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by

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Abstract

The document describes results of Pacific salmon trawl surveys by R/V "TINRO" and R/V "Professor Kaganovskii" during the summer of 2008 in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea. This survey was one in the row of north-west Pacific epipelagic community state observations during early summer period. Its main goal was total registration of pink salmon on its early preanadromous migration ways. The research results provided data on oceanological conditions, distribution and abundance of major zooplankton groups. Estimates of nekton and jellyfish species abundance and biomass are provided. The distributions, biological parameters of different species of Pacific salmon are described in detail. Foods habits are examined for different size groups of pink and chum salmon.

Material and methods

Ecosystem trawl survey in upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea was conducted by R/V "TINRO" and R/V "Professor Kaganovskii" from June the 9th to July the 8th 2008. During the survey there were made 86 trawl tows on an area of 1028,14 square km. The plan of Pacific Ocean open waters zoning is shown on figure 1. The plan of trawling stations made is shown on figure 2.

Trawl tows were conducted with a midwater trawl RT/TM 80/396. Cone-end was equipped with 10-mm mesh on the inside. This allowed doing catches in the top 50 meter epipelagic layer with the highest salmon concentration. Its mouth dimensions are following: vertical – 28-43 m, horizontal – 36-50 m, depending on weather and trawling speed. The trawl has being usually towed by the sea surface during one hour with average speed equal 4,6 knots. The trawlings were round-the-clock. The length of warps was 250-316 m. The abundance (in millions of individuals) and the biomass (in thousands of tons) of fishes and cephalopods were

calculated by multiplying the average density (individuals/km2) and mass (kg/km^2) for the particular species times area of the biostatistical region. Catching efficiency indexes were standard: 0,3 for adults and 0,4 for juveniles.

Hydrologic information was gathered via probe complex SeaBird SBE-25 on depth up to 1000 m.

To sample plankton, a Juday net (area of the mouth opening – 0.1 m², capron mesh # 48, mesh size - 0.168 mm) was used aboard the R/V "TINRO" during both daytime and nighttime hours on standard station net. Plankton net was towed in 200-0 m stratum in deep-water areas or between bottom and 0 m in shallow areas. Each plankton sample was divided into 3 fractions - small-sized (less than 1.5 mm), medium-sized (1.5 to 3.5 mm), and large-sized (3.5 mm and more). The biomass of each size group was determined with Yashnov volumenometer, the amount of each species is counted in Bogorov camera. When calculating plankton biomass, the following correction factors were set as following: for the small-sized fraction as 1.5, for the medium-sized – 2.0, for the large-sized – euphausiids and chaetognaths shorter than 10 mm – 2.0, for 10 to 20 mm long – 5.0, over 20 mm in length – 10.0. The correction factor for hyperiids shorter than 5 mm – 1.5, 5 – 10 mm long – 5.0, for copepods under 5 mm – 2.0, over 5 mm – 3.0.

The salmon feeding was examined in groups according to body size – 10 to 20 cm, 21 to 30 cm, 31 to 40 cm, 41 to 50 cm, 51 to 60 cm, and greater than 61 cm. The samples including from 10 to 25 stomachs of the same body size group were selected from catches processed without any prior fixation. Upon weighting the sample the species composition of food, the percentage of most numerous species and other typical parameters were analyzed. The stage of food digestion was evaluated using 5-step scale.

Results and Discussion

Hydrological conditions in the upper epipelagic layer of northwestern Pacific and Kuril

The year 2008 was rather warm compared to the mean annual temperature (+2-3°C), but compared to the year 2004 or 2006 it is on the contrary, rather cold. Concerning the spring processes development level, the year 2008 was much alike 2007, but the north-east part of the area researched was warmer (9-14 and 7-11°C respectively). Besides influence of the Sub-Arctic front north border did not lack in the top quasihomogeneous layer along the survey area south periphery. It could be observed only on the depth over 100 m. Nevertheless, the warm water species have started to appear northward and this fact has influenced the species diversity of the catches, which is now maximal for the last four years. Distribution of surface water temperature and scheme of geostrophic stream vector are shown on figure 3 and 4.

Plankton research in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea

Small-, medium- and large-size fractions of plankton distribution is shown on figure 5. Zooplankton total biomass on all the area was 22294,0 mg/m^3. The large-size fraction was predominate in the plankton community (83,5-97,5% throughout the epipelagic waters) during the survey period. Copepods, sagittas and in some regions euphausiids were the most abundant species. The upper epipelagic layer of coastal and open ocean waters near north and middle Kuril islands and open waters of Kamchatka and Komandor islands was most reach in fodder for salmon. There density of fodder plankton was 1,5-2 times as high as on the rest of the area. The fodder conditions in Kuril islands ocean waters were the most favorable in 2008 compared to the previous surveys results (table 1).

Ichthyological research in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea

The total abundance and biomass on nekton and megaplankton species within survey area amounted to 332,03 billion inds. and 3,11 million tons, among those 208,4 billion inds. and 1,57 million tons were registered in North-West Pacific (which is the minimum for all the four years of research). Biomass and structure of nekton species of Kuril islands coastal waters and North-West Pacific ocean upper epipelagic layer is shown in table 2. Ichtionekton accounted for 77,9% of total biomass, cephalopods - 15,8%, and the rest falls on jelly-fish (6,3%). While Stenobrachius leucopsarus and Diaphus theta biomass strongly decreased, none of the species hadn't shown any significant grow. This affected the overall decrease of level of nekton biomass in upper epipelagic layer (table 3, 4). Only the pacific salmon have been the most stable nekton group.

Pink salmon. In 2008 the pink salmon biomass registered was the least for the four-year research period – 314,6 th. t (or 263,8 million inds.). Though there was more pink salmon inside Russian EEZ (233 thousand tons) than in 2004 (150 thousand tons). About 1 billion juvenile pink salmon have leaved Okhotsk sea for the ocean. Which means that the survival rate of pink salmon from November to June was about 27%. One should remember that this estimate of abundance characterizes quantity of the runs but does not the quantity of a stock for fishery and reproduction. While passing through Kuril islands coastal waters and Okhotsk sea (July – September) salmon is hunted by many predators: mezopelagic predator fish, seals, killer whales, halibut, sharks and other.

The preanadromous migration was quite prolonged in 2008. The first mature salmons have entered Okhotsk sea by the first decade of June (catches – 1-12 inds./hour, density concentration – 8-91 inds./km^2) (fig. 6). Considering wide variation range of pink salmons biological parameters (FL 33-52 cm, average FL – 44,1 cm, GSI – female 2,5-6,1%, male 0,6-3,5%) and sex ration, we have met both from North Okhotsk sea and from West Kamchatka pink salmon stocks.

Pre-spawning pink salmon in the Pacific ocean was found allover the area surveyed with its distribution uneven (fig. 6). Its catches and density concentration increased from Kuril islands (1 – 7 inds./ hour, 8 – 58 inds./km^2) southwards (49 – 211 inds./hour, 450 – 1769 inds./km^2). Mean body size (fig. 6) and female maturity (GSI) of fishes (figure 7) increased towards Kuril islands and north-eastwards. It was determined by two factors. First, mature summer race of pink salmon was predominant in the vanguard of migration flow. Second, the more mature north stocks of summer race was predominant in the north-east part of the area, while the less mature later form was predominant in the south-west part. The approximate conditioned border between the stations was drawn in the ocean basing on female GSI rapid change. However abundance and biomass calculating for the two subdistricts have provided some useful information on quantity of the runs in West Kamchatka and Sakhalin.

