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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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April 21, 2003 F/AKC1:MG

Preliminary results of the March 2003 echo integration-trawl survey results for walleye pollock (*Theragra chalcogramma*) in Shelikof Strait and along the Gulf of Alaska shelf break near Chirikof and Middleton Islands

INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center conduct regular research surveys of walleye pollock (*Theragra chalcogramma*) to estimate pollock distribution and abundance. Preliminary cruise results presented here are from the echo integration-trawl (EIT) survey carried out 16-22 March 2003 in Shelikof Strait and between 24-31 March in two areas along the Gulf of Alaska shelf break near Chirikof Island and Middleton Island. This report presents observed pollock distribution, relative abundance, size composition, maturity information, and temperature profile data in these areas. Biomass estimates, acoustic system and intership calibration results and other cruise results will be reported in a subsequent document.

METHODS

Acoustic data were collected with Simrad EK 500[1] and EK 60 quantitative echo-sounding systems on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research. Three split-beam transducers (38 kHz, 120 kHz and 200 kHz) were

[1] Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

mounted on the bottom of the vessel's centerboard extending 9 m below the water surface. Simrad EK 500 data (38 and 120 kHz) were logged with SonarData EchoLog and analyzed using SonarData Echoview PC-based post-processing software. Data from the 200 kHz system were logged using EK 60 software. Results presented here are based on the 38 kHz data.

Two trawl nets were used to sample observed echosign depending on the depth stratum sampled. Midwater and near-bottom echosign was sampled using an Aleutian Wing (AWT) 30/26 mid-water trawl. Demersal or near-bottom echosign was sampled with a poly nor'eastern bottom trawl (PNE) with roller gear. Vertical net opening and depth were monitored with either a WESMAR third wire netsounder system or a Furuno netsounder system. Both nets were fished with 5 m^2 Fishbuster trawl doors. The codends of both nets were fitted with nylon mesh liners: 1.3 cm (0.5 in) the AWT and 32 mm (1.25 in) the PNE.

Physical oceanographic data collected during the cruise included temperature/depth profiles obtained with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope. Sea surface temperature, salinity, and other environmental data were collected using the *Miller Freeman's* Scientific Computing System (SCS). Ocean current profile data were obtained using the vessel's centerboard-mounted acoustic Doppler current profiler system operating continuously in bottom-tracking mode during the Shelikof Strait survey and in water-profiling mode during the shelf break survey.

Survey transects were oriented parallel to one another. Transect spacing was 7.5 nmi in Shelikof Strait, 8 nmi along the shelf break near Chirikof Island, and 5 nmi along the shelf break near Middleton Island. Echo integration and trawl data were collected 24 hours a day. Acoustic system settings used during the collection were based on results from acoustic system calibrations and on experience from prior surveys. Trawl hauls were conducted to identify echosign and to provide biological samples. Pollock were sampled to determine sex, fork length, body weight, age, maturity, and ovary weight of selected females. Fork lengths were measured to the nearest cm. Maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning.

PRELIMINARY RESULTS

Biological data and specimens were collected from 30 AWT and 3 PNE trawl hauls (Table 1). Biological samples for several additional research projects, including prey studies and genetics, were also collected at most trawl sites.

In Shelikof Strait, pollock and eulachon (*Thaleichthys pacificus*) were the most abundant species by weight in midwater trawl hauls, comprising 82% and 16% of the total catch (Table 2). In the 2 bottom trawls bottom, which were conducted slightly off bottom or in midwater, pollock comprised 77% of the catch, with arrowooth flounder (*Atheresthes stomias*, 9%), smooth lumpsucker (*Aptocyclus ventricosus*, 6%), and longnose skate (*Raja rhina*, (5%) comprising most of the bycatch (Table 3). Pollock (57%) and Pacific ocean perch (*Sebastes alutus*, 26%) comprised most of the catch in tows conducted near Chirikof Island (Table 4), and the single bottom trawl consisted of 99.8% Pacific ocean perch (Table 5). Tows conducted near Middleton Island caught mostly pollock (82%). Rougheye (*Sebastes aleutianus*, 7%) and shortraker rockfish (*Sebastes borealis*, 5%) were the predominant bycatch species caught (Table 6). A single tow conducted in Yakutat Canyon caught mostly a mixture of shortraker rockfish (55%) and pollock (37%; Table 7).

Pollock were observed on all transects in Shelikof Strait (Fig. 1). Pollock were most abundant in the center of the surveyed area, near the southern entrance to Shelikof Strait. The distribution was similar to that observed in 2002, although in 2003 pollock were found slightly farther to the northeast, extending into Shelikof Strait proper. Mid-water layers of sub-adult pollock, sometimes in the form of tight schools at about 175-200 m depth, were found on some transects. This type of aggregation was more common during the day than during hours of darkness.

Most echosign attributed to pollock along the shelf break near Chirikof Island occurred in diffuse mid-water layers between 300-500 m depth within the two shelf-break bights between Chirikof Island and Barnabas Trough over bottom depths of 300-800 m (Fig. 2). The small

amount of pollock detected both east and west of Middleton Island occurred at depths similar to those observed in the Chirikof Island survey area.

In Shelikof Strait, 1-year old pollock[2] were abundant only in hauls 1-3 and 19 (Fig. 4). These hauls were conducted in areas of relatively low pollock echosign, suggesting that the 2002 year class may be weak. Trawl hauls conducted in the densest pollock echosign contained fish which are likely from the 1999 year class, which has dominated population estimates of recent Shelikof Strait surveys. Few adults were present in the trawl catches, as was the case in recent survey results. Trawl hauls targeting pollock in the Chirikof Island area survey caught mostly pollock exceeding 45 cm (Fig. 5). In the Middleton Island area survey, the haul conducted west of the Island caught mostly pollock in the 36-45 cm range, whereas hauls conducted east of the Island caught mostly pollock exceeding 50 cm.

The unweighted maturity composition in Shelikof Strait for males longer than 40 cm was 7% immature, 22% developing, 27% mature pre-spawning, 36% spawning, and 7% spent (Fig. 6). The female maturity composition of fish longer than 40 cm was 10% immature, 42% developing, 46% pre-spawning, 0% spawning, and 2% spent. These results are similar to previous survey results in terms of low numbers of spawning and spent fish, and although the amount of developing fish appears to be markedly larger than previous Shelikof Strait surveys, most of pollock examined for maturity stage in 2003 were in the 41-45 cm range, which typically are immature, and relatively few fish exceeded 50 cm, which tend to be mature.

The unweighted maturity composition for males longer than 40 cm in the Chirikof Island area survey was 1% immature, 4% developing, 74% mature pre-spawning, 21% spawning, and 0% spent (Fig. 7). The female maturity composition of fish longer than 40 cm was 0% immature, 8% developing, 92% pre-spawning, 1% spawning, and 0% spent. These results are comparable to the 2002 survey result from the same area and suggest that survey timing was appropriate.

[2]Because age data are not yet available, length ranges were used as a proxy for age based on length at age from previous surveys. Pollock between 9-16 cm fork length (FL) are considered 1-year olds, most pollock between 17-24 cm FL are considered 2-year olds, most pollock from 25-30 cm FL are considered 3-year olds, most pollock from 31-35 cm FL are considered 4-year olds, and most pollock exceeding 35 cm FL are considered adults.

The unweighted maturity composition for males longer than 40 cm in the Middleton Island area survey was 0% immature, 3% developing, 44% mature pre-spawning, 52% spawning, and 0% spent (Fig. 8). The female maturity composition of fish longer than 40 cm was 0% immature, 5% developing, 95% pre-spawning, 0% spawning, and 1% spent.

Table 1. Summary of trawl and catch data from the 2003 pollock echo integration-trawl surveys of Shelikof Strait, the Gulf of Alaska shelf break near Chirikof and Middleton Islands, and Yakutat Canyon.

