Echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) in the southeastern Aleutian Basin near Bogoslof Island, February-March, 1999.

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Japan Fisheries Agency (JFA), in cooperation with Alaska Fisheries Science Center, conducted an echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) in the Bogoslof Island region in February-March 1999 aboard the Japanese research vessel *Kaiyo maru*. AFSC's Midwater Assessment and Conservation Engineering (MACE) Program has conducted this survey annually since 1988; in 1999 MACE collaborated with JFA aboard their vessel because NOAA ship *Miller Freeman* was in dry dock for repairs. The region was surveyed twice: Jan. 31-Feb. 9 (leg 1), and Feb. 21-Mar. 4 (leg 2). Leg 2 timing was approximately one week earlier than recent AFSC surveys. The primary cruise objective was to determine the distribution and abundance of pollock that spawn in March in this region of the southeastern Aleutian Basin. The survey design consisted of north-south parallel transects at 10 nmi spacing on leg 1, and 10 or 5 nmi spacing on leg 2 depending on fish distribution. Acoustic and biological sampling and analysis methodologies were similar to those employed by scientists of the MACE Program. Acoustic data collection and processing equipment and software were of Japanese design and construction. The acoustic system was calibrated using standard sphere methodology – as is the Simrad EK500 / BI500 system used by AFSC. The Japanese have recently installed a Simrad EK500 / BI500 system on the *Kaiyo maru*. Though this system was not actively transmitting during survey data collection, it was available for two experiments designed to yield "intersystem comparison" data between the Japanese system and the EK/BI500 system. Results of these comparisons are not yet available.

During leg 1, pollock were encountered along the southern ends of transects, near the Aleutian Islands, especially in Samalga Pass northeast of the Islands of Four Mountains (Fig. 1a). During leg 2, distribution was similar, but pollock aggregations appeared to be larger and more concentrated than during leg 1 (Fig. 1b), similar to distributions observed in recent years' surveys. Pollock caught in the six midwater trawls made during leg 1 had lengths ranging from 42-65 cm; those caught in the eight hauls made during leg 2 had lengths ranging from 39-67 cm (Figs. 2, 3). Hauls made on the eastern-most transects north of Akutan Is. caught smaller pollock (length modes between 42-45 cm) than those in the central and western part of the survey area (length modes 53-57 cm for males, and 55-59 cm for females). Maturity condition of the fish was similar to that of recent surveys. Most females were in a pre-spawning stage. Average gonadosomatic index (GSI) for mature female pollock increased from 12.6 during leg 1 to 16.1 during leg 2 (Fig. 4), and was comparable to female GSI as measured in March 1998.

Population and biomass estimates were based on leg 2 data as timing was closest to timing of previous U.S. Bogoslof-area surveys. Preliminary estimates of pollock biomass for leg 2 are

0.475 million tons (total), of which 0.393 million tons are in the Central Bering Sea convention (518) area (Tab. 1, Fig. 5). Population at length (Tab. 2, Fig. 6) shows two major length modes at 56 and 46 cm, similar to but slightly larger than length modes in 1998. The total (leg 2) population numbers 416 million fish.

Trends in population at age between 1988-1998 (Tab. 3, Fig. 7) show that in winter 1998, the spawning population comprised primarily the 1989 and 1990 year classes. Pollock from the 1992 year class, 6-years-old in 1998, showed a dramatic increase compared with 1997. This pattern is similar to that for other strong year classes which have typically recruited to the Bogoslof area at ages 5-7 (Fig. 7, note 1982, 1984, and 1989 year classes). In 1998, the 1978, 1982, and 1984 year classes were still present although greatly diminished in numbers. Age data are not yet available for 1999.

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Table 1. Pollock biomass in the Bogoslof Island region from acoustic-trawl surveys between 1988-1999. No survey was conducted in 1990.

Year	Biomass (million tons)	Inside area 518 / Convention Area	Outside area 518 / Convention Area	Prop. inside	Prop. outside
1988	2.396	2.396	0.000	1.00	0.00
1989	2.126	2.084	0.042	0.98	0.02
1990					
1991	1.289	1.283	0.006	1.00	0.00
1992	0.940	0.888	0.052	0.94	0.06
1993	0.635	0.631	0.005	0.99	0.01
1994	0.490	0.490	0.000	1.00	0.00
1995	1.104	1.020	0.084	0.92	0.08
1996	0.682	0.582	0.100	0.85	0.15
1997	0.392	0.342	0.051	0.87	0.13
1998	0.492	0.432	0.060	0.88	0.12
1999	0.475	0.393	0.083	0.83	0.17

Table 2. Population at length estimates (millions of fish) from February-March echo integration-trawl surveys* of spawning pollock in the Bogoslof Island area. No survey was conducted in 1990.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
10	0	0	–	0	0	0	0	<1	0	0	0	0
11	0	0	–	0	0	0	0	<1	0	0	0	0
12	0	0	–	0	0	0	0	1	0	0	0	0
13	0	0	–	0	0	0	0	<1	0	0	0	0
14	0	0	–	0	0	0	0	<1	0	0	0	0
15	0	0	–	0	0	0	0	0	0	0	0	0
16	0	0	–	0	0	0	0	0	0	0	0	0
17	0	0	–	0	0	0	0	0	0	0	0	0
18	0	0	–	0	0	0	0	0	0	0	0	0
19	0	0	–	0	0	0	0	0	0	0	0	0
20	0	0	–	0	0	0	0	0	0	0	0	0
21	0	0	–	0	0	0	0	0	0	0	0	0
22	0	0	–	<1	0	0	0	0	0	0	0	0
23	0	0	–	2	0	0	0	0	0	0	0	0
24	0	0	–	1	0	0	0	0	0	0	0	0
25	0	0	–	0	0	0	0	0	0	0	0	0
26	0	0	–	<1	0	0	0	0	0	0	0	0
27	0	0	–	0	0	0	0	0	0	0	0	0
28	0	0	–	0	0	0	0	0	0	0	0	0
29	0	0	–	0	0	0	0	0	0	0	0	0
30	0	0	–	0	0	0	0	0	0	0	0	0
31	0	0	–	0	<1	0	0	0	0	0	0	0
32	0	0	–	0	<1	0	0	0	0	0	0	0
33	0	0	–	0	<1	0	0	0	0	0	0	0
34	0	0	–	0	0	0	0	<1	<1	0	<1	0
35	0	0	–	0	0	0	0	<1	0	<1	0	0
36	0	0	–	0	<1	0	0	<1	<1	<1	<1	0
37	9	3	–	<1	0	0	0	<1	<1	<1	<1	0
38	6	0	–	2	<1	1	0	1	1	<1	1	0
39	16	4	–	5	0	2	<1	4	1	1	3	<1
40	24	3	–	7	1	4	3	12	4	1	7	1
41	27	4	–	19	3	5	6	20	8	2	9	6
42	48	23	–	23	7	7	9	40	14	3	11	8
43	118	33	–	31	14	6	14	40	17	4	11	13
44	179	54	–	36	18	7	21	41	21	5	10	13
45	329	159	–	46	28	8	21	50	23	7	9	17
46	488	177	–	55	32	13	21	53	31	10	11	19
47	547	389	–	79	42	22	18	40	36	14	9	14
48	476	434	–	130	68	28	17	55	36	15	12	11
49	389	431	–	168	102	46	16	47	37	18	15	10
50	248	366	–	205	129	69	39	52	40	21	20	16
51	162	279	–	189	144	76	46	58	45	24	23	11
52	80	168	–	160	118	73	52	78	52	26	28	20