Chum salmon. *Mature chum salmon* abundance in the Pacific ocean was estimated at 37,8 million inds., and biomass was estimated at 83,5 thousand tons basing on the result of the survey.

The main concentration places were found in the coastal Okhotsk sea and Kuril islands ocean waters (17 – 650 inds./km^2) (fig. 8). In the rest parts of the region the density was considerably lower. (9 – 102 inds./km^2). The individuals with body size from 36,5 to 66,9 cm were caught in the survey area (average FL – 55,2 cm). Average FL decreasing from Kuril islands coastal waters towards the Pacific ocean open waters was discovered during the survey (fig. 8).

Gonadosomatic indexes of the maturing individuals varied from 1 to 11,9% for females and from 0,1 to 6,8% for males throughout the area. The tendency of decreasing GSI for females while moving farther into the ocean was observed. For female the gonad maturity increased from Kuril island coast to ocean open waters.

Immature chum salmon was less abundant (30,1 million inds., 30,2 thousand tons) compared to the mature fish in the Kuril islands Pacific waters. It was distributed mainly outside the 200 mile zone (9 – 369 inds./km^2) (fig. 9). The highest catches were also registered there (15

– 40 inds./hour). Immature individuals were rarely found in coastal regions along the Kuril islands (1 – 4 inds./hour, 8 – 26 inds./km^2).

In summer 2008 immature chum salmon FL varied from 31 to 59 cm (average FL – 44,6 cm). The following size groups were well marked out on the surveyed area: 31-40 cm, 44-50 cm and over 51 cm. The mean size increased from open ocean waters towards the Kuril islands coast (fig. 9).

Sockeye salmon. *Mature sockeye salmon* was found only in the north-east part of the area with surface water temperature 4-8°C. Its concentration was no dense (8-28 inds./km^2) (fig. 10). The total of 10 individuals in 6 catches was caught, within which are 6 females (GSI – 1,2-3,6%, average GSI – 1,8%) and 3 males (GSI – 0,6-1,2%, average GSI – 0,8%). Chum salmon size varied from 42 to 62 cm (average FL – 52,2 cm). The registered abundance and biomass was 1,08 million inds. and 2,05 thousand tons.

Immature sockeye salmon migrations occurred with a slight delay. It was met only twice (9-47 inds./km^2) with temperature of surface water 7-8°C (fig. 10). Its size varied from 35,5 to 48,5 cm (average FL – 44,8 cm), abundance and biomass amounted to 0,7 million inds. and 0,8 thousand tons.

Chinook salmon. *Immature chinook salmon*, as well as sockeye salmon, showed migration delay. By the first decade of June it was met only in the warm waters (8-9°C) of North-East sector south periphery (fig. 10). There were caught 2 individuals with 52 and 55 cm. body size. The registered abundance and biomass was 0,2 million inds. and 0,5 thousand tons.

Coho salmon. The total abundance and biomass on coho salmon within survey area amounted 1,6 million inds. and 2,9 thousand tons. Coho salmon was met in 6-12°C waters. Its concentration was no dense (8-17 inds./km^2) (fig. 11). There were only 3 females out of 15 individuals caught in the ocean. Gonad maturity level of all the individuals was low (females – 2,5-3,5%, average GSI – 2,9%; males – 0,4-2,0%, average GSI – 1,02%). Body size varied from 47 to 61 cm (average FL – 53,5 cm).

Feeding behavior of pink and chum salmon of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea.

Copepods, euphausiids, amphipods and less significant pteropods, squid and fish larvae were forming the pink salmon diet in the North-west part of the Pacific Ocean in 2008. There were no basic differences found in various pink salmon size or age groups. The highest SFI was during the evening period decreasing by morning (fig. 12). All chum salmon size groups was feeding primarily on pteropods and amphipods. In general chum salmon's feeding activity was

less than pink salmon's one. There were two peaks (mourning and evening) of the daily feeding rhythm depending on the fish size group (fig. 13). The largest individuals (60-70 cm) had higher feeding activity during the night time the minor ones were active in the morning.

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Table 1

Density of plankton in Kuril islands Pacific Ocean waters in upper 200 m (t/sq. km) during summer, different years

Biostatistical area	Year	Phytoplankton	Sum of 3 fractions	Small-size fraction	Medium-size fraction	Large-size fraction, including:	Euphausiacea	Amphipoda	Copepoda	Sagitta	Coelenterata	Other
5	2008	26,6	201,3	19,4	13,7	168,1	0,0	0,0	95,4	69,8	1,2	1,7
	2006	5,0	148,9	7,4	3,9	137,5	7,6	1,4	100,1	27,8	0,4	0,2
	2004	1,6	81,5	4,8	3,3	73,4	15,8	0,4	37,6	16,1	2,5	1,0
6	2008	1,6	445,8	5,9	5,2	434,7	7,3	1,9	225,3	197,6	2,1	0,5
	2006	2,1	207,9	4,6	3,3	199,9	10,4	0,6	131,1	55,2	1,5	1,2
	2004	7,6	60,7	4,9	3,1	52,8	6,8	0,1	26,2	15,0	2,9	1,8
7	2008	150,3	225,8	21,1	4,1	200,6	3,2	1,6	150,4	39,8	4,2	1,3
	2006	24,6	153,2	5,8	3,0	144,3	11,0	0,6	96,9	33,0	0,8	2,2
	2004	18,9	136,4	4,4	5,5	126,5	51,3	1,1	61,6	10,8	1,5	0,2
8	2008	13,2	346,3	7,9	7,1	331,3	10,6	3,7	186,2	126,4	3,5	1,0
	2006	11,1	205,4	5,6	6,0	193,7	2,9	0,8	112,2	72,0	1,7	4,2
	2004	13,7	108,2	4,9	6,5	96,8	10,4	1,0	60,1	22,1	1,6	1,5
9	2008	36,2	213,0	4,9	5,9	202,2	20,5	1,1	131,0	42,4	1,2	0,1
	2006	85,9	72,1	5,4	7,5	59,2	5,5	0,4	47,2	5,6	0,4	0,1
	2004	40,3	15,1	0,8	3,6	10,6	0,3	0,2	0,1	3,4	0,7	0,0
10	2008	10,6	256,0	6,4	9,0	240,6	10,6	1,5	146,5	79,6	1,5	0,7
	2006	53,9	143,7	6,8	7,1	129,9	7,6	1,2	82,0	38,2	0,4	0,4
	2004	77,3	129,3	2,6	13,1	113,6	16,6	3,5	68,7	22,7	1,1	1,1
13*	2008	0,6	230,1	3,3	4,1	222,7	5,2	0,5	176,2	40,0	0,7	0,1
	2006	0,7	191,5	3,9	3,4	184,2	2,7	0,4	147,5	32,6	0,3	0,6
	2004	12,5	120,6	5,9	5,7	109,0	4,2	2,6	70,7	24,7	0,6	6,3

Note. * – waters outside Russian EEZ in the North-West part of the Pacific Ocean.

