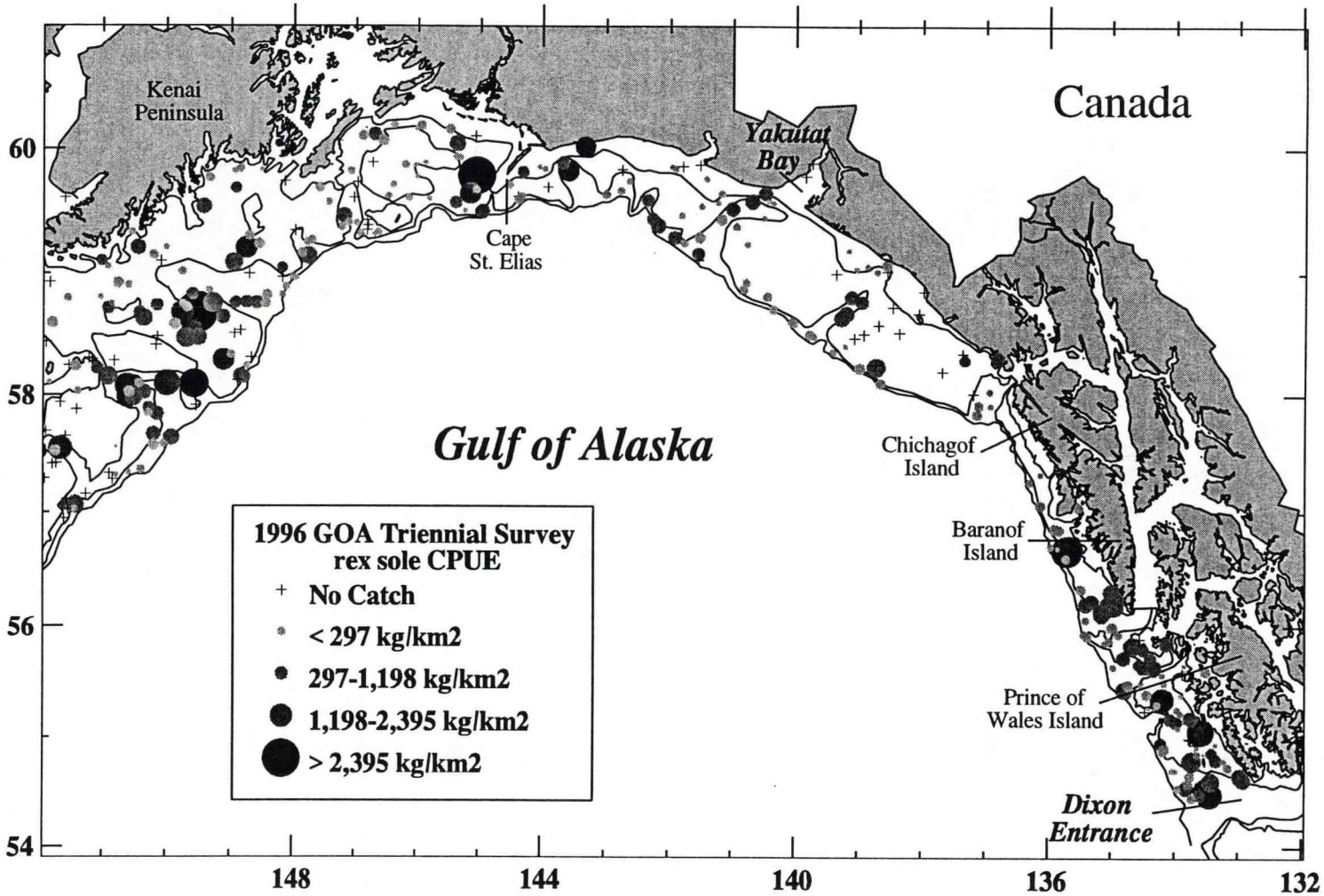


Figure 16.--Distribution and relative abundance of rex sole from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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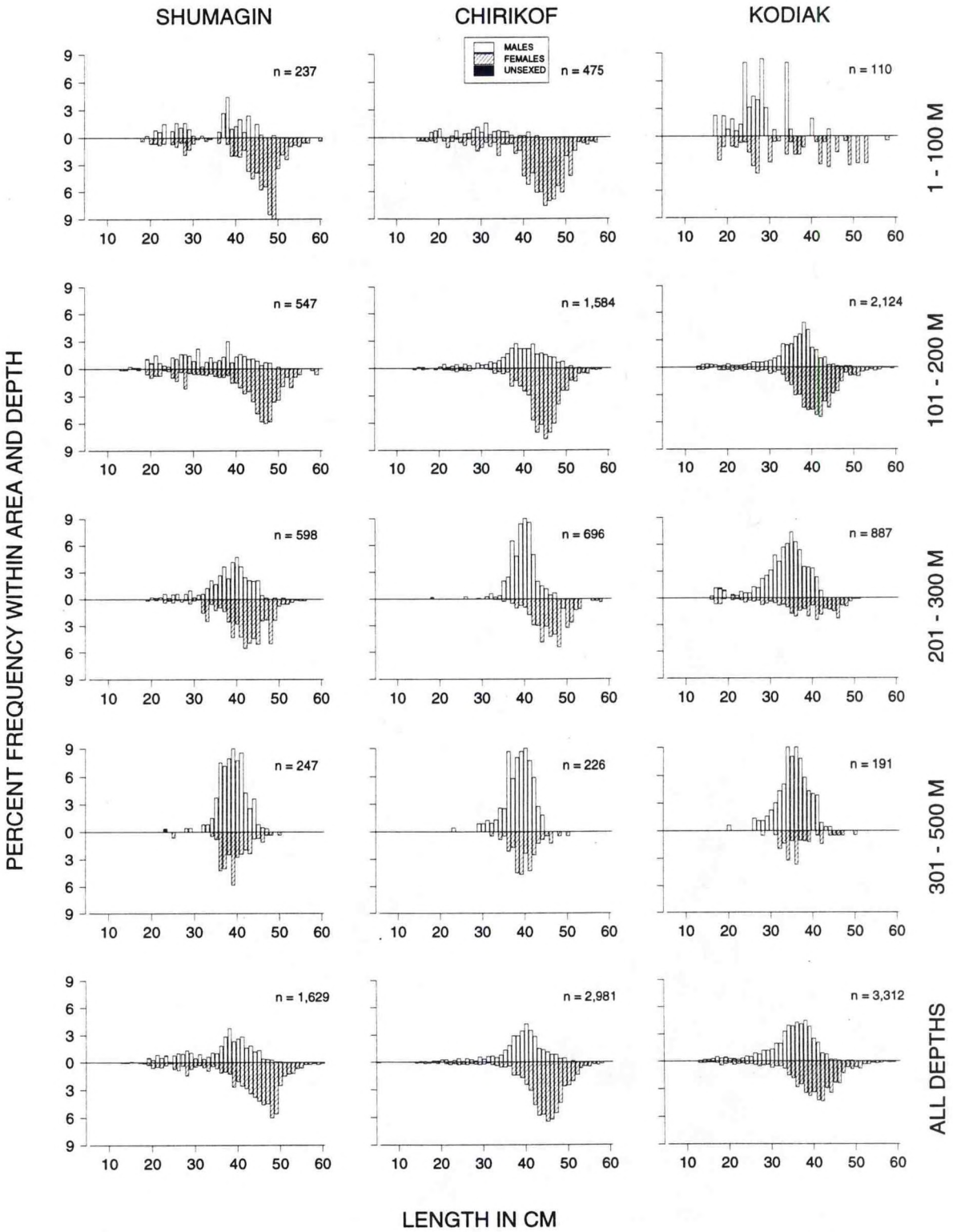
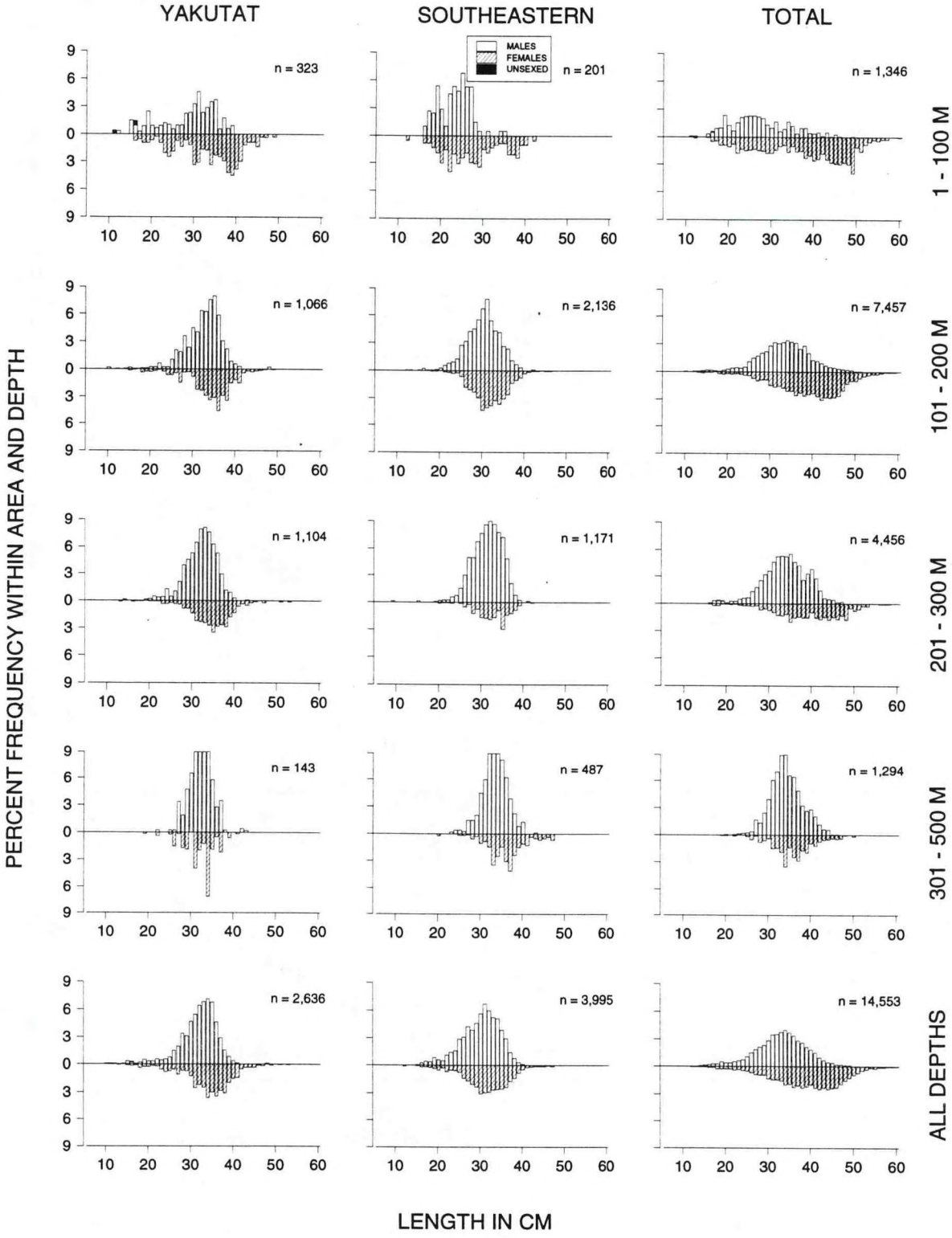


Figure 17.--Size composition of the estimated rex sole population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.



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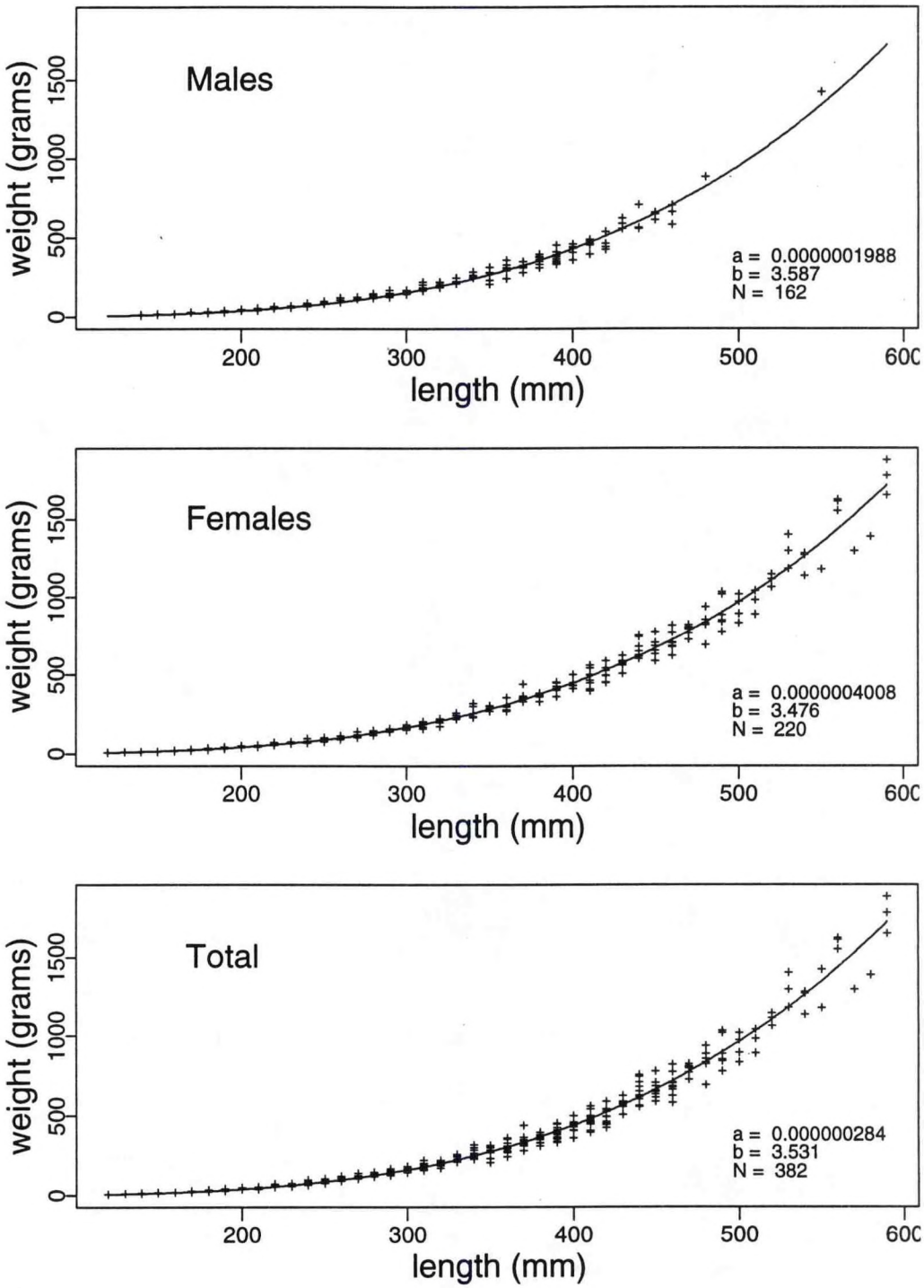


Figure 18.--Length-weight relationship for rex sole specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 14.--Catch per unit effort by stratum for rex sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km²)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	201-300	Chirikof Slope	9	8	1,515	2,315	131	4,498
Southeastern	101-200	Baranof-Chichagof Shelf	14	14	819	3,435	1,406	5,465
Kodiak	101-200	Portlock Flats	21	18	759	5,566	1,977	9,156
Chirikof	101-200	Chirikof Outer Shelf	24	16	666	3,339	1,537	5,140
Shumagin	201-300	Shumagin Slope	22	20	661	1,844	808	2,880
Chirikof	101-200	Shelikof Edge	28	25	577	4,462	2,204	6,720
Kodiak	101-200	Albatross Gullies	32	30	565	4,471	2,821	6,121
Southeastern	301-500	Southeastern Deep Gullies	8	8	560	1,312	201	2,423
Chirikof	101-200	East Shumagin Gully	16	14	542	6,015	1,207	10,823
Yakutat	201-300	Yakutat Gullies	11	11	503	1,531	862	2,201
Yakutat	301-500	Yakutat Slope	1	1	441	670		
Kodiak	201-300	Kenai Gullies	20	16	439	2,927	875	4,978
Southeastern	201-300	Baranof-Chichagof Slope	5	5	403	454	0	946
Kodiak	201-300	Kodiak Slope	5	4	381	618	0	1,425
Yakutat	101-200	Middleton Shelf	23	19	378	2,773	0	5,574
Southeastern	201-300	Prince of Wales Slope/Gullies	23	22	371	1,457	723	2,191
Kodiak	101-200	Kenai Flats	17	16	310	3,741	1,337	6,146
Southeastern	101-200	Prince of Wales Shelf	36	31	296	2,039	875	3,203
Yakutat	201-300	Yakutat Slope	16	16	279	594	381	807
Chirikof	301-500	Chirikof Slope	13	12	278	445	205	686
Chirikof	201-300	Lower Shelikof Gully	22	18	277	2,777	1,270	4,284
Shumagin	101-200	Sanak Gully	6	5	270	1,148	0	2,746
Chirikof	1-100	Chirikof Bank	35	10	251	2,714	446	4,982
Shumagin	301-500	Shumagin Slope	16	14	250	632	234	1,030
Shumagin	101-200	Shumagin Outer Shelf	41	21	247	2,014	337	3,692
Shumagin	1-100	Davidson Bank	25	9	237	3,238	0	7,826
Kodiak	301-500	Kodiak Slope	11	11	223	649	136	1,162
Kodiak	101-200	Kodiak Outer Shelf	24	11	181	911	235	1,587
Yakutat	101-200	Fairweather Shelf	10	4	164	1,268	0	3,065
Southeastern	301-500	Southeastern Slope	4	4	161	124	61	188
Yakutat	301-500	Yakutat Gullies	5	4	157	174	27	321
Chirikof	1-100	Semidi Bank	18	3	144	1,052	0	3,083
Southeastern	1-100	Southeastern Shallows	7	5	131	855	0	1,980
Yakutat	101-200	Yakutat Flats	9	7	127	1,150	3	2,297
Yakutat	1-100	Yakutat Shallows	22	13	121	1,202	0	2,424
Shumagin	101-200	West Shumagin Gully	13	13	114	259	21	497
Kodiak	101-200	Barren Islands	15	9	65	710	101	1,319
Yakutat	1-100	Middleton Shallows	11	9	56	365	82	648
Kodiak	1-100	Albatross Shallows	24	10	49	280	19	542
Shumagin	1-100	Fox Islands	28	5	28	230	0	525
Yakutat	101-200	Yakataga Shelf	8	5	22	119	14	223
Kodiak	1-100	Kenai Peninsula	4	2	21	110	0	456
Chirikof	1-100	Upper Alaska Peninsula	16	7	18	142	0	334
Kodiak	1-100	Northern Kodiak Shallows	6	2	18	39	0	135
Kodiak	201-300	Upper Shelikof Gully	6	3	7	22	0	63
Kodiak	1-100	Albatross Banks	19	3	6	91	0	253
Shumagin	1-100	Lower Alaska Peninsula	26	4	3	22	0	55
Shumagin	1-100	Shumagin Bank	23	2	2	28	0	75

Dover sole (Microstomus pacificus)

Dover sole were found in moderate numbers throughout the survey area and were caught in 45 of the 49 strata sampled (Tables 15 and 16; Fig. 19). Dover sole CPUEs were highest in the Yakutat area and increased with depth in all areas. Dover sole were found in 90% of the tows deeper than 300 m, and in 78% of the tows between 201 and 300 m (Table 15). Dover sole were usually absent from tows on the large flat areas less than 100 m in depth. The largest Dover sole were generally found in tows between 101 and 200 m with smaller fish found both deeper and shallower (Table 15). This appeared to be due to the predominance of larger female fish in this depth range (Fig. 20). The ratio of males to females increased with depth in all areas. The length-weight relationship for Dover sole specimens collected during the survey is depicted in Figure 21.

Table 15.-- Number of survey hauls, number of hauls with Dover sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	3	3	133	1.02	42.8
	101 - 200	60	8	23	337	1.33	47.8
	201 - 300	22	6	104	290	1.18	46.0
	301 - 500	16	10	276	698	0.84	43.0
	All depths	200	27	22	1,458	1.00	44.3
Chirikof	1 - 100	69	14	44	1,151	0.92	43.1
	101 - 200	68	51	255	6,069	1.15	46.8
	201 - 300	31	23	195	2,260	1.22	47.6
	301 - 500	13	13	990	1,588	0.78	41.7
	All depths	181	101	163	11,068	1.06	45.5
Kodiak	1 - 100	59	12	14	528	0.85	41.0
	101 - 200	109	72	355	15,384	1.06	45.1
	201 - 300	31	24	441	5,065	0.79	42.3
	301 - 500	11	11	1,284	3,739	0.68	40.0
	All depths	210	119	243	24,716	0.91	43.3
Yakutat	1 - 100	33	18	206	3,399	0.84	41.8
	101 - 200	50	40	500	14,701	0.97	44.5
	201 - 300	27	27	1,179	6,095	0.84	42.5
	301 - 500	6	6	2,114	5,556	0.76	41.5
	All depths	116	91	521	29,751	0.88	43.1
Southeastern	1 - 100	7	3	228	1,496	0.79	40.6
	101 - 200	50	28	123	1,366	0.47	36.1
	201 - 300	28	28	599	3,026	0.47	36.2
	301 - 500	12	12	1,743	5,432	0.63	39.2
	All depths	97	71	403	11,320	0.57	37.9
All areas	1 - 100	270	50	52	6,707	0.84	41.7
	101 - 200	337	199	309	37,857	0.99	44.4
	201 - 300	139	108	464	16,736	0.75	41.1
	301 - 500	58	52	1,330	17,013	0.70	40.4
	All depths	804	409	245	78,313	0.85	42.3

All areas biomass, 95% confidence interval: 66,952 - 89,674 metric tons (t).

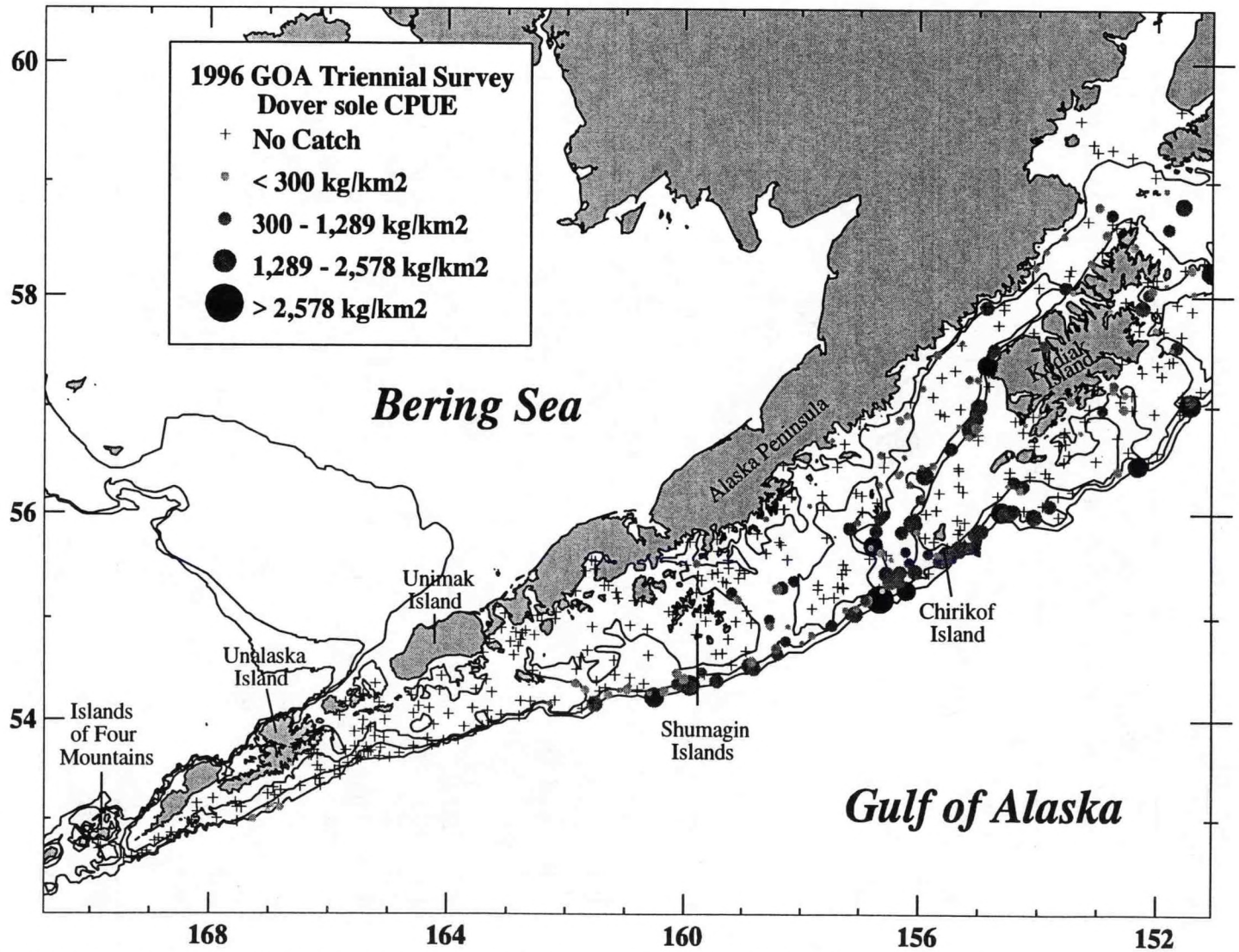
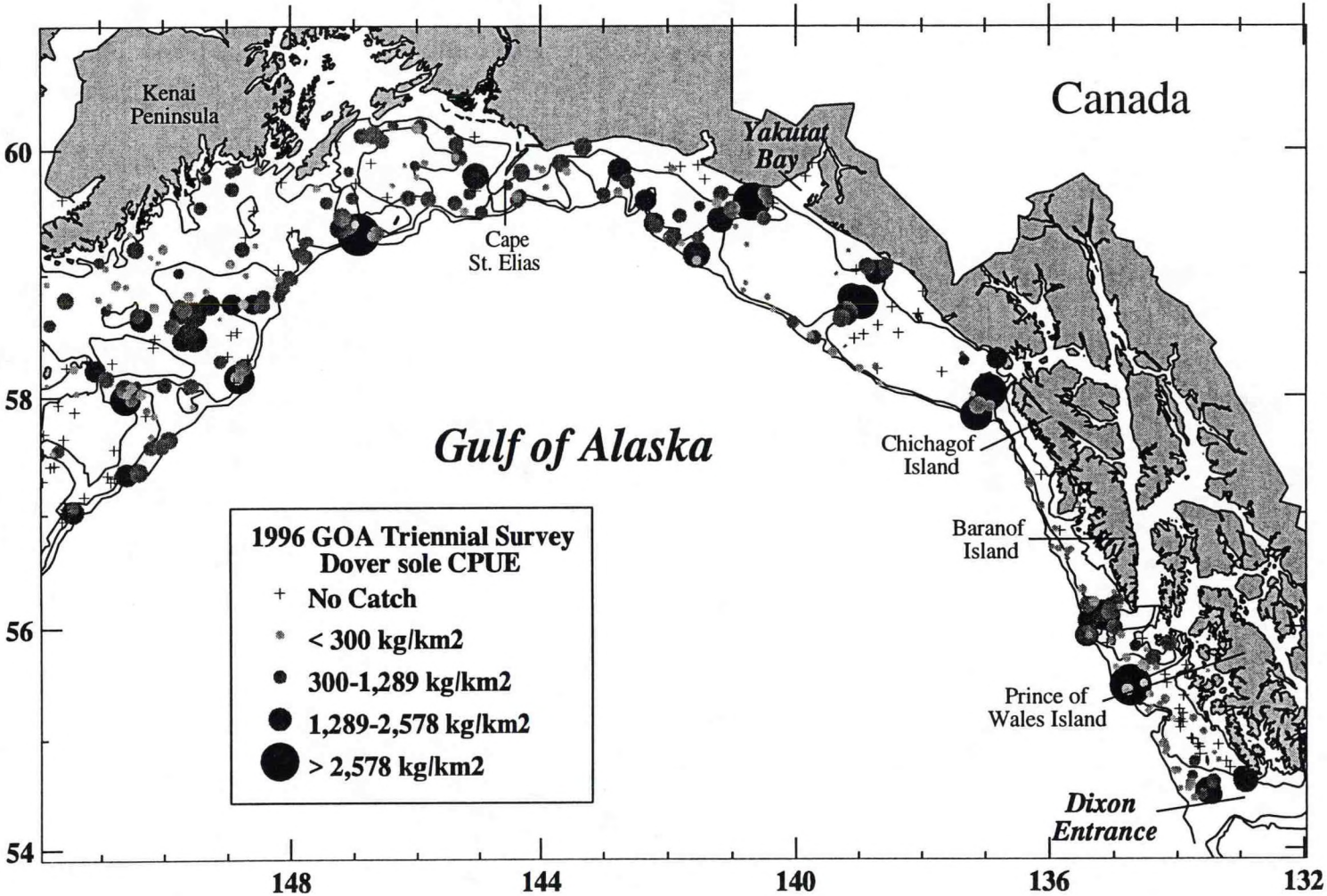


Figure 19.--Distribution and relative abundance of Dover sole from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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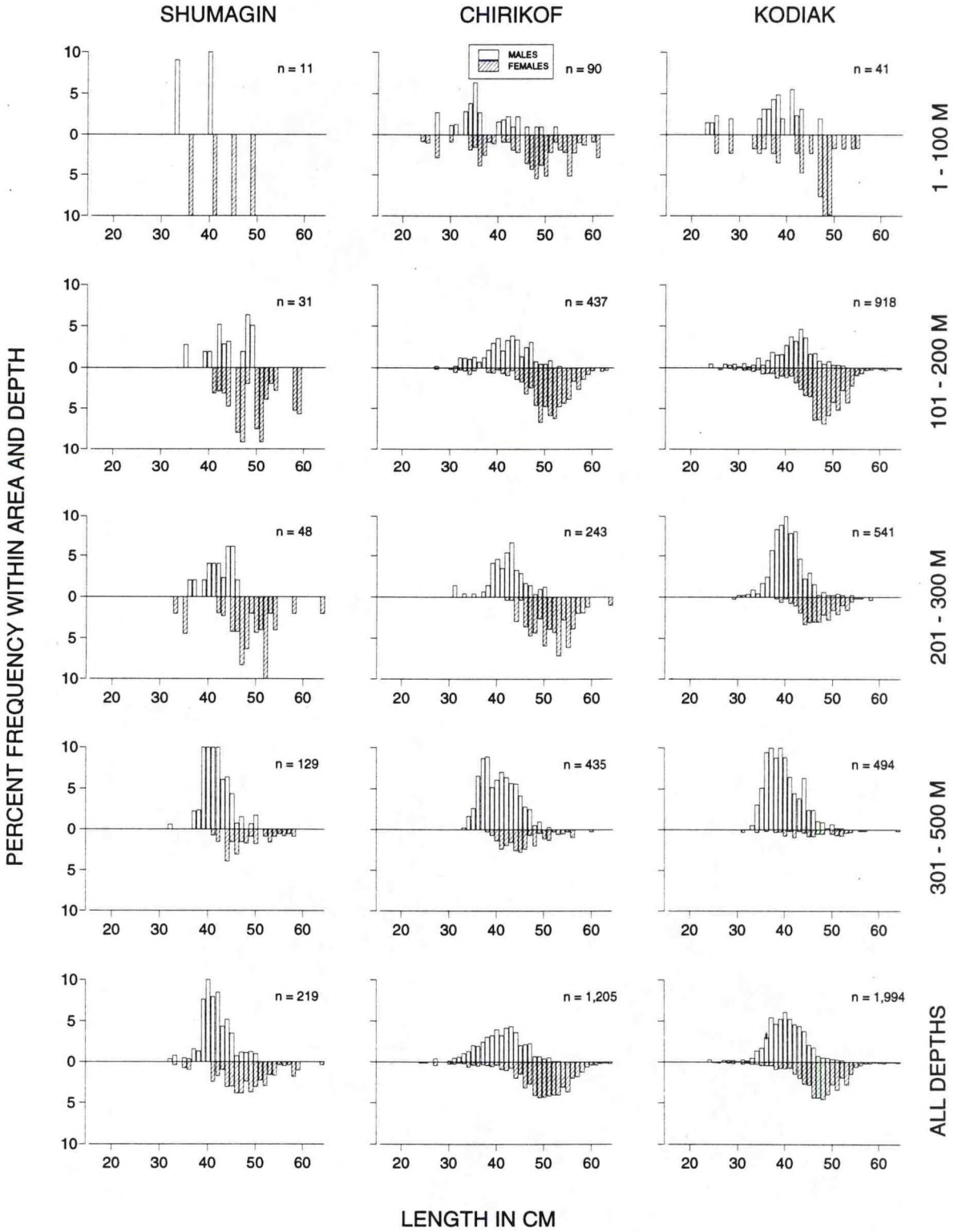
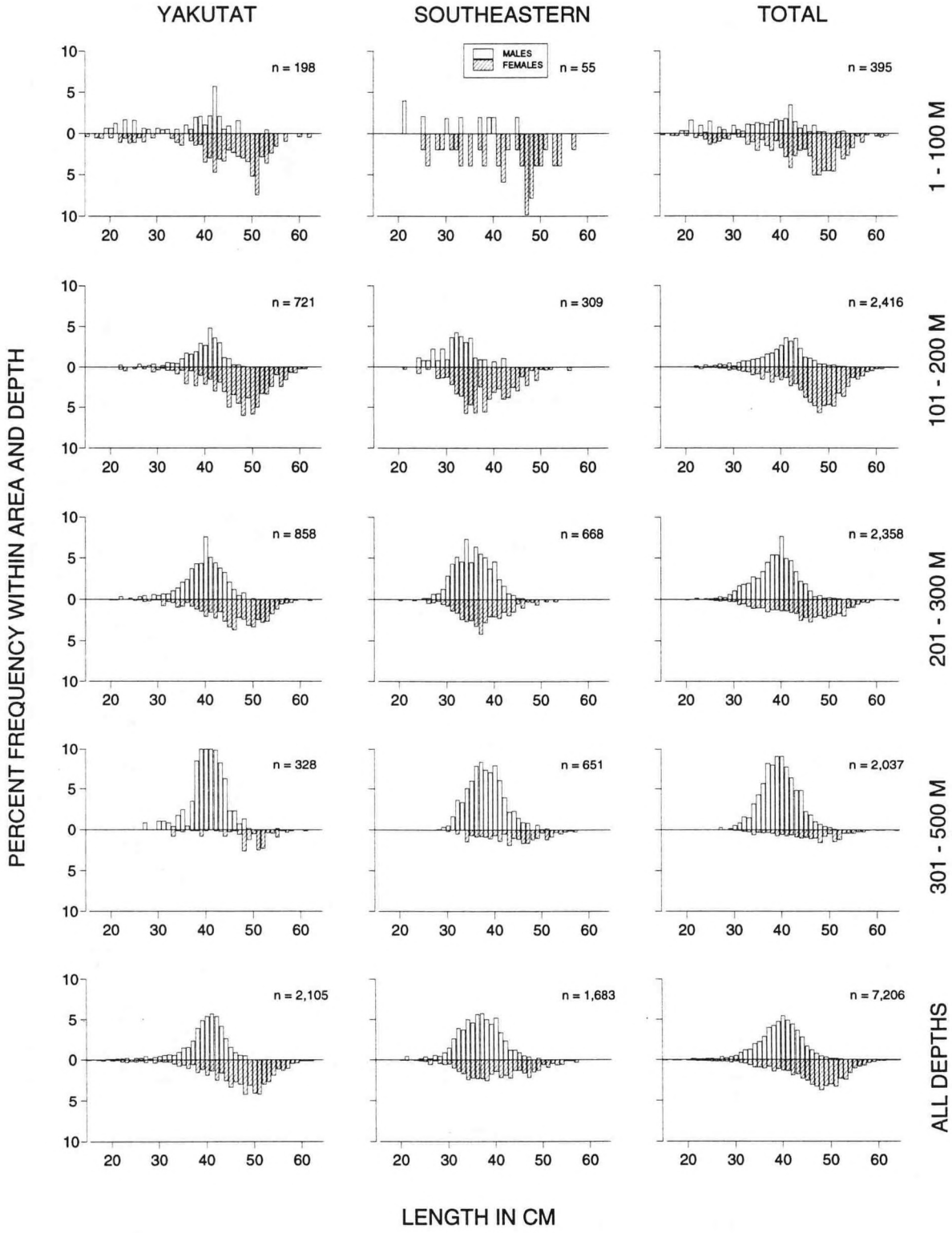


Figure 20.--Size composition of the estimated Dover sole population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.



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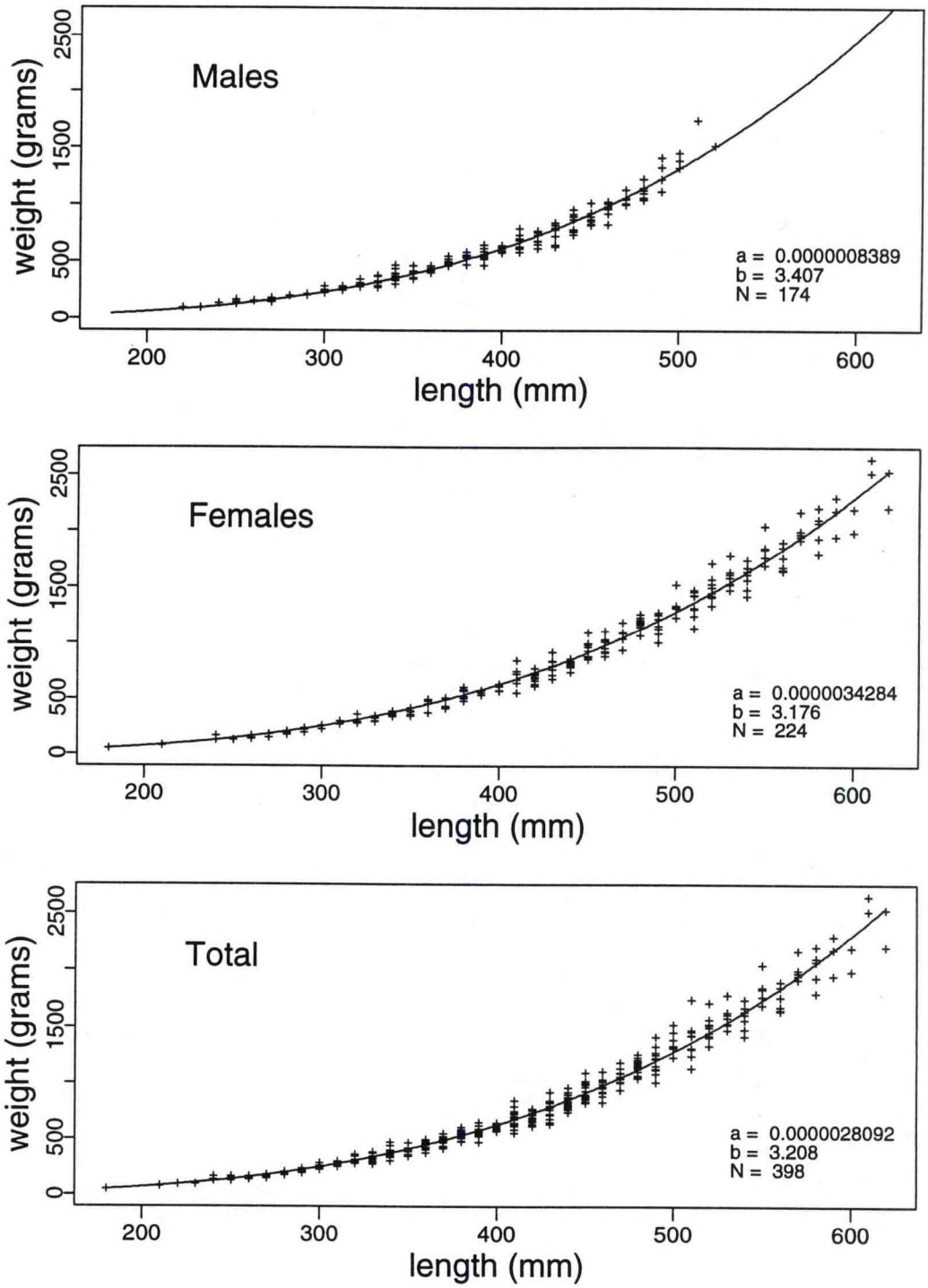


Figure 21.--Length-weight relationship for Dover sole specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 16.--Catch per unit effort by stratum for Dover sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Yakutat	301-500	Yakutat Slope	1	1	2,567	3,903		
Southeastern	301-500	Southeastern Deep Gullies	8	8	1,991	4,668	1,792	7,545
Yakutat	201-300	Yakutat Gullies	11	11	1,641	4,992	1,834	8,151
Yakutat	301-500	Yakutat Gullies	5	5	1,493	1,653	0	3,726
Kodiak	301-500	Kodiak Slope	11	11	1,284	3,739	2,130	5,347
Chirikof	301-500	Chirikof Slope	13	13	990	1,588	983	2,193
Southeastern	301-500	Southeastern Slope	4	4	989	764	0	1,604
Yakutat	101-200	Middleton Shelf	23	18	827	6,078	1,945	10,211
Southeastern	201-300	Baranof-Chichagof Slope	5	5	804	905	0	1,974
Kodiak	101-200	Portlock Flats	21	17	775	5,687	3,049	8,325
Chirikof	201-300	Chirikof Slope	9	8	631	965	402	1,528
Kodiak	201-300	Kenai Gullies	20	19	623	4,148	2,541	5,755
Yakutat	101-200	Yakutat Flats	9	9	616	5,566	0	12,767
Kodiak	201-300	Kodiak Slope	5	4	557	904	158	1,651
Southeastern	201-300	Prince of Wales Slope/Gullies	23	23	540	2,121	4	4,238
Yakutat	201-300	Yakutat Slope	16	16	518	1,103	619	1,586
Yakutat	101-200	Yakataga Shelf	8	7	507	2,678	0	5,487
Chirikof	101-200	Shelikof Edge	28	26	446	3,449	2,165	4,733
Kodiak	101-200	Albatross Gullies	32	22	372	2,947	1,034	4,860
Kodiak	101-200	Kenai Flats	17	16	325	3,928	2,081	5,775
Shumagin	301-500	Shumagin Slope	16	10	276	698	129	1,268
Chirikof	101-200	Chirikof Outer Shelf	24	18	275	1,378	778	1,978
Yakutat	1-100	Yakutat Shallows	22	10	269	2,680	764	4,596
Southeastern	1-100	Southeastern Shallows	7	3	228	1,496	0	5,108
Kodiak	101-200	Barren Islands	15	10	197	2,165	510	3,821
Southeastern	101-200	Baranof-Chichagof Shelf	14	12	193	812	234	1,390
Kodiak	101-200	Kodiak Outer Shelf	24	7	131	657	0	1,344
Chirikof	201-300	Lower Shelikof Gully	22	15	129	1,295	502	2,089
Chirikof	101-200	East Shumagin Gully	16	7	112	1,242	147	2,336
Yakutat	1-100	Middleton Shallows	11	8	110	719	163	1,275
Shumagin	201-300	Shumagin Slope	22	6	104	290	0	708
Kodiak	1-100	Northern Kodiak Shallows	6	4	102	225	0	569
Southeastern	101-200	Prince of Wales Shelf	36	16	80	554	185	923
Chirikof	1-100	Chirikof Bank	35	9	76	820	0	1,664
Shumagin	101-200	West Shumagin Gully	13	3	53	122	0	272
Yakutat	101-200	Fairweather Shelf	10	6	49	379	0	937
Kodiak	1-100	Albatross Shallows	24	6	34	198	8	387
Chirikof	1-100	Semidi Bank	18	1	33	239	0	745
Shumagin	101-200	Shumagin Outer Shelf	41	5	26	215	14	416
Chirikof	1-100	Upper Alaska Peninsula	16	4	12	92	0	203
Kodiak	1-100	Kenai Peninsula	4	1	12	63	0	264
Shumagin	1-100	Davidson Bank	25	1	9	123	0	378
Kodiak	201-300	Upper Shelikof Gully	6	1	4	13	0	48
Kodiak	1-100	Albatross Banks	19	1	3	42	0	130
Shumagin	1-100	Fox Islands	28	2	1	10	0	24

Yellowfin sole (Limanda asper)

Yellowfin sole catches were recorded almost exclusively in the shallowest strata in the Shumagin, Chirikof, and Kodiak INPFC areas (Table 17, Fig. 22). Approximately 22% of the trawls in these areas contained yellowfin sole. Small catches were also recorded in the Southeastern Shallows and East Shumagin Gully strata. Over one-half of the estimated gulf-wide biomass came from the Lower Alaska Peninsula stratum, which makes up just over 2% of the survey area (Table 18). About 81% of the tows in this stratum contained yellowfin sole. The population size composition data (Fig. 23) show a male length mode around 30 cm FL, while the female length mode is between 30 and 34 cm FL. The length-weight relationship for yellowfin sole specimens collected during the survey is depicted in Figure 24.

Table 17.-- Number of survey hauls, number of hauls with yellowfin sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	28	725	29,836	0.37	30.5
	101 - 200	60	1	1	15	0.70	38.3
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	29	459	29,851	0.37	30.5
Chirikof	1 - 100	69	11	348	9,058	0.47	32.0
	101 - 200	68	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	11	133	9,058	0.47	32.0
Kodiak	1 - 100	59	11	234	9,000	0.39	30.4
	101 - 200	109	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	11	89	9,000	0.39	30.4
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	0	---	---	---	---
Southeastern	1 - 100	7	1	40	261	0.30	29.0
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	1	9	261	0.30	29.0
All areas	1 - 100	270	51	374	48,155	0.39	30.7
	101 - 200	337	1	0	15	0.70	38.3
	201 - 300	139	0	---	---	---	---
	301 - 500	58	0	---	---	---	---
	All depths	804	52	151	48,170	0.39	30.7

All areas biomass, 95% confidence interval: 29,186 - 67,154 metric tons (t).

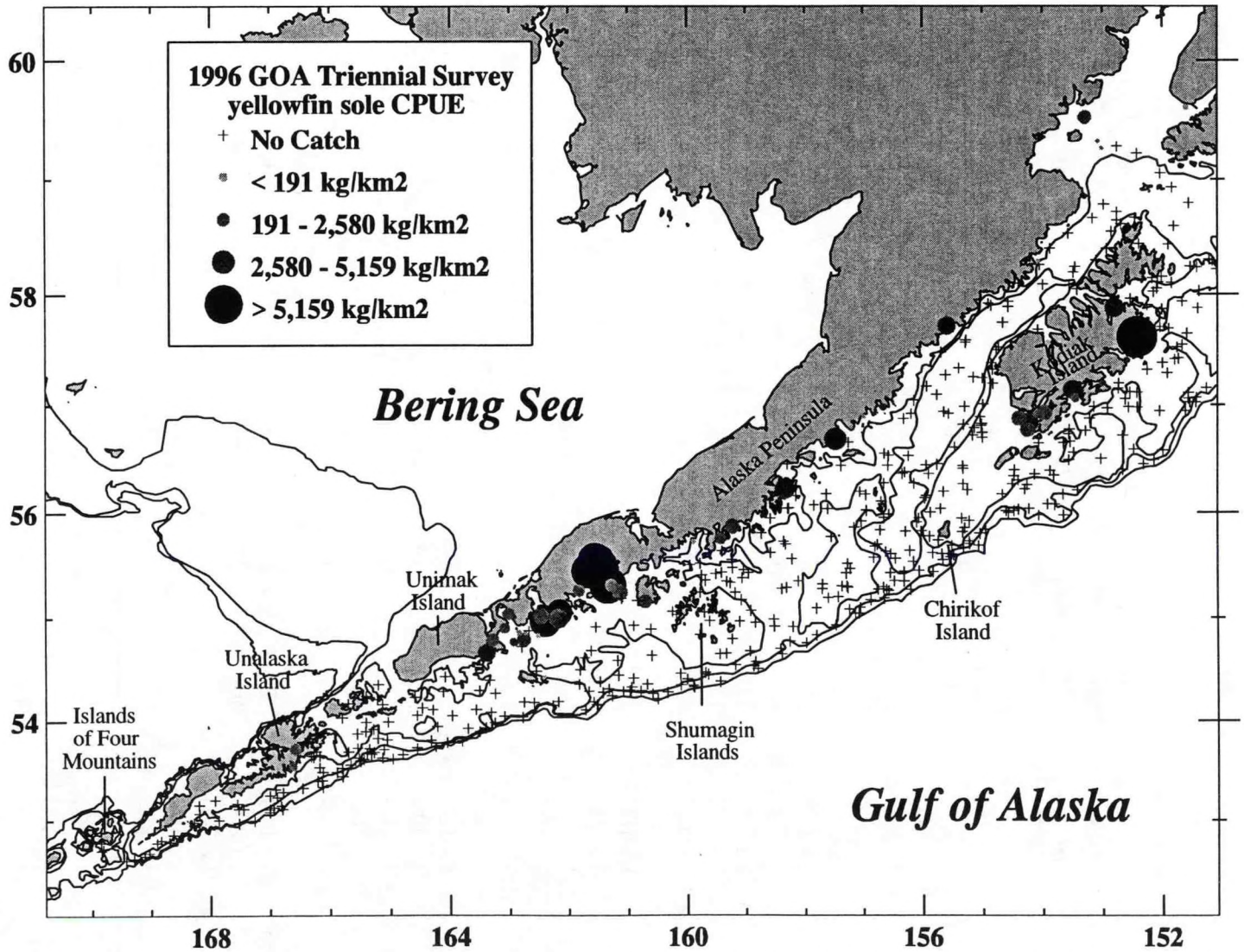


Figure 22.--Distribution and relative abundance of yellowfin sole from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

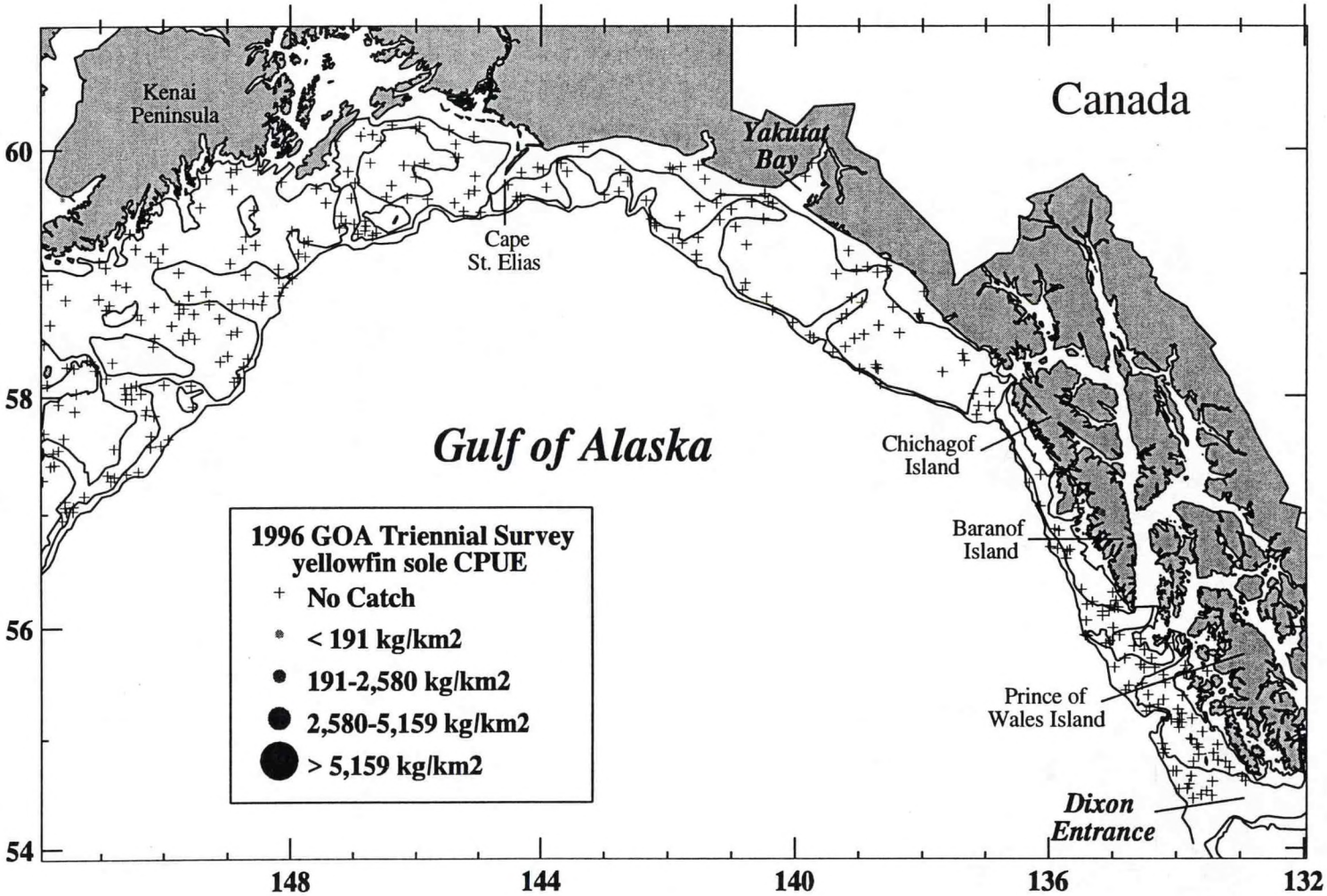


Figure 22.--Continued.