Table 2. continued.

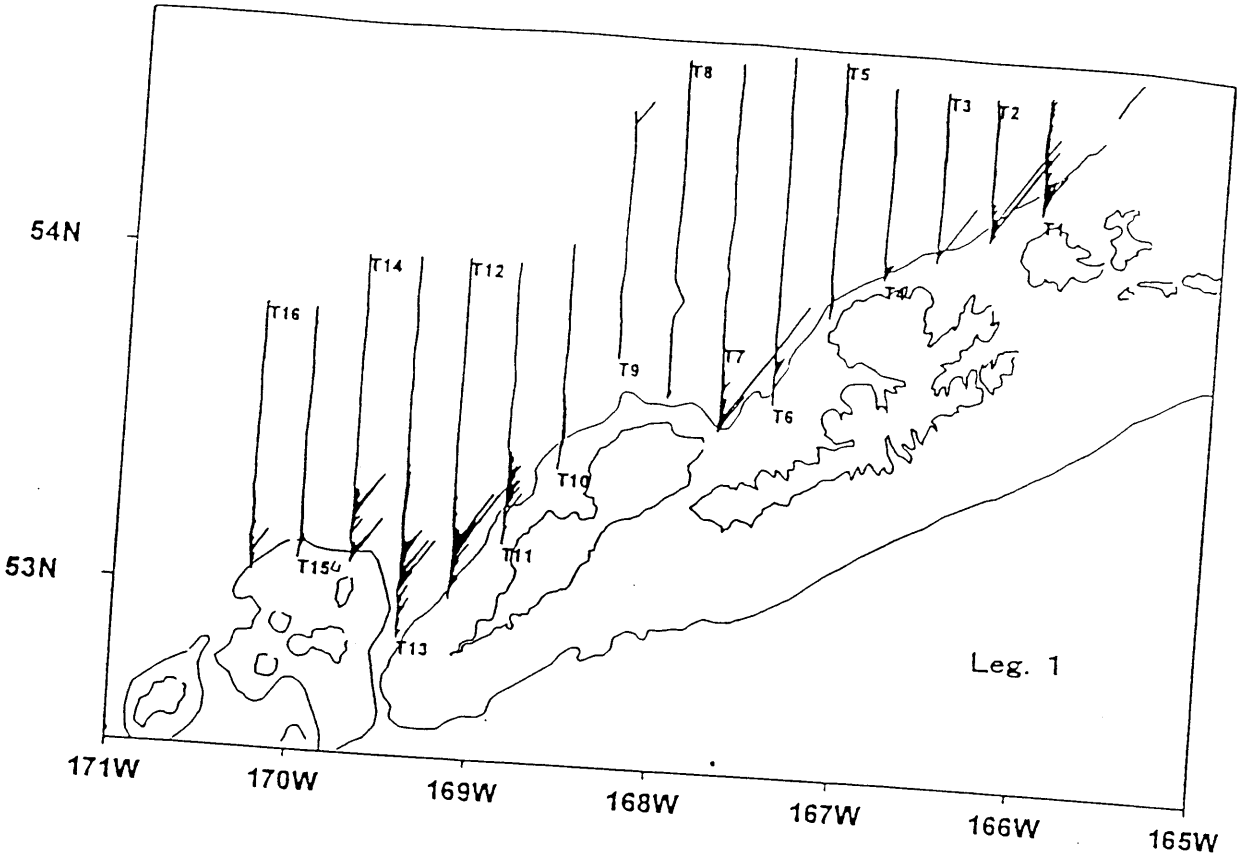
Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
53	48	85	--	122	106	73	49	81	52	26	35	17
54	19	50	--	63	67	66	43	88	53	31	41	21
55	12	13	--	40	41	50	37	81	48	28	38	33
56	4	5	--	17	27	29	26	69	40	24	35	38
57	3	8	--	8	13	14	17	58	37	22	30	33
58	1	1	--	4	6	9	10	47	28	17	27	36
59	0	0	--	1	5	3	6	31	19	13	18	23
60	0	0	--	1	1	1	3	17	12	12	13	15
61	2	0	--	1	<1	1	2	7	6	6	8	18
62	0	0	--	<1	<1	<1	1	4	2	3	5	13
63	0	0	--	0	0	0	<1	2	1	1	3	4
64	0	0	--	0	1	<1	0	1	<1	1	1	3
65	0	0	--	<1	0	0	0	<1	<1	<1	1	1
66	0	0	--	0	0	0	0	<1	0	<1	1	<1
67	0	0	--	0	0	0	0	0	0	0	0	1
68	0	0	--	0	0	0	0	1	0	0	<1	0
Totals	3236	2687	--	1419	975	613	478	1081	666	337	435	416

* Echo integration-trawl surveys in 1988-1998 were conducted by the Alaska Fisheries Science Center, Seattle, USA. The 1999 survey was conducted by Japan Fisheries Agency, Japan.

