Attachment 7

Seventh Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea

SEPTEMBER 16-19, 2002
Moscow, Russia

Status of Bering Sea Pollock Stocks in Russian EEZ.

Here is a review of the result of scientific cruises to the western and northwestern Bering Sea in 2001-2002.

Ten cruises were made to the northern and northwestern Bering Sea in 2001 and the first half of 2002.

Studies were made, as follows.

- April-May 2001, from BMRT "Nikolay Chepik" (large trawler of 104.4 t)
- May-December 2001, and Macrh-April 2002, from "Kaye-Maru 28" (medium trawler of Hokuten type, 52 long)
- June-July 2001, and April-June 2002, from RTSM "Bagration" (large trawler of 101.5 t)
- July-August 2001, from BMRT "Khaiduk" (large trawler of 83,2 t)
- July-September 2001, from ST "Vynosliviy" (medium trawler)
- August-November 2001, from RV "Professor Kaganovski".

Weather conditions were analyzed on the basis of on-land pressure maps transmitted by the Japanese Meteorological Agency (JMA), and on-board weather observation data.

Oceanographic studies were conducted using Neil Brown Mark III sounding complex (15.6 Hz), and independent sounds FSI MCTD (3.3 Hz). Calibration and control over retention of meter grading characteristics for temperature, electric conductivity and pressure were done by comparing sounder measurement data with the data obtained from the layers checked using deep-water thermometers, thermal depth-meters, and salinity meter "MK-601-III". The results of observations were processed by applying CTD, FSI FSK Acquisition, GRAPHER, SURFER, MAP-30, HYDRO, volume, Setion program packages. Currents were computed using the dynamic method.

The following specialized set of equipment was engaged in the echometric survey:

- echosounder EY-500 Simrad with a towed antenna (single Beam); 38 KHz; output capacity 250 watt4
- echosignal recording system – from the computer outlet to magnetooptical carrier (MO-disk) which had been used an accumulator of information;

- reception system of navigation GPS (Trimble Navigation Company, USA) connected with echosounder EY-500, automatically determining the position of the vessel which are recorded together with the acoustic data;
- postprocessing system EP-500 Simrad for processing survey data.

Midwater trawls were used for counting surveys. They placed small mesh inset into the codend part of the trawl (30,20 and 10 mm mesh).

The ichthyoplankton surveys were run using a standard conic net ICS-80 having an80 cm diameter opening, and the technique of total fishing within 500-0 m. or bottom to surface at smaller depths. Ichthyoplankton was captured on the windward side of the ship. The net was raised at 0.5-0.6 m/sec. Ichthyoplankton was separated from the overall mass of plankton. They determined its specific composition, number, egg stage by Rass, and then fixed it with a 4% solution of formaline for further cameral treatment.

The spartial distribution of Pollock and other species was plotted using SURFER and MAPDESIGNER programs by spline approximation.

There were 626 oceanographic, 682 bottom trawl stations and 178 ichthyoplankton survey stations made between June 2001 and June 2002.

Characteristics of atmospheric circulation

The position and intensity of the main centers of atmospheric effect (Arctic and Hawaii maxima, Aleutian depression and Siberian anticyclon) determine the circulation over the Bering Sea. By the origin the cyclones covering the sea belong two types, namely continental ones coming mostly from the West, and southern sea cyclones. It is the second type of cyclon that, as a rule, basically contribute to the cyclonic activity.

In the late summer of 2001 there were two regions of pronounced repetition of cyclones recorded in the Bering Sea: east of Kamchatka, and north of 60°n. near Alaska. North-eastern and southern winds prevailed. In autumn the cyclonic activity enhanced. A nucleus of repeated cyclones was formed in the Western Bering Sea. The center of cyclonic activity later shifted south-eastwards to the central Aleutians. Initially during the hydrological winter the number of cyclones even went down as compared to the previous months, as opposed to the conventional strengthening of cyclonic activity.

In April-June 2002 weather conditions differed from those of 2001 by a higher level of wind and wave processes, and by more frequent ten point cloudiness which was probably related to the intense cyclonic activity. Given that, air temperature in 2002 was much higher I march and April, but was somewhat behind in May and June in terms of growth.

Oceanological conditions

The Western Bering Sea waters (Karagin, Korfa, Olyutor) were colder than normal level in August-September 2001, as far as the thermal condition of water is concerned. On the whole, water temperature in the north-western part of the sea was close to the multiannual level; however, some positive anomalies were observed at 50-meter layer within the Navarin current range.

Anticyclonic circulation was predominant in Karagin and Korfa Bays. In Oluytor Bay and off the Koryak coast the field of currents had a complex whirl nature, with eddies of various signs. The Central Bering Sea current diverged far away from the Koryak coast. In October the Navarin current was weakened, and did not exceed 1-3 cm/sec. However, a considerable portion of the Anadyr Gulf was occupied with relatively warm and saline waters which had probably been caused by the advent to the gulf of less transformed waters from Navarin canyon area. In the second half of 2001 the Anadyr anticyclon was not pronounced, and the off-bottom range of negative temperatures turned out to be smaller than in the previous years. The Anadyr current was well developed extending rather rapidly westwards from Navarin Cape to 175°E. in a wide strip.

The water discharge through the kamchatka Strait within 0-1000 m. was 3.56 in August and 4.815v in November; within 0-1500 m. it was 5.18 in August and 6.97 Sv in November. The volume of summer discharge for the 0-1000 m. layer exceeded that of the previous five years.

In April-May 2002 cold and freshened waters were in most of the Navarin area which was brought about by the connective autumn-winter mixing. The impact of relatively warm and saline waters of the Aleutian Basin was noticeable only beyond the continental slope.

In spring 2002 the ice condition in the North-Western Bering Sea was abnormally "easy" versus some average multiannual data. In late April, 2002 the ice cover edge was located north of 62°n. The Oluytor Bay and the area along the Koryak coast were nearly completely freed of ice. The lowest ocean surface temperatures (-1.6°C) were recorded near the Koryak coast, off Anastasia and Dezhnev Bights. All layers of shelf waters there were nearly completely isothermic whereas the minimum temperature values in the east of Navarin area were recorded below 25 m.

Composition of catches

The catches taken during the trawl surveys contained 123 bottom, near-bottom and pelagic fish species belonging to 26 families.

Pollock made up the bulk of catches throughout the entire area of the Northern and Northwestern Bering Sea. Its weight share in catches reached 70-90%.

The species composition of bottom ichthyocoenoses varied among the

areas studied.

Besides pollock, bottom catches in Karagin Bay contained flounder, gobies, cod and navaga. In Olutor Bay a large biomass of flounders and gobies was observed. The same species in different proportion were predominant on the Koryak shelf. In Anadyr Bay representatives of flounder family clearly dominated in catches; their share was much greater than there were skates in other areas (Table 1).

Compared to the first half of the 1980-s the specific composition of flounders in the shelf ichthyocoenoses of the Karagin Bay has changed significantly. It was yellowfin flounder that prevailed previously (51.4%), while its share was 17.8 in 2001. Meanwhile the biomass of flathead sole went up by almost three times, and this species began to dominate among flounders. The proportion of representatives of Cottidae family changed notably. The largest predators, i.e. sculpins declined.

Arctic cod continued to increase in number and expand southwestwards. Its stocks in Navarin area of 5810 square miles amounted to 2182 billion individuals in June 2001. In autumn of 2001 it was found in catches taken from the southern part of Karagin Bay which is probably the southwestern most boundary of its range.

On the whole the bottom shelf ichthyocoenoses of the North and Northwest Bering Sea at present are turning into the polydominant type.

West Bering Sea pollock

At present the rate migration in pollock went down because of the low abundance of the West Bering Sea population. During feeding most fish concentrate in near-bottom aggregations which are usually found on the outer shelf and adjacent parts of the continental slope.

In autumn of 2001 most concentrations of pollock in Karagin Bay were found on the outer part of the shelf zone between Karagin Island and goven Peninsula (Figure 1). The maximum density and biomass were seen at 140-167 m. Their values were 306.2 thousand/km^2 was south 68.8. th./km^2 and biomass of up to 35.5 tons/km^2 was south of Karagin Island. In all the other parts of the area the concentration was lower by one or two orders of magnitude. Two year old fish 10-16 cm long mainly concentrated around goven Penensula in the south of Karagin Bay and Litke Strait. Three –year-olds of 17-24 cm and fish of four years 25-34 cm long were distributed more densely; their aggregations were formed south of goven Peninsula and Karagin Island. Mature Pollock occurred in catches nearly everywhere, though the most dense concentrations were found south of goven Peninsula and in the southern karagin Bay. Fish of 37-43 cm was more frequent in catches in karagin bay, in terms of number.

In August-November 2001 pollock occurred in trawl catches throughput the entire Olutor bay; the most dense near – bottom concentrations of over

10 th./km^2 were recorded on the outer edge of the shelf.

In 2001-2002 the most dense concentrations of pollock in the south-western part of koryak shelf were typically formed between 173-175°E.

In April-May 2002 the major concentrations of the West Bering Sea pollock were located in the northern part of Karagin Bay, central olutor bay, and near the southern tip of Olutor peninsula.

In spring of 2002 the bulk of fishing stock of the West Bering Sea Pollock were 41-45 cm long fish aged 5-6 years. The share of two year classes of 1997 and 1996 made up over 70% of the total number, five-year-old fish prevailing. It could be expected that in 2003 there would be a significant increase in spawning stock which will basically consist of the 1997 year-class.

The size and age composition of Pollock catches taken from the West Bering Sea population for the recent five years is summarized in Figure 3 and 4. The period under review is characterized by a change over of several dominant year-classes none of which has been important in catches for more than 2 years. In 1997 it was the 1992 and 1995 generations. The following year the fishery was based on the 1994-1995 year-class. Similarly to 1995, in the year 1999 the class of 1996 comes forward; correspondingly, the catches consist of 27-43 cm fish by over 60%. The studies made in 2000-2001 indicated share of the 1996-1997 fish catches. Besides, the latter year-class was much more important since its share in June catches of 2001 exceeded 65%. The contribution of older age groups (the same class on the average) did not exceed 4.7%.

The fulcrum of spawning among the West Bering Sea pollock in 2002 was in Olutor bay. Intensive reproduction also occurred around govena Peninsula. In addition, insignificant spots of spawning in the south of Karagin Bay and near Olutor Cape could be heeded. During recent 7 years the maximum number of eggs recorded at spawning grounds was found in 1996 (6.7×10^{12} eggs); the lowest number came about in 1999 (3×10^{12} eggs). The results of ichthyoplankton surveys of this year indicated an increase in the number of pollock eggs. In total, there were 5.2×10^{12} eggs counted in Karagin and Olutor Bays.

In autumn of 2001 the total number of concentrations of West Bering Sea pollock was estimated at 1.881 billion, of which only 13.2 % was recorded in Karagin Bay, the remaining part distributing about equally in Olutor Bay an on south-western part of Koryak shell (43.4 % each). The biomass of the West Bering Sea population of pollock was 286 thousand tons; 38.8 % was registered in Karagin Bay, 48.0 % in Olutor Bay and 13.2 % on Koryak shell. The size of fishing biomass (fish over 40 cm) was assessed at 170 thousand tons. This is higher than the levels of the past five years. However, in 1997-1999 the surveys did not cover Karagin Bay area.

Analytic approach to stock assessment

Age composition data from 1970-2001 catches were analyzed retrospectively using ISVPA model with governing catches, provided with unbias description by using age catch data for logarithm model. The median of distribution of model remnant squares in logarithms of data on age composition of catches was chosen as the target function of the model. In order to account for the relative increase in fishing pressure on younger age groups the procedure of assessment of model parameters in recent years evaluated two age distributions of the relative selectivity of the fishery: prior to 1989 inclusive **S1a**, and from 1990 on **S2a**.

The prognostic calculations were based on the principles of precautionary approach.

The results of retrospective stock assessment showed that SSB had stopped going down (Table 2, Figure 5). Besides, in view of the rising recruitment in 2001 compared to 2000 (Table 2) it seems possible to select the 2000 values of SSB as a marginal point of reference for biomass management, as adjusted by the level of uncertainty of its value assessed within operational model using bootstrap analysis: $SSB_{lim} = SSB_{2000} \times \exp(6\ SSB_{2000}) = 40.5$ thousand tons.