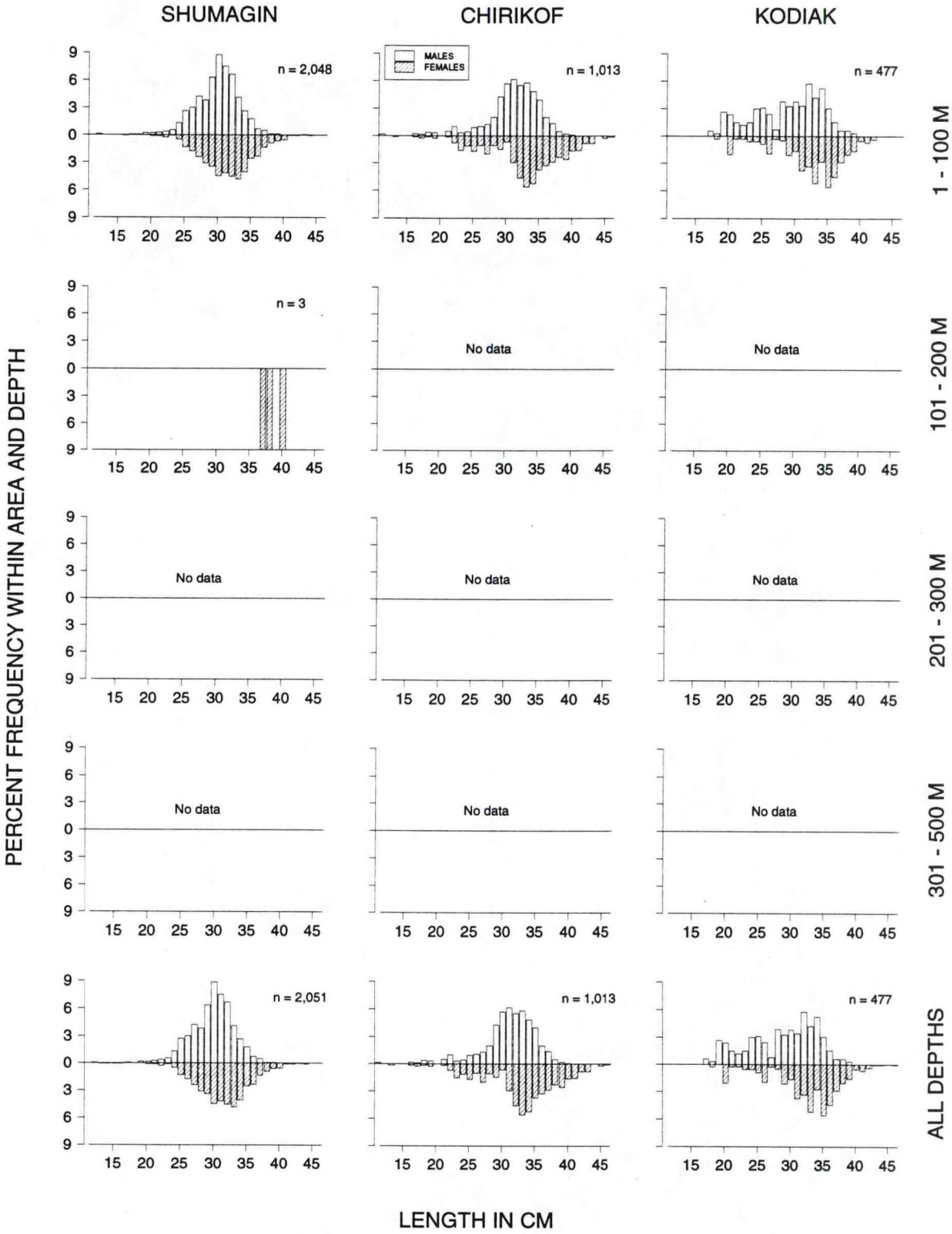


Figure 23.--Size composition of the estimated yellowfin sole population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

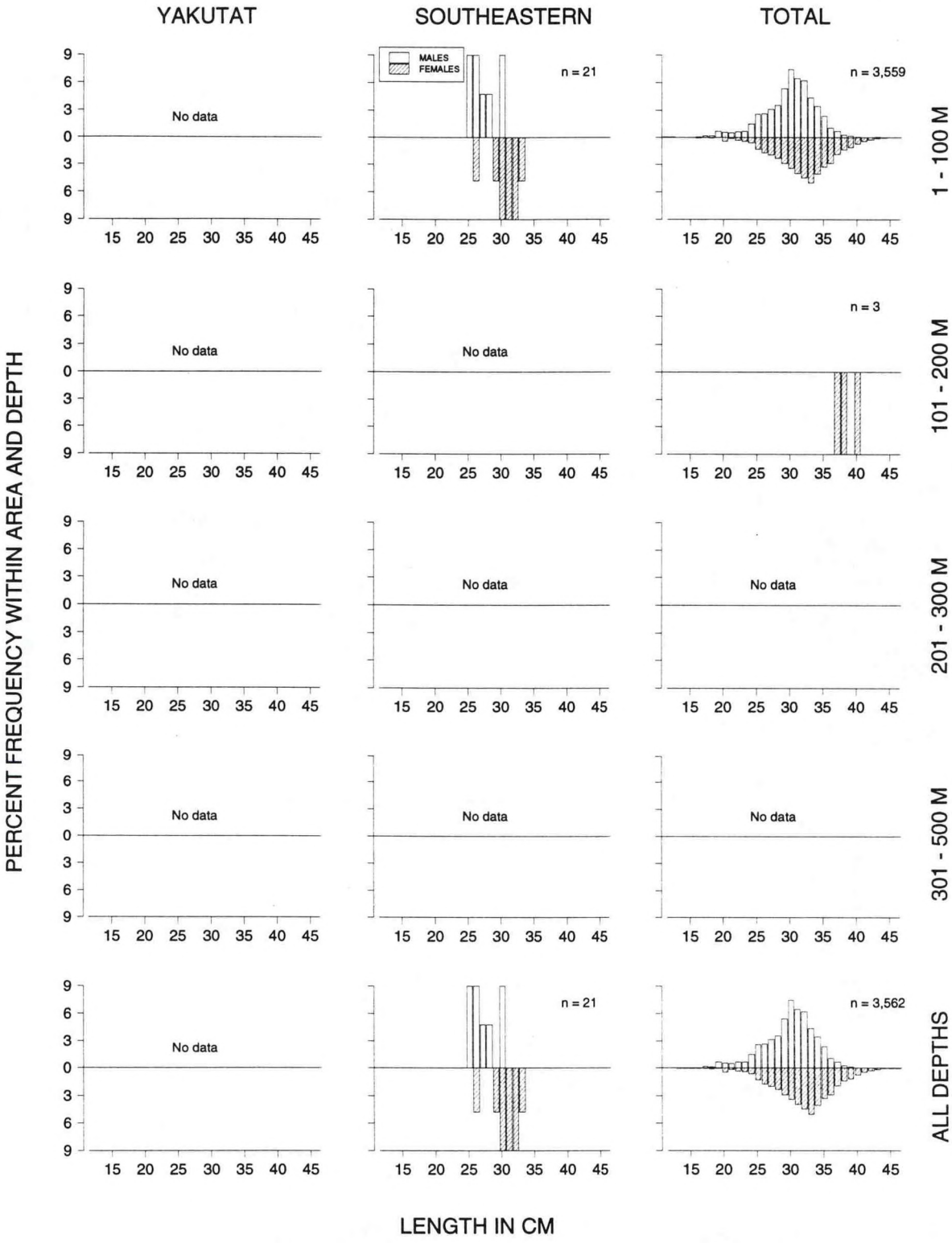


Figure 23.--Continued.

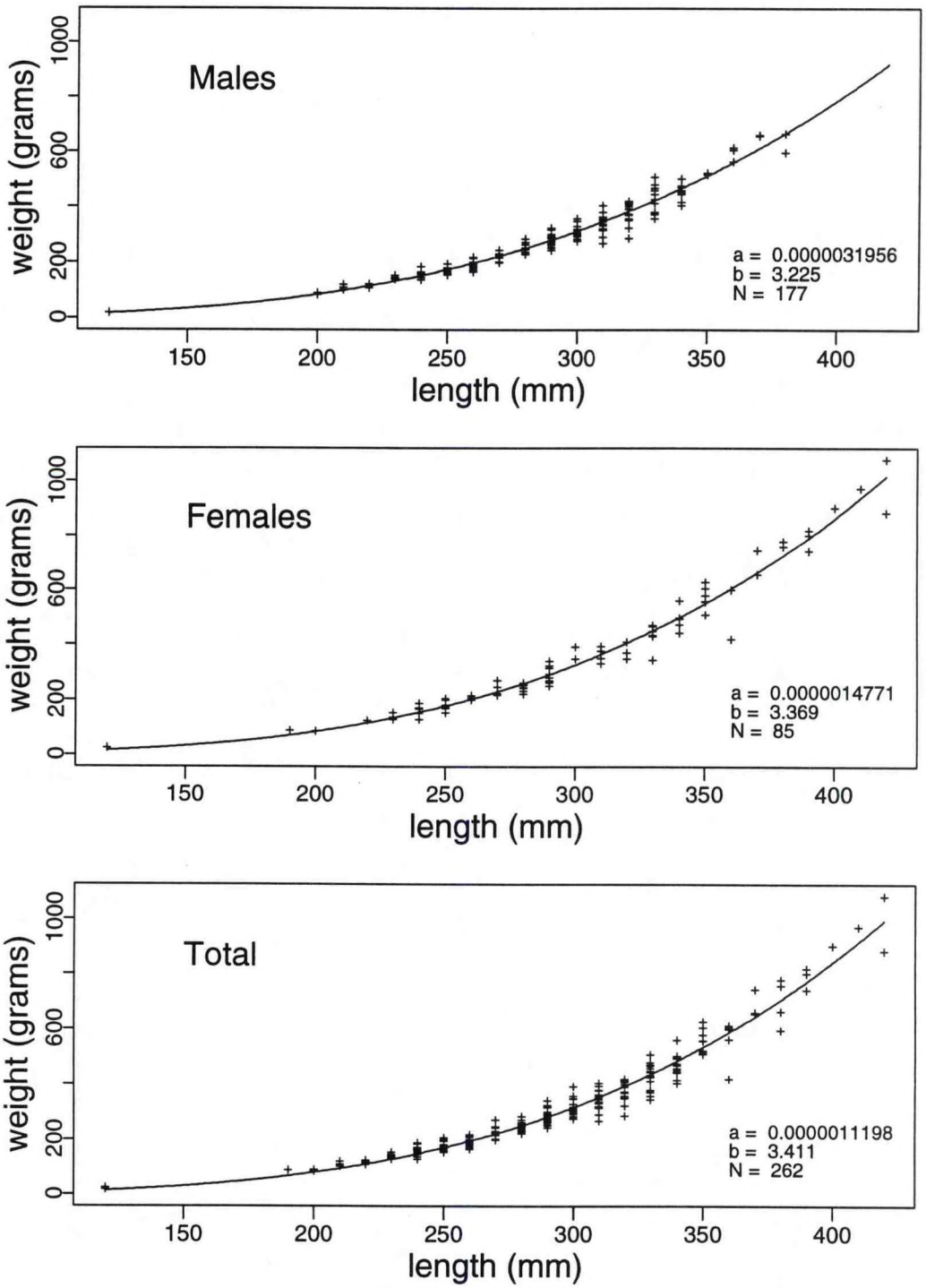


Figure 24.--Length-weight relationship for yellowfin sole specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 18.--Catch per unit effort by stratum for yellowfin sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Shumagin	1-100	Lower Alaska Peninsula	26	21	3,724	25,608	11,613	39,604
Kodiak	1-100	Albatross Shallows	24	5	850	4,899	0	12,931
Chirikof	1-100	Upper Alaska Peninsula	16	6	757	6,008	0	12,756
Kodiak	1-100	Northern Kodiak Shallows	6	2	595	1,309	0	4,601
Chirikof	1-100	Chirikof Bank	35	5	283	3,050	230	5,869
Kodiak	1-100	Lower Cook Inlet	6	4	282	2,792	0	9,424
Shumagin	1-100	Shumagin Bank	23	2	175	2,171	0	5,362
Shumagin	1-100	Davidson Bank	25	3	115	1,572	0	4,773
Shumagin	1-100	Fox Islands	28	2	59	485	0	1,231
Southeastern	1-100	Southeastern Shallows	7	1	40	261	0	901
Shumagin	101-200	West Shumagin Gully	13	1	7	15	0	47

Other Flatfish

Alaska plaice (Pleuronectes quadrituberculatus)

Approximately 79% of the total Alaska plaice biomass in the survey was estimated to be in shallow water (less than 100 m) in the Shumagin and Chirikof INPFC areas (Table 19). The Lower Alaska Peninsula stratum contained over one-third of the total estimated biomass despite making up just over 2% of the total survey area (Table 20). No Alaska plaice were recorded east of Cook Inlet.

Starry flounder (Platichthys stellatus)

Starry flounder were found almost exclusively in water depths less than 100 m (Table 21), especially in nearshore areas. The largest fish were found in the Kodiak area (Table 21). The highest mean CPUE was found in the Davidson Bank stratum where one tow accounted for nearly 47% of the total survey biomass estimate. Other relatively high CPUE areas included Lower Cook Inlet, the area around the Shumagin Islands (Shumagin Bank stratum), Yakutat Shallows and the shallow waters just to the south of the Alaska Peninsula (Table 22).

English sole (Parophrys vetulus)

Although CPUEs for English sole were low throughout the survey area, modest catches were recorded primarily in water less than 100 m in depth (Tables 23 and 24). About 58% of the total survey biomass estimate of English sole came from the nearshore areas in the Yakutat and Southeastern INPFC areas, and about 28% of the total came from one tow in the

Southeastern Shallows stratum. Catch rates were also relatively high in the nearshore areas around Kodiak Island. Fish size generally increased with depth.

Butter sole (Isopsetta isolepis)

Except for a few small catches in the Albatross Gullies and Shelikof Edge strata, all of the butter sole catches occurred in water less than 100 m deep (Tables 25 and 26). About 95% of the total biomass estimate came from water less than 100 m in the Shumagin, Chirikof and Kodiak INPFC areas (Table 26), with the Kodiak area accounting for over 48% of the total. About one-half of this estimate in the Kodiak area was attributable to one tow.

Table 19.-- Number of survey hauls, number of hauls with Alaska plaice, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	12	56	2,296	1.04	42.4
	101 - 200	60	0	---	---	---	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	12	35	2,296	1.04	42.4
Chirikof	1 - 100	69	14	61	1,592	1.31	44.5
	101 - 200	68	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	14	23	1,592	1.31	44.5
Kodiak	1 - 100	59	10	24	923	1.35	45.3
	101 - 200	109	2	3	114	1.25	45.2
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	12	10	1,037	1.34	45.3
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	0	---	---	---	---
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	0	---	---	---	---
All areas	1 - 100	270	36	37	4,811	1.17	43.5
	101 - 200	337	2	1	114	1.25	45.2
	201 - 300	139	0	---	---	---	---
	301 - 500	58	0	---	---	---	---
	All depths	804	38	15	4,925	1.17	43.5

All areas biomass, 95% confidence interval: 2,792 - 7,058 metric tons (t).

Table 20.--Catch per unit effort by stratum for Alaska plaice sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Shumagin	1-100	Lower Alaska Peninsula	26	9	243	1,674	214	3,133
Chirikof	1-100	Upper Alaska Peninsula	16	6	115	912	65	1,760
Kodiak	1-100	Albatross Shallows	24	6	100	576	11	1,141
Chirikof	1-100	Chirikof Bank	35	8	63	680	73	1,287
Kodiak	1-100	Northern Kodiak Shallows	6	2	47	103	0	282
Shumagin	1-100	Davidson Bank	25	1	38	520	0	1,594
Kodiak	1-100	Lower Cook Inlet	6	2	25	244	0	656
Kodiak	101-200	Barren Islands	15	2	10	114	0	280
Shumagin	1-100	Shumagin Bank	23	1	7	83	0	254
Shumagin	1-100	Fox Islands	28	1	2	19	0	57

Table 21.-- Number of survey hauls, number of hauls with starry flounder, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	22	393	16,179	1.74	49.2
	101 - 200	60	0	---	---	---	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	22	249	16,179	1.74	49.2
Chirikof	1 - 100	69	8	31	805	1.66	47.6
	101 - 200	68	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	8	12	805	1.66	47.6
Kodiak	1 - 100	59	9	229	8,827	2.32	53.8
	101 - 200	109	1	0	19	2.01	54.0
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	10	87	8,846	2.32	53.8
Yakutat	1 - 100	33	5	91	1,506	1.54	46.7
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	5	26	1,506	1.54	46.7
Southeastern	1 - 100	7	1	2	14	0.33	30.0
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	1	0	14	0.33	30.0
All areas	1 - 100	270	45	212	27,331	1.87	50.2
	101 - 200	337	1	0	19	2.01	54.0
	201 - 300	139	0	---	---	---	---
	301 - 500	58	0	---	---	---	---
	All depths	804	46	86	27,350	1.87	50.2

All areas biomass, 95% confidence interval: 0 - 58,166 metric tons (t).

Table 22.--Catch per unit effort by stratum for starry flounder sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Shumagin	1-100	Davidson Bank	25	1	933	12,767	0	39,118
Kodiak	1-100	Lower Cook Inlet	6	4	863	8,534	0	27,412
Shumagin	1-100	Shumagin Bank	23	4	182	2,262	0	4,956
Yakutat	1-100	Yakutat Shallows	22	5	151	1,506	0	3,067
Shumagin	1-100	Lower Alaska Peninsula	26	15	143	980	217	1,743
Chirikof	1-100	Upper Alaska Peninsula	16	5	86	684	0	1,509
Kodiak	1-100	Albatross Shallows	24	3	40	229	0	503
Kodiak	1-100	Northern Kodiak Shallows	6	2	29	64	0	172
Shumagin	1-100	Fox Islands	28	2	21	170	0	491
Chirikof	1-100	Chirikof Bank	35	3	11	121	0	265
Southeastern	1-100	Southeastern Shallows	7	1	2	14	0	47
Kodiak	101-200	Albatross Gullies	32	1	2	19	0	57

Table 23.-- Number of survey hauls, number of hauls with English sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	4	7	276	1.01	42.3
	101 - 200	60	2	1	18	1.16	48.6
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	6	5	294	1.02	42.7
Chirikof	1 - 100	69	2	4	96	0.91	42.6
	101 - 200	68	1	2	55	1.05	46.5
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	3	2	151	0.96	43.9
Kodiak	1 - 100	59	9	46	1,750	1.23	48.5
	101 - 200	109	2	1	40	1.76	63.0
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	11	18	1,790	1.24	48.8
Yakutat	1 - 100	33	14	101	1,676	0.46	35.2
	101 - 200	50	3	3	79	0.67	41.8
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	17	31	1,755	0.47	35.4
Southeastern	1 - 100	7	5	382	2,502	0.37	31.7
	101 - 200	50	5	27	308	0.63	39.8
	201 - 300	28	3	19	97	0.66	41.4
	301 - 500	12	0	---	---	---	---
	All depths	97	13	104	2,907	0.39	32.5
All areas	1 - 100	270	34	49	6,300	0.52	35.1
	101 - 200	337	13	4	500	0.71	41.6
	201 - 300	139	3	3	97	0.66	41.4
	301 - 500	58	0	---	---	---	---
	All depths	804	50	22	6,897	0.53	35.5

All areas biomass, 95% confidence interval: 2,106 - 11,688 metric tons (t).

Table 24.--Catch per unit effort by stratum for English sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	1-100	Southeastern Shallows	7	5	382	2,502	0	7,107
Kodiak	1-100	Northern Kodiak Shallows	6	3	270	593	0	1,738
Yakutat	1-100	Yakutat Shallows	22	11	151	1,503	123	2,883
Kodiak	1-100	Albatross Shallows	24	4	59	339	0	876
Kodiak	1-100	Albatross Banks	19	1	43	656	0	2,036
Southeastern	101-200	Prince of Wales Shelf	36	4	43	298	0	801
Yakutat	1-100	Middleton Shallows	11	3	26	173	0	397
Southeastern	201-300	Prince of Wales Slope/Gullies	23	3	25	97	0	270
Shumagin	1-100	Fox Islands	28	2	23	186	0	543
Kodiak	1-100	Lower Cook Inlet	6	1	16	162	0	578
Shumagin	1-100	Lower Alaska Peninsula	26	1	12	79	0	243
Chirikof	1-100	Upper Alaska Peninsula	16	1	11	89	0	278
Yakutat	101-200	Yakutat Flats	9	1	6	55	0	180
Chirikof	101-200	East Shumagin Gully	16	1	5	55	0	173
Kodiak	101-200	Albatross Gullies	32	2	5	40	0	101
Yakutat	101-200	Middleton Shelf	23	2	3	24	0	58
Shumagin	101-200	Shumagin Outer Shelf	41	2	2	18	0	44
Southeastern	101-200	Baranof-Chichagof Shelf	14	1	2	10	0	32
Shumagin	1-100	Shumagin Bank	23	1	1	11	0	34
Chirikof	1-100	Chirikof Bank	35	1	1	7	0	20

Table 25.-- Number of survey hauls, number of hauls with butter sole, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	16	152	6,265	0.45	33.8
	101 - 200	60	0	---	---	---	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	16	96	6,265	0.45	33.8
Chirikof	1 - 100	69	14	134	3,491	0.44	33.8
	101 - 200	68	2	11	270	0.31	30.3
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	16	55	3,761	0.42	33.5
Kodiak	1 - 100	59	19	264	10,175	0.32	30.4
	101 - 200	109	5	17	736	0.36	32.9
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	24	107	10,911	0.32	30.6
Yakutat	1 - 100	33	7	6	104	0.34	31.7
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	7	2	104	0.34	31.7
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	0	---	---	---	---
All areas	1 - 100	270	56	155	20,035	0.37	31.8
	101 - 200	337	7	8	1,006	0.35	32.1
	201 - 300	139	0	---	---	---	---
	301 - 500	58	0	---	---	---	---
	All depths	804	63	66	21,041	0.37	31.8

All areas biomass, 95% confidence interval: 29,186 - 67,154 metric tons (t).

Table 26.--Catch per unit effort by stratum for butter sole sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	1-100	Lower Cook Inlet	6	5	748	7,399	0	19,425
Kodiak	1-100	Albatross Shallows	24	10	393	2,266	57	4,476
Shumagin	1-100	Shumagin Bank	23	7	266	3,297	0	7,242
Chirikof	1-100	Upper Alaska Peninsula	16	5	263	2,089	0	6,085
Shumagin	1-100	Lower Alaska Peninsula	26	6	215	1,481	0	3,730
Chirikof	1-100	Chirikof Bank	35	9	130	1,402	10	2,794
Shumagin	1-100	Davidson Bank	25	2	104	1,428	0	4,034
Kodiak	101-200	Albatross Gullies	32	5	93	736	0	2,019
Chirikof	101-200	Shelikof Edge	28	2	35	270	0	817
Kodiak	1-100	Albatross Banks	19	3	32	499	0	1,479
Yakutat	1-100	Yakutat Shallows	22	7	10	104	0	213
Shumagin	1-100	Fox Islands	28	1	7	59	0	180
Kodiak	1-100	Northern Kodiak Shallows	6	1	5	11	0	38

Walleye pollock (Theragra chalcogramma)

Walleye pollock was the third most abundant species encountered during the survey (Table 2). Pollock were found throughout the survey area (Table 27) and were captured in all 49 strata (Fig. 25; Table 28). Pollock were caught in 83% of all tows during the survey (Table 27). The highest CPUEs of the survey were seen on the eastern edge of Lower Shelikof Gully and in Albatross Gullies to the south and east of Kodiak Island. Three strata (Chirikof Bank, Albatross Gullies and Shelikof Edge) accounted for about 45% of the total survey area biomass estimate, although they represent less than 9% of the total area. Catches were most consistent in the 201-300 m range where pollock were caught in 94% of the tows, although rarely in large numbers (Table 27). Definite modes of larger (ages 6 - 8) and smaller fish (ages 1 - 2) were present in all depths in the western and central GOA, while the larger fish were generally absent in the eastern GOA in water less than 200 m deep. Length modes representing age-1 (10-21 cm FL) and age-2 (22-30 cm FL) fish were apparent in several area-depths (Fig. 26). The length-weight relationship for walleye pollock specimens collected during the survey is depicted in Figure 27.

Table 27.-- Number of survey hauls, number of hauls with walleye pollock, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	82	2,856	117,532	0.47	32.5
	101 - 200	60	55	2,852	41,856	1.00	50.7
	201 - 300	22	22	845	2,357	0.54	36.6
	301 - 500	16	11	119	300	0.89	49.9
	All depths	200	170	2,489	162,045	0.54	35.1
Chirikof	1 - 100	69	52	6,288	163,714	0.92	45.5
	101 - 200	68	61	4,221	100,675	0.85	45.2
	201 - 300	31	29	809	9,338	0.25	27.4
	301 - 500	13	12	169	271	0.21	26.2
	All depths	181	154	4,026	273,998	0.82	43.3
Kodiak	1 - 100	59	44	1,876	72,279	0.93	42.8
	101 - 200	109	89	3,018	130,763	0.89	43.7
	201 - 300	31	30	724	8,325	0.51	33.9
	301 - 500	11	8	277	805	1.08	52.6
	All depths	210	171	2,090	212,172	0.88	42.8
Yakutat	1 - 100	33	29	389	6,428	0.05	17.4
	101 - 200	50	45	294	8,648	0.11	20.9
	201 - 300	27	25	757	3,913	0.42	35.6
	301 - 500	6	4	228	598	0.53	37.7
	All depths	116	103	343	19,587	0.09	19.6
Southeastern	1 - 100	7	3	3,848	25,193	0.15	25.5
	101 - 200	50	37	793	8,787	0.12	23.2
	201 - 300	28	24	1,095	5,531	0.69	43.5
	301 - 500	12	3	39	121	0.91	47.8
	All depths	97	67	1,413	39,632	0.16	25.4
All areas	1 - 100	270	210	2,991	385,146	0.48	32.6
	101 - 200	337	287	2,377	290,729	0.64	37.6
	201 - 300	139	130	817	29,464	0.39	32.0
	301 - 500	58	38	164	2,095	0.57	38.1
	All depths	804	665	2,213	707,434	0.53	34.3

All areas biomass, 95% confidence interval: 509,934 - 904,934 metric tons (t).

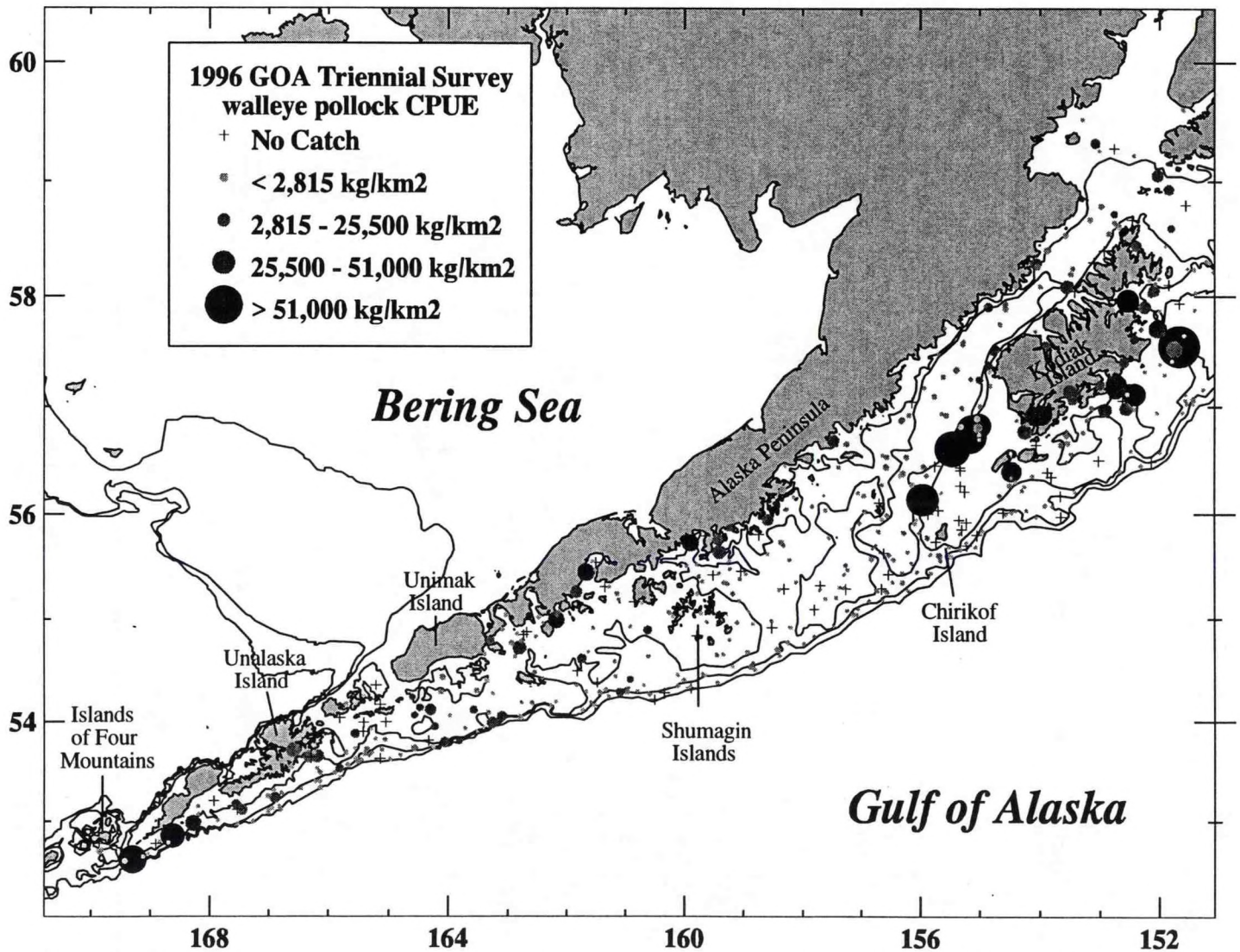


Figure 25.--Distribution and relative abundance of walleye pollock from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

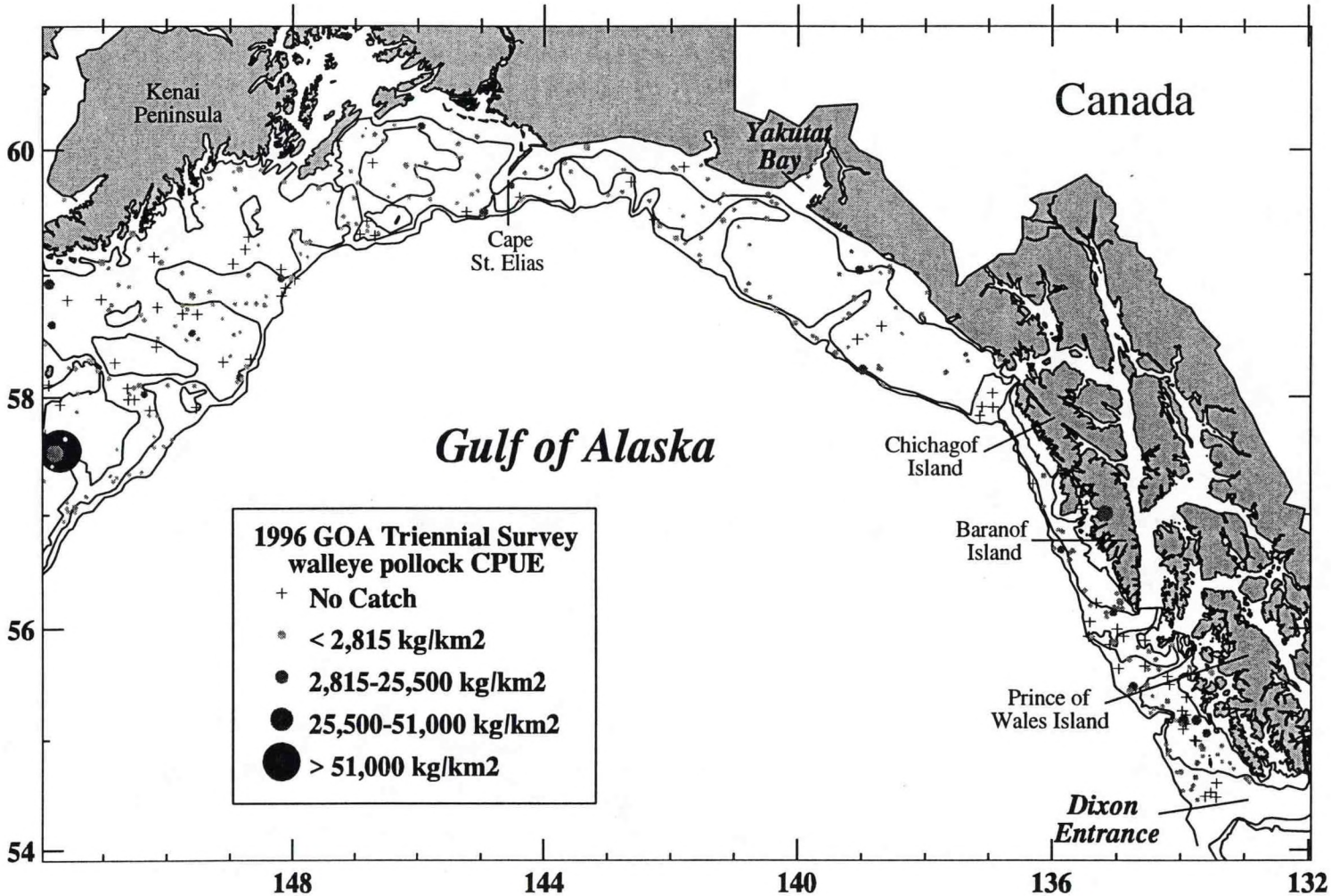


Figure 25.--Continued.

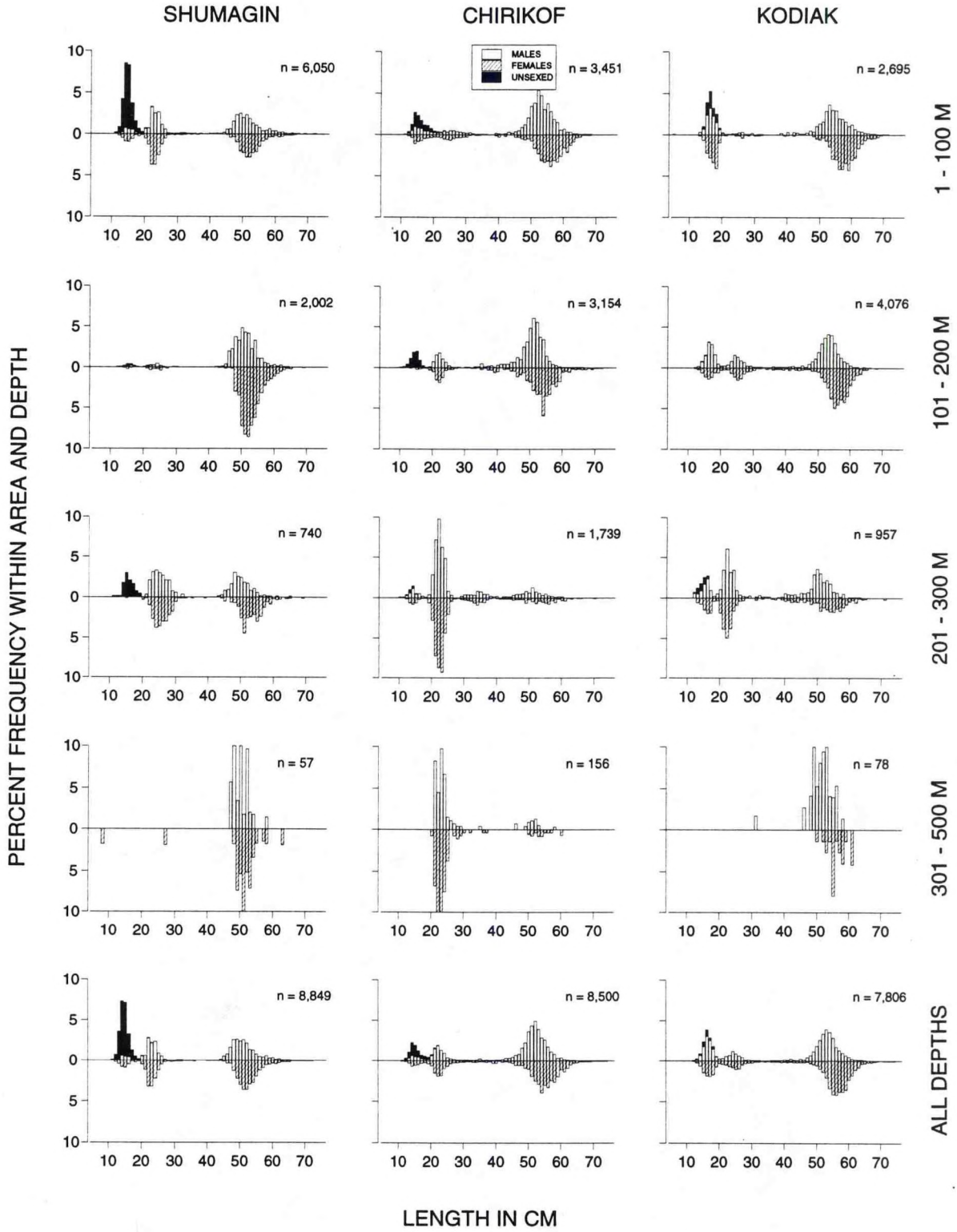


Figure 26.--Size composition of the estimated walleye pollock population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

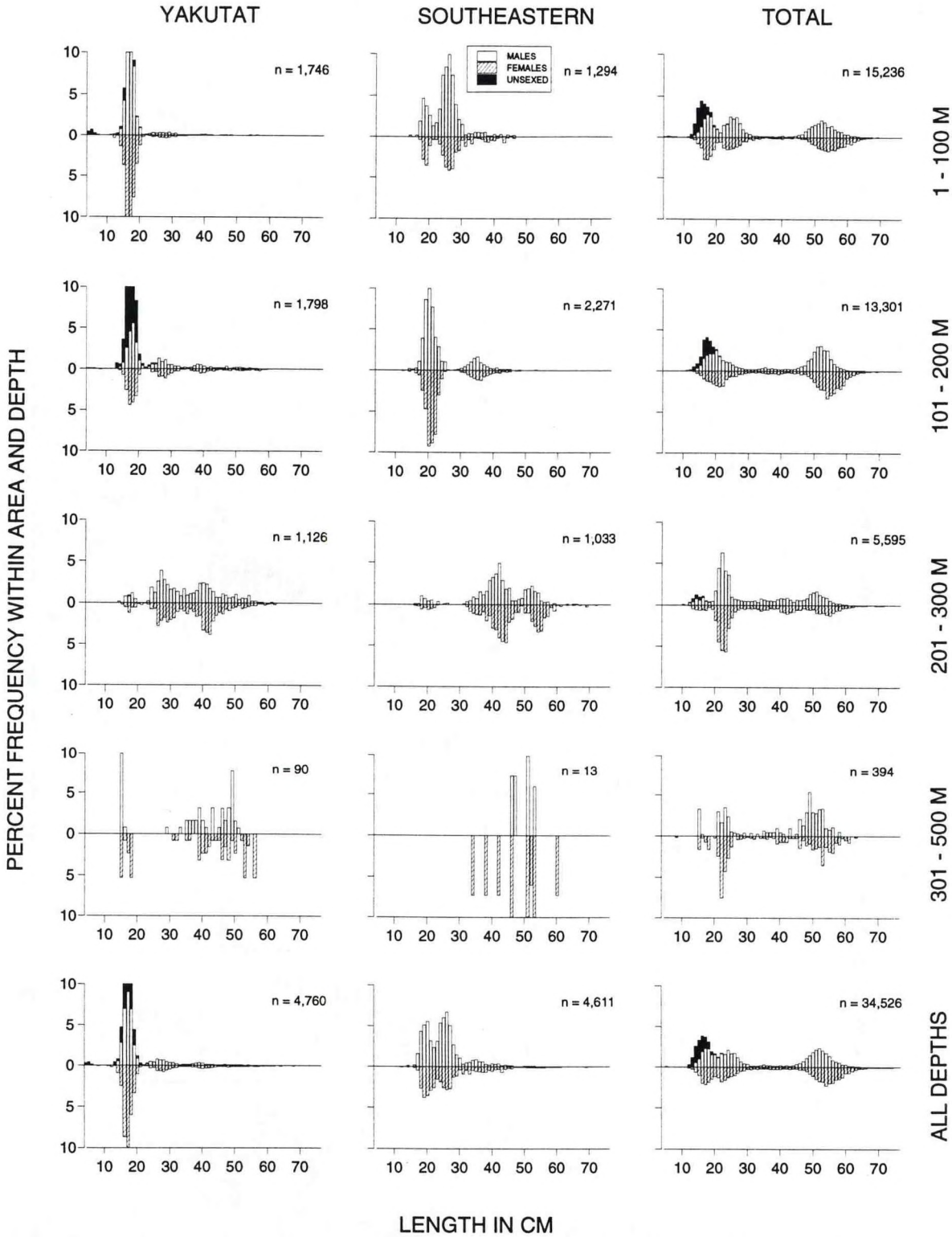


Figure 26.--Continued.

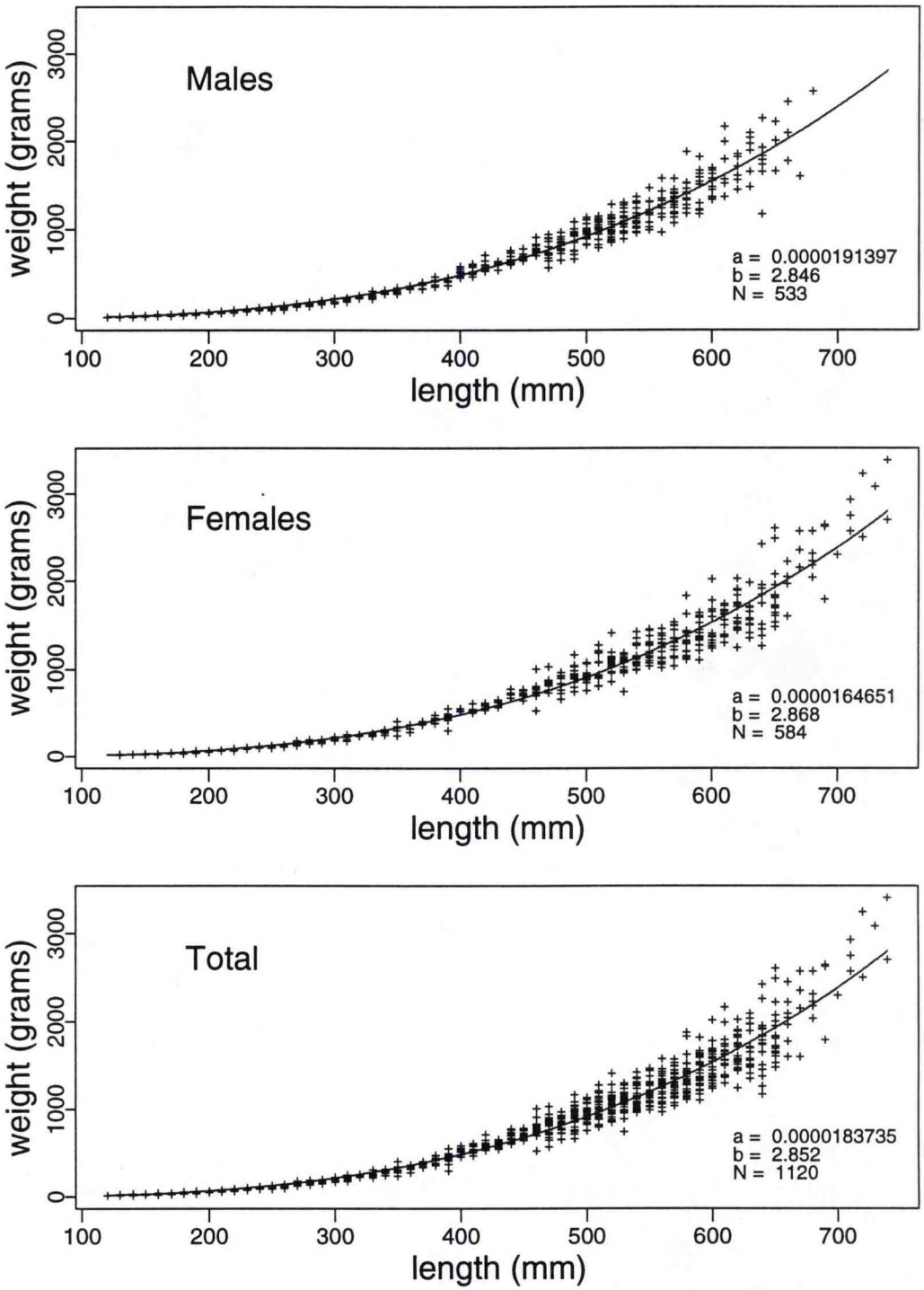


Figure 27.--Length-weight relationship for walleye pollock specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $\text{Weight}_{(grams)} = a * \text{Length}_{(mm)}^{b}$.

Table 28.--Catch per unit effort by stratum for walleye pollock sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	1-100	Chirikof Bank	35	24	12,795	138,090	30,564	245,615
Kodiak	101-200	Albatross Gullies	32	27	11,952	94,565	0	193,636
Chirikof	101-200	Shelikof Edge	28	25	10,876	84,125	0	183,590
Kodiak	1-100	Albatross Shallows	24	22	8,686	50,088	11,691	88,486
Shumagin	1-100	Fox Islands	28	17	5,755	47,148	3,963	90,333
Shumagin	1-100	Lower Alaska Peninsula	26	21	4,751	32,667	6,892	58,442
Southeastern	1-100	Southeastern Shallows	7	3	3,848	25,193	0	77,931
Shumagin	101-200	Shumagin Outer Shelf	41	39	3,366	27,442	0	61,963
Chirikof	1-100	Upper Alaska Peninsula	16	14	3,040	24,146	2,714	45,578
Kodiak	101-200	Barren Islands	15	13	2,752	30,225	7,840	52,609
Shumagin	101-200	West Shumagin Gully	13	11	2,589	5,898	0	17,769
Shumagin	1-100	Davidson Bank	25	24	2,402	32,866	11,433	54,299
Shumagin	101-200	Sanak Gully	6	5	2,005	8,516	0	22,434
Southeastern	201-300	Baranof-Chichagof Slope	5	5	1,792	2,016	0	4,405
Kodiak	1-100	Lower Cook Inlet	6	5	1,371	13,557	0	46,654
Chirikof	101-200	East Shumagin Gully	16	14	1,367	15,176	0	42,955
Kodiak	201-300	Kodiak Slope	5	4	1,346	2,184	0	5,716
Yakutat	201-300	Yakutat Slope	16	15	1,301	2,769	121	5,417
Kodiak	1-100	Northern Kodiak Shallows	6	3	1,282	2,821	0	8,105
Southeastern	101-200	Prince of Wales Shelf	36	24	944	6,504	802	12,207
Southeastern	201-300	Prince of Wales Slope/Gullies	23	19	895	3,515	827	6,204
Chirikof	201-300	Lower Shelikof Gully	22	21	865	8,663	4,833	12,493
Shumagin	201-300	Shumagin Slope	22	22	845	2,357	884	3,830
Kodiak	1-100	Kenai Peninsula	4	3	832	4,375	0	14,311
Kodiak	201-300	Upper Shelikof Gully	6	6	710	2,279	1,254	3,304
Kodiak	201-300	Kenai Gullies	20	20	580	3,862	1,011	6,712
Southeastern	101-200	Baranof-Chichagof Shelf	14	13	544	2,283	701	3,865
Yakutat	1-100	Yakutat Shallows	22	19	484	4,817	0	10,047
Chirikof	201-300	Chirikof Slope	9	8	442	675	0	1,474
Yakutat	101-200	Middleton Shelf	23	19	441	3,238	452	6,024
Shumagin	1-100	Shumagin Bank	23	20	391	4,851	0	11,291
Yakutat	201-300	Yakutat Gullies	11	10	376	1,144	557	1,730
Yakutat	301-500	Yakutat Gullies	5	3	376	416	0	1,382
Yakutat	101-200	Yakutat Flats	9	9	335	3,023	5	6,041
Kodiak	101-200	Kenai Flats	17	13	302	3,650	465	6,835
Kodiak	301-500	Kodiak Slope	11	8	277	805	0	2,141
Chirikof	101-200	Chirikof Outer Shelf	24	22	274	1,374	133	2,616
Kodiak	101-200	Portlock Flats	21	17	256	1,875	0	4,015
Yakutat	1-100	Middleton Shallows	11	10	245	1,611	0	3,551
Yakutat	101-200	Fairweather Shelf	10	10	244	1,889	0	3,795
Chirikof	1-100	Semidi Bank	18	14	202	1,478	284	2,673
Chirikof	301-500	Chirikof Slope	13	12	169	271	64	477
Yakutat	301-500	Yakutat Slope	1	1	120	182		
Shumagin	301-500	Shumagin Slope	16	11	119	300	62	538
Yakutat	101-200	Yakataga Shelf	8	7	94	498	0	1,008
Kodiak	1-100	Albatross Banks	19	11	93	1,438	0	3,690
Kodiak	101-200	Kodiak Outer Shelf	24	19	89	448	0	996
Southeastern	301-500	Southeastern Deep Gullies	8	2	45	105	0	271
Southeastern	301-500	Southeastern Slope	4	1	20	16	0	65

Pacific cod (Gadus macrocephalus)

Pacific cod were ubiquitous in the central and western Gulf of Alaska in water shallower than 200 m (Table 29; Fig. 28). About 85% of all tows in this area contained cod and over 95% of the total biomass came from this area. The two strata with the highest CPUEs (Albatross Banks and Shumagin Bank, Table 30) were strongly influenced by individual tows which together accounted for about 27% of the total biomass estimate. The mean length and weight of cod increased with depth, primarily because small cod (< 30 cm FL) were found almost exclusively in the shallower depths (Fig. 29). The length-weight relationship Pacific cod for specimens collected during the survey is depicted in Figure 30.

Table 29.-- Number of survey hauls, number of hauls with Pacific cod, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	95	3,789	155,917	1.85	52.2
	101 - 200	60	54	2,064	30,300	2.73	60.6
	201 - 300	22	16	554	1,545	3.34	63.6
	301 - 500	16	2	10	24	2.22	63.4
	All depths	200	167	2,885	187,786	1.96	53.3
Chirikof	1 - 100	69	56	1,989	51,781	2.09	53.2
	101 - 200	68	56	3,077	73,389	3.06	63.7
	201 - 300	31	19	782	9,031	3.30	65.9
	301 - 500	13	0	---	---	---	---
	All depths	181	131	1,972	134,201	2.61	58.8
Kodiak	1 - 100	59	49	3,732	143,748	1.07	36.5
	101 - 200	109	86	1,318	57,111	2.01	54.0
	201 - 300	31	11	243	2,797	3.31	65.7
	301 - 500	11	0	---	---	---	---
	All depths	210	146	2,006	203,656	1.25	39.7
Yakutat	1 - 100	33	13	126	2,084	3.45	65.3
	101 - 200	50	10	41	1,214	3.65	66.7
	201 - 300	27	8	43	224	3.82	70.7
	301 - 500	6	0	---	---	---	---
	All depths	116	31	62	3,522	3.54	66.1
Southeastern	1 - 100	7	4	220	1,439	2.34	50.8
	101 - 200	50	34	415	4,602	1.72	51.5
	201 - 300	28	21	206	1,043	2.47	61.0
	301 - 500	12	0	---	---	---	---
	All depths	97	59	253	7,084	1.91	52.5
All areas	1 - 100	270	217	2,757	354,969	1.45	43.7
	101 - 200	337	240	1,362	166,616	2.51	58.6
	201 - 300	139	75	406	14,640	3.24	65.3
	301 - 500	58	2	2	24	2.22	63.4
	All depths	804	534	1,677	536,249	1.70	47.2

All areas biomass, 95% confidence interval: 315,959 - 756,539 metric tons (t).

