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Data Report: 1993 Gulf of Alaska Bottom Trawl Survey

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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PREFACE

This data report is one of three types of standard reports presenting data from the 1993 Gulf of Alaska groundfish survey conducted by the National Marine Fisheries Service (NMFS). The three standard reports are:

1) A **Cruise Report,** outlining the survey objectives, documenting itinerary, personnel, and vessels employed and summarizing major accomplishments.

2) A **Report to Industry**, containing 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) A **Data Report** (this document), containing 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.

CONTENTS

ABSTRACT

The fourth triennial groundfish assessment survey of the Gulf of Alaska was conducted during the summer of 1993 by the Alaska Fisheries Science Center's Resource Assessment and Conservation Engineering (RACE) Division and the Auke Bay Laboratory (ABL). The survey area covered the continental shelf and the upper continental slope to 500 m in the Gulf of Alaska from Islands of Four Mountains (170°W long.) to Dixon Entrance (133°25'W long.). The RACE portion of the survey was conducted aboard three chartered trawlers, the Argosy, Alsea, and Progress. The ABL portion was conducted aboard the National Oceanic and Atmospheric Administration's (NOAA) research vessel Miller Freeman. A total of 775 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.

A total of 128 fish species were identified from the survey catches. Arrowtooth flounder (Atheresthes stomias), Pacific halibut (Hippoglossus stenolepis), walleye pollock (Theragra chalcogramma), Pacific cod (Gadus macrocephalus) and Pacific ocean perch (Sebastes alutus)

were the most abundant species within the survey area. Rock sole (Pleuronectes bilineata), sablefish (Anoplopoma fimbria), yellowfin sole (Pleuronectes asper), and redstripe rockfish (Sebastes proriger) 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.

INTRODUCTION

The fourth in a series of triennial groundfish surveys was conducted in the Gulf of Alaska (GOA) during the summer of 1993 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 Seattle-based Resource Assessment and Conservation Engineering (RACE) Division for the western and central GOA (Islands of Four Mountains to Cape St. Elias). The eastern GOA (Cape St. Elias to Dixon Entrance) was the responsibility of the AFSC's Auke Bay Laboratory (ABL) located in Juneau, Alaska.

This report presents the combined 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 two 1993 GOA groundfish surveys, and to supplement the status of stocks resource assessment and allocation process. This report presents the 1993 survey results only and makes no comparisons with previous GOA 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, and fish pathology.

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

5) Collect data for special research projects including:

a) Atka mackerel life history.

b) Atka mackerel genetics.

c) Atka mackerel maturity and fecundity.

d) Young-of-the-year walleye pollock.

e) Proximate composition of forage fish utilized by marine mammals and birds.

f) Dover sole mitochondrial DNA analysis.

g) Shortraker and rougheye rockfish mitochondrial DNA and electrophoretic analysis.

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. The features provide a variety of habitats resulting in a complex ecosystem (Fig. 1). Prevailing rough bottom conditions in many areas require the standard use of rubber bobbin roller gear for all bottom trawling operations. The 1993 GOA survey included the entire continental shelf and upper portion of the continental slope to the 500 m depth contour, excluding all the Southeastern INPFC area's generally untrawlable shallow (1-100 m) inner shelf.

The total survey area was approximately 299,410 km^2 (87,276 nautical miles squared (nm^2), Table 1). The shelf, comprising more than 90% of the total GOA survey area, extends approximately 220 km (120 nm) off Cook Inlet and narrows to 40 km (22 nm) 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 GOA and the Alaska Plain in the eastern GOA. The survey assessed only that portion of the slope shallower than 500 m, an area of approximately 15,000 km^2 (8,000 nmi^2).

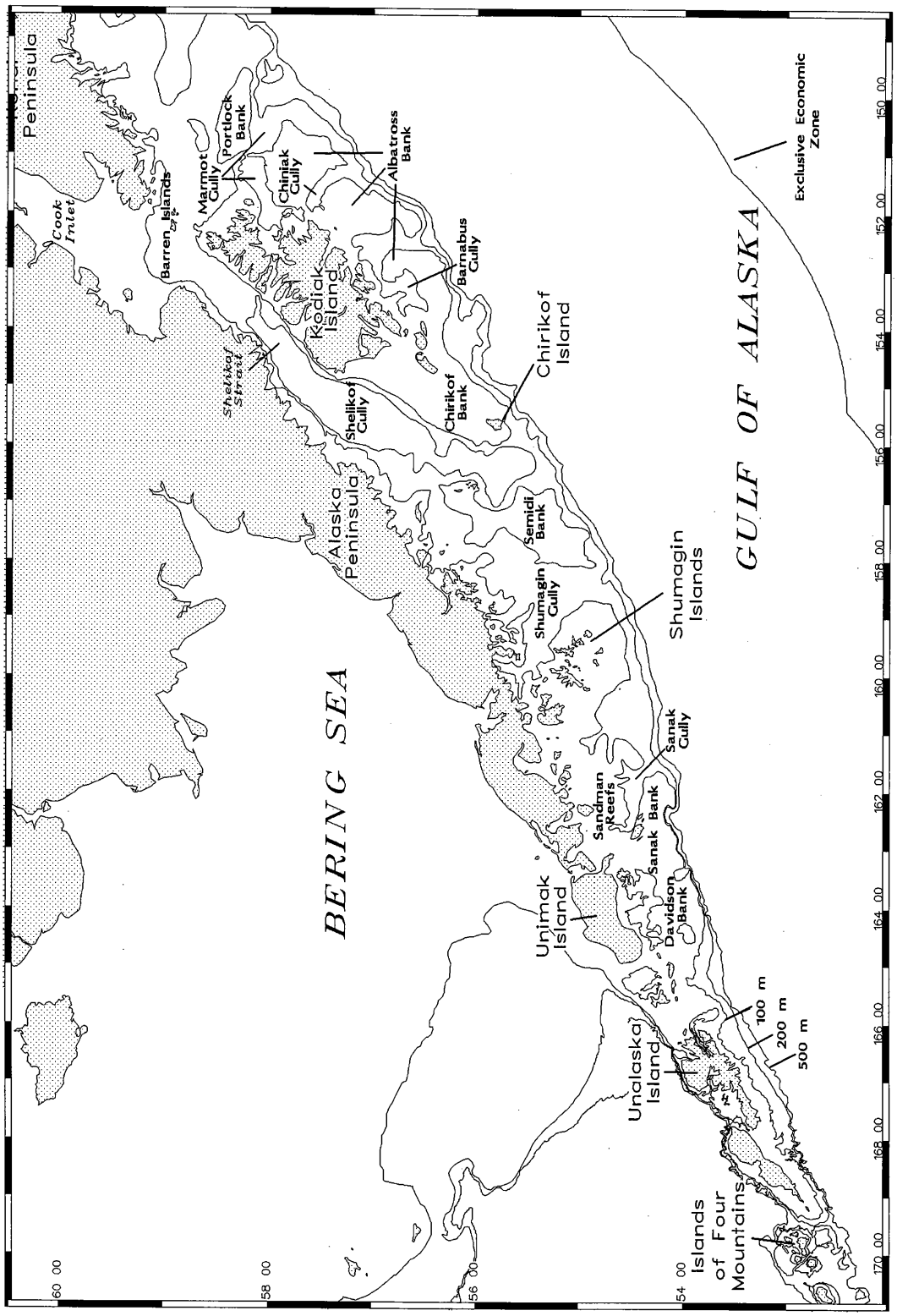


Figure 1.--Bathymetric and geographic features of the survey area for the 1993 Gulf of Alaska triennial groundfish survey.

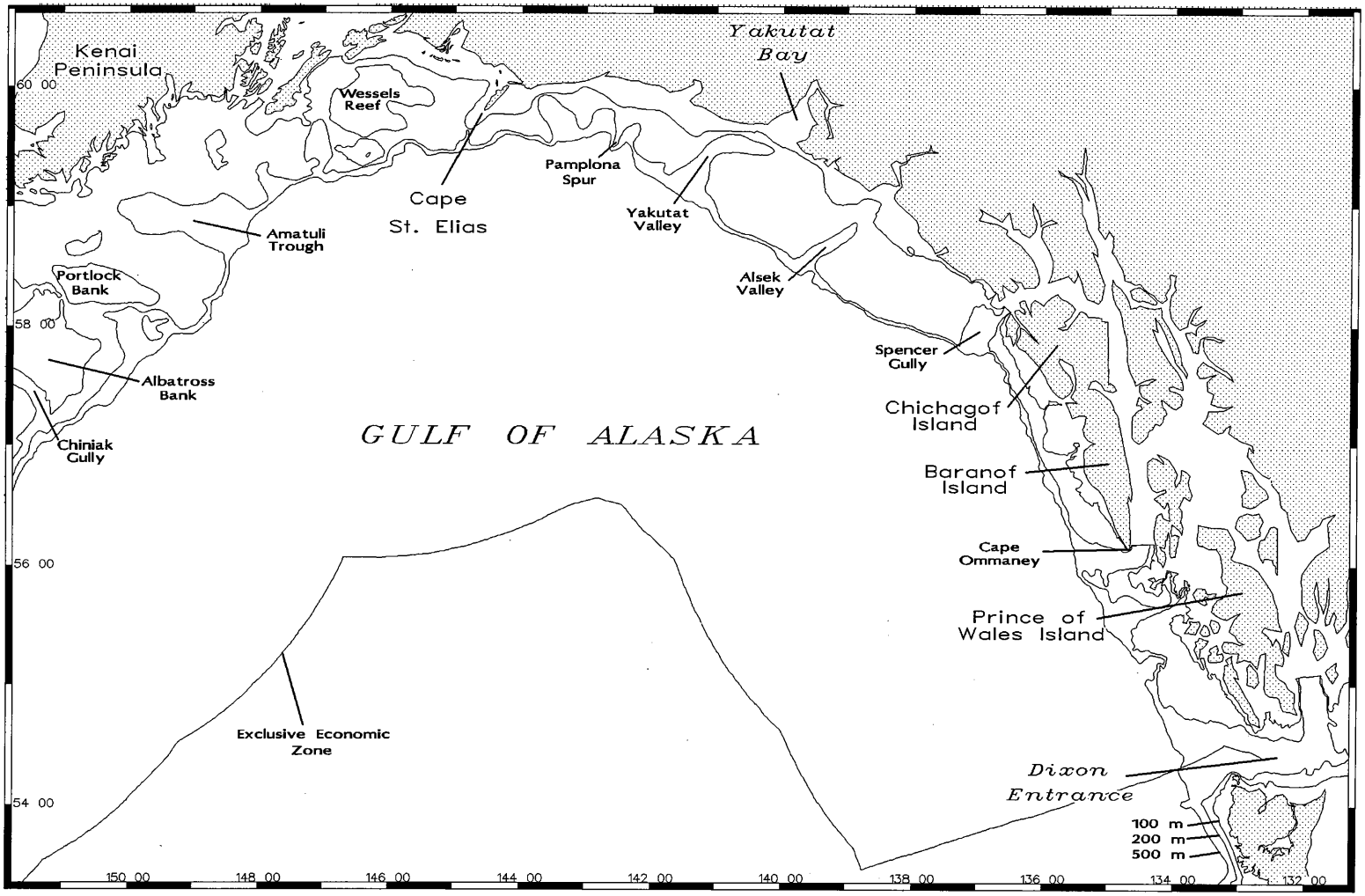


Figure 1.--Continued..

The Kodiak INPFC area with 97,529 km² (Table 1) has over 35% more total bottom area than any other GOA area. The Chirikof INPFC area totals 63,457 km², only 1% smaller than the Shumagin INPFC area (64,163 km²), while the Yakutat INPFC area has approximately 52,704 km² in bottom area. The Southeastern INPFC area's bottom area (21,557 km²) is only 20% of the size of the Kodiak INPFC area.

Vessels

The survey of the western and central areas of the Gulf of Alaska was conducted aboard the chartered commercial trawlers Argosy, Alsea, and Progress from June to September 1993. The Argosy is 37.95 meters in overall length, 13.71 m wide and powered by a single main engine generating 1,750 continuous horsepower. Deck equipment included paired hydraulic winches with 1,646 m of 2.54 cm cable per drum mounted on the main deck, two hydraulic net reels (one mounted over the stern ramp and the other mounted forward on the working deck), and two gilson winches mounted on the main boom for pulling/lifting. The Alsea is 38.05 m in overall length, 13.71 m wide and powered by a 1,750 continuous horsepower single main engine. Deck equipment included paired hydraulic trawl winches with 1,463 m of 2.54 cm cable per drum mounted on the bridge deck, two hydraulic net reels configured as previously noted and two gilson winches mounted on the main boom for pulling/lifting. The Progress is 35.42 m) in overall length, 9.29 m wide and powered by a single main engine generating 1,285 continuous horsepower. Deck equipment included paired hydraulic trawl winches on the working deck with

1,219 m of 2.22 cm cable per drum and two hydraulic net reels and gilson winches configured the same as the Argosy and Alsea.

The NOAA research vessel Miller Freeman was the only vessel used for the eastern GOA survey. The Miller Freeman is a 65.5 m stern trawler powered by a 2,250 horsepower main engine and auxiliary 400 horsepower bow thruster. Constant-tension hydraulic trawl winches contained 1,830 m of 2.54 cm diameter wire cable.

Fishing Gear

All vessels participating in both surveys used standard RACE Division poly-Nor'eastern high-opening bottom trawls rigged with rubber bobbin roller gear (Appendix A). 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 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 (1,700 lb.) each were used. The fishing dimensions of the trawls were measured aboard each vessel using Scanmar[1] acoustic net mensuration equipment.

SURVEY DESIGN

The Gulf of Alaska was divided into two survey areas divided by the 144°30' line of longitude. The 1993 triennial survey used a stratified random sampling pattern consistent with previous triennial surveys (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). Since the methods used were slightly different for the two surveys, descriptions of each survey's methods are detailed separately below.

Western and Central Gulf of Alaska

Sample allocation was determined following the method of Neyman for stratified random surveys, (Cochran 1977). Strata were assigned one of three sampling densities, based on the coefficients of variation, mean catch per unit effort (CPUE), and sampling densities for all fish species combined from the 1984, 1987, and 1990 surveys. The 1990 survey results were given greater weight in this process than the previous surveys. Strata with anticipated high fish densities were assigned a sampling density of one station per 100 km^2, while those strata expected to have moderate and low fish densities were assigned sampling densities of one station per 150 km^2 and

225 km^2, respectively. A corresponding number of points were randomly chosen from a grid consisting of points spaced at 5 nm intervals. Stations were allocated equally among the survey vessels within each stratum to allow a comparison of relative fishing efficiencies between vessels.

Stations were prioritized within each stratum to provide three potential levels of systemically 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 450, 600, or 750 total successful stations. Priority One stations were allocated from the minimum potential sampling level of 450 total stations and comprised 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 600 or 750 stations, respectively. The numbers of priority One and Two stations were adjusted upward in proportion to the percentage of bad tows within each stratum for the 1984-90 surveys combined to allow for bad tows in these areas. 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 nm 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 30 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 30 minutes, 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.

Eastern Gulf of Alaska

The design of the 1993 eastern GOA survey was nearly identical to that of its predecessor, the 1990 eastern GOA survey. This design was slightly different from that used in the central and western GOA surveys in these years. A brief description of this methodology follows:In the eastern GOA surveys, greater emphasis was placed on sampling rockfish species and sablefish, which are by far the most important commercial species in this region. These species inhabit primarily depths greater than 200 m on the continental slope and in gullies. Consequently,more stations per unit area were placed in these areas in an attempt to reduce the variance of CPUE values for these fish. Fewer stations were allocated to the continental shelf in depths less than 200 m. No stations were allocated in the 1-100 m stratum of the Southeastern INPFC area because virtually the entire stratum is untrawlable using the survey's standard nets. For a more detailed discussion of the survey design in the eastern GOA, see Stark and Clausen (1995).

A total of 180 stations were planned for the 1993 eastern GOA survey (Table 1). This number was based on the 36 fishing days available for this region in 1993 and an expected completion rate of five stations per day. The number of planned stations in each sampling stratum

was determined using the 1990 allocation scheme for the eastern GOA survey. However, because of the fewer fishing days available in 1993, the number of stations in each stratum was reduced by approximately 10%.

Stations in shelf and gully strata were randomly selected using the same 5 by 5 nm grid technique as previously described for the western and central GOA survey. The eastern GOA survey followed a different approach to select stations in slope strata. The grid method was not used because these strata are small and extremely narrow and elongate in shape. Instead, for each slope stratum, transect lines were drawn such that the area between lines was 25 nm^2. Thus, the slope strata were composed of several irregularly shaped areas analogous to the grid-areas on the shelf and gullies. The slope stations were then selected randomly from these areas.

For each of the 180 randomly located stations, an alternative, non-random station in the same stratum was also determined in case the original planned station was untrawlable. The alternative stations were selected from successful trawl hauls made during 11 previous Alaska Fisheries Science Center survey cruises in the eastern Gulf of Alaska from 1978 to 1990.

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 30 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 in the central and western portion of the survey. 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 for the central and western portion of the survey. Bottom temperatures in the eastern portion of the survey were collected with a Furuno net sounder attached to the headrope. In both portions of the survey, the vertical and horizontal net openings were monitored with Scanmar net sonde units. Scanmar data were generally not collected for tows over rough bottom or at depths greater than 400 m. The surface water temperature was measured at each station 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 nm/hour trawling speed.

A trawl sample was considered successful if horizontal and vertical net openings remained within the normal range, the roller gear consistently remained on bottom and the net suffered no or little damage during the tow. 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 1,100 kg were emptied directly onto a sorting table, sorted to species, and weighed. 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 Pacific halibut (Hippoglossus stenolepis), crab, and 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.

Additional data collection was concentrated on 17 species of high commercial value or abundance in the survey area including:

Arrowtooth flounder	Atheresthes stomias
Flathead sole	Hippoglossoides elassodon
Rock sole	Pleuronectes bilineatus
Rex sole	Errex zachirus
Dover sole	Microstomus pacificus

Yellowfin sole	Pleuronectes asper
Walleye pollock	Theragra chalcogramma
Pacific cod	Gadus macrocephalus
Sablefish	Anoplopoma fimbria
Atka mackerel	Pleurogrammus monopterygius
Pacific ocean perch	Sebastes alutus
Northern rockfish	Sebastes polyspinis
Rougheye rockfish	Sebastes aleutianus
Dusky rockfish	Sebastes ciliatus
Sharpchin rockfish	Sebastes zacentrus
Shortraker rockfish	Sebastes borealis
Shortspine thornyhead	Sebastolobus alascanus

A random subsample of 100 to 300 individuals (target value 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 or with plastic measuring 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. Length was estimated to the nearest 1 cm FL, and weight was estimated to the nearest gram with a platform scale when weather conditions allowed. To ensure that adequate samples for all

commonly observed age 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.

In addition, ancillary data and specimens were collected for other research projects including information on Atka mackerel life history, genetics, maturity and fecundity; young-of-the-year pollock; proximate composition of forage fish utilized by marine mammals and birds; Dover sole mitochondrial DNA analysis; and shortraker and rougheye rockfish mitochondrial DNA and electrophoretic analysis.

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 equilibrium and haulback. Equilibrium was defined by two criteria: 1) the net was in contact with the bottom; and 2) the net spread and height indicated that the gear had achieved a normal fishing configuration. Haulback was defined as when the trawl winches began to pull the net back to the vessel. In the central and western

portion of the survey, the distance traveled by the vessel was estimated by smoothing the GPS location data to eliminate the clock dither introduced by selective availability, the largest source of error in the GPS system, and measuring the distance along this line. In the eastern portion of the survey, distance was estimated as the straight-line distance between the equilibrium and haulback positions as determined by GPS. The mean net spread was estimated by averaging the net spread readings from the Scanmar units from equilibrium to haulback. In the central and western portions of the survey, net spreads for tows for which there were no Scanmar data were estimated using a generalized additive model using net number, net height (when available), mean speed over ground (when available), depth, and scope as variables. In the eastern portion of the survey, net spreads were estimated by linear multiple regression using depth and scope as variables. For each species, a CPUE was calculated for each stratum by dividing catch weight (in kg) by the area swept by the trawl (in km^2) for all tows in 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 stratum mean CPUEs by strata areas 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 $Weight_{(grams)} = a * Length_{(mm)}^{b}$

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

RESULTS

Of the 954 stations allocated for the 1993 survey, tows were attempted at 840 stations (88% of the allocated stations), and 775 of these (92%) were considered successful tows and included in the biomass and size composition analysis (Table 1). Scanmar net spread data were collected for 499 tows in the central and western GOA (74%) and 51 tows in the eastern GOA (31%). Continuous GPS data were collected from 607 tows (90%) in the central and western GOA. Headrope depth and temperature data were collected for a total of 630 tows (93%) in the western and central GOA. Bottom temperature data were collected at an additional 154 stations (92%) in the eastern GOA. Bottom temperatures ranged from 1.9° to 11.4°C. Sea surface temperatures were collected at a total of 804 stations (96%). Sea surface temperatures ranged from 5.4° to 18.1°C.

Table 1.--Number of allocated, attempted, and successfully completed stations and sampling density for the 1993 Gulf of Alaska triennial groundfish survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

Area	Depth (m)	Number of stations			Area (km^2)	Sampling density (stations/1,000 km^2)
		Allocated	Attempted	Successful		
Shumagin	1 - 100	147	115	106	44,362	2.39
	101 - 200	77	56	51	14,536	3.51
	201 - 300	10	10	8	2,737	2.92
	301 - 500	9	6	6	2,528	2.37
	All depths	243	187	171	64,163	2.67
Chirikof	1 - 100	77	58	54	26,575	2.03
	101 - 200	87	85	81	23,749	3.41
	201 - 300	30	33	31	11,500	2.70
	301 - 500	6	6	6	1,633	3.67
	All depths	200	182	172	63,457	2.71
Kodiak	1 - 100	96	75	68	39,842	1.71
	101 - 200	143	143	134	43,182	3.10
	201 - 300	35	32	28	11,545	2.43
	301 - 500	11	12	10	2,960	3.38
	All depths	285	262	240	97,529	2.46
Yakutat	1 - 100	20	17	16	16,220	0.99
	101 - 200	62	62	61	28,647	2.13
	201 - 300	30	32	29	4,874	5.95
	301 - 500	21	19	18	2,963	6.07
	All depths	133	130	124	52,704	2.35
Southeastern	1 - 100	0	0	0	3,766	0.00
	101 - 200	32	29	24	9,871	2.43
	201 - 300	38	34	30	5,035	5.96
	301 - 500	23	16	14	2,885	4.85
	All depths	93	79	68	21,557	3.15
All areas	1 - 100	340	265	244	130,765	1.87
	101 - 200	401	375	351	119,985	2.93
	201 - 300	143	141	126	35,691	3.53
	301 - 500	70	59	54	12,969	4.16
	All depths	954	840	775	299,410	2.59

Catch Results by Area

A total of 128 fish species from 35 families were identified during the 1993 GOA groundfish survey. Appendix C presents lists of fish (Table C-1) and invertebrate (Table 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. Walleye pollock and Pacific halibut were also very important components of the gulf-wide species composition, particularly in the central and western GOA. The CPUE was also high for Pacific ocean perch across the Gulf of Alaska, particularly in the Southeastern INPFC area. Pacific cod was the fifth most important fish species in terms of CPUE, although their numbers were relatively low in the eastern GOA.

In the Shumagin INPFC area, pollock and arrowtooth flounder were by far the most abundant groundfish species, accounting for more than 47% of the total fish CPUE. CPUEs were also high for Pacific cod, Pacific halibut, rock sole, Pacific ocean perch, yellowfin sole, and flathead sole. In the Chirikof INPFC area, arrowtooth flounder was the dominant species, accounting for approximately 39% of the total fish CPUE. Pollock, Pacific ocean perch, Pacific cod and Pacific halibut were also important in the species composition. In the Kodiak INPFC

Table 2.-- Mean CPUE (kg/km^2) for the 20 most abundant groundfish in each International North Pacific Fisheries Commission area during the1993 Triennial Gulf of Alaska groundfish survey.

Shumagin Area		Chirikof Area		Kodiak Area	
Species	CPUE	Species	CPUE	Species	CPUE
Walleye pollock	5,739	Arrowtooth flounder	7,502	Arrowtooth flounder	6,696
Arrowtooth flounder	3,543	Walleye pollock	2,926	Pacific halibut	3,358
Pacific cod	1,947	Pacific ocean perch	1,621	Walleye pollock	1,987
Pacific halibut	1,917	Pacific cod	1,568	Pacific cod	1,812
Rock sole	1,461	Pacific halibut	1,530	Sablefish	1,641
Pacific ocean perch	1,182	Flathead sole	869	Pacific ocean perch	1,582
Yellowfin sole	1,141	Northern rockfish	718	Flathead sole	635
Flathead sole	960	Sablefish	553	Rock sole	535
Giant grenadier	541	Rock sole	527	Northern rockfish	512
Atka mackerel	336	Rex sole	429	Rougheye rockfish	350
Sablefish	249	Skates	290	Dover sole	324
Northern rockfish	244	Dover sole	209	Rex sole	298
Dusky rockfish	205	Dusky rockfish	206	Starry flounder	277
Rougheye rockfish	172	Giant grenadier	177	Dusky rockfish	245
Rex sole	170	Eulachon	171	Skates	230
Yellow Irish lord	153	Rougheye rockfish	149	Butter sole	189
Butter sole	62	Yellowfin sole	127	Eulachon	137
Starry flounder	60	Shortspine thornyhead	99	Harlequin rockfish	87
Shortspine	58	Starry flounder	97	Spiny dogfish	79
Skates	56	Butter sole	92	Sharpchin rockfish	73
Number of hauls	171	Number of hauls	172	Number of hauls	240

Yakutat Area		Southeastern Area		All Areas	
Species	CPUE	Species	CPUE	Species	CPUE
Arrowtooth flounder	3,404	Pacific ocean perch	5,022	Arrowtooth flounder	5,329
Pacific halibut	648	Arrowtooth flounder	2,232	Walleye pollock	2,659
Pacific ocean perch	637	Redstripe rockfish	1,496	Pacific halibut	1,998
Walleye pollock	627	Silvergray rockfish	884	Pacific ocean perch	1,542
Sablefish	592	Dover sole	664	Pacific cod	1,426
Dover sole	541	Sablefish	651	Sablefish	859
Spiny dogfish	482	Sharpchin rockfish	615	Flathead sole	664
Skates	412	Pacific halibut	509	Rock sole	612
Flathead sole	330	Shortspine thornyhead	421	Northern rockfish	376
Rex sole	311	Walleye pollock	301	Rex sole	299
Pacific cod	297	Pacific cod	277	Dover sole	296
Pacific herring	269	Rex sole	275	Yellowfin sole	285
Shortspine	178	Lingcod	200	Skates	225
Lingcod	160	Yellowmouth rockfish	194	Rougheye rockfish	216
Eulachon	149	Rougheye rockfish	128	Dusky rockfish	199
Rougheye rockfish	135	Redbanded rockfish	112	Giant grenadier	174
Dusky rockfish	133	Pacific hake	97	Starry flounder	146
Shortraker rockfish	131	Spotted ratfish	96	Eulachon	120
Starry flounder	116	Shortraker rockfish	94	Spiny dogfish	117
English sole	109	Dusky rockfish	90	Shortspine thornyhead	114
Number of hauls	124	Number of hauls	68	Number of hauls	775

area, arrowtooth flounder and halibut were the two most important species in terms of CPUE, comprising about 48% of the total fish CPUE. Pacific halibut, pollock, Pacific cod, sablefish, and Pacific ocean perch also had relatively high CPUEs. In the Yakutat INPFC area, arrowtooth flounder comprised about 40% of the total fish CPUE. This was more than five times the next highest CPUE, Pacific halibut. In the Southeastern INPFC area, three rockfish species (Pacific ocean perch, redstripe rockfish, and silvergray rockfish) and arrowtooth flounder predominated in the catches.

Catch Results by Species

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

1. A brief synopsis or overview of the data collected.
2. A table presenting the number of hauls, the number of hauls with catch, CPUE, 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.

Arrowtooth flounder (*Atherestes stomias*)

Arrowtooth flounder had the highest CPUE of any species in the 1993 survey, and its biomass was over twice that of the next most abundant species (Table 3). Arrowtooth flounder were distributed throughout the survey area (Fig. 2), occurring in all 48 strata sampled (Table 4) and at more than 92% of the sampled stations, including more than 99% of the stations at depths greater than 100 m (Table 3). Approximately 50% 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, Portlock Flats, and Chirikof Outer Shelf and Slope (Table 4). Arrowtooth flounder had the highest estimated biomass of any species in three of the five areas surveyed and was second in estimated biomass in the other two areas. Both mean length and mean weight increased with depth in all areas. Length data were collected for more than 83,000 arrowtooth flounder (Fig. 3). Length modes were generally found between 40 and 45 cm FL for males and between 55 and 60 cm FL for females. Length modes were also seen at 21-22 cm FL for both sexes in water less than 100 m in depth in the western Gulf of Alaska. The length-weight relationship for arrowtooth flounder specimens collected during the survey is depicted in Figure 4.

Table 3.--Number of survey hauls, hauls containing arrowtooth flounder, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	91	2,739	121,508	0.5	34.5
	101 200	51	51	6,826	99,220	0.7	41.0
	21 - 300	8	8	751	2,055	1.0	45.9
	301 - 500	6	6	1,792	4,529	1.4	51.1
	All depths	171	156	3,543	227,312	0.6	37.0
Chirikof	1 - 100	54	38	2,914	77,437	0.6	36.7
	101 - 200	81	80	12,947	307,480	0.9	43.7
	201 - 300	31	31	6,637	76,327	1.3	49.9
	301 - 500	6	6	9,071	14,810	1.6	53.8
	All depths	172	155	7,502	476,053	0.9	43.0
Kodiak	1 - 100	68	43	3,413	135,989	0.8	42.3
	101 - 200	134	133	10,787	465,831	0.9	44.7
	201 - 300	28	28	4,145	47,858	1.4	51.0
	301 - 500	10	10	1,152	3,411	1.5	52.6
	All depths	240	214	6,696	653,089	0.9	44.4
Yakutat	1 - 100	16	16	2,462	39,934	0.7	40.4
	101 - 200	61	61	4,098	117,404	0.7	39.9
	201 - 300	29	29	3,709	18,075	1.2	48.8
	301 - 500	18	18	1,349	3,998	2.1	57.4
	All depths	124	124	3,404	179,411	0.8	40.7
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	23	3,145	31,042	0.6	39.5
	201 - 300	30	29	1,037	5,223	0.8	40.5
	301 - 500	14	14	1,192	3,439	1.4	53.5
	All depths	68	66	2,232	39,705	0.7	40.1
All areas	1 - 100	244	188	2,952	374,869	0.6	37.8
	101 - 200	351	348	8,509	1,020,977	0.8	43.1
	201 - 300	126	125	4,190	149,539	1.3	49.6
	301 - 500	54	54	2,328	30,187	1.6	53.6
	All depths	775	715	5,329	1,575,571	0.8	42.0

All areas biomass, 95% confidence interval: 1,375,663 - 1,775,479 metric tons (t).

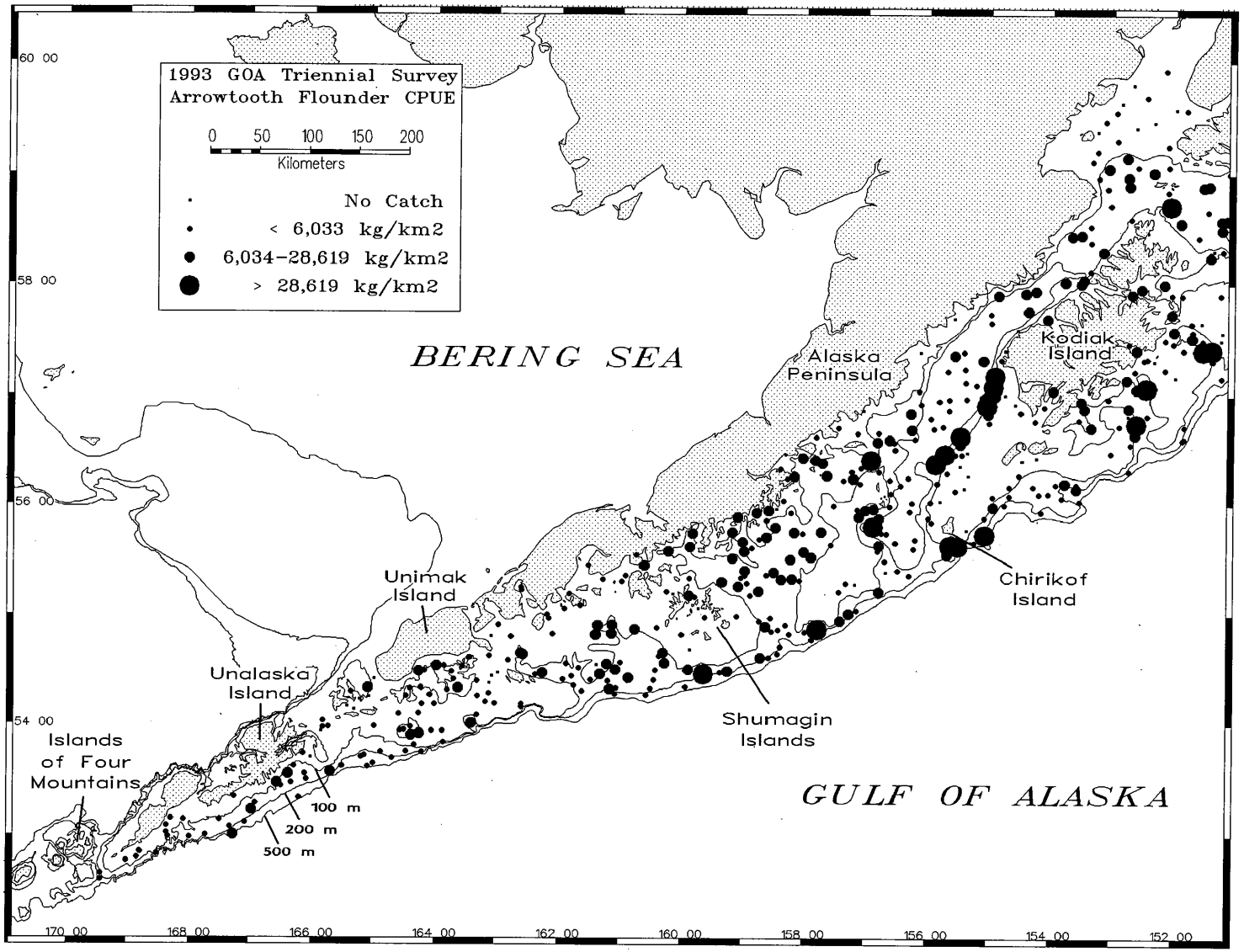


Figure 2.--Distribution and relative abundance of arrowtooth flounder from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

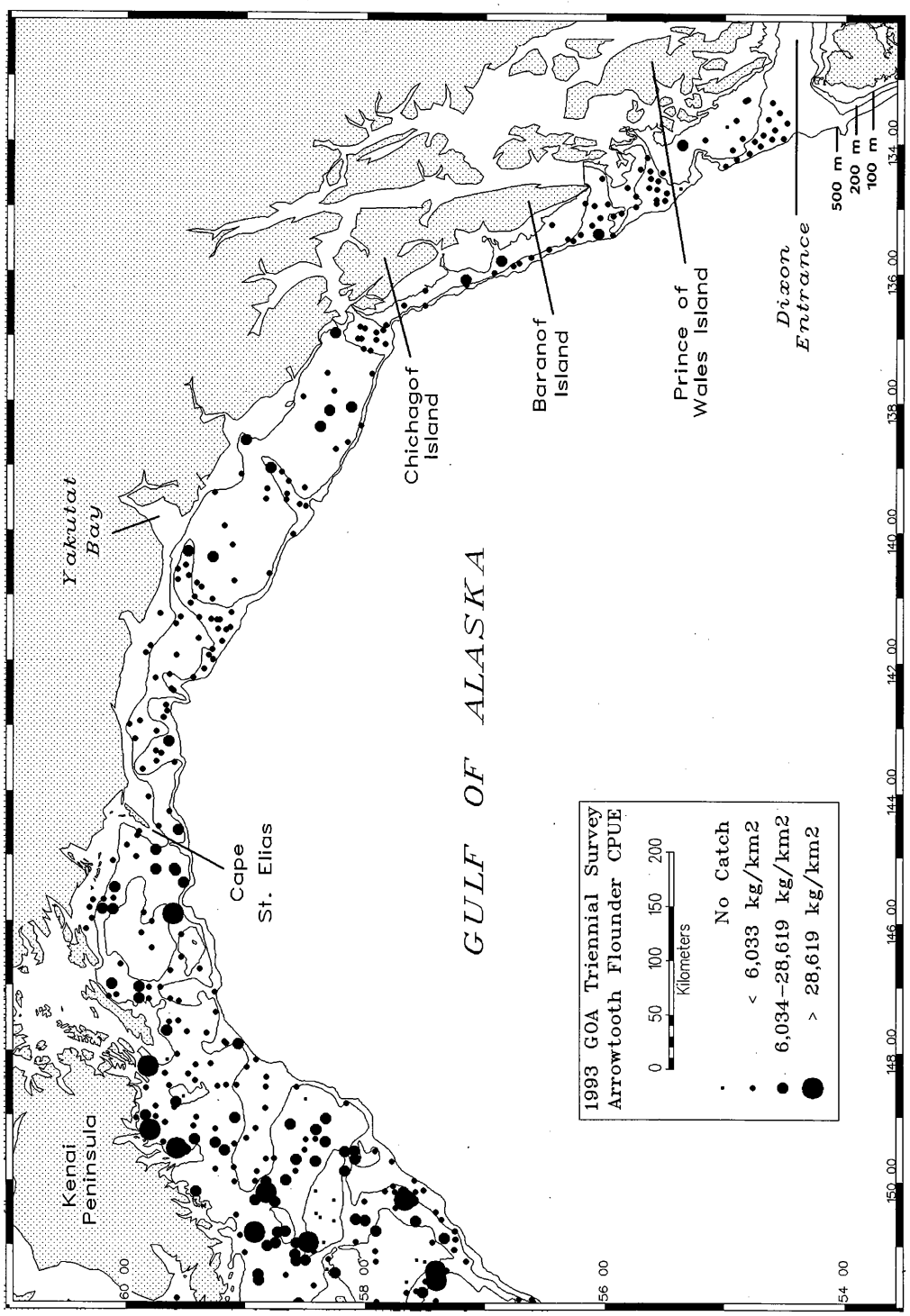


Figure 2.--Continued.

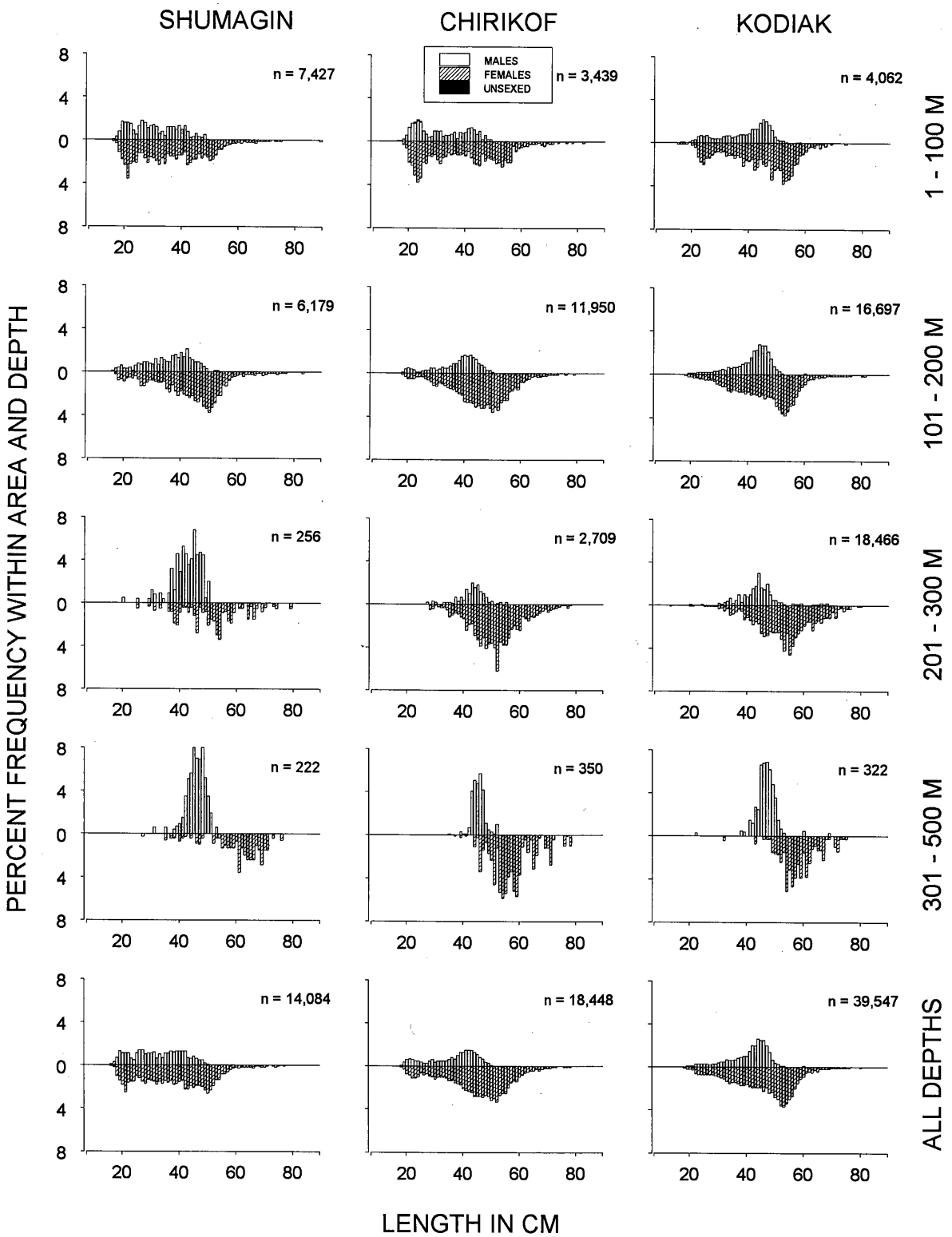


Figure 3.--Size composition of the estimated arrowtooth flounder population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

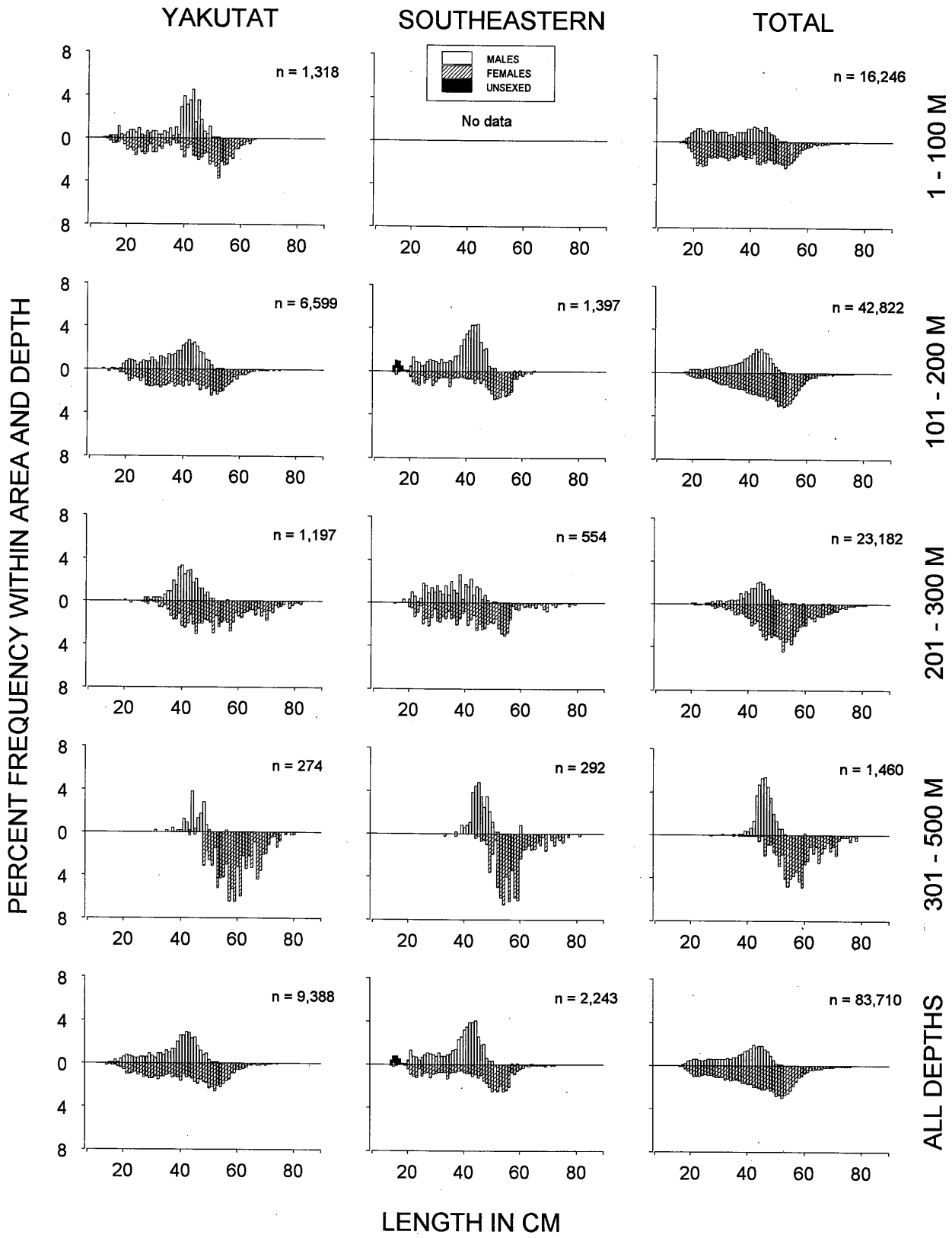


Figure 3.--Continued.

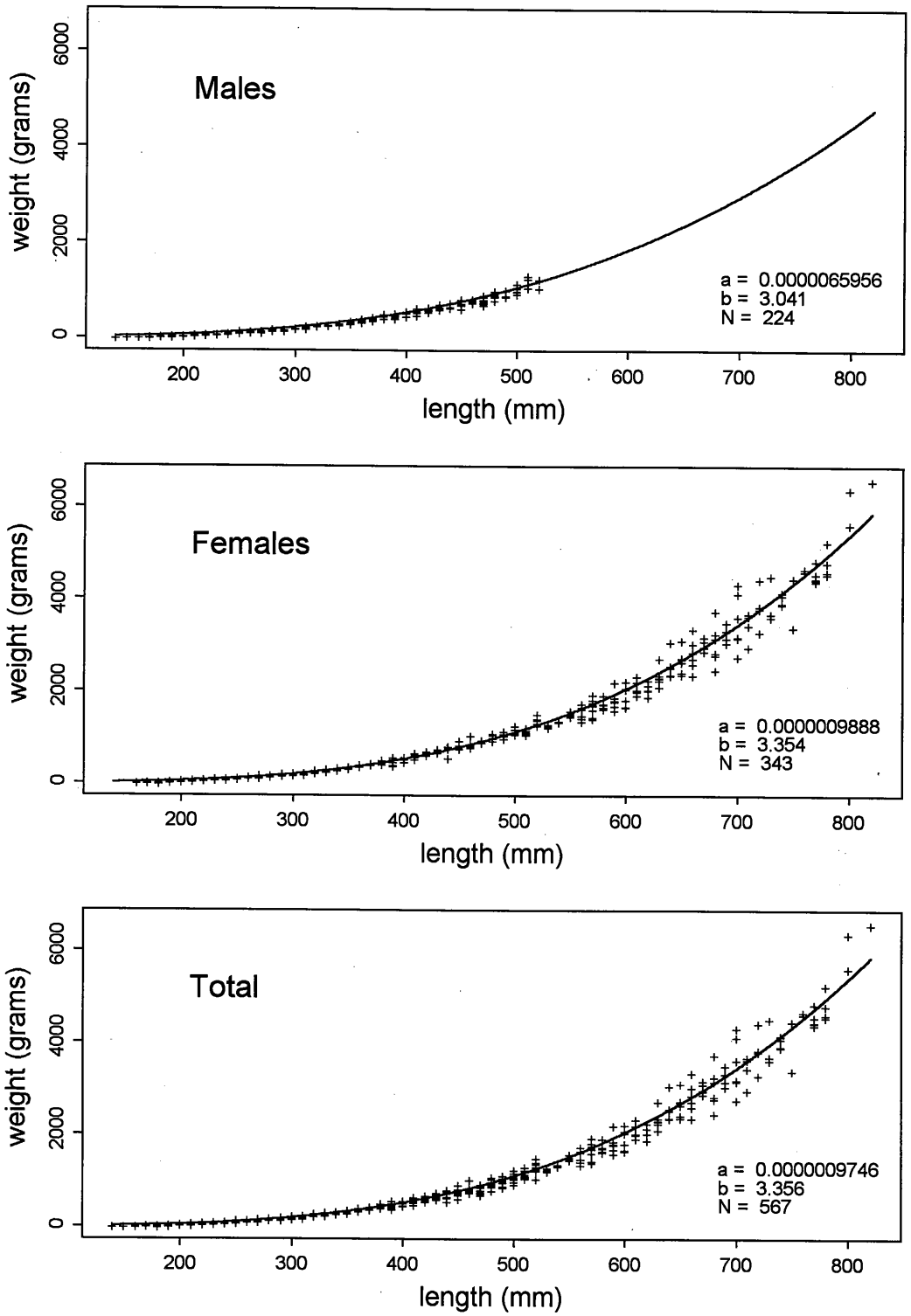


Figure 4.--Length-weight relationship for arrowtooth flounder specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 4.--Catch per unit effort by stratum for arrowtooth flounder sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
121	Shelikof Edge	24	23	19,572	150,173	48,379	251,967
130	Albatross Gullies	29	29	15,766	123,561	82,698	164,424
131	Portlock Flats	22	21	12,730	93,173	45,080	141,265
122	Chirikof Outer Shelf	18	18	11,203	55,946	20,641	91,250
221	Chirikof Slope	4	4	11,119	17,047	0	59,971
133	Kenai Flats	41	41	9,475	113,716	41,528	185,903
120	East Shumagin Gully	39	39	9,146	101,361	72,642	130,081
320	Chirikof Slope	6	6	9,071	14,810	0	39,445
112	West Shumagin Gully	6	6	8,943	20,275	9,259	31,291
132	Barren Islands	27	27	8,845	96,840	64,551	129,129
140	Middleton Shelf	28	28	8,273	60,495	38,865	82,124
35	Northern Kodiak Shallows	6	4	7,601	18,249	0	40,327
134	Kodiak Outer Shelf	15	15	7,592	38,541	15,212	61,870
232	Upper Shelikof Gully	5	5	6,704	21,383	8,613	34,154
111	Shumagin Outer Shelf	25	25	6,514	52,350	22,676	82,024
110	Sanak Gully	20	20	6,283	26,595	18,312	34,877
220	Lower Shelikof Gully	27	27	5,947	59,280	26,221	92,340
31	Albatross Banks	33	20	5,533	84,871	2,004	167,739
22	Chirikof Bank	31	21	4,729	51,981	0	118,649
240	Yakutat Gullies	18	18	4,430	15,938	7,753	24,124
150	Baranof-Chichagof Shelf	10	10	4,284	17,574	472	34,676
30	Albatross Shallows	11	9	4,090	25,025	5,303	44,747
13	Shumagin Bank	20	16	3,670	53,678	14,523	92,833
12	Lower Alaska Peninsula	18	17	3,568	26,555	3,635	49,475
143	Fairweather Shelf	11	11	3,424	25,989	9,821	42,158
230	Kenai Gullies	19	19	3,287	22,121	8,435	35,807
40	Yakutat Shallows	5	5	2,859	23,909	1,469	46,349
231	Kodiak Slope	4	4	2,678	4,354	0	13,864
142	Yakutat Flats	12	12	2,652	22,203	10,518	33,887
11	Davidson Bank	44	40	2,408	32,936	20,560	45,313
151	Prince of Wales Shelf	14	13	2,335	13,469	2,292	24,645
20	Upper Alaska Peninsula	15	10	2,114	17,512	2,869	32,156
41	Middleton Shallows	11	11	2,039	16,025	3,479	28,571
341	Yakutat Slope	3	3	1,884	2,307	346	4,267
310	Shumagin Slope	6	6	1,792	4,529	0	10,308
241	Yakutat Slope	11	11	1,675	2,137	800	3,474
141	Yakataga Shelf	10	10	1,623	8,718	4,579	12,857
350	Southeastern Deep Gullies	13	13	1,514	3,141	1,234	5,049
330	Kodiak Slope	10	10	1,152	3,411	1,310	5,512
250	Baranof-Chichagof Slope	8	8	1,125	1,166	385	1,946
21	Semidi Bank	8	7	1,088	7,943	0	19,908
251	Prince of Wales Slope/Gullies	22	21	1,015	4,058	2,139	5,976
340	Yakutat Deep Gullies	15	15	973	1,691	934	2,449
10	Fox Islands	24	18	968	8,339	1,387	15,291
210	Shumagin Slope	8	8	751	2,055	386	3,724
32	Lower Cook Inlet	15	9	494	5,174	145	10,202
33	Kenai Peninsula	3	1	484	2,670	0	14,160
351	Southeastern Slope	1	1	368	298	0	0

Pacific halibut (Hippoglossus stenolepis)

Pacific halibut were consistently found at all surveyed depths less than 400 m, but approximately 77% of the biomass was estimated to be between 1and 100 m (Tables 5 and 6). Halibut were encountered at 98% of the stations sampled in this depth range. The largest CPUEs were from the nearshore areas around Kodiak Island and Albatross Bank (Fig. 5). Three strata in these areas (strata 30, 31, and 35; Table 5) accounted for about 38% of the total estimated biomass of halibut, although they comprise only 8% of the total survey area. Pacific halibut had the third highest estimated biomass in the survey area of any species. All areas sampled except the Southeastern INPFC area exhibited a length mode between 48 and 58 cm FL (Fig. 6). In addition, modes between 20 and 22 cm and between 35 and 38 cm FL were found in the Chirikof INPFC area. Mean length and weight generally increased with depth throughout the survey area (Table 5).

Table 5.--Number of survey hauls, hauls containing Pacific halibut, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	106	2,452	108,787	2.5	54.6
	101 - 200	51	48	916	13,310	4.3	66.1
	201 - 300	8	3	148	405	7.7	82.3
	301 - 500	6	3	202	511	12.7	99.9
	All depths	171	160	1,917	123,011	2.7	55.4
Chirikof	1 - 100	54	53	2,541	67,523	2.4	49.1
	101 - 200	81	71	999	23,731	6.9	76.8
	201 - 300	31	23	452	5,193	9.2	86.7
	301 - 500	6	3	378	617	18.2	108.3
	All depths	172	150	1,530	97,065	3.0	52.7
Kodiak	1 - 100	68	67	6,576	261,981	2.8	58.4
	101 - 200	134	113	1,352	58,379	8.4	82.3
	201 - 300	28	21	612	7,071	10.8	91.0
	301 - 500	10	1	41	120	15.2	106.0
	All depths	240	202	3,358	327,551	3.2	60.3
Yakutat	1 - 100	16	13	966	15,663	4.4	66.3
	101 - 200	61	40	533	15,273	6.5	74.5
	201 - 300	29	16	462	2,250	10.9	89.3
	301 - 500	18	7	327	969	13.5	95.1
	All depths	124	76	648	34,156	5.5	70.5
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	14	830	8,195	6.9	79.4
	201 - 300	30	9	161	811	11.9	95.0
	301 - 500	14	2	17	48	7.5	84.2
	All depths	68	25	509	9,054	7.2	80.3
All areas	1 - 100	244	239	3,574	453,954	2.7	56.1
	101 - 200	351	286	991	118,888	7.0	77.0
	201 - 300	126	72	441	15,729	10.2	89.1
	301 - 500	54	16	175	2,266	14.2	99.2
	All depths	775	613	1,998	590,838	3.1	58.3

All areas biomass, 95% confidence interval: 449,312 - 732,364 metric tons (t).

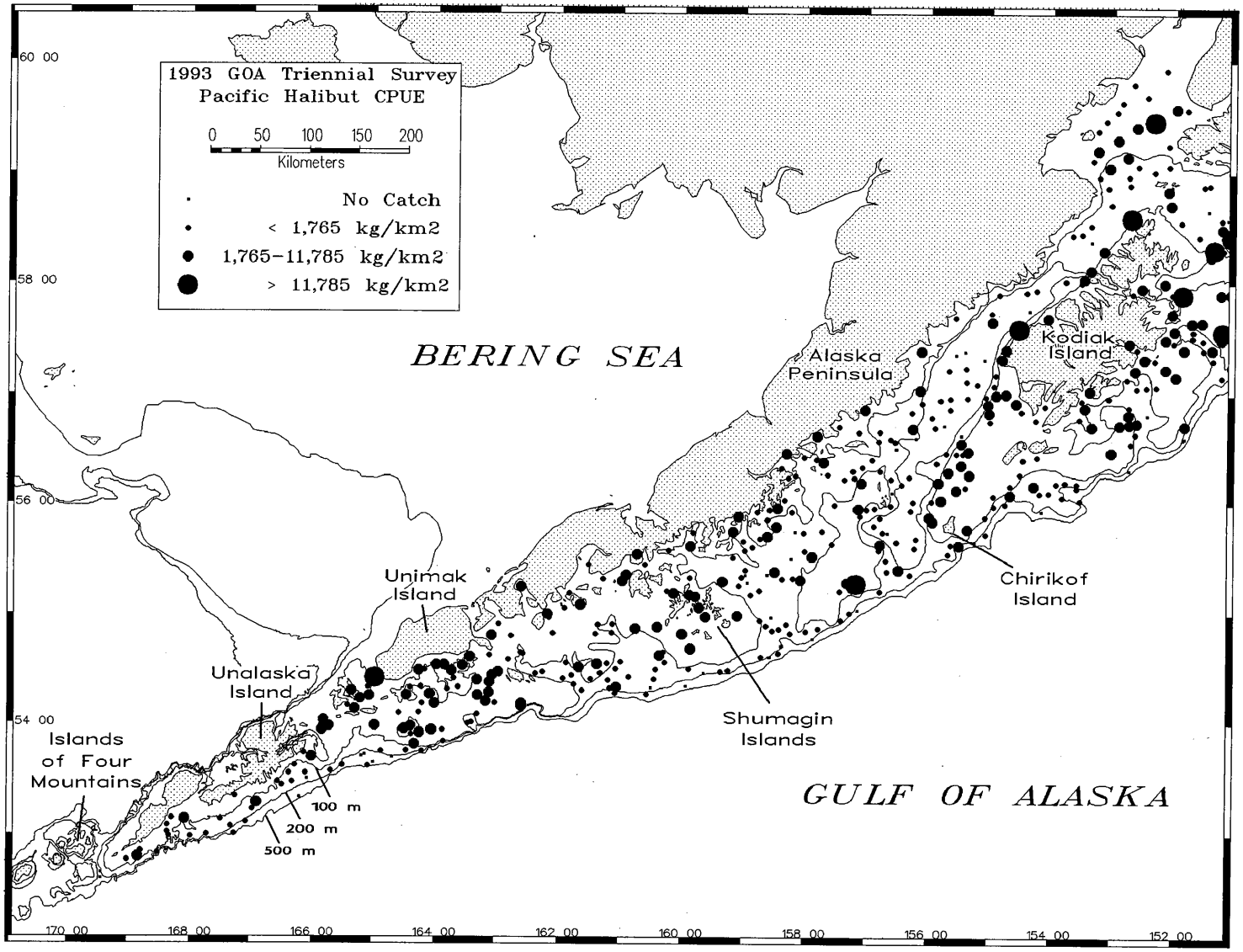


Figure 5.--Distribution and relative abundance of Pacific halibut from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

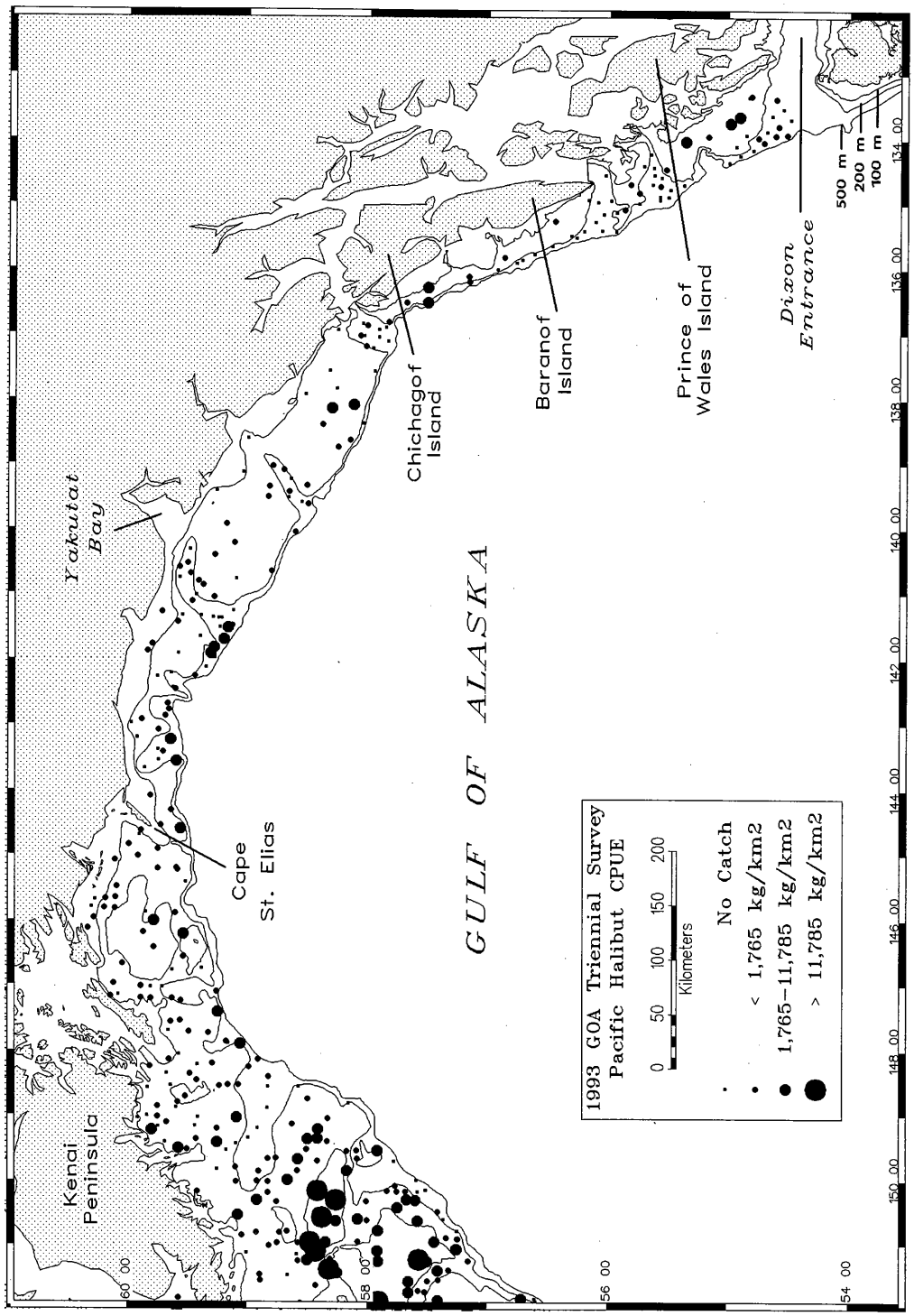


Figure 5.--Continued.