The results of research made during two recent years one can observe a stabilized status of the West Bering Sea stock of pollock, with prospects of slight growth. Since the biomass of the West Bering Sea pollock went down by 15-20 times during the past 20 years, its recovery could only take place provided the moratorium for its target fishery remains in force in the ensuing years.

North Bering Sea (Navarin) pollock

The spatial distribution of pollock in Navarin area in 2000-2001 was conventional for this region. In spring and summer the spawning and post-spawning concentrations were formed along the outer edge of the shelf. Depending on the hydrological features of the year, and as water warmed up and zooplankton developed, pollock concentrations shifted onto the shelf, and deeper into Anadyr Bay during June. In late August-October pollock returned to great depths upon the completion of feeding; its wintering concentrations were finally formed there in December at 250-350 m (Figure 7).

In 1997-2001 the bulk of Navarin pollock stock consisted of individuals of 35-50 cm. At the same time smaller pollock was predominant in catches of fishing vessels. For example, in 2001 fish 36-39 cm long made up 47 % in terms of abundance. In 2002 the share of pollock of 37-39 cm went down to 33 %, whereas the share of larger pollock 40-44 cm long went up from 15 to 27 % as compared to 2001. The bottom trawl surveys showed that the concentrations of Navarin pollock between June and December comprised fish of various size, with 4-7 year-olds prevailing (Figure 8). During the 2000-2001 surveys the leading year-classes in catches were those of 1996 and 1997. The results

obtained from research ships show that in spring 2002 the average size of pollock in Navarin area was 34,9 cm, with the mean weight of 337 g. The more frequent size were 31-39 cm classes.

In the coastal waters of the Anadyr Bay, and on the eastern part of Koryak shell in August-September 2001 juvenile pollock constituted over 70 % of catches in terms of number at 16-80 m.

The surveys of juveniles show that all year classes of the last five years have average abundance. The maximum number of the young fish counted belonged to 1997 year of birth. The number of individuals of this year-class aged 2 years accounted for at 11028 miles^2 was 3,518 billion. The 2000 year-class ranked second by their number: the maximum figure recorded for the same area was 2,638 billion.

The reproductive intensity of pollock was evaluated since 2000 by the results of spring ichthyoplankton surveys, and it did not change much. This allows us to expect that the 2000 and 2001 generations of Navarin pollock have at least the medium abundance.

For the last 5 years the minimum values of Navarin pollock biomass for the bottom component were observed in 1999 (Figure 9); for the pelagic part they were in 2000 (Figure 10). The 2001 direct count data show that the bottom part of biomass of this stock increased during the feeding period by 22%, and in pre-wintering period by 10%, compared to the same period of 2000. The results of echo integration surveys made in October 2000 and 2001 indicate that the biomass had increased by 2.2 times.

Analytic approach to stock assessment

The retrospective analysis of the status of Navarin Pollock stock was performed using age data from catches taken in 1994-2002. Separable cohort model ISVPA in the governing effort version that refers model approximation error to data error was applied. The target function of the model was the median of distribution of squares of model remnants in logarithms of age composition data from catches; their unbiased was ensured.

The retrospective analysis makes it possible to conclude that in recent years SSB was stable enough, with some probability of an upward trend (Figure 11, Table 3). Abundance estimates show that at present fish of medium ages prevail (Figure 12) which agrees well with the fishery data and the results of trawl surveys, and can be regarded as an indicator of a rather high stability of population.

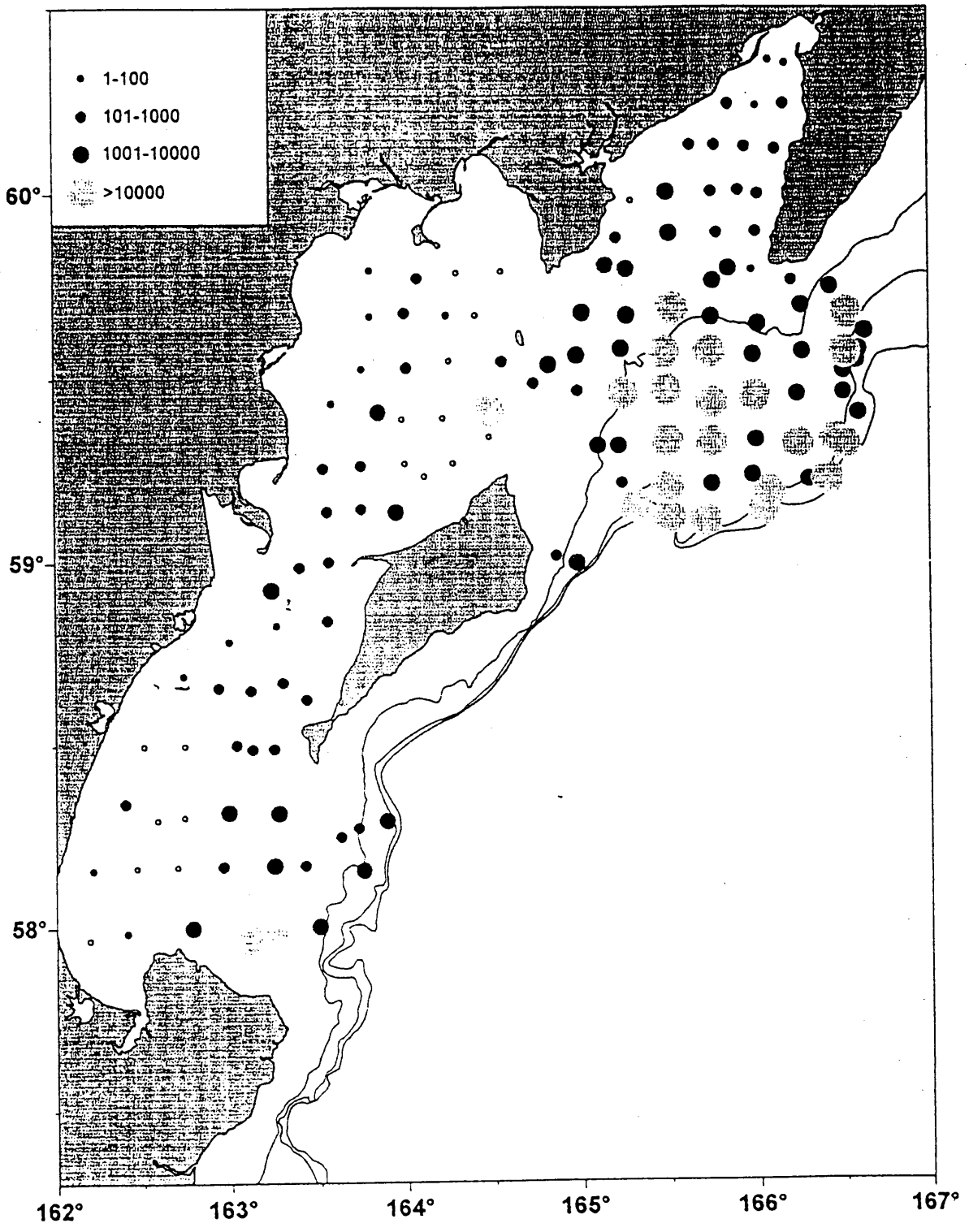
Consequently, there has been signs of stabilization, and even growth in Navarin Pollock stock during recent two years. However, since there are no strong year classes, and pursuant to the principles of precautionary approach the State Committee for Fisheries maintains its recommendation to keep fishing exploitation of this stock at a low level. The TAC for Pollock in the ~~West~~ Navarin Bering Sea zone for 2002 is 365 000 tons.

Genetic research

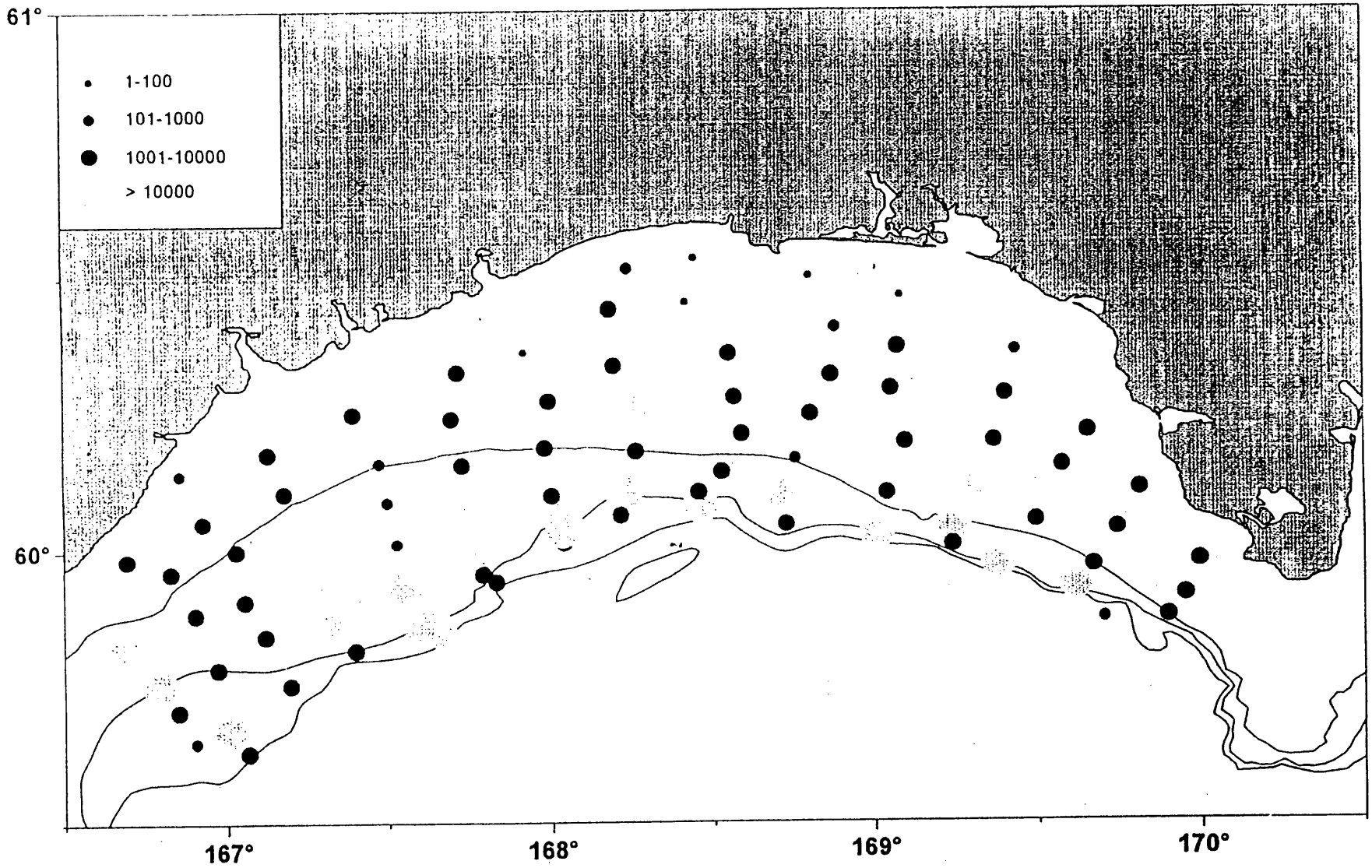
In order to identify the genetic population structure of Pollock of the North-West Bering Sea studies were continued in 2001-2002 as regards the genome DNA, including microsatellite sequences. The preliminary cluster analysis (TREECON) based on PCR-RAPD experiments showed the presence of stable clusters; however, the level of polymorphism of this class of markers turned out to be low. The use of microsatellite sequences (loci Tch 12, Tch 14, Tch 15 and Tch 18) led us to make a conclusion of imparity of concentrations, and stock differentiation. The size of inter-group variance (F_{st}=0./02) agrees with the data published for the species subjected a high level of gene migration/ The West Koryak grouping of Pollock was found to be equidistant from both Navarin and Olutor ones between which the genetic distance is much shorter.

Conclusion

The climate/oceanographic restructuring, and compliance with the guiding principles regulating the application of precautionary reference points for conservation and management of straddling and highly migratory fish stocks have stabilized the major Pollock stocks in the northern and north-western parts of the Bering Sea on a low level. The low abundance of the West Bering Sea and Navarin stocks will prevent Pollock from extending into the Aleutian and Commander basins in any large numbers in 2003.