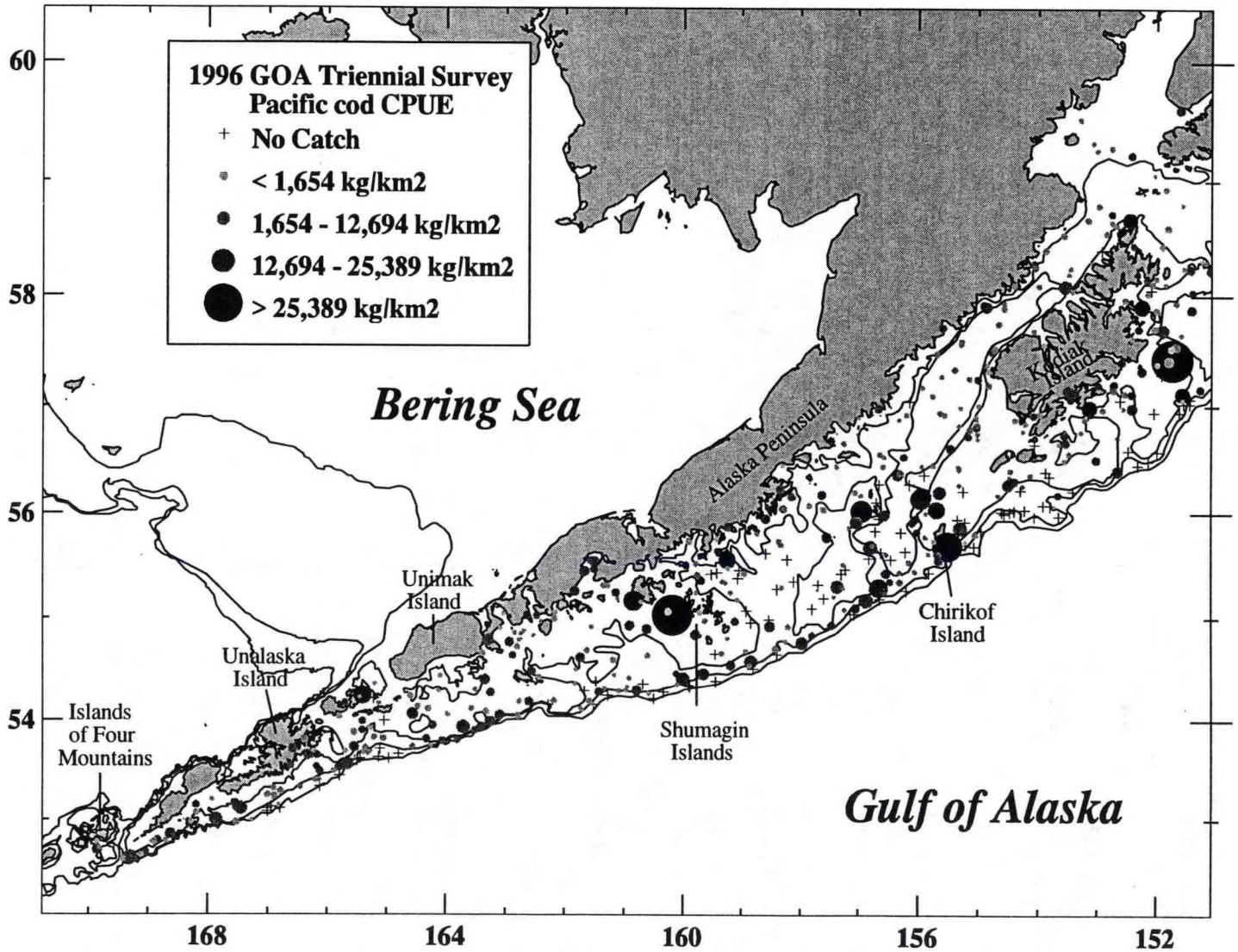
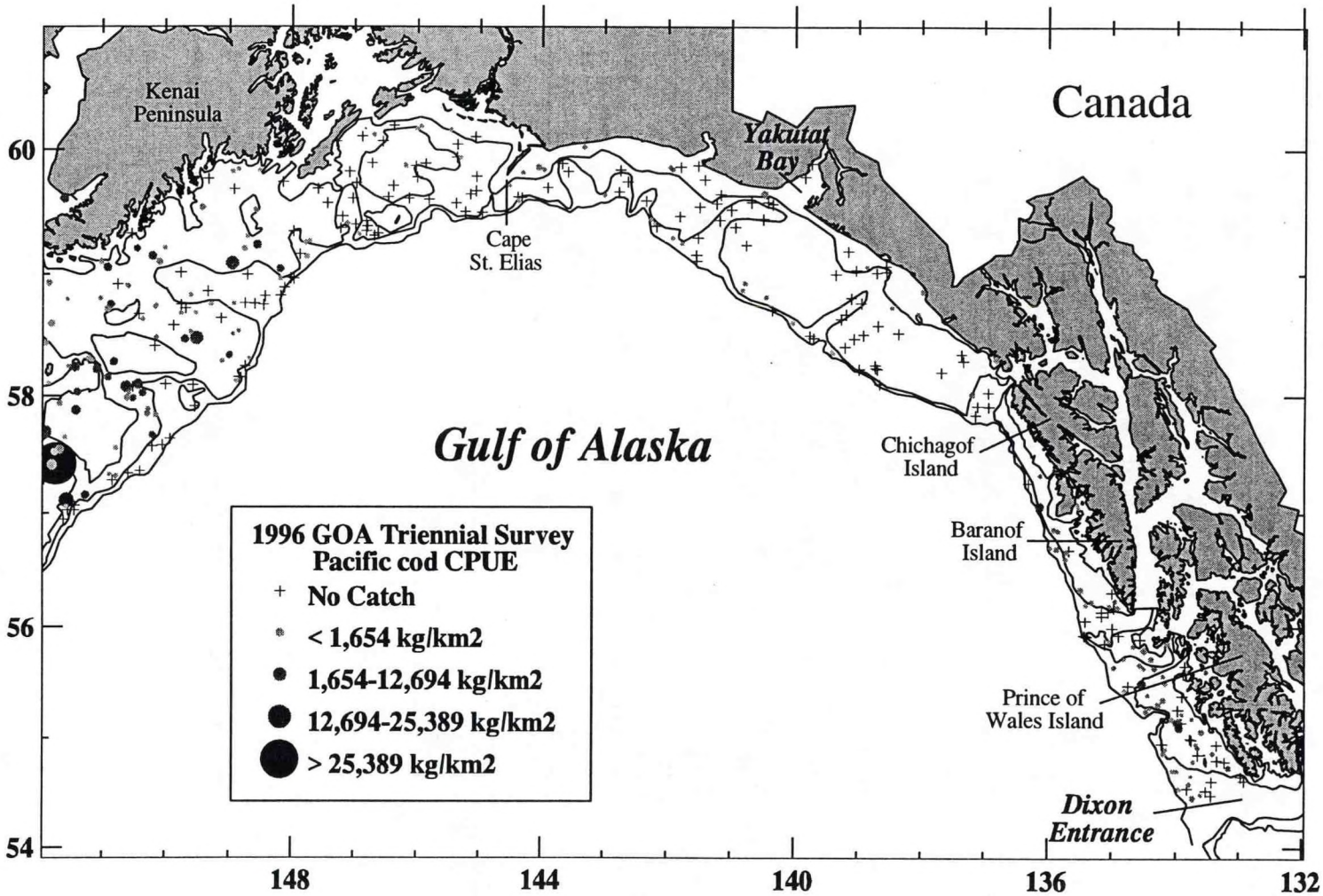


Figure 28.--Distribution and relative abundance of Pacific cod from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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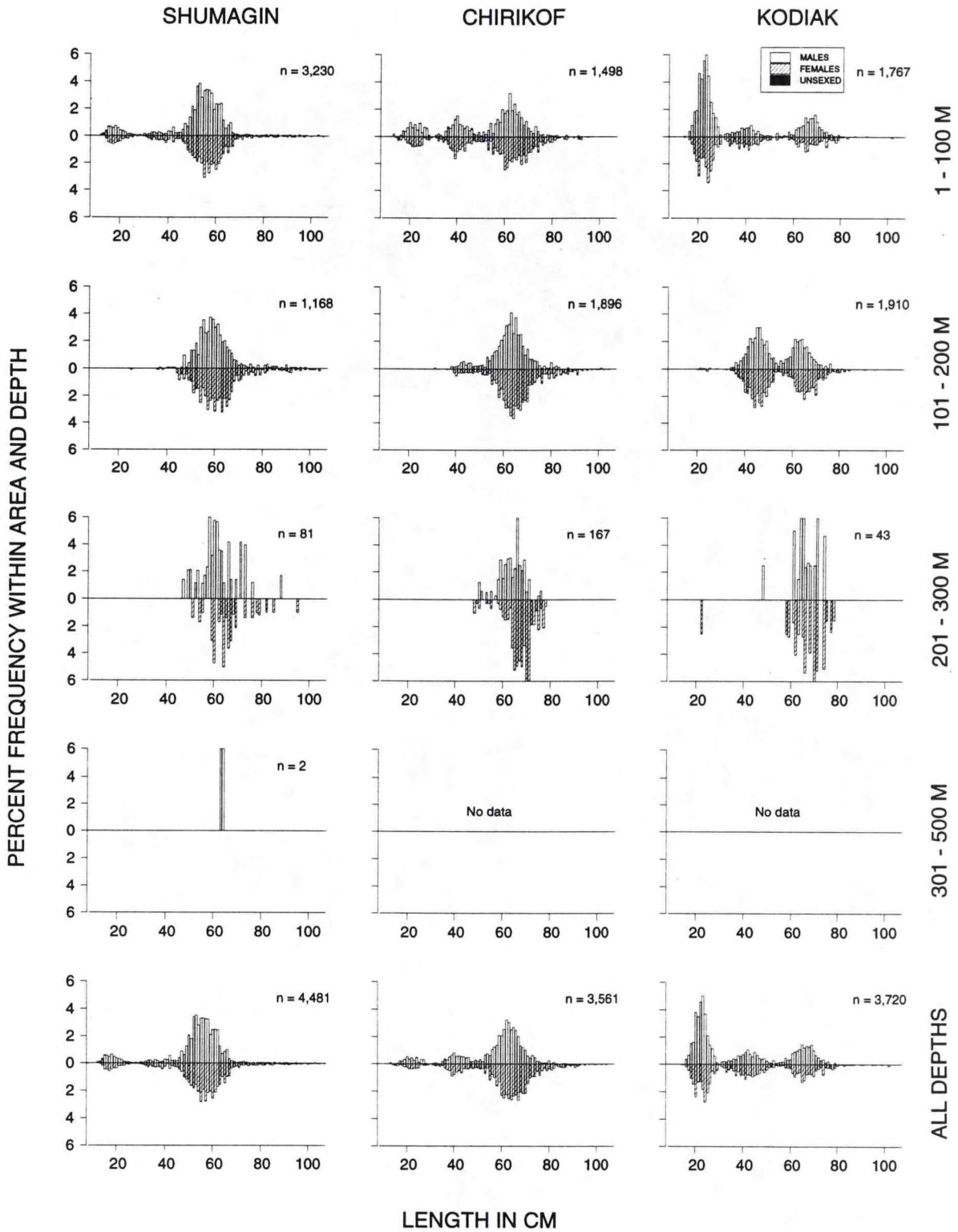


Figure 29.--Size composition of the estimated Pacific cod population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

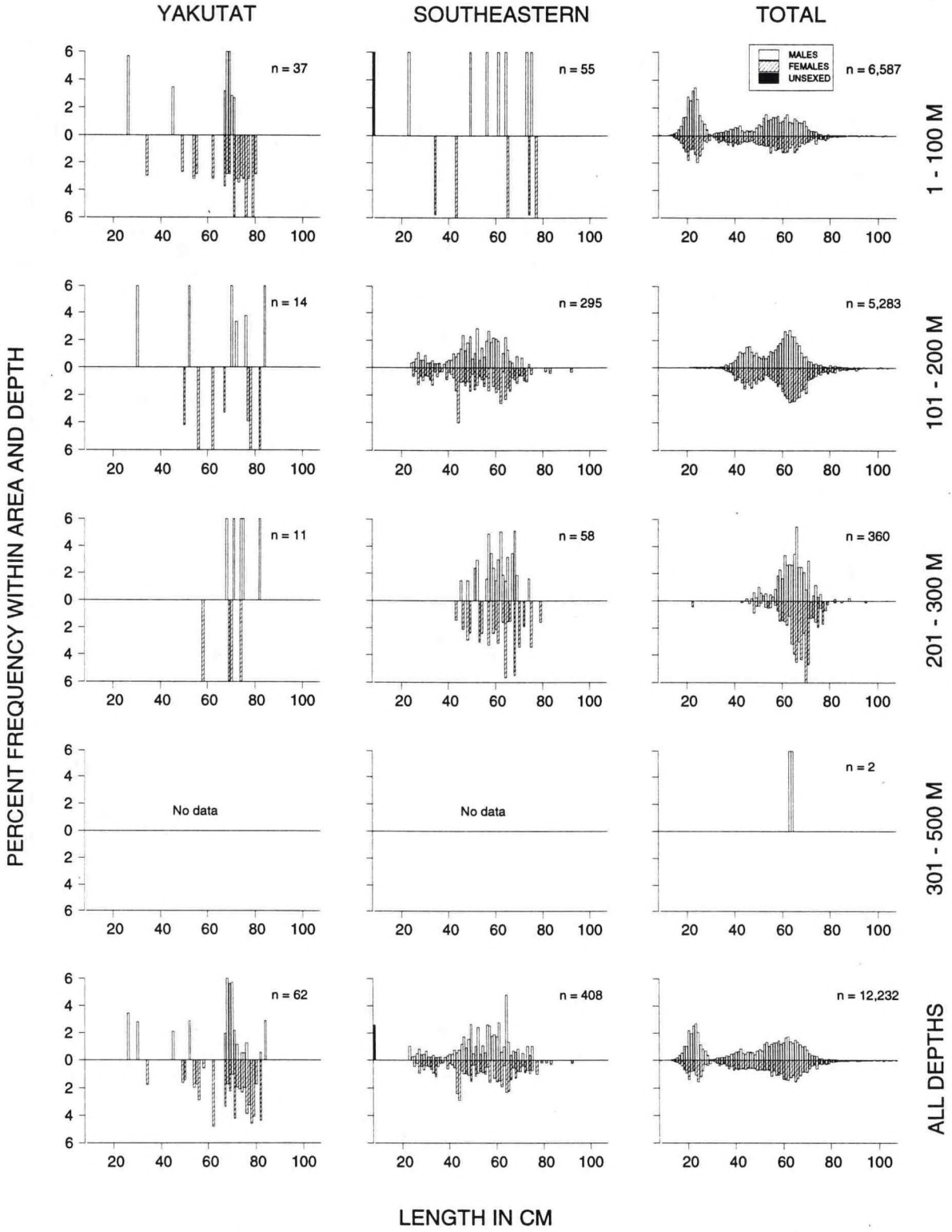


Figure 29.--Continued.

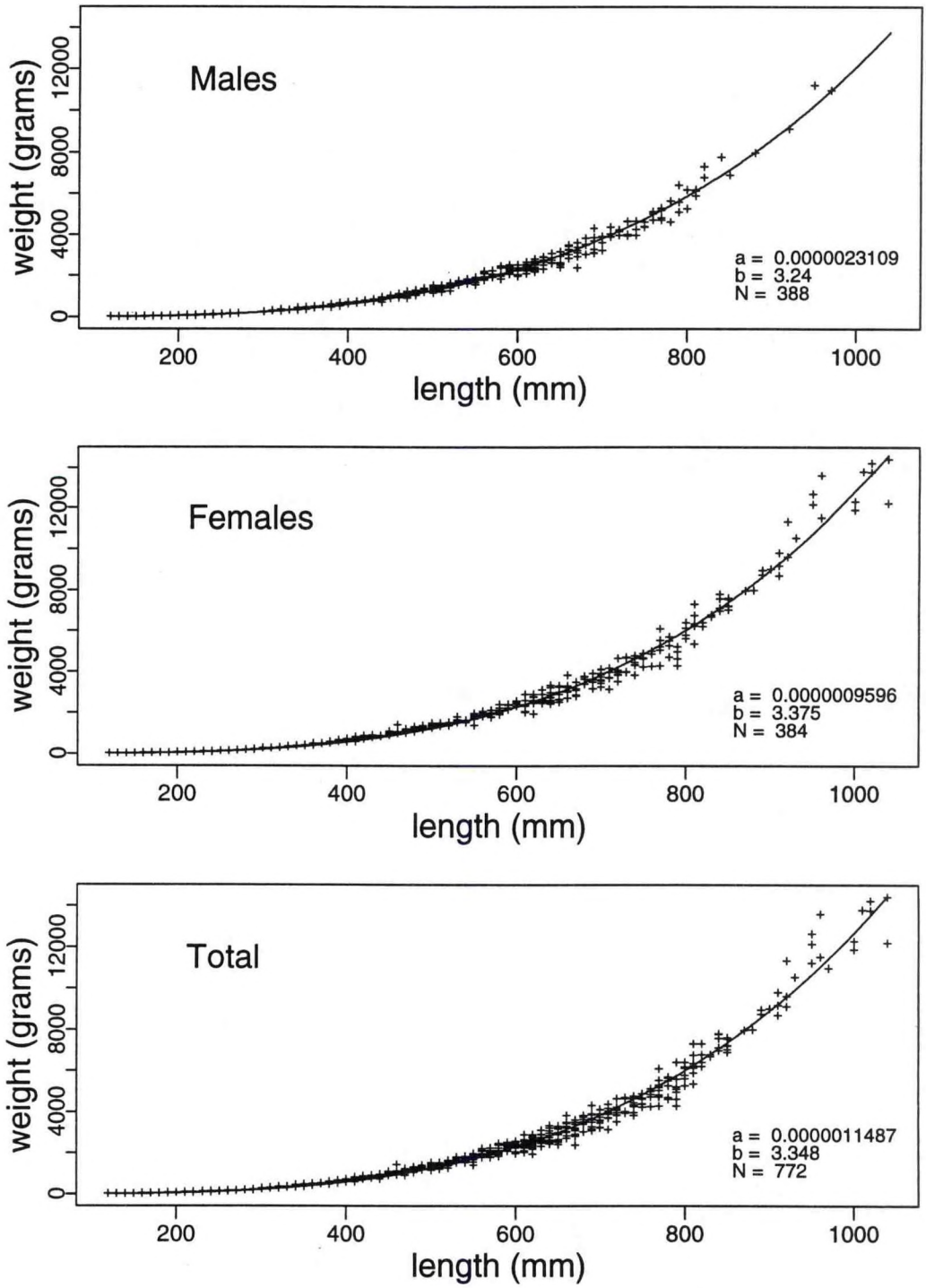


Figure 30.--Length-weight relationship for Pacific cod specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 30.--Catch per unit effort by stratum for Pacific cod sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	1-100	Albatross Banks	19	14	7,425	114,381	0	298,463
Shumagin	1-100	Shumagin Bank	23	19	6,782	84,095	0	200,562
Chirikof	101-200	Chirikof Outer Shelf	24	20	5,360	26,859	1,813	51,905
Chirikof	101-200	Shelikof Edge	28	25	4,024	31,123	12,288	49,958
Shumagin	101-200	Shumagin Outer Shelf	41	39	2,783	22,686	14,328	31,045
Kodiak	1-100	Albatross Shallows	24	23	2,562	14,772	5,810	23,734
Shumagin	1-100	Davidson Bank	25	25	2,522	34,509	19,678	49,340
Shumagin	1-100	Fox Islands	28	26	2,482	20,330	7,751	32,909
Shumagin	1-100	Lower Alaska Peninsula	26	25	2,470	16,983	6,172	27,793
Chirikof	1-100	Semidi Bank	18	11	2,365	17,270	0	43,575
Kodiak	101-200	Albatross Gullies	32	29	2,224	17,594	9,071	26,118
Chirikof	1-100	Chirikof Bank	35	30	1,895	20,451	6,434	34,468
Chirikof	1-100	Upper Alaska Peninsula	16	15	1,771	14,060	8,186	19,934
Shumagin	101-200	Sanak Gully	6	6	1,480	6,287	0	14,406
Kodiak	101-200	Kenai Flats	17	13	1,458	17,614	2,084	33,145
Chirikof	101-200	East Shumagin Gully	16	11	1,387	15,407	3,924	26,891
Kodiak	1-100	Lower Cook Inlet	6	6	1,349	13,336	0	27,743
Kodiak	101-200	Kodiak Outer Shelf	24	13	1,199	6,027	0	12,080
Kodiak	101-200	Portlock Flats	21	16	957	7,024	20	14,027
Chirikof	201-300	Lower Shelikof Gully	22	16	829	8,306	1,709	14,902
Kodiak	101-200	Barren Islands	15	15	806	8,852	5,267	12,437
Kodiak	201-300	Upper Shelikof Gully	6	6	742	2,382	1,438	3,325
Shumagin	101-200	West Shumagin Gully	13	9	582	1,327	170	2,483
Shumagin	201-300	Shumagin Slope	22	16	554	1,545	108	2,982
Chirikof	201-300	Chirikof Slope	9	3	474	725	0	2,160
Southeastern	101-200	Baranof-Chichagof Shelf	14	11	438	1,837	5	3,670
Southeastern	101-200	Prince of Wales Shelf	36	23	401	2,765	871	4,660
Southeastern	1-100	Southeastern Shallows	7	4	220	1,439	0	4,429
Southeastern	201-300	Prince of Wales Slope/Gullies	23	18	220	865	426	1,305
Kodiak	1-100	Northern Kodiak Shallows	6	5	210	461	0	978
Yakutat	1-100	Yakutat Shallows	22	10	177	1,761	119	3,402
Southeastern	201-300	Baranof-Chichagof Slope	5	3	158	178	0	466
Kodiak	1-100	Kenai Peninsula	4	1	152	798	0	3,339
Yakutat	201-300	Yakutat Slope	16	8	105	224	75	373
Yakutat	101-200	Yakutat Flats	9	3	68	611	0	1,342
Kodiak	201-300	Kenai Gullies	20	5	62	415	0	845
Yakutat	101-200	Fairweather Shelf	10	2	51	394	0	1,267
Yakutat	1-100	Middleton Shallows	11	3	49	323	0	748
Yakutat	101-200	Middleton Shelf	23	5	28	209	24	395
Shumagin	301-500	Shumagin Slope	16	2	10	24	0	59

Atka mackerel (Pleurogrammus monopterygius)

Approximately 99% of the total Gulf of Alaska biomass estimate came from a single tow in the Davidson Bank stratum (Fig. 31). Catch rates were quite low everywhere else in the survey area (Tables 31 and 32). No Atka mackerel were caught east of 148°W. Most of the Atka mackerel captured were between 40 and 53 cm FL (Fig. 32). The length-weight relationship for Atka mackerel specimens collected during the survey is depicted in Figure 33.

Table 31.-- Number of survey hauls, number of hauls with Atka mackerel, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	11	8,376	344,677	1.47	46.4
	101 - 200	60	12	21	305	1.13	43.9
	201 - 300	22	2	3	9	1.16	45.7
	301 - 500	16	0	---	---	---	---
	All depths	200	25	5,300	344,991	1.47	46.4
Chirikof	1 - 100	69	3	3	80	1.61	49.4
	101 - 200	68	16	29	705	1.45	47.5
	201 - 300	31	6	14	154	1.46	47.3
	301 - 500	13	0	---	---	---	---
	All depths	181	25	14	939	1.46	47.7
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	2	1	43	1.66	47.1
	201 - 300	31	1	2	17	1.21	47.0
	301 - 500	11	0	---	---	---	---
	All depths	210	3	1	60	1.50	47.1
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	0	---	---	---	---
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	0	---	---	---	---
All areas	1 - 100	270	14	2,677	344,757	1.47	46.4
	101 - 200	337	30	9	1,053	1.35	46.3
	201 - 300	139	9	5	180	1.41	47.2
	301 - 500	58	0	---	---	---	---
	All depths	804	53	1,082	345,990	1.47	46.4

All areas biomass, 95% confidence interval: 0 - 1,051,540 metric tons (t).

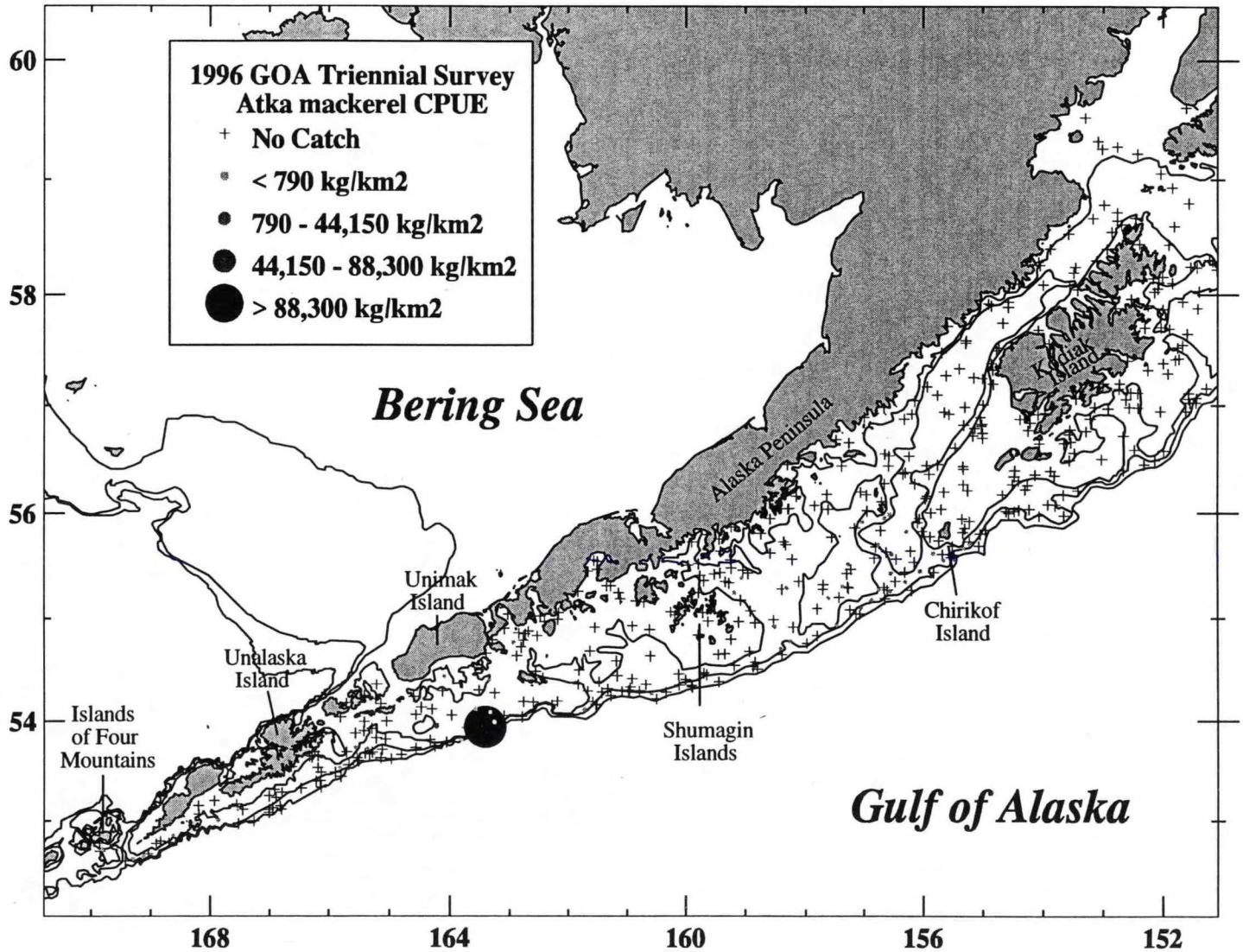
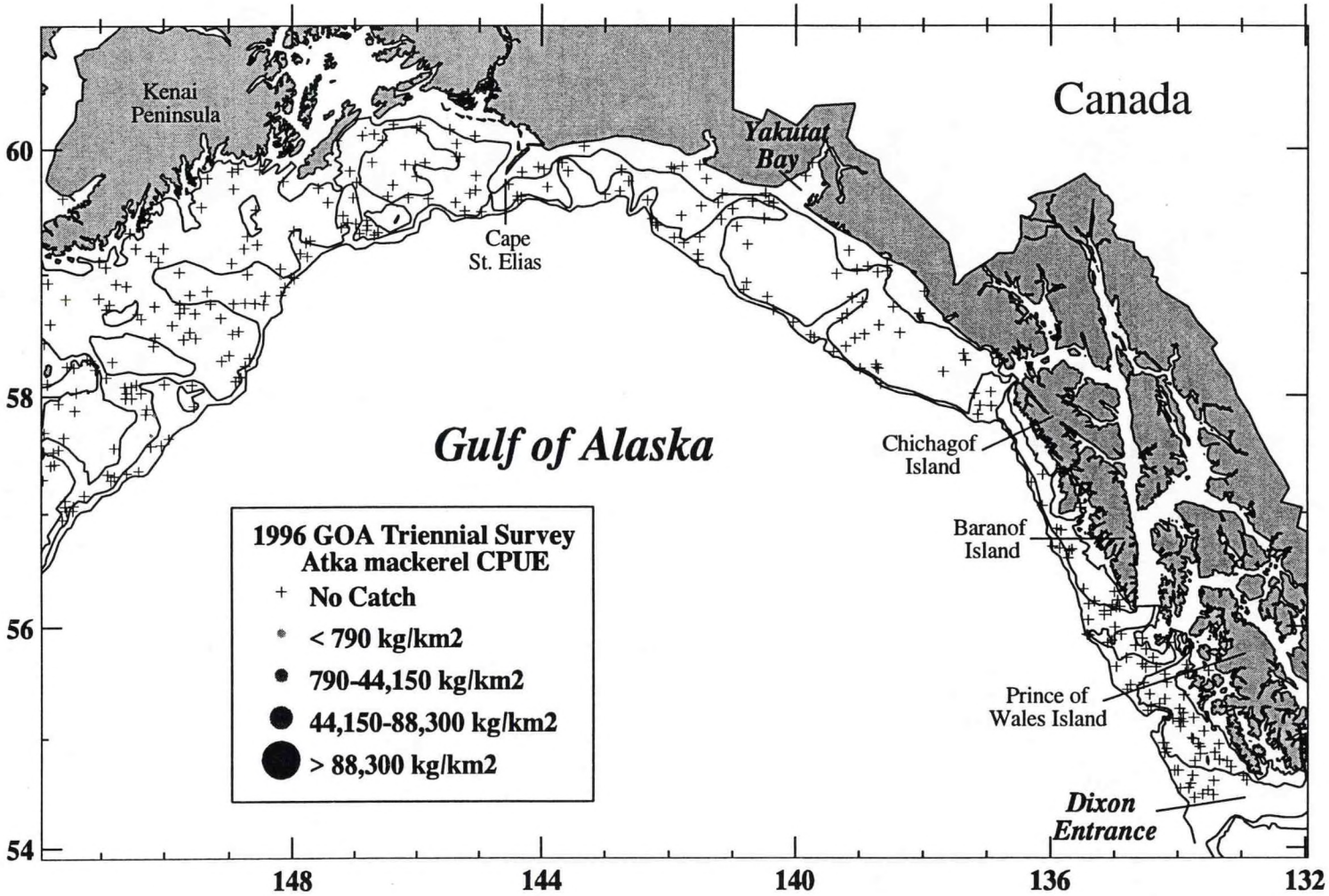


Figure 31.--Distribution and relative abundance of Atka mackerel from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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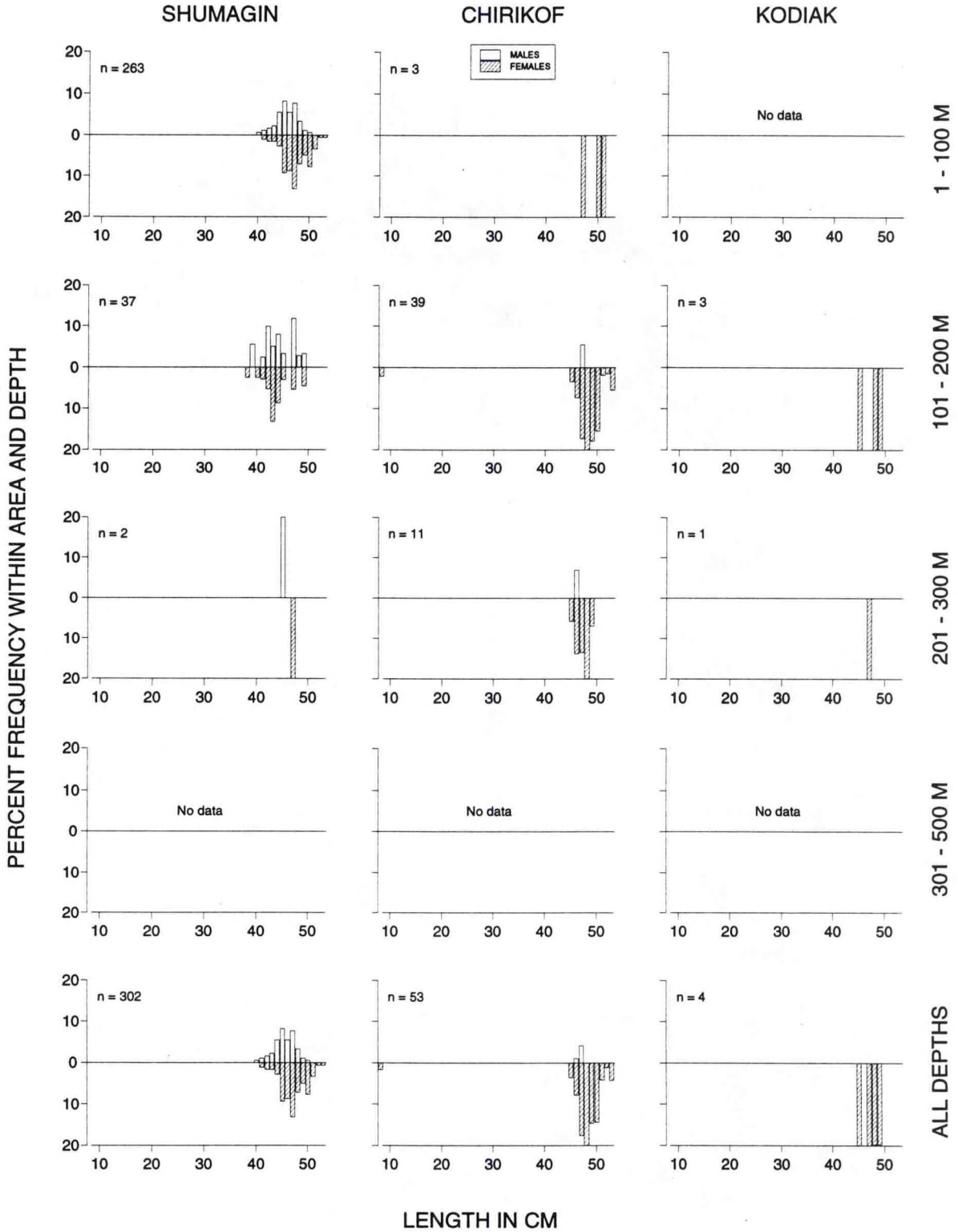
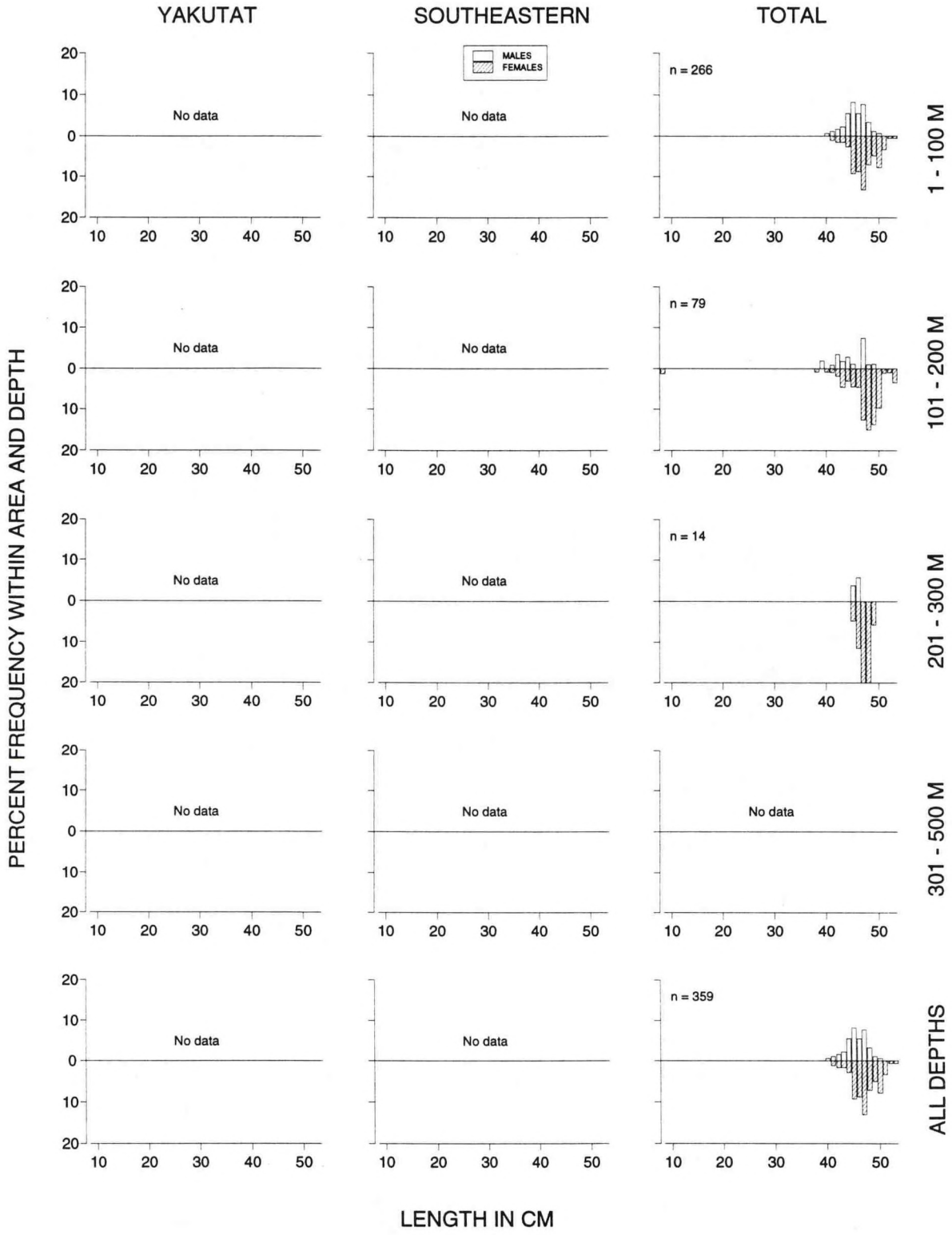


Figure 32.--Size composition of the estimated Atka mackerel population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.



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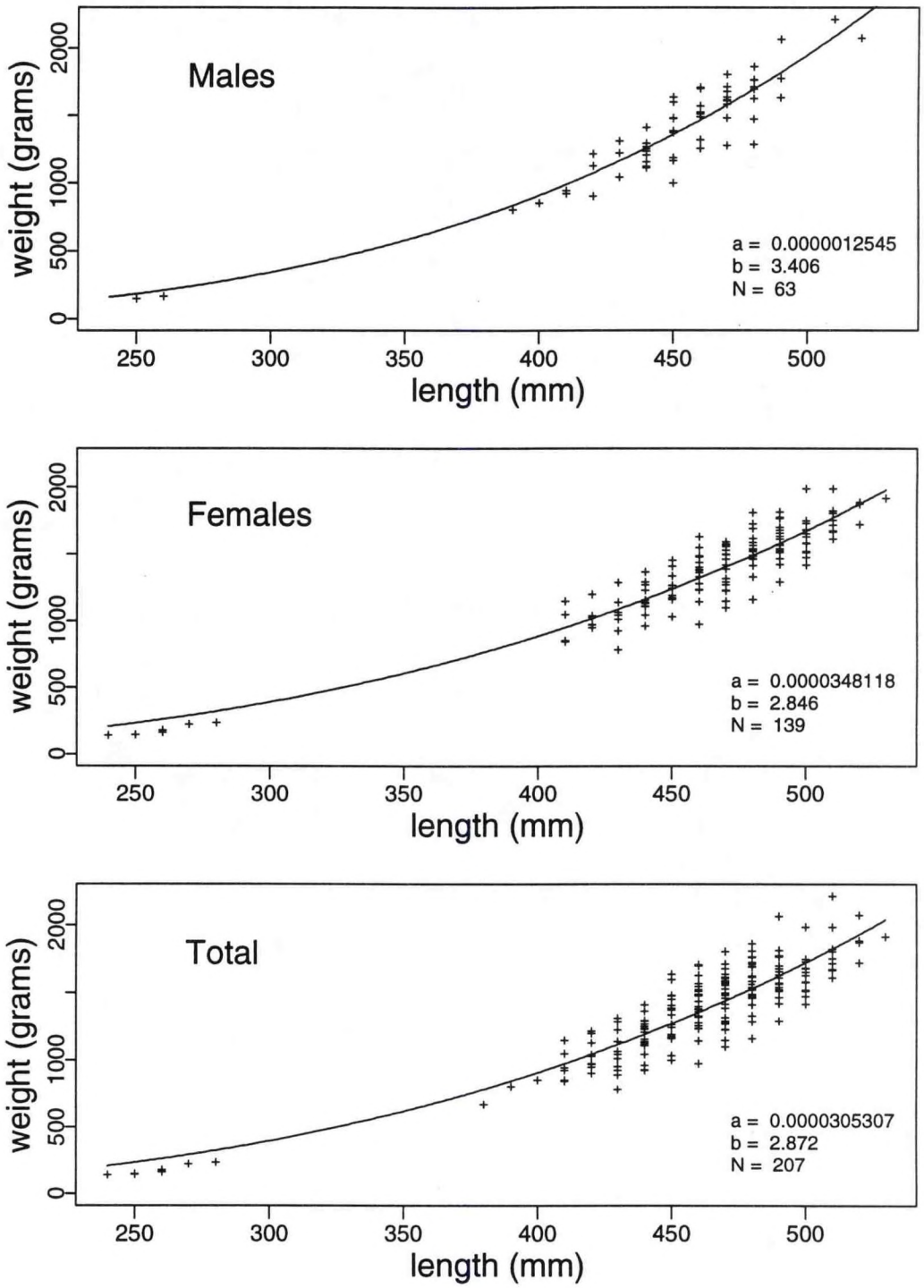


Figure 33.--Length-weight relationship for Atka mackerel specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 32.--Catch per unit effort by stratum for Atka mackerel sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km²)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Shumagin	1-100	Davidson Bank	25	7	25,185	344,593	0	1,051,513
Chirikof	201-300	Chirikof Slope	9	4	64	97	0	255
Chirikof	101-200	Chirikof Outer Shelf	24	9	54	271	78	464
Shumagin	101-200	Shumagin Outer Shelf	41	9	31	249	41	456
Chirikof	101-200	East Shumagin Gully	16	2	25	281	0	804
Chirikof	101-200	Shelikof Edge	28	5	20	153	0	309
Chirikof	1-100	Semidi Bank	18	3	11	80	0	171
Shumagin	101-200	Sanak Gully	6	1	9	40	0	143
Shumagin	1-100	Fox Islands	28	3	8	69	0	155
Shumagin	101-200	West Shumagin Gully	13	2	7	16	0	41
Chirikof	201-300	Lower Shelikof Gully	22	2	6	57	0	139
Kodiak	101-200	Kodiak Outer Shelf	24	1	5	23	0	70
Kodiak	101-200	Albatross Gullies	32	1	3	20	0	61
Shumagin	201-300	Shumagin Slope	22	2	3	9	0	22
Kodiak	201-300	Kenai Gullies	20	1	3	17	0	54
Shumagin	1-100	Lower Alaska Peninsula	26	1	2	15	0	47

Sablefish (Anoplopoma fimbria)

Since the depth range of this species extends to greater than 1,000 m, the survey estimates of biomass are only for that portion of the population that inhabits the continental shelf and upper slope to 500 m. Sablefish were found throughout the survey area, but were mostly concentrated on the continental slope and in major gully areas at depths greater than 200 m (Fig. 34). Sablefish were taken in more than 90% of the tows between 200 and 500 m, but in only about 30% of the tows less than 200 m (Table 33). The Kodiak INPFC area between 101 and 200 m had an exceptionally high CPUE compared with the same depth range in other areas (Table 33). CPUEs increased with depth throughout the survey, except in the Kodiak INPFC area where CPUEs were highest between 201 and 300 m. The highest stratum mean CPUEs were estimated to be in the large gullies of the Yakutat INPFC area and the continental slope in the Kodiak area (Table 34). The stratum with the highest biomass estimate, Kenai Flats was strongly influenced by a single tow, the largest sablefish catch of the survey (Fig. 34). Sablefish size generally increased with depth (Fig. 35). The largest fish on the average came from the 301-500 m depth range in the Yakutat and Southeastern INPFC areas. Sablefish less than 40 cm FL predominated in the 101 - 200 m range. The length-weight relationship for sablefish is presented in Figure 36.

Table 33.-- Number of survey hauls, number of hauls with sablefish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	11	3	126	0.35	32.1
	101 - 200	60	7	174	2,558	2.62	58.2
	201 - 300	22	18	1,176	3,279	2.20	59.7
	301 - 500	16	16	855	2,165	2.05	59.4
	All depths	200	52	125	8,128	2.09	56.7
Chirikof	1 - 100	69	4	1	35	0.39	41.9
	101 - 200	68	17	118	2,812	2.63	61.5
	201 - 300	31	29	1,051	12,128	3.12	64.2
	301 - 500	13	13	2,980	4,780	3.13	67.1
	All depths	181	63	290	19,755	3.01	64.1
Kodiak	1 - 100	59	6	12	446	1.50	49.9
	101 - 200	109	60	986	42,693	2.87	63.0
	201 - 300	31	26	2,526	29,024	2.37	58.4
	301 - 500	11	11	3,528	10,274	3.17	67.0
	All depths	210	103	812	82,437	2.69	61.5
Yakutat	1 - 100	33	16	41	674	0.47	36.8
	101 - 200	50	29	96	2,815	1.00	44.4
	201 - 300	27	23	2,314	11,964	2.40	57.7
	301 - 500	6	6	3,209	8,434	3.75	69.7
	All depths	116	74	419	23,887	2.08	54.2
Southeastern	1 - 100	7	3	79	514	0.51	37.9
	101 - 200	50	27	189	2,099	0.89	44.3
	201 - 300	28	25	334	1,691	1.88	54.8
	301 - 500	12	11	1,888	5,884	3.46	68.0
	All depths	97	66	363	10,188	1.70	51.6
All areas	1 - 100	270	40	14	1,795	0.56	38.0
	101 - 200	337	140	433	52,977	2.40	58.4
	201 - 300	139	121	1,611	58,086	2.47	59.2
	301 - 500	58	57	2,465	31,537	3.23	67.0
	All depths	804	358	452	144,395	2.46	59.0

All areas biomass, 95% confidence interval: 92,419 - 196,371 metric tons (t).

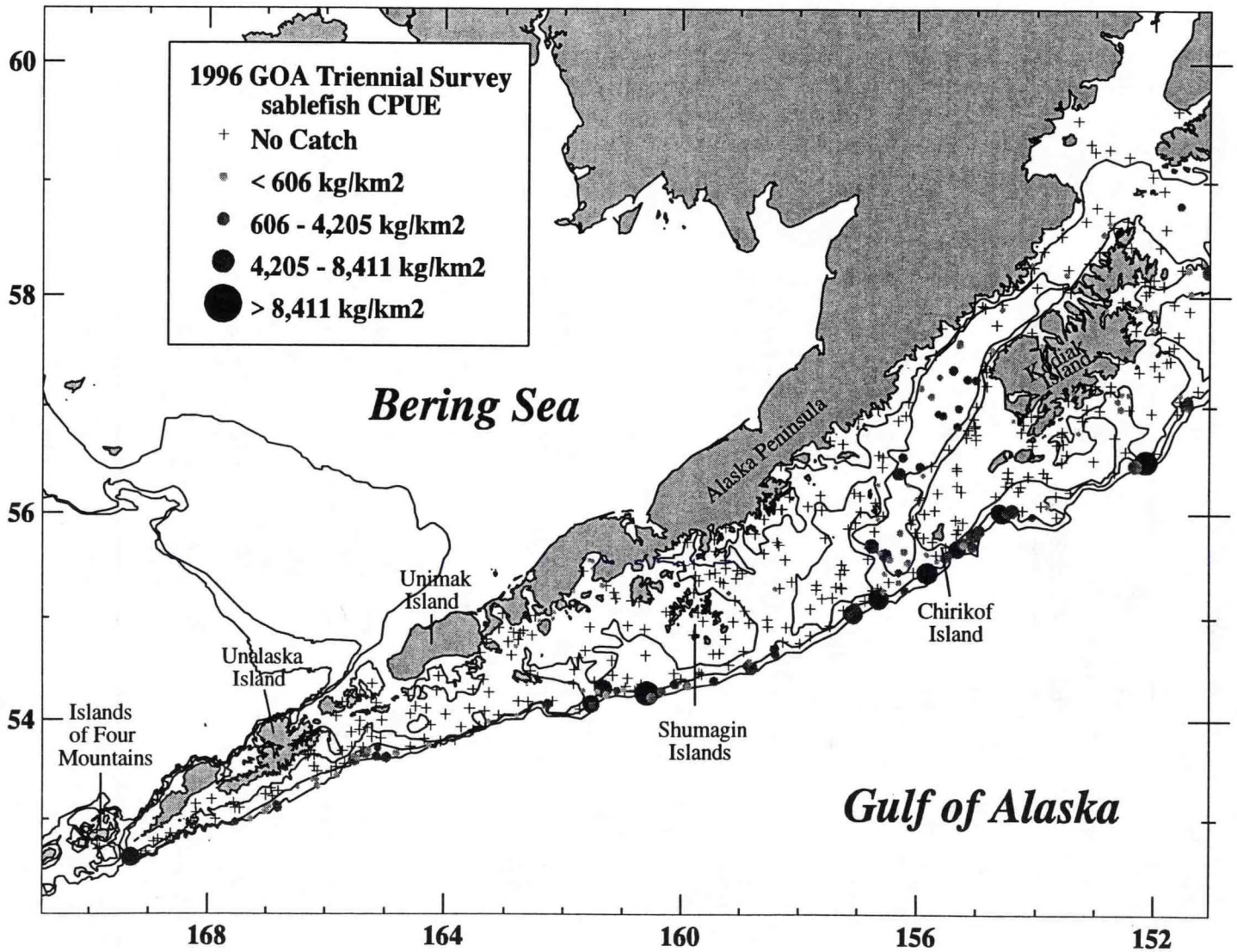
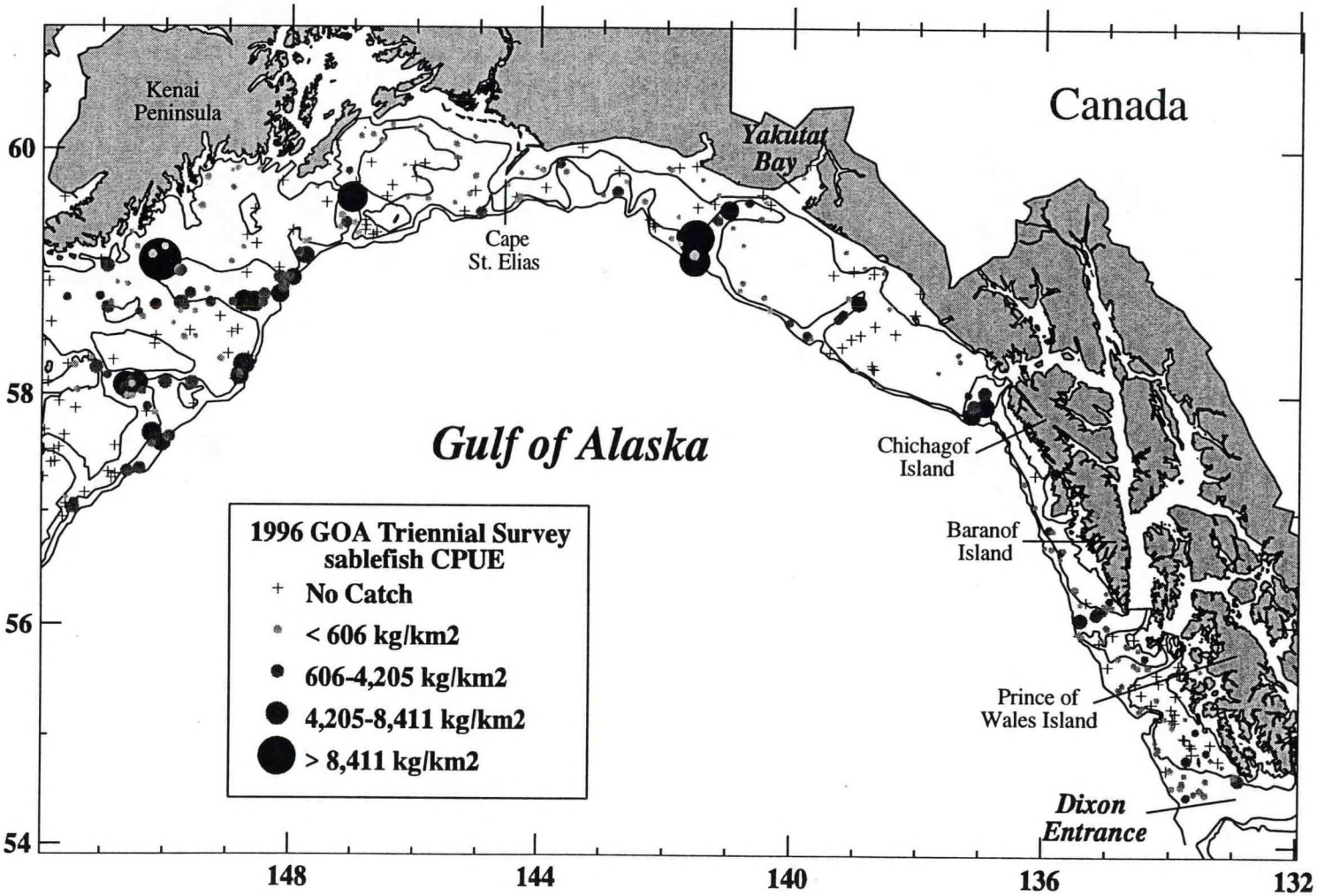


Figure 34.--Distribution and relative abundance of sablefish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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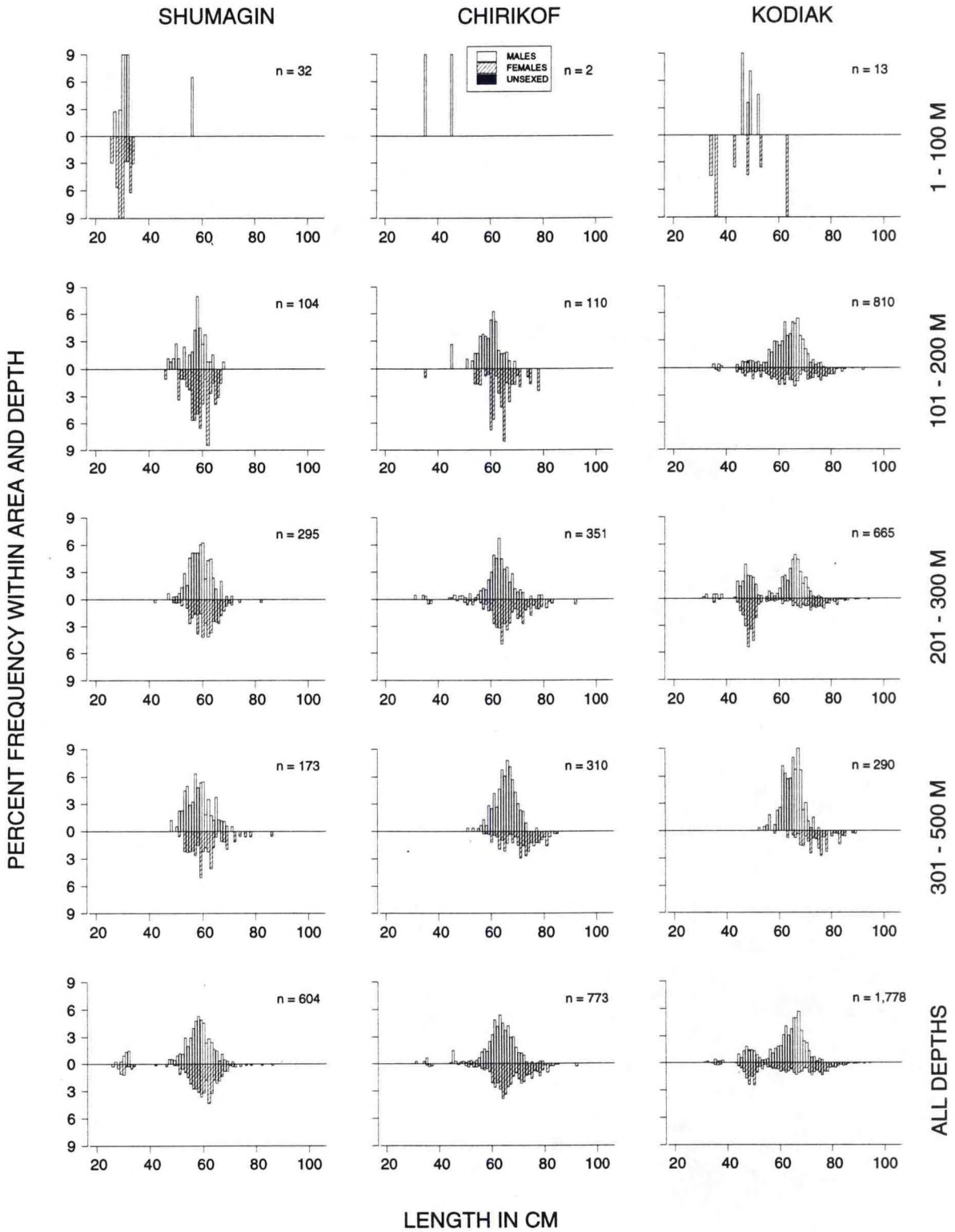


Figure 35.--Size composition of the estimated sablefish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

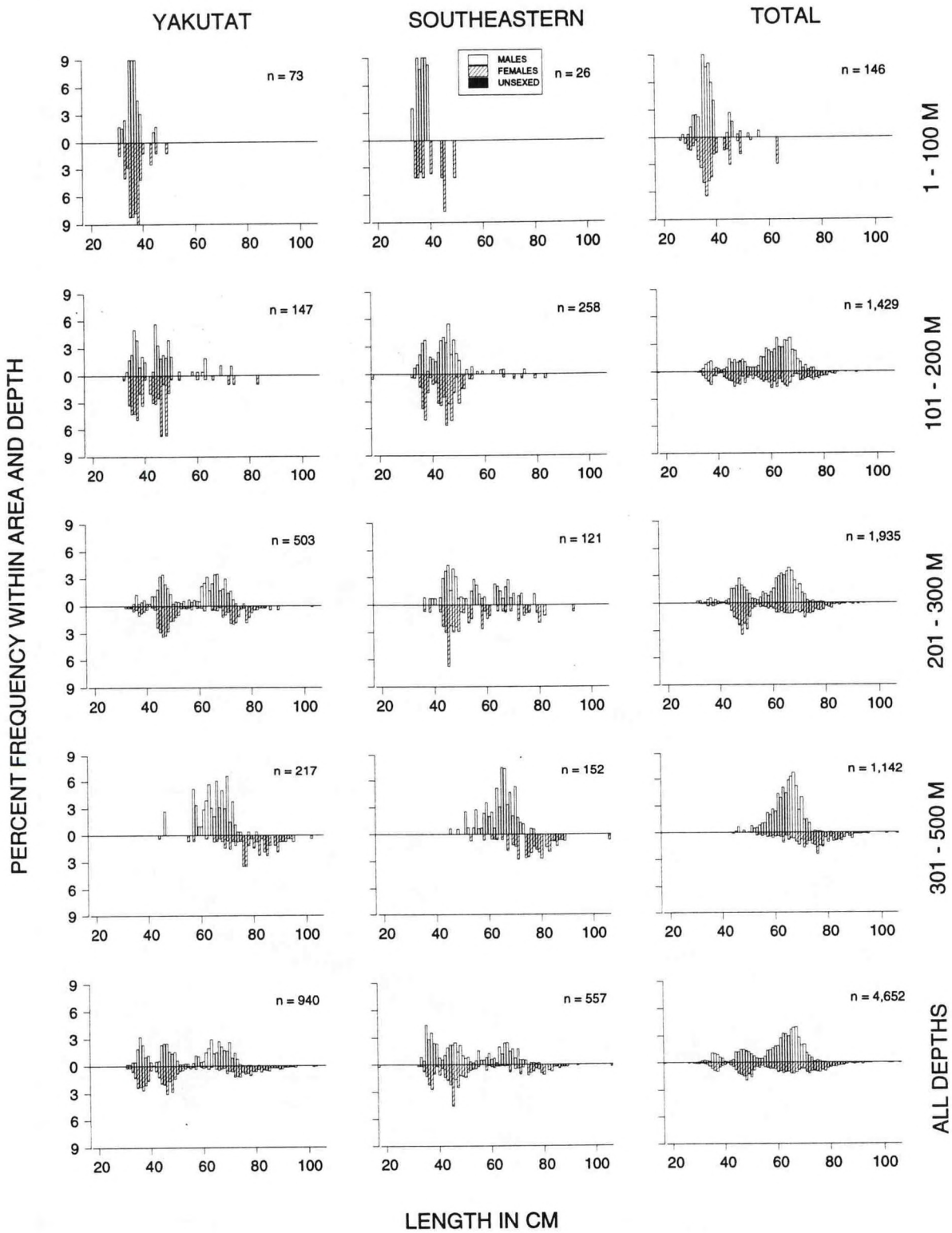


Figure 35.--Continued.