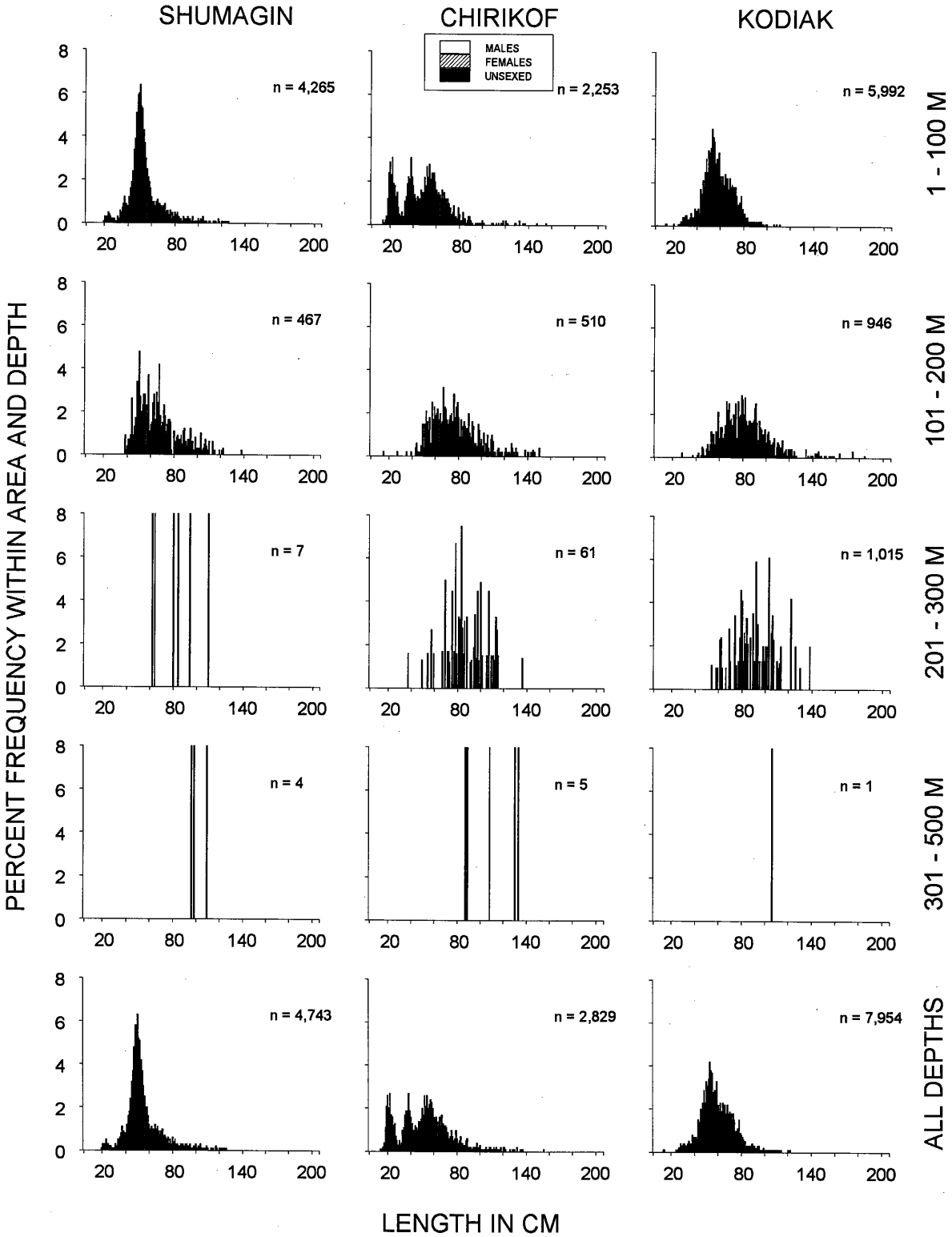


Figure 6.--Size composition of the estimated Pacific halibut population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals

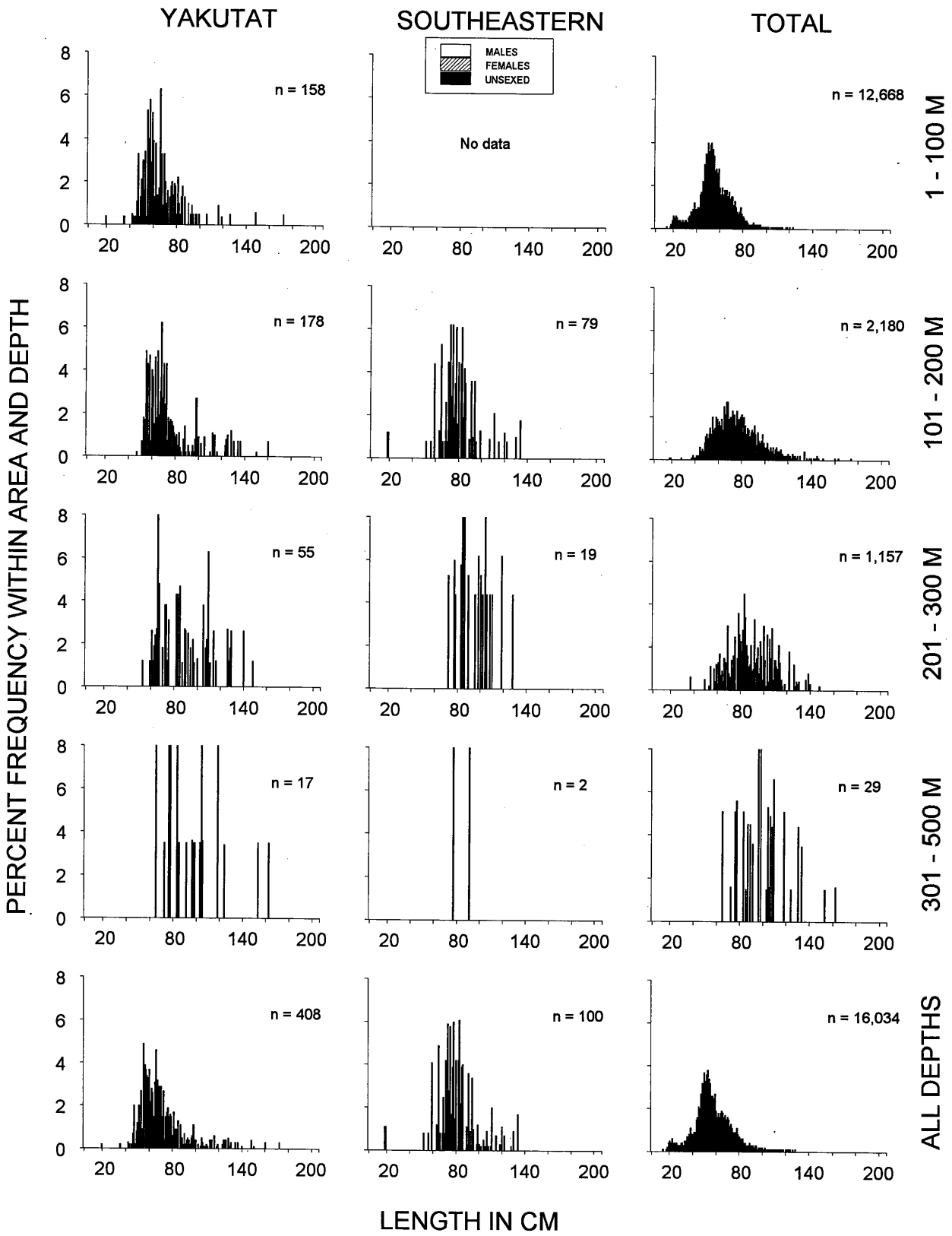


Figure 6.--Continued.

Table 6.--Catch per unit effort by stratum for Pacific halibut sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
30	Albatross Shallows	11	11	12,392	75,825	0	200,424
35	Northern Kodiak Shallows	6	6	8,444	20,273	0	48,037
31	Albatross Banks	33	33	8,384	128,602	66,301	190,904
21	Semidi Bank	8	8	3,054	22,289	0	46,306
32	Lower Cook Inlet	15	15	3,039	31,823	7,845	55,801
11	Davidson Bank	44	44	2,794	38,217	26,763	49,671
22	Chirikof Bank	31	30	2,608	28,669	21,568	35,770
10	Fox Islands	24	24	2,480	21,369	13,118	29,620
12	Lower Alaska Peninsula	18	18	2,359	17,558	8,472	26,645
13	Shumagin Bank	20	20	2,164	31,642	22,519	40,766
134	Kodiak Outer Shelf	15	14	2,132	10,821	5,128	16,513
130	Albatross Gullies	29	28	2,062	16,161	9,532	22,789
20	Upper Alaska Peninsula	15	15	2,000	16,566	8,903	24,228
112	West Shumagin Gully	6	6	1,506	3,415	312	6,518
41	Middleton Shallows	11	9	1,391	10,928	0	23,005
132	Barren Islands	27	23	1,292	14,150	6,819	21,481
131	Portlock Flats	22	22	1,191	8,714	5,847	11,581
120	East Shumagin Gully	39	33	1,126	12,475	8,200	16,750
232	Upper Shelikof Gully	5	4	1,091	3,480	461	6,499
122	Chirikof Outer Shelf	18	17	1,059	5,288	2,576	8,000
241	Yakutat Slope	11	8	993	1,268	320	2,215
33	Kenai Peninsula	3	2	990	5,457	0	17,203
151	Prince of Wales Shelf	14	8	889	5,126	325	9,928
110	Sanak Gully	20	20	812	3,436	2,135	4,736
111	Shumagin Outer Shelf	25	22	804	6,459	2,679	10,239
143	Fairweather Shelf	11	7	798	6,058	395	11,720
121	Shelikof Edge	24	21	778	5,968	3,808	8,128
150	Baranof-Chichagof Shelf	10	6	748	3,068	365	5,771
133	Kenai Flats	41	26	711	8,534	4,318	12,749
40	Yakutat Shallows	5	4	566	4,735	0	10,741
221	Chirikof Slope	4	2	545	835	0	3,198
142	Yakutat Flats	12	9	479	4,013	1,086	6,940
220	Lower Shelikof Gully	27	21	437	4,358	2,722	5,993
230	Kenai Gullies	19	14	436	2,936	1,091	4,780
140	Middleton Shelf	28	20	416	3,045	1,600	4,490
231	Kodiak Slope	4	3	403	656	0	1,402
141	Yakataga Shelf	10	4	402	2,157	0	5,753
250	Baranof-Chichagof Slope	8	2	388	401	0	1,111
320	Chirikof Slope	6	3	378	617	0	1,440
341	Yakutat Slope	3	2	343	420	0	1,536
340	Yakutat Deep Gullies	15	5	316	550	0	1,138
240	Yakutat Gullies	18	8	273	982	0	2,141
310	Shumagin Slope	6	3	202	511	0	1,252
210	Shumagin Slope	8	3	148	405	0	1,009
251	Prince of Wales Slope/Gullies	22	7	102	410	60	759
330	Kodiak Slope	10	1	41	120	0	393
350	Southeastern Deep Gullies	13	2	23	48	0	122

Flathead sole (Hippoglossoides elassodon)

Flathead sole CPUEs were highest in samples from water less than 100 m, particularly south of Kodiak Island in the lower Alaska Peninsula and Albatross Shallows strata (strata 12 and 30, Table 8). These strata accounted for approximately 33% of the total estimated biomass while comprising less than 5% of the total survey area. Flathead sole were found most often in tows from the major gully areas, especially in the Shumagin and Chirikof INPFC areas where they were caught in 100% of the tows in the major gullies (Sanak, Shumagin, and Shelikof Gullies; Fig. 7). The male length frequency data generally showed a frequency mode between 30 and 35 cm FL, while the female mode consistently appeared between 36 and 40 cm FL (Fig. 8). The length-weight relationship for flathead sole specimens collected during the survey is depicted in Figure 9.

Table 7.--Number of survey hauls, hauls containing flathead sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	68	1,142	50,647	0.3	30.4
	101 - 200	51	32	750	10,904	0.2	28.1
	201 - 300	8	5	24	67	0.2	25.7
	301 - 500	6	1	2	5	0.2	38.5
	All depths	171	106	960	61,624	0.3	29.9
Chirikof	1 - 100	54	26	993	26,386	0.3	30.1
	101 - 200	81	65	995	23,631	0.3	29.5
	201 - 300	31	29	444	5,107	0.4	35.3
	301 - 500	6	0	0	0	---	---
	All depths	172	120	869	55,125	0.3	30.2
Kodiak	1 - 100	68	29	1,030	41,042	0.3	30.7
	101 - 200	134	90	400	17,277	0.3	30.0
	201 - 300	28	23	315	3,638	0.4	33.5
	301 - 500	10	0	0	0	---	---
	All depths	240	142	635	61,957	0.3	30.6
Yakutat	1 - 100	16	12	311	5,052	0.3	30.6
	101 - 200	61	46	358	10,250	0.3	30.9
	201 - 300	29	18	371	1,809	0.3	32.7
	301 - 500	18	4	102	303	0.4	33.9
	All depths	124	80	330	17,414	0.3	31.0
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	4	9	86	0.3	---
	201 - 300	30	7	6	33	0.3	---
	301 - 500	14	0	0	0	---	---
	All depths	68	11	7	119	0.3	---
All areas	1 - 100	244	135	970	123,127	0.3	30.4
	101 - 200	351	237	518	62,148	0.3	29.6
	201 - 300	126	82	299	10,654	0.4	34.0
	301 - 500	54	5	24	308	0.4	34.0
	All depths	775	459	664	196,238	0.3	30.3

All areas biomass, 95% confidence interval: 143,355 - 249,122 metric tons

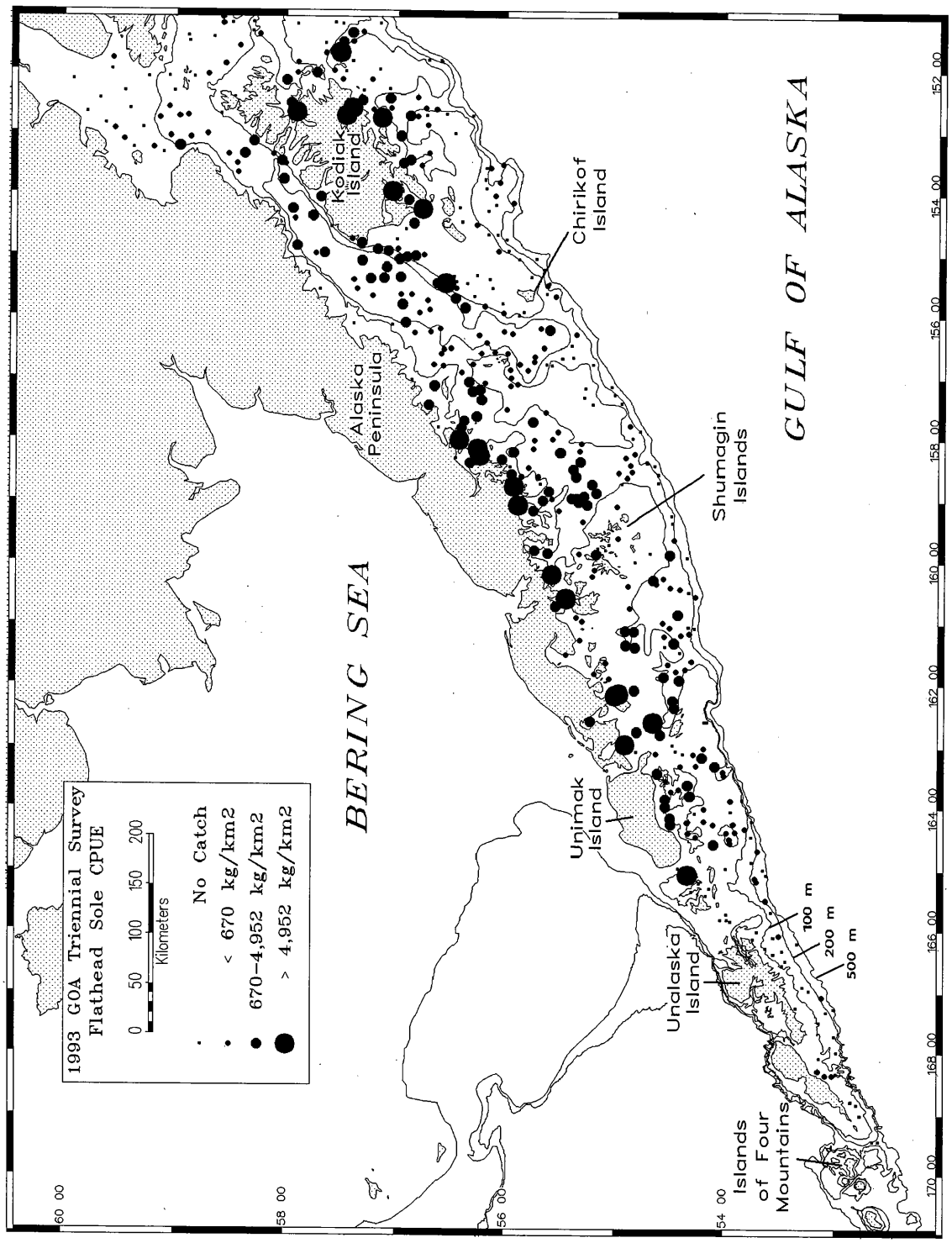


Figure 7.--Distribution and relative abundance of flathead sole from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

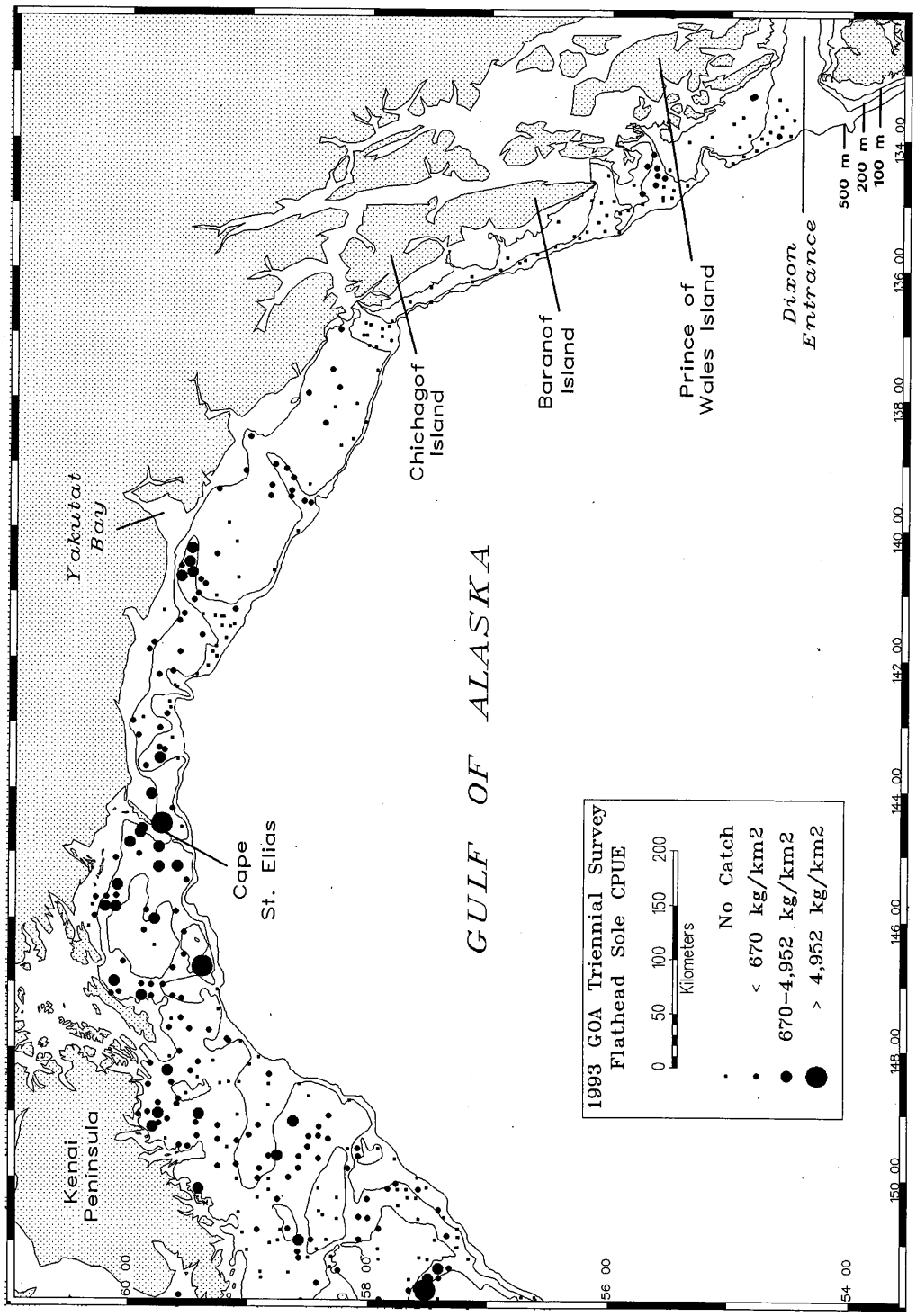


Figure 7.--Continued.

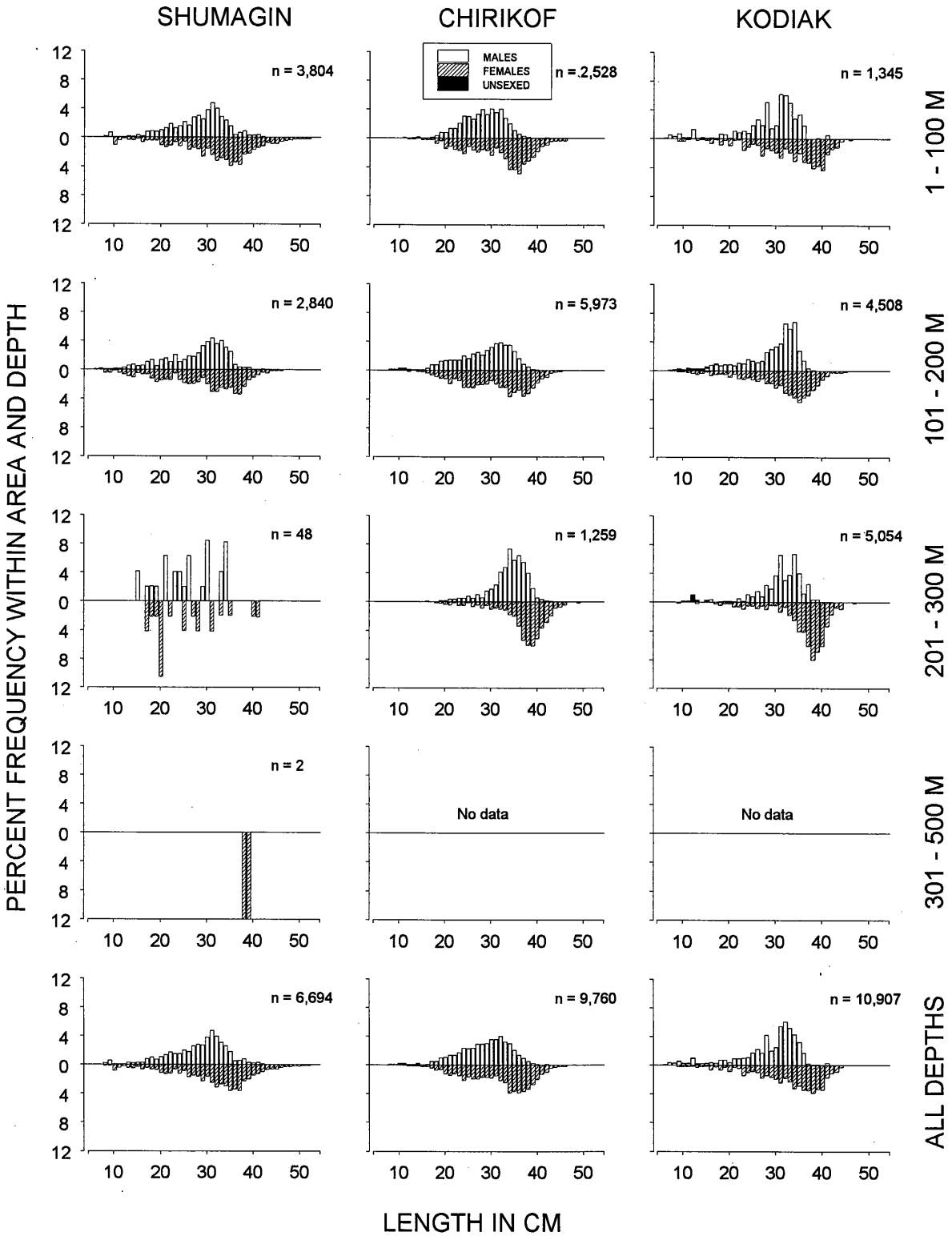


Figure 8.--Size composition of the estimated flathead sole population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

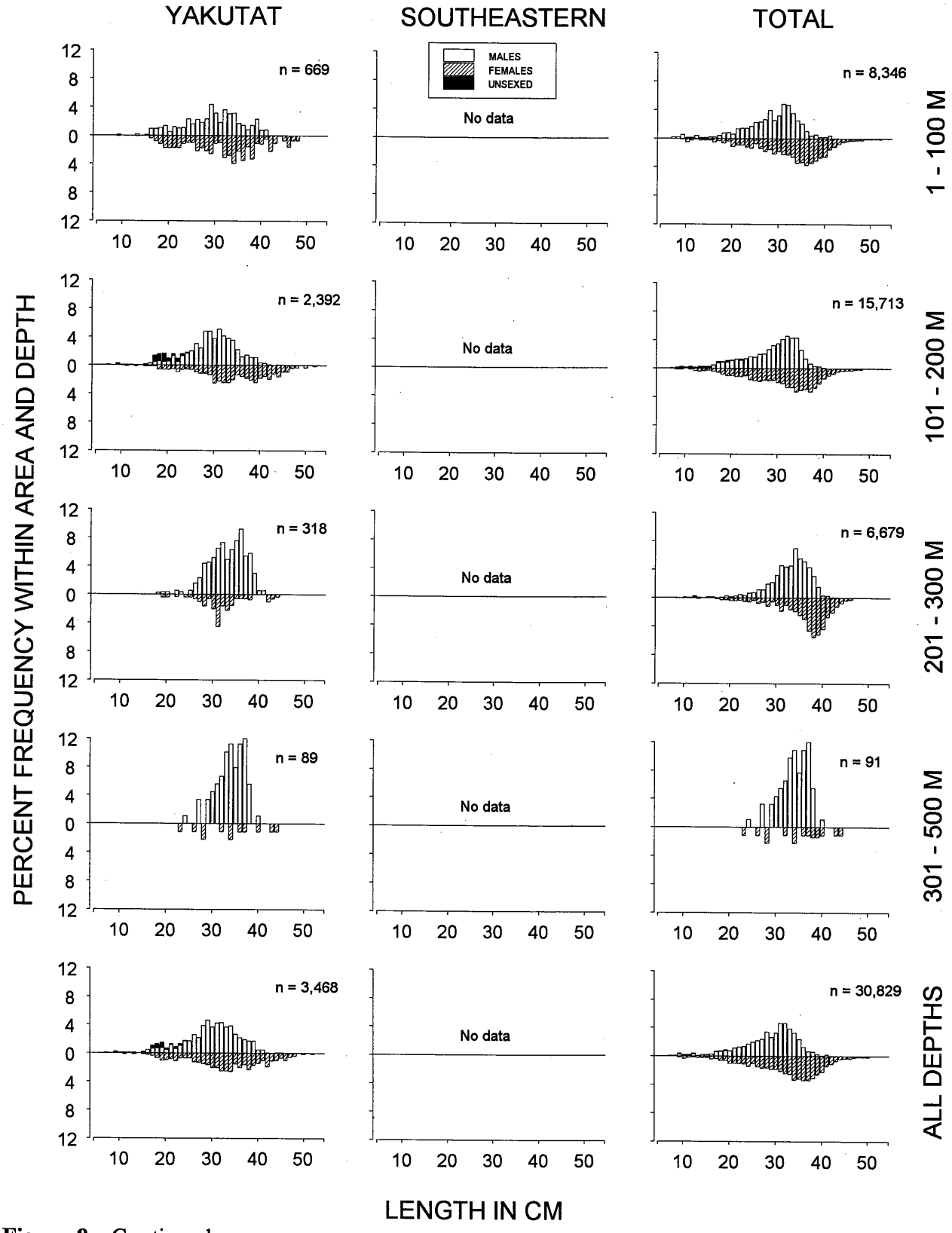


Figure 8.--Continued.

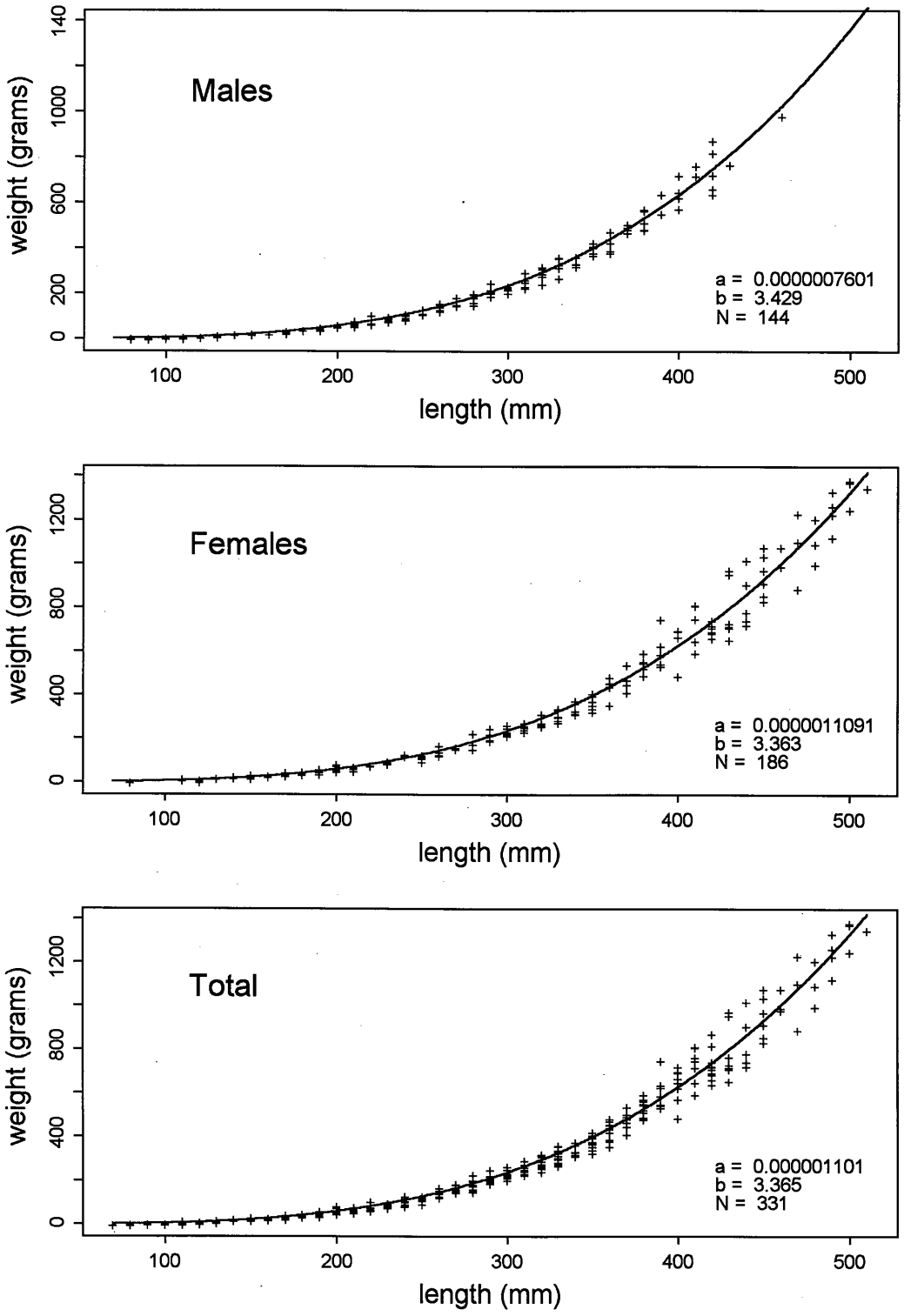


Figure 9.--Length-weight relationship for flathead sole specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 8.--Catch per unit effort by stratum for flathead sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
30	Albatross Shallows	11	7	5,992	36,665	0	81,956
12	Lower Alaska Peninsula	18	17	3,760	27,982	8,762	47,202
112	West Shumagin Gully	6	6	2,105	4,772	748	8,797
120	East Shumagin Gully	39	39	1,477	16,366	8,100	24,633
20	Upper Alaska Peninsula	15	7	1,435	11,885	305	23,466
35	Northern Kodiak Shallows	6	5	1,368	3,284	0	8,056
110	Sanak Gully	20	20	1,298	5,492	2,196	8,788
130	Albatross Gullies	29	25	1,257	9,855	4,894	14,817
22	Chirikof Bank	31	15	1,233	13,554	3,952	23,156
140	Middleton Shelf	28	27	1,218	8,908	3,241	14,574
232	Upper Shelikof Gully	5	5	944	3,010	0	6,284
121	Shelikof Edge	24	21	923	7,079	3,465	10,693
10	Fox Islands	24	4	762	6,561	0	20,004
13	Shumagin Bank	20	13	652	9,538	573	18,502
220	Lower Shelikof Gully	27	27	509	5,077	3,388	6,766
240	Yakutat Gullies	18	14	497	1,787	737	2,837
11	Davidson Bank	44	34	480	6,566	3,896	9,236
41	Middleton Shallows	11	8	342	2,690	369	5,012
131	Portlock Flats	22	15	295	2,160	442	3,878
40	Yakutat Shallows	5	4	282	2,362	0	5,385
132	Barren Islands	27	18	250	2,742	1,066	4,418
133	Kenai Flats	41	30	206	2,469	1,056	3,883
340	Yakutat Deep Gullies	15	4	174	303	0	902
141	Yakataga Shelf	10	8	134	720	0	1,514
21	Semidi Bank	8	4	130	947	0	2,327
230	Kenai Gullies	19	14	91	611	217	1,005
111	Shumagin Outer Shelf	25	6	80	640	0	1,486
31	Albatross Banks	33	12	64	977	0	2,215
142	Yakutat Flats	12	7	59	493	0	1,187
122	Chirikof Outer Shelf	18	5	37	186	0	459
210	Shumagin Slope	8	5	24	67	0	157
221	Chirikof Slope	4	2	19	30	0	115
143	Fairweather Shelf	11	4	17	128	0	289
241	Yakutat Slope	11	4	17	22	0	45
150	Baranof-Chichagof Shelf	10	1	15	60	0	194
134	Kodiak Outer Shelf	15	2	10	50	0	141
231	Kodiak Slope	4	4	10	17	0	41
32	Lower Cook Inlet	15	4	9	96	0	210
251	Prince of Wales Slope/Gullies	22	7	8	33	6	60
151	Prince of Wales Shelf	14	3	5	27	0	65
33	Kenai Peninsula	3	1	4	20	0	105
310	Shumagin Slope	6	1	2	5	0	18

Rock sole (Pleuronectes bilineatus)

Rock sole were found primarily in the central and western Gulf of Alaska in water shallower than 100 m. (Tables 9 and 10; Fig. 10). Approximately 94% of the total survey area biomass was found in this area. About 50% of the estimated total survey area biomass was from the Shumagin INPFC area at depths less than 100 m (Table 9). Rock sole occurred in 89% of all samples taken between zero and 100 meters, including 99% of tows in this depth range in the Shumagin INPFC area. The length frequency data showed that a mode for male lengths existed between 30 and 35 cm FL and between 37 and 40 cm FL for females in all areas where adequate sample sizes were realized (Fig. 11). Both mean length and mean weight increased with depth in all areas (Table 9). The length-weight relationship for rock sole specimens collected during the survey is depicted in Figure 12.

Table 9.--Number of survey hauls, hauls containing rock sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	105	2,024	89,796	0.5	32.2
	101 - 200	51	30	270	3,918	0.7	36.7
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	135	1,461	93,714	0.5	32.3
Chirikof	1 - 100	54	46	1,216	32,321	0.6	32.7
	101 - 200	81	25	47	1,126	0.8	38.5
	201 - 300	31	3	2	23	0.7	---
	301 - 500	6	0	0	0	---	---
	All depths	172	74	527	33,470	0.6	32.8
Kodiak	1 - 100	68	62	1,204	47,963	0.5	33.7
	101 - 200	134	44	98	4,215	0.6	35.2
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	106	535	52,177	0.5	33.8
Yakutat	1 - 100	16	4	26	415	0.7	36.5
	101 - 200	61	2	1	20	0.9	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	6	8	435	0.7	36.5
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	5	119	1,177	0.4	32.9
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	5	66	1,177	0.4	32.9
All areas	1 - 100	244	217	1,342	170,496	0.5	32.7
	101 - 200	351	106	87	10,455	0.6	35.7
	201 - 300	126	3	1	23	0.7	---
	301 - 500	54	0	0	0	---	---
	All depths	775	326	612	180,974	0.5	32.8

All areas biomass, 95% confidence interval: 149,997 - 211,951 metric tons (t).

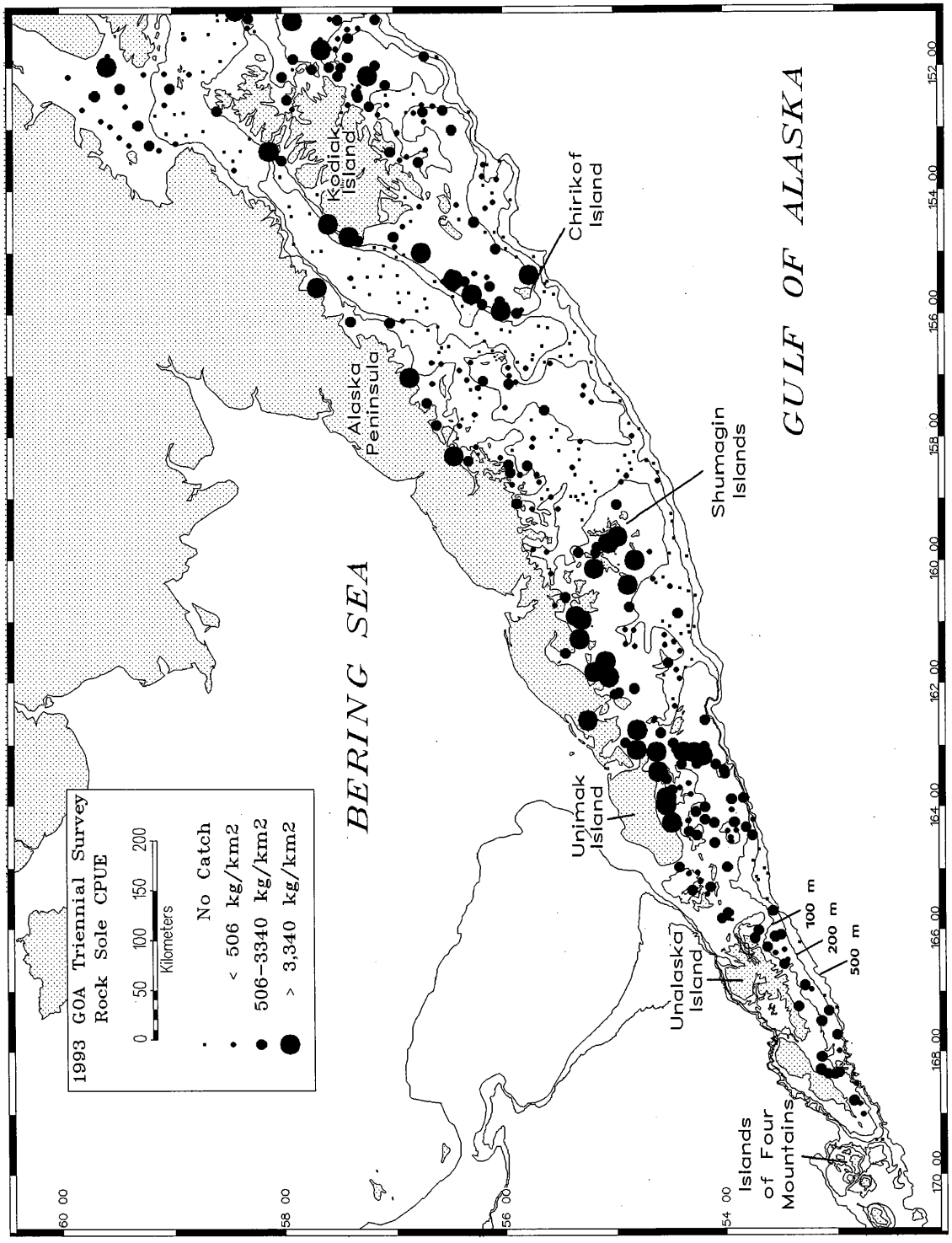


Figure 10.--Distribution and relative abundance of rock sole from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

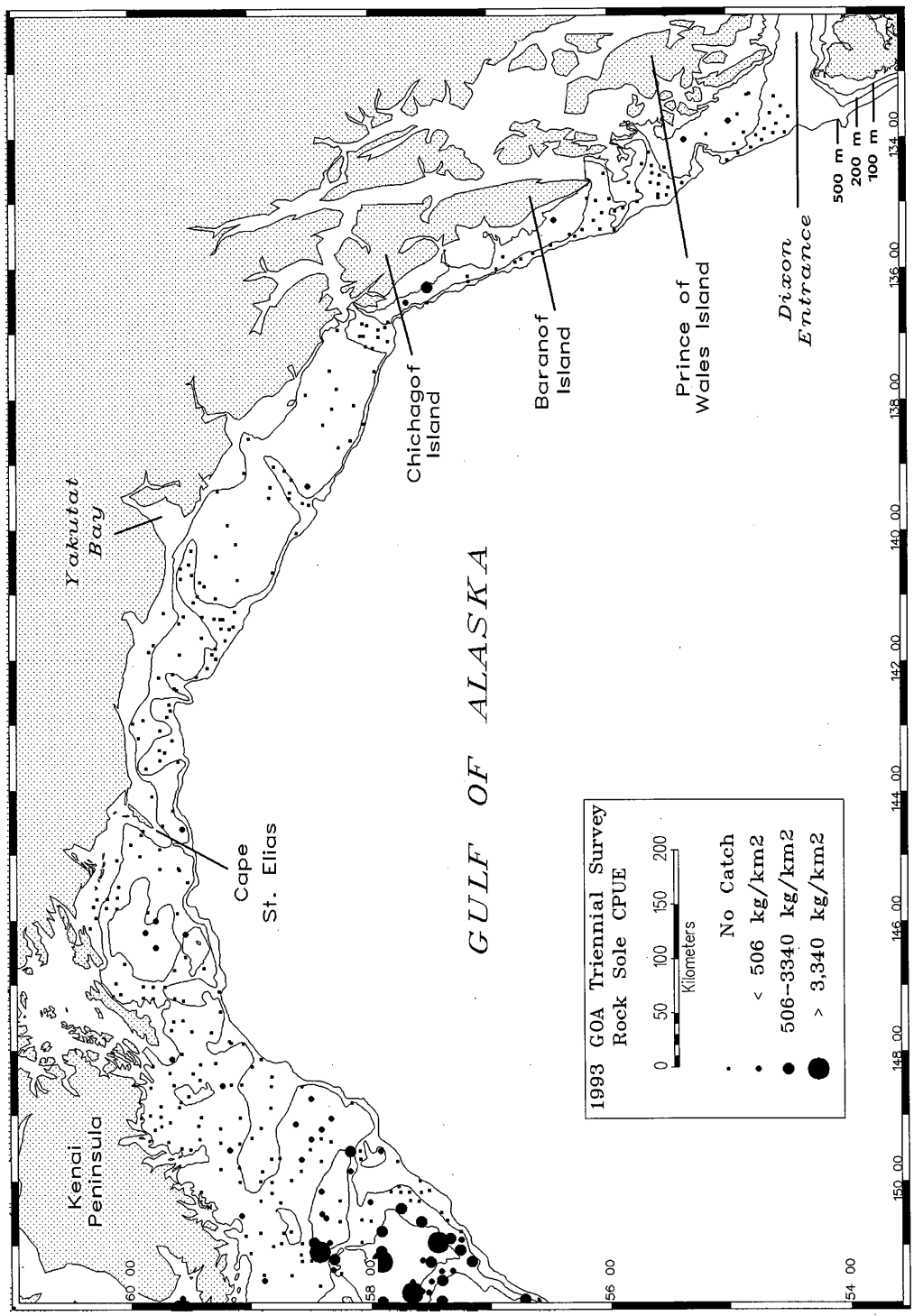


Figure 10.--Continued.

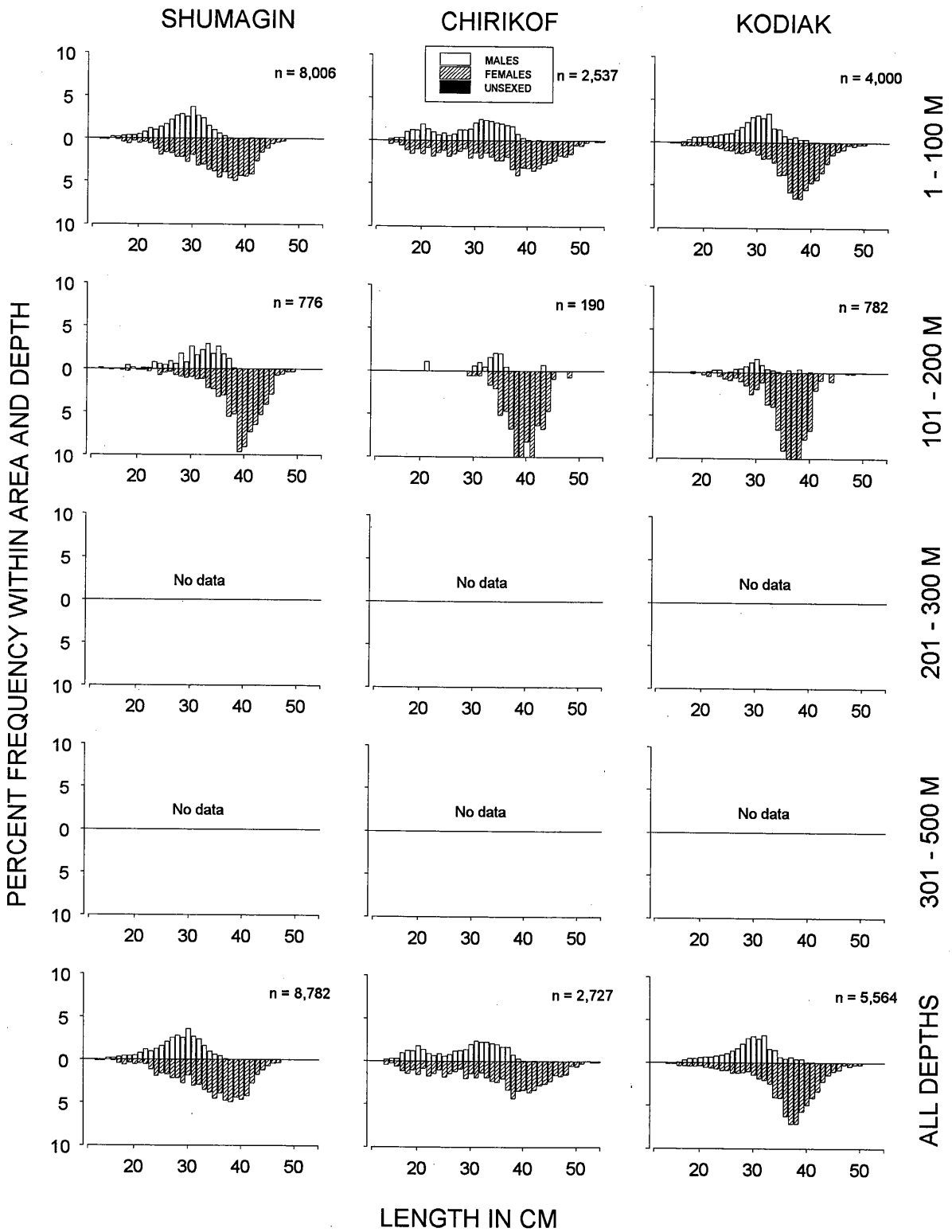


Figure 11.--Size composition of the estimated rock sole population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

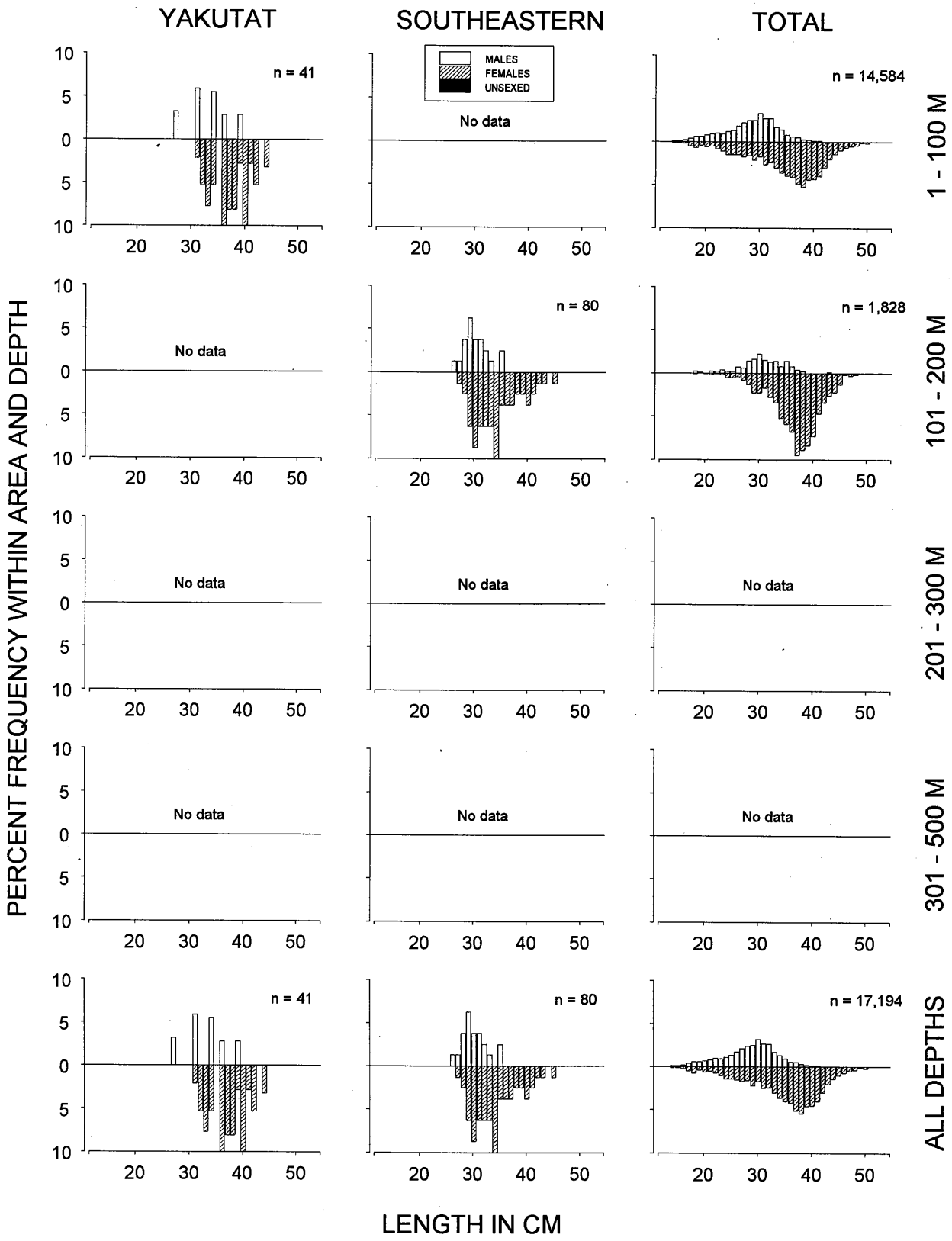


Figure 11.--Continued.

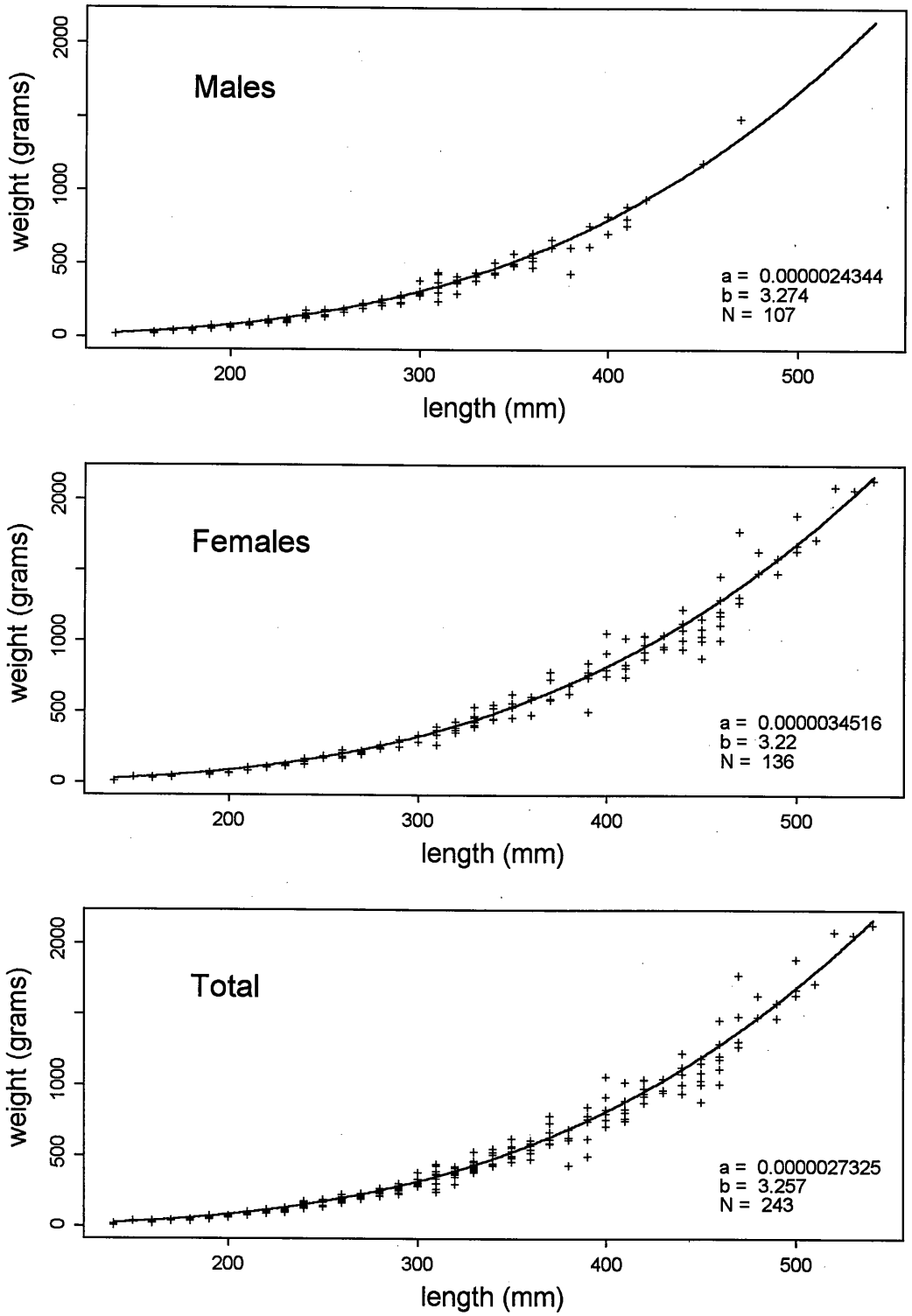


Figure 12.--Length-weight relationship for rock sole specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 10.--Catch per unit effort by stratum for rock sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
35	Northern Kodiak Shallows	6	5	3,792	9,105	0	19,867
12	Lower Alaska Peninsula	18	18	3,410	25,384	12,994	37,774
13	Shumagin Bank	20	20	2,061	30,149	12,018	48,280
20	Upper Alaska Peninsula	15	14	1,836	15,208	4,474	25,942
11	Davidson Bank	44	44	1,818	24,866	17,921	31,810
31	Albatross Banks	33	31	1,706	26,161	12,462	39,859
22	Chirikof Bank	31	24	1,370	15,063	7,673	22,452
10	Fox Islands	24	23	1,091	9,398	6,597	12,199
32	Lower Cook Inlet	15	15	794	8,312	436	16,188
30	Albatross Shallows	11	10	689	4,217	928	7,506
134	Kodiak Outer Shelf	15	9	469	2,381	146	4,616
111	Shumagin Outer Shelf	25	15	393	3,162	1,428	4,896
21	Semidi Bank	8	8	281	2,051	579	3,522
150	Baranof-Chichagof Shelf	10	3	264	1,083	0	3,249
110	Sanak Gully	20	12	160	677	0	1,465
130	Albatross Gullies	29	18	122	957	26	1,888
120	East Shumagin Gully	39	16	78	868	0	1,785
131	Portlock Flats	22	7	56	413	0	940
41	Middleton Shallows	11	4	53	415	0	995
132	Barren Islands	27	7	37	408	0	966
122	Chirikof Outer Shelf	18	4	36	179	0	370
112	West Shumagin Gully	6	3	35	79	0	242
33	Kenai Peninsula	3	1	30	168	0	889
151	Prince of Wales Shelf	14	2	16	95	0	259
121	Shelikof Edge	24	5	10	79	3	155
133	Kenai Flats	41	3	5	56	0	146
143	Fairweather Shelf	11	1	2	16	0	52
220	Lower Shelikof Gully	27	3	2	23	0	50
140	Middleton Shelf	28	1	0	4	0	11

Rex sole (Errex zachirus)

Rex sole were widely distributed throughout the survey area, occurring in 69% of all tows and 89% of all tows greater than 100 m in depth (Table 11). They were captured in 47 of the 48 strata sampled, yet large catches of rex sole were rare (Table 12). The highest CPUEs for rex sole were seen on the outer shelf, the continental slope and the deep gullies (Fig. 13). Eighty-one percent of the total biomass of rex sole within the survey area was estimated to be between 101 and 300 m (Table 11). The male length frequency data indicate a mode between 32 and 38 cm FL for males and around 40 cm FL for females (Fig. 14). Mean length and weight generally decreased with sample depth (Table 11). The length-weight relationship for rex sole specimens collected during the survey is depicted in Figure 15.

Table 11.--Number of survey hauls, hauls containing rex sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	29	72	3,207	0.5	40.4
	101 - 200	51	43	425	6,171	0.5	40.2
	201 - 300	8	6	208	569	0.4	37.4
	301 - 500	6	6	378	956	0.4	37.1
	All depths	171	84	170	10,902	0.5	39.7
Chirikof	1 - 100	54	10	115	3,069	0.6	42.3
	101 - 200	81	68	683	16,211	0.5	41.1
	201 - 300	31	30	588	6,761	0.5	40.7
	301 - 500	6	6	719	1,174	0.4	37.4
	All depths	172	114	429	27,216	0.5	40.9
Kodiak	1 - 100	68	13	54	2,169	0.4	36.3
	101 - 200	134	116	492	21,249	0.4	38.1
	201 - 300	28	25	432	4,992	0.3	34.0
	301 - 500	10	8	214	634	0.3	34.4
	All depths	240	162	298	29,044	0.4	36.9
Yakutat	1 - 100	16	12	214	3,471	0.2	31.0
	101 - 200	61	56	329	9,416	0.3	34.0
	201 - 300	29	28	567	2,762	0.2	33.7
	301 - 500	18	17	249	738	0.2	---
	All depths	124	113	311	16,387	0.3	33.4
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	19	153	1,507	0.2	32.2
	201 - 300	30	29	460	2,315	0.2	31.3
	301 - 500	14	14	373	1,076	0.2	33.4
	All depths	68	62	275	4,897	0.2	32.0
All areas	1 - 100	244	64	94	11,916	0.4	36.6
	101 - 200	351	302	455	54,553	0.4	37.7
	201 - 300	126	118	487	17,399	0.3	35.0
	301 - 500	54	51	353	4,578	0.3	35.4
	All depths	775	535	299	88,447	0.4	36.8

All areas biomass, 95% confidence interval: 76,044 - 100,849 metric tons (t).

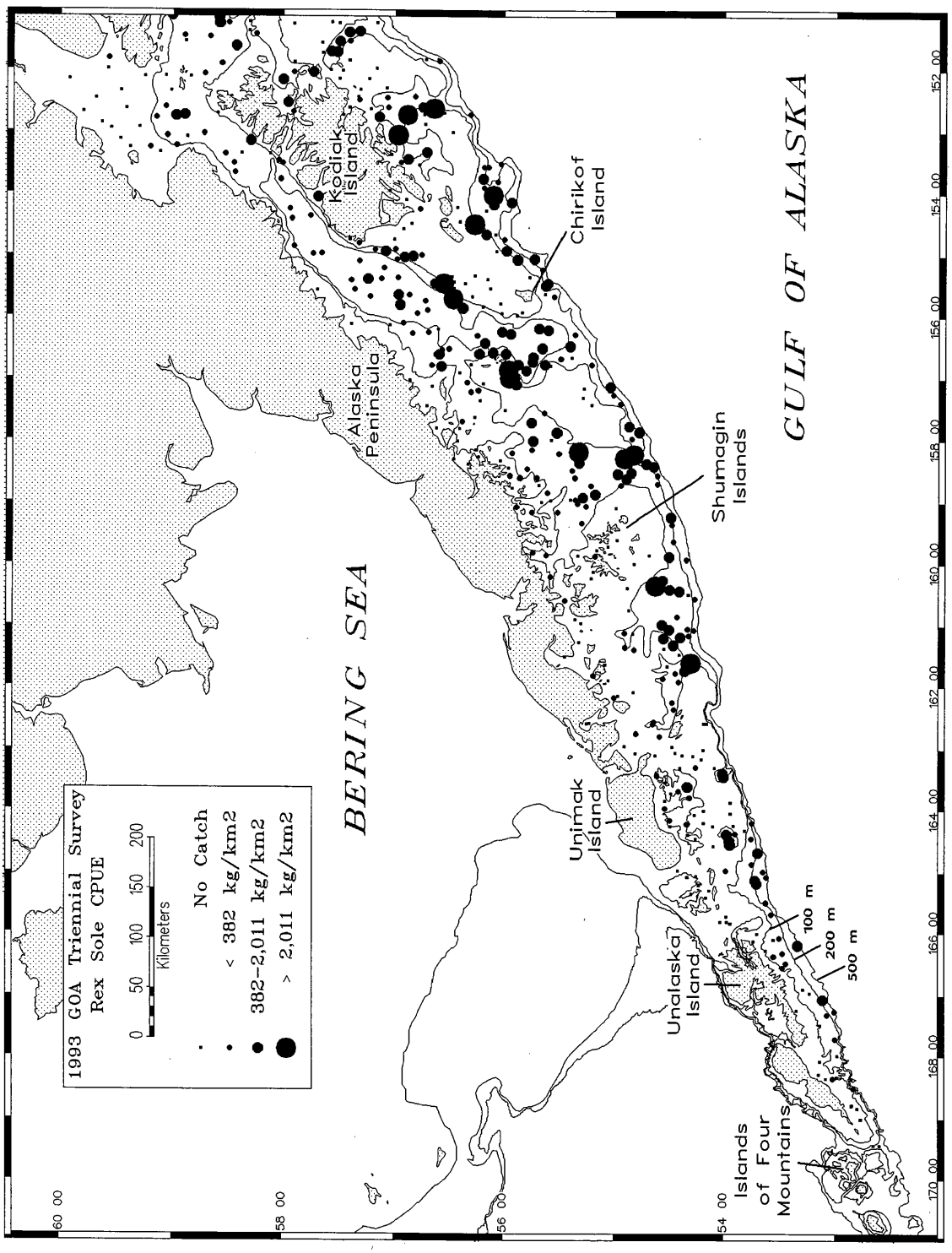


Figure 13.--Distribution and relative abundance of rex sole from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

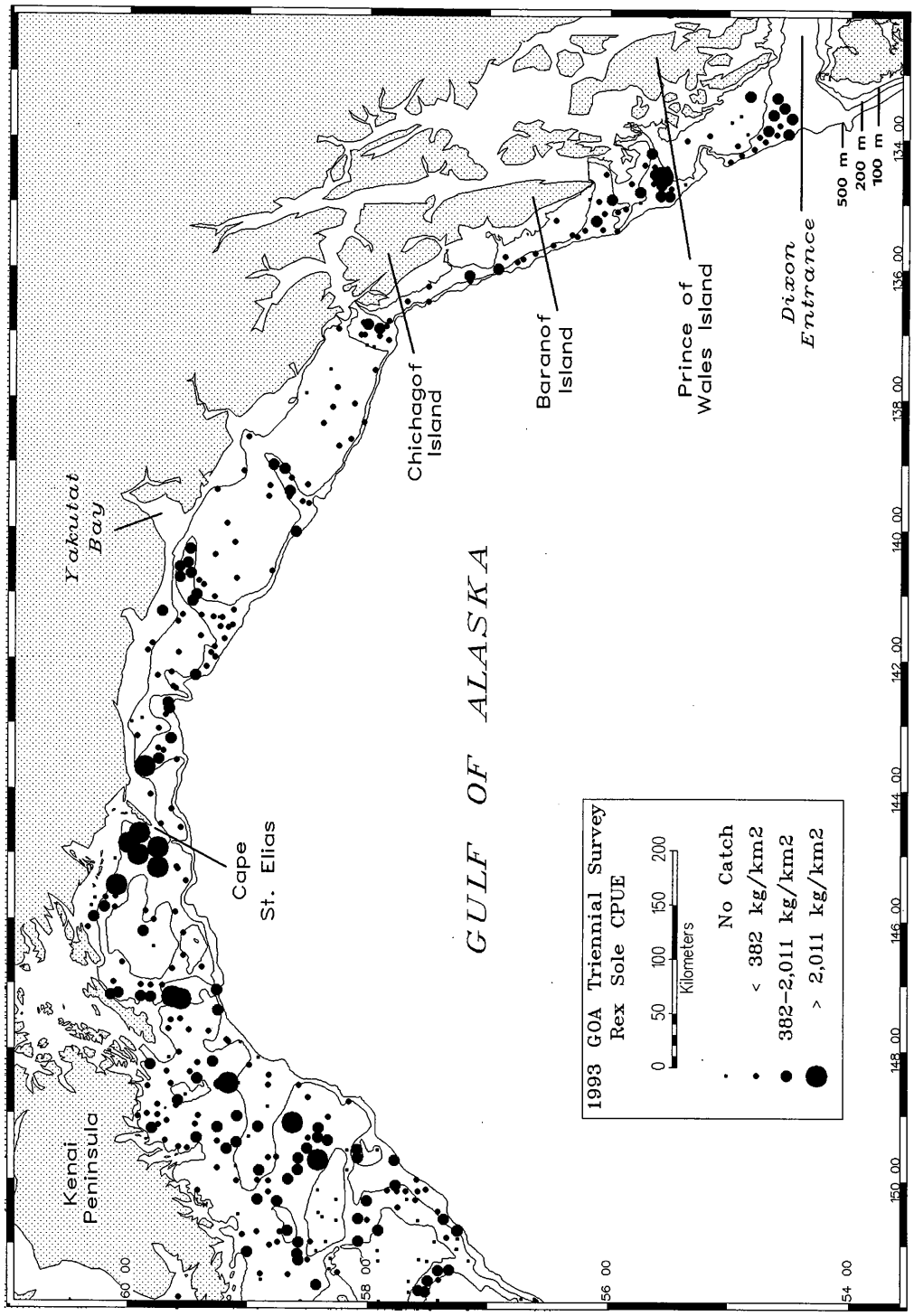


Figure 13.--Continued.