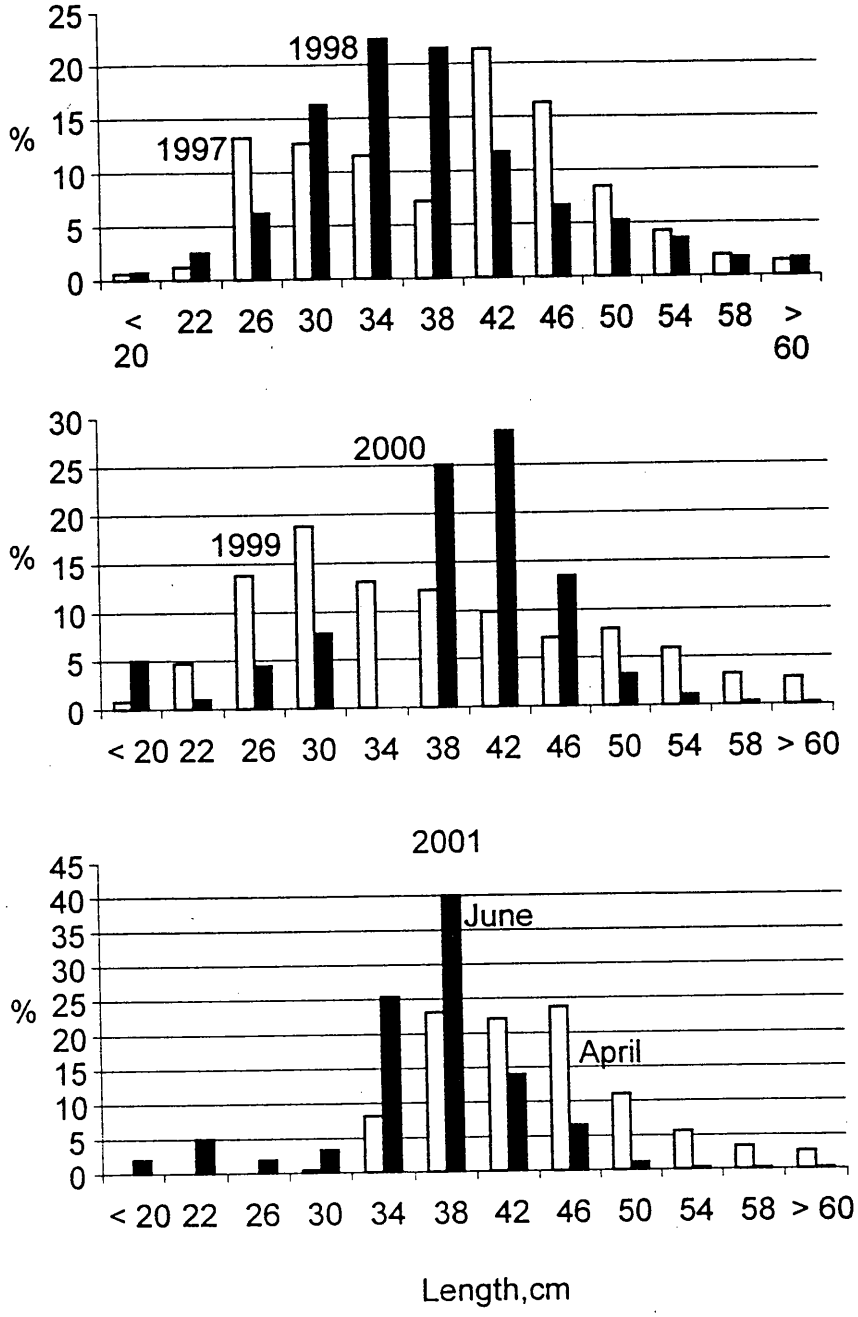
Walleye pollock spatial distribution in Karaginsky bay, August-September 2001, biomass kg/km^2



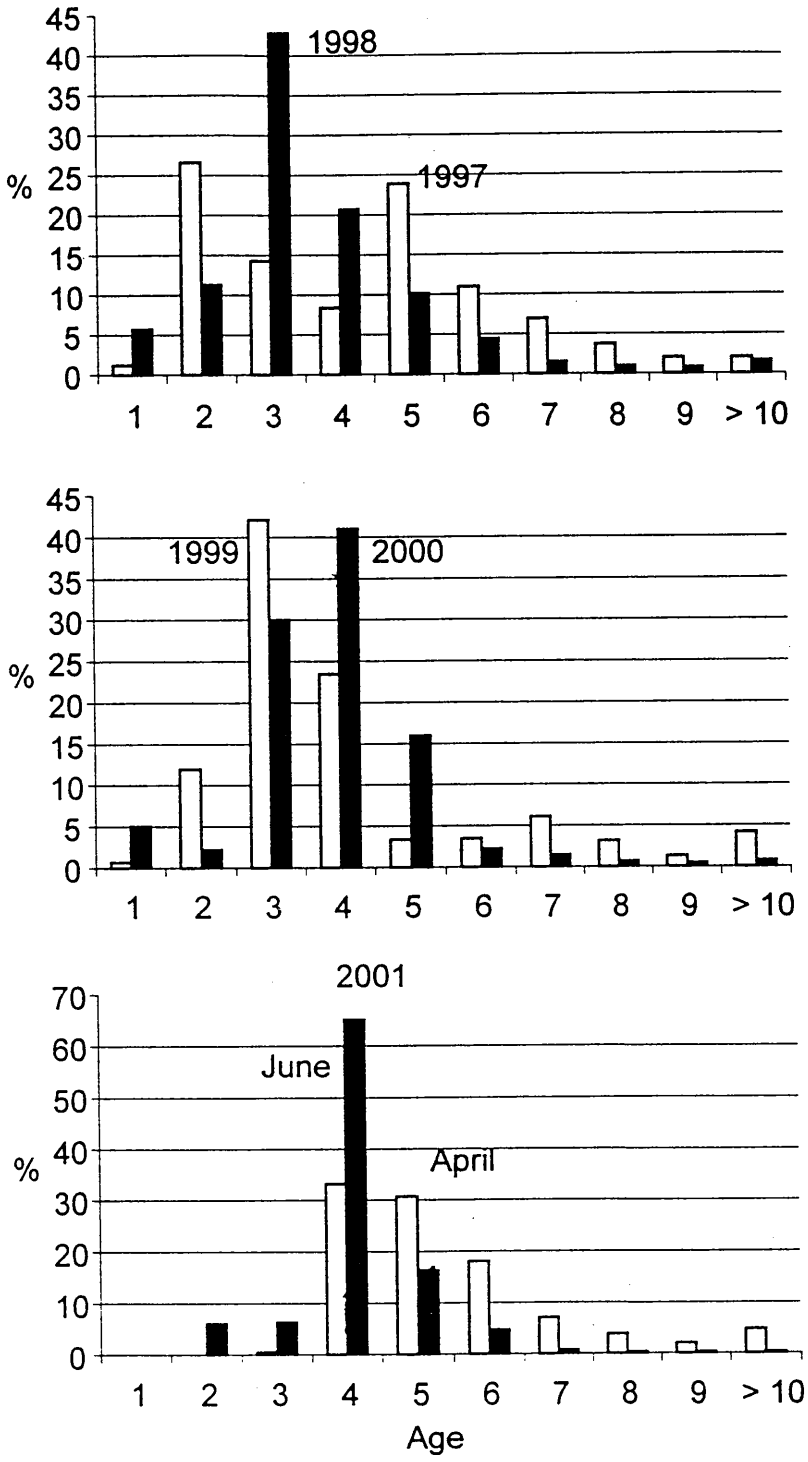
Walleye pollock spatial distribution in Oluytor bay, September 2001, biomass kg/km^2

Catch composition of fish in West and North-West Bering Sea in 2001 based on the bottom trawl survey (kg/sq.km).

Taxon	Karagyn Bay	Oluytor Bay	Koryac Shelf	Anadyr Bay
Skates	62	104	111	131
Cod	384	246	349	189
Navaga	293	225	38	10
Sculpins	246	418	283	73
Lords	146	179	235	18
Staghorn sculpins	182	238	142	2
Sea poachers	20	26	17	1
Sea snails	84	483	239	149
Eelpouts	45	146	31	113
Plaices	915	1759	242	740
Others	97	382	578	46
Total	2474	4206	2265	1472



Length composition of Western Bering sea walleye pollock.



7 Age composition of Western Bering sea walleye pollock.

Year/Age	2	3	4	5	6	7	8+
1970	769.25	347.95	162.29	263.18	48.10	18.17	11.31
1971	803.02	575.71	257.43	127.75	204.89	30.40	8.86
1972	566.63	590.35	422.06	174.49	82.76	127.84	9.03
1973	351.82	428.06	470.56	336.54	101.75	22.29	4.21
1974	1038.25	251.52	337.11	356.98	235.66	49.95	10.75
1975	1793.93	778.92	194.74	269.12	209.85	137.69	42.02
1976	1944.06	1329.99	572.16	133.77	173.02	62.61	20.55
1977	716.54	1448.14	1008.87	434.52	81.57	104.86	31.34
1978	1510.51	526.18	1025.75	702.91	346.32	56.01	17.14
1979	2210.79	1094.07	367.49	773.18	479.62	200.35	156.85
1980	3651.25	1466.97	859.68	284.34	512.49	260.85	104.01
1981	4075.00	2426.34	1040.88	615.22	184.31	227.20	94.39
1982	1594.89	3067.68	1748.70	751.70	408.29	74.08	17.64
1983	720.54	1132.36	2032.55	974.53	547.07	288.00	138.98
1984	2457.51	531.14	834.90	1465.55	524.56	305.98	109.36
1985	1171.69	1832.64	365.78	538.91	878.58	251.31	84.07
1986	2318.70	859.10	1367.16	290.12	286.40	507.43	149.89
1987	1712.45	1734.56	664.40	997.33	214.41	131.76	103.64
1988	1832.61	1267.10	1199.56	448.45	593.26	103.89	73.34
1989	1137.41	1208.21	916.39	706.88	279.85	359.13	169.30
1990	1051.26	818.45	898.04	677.99	482.93	121.71	234.94
1991	808.36	752.48	516.89	511.86	280.49	276.51	102.53
1992	651.75	545.75	601.06	325.49	264.74	124.95	142.25
1993	253.75	328.05	355.54	385.80	202.75	141.65	181.29
1994	366.64	181.60	204.53	189.90	147.55	64.16	70.63
1995	133.28	211.50	102.58	94.25	55.49	60.54	63.74
1996	156.75	97.02	149.36	52.47	45.20	28.34	77.78
1997	343.29	115.15	67.89	82.83	25.29	25.57	31.23
1998	247.20	229.66	75.89	45.82	38.78	6.74	16.40
1999	228.39	159.91	79.23	10.80	11.74	18.83	28.79
2000	43.60	151.07	50.45	20.96	2.38	2.59	3.72
2001	117.38	31.93	107.10	21.81	9.29	0.79	2.20

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Table. Estimates of numbers at age for the Western Bering sea walleye pollock stock (thousands).