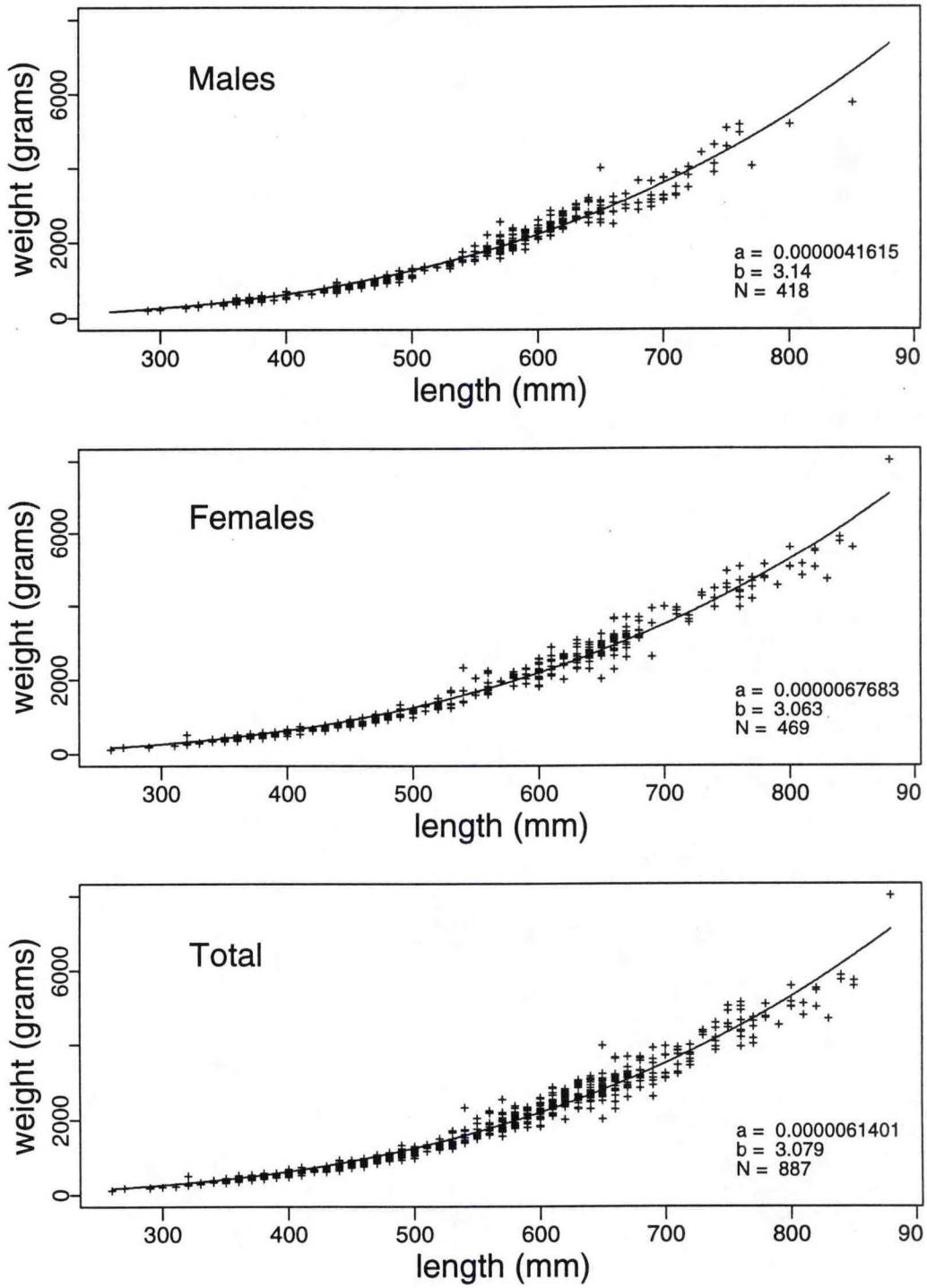


Figure 36.--Length-weight relationship for sablefish specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 34.--Catch per unit effort by stratum for sablefish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km²)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Yakutat	301-500	Yakutat Gullies	5	5	5,861	6,490	0	15,333
Kodiak	201-300	Kodiak Slope	5	5	4,484	7,276	0	15,845
Yakutat	201-300	Yakutat Gullies	11	11	3,681	11,200	0	25,533
Kodiak	301-500	Kodiak Slope	11	11	3,528	10,274	6,769	13,779
Kodiak	201-300	Kenai Gullies	20	18	3,203	21,332	8,917	33,747
Chirikof	301-500	Chirikof Slope	13	13	2,980	4,780	2,352	7,209
Chirikof	201-300	Chirikof Slope	9	8	2,504	3,827	632	7,022
Southeastern	301-500	Southeastern Deep Gullies	8	8	2,467	5,784	1,705	9,863
Kodiak	101-200	Kenai Flats	17	14	2,233	26,964	0	73,602
Yakutat	301-500	Yakutat Slope	1	1	1,278	1,944		
Shumagin	201-300	Shumagin Slope	22	18	1,176	3,279	187	6,370
Kodiak	101-200	Albatross Gullies	32	20	1,098	8,684	1,344	16,025
Shumagin	301-500	Shumagin Slope	16	16	855	2,165	1,522	2,809
Chirikof	201-300	Lower Shelikof Gully	22	21	829	8,301	5,208	11,393
Southeastern	201-300	Baranof-Chichagof Slope	5	5	548	617	0	1,428
Kodiak	101-200	Portlock Flats	21	15	495	3,630	1,066	6,193
Yakutat	201-300	Yakutat Slope	16	12	359	764	173	1,355
Kodiak	101-200	Kodiak Outer Shelf	24	6	337	1,695	0	4,817
Chirikof	101-200	Chirikof Outer Shelf	24	9	327	1,640	0	3,358
Shumagin	101-200	Shumagin Outer Shelf	41	6	313	2,551	0	6,054
Southeastern	101-200	Baranof-Chichagof Shelf	14	12	278	1,166	490	1,842
Southeastern	201-300	Prince of Wales Slope/Gullies	23	20	273	1,074	740	1,408
Kodiak	101-200	Barren Islands	15	5	157	1,720	0	3,714
Yakutat	101-200	Middleton Shelf	23	15	147	1,081	536	1,625
Chirikof	101-200	Shelikof Edge	28	6	142	1,096	0	3,039
Southeastern	101-200	Prince of Wales Shelf	36	15	135	933	214	1,651
Kodiak	201-300	Upper Shelikof Gully	6	3	130	416	0	994
Southeastern	301-500	Southeastern Slope	4	3	130	100	0	269
Yakutat	101-200	Fairweather Shelf	10	5	109	840	0	2,090
Yakutat	101-200	Yakutat Flats	9	7	93	843	198	1,487
Southeastern	1-100	Southeastern Shallows	7	3	79	514	0	1,471
Yakutat	1-100	Yakutat Shallows	22	11	41	404	106	702
Yakutat	1-100	Middleton Shallows	11	5	41	270	19	522
Kodiak	1-100	Albatross Banks	19	1	19	287	0	890
Kodiak	1-100	Northern Kodiak Shallows	6	2	16	35	0	96
Kodiak	1-100	Kenai Peninsula	4	1	13	71	0	296
Shumagin	1-100	Lower Alaska Peninsula	26	9	11	76	13	140
Yakutat	101-200	Yakataga Shelf	8	2	10	51	0	134
Kodiak	1-100	Albatross Shallows	24	2	9	53	0	143
Chirikof	101-200	East Shumagin Gully	16	2	7	76	0	203
Shumagin	1-100	Davidson Bank	25	1	3	47	0	143
Chirikof	1-100	Upper Alaska Peninsula	16	2	3	26	0	67
Shumagin	101-200	West Shumagin Gully	13	1	3	7	0	22
Chirikof	1-100	Chirikof Bank	35	2	1	9	0	23
Shumagin	1-100	Fox Islands	28	1	0	3	0	9

Pacific ocean perch (Sebastes alutus)

Pacific ocean perch (POP) was by far the most abundant and widely distributed rockfish species and the second most abundant groundfish encountered during the survey (Table 2). The estimated biomass of POP was nearly eight times greater than that of the next most abundant rockfish, northern rockfish. Pacific ocean perch was the most abundant groundfish in the Southeastern INPFC area with a mean CPUE well over twice that of the next most abundant groundfish. POP was the second most abundant groundfish species in both the Kodiak and Yakutat INPFC areas, and was the third most abundant in the Chirikof INPFC area. Pacific ocean perch were caught in about 95% of the tows on the upper continental slope between 201 and 300 m (Fig. 35). Pacific ocean perch were captured in 42 of the 49 strata sampled, but densities were highest on the upper continental slope and outer shelf areas and in the deep gully strata (Table 36; Fig. 37). These areas contained about 25% of the total survey area biomass while making up less than 8% of the area. About 92% of the estimated biomass was found between 101 and 300 m (Table 35). Catch from the Kodiak INPFC area between 101 and 300 m (approximately 18% of the survey area) accounted for 42% of the total survey biomass estimate. Mean fish size generally increased with depth, and small fish (< 20 cm FL) were found primarily in water less than 100 m (Fig. 38). The length-weight relationship for POP specimens collected during the survey is depicted in Figure 39.

Table 35.-- Number of survey hauls, number of hauls with Pacific ocean perch, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	19	92	3,780	0.43	29.3
	101 - 200	60	25	2,664	39,094	0.49	31.6
	201 - 300	22	22	17,683	49,302	0.64	35.3
	301 - 500	16	9	171	432	0.60	35.1
	All depths	200	75	1,423	92,608	0.56	33.2
Chirikof	1 - 100	69	14	46	1,199	0.07	16.2
	101 - 200	68	34	2,956	70,507	0.63	35.6
	201 - 300	31	12	6,414	74,067	0.64	35.4
	301 - 500	13	8	1,208	1,938	0.59	34.3
	All depths	181	68	2,170	147,711	0.59	34.1
Kodiak	1 - 100	59	3	1	60	0.04	13.7
	101 - 200	109	42	4,348	188,437	0.71	36.8
	201 - 300	31	21	11,964	137,475	0.70	37.4
	301 - 500	11	6	112	326	0.72	36.6
	All depths	210	72	3,215	326,298	0.70	36.9
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	18	1,098	32,272	0.29	27.3
	201 - 300	27	26	3,301	17,070	0.56	33.8
	301 - 500	6	3	401	1,054	0.75	37.8
	All depths	116	47	883	50,396	0.35	28.8
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	25	3,896	43,184	0.56	33.6
	201 - 300	28	26	13,270	67,049	0.64	35.6
	301 - 500	12	9	16,494	51,417	0.96	40.2
	All depths	97	60	5,765	161,650	0.69	36.0
All areas	1 - 100	270	36	39	5,039	0.18	20.2
	101 - 200	337	144	3,053	373,494	0.58	33.9
	201 - 300	139	107	9,569	344,963	0.66	36.1
	301 - 500	58	35	4,312	55,167	0.93	39.7
	All depths	804	322	2,435	778,663	0.62	34.8

All areas biomass, 95% confidence interval: 358,923 - 1,198,403 metric tons (t).

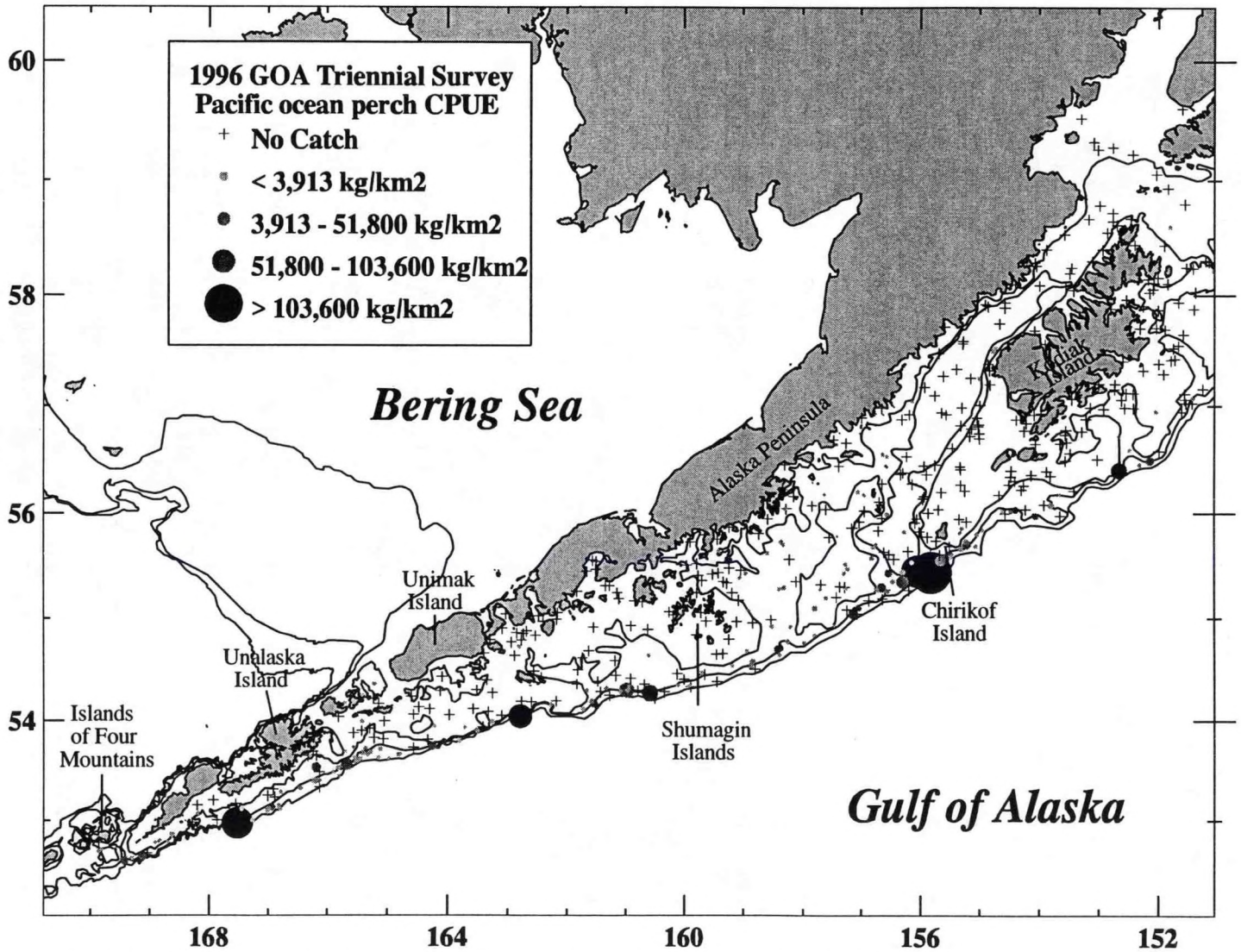


Figure 37.--Distribution and relative abundance of Pacific ocean perch from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

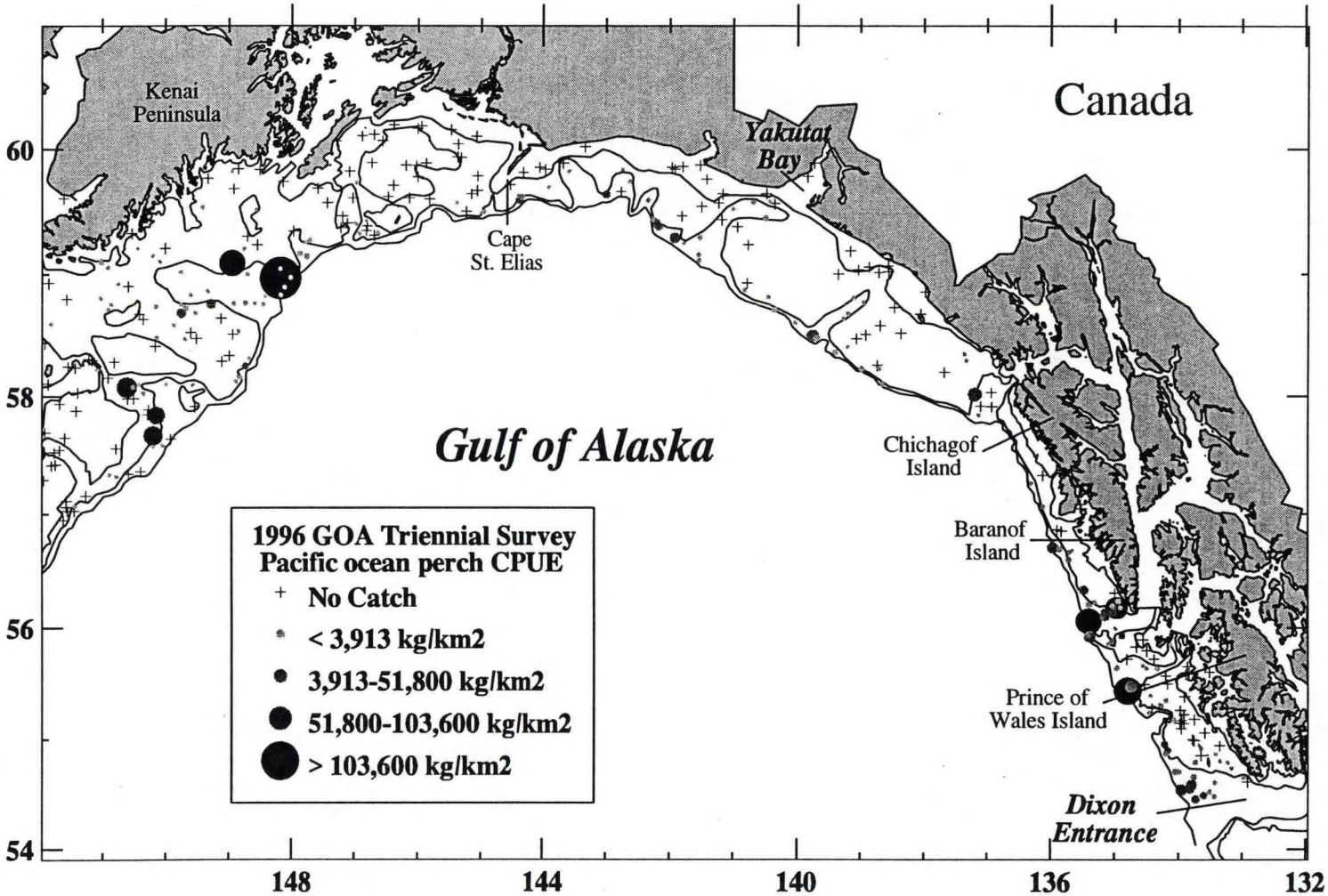


Figure 37.--Continued.

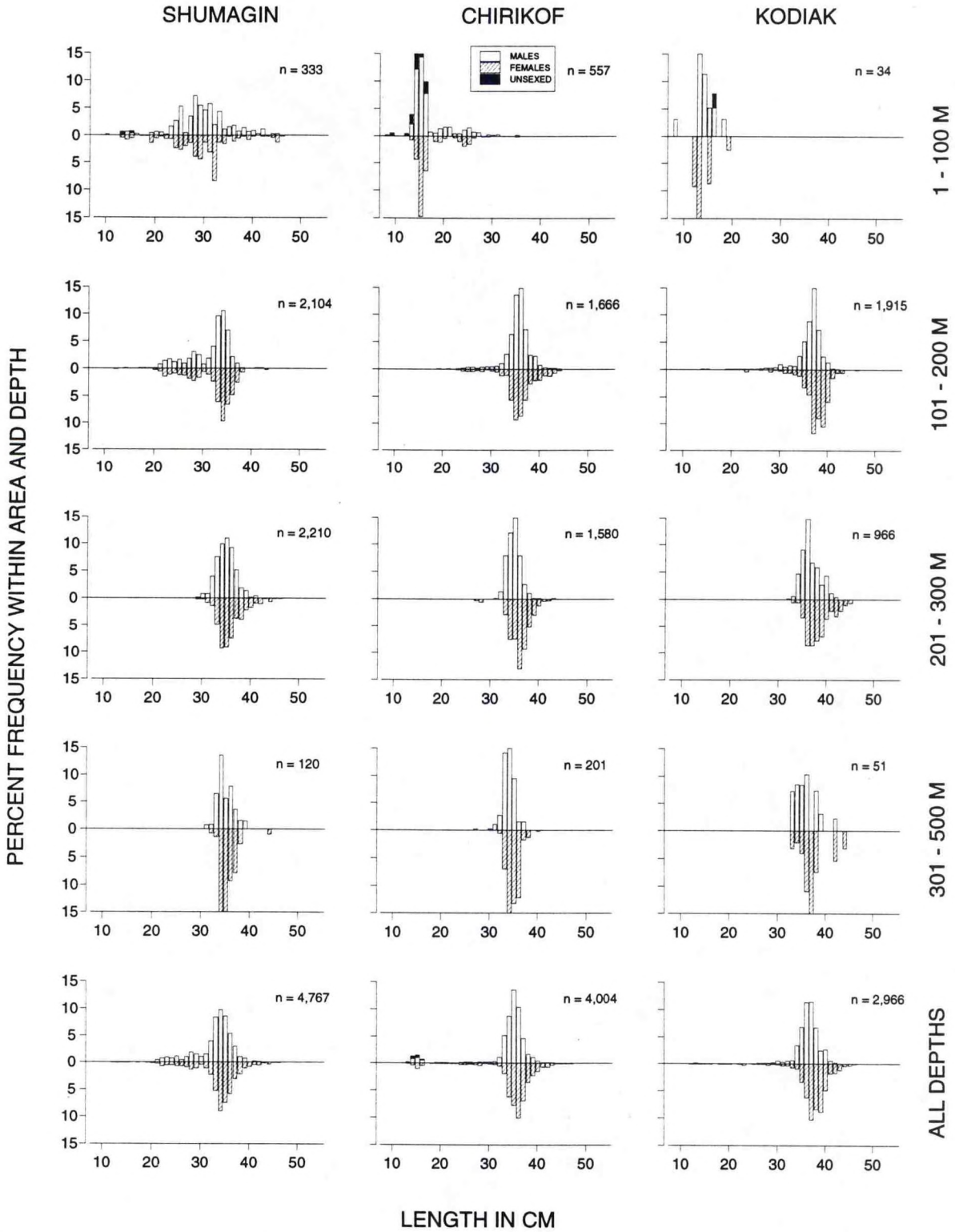


Figure 38.--Size composition of the estimated Pacific ocean perch population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

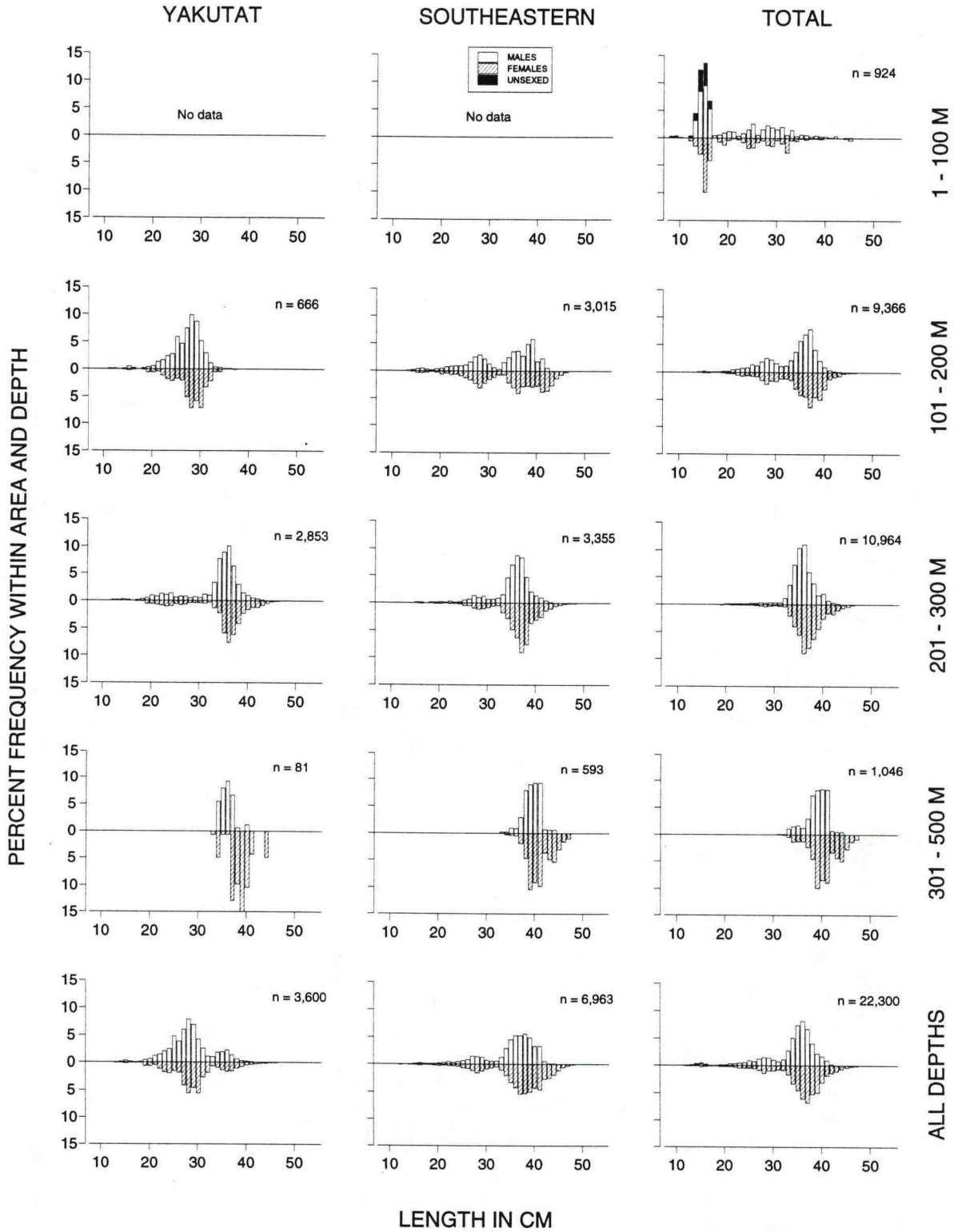


Figure 38.--Continued.

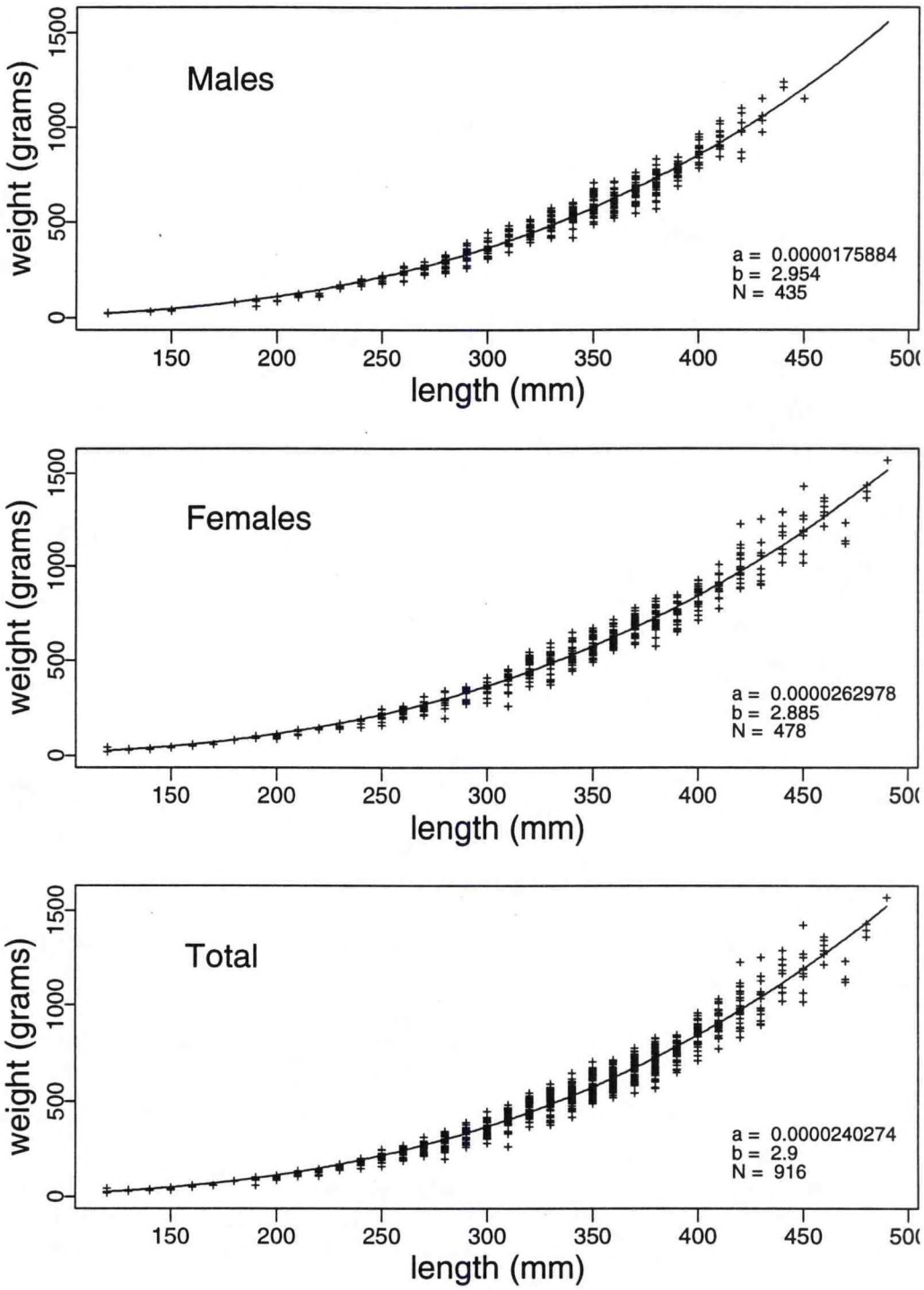


Figure 39.--Length-weight relationship for Pacific ocean perch specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 36.--Catch per unit effort by stratum for Pacific ocean perch sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km²)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	201-300	Chirikof Slope	9	9	48,210	73,684	0	225,418
Southeastern	301-500	Southeastern Deep Gullies	8	5	21,106	49,483	0	152,559
Kodiak	201-300	Kenai Gullies	20	16	19,878	132,381	0	403,496
Shumagin	201-300	Shumagin Slope	22	22	17,683	49,302	0	109,326
Southeastern	201-300	Prince of Wales Slope/Gullies	23	21	13,549	53,212	0	111,033
Chirikof	101-200	Chirikof Outer Shelf	24	15	13,334	66,813	0	168,589
Southeastern	201-300	Baranof-Chichagof Slope	5	5	12,296	13,837	0	29,388
Southeastern	101-200	Baranof-Chichagof Shelf	14	10	9,362	39,287	0	107,257
Kodiak	101-200	Kenai Flats	17	8	8,880	107,245	0	333,704
Yakutat	201-300	Yakutat Slope	16	16	6,809	14,486	5,810	23,162
Kodiak	101-200	Kodiak Outer Shelf	24	13	5,855	29,427	0	70,812
Kodiak	101-200	Albatross Gullies	32	6	4,815	38,101	0	92,554
Shumagin	101-200	Shumagin Outer Shelf	41	23	4,792	39,063	0	91,034
Yakutat	101-200	Fairweather Shelf	10	6	3,913	30,237	0	98,163
Kodiak	201-300	Kodiak Slope	5	5	3,139	5,094	0	13,858
Southeastern	301-500	Southeastern Slope	4	4	2,502	1,934	0	5,722
Kodiak	101-200	Portlock Flats	21	12	1,644	12,062	0	27,860
Chirikof	301-500	Chirikof Slope	13	8	1,208	1,938	0	5,956
Yakutat	201-300	Yakutat Gullies	11	10	849	2,584	284	4,884
Yakutat	301-500	Yakutat Slope	1	1	567	862		
Southeastern	101-200	Prince of Wales Shelf	36	15	566	3,897	559	7,236
Chirikof	101-200	Shelikof Edge	28	9	355	2,746	0	7,310
Shumagin	1-100	Lower Alaska Peninsula	26	2	337	2,317	0	7,074
Yakutat	101-200	Yakutat Flats	9	3	195	1,764	0	4,036
Yakutat	301-500	Yakutat Gullies	5	2	173	192	0	704
Shumagin	301-500	Shumagin Slope	16	9	171	432	8	855
Chirikof	1-100	Semidi Bank	18	10	159	1,163	0	2,538
Kodiak	101-200	Barren Islands	15	3	146	1,602	0	4,842
Kodiak	301-500	Kodiak Slope	11	6	112	326	0	659
Chirikof	101-200	East Shumagin Gully	16	10	85	948	0	1,910
Shumagin	1-100	Davidson Bank	25	3	77	1,054	0	3,029
Shumagin	1-100	Fox Islands	28	12	45	373	0	831
Yakutat	101-200	Yakataga Shelf	8	4	44	233	0	721
Chirikof	201-300	Lower Shelikof Gully	22	3	38	383	0	1,105
Kodiak	1-100	Kenai Peninsula	4	1	7	37	0	153
Shumagin	101-200	Sanak Gully	6	1	7	29	0	105
Yakutat	101-200	Middleton Shelf	23	5	5	38	0	91
Shumagin	1-100	Shumagin Bank	23	2	3	36	0	109
Chirikof	1-100	Chirikof Bank	35	2	2	26	0	63
Chirikof	1-100	Upper Alaska Peninsula	16	2	1	10	0	28
Kodiak	1-100	Albatross Banks	19	2	1	23	0	65
Shumagin	101-200	West Shumagin Gully	13	1	1	2	0	5

Northern rockfish (*Sebastes polyspinus*)

Northern rockfish were estimated to be the second most abundant rockfish in the survey area (Table 2). However, very few were captured east of the Kodiak INPFC area and none were caught in the Southeastern INPFC area (Table 37, Fig. 40). More than 85% of the total biomass was estimated to be at depths between 101 and 200 m. Approximately 65% of the total biomass was concentrated in three strata on the outer continental shelf between 101 and 200 m (Chirikof Outer Shelf, Kodiak Outer Shelf, and Shumagin Outer Shelf, Table 38). Only one fish was caught at depths greater than 300 m during the survey. The largest fish were found in the depths with the greatest abundance, and small fish (< 30 cm FL) were found almost exclusively in water less than 100 m in depth (Fig. 41). The length-weight relationship for northern rockfish specimens collected during the survey is depicted in Figure 42.

Table 37.-- Number of survey hauls, number of hauls with northern rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	17	140	5,761	0.80	35.4
	101 - 200	60	22	1,514	22,225	0.94	37.9
	201 - 300	22	11	34	96	0.68	36.1
	301 - 500	16	1	1	3	0.47	32.0
	All depths	200	51	431	28,085	0.90	37.3
Chirikof	1 - 100	69	11	309	8,052	0.63	33.0
	101 - 200	68	21	1,353	32,274	0.89	38.6
	201 - 300	31	6	12	134	0.66	34.7
	301 - 500	13	0	---	---	---	---
	All depths	181	38	595	40,460	0.82	37.1
Kodiak	1 - 100	59	5	5	181	0.32	25.6
	101 - 200	109	24	688	29,821	0.72	37.6
	201 - 300	31	5	18	208	0.72	36.4
	301 - 500	11	0	---	---	---	---
	All depths	210	34	298	30,210	0.71	37.4
Yakutat	1 - 100	33	1	1	11	0.61	32.0
	101 - 200	50	2	2	56	0.60	35.4
	201 - 300	27	9	24	125	0.68	36.6
	301 - 500	6	0	---	---	---	---
	All depths	116	12	3	192	0.65	35.9
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	0	---	---	---	---
All areas	1 - 100	270	34	109	14,005	0.68	33.6
	101 - 200	337	69	690	84,376	0.83	38.0
	201 - 300	139	31	16	563	0.69	36.0
	301 - 500	58	1	0	3	0.47	32.0
	All depths	804	135	310	98,947	0.80	37.3

All areas biomass, 95% confidence interval: 46,290 - 151,604 metric tons (t).

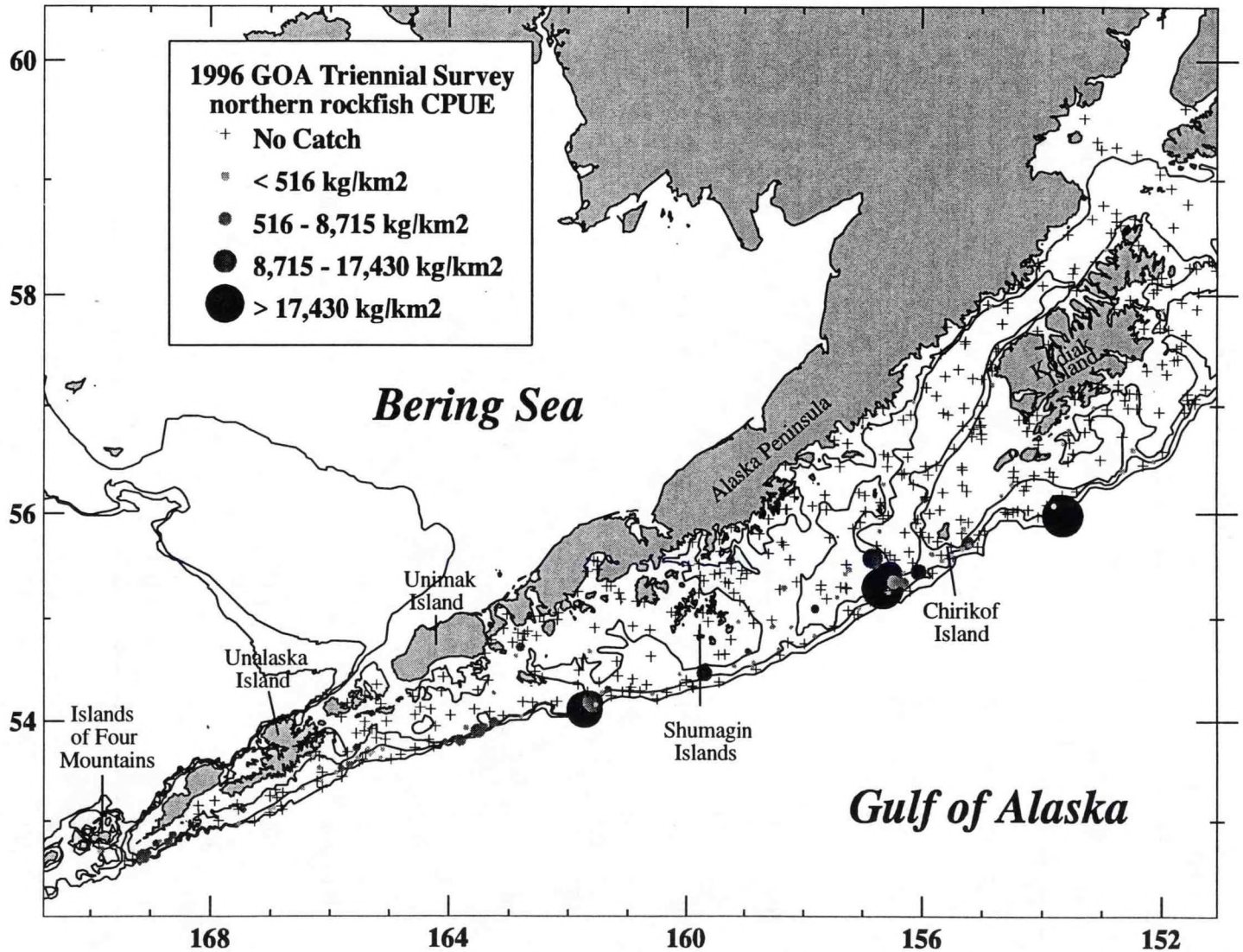


Figure 40.--Distribution and relative abundance of northern rockfish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

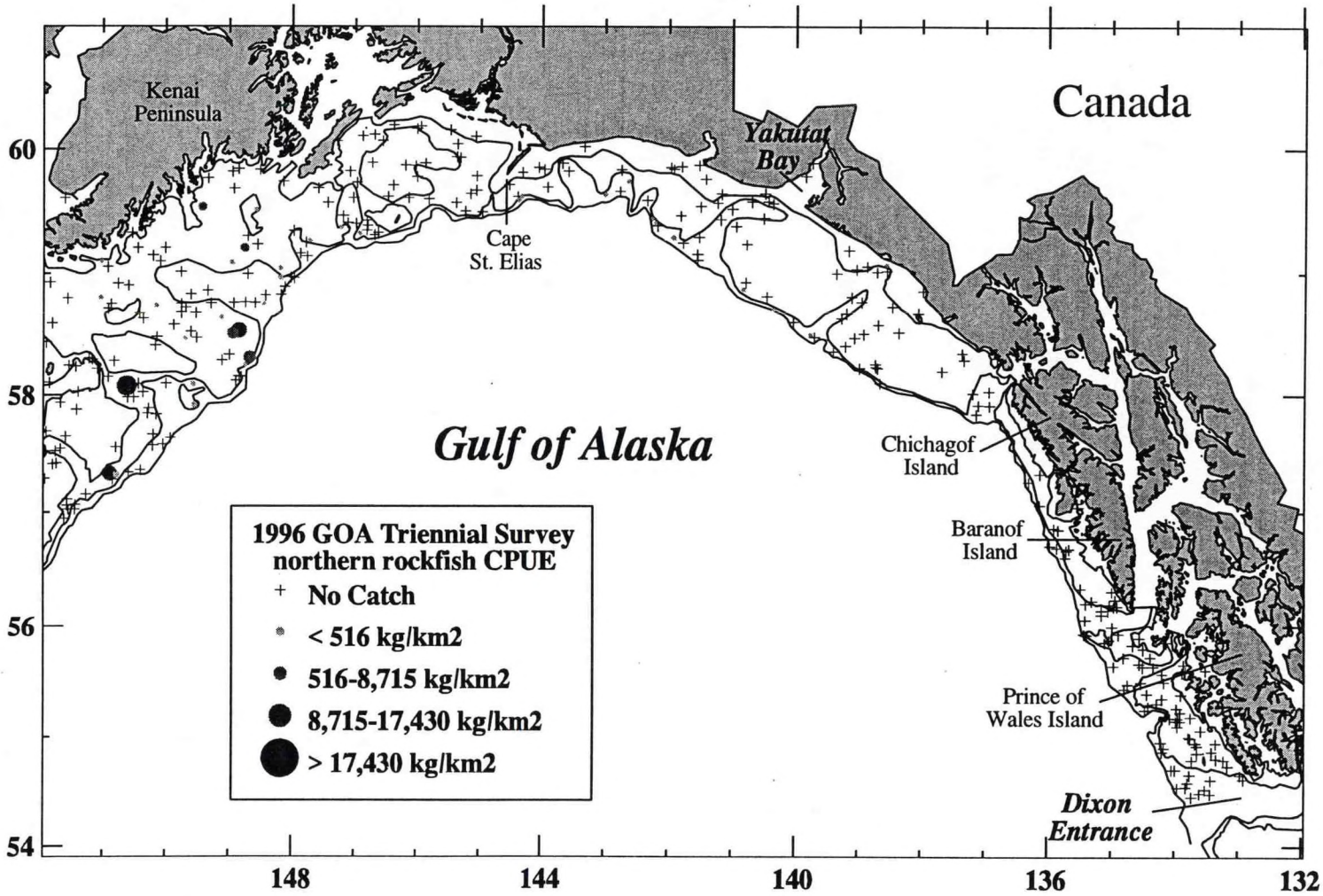


Figure 40.--Continued.

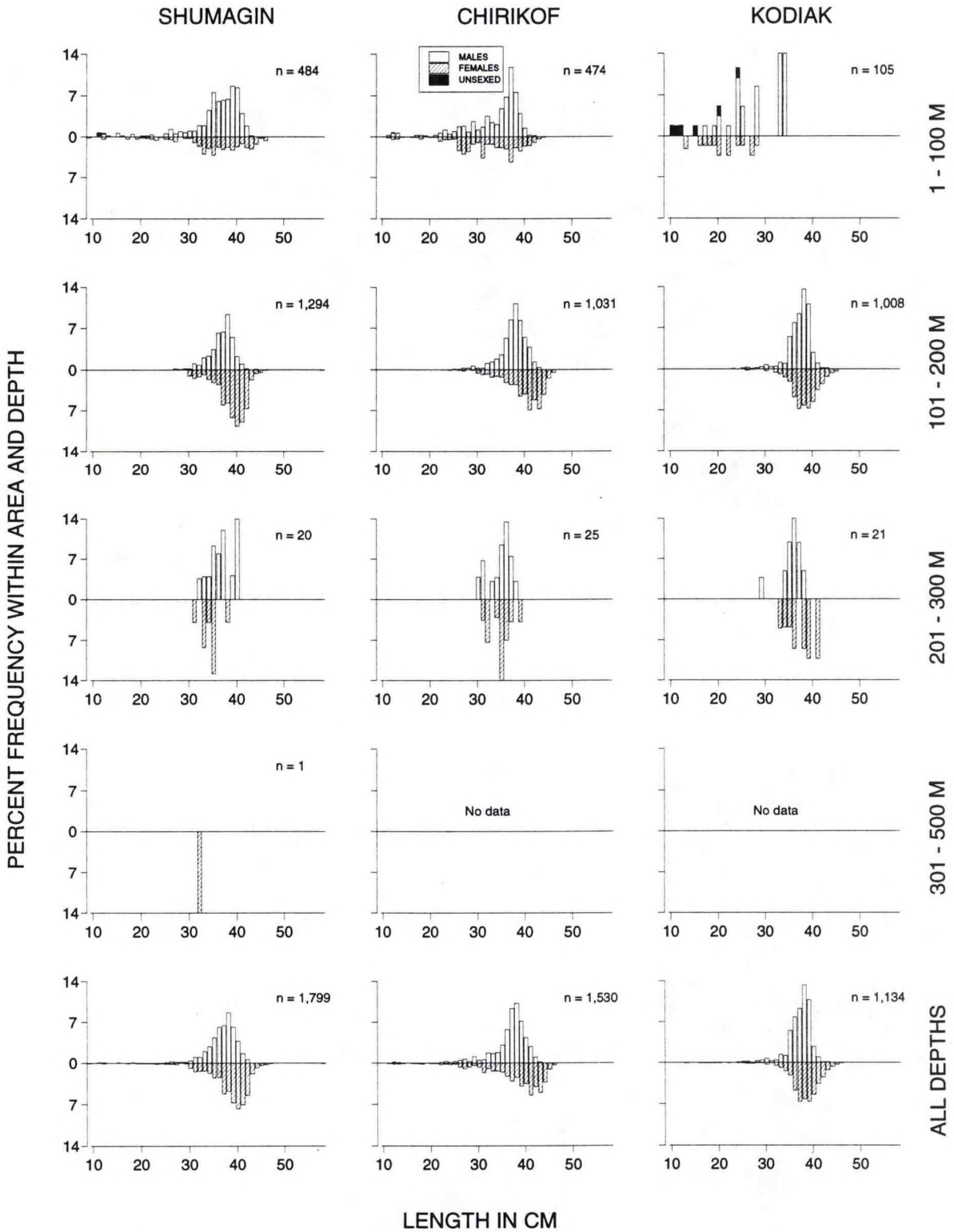


Figure 41.--Size composition of the estimated northern rockfish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

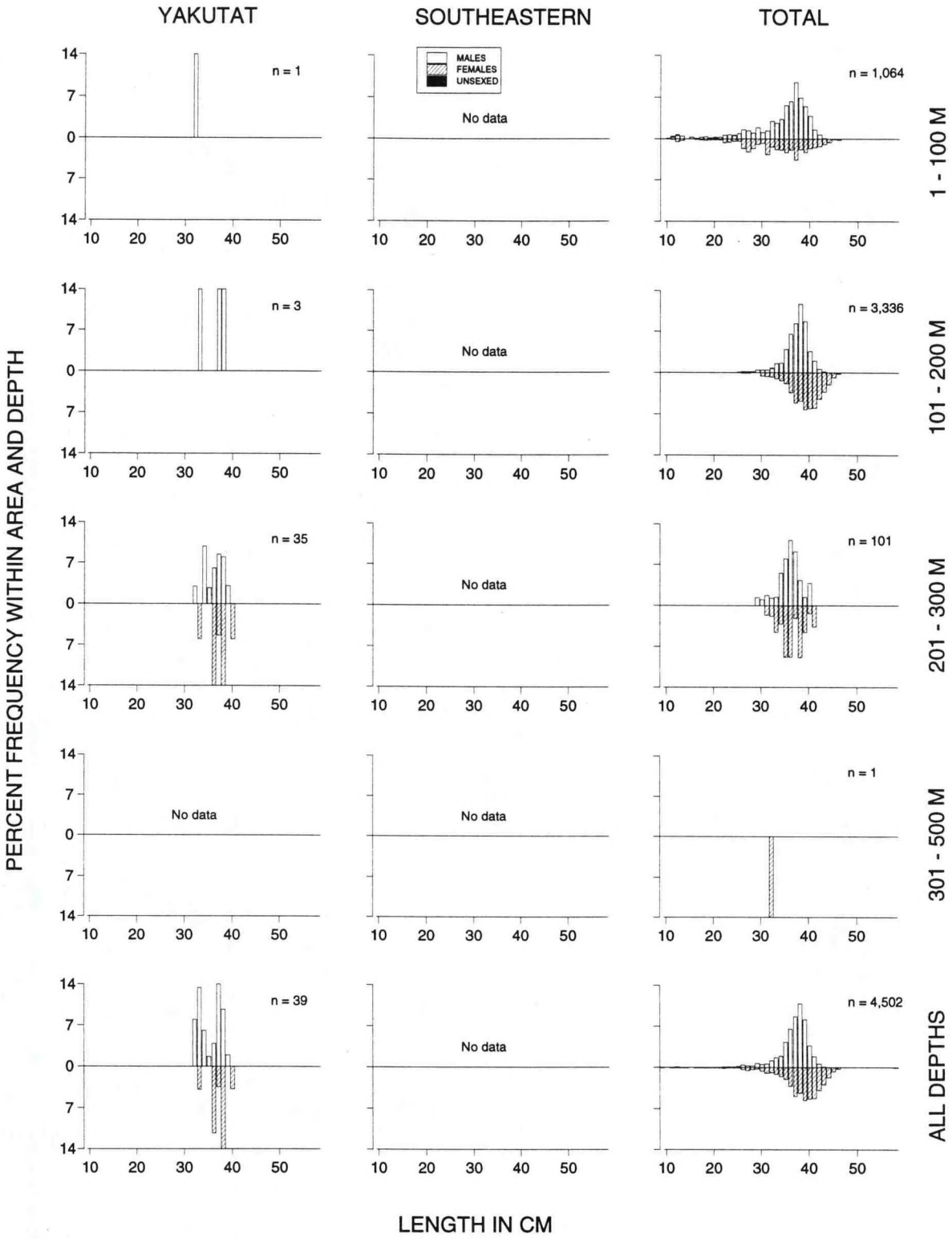


Figure 41.--Continued.