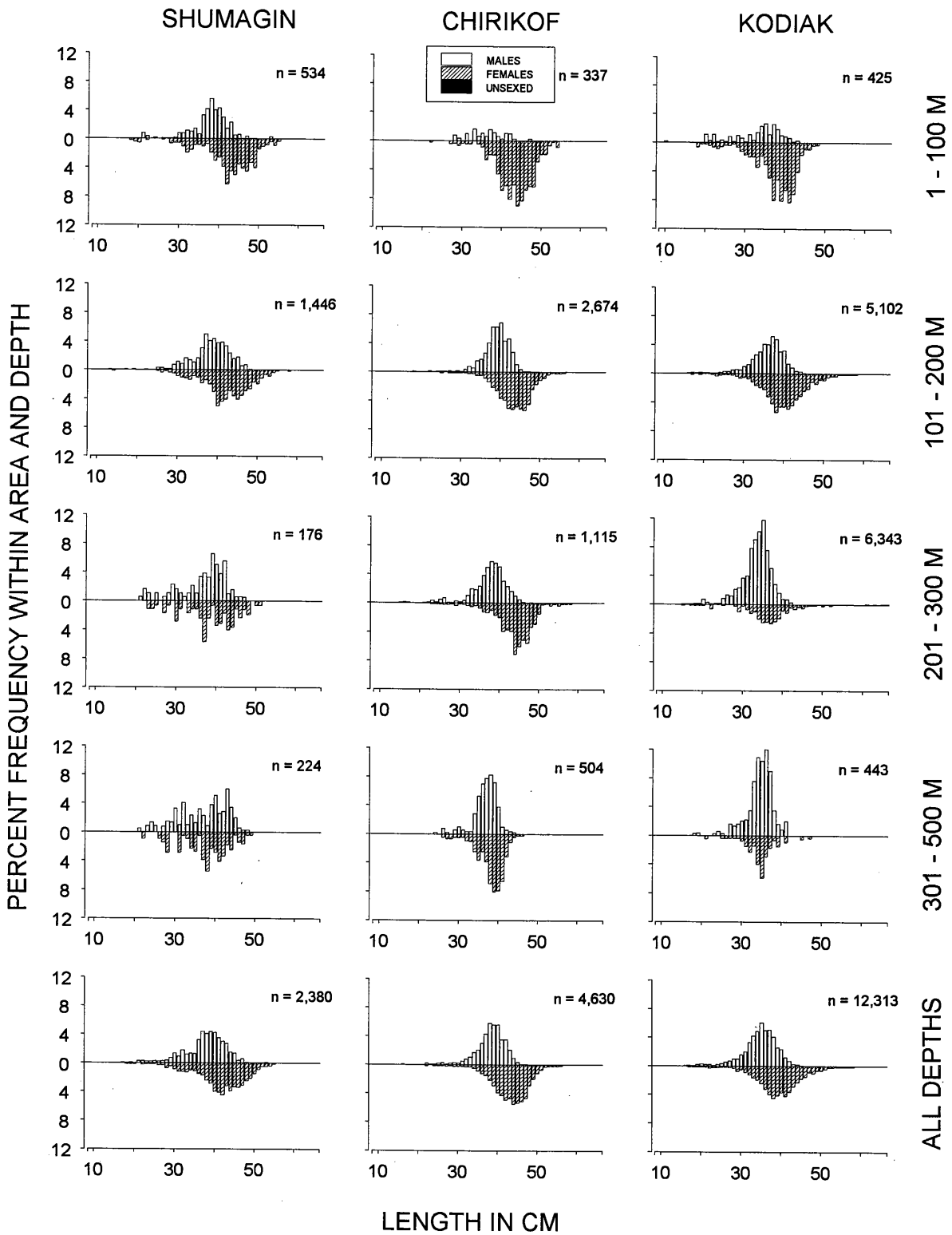


Figure 14.--Size composition of the estimated rex sole population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

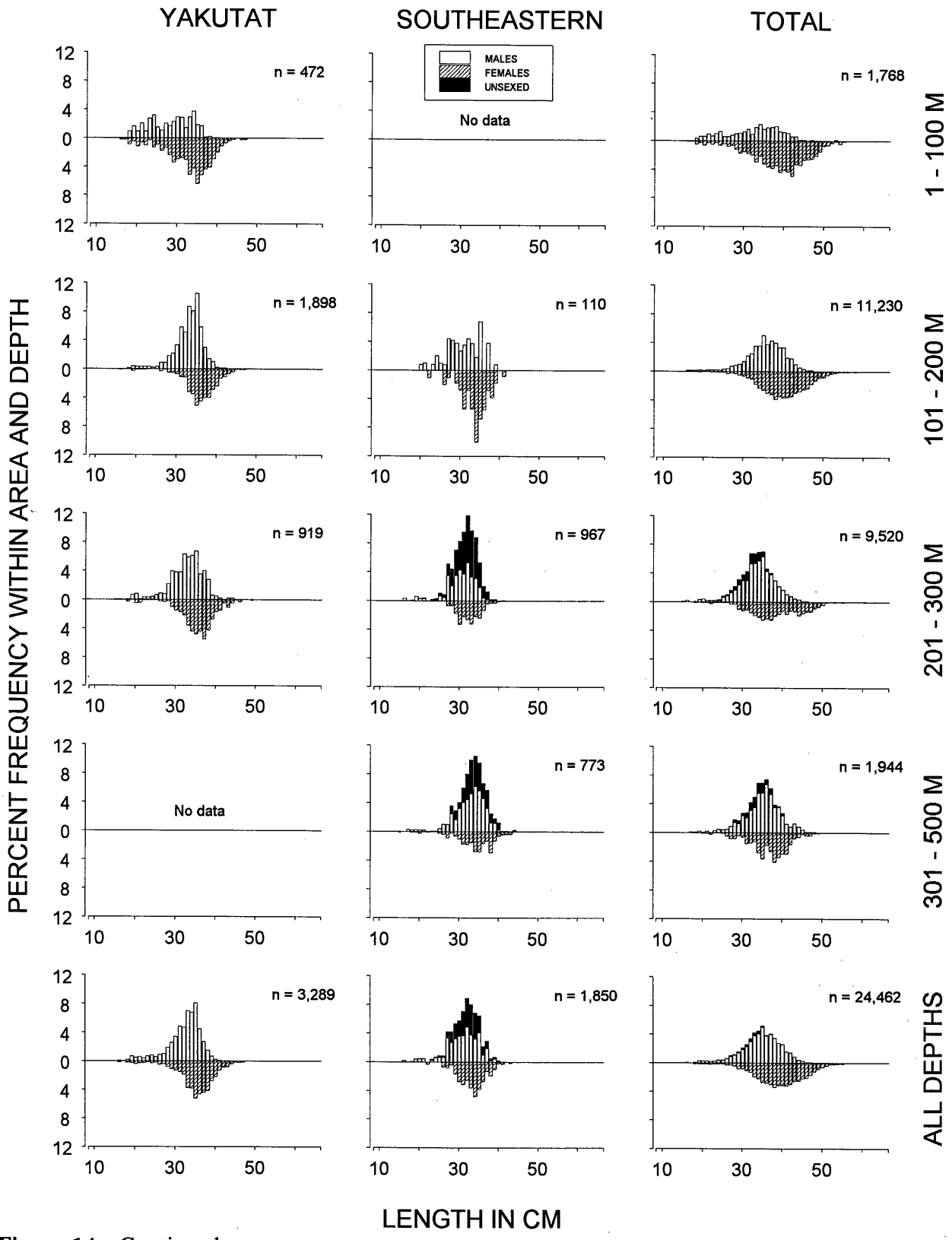


Figure 14.--Continued.

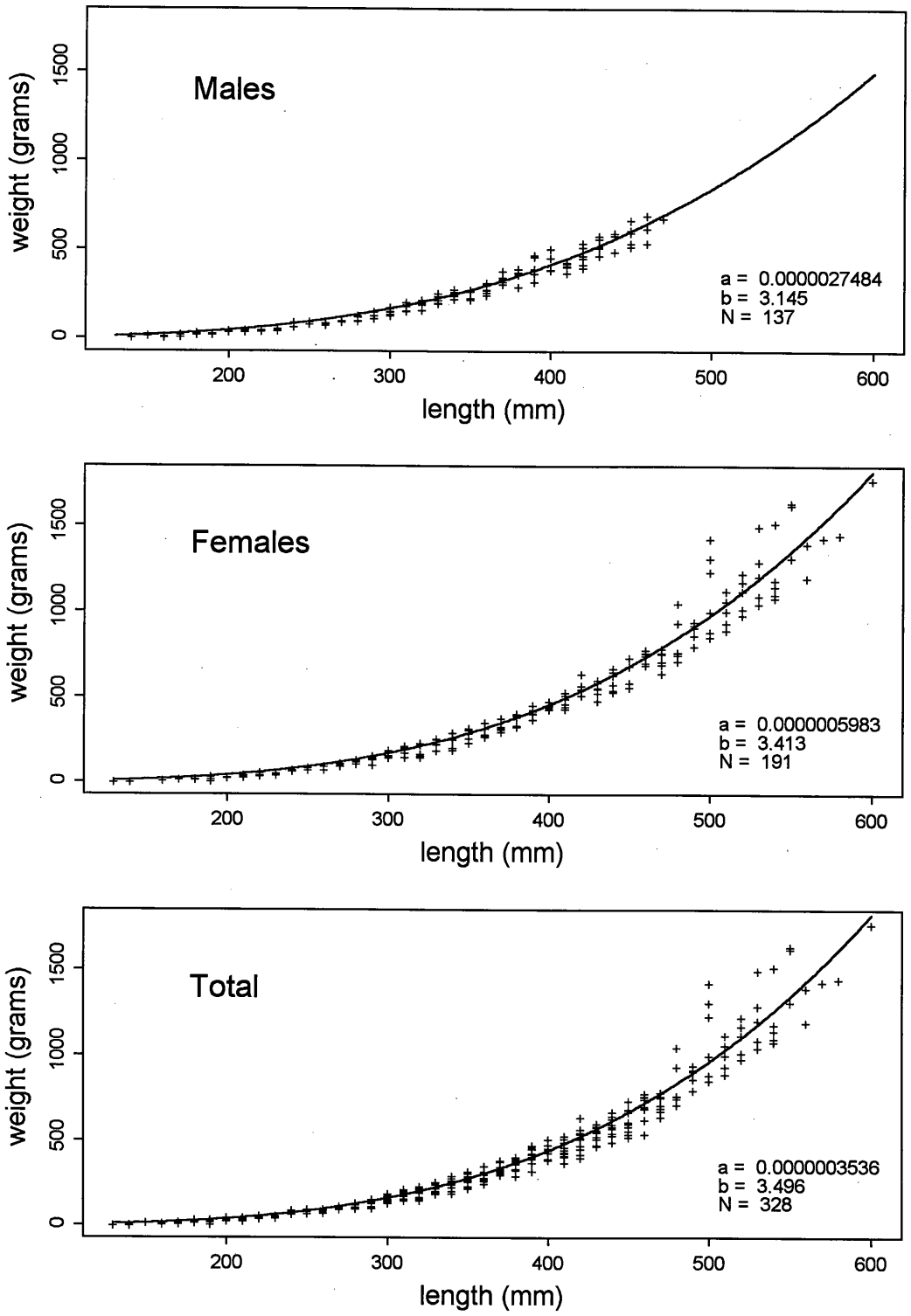


Figure 15.--Length-weight relationship for rex sole specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 12.--Catch per unit effort by stratum for rex sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
140	Middleton Shelf	28	28	1,144	8,366	3,226	13,506
122	Chirikof Outer Shelf	18	15	1,012	5,053	1,064	9,042
130	Albatross Gullies	29	26	992	7,773	2,147	13,399
221	Chirikof Slope	4	4	907	1,391	0	3,385
121	Shelikof Edge	24	23	852	6,538	2,658	10,418
320	Chirikof Slope	6	6	719	1,174	655	1,694
110	Sanak Gully	20	18	703	2,977	899	5,056
230	Kenai Gullies	19	16	694	4,670	1,802	7,539
240	Yakutat Gullies	18	17	686	2,469	1,417	3,521
131	Portlock Flats	22	21	670	4,905	2,717	7,093
251	Prince of Wales Slope/Gullies	22	21	558	2,233	1,140	3,327
220	Lower Shelikof Gully	27	26	539	5,370	3,038	7,701
350	Southeastern Deep Gullies	13	13	459	953	469	1,438
133	Kenai Flats	41	39	431	5,172	3,050	7,294
120	East Shumagin Gully	39	30	417	4,620	1,897	7,344
310	Shumagin Slope	6	6	378	956	262	1,650
35	Northern Kodiak Shallows	6	3	362	870	0	2,265
111	Shumagin Outer Shelf	25	19	353	2,836	0	6,038
341	Yakutat Slope	3	3	289	354	0	1,070
22	Chirikof Bank	31	9	273	2,998	0	6,159
41	Middleton Shallows	11	7	260	2,042	0	4,160
241	Yakutat Slope	11	11	230	293	134	452
132	Barren Islands	27	21	223	2,438	1,180	3,697
340	Yakutat Deep Gullies	15	14	221	385	14	755
330	Kodiak Slope	10	8	214	634	214	1,054
210	Shumagin Slope	8	6	208	569	62	1,075
150	Baranof-Chichagof Shelf	10	9	196	805	7	1,604
134	Kodiak Outer Shelf	15	9	189	960	104	1,817
40	Yakutat Shallows	5	5	171	1,429	0	3,094
112	West Shumagin Gully	6	6	158	357	116	599
351	Southeastern Slope	1	1	151	122	0	0
231	Kodiak Slope	4	4	146	237	0	520
11	Davidson Bank	44	16	132	1,799	369	3,229
151	Prince of Wales Shelf	14	10	122	701	221	1,182
13	Shumagin Bank	20	5	93	1,359	0	3,210
250	Baranof-Chichagof Slope	8	8	79	82	26	137
143	Fairweather Shelf	11	8	71	540	56	1,024
30	Albatross Shallows	11	3	66	402	0	1,171
31	Albatross Banks	33	4	42	644	0	1,846
142	Yakutat Flats	12	12	40	332	129	534
33	Kenai Peninsula	3	1	39	218	0	1,154
141	Yakataga Shelf	10	8	33	179	40	317
232	Upper Shelikof Gully	5	5	27	85	30	140
20	Upper Alaska Peninsula	15	1	9	71	0	224
12	Lower Alaska Peninsula	18	6	4	30	0	71
32	Lower Cook Inlet	15	2	3	35	0	98
10	Fox Islands	24	2	2	18	0	50

Dover sole (Microstomus pacificus)

Dover sole were found in moderate numbers throughout the survey area (Table 13; Fig. 16). Dover sole CPUEs generally increased from west to east and from shallow to deep with the highest CPUE in the Southeastern Deep Gullies (Table 14). The highest stratum biomass occurred in the Middleton Shelf stratum where Dover sole were recorded in all 28 samples. Dover sole were found in 94% of the tows over 300 m, and in 87% of the tows between 201-300 m. The largest Dover sole were generally found between 101 and 200 m with smaller fish found both deeper and shallower (Fig. 17). This appeared to be due to the predominance of larger female fish in this depth range. The length-weight relationship for Dover sole specimens collected during the survey is depicted in Figure 18.

Table 13.--Number of survey hauls, hauls containing Dover sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	8	5	222	0.7	45.0
	101 - 200	51	27	73	1,066	1.2	47.4
	201 - 300	8	4	55	151	1.0	44.7
	301 - 500	6	4	397	1,003	0.9	45.3
	All depths	171	43	38	2,442	1.0	46.0
Chirikof	1 - 100	54	10	33	887	0.9	42.2
	101 - 200	81	53	307	7,298	1.1	46.6
	201 - 300	31	25	289	3,328	1.0	44.9
	301 - 500	6	6	1,072	1,750	0.7	41.1
	All depths	172	94	209	13,263	1.0	44.8
Kodiak	1 - 100	68	12	85	3,377	0.6	41.5
	101 - 200	134	111	398	17,205	0.8	43.9
	201 - 300	28	23	704	8,126	0.7	40.7
	301 - 500	10	10	973	2,881	0.6	38.9
	All depths	240	156	324	31,589	0.7	42.1
Yakutat	1 - 100	16	8	42	682	0.6	33.0
	101 - 200	61	51	598	17,128	0.9	43.3
	201 - 300	29	28	1,383	6,740	0.8	43.1
	301 - 500	18	17	1,340	3,972	0.8	43.4
	All depths	124	104	541	28,521	0.8	43.0
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	13	166	1,640	0.7	48.6
	201 - 300	30	29	575	2,895	0.5	35.3
	301 - 500	14	14	2,524	7,279	0.6	40.0
	All depths	68	56	664	11,814	0.6	39.0
All areas	1 - 100	244	38	41	5,169	0.6	40.9
	101 - 200	351	255	370	44,336	0.9	44.2
	201 - 300	126	109	595	21,240	0.7	40.7
	301 - 500	54	51	1,302	16,885	0.7	40.8
	All depths	775	453	296	87,630	0.8	42.3

All areas biomass, 95% confidence interval: 74,841 - 100,418 metric tons (t).

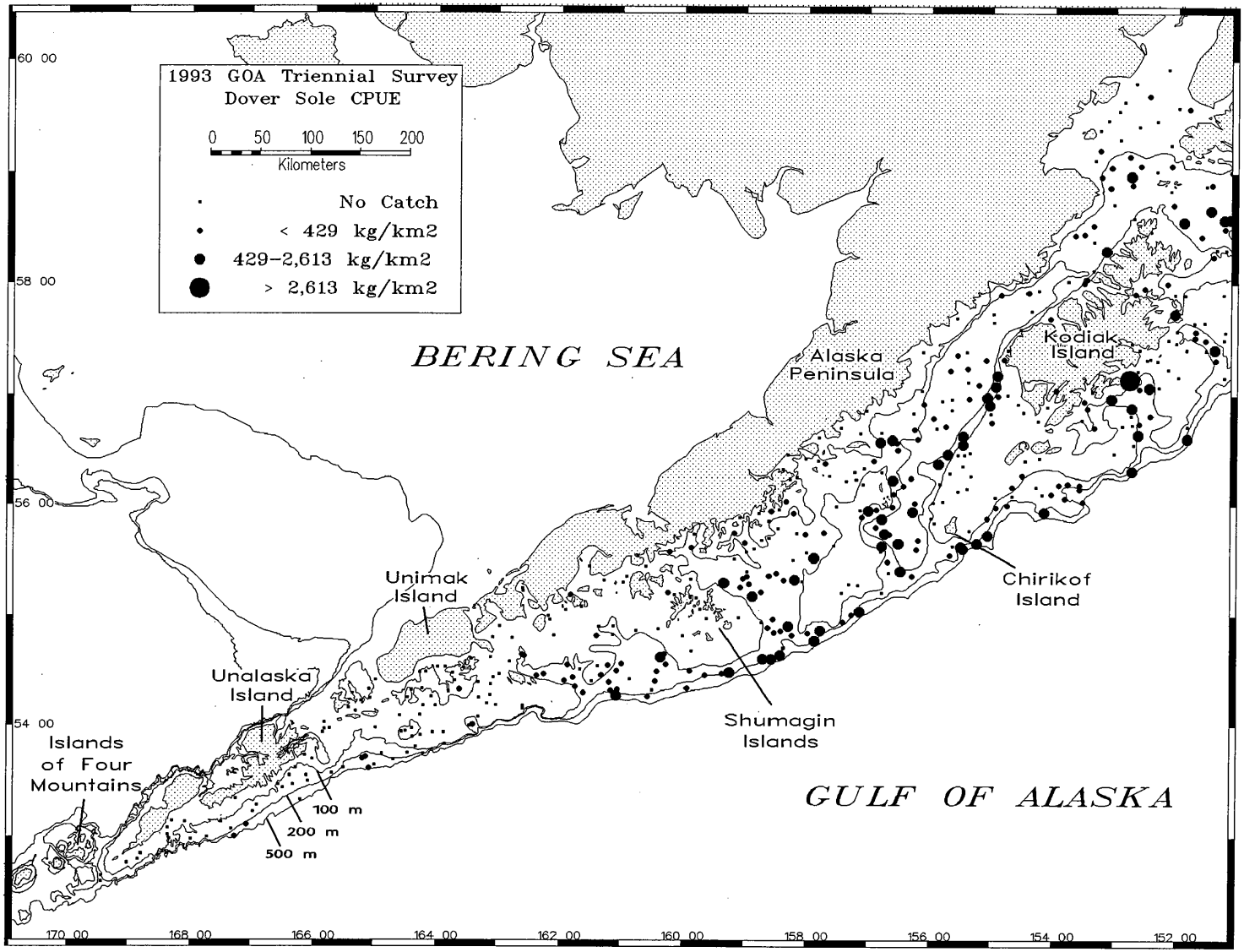


Figure 16.--Distribution and relative abundance of Dover sole from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

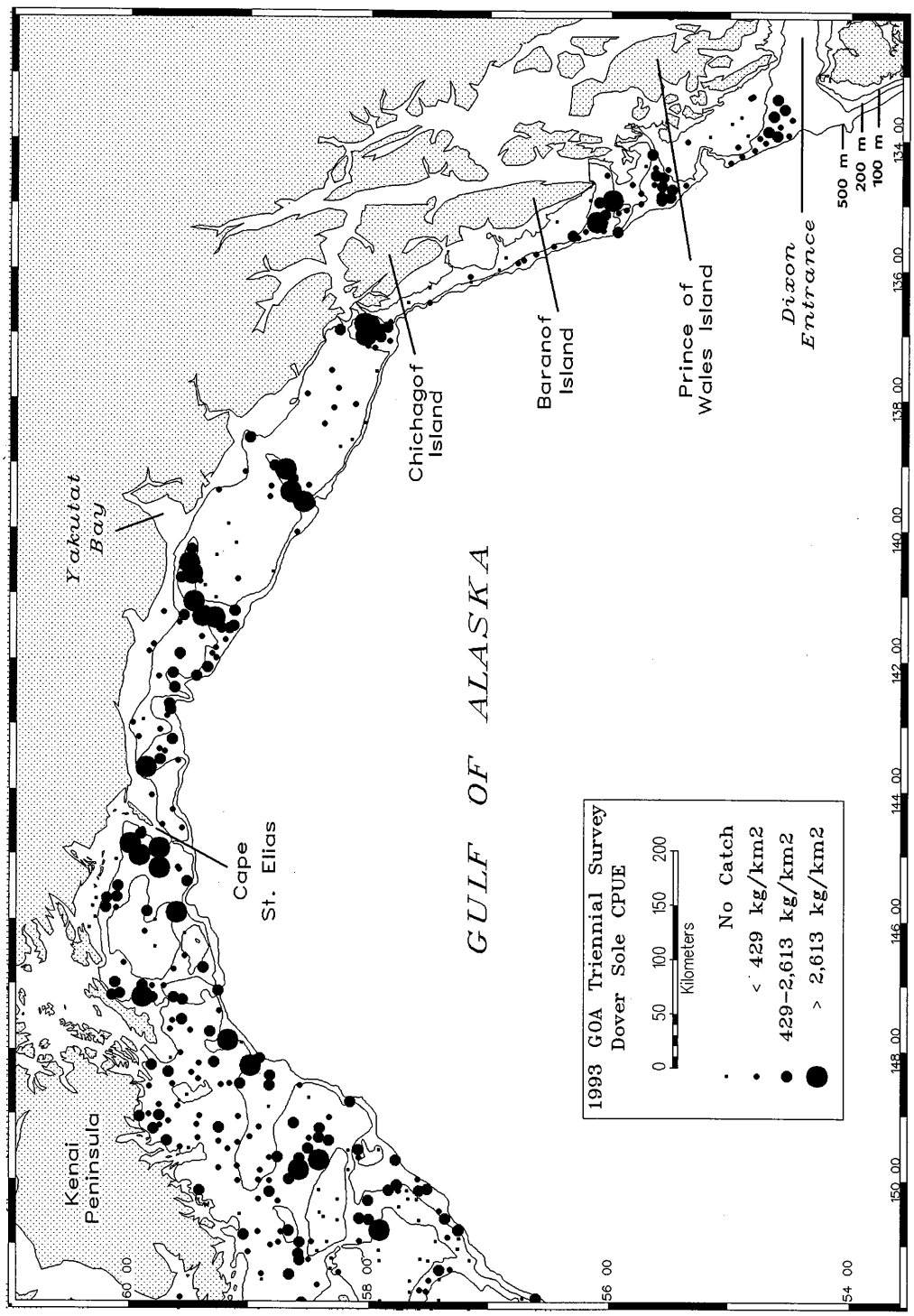


Figure 16.--Continued.

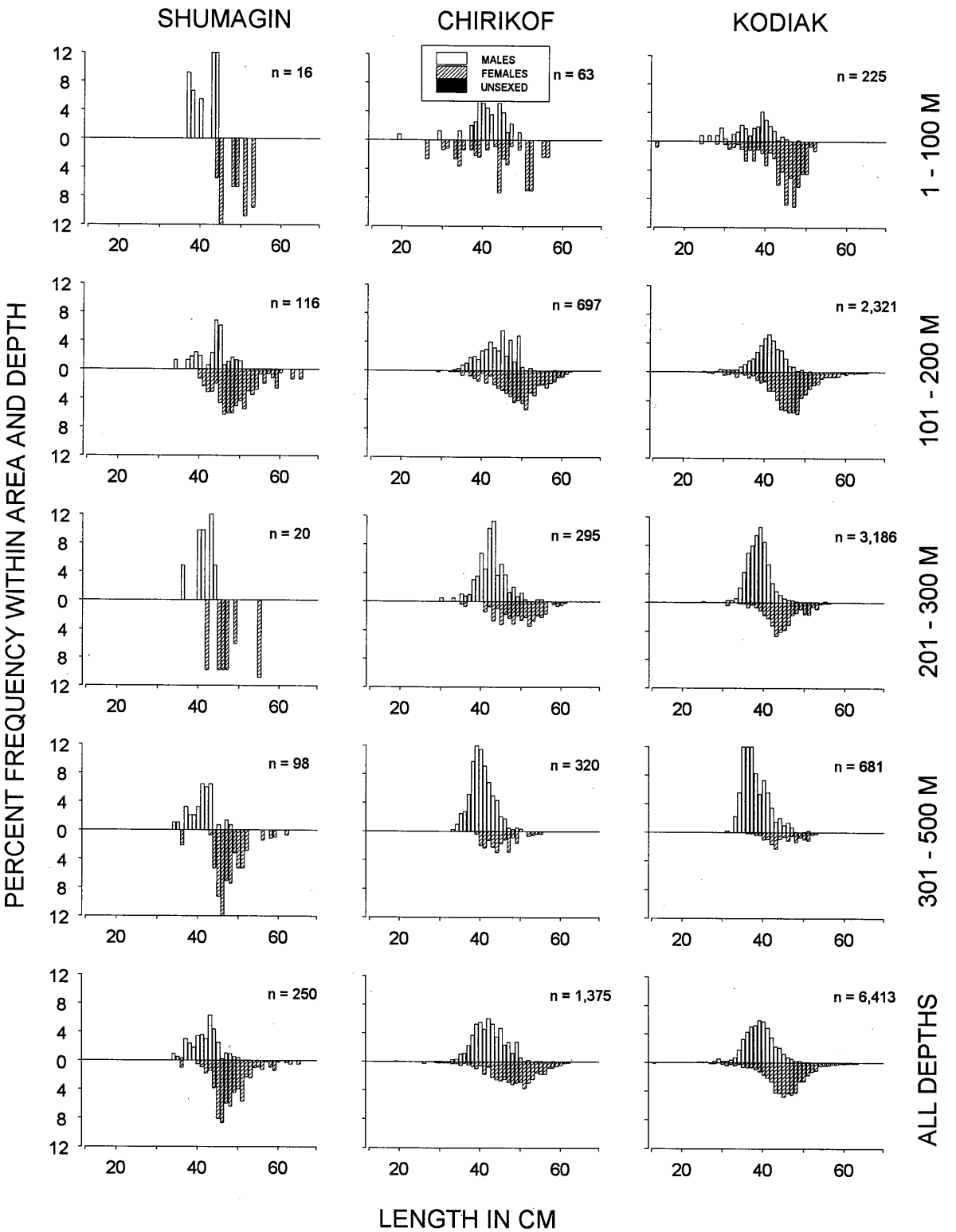


Figure 17.--Size composition of the estimated Dover sole population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

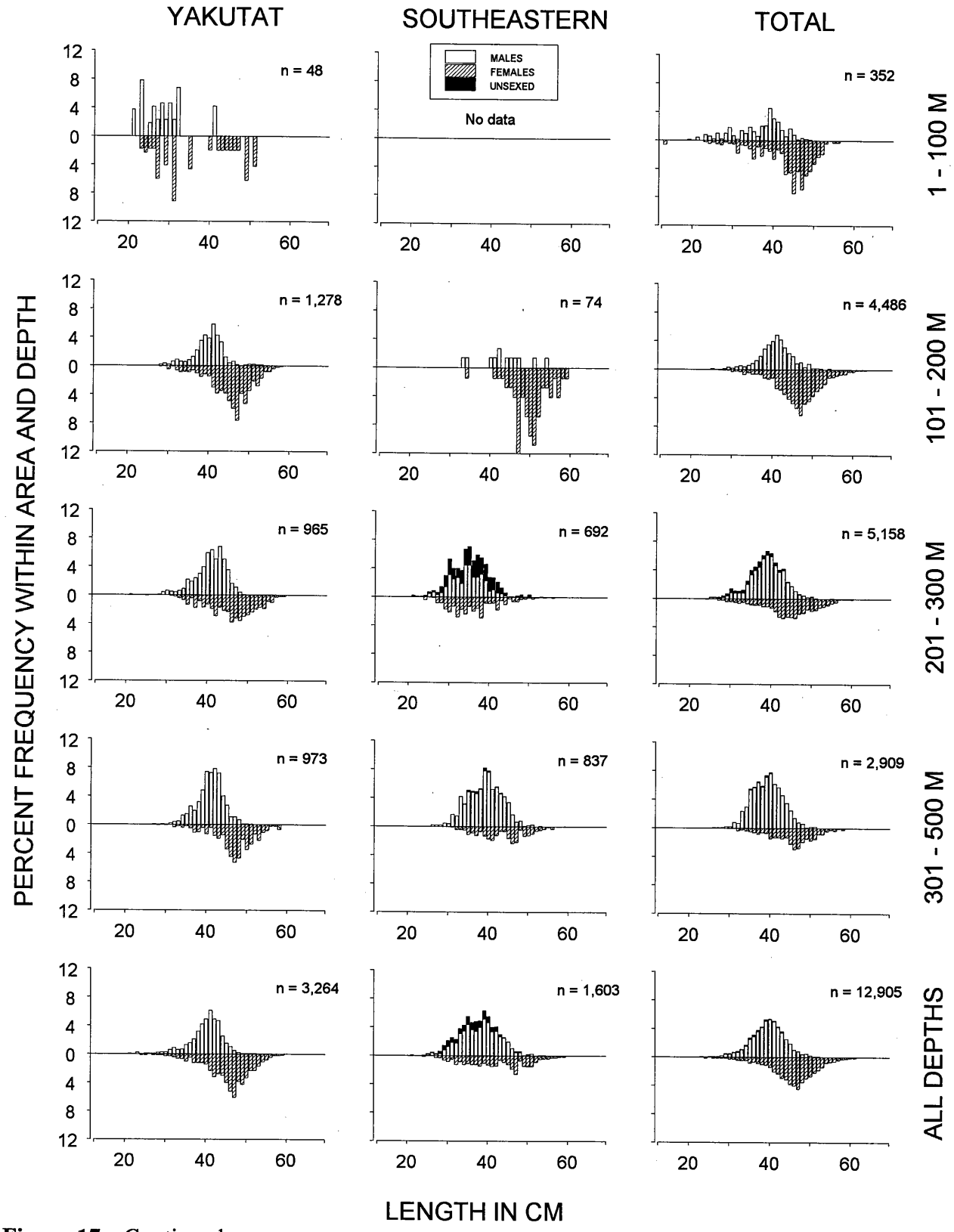


Figure 17.--Continued.

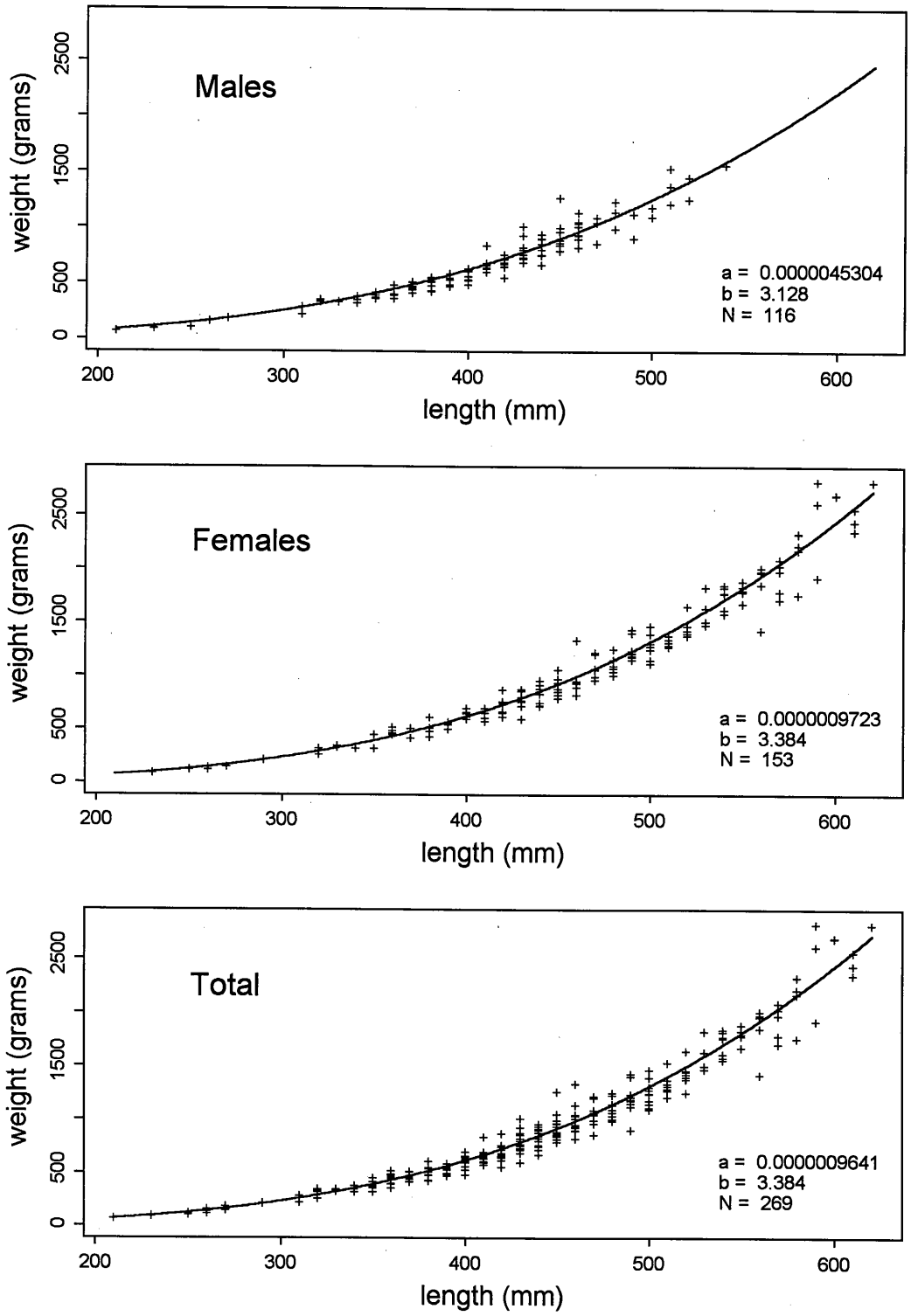


Figure 18.--Length-weight relationship for Dover sole specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 14.--Catch per unit effort by stratum for Dover sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
350	Southeastern Deep Gullies	13	13	3,110	6,453	1,387	11,520
340	Yakutat Deep Gullies	15	14	1,853	3,222	1,460	4,985
140	Middleton Shelf	28	28	1,833	13,403	4,921	21,886
240	Yakutat Gullies	18	18	1,676	6,031	3,962	8,099
230	Kenai Gullies	19	18	1,125	7,573	3,946	11,199
320	Chirikof Slope	6	6	1,072	1,750	1,077	2,423
351	Southeastern Slope	1	1	1,020	826	0	0
330	Kodiak Slope	10	10	973	2,881	1,746	4,016
131	Portlock Flats	22	20	820	6,003	2,701	9,305
251	Prince of Wales Slope/Gullies	22	22	700	2,798	1,487	4,109
121	Shelikof Edge	24	20	658	5,045	2,646	7,444
341	Yakutat Slope	3	3	612	749	114	1,385
241	Yakutat Slope	11	10	556	709	51	1,368
221	Chirikof Slope	4	4	550	844	283	1,405
130	Albatross Gullies	29	24	491	3,848	1,813	5,882
310	Shumagin Slope	6	4	397	1,003	0	2,954
133	Kenai Flats	41	38	347	4,159	3,001	5,317
231	Kodiak Slope	4	4	335	544	0	1,347
150	Baranof-Chichagof Shelf	10	4	295	1,208	0	3,351
141	Yakataga Shelf	10	9	286	1,534	227	2,840
132	Barren Islands	27	22	265	2,900	1,663	4,137
220	Lower Shelikof Gully	27	21	249	2,484	1,202	3,767
33	Kenai Peninsula	3	1	244	1,345	0	7,133
122	Chirikof Outer Shelf	18	12	207	1,033	235	1,830
142	Yakutat Flats	12	6	172	1,440	0	3,706
120	East Shumagin Gully	39	21	110	1,220	482	1,959
112	West Shumagin Gully	6	4	101	228	0	657
31	Albatross Banks	33	2	99	1,512	0	4,422
143	Fairweather Shelf	11	8	99	751	105	1,396
110	Sanak Gully	20	15	98	415	135	694
250	Baranof-Chichagof Slope	8	7	94	97	11	183
35	Northern Kodiak Shallows	6	3	86	205	0	450
151	Prince of Wales Shelf	14	9	75	431	120	742
22	Chirikof Bank	31	8	70	771	0	1,765
134	Kodiak Outer Shelf	15	7	58	296	46	545
210	Shumagin Slope	8	4	55	151	0	413
111	Shumagin Outer Shelf	25	8	53	423	20	827
30	Albatross Shallows	11	3	50	309	0	724
41	Middleton Shallows	11	3	43	337	0	819
40	Yakutat Shallows	5	5	41	345	106	584
20	Upper Alaska Peninsula	15	2	14	117	0	330
13	Shumagin Bank	20	4	12	176	0	362
12	Lower Alaska Peninsula	18	2	4	27	0	80
232	Upper Shelikof Gully	5	1	3	9	0	33
11	Davidson Bank	44	2	1	18	0	47
32	Lower Cook Inlet	15	3	1	7	0	14

Yellowfin sole (Pleuronectes asper)

Yellowfin sole catches were recorded almost exclusively in the shallowest strata in the Shumagin, Chirikof, and Kodiak INPFC areas (Table 16). Approximately 18% of the trawls in these areas contained yellowfin sole. Small catches were also recorded in Shumagin and Sanak Gullies. No yellowfin sole were caught east of Cook Inlet (Fig. 19). Seventy-eight percent of the estimated gulf-wide biomass came from stratum 12, the nearshore area south of the Alaska Peninsula (Table 16).

Table 15.--Number of survey hauls, hauls with yellowfin sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	20	1,647	73,070	0.4	29.6
	101 - 200	51	4	9	129	0.6	36.7
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	24	1,141	73,199	0.4	29.6
Chirikof	1 - 100	54	11	303	8,042	0.4	30.6
	101 - 200	81	1	1	35	0.9	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	12	127	8,078	0.4	30.6
Kodiak	1 - 100	68	9	76	3,040	0.5	33.1
	101 - 200	134	0	0	0	---	---
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	9	31	3,040	0.5	33.1
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	0	0	0	---	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	0	0	0	---	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	0	0	0	---	---
All areas	1 - 100	244	40	663	84,153	0.4	29.7
	101 - 200	351	5	1	164	0.6	36.7
	201 - 300	126	0	0	0	---	---
	301 - 500	54	0	0	0	---	---
	All depths	775	45	285	84,317	0.4	29.8

All areas biomass, 95% confidence interval: 39,258 - 129,376 metric tons (t).

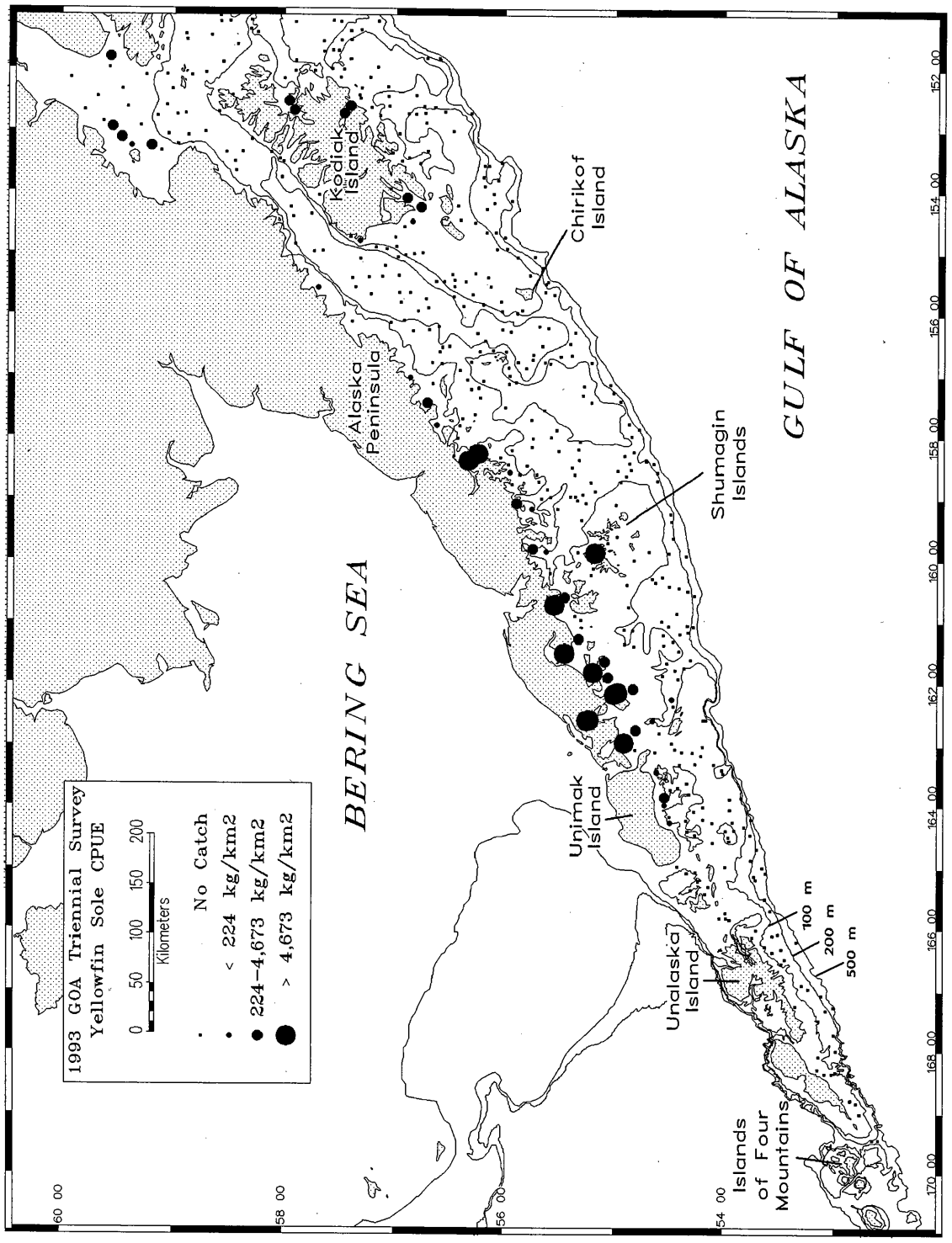


Figure 19.--Distribution and relative abundance of yellowfin sole from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

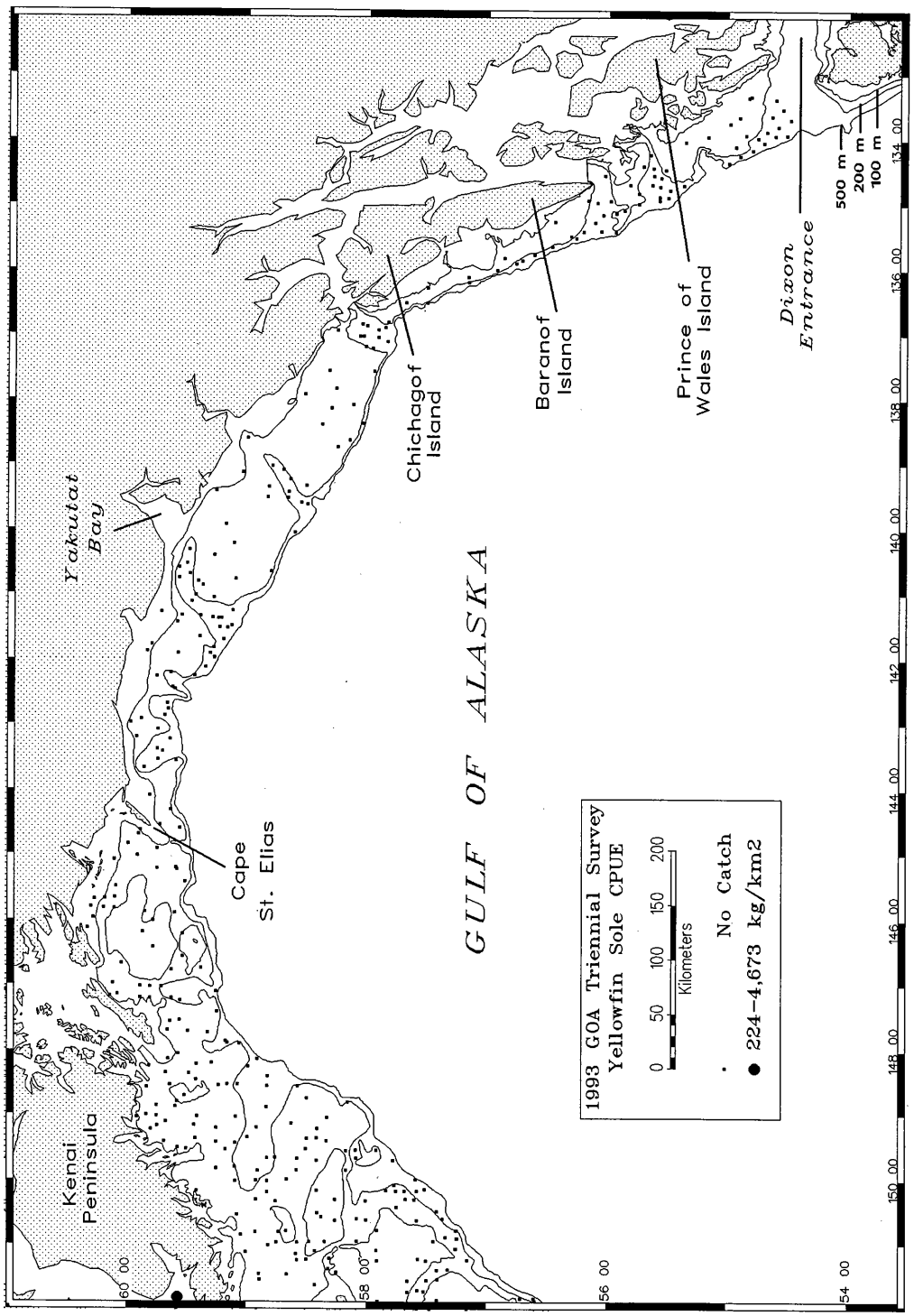


Figure 19.--Continued.

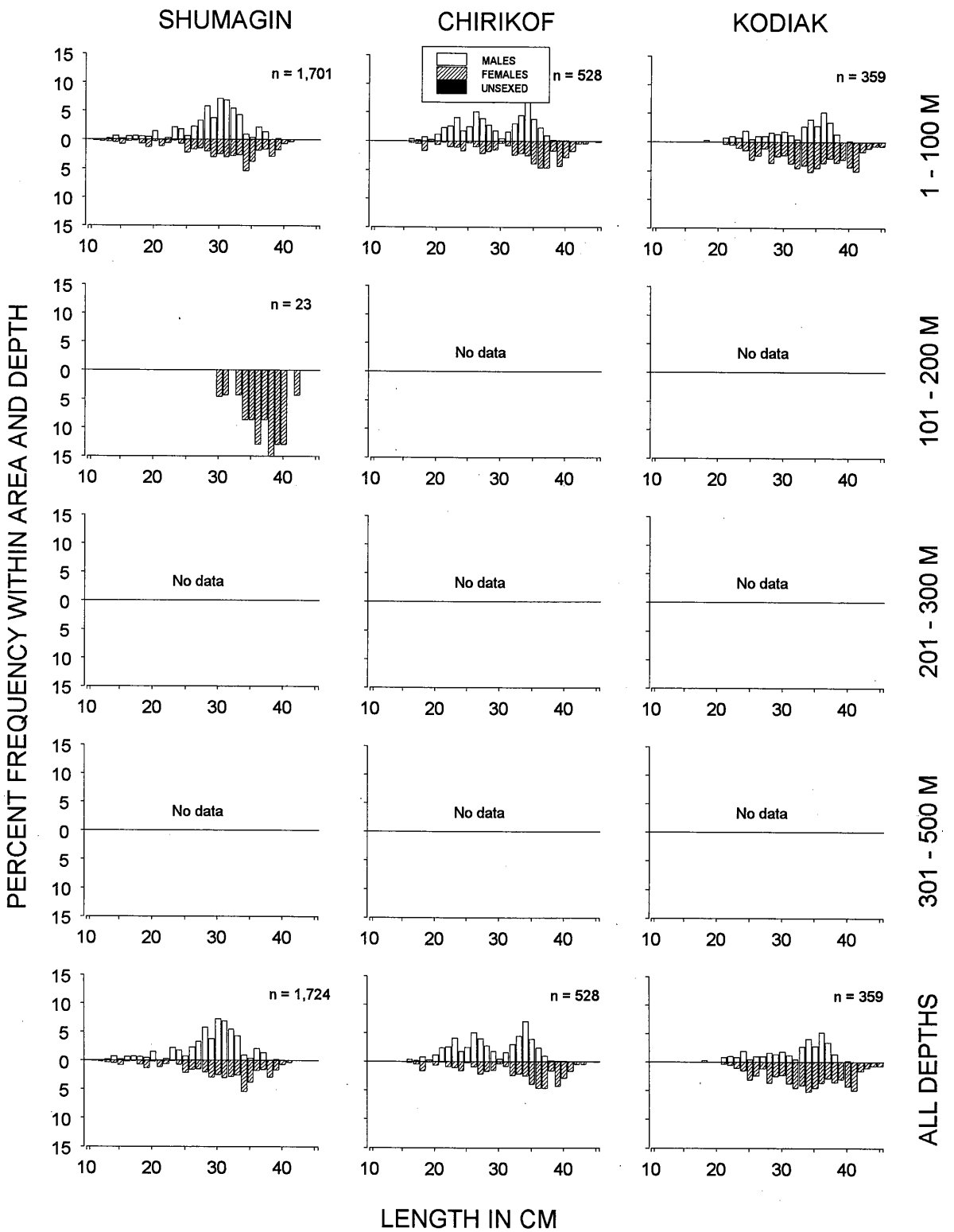


Figure 20.--Size composition of the estimated yellowfin population sole from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

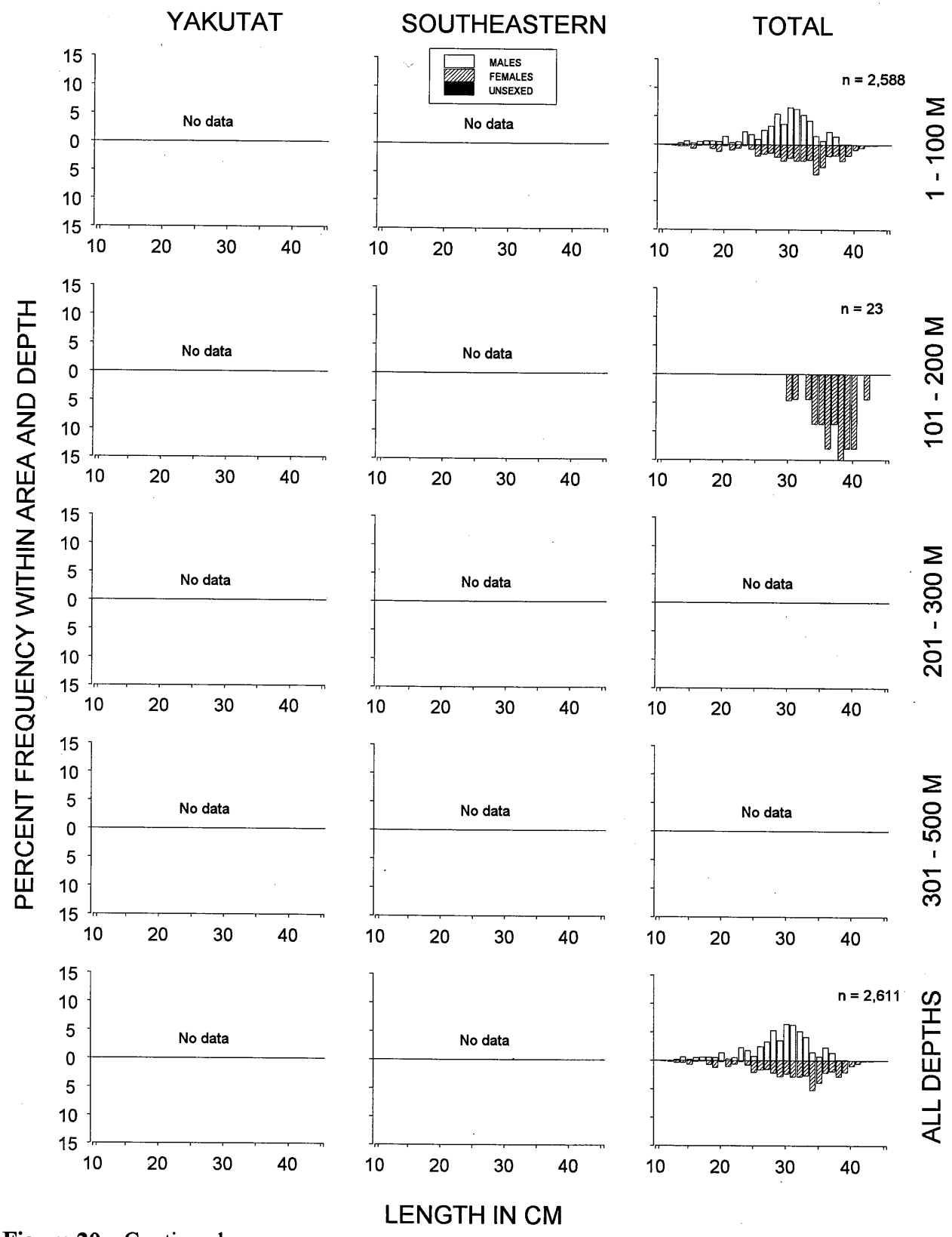


Figure 20.--Continued.

Table 16.--Catch per unit effort by stratum for yellowfin sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
12	Lower Alaska Peninsula	18	14	8,842	65,814	22,313	109,314
20	Upper Alaska Peninsula	15	7	807	6,684	0	15,631
13	Shumagin Bank	20	2	487	7,117	0	17,523
30	Albatross Shallows	11	4	263	1,611	0	3,488
32	Lower Cook Inlet	15	5	136	1,429	0	3,024
22	Chirikof Bank	31	4	124	1,359	0	3,237
112	West Shumagin Gully	6	2	55	124	0	354
11	Davidson Bank	44	4	10	140	0	315
120	East Shumagin Gully	39	1	3	35	0	106
110	Sanak Gully	20	2	1	5	0	13

OTHER FLATFISH

Alaska plaice (Pleuronectes quadrituberculatus)

Approximately 57% of the total Alaska plaice biomass in the survey was estimated to be in the Shumagin INPFC area in water less than 100 m (Table 17). Approximately 78% of this biomass was estimated to be in one stratum, Lower Alaska Peninsula (Table 18). Modest catches were also recorded in other strata on the continental shelf in the Shumagin, Chirikof, and Kodiak INPFC areas. No Alaska plaice were recorded east of Cook Inlet. The mean length of Alaska plaice increased with depth (Table 17).

Starry flounder (Platichthys stellatus)

Starry flounder were found almost exclusively in water depths less than 100 m (Table 19), particularly between the western end of the Alaska Peninsula and Montague Island. The highest CPUE areas were the shallow water northwest of Kodiak Island and Lower Cook Inlet (Table 20). Approximately 44% of the biomass from the survey area was estimated to be in Lower Cook Inlet.

English sole (Parophrys vetulus)

Although CPUEs for English sole were low throughout the survey, modest catches were recorded primarily in water less than 100 m in depth (Table 21). Approximately 56% of the total biomass from the survey area was estimated to be in Middleton Shallows, the only stratum where more than half of the samples contained English sole (Table 22).

Butter sole (Pleuronectes isolepis)

Except for a few small catches in Albatross Gullies, all of the butter sole catches occurred in water less than 100 m deep (Table 23). Fifty-eight percent of the total biomass was estimated to be in water shallower than 100 m in the Kodiak INPFC area, primarily near Kodiak Island and in Lower Cook Inlet (Table 24).

Table 17.--Number of survey hauls, hauls containing Alaska plaice, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	13	35	1,547	1.0	42.0
	101 - 200	51	4	15	213	1.9	51.6
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	17	27	1,760	1.1	42.6
Chirikof	1 - 100	54	11	26	701	0.7	34.1
	101 - 200	81	1	< 1	6	0.9	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	12	11	707	0.7	34.1
Kodiak	1 - 100	68	4	6	235	1.1	43.0
	101 - 200	134	1	< 1	11	1.1	46.0
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	5	3	246	1.1	43.1
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	0	0	0	---	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	0	0	0	---	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	0	0	0	---	---
All areas	1 - 100	244	28	20	2,483	0.9	39.2
	101 - 200	351	6	2	230	1.8	51.2
	201 - 300	126	0	0	0	---	---
	301 - 500	54	0	0	0	---	---
	All depths	775	34	9	2,713	1.0	39.7

All areas biomass, 95% confidence interval: 887 - 4,539 metric tons (t).

Table 18.--Catch per unit effort by stratum for Alaska plaice sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
12	Lower Alaska Peninsula	18	9	162	1,208	0	2,845
112	West Shumagin Gully	6	2	85	194	0	523
20	Upper Alaska Peninsula	15	4	41	336	0	856
22	Chirikof Bank	31	7	33	365	0	791
30	Albatross Shallows	11	1	32	197	0	637
13	Shumagin Bank	20	2	13	184	0	455
11	Davidson Bank	44	2	11	154	0	444
110	Sanak Gully	20	2	5	19	0	48
32	Lower Cook Inlet	15	3	4	38	0	86
120	East Shumagin Gully	39	1	1	6	0	18
132	Barren Islands	27	1	1	11	0	33

Table 19.--Number of survey hauls, hauls with starry flounder, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	6	87	3,866	1.2	43.7
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	6	60	3,866	1.2	43.7
Chirikof	1 - 100	54	15	229	6,095	2.1	49.8
	101 - 200	81	2	1	30	1.4	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	17	97	6,125	2.1	49.8
Kodiak	1 - 100	68	14	677	26,954	2.2	52.7
	101 - 200	134	0	0	0	---	---
	201 - 300	28	1	2	24	1.8	---
	301 - 500	10	0	0	0	---	---
	All depths	240	15	277	26,978	2.2	52.7
Yakutat	1 - 100	16	3	377	6,117	1.3	43.4
	101 - 200	61	0	0	0	---	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	3	116	6,117	1.3	43.4
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	0	0	0	---	---
All areas	1 - 100	244	38	339	43,031	1.9	49.2
	101 - 200	351	2	< 1	30	1.4	---
	201 - 300	126	1	1	24	1.8	---
	301 - 500	54	0	0	0	---	---
	All depths	775	41	146	43,085	1.9	49.2

All areas biomass, 95% confidence interval: 13,905 - 72,264 metric tons (t).