Haul	Gear[1]	Survey	Date	Time	Duration	Start position		Depth (m)		Temp. (deg. C)		Pollock catch		Other catch	
No.	type	area	(GMT)	(GMT)	(minutes)	Lat (N)	Long (W)	gear	bottom	gear	surface	kg	number	kg	number
1	awt	shelikof	17-Mar	8:31	34	55 49.40	156 20.62	236	247	4.9	5.7	127	1,485	83	3,804
2	pne	shelikof	17-Mar	17:57	21	56 4.18	156 15.73	208	214	5.2	5.4	59	205	54	212
3	awt	shelikof	18-Mar	2:59	18	56 12.38	156 5.88	228	236	5.3	5.6	681	3,317	75	1,667
4	awt	shelikof	18-Mar	8:42	30	56 26.51	156 7.91	258	273	4.8	5.8	269	936	20	436
5	awt	shelikof	18-Mar	18:12	5	56 39.41	155 57.15	259	288	5.1	5.5	2,316	9,679	34	832
6	awt	shelikof	18-Mar	21:03	5	56 37.88	155 49.20	244	259	5.1	5.1	701	2,687	122	2,854
7	awt	shelikof	18-Mar	23:28	20	56 39.04	155 53.08	215	279	4.9	5.6	616	2,453	34	1,597
8	awt	shelikof	19-Mar	12:35	3	56 50.69	155 53.11	227	305	5.0	5.6	250	1,043	22	662
9	awt	shelikof	19-Mar	14:19	5	56 52.92	155 45.50	227	292	5.0	5.6	1,301	6,805	69	1,494
10	awt	shelikof	19-Mar	18:51	10	57 2.29	155 55.58	192	237	5.0	6.0	1,358	5,835	2	13
11	awt	shelikof	20-Mar	3:10	25	57 5.49	155 22.93	244	258	5.0	5.3	2,546	8,530	1,046	3,079
12	pne	shelikof	20-Mar	14:31	8	57 20.98	155 20.64	223	254	5.0	5.4	187	694	21	115
13	awt	shelikof	20-Mar	21:38	4	57 26.59	154 53.63	157	215	5.0	6.1	5,189	24,598	11	257
14	awt	shelikof	21-Mar	2:10	15	57 34.95	155 18.44	260	301	5.4	5.7	1,415	5,144	683	8,059
15	awt	shelikof	21-Mar	10:09	12	57 43.55	154 53.62	228	248	4.8	5.7	1,194	4,575	146	1,197
16	awt	shelikof	21-Mar	14:27	5	57 51.13	154 47.90	240	281	4.4	5.8	1,159	2,915	271	2,340
17	awt	shelikof	21-Mar	22:55	40	57 52.92	154 5.30	186	200	5.6	5.9	1,006	3,358	664	15,576
18	awt	shelikof	22-Mar	5:37	30	58 4.37	153 50.13	188	195	5.6	5.9	660	2,092	822	7,572
19	awt	shelikof	22-Mar	13:41	11	58 11.28	153 21.03	202	219	5.5	5.8	468	2,278	445	7,782
20	awt	chirikof	25-Mar	22:04	25	55 42.39	154 59.90	341	443	5.8	4.8	114	98	1	20
21	awt	chirikof	26-Mar	9:41	10	56 0.10	154 29.10	338	516	5.4	4.9	90	96	3	82
22	awt	chirikof	26-Mar	17:05	30	55 52.95	153 49.17	340	611	5.4	5.4	0	0	252	383
23	awt	chirikof	26-Mar	20:41	35	55 55.51	153 35.29	391	448	6.1	4.6	169	159	43	558
24	awt	chirikof	27-Mar	5:39	30	56 16.51	153 7.08	331	496	5.7	5.1	181	156	59	799
25	awt	chirikof	27-Mar	10:34	20	56 18.63	152 35.98	307	1336	5.5	5.5	0	0	5	850
26	awt	chirikof	27-Mar	14:57	11	56 32.14	152 33.37	181	204	5.1	5.8	0	0	61	9
27	pne	chirikof	27-Mar	16:32	15	56 32.13	152 33.29	194	216	5.8	5.5	0	0	2,640	4,443
28	awt	middleton	28-Mar	22:39	25	59 14.25	146 54.03	342	466	6.4	4.8	349	591	137	1,287
29	awt	middleton	29-Mar	9:39	17	59 29.16	145 50.80	324	420	5.7	5.7	12	7	65	651
30	awt	middleton	29-Mar	13:55	40	59 28.15	145 34.02	351	422	6.3	5.0	1,328	970	202	78
31	awt	middleton	29-Mar	23:44	40	59 31.58	145 48.08	364	614	6.1	5.0	956	766	158	2,563
32	awt	middleton	30-Mar	2:44	30	59 26.18	145 25.27	294	505	4.6	5.6	0	0	3	127
33	awt	yakutat	31-Mar	11:48	1	59 27.28	141 11.82	98	134	5.3	5.1	365	407	619	1,258

[1]awt = Aleutian wing trawl, pne = poly nor'eastern bottom trawl.

Table 2. Summary of catch by species in midwater trawls conducted during the 2003 pollock echo integration-trawl survey of the Shelikof Strait area.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	*Theragra chalcogramma*	21256.6	82.4%	87730	59.7%
Eulachon	*Thaleichthys pacificus*	4120.4	16.0%	57264	39.0%
Pacific sleeper shark	*Somniosus pacificus*	180.6	0.7%	4	<0.1%
Chinook salmon	*Oncorhynchus tshawytscha*	37.8	0.1%	59	<0.1%
Squid unident.	Teuthoidea (order)	37.6	0.1%	659	0.4%
Arrowtooth flounder	*Atheresthes stomias*	37.3	0.1%	119	0.1%
Smooth lumpsucker	*Aptocyclus ventricosus*	37.2	0.1%	28	<0.1%
Chinook salmon	*Oncorhynchus tshawytscha*	29.4	0.1%	21	<0.1%
Pacific cod	*Gadus macrocephalus*	21.4	0.1%	10	<0.1%
Rougheye rockfish	*Sebastes aleutianus*	18.7	0.1%	6	<0.1%
Flathead sole	*Hippoglossoides elassodon*	11.7	<0.1%	45	<0.1%
Shrimp unident.	Decapoda (order)	5.8	<0.1%	896	0.6%
Jellyfish unident.	Scyphozoa (class)	5.3	<0.1%	17	<0.1%
Majestic squid	*Berryteuthis magister*	2.3	<0.1%	3	<0.1%
Rock sole sp.	*Lepidopsetta bilineata*	1.5	<0.1%	3	<0.1%
Northern smoothtongue	*Leuroglossus schmidti*	0.6	<0.1%	30	<0.1%
Yellow Irish lord	*Hemilepidotus jordani*	0.4	<0.1%	3	<0.1%
Longnose poacher	*Sarritor frenatus*	0.1	<0.1%	3	<0.1%
Fish unident.		0.1	<0.1%	47	<0.1%
Capelin	*Mallotus villosus*	0.0	<0.1%	4	<0.1%
Total		25,804.7		146,951	

Table 3. Summary of catch by species in bottom trawls conducted during the 2003 pollock echo integration-trawl survey of the Shelikof Strait area.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	*Theragra chalcogramma*	245.8	76.5%	899	73.3%
Arrowtooth flounder	*Atheresthes stomias*	27.9	8.7%	26	2.1%
Smooth lumpsucker	*Aptocyclus ventricosus*	19.8	6.2%	14	1.1%
Longnose skate	*Raja rhina*	17.3	5.4%	1	0.1%
Eulachon	*Thaleichthys pacificus*	7.3	2.3%	207	16.9%
Pacific cod	*Gadus macrocephalus*	2.2	0.7%	1	0.1%
Squid unident.	Teuthoidea (order)	0.8	0.2%	8	0.7%
Jellyfish unident.	Scyphozoa (class)	0.4	0.1%	3	0.2%
Shrimp unident.	Decapoda (order)	0.0	<0.1%	67	5.5%
Total		321.4		1,226	