Table 2

Nekton structure and biomass (th. t) in upper epipelagic layer of North-West part of Pacific Ocean and Kuril islands coastal waters of Okhotsk sea and 09.06-08.07.2008

Families, species	Sea of Okhotsk	Biostatistical area							Ocean total
		13*	10	9	8	7	6	5	
Oncorhynchus gorbuscha	*3,80*	*66,78*	*66,33*	*16,15*	*130,66*	*19,92*	*10,99*	-	310,83
Oncorhynchus keta	*16,15*	*22,48*	*7,96*	*18,22*	*15,85*	*22,06*	*8,34*	*2,61*	97,52
Oncorhynchus kisutch	*0,12*	*1,48*	*0,25*	-	*0,87*	-	*0,16*	-	2,76
Oncorhynchus nerka	-	*1,57*	-	-	*0,24*	*0,30*	*0,70*	-	2,81
Oncorhynchus tschawytscha	-	*0,46*	-	-	-	-	-	-	0,46
Salvelinus malma	*0,14*	-	-	-	-	-	-	-	-
Mesopelagic species,	*1329,59*	*94,63*	*417,96*	-	*109,42*	*8,69*	*4,55*	-	635,25
***including**:*									
Leuroglossus schmidti	*1329,59*	*2,85*	*0,03*	-	*0,47*	*5,33*	*2,82*	-	11,50
Diaphus theta	-	*4,11*	*50,63*	-	*101,60*	*0,33*	*0,17*	-	156,84
Notoscopelus japonicus	-	*10,90*	*18,92*	-	-	-	-	-	29,82
Symbolophorus californiensis	*ŭ*	*5,87*	*112,25*	-	-	-	-	-	118,12
Trachypteridae		*1,08*							1,08
Other fish species	*72,81*	*20,39*	*6,46*	*26,76*	*18,53*	*103,42*	*0,01*	*0,07*	175,64
***including**:*									
Brama japonica	-	*9,14*	*4,39*	-	*13,69*	-	-	-	27,22
Cololabis saira	-	*1,17*	-	-	-	-	-	-	1,17
All fish species	**1422,61**	**207,79**	**498,96**	**61,13**	**275,57**	**154,39**	**24,75**	**2,68**	**1225,27**
Watasenia scintillans	-	*20,18*	*21,47*	-	*6,90*	-	-	-	48,55
Gonatopsis borealis	*65,04*	*50,26*	*17,64*	-	*57,22*	*10,05*	*5,07*	-	140,24
Total for Cephalopods	**67,43**	**87,44**	**61,75**	**0,00**	**70,67**	**12,18**	**16,10**	**0,23**	**248,37**
Total	**1490,04**	**295,23**	**560,71**	**61,13**	**346,24**	**166,57**	**40,85**	**2,91**	**1473,64**

Note. * – waters outside Russian EEZ in the North-West part of the Pacific Ocean.

Table 3

Biomass (thousand tons), ratio (%) and density (t/km^2) of nekton within Russian EEZ in the North-West part of the Pacific Ocean (regions 7-10) during summer period

Families, species	2004			2006			2007			2008		
	Th. t	%	t/km^2	Th. t	%	t/km^2	Th. t	%	t/km^2	Th. t	%	t/km^2
Oncorhynchus gorbuscha	149,76	10,6	0,3	292,42	21,7	0,52	302,45	24,9	0,54	233,06	20,5	0,42
Oncorhynchus keta	64,12	4,5	0,13	53,64	4,0	0,1	63,03	5,2	0,11	64,09	5,6	0,12
Other pacific salmon	3,46	0,2	0,01	2,31	0,2	+	1,98	0,2	+	1,66	0,1	+
Stenobrachius leucopsarus	63,4	4,5	0,13	14,7	1,1	0,03	309,24	25,4	0,55	238,87	21,1	0,42
Diaphus theta	106,36	7,5	0,21	282,37	21,0	0,51	154,78	12,7	0,28	152,56	13,4	0,27
Leuroglossus schmidti	438,15	31,1	0,89	85,96	6,4	0,15	37,08	3,0	0,07	5,83	0,5	0,01
Other mesopelagic species	152,09	10,8	0,31	320,7	23,8	0,58	88,26	7,3	0,16	138,81	12,2	0,25
Brama japonica	11,98	0,8	0,02	37,91	2,8	0,07	11,05	0,9	0,02	18,08	1,6	0,03
Other fish species	36,92	2,6	0,07	50,17	3,7	0,08	48,69	4,0	0,09	137,09	12,1	0,25
All fish species	**1026,24**	**72,7**	**2,07**	**1140,18**	**84,7**	**2,04**	**1016,56**	**83,6**	**1,82**	**990,05**	**87,3**	**1,77**
Cephalopoda	384,52	27,3	0,78	206,27	15,3	0,37	200,08	16,4	0,36	144,6	12,7	0,26
Total	**1410,76**	**100**	**2,85**	**1346,45**	**100**	**2,41**	**1216,64**	**100**	**2,18**	**1134,65**	**100**	**2,03**
Area, th. sq. km	494,77			558,1			558,1			558,1		

Table 4

Biomass (thousand tons), ratio (%) and density (t/km^2) of nekton outside Russian EEZ in the North-West part of the Pacific Ocean (regions 13) during summer period.

Families, species	2004 (June-July)			2006 (June-July)			2007 (June-July)			2008 (June-July)		
	Th. t	%	t/km^2	Th. t	%	t/km^2	Th. t	%	t/km^2	Th. t	%	t/km^2
Oncorhynchus gorbuscha	227,84	19,0	0,71	38,05	11,4	0,19	171,76	20,9	0,74	66,78	22,6	0,23
Oncorhynchus keta	43,06	3,6	0,14	9,64	2,9	0,05	27,99	3,4	0,12	22,48	7,6	0,08
Other pacific salmon	14,45	1,2	0,05	1,91	0,6	0,01	4,81	0,6	0,02	3,51	1,2	0,01
Stenobrachius leucopsarus	17,98	1,5	0,06	14,55	4,4	0,07	309,57	37,6	1,32	39,55	13,4	0,14
Diaphus theta	46,02	3,8	0,14	123,41	37,1	0,61	127,24	15,5	0,54	4,11	1,4	0,01
Leuroglossus schmidti	19,27	1,6	0,06	2,84	0,9	0,01	17,1	2,1	0,07	2,85	1,0	0,01
Other mesopelagic species	32	2,7	0,1	33,72	10,1	0,17	10,86	1,3	0,07	47,04	15,9	0,17
Brama japonica	11,81	1,0	0,04	31,35	9,4	0,15	9,09	1,1	0,04	9,14	3,1	0,03
Other fish species	582,27	48,6	1,82	21,74	6,5	0,1	30,14	3,7	0,11	12,33	4,2	0,05
All fish species	**994,7**	**83,0**	**3,12**	**277,21**	**83,3**	**1,36**	**708,56**	**86,1**	**3,03**	**207,79**	**70,4**	**0,73**
Cephalopoda	203,2	17,0	0,64	55,5	16,7	0,27	114,44	13,9	0,49	87,44	29,6	0,31
Total	**1197,9**	**100**	**3,76**	**332,71**	**100**	**1,63**	**823**	**100**	**3,52**	**295,23**	**100**	**1,04**
Area, th. sq. km	318,82			203,41			233,74			285,72		

