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Results marine research on the STR "Izyskatel-1" in 2002

by

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Abstract

The expedition of the STR «Izyskatel-1» has been undertaken in the period from May to July 2002. General purpose of the expedition was to study Pacific Salmon distribution and the character of local stock interactions in the area of migration and feeding in relation to stock abundance dynamics and environment conditions. The research has been carried out in the fishery area including Western-Bering zone - 61.01 (from 27 June to 2 July in the coordinates 54?41'-55?15' N and 170?05'-170?43' E), Karaginski subzone – 61.02.1 (from16 to 23 June in the coordinates 56?01'-56?54' N and 163?58'-169?09' E), Petropavlovsk-Kommander subzone – 61.02.2 (from 20 May to 13 June in the coordinates 52?50'-54?13' N and 163?34'-168?55' E; from 14 to 20 July in the coordinates 51?26'-51?31' N and 158?25'-163?00' E) and Kamchatka-Kuril subzone – 61.04.5 (from 5 to 13 July in the coordinates 50?37'-51?52' N and 154?50'-155?59' E). The research consisted of ichthyological and oceanographic observations. The data have got on distribution and biological characteristics of Pacific Salmon in the course of spring-summer prespawning migrations in south-west part of Bering Sea and adjacent Pacific Ocean waters in 2002. Sampling was carried out by driftnets with the mesh of 55-mm (110-mm according to the system accepted in Japan). 55 driftnet settings have been set. Total catch of Pacific Salmon included 4310 specimens (1617 sockeye salmon specimens, 1583 chum salmon specimens, 1097 pink salmon specimens, 2 chinook salmon and 11 coho salmon specimens). 2270 specimens were analysed.

Introduction

Regular for the second half of XX century marine studies carried out by KamchatNIRO provided better understanding of the basis factors determining the dynamic run of Pacific Salmon in the period of prespawning migrations in the south-west part of Bering Sea and adjacent waters of the Pacific Ocean. Results of the studies have been used for the purpose of short-term forecast in order to provide fisherman with current information on the strategy of fishery campaigns.

General purpose of the marine expedition work is to study Pacific Salmon distribution, stock abundance dynamics and local stock interactions within the area of migration and feeding.

The purposes of the expedition work implied:

1. To trace the dynamics of the Pacific Salmon run from the basis analysis of quantitative and qualitative composition of the drift net (55-mm mesh) catches;
2. To collect the data on the abundance, composition of species, biological parameters, age structure and feeding of salmons in the course of their pre-spawn migration;
3. To collect the data might be useful as identification criteria of origin of salmons from mixed marine catches (scale samples, tissue samples, otoliths, parasites occurring);
4. To make meteorological and hydrobiological observations for characterize environmental.

1. Material and methods

The expedition of the STR "Izyskatel-1" was carried out for the period from May 20 to July 20. The area of observations included: 1) Western-Bering zone – 61.01 (June 27 – July 2, restricted by 54?41'-55?15' N and 170?05'-170?43' E), 2) Karaginski subzone – 61.02.1 (June 16-23, restricted by 56?01'-56?54' N and 163?58'-169?09' E), 3) Petropavlovsk-Kommander subzone – 61.02.2 (May 20 – June 13, restricted by 52?50'-54?13' N and 163?34'-168?55' E;), Kamchatka-Kuril subzone (61.04.5, restricted by 51?21'-51?32' N and 154?50'-155?33' E) (Fig. 1).

1.1. Hydrological observations

Hydrological observations included making measurements of temperature and salinity in 200-n layer using STD-1000 (both parameters were measured with the step not less than 2 meters) before control net setting and after control net lifting. Moreover, standard registration of surface water temperature was set on the basis of sensor aboard. Total estimation of hydrological and meteorological conditions was carried out on the base of pentad and decade maps and daily diagrams of near-land atmosphere pressure.

1.2. Ichthyological research

Every day to set 20-30 control drift nets (55 mm mesh). The time of setting took 10 hours approximately. Catches were systematised by species, qualitatively and quantitatively. Every 5 days about 100 sockeye salmon, chum salmon and pink salmon individuals have been taken for analysis. Chinook salmon and coho salmon were analysed totally. Total catches of pacific salmon from control drift nets is represented in the Table 1.

