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Pacific Salmon in the Nekton Communities in Upper Epipelagic Southern Part of the Sea of Okhotsk in Autumn 2005.

by

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Pacific Salmon in the Nekton Communities in Upper Epipelagic Southern Part of the Sea of Okhotsk in Autumn 2005.

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Abstract.

Combined survey of the upper epipelagic (0-50) southern part of the Sea of Okhotsk was carried out in October – November, 2005. Total biomass and number of the nekton were estimated, prevailing groups and species were discovered, the part of salmon in nekton was determined and their short description (distribution of catches and dimensions structure of the salmon) was given.

Introduction.

Since 1995 summer and autumn combined surveys of epipelagic southern part of the Sea of Okhotsk are annually in progress by TINRO-centre. During survey the general ecological situation is estimated, resource of pelagic fishes are studied, and also the stock of the Far Eastern salmons are taken during their anadromous and catadromous migrations. The massive migrations of the Pacific salmons pass through the Southern part of the Sea of Okhotsk. In the same place the ways of migrations of regional groupings of these fishes are traversed. There are large masses of salmons in the southern part of the Sea from July till January. It determines the necessity of the study of their role as the important component of the pelagic ichtyocenos in this part of the Sea. Such researches are important for updating forecasts of the salmons catch in advance with different time (Temnykh at al, 2003).

Material and methods.

In 2005 combined survey of the upper epipelagic (0-50) southern part of the Sea of Okhotsk was in progress aboard the R/V "Professor Kaganovsky" from October, 24 till November, 12. Trawling were implemented with different depth trawl RT/TM – 80/396 with the length of 130 meters with fine-meshed (10 mm) insert. The duration of trawlings was 1 hour at the speed of 4.5-5 knots. The method of the areas with the application of the corresponding standard fishing efficiency of trawl (for juvenile salmons (up to 30 cm) – 0.4, for adult salmons (> 30 cm) – 0.3) was used for calculation of the number and the biomass of all species. The scheme of zonation of the southern part of the Sea of Okhotsk is shown in fig. 1.

Results and discussions.

The biomass of all nekton has been estimated of 370.9 thousand tons; at the number of 5204.3 million specimen. The fishes constituted almost 68% of the biomass (250.6 thousand tons), the share of squids constituted 13.0 % (48.3 thousand tons), it is the lowest index for the last six years. The biomass of gellyfishes exceeded squids 1.5 times - 72 thousand tons (19.4 %) (table 1). According to the change of biomasses, average

density of fishes, squids and gellyfishes distribution per sq. km varied also (table 1). Apparent reduction of the distribution density was noted for all three groups (fishes, gellyfishes and squids) in comparison with the previous years. The density of squids reached the least value in comparison with the last six years. Thus, the average density of the all nekton distribution per sq. km was much lower than in the majority of the previous years (2000 - 2005). And, accordingly, the total productivity of the upper epipelagic of southern part of the Sea of Okhotsk was not high in 2005.

Pacific salmons are dominating group of fishes in nekton of abyssal part of the Sea of Okhotsk in autumn. Their biomass varied from 120.2 up to 319.1 thousand tons from 2000 the 2005 (table 2). The share of salmons in catches varied from 48.5 up to 95.8 % for this period. As it is known, the migrants in nekton from subtropical waters essentially influence on total biomass of fishes, and accordingly, on the ratio of separate species. Their penetration into southern part of the Sea of Okhotsk depends on developing oceanologic conditions, and also on the distribution of warm Soya current from the Sea of Japan. *Engraulis japonicus* is such subtropical species (Temnykh at al, 2003). Though, last years (table 2) its share in catches did not exceed 2 % of total biomass of fishes, it still remains the most numerous, except for 2003, when its biomass has reached 45.0 thousand tons (18.2 %). Already during the several years (2000 - 2005), juvenile pink and chum salmons *(Oncorhynchus gorbuscha and Oncorhynchus keta), Pleurogrammus azonus*, *Leuroglossus schmidti* and *Engraulis japonicus* are the basis of fishes biomass in nekton. 2005 was not exception. Juvenile pink (43.5%) and juvenile chum (17.6%) salmons prevailed in nekton. 5.1 % of the biomass of nekton constituted three species - immature, the second and third year foraging, and mature chum salmons (2.6 %), *Engraulis japonicus* (1.3 %) and *Leuroglossus schmidti* (1.2 %). The share of the rest species of fishes in nekton was not more than 1 % (table 2).