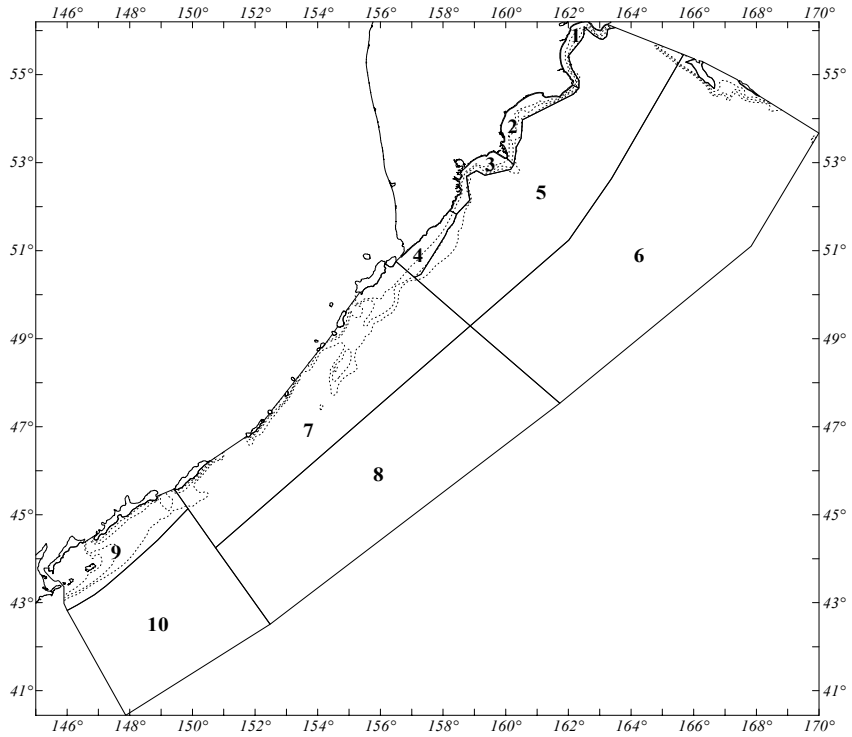

Fig. 1. Pacific ocean open waters zoning plan. Bold line shows the regions borders, dotted line – isobaths 100, 200, 500 m, numbers show the regions: 1 – Kamchatka Gulf, 2 – Kronotsky Bay, 3 – Avacha Gulf, 4 – southeastern Kamchatka, 5 – Kamchatka depression, 6 – offshore waters of Kamchatka and Komandor Islands, 7 – inshore waters of central and northern Kurils, 8 – offshore waters of central and northern Kurils, 9 – inshore waters of southern Kurils, 10 – offshore waters of southern Kurils

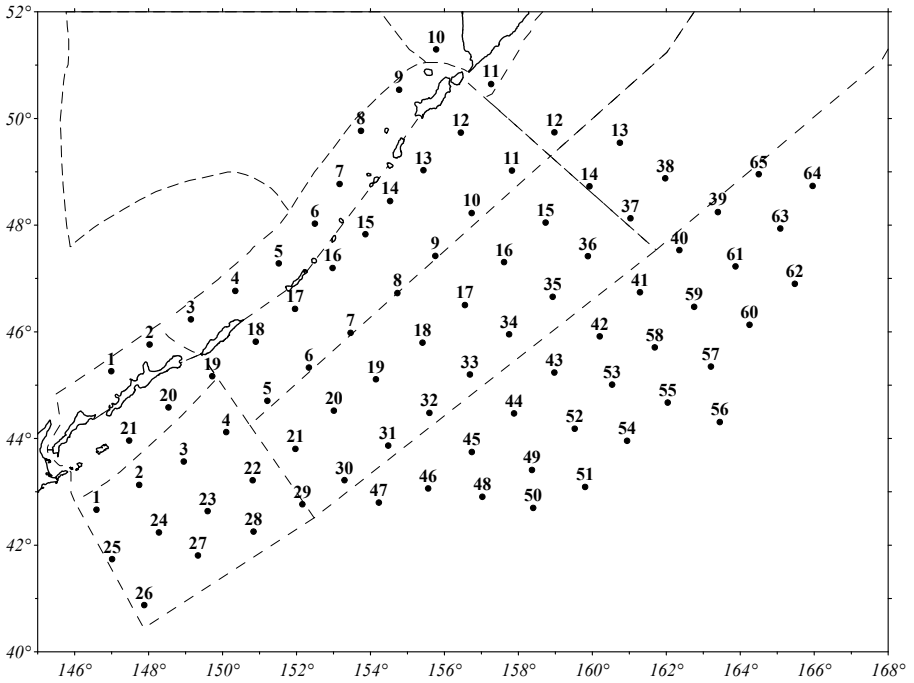

Fig. 2. The schema of trawl surveys by R/V “TINRO” and R/V “Professor Kaganovskii” in June-July 2008.

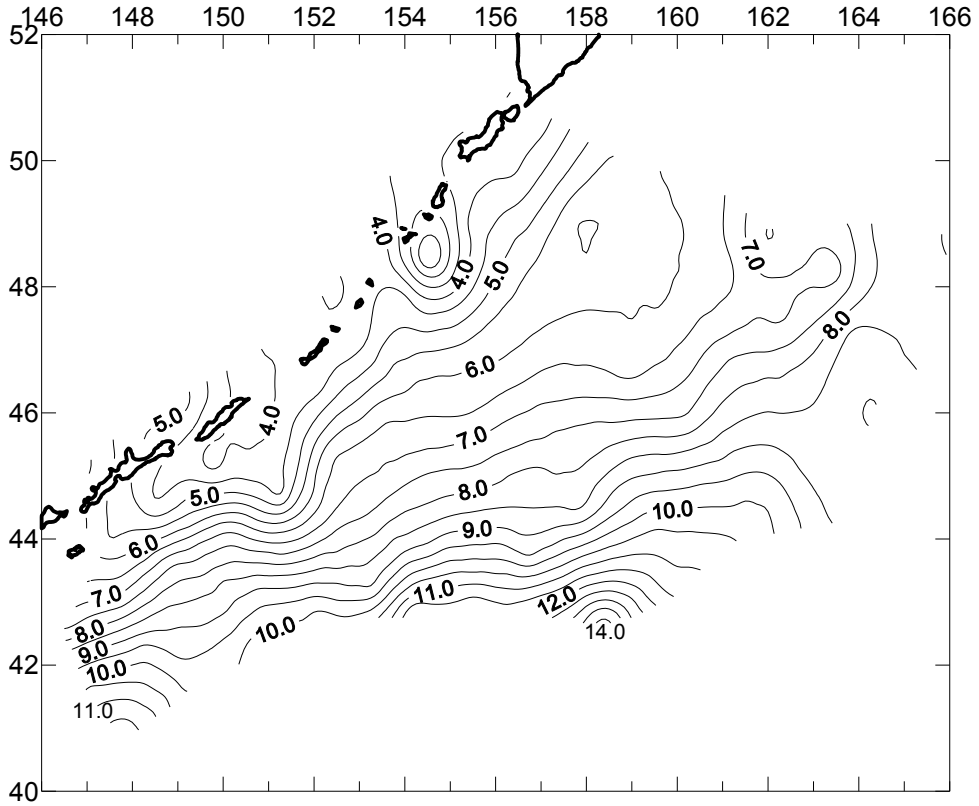

Fig. 3. Surface temperature distribution.