Table 4. Summary of catch by species in midwater trawls conducted during the 2003 pollock echo integration-trawl survey of the Gulf of Alaska shelf break near Chirikof Island.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	*Theragra chalcogramma*	554.5	56.6%	509	15.9%
Pacific ocean perch	*Sebastes alutus*	250.8	25.6%	359	11.2%
Giant grenadier	*Albatrossia pectoralis*	42.6	4.3%	13	0.4%
Shortraker rockfish	*Sebastes borealis*	38.6	3.9%	11	0.3%
Pacific cod	*Gadus macrocephalus*	23.9	2.4%	1	<0.1%
Chinook salmon	*Oncorhynchus tshawytscha*	20.0	2.0%	6	0.2%
Arrowtooth flounder	*Atheresthes stomias*	17.1	1.7%	2	0.1%
Eulachon	*Thaleichthys pacificus*	14.1	1.4%	247	7.7%
Myctophidae	Myctophidae	8.6	0.9%	1,474	45.9%
Rougheye rockfish	*Sebastes aleutianus*	5.8	0.6%	3	0.1%
Jellyfish unident.	Scyphozoa (class)	1.4	0.1%	7	0.2%
Glass shrimp	*Archaeomysis grebnitzkii*	0.7	0.1%	405	12.6%
Northern smoothtongue	*Leuroglossus schmidti*	0.5	0.1%	28	0.9%
Majestic squid	Berryteuthis magister	0.5	<0.1%	4	0.1%
Squid unident.	Teuthoidea (order)	0.3	<0.1%	61	1.9%
Salps unident.	Thaliacea	0.2	<0.1%	3	0.1%
Mytilidae	Mytilidae	0.1	<0.1%	11	0.3%
Diaphus theta	*Diaphus theta*	0.0	<0.1%	7	0.2%
Fish unident.		0.0	<0.1%	1	<0.1%
Shrimp unident.	Decapoda (order)	0.0	<0.1%	55	1.7%
Argentinidae	Argentinidae	0.0	<0.1%	1	<0.1%
Shining loosejaw	*Aristostomias scintillans*	0.0	<0.1%	1	<0.1%
Viperfish unident.	Chauliodontidae	0.0	<0.1%	1	<0.1%
Total		979.6		3,210	

Table 5. Summary of catch by species in the bottom trawl conducted during the 2003 pollock echo integration-trawl survey of the the Gulf of Alaska shelf break near Chirikof Island.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Pacific ocean perch	*Sebastes alutus*	2,633.5	99.8%	4,440	99.9%
Shortraker rockfish	*Sebastes borealis*	3.8	0.1%	1	<0.1%
Arrowtooth flounder	*Atheresthes stomias*	1.6	0.1%	1	<0.1%
Dusky rockfish	*Sebastes ciliatus*	1.2	<0.1%	1	<0.1%
Total		2,640.0		4,443	

Table 6. Summary of catch by species in midwater trawls conducted during the 2003 pollock echo integration-trawl survey of the the Gulf of Alaska shelf break near Middleton Island.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	*Theragra chalcogramma*	2,645.2	82.4%	2,334	33.2%
Rougheye rockfish	*Sebastes aleutianus*	207.2	6.5%	106	1.5%
Shortraker rockfish	*Sebastes borealis*	174.1	5.4%	28	0.4%
Giant grenadier	*Albatrossia pectoralis*	71.2	2.2%	24	0.3%
Pacific ocean perch	*Sebastes alutus*	34.4	1.1%	45	0.6%
Arrowtooth flounder	*Atheresthes stomias*	30.7	1.0%	38	0.5%
Myctophidae	Myctophidae	17.6	0.5%	2,981	42.3%
Majestic squid	*Berryteuthis magister*	15.4	0.5%	31	0.4%
Chum salmon	*Oncorhynchus nerka*	4.9	0.2%	2	<0.1%
Eulachon	*Thaleichthys pacificus*	4.0	0.1%	54	0.8%
Jellyfish unident.	Scyphozoa (class)	2.9	0.1%	16	0.2%
Glass shrimp	*Archaeomysis grebnitzkii*	1.8	0.1%	1,280	18.2%
Squid unident.	Teuthoidea	0.4	<0.1%	58	0.8%
Diaphus theta	*Diaphus theta*	0.1	<0.1%	7	0.1%
Northern smoothtongue	*Leuroglossus schmidti*	0.0	<0.1%	4	0.1%
Pacific lamprey	*Lampetra tridentata*	0.0	<0.1%	2	<0.1%
Shrimp unident.	Decapoda (order)	0.0	<0.1%	28	0.4%
Pacific viperfish	Chauliodus macouni	0.0	<0.1%	2	<0.1%
Total		3,209.9		7,040	

Table 7. Summary of catch by species in the midwater trawls conducted during the 2003 pollock echo integration-trawl survey of Yakutat Canyon.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Shortraker rockfish	*Sebastes borealis*	544.2	55.3%	95	5.7%
Walleye pollock	*Theragra chalcogramma*	365.3	37.1%	407	24.4%
Eulachon	*Thaleichthys pacificus*	33.8	3.4%	727	43.7%
Rougheye rockfish	*Sebastes aleutianus*	17.0	1.7%	16	1.0%
Spiny dogfish	*Squalus acanthias*	16.7	1.7%	5	0.3%
Chinook salmon	*Oncorhynchus tshawytscha*	6.1	0.6%	2	0.1%
Myctophidae	Myctophidae	0.6	0.1%	129	7.7%
Pasiphaea pacifica	*Pasiphaea pacifica*	0.5	<0.1%	274	16.5%
Majestic squid	*Berryteuthis magister*	0.2	<0.1%	9	0.5%
Jellyfish unident.	Scyphozoa (class)	0.1	<0.1%	1	0.1%
Total		984.5		1,665	