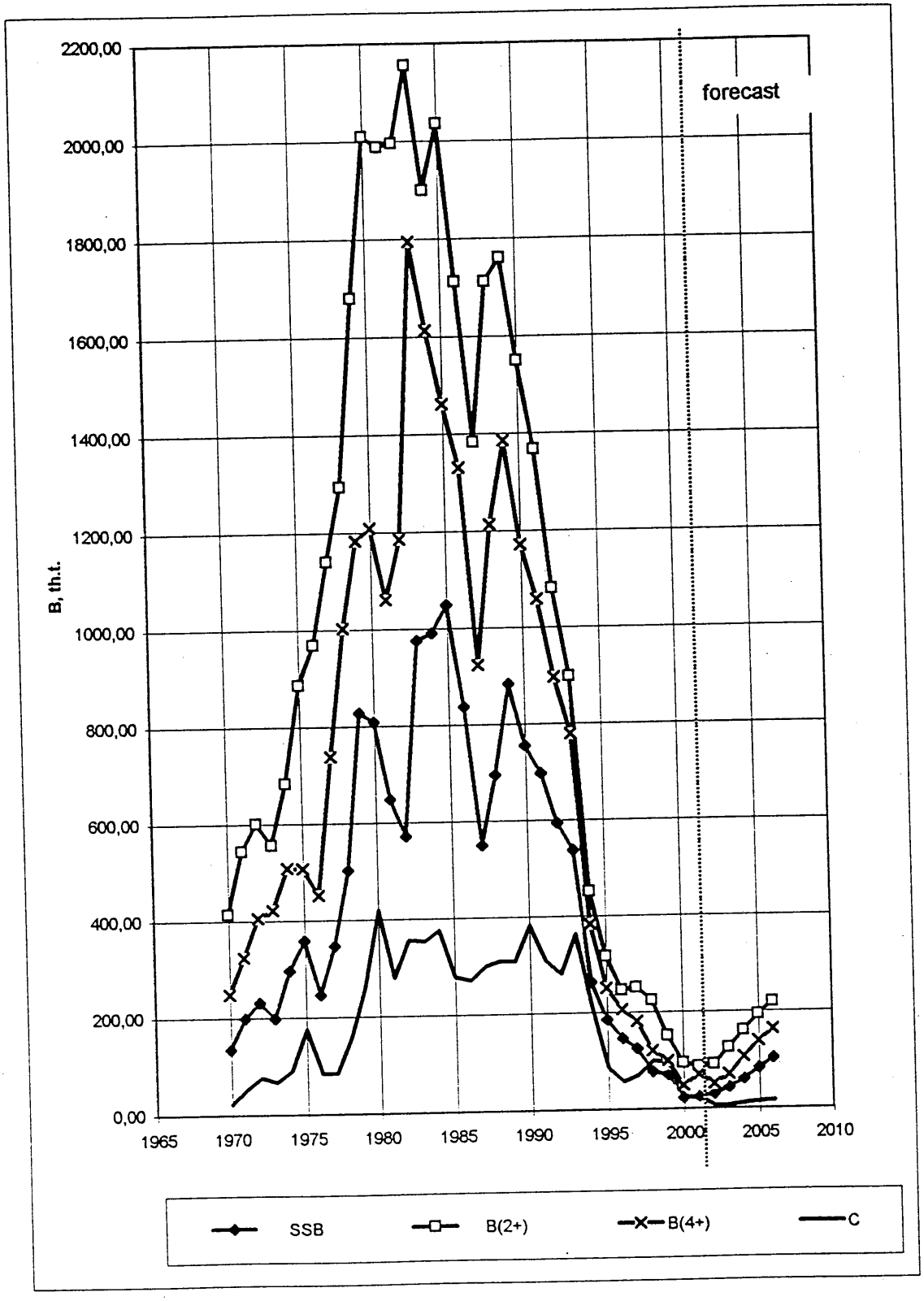


Fig. Estimates of WBS walleye pollock biomass and catch (thousand tons).

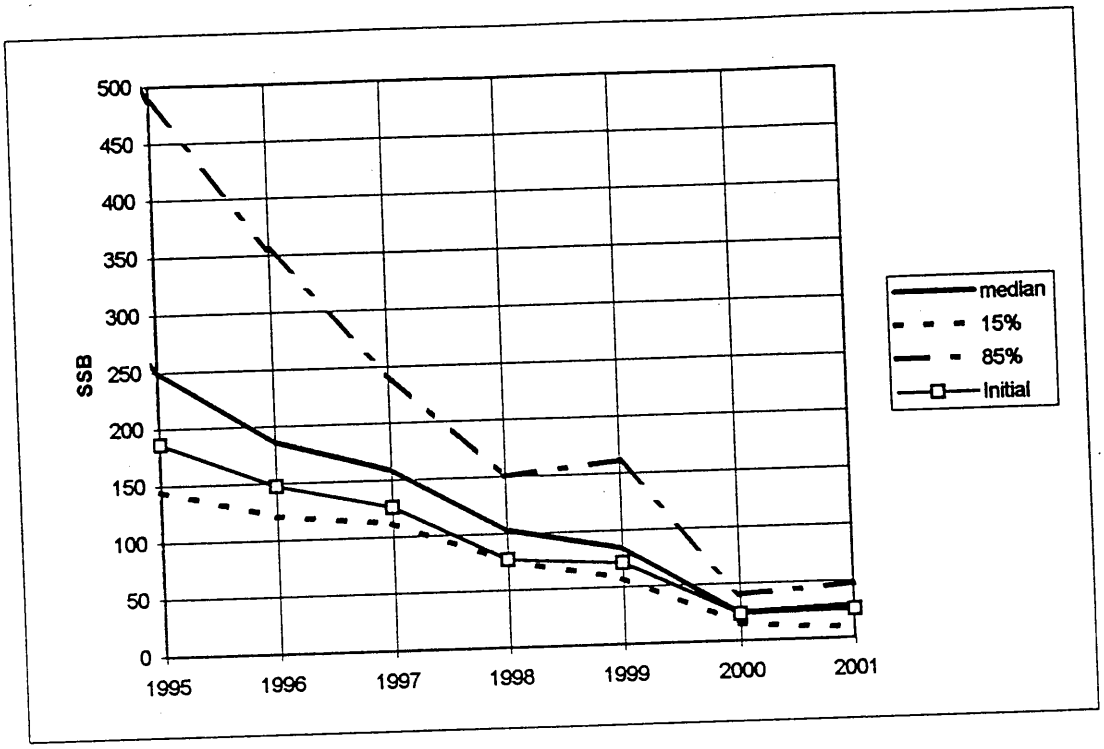
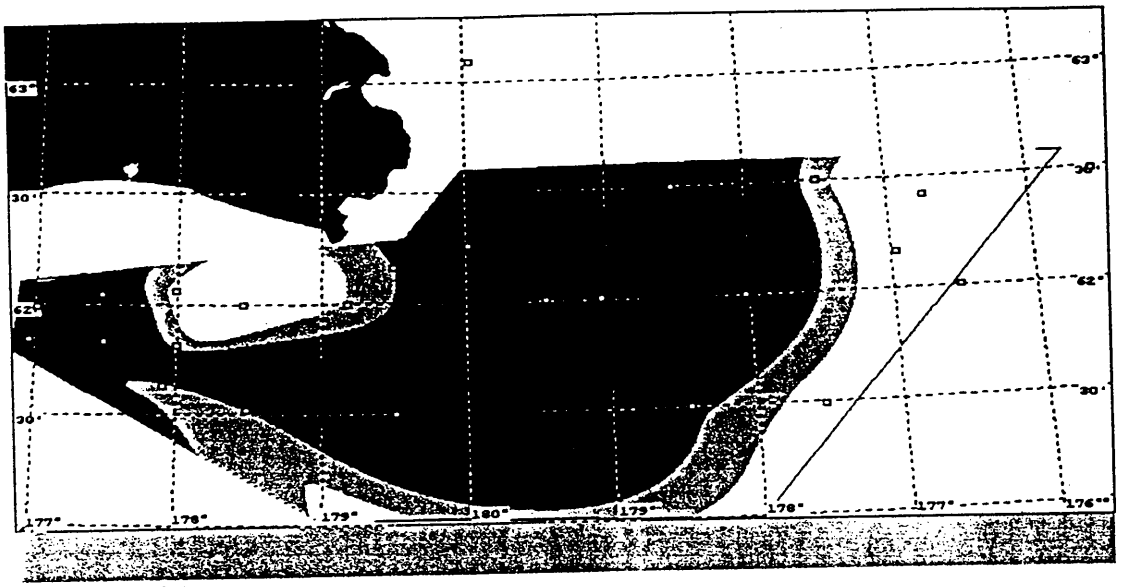
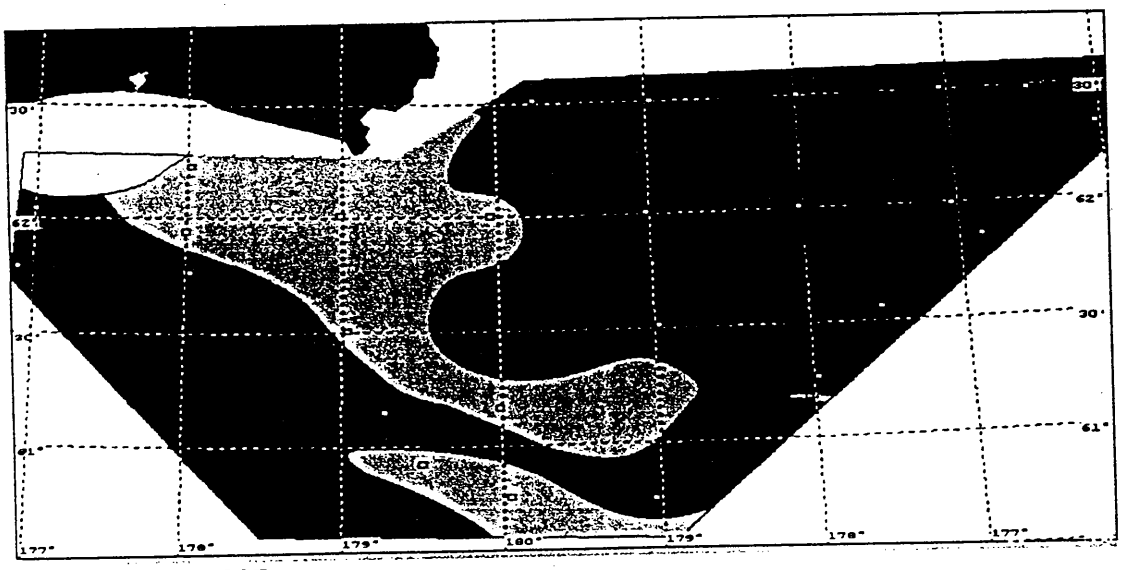


Fig. . Estimates of WBS walleye pollock SSB by percentile method (thousand tons).



(a) June 1997



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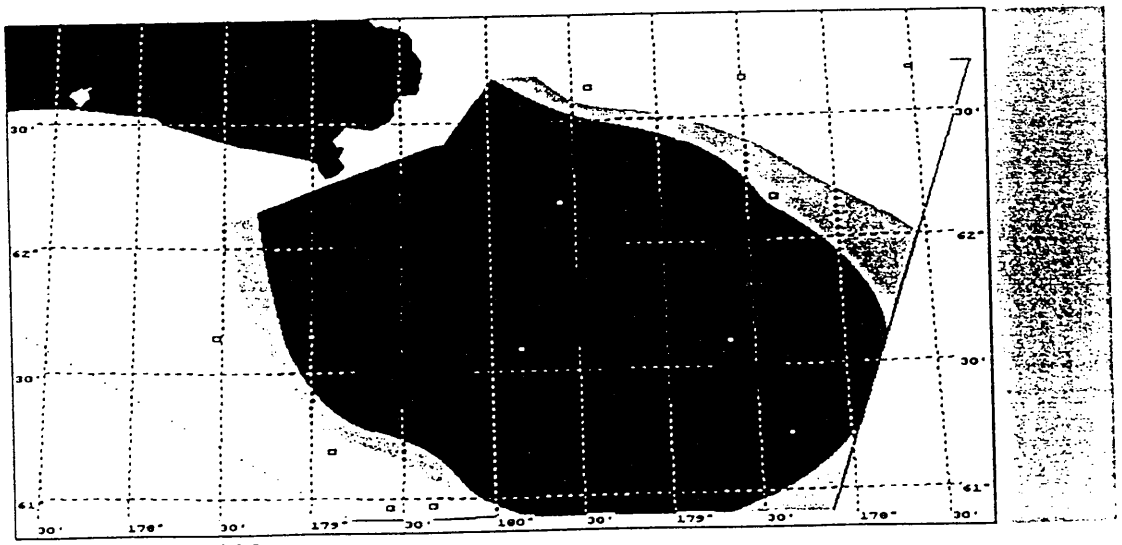