Table 20.--Catch per unit effort by stratum for starry flounder sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
35	Northern Kodiak Shallows	6	1	2,531	6,077	0	21,703
32	Lower Cook Inlet	15	8	1,796	18,805	0	43,705
41	Middleton Shallows	11	3	778	6,117	0	15,004
12	Lower Alaska Peninsula	18	6	519	3,866	0	8,558
20	Upper Alaska Peninsula	15	6	454	3,759	0	8,136
22	Chirikof Bank	31	9	213	2,336	312	4,360
31	Albatross Banks	33	4	129	1,978	0	5,473
30	Albatross Shallows	11	1	15	93	0	301
232	Upper Shelikof Gully	5	1	8	24	0	91
121	Shelikof Edge	24	1	3	20	0	60
120	East Shumagin Gully	39	1	1	10	0	30

Table 21.--Number of survey hauls, hauls containing English sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	7	30	1,343	1.1	46.0
	101 - 200	51	2	1	19	1.0	44.0
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	9	21	1,362	1.1	46.0
Chirikof	1 - 100	54	5	11	287	1.0	44.3
	101 - 200	81	1	< 1	9	1.1	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	6	5	296	1.0	44.3
Kodiak	1 - 100	68	9	41	1,623	1.0	45.0
	101 - 200	134	7	1	42	0.8	37.3
	201 - 300	28	2	1	11	0.7	46.0
	301 - 500	10	0	0	0	---	---
	All depths	240	18	17	1,676	1.0	44.8
Yakutat	1 - 100	16	10	349	5,665	0.5	36.9
	101 - 200	61	13	3	80	0.6	42.4
	201 - 300	29	1	< 1	2	0.5	---
	301 - 500	18	0	0	0	---	---
	All depths	124	24	109	5,747	0.5	36.9
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	7	31	302	0.6	---
	201 - 300	30	1	< 1	2	0.7	---
	301 - 500	14	0	0	0	---	---
	All depths	68	8	17	304	0.6	---
All areas	1 - 100	244	31	70	8,919	0.6	38.7
	101 - 200	351	30	4	451	0.6	41.3
	201 - 300	126	4	< 1	15	0.7	46.0
	301 - 500	54	0	0	0	---	---
	All depths	775	65	32	9,384	0.6	38.7

All areas biomass, 95% confidence interval: 0 - 19,703 metric tons (t).

Table 22.--Catch per unit effort by stratum for English sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
41	Middleton Shallows	11	7	665	5,223	0	15,351
35	Northern Kodiak Shallows	6	2	195	468	0	1,511
32	Lower Cook Inlet	15	2	87	914	0	2,710
13	Shumagin Bank	20	4	77	1,126	0	2,853
40	Yakutat Shallows	5	3	53	442	0	1,116
151	Prince of Wales Shelf	14	4	44	254	0	614
22	Chirikof Bank	31	3	21	233	0	682
11	Davidson Bank	44	2	16	215	0	631
31	Albatross Banks	33	4	15	224	0	604
150	Baranof-Chichagof Shelf	10	3	12	48	0	104
140	Middleton Shelf	28	12	10	71	10	133
20	Upper Alaska Peninsula	15	2	7	54	0	145
110	Sanak Gully	20	2	4	19	0	48
30	Albatross Shallows	11	1	3	17	0	54
133	Kenai Flats	41	3	2	20	0	43
230	Kenai Gullies	19	2	2	11	0	28
134	Kodiak Outer Shelf	15	1	2	8	0	25
250	Baranof-Chichagof Slope	8	1	2	2	0	7
142	Yakutat Flats	12	1	1	8	0	27
130	Albatross Gullies	29	1	1	5	0	15
120	East Shumagin Gully	39	1	1	9	0	26
241	Yakutat Slope	11	1	1	2	0	5
131	Portlock Flats	22	1	1	6	0	20

Table 23.--Number of survey hauls, hauls with butter sole, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	20	90	4,009	0.4	32.2
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	20	62	4,009	0.4	32.2
Chirikof	1 - 100	54	19	219	5,831	0.4	33.2
	101 - 200	81	0	0	0	---	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	19	92	5,831	0.4	33.2
Kodiak	1 - 100	68	23	461	18,377	0.3	30.6
	101 - 200	134	5	2	66	0.3	32.0
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	28	189	18,444	0.3	30.6
Yakutat	1 - 100	16	6	202	3,269	0.3	30.1
	101 - 200	61	0	0	0	---	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	6	62	3,269	0.3	30.1
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	0	0	0	---	---
All areas	1 - 100	244	68	248	31,487	0.3	31.2
	101 - 200	351	5	1	66	0.3	32.0
	201 - 300	126	0	0	0	---	---
	301 - 500	54	0	0	0	---	---
	All depths	775	73	107	31,553	0.3	31.2

All areas biomass, 95% confidence interval: 12,124 - 50,981 metric tons (t).

Table 24.--Catch per unit effort by stratum for butter sole sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
30	Albatross Shallows	11	4	853	5,217	0	12,386
32	Lower Cook Inlet	15	9	841	8,805	0	25,773
22	Chirikof Bank	31	15	368	4,044	731	7,357
35	Northern Kodiak Shallows	6	1	361	867	0	3,097
40	Yakutat Shallows	5	3	333	2,781	0	9,005
31	Albatross Banks	33	9	227	3,488	0	7,274
12	Lower Alaska Peninsula	18	9	227	1,691	0	3,616
20	Upper Alaska Peninsula	15	4	216	1,788	0	4,041
13	Shumagin Bank	20	5	154	2,249	0	5,756
41	Middleton Shallows	11	3	62	488	0	1,231
130	Albatross Gullies	29	5	8	66	0	149
11	Davidson Bank	44	5	4	61	0	138
10	Fox Islands	24	1	1	8	0	25

Walleye pollock (Theragra chalcogramma)

Walleye pollock was the second most abundant species encountered during the survey (Table 2). Pollock were found throughout the survey area (Table 25) and were captured in all but one sampled stratum, the Southeastern Slope (Fig. 21; Table 26). Pollock were caught in 81% of all tows during the survey (Table 25). Pollock CPUEs generally decreased from west to east (Fig. 21). The stratum with the highest estimated CPUE was stratum 10, the Fox Islands (9,673 kg/km^2, Table 26). One observation (Argosy, Haul 13) was very influential in the estimates for this stratum, accounting for about 99% of the biomass estimate. Approximately 56% of the total biomass of walleye pollock was estimated to be in the Shumagin and Chirikof INPFC areas at depth less than 100 m (about 24% of the total area covered by the survey). No clear relationship between depth and fish size was apparent (Fig. 22). Length modes representing age groups 0 (< 10 cm FL), 1 (10-23 cm FL), and 2 (24-33 cm FL) were apparent in several area-depths (Fig. 22). The length-weight relationship for walleye pollock specimens collected during the survey is depicted in Figure 23.

Table 25.--Number of survey hauls, hauls with walleye pollock, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	80	6,454	286,333	0.8	44.8
	101 - 200	51	50	5,127	74,527	0.9	49.2
	201 - 300	8	7	2,658	7,274	1.1	52.3
	301 - 500	6	3	36	92	0.8	46.7
	All depths	171	140	5,739	368,226	0.8	45.6
Chirikof	1 - 100	54	33	5,788	153,827	0.9	46.9
	101 - 200	81	58	999	23,715	1.0	49.5
	201 - 300	31	30	695	7,991	0.6	39.9
	301 - 500	6	3	84	137	0.8	47.0
	All depths	172	124	2,926	185,670	0.9	46.8
Kodiak	1 - 100	68	36	1,499	59,717	0.6	35.5
	101 - 200	134	119	2,555	110,350	1.0	49.5
	201 - 300	28	28	2,026	23,394	0.8	43.8
	301 - 500	10	7	114	336	0.7	46.6
	All depths	240	190	1,987	193,798	0.8	42.9
Yakutat	1 - 100	16	16	1,260	20,438	0.4	31.2
	101 - 200	61	57	246	7,046	0.2	29.5
	201 - 300	29	29	644	3,138	0.3	35.6
	301 - 500	18	17	827	2,450	0.7	45.8
	All depths	124	119	627	33,072	0.3	31.6
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	19	307	3,029	0.1	22.0
	201 - 300	30	29	445	2,240	0.7	42.5
	301 - 500	14	7	28	80	1.2	---
	All depths	68	55	301	5,349	0.2	24.3
All areas	1 - 100	244	165	4,097	520,315	0.7	42.8
	101 - 200	351	303	1,822	218,669	0.8	44.6
	201 - 300	126	123	1,234	44,036	0.7	42.6
	301 - 500	54	37	239	3,095	0.7	46.0
	All depths	775	628	2,659	786,115	0.8	43.3

All areas biomass, 95% confidence interval: 537,522 - 1,034,708 metric tons (t).

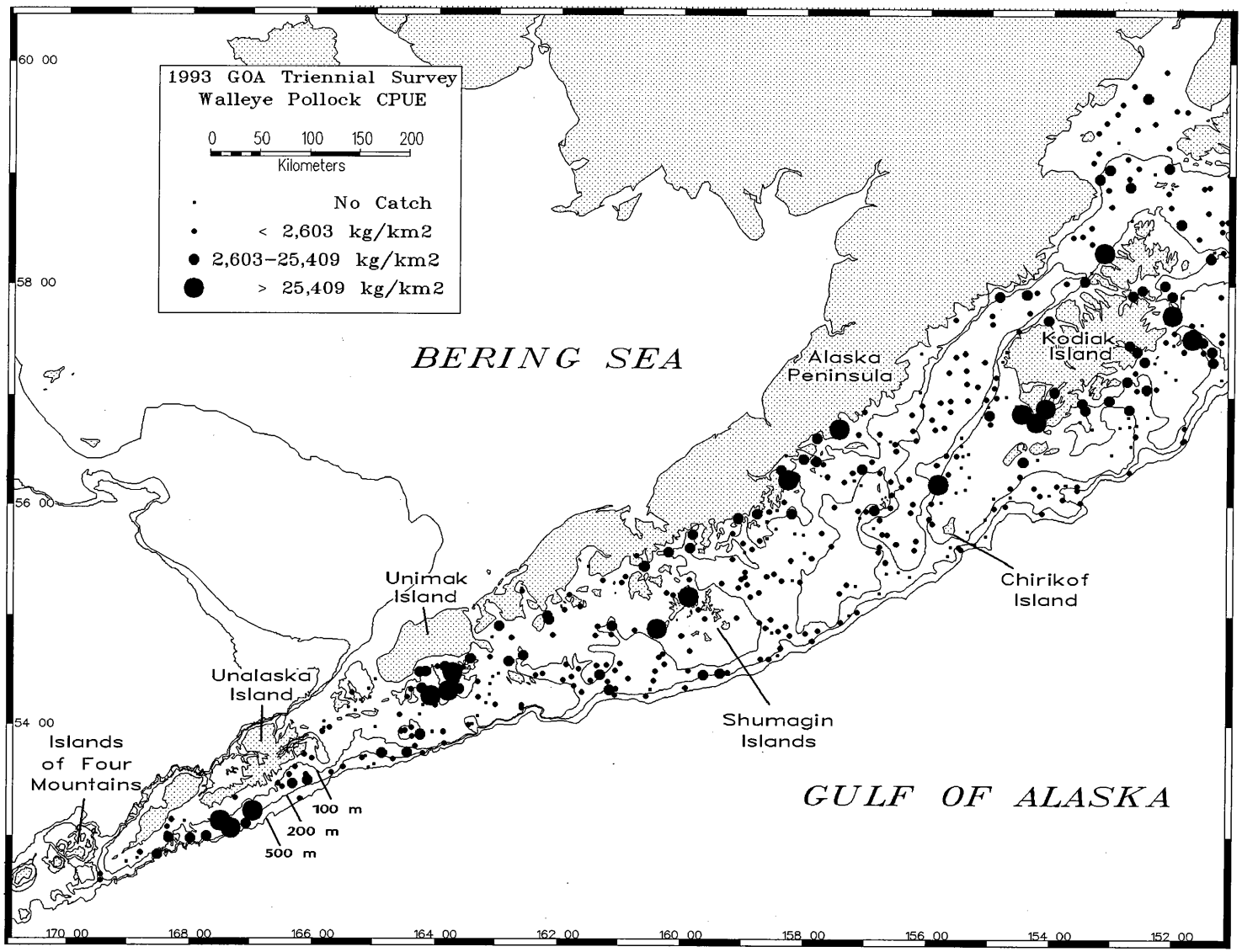


Figure 21.--Distribution and relative abundance of walleye pollock from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

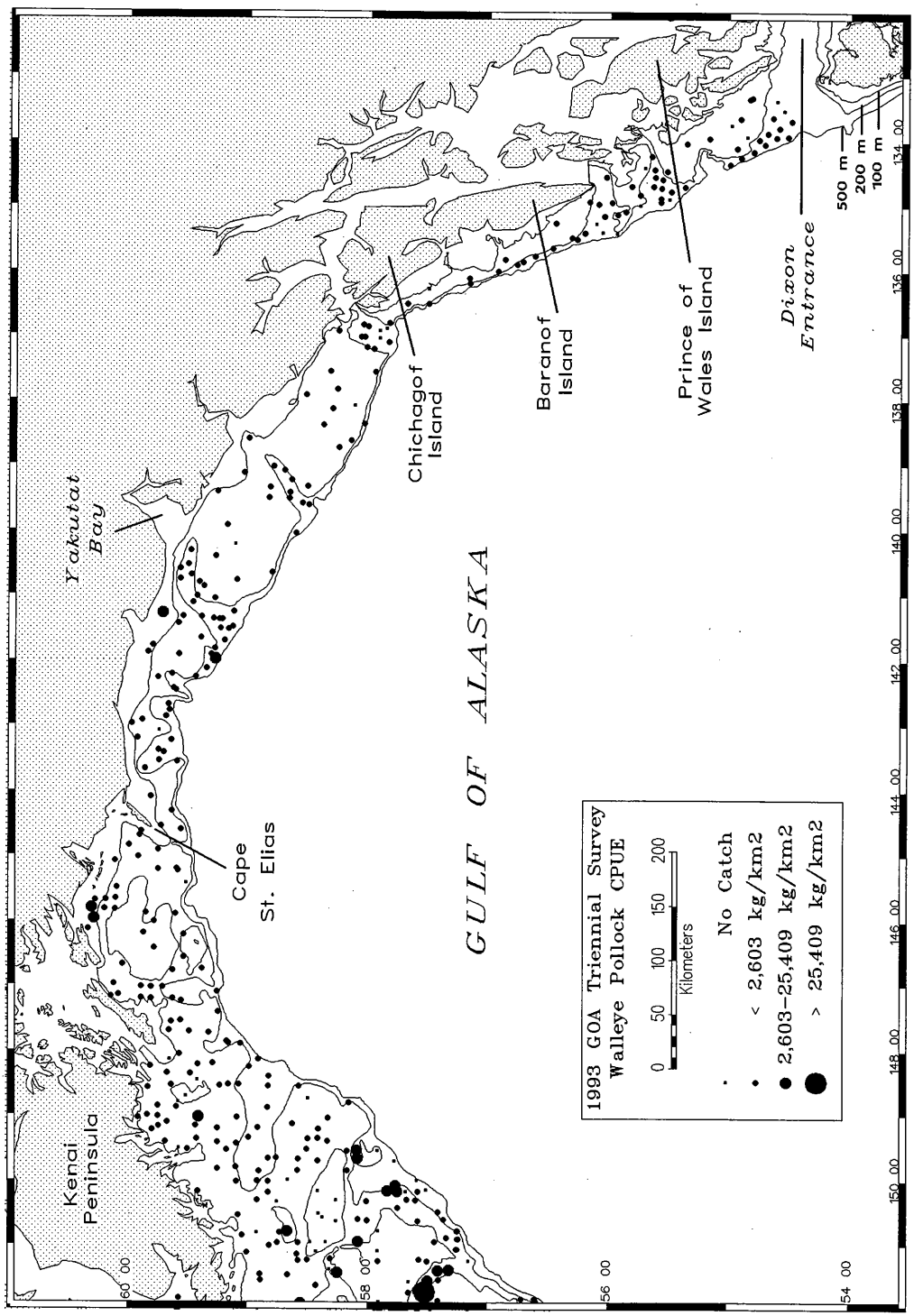


Figure 21.--Continued.

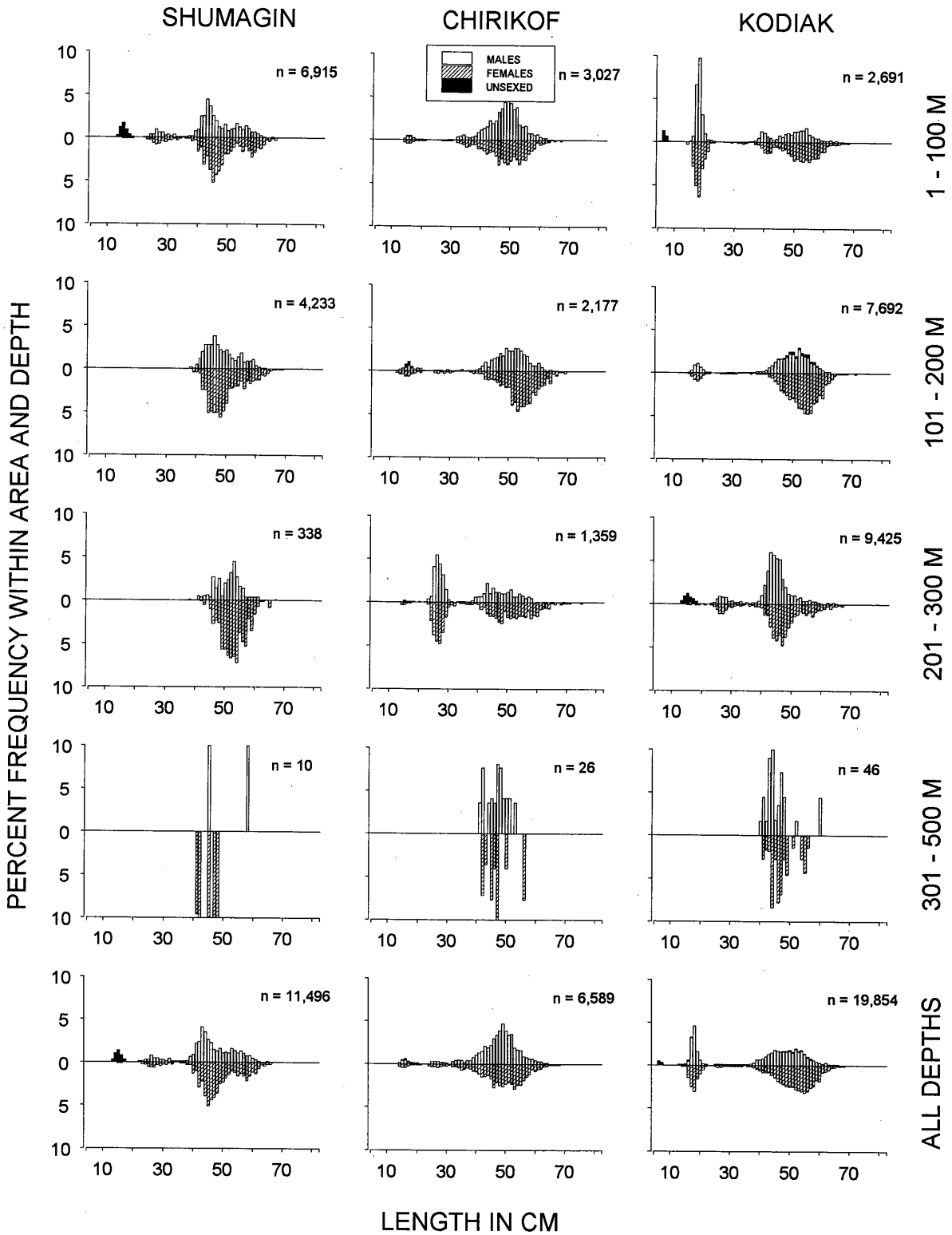
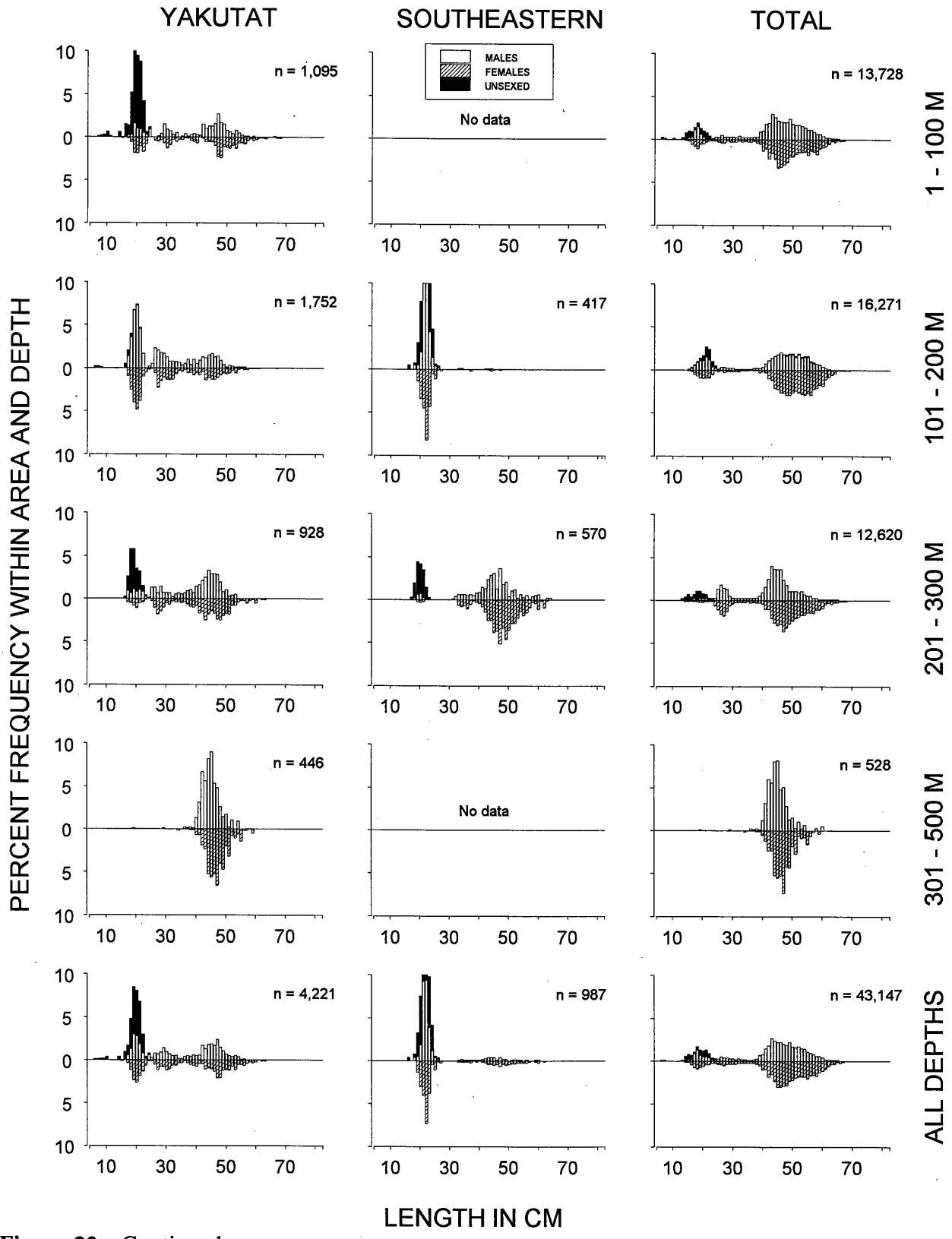


Figure 22.--Size composition of the estimated walleye pollock population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.



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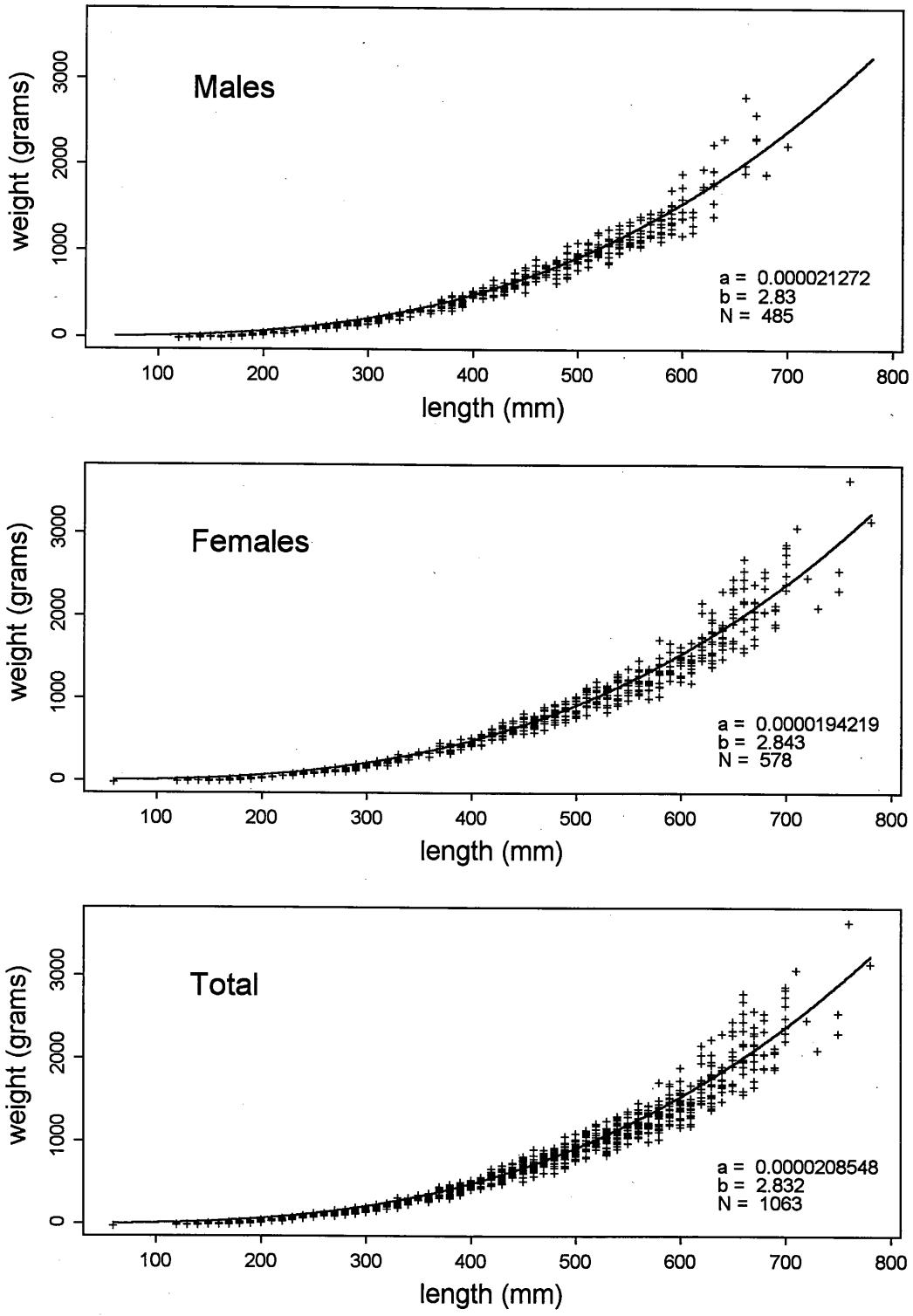


Figure 23.--Length-weight relationship for walleye pollock specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 26.--Catch per unit effort by stratum for walleye pollock sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
10	Fox Islands	24	14	9,673	83,343	0	253,066
20	Upper Alaska Peninsula	15	11	8,318	68,898	0	149,447
111	Shumagin Outer Shelf	25	24	8,129	65,328	22,077	108,579
22	Chirikof Bank	31	16	7,694	84,577	6,177	162,977
130	Albatross Gullies	29	26	6,797	53,267	24,980	81,554
13	Shumagin Bank	20	20	6,164	90,147	0	209,169
11	Davidson Bank	44	32	6,131	83,862	21,290	146,434
35	Northern Kodiak Shallows	6	3	5,342	12,827	0	33,706
30	Albatross Shallows	11	7	4,527	27,703	4,588	50,817
132	Barren Islands	27	26	4,371	47,858	2,517	93,198
12	Lower Alaska Peninsula	18	14	3,894	28,980	5,386	52,574
210	Shumagin Slope	8	7	2,658	7,274	0	22,333
230	Kenai Gullies	19	19	2,277	15,325	635	30,014
232	Upper Shelikof Gully	5	5	2,271	7,243	5,255	9,231
112	West Shumagin Gully	6	6	1,675	3,797	444	7,150
120	East Shumagin Gully	39	30	1,412	15,643	3,466	27,819
41	Middleton Shallows	11	11	1,401	11,009	0	23,649
341	Yakutat Slope	3	3	1,384	1,695	0	8,319
110	Sanak Gully	20	20	1,276	5,402	715	10,090
32	Lower Cook Inlet	15	14	1,183	12,386	0	32,486
40	Yakutat Shallows	5	5	1,128	9,429	0	30,421
121	Shelikof Edge	24	19	1,042	7,997	0	16,129
221	Chirikof Slope	4	4	1,038	1,592	0	4,134
240	Yakutat Gullies	18	18	683	2,456	1,411	3,502
220	Lower Shelikof Gully	27	26	642	6,399	4,051	8,747
250	Baranof-Chichagof Slope	8	8	541	560	128	992
241	Yakutat Slope	11	11	534	681	53	1,310
231	Kodiak Slope	4	4	508	826	0	3,105
133	Kenai Flats	41	38	481	5,773	3,038	8,508
340	Yakutat Deep Gullies	15	14	434	754	405	1,104
251	Prince of Wales Slope/Gullies	22	21	420	1,680	831	2,529
131	Portlock Flats	22	18	419	3,070	1,000	5,141
140	Middleton Shelf	28	27	416	3,045	1,643	4,448
31	Albatross Banks	33	11	349	5,358	0	15,923
141	Yakataga Shelf	10	9	339	1,822	0	3,667
150	Baranof-Chichagof Shelf	10	9	315	1,294	0	3,306
151	Prince of Wales Shelf	14	10	301	1,736	0	3,818
33	Kenai Peninsula	3	1	262	1,444	0	7,657
143	Fairweather Shelf	11	10	142	1,078	0	2,222
142	Yakutat Flats	12	11	131	1,100	173	2,028
330	Kodiak Slope	10	7	114	336	7	665
320	Chirikof Slope	6	3	84	137	0	358
134	Kodiak Outer Shelf	15	11	75	383	0	864
21	Semidi Bank	8	6	48	352	0	939
350	Southeastern Deep Gullies	13	7	38	80	0	161
310	Shumagin Slope	6	3	36	92	0	232
122	Chirikof Outer Shelf	18	9	15	75	0	164

Pacific cod (Gadus macrocephalus)

Pacific cod were mostly concentrated in the central and western Gulf of Alaska in water shallower than 200 m (Table 27; Fig. 24). About 86% of all tows in this area contained cod and more than 90% of the gulf-wide biomass was estimated to be here. Pacific cod were caught in all 43 strata shallower than 300 m (Table 28). The highest CPUE came from Albatross shallows, which accounted for about 19% of the total biomass estimate for the Gulf of Alaska. One haul (Argosy, Haul 242) was very influential in the biomass estimate for this stratum and was by far the largest catch of cod encountered during the survey (5,200 kg). The mean length and weights of cod were lowest in water less than 100 m, because small cod (< 30 cm FL) were found almost exclusively in these depths (Fig. 25). The length-weight relationship Pacific cod for specimens collected during the survey is depicted in Figure 26.

Table 27.--Number of survey hauls, hauls containing Pacific cod, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	101	2,195	97,370	1.3	44.6
	101 - 200	51	51	1,833	26,639	2.4	57.7
	201 - 300	8	6	328	897	2.0	56.4
	301 - 500	6	0	0	0	---	---
	All depths	171	158	1,947	124,907	1.4	46.3
Chirikof	1 - 100	54	41	1,445	38,393	2.3	56.3
	101 - 200	81	68	2,107	50,030	2.3	57.9
	201 - 300	31	26	959	11,034	1.7	54.6
	301 - 500	6	1	27	44	2.0	---
	All depths	172	136	1,568	99,501	2.2	56.9
Kodiak	1 - 100	68	51	2,923	116,459	1.6	50.1
	101 - 200	134	112	1,267	54,716	2.3	57.9
	201 - 300	28	18	480	5,543	2.8	62.7
	301 - 500	10	0	0	0	---	---
	All depths	240	181	1,812	176,717	1.8	52.2
Yakutat	1 - 100	16	11	626	10,148	2.6	61.2
	101 - 200	61	27	177	5,058	2.8	65.2
	201 - 300	29	11	89	434	2.1	---
	301 - 500	18	0	0	0	---	---
	All depths	124	49	297	15,639	2.6	62.3
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	11	341	3,363	2.4	61.2
	201 - 300	30	23	311	1,564	2.7	63.3
	301 - 500	14	1	1	4	1.4	---
	All depths	68	35	277	4,931	2.5	61.9
All areas	1 - 100	244	204	2,066	262,369	1.5	48.5
	101 - 200	351	269	1,165	139,806	2.3	58.2
	201 - 300	126	84	546	19,472	2.0	56.9
	301 - 500	54	2	4	48	2.0	---
	All depths	775	559	1,426	421,695	1.7	51.2

All areas biomass, 95% confidence interval: 254,318 - 589,072 metric tons (t).

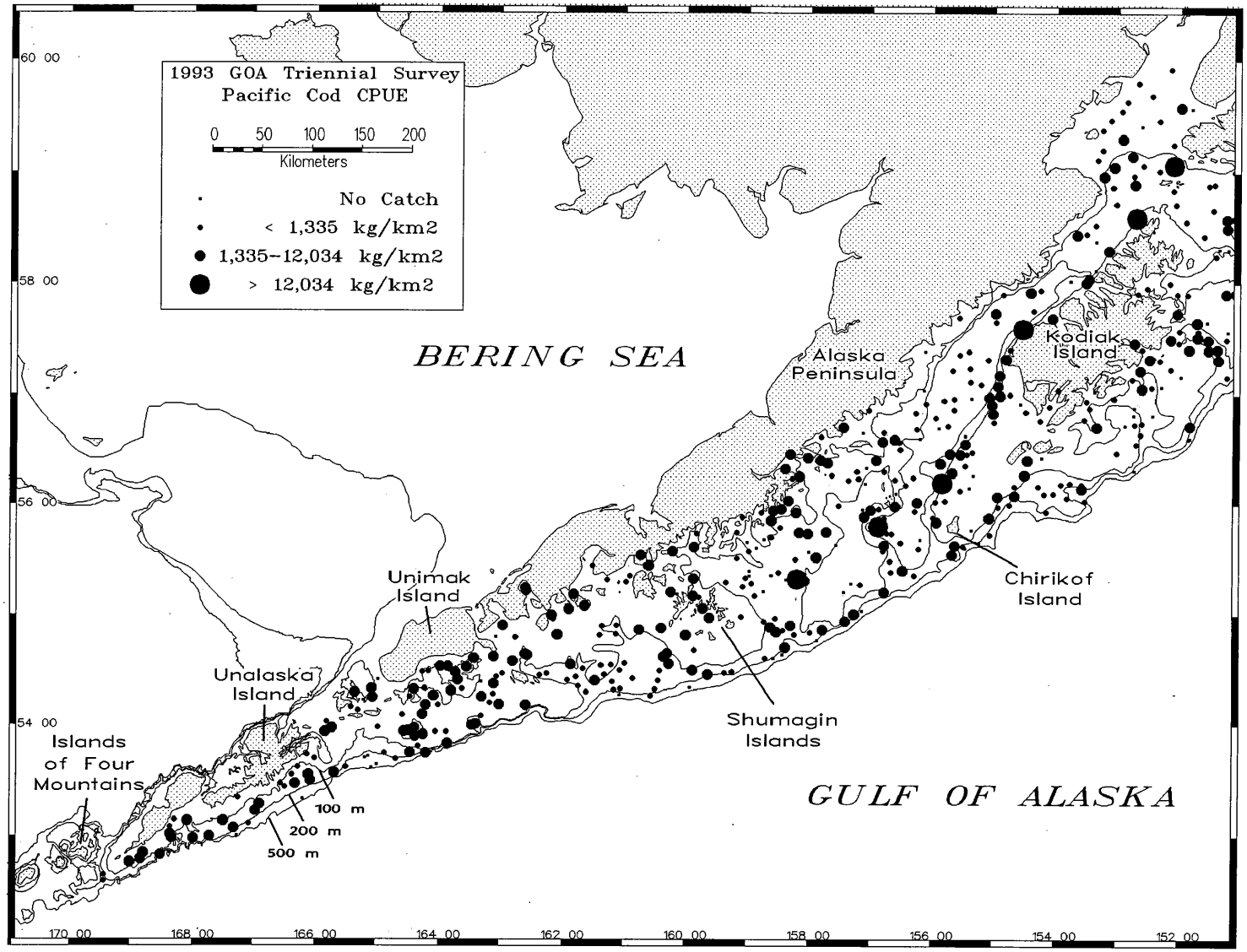
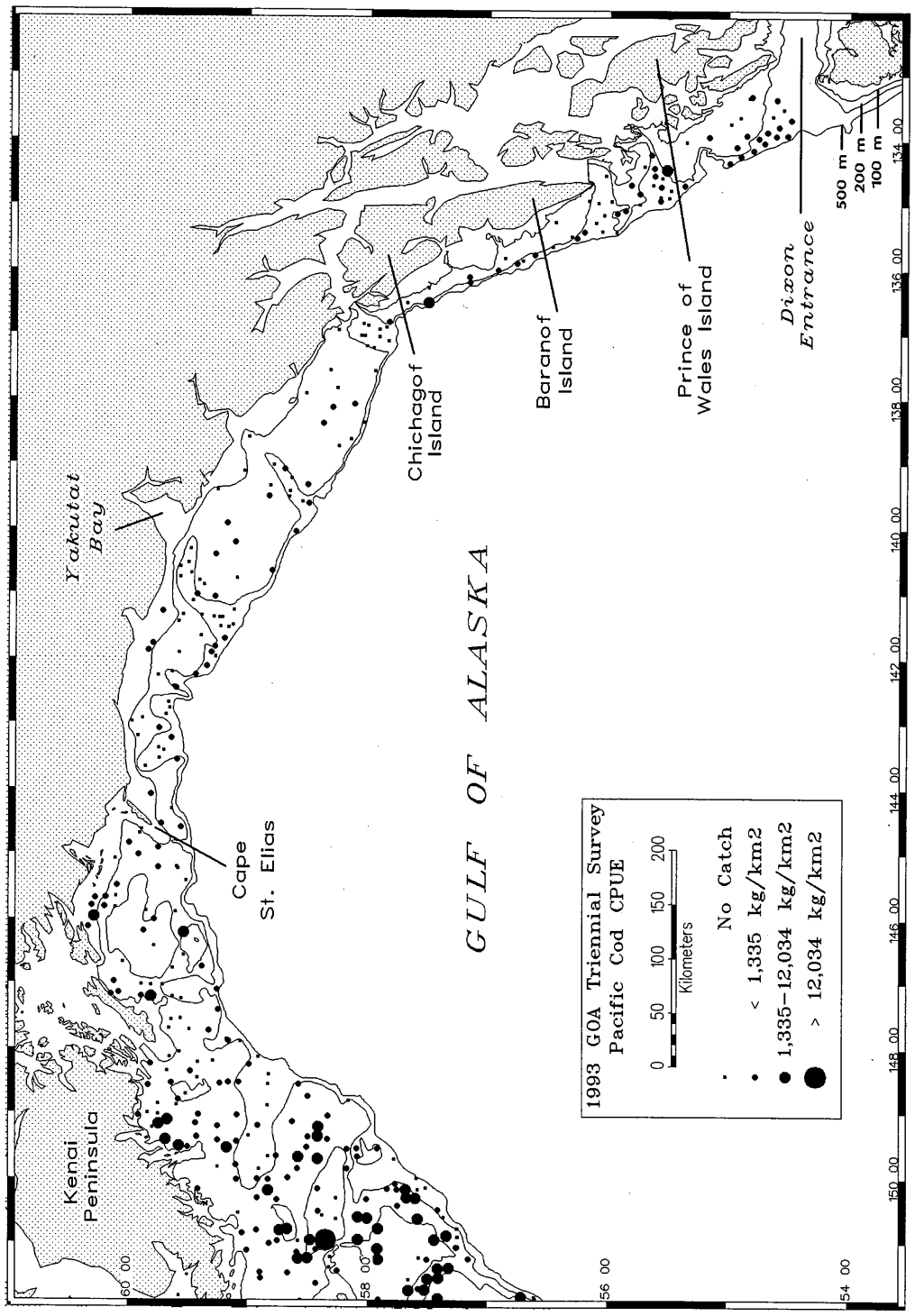


Figure 24.--Distribution and relative abundance of Pacific cod from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.



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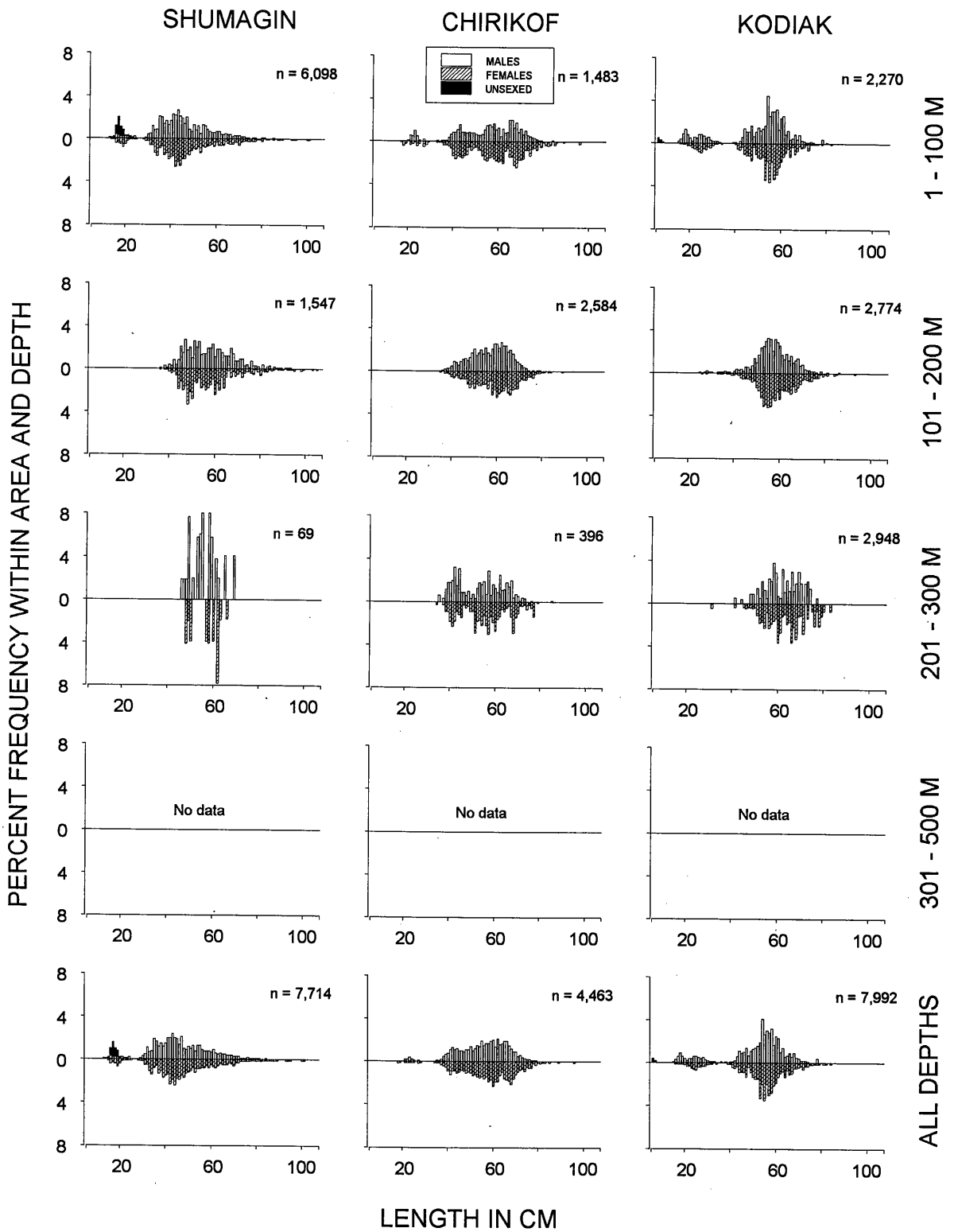


Figure 25.--Size composition of the estimated Pacific cod population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

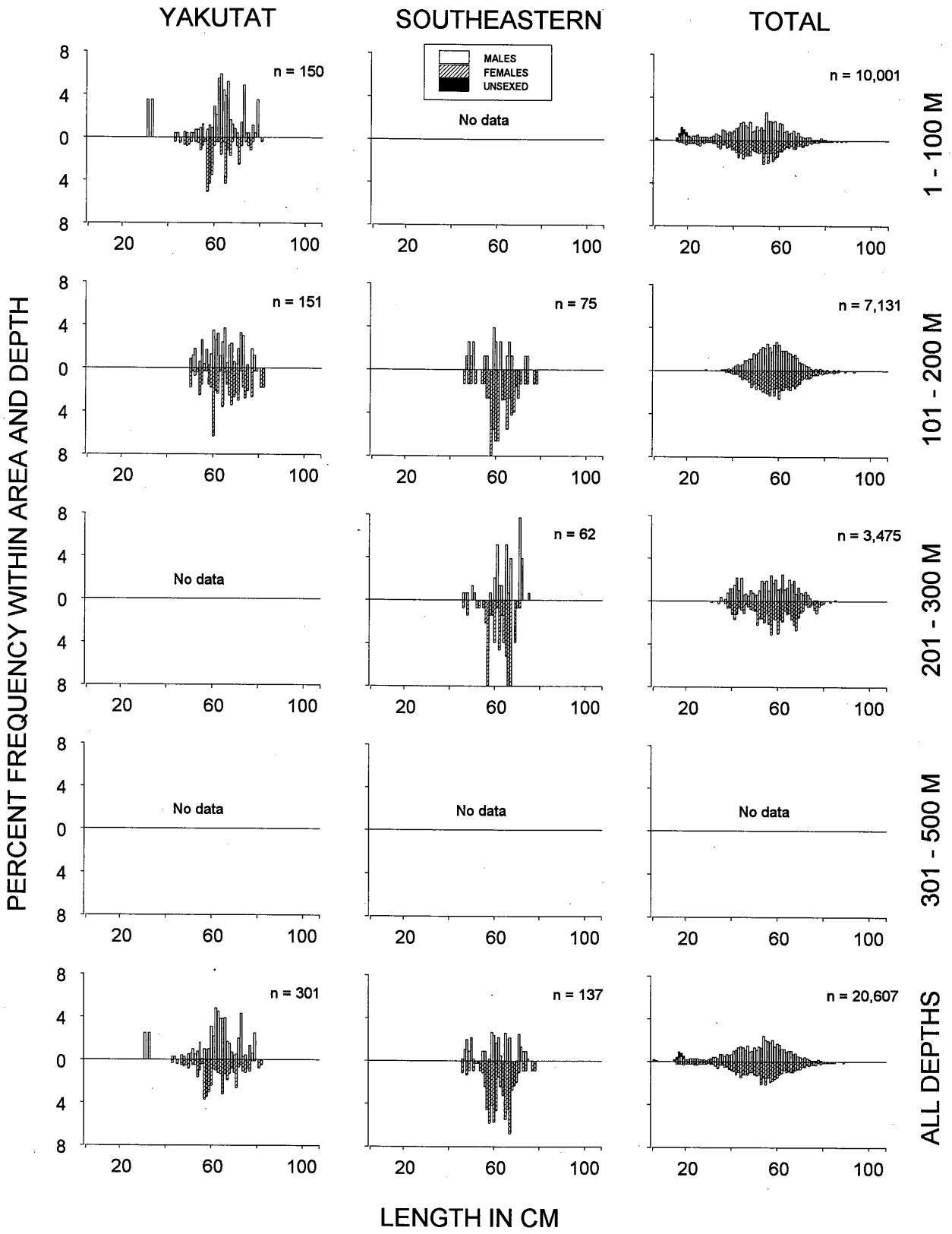


Figure 25.--Continued.

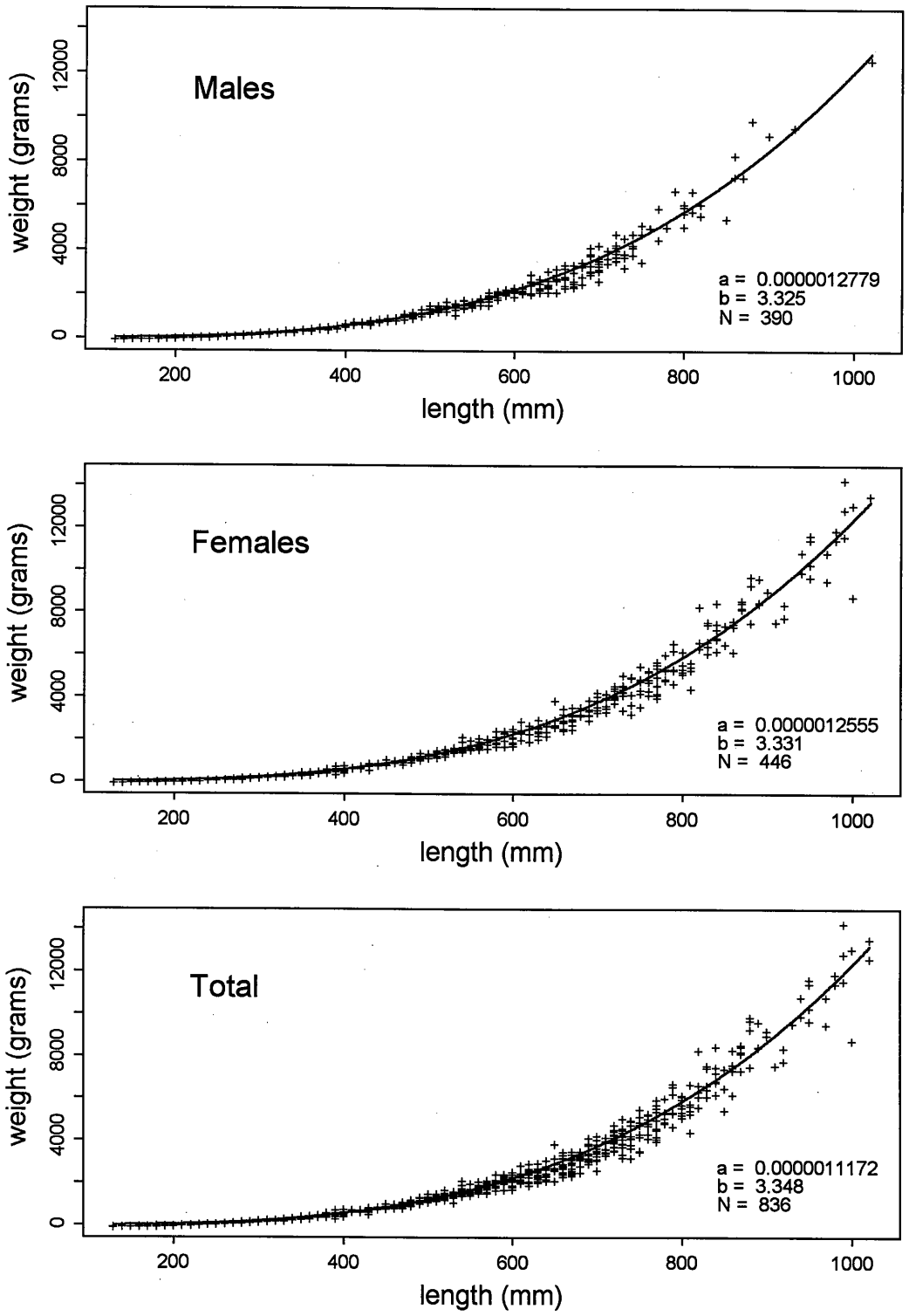


Figure 26.--Length-weight relationship for Pacific cod specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 28.--Catch per unit effort by stratum for Pacific cod sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
30	Albatross Shallows	11	8	12,949	79,234	0	241,844
35	Northern Kodiak Shallows	6	5	3,959	9,506	0	23,895
10	Fox Islands	24	23	2,622	22,588	11,688	33,489
22	Chirikof Bank	31	26	2,618	28,783	10,261	47,305
111	Shumagin Outer Shelf	25	25	2,499	20,085	12,660	27,511
120	East Shumagin Gully	39	29	2,477	27,447	11,708	43,186
132	Barren Islands	27	26	2,461	26,943	1,505	52,380
11	Davidson Bank	44	42	2,370	32,419	23,034	41,805
12	Lower Alaska Peninsula	18	17	2,096	15,599	7,184	24,014
122	Chirikof Outer Shelf	18	18	1,950	9,736	4,017	15,454
13	Shumagin Bank	20	19	1,830	26,764	10,833	42,695
121	Shelikof Edge	24	21	1,675	12,848	7,227	18,470
31	Albatross Banks	33	24	1,517	23,266	246	46,285
130	Albatross Gullies	29	27	1,337	10,479	7,375	13,582
110	Sanak Gully	20	20	1,152	4,878	2,983	6,772
232	Upper Shelikof Gully	5	5	1,126	3,592	65	7,119
20	Upper Alaska Peninsula	15	11	1,054	8,727	3,168	14,286
220	Lower Shelikof Gully	27	23	1,051	10,473	0	21,622
134	Kodiak Outer Shelf	15	13	920	4,669	1,951	7,386
131	Portlock Flats	22	21	903	6,609	3,687	9,531
41	Middleton Shallows	11	7	757	5,946	0	13,505
112	West Shumagin Gully	6	6	739	1,676	131	3,221
151	Prince of Wales Shelf	14	8	522	3,010	0	6,648
40	Yakutat Shallows	5	4	503	4,202	0	9,201
133	Kenai Flats	41	25	501	6,017	2,546	9,489
32	Lower Cook Inlet	15	13	414	4,334	367	8,300
231	Kodiak Slope	4	3	397	646	0	2,387
250	Baranof-Chichagof Slope	8	6	378	392	0	1,033
221	Chirikof Slope	4	3	365	560	0	1,528
210	Shumagin Slope	8	6	328	897	0	1,941
251	Prince of Wales Slope/Gullies	22	17	293	1,172	534	1,811
143	Fairweather Shelf	11	4	259	1,967	0	4,319
140	Middleton Shelf	28	15	205	1,498	484	2,513
230	Kenai Gullies	19	10	194	1,305	70	2,540
241	Yakutat Slope	11	7	176	224	85	364
142	Yakutat Flats	12	6	145	1,215	0	3,017
21	Semidi Bank	8	4	121	883	0	1,992
150	Baranof-Chichagof Shelf	10	3	86	353	0	907
141	Yakataga Shelf	10	2	70	377	0	1,091
240	Yakutat Gullies	18	4	58	210	0	453
320	Chirikof Slope	6	1	27	44	0	156
33	Kenai Peninsula	3	1	22	119	0	629
350	Southeastern Deep Gullies	13	1	2	4	0	13

Atka mackerel (Pleurogrammus monopterygius)

Approximately 97% of the total estimated Atka mackerel biomass in the Gulf of Alaska came from waters less than 100 m in the Shumagin INPFC area (Table 29). Two large catches of Atka mackerel from the western end of the Fox Islands stratum were very influential in this estimate (Fig. 27; Table 30). Catches were low or nonexistent in all other strata. Most of the Atka mackerel captured were between 40 and 50 cm FL (Fig. 28). The length-weight relationship for Atka mackerel specimens collected during the survey is depicted in Figure 29.

Table 29.--Number of survey hauls, hauls with Atka mackerel, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	34	475	21,084	1.3	43.4
	101 - 200	51	13	31	457	1.4	46.1
	201 - 300	8	1	5	13	1.8	45.0
	301 - 500	6	0	0	0	---	---
	All depths	171	48	336	21,554	1.3	43.4
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	6	4	86	1.4	47.3
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	6	1	86	1.4	47.3
Kodiak	1 - 100	68	1	< 1	10	0.9	---
	101 - 200	134	0	0	0	---	---
	201 - 300	28	1	1	12	1.4	49.0
	301 - 500	10	0	0	0	---	---
	All depths	240	2	< 1	22	1.1	49.0
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	0	0	0	---	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	0	0	0	---	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	0	0	0	---	---
All areas	1 - 100	244	35	166	21,095	1.3	43.4
	101 - 200	351	19	5	543	1.4	46.3
	201 - 300	126	2	1	24	1.6	47.2
	301 - 500	54	0	0	0	---	---
	All depths	775	56	73	21,662	1.3	43.5

All areas biomass, 95% confidence interval: 0 - 49,036 metric tons (t).

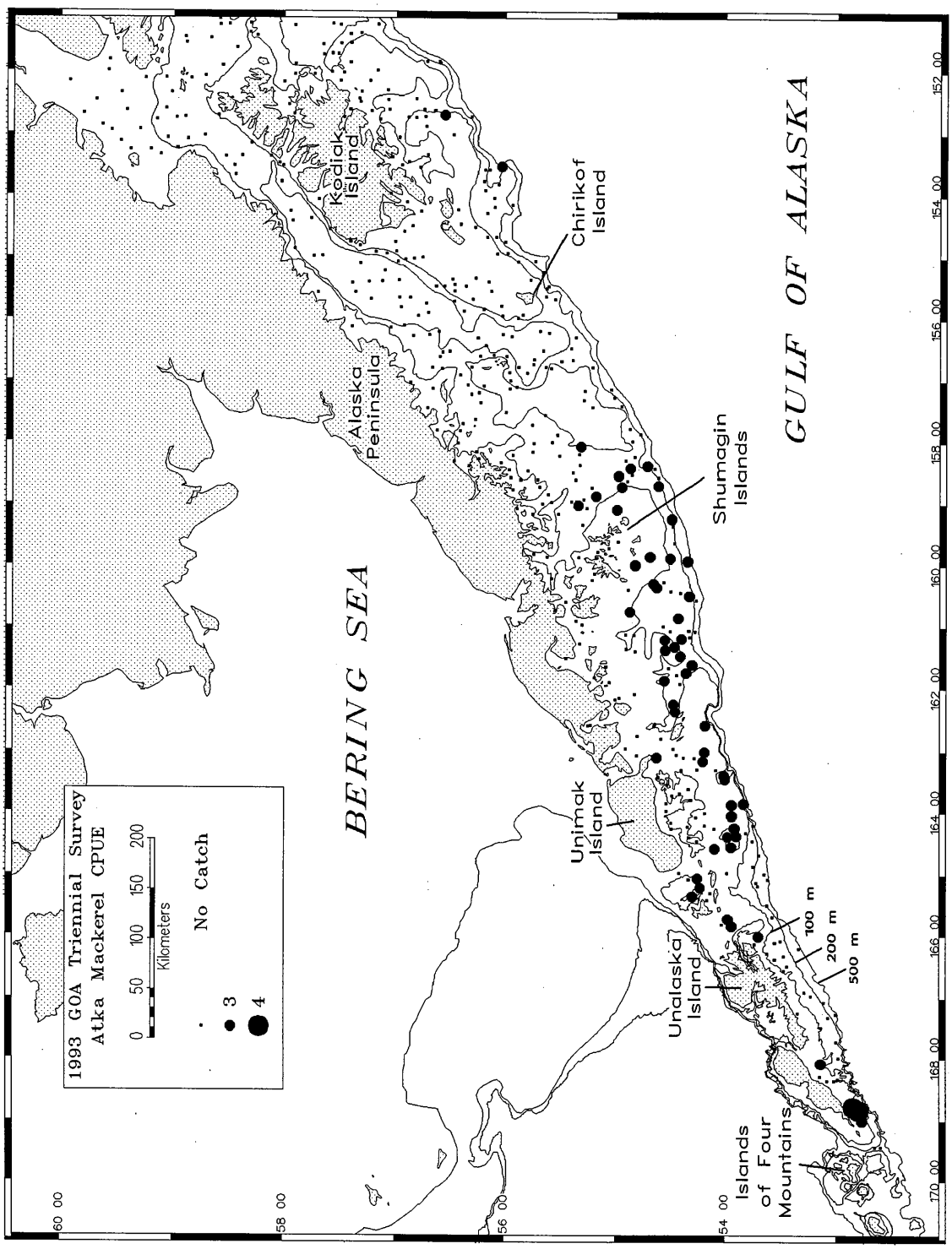


Figure 27.--Distribution and relative abundance of Atka mackerel from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

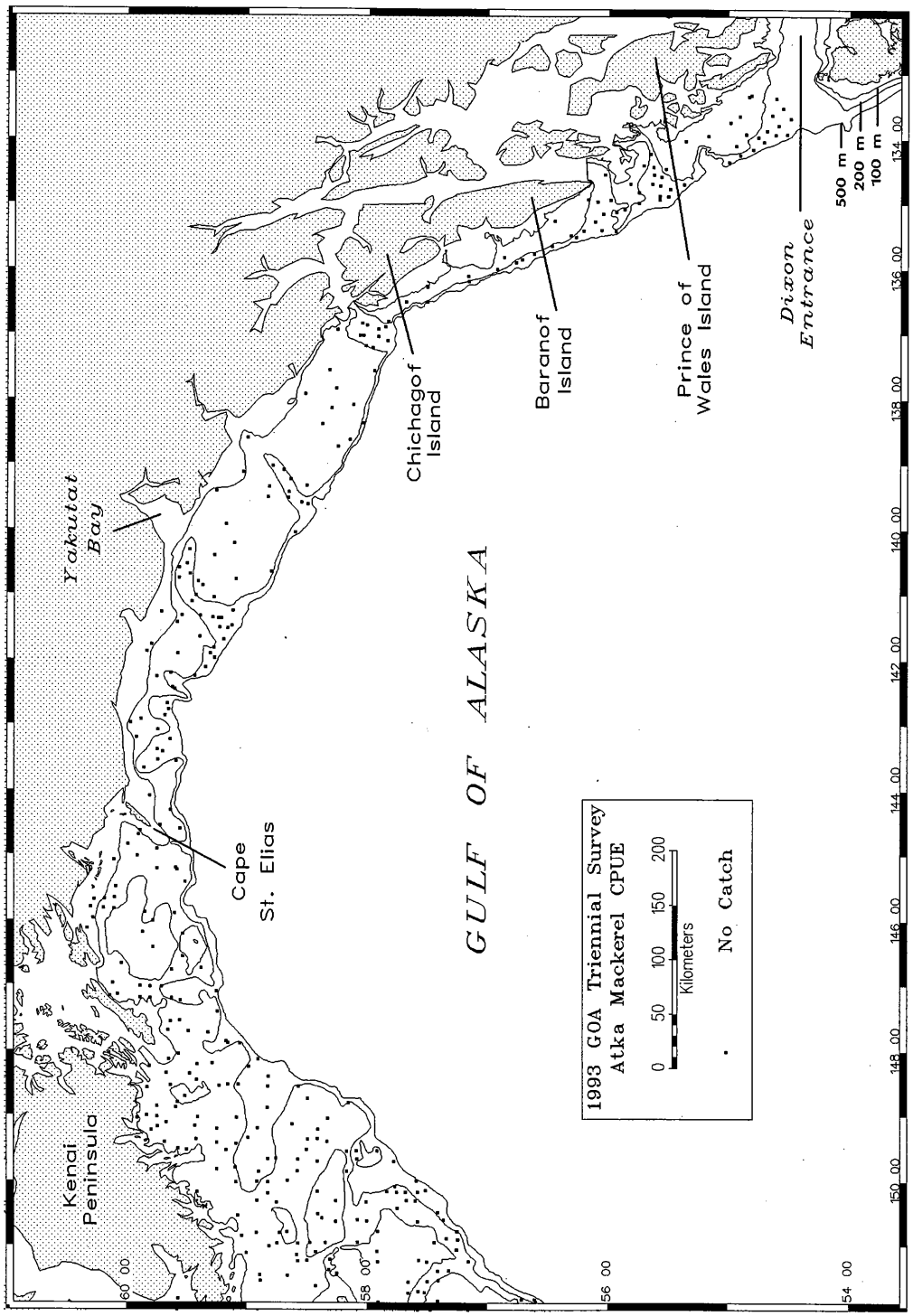


Figure 27.--Continued.