Table 3. Bogoslof spawning pollock population estimates (millions of fish) from February-March echo integration-trawl surveys. No survey was conducted in 1990.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
0	0	0	--	0	0	0	0	0	0	0	0
1	0	0	--	0	0	0	0	1	0	0	0
2	0	0	--	4	0	0	0	0	0	0	0
3	0	0	--	0	1	1	0	2	0	0	0
4	0	6	--	2	2	33	21	6	<1	<1	<1
5	28	15	--	12	27	17	86	75	6	4	11
6	327	58	--	46	54	44	26	278	96	16	61
7	247	363	--	213	97	46	38	105	187	55	34
8	164	147	--	93	74	48	36	68	85	88	70
9	350	194	--	160	71	42	36	80	40	38	77
10	1201	91	--	44	55	28	17	53	37	28	32
11	288	1105	--	92	57	51	27	54	24	16	25
12	287	222	--	60	33	25	23	19	24	16	21
13	202	223	--	373	34	27	13	59	12	13	19
14	89	82	--	119	142	42	9	32	36	7	18
15	27	90	--	41	164	92	45	12	18	13	9
16	17	30	--	38	59	47	36	31	4	5	15
17	7	60	--	29	8	25	28	103	16	4	5
18	3	0	--	32	15	11	16	60	35	12	8
19	0	0	--	56	22	11	4	18	26	12	10
20	0	0	--	4	42	11	4	5	12	7	15
21	0	0	--	2	13	10	8	5	3	2	4
22	0	0	--	0	3	1	2	6	2	1	1
23	0	0	--	0	1	1	2	6	1	<1	0
24	0	0	--	0	0	0	1	2	0	1	0
25	0	0	--	0	0	0	0	0	0	0	0
Totals	3236	2687	--	1419	975	613	478	1081	666	336	435

a



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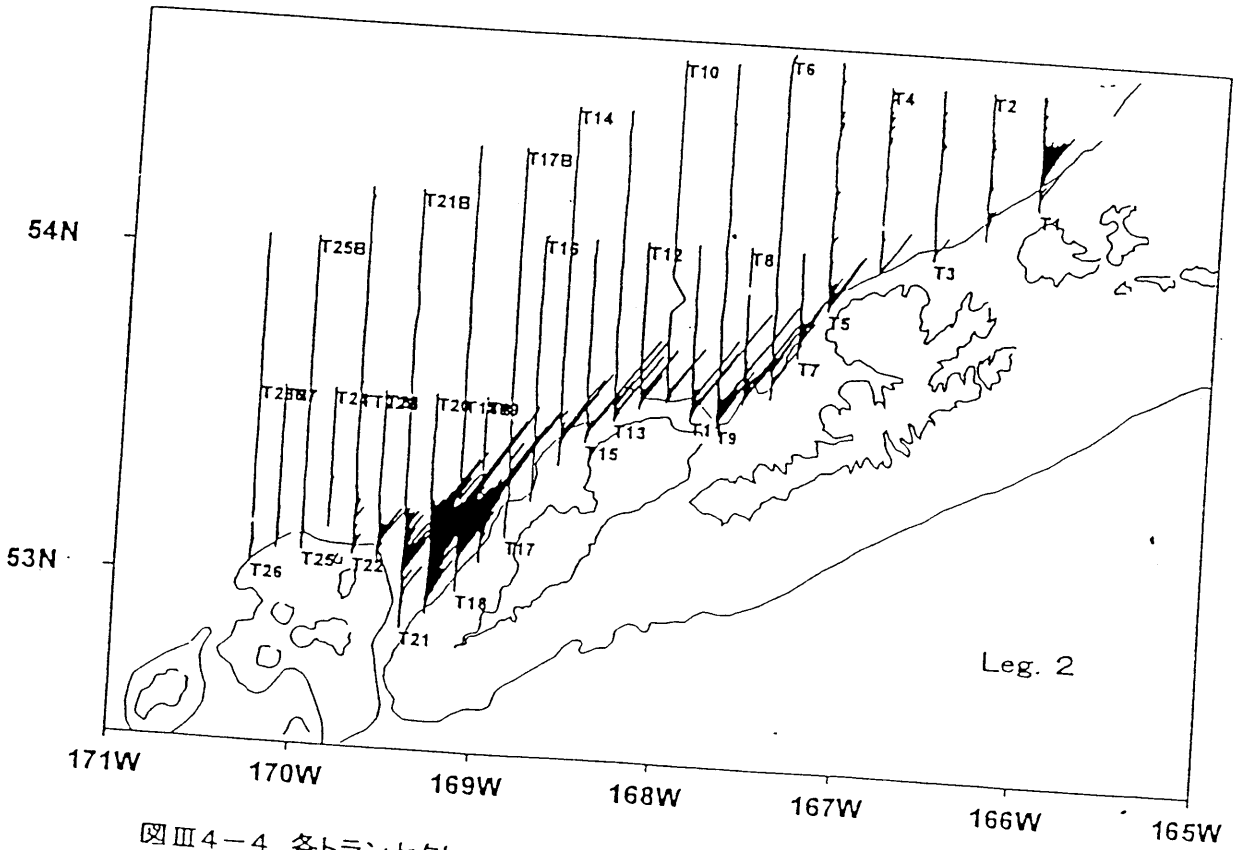


図Ⅲ4－4. 各トランセクトでのスケトウダラのSA分布

Figure 1 Relative acoustic density of walleye pollock along each transect.