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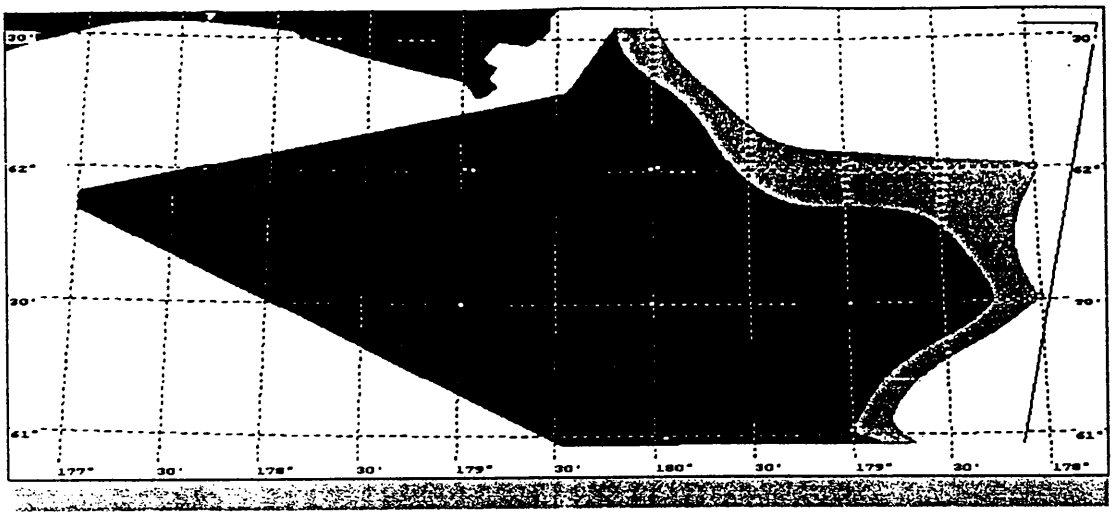

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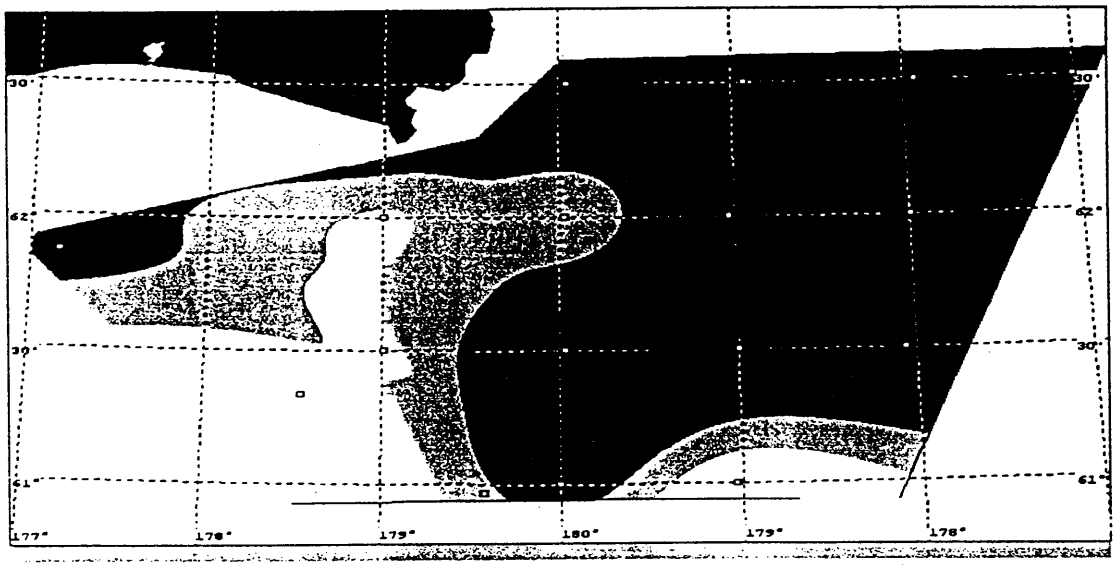

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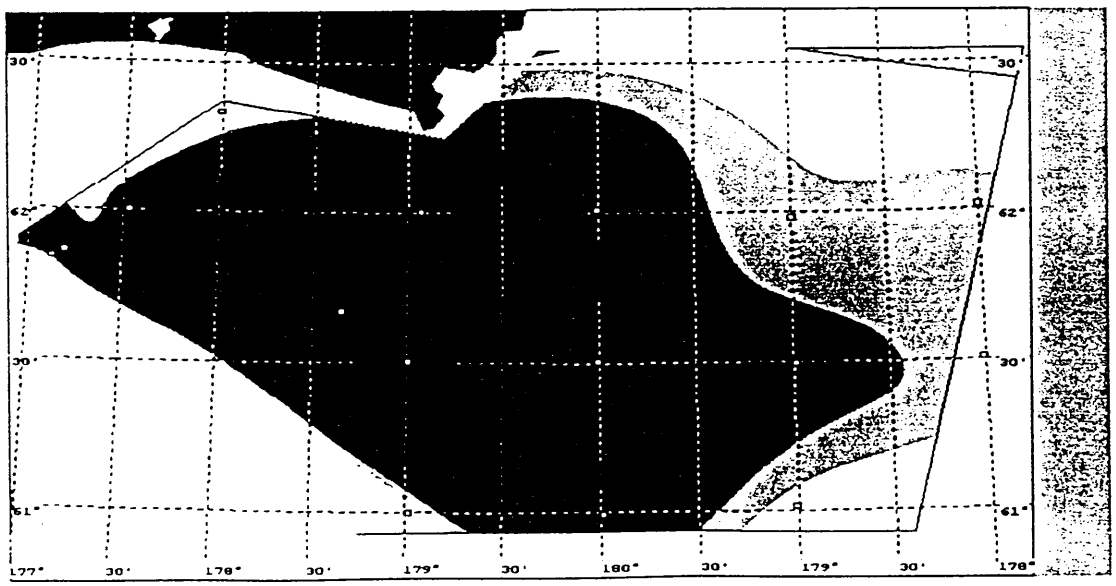

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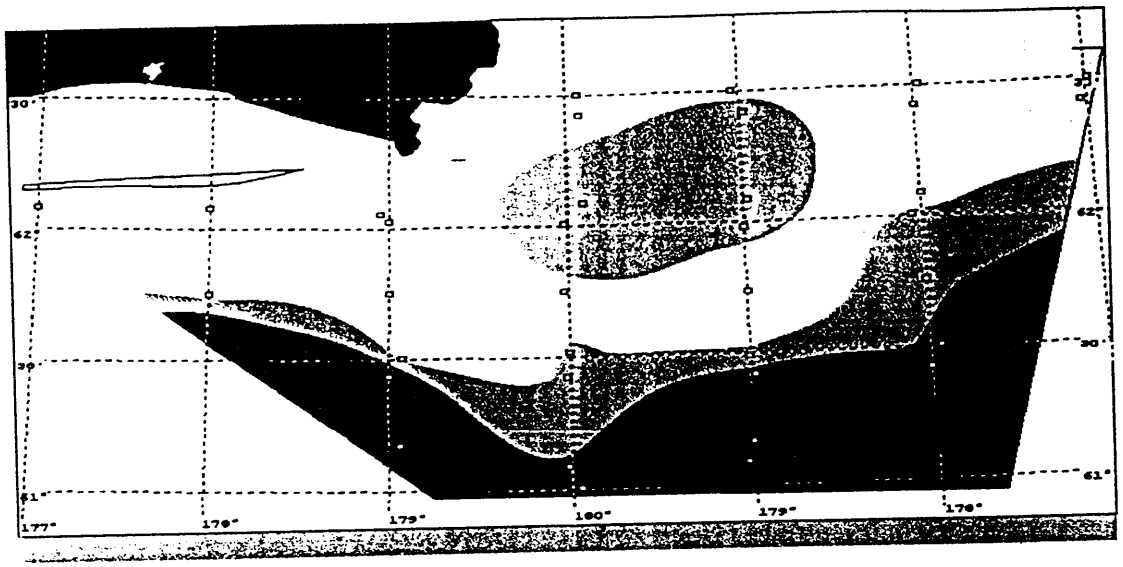

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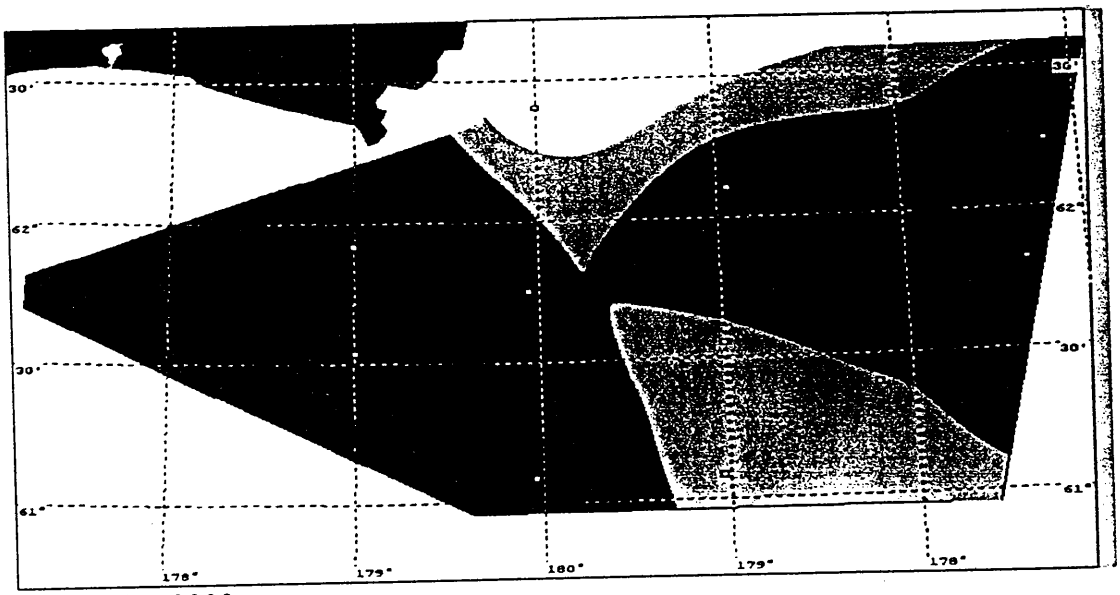

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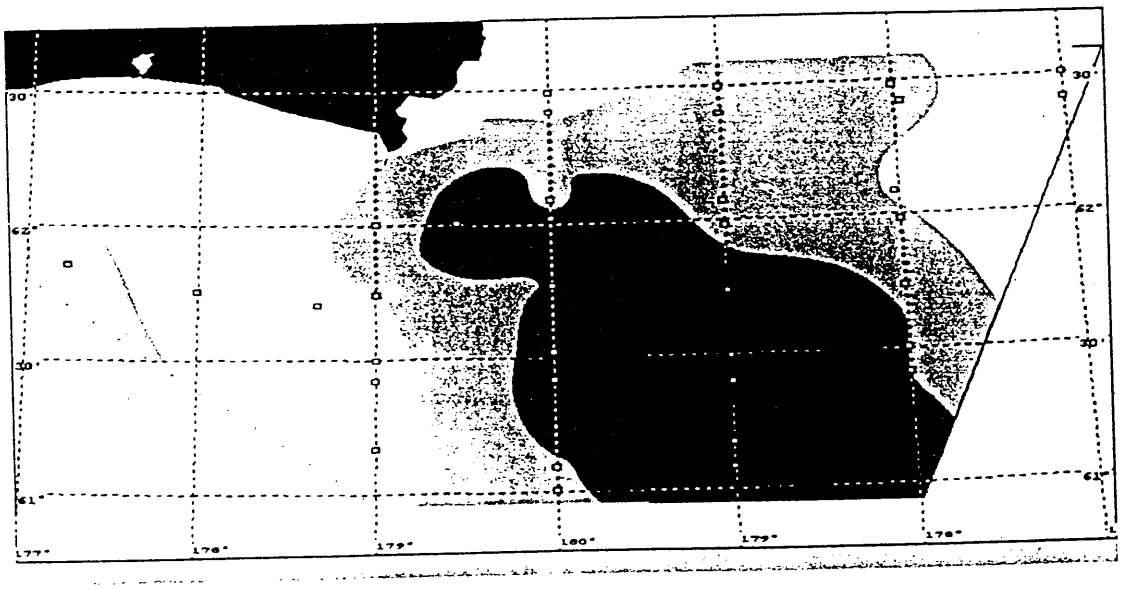