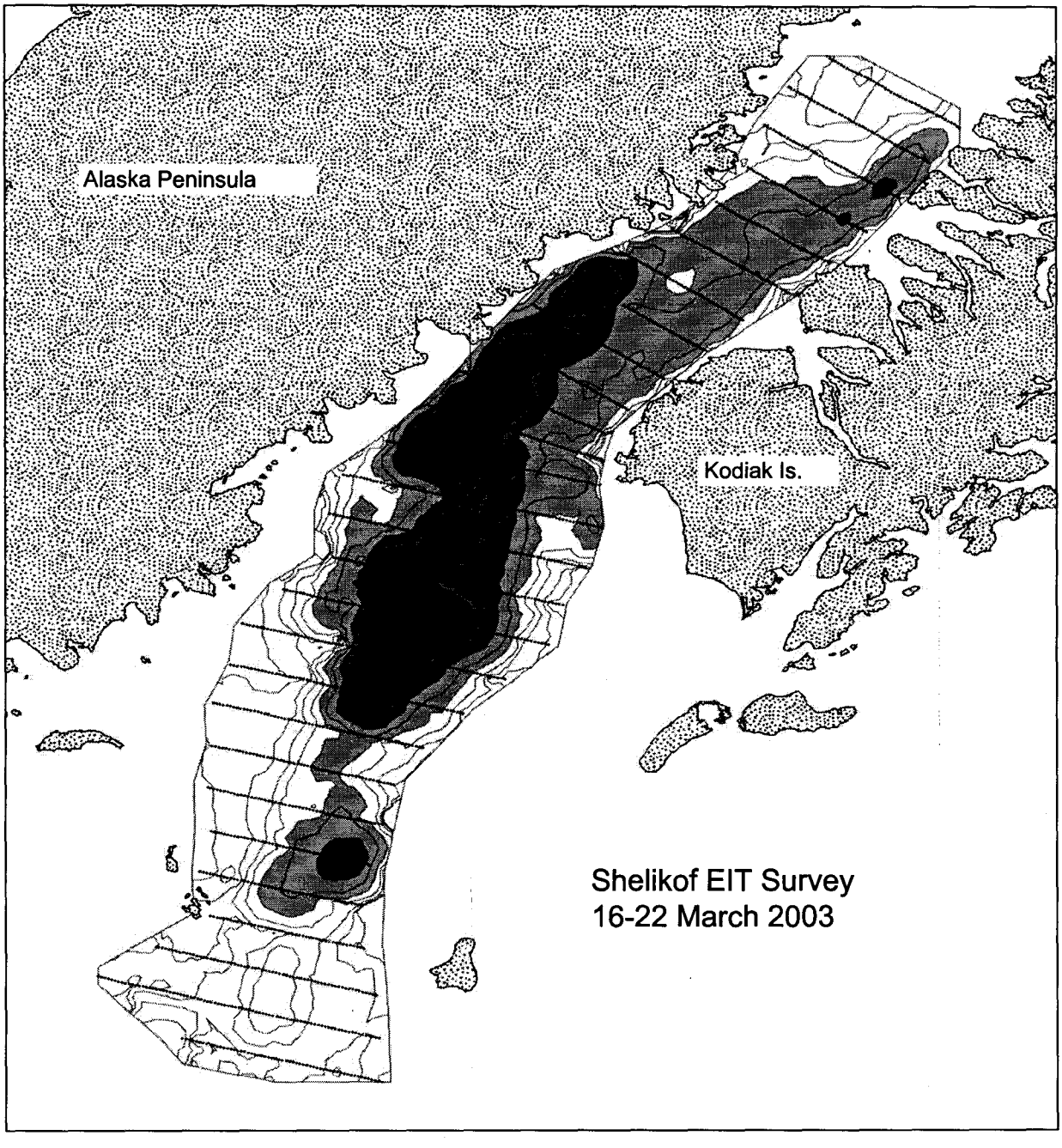

Figure 1. The distribution of combined juvenile walleye pollock and pollock-eulachon mix echosign in the the Shelikof EIT Survey, 16-22 March 2003. Transect locations are indicated by lines across the mapped distribution.

Pollock Acoustic Backscatter (s_A)
NOAA Ship *Miller Freeman*
25-27 March, 2003

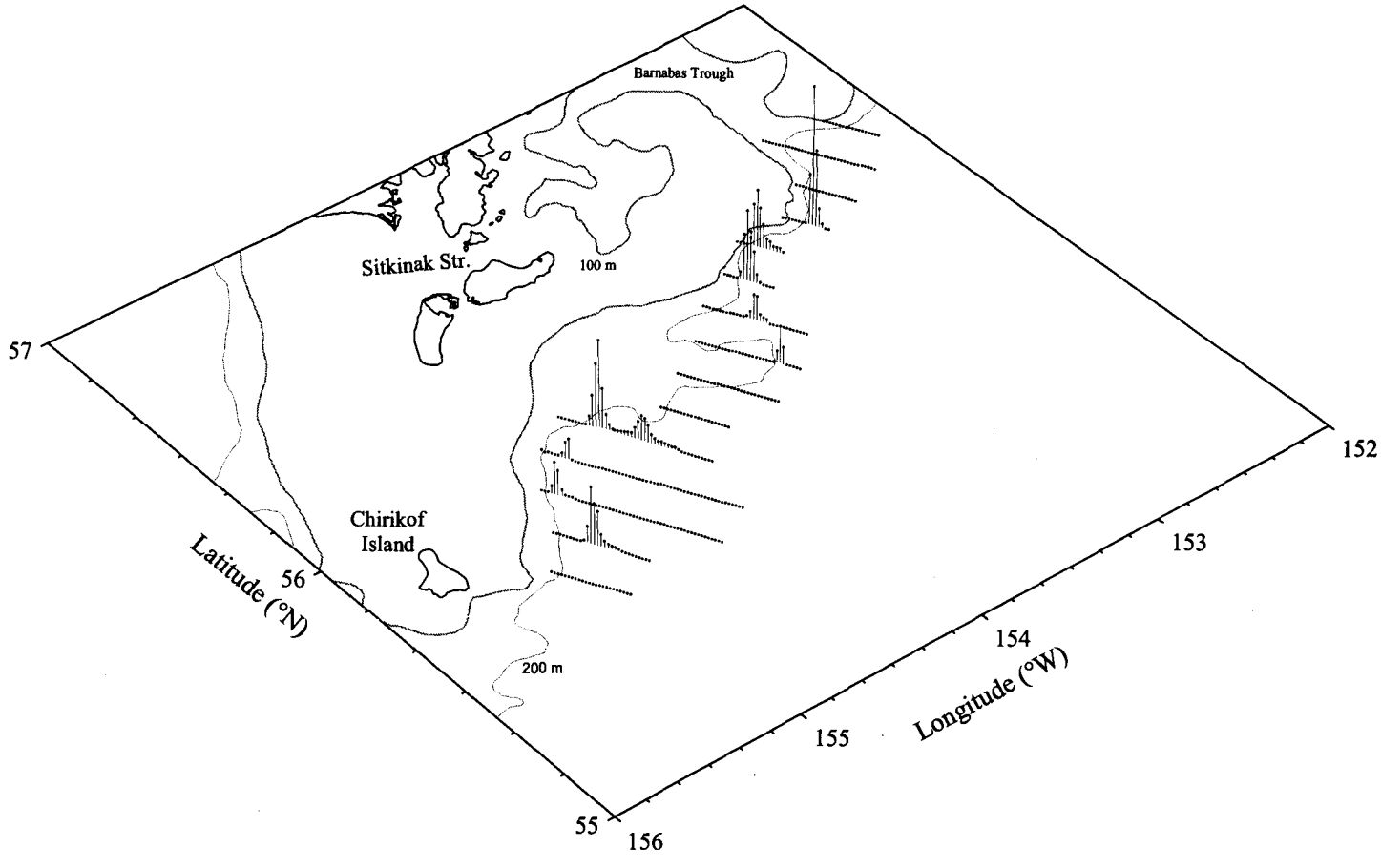

Figure 2. Relative pollock backscatter (s_A) along transects from the 2003 echo integration-trawl survey of the Gulf of Alaska shelf break near Chirikof Island.