Engraulis japonicus (28.4 % from all nekton) remains the most numerous species of fishes. The second place is for juvenile pink salmon (18.5%), then *Leuroglossus schmidti* (9.5 %) and juvenile chum salmon (9.1%) (fig. 2).

According to the observations of the last years, the distribution of the **pink salmon** was typical for the given period (fig. 3). Basic mass of the pink salmon concentrated in the southwest part of the sea. The largest catches were marked in the central and southern parts of the abyssal hollow where the considerable stocks of the macroplankton concentrated this time. Not far from the southern Kuril channels connecting the Sea of Okhotsk and the Pacific Ocean waters, the catches of the pink salmon were small. Near the northern Straits of Kurile the juvenile pink met singlely. Such distribution shows that in the period of survey juvenile pink salmons did not yet migrate to the ocean waters for wintering. The pink salmon sizes in catches varied from 16.5 up to 33.0 cm, fishes 24.5 - 27 cm in length prevailed. Such large sizes (average length - 25.1cm) and relatively low number (0.962 billion fishes) of juvenile salmons are not typical for even generation of the pink salmon. As a rule, the pink salmon of even generation has the smaller sizes thanks to the prevalence of the western - Kamchatka herds of the pink salmons in mixed stocks (Temnykh, 2004). The results of the differentional analysis showed that the

juvenile pink salmon of Sakhalin and southern Kuril Islands prevailed mixed stocks in the southern part of the Sea of Okhotsk in 2005 contrary to all expectations. It, undoubtedly, should influence on the ratio of the western - Kamchatka and Sakhalin-Kuril herds of pink salmon in 2006 during their anadromous migrations.

In autumn after seaward migration of the juvenile salmons of different regional groupings mix up after some time. Therefore the distribution of average lengths in catches is enough chaotic. In spite of this, some tendencies are traced. In 2005 the larger fishes concentrated in the central part of abyssal hollow, but not in Kurile waters as it was marked earlier (fig. 3).

In 2005 juvenile **chum salmon** distributed relatively in regular intervals on all surveyed aquatory (fig. 4). Areas of large catches of pink and chum salmon coincided, as well as in previous years. Such similarity in distribution of juvenile salmon is probably explained by similarity in their behaviour (nutrition, reaction to the change of surface water temperature, etc.).

The length of juvenile chum salmon varied from 14.5 up to 31 cm, fishes of 22 - 26 cm in length prevailed. Distribution of average lengths at chum salmon did not differ from those in previous years (fig. 3). The average sizes of fishes increased from the north to the south. The larger fishes concentrated near the central and boreal Kuril straits.

Immature individuals of chum salmon, the second and third year foraging, and mature individuals were met in catches near the Kuril Islands. Number of these groups was small (5.3 million individuals). Fishes of 48 - 54 cm in length prevailed (fig. 5).

Besides pink and the chum salmons the juvenile **masu salmon** *(Oncorhynchus masu)* and coho salmon occurred in catches bare number. During survey masu salmon concentrated far from Kuriles in southwest part of the sea (fig. 6). Its sizes varied from 23 up to 43 cm, fishes of 30 - 32 cm in length prevailed. The size fishes increased from the east to the west and from the north to the south. It is visible by the distribution of average lengths of fishes in catches. Juvenile **coho salmon** *(Oncorhynchus kisutch)* were met less often than masu salmon basically above the central and southern abyssal hollows (fig. 7). Their sizes varied from 25.4 up to 48.6 cm, fishes of 28-30 cm in length prevailed. The average sizes of fishes, as well as juvenile masu salmon, increased from the north to the south and from the east to the west.