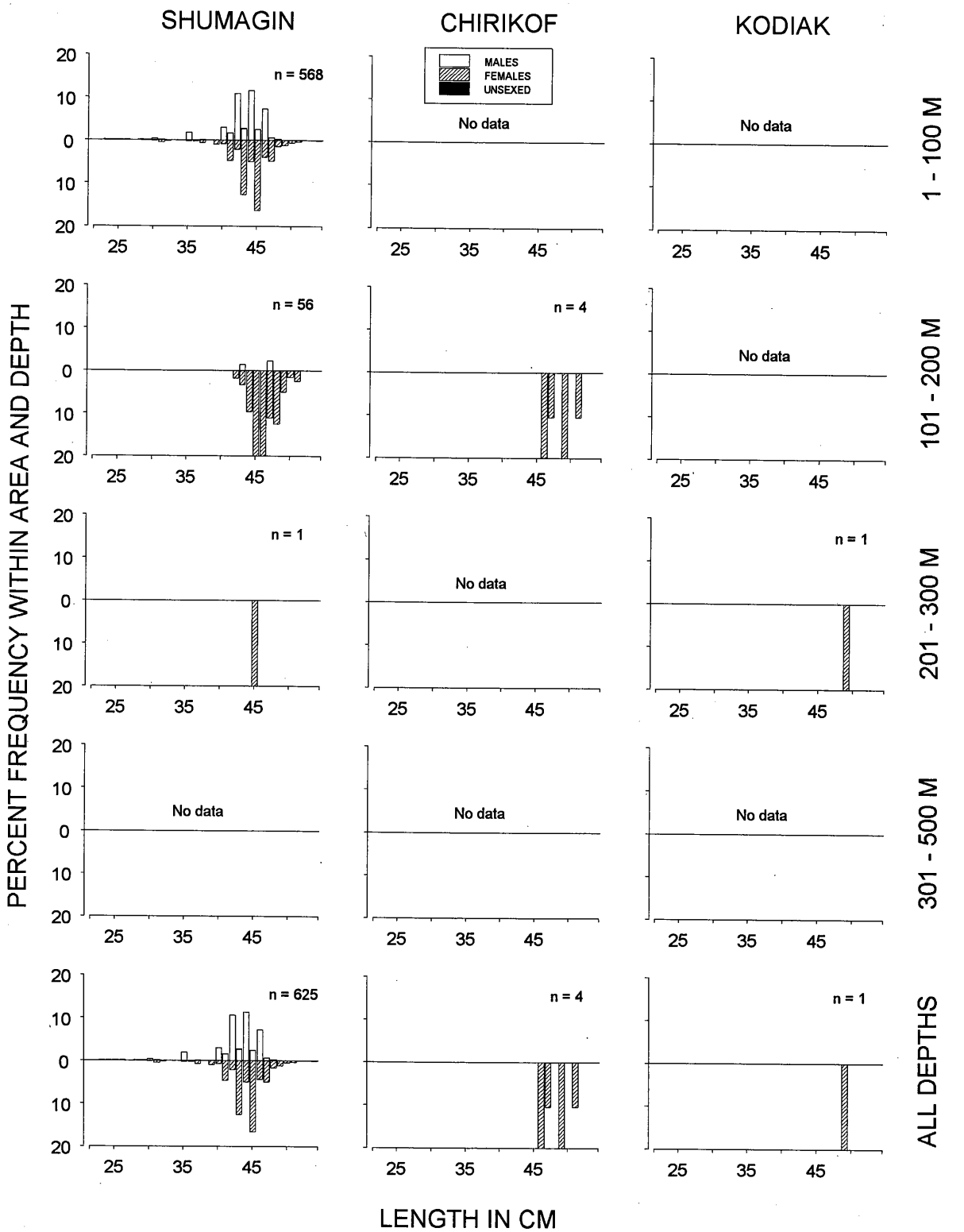


Figure 28.--Size composition of the estimated Atka mackerel population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

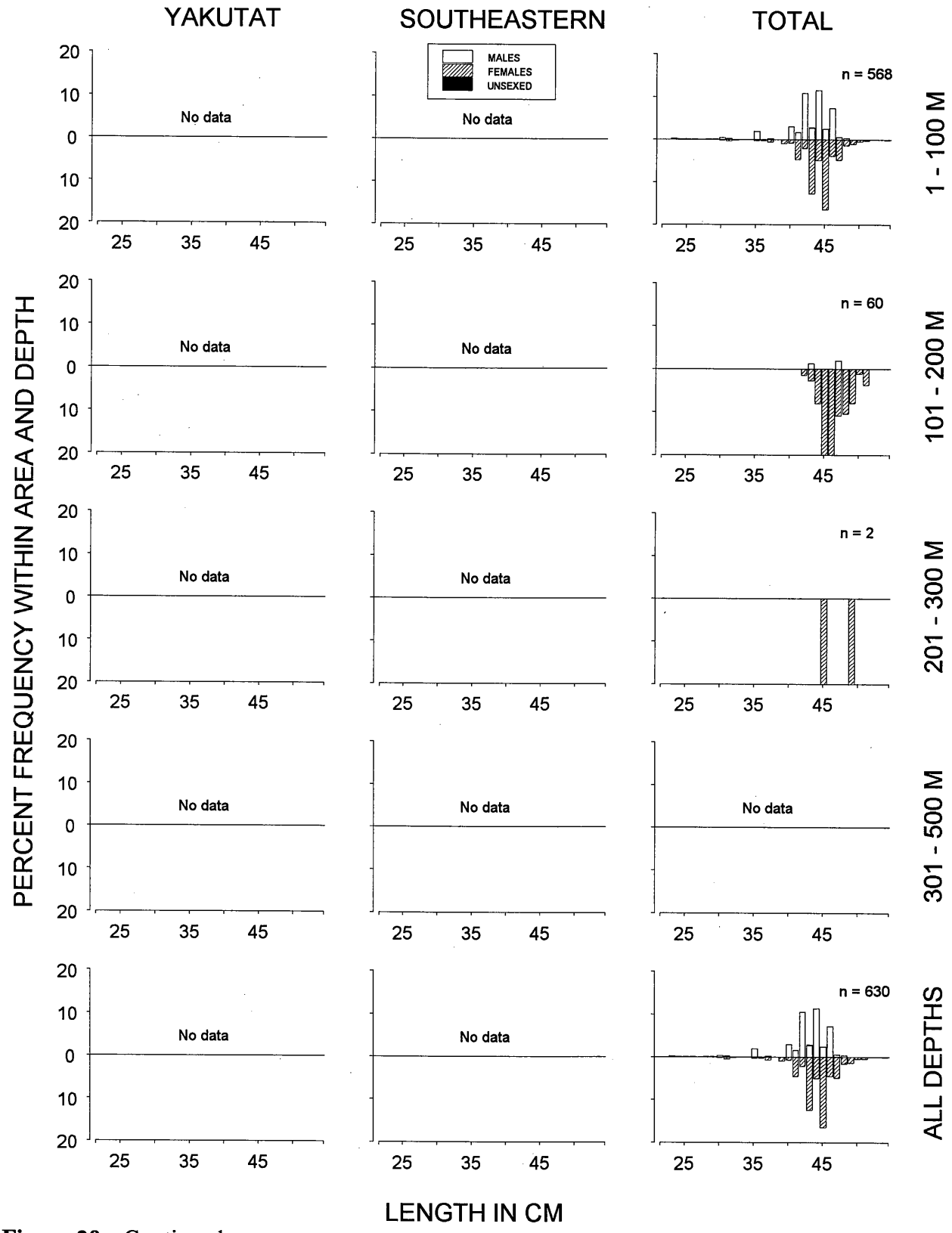


Figure 28.--Continued.

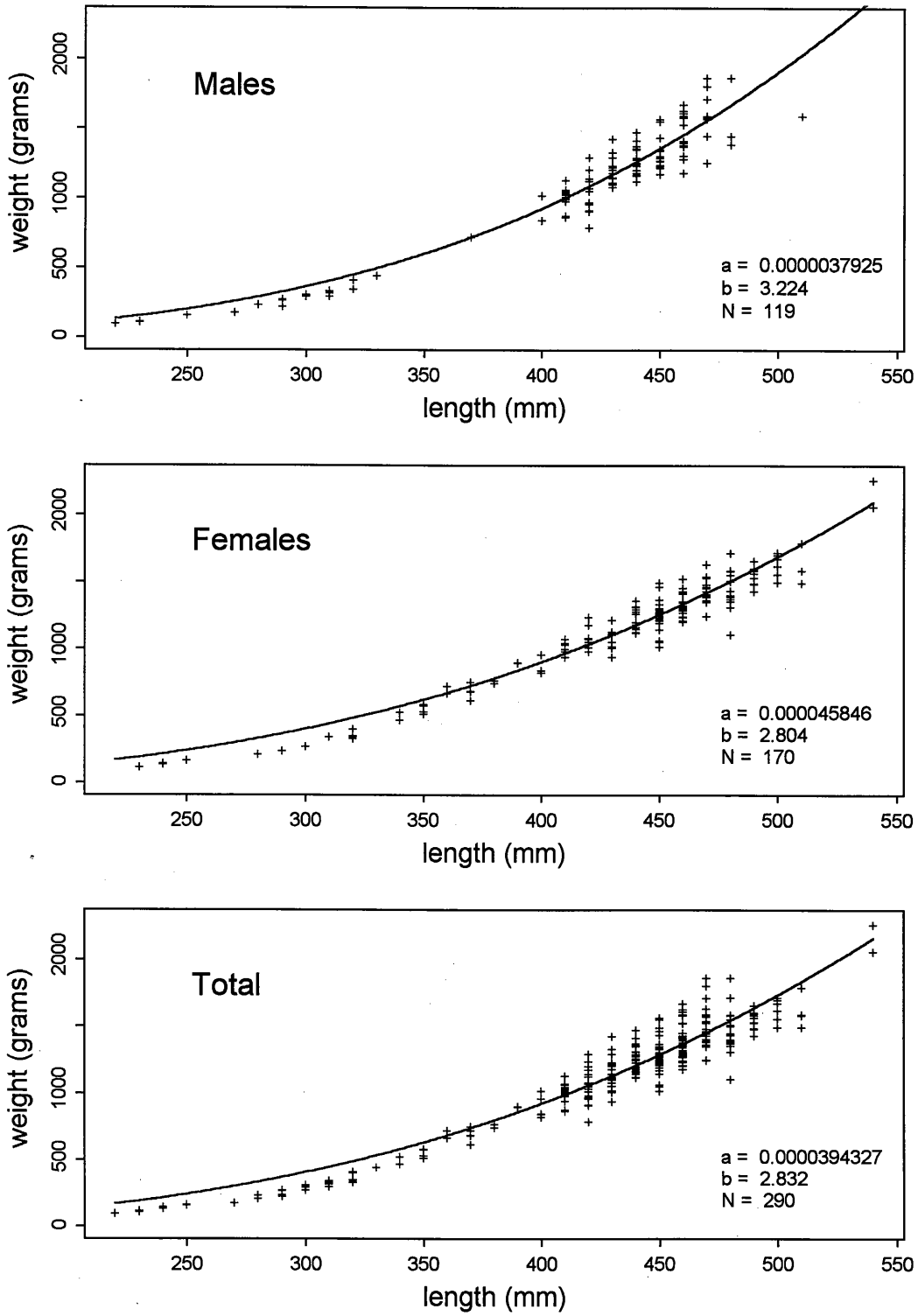


Figure 29.--Length-weight relationship for Atka mackerel specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 30.--Catch per unit effort by stratum for Atka mackerel sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
10	Fox Islands	24	11	2,278	19,629	0	46,976
110	Sanak Gully	20	8	83	353	0	797
13	Shumagin Bank	20	9	65	957	0	2,012
11	Davidson Bank	44	14	36	499	56	941
111	Shumagin Outer Shelf	25	4	11	91	0	188
122	Chirikof Outer Shelf	18	2	8	40	0	97
231	Kodiak Slope	4	1	7	12	0	49
112	West Shumagin Gully	6	1	6	14	0	49
210	Shumagin Slope	8	1	5	13	0	42
120	East Shumagin Gully	39	4	4	46	0	96
31	Albatross Banks	33	1	1	10	0	31

Sablefish (Anoplopoma fimbria)

Sablefish were found throughout the survey area, particularly on the continental slope and in major gully areas at depths greater than 200 m (Fig. 30). Sablefish were taken in approximately 94% of the tows between 200 and 500 m, but in only about 11% of the tows less than 200 m (Table 31). One notable exception to this distribution pattern was seen in the Kodiak INPFC area between 101 and 200 m where 82% of the tows contained sablefish. About 38% of the gulf-wide biomass was estimated to be in this area-depth. Since the depth range of this species extends to greater than 1,000 m, the estimates of biomass are only for that portion of the population that inhabits the continental shelf and upper slope to 500 m. CPUEs generally increased with depth throughout the survey, except in the Kodiak and Shumagin INPFC areas where sablefish CPUEs were highest between 201 and 300 m. The highest stratum mean CPUE was estimated to be in the Chirikof Slope area, while the highest biomass stratum was Portlock Flats, south of the Kenai Peninsula (Table 32). Sablefish size generally increased with depth (Fig. 31). The largest fish on the average came from the 301-500 m depth range in the Yakutat and Southeastern INPFC areas.

Table 31.--Number of survey hauls, hauls containing sablefish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	6	3	111	0.8	43.6
	101 - 200	51	16	650	9,450	1.9	56.8
	201 - 300	8	7	1,436	3,931	1.6	54.8
	301 - 500	6	6	978	2,473	2.3	59.3
	All depths	171	35	249	15,966	1.9	56.3
Chirikof	1 - 100	54	3	1	34	0.7	53.0
	101 - 200	81	30	152	3,610	1.8	56.4
	201 - 300	31	28	1,878	21,598	3.0	63.5
	301 - 500	6	6	6,048	9,874	3.2	65.8
	All depths	172	67	553	35,116	2.8	62.9
Kodiak	1 - 100	68	10	624	24,868	1.4	52.1
	101 - 200	134	110	2,250	97,164	1.8	55.0
	201 - 300	28	27	3,121	36,035	2.6	62.9
	301 - 500	10	8	654	1,936	2.1	58.9
	All depths	240	155	1,641	160,003	1.9	55.7
Yakutat	1 - 100	16	8	82	1,330	1.0	43.8
	101 - 200	61	44	174	4,987	1.4	49.6
	201 - 300	29	29	3,015	14,697	3.5	68.8
	301 - 500	18	18	3,433	10,173	3.1	68.2
	All depths	124	99	592	31,187	2.5	60.1
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	9	79	783	1.7	---
	201 - 300	30	28	273	1,375	1.5	---
	301 - 500	14	13	3,268	9,427	3.2	68.5
	All depths	68	50	651	11,585	2.7	68.5
All areas	1 - 100	244	27	207	26,343	1.3	51.4
	101 - 200	351	209	967	115,995	1.8	54.9
	201 - 300	126	119	2,175	77,637	2.7	63.2
	301 - 500	54	51	2,613	33,883	3.0	65.8
	All depths	775	406	859	253,857	2.1	57.2

All areas biomass, 95% confidence interval: 173,423 - 334,292 metric tons (t).

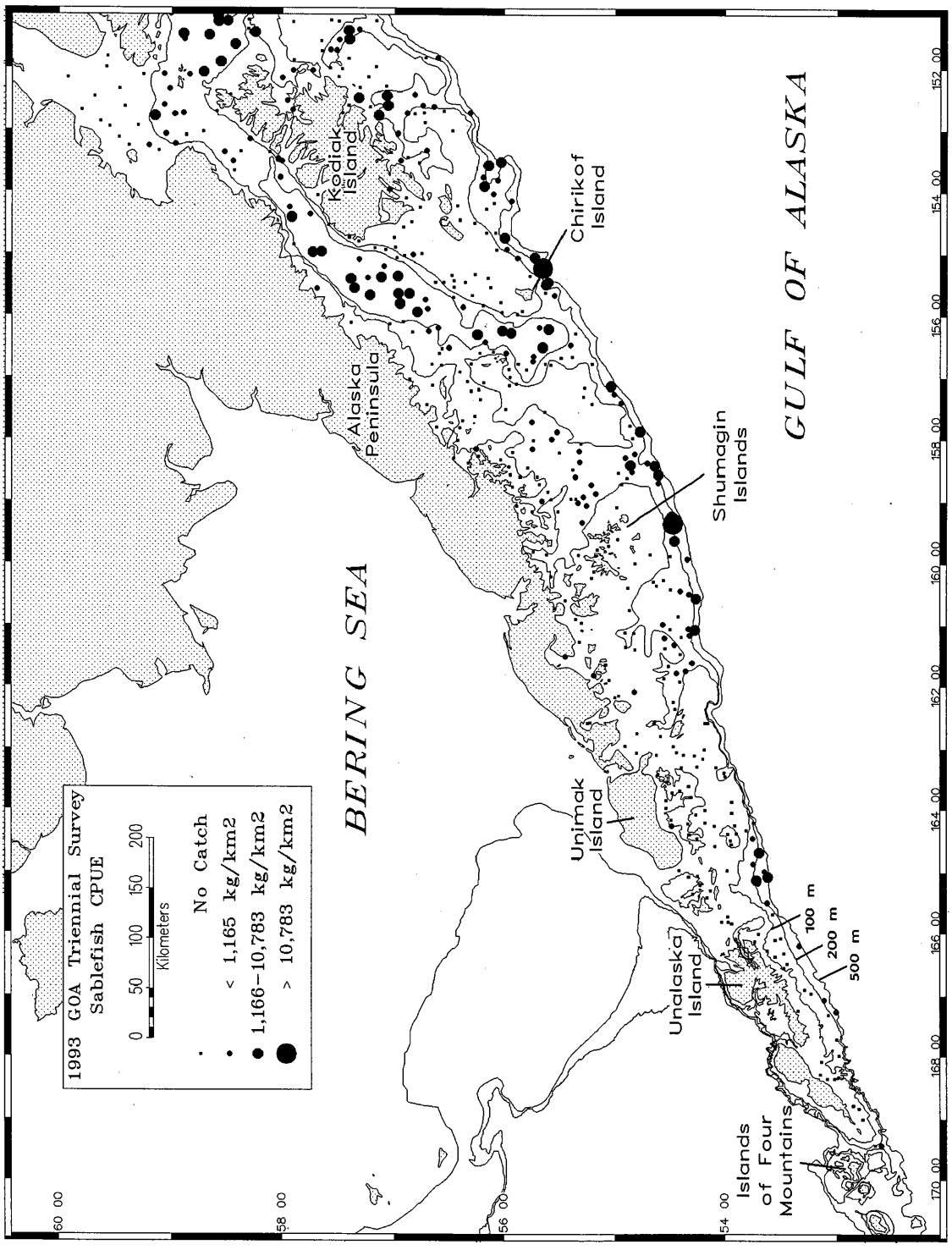


Figure 30.--Distribution and relative abundance of sablefish from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

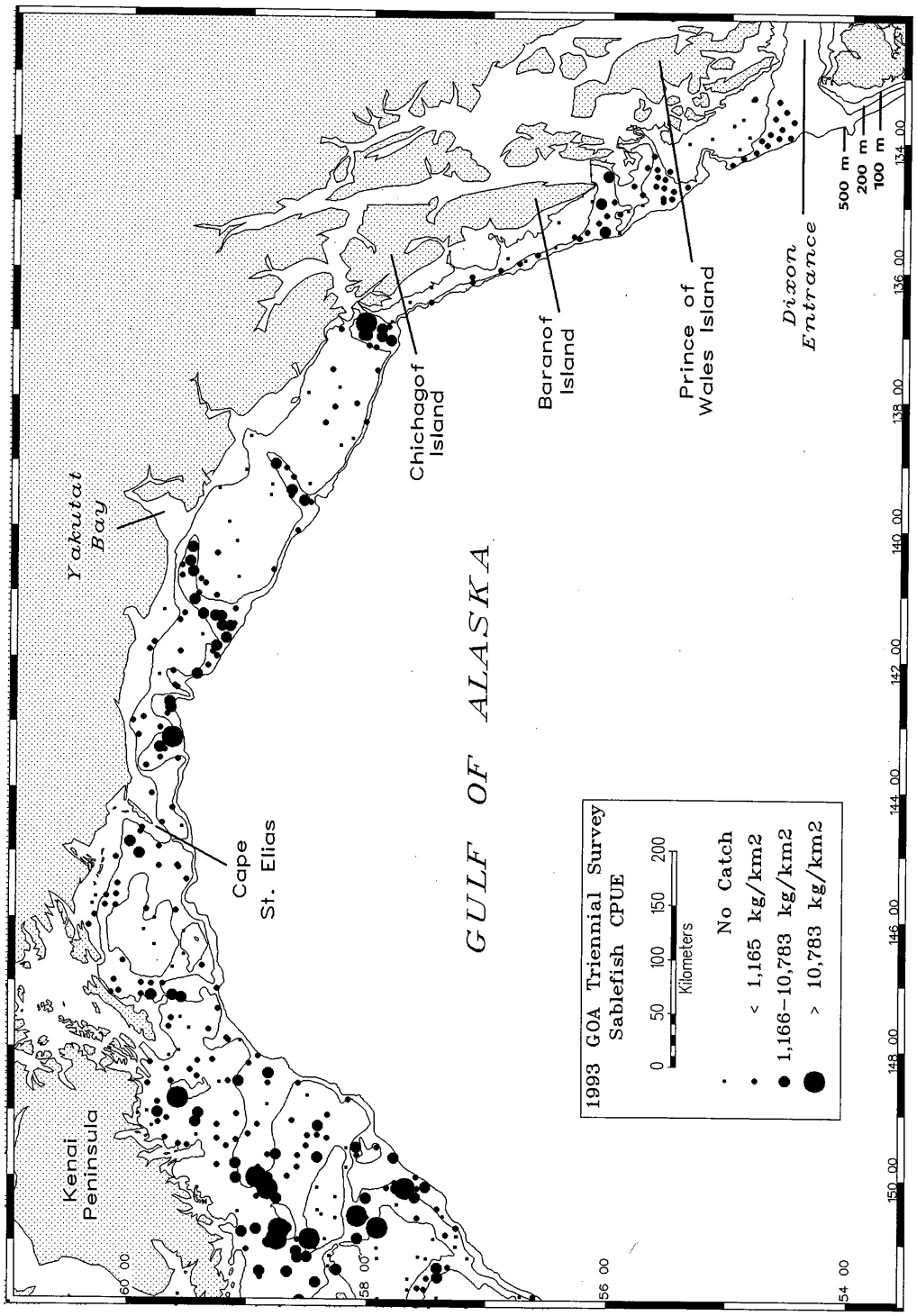


Figure 30.--Continued.

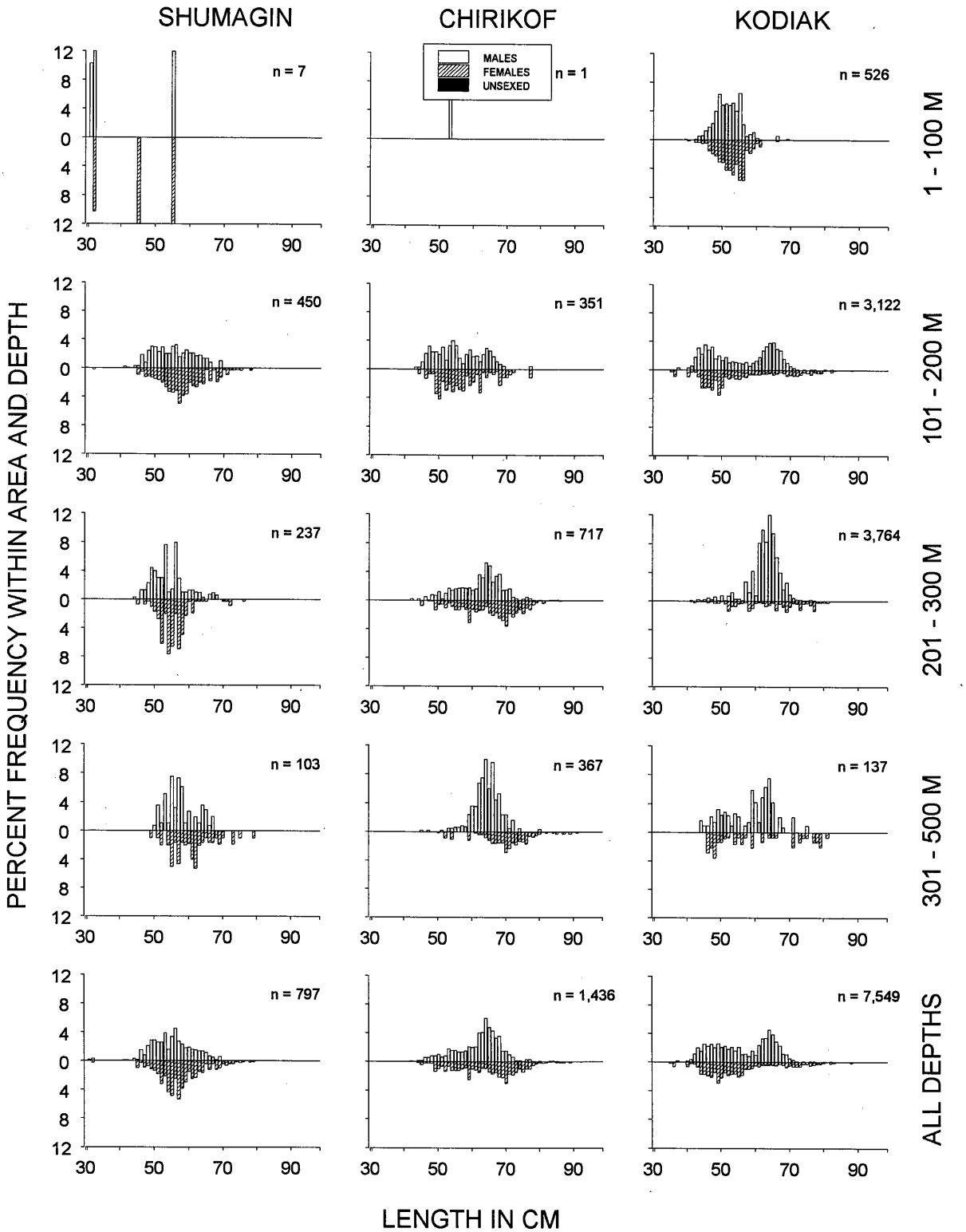


Figure 31.--Size composition of the estimated sablefish population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

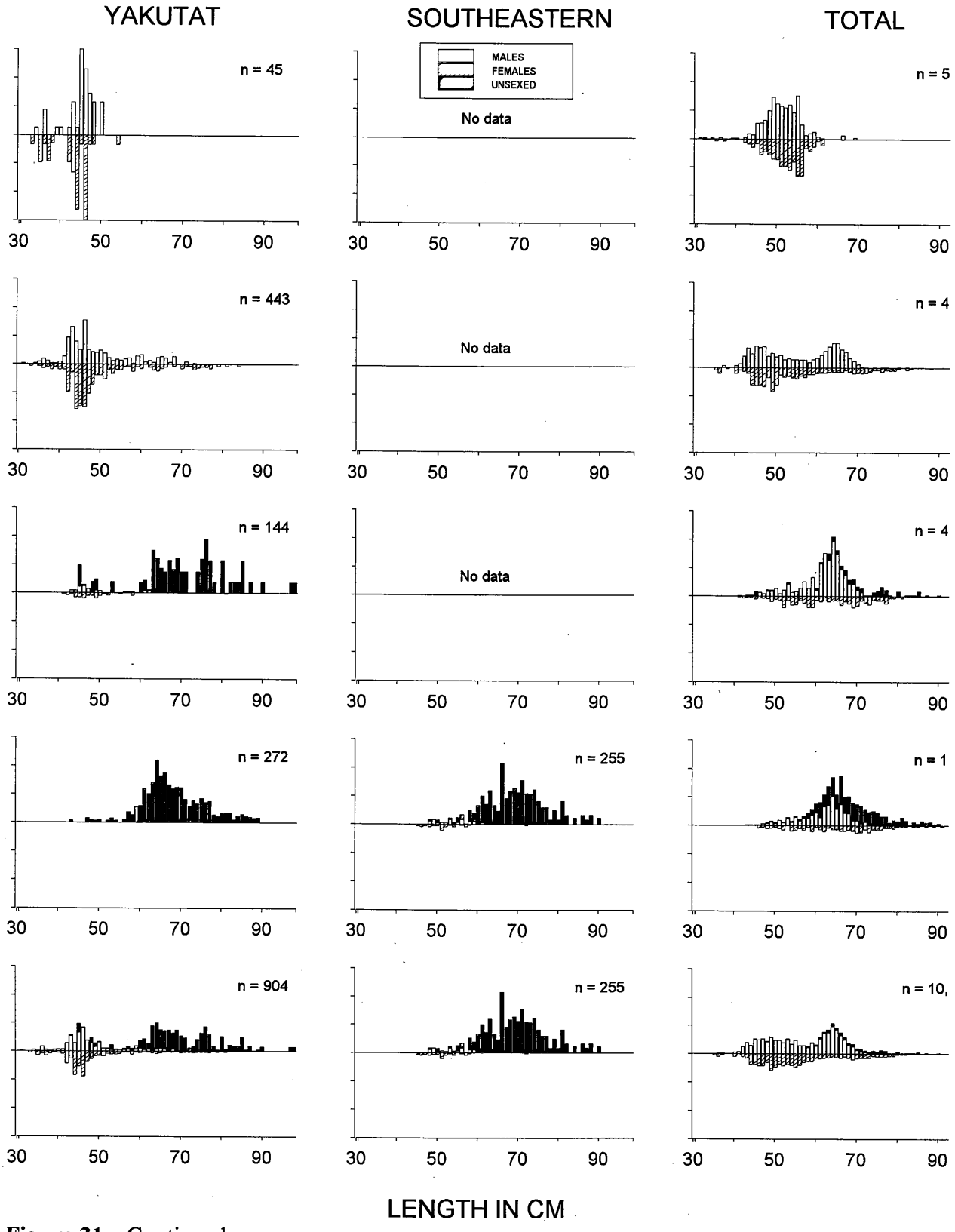


Figure 31.--Continued.

Table 32.--Catch per unit effort by stratum for sablefish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
320	Chirikof Slope	6	6	6,048	9,874	1,736	18,012
131	Portlock Flats	22	20	4,629	33,884	2,365	65,402
350	Southeastern Deep Gullies	13	13	4,543	9,427	0	21,124
230	Kenai Gullies	19	18	4,238	28,523	0	75,184
340	Yakutat Deep Gullies	15	15	3,891	6,766	3,544	9,988
240	Yakutat Gullies	18	18	3,754	13,508	0	33,948
341	Yakutat Slope	3	3	2,783	3,407	0	10,174
221	Chirikof Slope	4	4	2,594	3,977	0	9,141
133	Kenai Flats	41	32	2,190	26,287	0	67,026
130	Albatross Gullies	29	26	2,032	15,923	1,572	30,274
231	Kodiak Slope	4	4	1,910	3,105	0	8,828
220	Lower Shelikof Gully	27	24	1,768	17,621	9,288	25,955
134	Kodiak Outer Shelf	15	9	1,685	8,552	0	18,327
31	Albatross Banks	33	4	1,565	24,007	0	55,698
210	Shumagin Slope	8	7	1,436	3,931	0	8,096
232	Upper Shelikof Gully	5	5	1,382	4,408	367	8,448
111	Shumagin Outer Shelf	25	10	1,148	9,223	0	20,193
132	Barren Islands	27	23	1,143	12,518	5,391	19,646
310	Shumagin Slope	6	6	978	2,473	767	4,179
241	Yakutat Slope	11	11	932	1,189	325	2,053
330	Kodiak Slope	10	8	654	1,936	827	3,045
140	Middleton Shelf	28	25	495	3,622	1,993	5,251
251	Prince of Wales Slope/Gullies	22	22	320	1,282	762	1,801
120	East Shumagin Gully	39	15	217	2,409	43	4,775
122	Chirikof Outer Shelf	18	10	195	974	218	1,729
150	Baranof-Chichagof Shelf	10	4	153	626	0	1,385
30	Albatross Shallows	11	3	131	799	0	1,970
112	West Shumagin Gully	6	3	91	207	0	507
250	Baranof-Chichagof Slope	8	6	90	94	20	168
41	Middleton Shallows	11	5	86	674	0	1,911
40	Yakutat Shallows	5	3	78	656	0	2,064
142	Yakutat Flats	12	5	69	581	0	1,186
143	Fairweather Shelf	11	6	67	506	0	1,020
141	Yakataga Shelf	10	8	52	279	102	456
121	Shelikof Edge	24	5	30	228	0	484
151	Prince of Wales Shelf	14	5	27	157	0	319
35	Northern Kodiak Shallows	6	2	17	40	0	105
13	Shumagin Bank	20	3	5	76	0	172
110	Sanak Gully	20	3	5	20	0	47
12	Lower Alaska Peninsula	18	2	2	16	0	45
20	Upper Alaska Peninsula	15	1	2	16	0	50
22	Chirikof Bank	31	2	2	18	0	45
32	Lower Cook Inlet	15	1	2	22	0	70
11	Davidson Bank	44	1	1	19	0	57

Pacific ocean perch (Sebastes alutus)

Pacific ocean perch (POP) was the most abundant rockfish and the fourth most abundant groundfish encountered during the survey (Table 2). The estimated biomass of POP was more than four times greater than that of the next most abundant rockfish, northern rockfish. POP was the most abundant groundfish in the Southeastern INPFC area, and the third most abundant groundfish species in both the Chirikof and Yakutat INPFC areas. POP were found in the highest densities on the upper slope and outer shelf areas and in the deep gully strata (Table 33; Fig. 32). POP generally showed a patchy distribution, even in areas of relatively high abundance, which explains the very large confidence intervals in Table 34. For example, in several strata with high mean catch rates, including Kodiak Slope (201-300 m), Shumagin Slope (201-300 m) and Prince of Wales Shelf (101-200 m), one large POP catch (CPUE > 89,000 kg/km^2) was very influential in the estimated biomass for these strata. Mean fish size generally increased with depth, and small fish (< 20 cm FL) were found primarily in water less than 100 m (Fig. 33). The length-weight relationship for POP specimens collected during the survey is depicted in Figure 34.

Table 33.--Number of survey hauls, hauls containing Pacific ocean perch, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	21	80	3,556	0.3	26.7
	101 - 200	51	16	2,181	31,704	0.4	30.9
	201 - 300	8	7	14,805	40,522	0.6	32.2
	301 - 500	6	2	35	89	0.8	34.8
	All depths	171	46	1,182	75,872	0.5	31.2
Chirikof	1 - 100	54	6	76	2,019	0.1	20.4
	101 - 200	81	38	4,143	98,385	0.5	33.3
	201 - 300	31	8	123	1,417	0.7	35.8
	301 - 500	6	4	652	1,065	0.6	34.4
	All depths	172	56	1,621	102,886	0.5	32.5
Kodiak	1 - 100	68	6	34	1,344	0.2	24.2
	101 - 200	134	75	2,400	103,625	0.6	35.4
	201 - 300	28	17	4,155	47,970	0.7	35.0
	301 - 500	10	4	465	1,378	0.6	34.8
	All depths	240	102	1,582	154,317	0.6	35.0
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	13	143	4,099	0.3	26.8
	201 - 300	29	26	4,149	20,221	0.5	33.1
	301 - 500	18	10	3,131	9,278	0.8	37.1
	All depths	124	49	637	33,598	0.5	32.4
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	11	6,637	65,518	0.7	37.5
	201 - 300	30	29	2,956	14,882	0.5	32.8
	301 - 500	14	10	3,103	8,952	0.8	38.1
	All depths	68	50	5,022	89,351	0.7	36.5
All areas	1 - 100	244	33	54	6,919	0.2	23.3
	101 - 200	351	153	2,528	303,332	0.6	34.1
	201 - 300	126	87	3,503	125,012	0.6	33.5
	301 - 500	54	30	1,601	20,761	0.8	37.1
	All depths	775	303	1,542	456,024	0.6	33.6

All areas biomass, 95% confidence interval: 253,774 - 658,274 metric tons (t).

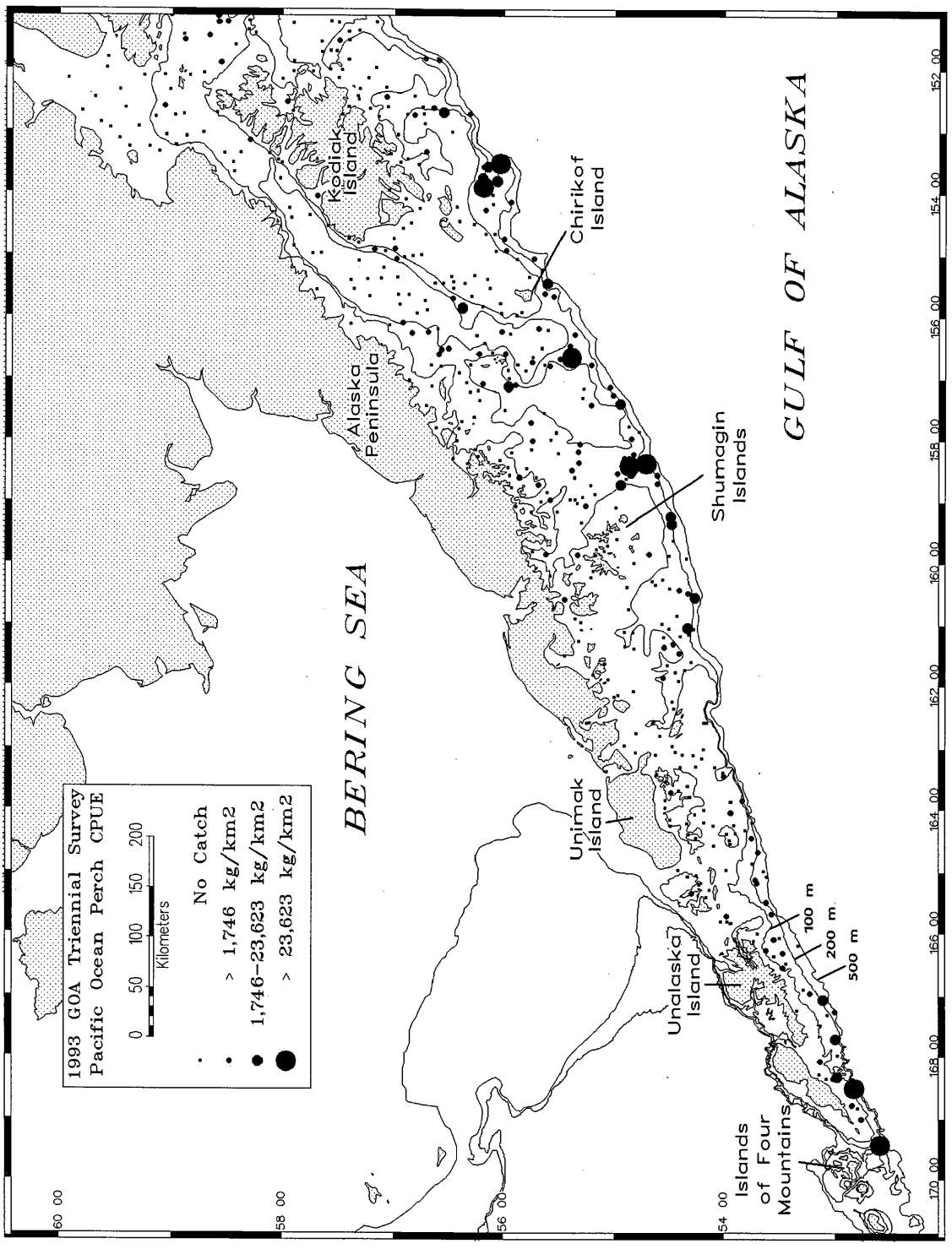


Figure 32.--Distribution and relative abundance of Pacific ocean perch from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

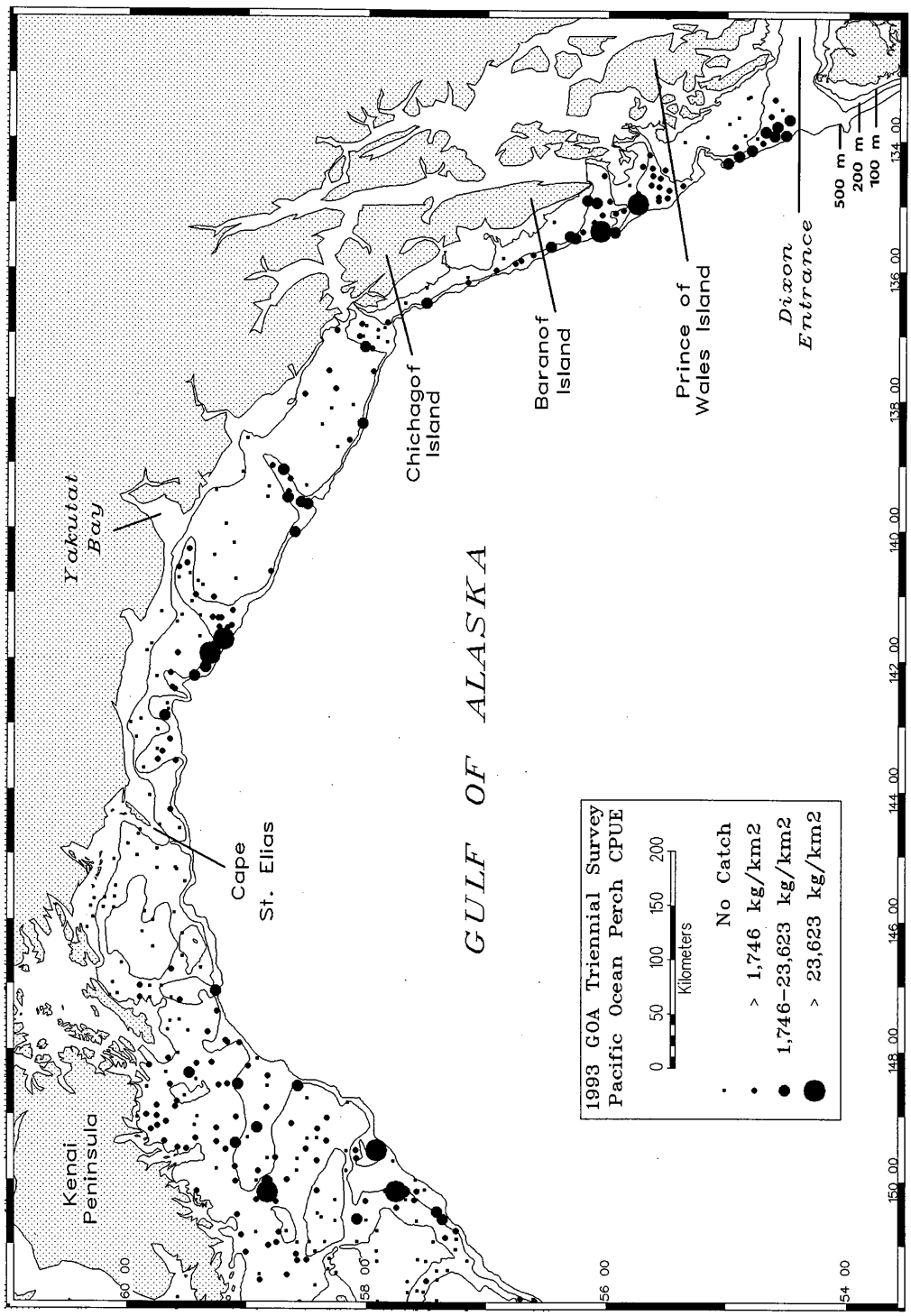


Figure 32.--Continued.

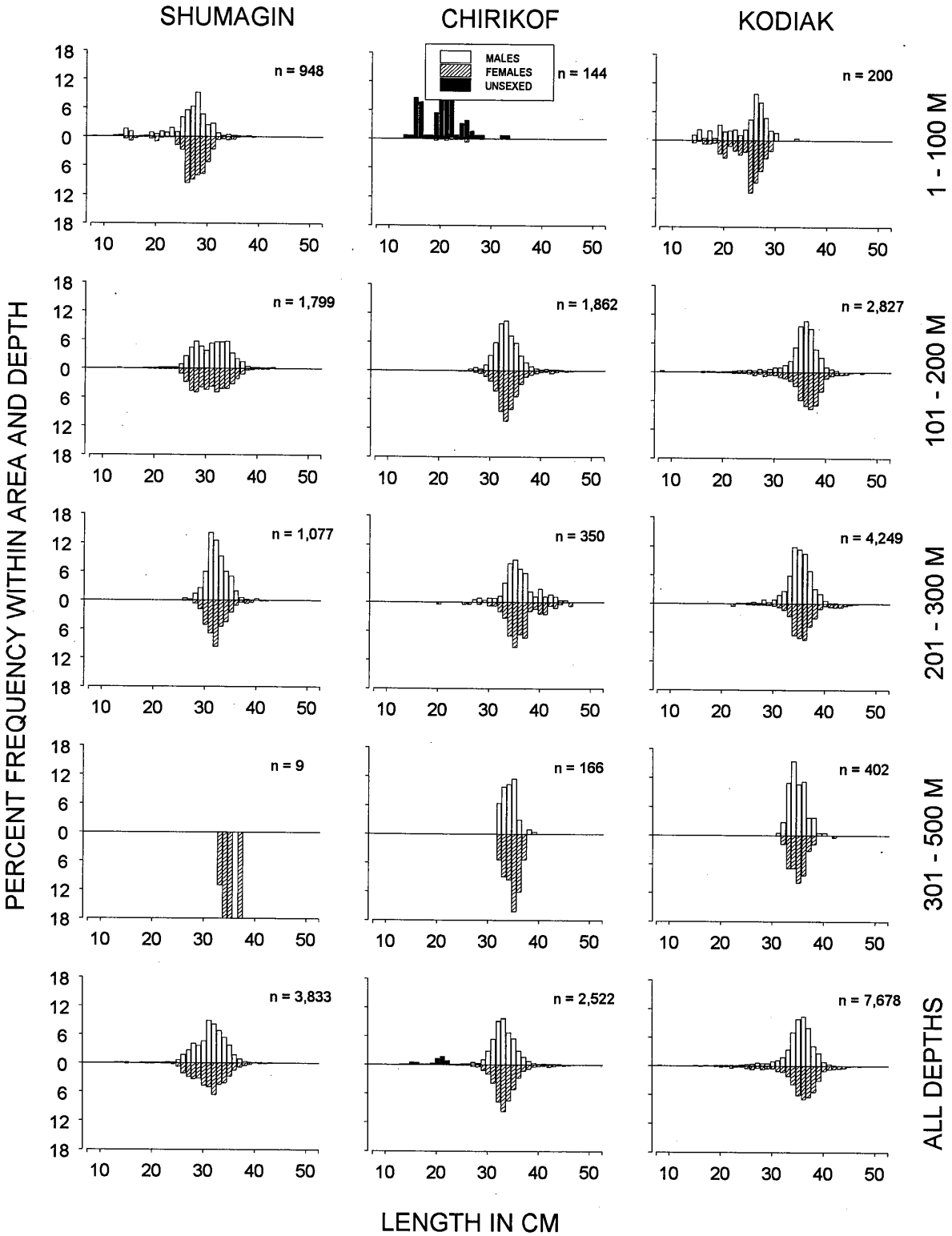


Figure 33.--Size composition of the estimated Pacific ocean perch population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

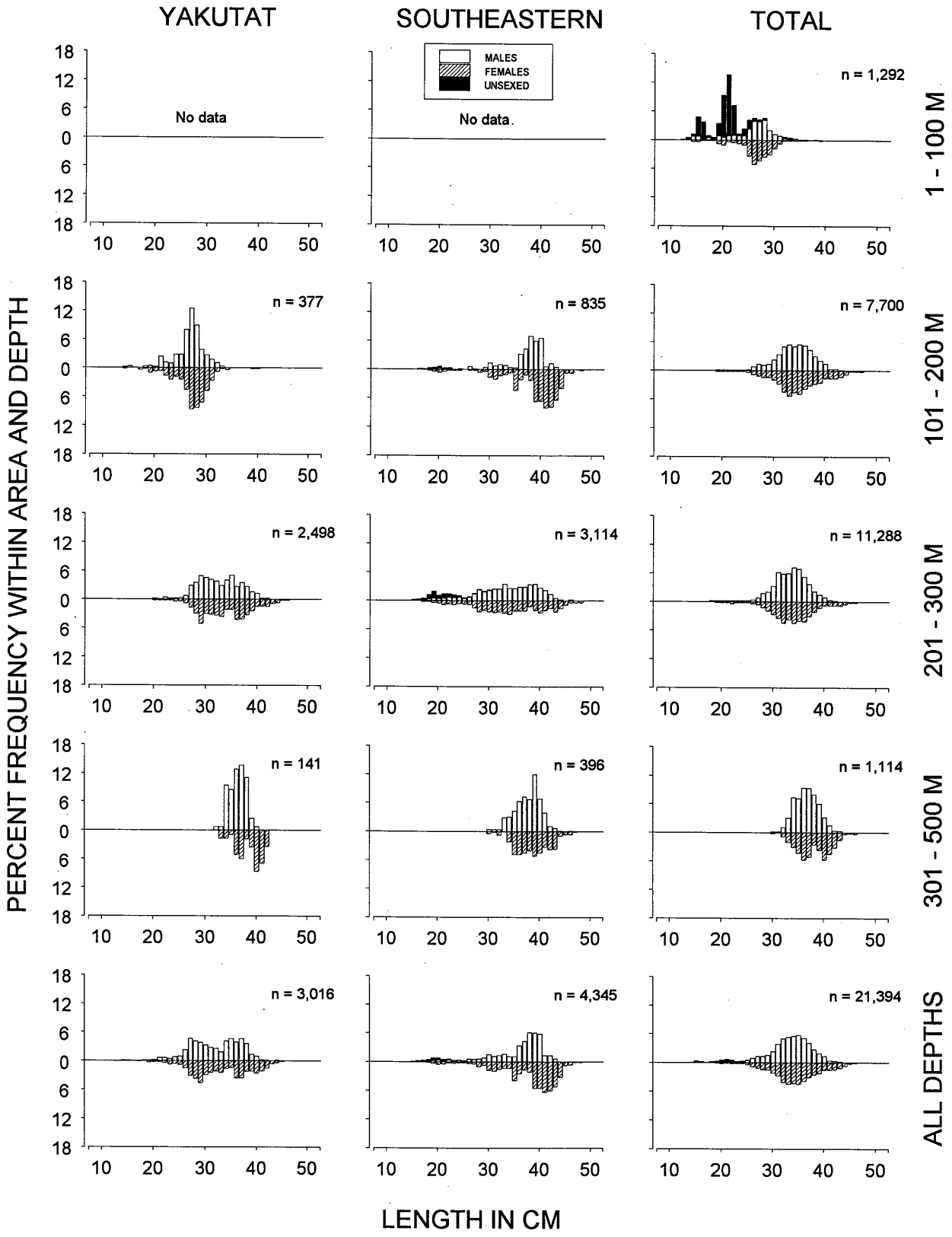


Figure 33.--Continued.

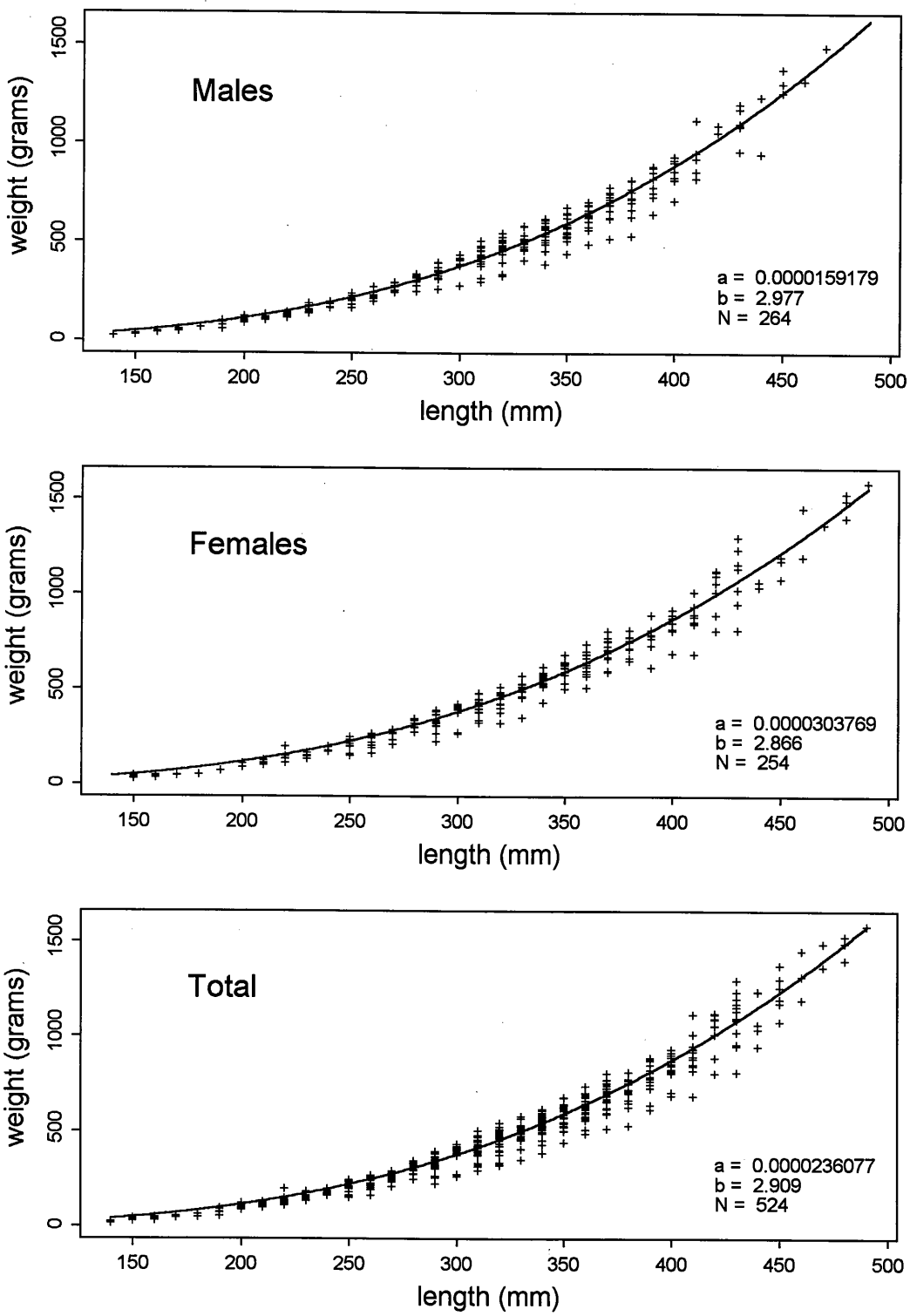


Figure 34.--Length-weight relationship for Pacific ocean perch specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 34.--Catch per unit effort by stratum for Pacific ocean perch sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
231	Kodiak Slope	4	4	24,471	39,784	0	151,734
210	Shumagin Slope	8	7	14,805	40,522	0	119,051
241	Yakutat Slope	11	11	11,654	14,869	2,663	27,075
134	Kodiak Outer Shelf	15	12	10,766	54,651	0	110,067
151	Prince of Wales Shelf	14	6	10,097	58,250	0	181,944
122	Chirikof Outer Shelf	18	13	8,199	40,945	0	114,980
341	Yakutat Slope	3	1	7,516	9,203	0	48,803
121	Shelikof Edge	24	14	4,435	34,025	0	95,166
111	Shumagin Outer Shelf	25	13	3,944	31,698	0	73,253
130	Albatross Gullies	29	9	3,306	25,911	0	76,802
350	Southeastern Deep Gullies	13	9	3,262	6,769	0	19,957
251	Prince of Wales Slope/Gullies	22	21	3,132	12,526	5,008	20,045
351	Southeastern Slope	1	1	2,696	2,182	0	0
131	Portlock Flats	22	14	2,596	19,000	0	48,959
250	Baranof-Chichagof Slope	8	8	2,274	2,355	311	4,400
120	East Shumagin Gully	39	11	2,113	23,415	0	62,574
150	Baranof-Chichagof Shelf	10	5	1,772	7,268	0	17,254
240	Yakutat Gullies	18	15	1,487	5,352	269	10,434
230	Kenai Gullies	19	13	1,217	8,186	0	17,368
221	Chirikof Slope	4	4	656	1,006	0	2,750
320	Chirikof Slope	6	4	652	1,065	0	2,797
143	Fairweather Shelf	11	6	506	3,842	0	10,238
330	Kodiak Slope	10	4	465	1,378	0	4,235
133	Kenai Flats	41	30	315	3,780	291	7,270
21	Semidi Bank	8	4	276	2,014	0	6,181
13	Shumagin Bank	20	6	213	3,117	0	9,516
31	Albatross Banks	33	3	87	1,329	0	3,940
340	Yakutat Deep Gullies	15	9	43	75	0	176
220	Lower Shelikof Gully	27	4	41	411	0	1,038
310	Shumagin Slope	6	2	35	89	0	296
141	Yakataga Shelf	10	2	31	166	0	539
132	Barren Islands	27	10	26	282	26	538
10	Fox Islands	24	9	20	172	0	349
11	Davidson Bank	44	4	19	259	0	739
142	Yakutat Flats	12	2	10	87	0	243
35	Northern Kodiak Shallows	6	1	3	7	0	23
112	West Shumagin Gully	6	2	2	5	0	12
12	Lower Alaska Peninsula	18	2	1	8	0	20
20	Upper Alaska Peninsula	15	1	1	5	0	16
33	Kenai Peninsula	3	1	1	6	0	32
140	Middleton Shelf	28	3	1	4	0	12
22	Chirikof Bank	31	1	0	0	0	2
30	Albatross Shallows	11	1	0	3	0	9

Northern rockfish (Sebastes polyspinus)

Northern rockfish were estimated to be the second most abundant rockfish in the survey area (Table 2). Very few, however, were captured east of the Kodiak INPFC area and none were caught in the Southeastern area (Table 35; Fig. 35). Approximately 79% of the northern rockfish biomass was concentrated in four strata, Chirikof Outer Shelf, Portlock Flats, Albatross Banks, and Shumagin Bank (about 14% of the survey area; Table 36). Similar to Pacific ocean perch, catches of northern rockfish were highly variable. Approximately 90% of the biomass in the stratum with the highest CPUE, the Chirikof Outer Shelf, was attributable to just one haul (Argosy, Haul 134), although northern rockfish were caught in about 89% of the tows in this stratum. Northern rockfish less than 30 cm FL were found almost exclusively in water less than 100 m deep, which explains the smaller average size of the fish in these areas (Fig. 36). The length-weight relationship for northern rockfish specimens collected during the survey is depicted in Figure 37.

Table 34.--Number of survey hauls, hauls with northern rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	17	287	12,747	0.6	33.9
	101 - 200	51	18	187	2,712	0.7	35.0
	201 - 300	8	5	68	187	0.6	34.4
	301 - 500	6	0	0	0	---	---
	All depths	171	40	244	15,646	0.6	34.0
Chirikof	1 - 100	54	7	68	1,799	0.4	29.2
	101 - 200	81	32	1,831	43,485	0.8	37.7
	201 - 300	31	9	24	276	0.6	36.2
	301 - 500	6	1	2	4	0.5	---
	All depths	172	49	718	45,563	0.8	37.1
Kodiak	1 - 100	68	8	436	17,354	0.5	35.8
	101 - 200	134	41	751	32,424	0.7	36.0
	201 - 300	28	5	11	123	0.6	36.0
	301 - 500	10	1	6	17	0.8	36.7
	All depths	240	55	512	49,918	0.6	35.9
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	2	1	15	0.7	---
	201 - 300	29	2	3	13	0.7	---
	301 - 500	18	0	0	0	---	---
	All depths	124	4	1	28	0.7	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	0	0	0	---	---
	All depths	68	0	0	0	---	---
All areas	1 - 100	244	32	251	31,901	0.6	34.6
	101 - 200	351	93	655	78,637	0.7	36.9
	201 - 300	126	21	17	598	0.6	35.6
	301 - 500	54	2	2	20	0.7	36.7
	All depths	775	148	376	111,156	0.7	36.1

All areas biomass, 95% confidence interval: 29,515 - 192,796 metric tons (t).