Pollock Acoustic Backscatter (s_A)
NOAA Ship *Miller Freeman*
28-29 March, 2003

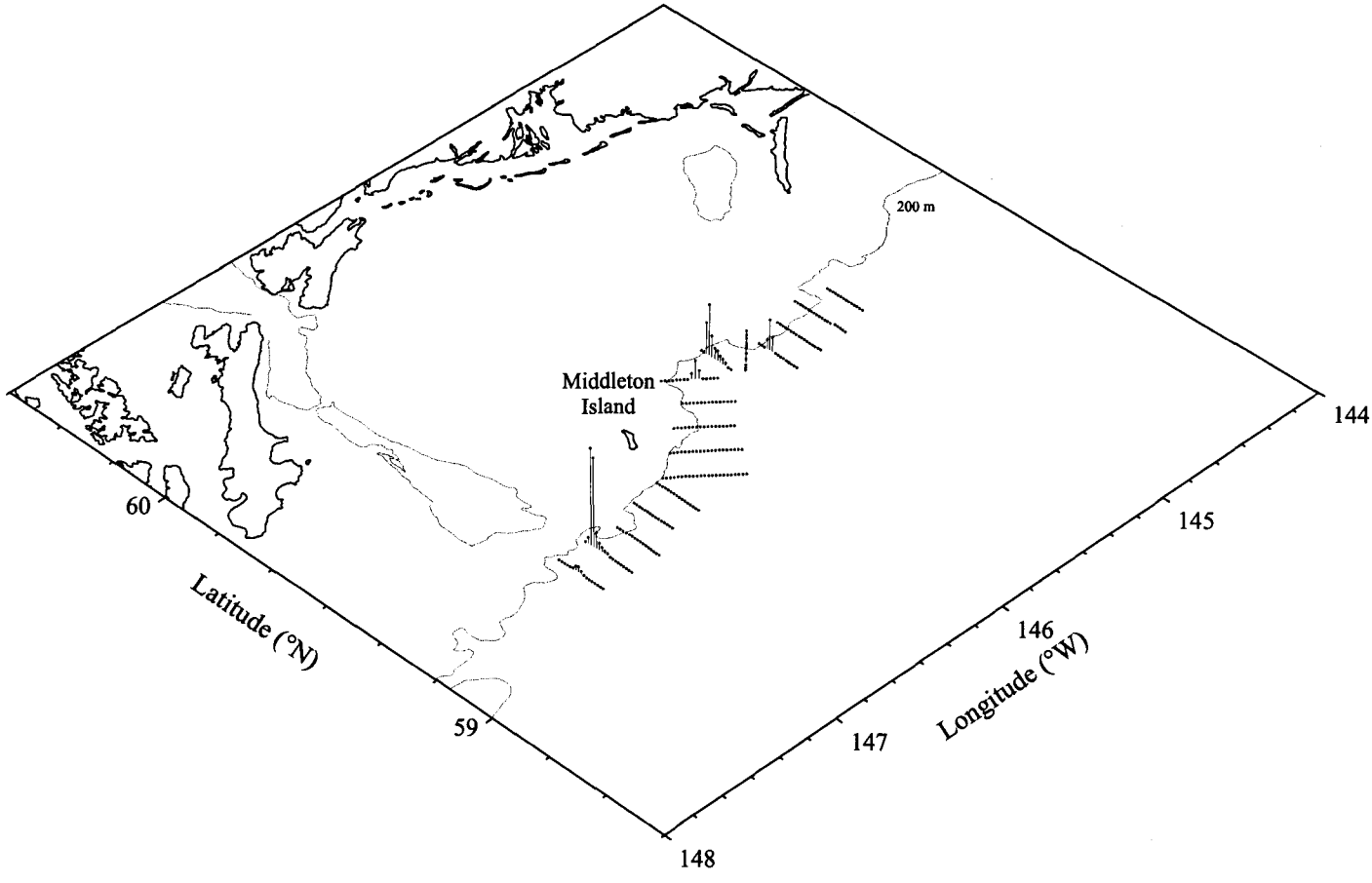

Figure 3. Relative pollock backscatter (s_A) along transects from the 2003 echo integration-trawl survey of the Gulf of Alaska shelf break near Middleton Island.

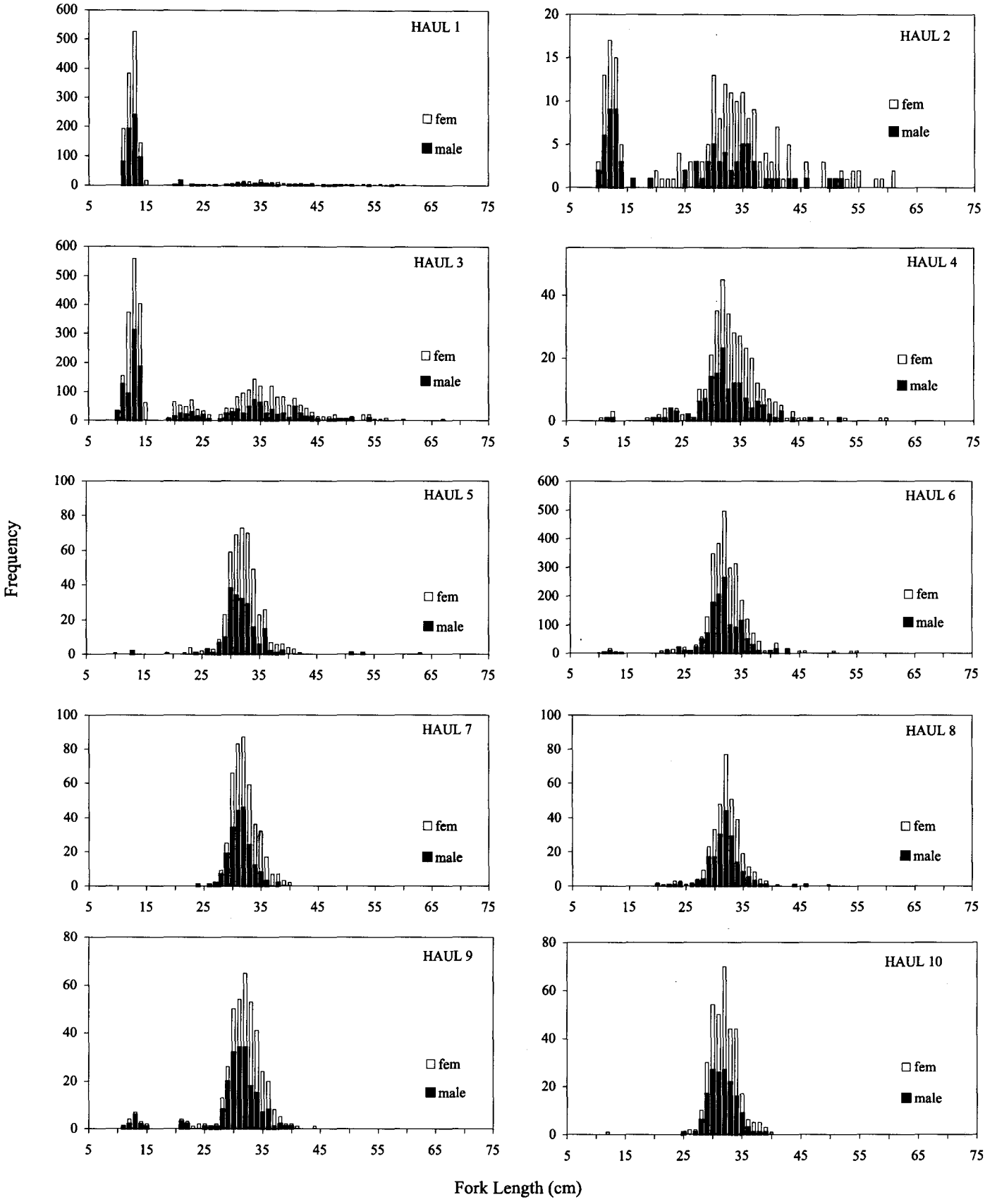

Figure 4. Length distribution by sex and haul of pollock taken during the 2003 echo integration-trawl survey of Shelikof Strait.