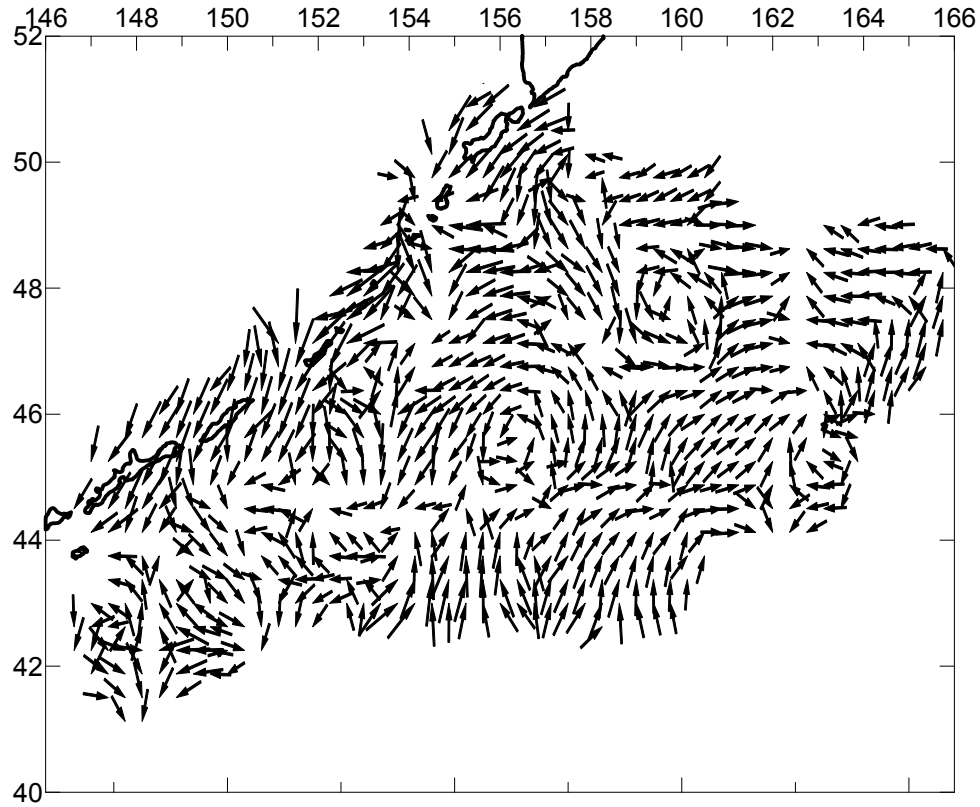

Fig. 4. Vectors of geostrophic currents of surface waters.

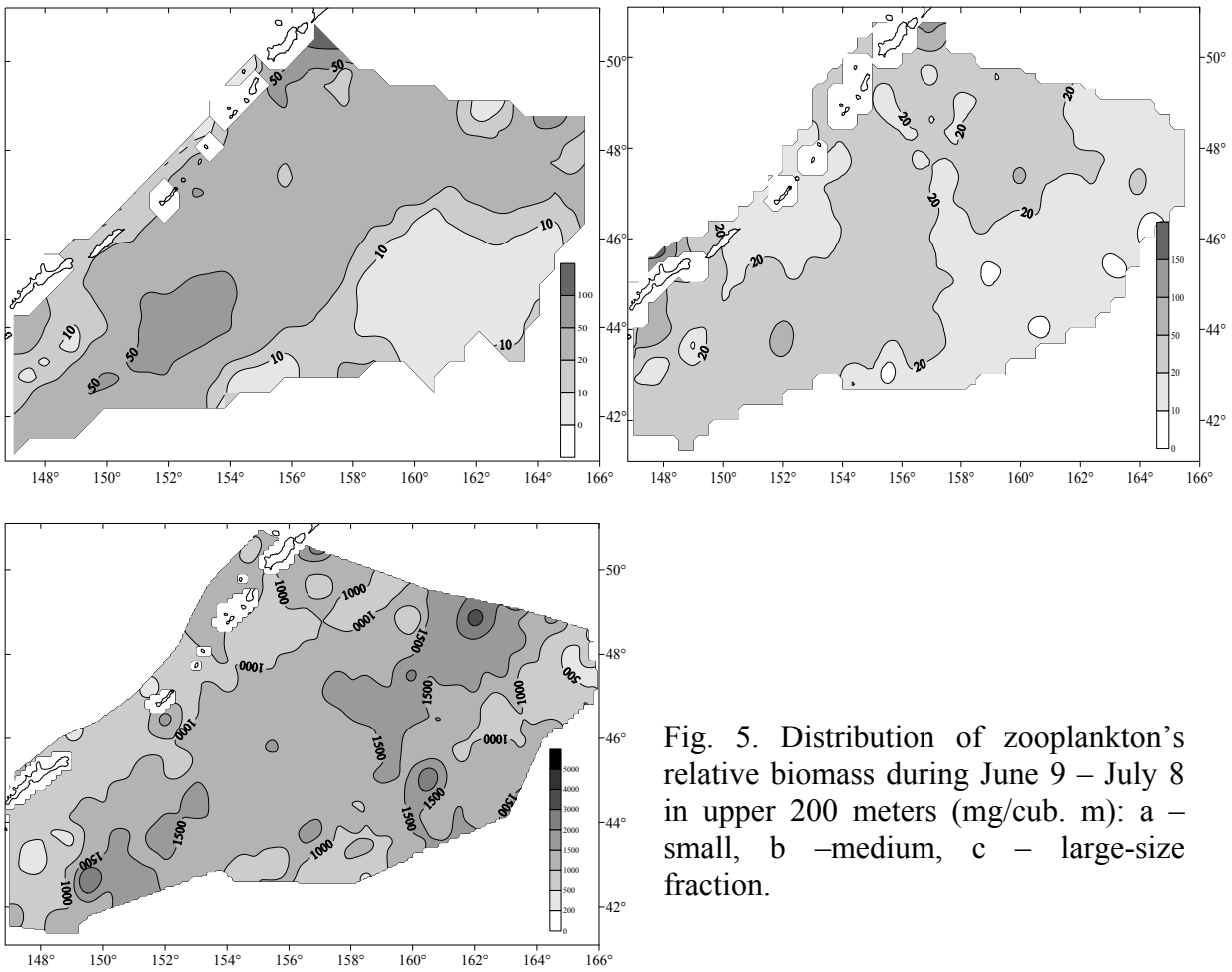

Fig. 5. Distribution of zooplankton's relative biomass during June 9 – July 8 in upper 200 meters (mg/cub. m): a – small, b –medium, c – large-size fraction.