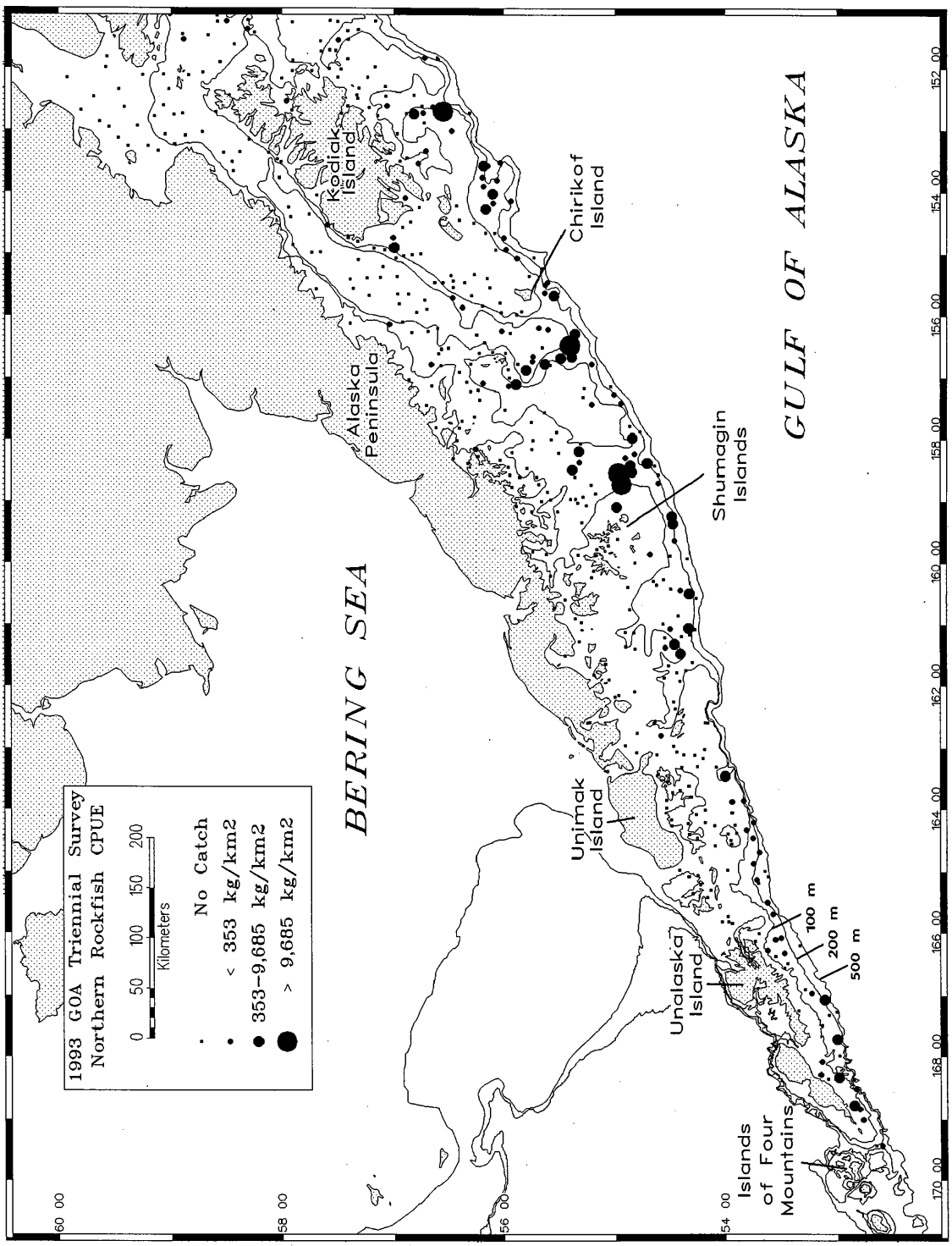


Figure 35.--Distribution and relative abundance of northern rockfish from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

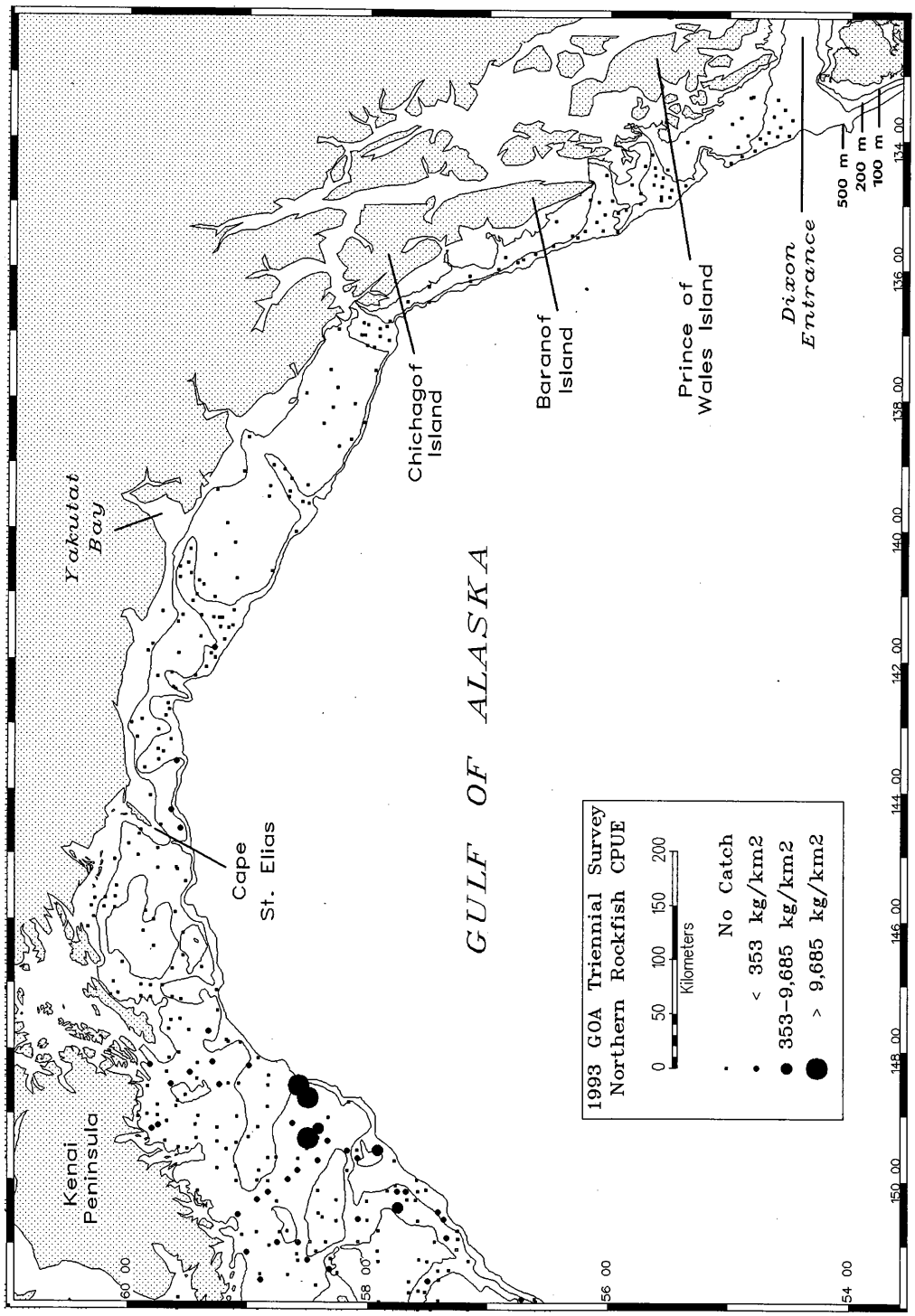


Figure 35.--Continued.

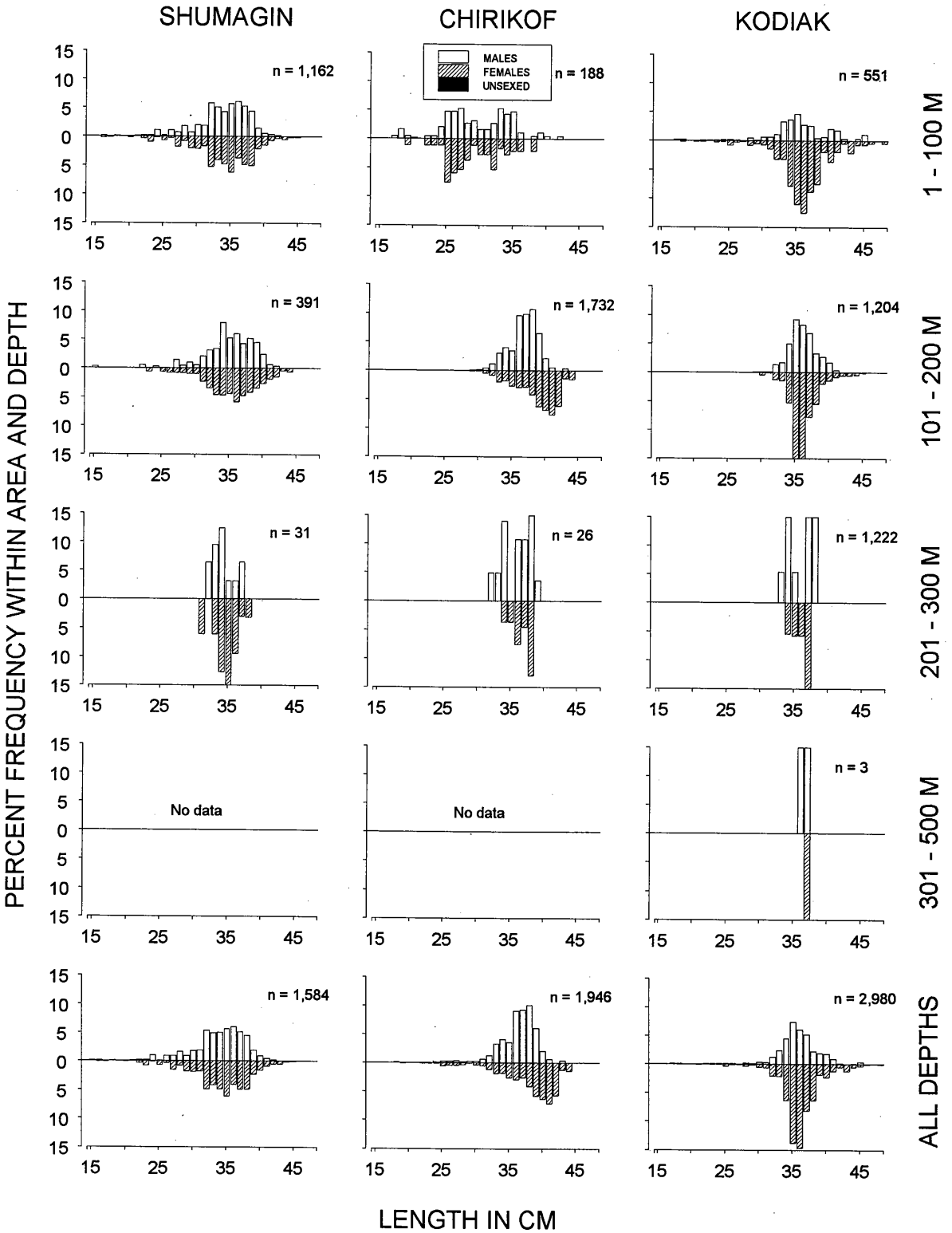


Figure 36.--Size composition of the estimated northern rockfish population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

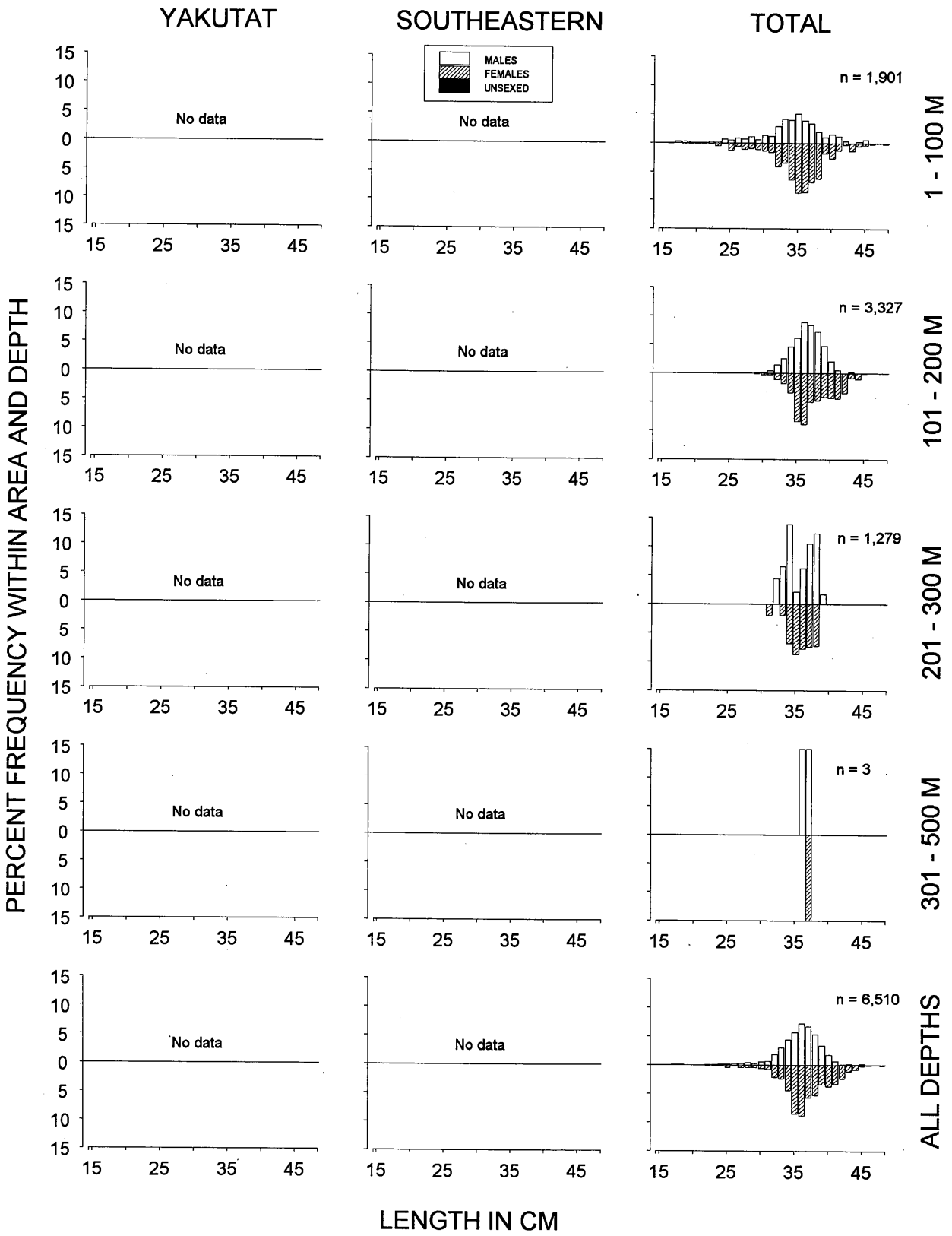


Figure 36.--Continued.

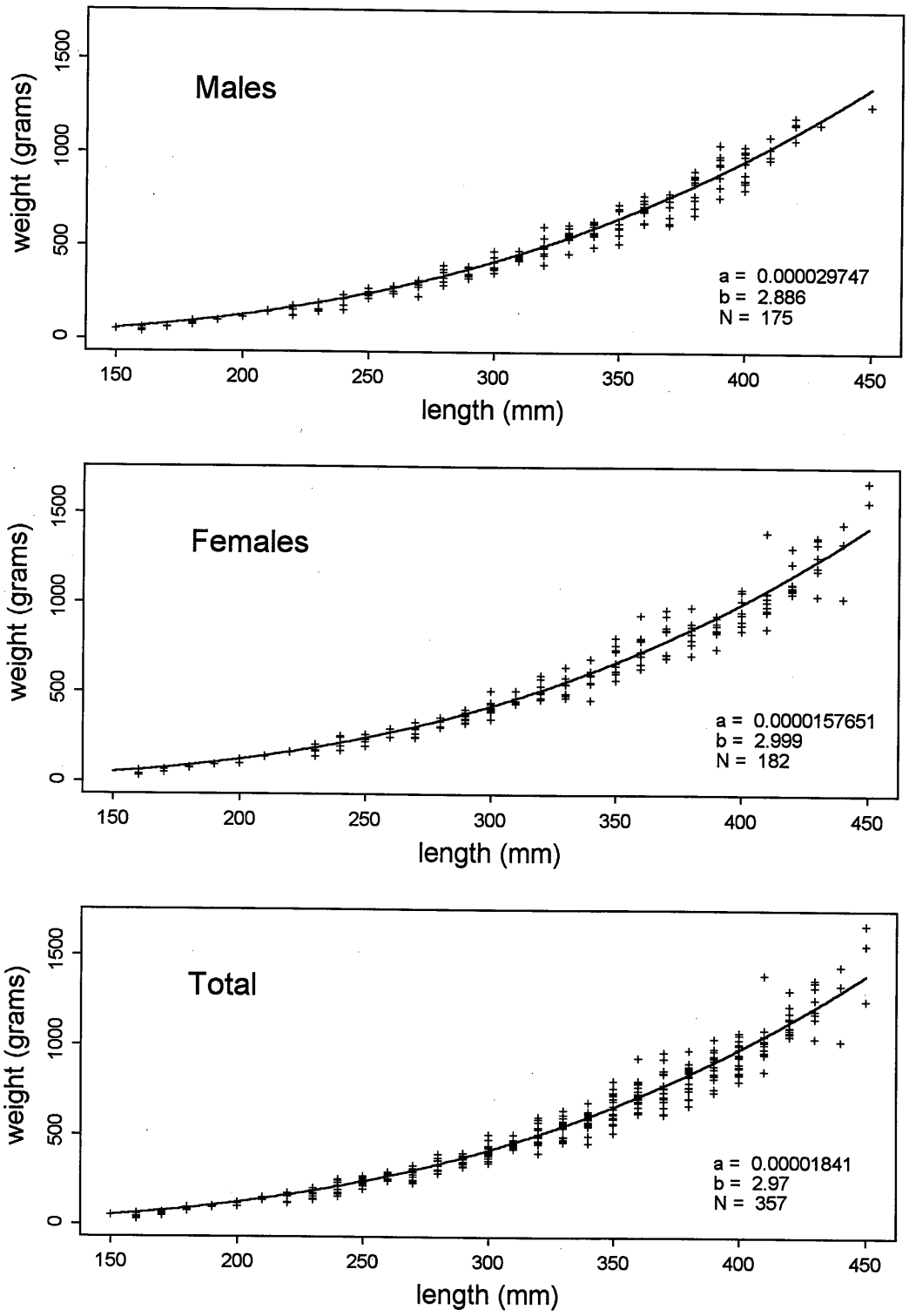


Figure 37.--Length-weight relationship for northern rockfish specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 36.--Catch per unit effort by stratum for northern rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
122	Chirikof Outer Shelf	18	16	6,678	33,349	0	96,014
131	Portlock Flats	22	13	3,534	25,868	0	66,226
31	Albatross Banks	33	4	1,124	17,240	0	50,795
134	Kodiak Outer Shelf	15	9	1,021	5,183	0	13,852
13	Shumagin Bank	20	6	780	11,403	0	29,476
120	East Shumagin Gully	39	9	543	6,017	0	12,991
121	Shelikof Edge	24	7	537	4,119	0	10,254
111	Shumagin Outer Shelf	25	17	336	2,699	261	5,138
22	Chirikof Bank	31	3	157	1,727	0	5,247
130	Albatross Gullies	29	7	154	1,203	0	3,293
10	Fox Islands	24	6	86	745	0	1,910
231	Kodiak Slope	4	3	70	114	0	297
210	Shumagin Slope	8	5	68	187	0	536
221	Chirikof Slope	4	3	59	91	0	221
11	Davidson Bank	44	5	44	600	0	1,529
30	Albatross Shallows	11	3	19	113	0	320
220	Lower Shelikof Gully	27	6	19	185	0	463
133	Kenai Flats	41	9	12	149	4	293
241	Yakutat Slope	11	2	10	13	0	31
21	Semidi Bank	8	3	9	66	0	145
330	Kodiak Slope	10	1	6	17	0	54
110	Sanak Gully	20	1	3	13	0	39
141	Yakataga Shelf	10	1	3	14	0	45
132	Barren Islands	27	3	2	21	0	46
320	Chirikof Slope	6	1	2	4	0	13
20	Upper Alaska Peninsula	15	1	1	6	0	20
230	Kenai Gullies	19	2	1	9	0	23
35	Northern Kodiak Shallows	6	1	0	1	0	3
140	Middleton Shelf	28	1	0	2	0	5

Rougheye rockfish (Sebastes aleutianus)

Rougheye rockfish were estimated to be the third most abundant rockfish in the survey area (Table 2). The highest CPUEs for rougheye rockfish were found on the continental slope in the Shumagin, Kodiak, and Chirikof INPFC areas (Table 37), and in the Kenai Flats stratum (Table 38; Fig. 38). These four strata, comprising about 6% of the survey area, were estimated to contain about 58% of the rougheye rockfish biomass. Rougheye rockfish were also consistently found in Shelikof Gully stations, although no large catches were recorded (Fig. 38). Fish sizes generally increased with depth (Table 37; Fig. 39). In the Shumagin, Chirikof, and Kodiak INPFC areas, length modes for both males and females were readily apparent around 40 cm FL for fish captured between 101 and 200 m and around 45 cm FL at capture depths greater than 200 m (Fig. 39). In the Yakutat INPFC area, a discernible mode of small juvenile fish about 16 cm FL was seen. The length-weight relationship for rougheye rockfish specimens collected during the survey is depicted in Figure 40.

Table 36.--Number of survey hauls, hauls with rougheye rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	4	1	64	0.5	28.9
	101 - 200	51	9	41	595	0.9	38.0
	201 - 300	8	6	288	788	0.8	37.2
	301 - 500	6	5	3,790	9,581	1.7	43.8
	All depths	171	24	172	11,028	1.5	42.2
Chirikof	1 - 100	54	4	13	351	0.6	29.5
	101 - 200	81	26	33	789	0.9	34.6
	201 - 300	31	20	513	5,895	1.3	42.1
	301 - 500	6	5	1,490	2,432	1.4	45.3
	All depths	172	55	149	9,466	1.2	40.8
Kodiak	1 - 100	68	3	4	168	0.7	33.0
	101 - 200	134	56	384	16,598	0.9	36.8
	201 - 300	28	25	585	6,753	0.8	35.1
	301 - 500	10	8	3,586	10,614	1.4	42.9
	All depths	240	92	350	34,133	1.0	37.7
Yakutat	1 - 100	16	4	5	76	0.1	16.6
	101 - 200	61	41	176	5,043	0.6	31.4
	201 - 300	29	20	270	1,314	0.7	33.7
	301 - 500	18	17	222	657	0.9	36.5
	All depths	124	82	135	7,090	0.6	30.9
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	1	2	19	0.2	23.3
	201 - 300	30	2	4	19	1.5	---
	301 - 500	14	12	774	2,234	1.1	38.7
	All depths	68	15	128	2,272	1.1	38.0
All areas	1 - 100	244	15	5	659	0.3	24.0
	101 - 200	351	133	192	23,044	0.8	35.2
	201 - 300	126	73	414	14,768	1.0	37.1
	301 - 500	54	47	1,968	25,518	1.4	42.7
	All depths	775	268	216	63,988	1.0	37.4

All areas biomass, 95% confidence interval: 33,250 - 94, 727 metric tons (t).

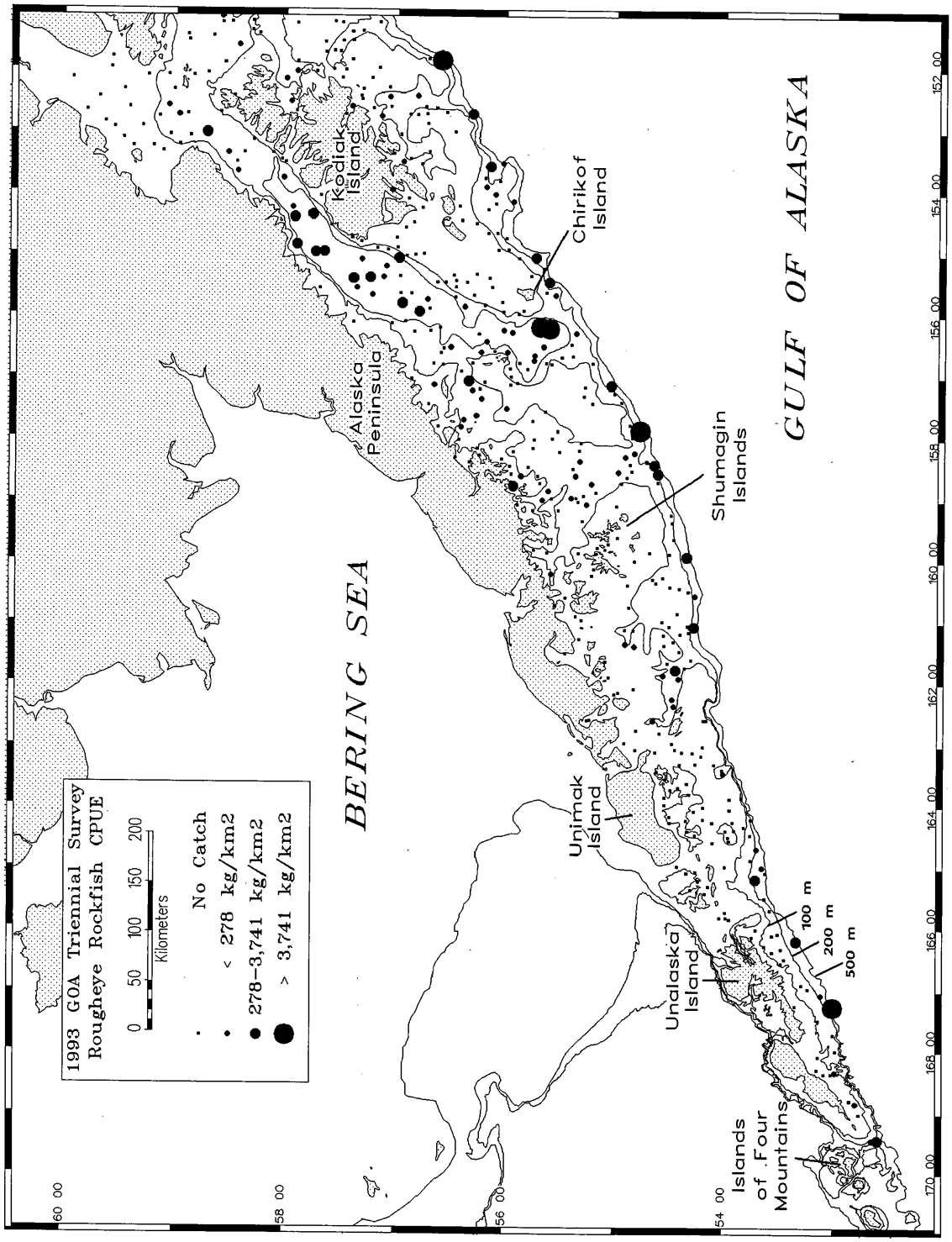
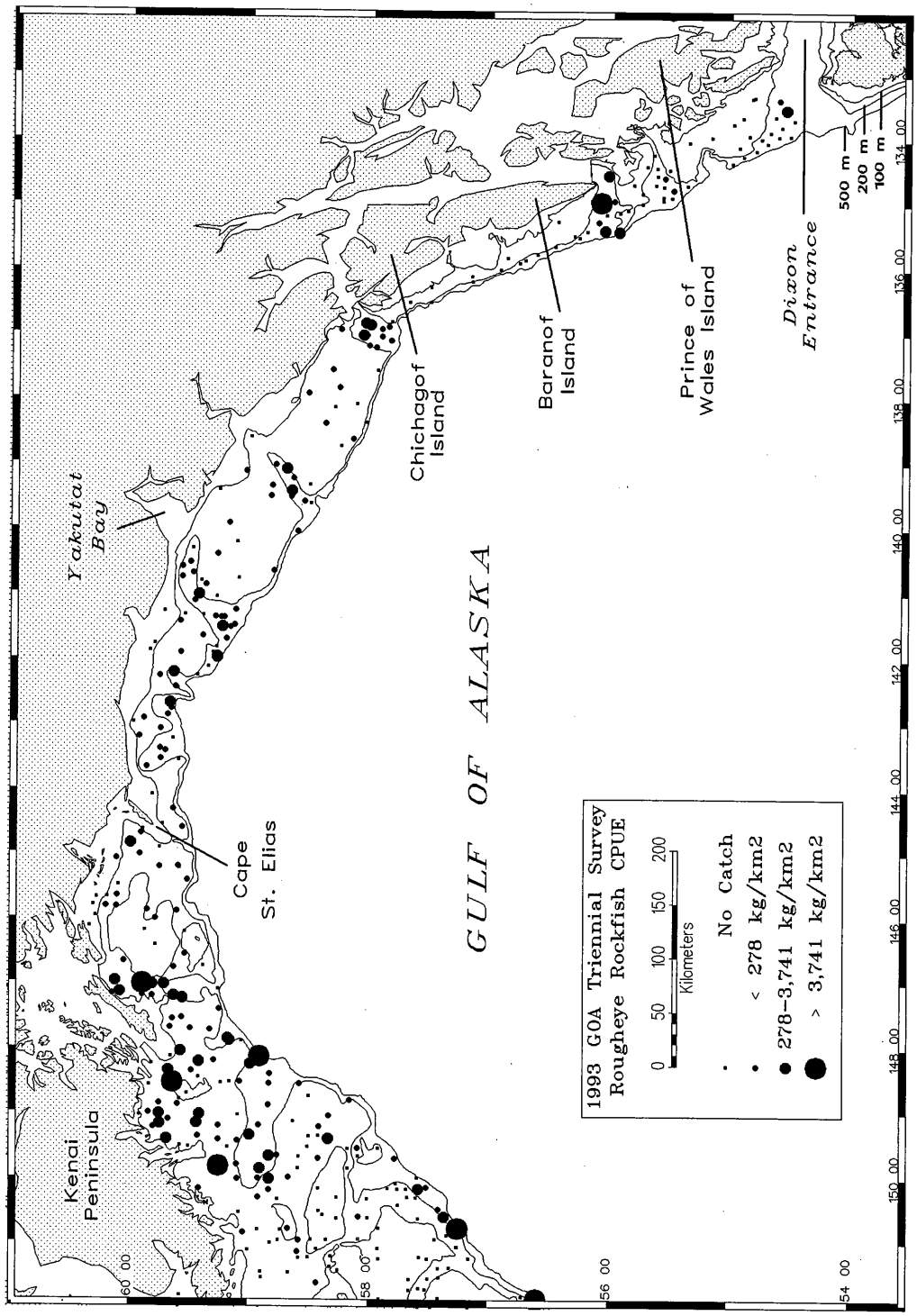


Figure 38.--Distribution and relative abundance of rougheye rockfish from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.



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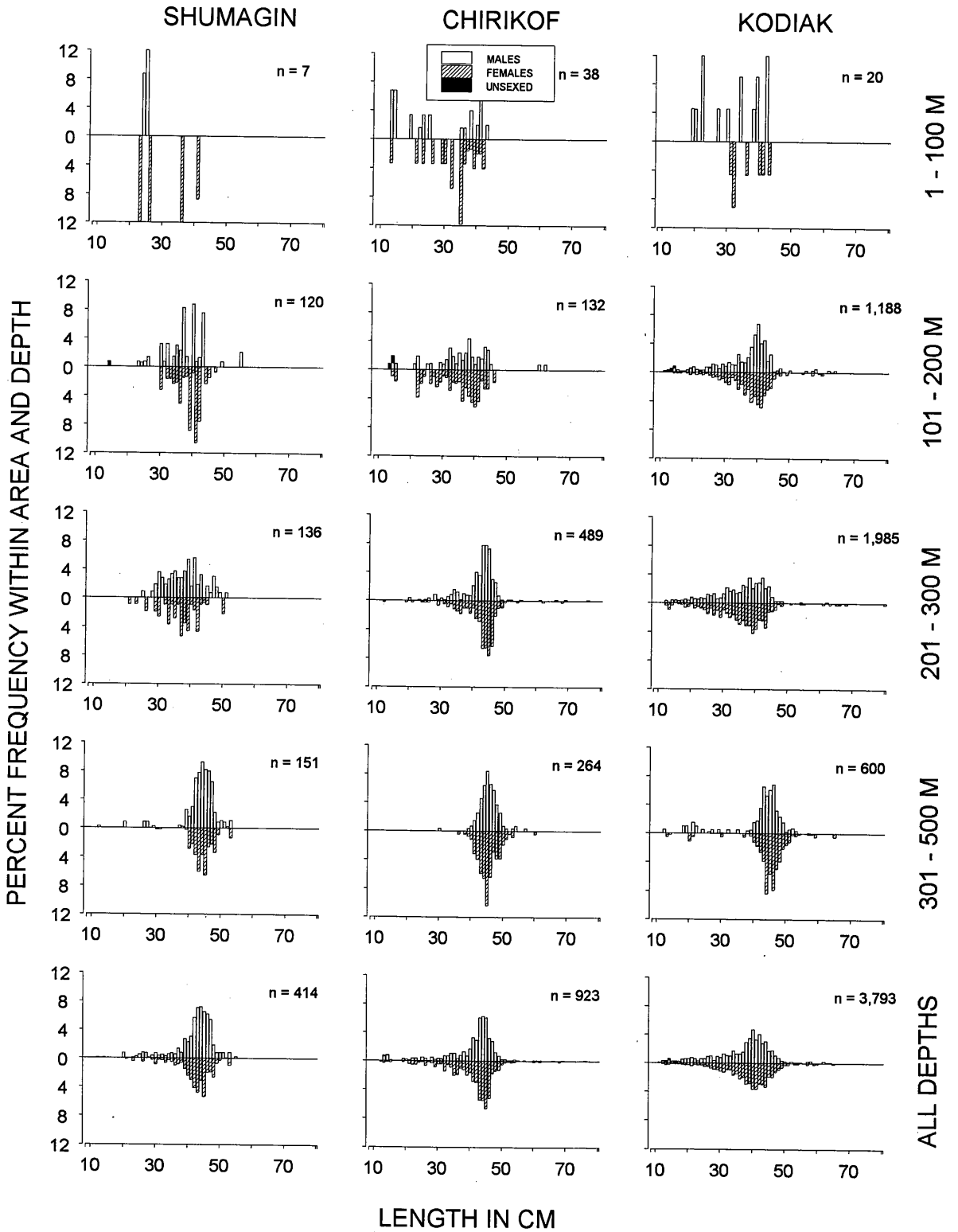


Figure 39.--Size composition of the estimated rougheye rockfish population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

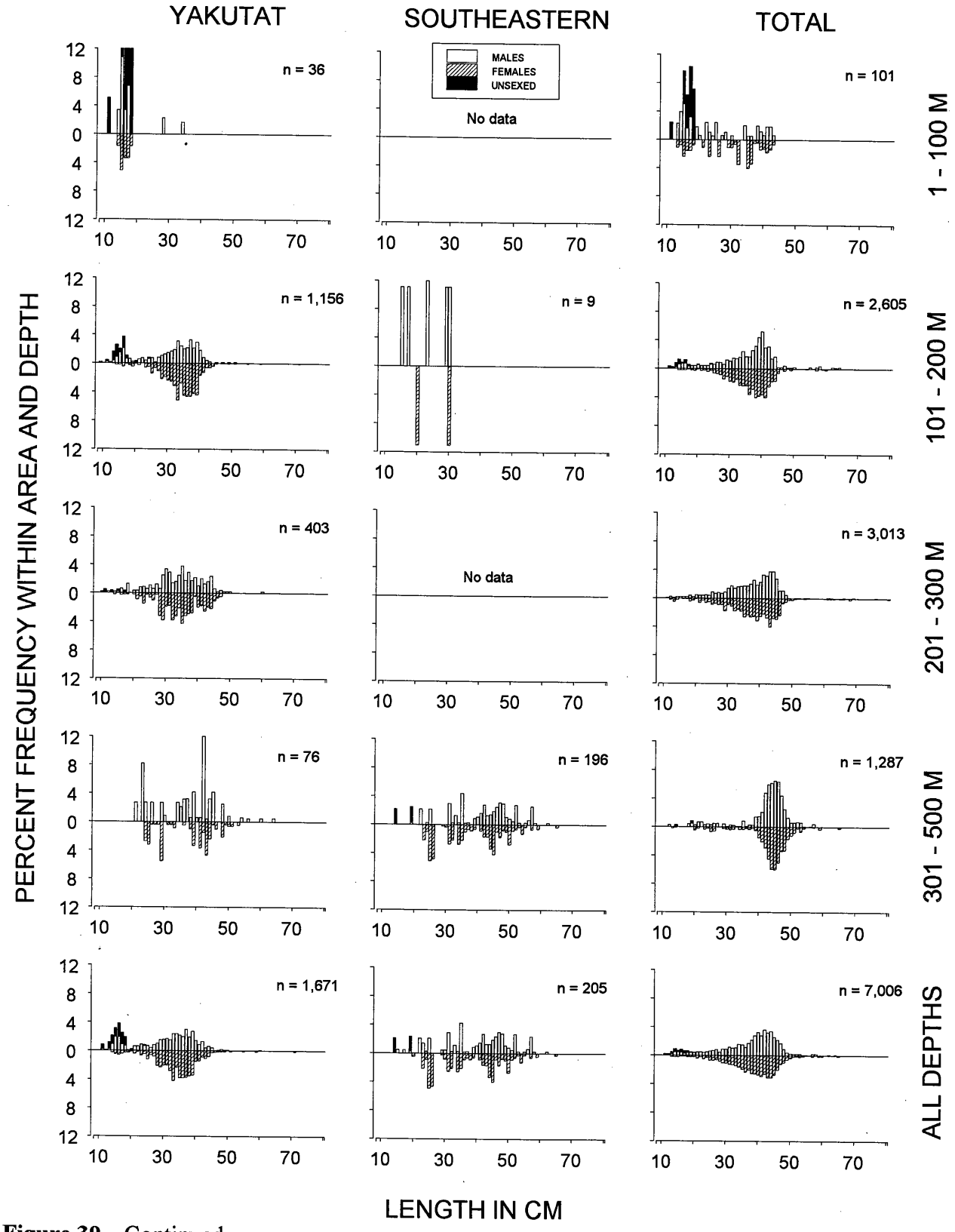


Figure 39.--Continued.

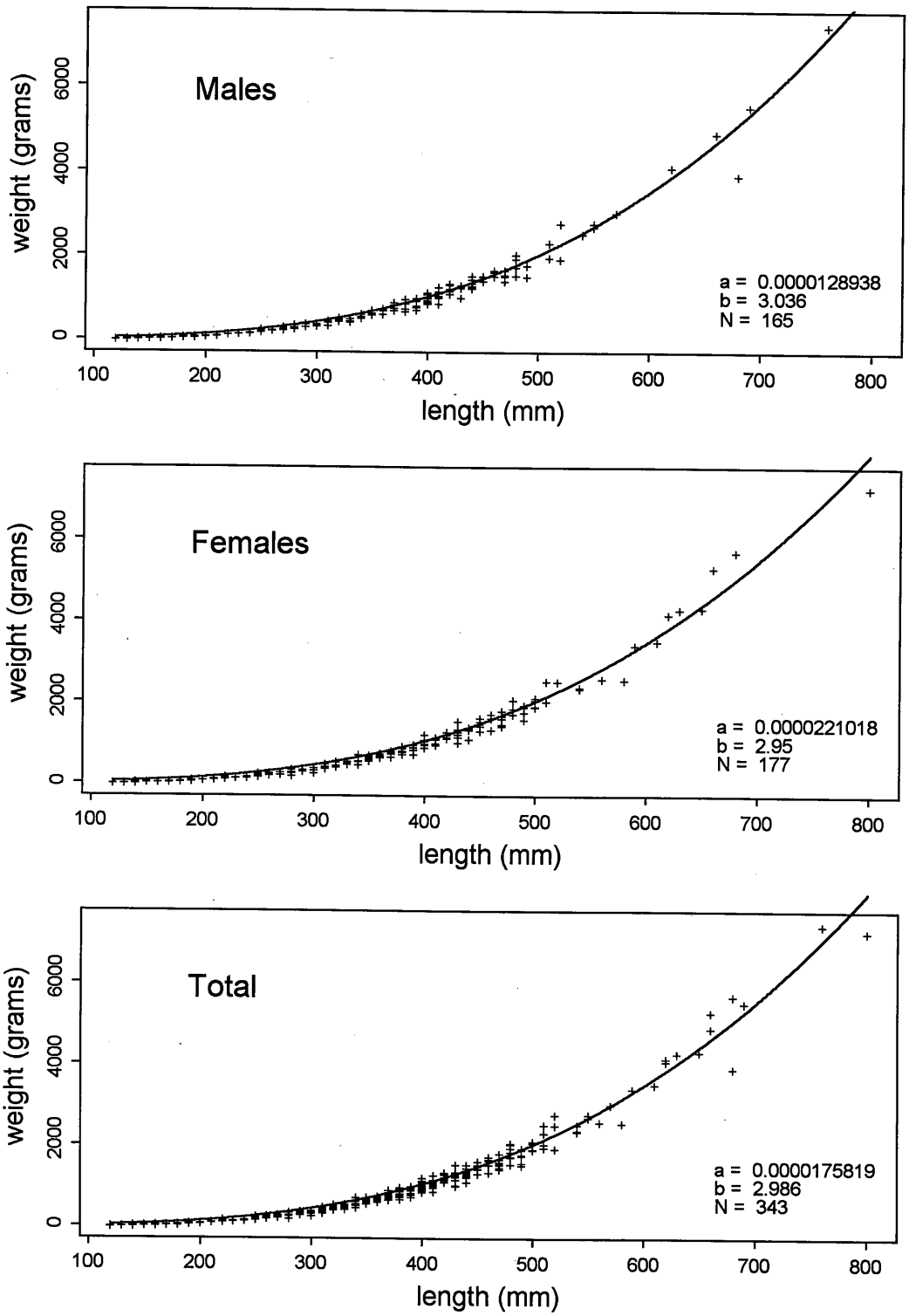


Figure 40.--Length-weight relationship for rougheye rockfish specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 37.--Catch per unit effort by stratum for rougheye rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
310	Shumagin Slope	6	5	3,790	9,581	0	31,952
330	Kodiak Slope	10	8	3,586	10,614	0	22,213
320	Chirikof Slope	6	5	1,490	2,432	0	5,279
133	Kenai Flats	41	30	1,213	14,554	0	35,841
232	Upper Shelikof Gully	5	5	996	3,178	1,044	5,312
351	Southeastern Slope	1	1	877	710	0	0
350	Southeastern Deep Gullies	13	11	734	1,524	69	2,979
140	Middleton Shelf	28	22	646	4,725	1,186	8,264
231	Kodiak Slope	4	4	586	953	0	2,776
220	Lower Shelikof Gully	27	18	565	5,630	51	11,210
341	Yakutat Slope	3	3	396	485	11	959
230	Kenai Gullies	19	16	390	2,622	1,007	4,237
240	Yakutat Gullies	18	15	351	1,263	124	2,401
210	Shumagin Slope	8	6	288	788	0	1,970
131	Portlock Flats	22	10	188	1,376	0	3,484
221	Chirikof Slope	4	2	173	265	0	1,013
110	Sanak Gully	20	7	123	519	0	1,357
340	Yakutat Deep Gullies	15	14	99	172	22	322
121	Shelikof Edge	24	7	53	404	0	873
241	Yakutat Slope	11	5	40	51	0	113
130	Albatross Gullies	29	6	34	263	22	503
120	East Shumagin Gully	39	15	31	348	91	605
132	Barren Islands	27	7	30	328	0	727
141	Yakataga Shelf	10	7	30	159	0	332
20	Upper Alaska Peninsula	15	2	27	223	0	612
30	Albatross Shallows	11	3	27	168	0	388
21	Semidi Bank	8	1	17	122	0	411
134	Kodiak Outer Shelf	15	3	15	78	0	228
143	Fairweather Shelf	11	6	12	90	0	239
111	Shumagin Outer Shelf	25	1	8	61	0	187
142	Yakutat Flats	12	6	8	69	9	129
112	West Shumagin Gully	6	1	7	15	0	54
122	Chirikof Outer Shelf	18	4	7	37	0	76
40	Yakutat Shallows	5	1	5	40	0	153
41	Middleton Shallows	11	3	5	36	0	84
150	Baranof-Chichagof Shelf	10	1	5	19	0	62
251	Prince of Wales Slope/Gullies	22	2	5	19	0	47
12	Lower Alaska Peninsula	18	1	2	14	0	43
13	Shumagin Bank	20	1	2	36	0	111
10	Fox Islands	24	1	1	9	0	27
22	Chirikof Bank	31	1	1	6	0	17
11	Davidson Bank	44	1	0	5	0	15

Dusky rockfish (Sebastes ciliatus)

Dusky rockfish were found in modest numbers in depths less than 300 m throughout the survey area (Table 39; Fig. 41). Larger catches seemed to occur most often on the continental shelf near areas of deeper water, particularly major gullies and the continental slope. Approximately 65% of the biomass estimate for the survey area came from four strata: Portlock Flats, Kodiak Outer Shelf, Chirikof Bank, and Shumagin Bank (Table 40). In two of these strata, Kodiak Outer Shelf and Chirikof Bank, more than 95% of the biomass estimate for the stratum resulted from one sample. The catch from the influential tow in the Kodiak Outer Shelf stratum (Progress, Haul 287) was estimated at 1,015 kg (CPUE - 18,798 kg/km^2), while the large tow in the Chirikof Bank stratum (Argosy, Haul 191) was estimated at 842 kg (CPUE - 26,034 kg/km^2). Mean fish length generally increased with depth throughout the survey area (Fig. 42). An exception to this was noted in the 0-100 m interval in the Yakutat INPFC area where the largest mean size for any area-depth was observed. The sample size was quite small in this area-depth, however. The length-weight relationship for dusky rockfish specimens collected during the survey is depicted in Figure 43.

Table 39.--Number of survey hauls, hauls containing dusky rockfish, CPUE, iomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	14	275	12,210	1.0	37.1
	101 - 200	51	4	65	938	1.2	39.4
	201 - 300	8	3	10	28	1.1	42.0
	301 - 500	6	0	0	0	---	---
	All depths	171	21	205	13,176	1.0	37.2
Chirikof	1 - 100	54	4	351	9,326	0.5	31.8
	101 - 200	81	21	156	3,694	1.1	40.3
	201 - 300	31	4	4	49	1.4	45.0
	301 - 500	6	1	3	5	0.7	43.0
	All depths	172	30	206	13,073	0.6	33.1
Kodiak	1 - 100	68	7	86	3,413	1.2	38.0
	101 - 200	134	40	471	20,334	1.5	44.5
	201 - 300	28	5	11	123	1.4	43.1
	301 - 500	10	0	0	0	---	---
	All depths	240	52	245	23,869	1.4	43.4
Yakutat	1 - 100	16	2	43	704	2.2	49.6
	101 - 200	61	10	212	6,075	1.4	44.6
	201 - 300	29	8	51	247	1.5	44.8
	301 - 500	18	0	0	0	---	---
	All depths	124	20	133	7,027	1.5	45.0
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	4	24	236	1.3	43.6
	201 - 300	30	5	272	1,371	1.4	44.7
	301 - 500	14	0	0	0	---	---
	All depths	68	9	90	1,607	1.4	44.5
All areas	1 - 100	244	27	202	25,653	0.8	34.4
	101 - 200	351	79	261	31,277	1.4	43.7
	201 - 300	126	25	51	1,817	1.4	44.5
	301 - 500	54	1	< 1	5	0.7	43.0
	All depths	775	132	199	58,752	1.0	38.2

All areas biomass, 95% confidence interval: 23,977 - 93,528 metric tons (t).

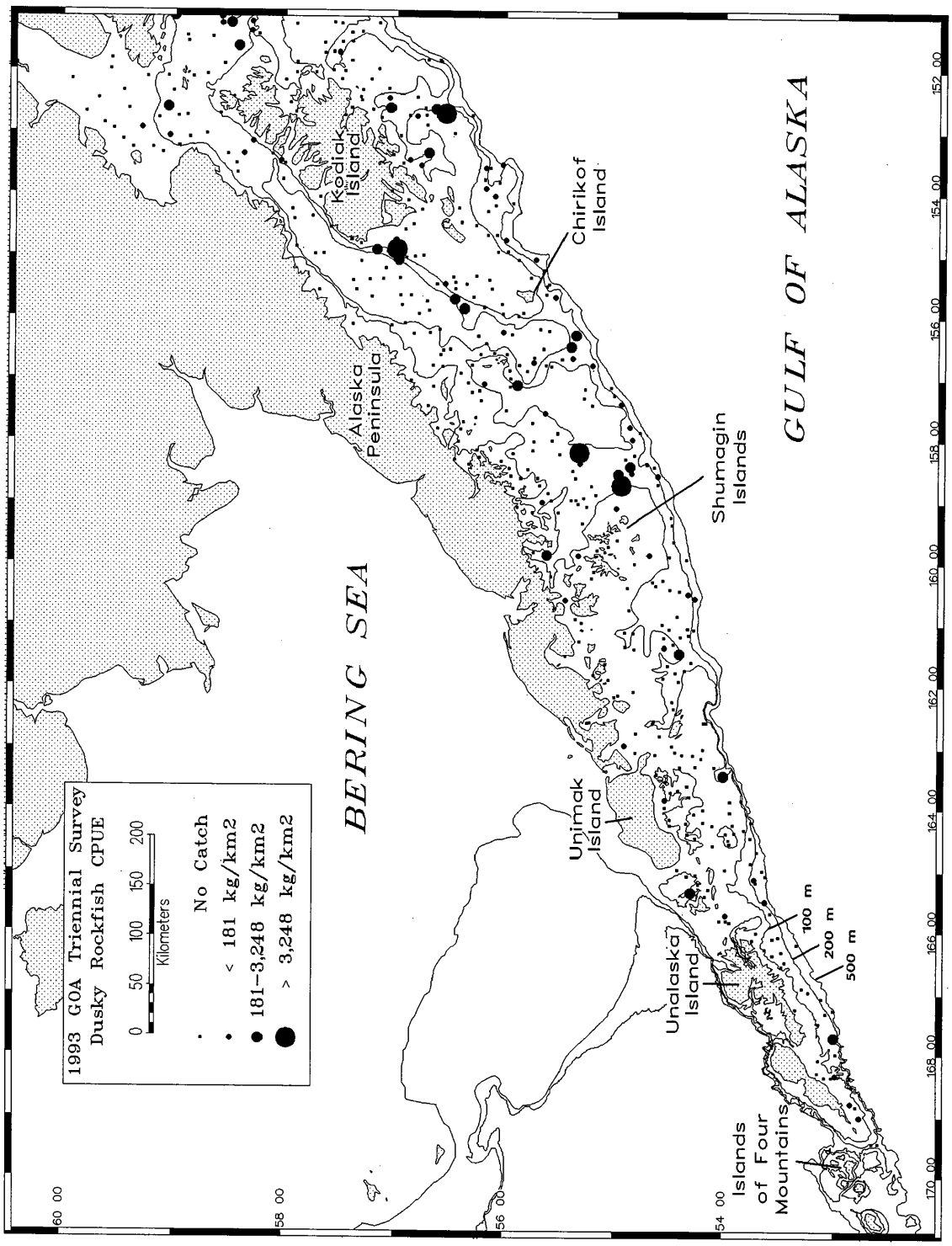
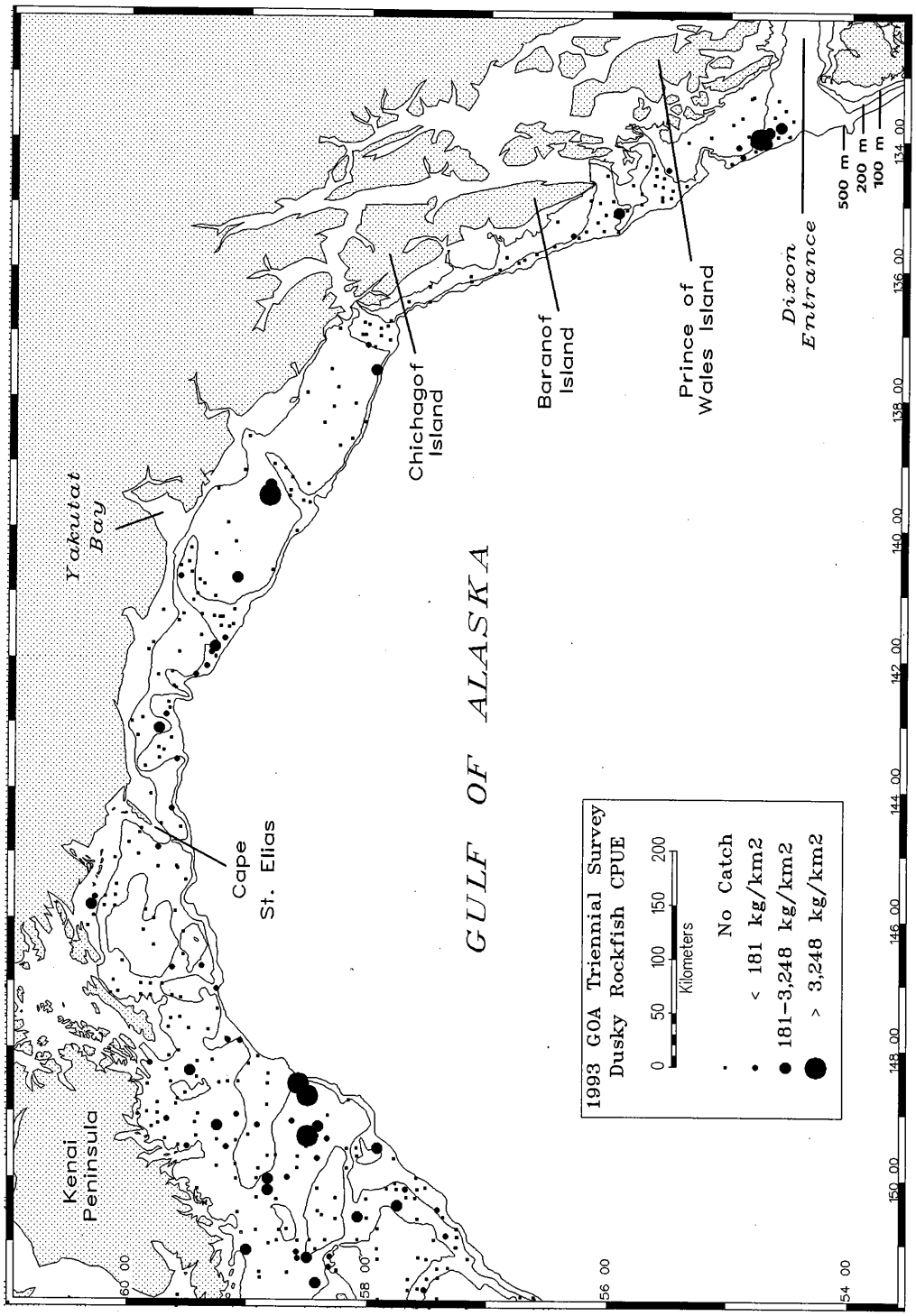


Figure 41.--Distribution and relative abundance of dusky rockfish from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.



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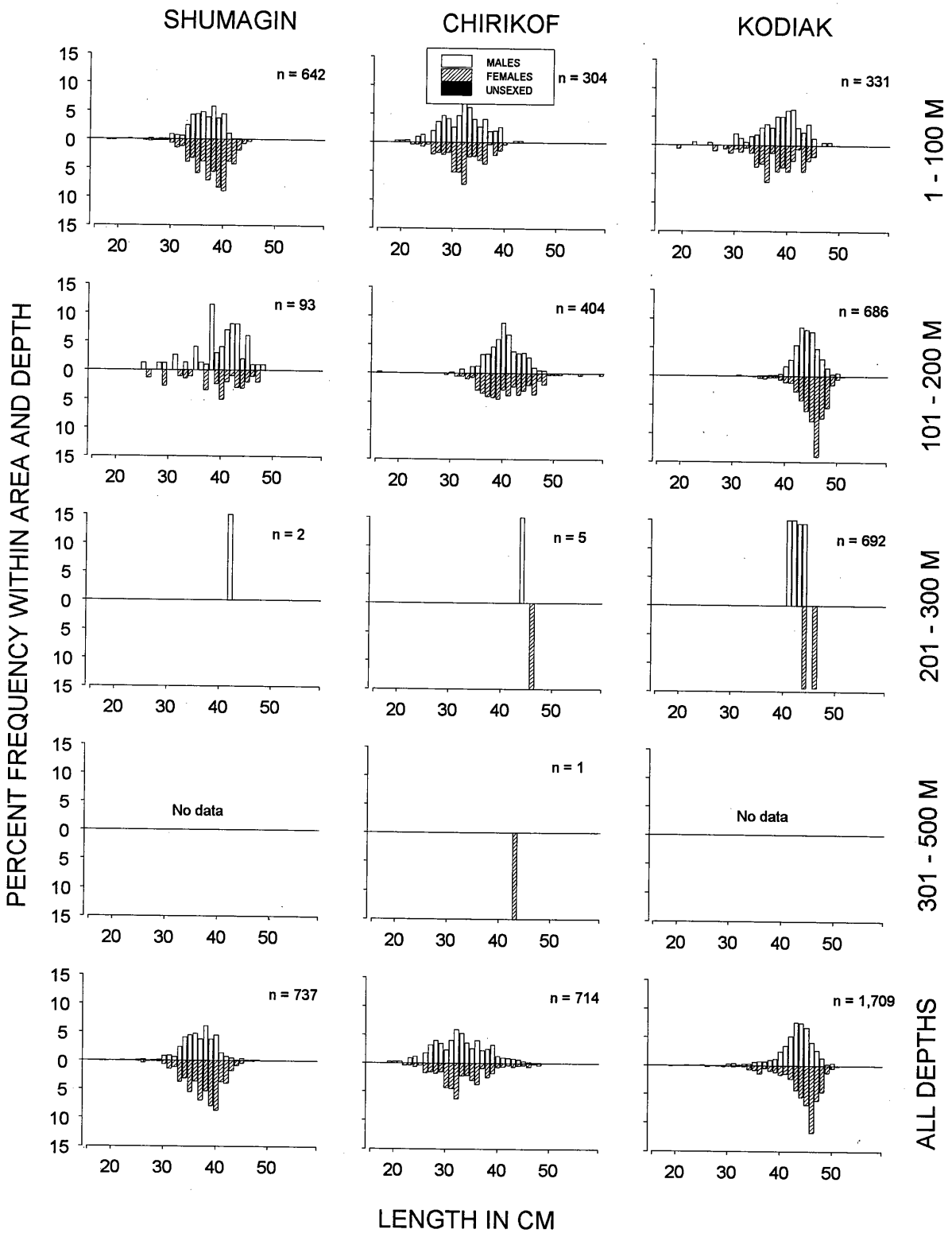

Figure 42.--Size composition of the estimated dusky rockfish population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

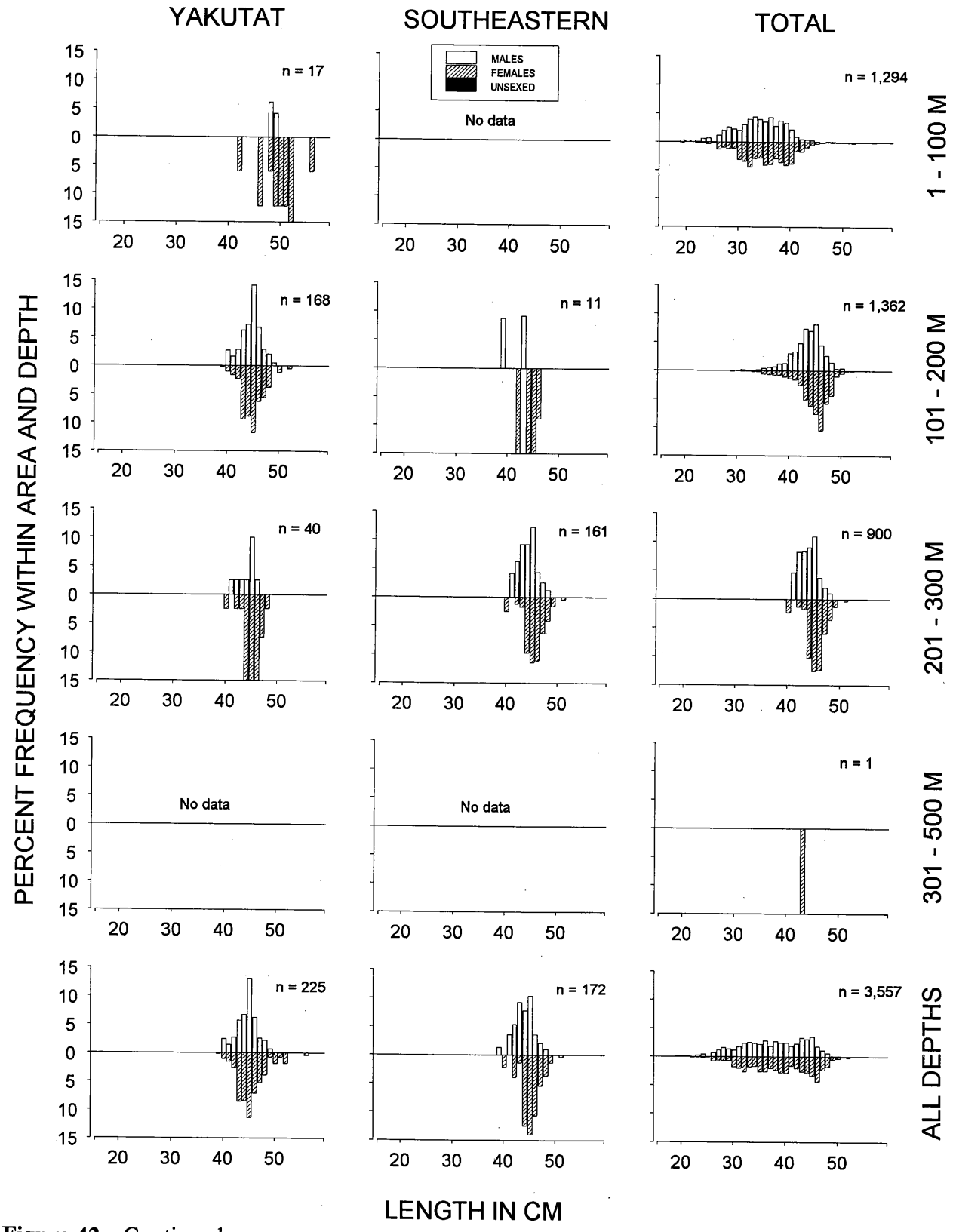

Figure 42.--Continued.

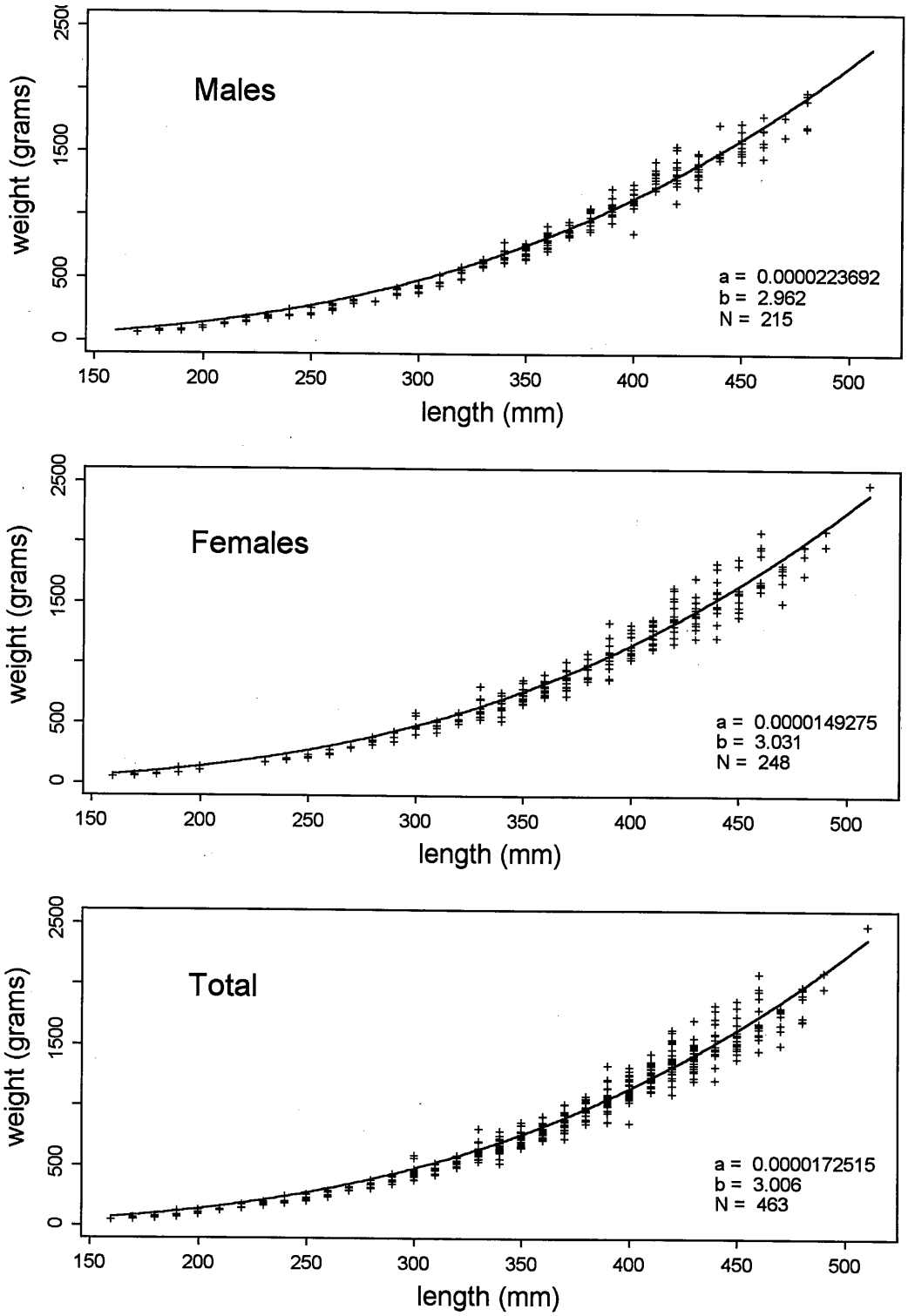

Figure 43.--Length-weight relationship for dusky rockfish specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 40.--Catch per unit effort by stratum for dusky rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
131	Portlock Flats	22	9	1,521	11,130	0	25,429
134	Kodiak Outer Shelf	15	7	1,286	6,526	0	20,149
22	Chirikof Bank	31	3	846	9,299	0	28,150
13	Shumagin Bank	20	6	803	11,748	0	33,139
142	Yakutat Flats	12	3	597	5,002	0	12,017
251	Prince of Wales Slope/Gullies	22	5	343	1,371	0	3,235
31	Albatross Banks	33	2	215	3,301	0	9,988
241	Yakutat Slope	11	7	189	241	0	648
121	Shelikof Edge	24	6	187	1,433	0	3,054
120	East Shumagin Gully	39	7	168	1,860	0	5,160
132	Barren Islands	27	9	131	1,429	0	3,471
143	Fairweather Shelf	11	2	106	805	0	2,486
130	Albatross Gullies	29	8	104	814	0	1,687
111	Shumagin Outer Shelf	25	3	102	817	0	2,379
41	Middleton Shallows	11	2	90	704	0	2,134
122	Chirikof Outer Shelf	18	8	80	400	0	822
112	West Shumagin Gully	6	1	53	121	0	432
141	Yakataga Shelf	10	2	43	230	0	662
231	Kodiak Slope	4	2	42	69	0	215
151	Prince of Wales Shelf	14	3	39	225	0	617
133	Kenai Flats	41	7	36	435	0	981
10	Fox Islands	24	4	23	197	0	439
221	Chirikof Slope	4	2	18	28	0	80
11	Davidson Bank	44	2	15	209	0	597
30	Albatross Shallows	11	3	12	74	0	186
210	Shumagin Slope	8	3	10	28	0	60
12	Lower Alaska Peninsula	18	2	8	56	0	153
230	Kenai Gullies	19	3	8	54	0	118
140	Middleton Shelf	28	3	5	38	0	81
21	Semidi Bank	8	1	4	27	0	89
35	Northern Kodiak Shallows	6	1	4	10	0	34
32	Lower Cook Inlet	15	1	3	28	0	87
150	Baranof-Chichagof Shelf	10	1	3	11	0	37
320	Chirikof Slope	6	1	3	5	0	17
220	Lower Shelikof Gully	27	2	2	20	0	52
240	Yakutat Gullies	18	1	2	6	0	20

Sharpchin rockfish (Sebastes zacentrus)

Sharpchin rockfish were found almost exclusively east of Kodiak Island (Fig. 44). The highest catch rates occurred in the Southeastern area between 201 and 300 m (Table 41). Two strata, Prince of Wales Slope and Gullies and Kodiak Outer Shelf accounted for about 63% of the total biomass for the survey area (Table 42). In the Kodiak Outer Shelf stratum, one sample (Progress, Haul 287) accounted for more than 98% of the total biomass estimate for that stratum. Fish size generally increased with depth (Fig. 45).