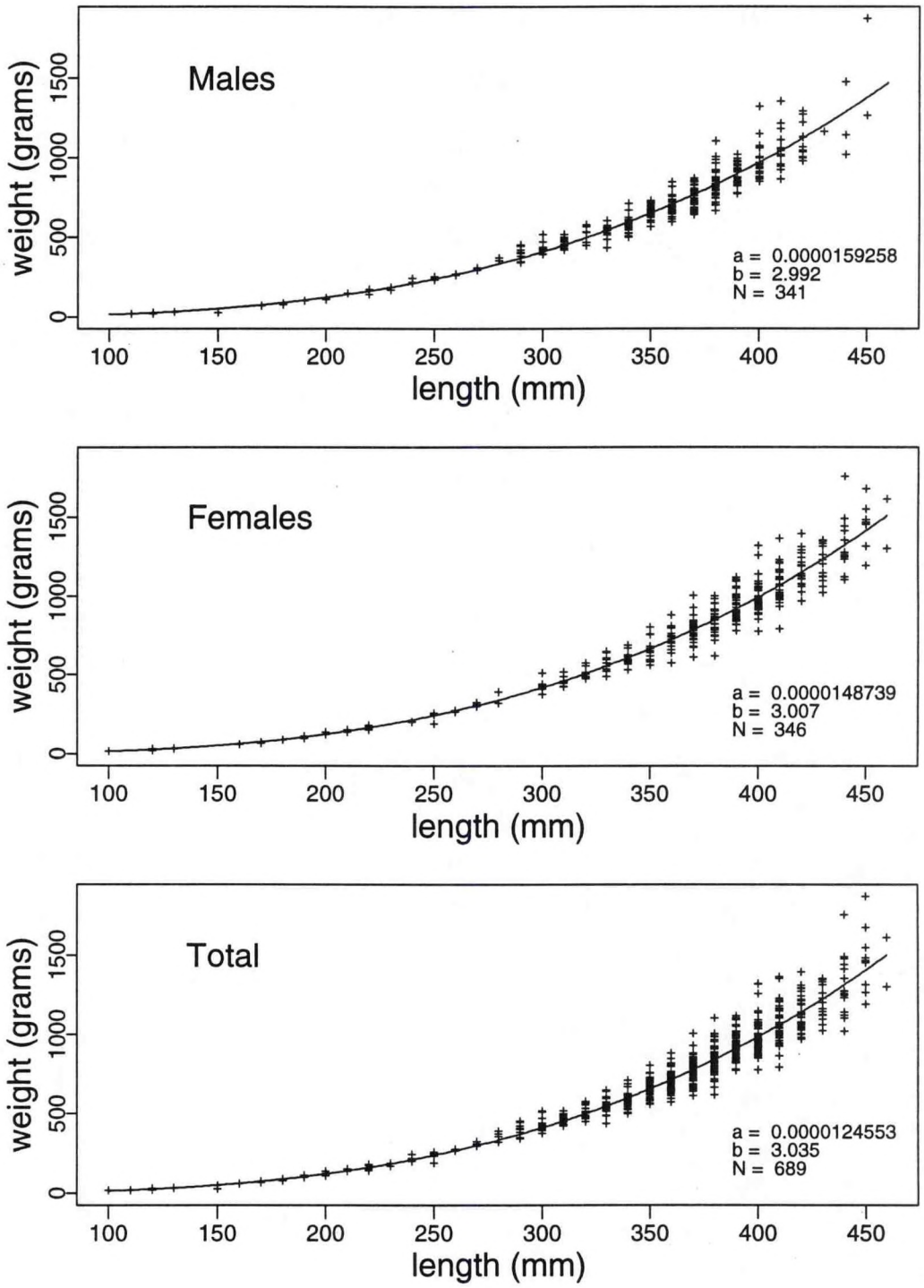


Figure 42.--Length-weight relationship for northern rockfish specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 38.--Catch per unit effort by stratum for northern rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	101-200	Chirikof Outer Shelf	24	13	4,838	24,241	0	55,552
Kodiak	101-200	Kodiak Outer Shelf	24	11	3,600	18,093	0	48,474
Shumagin	101-200	Shumagin Outer Shelf	41	22	2,726	22,225	0	45,184
Chirikof	1-100	Semidi Bank	18	5	1,086	7,929	0	22,429
Chirikof	101-200	Shelikof Edge	28	5	968	7,488	0	22,131
Kodiak	101-200	Portlock Flats	21	5	644	4,724	0	11,815
Kodiak	101-200	Albatross Gullies	32	2	499	3,946	0	11,978
Kodiak	101-200	Kenai Flats	17	3	242	2,918	0	7,044
Shumagin	1-100	Lower Alaska Peninsula	26	2	180	1,236	0	3,001
Shumagin	1-100	Fox Islands	28	7	176	1,444	0	3,007
Shumagin	1-100	Davidson Bank	25	5	176	2,414	0	5,828
Chirikof	201-300	Chirikof Slope	9	5	71	108	1	215
Shumagin	1-100	Shumagin Bank	23	3	54	667	0	1,946
Yakutat	201-300	Yakutat Slope	16	8	52	110	20	200
Chirikof	101-200	East Shumagin Gully	16	3	49	545	0	1,353
Shumagin	201-300	Shumagin Slope	22	11	34	96	38	155
Kodiak	201-300	Kenai Gullies	20	3	26	170	0	409
Kodiak	1-100	Kenai Peninsula	4	1	25	130	0	545
Kodiak	201-300	Kodiak Slope	5	2	24	38	0	104
Kodiak	101-200	Barren Islands	15	3	13	140	0	344
Chirikof	1-100	Chirikof Bank	35	5	10	110	0	246
Kodiak	1-100	Albatross Shallows	24	2	7	40	0	116
Yakutat	101-200	Yakutat Flats	9	1	5	44	0	144
Yakutat	201-300	Yakutat Gullies	11	1	5	15	0	49
Chirikof	201-300	Lower Shelikof Gully	22	1	3	26	0	81
Chirikof	1-100	Upper Alaska Peninsula	16	1	2	13	0	42
Yakutat	101-200	Middleton Shelf	23	1	2	12	0	38
Kodiak	1-100	Albatross Banks	19	1	1	11	0	33
Yakutat	1-100	Yakutat Shallows	22	1	1	11	0	33
Shumagin	301-500	Shumagin Slope	16	1	1	3	0	9
Kodiak	1-100	Northern Kodiak Shallows	6	1	0	0	0	1

Rougheye rockfish (Sebastes aleutianus)

Although rougheye rockfish were caught in 42 of the 49 strata, the tows with the highest catch rates were exclusively on the continental slope or in adjacent gully areas (Fig. 43). More than 65% of the total biomass in the survey area was estimated to be between 301 and 500 m in depth (about 4% of the survey area; Table 39). The stratum with the highest mean CPUE was the Kodiak Slope stratum (Table 40). This stratum accounted for about 20% of the total biomass estimate, although comprising less than 1% of the total area (Table 40). The mean size of fish generally increased with depth as the ratio of fish less than 30 cm FL to those greater than 30 cm FL decreased with depth (Fig. 44). The length-weight relationship for rougheye rockfish specimens collected during the survey is depicted in Figure 45.

Table 39.-- Number of survey hauls, number of hauls with rougheye rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	4	1	45	0.64	36.2
	101 - 200	60	10	24	354	0.59	31.6
	201 - 300	22	8	149	415	1.01	37.6
	301 - 500	16	12	1,041	2,635	1.45	42.9
	All depths	200	34	53	3,449	1.19	39.7
Chirikof	1 - 100	69	1	5	136	1.15	40.2
	101 - 200	68	15	36	876	0.69	32.4
	201 - 300	31	19	425	4,903	1.43	42.4
	301 - 500	13	11	2,514	4,033	1.49	45.0
	All depths	181	46	146	9,948	1.32	41.7
Kodiak	1 - 100	59	7	19	712	0.93	37.5
	101 - 200	109	35	70	3,041	0.54	29.1
	201 - 300	31	29	461	5,298	0.84	35.7
	301 - 500	11	7	3,178	9,254	1.36	43.5
	All depths	210	78	180	18,305	0.93	36.5
Yakutat	1 - 100	33	5	2	24	0.17	21.9
	101 - 200	50	26	96	2,829	0.41	27.8
	201 - 300	27	19	151	778	0.59	30.7
	301 - 500	6	6	1,012	2,661	0.93	37.2
	All depths	116	56	110	6,292	0.56	30.5
Southeastern	1 - 100	7	2	42	277	0.40	26.7
	101 - 200	50	3	1	18	0.17	21.0
	201 - 300	28	7	73	369	0.66	30.9
	301 - 500	12	12	2,293	7,148	1.32	42.8
	All depths	97	24	278	7,812	1.15	39.8
All areas	1 - 100	270	19	9	1,194	0.67	32.2
	101 - 200	337	89	58	7,118	0.49	28.8
	201 - 300	139	82	326	11,763	0.98	36.9
	301 - 500	58	48	2,011	25,731	1.31	42.5
	All depths	804	238	143	45,806	0.95	36.6

All areas biomass, 95% confidence interval: 30,786 - 60,826 metric tons (t).

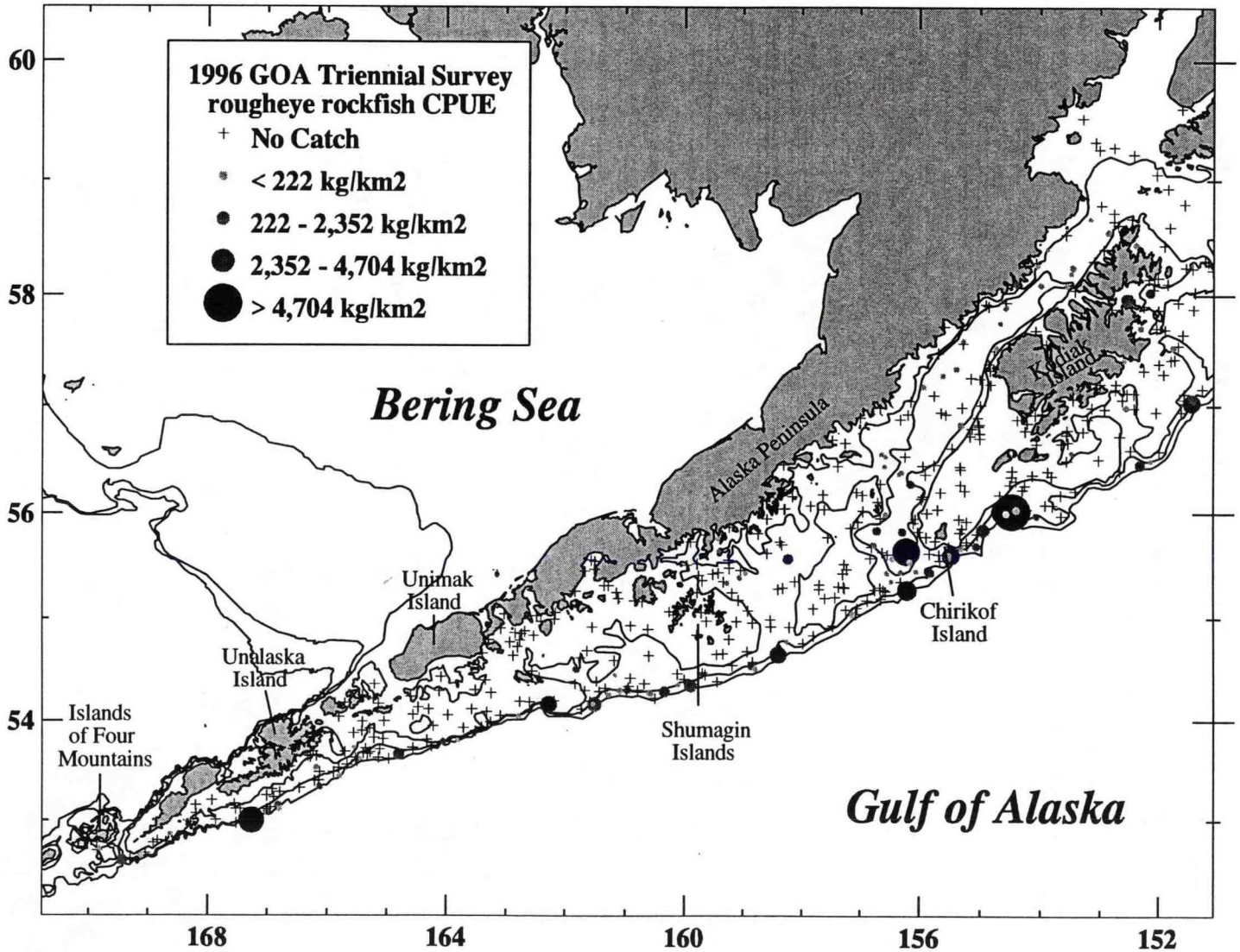


Figure 43.--Distribution and relative abundance of rougheye rockfish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

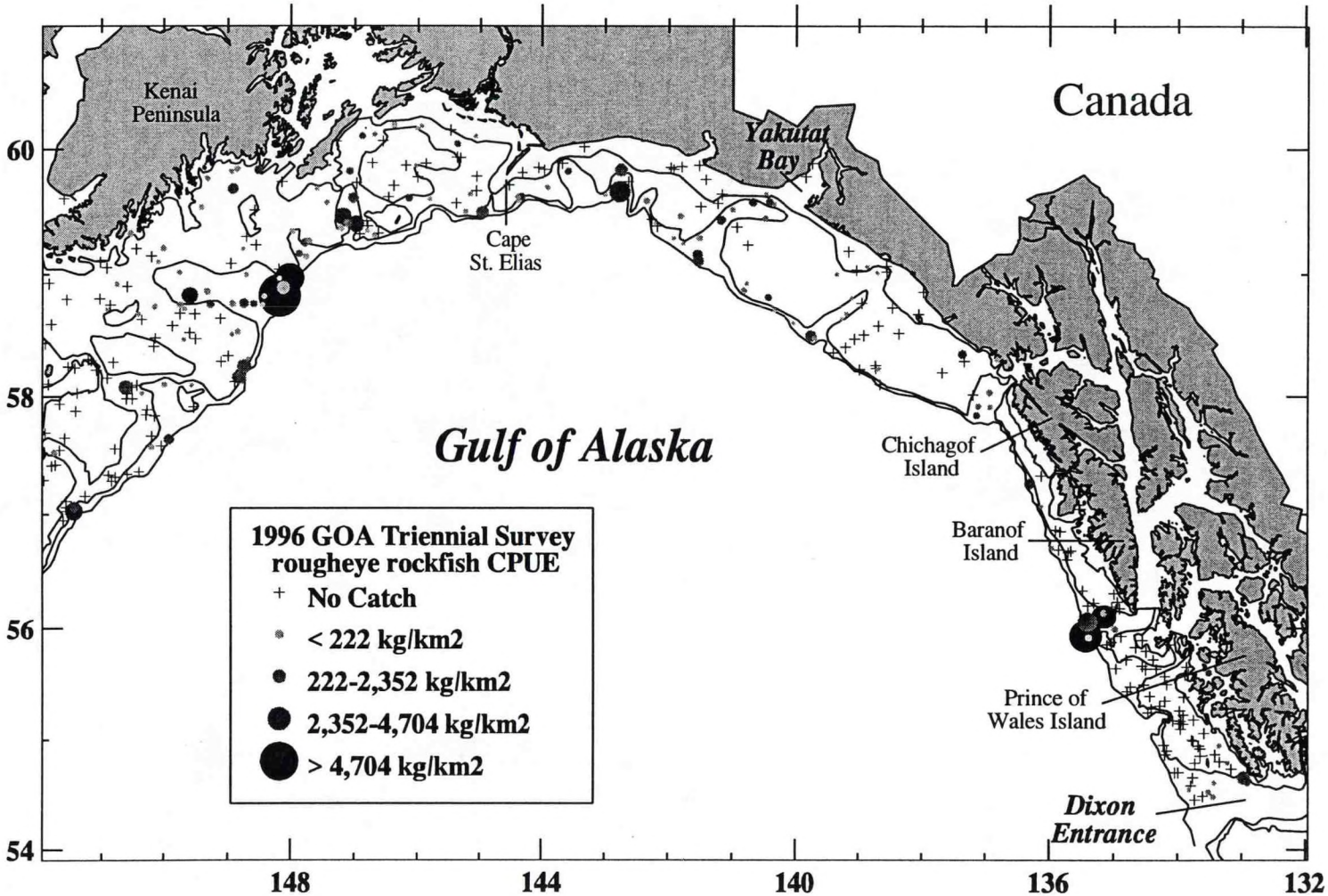


Figure 43.--Continued.

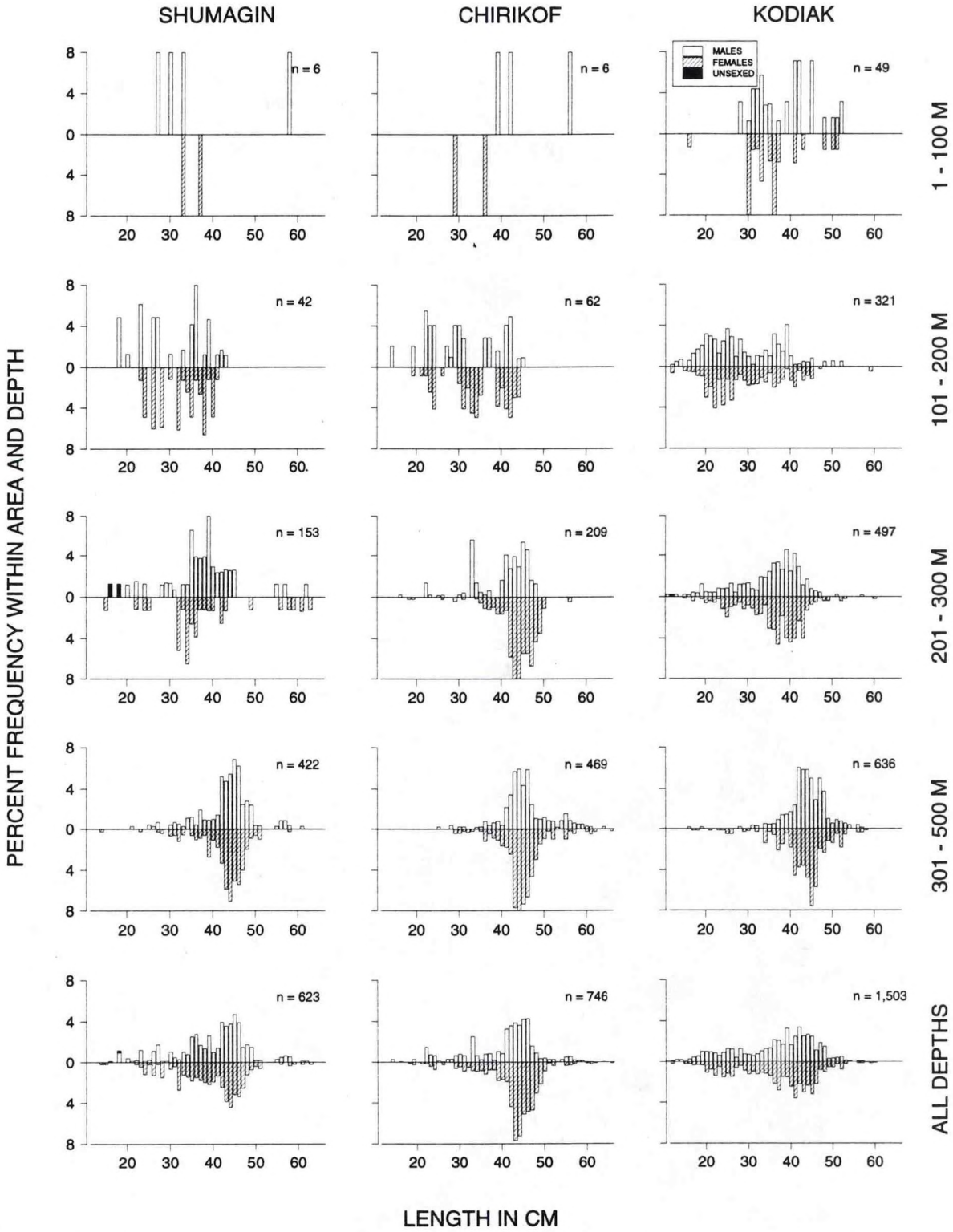


Figure 44.--Size composition of the estimated rougheye rockfish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

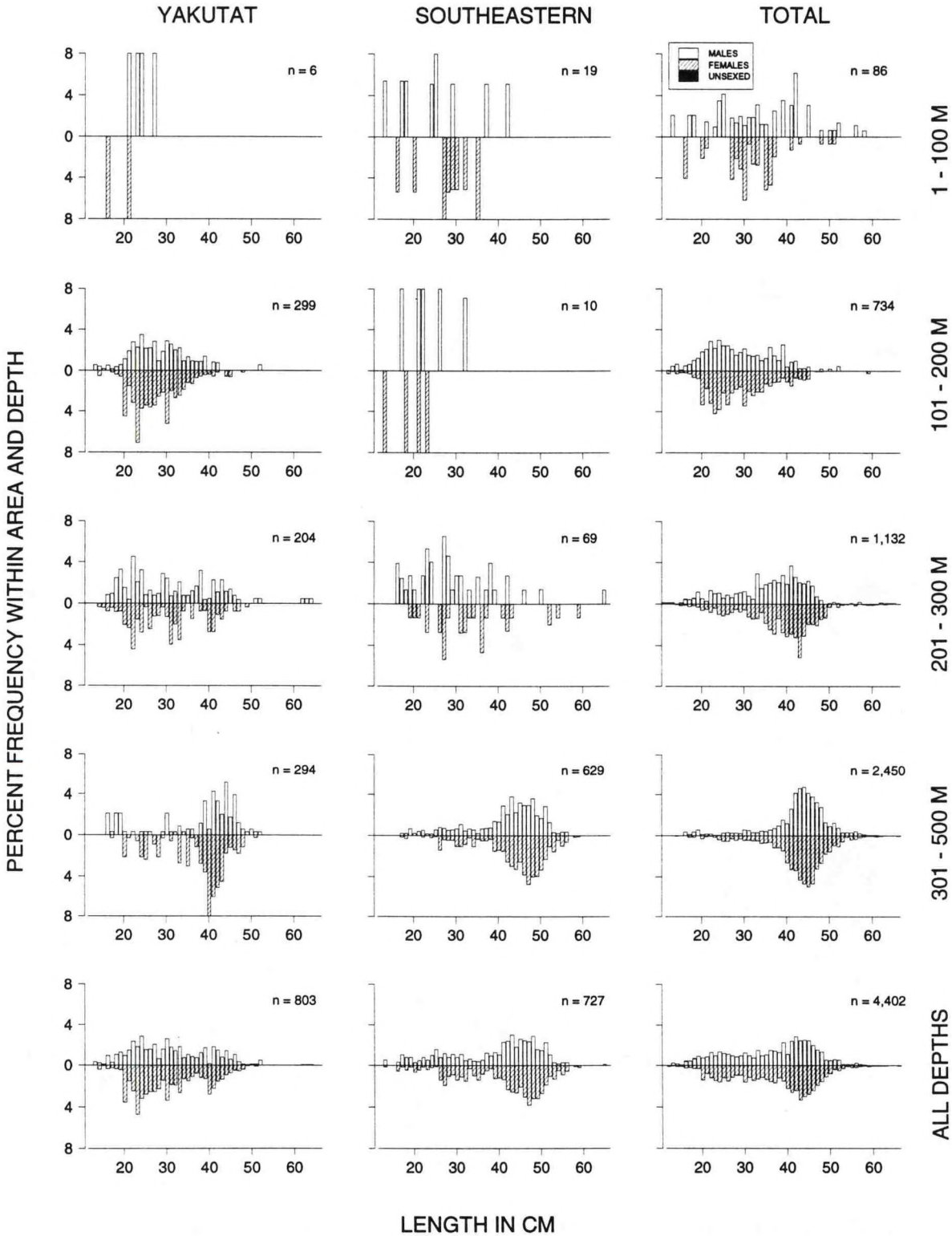


Figure 44.--Continued.

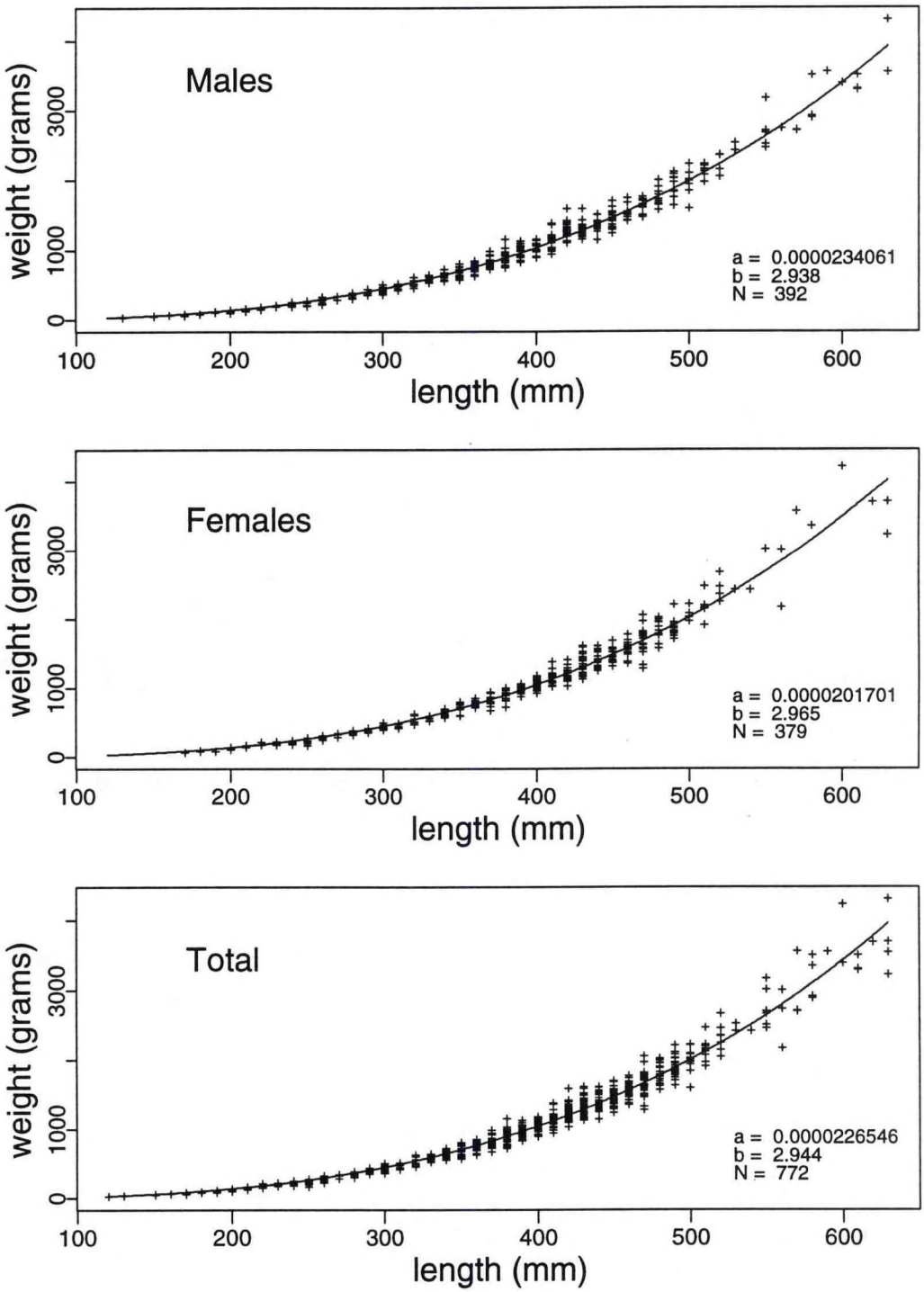


Figure 45.--Length-weight relationship for rougheye rockfish specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 40.--Catch per unit effort by stratum for rougheye rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	301-500	Southeastern Slope	4	4	5,227	4,039	0	10,743
Kodiak	301-500	Kodiak Slope	11	7	3,178	9,254	0	20,243
Chirikof	301-500	Chirikof Slope	13	11	2,514	4,033	190	7,876
Yakutat	301-500	Yakutat Gullies	5	5	1,326	1,468	0	4,086
Southeastern	301-500	Southeastern Deep Gullies	8	8	1,326	3,109	0	7,508
Shumagin	301-500	Shumagin Slope	16	12	1,041	2,635	167	5,104
Kodiak	201-300	Kodiak Slope	5	5	790	1,282	0	2,795
Yakutat	301-500	Yakutat Slope	1	1	784	1,193		
Kodiak	201-300	Kenai Gullies	20	20	586	3,901	1,062	6,739
Chirikof	201-300	Lower Shelikof Gully	22	12	458	4,589	0	11,985
Yakutat	101-200	Yakataga Shelf	8	6	276	1,456	0	3,683
Chirikof	201-300	Chirikof Slope	9	7	205	314	64	563
Yakutat	201-300	Yakutat Slope	16	11	196	416	0	881
Shumagin	201-300	Shumagin Slope	22	8	149	415	0	867
Kodiak	101-200	Kenai Flats	17	11	124	1,501	0	3,033
Yakutat	201-300	Yakutat Gullies	11	8	119	362	63	661
Kodiak	101-200	Albatross Gullies	32	6	92	729	0	1,723
Kodiak	1-100	Albatross Shallows	24	6	81	467	0	1,207
Southeastern	201-300	Prince of Wales Slope/Gullies	23	5	76	298	0	863
Yakutat	101-200	Middleton Shelf	23	12	69	509	142	875
Southeastern	201-300	Baranof-Chichagof Slope	5	2	63	71	0	219
Chirikof	101-200	East Shumagin Gully	16	3	60	671	0	2,014
Yakutat	101-200	Fairweather Shelf	10	2	58	448	0	1,411
Kodiak	1-100	Kenai Peninsula	4	1	47	245	0	1,025
Yakutat	101-200	Yakutat Flats	9	6	46	416	0	1,015
Shumagin	101-200	Sanak Gully	6	2	45	191	0	657
Kodiak	101-200	Portlock Flats	21	9	43	316	0	643
Southeastern	1-100	Southeastern Shallows	7	2	42	277	0	790
Kodiak	101-200	Kodiak Outer Shelf	24	4	37	185	0	421
Kodiak	201-300	Upper Shelikof Gully	6	4	36	115	0	247
Kodiak	101-200	Barren Islands	15	5	28	310	0	721
Chirikof	101-200	Shelikof Edge	28	9	23	179	51	308
Chirikof	1-100	Upper Alaska Peninsula	16	1	17	136	0	427
Shumagin	101-200	Shumagin Outer Shelf	41	6	17	140	8	272
Shumagin	101-200	West Shumagin Gully	13	2	10	23	0	57
Chirikof	101-200	Chirikof Outer Shelf	24	3	5	26	0	62
Shumagin	1-100	Fox Islands	28	3	4	36	0	81
Yakutat	1-100	Middleton Shallows	11	3	3	18	0	43
Southeastern	101-200	Prince of Wales Shelf	36	2	2	17	0	43
Shumagin	1-100	Lower Alaska Peninsula	26	1	1	9	0	26
Yakutat	1-100	Yakutat Shallows	22	2	1	6	0	15
Southeastern	101-200	Baranof-Chichagof Shelf	14	1	0	1	0	3

Light dusky rockfish (Sebastes sp.cf. ciliatus)

Light dusky rockfish were found in modest numbers in depths less than 300 m throughout the survey area (Table 41; Fig. 46). Nearly 90% of the total survey area biomass was estimated to occupy water between 201 and 300 m in depth. Larger catches occurred most often on the continental shelf near areas of deeper water, particularly major gullies and the continental slope (Fig. 46). Approximately 58% of the biomass estimate for the survey area came from two strata: Albatross Gullies and Chirikof Outer Shelf (Table 42) and one large tow accounted for almost the entire estimate in each stratum. Mean fish length generally increased with depth throughout the survey area and fish less than 35 cm FL were found almost exclusively in water less than 100 m in depth (Fig. 47). The length-weight relationship for dusky rockfish specimens collected during the survey is depicted in Figure 48.

Table 41.-- Number of survey hauls, number of hauls with light dusky rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	11	11	458	0.94	37.0
	101 - 200	60	12	208	3,060	1.34	42.9
	201 - 300	22	4	12	33	1.36	43.5
	301 - 500	16	0	---	---	---	---
	All depths	200	27	55	3,551	1.27	41.9
Chirikof	1 - 100	69	5	5	124	0.52	30.1
	101 - 200	68	17	795	18,954	1.58	44.1
	201 - 300	31	6	14	157	1.35	42.6
	301 - 500	13	0	---	---	---	---
	All depths	181	28	283	19,235	1.56	43.8
Kodiak	1 - 100	59	6	27	1,048	0.65	31.2
	101 - 200	109	21	794	34,405	1.54	44.4
	201 - 300	31	3	51	587	1.51	43.9
	301 - 500	11	0	---	---	---	---
	All depths	210	30	355	36,040	1.48	43.5
Yakutat	1 - 100	33	1	2	34	1.76	46.0
	101 - 200	50	7	342	10,052	1.74	46.0
	201 - 300	27	9	794	4,107	1.73	45.7
	301 - 500	6	0	---	---	---	---
	All depths	116	17	249	14,193	1.74	45.9
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	8	293	1,479	1.46	44.2
	301 - 500	12	0	---	---	---	---
	All depths	97	8	53	1,479	1.46	44.2
All areas	1 - 100	270	23	13	1,664	0.70	32.4
	101 - 200	337	57	543	66,471	1.57	44.4
	201 - 300	139	30	177	6,363	1.63	45.1
	301 - 500	58	0	---	---	---	---
	All depths	804	110	233	74,498	1.53	43.9

All areas biomass, 95% confidence interval: 8,102 - 140,894 metric tons (t).

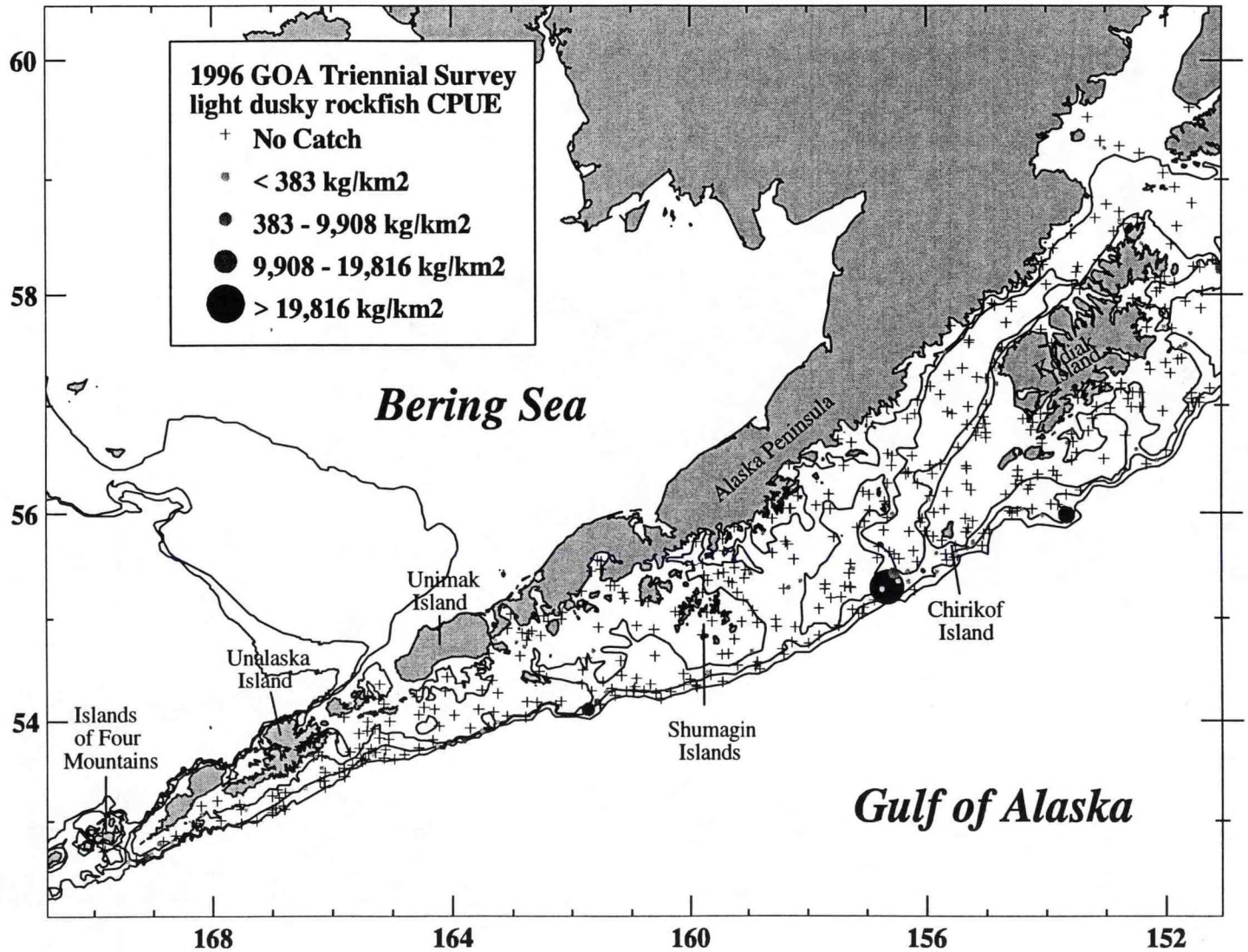
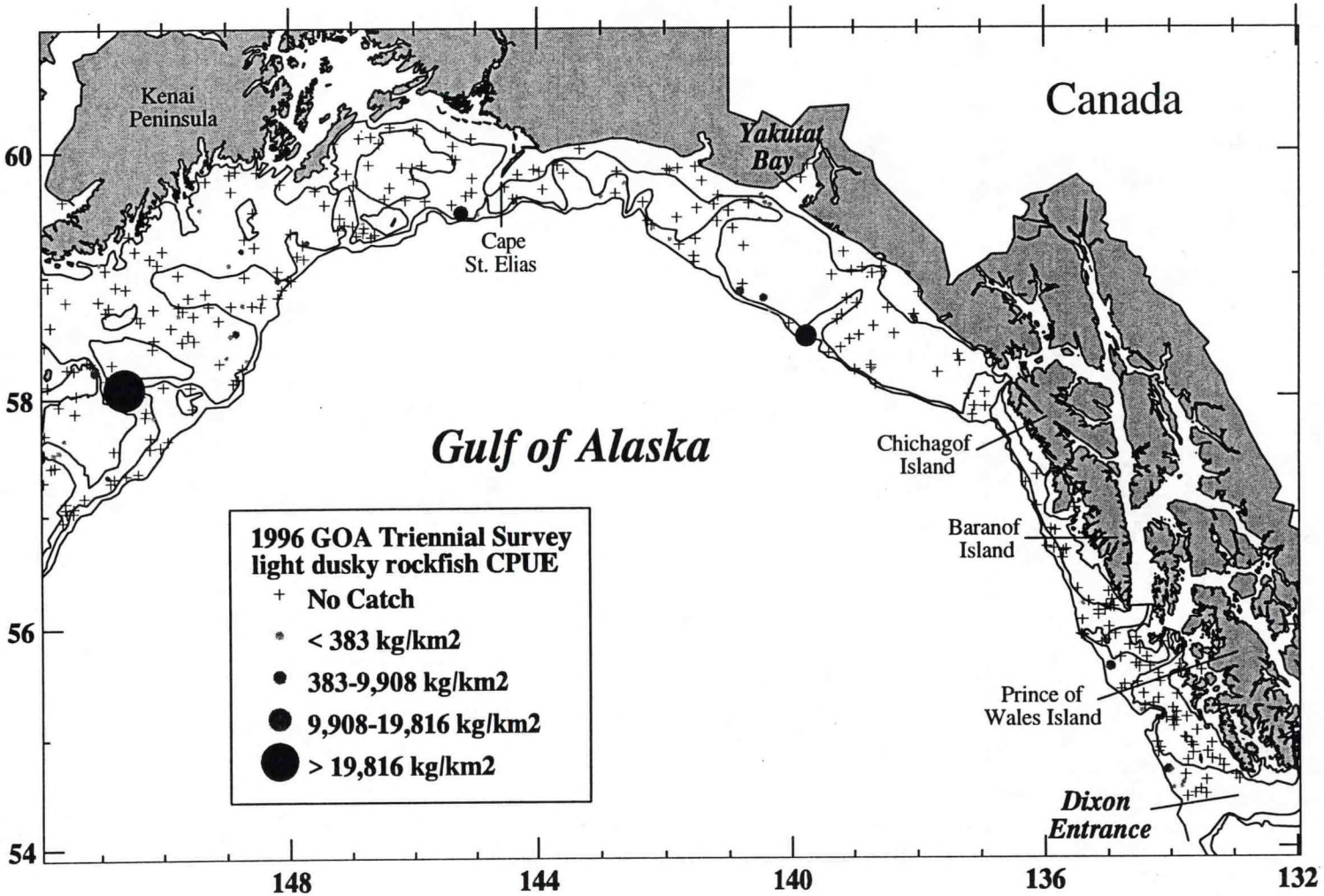


Figure 46.--Distribution and relative abundance of light dusky rockfish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.



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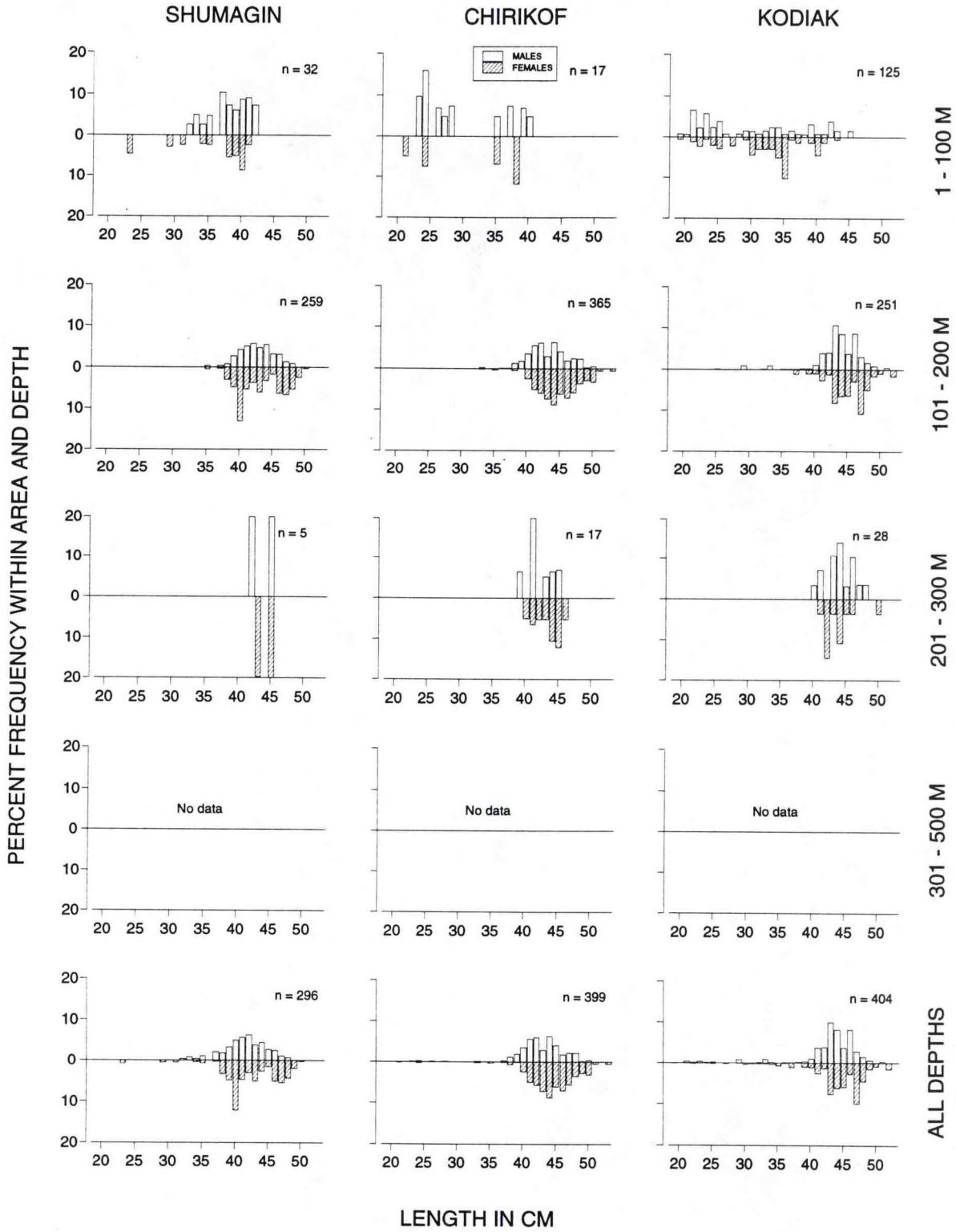

Figure 47.--Size composition of the estimated light dusky rockfish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

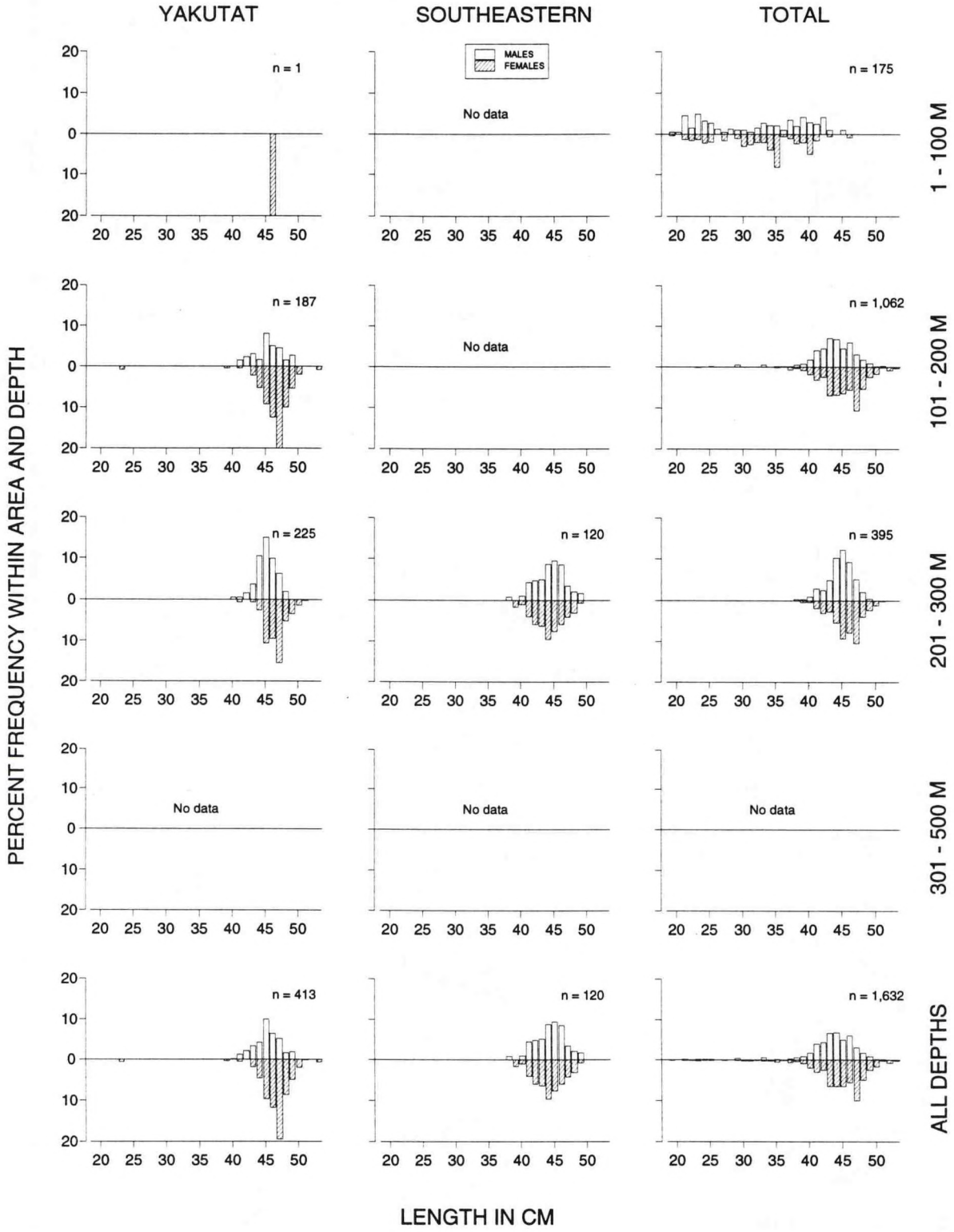

Figure 47.--Continued.