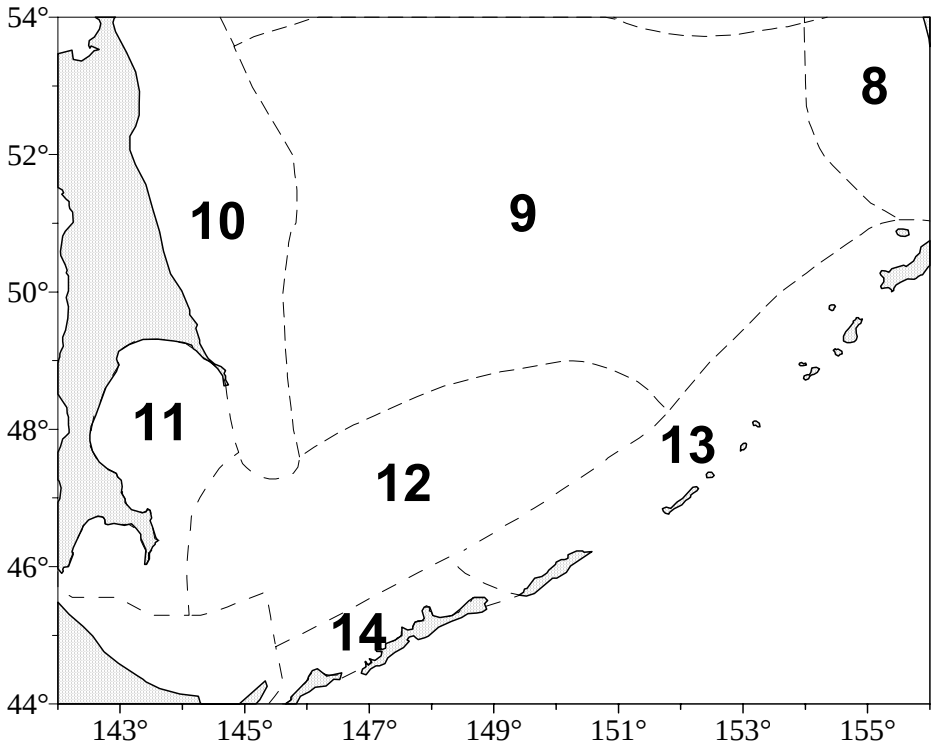

Fig. 1. The scheme of the zonation of the southern part of the Sea of Okhotsk. Areas: 8 - south-western-Kamchatka of the Sea of Okhotsk, 9 – the central hollow of the Sea of Okhotsk, 10 – the eastern-Sakhalin shelf, 11 - bays of Terpeniya and Aniva, 12 – the southern hollow, 13 – the middle-northern-Kuril of the Sea of Okhotsk, 14 – the southern - Sakhalin of the Sea of Okhotsk.

Table 1

Biomass and density of fishes**,** squids and gellyfishes distribution in upper epipelagic southern part of the Sea of Okhotsk in autumn in 2000 - 2005.

Groups	**2000**		**2001**		**2002**		**2003**		**2004**		**2005**	
	thousand tons	%	**thousand tons**	%	**thousand tons**	%	**thousand tons**	%	**thousand tons**	%	**thousand tons**	%
All species of the fish	330,6	83,8	229,1	78,2	247,7	44,7	413,0	61,6	250,6	67,6	250,6	67,6
Squids	56,2	14,2	63,9	21,8	192,8	34,8	140,8	21,0	48,3	13,0	48,3	13,0
Gellyfishes	7,7	2,0	-	-	113,3	20,5	117,0	17,4	72,0	19,4	72,0	19,4
All nekton	394,5	100	293,0	100	553,8	100	670,8	100	370,9	100	370,9	100
	Tons per square kilometers											
All species of the fish	0,81		1,41		0,88		0,46		0,86		0,53	
Squids	0,14		0,11		0,24		0,36		0,29		0,10	
Gellyfishes	0,02		0,24		-		0,21		0,24		0,15	
All nekton	0,97		1,75		1,12		1,04		1,38		0,78	
Total area (thousand sq. km)	408,0		477,0		261,7		533,9		487,8		479,0	

Table 2

Structure and biomass of mass species of nekton in the southern part of the Sea of Okhotsk in autumn 2000 - 2005.