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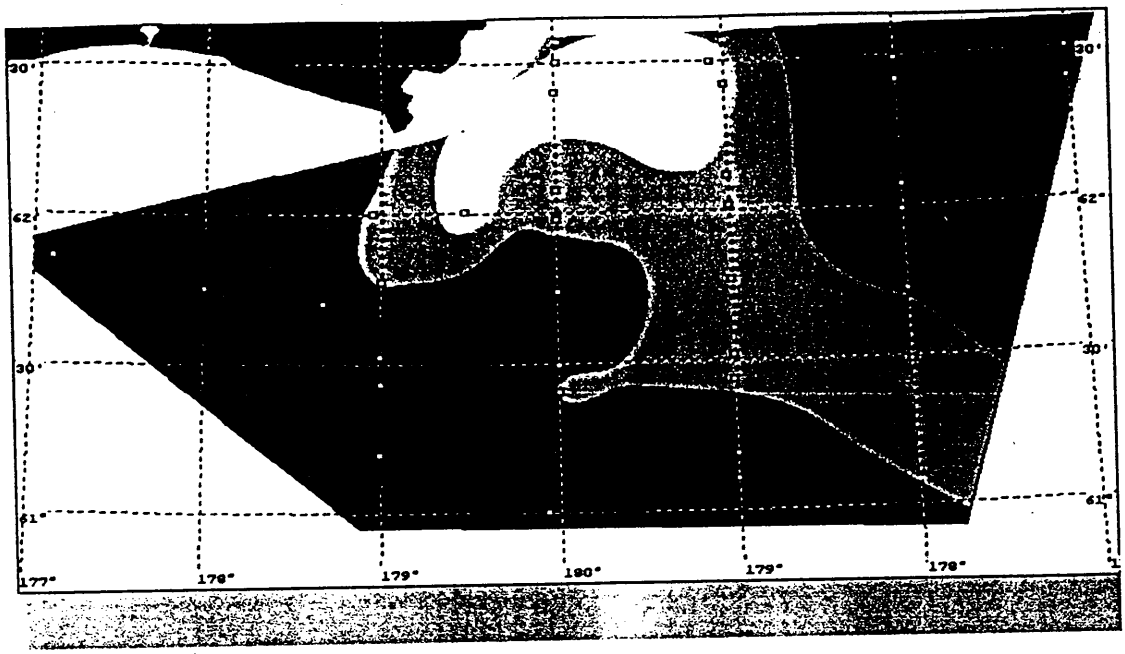
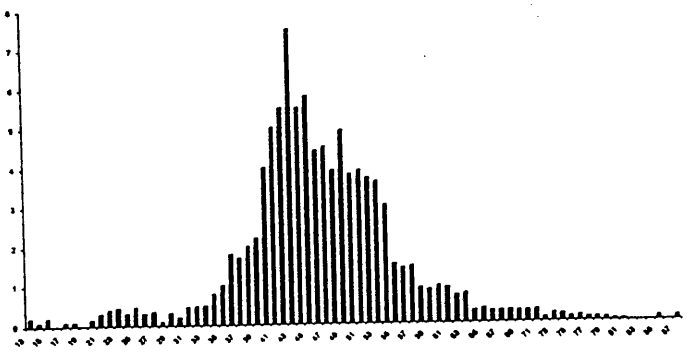
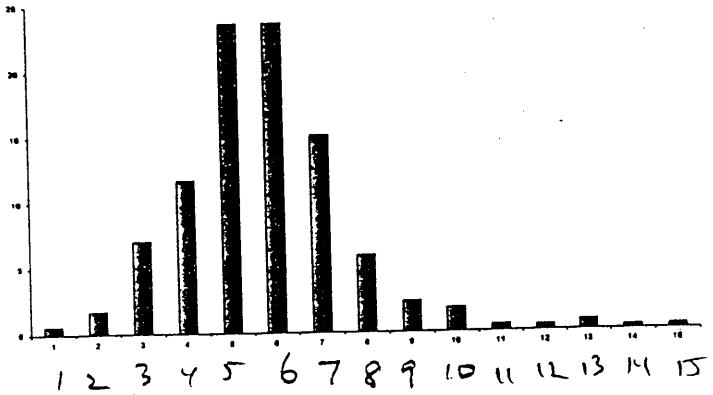


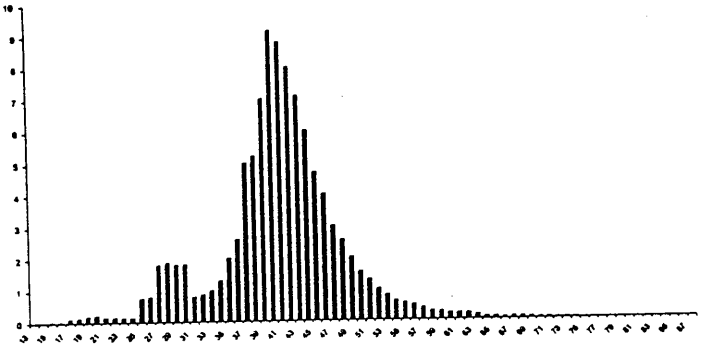
(j) August 2001

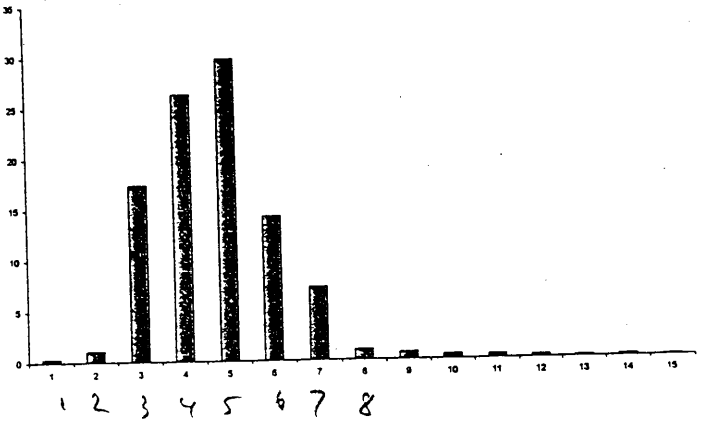
2 Navarin walleye pollock spatial distribution.