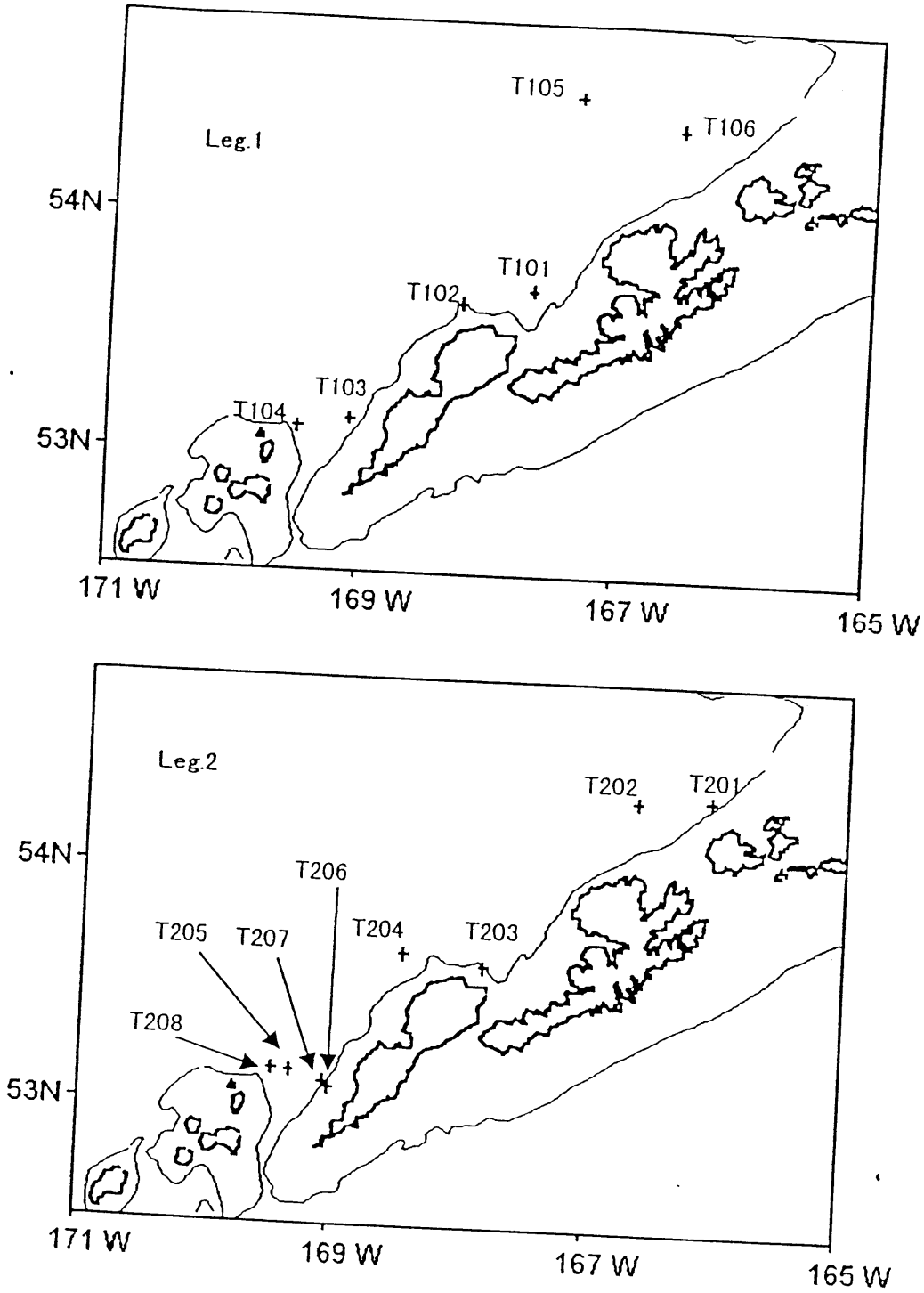
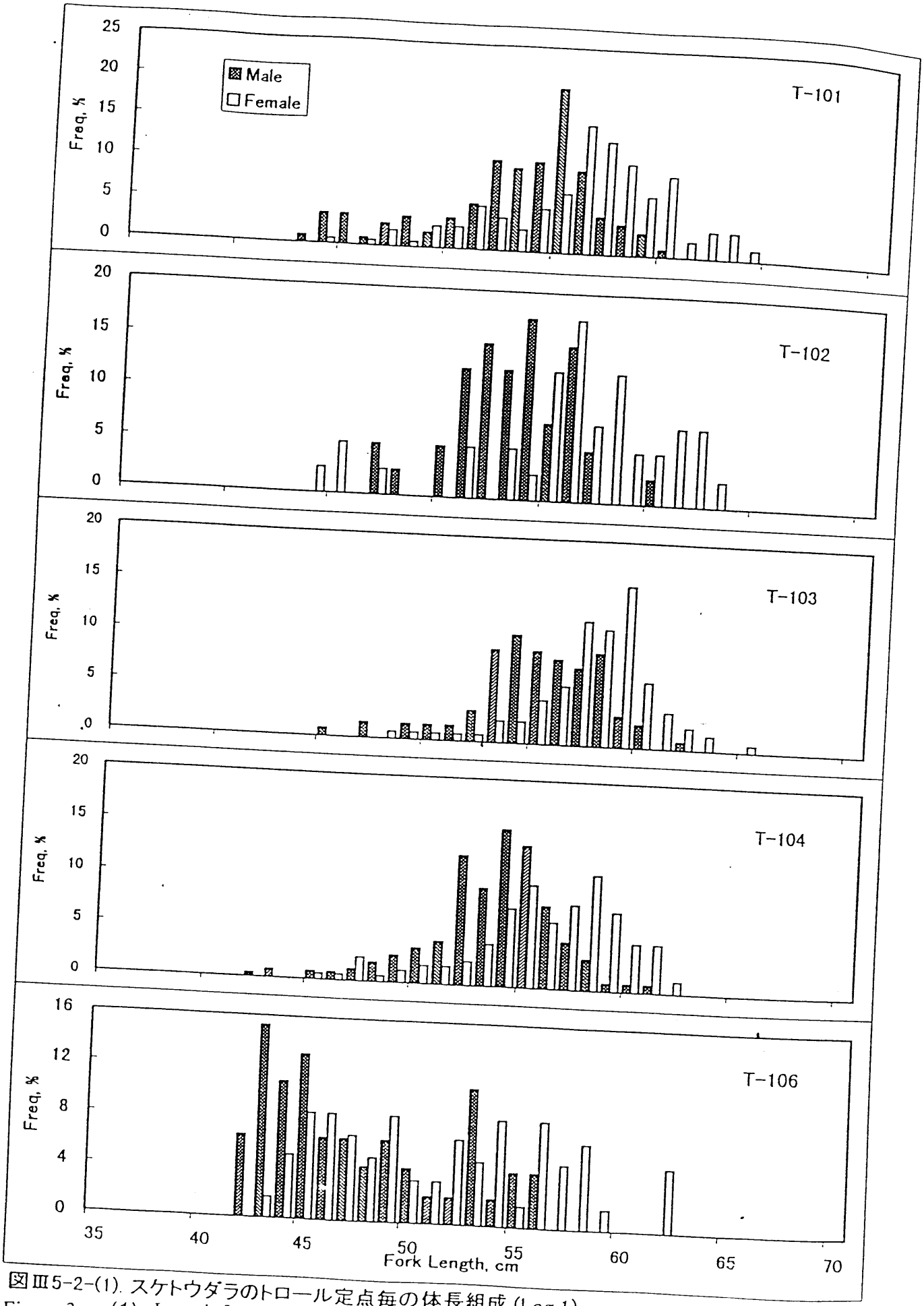