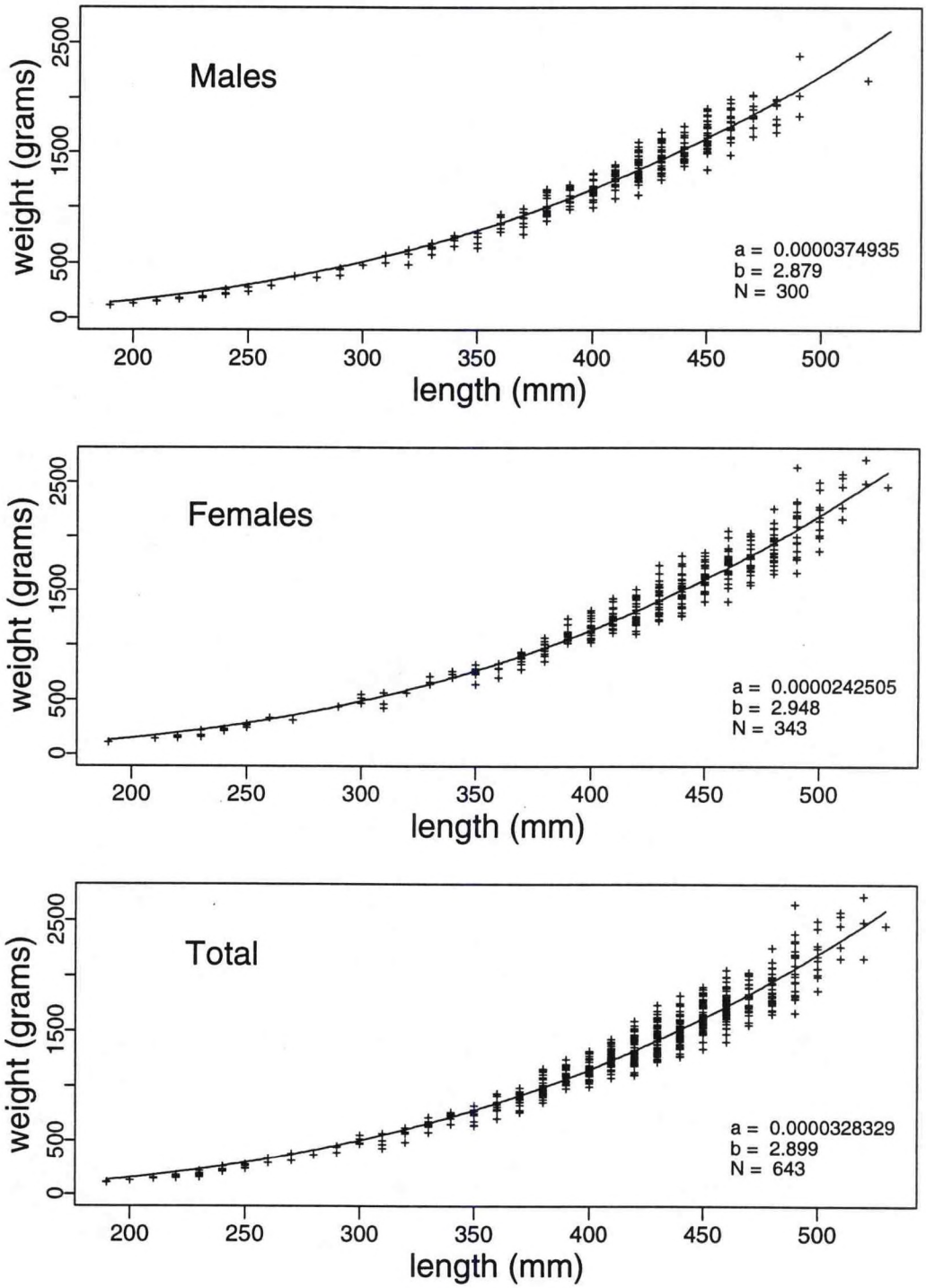

Figure 48.--Length-weight relationship for light dusky rockfish specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 42.--Catch per unit effort by stratum for light dusky rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	101-200	Albatross Gullies	32	6	3,621	28,650	0	84,610
Chirikof	101-200	Chirikof Outer Shelf	24	8	3,279	16,430	0	49,569
Yakutat	201-300	Yakutat Slope	16	7	1,916	4,076	0	12,477
Kodiak	101-200	Kodiak Outer Shelf	24	6	835	4,196	0	12,039
Yakutat	101-200	Yakutat Flats	9	2	630	5,688	0	14,381
Yakutat	101-200	Middleton Shelf	23	2	562	4,130	0	12,647
Kodiak	1-100	Northern Kodiak Shallows	6	1	396	872	0	3,114
Shumagin	101-200	Shumagin Outer Shelf	41	12	375	3,060	0	7,423
Southeastern	201-300	Prince of Wales Slope/Gullies	23	7	374	1,468	0	3,511
Chirikof	101-200	Shelikof Edge	28	6	280	2,163	0	5,828
Kodiak	101-200	Portlock Flats	21	4	115	841	0	2,354
Chirikof	201-300	Chirikof Slope	9	6	103	157	0	318
Kodiak	201-300	Kenai Gullies	20	2	86	571	0	1,654
Kodiak	101-200	Kenai Flats	17	3	55	669	0	1,737
Yakutat	101-200	Yakataga Shelf	8	2	36	191	0	488
Shumagin	1-100	Lower Alaska Peninsula	26	4	33	227	0	647
Chirikof	101-200	East Shumagin Gully	16	3	32	361	0	885
Shumagin	201-300	Shumagin Slope	22	4	12	33	0	65
Shumagin	1-100	Fox Islands	28	4	10	79	0	206
Yakutat	201-300	Yakutat Gullies	11	2	10	31	0	79
Southeastern	201-300	Baranof-Chichagof Slope	5	1	10	11	0	42
Kodiak	201-300	Kodiak Slope	5	1	10	16	0	62
Shumagin	1-100	Shumagin Bank	23	2	10	120	0	291
Kodiak	1-100	Lower Cook Inlet	6	1	7	70	0	249
Chirikof	1-100	Semidi Bank	18	1	6	46	0	144
Kodiak	1-100	Albatross Shallows	24	2	6	34	0	88
Yakutat	101-200	Fairweather Shelf	10	1	6	43	0	141
Chirikof	1-100	Chirikof Bank	35	3	5	53	0	146
Kodiak	1-100	Albatross Banks	19	2	5	72	0	182
Kodiak	101-200	Barren Islands	15	2	4	49	0	140
Chirikof	1-100	Upper Alaska Peninsula	16	1	3	25	0	77
Yakutat	1-100	Yakutat Shallows	22	1	3	34	0	106
Shumagin	1-100	Davidson Bank	25	1	2	32	0	99

Dark dusky rockfish (Sebastes ciliatus)

Dark dusky rockfish were rarely caught during the survey appearing in just over 1% of the survey hauls (Table 43). Four of these tows accounted for almost 84% of the total survey biomass estimate (Table 44). No stratum had more than one catch of dark dusky rockfish. No dark dusky were caught east of 150°W (Fig. 49). The length data collected are summarized in Figure 50. Too few length data were collected to estimate a length-weight relationship.

Table 43.-- Number of survey hauls, number of hauls with dark dusky rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	4	4	161	1.27	37.7
	101 - 200	60	1	1	8	1.11	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	5	2	169	1.26	37.7
Chirikof	1 - 100	69	1	5	124	1.10	36.9
	101 - 200	68	2	1	16	0.52	32.7
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	3	2	140	0.98	36.0
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	2	1	58	1.35	41.4
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	2	1	58	1.35	41.4
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	0	---	---	---	---
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	0	---	---	---	---
	301 - 500	12	0	---	---	---	---
	All depths	97	0	---	---	---	---
All areas	1 - 100	270	5	2	285	1.19	37.3
	101 - 200	337	5	1	82	1.01	37.8
	201 - 300	139	0	---	---	---	---
	301 - 500	58	0	---	---	---	---
	All depths	804	10	1	367	1.15	37.4

All areas biomass, 95% confidence interval: 24 - 710 metric tons (t).

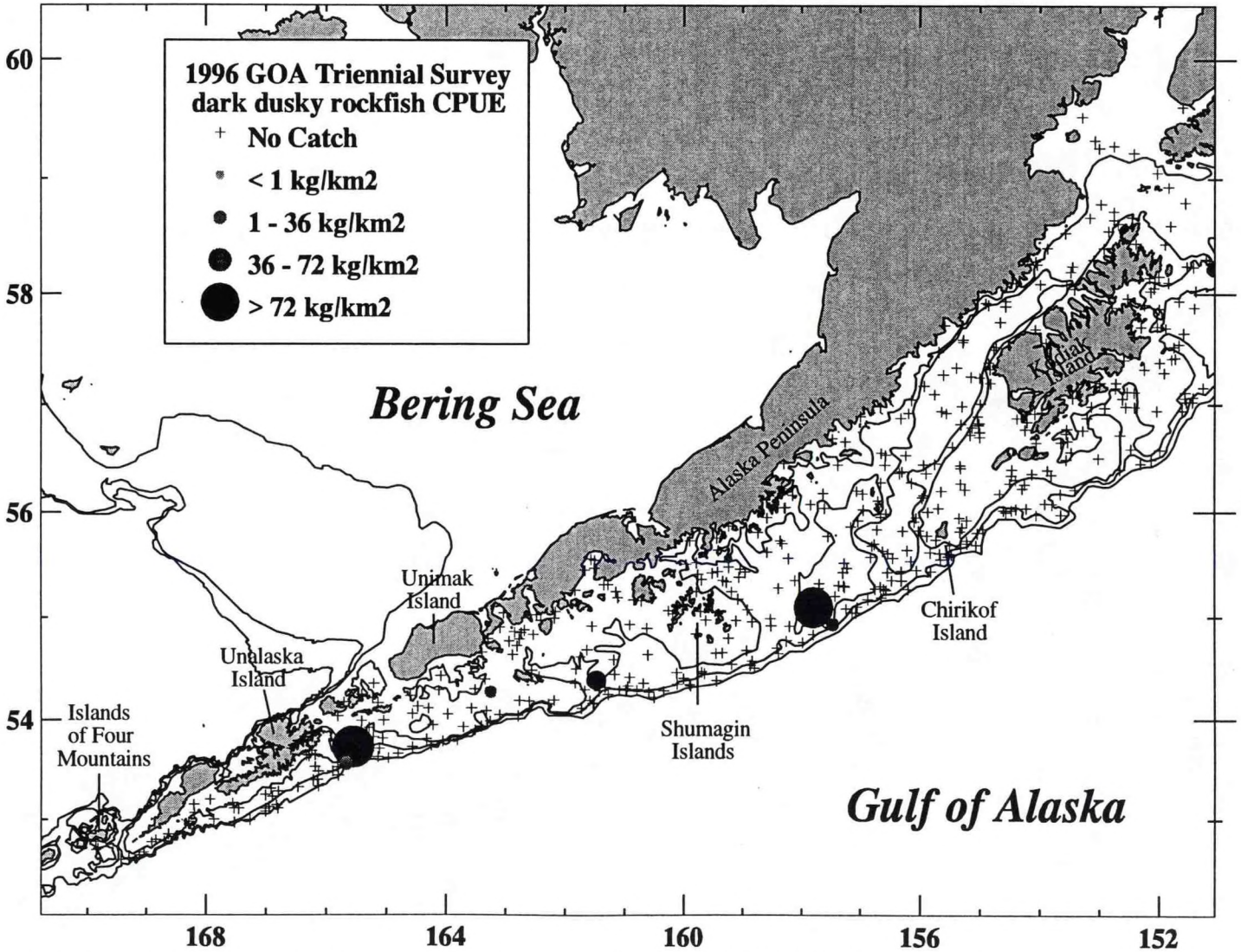

Figure 49.--Distribution and relative abundance of dark dusky rockfish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

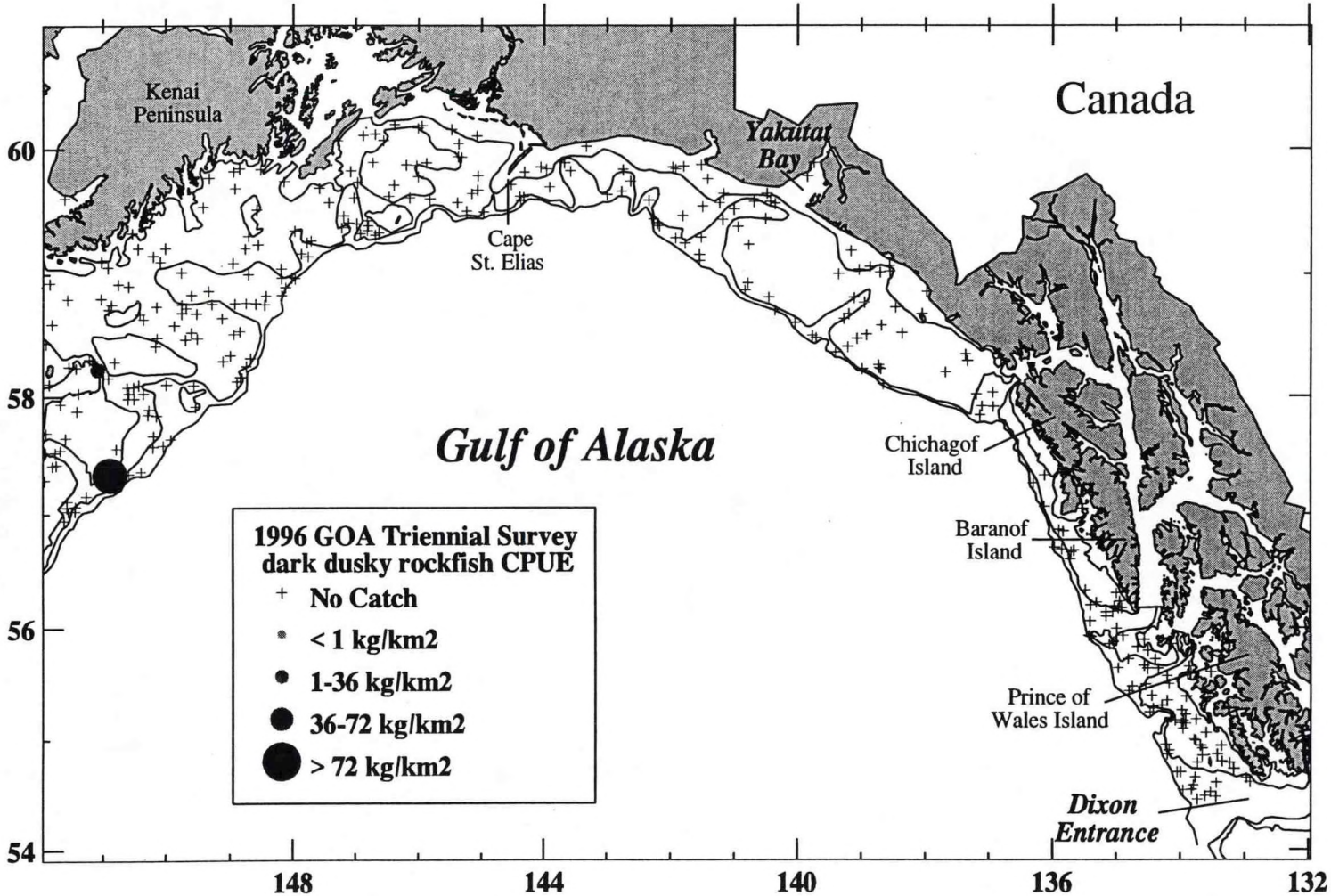

Figure 49.--Continued.

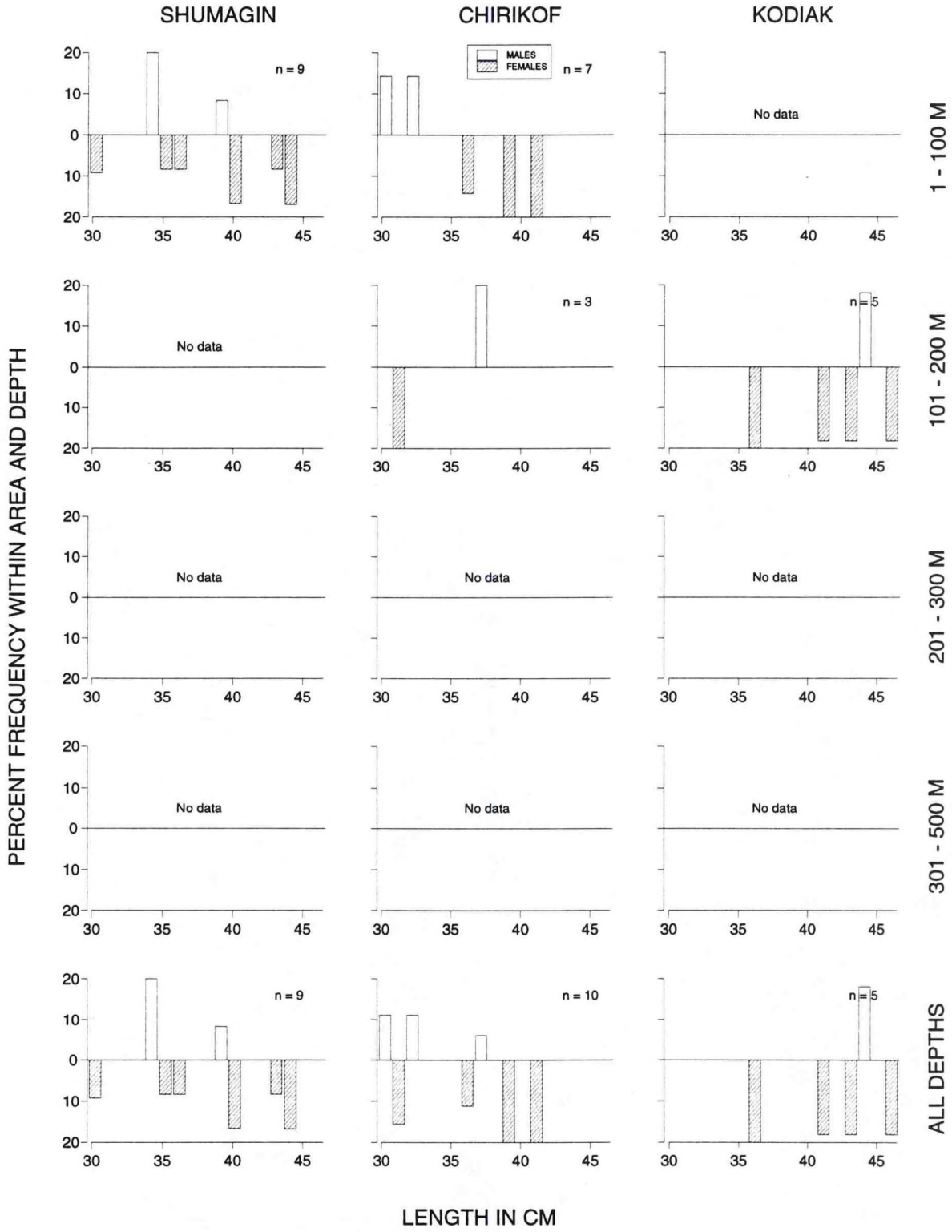

Figure 50.--Size composition of the estimated dark dusky rockfish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

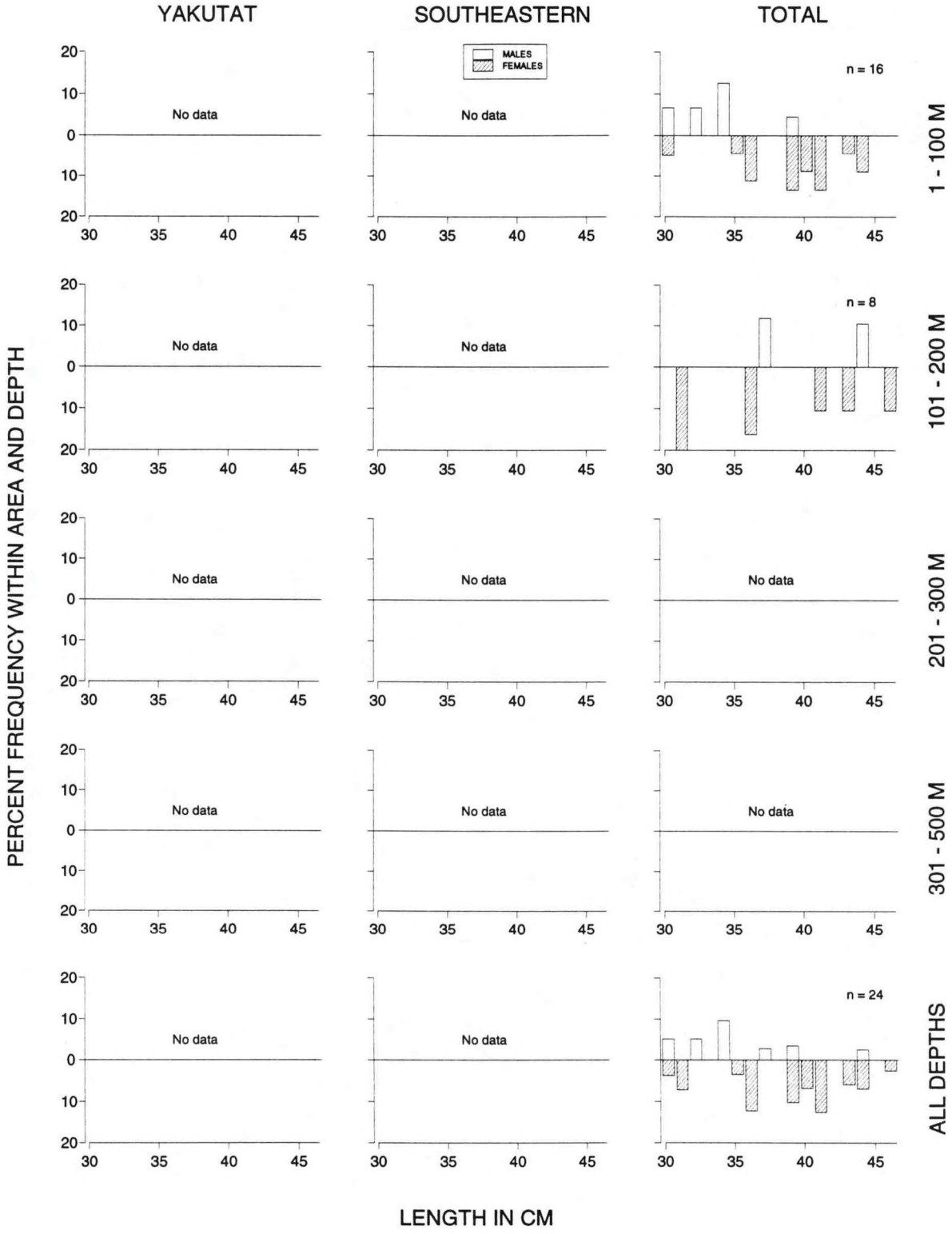

Figure 50.--Continued.

Table 44.--Catch per unit effort by stratum for dark dusky rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	1-100	Semidi Bank	18	1	17	124	0	384
Shumagin	1-100	Fox Islands	28	1	11	93	0	285
Kodiak	101-200	Kodiak Outer Shelf	24	1	9	47	0	146
Shumagin	1-100	Shumagin Bank	23	1	3	43	0	132
Chirikof	101-200	Chirikof Outer Shelf	24	1	2	8	0	25
Shumagin	1-100	Davidson Bank	25	1	1	20	0	60
Kodiak	101-200	Albatross Gullies	32	1	1	11	0	34
Shumagin	1-100	Lower Alaska Peninsula	26	1	1	5	0	16
Shumagin	101-200	Shumagin Outer Shelf	41	1	1	8	0	25
Chirikof	101-200	East Shumagin Gully	16	1	1	8	0	24

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Sharpchin rockfish (Sebastes zacentrus)

Sharpchin rockfish were found only rarely west of Kodiak Island (Fig. 51). About 84% of the total survey biomass was estimated to have occurred in water 201-300 m in depth (Table 45). Nearly 61% of the total was concentrated in one stratum, Prince of Wales Slope and Gullies (Table 46). Fish size generally increased with depth (Fig. 52). The length-weight relationship for sharpchin rockfish specimens collected during the survey is depicted in Figure 53.

Table 45.-- Number of survey hauls, number of hauls with sharpchin rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	1	1	33	0.57	33.2
	101 - 200	60	1	1	7	0.69	34.0
	201 - 300	22	1	11	32	0.36	28.1
	301 - 500	16	0	---	---	---	---
	All depths	200	3	1	72	0.46	30.4
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	0	---	---	---	---
	201 - 300	31	1	81	934	0.40	30.5
	301 - 500	13	0	---	---	---	---
	All depths	181	1	14	934	0.40	30.5
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	13	16	678	0.23	24.4
	201 - 300	31	2	35	399	0.40	29.3
	301 - 500	11	1	1	4	0.42	28.0
	All depths	210	16	11	1,081	0.27	25.7
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	5	213	6,274	0.22	24.7
	201 - 300	27	15	2,436	12,597	0.31	27.5
	301 - 500	6	0	---	---	---	---
	All depths	116	20	331	18,871	0.27	26.4
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	17	303	3,352	0.21	24.2
	201 - 300	28	16	7,987	40,356	0.33	27.8
	301 - 500	12	0	---	---	---	---
	All depths	97	33	1,559	43,708	0.31	27.4
All areas	1 - 100	270	1	0	33	0.57	33.2
	101 - 200	337	36	84	10,311	0.22	24.5
	201 - 300	139	35	1,507	54,318	0.32	27.8
	301 - 500	58	1	0	4	0.42	28.0
	All depths	804	73	202	64,666	0.30	27.1

All areas biomass, 95% confidence interval: 23,224 - 106,108 metric tons (t).

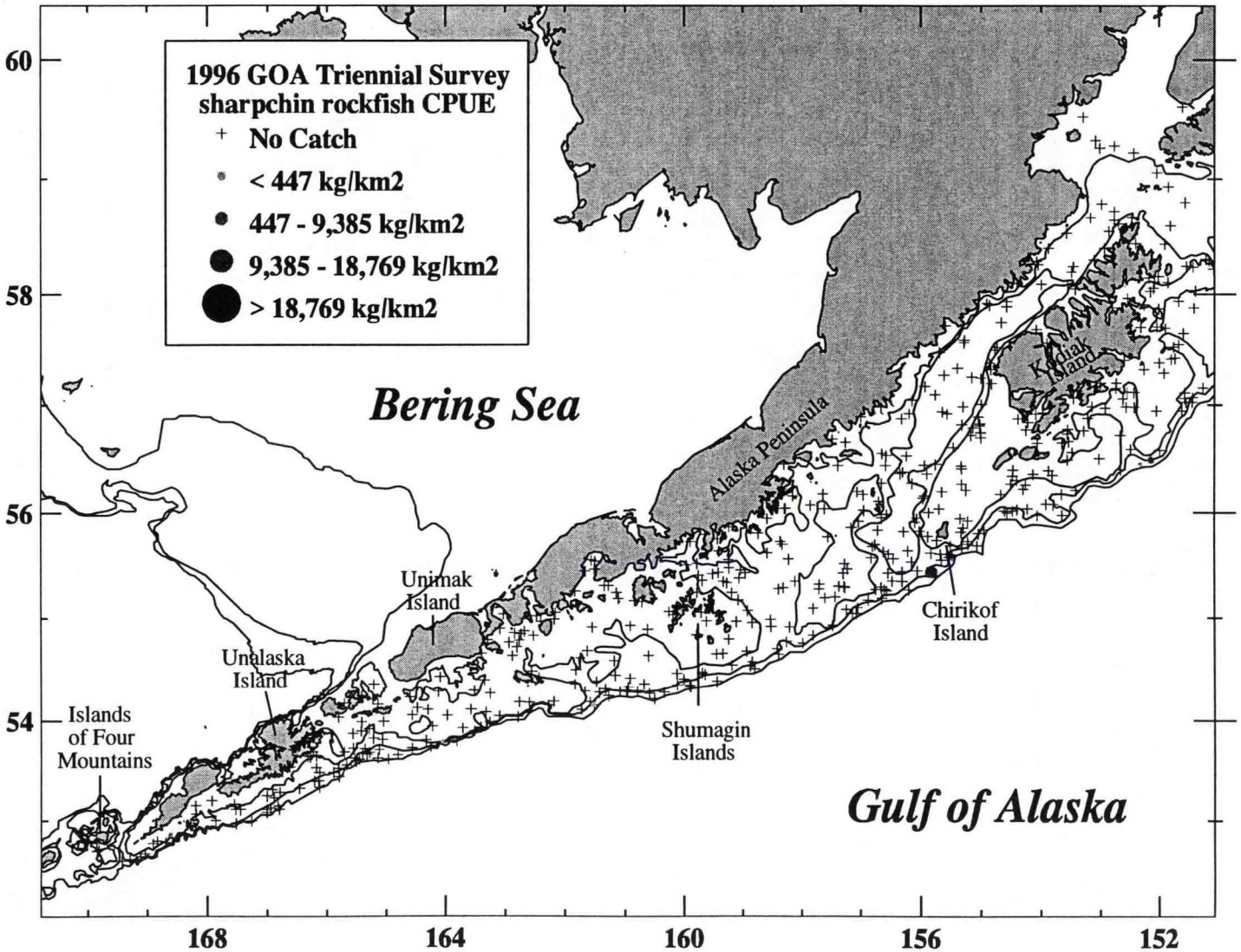


Figure 51.--Distribution and relative abundance of sharpchin rockfish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

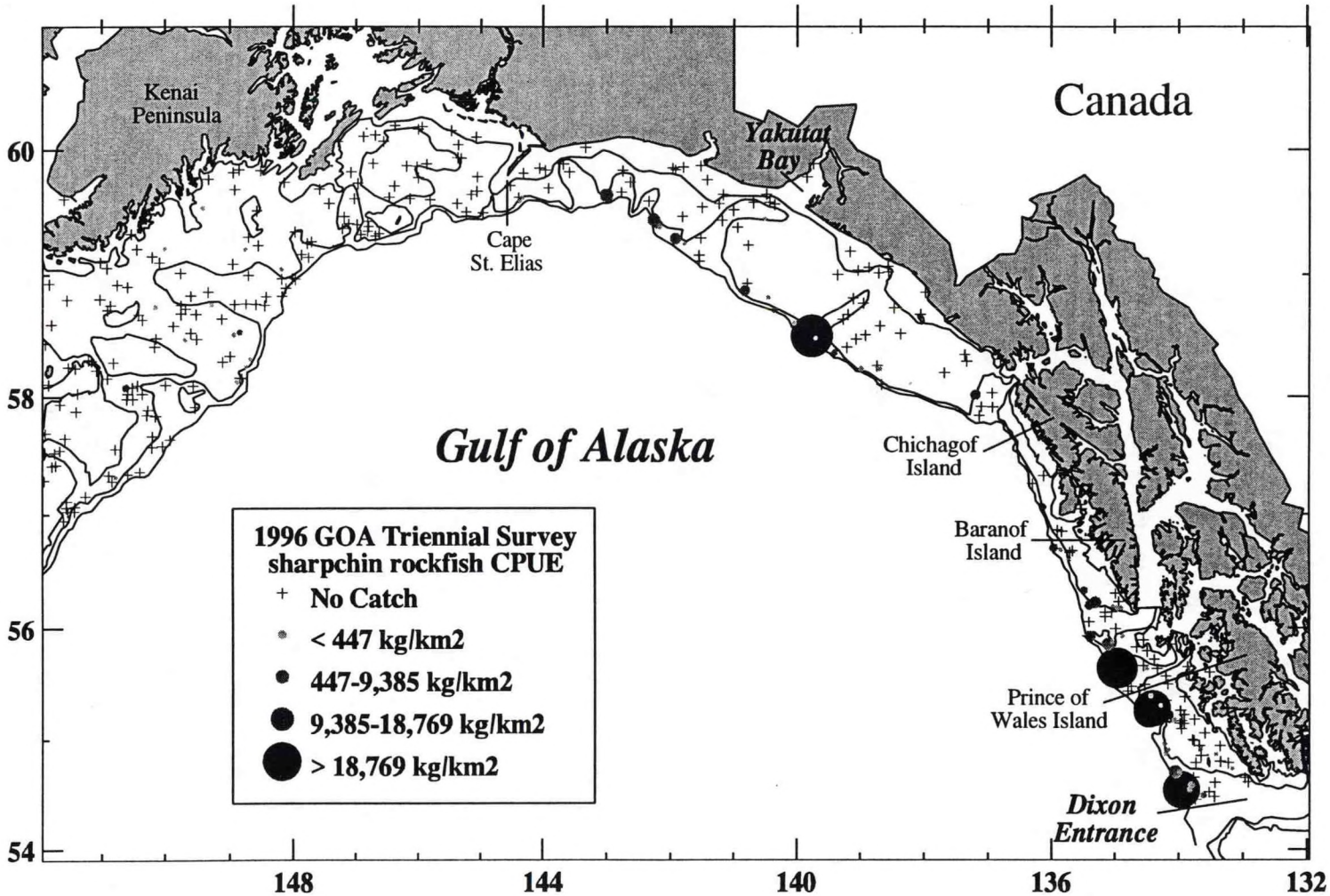


Figure 51.--Continued.

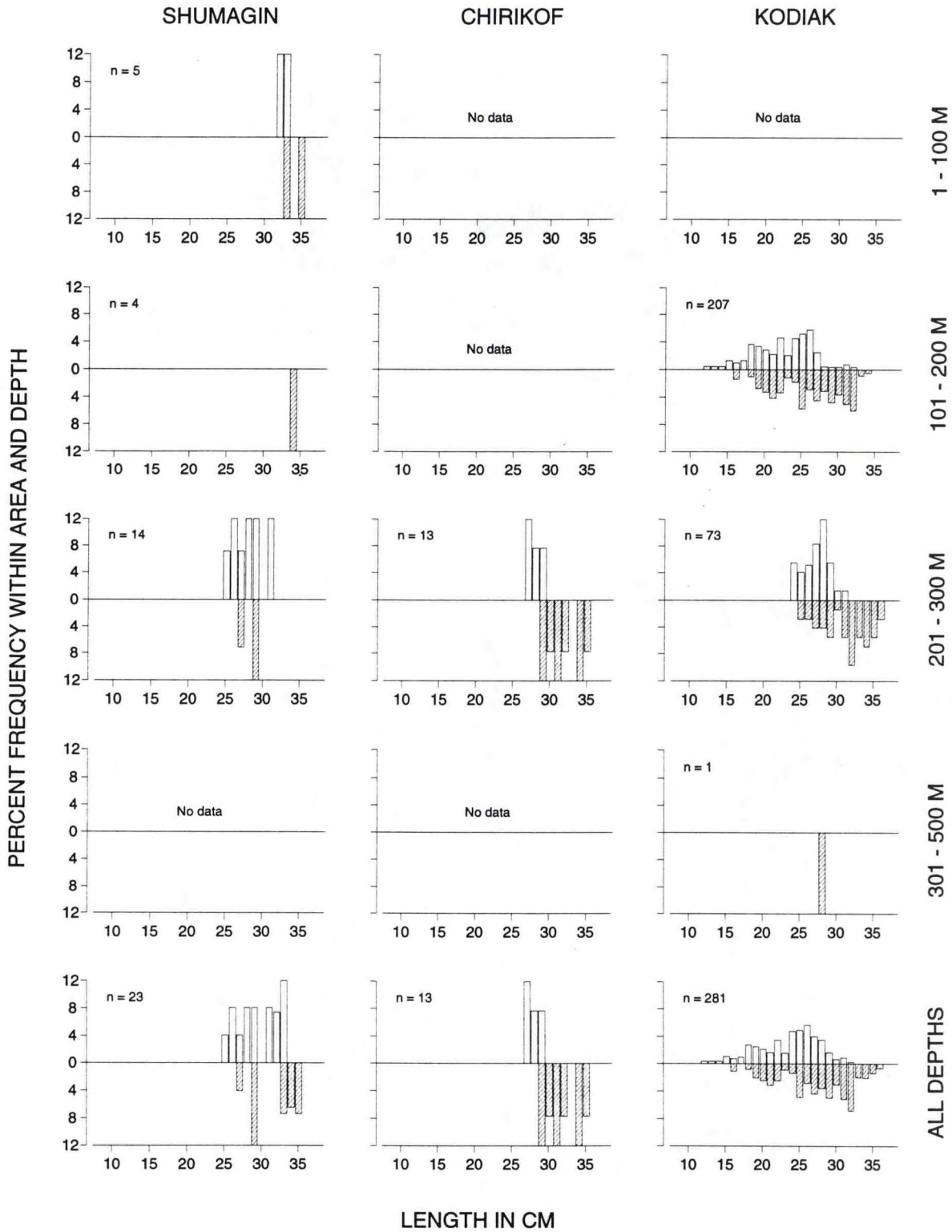


Figure 52.--Size composition of the estimated sharpchin rockfish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

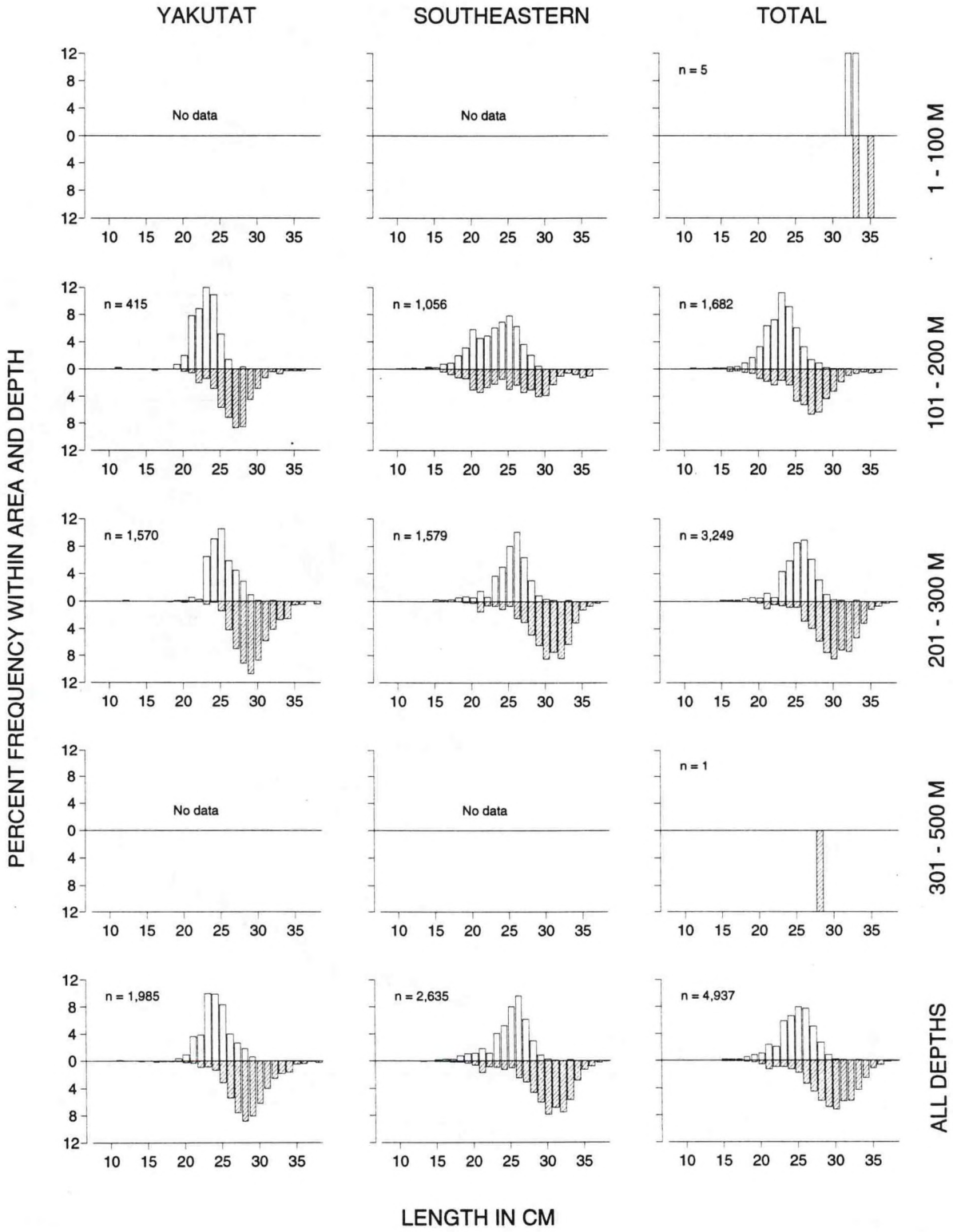


Figure 52.--Continued.

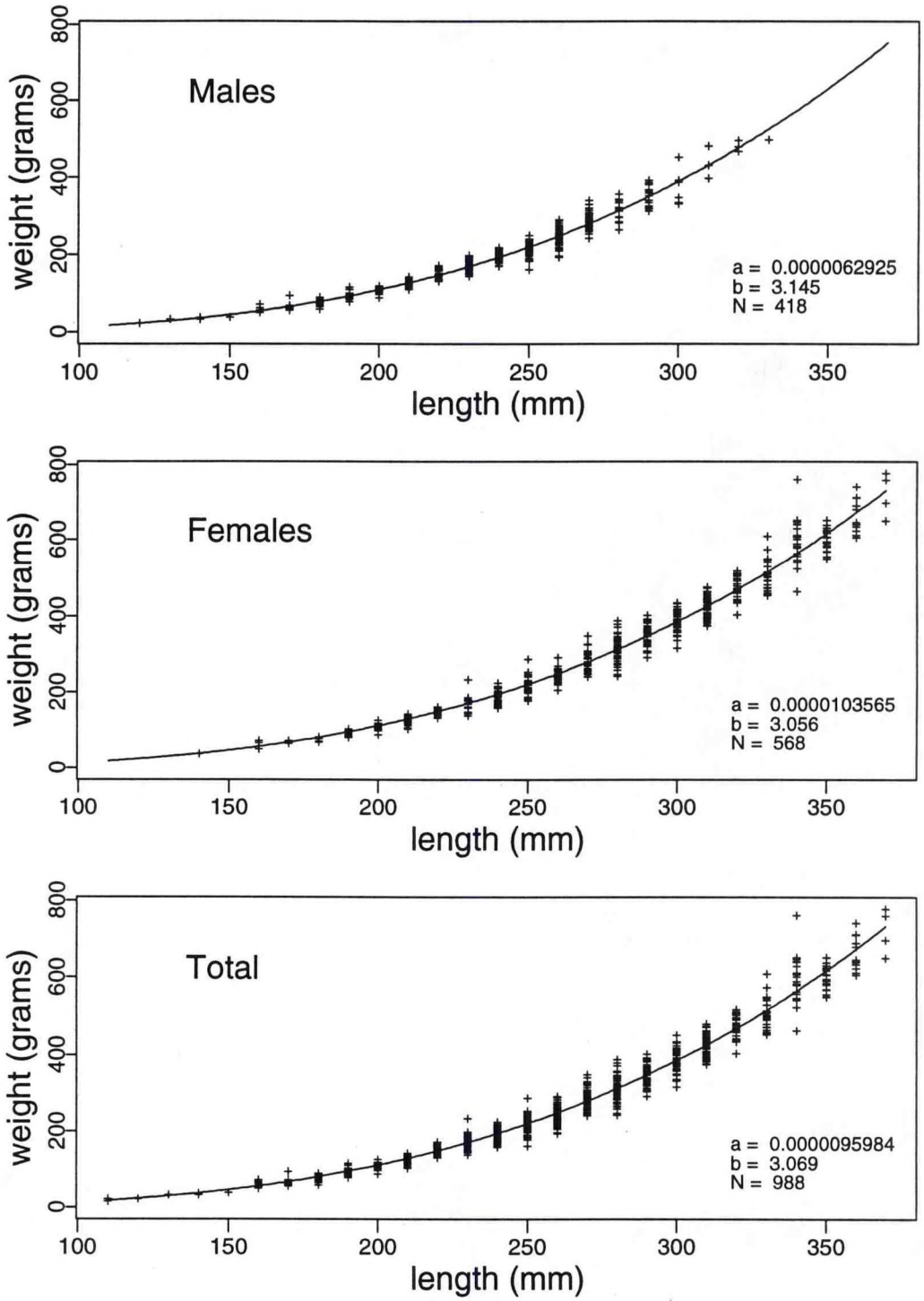


Figure 53.--Length-weight relationship for sharpchin rockfish specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 46.--Catch per unit effort by stratum for sharpchin rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	13	9,999	39,271	3,097	75,444
Yakutat	201-300	Yakutat Slope	16	14	5,920	12,595	0	33,025
Southeastern	201-300	Baranof-Chichagof Slope	5	3	964	1,085	0	2,905
Chirikof	201-300	Chirikof Slope	9	1	611	934	0	3,086
Southeastern	101-200	Baranof-Chichagof Shelf	14	7	499	2,095	0	5,149
Yakutat	101-200	Yakutat Flats	9	2	412	3,723	0	12,190
Yakutat	101-200	Fairweather Shelf	10	3	330	2,551	0	8,133
Kodiak	201-300	Kodiak Slope	5	2	246	399	0	1,498
Southeastern	101-200	Prince of Wales Shelf	36	10	183	1,257	0	3,518
Kodiak	101-200	Portlock Flats	21	5	40	292	0	654
Kodiak	101-200	Albatross Gullies	32	1	36	289	0	878
Shumagin	201-300	Shumagin Slope	22	1	11	32	0	98
Kodiak	101-200	Kenai Flats	17	3	6	74	0	197
Kodiak	101-200	Kodiak Outer Shelf	24	4	5	23	0	48
Shumagin	1-100	Fox Islands	28	1	4	33	0	99
Shumagin	101-200	Shumagin Outer Shelf	41	1	1	7	0	22
Kodiak	301-500	Kodiak Slope	11	1	1	4	0	13
Yakutat	201-300	Yakutat Gullies	11	1	1	2	0	7

Shortraker rockfish (Sebastes borealis)

Shortraker rockfish were most abundant in the deepest waters of the survey on the continental slope and in deep gullies (Fig. 54). About 86% of tows greater than 300 m contained shortraker rockfish, while less than 3% of tows in all other depths did (Table 47). The highest shortraker rockfish CPUEs of the survey were seen in the continental slope waters between 301 and 500 m in the Chirikof, Kodiak and Yakutat INPFC areas, where more than 57% of the gulf-wide biomass was concentrated in less than 2% of the survey area (Table 48). Fish size generally increased from west to east over the survey area (Fig. 55). Very few fish smaller than 40 cm FL were caught in the survey (Fig. 55). The length-weight relationship for shortraker rockfish specimens collected during the survey is depicted in Figure 56.

Table 47.-- Number of survey hauls, number of hauls with shortraker rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	2	11	164	3.91	54.9
	201 - 300	22	2	53	148	3.34	58.0
	301 - 500	16	13	630	1,594	2.48	51.8
	All depths	200	17	29	1,906	2.62	52.4
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	0	---	---	---	---
	201 - 300	31	3	23	263	3.51	60.0
	301 - 500	13	13	1,337	2,145	3.18	54.6
	All depths	181	16	35	2,408	3.21	55.2
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	1	2	74	2.89	57.0
	201 - 300	31	2	15	175	3.53	57.8
	301 - 500	11	9	2,568	7,477	3.94	59.9
	All depths	210	12	76	7,726	3.92	59.8
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	1	4	108	4.02	61.0
	201 - 300	27	7	347	1,796	5.30	66.7
	301 - 500	6	6	997	2,619	3.67	59.4
	All depths	116	14	79	4,523	4.19	61.7
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	1	11	122	9.69	84.0
	201 - 300	28	3	343	1,729	9.69	81.3
	301 - 500	12	9	592	1,847	4.47	63.6
	All depths	97	13	132	3,698	6.12	69.3
All areas	1 - 100	270	0	---	---	---	---
	101 - 200	337	5	4	468	4.37	60.4
	201 - 300	139	17	114	4,111	5.99	68.6
	301 - 500	58	50	1,226	15,682	3.61	58.2
	All depths	804	72	63	20,261	3.95	59.6

All areas biomass, 95% confidence interval: 10,654 - 29,868 metric tons (t).

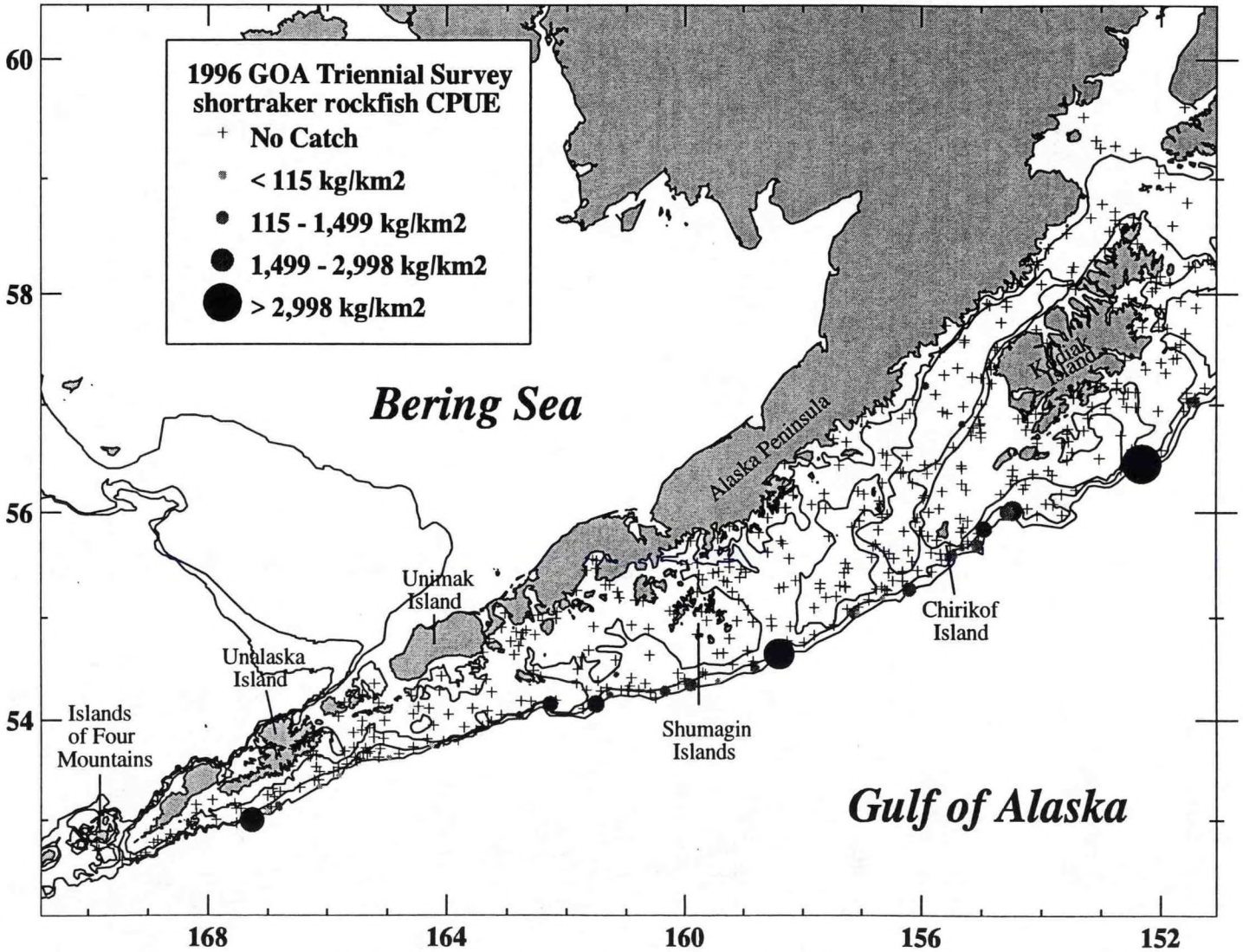


Figure 54.--Distribution and relative abundance of shortraker rockfish from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

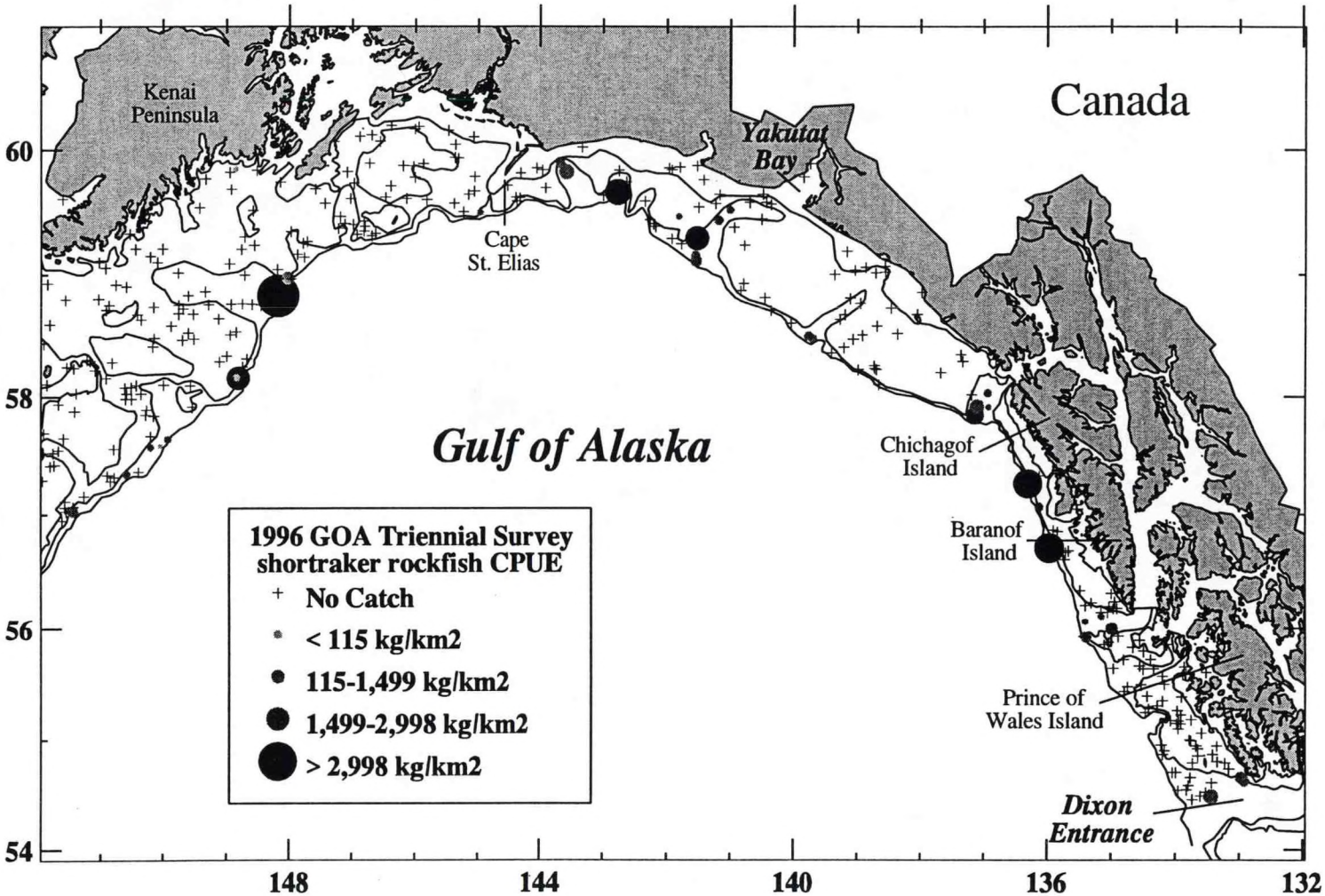


Figure 54.--Continued.