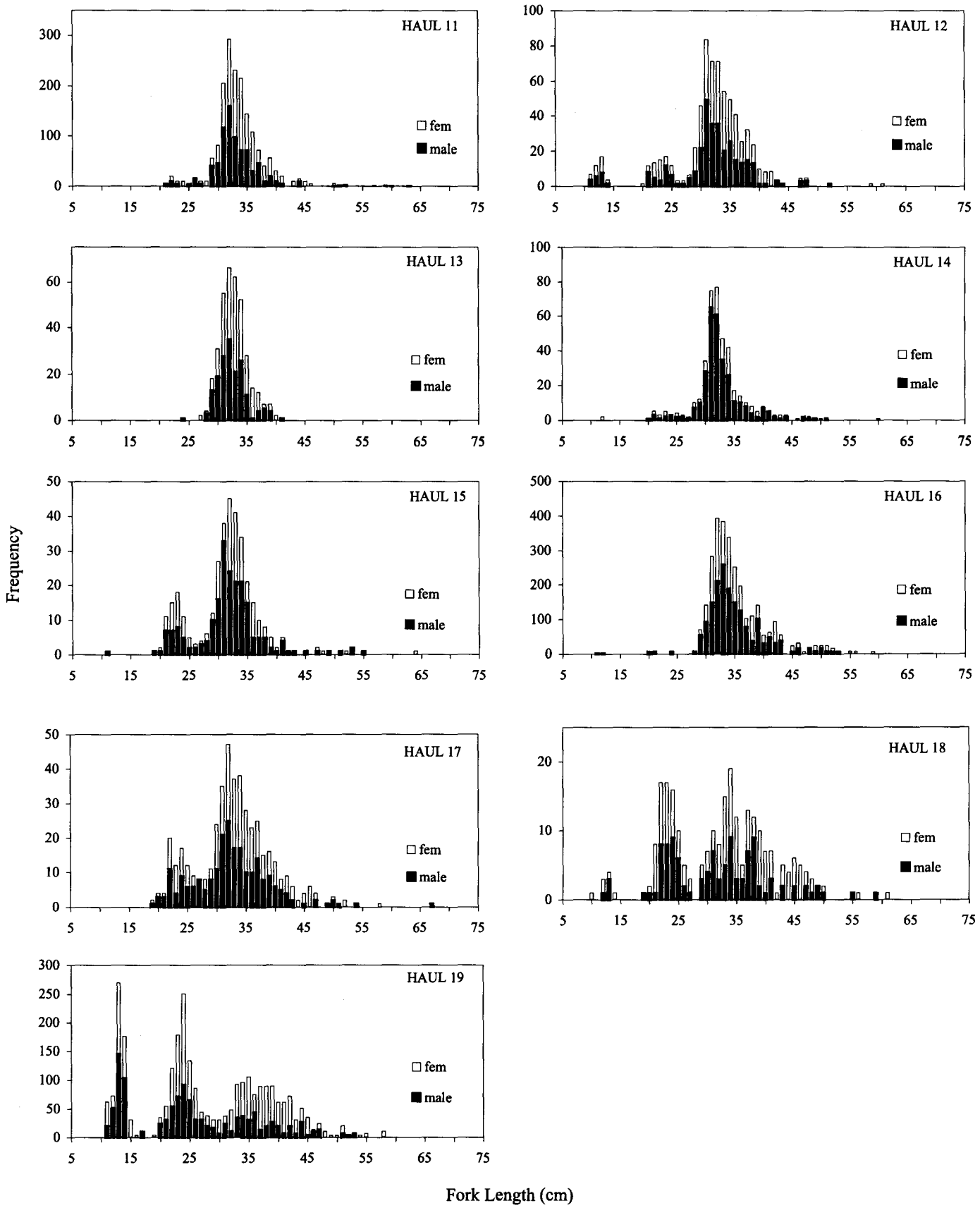

Figure 4 (cont.).

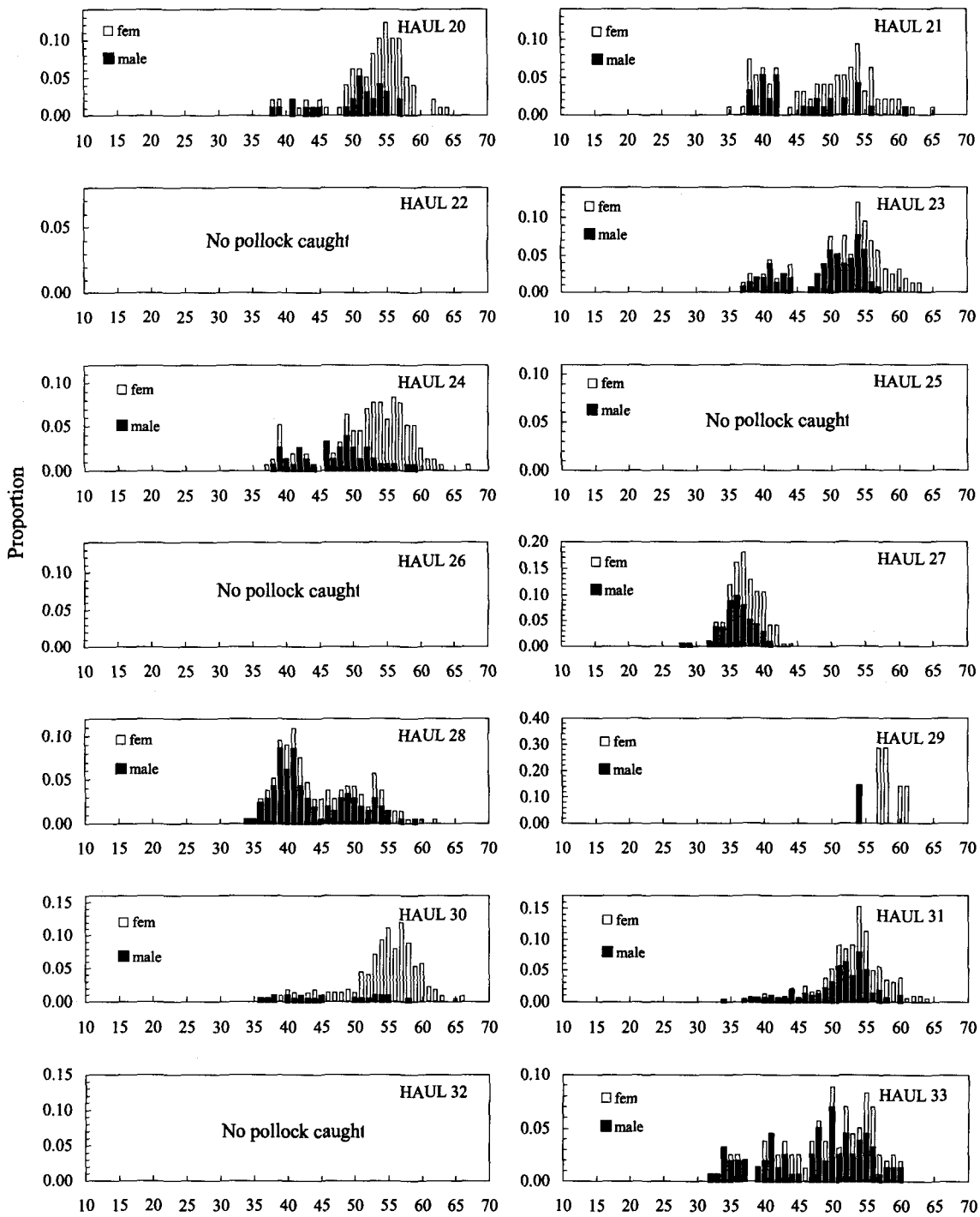

Figure 5. Length distribution by sex and haul of pollock taken during the 2003 echo integration-trawl survey of the Gulf of Alaska shelf break near Chirikof Island (hauls 20-26) and Middleton Island (hauls 27-32), and Yakutat Canyon (haul 33).