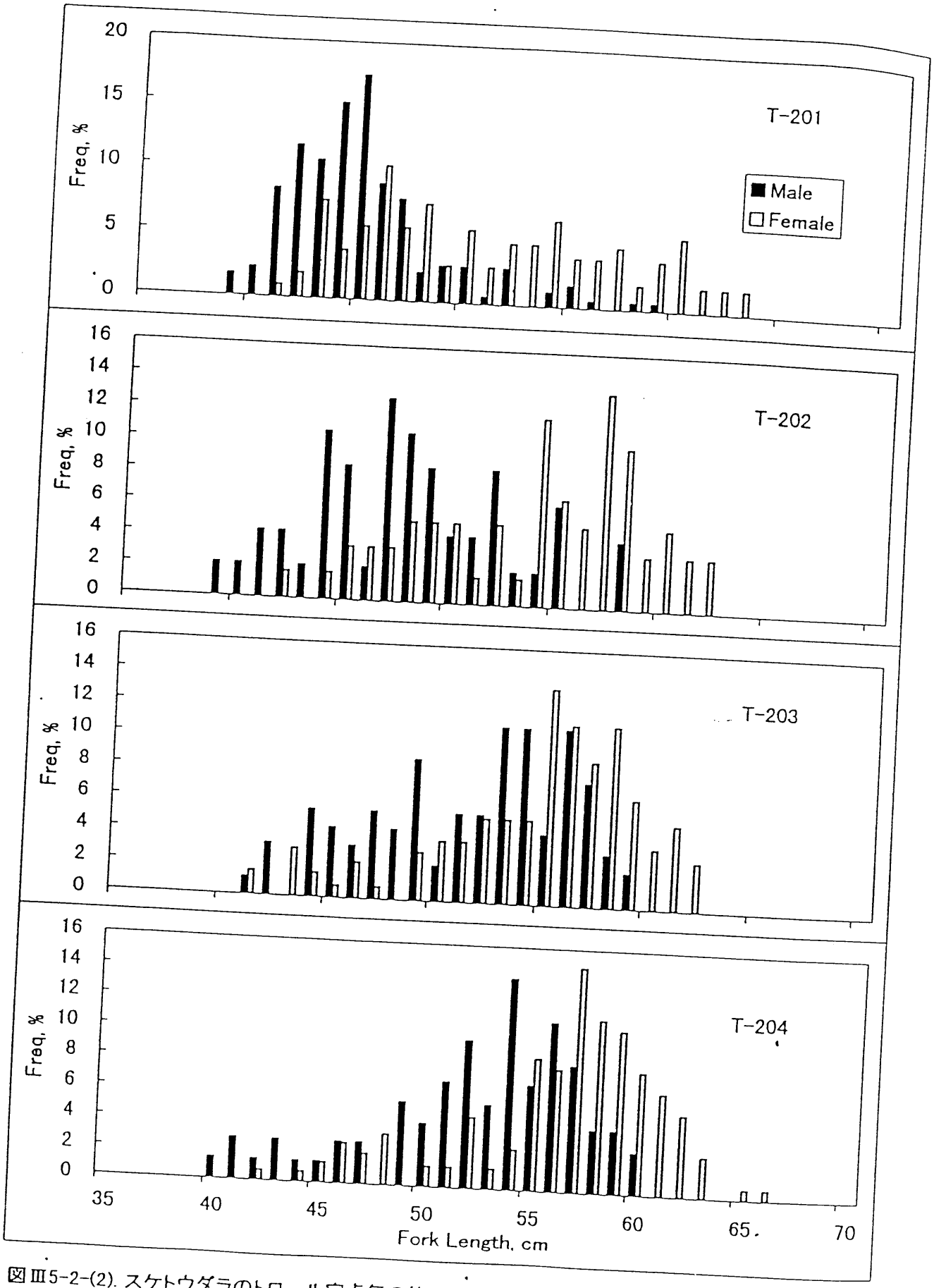
Figure 2　　中層トロール位置の分布図

Trawl locations during leg 1 (top) and leg 2 (bottom) of the 1999 winter EIT survey of the Bogoslof Island area.