Species and groups	2000			2001			2002			2003			2004			2005		
	thousand tons	% of fishes	% of nekton	**thousand tons**	% of fishes	% of nekton	**thousand tons**	% of fishes	% of nekton	**thousand tons**	% of fishes	% of nekton	**thousand tons**	% of fishes	% of nekton	**thousand tons**	% of fishes	% of nekton
Salmons, including	**218,88**	**66,2**	**55,5**	**318,41**	**56,2**	**43,4**	**173,03**	**75,5**	**59,1**	**120,20**	**48,5**	**21,7**	**391,10**	**94,7**	**58,3**	**240,10**	**95,8**	**64,7**
Pink salmon (juv.)	150,95	45,7	38,3	203,45	35,9	27,8	108,46	47,3	37,0	62,90	25,4	11,4	241,00	58,4	35,9	161,30	64,4	43,5
Mature pink salmon	-	-	-	0,10	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Chum salmon (juv.)	61,50	18,6	15,6	85,61	15,1	11,7	57,62	25,1	19,7	35,90	14,5	6,5	115,30	27,9	17,2	65,30	26,1	17,6
Chum salmon > 30 cm	1,65	0,5	0,4	6,55	1,2	0,9	4,67	2,0	1,6	16,10	6,5	2,9	30,40	7,4	4,5	9,60	3,8	2,6
Sockeye salmon (juv.)	2,41	0,7	0,6	8,96	1,6	1,2	+	+	-	-	-	-	-	-	-	-	-	-
Chinook salmon (juv.)	0,33	0,1	0,1	5,30	0,9	0,7	-	-	-	-	-	-	-	-	-	-	-	-
Coho salmon (juv.)	0,16	+	+	2,90	0,5	0,4	0,78	0,3	0,3	2,70	1,1	0,5	1,40	0,3	0,2	1,50	0,6	0,4
Masu salmon (juv.)	1,88	0,6	0,5	5,56	1,0	0,8	1,50	0,7	0,5	2,60	1,0	0,5	3,00	0,7	0,4	2,40	1,0	0,6
Leuroglossus schmidti	68,01	20,6	17,2	175,83	31,0	24,0	41,89	18,3	14,3	10,50	4,2	1,9	7,40	1,8	1,1	4,60	1,8	1,2
Pleurogrammus azonus	0,54	0,2	0,1	0,36	0,1	+	3,45	1,5	1,2	57,20	23,1	10,3	0,20	+	+	0,25	0,1	0,1
Engraulis japonicus	0,96	0,3	0,2	0,29	0,1	+	0,02	+	+	45,00	18,2	8,1	0,10	+	+	4,70	1,9	1,3
Other species of the fishes	42,22	12,8	10,7	72,08	12,7	9,8	10,74	4,7	3,7	14,30	5,8	2,6	14,20	3,4	2,1	0,95	0,4	0,3
All species of the fishes	**330,61**	**100**	**83,8**	**566,97**	**100**	**77,4**	**229,13**	**100**	**78,2**	**247,70**	**100**	**44,7**	**413,00**	**100**	**61,6**	**250,60**	**100**	**67,6**
All nekton, thousand tons	**394,52**			**732,83**			**293,01**			**553,8**			**670,8**			**370,9**		
Total area (thousand sq. km)	408			477			261,7			533,9			487,8			479		