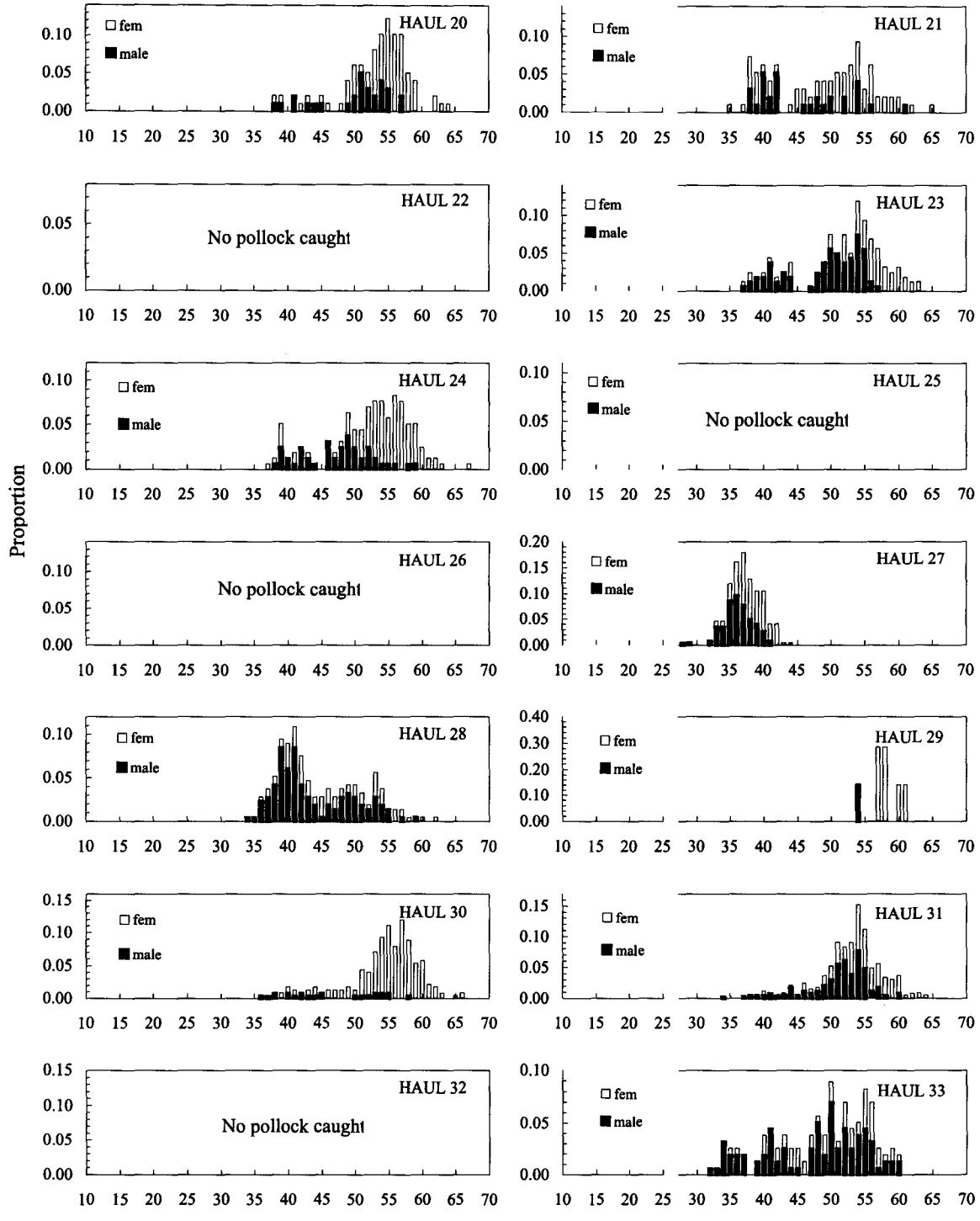

Figure 5. Length distribution by sex and haul of pollock taken during the 2003 echo integration-trawl survey of the Gulf of Alaska shelf break near Chirikof Island (hauls 2(26) and Middleton Island (hauls 27-32), and Yakutat Canyon (haul 33).

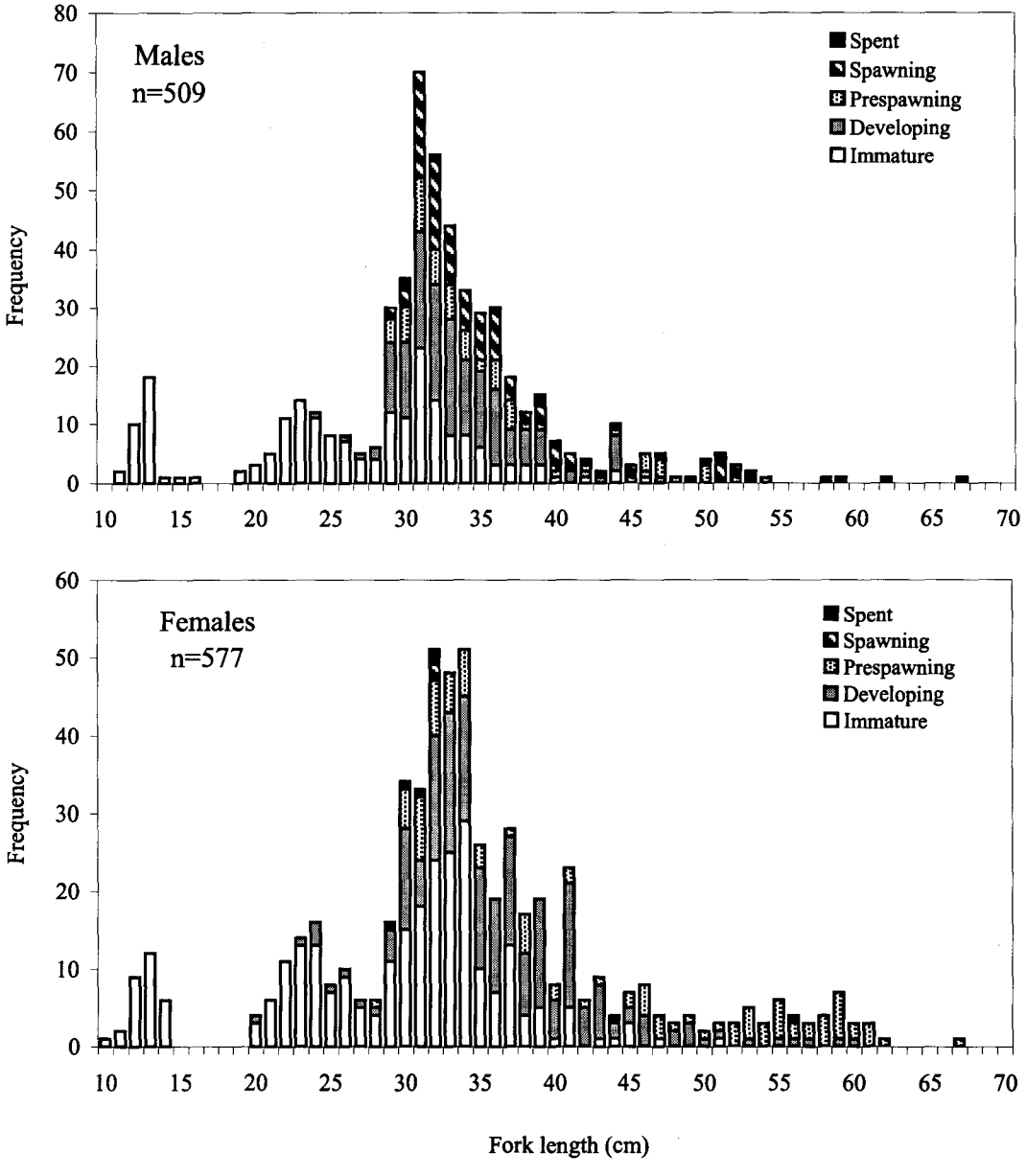

Figure 6. Maturity-length composition for male and female pollock taken during the winter 2003 echo integration-trawl survey of Shelikof Strait. The maturity-length composition does not necessarily represent the population size composition.