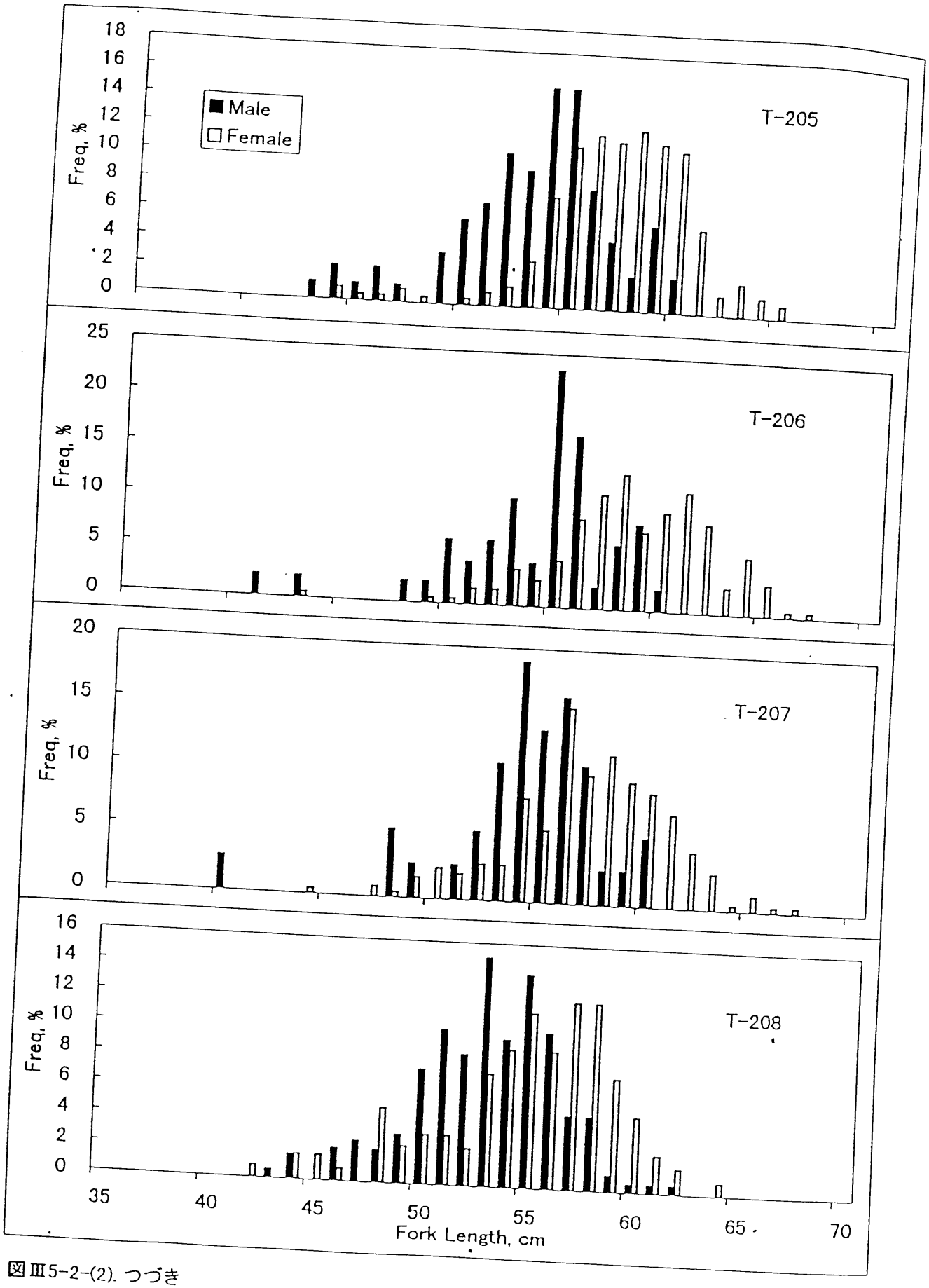


図Ⅲ5-2-(1). スケトウダラのトロール定点毎の体長組成 (Leg 1)

Figure 3 (1). Length frequency distribution at each trawl station in Leg 1

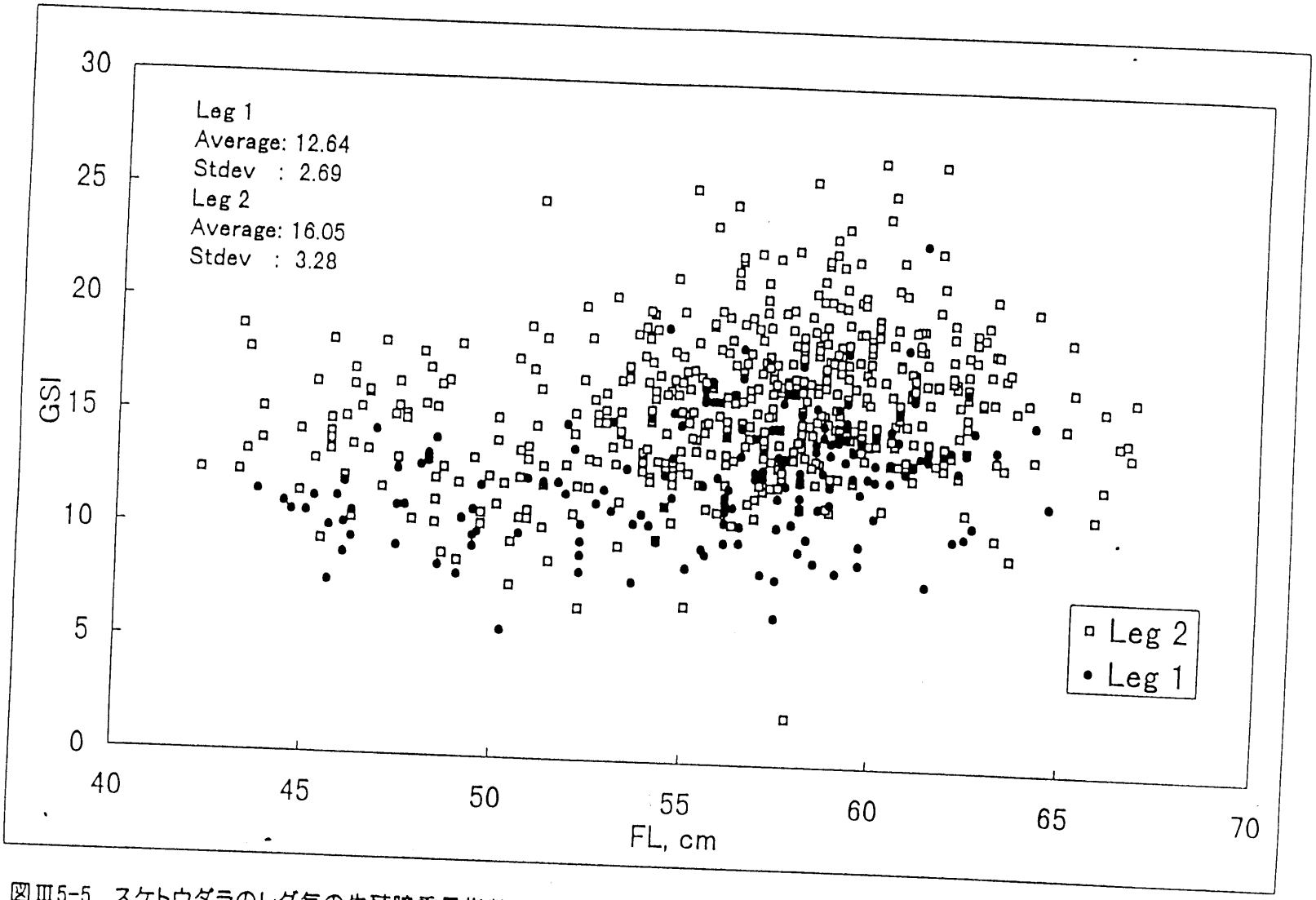


図Ⅲ5-2-(2). スケトウダラのトロール定点毎の体長組成 (Leg 2)
Figure 3 -(2). Length frequency distribution at each trawl station in Leg 2