The note. All values <0.1 were marked +

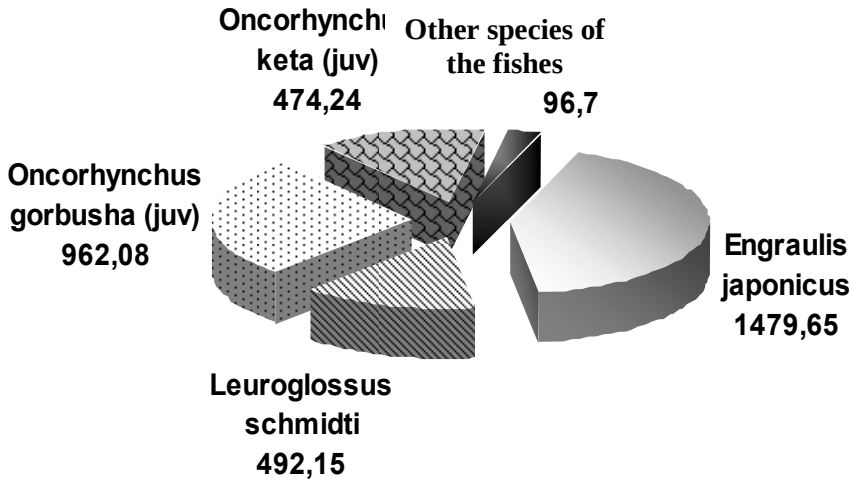

Fig. 2. Number (million specimen) of mass species of nekton in the southern part of the Sea of Okhotsk from October, 24 till November, 12, 2005.