Table 41.--Number of survey hauls, hauls with sharpchin rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	1	1	61	0.2	21.2
	101 - 200	51	0	0	0	---	---
	201 - 300	8	2	8	22	0.3	26.4
	301 - 500	6	0	0	0	---	---
	All depths	171	3	1	82	0.2	22.0
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	1	< 1	1	0.1	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	1	< 1	1	0.1	---
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	29	165	7,129	0.2	24.5
	201 - 300	28	5	1	8	0.2	30.0
	301 - 500	10	0	0	0	---	---
	All depths	240	34	73	7,137	0.2	24.5
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	8	61	1,745	0.2	24.1
	201 - 300	29	13	371	1,806	0.3	27.0
	301 - 500	18	1	1	2	0.3	---
	All depths	124	22	67	3,554	0.2	25.4
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	11	232	2,287	0.3	27.4
	201 - 300	30	21	1,717	8,645	0.3	28.0
	301 - 500	14	2	1	3	0.1	---
	All depths	68	34	615	10,936	0.3	27.8
All areas	1 - 100	244	1	< 1	61	0.2	21.2
	101 - 200	351	49	93	11,162	0.2	24.9
	201 - 300	126	41	294	10,481	0.3	27.8
	301 - 500	54	3	< 1	6	0.2	---
	All depths	775	94	73	21,710	0.3	26.0

All areas biomass, 95% confidence interval: 6,391 - 37,028 metric tons (t).

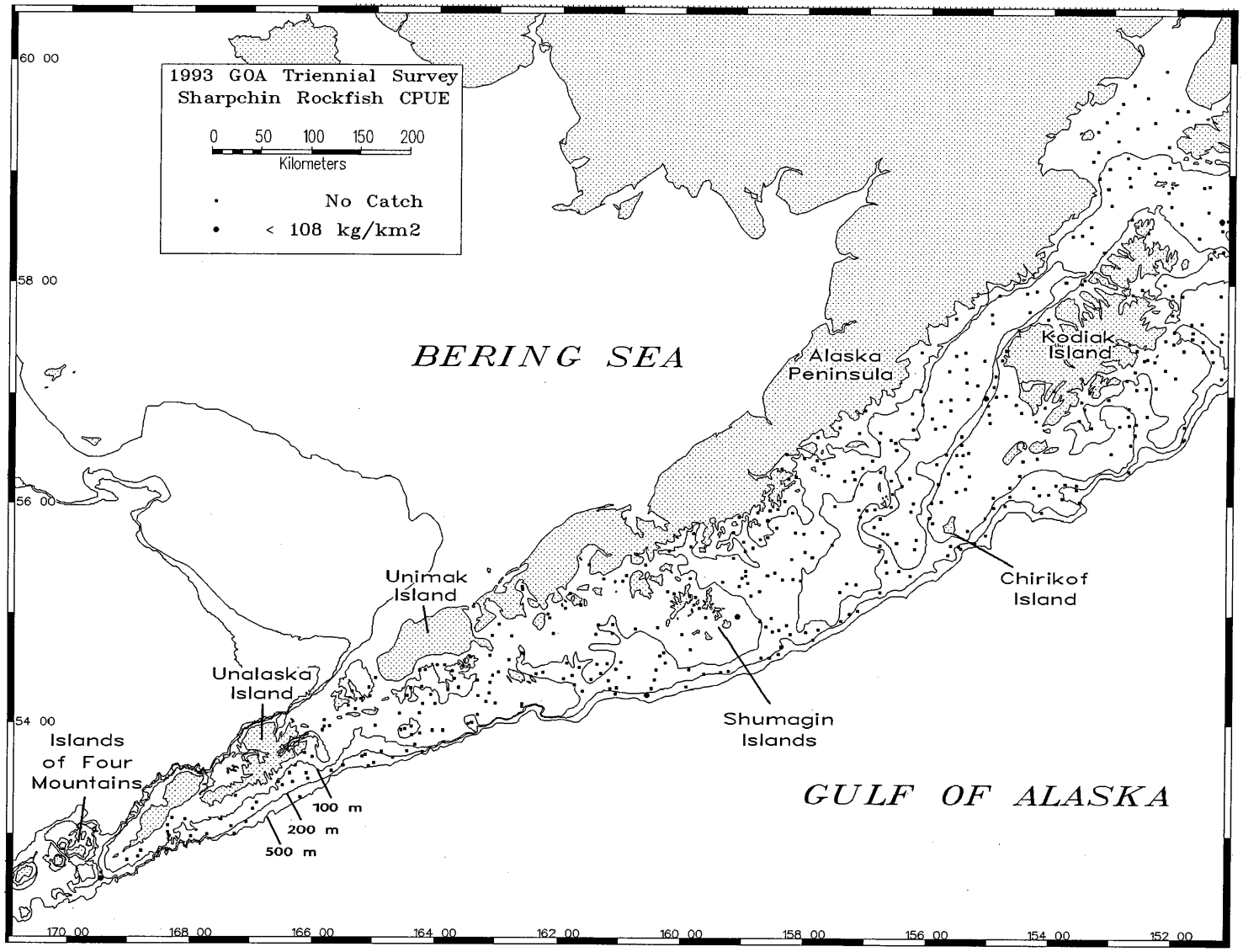

Figure 44.--Distribution and relative abundance of sharpchin rockfish from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

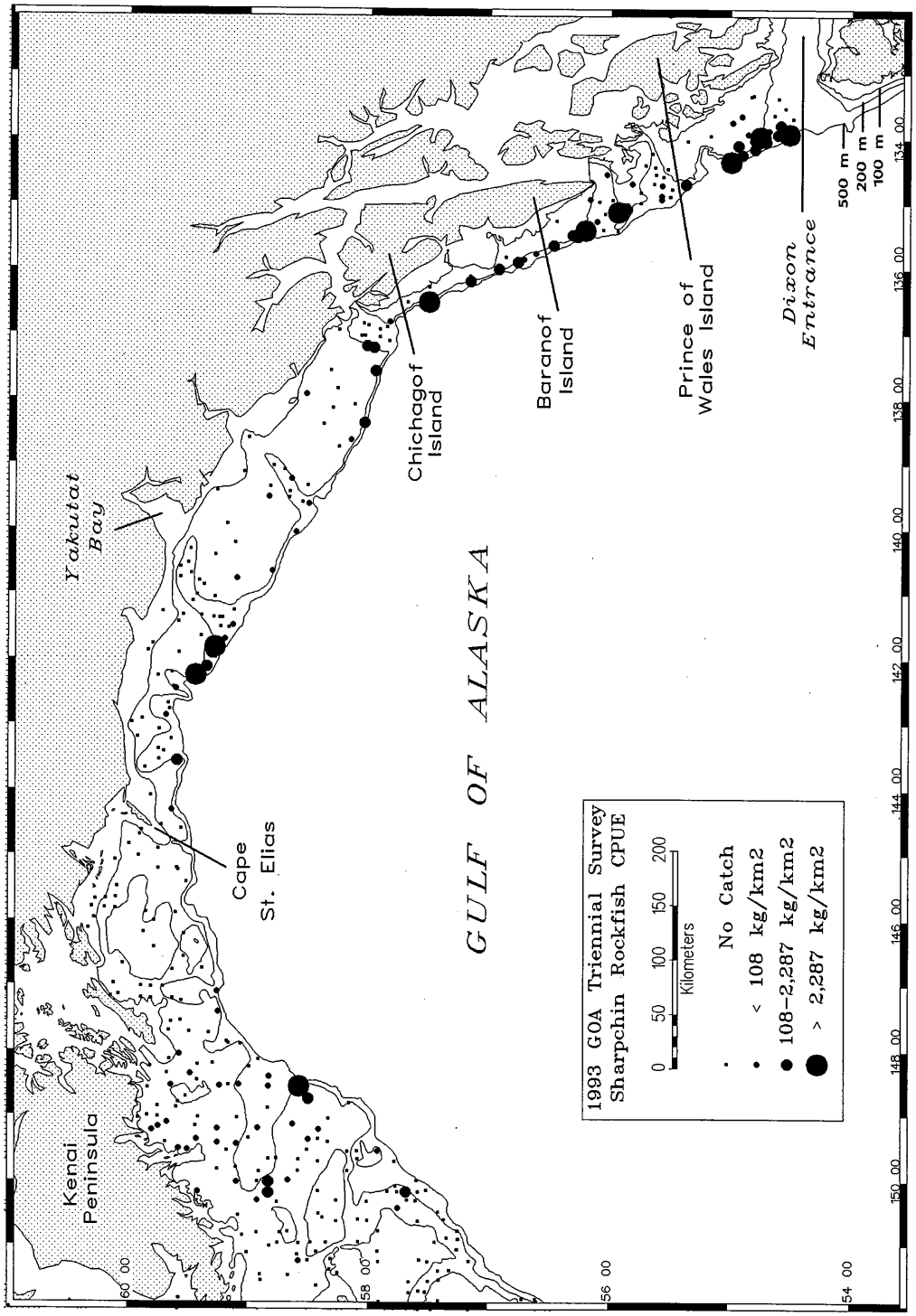

Figure 44.--Continued.

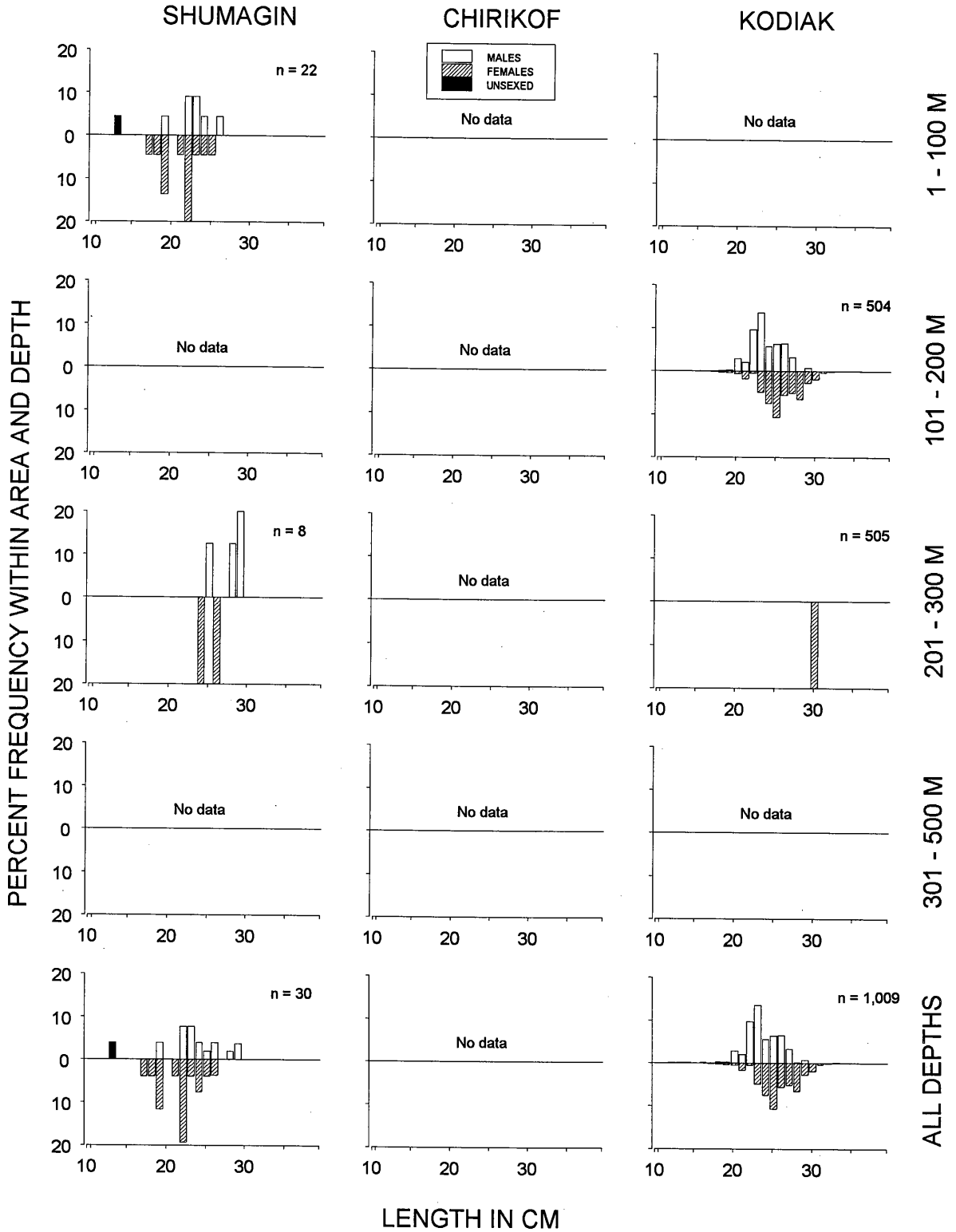

Figure 45.--Size composition of the estimated sharpchin rockfish population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

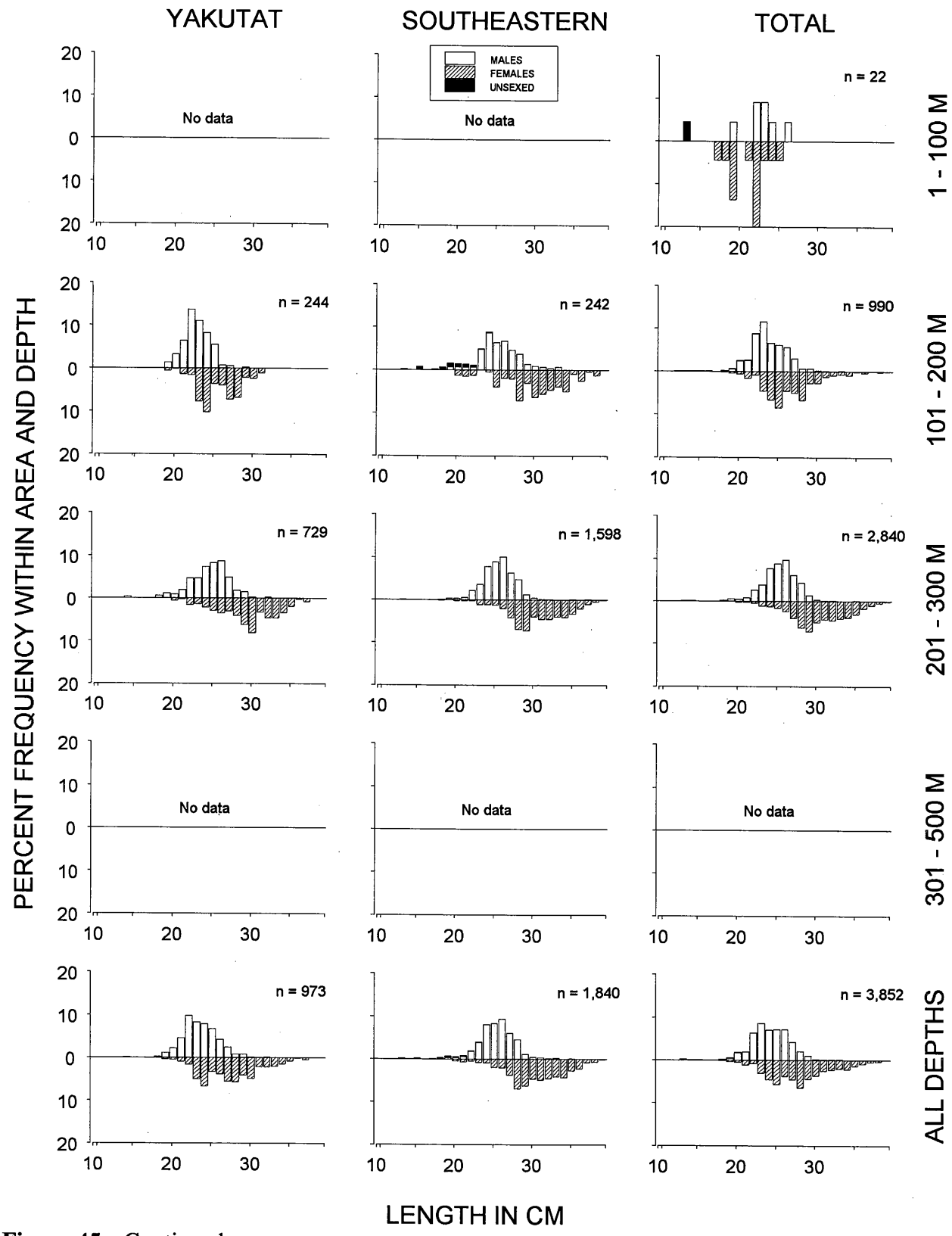

Figure 45.--Continued.

Table 42.--Catch per unit effort by stratum for sharpchin rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
251	Prince of Wales Slope/Gullies	22	13	1,842	7,366	0	15,059
241	Yakutat Slope	11	10	1,314	1,677	0	3,893
250	Baranof-Chichagof Slope	8	8	1,235	1,279	0	2,648
134	Kodiak Outer Shelf	15	4	1,226	6,223	0	19,377
151	Prince of Wales Shelf	14	7	279	1,612	0	4,225
143	Fairweather Shelf	11	4	210	1,597	0	4,204
150	Baranof-Chichagof Shelf	10	4	165	675	0	1,866
131	Portlock Flats	22	8	108	792	0	1,701
240	Yakutat Gullies	18	3	36	130	0	374
141	Yakataga Shelf	10	1	21	115	0	375
133	Kenai Flats	41	15	9	111	33	190
210	Shumagin Slope	8	2	8	22	0	57
13	Shumagin Bank	20	1	4	61	0	188
142	Yakutat Flats	12	3	4	33	0	88
350	Southeastern Deep Gullies	13	2	2	3	0	9
230	Kenai Gullies	19	5	1	8	1	14
340	Yakutat Deep Gullies	15	1	1	2	0	8
121	Shelikof Edge	24	1	0	1	0	3
130	Albatross Gullies	29	1	0	2	0	7
132	Barren Islands	27	1	0	1	0	3

Shortraker rockfish (Sebastes borealis)

Shortraker rockfish were most abundant in the deepest waters of the survey on the continental slope or in deep gullies (Table 43; Fig. 46). About 76% of the tows in this depth range contained shortraker rockfish, while less than 2% of tows in all other depths did. The highest shortraker rockfish CPUEs of the survey were seen in the continental slope waters between 301 and 500 m in the Kodiak and Yakutat INPFC areas, where 54% of the gulf-wide biomass was concentrated into less than 2% of the survey area (Table 44). Fish size generally increased from west to east (Fig. 47). Very few fish less than 40 cm FL were caught in the survey. The length-weight relationship for shortraker rockfish specimens collected during the survey is depicted in Figure 48.

Table 43.--Number of survey hauls, hauls containing shortraker rockfish, CPUE, biomass, mean weight and mean length from the 1993 Gulf of Alaska groundfish 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	106	1	3	132	1.4	43.0
	101 - 200	51	0	0	0	---	---
	201 - 300	8	1	22	61	2.9	55.0
	301 - 500	6	5	1,032	2,610	2.6	51.7
	All depths	171	7	44	2,803	2.5	51.0
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	1	2	46	7.0	78.0
	201 - 300	31	1	5	60	5.9	69.0
	301 - 500	6	5	1,381	2,254	3.6	59.0
	All depths	172	7	37	2,360	3.6	59.4
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	0	0	0	---	---
	201 - 300	28	1	4	47	7.3	77.0
	301 - 500	10	8	1,705	5,047	4.4	60.8
	All depths	240	9	52	5,093	4.4	60.9
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	0	0	0	---	---
	201 - 300	29	8	149	725	5.5	68.0
	301 - 500	18	14	2,089	6,190	4.0	63.9
	All depths	124	22	131	6,914	4.1	64.2
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	0	0	0	---	---
	201 - 300	30	0	0	0	---	---
	301 - 500	14	9	581	1,675	7.1	71.9
	All depths	68	9	94	1,675	7.1	71.9
All areas	1 - 100	244	1	1	132	1.4	43.0
	101 - 200	351	1	< 1	46	7.0	78.0
	201 - 300	126	11	25	892	5.3	66.8
	301 - 500	54	41	1,371	17,775	3.9	60.1
	All depths	775	54	64	18,846	3.9	60.1

All areas biomass, 95% confidence interval: 11,002 - 26,689 metric tons (t).

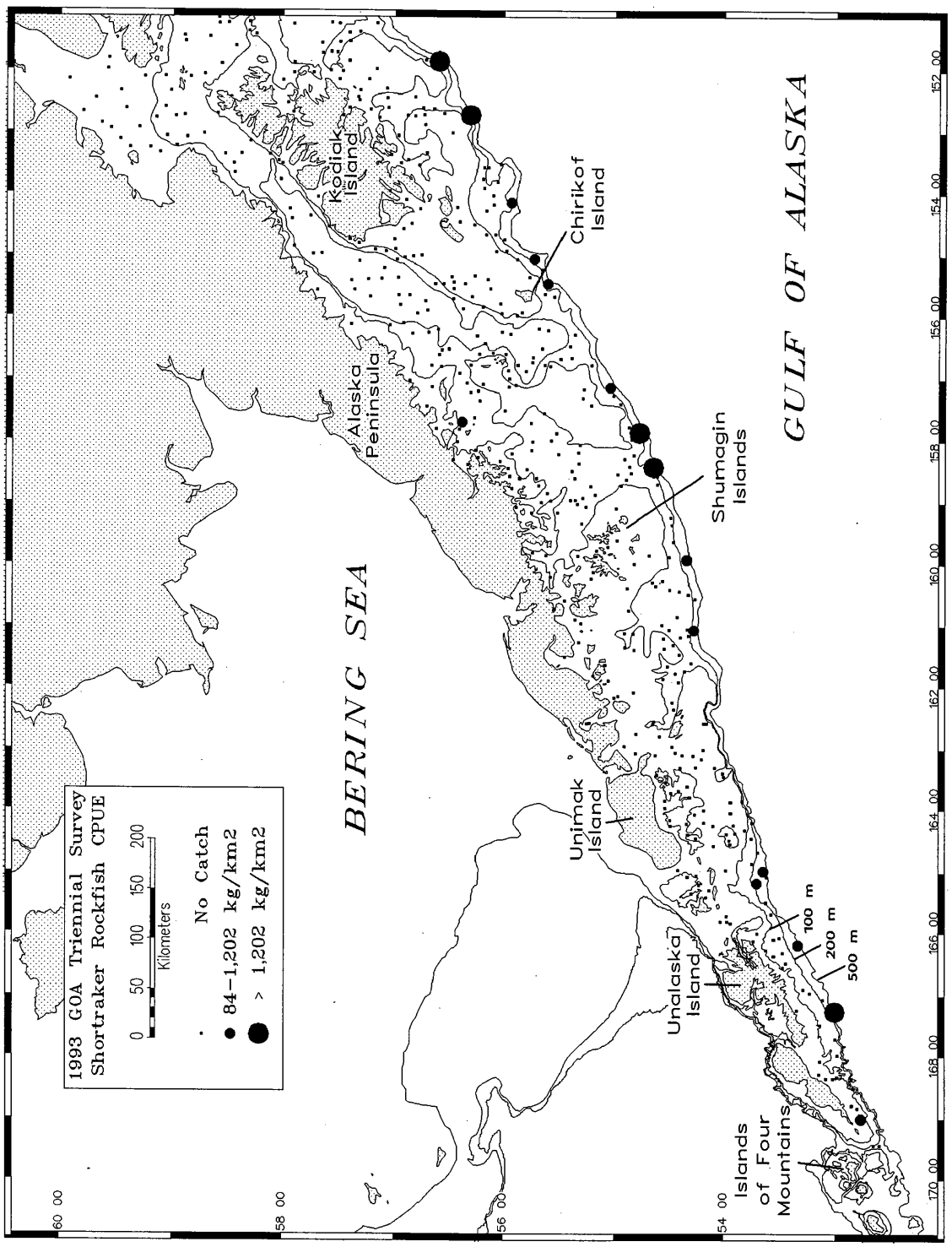

Figure 46.--Distribution and relative abundance of shortraker rockfish from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

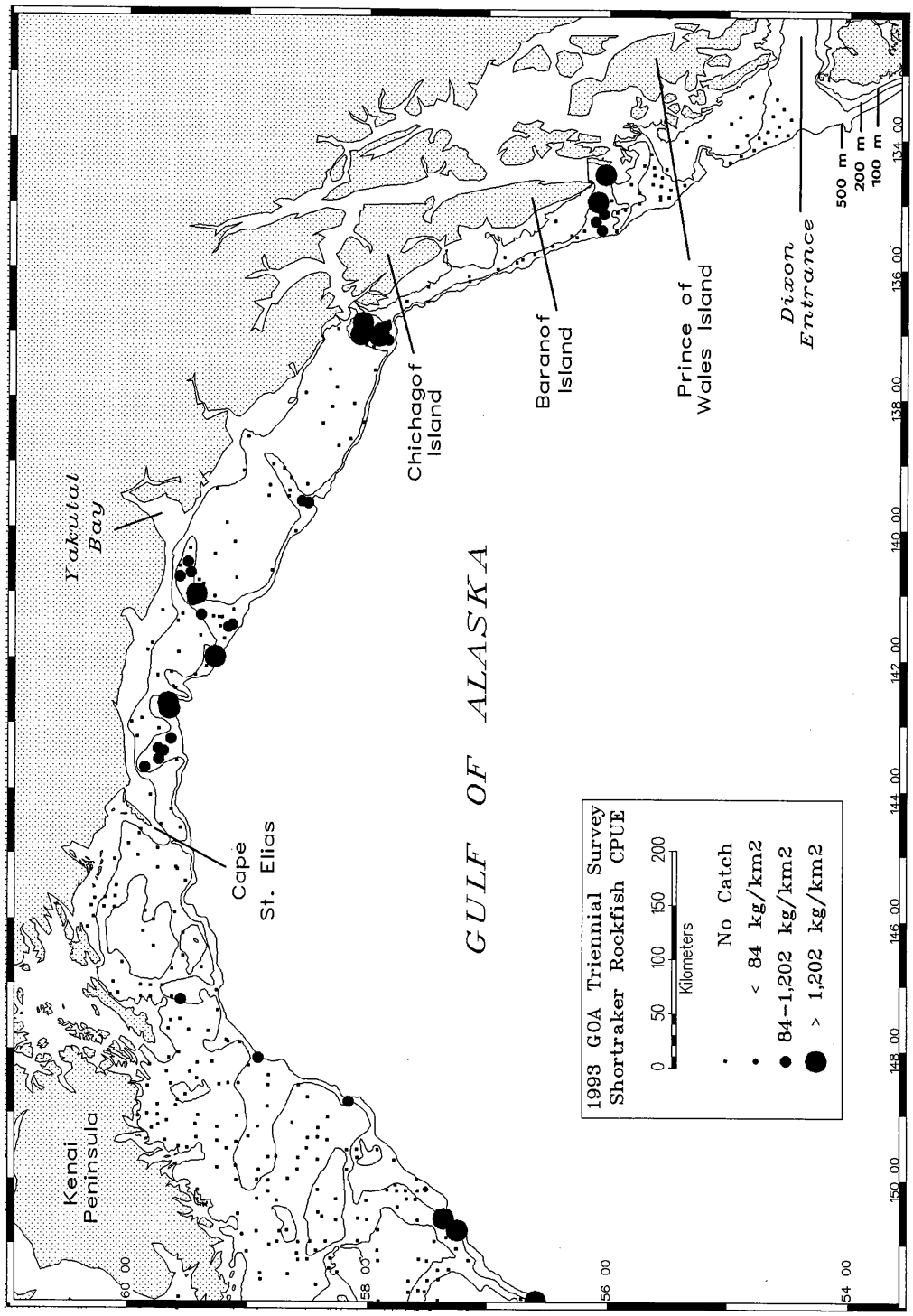

Figure 46.--Continued.

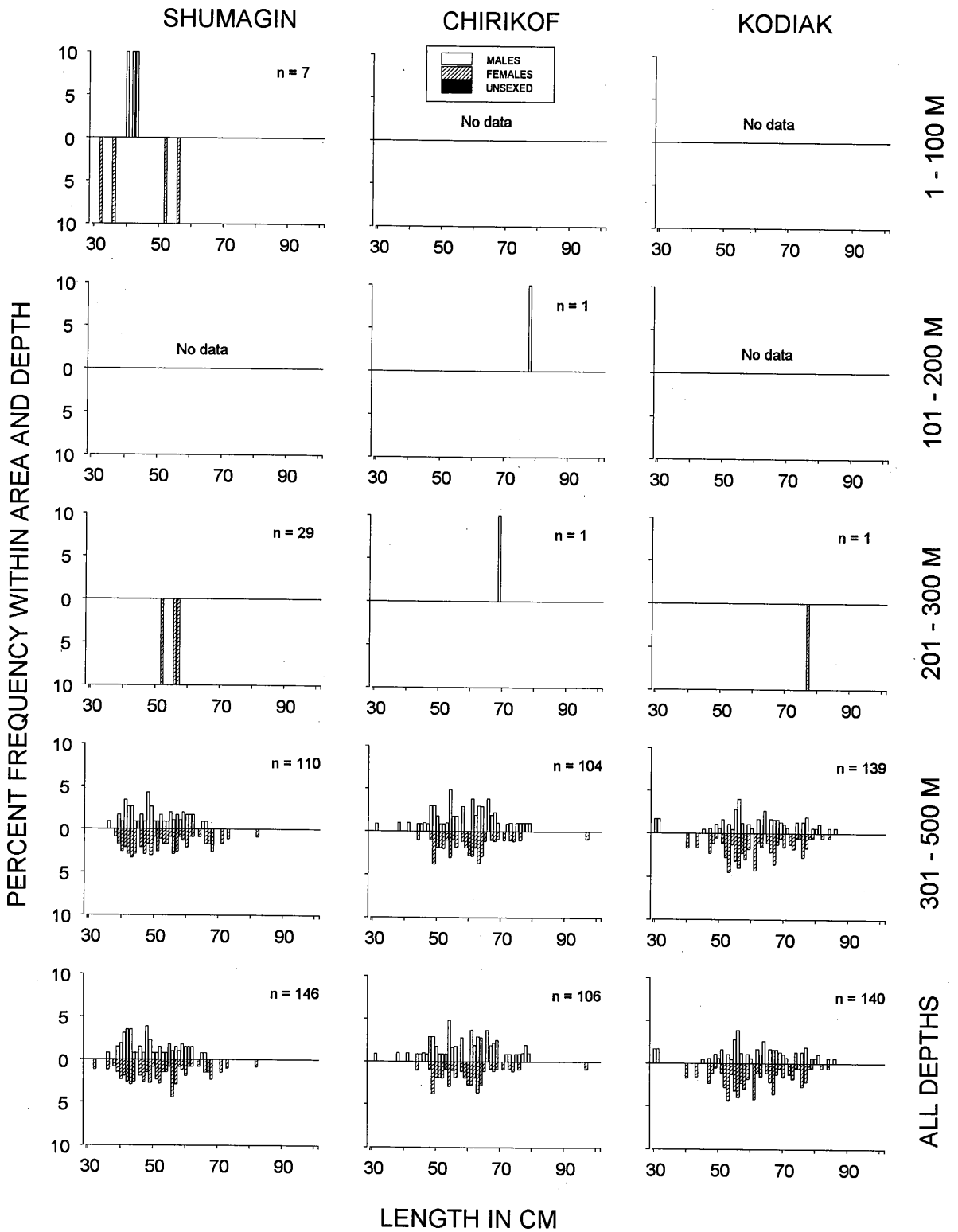

Figure 47.--Size composition of the estimated shortraker rockfish population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

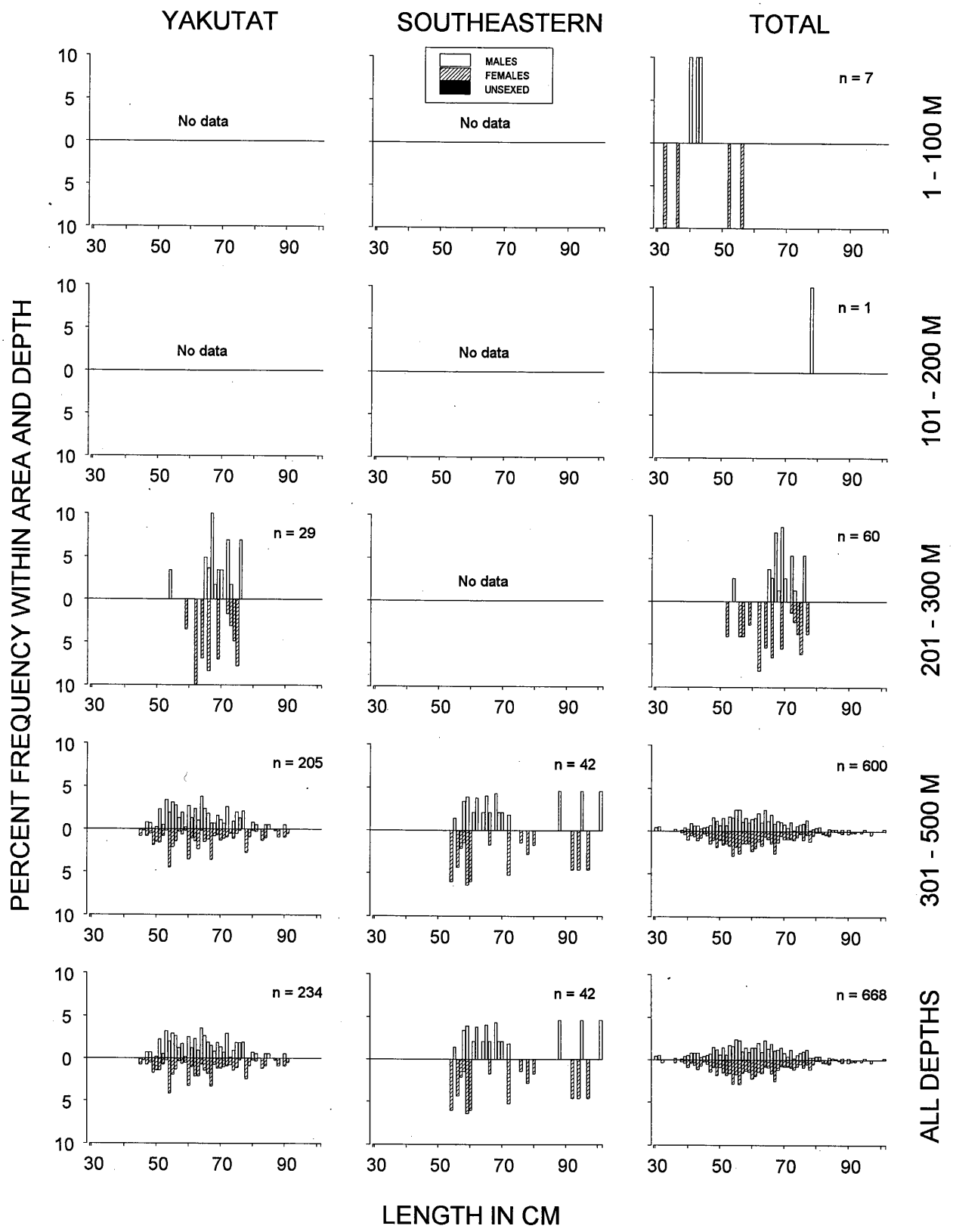

Figure 47.--Continued.

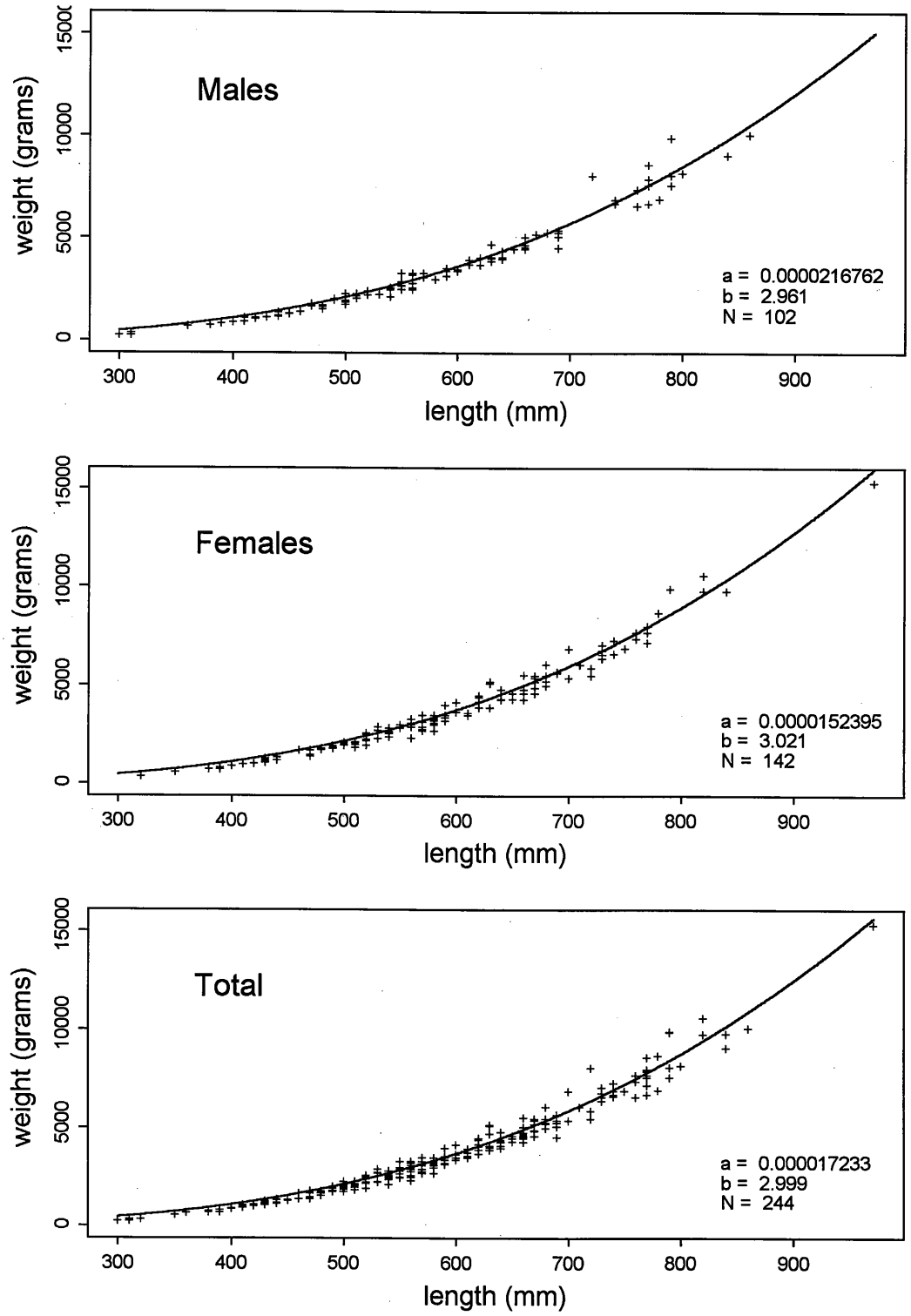

Figure 48.--Length-weight relationship for shortraker rockfish specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 44.--Catch per unit effort by stratum for shortraker rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
341	Yakutat Slope	3	3	4,192	5,133	0	12,012
330	Kodiak Slope	10	8	1,705	5,047	0	10,640
320	Chirikof Slope	6	5	1,381	2,254	0	4,994
310	Shumagin Slope	6	5	1,032	2,610	0	7,418
350	Southeastern Deep Gullies	13	9	807	1,675	66	3,284
340	Yakutat Deep Gullies	15	11	607	1,056	343	1,769
240	Yakutat Gullies	18	7	191	687	0	1,498
221	Chirikof Slope	4	1	39	60	0	249
241	Yakutat Slope	11	1	30	38	0	123
210	Shumagin Slope	8	1	22	61	0	206
10	Fox Islands	24	1	15	132	0	406
230	Kenai Gullies	19	1	7	47	0	144
120	East Shumagin Gully	39	1	4	46	0	140

Shortspine thornyhead (Sebastolobus alascanus)

Shortspine thornyhead were found in every haul on the upper continental slope in depths between 301 and 500 m (Table 45; Fig. 49). Mean CPUEs were also relatively high in the deep gullies of the Kodiak, Yakutat, and Southeastern INPFC areas (Table 46). 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. 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 (Fig. 50). The length-weight relationship for shortspine thornyhead specimens collected during the survey is depicted in Figure 51.

Table 45.--Number of survey hauls, hauls with shortspine thornyhead, estimated CPUE, biomass, mean weight and mean length from the 1993 Gulf of Alaska groundfish 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	106	0	0	0	---	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	6	176	482	0.2	24.0
	301 - 500	6	6	1,278	3,231	0.2	23.9
	All depths	171	12	58	3,713	0.2	23.9
Chirikof	1 - 100	54	1	< 1	2	0.2	---
	101 - 200	81	1	< 1	3	0.5	---
	201 - 300	31	6	293	3,364	0.2	25.7
	301 - 500	6	6	1,774	2,896	0.3	26.5
	All depths	172	14	99	6,264	0.2	26.0
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	13	9	368	0.4	29.5
	201 - 300	28	22	336	3,885	0.3	26.3
	301 - 500	10	10	837	2,476	0.2	22.5
	All depths	240	45	69	6,729	0.2	24.5
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	23	54	1,537	0.2	26.2
	201 - 300	29	29	728	3,550	0.2	23.7
	301 - 500	18	18	1,449	4,293	0.2	25.3
	All depths	124	70	178	9,380	0.2	24.8
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	4	22	214	0.1	---
	201 - 300	30	29	451	2,270	0.2	22.4
	301 - 500	14	14	1,733	5,000	0.2	24.3
	All depths	68	47	421	7,485	0.2	23.6
All areas	1 - 100	244	1	< 1	2	0.2	---
	101 - 200	351	41	18	2,123	0.2	26.6
	201 - 300	126	92	380	13,551	0.2	24.5
	301 - 500	54	54	1,380	17,896	0.2	24.4
	All depths	775	188	114	33,572	0.2	24.5

All areas biomass, 95% confidence interval: 27,882 - 39,262 metric tons (t).

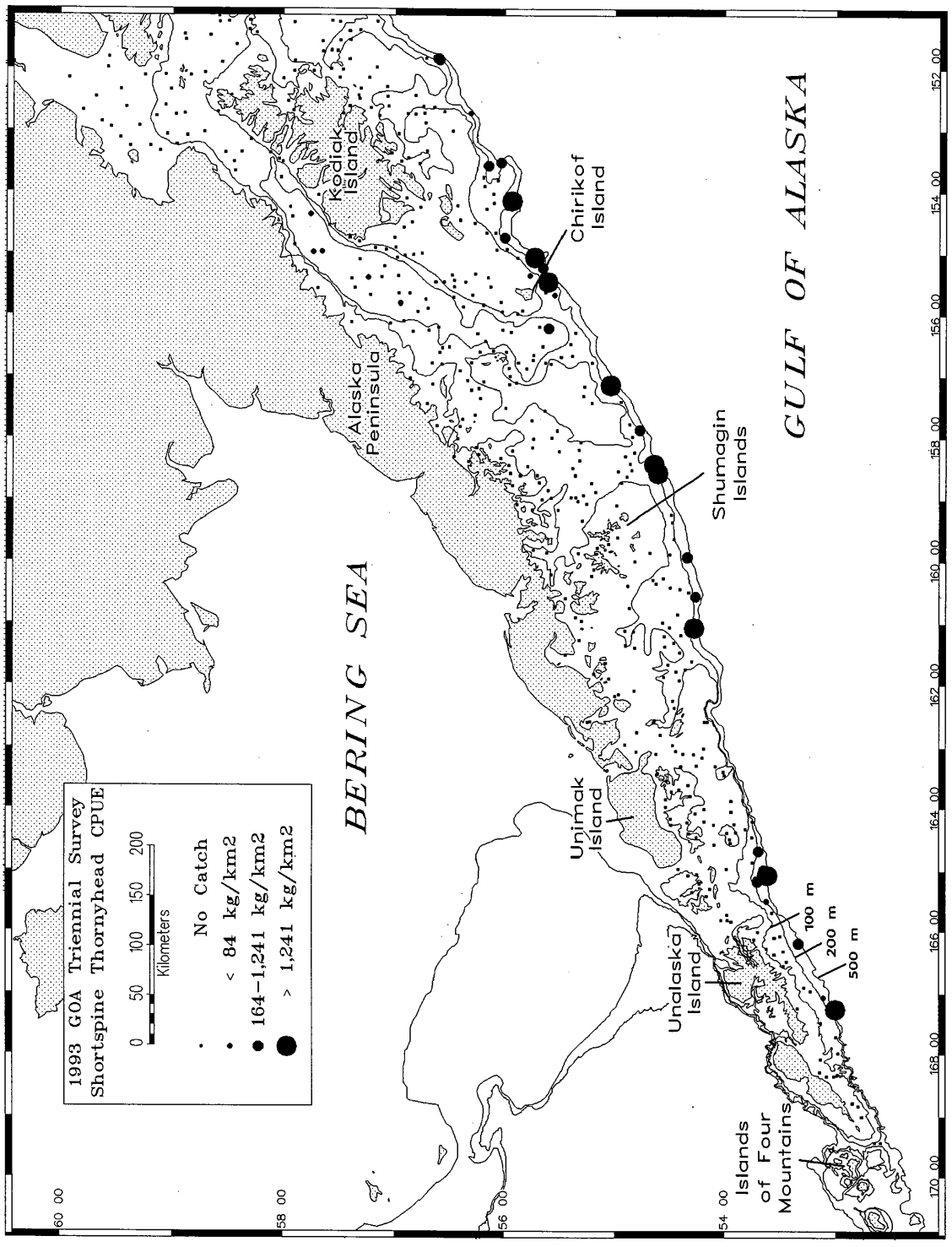

Figure 49.--Distribution and relative abundance of shortspine thornyhead from the 1993 Gulf of Alaska bottom trawl survey. Abundance is categorized by catches below the mean, between the mean and two standard deviations above the mean, and greater than two standard deviations above the mean.

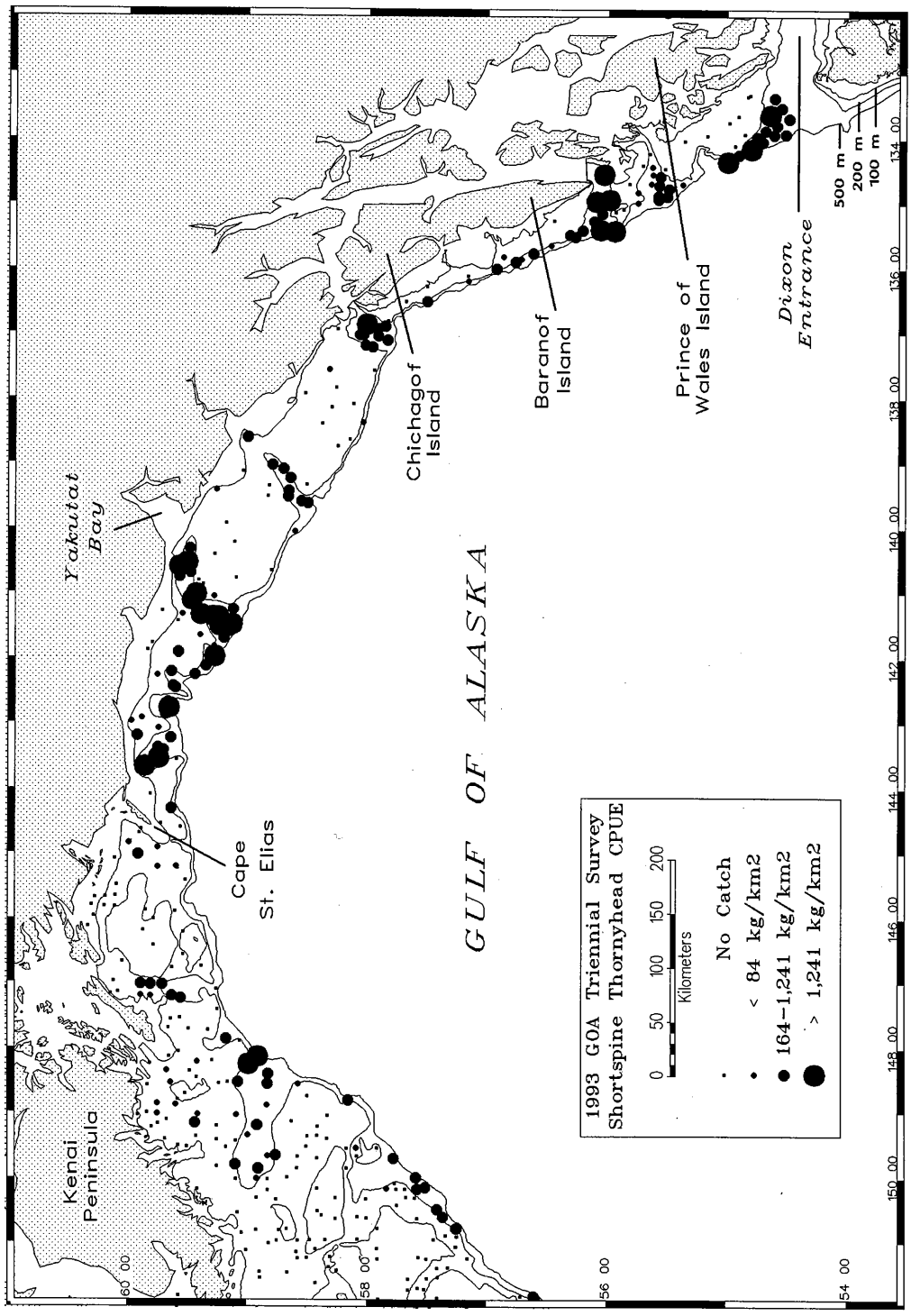

Figure 49.--Continued.

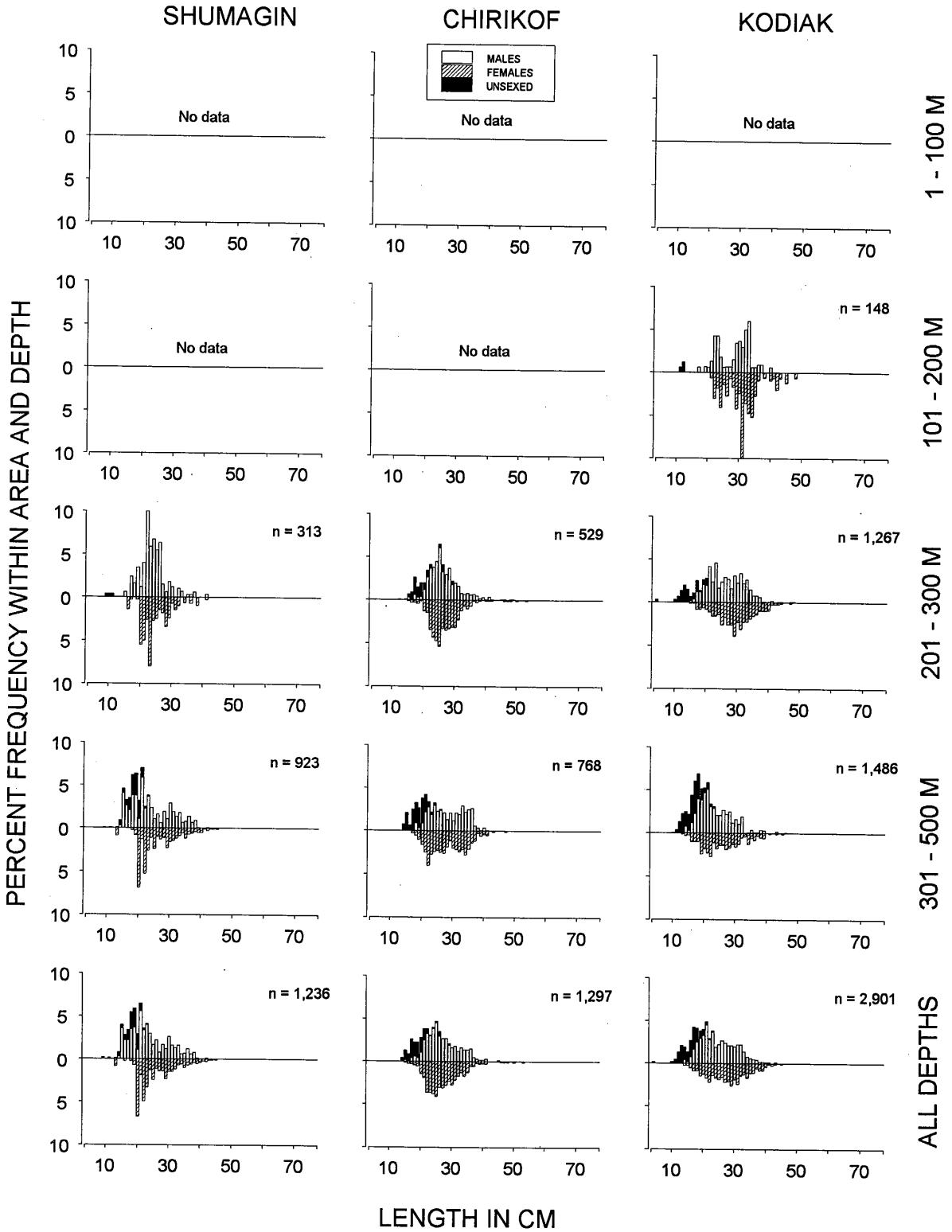

Figure 50.--Size composition of the estimated shortspine thornyhead population from the 1993 Gulf of Alaska survey by International North Pacific Fisheries Commission statistical areas and depth intervals.

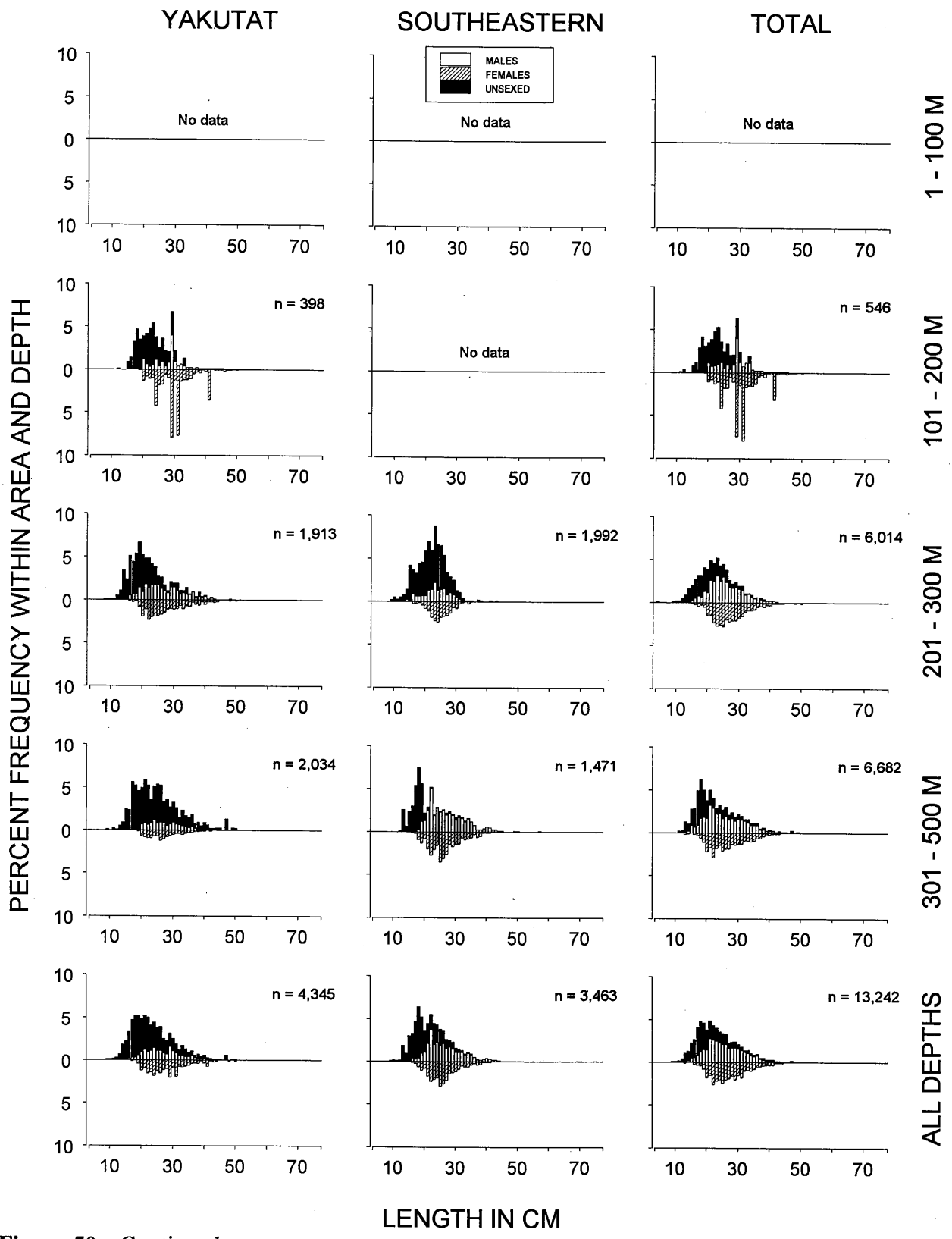

Figure 50.--Continued.

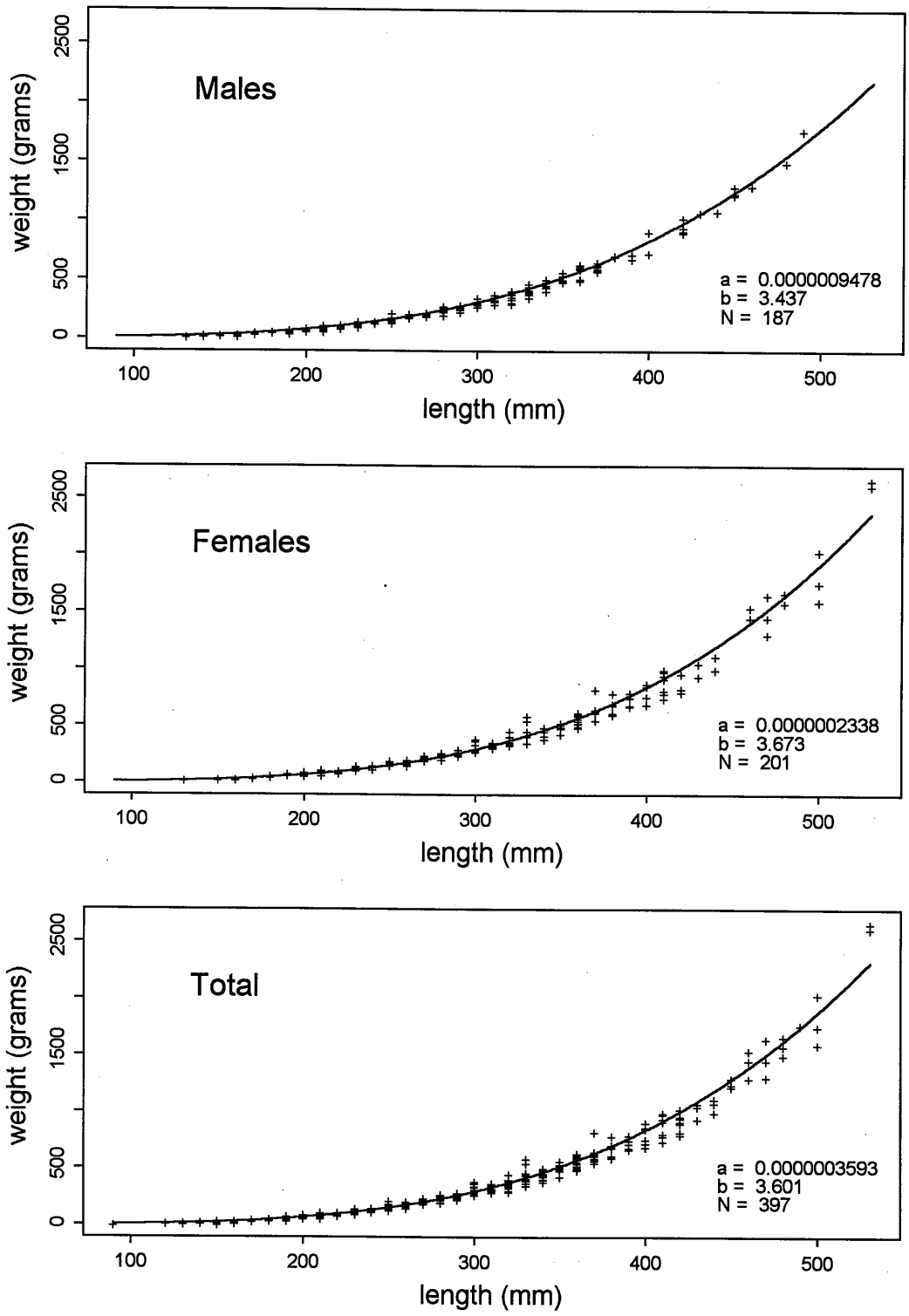

Figure 51.--Length-weight relationship for shortspine thornyhead specimens collected during the 1993 Gulf of Alaska bottom trawl survey. The non-linear least squares regression (solid line) was calculated using the formula $Weight_{(grams)} = a * Length_{(mm)}^{b}$.