図Ⅲ5-2-(2). つづき

Figure 3 2-(2). Length frequency distribution at each trawl station in Leg 2



図Ⅲ5-5. スケトウダラのレグ毎の生殖腺重量指数の分布
Figure 4 . Distribution of gonad somatic index (GSI) by each leg

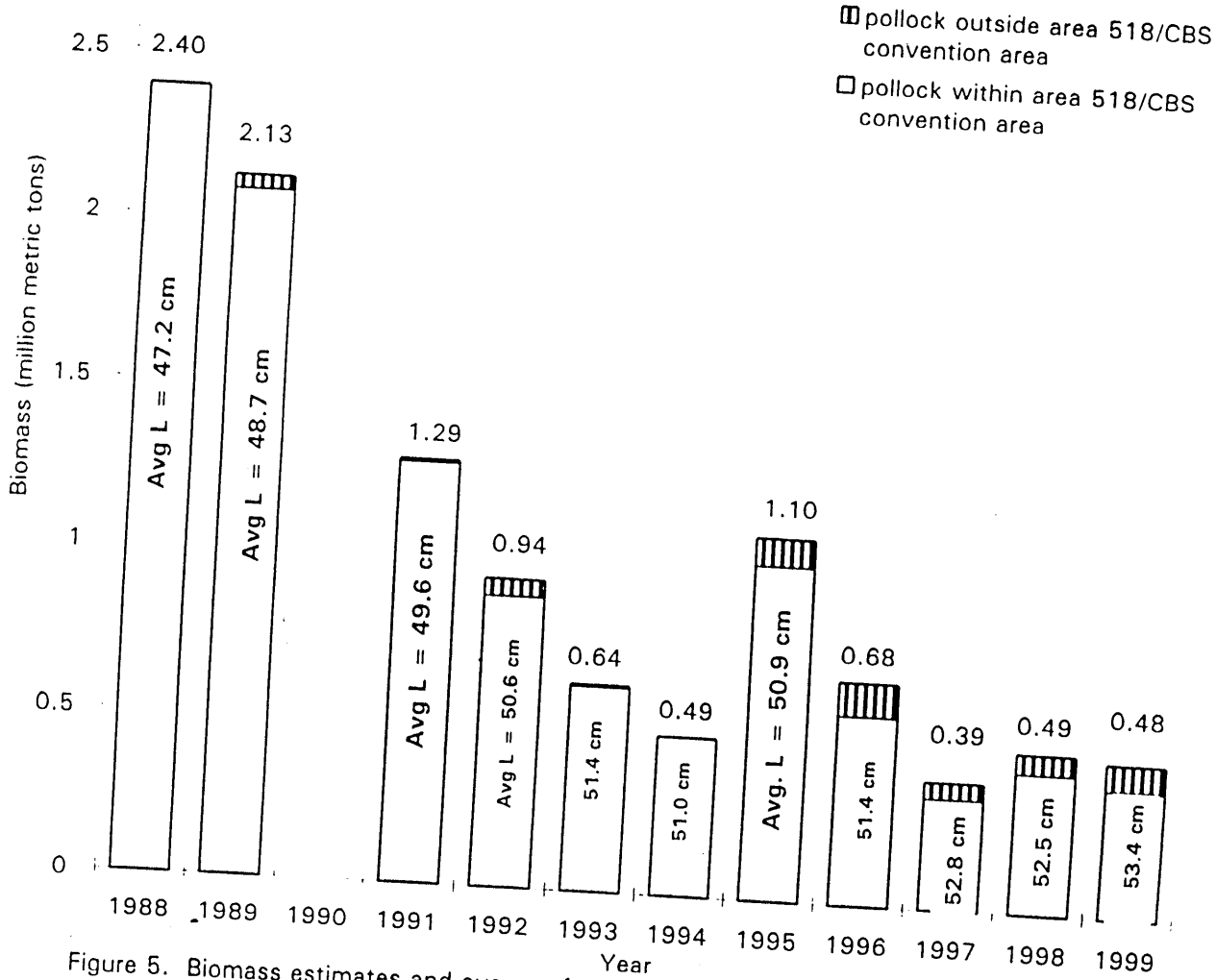


Figure 5. Biomass estimates and average fork lengths obtained during winter echo integration-trawl surveys for spawning walleye pollock near Bogoslof Island, 1988-99. There was no survey in 1990. Total pollock biomass for each survey year is indicated.