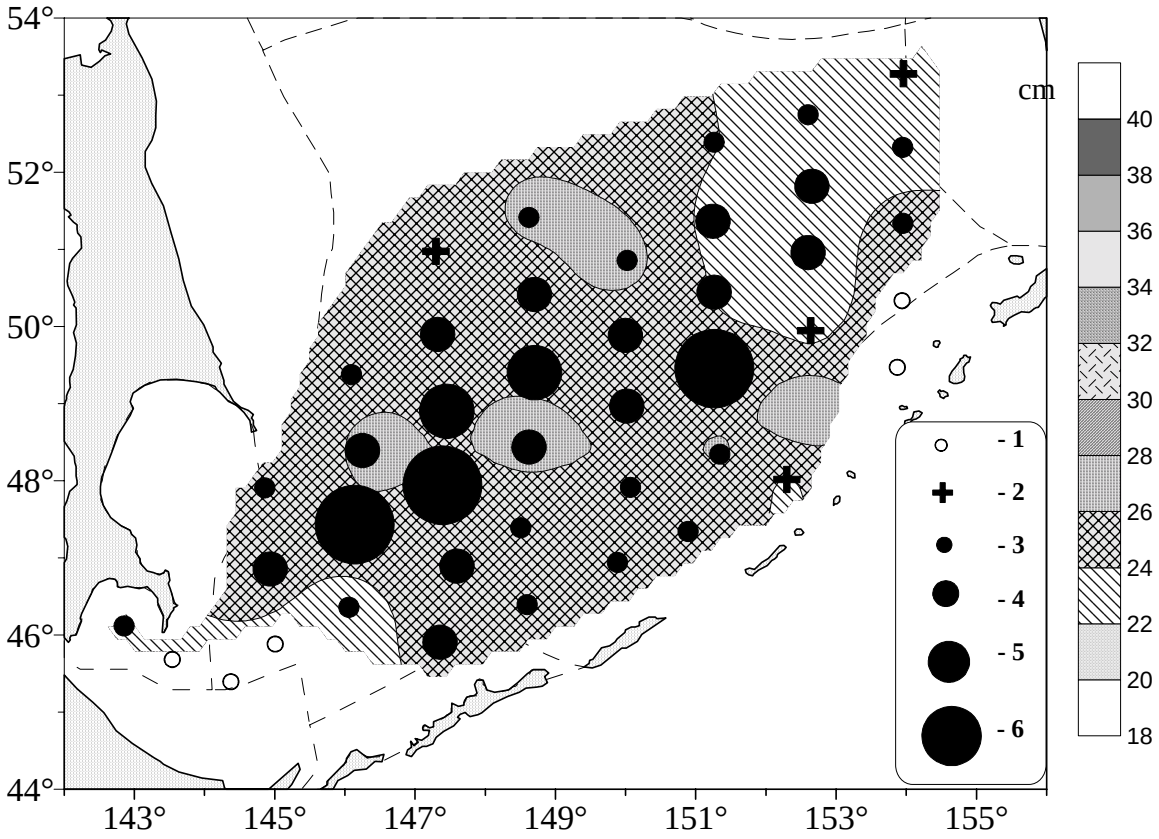

Fig. 3. Distribution of juvenile pink salmon catches in the southern part of the Sea of Okhotsk from October, 24 till November, 12, 2005. Graphical symbols: 1 – no catch; 2 - 1-10; 3 - 10-100; 4 - 100-500; 5 - 500-1000; 6 - more than 1000 specimen per hour of the trawling.

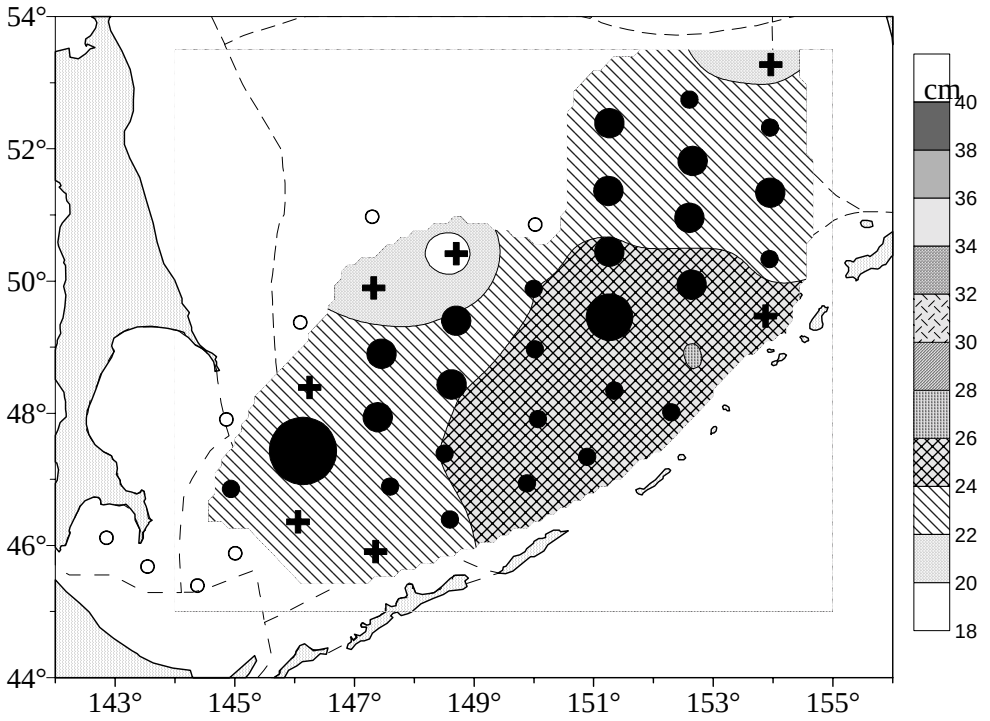

Fig. 4. Distribution of juvenile chum salmon catches in the southern part of the Sea of Okhotsk from October, 24 till November, 12, 2005. Graphical symbols: 1 – no catch; 2 - 1-10; 3 - 10-100; 4 - 100-500; 5 - 500-1000; 6 - more than 1000 specimen per hour of the trawling.