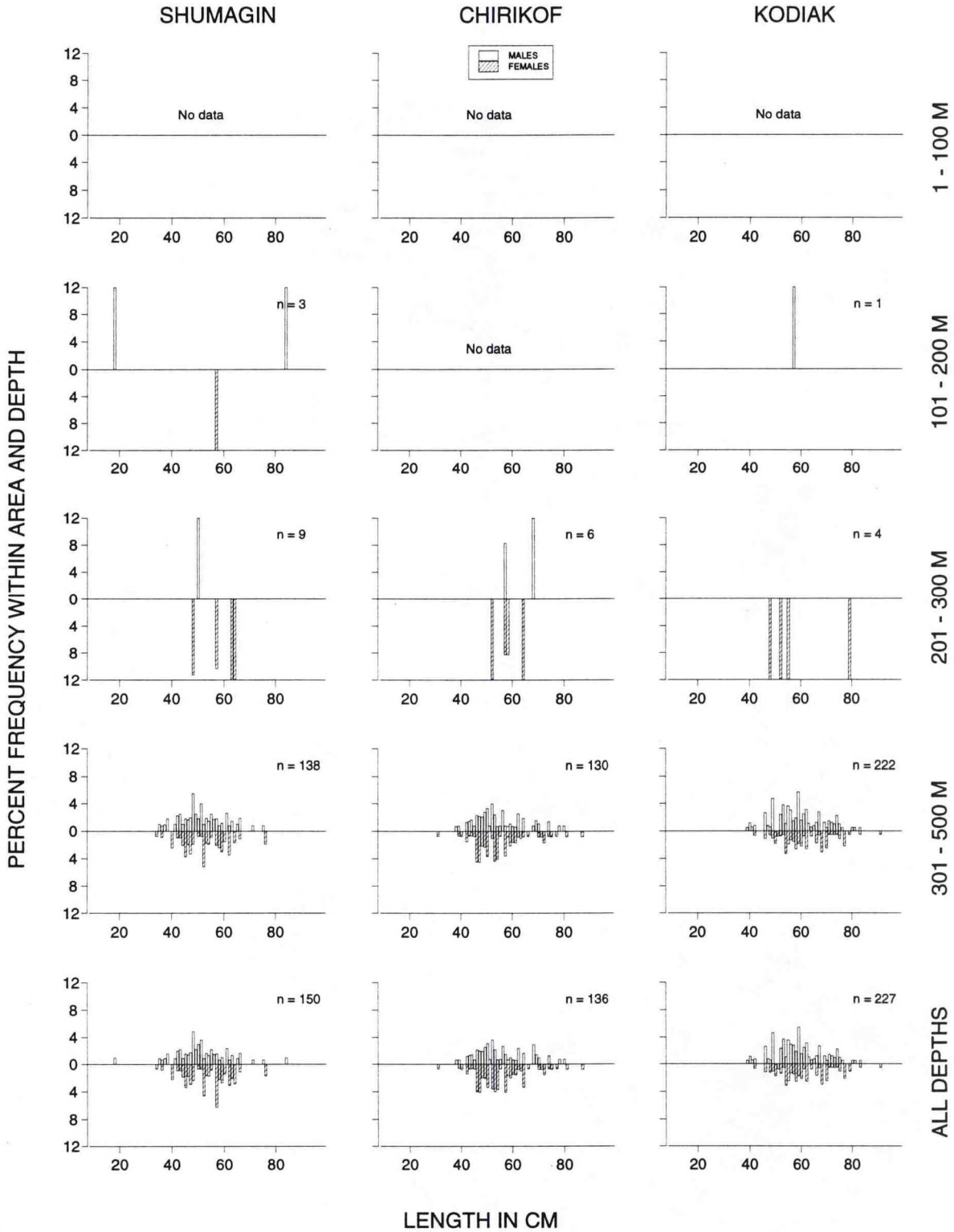


Figure 55.--Size composition of the estimated shortraker rockfish population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

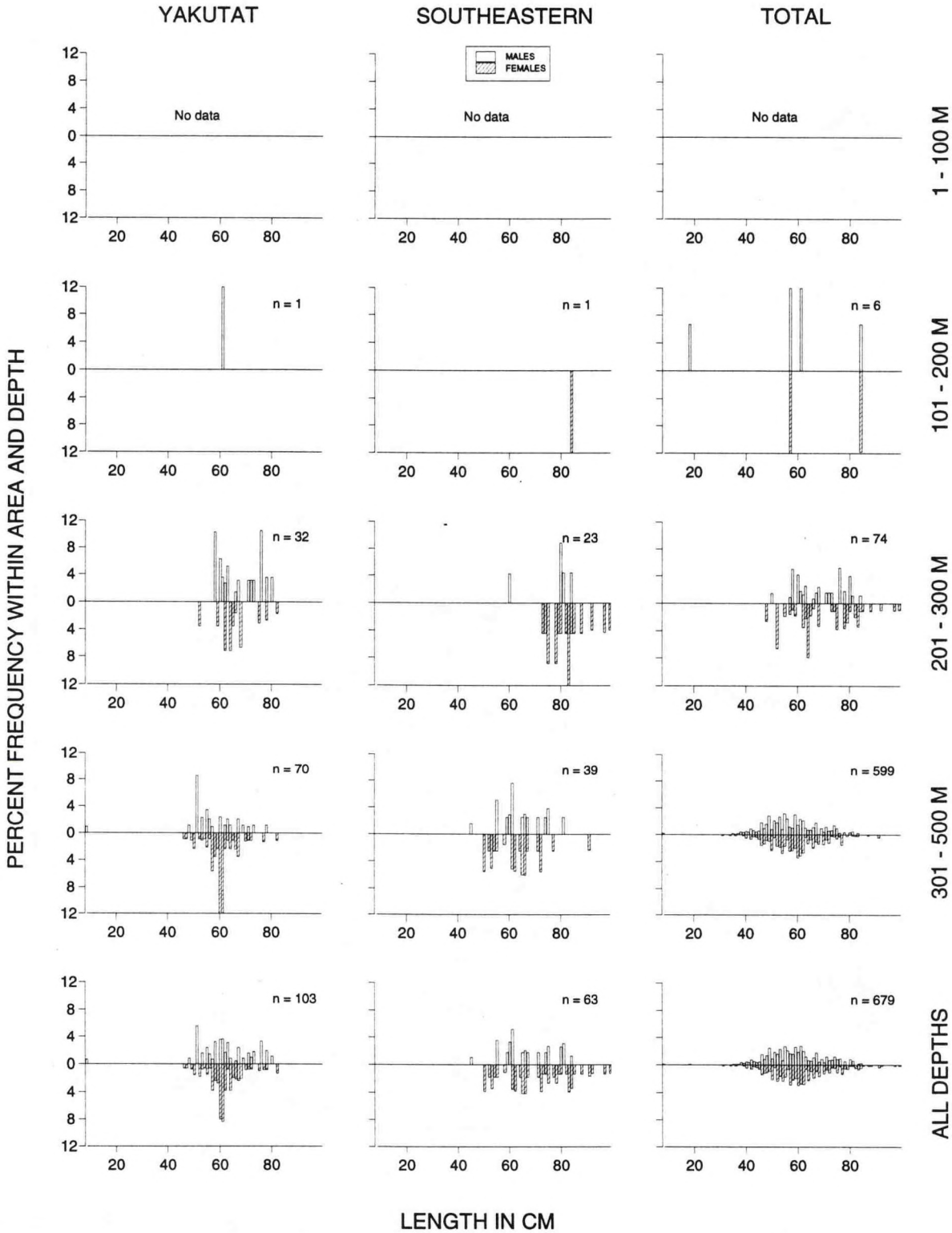


Figure 55.--Continued.

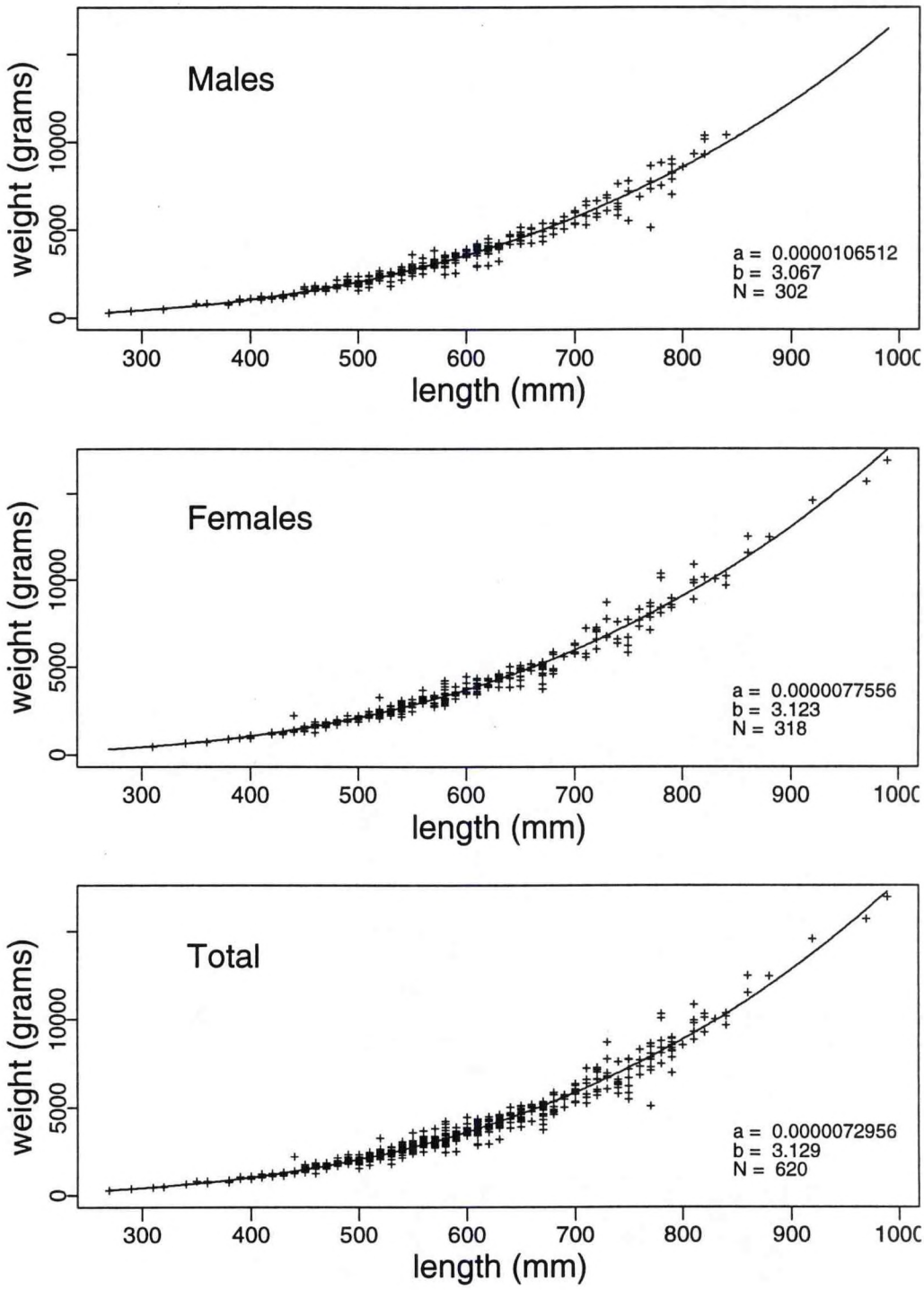


Figure 56.--Length-weight relationship for shortraker rockfish specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $\text{Weight}_{(grams)} = a * \text{Length}_{(mm)}^{b}$.

Table 48.--Catch per unit effort by stratum for shortraker rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Kodiak	301-500	Kodiak Slope	11	9	2,568	7,477	0	15,968
Yakutat	301-500	Yakutat Gullies	5	5	1,834	2,030	0	4,287
Southeastern	301-500	Southeastern Slope	4	3	1,592	1,230	0	4,550
Chirikof	301-500	Chirikof Slope	13	13	1,337	2,145	516	3,775
Southeastern	201-300	Baranof-Chichagof Slope	5	1	1,200	1,350	0	5,098
Shumagin	301-500	Shumagin Slope	16	13	630	1,594	90	3,097
Yakutat	201-300	Yakutat Gullies	11	4	548	1,668	0	4,054
Yakutat	301-500	Yakutat Slope	1	1	387	589		
Southeastern	301-500	Southeastern Deep Gullies	8	6	263	617	62	1,172
Kodiak	201-300	Kodiak Slope	5	2	108	175	0	473
Southeastern	201-300	Prince of Wales Slope/Gullies	23	2	97	379	0	934
Yakutat	201-300	Yakutat Slope	16	3	60	128	0	287
Shumagin	201-300	Shumagin Slope	22	2	53	148	0	428
Southeastern	101-200	Baranof-Chichagof Shelf	14	1	29	122	0	386
Chirikof	201-300	Lower Shelikof Gully	22	2	23	232	0	571
Shumagin	101-200	Sanak Gully	6	1	21	88	0	314
Yakutat	101-200	Yakataga Shelf	8	1	20	108	0	362
Chirikof	201-300	Chirikof Slope	9	1	20	31	0	103
Shumagin	101-200	Shumagin Outer Shelf	41	1	9	76	0	229
Kodiak	101-200	Kenai Flats	17	1	6	74	0	232

Shortspine thornyhead (Sebastolobus alascanus)

Shortspine thornyheads were caught in every survey haul between 301 and 500 m and in about 73% of the tows between 201 and 300 m (Table 49). No shortspine thornyheads were caught in water less than 100 m. Mean CPUEs were highest along the continental slope throughout the survey area and in the deep gullies of the Kodiak, Yakutat, and Southeastern INPFC areas (Fig. 57). Approximately 87% of the total biomass was estimated to be in water greater than 200 m (Table 50). Catches were generally much less variable than those of other rockfish species, as evidenced by the much narrower confidence interval for the gulf-wide biomass estimate (Table 49). Since the survey did not include the entire depth range of this species, the estimates of biomass are only for that portion of the population that inhabits surveyed areas less than 500 m in depth. Length distributions were generally similar in all areas and depths with modes for both male and female fish between 20 and 25 cm FL (Fig. 58). The length-weight relationship for shortspine thornyhead specimens collected during the survey is depicted in Figure 59.

Table 49.-- Number of survey hauls, number of hauls with shortspine thornyhead, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	6	21	313	0.36	28.1
	201 - 300	22	20	1,117	3,115	0.21	25.7
	301 - 500	16	16	1,823	4,615	0.23	25.4
	All depths	200	42	123	8,043	0.23	25.6
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	4	2	55	0.23	24.8
	201 - 300	31	9	247	2,844	0.24	26.0
	301 - 500	13	13	2,163	3,470	0.21	24.8
	All depths	181	26	94	6,369	0.22	25.3
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	10	6	255	0.30	27.9
	201 - 300	31	25	637	7,321	0.27	26.7
	301 - 500	11	11	1,647	4,796	0.20	23.9
	All depths	210	46	122	12,372	0.24	25.4
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	29	188	5,532	0.24	25.8
	201 - 300	27	26	996	5,150	0.17	23.3
	301 - 500	6	6	1,465	3,851	0.18	22.8
	All depths	116	61	255	14,533	0.19	24.0
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	11	42	471	0.15	22.3
	201 - 300	28	22	643	3,248	0.17	22.9
	301 - 500	12	12	2,137	6,660	0.21	24.3
	All depths	97	45	370	10,379	0.19	23.7
All areas	1 - 100	270	0	---	---	---	---
	101 - 200	337	60	54	6,626	0.23	25.5
	201 - 300	139	102	601	21,678	0.21	24.8
	301 - 500	58	58	1,829	23,392	0.20	24.2
	All depths	804	220	162	51,696	0.21	24.6

All areas biomass, 95% confidence interval: 44,283 - 59,109 metric tons (t).

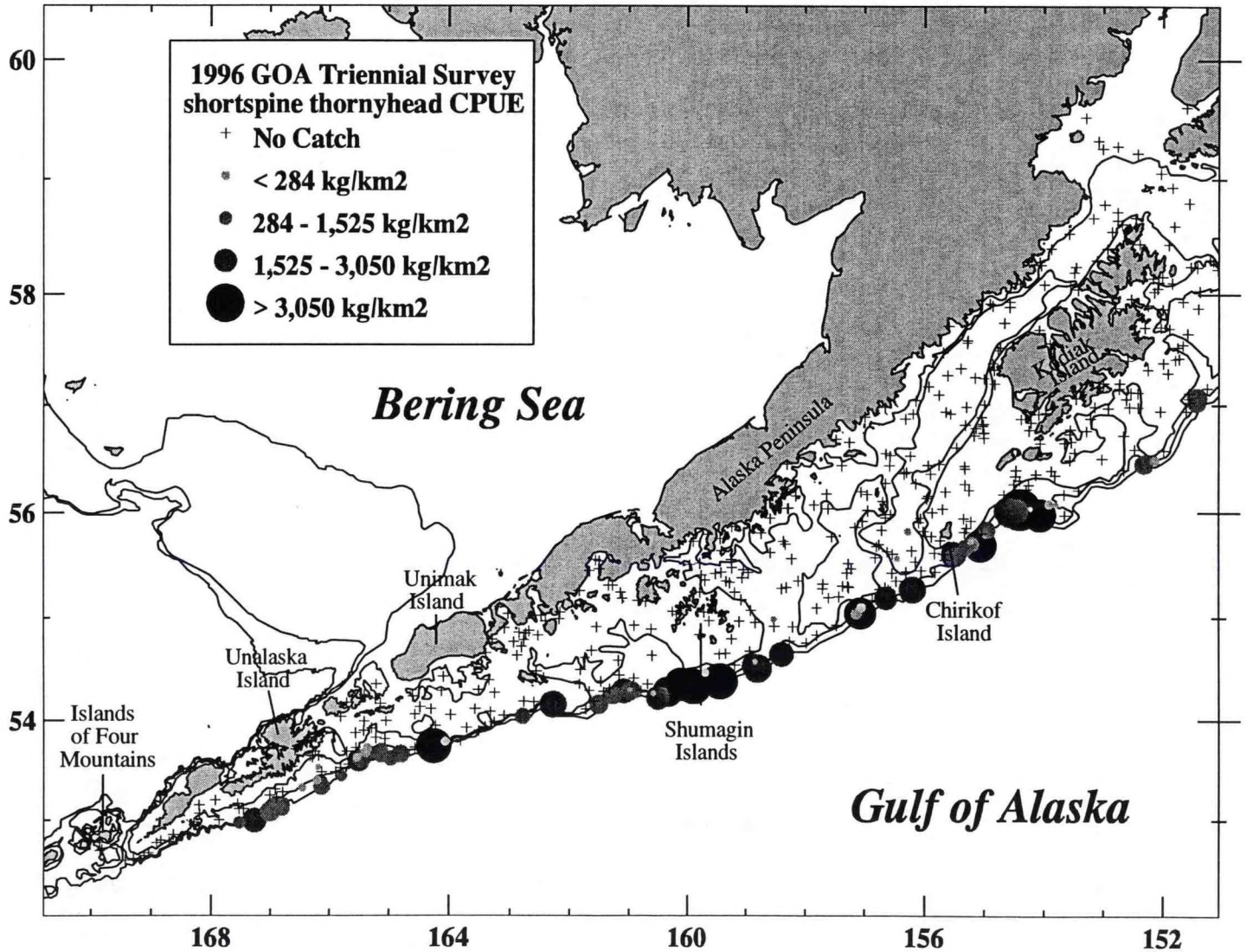


Figure 57.--Distribution and relative abundance of shortspine thornyheads from the 1996 Gulf of Alaska bottom trawl survey. Relative abundance is categorized by no catch, sample CPUE less than the mean CPUE, between mean CPUE and two standard deviations above mean CPUE, between two and four standard deviations above mean CPUE, and greater than four standard deviations above mean CPUE. Each symbol is proportional to the sample CPUE.

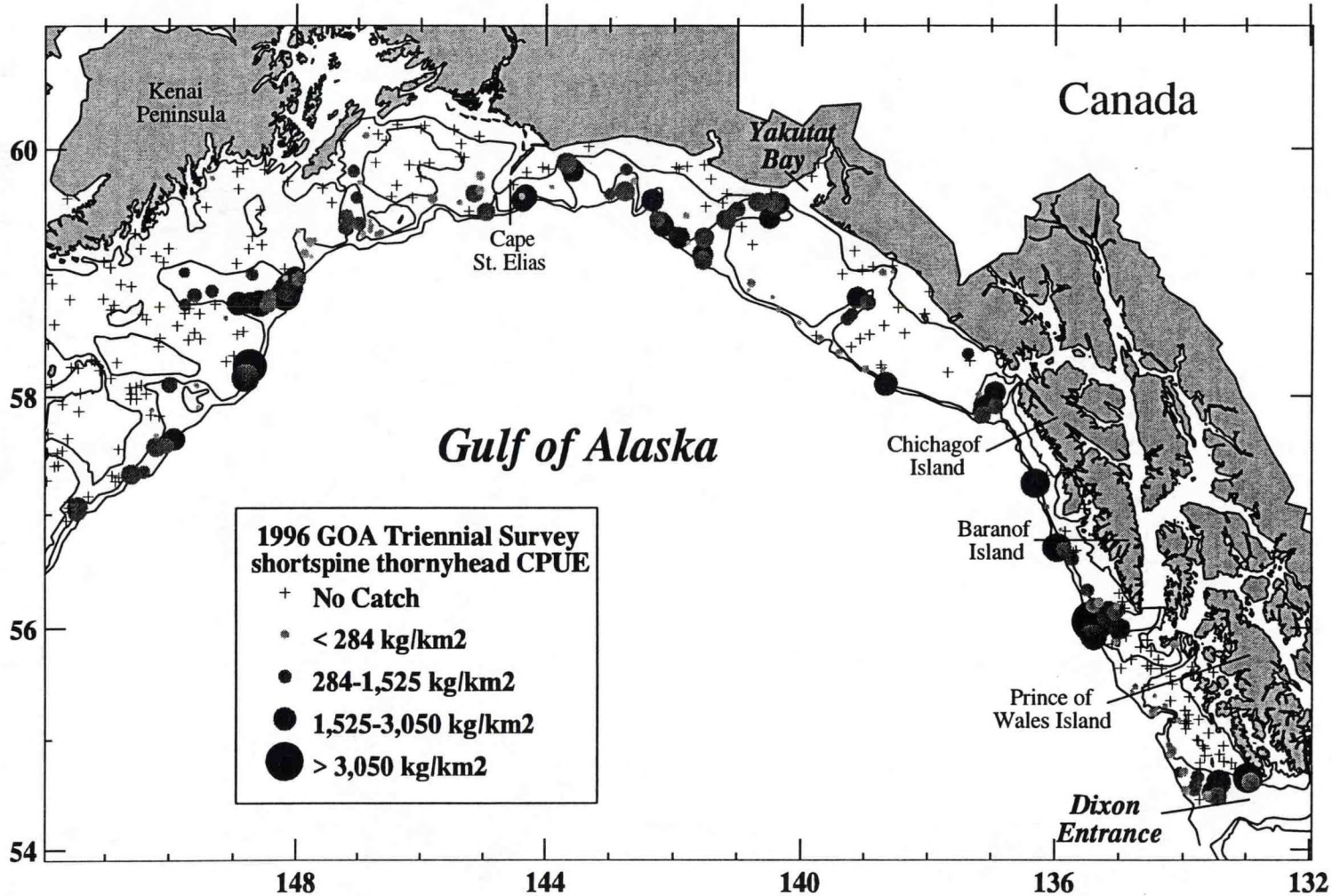


Figure 57.--Continued.

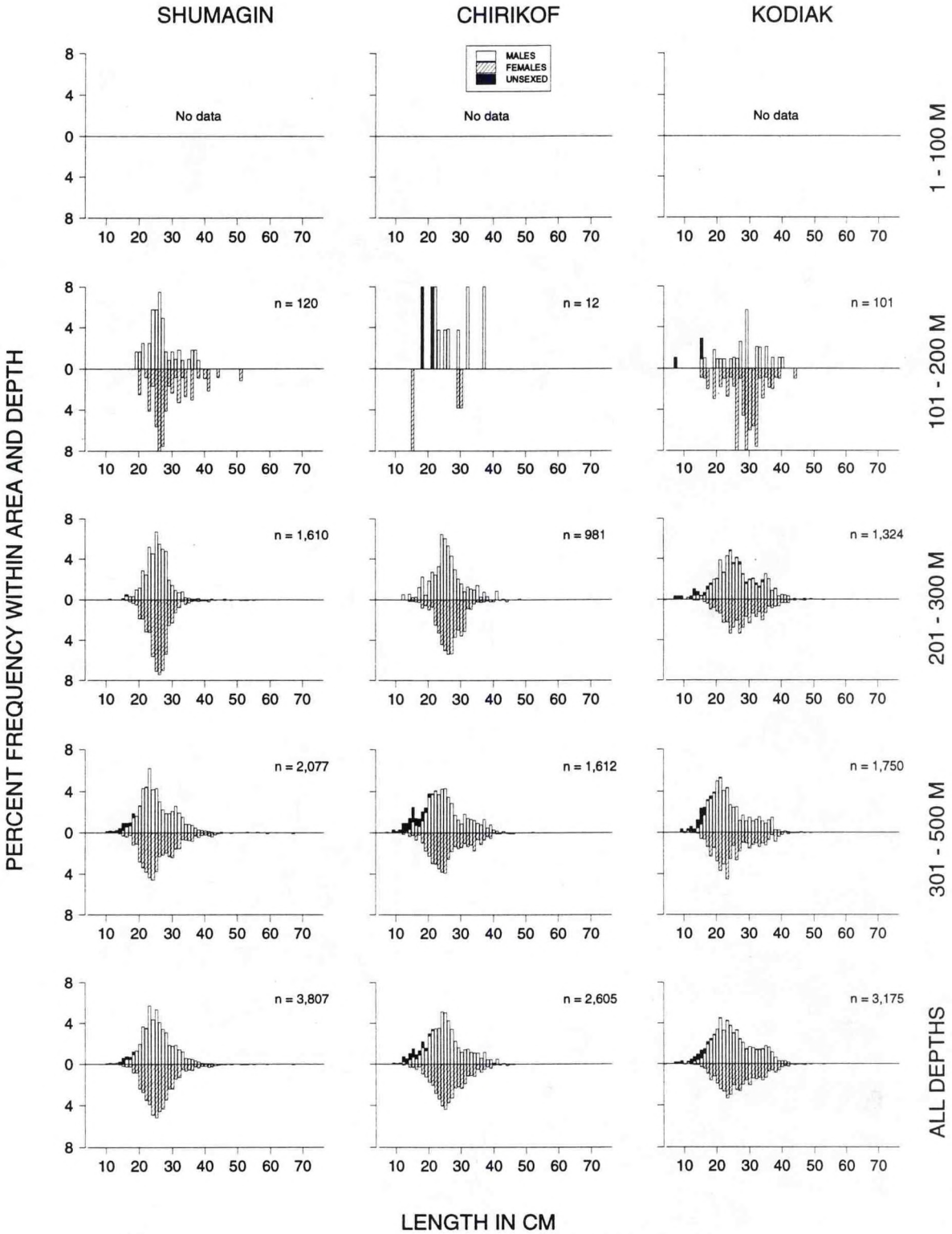


Figure 58.--Size composition of the estimated shortspine thornyhead population from the 1996 Gulf of Alaska bottom trawl survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

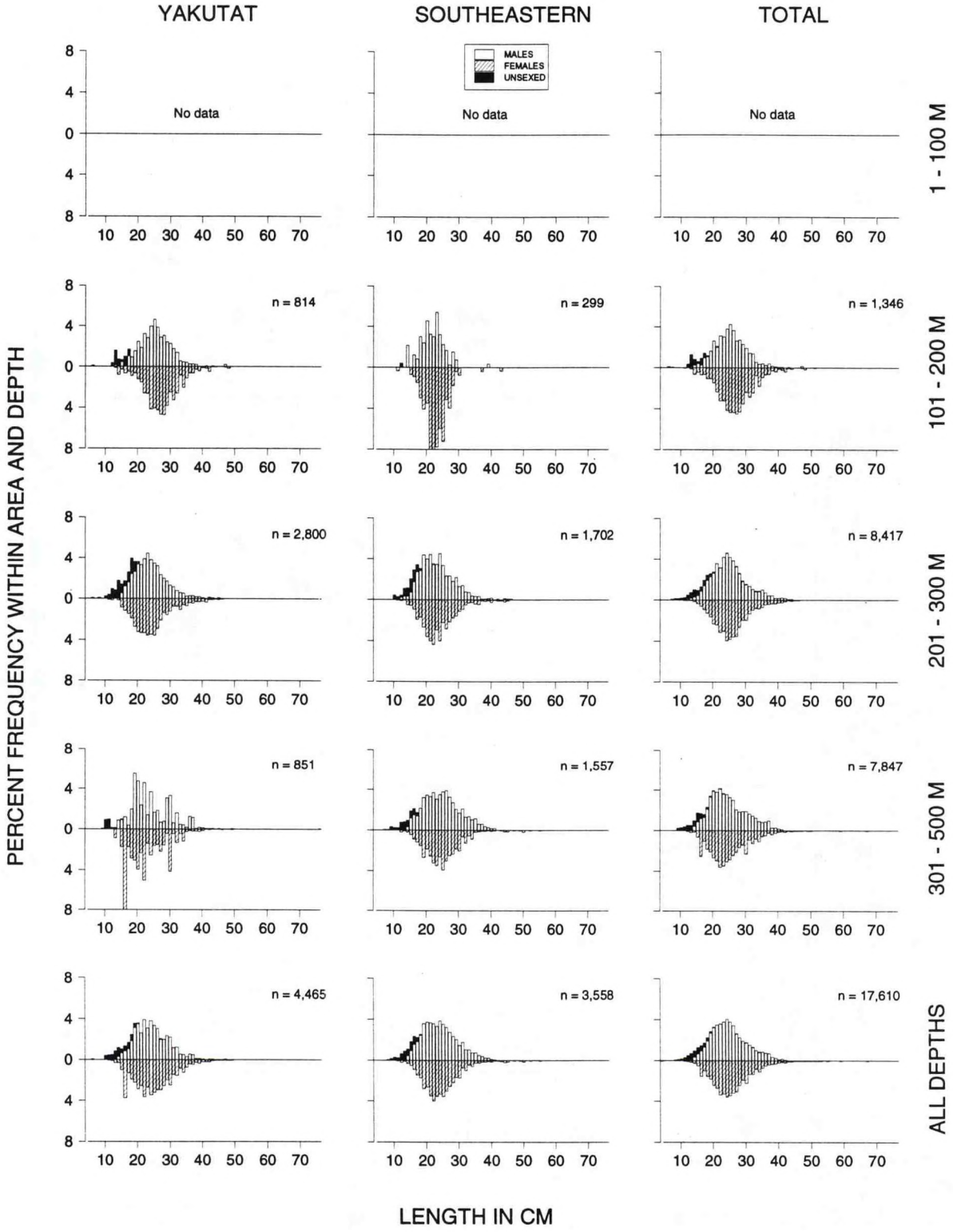


Figure 58.--Continued.

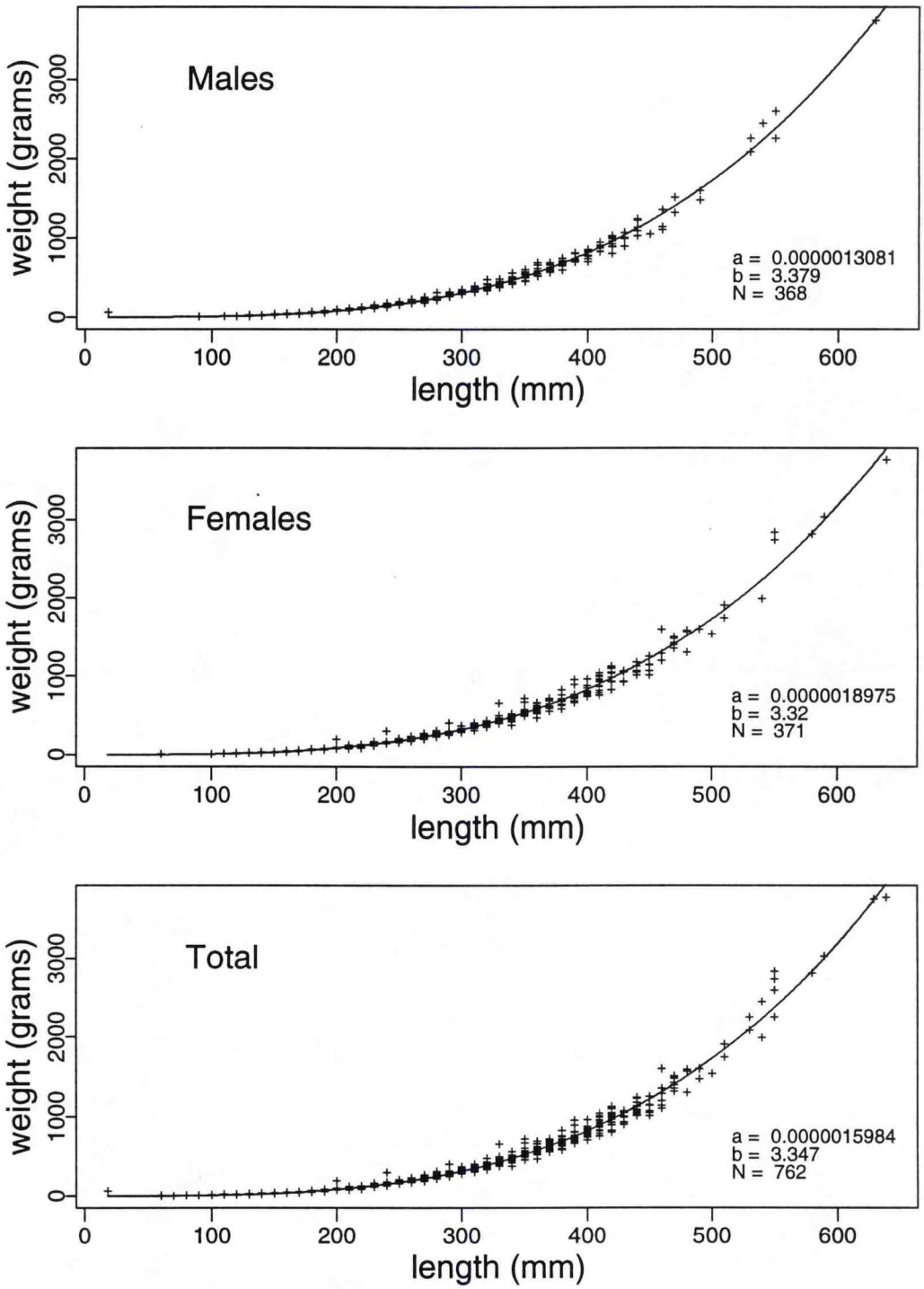


Figure 59.--Length-weight relationship for shortspine thornyhead specimens collected during the 1996 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $\text{Weight}_{(grams)} = a * \text{Length}_{(mm)}^{b}$.

Table 50.--Catch per unit effort by stratum for shortspine thornyheads sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Chirikof	301-500	Chirikof Slope	13	13	2,163	3,470	2,426	4,513
Southeastern	301-500	Southeastern Slope	4	4	2,154	1,664	859	2,469
Southeastern	301-500	Southeastern Deep Gullies	8	8	2,131	4,996	1,881	8,111
Shumagin	301-500	Shumagin Slope	16	16	1,823	4,615	2,779	6,451
Chirikof	201-300	Chirikof Slope	9	7	1,817	2,778	350	5,205
Kodiak	201-300	Kodiak Slope	5	5	1,814	2,943	152	5,734
Kodiak	301-500	Kodiak Slope	11	11	1,647	4,796	3,026	6,567
Yakutat	301-500	Yakutat Slope	1	1	1,568	2,385		
Southeastern	201-300	Baranof-Chichagof Slope	5	5	1,402	1,577	248	2,906
Yakutat	301-500	Yakutat Gullies	5	5	1,324	1,466	1,141	1,791
Shumagin	201-300	Shumagin Slope	22	20	1,117	3,115	1,411	4,819
Yakutat	201-300	Yakutat Gullies	11	11	1,079	3,283	2,159	4,406
Yakutat	201-300	Yakutat Slope	16	15	878	1,867	887	2,848
Kodiak	201-300	Kenai Gullies	20	20	657	4,378	2,377	6,379
Yakutat	101-200	Yakataga Shelf	8	6	452	2,384	0	5,356
Southeastern	201-300	Prince of Wales Slope/Gullies	23	17	425	1,671	382	2,960
Yakutat	101-200	Yakutat Flats	9	6	210	1,897	0	5,541
Yakutat	101-200	Middleton Shelf	23	14	118	866	94	1,638
Southeastern	101-200	Baranof-Chichagof Shelf	14	6	99	416	0	881
Yakutat	101-200	Fairweather Shelf	10	3	50	385	0	1,134
Kodiak	101-200	Kodiak Outer Shelf	24	7	46	232	0	503
Shumagin	101-200	Shumagin Outer Shelf	41	6	38	313	0	684
Southeastern	101-200	Prince of Wales Shelf	36	5	8	55	0	125
Chirikof	201-300	Lower Shelikof Gully	22	2	7	66	0	168
Chirikof	101-200	East Shumagin Gully	16	1	4	41	0	127
Chirikof	101-200	Chirikof Outer Shelf	24	3	3	14	0	31
Kodiak	101-200	Albatross Gullies	32	1	1	4	0	12
Kodiak	101-200	Portlock Flats	21	1	1	6	0	18
Kodiak	101-200	Kenai Flats	17	1	1	13	0	41

Other Rockfish

Redstripe rockfish (Sebastes proriger)

Redstripe rockfish were observed in all INPFC areas except the Kodiak area (Tables 51 and 52). Approximately 95% of the total redstripe rockfish biomass estimate came from one stratum, the Prince of Wales Slope and Gullies stratum with only small numbers caught outside this stratum (Table 52). One large tow of redstripe rockfish accounted for over one-half the total survey area biomass estimate.

Silvergray rockfish (Sebastes brevispinus)

Silvergray rockfish abundance in the survey area generally increased from west to east (Table 53). Silvergray rockfish were the third most abundant groundfish in the Southeastern INPFC area (Table 2), and no silvergray rockfish were captured in the Shumagin INPFC area. About 81% of the gulf-wide biomass was estimated to be in the Southeastern INPFC area, with 69% coming from the Prince of Wales Slope and Gullies stratum (Table 54). The smallest fish were found in shallow water (less than 100 m).

Harlequin rockfish (Sebastes variegatus)

Harlequin rockfish were caught most frequently in the Southeastern INPFC area, where they were present in more than one-third of all tows in depths greater than 100 m (Table 55). About 65% of the total survey area biomass estimated was from the Prince of Wales Slope and Gullies stratum (Table 56), and most of this estimate was attributable to one large tow. Fish

size increased with depth, although this trend was not apparent in the Southeastern INPFC area (Table 55).

Redbanded rockfish (Sebastes babcocki)

Redbanded rockfish were caught most often between 201 and 300 m in depth especially in the Yakutat and Southeastern INPFC areas where they occurred in about 67% of the tows (Table 57). Redbanded rockfish abundance generally increased from west to east, with the highest abundance occurring in the Prince of Wales Slope and Gullies stratum where about 45% of the total biomass was estimated to be (Table 58). A single tow in this stratum was quite influential in this estimate and accounted for about 31% of the total survey biomass.

Yellowmouth rockfish (Sebastes reedi)

Yellowmouth rockfish were caught in only one stratum in the Southeastern INPFC area, the Prince of Wales Slope and Gullies (Table 59 and 60). Therefore the total biomass for this species was quite low in the survey area.

Yelloweye rockfish (Sebastes ruberrimus)

Yelloweye rockfish CPUEs were low throughout the survey area (Tables 61 and 62). They were most abundant in the Southeastern INPFC area in water less than 300 m, where about 69% of the total survey area biomass was estimated to be. The only other area of relatively high abundance was in the strata to the north and east of Afognak Island (Barren Islands and Portlock Flats, Table 62). Fish size decreased with depth in the Southeastern INPFC area (Table 61).

Rosethorn rockfish (Sebastes helvomaculatus)

Rosethorn rockfish were found only in the Yakutat and Southeastern INPFC areas (Table 63). About 58% of the total biomass estimate came from the Yakutat Flats stratum, mostly due to a single tow (Table 64). Rosethorn were caught most frequently in the Prince of Wales Slope and Gullies stratum where they occurred in almost 61% of the tows, although never in large numbers. No clear relationship between depth and fish size was apparent (Table 63).

Table 51.-- Number of survey hauls, number of hauls with redstripe rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	1	11	152	0.59	34.1
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	1	2	152	0.59	34.1
Chirikof	1 - 100	69	1	<1	2	0.12	21.0
	101 - 200	68	1	4	89	0.89	40.8
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	2	1	91	0.78	38.1
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	0	---	---	---	---
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	2	2	12	0.59	35.9
	301 - 500	6	0	---	---	---	---
	All depths	116	2	<1	12	0.59	35.9
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	9	46	510	0.45	32.2
	201 - 300	28	10	2,811	14,200	0.48	33.6
	301 - 500	12	0	---	---	---	---
	All depths	97	19	525	14,710	0.47	33.5
All areas	1 - 100	270	1	<1	2	0.12	21.0
	101 - 200	337	11	6	751	0.50	33.1
	201 - 300	139	12	394	14,212	0.48	33.6
	301 - 500	58	0	---	---	---	---
	All depths	804	24	47	14,965	0.48	33.6

All areas biomass, 95% confidence interval: 0 - 31,718 metric tons (t).

Table 52.--Catch per unit effort by stratum for redstripe rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	10	3,616	14,200	0	30,980
Southeastern	101-200	Prince of Wales Shelf	36	6	56	386	0	915
Southeastern	101-200	Baranof-Chichagof Shelf	14	3	30	124	0	289
Shumagin	101-200	Shumagin Outer Shelf	41	1	19	152	0	459
Chirikof	101-200	Chirikof Outer Shelf	24	1	18	89	0	272
Yakutat	201-300	Yakutat Slope	16	2	6	12	0	31
Chirikof	1-100	Semidi Bank	18	1	<1	2	0	6

Table 53.-- Number of survey hauls, number of hauls with silvergrey rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	0	---	---	---	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	0	---	---	---	---
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	1	<1	10	0.92	---
	201 - 300	31	2	2	21	1.76	49.1
	301 - 500	13	0	---	---	---	---
	All depths	181	3	<1	31	1.36	49.1
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	5	35	1,524	1.72	44.0
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	5	15	1,524	1.72	44.0
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	4	61	1,784	1.79	51.4
	201 - 300	27	11	222	1,150	1.74	49.7
	301 - 500	6	0	---	---	---	---
	All depths	116	15	51	2,934	1.77	50.8
Southeastern	1 - 100	7	3	17	112	0.36	27.8
	101 - 200	50	20	254	2,810	1.70	49.8
	201 - 300	28	19	3,312	16,734	1.69	49.8
	301 - 500	12	0	---	---	---	---
	All depths	97	42	701	19,656	1.65	49.2
All areas	1 - 100	270	3	1	112	0.36	27.8
	101 - 200	337	30	50	6,128	1.73	48.8
	201 - 300	139	32	497	17,905	1.69	49.8
	301 - 500	58	0	---	---	---	---
	All depths	804	65	76	24,145	1.67	49.1

All areas biomass, 95% confidence interval: 10,975 - 37,315 metric tons (t).

Table 54.--Catch per unit effort by stratum for silvergray rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	17	4,250	16,692	4,207	29,177
Yakutat	201-300	Yakutat Slope	16	10	487	1,036	0	2,276
Southeastern	101-200	Prince of Wales Shelf	36	13	344	2,367	13	4,722
Yakutat	101-200	Yakutat Flats	9	1	160	1,443	0	4,771
Kodiak	101-200	Albatross Gullies	32	1	152	1,206	0	3,668
Southeastern	101-200	Baranof-Chichagof Shelf	14	7	106	443	0	937
Yakutat	101-200	Fairweather Shelf	10	2	43	333	0	881
Yakutat	201-300	Yakutat Gullies	11	1	37	114	0	368
Southeastern	201-300	Baranof-Chichagof Slope	5	2	37	42	0	113
Kodiak	101-200	Kodiak Outer Shelf	24	2	23	115	0	287
Southeastern	1-100	Southeastern Shallows	7	3	17	112	0	244
Chirikof	201-300	Chirikof Slope	9	2	13	21	0	52
Kodiak	101-200	Barren Islands	15	1	12	130	0	408
Kodiak	101-200	Kenai Flats	17	1	6	73	0	229
Chirikof	101-200	Shelikof Edge	28	1	1	10	0	30
Yakutat	101-200	Middleton Shelf	23	1	1	8	0	24

Table 55.-- Number of survey hauls, number of hauls with harlequin rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	6	52	764	0.43	30.7
	201 - 300	22	2	2	6	0.41	31.0
	301 - 500	16	1	1	2	0.41	34.0
	All depths	200	9	12	772	0.43	30.7
Chirikof	1 - 100	69	1	<1	1	0.06	15.0
	101 - 200	68	6	5	114	0.35	29.4
	201 - 300	31	2	14	158	0.43	31.5
	301 - 500	13	0	---	---	---	---
	All depths	181	9	4	273	0.38	30.2
Kodiak	1 - 100	59	1	25	960	0.12	20.3
	101 - 200	109	13	38	1,651	0.21	23.2
	201 - 300	31	2	1	14	0.24	25.8
	301 - 500	11	0	---	---	---	---
	All depths	210	16	26	2,625	0.17	21.8
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	4	23	680	0.26	25.1
	201 - 300	27	8	270	1,393	0.28	27.0
	301 - 500	6	0	---	---	---	---
	All depths	116	12	36	2,073	0.27	26.3
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	15	100	1,100	0.20	24.9
	201 - 300	28	12	2,611	13,192	0.21	24.5
	301 - 500	12	2	2	7	0.19	25.4
	All depths	97	29	510	14,299	0.21	24.6
All areas	1 - 100	270	2	7	961	0.12	20.3
	101 - 200	337	44	35	4,309	0.23	24.9
	201 - 300	139	26	410	14,763	0.21	24.7
	301 - 500	58	3	1	9	0.22	26.4
	All depths	804	75	63	20,042	0.21	24.4

All areas biomass, 95% confidence interval: 0 - 46,310 metric tons (t).

Table 56.--Catch per unit effort by stratum for harlequin rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	9	3,357	13,183	0	39,376
Yakutat	201-300	Yakutat Slope	16	8	655	1,393	0	4,304
Southeastern	101-200	Baranof-Chichagof Shelf	14	4	240	1,007	0	2,868
Kodiak	1-100	Kenai Peninsula	4	1	182	960	0	4,014
Chirikof	201-300	Chirikof Slope	9	2	104	158	0	516
Shumagin	101-200	Shumagin Outer Shelf	41	5	93	762	0	2,028
Kodiak	101-200	Albatross Gullies	32	1	92	727	0	2,211
Kodiak	101-200	Portlock Flats	21	4	80	587	0	1,545
Yakutat	101-200	Yakutat Flats	9	1	58	521	0	1,721
Kodiak	101-200	Kodiak Outer Shelf	24	5	21	106	0	217
Chirikof	101-200	Chirikof Outer Shelf	24	5	18	89	0	190
Southeastern	101-200	Prince of Wales Shelf	36	11	14	93	0	242
Kodiak	101-200	Barren Islands	15	1	13	147	0	461
Yakutat	101-200	Middleton Shelf	23	1	12	90	0	278
Yakutat	101-200	Fairweather Shelf	10	2	9	69	0	180
Southeastern	201-300	Baranof-Chichagof Slope	5	3	8	9	0	19
Kodiak	101-200	Kenai Flats	17	2	7	84	0	255
Kodiak	201-300	Kodiak Slope	5	1	4	6	0	23
Chirikof	101-200	Shelikof Edge	28	1	3	25	0	76
Southeastern	301-500	Southeastern Deep Gullies	8	2	3	7	0	21
Shumagin	201-300	Shumagin Slope	22	2	2	6	0	16
Shumagin	101-200	West Shumagin Gully	13	1	1	2	0	8
Shumagin	301-500	Shumagin Slope	16	1	1	2	0	7
Kodiak	201-300	Kenai Gullies	20	1	1	8	0	26
Chirikof	1-100	Semidi Bank	18	1	<1	1	0	2

Table 57.-- Number of survey hauls, number of hauls with redbanded rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	0	---	---	---	---
	201 - 300	22	3	21	58	0.91	36.9
	301 - 500	16	1	1	3	0.62	34.0
	All depths	200	4	1	61	0.89	36.7
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	2	1	18	0.86	38.0
	201 - 300	31	4	2	25	0.70	33.0
	301 - 500	13	0	---	---	---	---
	All depths	181	6	1	43	0.76	34.9
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	5	1	54	0.79	33.5
	201 - 300	31	6	8	99	0.77	32.6
	301 - 500	11	1	2	7	0.69	33.0
	All depths	210	12	2	160	0.77	32.9
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	7	32	937	1.04	36.7
	201 - 300	27	19	108	560	0.68	31.2
	301 - 500	6	0	---	---	---	---
	All depths	116	26	26	1,497	0.87	34.1
Southeastern	1 - 100	7	1	6	41	1.15	39.0
	101 - 200	50	12	44	479	0.70	30.9
	201 - 300	28	20	431	2,178	1.26	38.7
	301 - 500	12	8	46	144	0.50	29.2
	All depths	97	41	101	2,842	1.04	35.8
All areas	1 - 100	270	1	<1	41	1.15	39.0
	101 - 200	337	26	12	1,488	0.89	34.2
	201 - 300	139	52	81	2,920	1.05	36.1
	301 - 500	58	10	12	154	0.51	29.4
	All depths	804	89	14	4,603	0.96	35.0

All areas biomass, 95% confidence interval: 1,485 - 7,721 metric tons (t).

Table 58.--Catch per unit effort by stratum for redbanded rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	15	535	2,101	0	5,066
Yakutat	201-300	Yakutat Gullies	11	5	112	341	0	776
Yakutat	201-300	Yakutat Slope	16	14	103	219	29	408
Yakutat	101-200	Yakataga Shelf	8	1	70	369	0	1,242
Southeastern	201-300	Baranof-Chichagof Slope	5	5	68	77	0	164
Southeastern	301-500	Southeastern Slope	4	4	53	41	3	78
Yakutat	101-200	Fairweather Shelf	10	3	50	389	0	1,049
Southeastern	101-200	Prince of Wales Shelf	36	7	50	342	0	765
Southeastern	301-500	Southeastern Deep Gullies	8	4	44	103	0	228
Southeastern	101-200	Baranof-Chichagof Shelf	14	5	33	137	0	284
Shumagin	201-300	Shumagin Slope	22	3	21	58	0	154
Yakutat	101-200	Yakutat Flats	9	3	20	179	0	415
Kodiak	201-300	Kodiak Slope	5	2	18	29	0	82
Chirikof	201-300	Chirikof Slope	9	4	16	25	0	51
Kodiak	201-300	Kenai Gullies	20	4	10	70	0	168
Southeastern	1-100	Southeastern Shallows	7	1	6	41	0	140
Kodiak	101-200	Portlock Flats	21	2	4	29	0	71
Chirikof	101-200	Shelikof Edge	28	2	2	18	0	45
Kodiak	301-500	Kodiak Slope	11	1	2	7	0	22
Kodiak	101-200	Kodiak Outer Shelf	24	1	2	9	0	28
Kodiak	101-200	Kenai Flats	17	1	1	13	0	39
Shumagin	301-500	Shumagin Slope	16	1	1	3	0	10
Kodiak	101-200	Albatross Gullies	32	1	<1	3	0	10

Table 59.-- Number of survey hauls, number of hauls with yellowmouth rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	0	---	---	---	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	0	---	---	---	---
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	0	---	---	---	---
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	0	---	---	---	---
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	0	---	---	---	---
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	0	---	---	---	---
	201 - 300	28	5	183	923	1.05	38.9
	301 - 500	12	0	---	---	---	---
	All depths	97	5	33	923	1.05	38.9
All areas	1 - 100	270	0	---	---	---	---
	101 - 200	337	0	---	---	---	---
	201 - 300	139	5	26	923	1.05	38.9
	301 - 500	58	0	---	---	---	---
	All depths	804	5	3	923	1.05	38.9

All areas biomass, 95% confidence interval: 0 - 2,027 metric tons (t).

Table 60.--Catch per unit effort by stratum for yellowmouth rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	5	235	923	0	2,029

Table 61.-- Number of survey hauls, number of hauls with yelloweye rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	1	<1	<1	<0.01	9.0
	101 - 200	60	2	3	43	1.72	45.7
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	3	1	43	1.17	33.9
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	1	2	48	4.42	63.0
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	1	1	48	4.42	63.0
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	5	10	431	3.48	55.4
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	5	4	431	3.48	55.4
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	1	2	53	4.51	63.0
	201 - 300	27	0	---	---	---	---
	301 - 500	6	0	---	---	---	---
	All depths	116	1	1	53	4.51	63.0
Southeastern	1 - 100	7	1	54	351	5.85	65.0
	101 - 200	50	1	14	150	4.07	60.0
	201 - 300	28	4	72	359	3.62	55.8
	301 - 500	12	0	---	---	---	---
	All depths	97	6	31	860	4.38	59.4
All areas	1 - 100	270	2	3	351	4.89	55.8
	101 - 200	337	10	6	725	3.48	55.9
	201 - 300	139	4	10	359	3.62	55.8
	301 - 500	58	0	---	---	---	---
	All depths	804	16	4	1,435	3.78	55.9

All areas biomass, 95% confidence interval: 333 - 2,537 metric tons (t).

Table 62.--Catch per unit effort by stratum for yelloweye rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Southeastern	201-300	Prince of Wales Slope/Gullies	23	4	92	359	0	855
Southeastern	1-100	Southeastern Shallows	7	1	54	351	0	1,209
Southeastern	101-200	Baranof-Chichagof Shelf	14	1	36	150	0	474
Kodiak	101-200	Portlock Flats	21	2	24	174	0	442
Kodiak	101-200	Barren Islands	15	1	18	200	0	629
Yakutat	101-200	Middleton Shelf	23	1	7	53	0	162
Chirikof	101-200	Shelikof Edge	28	1	6	48	0	146
Shumagin	101-200	Shumagin Outer Shelf	41	2	5	43	0	121
Kodiak	101-200	Kodiak Outer Shelf	24	1	5	23	0	71
Kodiak	101-200	Albatross Gullies	32	1	4	34	0	104
Shumagin	1-100	Fox Islands	28	1	<1	<1	0	<1

Table 63.-- Number of survey hauls, number of hauls with rosethorn rockfish, mean CPUE, biomass, mean weight and mean length based on the 1996 Gulf of Alaska triennial bottom trawl survey, by International North Pacific Fisheries Commission statistical areas and depth intervals.