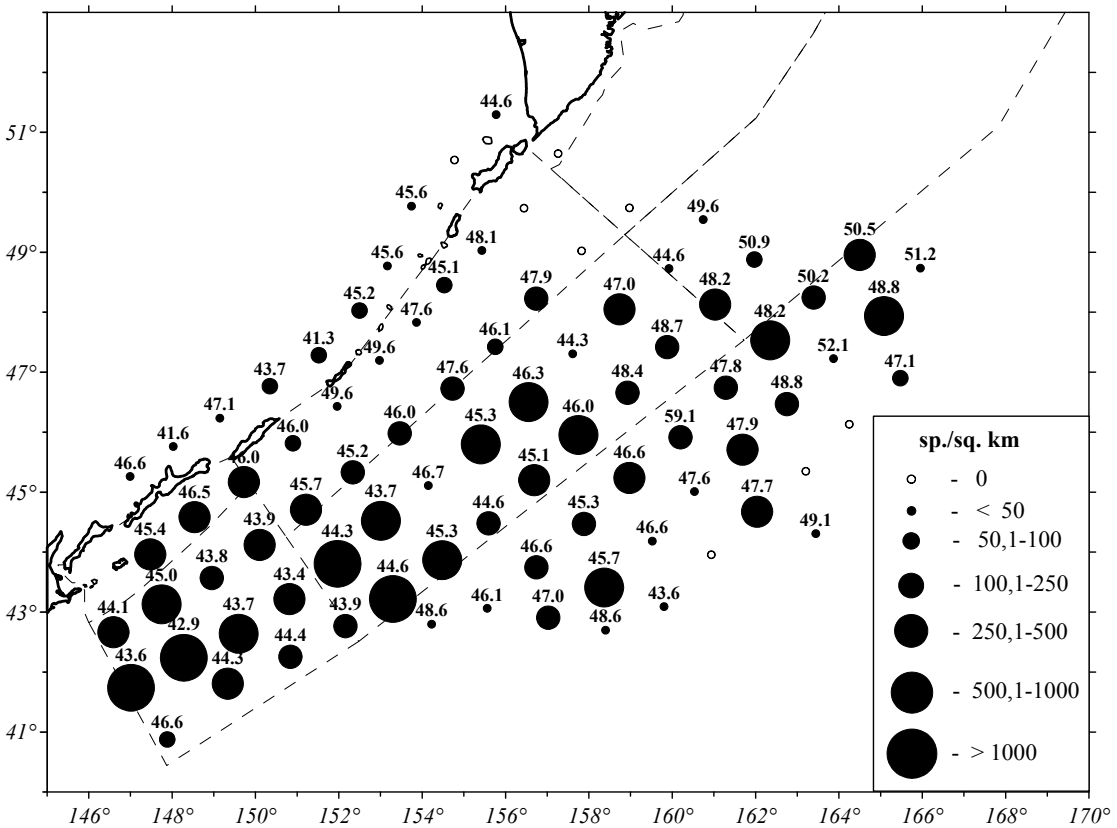

Fig. 6. Spatial distribution of mature pink salmon (inds./sq. km) in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea 09.06-08.07.2008. Numbers – average FL (cm).

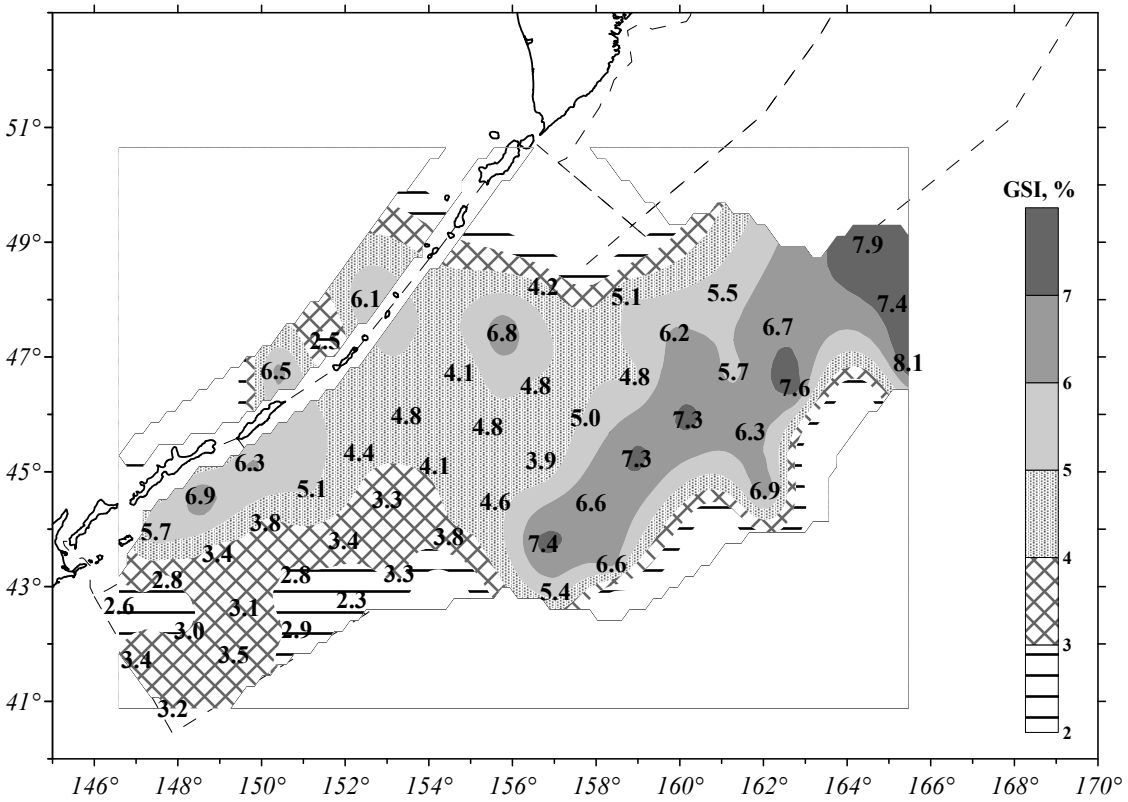

Fig. 7. Spatial distribution of pink salmon females GSI (%) (if at least two females were caught) in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea 09.06-08.07.2008. Numbers show - GSI (%)

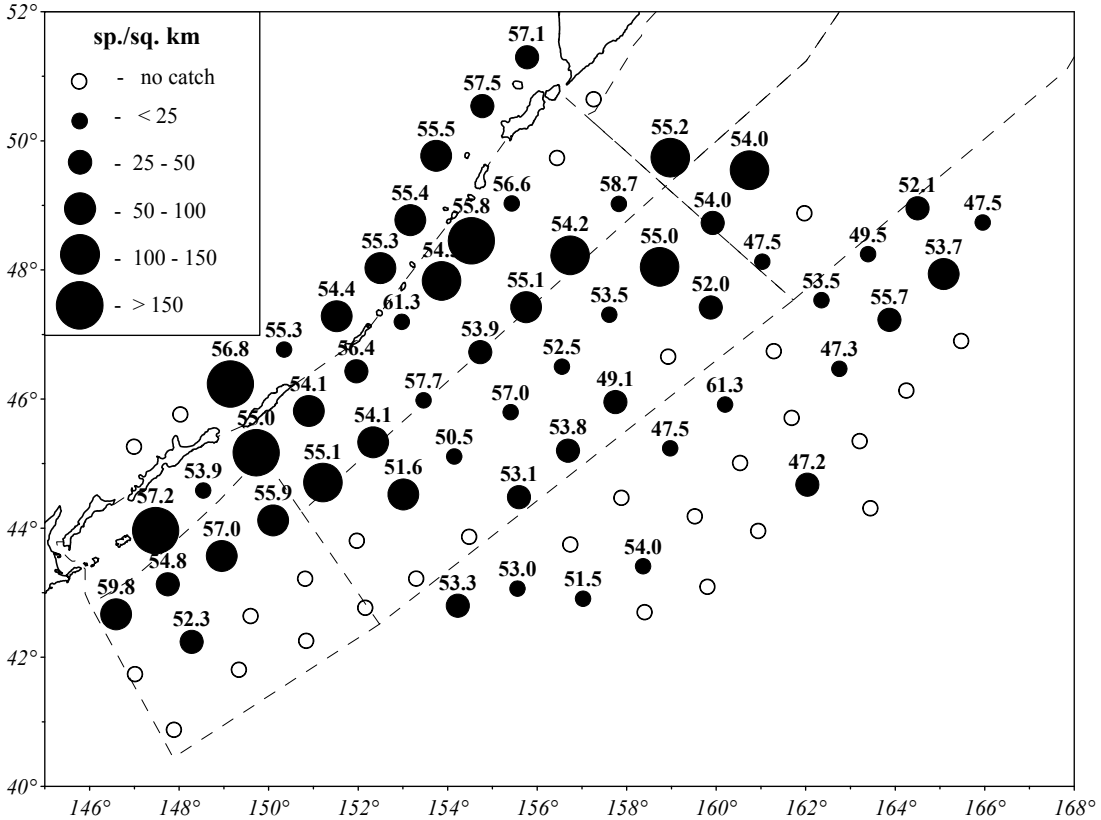

Fig. 8. Spatial distribution of mature chum salmon (inds./sq. km) in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea 09.06-08.07.2008. Numbers – average FL (cm).