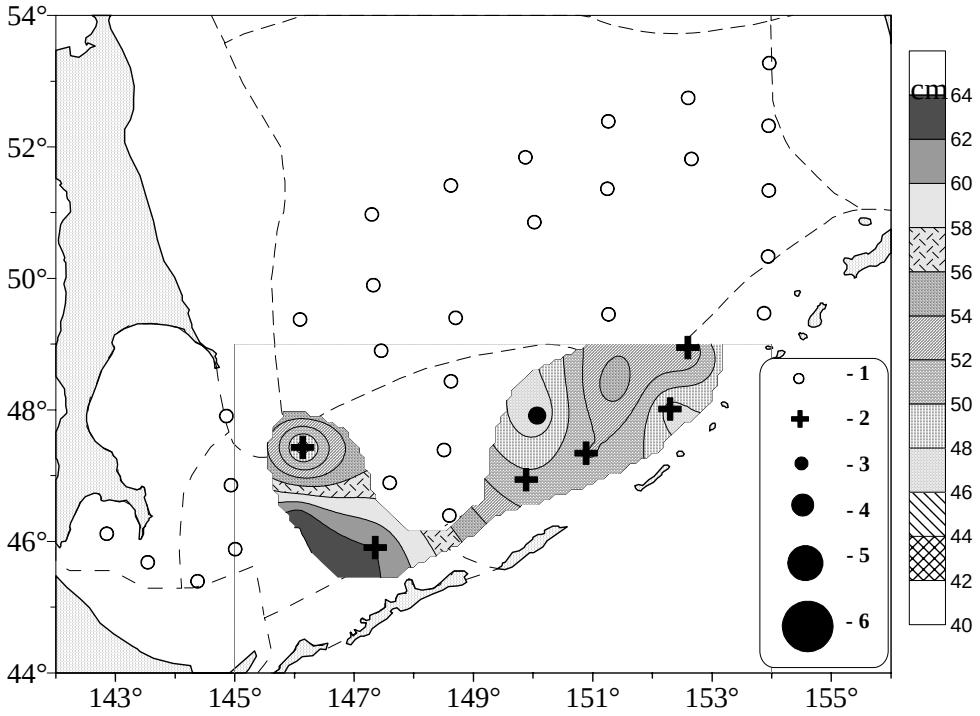

Fig. 5. Immature individuals of chum salmon, the second and third year foraging, and mature individuals in the southern part of the Sea of Okhotsk from October, 24 till November, 12, 2005. Graphical symbols: 1 – no catch; 2 - 1-10; 3 - 10-100; 4 - 100-500; 5 - 500-1000; 6 - more than 1000 specimen per hour of the trawling.