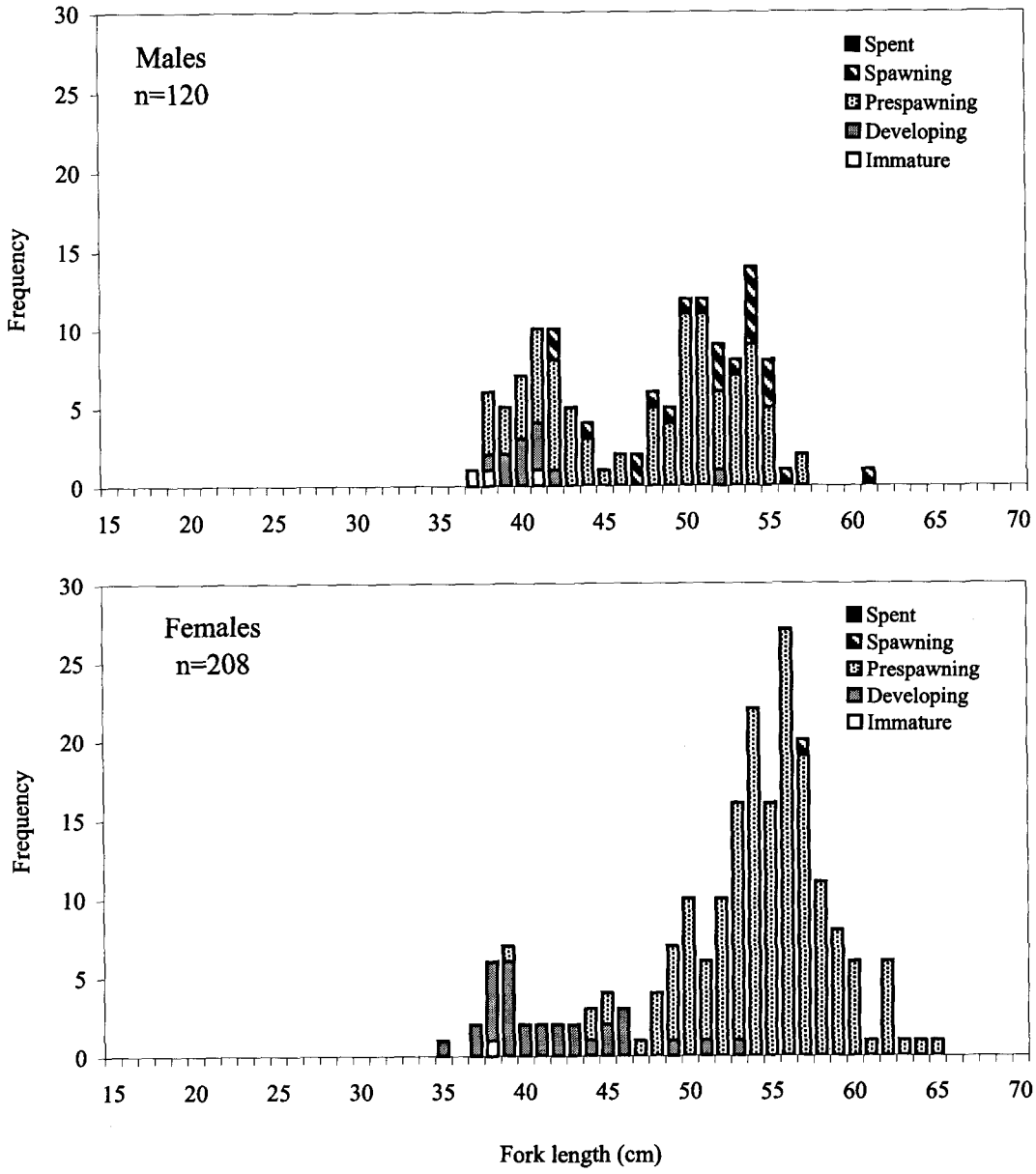

Figure 7. Maturity-length composition for male and female pollock taken during the spring 2003 echo integration-trawl survey of the Gulf of Alaska shelf break near Chirikof Island. The maturity-length composition does not necessarily represent the population size composition.

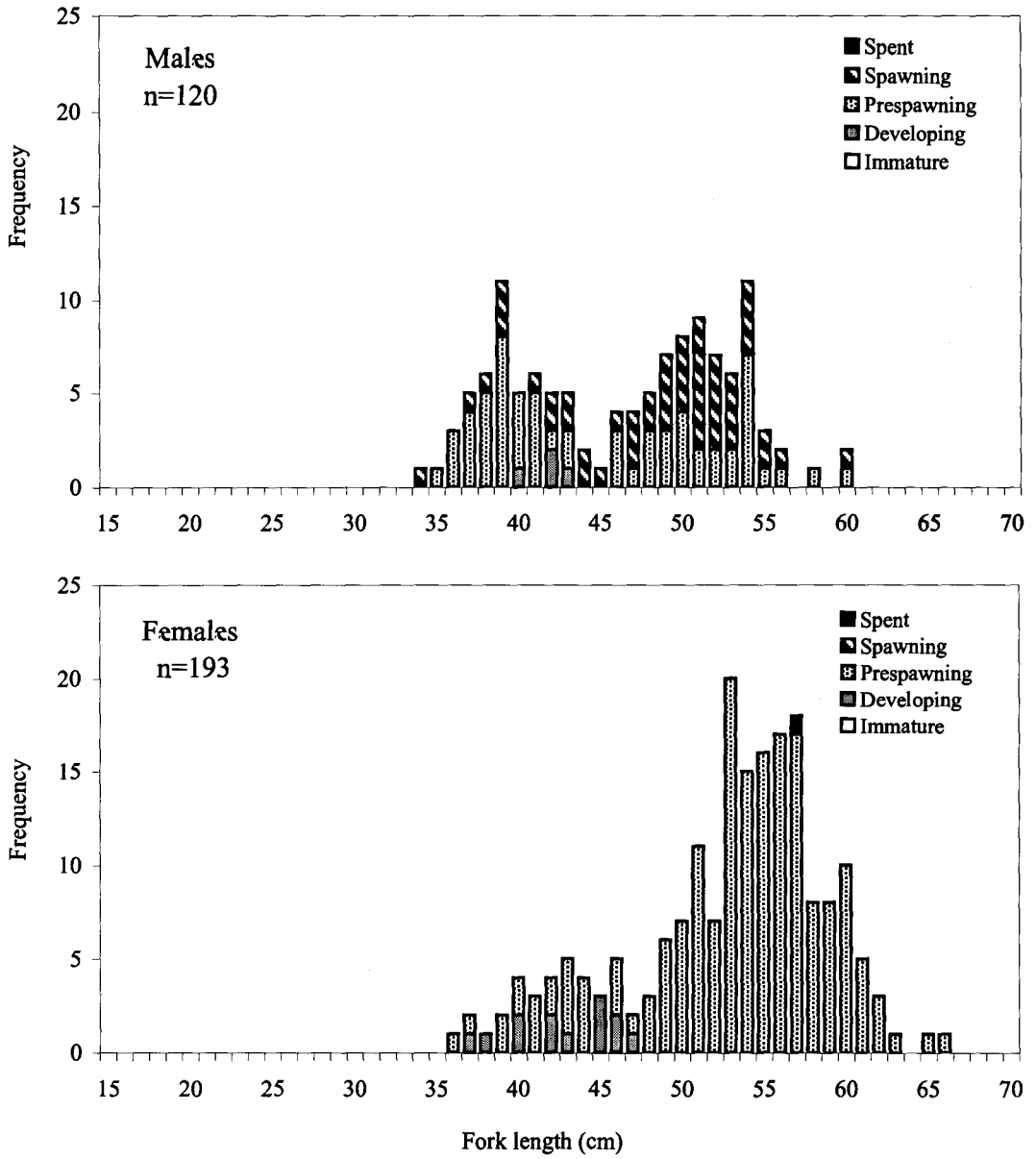

Figure 8. Maturity-length composition for male and female pollock taken during the spring 2003 echo integration-trawl survey of the Gulf of Alaska shelf break near Middleton Island. The maturity-length composition does not necessarily represent the population size composition.