Table 46.--Catch per unit effort by stratum for shortspine thornyhead sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
221	Chirikof Slope	4	3	1,933	2,964	0	8,187
350	Southeastern Deep Gullies	13	13	1,840	3,817	1,419	6,215
341	Yakutat Slope	3	3	1,788	2,189	0	4,515
320	Chirikof Slope	6	6	1,774	2,896	1,409	4,382
351	Southeastern Slope	1	1	1,461	1,183	0	0
310	Shumagin Slope	6	6	1,278	3,231	1,153	5,309
340	Yakutat Deep Gullies	15	15	1,210	2,103	1,600	2,607
240	Yakutat Gullies	18	18	864	3,107	2,267	3,947
231	Kodiak Slope	4	4	850	1,382	770	1,993
330	Kodiak Slope	10	10	837	2,476	1,008	3,944
251	Prince of Wales Slope/Gullies	22	21	502	2,009	1,251	2,767
230	Kenai Gullies	19	15	366	2,462	330	4,594
241	Yakutat Slope	11	11	347	443	228	658
250	Baranof-Chichagof Slope	8	8	252	261	107	416
210	Shumagin Slope	8	6	176	482	26	938
141	Yakataga Shelf	10	8	98	525	101	949
140	Middleton Shelf	28	10	69	503	27	979
142	Yakutat Flats	12	3	42	349	0	1,085
220	Lower Shelikof Gully	27	3	40	400	0	1,092
150	Baranof-Chichagof Shelf	10	3	39	159	0	392
143	Fairweather Shelf	11	2	21	160	0	430
133	Kenai Flats	41	10	19	232	3	462
131	Portlock Flats	22	1	16	120	0	368
232	Upper Shelikof Gully	5	3	13	41	0	107
151	Prince of Wales Shelf	14	1	10	55	0	174
134	Kodiak Outer Shelf	15	1	3	14	0	44
122	Chirikof Outer Shelf	18	1	1	3	0	9

OTHER ROCKFISH

Redstripe rockfish (Sebastes proriger)

Redstripe rockfish was the third most abundant groundfish in the Southeastern INPFC area (Table 2). Its abundance was very low for areas west of this area (Table 47). Redstripe rockfish catches were found in high densities in only two strata, Prince of Wales Shelf and Prince of Wales Slope/Gullies, which accounted for more than 97% of the total biomass estimate for the entire survey area (Table 48).

Silvergray rockfish (Sebastes brevispinus)

Silvergray rockfish abundance in the survey area increased from west to east (Table 49). Ninety-two percent of the gulf-wide biomass was estimated to be in the Southeastern INPFC area, where they were the fourth most abundant groundfish in the Southeastern INPFC area (Table 2), and no silvergray rockfish were captured in the Shumagin INPFC area. Eighty-nine percent of the total biomass was attributable to two strata, Prince of Wales Shelf and Prince of Wales Slope/Gullies (Table 50). Fish size also increased from west to east.

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. However, over 90% of the biomass of harlequin rockfish was estimated to be in the Kodiak INPFC area (Table 51). Of this biomass, 77% was estimated to be in two strata, Kodiak Outer Shelf and Portlock Flats (Table 52).

Redbanded rockfish (Sebastes babcocki)

Redbanded rockfish were caught most often between 201 and 300 m in depth, occurring in about 43% of all tows in this depth range, including 87% of the tows in the Southeastern INPFC area (Table 53). Its abundance generally increased from west to east, with the highest abundance areas being the Prince of Wales Slope/Gullies and the Southeastern Deep Gullies (Table 54). The largest redbanded rockfish CPUE of the survey was about 2,295 kg/km^2.

Yellowmouth rockfish (Sebastes reedi)

The total biomass of yellowmouth rockfish was estimated at 3,460 t for the entire survey area (Table 55). Yellowmouth rockfish were recorded in only two strata in the Southeastern INPFC area (Table 56).

Yelloweye rockfish (Sebastes ruberrimus)

Yelloweye rockfish were never captured in large numbers (Tables 57, 58). The largest catch recorded consisted of eight individuals weighing approximately 20 kg. Yelloweye rockfish were most abundant between 101 and 200 m, east of Kodiak Island (Table 57).

Rosethorn rockfish (Sebastes helvomaculatus)

Rosethorn rockfish were most abundant between 201 and 300 m in the Southeastern INPFC area, where they occurred in 50% of all tows (Table 59). Rosethorn rockfish occurred in only one tow west of the Yakutat INPFC area. The Prince of Wales Slope/Gullies stratum was estimated to contain about 53% of the total rosethorn rockfish biomass (Table 60).

Table 47.--Number of survey hauls, hauls with redstripe rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	1	< 1	6	0.4	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	1	< 1	6	0.4	---
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	1	4	96	0.8	39.8
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	1	2	96	0.8	39.8
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	2	< 1	15	0.5	---
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	2	< 1	15	0.5	---
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	0	0	0	---	---
	201 - 300	29	1	0	0	0.1	---
	301 - 500	18	1	1	2	0.9	---
	All depths	124	2	< 1	3	0.5	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	7	1,606	15,856	0.6	35.2
	201 - 300	30	13	2,137	10,761	0.5	33.7
	301 - 500	14	0	0	0	---	---
	All depths	68	20	1,496	26,617	0.6	34.5
All areas	1 - 100	244	1	< 1	6	0.4	---
	101 - 200	351	10	133	15,967	0.6	35.2
	201 - 300	126	14	302	10,761	0.5	33.7
	301 - 500	54	1	< 1	2	0.9	---
	All depths	775	26	90	26,737	0.6	34.5

All areas biomass, 95% confidence interval: 0 - 56,257 metric tons (t).

Table 48.--Catch per unit effort by stratum for redstripe rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
151	Prince of Wales Shelf	14	6	2,713	15,649	0	43,944
251	Prince of Wales Slope/Gullies	22	12	2,611	10,441	255	20,627
250	Baranof-Chichagof Slope	8	1	309	320	0	1,077
150	Baranof-Chichagof Shelf	10	1	50	207	0	675
122	Chirikof Outer Shelf	18	1	19	96	0	298
131	Portlock Flats	22	1	2	11	0	35
134	Kodiak Outer Shelf	15	1	1	4	0	13
340	Yakutat Deep Gullies	15	1	1	2	0	7
13	Shumagin Bank	20	1	0	6	0	19

Table 49.--Number of survey hauls, hauls with silvergray rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	0	0	0	---	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	0	0	0	---	---
Chirikof	1 - 100	54	1	< 1	12	0.4	37.7
	101 - 200	81	1	2	49	1.0	42.6
	201 - 300	31	1	2	21	1.4	---
	301 - 500	6	0	0	0	---	---
	All depths	172	3	1	82	0.8	40.6
Kodiak	1 - 100	68	2	2	93	0.8	39.4
	101 - 200	134	11	9	406	1.2	44.7
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	13	5	499	1.1	43.0
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	4	5	133	1.5	---
	201 - 300	29	6	117	569	1.3	45.3
	301 - 500	18	0	0	0	---	---
	All depths	124	10	13	702	1.3	45.3
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	12	838	8,267	1.5	48.1
	201 - 300	30	26	1,482	7,461	1.7	51.0
	301 - 500	14	0	0	0	---	---
	All depths	68	38	884	15,728	1.6	49.4
All areas	1 - 100	244	3	1	106	0.7	39.0
	101 - 200	351	28	74	8,856	1.5	47.9
	201 - 300	126	33	226	8,050	1.7	50.5
	301 - 500	54	0	0	0	---	---
	All depths	775	64	58	17,012	1.6	48.9

All areas biomass, 95% confidence interval: 6,316 - 27,707 metric tons

Table 50.--Catch per unit effort by stratum for silvergray rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
251	Prince of Wales Slope/Gullies	22	20	1,789	7,154	0	14,674
151	Prince of Wales Shelf	14	8	1,394	8,040	0	16,186
241	Yakutat Slope	11	3	407	519	0	1,411
250	Baranof-Chichagof Slope	8	6	296	307	0	694
150	Baranof-Chichagof Shelf	10	4	55	227	0	523
133	Kenai Flats	41	6	23	274	0	597
134	Kodiak Outer Shelf	15	2	17	84	0	235
240	Yakutat Gullies	18	3	14	49	0	106
142	Yakutat Flats	12	1	9	76	0	244
31	Albatross Banks	33	1	6	88	0	266
143	Fairweather Shelf	11	1	5	40	0	129
120	East Shumagin Gully	39	1	4	49	0	149
131	Portlock Flats	22	1	3	19	0	60
132	Barren Islands	27	2	3	28	0	68
140	Middleton Shelf	28	2	2	17	0	47
220	Lower Shelikof Gully	27	1	2	21	0	63
22	Chirikof Bank	31	1	1	12	0	38
30	Albatross Shallows	11	1	1	6	0	18

Table 51.--Number of survey hauls, hauls with harlequin rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	2	1	58	0.4	28.1
	101 - 200	51	4	2	28	0.2	24.5
	201 - 300	8	1	2	6	0.3	---
	301 - 500	6	0	0	0	---	---
	All depths	171	7	1	92	0.3	26.6
Chirikof	1 - 100	54	2	7	187	0.2	26.2
	101 - 200	81	7	3	71	0.3	27.7
	201 - 300	31	1	< 1	1	0.1	---
	301 - 500	6	1	1	2	0.2	---
	All depths	172	11	4	260	0.3	26.6
Kodiak	1 - 100	68	4	26	1,041	0.2	25.9
	101 - 200	134	41	170	7,358	0.3	26.8
	201 - 300	28	5	4	41	0.3	29.0
	301 - 500	10	1	2	6	0.4	---
	All depths	240	51	87	8,446	0.3	26.7
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	4	5	137	0.2	21.8
	201 - 300	29	10	26	126	0.2	24.8
	301 - 500	18	1	< 1	1	0.2	---
	All depths	124	15	5	263	0.2	23.1
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	8	20	196	0.2	24.2
	201 - 300	30	16	14	70	0.2	---
	301 - 500	14	1	< 1	1	0.2	---
	All depths	68	25	15	267	0.2	24.2
All areas	1 - 100	244	8	10	1,287	0.3	26.0
	101 - 200	351	64	65	7,790	0.3	26.6
	201 - 300	126	33	7	243	0.2	25.6
	301 - 500	54	4	1	9	0.3	---
	All depths	775	109	32	9,329	0.3	26.5

All areas biomass, 95% confidence interval: 19 - 18,638 metric tons (t).

Table 52.--Catch per unit effort by stratum for harlequin rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
134	Kodiak Outer Shelf	15	6	886	4,499	0	13,434
131	Portlock Flats	22	9	272	1,990	0	4,179
241	Yakutat Slope	11	6	92	117	0	311
31	Albatross Banks	33	2	68	1,036	0	3,033
133	Kenai Flats	41	23	50	600	0	1,252
150	Baranof-Chichagof Shelf	10	4	27	112	0	331
130	Albatross Gullies	29	2	24	185	0	558
231	Kodiak Slope	4	3	23	38	0	83
22	Chirikof Bank	31	1	16	177	0	538
143	Fairweather Shelf	11	2	15	115	0	357
151	Prince of Wales Shelf	14	4	15	84	0	190
251	Prince of Wales Slope/Gullies	22	9	14	57	0	145
250	Baranof-Chichagof Slope	8	7	12	13	2	23
132	Barren Islands	27	1	8	84	0	257
121	Shelikof Edge	24	4	7	50	0	105
122	Chirikof Outer Shelf	18	3	4	21	0	49
13	Shumagin Bank	20	1	3	45	0	140
111	Shumagin Outer Shelf	25	3	3	24	0	60
141	Yakataga Shelf	10	1	3	16	0	52
112	West Shumagin Gully	6	1	2	4	0	14
210	Shumagin Slope	8	1	2	6	0	20
240	Yakutat Gullies	18	4	2	9	0	20
330	Kodiak Slope	10	1	2	6	0	18
11	Davidson Bank	44	1	1	13	0	40
21	Semidi Bank	8	1	1	10	0	33
33	Kenai Peninsula	3	1	1	3	0	16
142	Yakutat Flats	12	1	1	6	0	19
221	Chirikof Slope	4	1	1	1	0	4
230	Kenai Gullies	19	2	1	3	0	9
320	Chirikof Slope	6	1	1	2	0	6
350	Southeastern Deep Gullies	13	1	1	1	0	4
340	Yakutat Deep Gullies	15	1	0	1	0	2

Table 53.--Number of survey hauls, hauls with redbanded rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	0	0	0	---	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	1	2	5	0.6	32.0
	301 - 500	6	1	2	5	0.7	---
	All depths	171	2	< 1	10	0.6	32.0
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	4	1	27	0.5	32.3
	201 - 300	31	3	8	89	1.0	---
	301 - 500	6	0	0	0	---	---
	All depths	172	7	2	116	0.8	32.3
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	11	3	111	0.6	43.2
	201 - 300	28	11	19	215	0.6	29.7
	301 - 500	10	0	0	0	---	---
	All depths	240	22	3	326	0.6	30.8
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	3	25	705	0.6	32.5
	201 - 300	29	13	81	395	0.7	32.9
	301 - 500	18	2	1	3	0.5	---
	All depths	124	18	21	1,103	0.7	32.7
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	8	75	740	1.5	43.0
	201 - 300	30	26	171	861	0.7	29.8
	301 - 500	14	6	133	385	1.0	46.1
	All depths	68	40	112	1,986	1.0	35.6
All areas	1 - 100	244	0	0	0	---	---
	101 - 200	351	26	13	1,583	0.9	35.4
	201 - 300	126	54	44	1,565	0.7	30.6
	301 - 500	54	9	30	393	1.0	46.1
	All depths	775	89	12	3,541	0.8	33.8

All areas biomass, 95% confidence interval: 1,577 - 5,505 metric tons (t).

Table 54.--Catch per unit effort by stratum for redbanded rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
251	Prince of Wales Slope/Gullies	22	18	204	814	0	1,667
350	Southeastern Deep Gullies	13	5	175	362	0	944
151	Prince of Wales Shelf	14	5	111	641	0	1,729
240	Yakutat Gullies	18	10	103	369	47	691
143	Fairweather Shelf	11	3	93	705	0	2,129
231	Kodiak Slope	4	3	66	107	0	288
250	Baranof-Chichagof Slope	8	8	45	47	5	88
221	Chirikof Slope	4	2	41	64	0	185
351	Southeastern Slope	1	1	28	22	0	0
150	Baranof-Chichagof Shelf	10	3	24	99	0	245
241	Yakutat Slope	11	3	21	26	0	78
230	Kenai Gullies	19	8	16	108	9	207
131	Portlock Flats	22	3	7	50	0	130
134	Kodiak Outer Shelf	15	2	7	35	0	98
121	Shelikof Edge	24	3	3	20	0	53
220	Lower Shelikof Gully	27	1	3	26	0	78
133	Kenai Flats	41	5	2	24	0	55
210	Shumagin Slope	8	1	2	5	0	17
310	Shumagin Slope	6	1	2	5	0	19
340	Yakutat Deep Gullies	15	2	2	3	0	7
120	East Shumagin Gully	39	1	1	7	0	20
132	Barren Islands	27	1	0	1	0	4

Table 55.--Number of survey hauls, hauls with yellowmouth rockfish, estimated CPUE, biomass, mean weight and mean length from the 1993 Gulf of Alaska groundfish 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	106	0	0	0	---	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	0	0	0	---	---
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	0	0	0	---	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	0	0	0	---	---
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	0	0	0	---	---
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	0	0	0	---	---
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	0	0	0	---	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	0	0	0	---	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	2	78	771	1.5	---
	201 - 300	30	3	534	2,688	1.8	45.7
	301 - 500	14	0	0	0	---	---
	All depths	68	5	194	3,460	1.7	45.7
All areas	1 - 100	244	0	0	0	---	---
	101 - 200	351	2	6	771	1.5	---
	201 - 300	126	3	75	2,688	1.8	45.7
	301 - 500	54	0	0	0	---	---
	All depths	775	5	12	3,460	1.7	45.7

All areas biomass, 95% confidence interval: 0 - 8,988 metric tons (t).

Table 56.--Catch per unit effort by stratum for yellowmouth rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
151	Prince of Wales Slope/Gullies	22	3	672	2,688	0	8,056
251	Prince of Wales Shelf	14	2	134	771	0	2,320

Table 57.--Number of survey hauls, hauls with yelloweye rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	1	< 1	16	0.9	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	1	< 1	16	0.9	---
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	2	1	29	2.3	48.4
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	2	< 1	29	2.3	48.4
Kodiak	1 - 100	68	1	1	31	2.7	52.0
	101 - 200	134	14	13	546	2.3	50.0
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	15	6	576	2.3	50.2
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	2	9	257	4.0	---
	201 - 300	29	0	0	0	---	---
	301 - 500	18	0	0	0	---	---
	All depths	124	2	5	257	4.0	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	2	14	135	2.6	---
	201 - 300	30	3	28	142	3.1	---
	301 - 500	14	0	0	0	---	---
	All depths	68	5	16	277	2.9	---
All areas	1 - 100	244	2	< 1	47	1.6	52.0
	101 - 200	351	20	8	966	2.6	49.9
	201 - 300	126	3	4	142	3.1	---
	301 - 500	54	0	0	0	---	---
	All depths	775	25	4	1,155	2.6	50.0

All areas biomass, 95% confidence interval: 438 - 1,871 metric tons (t).

Table 58.--Catch per unit effort by stratum for yelloweye rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
143	Fairweather Shelf	11	1	32	246	0	794
251	Prince of Wales Slope/Gullies	22	1	32	126	0	388
131	Portlock Flats	22	3	26	189	0	496
150	Baranof-Chichagof Shelf	10	1	17	68	0	221
250	Baranof-Chichagof Slope	8	2	15	16	0	40
133	Kenai Flats	41	6	13	154	0	317
151	Prince of Wales Shelf	14	1	12	67	0	212
132	Barren Islands	27	2	11	122	0	296
134	Kodiak Outer Shelf	15	2	11	55	0	142
122	Chirikof Outer Shelf	18	1	5	23	0	72
130	Albatross Gullies	29	1	3	25	0	75
31	Albatross Banks	33	1	2	31	0	94
13	Shumagin Bank	20	1	1	16	0	50
120	East Shumagin Gully	39	1	1	6	0	18
140	Middleton Shelf	28	1	1	11	0	33

Table 59.--Number of survey hauls, hauls with rosethorn rockfish, CPUE, biomass, mean weight and mean length based on the 1993 Gulf of Alaska groundfish 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	106	0	0	0	---	---
	101 - 200	51	0	0	0	---	---
	201 - 300	8	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	171	0	0	0	---	---
Chirikof	1 - 100	54	0	0	0	---	---
	101 - 200	81	0	0	0	---	---
	201 - 300	31	0	0	0	---	---
	301 - 500	6	0	0	0	---	---
	All depths	172	0	0	0	---	---
Kodiak	1 - 100	68	0	0	0	---	---
	101 - 200	134	1	< 1	9	0.3	---
	201 - 300	28	0	0	0	---	---
	301 - 500	10	0	0	0	---	---
	All depths	240	1	< 1	9	0.3	---
Yakutat	1 - 100	16	0	0	0	---	---
	101 - 200	61	3	2	52	0.3	---
	201 - 300	29	3	3	15	0.4	---
	301 - 500	18	1	1	3	0.2	---
	All depths	124	7	1	71	0.3	---
Southeastern	1 - 100	0	0	---	---	---	---
	101 - 200	24	8	23	231	0.3	---
	201 - 300	30	15	76	382	0.2	---
	301 - 500	14	1	3	8	0.2	---
	All depths	68	24	35	620	0.3	---
All areas	1 - 100	244	0	0	0	---	---
	101 - 200	351	12	2	291	0.3	---
	201 - 300	126	18	11	397	0.2	---
	301 - 500	54	2	1	11	0.2	---
	All depths	775	32	2	700	0.3	---

All areas biomass, 95% confidence interval: 362 - 1,037 metric tons (t).

Table 60.--Catch per unit effort by stratum for rosethorn rockfish sorted by descending CPUE for the 1993 Gulf of Alaska groundfish survey.

Stratum code	Stratum name	Number of hauls	Hauls with catch	CPUE (kg/km^2)	Biomass (t)	Lower C.I. Biomass	Upper C.I. Biomass
251	Prince of Wales Slope/Gullies	22	12	93	372	100	643
151	Prince of Wales Shelf	14	5	27	156	0	320
150	Baranof-Chichagof Shelf	10	3	18	75	0	212
241	Yakutat Slope	11	3	12	15	0	37
351	Southeastern Slope	1	1	10	8	0	0
250	Baranof-Chichagof Slope	8	3	9	10	0	29
142	Yakutat Flats	12	1	4	30	0	97
141	Yakataga Shelf	10	1	3	14	0	45
341	Yakutat Slope	3	1	3	3	0	18
134	Kodiak Outer Shelf	15	1	2	9	0	27
143	Fairweather Shelf	11	1	1	8	0	26

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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 1993 triennial Gulf of Alaska bottom trawl survey.

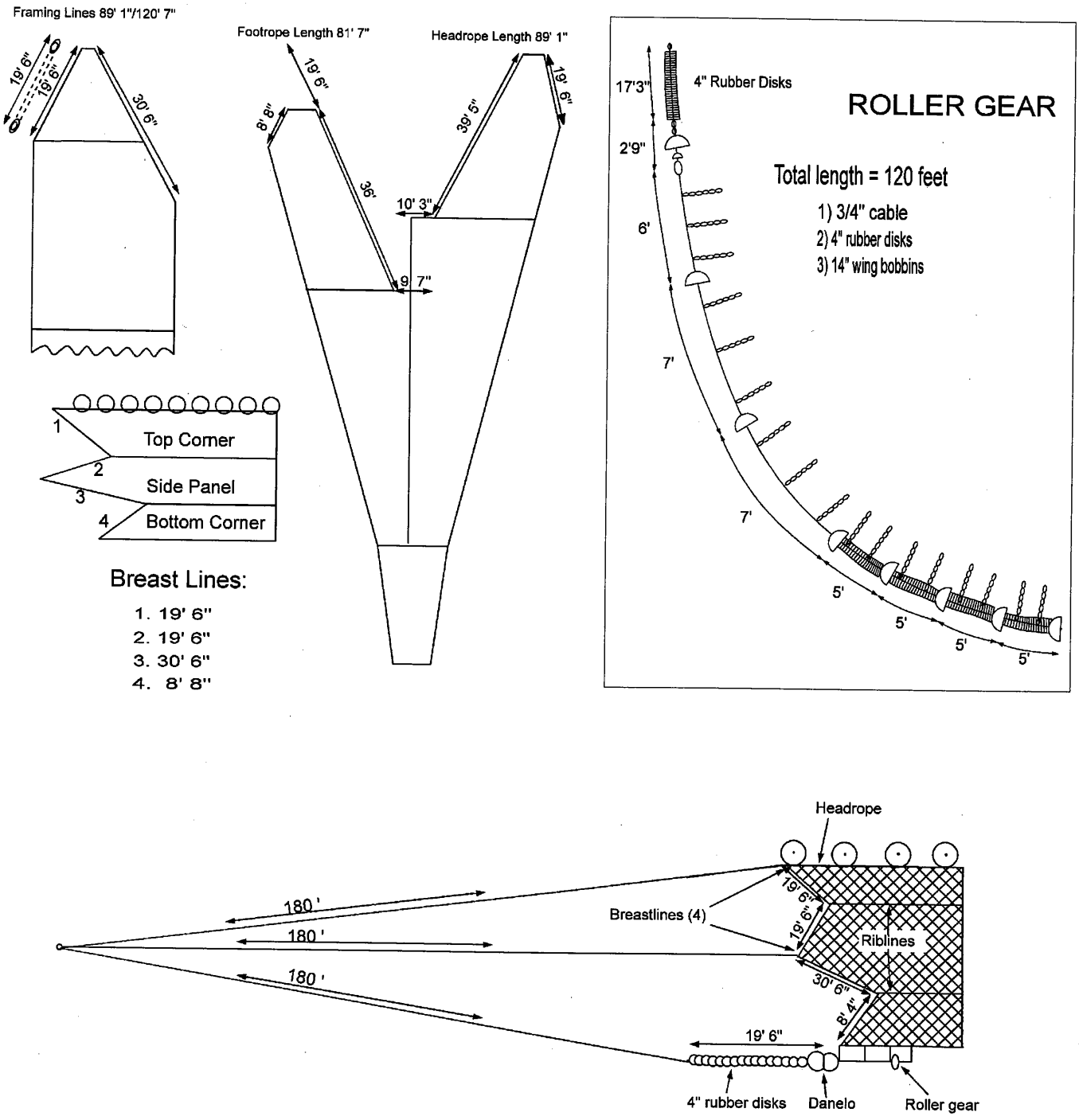

Figure A-1.--Schematic diagram of the 90-105 polyethylene Nor'eastern bottom trawl, roller gear and accessory gear used during the 1993 Gulf of Alaska triennial bottom trawl survey.

APPENDIX B

Strata Specifications and Locations

Table B-1 presents the survey strata definitions for the 1993 Gulf of Alaska triennial survey including depth range, stratum name, and the area in square nautical miles and square kilometers. Table B-2 presents the summary strata code definitions. Figures B-1 through B-5 are charts showing the locations and extent of the strata as defined.

Table B-1.--Survey strata used for the 1993 Gulf of Alaska triennial survey including depth, stratum code, name and area in square nautical miles (nm^2 and square kilometers (km^2).

Depth Range (m)	Stratum Code	Stratum Name	Area (nmi^2)	Area (km^2)
1-100	10	Fox Islands	2,512	8,616
	11	Davidson Bank	3,988	13,678
	12	Lower Alaska Peninsula	2,170	7,443
	13	Shumagin Bank	4,264	14,625
	20	Upper Alaska Peninsula	2,415	8,283
	21	Semidi Bank	2,128	7,299
	22	Chirikof Bank	3,205	10,993
	30	Albatross Shallows	1,784	6,119
	31	Albatross Banks	4,472	15,339
	32	Lower Cook Inlet	3,053	10,471
	33	Kenai Peninsula	1,607	5,512
	35	Northern Kodiak Shallows	700	2,401
	40	Yakutat Shallows	2,438	8,362
	41	Middleton Shallows	2,291	7,858
	50	Southeastern Shallows	1,098	3,766
	991	**subtotal**	38,125	130,765
101-200	110	Sanak Gully	1,234	4,233
	111	Shumagin Outer Shelf	2,343	8,036
	112	West Shumagin Gully	661	2,267
	120	East Shumagin Gully	3,231	11,082
	121	Shelikof Edge	2,237	7,673
	122	Chirikof Outer Shelf	1,456	4,994
	130	Albatross Gullies	2,285	7,837
	131	Portlock Flats	2,134	7,319
	132	Barren Islands	3,192	10,948
	133	Kenai Flats	3,499	12,001
	134	Kodiak Outer Shelf	1,480	5,076
	140	Middleton Shelf	2,132	7,313
	141	Yakataga Shelf	1,566	5,371
	142	Yakutat Flats	2,441	8,372
	143	Fairweather Shelf	2,213	7,590
	150	Baranof-Chichagof Shelf	1,196	4,102
	151	Prince of Wales Shelf	1,682	5,769
	992	**subtotal**	34,982	119,983

Table B-1.--Continued.

Depth Range (m)	Stratum Code	Stratum Name	Area (nmi^2)	Area (km^2)
	221	Chirikof Slope	447	1,533
	230	Kenai Gullies	1,962	6,729
	231	Kodiak Slope	474	1,626
	232	Upper Shelikof Gully	930	3,190
	240	Yakutat Gullies	1,049	3,598
	241	Yakutat Slope	372	1,276
	250	Baranof-Chichagof Slope	302	1,036
	251	Prince of Wales Slope	1,166	3,999
	993	**subtotal**	10,406	35,691
301-500	310	Shumagin Slope	737	2,528
	320	Chirikof Slope	476	1,633
	330	Kodiak Slope	863	2,960
	340	Yakutat Deep Gullies	507	1,739
	341	Yakutat Slope	357	1,224
	350	Southeastern Deep Gullies	605	2,075
	351	Southeastern Slope	236	809
	994	**subtotal**	3,781	12,968
1-500		**GRAND TOTAL**	87,294	299,407

Table B-2.--Summary strata codes used for the 1993 Gulf of Alaska triennial survey including depth range, strata code, International North Pacific Fisheries Commission statistical areas and area.

Depth (m)	Code Number	INPFC area	Area (nmi^2)	Area (km^2)	Subareas included
1-100	911	Shumagin	12,934	44,362	10 -13
101-200	912		4,238	14,536	110 - 112
201-300	913		798	2,737	210
301-500	914		737	2,528	310
1-500	919		18,707	64,163	
1-100	921	Chirikof	7,748	26,575	20 - 22
101-200	922		6,924	23,749	120 - 122
201-300	923		3,353	11,500	220, 221
301-500	924		476	1,633	320
1-500	929		18,501	63,457	
1-100	931	Kodiak	11,616	39,842	30 - 33, 35
101-200	932		12,590	43,181	130 - 134
201-300	933		3,366	11,545	230 - 232
301-500	934		863	2,960	330
1-500	939		28,435	97,528	
1-100	941	Yakutat	4,729	16,220	40, 41
101-200	942		8,352	28,646	140 - 143
201-300	943		1,421	4,874	240, 241
301-500	944		864	2,963	340, 341
1-500	949		15,366	52,703	
1-100	951	Southeastern	1,098	3,766	50
101-200	952		2,878	9,871	150, 151
201-300	953		1,468	5,035	250, 251
301-500	954		841	2,885	350, 351
1-500	959		6,285	21,557	
1-500	999	All areas	87,294	299,408	

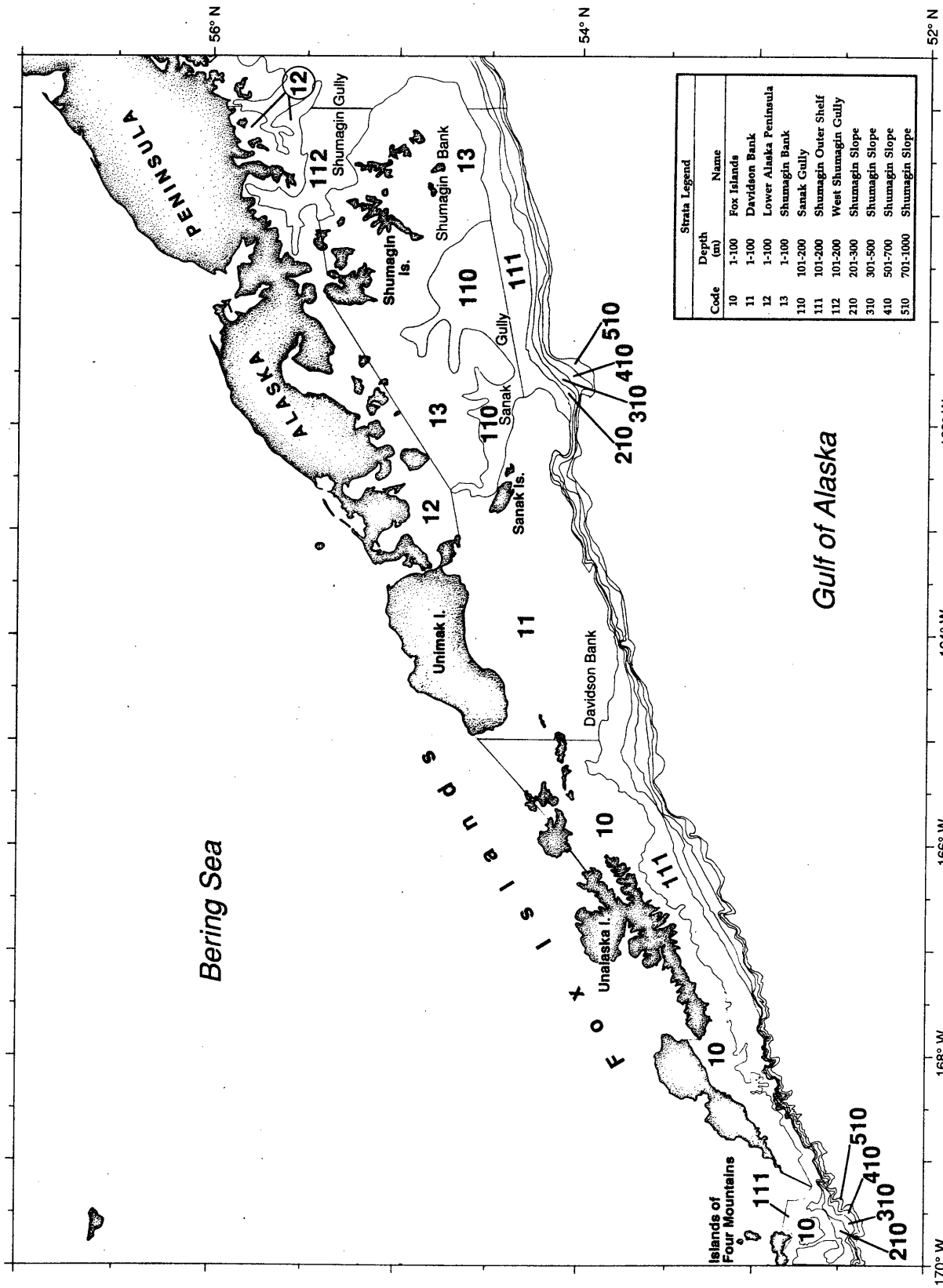

Figure B-1.--Survey strata in the Shumagin INPFC statistical area used for the 1993 Gulf of Alaska triennial groundfish survey. Strata in depths greater than 500 m were not sampled in this survey.

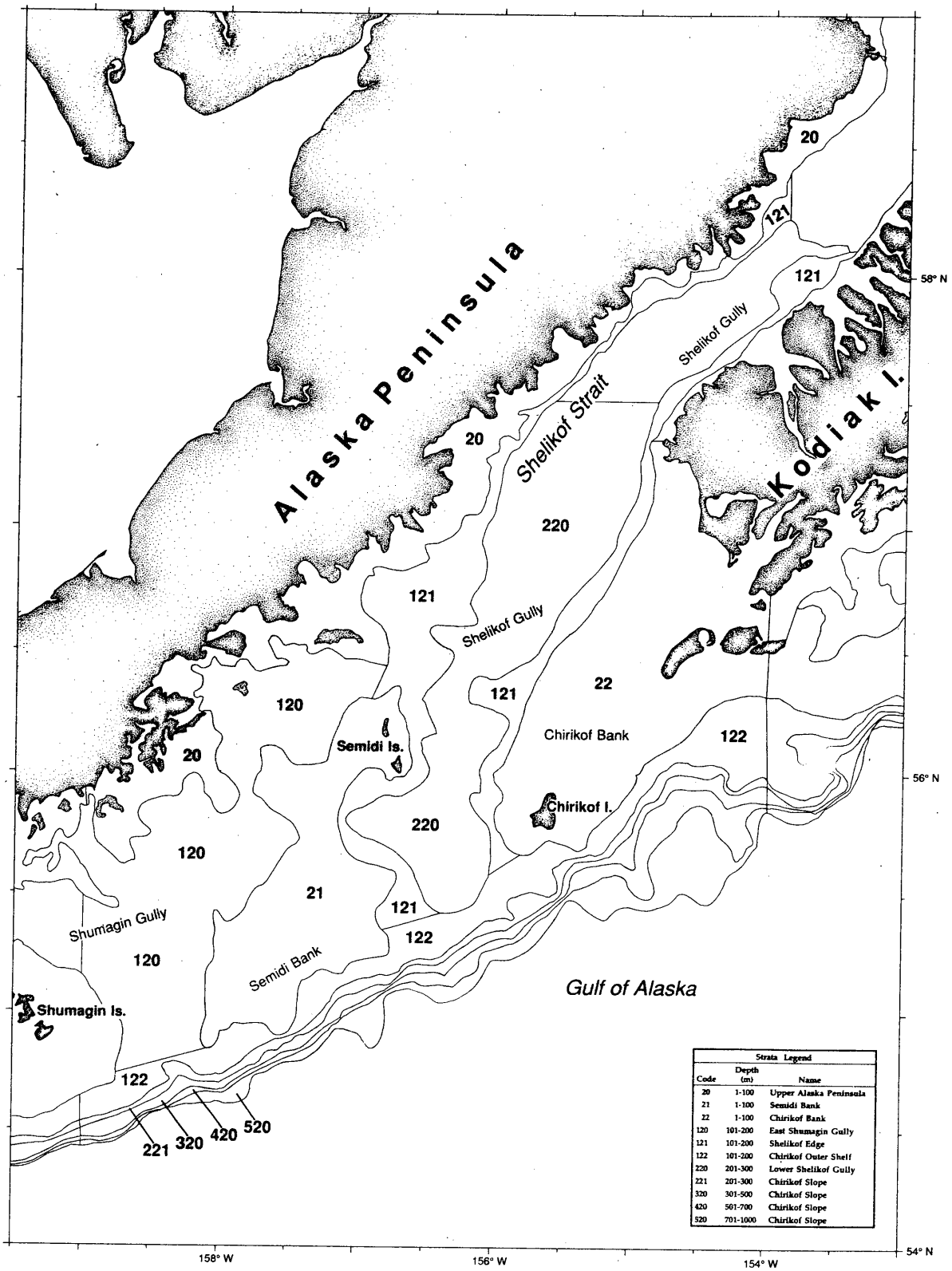

Figure B-2.--Survey strata in the Chirikof INPFC statistical area used for the 1993 Gulf of Alaska triennial groundfish survey. Strata in depths greater than 500 m were not sampled in this survey.

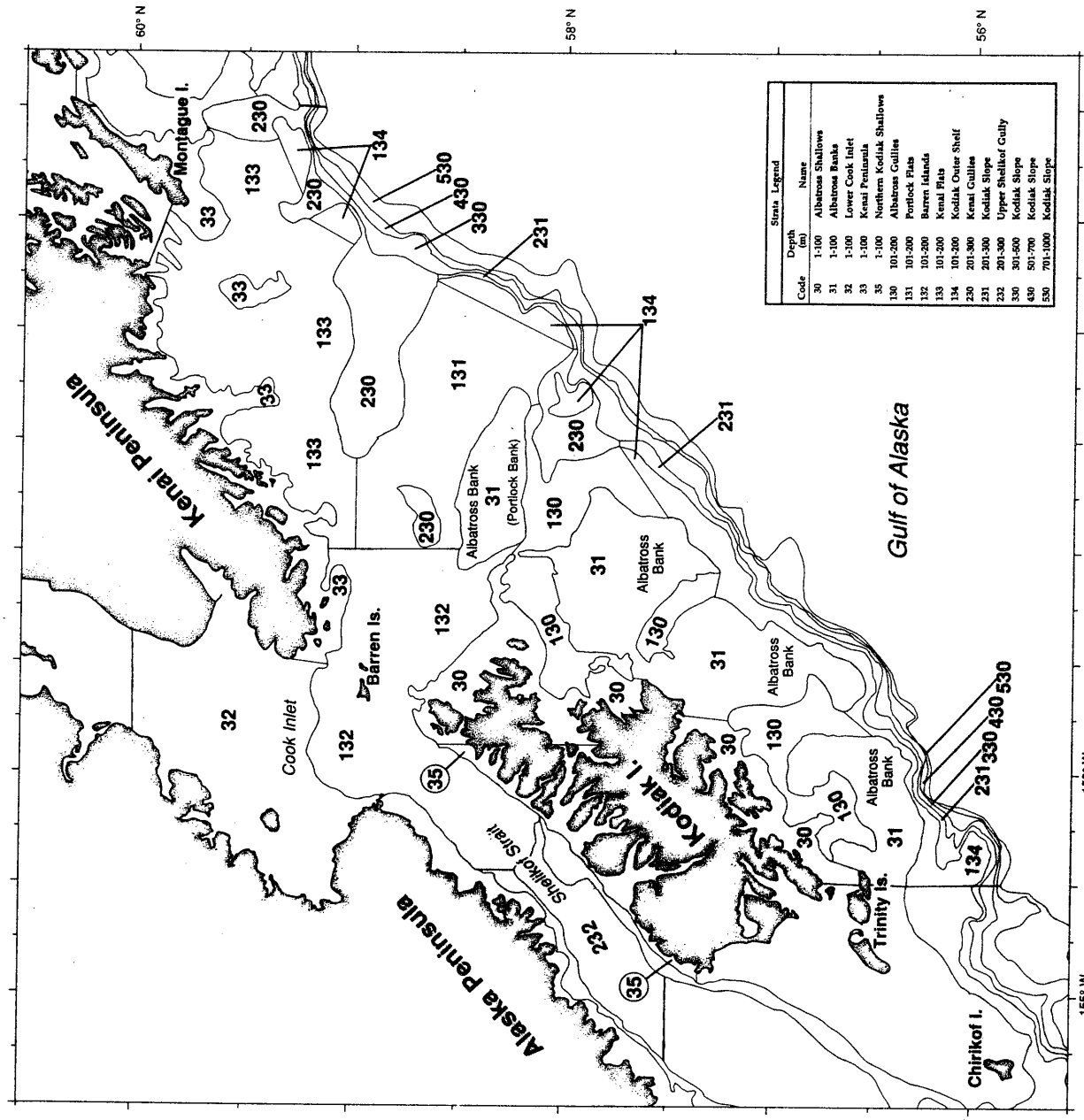

Figure B-3.--Survey strata in the Kodiak INPFC statistical area used for the 1993 Gulf of Alaska triennial groundfish survey. Strata in depths greater than 500 m were not sampled in this survey.

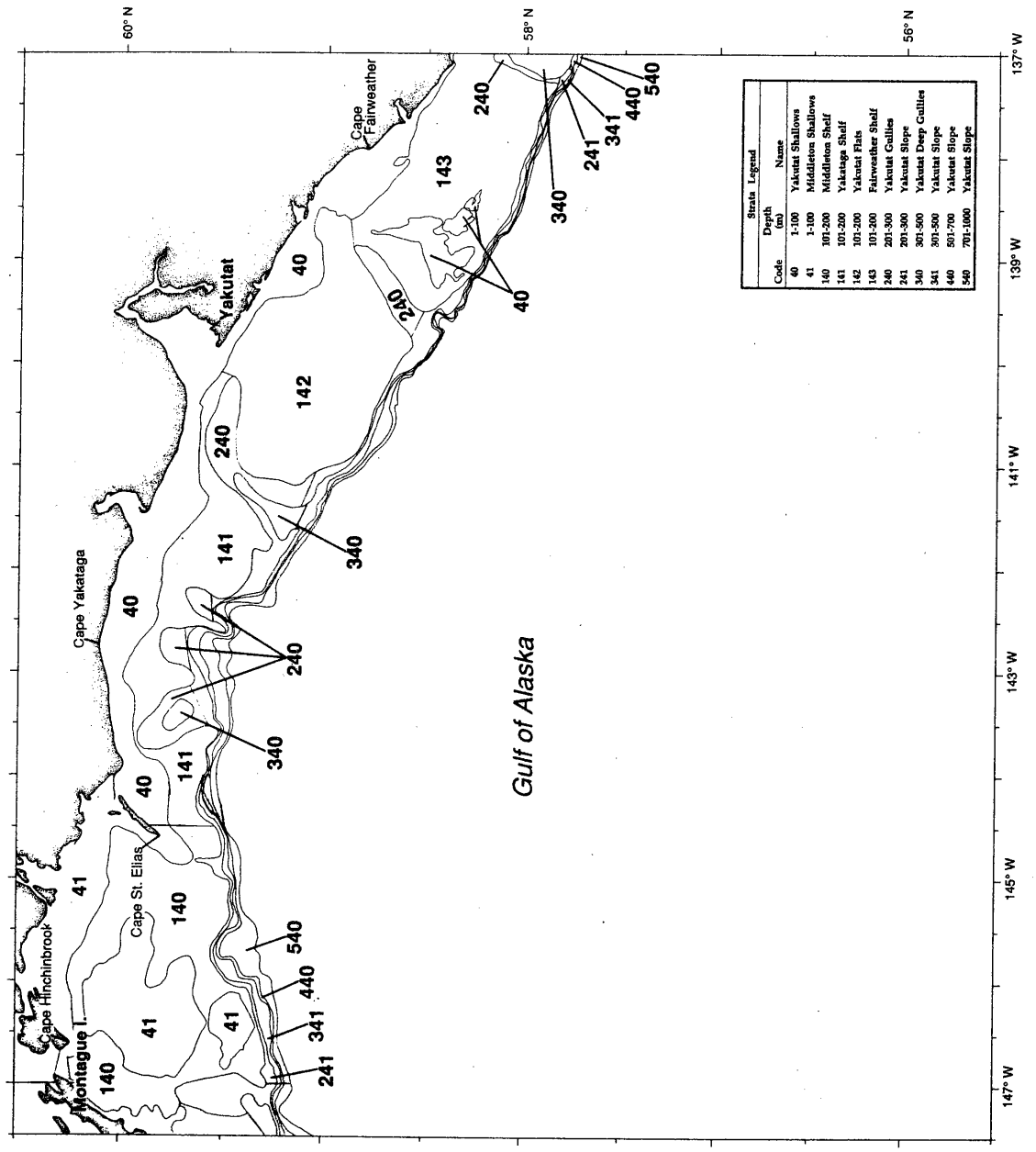

Figure B-4.--Survey strata in the Yakutat INPFC statistical area used for the 1993 Gulf of Alaska triennial groundfish survey. Strata in depths greater than 500 m were not sampled in this survey.

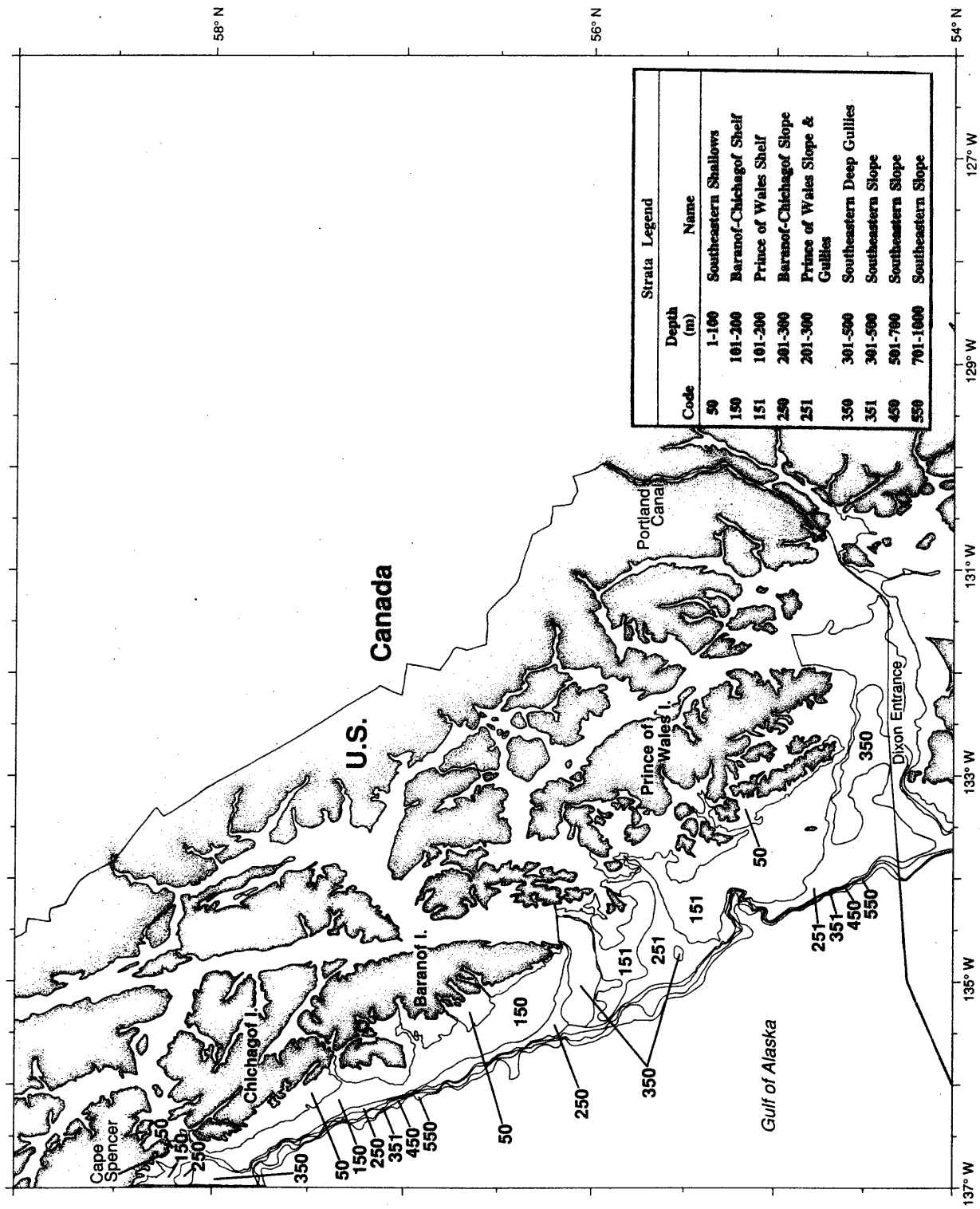

Figure B-5.--Survey strata in the Southeastern INPFC statistical area used for the 1993 Gulf of Alaska triennial groundfish survey. Strata in depths greater than 500 m were not sampled in this survey.

APPENDIX C

Animal Species Encountered

Tables C-1 and C-2 list fish and invertebrate taxa encountered and identified during the 1993 Gulf of Alaska triennial groundfish 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.

Table C1.--Fish species encountered during the 1993 Gulf of Alaska triennial trawl survey.

Family	Species Name	Common Name
Petromyzontidae	Lampetra tridentata	Pacific lamprey
Lamnidae	Lamna ditropis	salmon shark
Squalidae	Somniosus pacificus	Pacific sleeper shark
	Squalus acanthias	spiny dogfish
Rajidae	Bathyraja aleutica	Aleutian skate
	Bathyraja interrupta	Bering skate
	Raja binoculata	big skate
	Raja rhina	longnose skate
Chimaeridae	Hydrolagus colliei	spotted ratfish
Pleuronectidae	Atheresthes evermanni	Kamchatka flounder
	Atheresthes stomias	arrowtooth flounder
	Eopsetta jordani	petrale sole
	Errex zachirus	rex sole
	Hippoglossoides elassodon	flathead sole
	Hippoglossus stenolepis	Pacific halibut
	Pleuronectes isolepis	butter sole
	Eopsetta exilis	slender sole
	Microstomus pacificus	Dover sole
	Pleuronectes vetulus	English sole
	Platichthys stellatus	starry flounder
	Pleuronectes asper	yellowfin sole
	Pleuronectes bilineatus	rock sole
	Pleuronectes quadrituberculatus	Alaska plaice
	Psettichthys melanostictus	sand sole
Agonidae	Agonopsis vulsa	northern spearnose poacher
	Bathyagonus alascanus	gray starsnout
	Bathyagonus nigripinnis	blackfin poacher
	Hypsagonus quadricornis	fourhorn poacher
	Podothecus acipenserinus	sturgeon poacher
	Sarritor frenatus	sawback poacher
Ammodytidae	Ammodytes hexapterus	Pacific sand lance

Table C1.--Continued.

Family	Species Name	Common Name
Anarhichadidae	Anarhichas orientalis	Bering wolffish
	Anarrhichthys ocellatus	wolf-eel
Anoplopomatidae	Anoplopoma fimbria	sablefish
Bathylagidae	Leuroglossus schmidti	northern smoothtongue
Bathymasteridae	Bathymaster signatus	searcher
Chauliodontidae	Chauliodus macouni	Pacific viperfish
Clupeidae	Clupea pallasi	Pacific herring
Macrouridae	Albatrossia pectoralis	giant grenadier
	Coryphaenoides acrolepis	Pacific grenadier
Cottidae	Artedius lateralis	smoothhead sculpin
	Blepsias bilobus	crested sculpin
	Dasycottus setiger	spinyhead sculpin
	Eurymen gyrinus	smoothcheek sculpin
	Gymnocanthus galeatus	armorhead sculpin
	Gymnocanthus pistilliger	threaded sculpin
	Hemilepidotus hemilepidotus	red Irish lord
	Hemilepidotus jordani	yellow Irish lord
	Hemitripterus bolini	bigmouth sculpin
	Icelus spiniger	thorny sculpin
	Malacocottus kincaidi	blackfin sculpin
	Malacocottus zonurus	darkfin sculpin
	Myoxocephalus jaok	plain sculpin
	Myoxocephalus polyacanthocephalus	great sculpin
	Nautichthys oculofasciatus	sailfin sculpin
	Rhamphocottus richardsoni	grunt sculpin
	Triglops forficatus	scissortail sculpin
	Triglops macellus	roughspine sculpin
	Triglops pingeli	ribbed sculpin
	Triglops scepticus	spectacled sculpin
Trichodontidae	Trichodon trichodon	Pacific sandfish
Gadidae	Gadus macrocephalus	Pacific cod

Table C1.--Continued.

Family	Species Name	Common Name
	Microgadus proximus	Pacific tomcod
	Theragra chalcogramma	walleye pollock
Hexagrammidae	Hexagrammos decagrammus	kelp greenling
	Hexagrammos stelleri	whitespotted greenling
	Ophiodon elongatus	lingcod
	Pleurogrammus monopterygius	Atka mackerel
Cyclopteridae	Aptocyclus ventricosus	smooth lumpsucker
	Careproctus cypselurus	blackfinned snailfish
	Careproctus melanurus	blacktail snailfish
	Careproctus phasma	monster snailfish
	Eumicrotremus orbis	Pacific spiny lumpsucker
	Liparis dennyi	marbled snailfish
	Liparis gibbus	dusky snailfish
Melamphaeidae	Poromitra crassiceps	crested bigscale
Merluccidae	Merluccius productus	Pacific hake
Anotopteridae	Anotopterus pharao	daggertooth
Myctophidae	Myctophidae	lanternfish
Osmeridae	Mallotus villosus	capelin
	Osmerus mordax	rainbow smelt
	Spirinchus thaleichthys	longfin smelt
	Thaleichthys pacificus	eulachon
Salmonidae	Oncorhynchus gorbuscha	pink salmon
	Oncorhynchus keta	chum salmon
	Oncorhynchus kisutch	coho salmon
	Oncorhynchus nerka	sockeye salmon
	Oncorhynchus tshawytscha	chinook salmon
Scombridae	Scombridae	mackerel unident.
Cryptacanthodidae	Cryptacanthodes giganteus	giant wrymouth
	Lyconectes aleutensis	dwarf wrymouth
Stichaeidae	Chirolophis decoratus	decorated warbonnet
	Chirolophis snyderi	bearded warbonnet

Table C1.--Continued.

Family	Species Name	Common Name
	Lumpenella longirostris	longsnout prickleback
	Lumpenus sagitta	snake prickleback
Pholididae	Pholis laeta	crescent gunnel
Trachipteridae	Trachipterus altivelis	king-of-the-salmon
Zaproridae	Zaprora silenus	prowfish
Zoarcidae	Bothrocara pusillum	Alaska eelpout
	Lycodes brevipes	shortfin eelpout
	Lycodes cortezianus	bigfin eelpout
	Lycodes diapterus	black eelpout
	Lycodes palearis	wattled eelpout
Percichthyidae	Howella sherborni	
Scorpaenidae	Sebastes aleutianus	rougheye rockfish
	Sebastes alutus	Pacific ocean perch
	Sebastes babcocki	redbanded rockfish
	Sebastes borealis	shortraker rockfish
	Sebastes brevispinis	silvergray rockfish
	Sebastes ciliatus	dusky rockfish
	Sebastes crameri	darkblotched rockfish
	Sebastes elongatus	greenstriped rockfish
	Sebastes emphaeus	Puget Sound rockfish
	Sebastes helvomaculatus	rosethorn rockfish
	Sebastes maliger	quillback rockfish
	Sebastes melanops	black rockfish
	Sebastes miniatus	vermilion rockfish
	Sebastes paucispinis	bocaccio
	Sebastes pinniger	canary rockfish
	Sebastes polyspinis	northern rockfish
	Sebastes proriger	redstripe rockfish
	Sebastes reedi	yellowmouth rockfish
	Sebastes ruberrimus	yelloweye rockfish
	Sebastes variegatus	harlequin rockfish

Table C1.--Continued.

Family	Species Name	Common Name
	Sebastes wilsoni	pygmy rockfish
	Sebastes zacentrus	sharpchin rockfish
	Sebastolobus alascanus	shortspine thornyhead

Table C2 .--Invertebrate species encountered during the 1993 Gulf of Alaska triennial.

Phylum	Species/Taxon Name	Common Name
Cnidaria		
		hydroid unident.
	Scyphozoa	jellyfish unident.
	Cyanea capillata	
	Alcyonacea	soft coral unident.
	Gersemia sp.	sea raspberry
	Gorgonacea	coral unident.
	Primnoa willeyi	
	Paragorgia arborea	
	Callogorgia sp.	
	Virgularia sp.	smoothstem seawhip
	Stylatula sp.	slender seawhip
	Ptilosarcus gurneyi	
	Actiniaria	sea anemone unident.
	Metridium sp.	
	Madreporaria	stony coral unident.
Annelida		
	Polychaeta	polychaete worm unident.
		tube worm unident.
	Aphroditidae	sea mouse unident.
	Cheilonereis cyclurus	
	Polynoidae	scale worm unident.
	Carcinobdella cyclostomum	striped sea leech
Arthropoda		
	Isopoda	isopod unident.
	Cirripedia	barnacle unident.
barnacles	Balanus evermanni	giant barnacle
	Balanus hesperius	crab barnacle
	Balanus rostratus	beaked barnacle
shrimp	Pandalus jordani	ocean shrimp
	Pandalus borealis	northern shrimp

Table C2 .--Continued.

Phylum	Species/Taxon Name	Common Name
	Pandalus tridens	yellowleg pandalid
	Pandalus platyceros	spot shrimp
	Pandalus hypsinotus	coonstripe shrimp
	Pandalopsis dispar	sidestripe shrimp
	Eualus barbatus	
	Lebbeus groenlandicus	
	Crangon communis	common crangon
	Crangon dalli	ridged crangon
	Argis dentata	Arctic argid
	Sclerocrangon boreas	tank shrimp
	Argis lar	northern argid
	Argis ovifer	split-eye argid
	Pasiphaea pacifica	glass shrimp
crabs	Cancer magister	Dungeness crab
	Cancer oregonensis	Oregon rock crab
	Cancer productus	red rock crab
	Majidae unident.	spider crabs unident.
	Oregonia gracilis	longhorned decorator
	Chorilia longipes	
	Chionoecetes bairdi	Bairdi tanner crab
	Hyas lyratus	North Pacific toad crab
	Chionoecetes opilio	Opilio tanner crab
	Chionoecetes hybrid	hybrid tanner crab
	Telmessus cheiragonus	telmessus crab
	Pagurus aleuticus	Aleutian hermit
	Labidochirus splendescens	
	Pagurus confragosus	knobbyhand hermit crab
	Pagurus cornutus	
	Pagurus dalli	
	Pagurus rathbuni	longfinger hermit
	Pagurus tanneri	

Table C2 .--Continued.

Phylum	Species/Taxon Name	Common Name
	Lopholithodes sp.	box crab unident.
	Lopholithodes foraminatus	
	Lopholithodes mandtii	
	Acantholithodes hispidus	fuzzy crab
	Lithodes aequispina	golden king crab
	Rhinolithodes wosnessenskii	rhinoceros crab
	Paralithodes camtschatica	red king crab
	Paralithodes brevipes	brown king crab
	Placetron wosnessenskii	scaled crab
	Pycnogonida	sea spider unident.
Mollusca		
pelecypods	Cryptochiton stelleri	giant Pacific chiton
	Buccinum sp.	
	Fusitriton oregonensis	
	Tochuina tetraquetra	giant orange tochui
	Tritonia diomedea	rosy tritonia
	Chlamylla sp.	
	Natica aleutica	
	Natica russa	rusty moonsnail
	Nucella lamellosa	frilled dogwinkle
	Modiolus modiolus	northern horsemussel
	Chlamys behringiana	Iceland scallop
	Chlamys rubida	
	Chlamys hericia	
	Patinopecten caurinus	weathervane scallop
	Yoldia scissurata	crisscrossed yoldia
	Musculus niger	black mussel
	Astarte crenata	crenulate astarte
	Clinocardium ciliatum	hairy cockle
	Clinocardium californiense	California cockle
	Mactromeris polynyma	Arctic surfclam

Table C2 .--Continued.

Phylum	Species/Taxon Name	Common Name
	Tellina sp.	
	Macoma brota	heavy macoma
	Siliqua alta	Alaska razor
	Serripes groenlandicus	Greenland cockle
	Pododesmus macroschisma	Alaska falsejingle
	Anomiidae	falsejingles unident.
gastropods	Colus sp.	
	Pyrulofusus harpa	left-handed whelk
	Beringius kennicottii	
	Neptunea amianta	
	Neptunea pribiloffensis	Pribilof whelk
	Neptunea lyrata	lyre whelk
	Plicifusus kroyeri	
	Torellia ammonia	
	Boreotrophon stuarti	winged trophon
	Fusitriton oregonensis	Oregon triton
	Cidarina cidaris	
	Buccinum plectrum	sinuous whelk
	Buccinum scalariforme	ladder whelk
	Arctomelon stearnsii	Alaska volute
cephalopods	Octopus leioderma	smoothskin octopus
	Opisthoteuthis californiana	flapjack devilfish
	Octopus dofleini	giant octopus
	Rossia pacifica	
	Loligo opalescens	California market squid
	Gonatus sp.	
	Berryteuthis magister	magistrate armhook squid
	Moroteuthis robusta	robust clubhook squid
Echinodermata		
starfish	Evasterias troschelii	
	Evasterias echinosoma	

Table C2 .--Continued.

Phylum	Species/Taxon Name	Common Name
	Orthasterias sp.	
	Orthasterias koehleri	
	Leptasterias hylodes	
	Pycnopodia helianthoides	
	Stylasterias forreri	
	Lethasterias nanimensis	
	Pedicellaster magister	
	Poraniopsis inflata	
	Henricia sanguinolenta	
	Henricia leviuscula	
	Leptasterias polaris	
	Gephyreaster swifti	
	Pseudarchaster sp.	
	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	
	Diplopteraster multipes	
	Asterias amurensis	purple-orange seastar
	Ctenodiscus crispatus	common mud star

Table C2 .--Continued.

Phylum	Species/Taxon Name	Common Name
	Leptychaster pacificus	
	Dipsacaster borealis	
	Luidiaster dawsoni	
sea urchins	Strongylocentrotus droebachiensis	green sea urchin
	Strongylocentrotus franciscanus	red sea urchin
	Strongylocentrotus pallidus	white sea urchin
	Allocentrotus fragilis	orange-pink sea urchin
		heart urchin unident.
sand dollars	Brisaster latifrons	
	Echinarachnius parma	parma sand dollar
		crinoid unident.
brittle stars	Ophiuroid	brittlestarfish unident.
	Gorgonocephalus caryi	
	Ophiura sarsi	
	Amphiophiura ponderosa	
	Ophiopholis longispina	
	Ophiopholis aculeata	
sea cucumbers	Holothuroidea unident.	sea cucumber unident.
	Molpadia intermedia	
	Bathyplotes sp.	
	Cucumaria fallax	
	Stichopus japonicus	
	Psolus sp.	
Porifera		
	Porifera	sponge unident.
	Suberites ficus	hermit sponge
	Aphrocallistes vastus	clay pipe sponge
	Mycale loveni	tree sponge
	Halichondria panicea	barrel sponge
	Myxilla incrustans	scallop sponge
	Hexactinellida	glass sponge unident.

Table C2 .--Continued.

Phylum	Species/Taxon Name	Common Name
Sipuncula		
	Sipuncula	sipunculid worm unident.
Bryozoa		
	Eucratea loricata	feathery bryozoan
	Flustra serrulata	leafy bryozoan
	Myriozoum subgracile	
	Porella compressa	flattened bryozoan
	Escharopsis sarsi	
Brachiopoda		
	Terebratalia transversa	
	Laqueus californianus	
Chordata		
		cow-eye tunicate
	Thaliacea unident.	salps unident.
	Styela rustica	sea potato
	Boltenia sp.	
	Halocynthia aurantium	sea peach
	Aplidium sp.	
	Synoicum sp.	
	Molgula grifithsii	sea grape
	Molgula retortiformis	sea clod

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