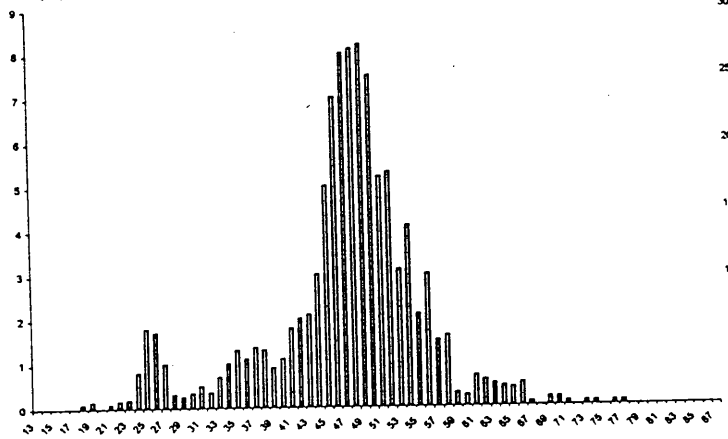


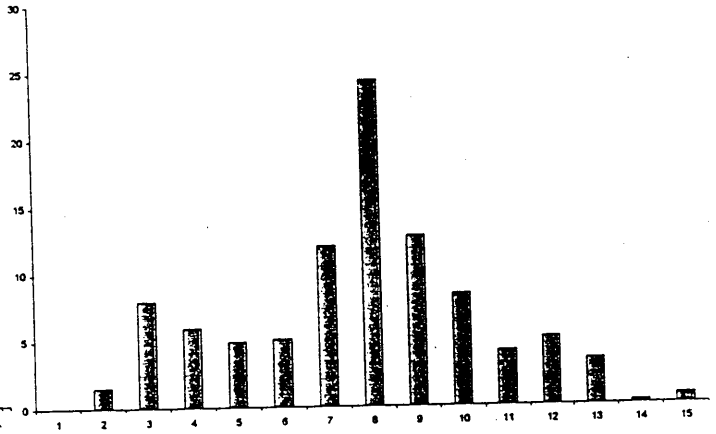
(a) June 1997



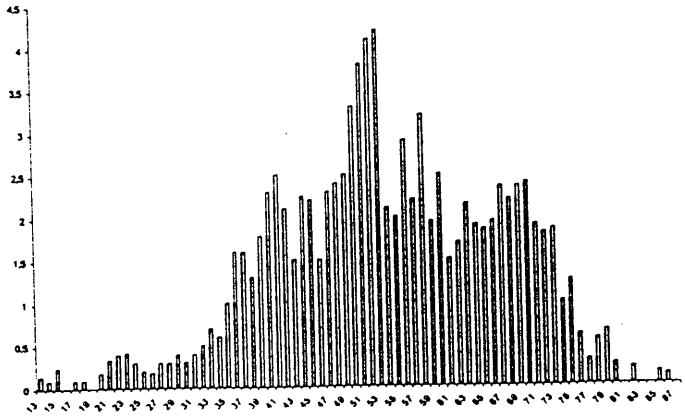


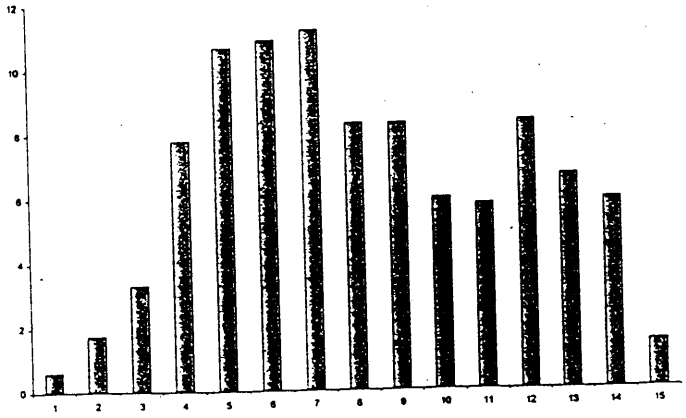
(b) September 1997



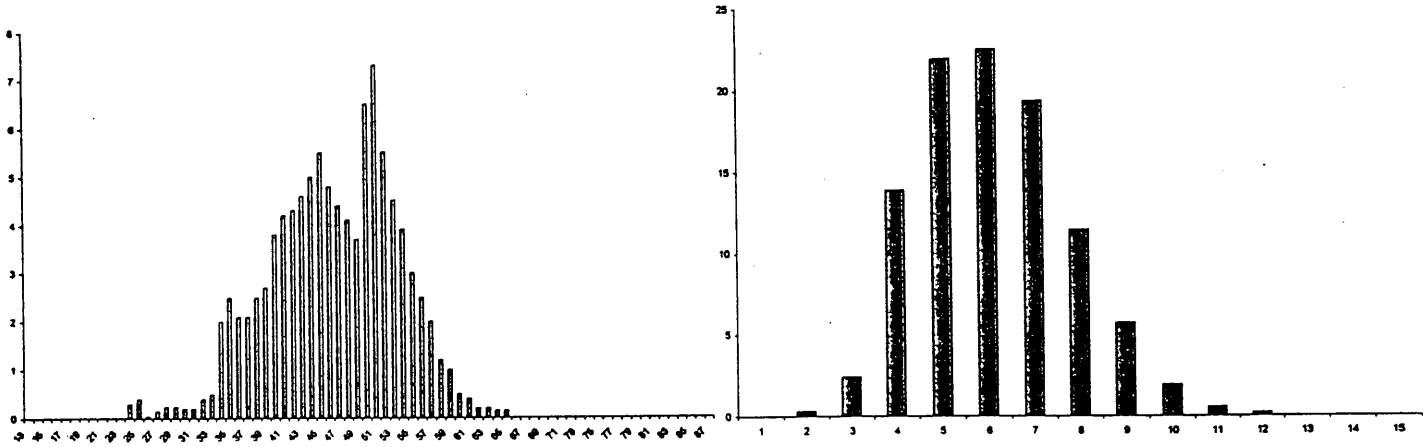


(c) November 1998

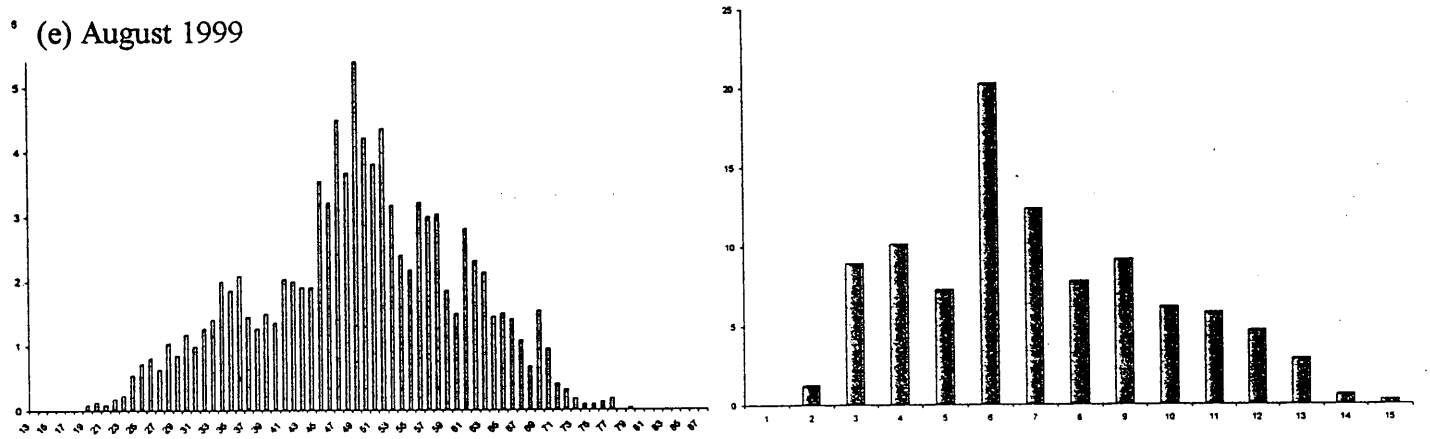




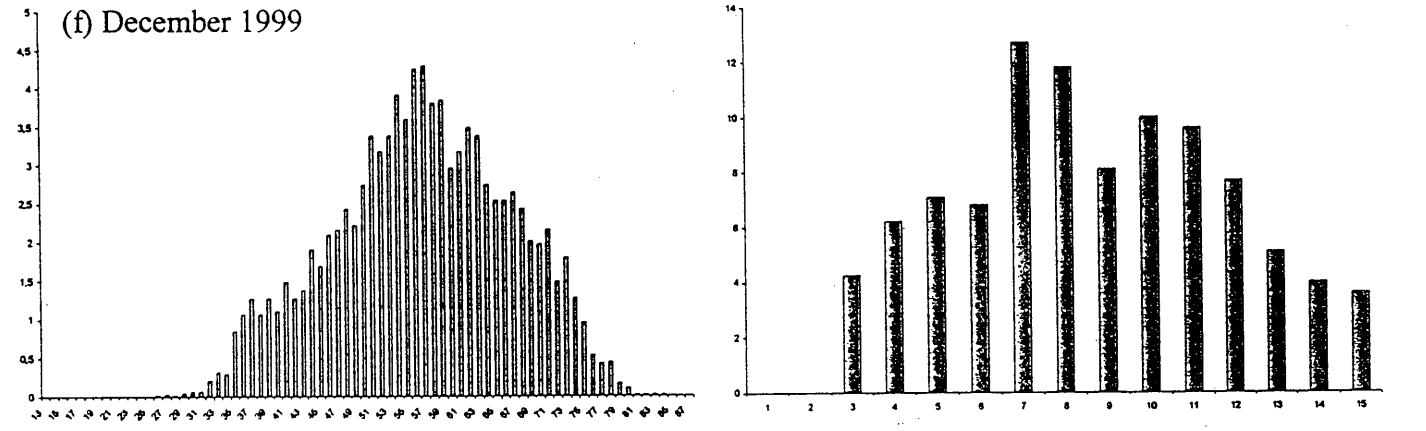
(d) June 1999



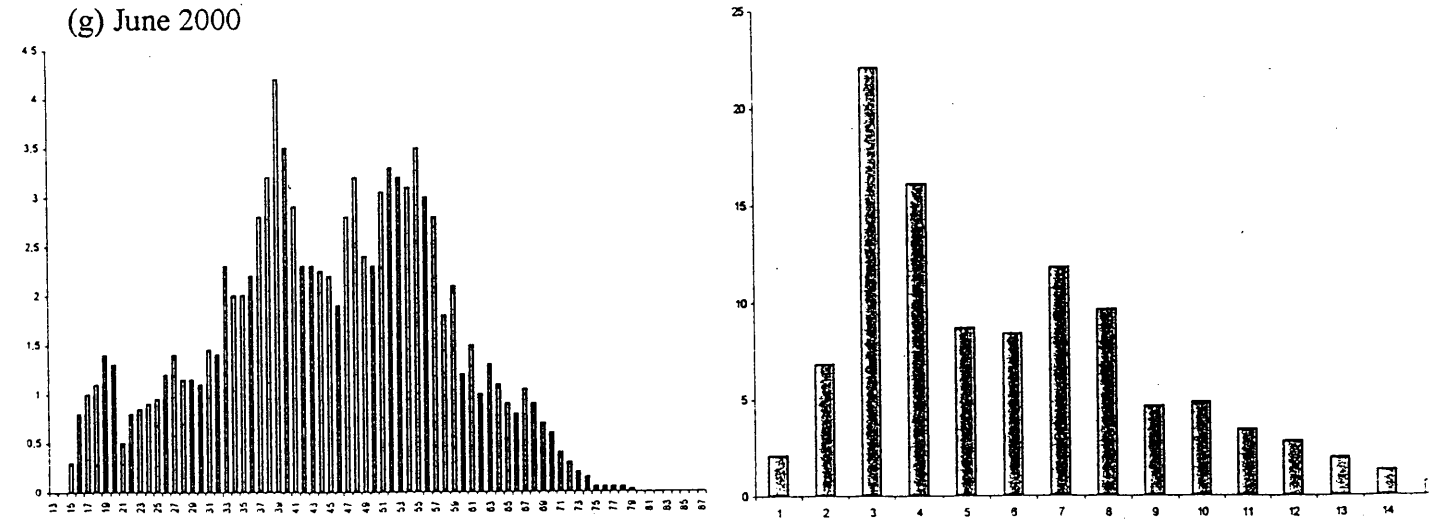
(e) August 1999



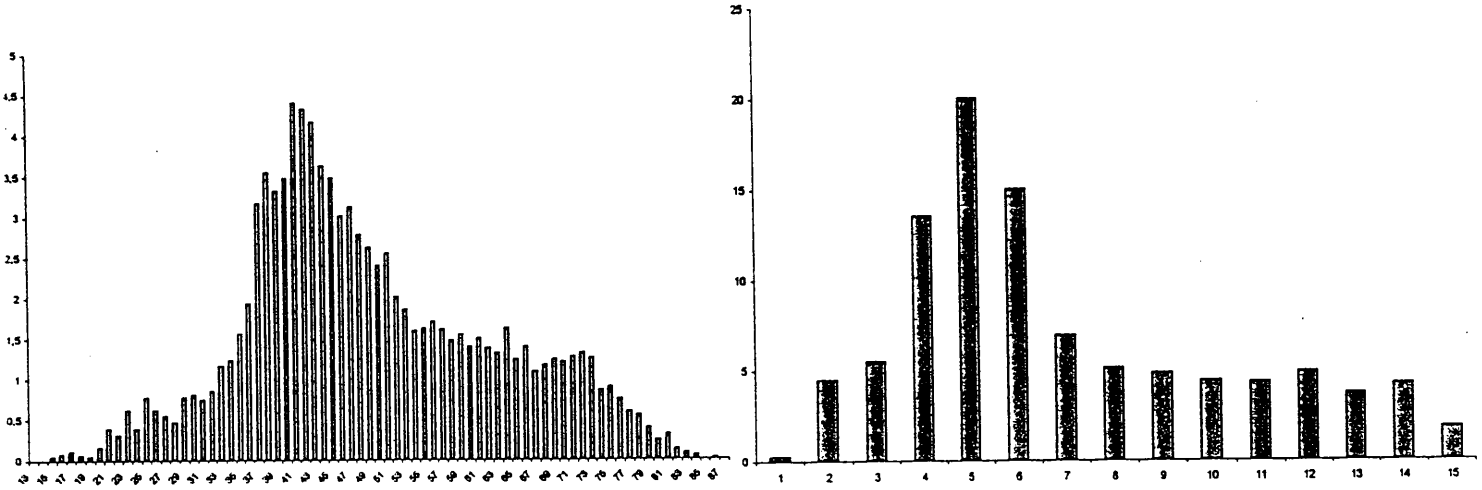
(f) December 1999



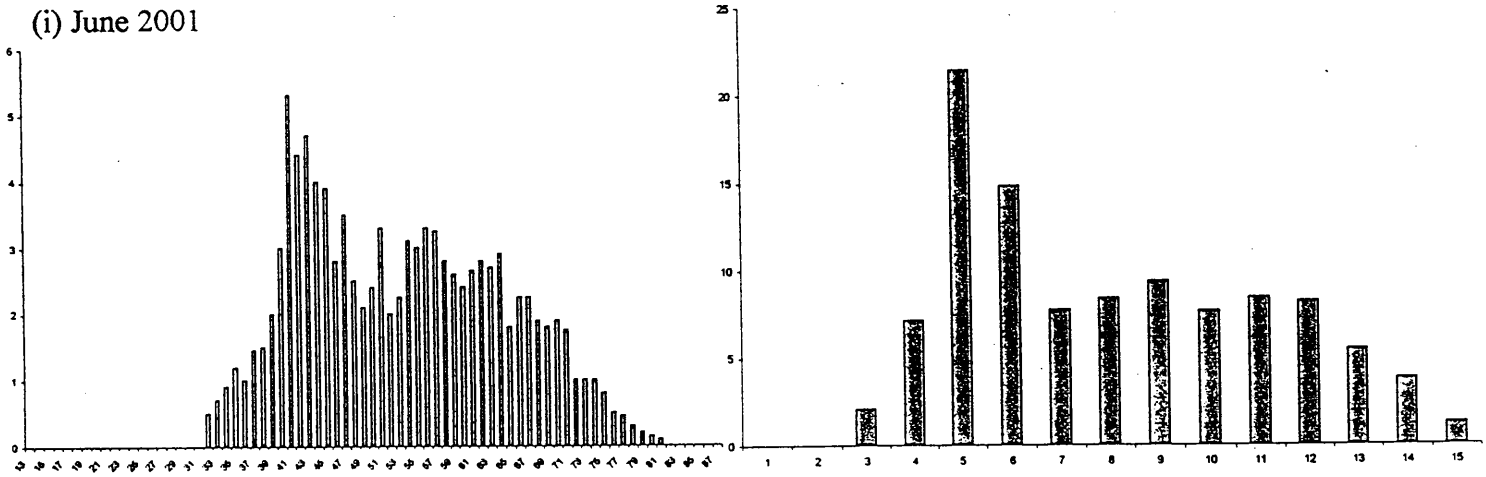
(g) June 2000



(h) October 2000



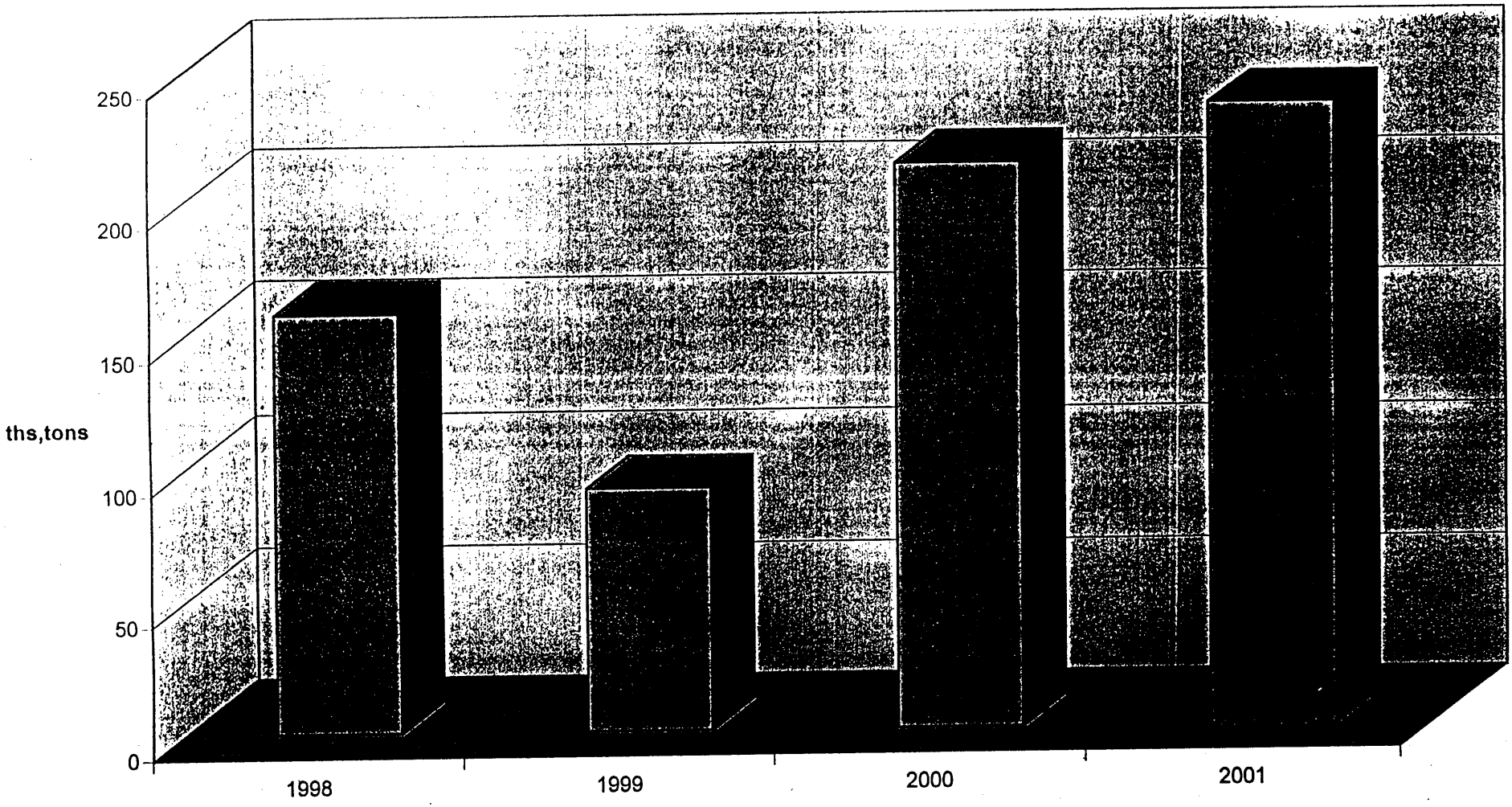
(i) June 2001



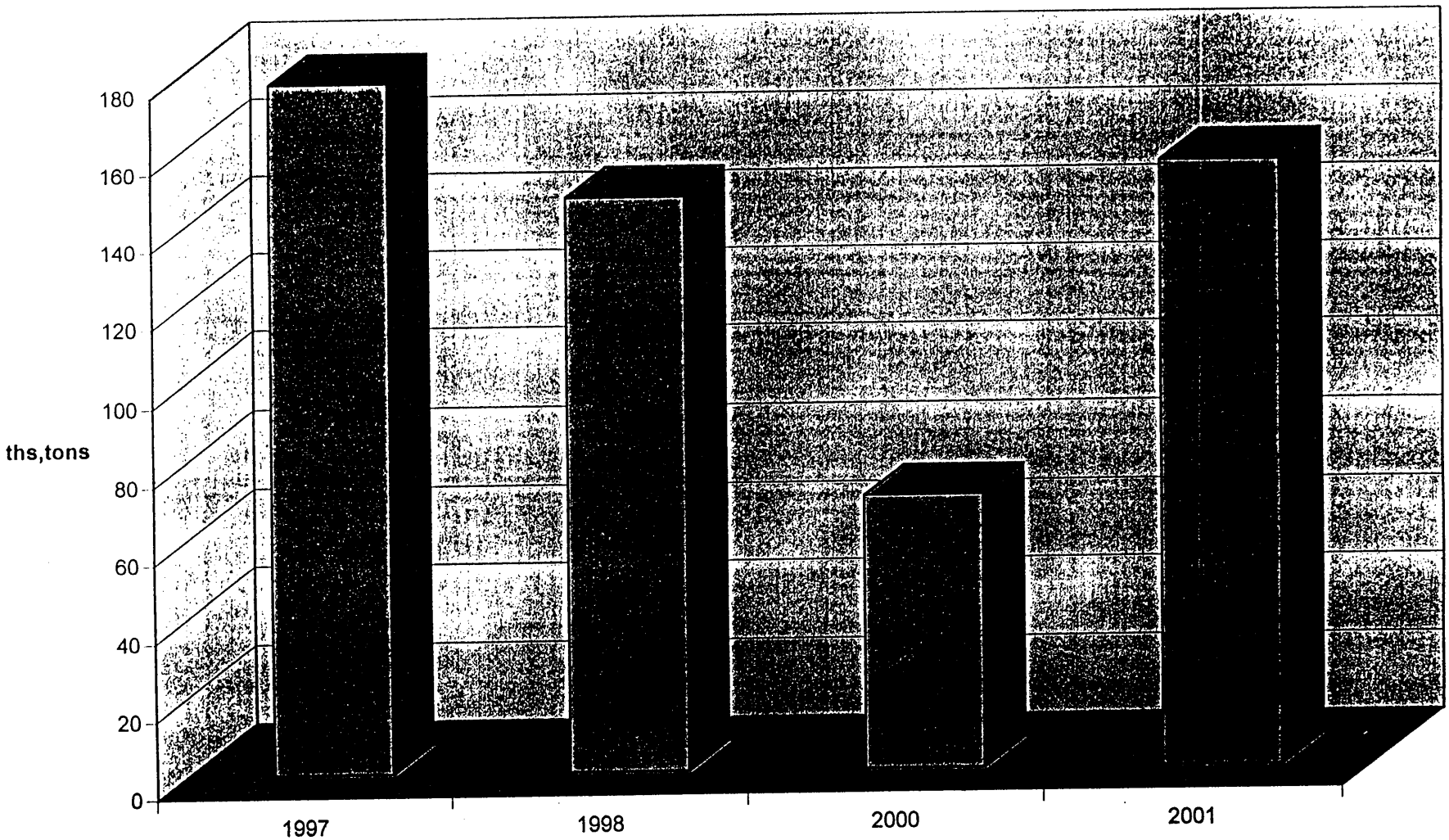
(j) August 2001

Length and age composition of Navarin walleye pollock, left column – length; right column - age.

Navarin walleye pollock bottom biomass based on bottom trawl surveys, autumns 1998-2001, area 7330 sq.miles



Navarin walleye pollock pelagic biomass based on hydro-acoustic surveys, autumn 1997-2001, area 7330 sq.miles



Year	Catch	SSB (bootstrap-median estimate)	