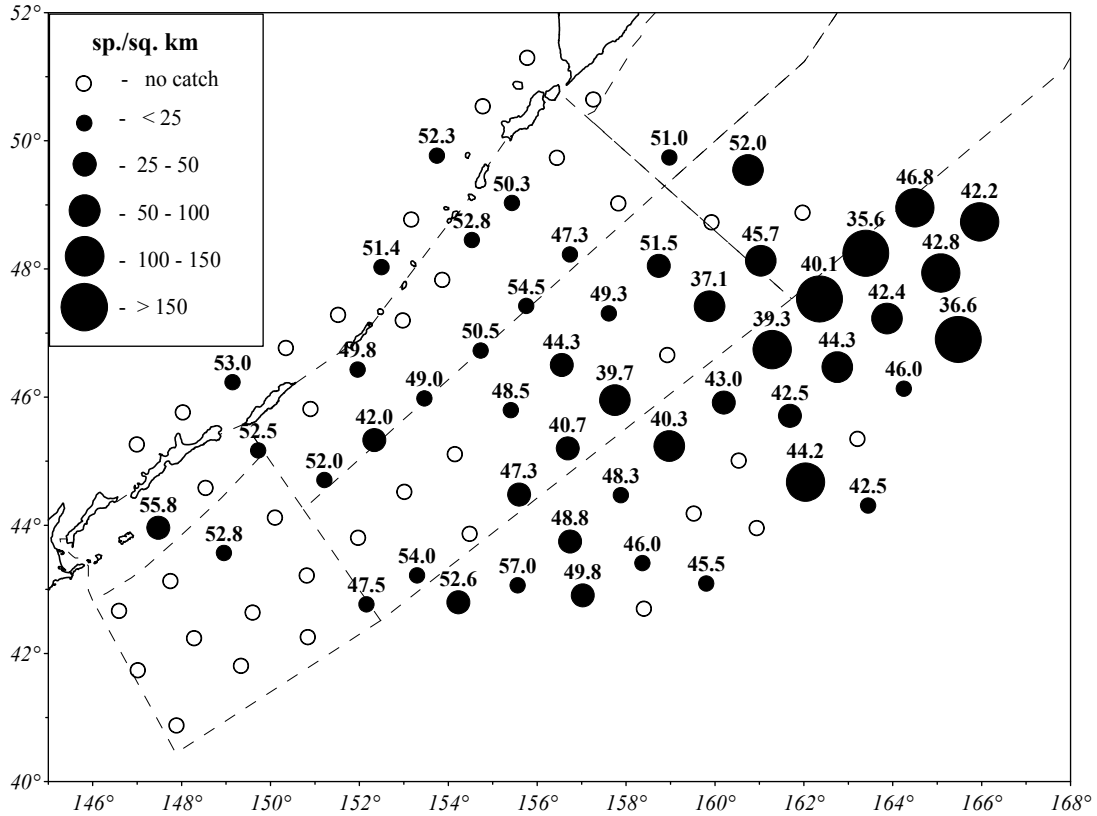

Fig. 9. Spatial distribution of immature chum salmon (inds./sq. km) in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea 09.06-08.07.2008. Numbers – average FL (cm).

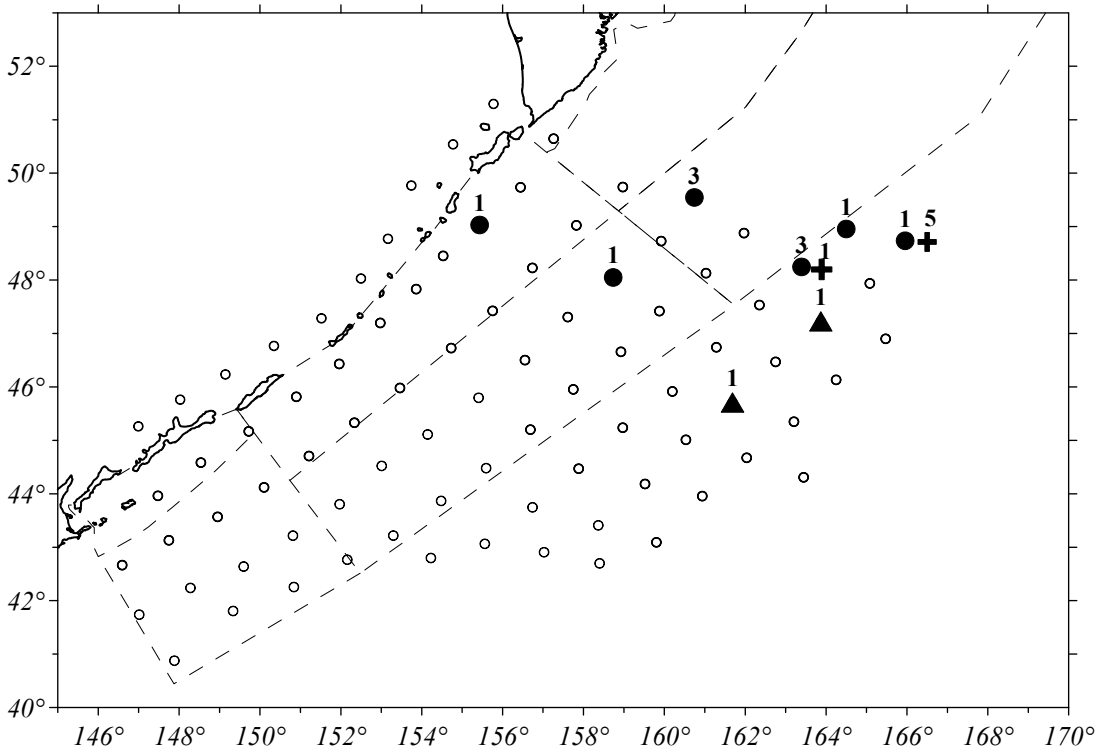

Fig. 10. Spatial distribution (inds./sq. km) of mature (circles) and immature (crosses) sockeye salmon and immature chinook salmon (triangles) in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea 09.06-08.07.2008. Numbers show catch (inds./hour).