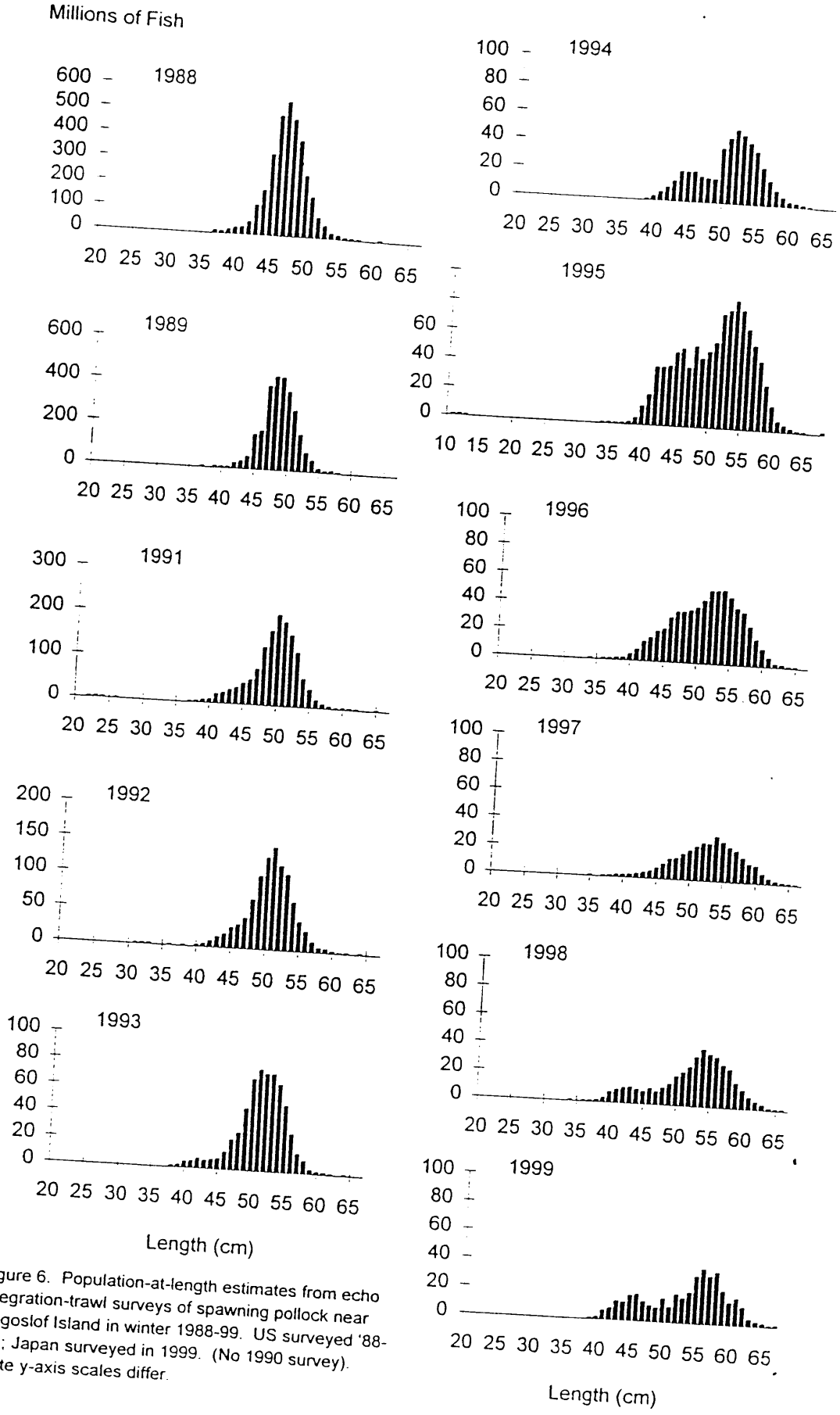


Figure 6. Population-at-length estimates from echo integration-trawl surveys of spawning pollock near Bogoslof Island in winter 1988-99. US surveyed '88-'98; Japan surveyed in 1999. (No 1990 survey). Note y-axis scales differ.

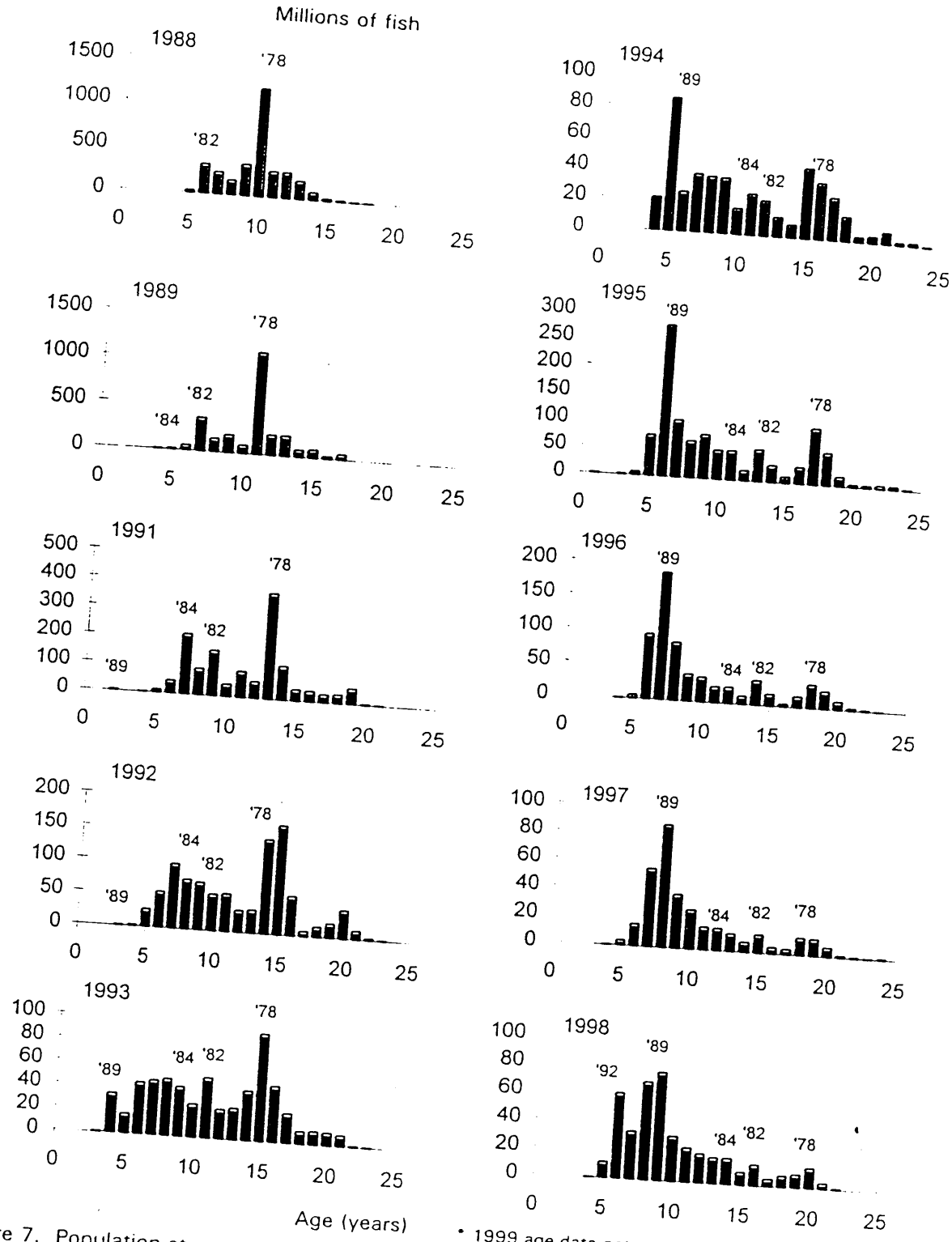


Figure 7. Population-at-age estimates obtained during echo integration-trawl surveys of spawning walleye pollock near Bogoslof Island in winter 1988-99*. Major year classes are indicated. No survey was conducted in 1990. Note y-axis scale differences.

* 1999 age data not yet available