1994	288.9	49	585
1995	427.3	62	691
1996	753.0	92	821
1997	735.0	154	788
1998	719.7	154	467
1999	639.0	131	488
2000	507.0	118	431
2001	526.0	115	444
2002	365.0	79	462

SSB Range

497-1082 — —

587-1278 — 2177-2

698-1579 — 2425

1138 —

763 —

770 —

758 —

1013 —

— —

Table. 3 . Estimates of SSB for the Navarin walleye pollock (ths.t)

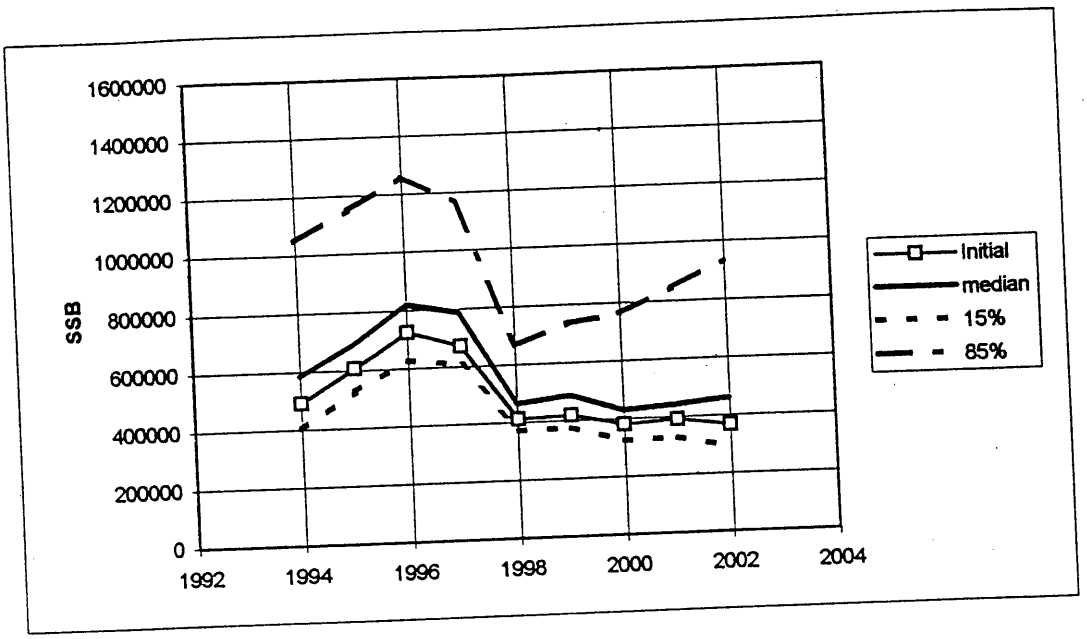


Fig. 11. Estimates of Navarin walleye pollock SSB by percentile method (tons).

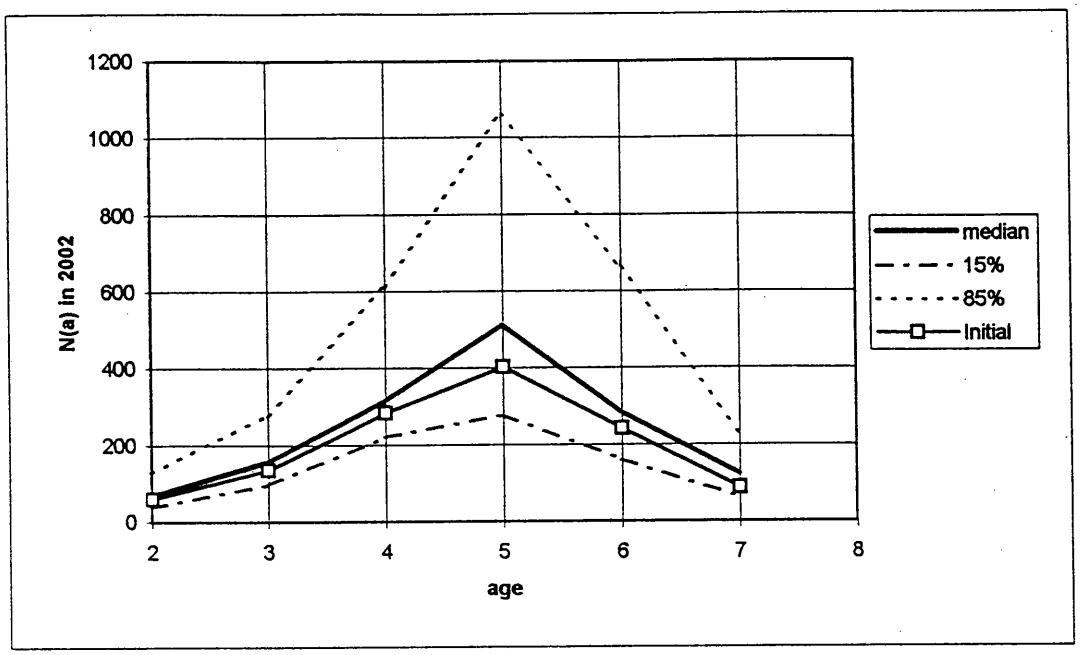


Fig. 12. Estimates of numbers at age for the Navarin walleye pollock by percentile method (thousands).

Year	Catch	SSB (bootstrap-median estimate)	Range	Biomass 7329 sq.miles	Biomass Total area
1994	288.9	585	497-1082	-	-
1995	427.3	691	587-1278	-	2500-2800
1996	753.0	821	698-1519	-	2425
1997	735.0	788	670-1458	1138	-
1998	719.7	467	397-864	763	-
1999	639.0	488	415-903	770	-
2000	507.0	431	366-797	758	-
2001	526.0	444	377-821	1013	-
2002	365.0	462	393-855	-	-

Table. . Estimates of SSB for the Navarin walleye pollock (ths.t)