INPFC area	Depth (m)	Number of trawl hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Mean weight (kg)	Mean length (cm)
Shumagin	1 - 100	102	0	---	---	---	---
	101 - 200	60	0	---	---	---	---
	201 - 300	22	0	---	---	---	---
	301 - 500	16	0	---	---	---	---
	All depths	200	0	---	---	---	---
Chirikof	1 - 100	69	0	---	---	---	---
	101 - 200	68	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	13	0	---	---	---	---
	All depths	181	0	---	---	---	---
Kodiak	1 - 100	59	0	---	---	---	---
	101 - 200	109	0	---	---	---	---
	201 - 300	31	0	---	---	---	---
	301 - 500	11	0	---	---	---	---
	All depths	210	0	---	---	---	---
Yakutat	1 - 100	33	0	---	---	---	---
	101 - 200	50	2	45	1,313	0.36	28.3
	201 - 300	27	6	28	144	0.38	28.5
	301 - 500	6	0	---	---	---	---
	All depths	116	8	25	1,457	0.36	28.3
Southeastern	1 - 100	7	0	---	---	---	---
	101 - 200	50	10	36	404	0.21	24.1
	201 - 300	28	15	78	391	0.20	24.0
	301 - 500	12	2	4	11	0.23	25.7
	All depths	97	27	29	806	0.21	24.1
All areas	1 - 100	270	0	---	---	---	---
	101 - 200	337	12	14	1,717	0.31	26.8
	201 - 300	139	21	15	535	0.23	24.7
	301 - 500	58	2	1	11	0.23	25.7
	All depths	804	35	7	2,263	0.29	26.2

All areas biomass, 95% confidence interval: 0 - 5,189 metric tons (t).

Table 64.--Catch per unit effort by stratum for rosethorn rockfish sorted by descending CPUE for the 1996 Gulf of Alaska bottom trawl survey.

INPFC area	Depth range	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
Yakutat	101-200	Yakutat Flats	9	2	145	1,313	0	4,253
Southeastern	201-300	Prince of Wales Slope/Gullies	23	14	97	380	133	627
Yakutat	201-300	Yakutat Slope	16	6	68	144	0	327
Southeastern	101-200	Prince of Wales Shelf	36	7	41	283	21	544
Southeastern	101-200	Baranof-Chichagof Shelf	14	3	29	121	0	328
Southeastern	201-300	Baranof-Chichagof Slope	5	1	10	11	0	42
Southeastern	301-500	Southeastern Slope	4	1	6	4	0	19
Southeastern	301-500	Southeastern Deep Gullies	8	1	3	7	0	23

CITATIONS

Alverson, D.L., and W.T. Pereyra 1969. Demersal fish explorations in the northeastern Pacific Ocean -- An evaluation of exploratory fishing methods and analytical approaches to stock size and yield forecasts. J. Fish. Res. Board Can. 26:1985-2001.

Berendzen, P.B. 1997. Phylogenetic analysis of the Order Pleuronectiformes using molecular and morphological evidence. Abstracts of the 1997 Annual Meeting of the American Society of Ichthyologists and Herpetologists, Seattle, Washington.

Cochran, W.G. 1977. Sampling Techniques. 3rd ed. Wiley Series in Probability and Mathematical Statistics - Applied. John Wiley & Sons. N.Y., NY 428 p.

Cooper, J., and F. Chapleau 1996. The monophyletic status of Pleuronectes (Pleuronectidae: Pleuronectiformes). Abstracts of the 1996 Annual Meeting of the American Society of Ichthyologists and Herpetologists, New Orleans, Louisiana.

Hughes, S.E. 1976. System for sampling large trawl catches of research vessels. J. Fish. Res. Board Can. 33:833-839.

Martin, M.H., and D.M. Clausen. 1995. Data report: 1993 Gulf of Alaska bottom trawl survey. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-59, 217 p.

Munro, P.T., and R.Z. Hoff. 1995. Two demersal trawl surveys in the Gulf of Alaska: Implications of survey design and methods. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-50, 139 p.

Rass, T.S. 1996. On taxonomy of Pleuronectini (Pleuronectidae). J. Ichthy. 36:546-548.

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, R.N. Lea, and W.B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. Fifth ed. Am. Fish. Soc. Spec. Publ. No. 20. 183 p.

Stark, J.W., and D.M. Clausen. 1995. Data report: 1990 Gulf of Alaska bottom trawl survey. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-49, 221 p.

Wakabayashi, K., R.G. Bakkala, and M.S. Alton. 1985. Methods of the U.S.-Japan demersal trawl surveys. P. 7-29, In R. G. Bakkala and K. Wakabayashi (eds.), Results of cooperative U.S.-Japan groundfish investigations in the Bering Sea during May-August 1979. Int. North Pac. Fish. Comm. Bull. 44.

APPENDIX A

Gear Specifications and Diagrams

Figure A-1 is a schematic diagram of the Poly-Nor'eastern bottom trawl and roller gear used during the 1996 Gulf of Alaska triennial bottom trawl survey.

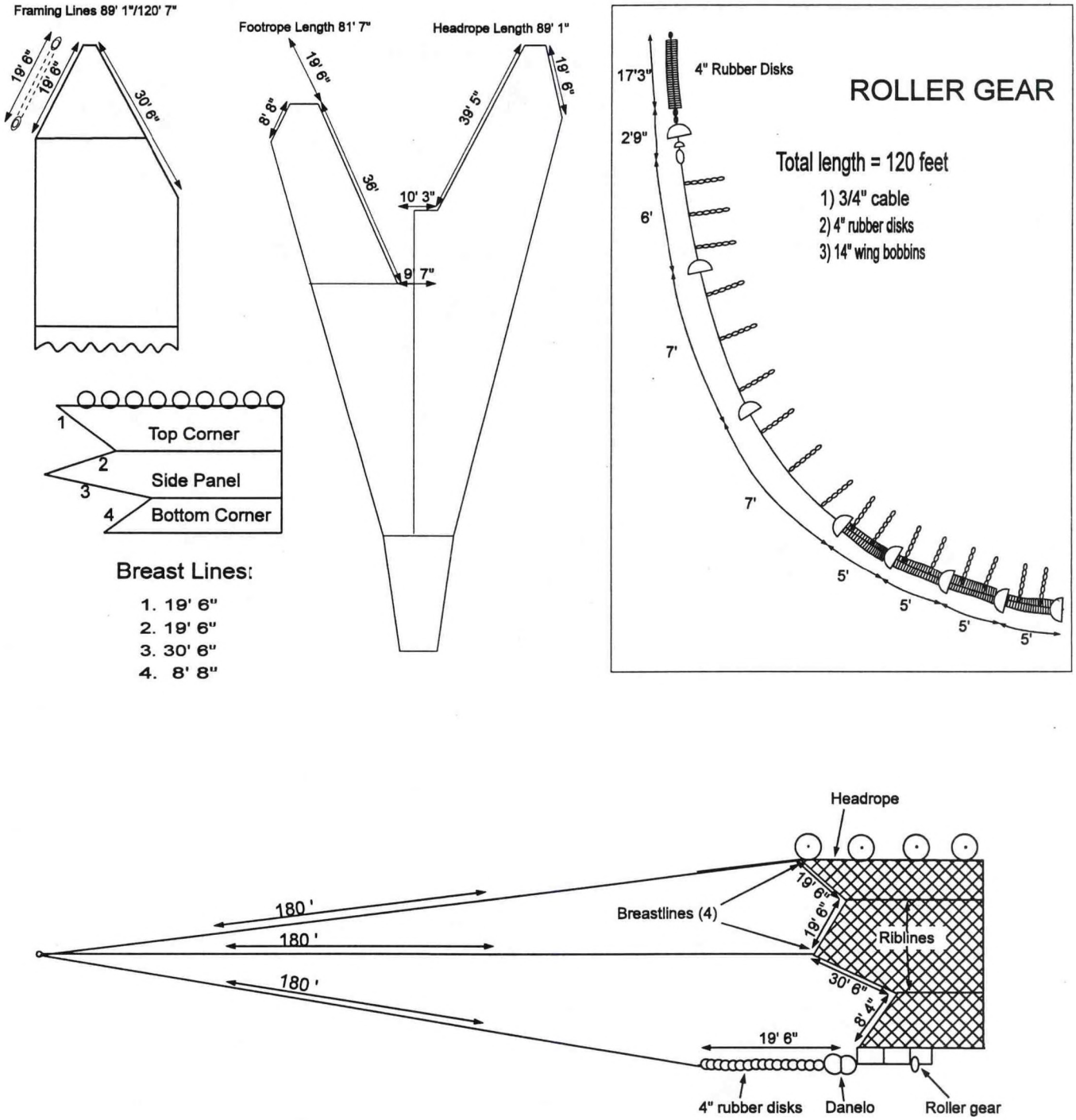


Figure A-1.--Schematic diagram of the 90-105 polyethylene Nor'eastern bottom trawl, roller gear and accessory gear used during the 1996 Gulf of Alaska triennial bottom trawl survey.

APPENDIX B

Strata Specifications and Locations

Appendix table B-1 presents the survey strata definitions for the 1996 Gulf of Alaska triennial bottom trawl survey including depth range, stratum name, and the area in square nautical miles and square kilometers. Appendix Table B-2 presents the summary strata code definitions. Appendix Figures B-1 through B-5 are charts showing the locations and extent of the strata as defined.

Appendix Table B-1.--Survey strata used for the 1996 Gulf of Alaska triennial survey including depth, stratum code, name and area in square nautical miles (nmi^2) and square kilometers (km^2).

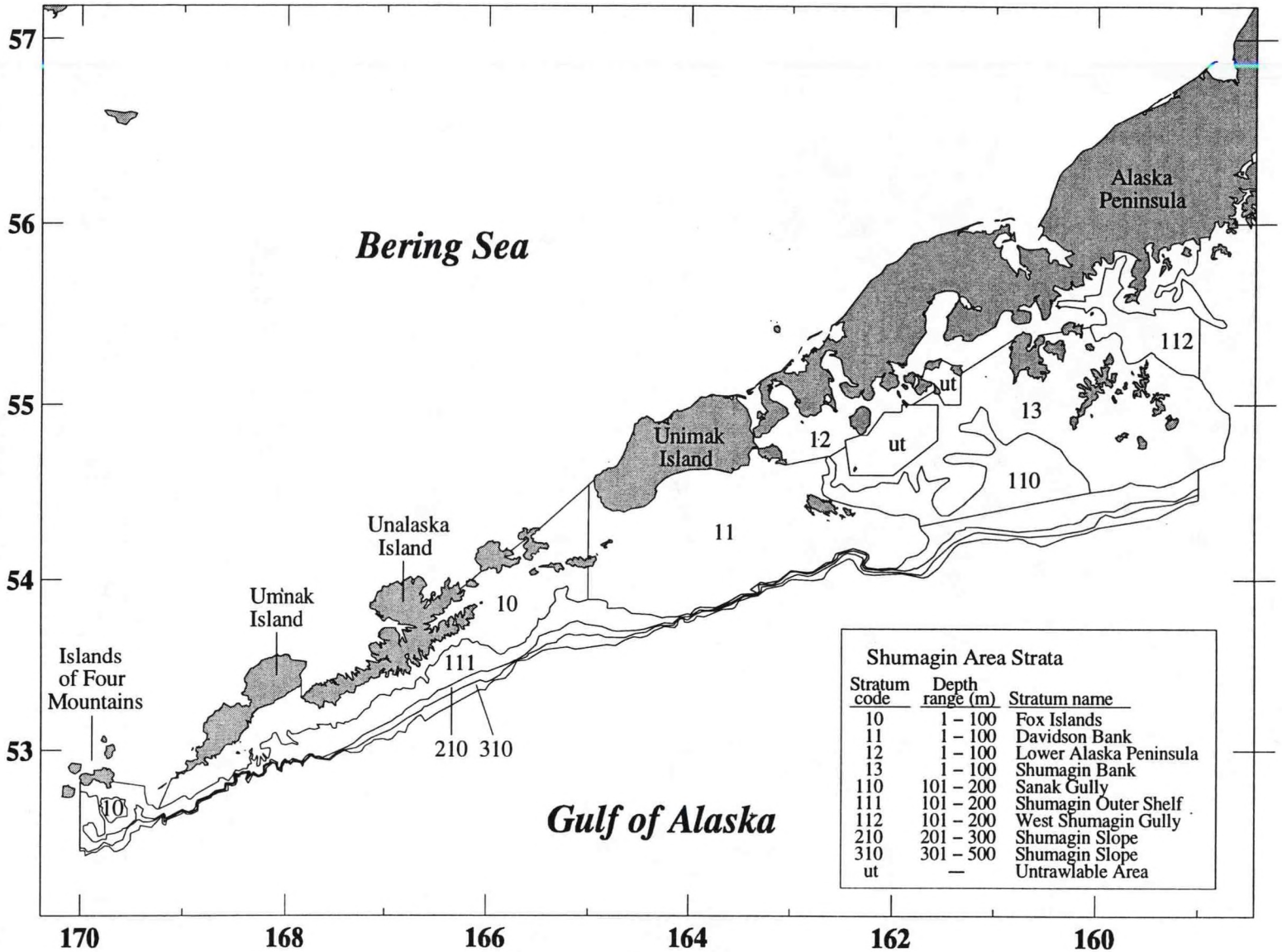
Depth Range (m)	Stratum Code	Stratum Name	Area (nmi^2)	Area (km^2)
1 - 100	10	Fox Islands	2,389	8,193
	11	Davidson Bank	3,989	13,683
	12	Lower Alaska Peninsula	2,005	6,876
	13	Shumagin Bank	3,615	12,399
	20	Upper Alaska Peninsula	2,315	7,941
	21	Semidi Bank	2,129	7,302
	22	Chirikof Bank	3,147	10,793
	30	Albatross Shallows	1,681	5,766
	31	Albatross Banks	4,491	15,404
	32	Lower Cook Inlet	2,883	9,887
	33	Kenai Peninsula	1,534	5,260
	35	Northern Kodiak Shallows	641	2,200
	40	Yakutat Shallows	2,900	9,948
	41	Middleton Shallows	1,914	6,565
	50	Southeastern Shallows	1,909	6,547
	991	**subtotal**	**37,541**	**128,765**
101 - 200	110	Sanak Gully	1,238	4,247
	111	Shumagin Outer Shelf	2,377	8,152
	112	West Shumagin Gully	664	2,278
	120	East Shumagin Gully	3,238	11,105
	121	Shelikof Edge	2,255	7,735
	122	Chirikof Outer Shelf	1,461	5,011
	130	Albatross Gullies	2,307	7,912
	131	Portlock Flats	2,139	7,337
	132	Barren Islands	3,202	10,981
	133	Kenai Flats	3,521	12,078
	134	Kodiak Outer Shelf	1,465	5,026
	140	Middleton Shelf	2,142	7,346
	141	Yakataga Shelf	1,538	5,277
	142	Yakutat Flats	2,633	9,032
	143	Fairweather Shelf	2,253	7,728
	150	Baranof-Chichagof Shelf	1,224	4,197
	151	Prince of Wales Shelf	2,008	6,888
	992	**subtotal**	**35,666**	**122,331**

Appendix Table B-1.--Continued.

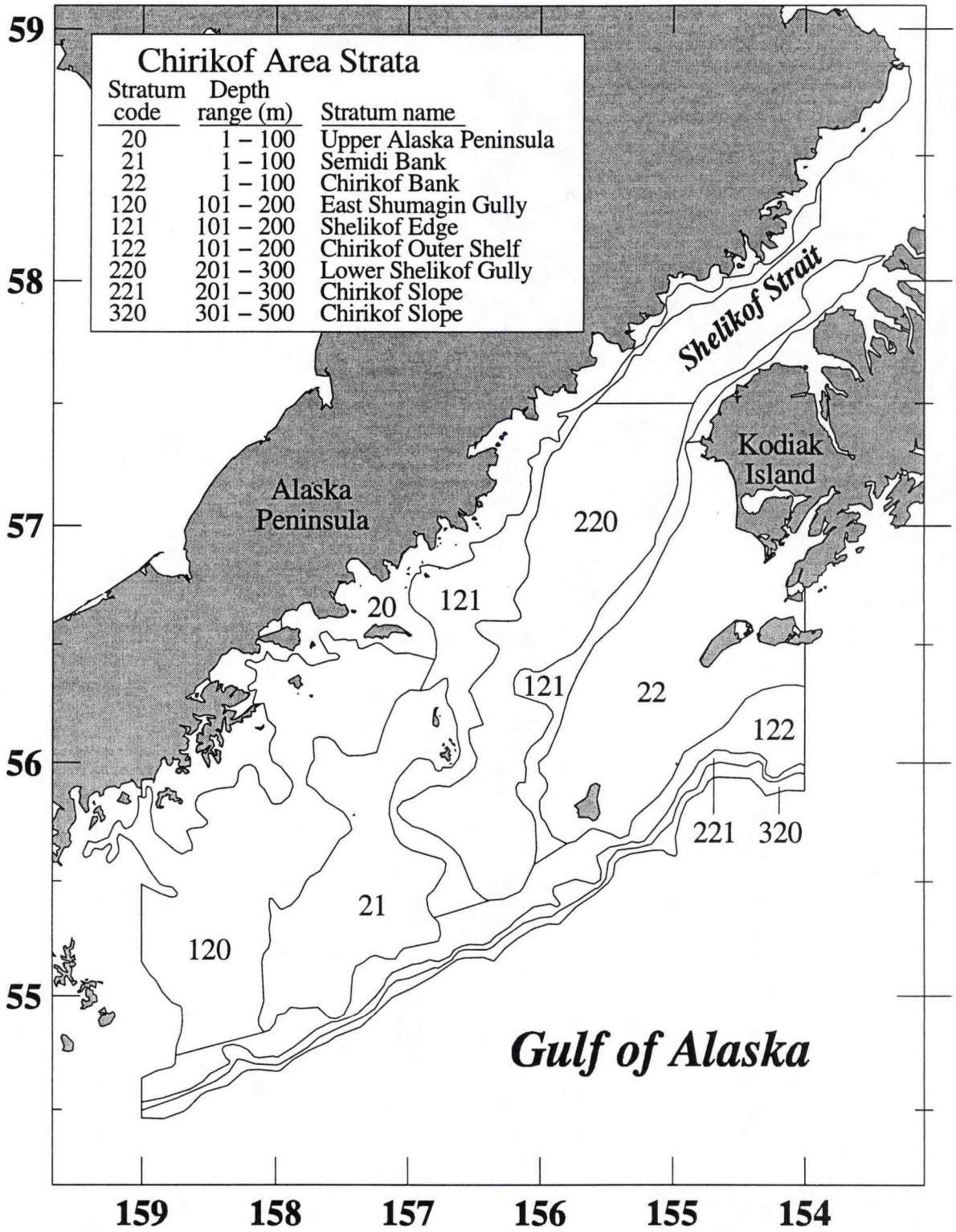
Depth Range (m)	Stratum Code	Stratum Name	Area (nmi^2)	Area (km^2)
201 - 300	210	Shumagin Slope	813	2,788
	220	Lower Shelikof Gully	2,921	10,018
	221	Chirikof Slope	446	1,528
	230	Kenai Gullies	1,942	6,660
	231	Kodiak Slope	473	1,623
	232	Upper Shelikof Gully	935	3,208
	240	Yakutat Gullies	887	3,043
	241	Yakutat Slope	620	2,127
	250	Baranof-Chichagof Slope	328	1,125
	251	Prince of Wales Slope/Gullies	1,145	3,927
	993	**subtotal**	**10,510**	**36,049**
301 - 500	310	Shumagin Slope	738	2,531
	320	Chirikof Slope	468	1,604
	330	Kodiak Slope	849	2,912
	340	Yakutat Gullies	323	1,107
	341	Yakutat Slope	443	1,521
	350	Southeastern Deep Gullies	684	2,344
	351	Southeastern Slope	225	773
	994	**subtotal**	**3,730**	**12,792**
1 - 500	**999**	**GRAND TOTAL**	**87,446**	**299,936**

Appendix Table B-2.-- Summary codes used for the 1996 Gulf of Alaska triennial bottom trawl survey including depth range, International North Pacific Fisheries Commission statistical areas and square area, and strata included in the summary area.

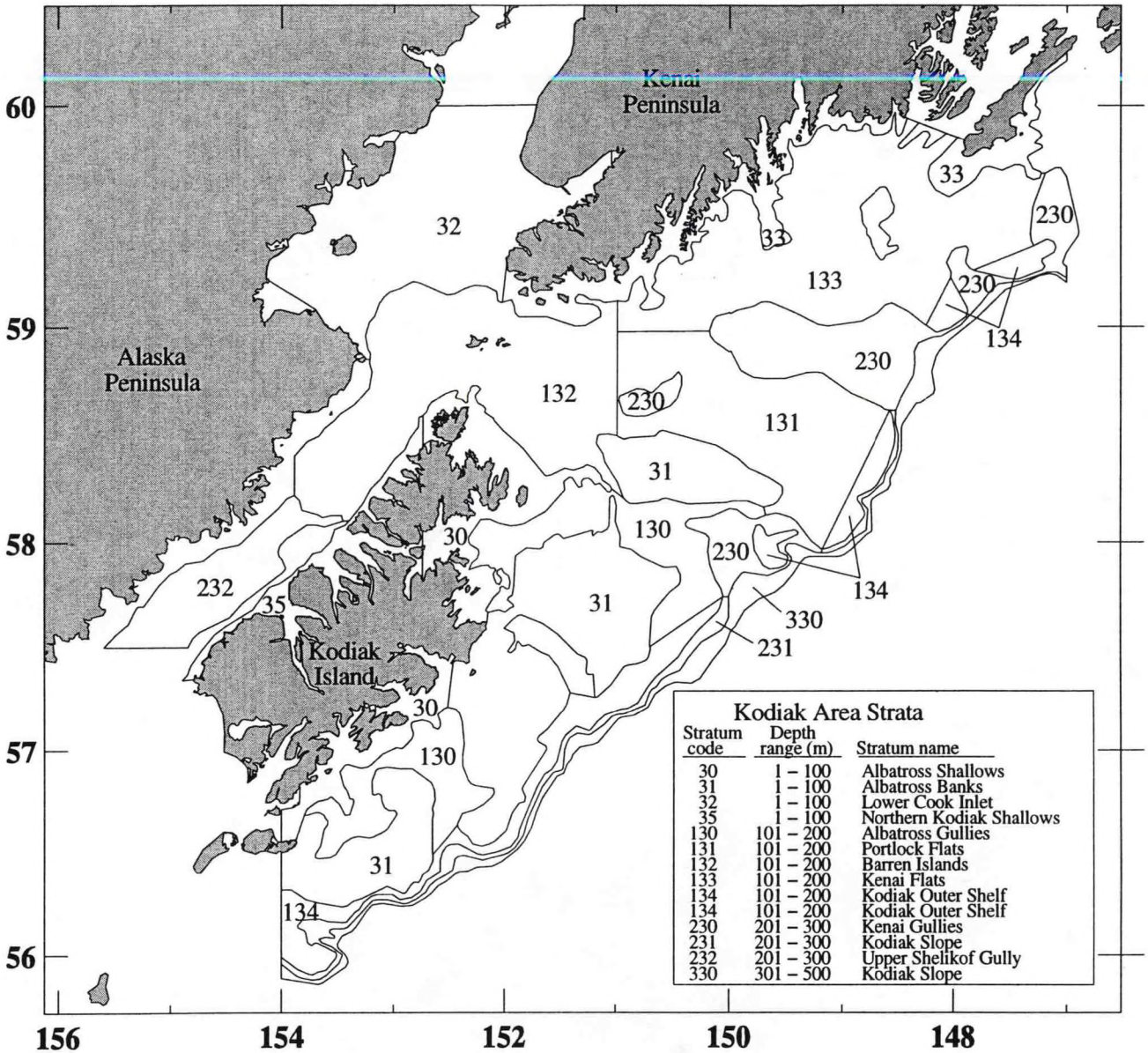
Summary Code Number	Depth Range (m)	INPFC area	Area (nmi^2)	Area (km^2)	Strata included
911	1 - 100	**Shumagin**	11,998	41,151	10 -13
912	101 - 200		4,279	14,678	110 - 112
913	201 - 300		813	2,788	210
914	301 - 500		738	2,531	310
919	1 - 500		17,828	61,148	
921	1 - 100	**Chirikof**	7,591	26,036	20 - 22
922	101 - 200		6,954	23,851	120 - 122
923	201 - 300		3,366	11,547	220, 221
924	301 - 500		468	1,604	320
929	1 - 500		18,379	63,038	
931	1 - 100	**Kodiak**	11,230	38,518	30 - 33, 35
932	101 - 200		12,634	43,334	130 - 134
933	201 - 300		3,350	11,491	230 - 232
934	301 - 500		849	2,912	330
939	1 - 500		28,063	96,255	
941	1 - 100	**Yakutat**	4,814	16,513	40, 41
942	101 - 200		8,567	29,383	140 - 143
943	201 - 300		1,507	5,170	240, 241
944	301 - 500		766	2,628	340, 341
949	1 - 500		15,655	53,694	
951	1 - 100	**Southeastern**	1,909	6,547	50
952	101 - 200		3,232	11,085	150, 151
953	201 - 300		1,473	5,053	250, 251
954	301 - 500		909	3,117	350, 351
959	1 - 500		7,522	25,801	
999	1 - 500	**All Areas**	87,446	299,936	



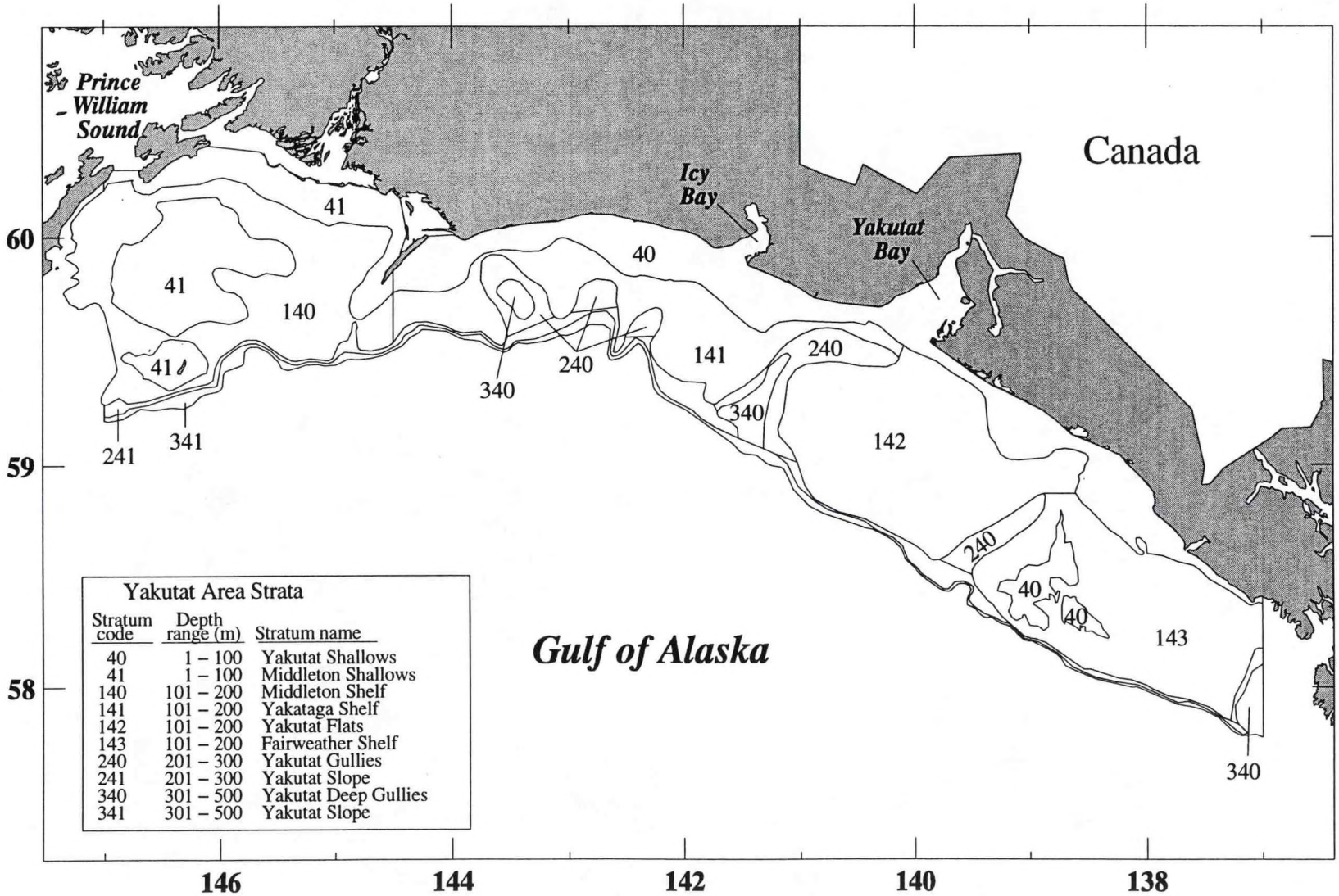
Appendix Figure B-1..--Survey strata in the Shumagin INPFC statistical area used for the 1996 Gulf of Alaska bottom trawl survey.



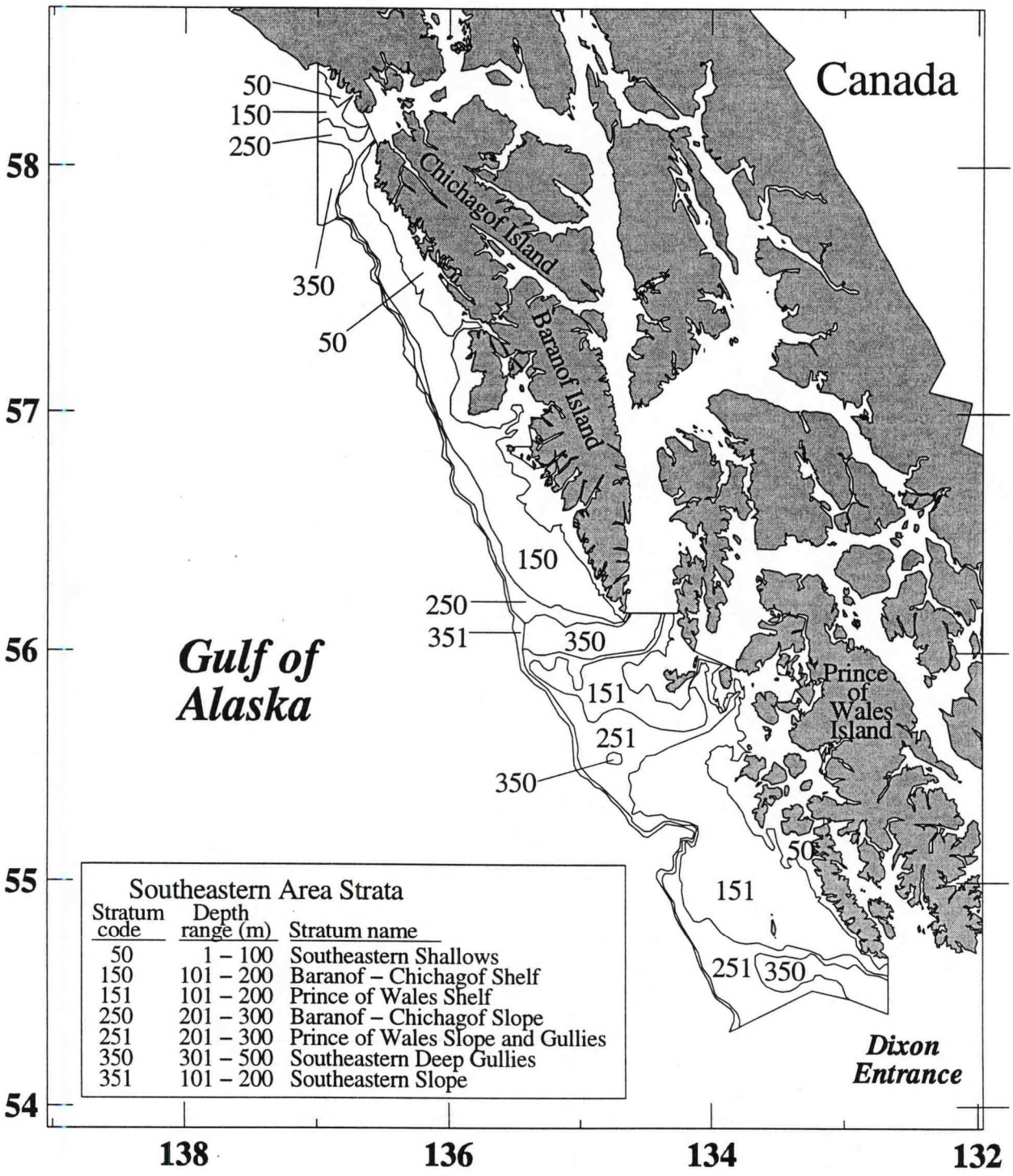
Appendix Figure B-2..-- Survey strata in the Chirikof INPFC statistical area used for the 1996 Gulf of Alaska bottom trawl survey.



Appendix Figure B-3..--Survey strata in the Kodiak INPFC statistical area used for the 1996 Gulf of Alaska bottom trawl survey.



Appendix Figure B-4..--Survey strata in the Yakutat INPFC statistical area used for the 1996 Gulf of Alaska bottom trawl survey.



Appendix Figure B-5..-- Survey strata in the Southeastern INPFC statistical area used for the 1996 Gulf of Alaska bottom trawl survey.

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APPENDIX C

Fish Species Encountered

Appendix Tables C-1 and C-2 list fish and invertebrate taxa encountered and identified during the 1996 Gulf of Alaska triennial bottom trawl survey. Most common and scientific names are from Robins et al. (1991). Order of listings and common names used are for convenience and do not imply adherence to a particular phylogenetic system.

Appendix Table C-1.--Fish species encountered during the 1996 Gulf of Alaska bottom trawl survey.

Family	Species Name	Common Name
Lamnidae	Lamna ditropis	salmon shark
Squalidae	Squalus acanthias	spiny dogfish
	Somniosus pacificus	Pacific sleeper shark
Rajidae	Raja binoculata	big skate
	Bathyraja interrupta	Bering skate
	Raja rhina	longnose skate
	Bathyraja trachura	black skate
	Bathyraja parmifera	Alaska skate
	Bathyraja aleutica	Aleutian skate
Chimaeridae	Hydrolagus colliei	spotted ratfish
Bothidae	Citharichthys sordidus	Pacific sanddab
Pleuronectidae	Atheresthes stomias	arrowtooth flounder
	Atheresthes evermanni	Kamchatka flounder
	Hippoglossus stenolepis	Pacific halibut
	Hippoglossoides elassodon	flathead sole
	Lyopsetta exilis	slender sole
	Eopsetta jordani	petrale sole
	Parophrys vetulus	English sole
	Microstomus pacificus	Dover sole
	Glyptocephalus zachirus	rex sole
	Limanda asper	yellowfin sole
	Platichthys stellatus	starry flounder
	Psettichthys melanostictus	sand sole
	Lepidopsetta cf. sp. bilineata	northern rock sole
	Lepidopsetta bilineata	southern rock sole
	Isopsetta isolepis	butter sole
	Pleuronectes quadrituberculatus	Alaska plaice
Agonidae	Sarritor frenatus	sawback poacher
	Xeneretmus leiops	smootheye poacher
	Bathyagonus pentacanthus	bigeye poacher
	Bathyagonus nigripinnis	blackfin poacher
	Podothecus acipenserinus	sturgeon poacher

Appendix Table C-1.--Continued.

Family	Species Name	Common Name
Agonidae - cont.	Aspidophoroides bartoni	Aleutian alligatorfish
	Hypsagonus quadricornis	fourhorn poacher
Ammodytidae	Ammodytes hexapterus	Pacific sand lance
Anarhichadidae	Anarrhichthys ocellatus	wolf-eel
Anoplopomatidae	Anoplopoma fimbria	sablefish
Argentinidae	Nansenia candida	bluethroat argentine
Bathylagidae	Leuroglossus schmidti	northern smoothtongue
Bathymasteridae	Bathymaster caeruleofasciatus	Alaskan ronquil
	Bathymaster signatus	searcher
Chauliodontidae	Chauliodus macouni	Pacific viperfish
Clupeidae	Clupea pallasi	Pacific herring
Macrouridae	Albatrossia pectoralis	giant grenadier
	Coryphaenoides cinereus	popeye grenadier
Cottidae	Thyriscus anoplus	
	Icelinus borealis	northern sculpin
	Icelinus tenuis	spotfin sculpin
	Gymnocanthus pistilliger	threaded sculpin
	Gymnocanthus galeatus	armorhead sculpin
	Artediellus sp.	
	Malacocottus zonurus	darkfin sculpin
	Hemilepidotus hemilepidotus	red Irish lord
	Hemilepidotus jordani	yellow Irish lord
	Hemilepidotus papilio	butterfly sculpin
	Triglops forficata	scissortail sculpin
	Triglops scepticus	spectacled sculpin
	Triglops pingeli	ribbed sculpin
	Triglops macellus	roughspine sculpin
	Myoxocephalus polyacanthocephalus	great sculpin
	Myoxocephalus jaok	plain sculpin
	Dasycottus setiger	spinyhead sculpin
	Psychrolutes paradoxus	tadpole sculpin
	Nautichthys pribilovius	eyeshade sculpin
	Nautichthys oculofasciatus	sailfin sculpin

Appendix Table C-1.--Continued.

Family	Species Name	Common Name
Cottidae - cont.	Rhamphocottus richardsoni	grunt sculpin
	Hemitripterus bolini	bigmouth sculpin
	Eurymen gyrinus	smoothcheek sculpin
	Icelus spiniger	thorny sculpin
Trichodontidae	Trichodon trichodon	Pacific sandfish
Gadidae	Microgadus proximus	Pacific tomcod
	Gadus macrocephalus	Pacific cod
	Theragra chalcogramma	walleye pollock
Hexagrammidae	Ophiodon elongatus	lingcod
	Pleurogrammus monopterygius	Atka mackerel
	Hexagrammos octogrammus	masked greenling
	Hexagrammos stelleri	whitespotted greenling
	Hexagrammos decagrammus	kelp greenling
Cyclopteridae	Aptocyclus ventricosus	smooth lumpsucker
	Eumicrotremus birulai	round lumpsucker
	Eumicrotremus orbis	Pacific spiny lumpsucker
	Careproctus melanurus	blacktail snailfish
	Careproctus gilberti	smalldisk snailfish
	Paraliparis sp.	
Melamphaeidae	Poromitra crassiceps	crested bigscale
Melanostomiidae	Tactostoma macropus	longfin dragonfish
Merluccidae	Merluccius productus	Pacific hake
Myctophidae	Stenobrachius leucopsarus	northern lampfish
	Diaphus theta	California headlightfish
	Lampanyctus ritteri	broadfin lanternfish
	Lampanyctus jordani	brokenline lampfish
Paralepidae	Paralepis atlantica	duckbill barracudina
Osmeridae	Thaleichthys pacificus	eulachon
	Hypomesus pretiosus	surf smelt
	Mallotus villosus	capelin
	Spirinchus thaleichthys	longfin smelt
Salmonidae	Oncorhynchus tshawytscha	chinook salmon
	Oncorhynchus kisutch	coho salmon

Appendix Table C-1.--Continued.

Family	Species Name	Common Name
Salmonidae - cont.	Oncorhynchus gorbuscha	pink salmon
	Oncorhynchus keta	chum salmon
	Oncorhynchus nerka	sockeye salmon
	Salvelinus malma	Dolly Varden
Cryptacanthodidae	Cryptacanthodes giganteus	giant wrymouth
Stichaeidae	Lumpenus maculatus	daubed shanny
	Lumpenus sagitta	snake prickleback
	Lumpenella longirostris	longsnout prickleback
	Chirolophis decoratus	decorated warbonnet
	Poroclinus rothrocki	whitebarred prickleback
Zaproridae	Zaprora silenus	prowfish
Zoarcidae	Bothrocara pusillum	Alaska eelpout
	Lycodes palearis	wattled eelpout
	Lycodes diapterus	black eelpout
	Lycodes brevipes	shortfin eelpout
	Lycodes pacificus	blackbelly eelpout
	Lycodapus sp.	
Scorpaenidae	Sebastolobus alascanus	shortspine thornyhead
	Sebastes aleutianus	rougheye rockfish
	Sebastes alutus	Pacific ocean perch
	Sebastes brevispinis	silvergray rockfish
	Sebastes ciliatus	dark dusky rockfish
	Sebastes cf. sp. ciliatus	light dusky rockfish
	Sebastes crameri	darkblotched rockfish
	Sebastes elongatus	greenstriped rockfish
	Sebastes entomelas	widow rockfish
	Sebastes flavidus	yellowtail rockfish
	Sebastes helvomaculatus	rosethorn rockfish
	Sebastes maliger	quillback rockfish
	Sebastes melanops	black rockfish
	Sebastes nigrocinctus	tiger rockfish
	Sebastes paucispinis	bocaccio
	Sebastes pinniger	canary rockfish

Appendix Table C-1.--Continued.

Family	Species Name	Common Name
Scorpaenidae - cont.	Sebastes polyspinis	northern rockfish
	Sebastes proriger	redstripe rockfish
	Sebastes ruberrimus	yelloweye rockfish
	Sebastes babcocki	redbanded rockfish
	Sebastes variegatus	harlequin rockfish
	Sebastes wilsoni	pygmy rockfish
	Sebastes zacentrus	sharpchin rockfish
	Sebastes borealis	shortraker rockfish
	Sebastes reedi	yellowmouth rockfish

Appendix Table C2 .--Invertebrate species encountered during the 1996 Gulf of Alaska bottom trawl survey.

Phylum	Species/Taxon Name	Common Name
Cnidaria	Cyanea capillata	
	Alcyonium sp.	
	Gersemia sp.	sea raspberry
	Anthomastus sp.	
	Anthomastus sp. A	
	Anthomastus sp. B	
	Primnoa willeyi	
	Paragorgia arborea	
	Callogorgia sp.	
	Stylatula sp.	slender seawhip
	Pavonaria finmarchica	
	Ptilosarcus gurneyi	
	Metridium senile	
	Liponemis brevicornis	
	Stylaster brochi	
	Cyclohelia lancellata	
	Errinopora sp.	
	Plumarella sp. 1	
	Thouarella sp.	
	Fanellia compressa	
	Muriceides sp.	
	Amphilaphis sp.	
	Arthrogorgia sp.	
Annelida	Cheilonereis cyclurus	
	Eunoe nodosa	giant scale worm
	Eunoe depressa	depressed scale worm
	Serpula vermicularis	
	Carcinobdella cyclostomum	striped sea leech
Arthropoda	Balanus evermanni	giant barnacle
	Balanus rostratus	beaked barnacle
	Pandalus jordani	ocean shrimp
	Pandalus borealis	northern shrimp

Appendix Table C-2.--Continued.

Phylum	Species/Taxon Name	Common Name
Arthropoda - cont.	Pandalus tridens	yellowleg pandalid
	Pandalus platyceros	spot shrimp
	Pandalus goniurus	humpy shrimp
	Pandalus hypsinotus	coonstripe shrimp
	Pandalopsis dispar	sidestripe shrimp
	Eualus macilenta	
	Lebbeus groenlandicus	
	Crangon communis	twospine crangon
	Crangon dalli	ridged crangon
	Crangon septemspinosa	sevenspine bay shrimp
	Argis dentata	Arctic argid
	Sclerocrangon boreas	sculptured shrimp
	Argis lar	kuro argid
	Pasiphaea pacifica	Pacific glass shrimp
	Pasiphaea tarda	crimson pasiphaeid
	Cancer magister	Dungeness crab
	Cancer oregonensis	Oregon rock crab
	Cancer gracilis	graceful rock crab
	Pinnixa occidentalis	pea crab
	Oregonia gracilis	graceful decorator crab
	Chorilia longipes	longhorned decorator crab
	Chionoecetes tanneri	groved tanner crab
	Chionoecetes bairdi	bairdi tanner crab
	Chionoecetes angulatus	triangle tanner crab
	Hyas lyratus	Pacific lyre crab
	Pagurus brandti	sponge hermit
	Pagurus aleuticus	Aleutian hermit
	Labidochirus splendescens	splendid hermit
	Pagurus confragosus	knobbyhand hermit
	Pagurus dalli	whiteknee hermit
	Pagurus kennerlyi	bluespine hermit
	Pagurus ochotensis	Alaskan hermit
	Pagurus rathbuni	longfinger hermit

Appendix Table C-2.--Continued.

Phylum	Species/Taxon Name	Common Name
Arthropoda - cont.	Pagurus tanneri	longhand hermit
	Elassochirus tenuimanus	widehand hermit crab
	Pagurus capillatus	hairy hermit crab
	Elassochirus cavimanus	purple hermit
	Elassochirus gilli	Pacific red hermit
	Lopholithodes foraminatus	box crab
	Acantholithodes hispidus	fuzzy crab
	Lithodes aequispina	golden king crab
	Hapalogaster grebnitzkii	
	Rhinolithodes wosnessenskii	rhinoceros crab
	Paralithodes camtschaticus	red king crab
	Paralithodes platypus	blue king crab
	Placetron wosnessenskii	scaled crab
	Pugettia sp.	kelp crab
	Munida quadrispina	
Mollusca	Tochuina tetraquetra	giant orange tochui
	Tritonia diomedea	rosy tritonia
	Chlamylla sp.	
	Cranopsis major	
	Natica clausa	arctic moonsnail
	Natica russa	rusty moonsnail
	Polinices pallidus	pale moonsnail
	Colus herendeenii	thin-ribbed whelk
	Volutopsius harpa	left-hand whelk
	Volutopsius fragilis	fragile whelk
	Beringius kennicottii	
	Beringius undatus	
	Neptunea amianta	
	Neptunea pribiloffensis	Pribilof whelk
	Neptunea lyrata	lyre whelk
	Plicifusus kroyeri	
	Volutopsius callorhinus	
	Aforia circinata	keeled aforia

Appendix Table C-2.--Continued.

Phylum	Species/Taxon Name	Common Name
Mollusca - cont.	Fusitriton oregonensis	Oregon triton
	Bathybembix bairdii	
	Cidarina cidaris	
	Buccinum plectrum	sinuous whelk
	Buccinum scalariforme	ladder whelk
	Arctomelon stearnsii	Alaska volute
	Modiolus modiolus	northern horsemussel
	Mytilus edulis	blue mussel
	Chlamys rubida	reddish scallop
	Patinopecten caurinus	weathervane scallop
	Yoldia scissurata	crisscrossed yoldia
	Yoldia thraciaeformis	broad yoldia
	Nuculana sp.	
	Limopsis akutanica	Akutan limops
	Musculus niger	black mussel
	Musculus discors	discordant mussel
	Astarte crenata	crenulate astarte
	Tridonta borealis	boreal tridonta
	Cyclocardia ventricosa	stout cyclocardia
	Cyclocardia crebricostata	many-rib cyclocardia
	Clinocardium nuttallii	Nuttall cockle
	Clinocardium ciliatum	hairy cockle
	Clinocardium californiense	California cockle
	Mactromeris polynyma	Arctic surfclam
	Siliqua sp.	
	Serripes groenlandicus	Greenland cockle
	Serripes laperousii	broad cockle
	Pododesmus macroschisma	Alaska falsejingle
	Opisthoteuthis californiana	flapjack devilfish
	Octopus dofleini	giant octopus
	Rossia pacifica	eastern Pacific bobtail
	Berryteuthis magister	magistrate armhook squid
Echinodermata	Evasterias troschelii	

Appendix Table C-2.--Continued.

Phylum	Species/Taxon Name	Common Name
Echinodermata - cont.	Evasterias echinosoma	
	Orthasterias koehleri	
	Leptasterias hylodes	
	Rathbunaster californicus	
	Pycnopodia helianthoides	
	Stylasterias forreri	
	Lethasterias nanimensis	
	Pedicellaster magister	
	Poraniopsis inflata	
	Henricia sanguinolenta	
	Henricia leviuscula	
	Leptasterias polaris	
	Gephyreaster swifti	
	Hippasteria spinosa	
	Pseudarchaster parelii	
	Mediaster aequalis	
	Ceramaster japonicus	red bat star
	Ceramaster patagonicus	orange bat star
	Luidia foliata	
	Solaster endeca	
	Solaster dawsoni	
	Solaster stimpsoni	
	Solaster paxillatus	
	Crossaster borealis	
	Crossaster papposus	rose sea star
	Lophaster furcilliger	
	Pteraster tesselatus	
	Pteraster militaris	
	Pteraster obscurus	
	Diplopteraster multipes	
	Asterias amurensis	purple-orange seastar
	Ctenodiscus crispatus	common mud star
	Leptychaster pacificus	

Appendix Table C-2.--Continued.

Phylum	Species/Taxon Name	Common Name
Echinodermata - cont.	Dipsacaster borealis	
	Luidiaster dawsoni	
	Strongylocentrotus droebachiensis	green sea urchin
	Strongylocentrotus franciscanus	red sea urchin
	Strongylocentrotus pallidus	white sea urchin
	Allocentrotus fragilis	orange-pink sea urchin
	Brisaster latifrons	
	Echinarachnius parma	Parma sand dollar
	Gorgonocephalus caryi	
	Asteronyx loveni	
	Ophiura sarsi	
	Amphiophiura ponderosa	
	Ophiopholis aculeata	
	Parastichopus californicus	
	Molpadia intermedia	
	Pentamera lissoplaca	
	Bathyplotes sp.	
	Cucumaria fallax	
	Stichopus japonicus	
	Psolus fabricii	
Porifera	Suberites ficus	hermit sponge
	Aphrocallistes vastus	clay pipe sponge
	Mycale loveni	tree sponge
	Halichondria panicea	barrel sponge
	Myxilla incrustans	scallop sponge
	Hylonema sp.	fiberoptic sponge
Bryozoa	Eucratea loricata	feathery bryozoan
	Flustra serrulata	leafy bryozoan
Brachiopoda	Terebratalia transversa	
	Terebratulina unguicula	
	Laqueus californianus	
Chordata	Styela rustica	sea potato
	Boltenia sp.	

Appendix Table C-2.--Continued.

Phylum	Species/Taxon Name	Common Name
Chordata -- cont.	Halocynthia aurantium	sea peach
	Aplidium sp.	
	Synoicum sp.	
	Molgula grifithsii	sea grape
	Molgula retortiformis	sea clod

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AFSC-

81 LAUTH, R. R. 1997. The 1996 Pacific West Coast upper continental slope trawl survey of groundfish resources off Washington and Oregon: Estimates of distribution, abundance, and length composition, 156 p. NTIS No. PB97-208912.

80 LAUTH, R. R. 1997. The 1985 Pacific West Coast upper continental slope trawl survey of groundfish resources off southern Oregon and northern California: Estimates of distribution, abundance, and length composition, 110 p. NTIS No. PB97-208920.

79 LAUTH, R. R., M. E. WILKINS, and P. A. RAYMORE JR. 1997. Results of trawl surveys of groundfish resources of the West Coast upper continental slope from 1989 to 1993, 342 p. NTIS number pending.

78 HILL, P. S., D. P. DEMASTER, and R. J. SMALL. 1997. Alaska marine mammal stock assessments, 1996, 150 p. NTIS No. PB97-203277.

77 CHUMBLEY, K., J. SEASE, M. STRICK, and R. TOWELL. 1997. Field studies of Steller sea lions (Eumetopias jubatus) at Marmot Island, Alaska, 1979 through 1994, 99 p. NTIS No. PB97-203376.

76 OSMEK, S., J. CALAMBOKIDIS, J. LAAKE, P. GEARIN, R. DELONG, J. SCORDINO, S. JEFFRIES, and R. BROWN. 1997. Assessment of the status of harbor porpoise (*Phocoena phocoena*) in Oregon and Washington waters, 46 p. NTIS No. PB97-198436.

75 WING, B. L., C. W. DERRAH, and V. M. O'CONNELL. 1997. Ichthyoplankton in the eastern Gulf of Alaska, May 1990, 42 p. NTIS No. PB97-174379.

74 WILSON, C. D., and M. A. GUTTORMSEN. 1997. Echo integration-trawl survey of Pacific whiting, Merluccius productus, off the west coasts of the United States and Canada during July-September 1995, 70 p. NTIS No. PB97-174387.

73 CELEWYCZ, A. G., and A. C. WERTHEIMER. 1997. Suitability of Dry Bay, southeastern Alaska, as rearing habitat for juvenile salmon, 19 p. NTIS No. PB97-161343.

72 KINOSHITA, R. K., A. GREIG, D. COLPO, and J.M. TERRY. 1997. Economic status of the groundfish fisheries off Alaska, 1995, 91 p. NTIS No. PB97-161269.

71 STRICK, J. M., L. W. FRITZ, and J. P. LEWIS. 1997. Aerial and ship-based surveys of Steller sea lions (Eumetopias jubatus) in Southeast Alaska, the Gulf of Alaska, and Aleutian Islands during June and July, 55 p. NTIS No. PB97-144026.

70 EBBERTS, B. D., and B. L. WING. 1997. Diversity and abundance of neustonic zooplankton in the north Pacific subarctic frontal zone, 34 p. NTIS No. PB97-138218.

69 SINCLAIR, E.H. (editor). 1996. Fur seal investigations, 1994, 144 p. NTIS No. PB97-129456.

68 MERRICK, R. L., T. R. LOUGHLIN, and D. G. CALKINS. 1996. Hot branding: A technique for long-term marking of pinnipeds, 21 p. NTIS No. PB97-124226.

67 LANG, G M., and P. A. LIVINGSTON. 1996. Food habits of key groundfish species in the eastern Bering Sea slope region, 111 p. NTIS No. PB97-124010.