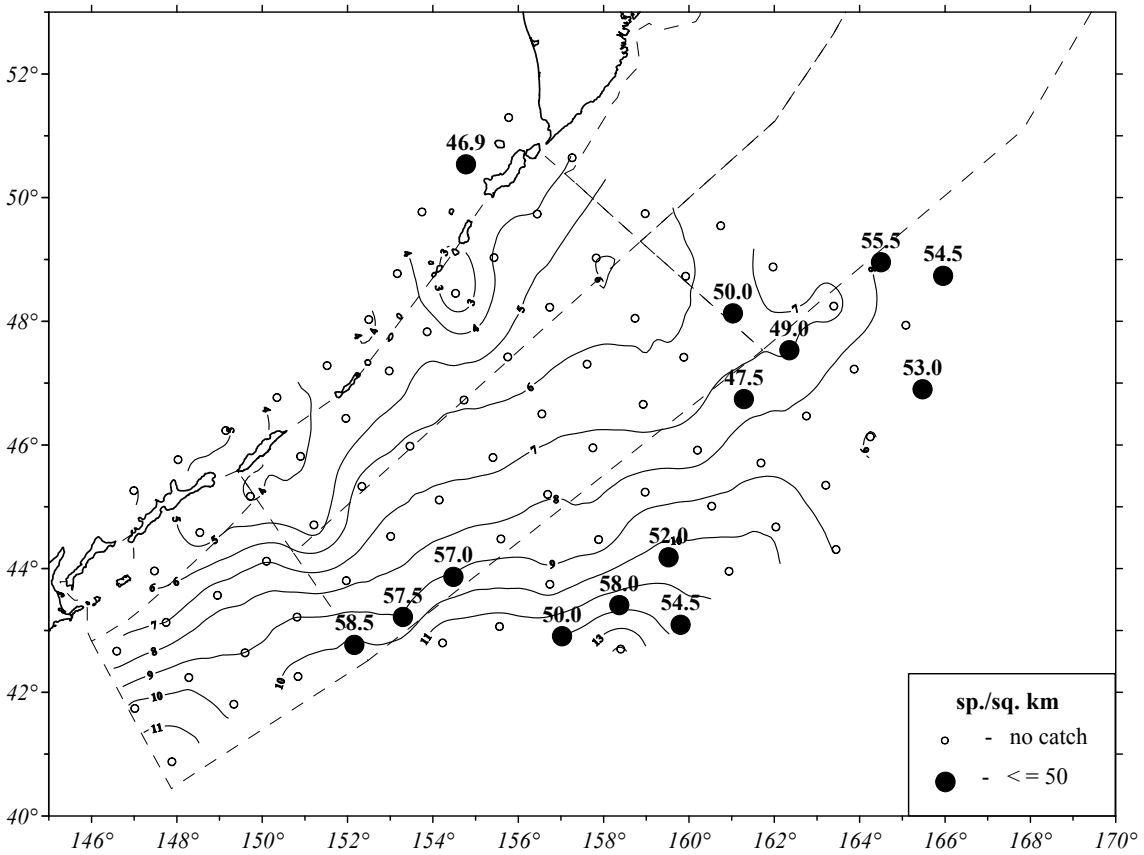

Fig. 11. Spatial distribution of coho salmon (inds./sq. km) in the upper epipelagic layer of northwestern Pacific and Kuril islands coastal waters of Okhotsk sea 09.06-08.07.2008. Numbers – average FL (cm). Isolines indicate SST.

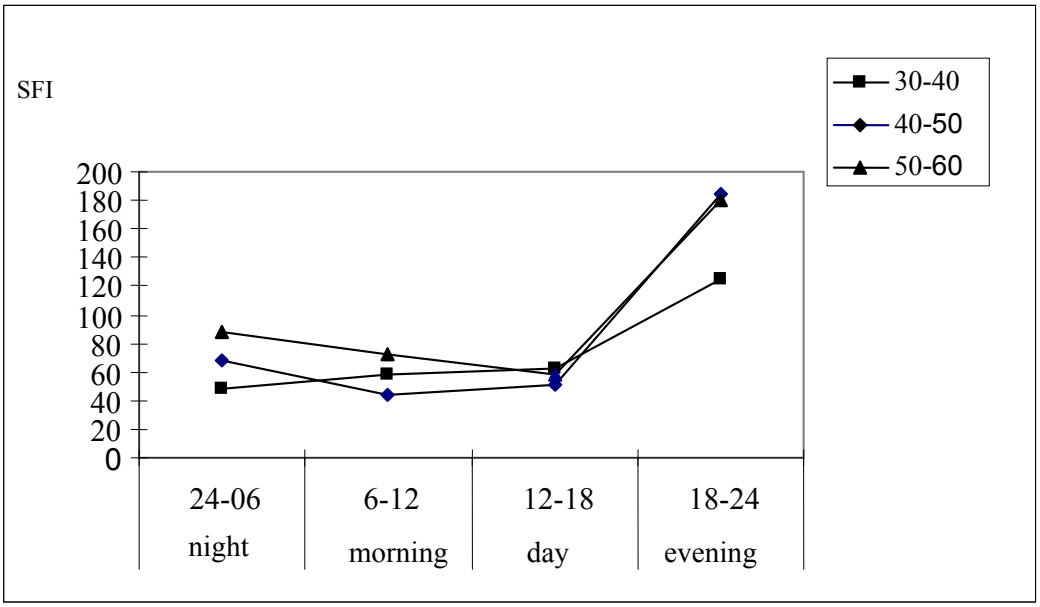

Fig. 12. Daily feeding activity rhythm (Stomach filling index -‰) of pink salmon

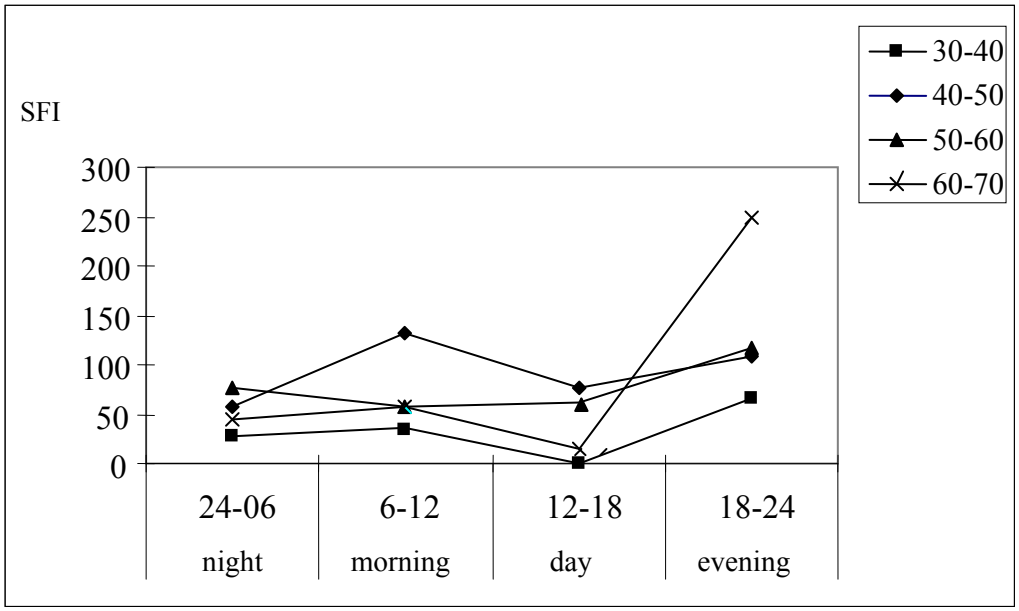

Fig. 13. Daily feeding activity rhythm (Stomach filling index -‰) of chum salmon