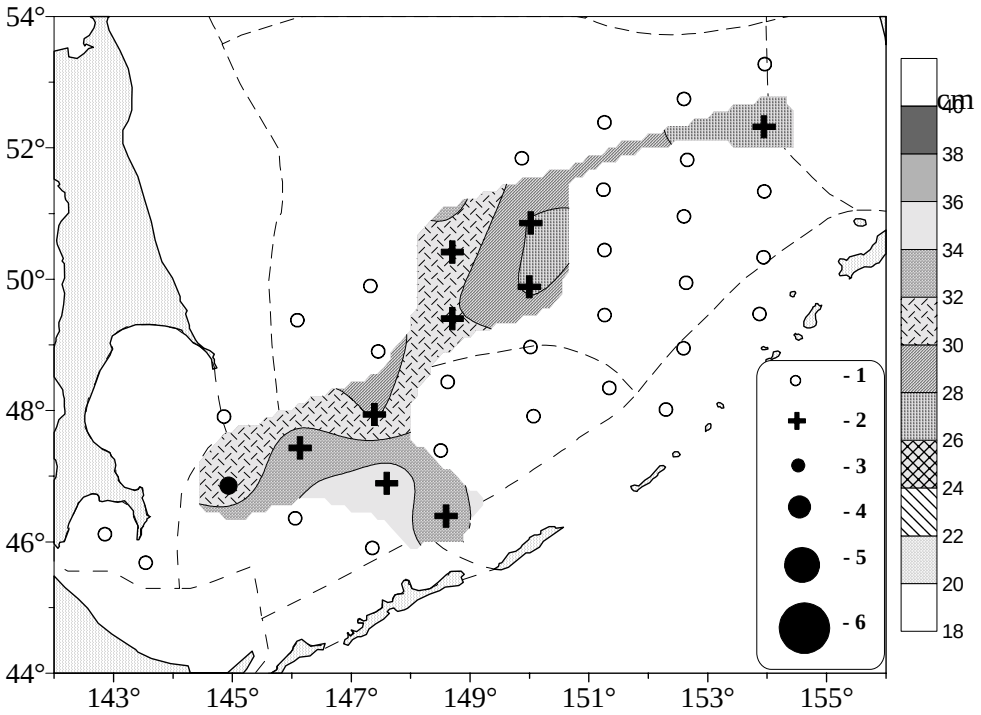

Fig. 6. Distribution of juvenile masu salmon catches in the southern part of the Sea of Okhotsk from October, 24 till November, 12, 2005. Graphical symbols: 1 – no catch; 2 - 1-10; 3 - 10-100; 4 - 100-500; 5 - 500-1000; 6 - more than 1000 specimen per hour of the trawling.

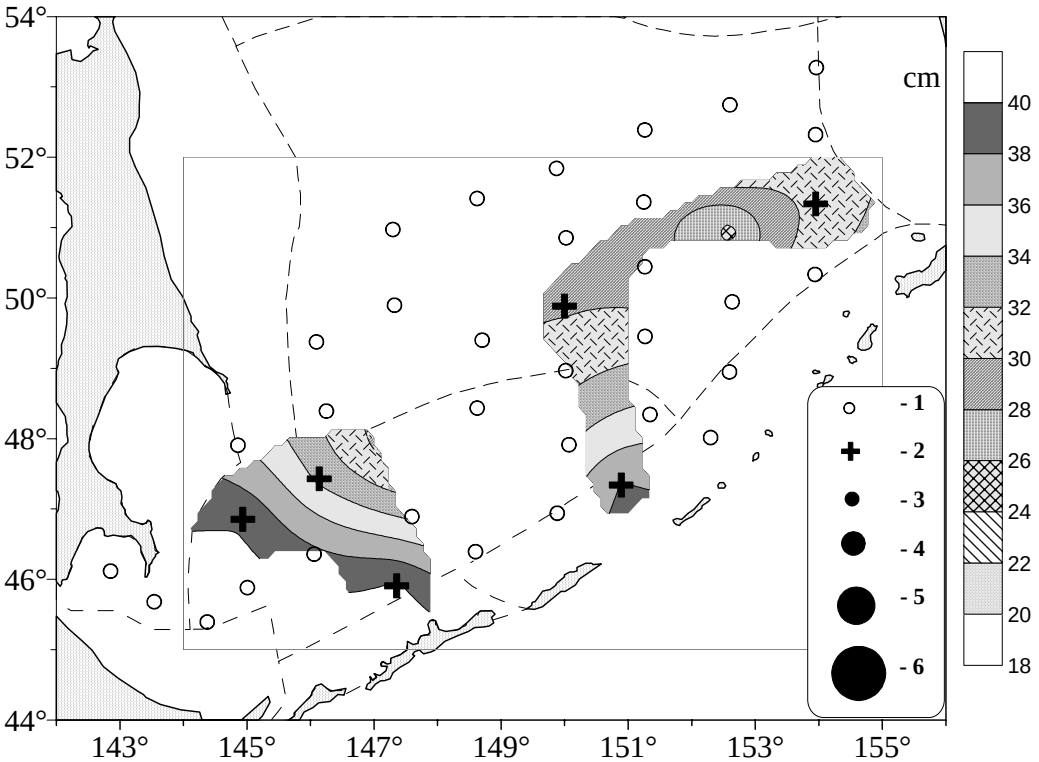

Fig. 7. Distribution of juvenile coho salmon catches in the southern part of the Sea of Okhotsk from October, 24 till November, 12, 2005. Graphical symbols: 1 – no catch; 2 - 1-10; 3 - 10-100; 4 - 100-500; 5 - 500-1000; 6 - more than 1000 specimen per hour of the trawling.

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