Biological analysis consisted:

1) Fork length measuring (AC);

2) Gutted and none gutted fish weight measuring and gonad weight measuring. The weight of fish has been assessed with the accuracy up to 50 g, gonad weight – up to 1 g. Gonad-somatic index has been estimated as gonad weight diluted into none gutted fish weight and multiplied in 100;

3) Scale sampling according to standard method (Clutter, Whitesel, 1956; Knudsen,

Davis, 1985);

4) Otolith sampling in chum salmon and sockeye salmon (by 100 specimens for the expedition);

5) Stomach filling estimation on the basis of 5-ball scale and food composition estimation; the percentage of the components represented by large taxons (for example: euphausiids-50%, hiperiids-10%, squids (juvenile)-20%, myctophyds-15%, others-5%) has been estimated once a ten-day period for every Pacific Salmon species;

6) The number of immature fish assessed, i.e. of the fish that wouldn't spawn in current year. Maturity estimation has been carried out from gonad weight differentiation on the basis of histology (Ishida et al., 1961; Ito et al., 1974; Takagi, 1961);

7) The number of inquired fishes assessed with notification of the origin of the trauma;

8) The number of deceased fishes assessed with notification of their visible abnormalities, for example tumours, development abnormalities, ulcers, and parasites occurring.

Table 1. Total catch of pacific salmon from control drift nets, specimens.

Area	Species					Total
	Sockeye salmon	Chum salmon	Pink salmon	Chinook salmon	Coho salmon	
61.01	262	330	71	-	-	663
61.02.1	61	106	314	-	-	481
61.02.2	1243	755	188	1	7	2194
61.05.4	51	392	524	1	4	972
Total	1617	1583	1097	2	11	4310

Biological analysis was carried out on a part of the harvest. Special data for biochemical studies (muscles and gonads for histological studies) and samples of egg (for fecundity estimation) were collected. All sample sizes are represented in the Table 2.

Table 2. Total size collected of biological materials, specimens.

Species	Biological analysis	Otoliths	? ??????	Biochemical samples	Samples of egg
Sockeye salmon	878	100	99	15	33
Chum salmon	848	100	112	15	41
Pink salmon	531	-	93	-	19
Chinook salmon	2	-	22	-	-
Coho salmon	11	-	10	-	-
Total	2270	200	336	30	93

In the period of the expedition of STR “Izyskatel-1” within Petropavlovsk-Kommander subzone to made two standard ichthyological surveys (1 - July 11-15, 51-53? N 158-161?E; 2 - July 16-20, four stations by 51?30’ N and 158?30’, 160?00’, 161?30’, 163?00’ E).

2. Results and discussion

Generally, the results of studies obtained by STR “Izyskatel-1” due to expedition time limitation were fragmental and could not give complete insight to all areas of observation, being the expedition just a part of annual complex research activity of KamchatNIRO. Therefor for the purposes of more information support some data have been represented they being from “Izyskatel-1” only or generalised on scientific fleet in total in this part.

2.1. Hydrological observations

2.1.1. Surface water temperature distribution on the from all vessels

Synoptic situation in North Pacific it is a factor determining development of hydrological conditions within the south-west part of Bering Sea and adjacent waters of Pacific Ocean. Hydrological situation in the area of observation has been mostly determined by meteorological conditions of both previous and current seasons. In 2002 hydrological situation in spring-summer period in the area of drifting fleet activity could be reckoned as relatively warm (Fig. 2). It has been clear that in south-east part of Bering Sea in May surface water temperature distribution varied in range 1.8-2.6?C. In June and July significant surface warming 3.0-5.0?C and 7.0-9.0?C respectively has been obvious. In adjacent waters of the north-west part of Pacific Ocean the temperature has got some higher. In May surface water temperature varied in range 3.0-3.8?C, than in June it has been growing up to 4.0-6.0?C. In July the temperature in the south-west part of Bering Sea has got 7.0-9.0?C.

2.1.2. Surface water temperature dynamics on the data by STR “Izyskatel-1”

Observations for the surface water temperature dynamics have been carried out by STR “Izyskatel-1” in during of the working period (Table 3).

Table 3. Surface water temperature dynamics in the area of studies

Month	Period					
	1-5	6-10	11-15	16-20	21-25	26-30
Petropavlovsk-Kommander subzone – 61.02.2						
May	-	-	-	2.9	3.4	3.4
June	3.4	4.5	4.0	-	5.1	-
July	-	-	7.6	9.2	-	-
Karaginski subzone – 61.02.1						
June	-	-	-	3.6	4.5	-
July	-	-	-	-	8.9	-
Western-Bering zone – 61.01						
June	-	-	-	-	-	6.1
July	6.9	-	-	-	-	-
Kamchatka-Kuril subzone – 61.05.4						
July	6.9	7.6	8.7	-	-	-

Results of the observations for the surface water temperature dynamics in the area of this scientific vessel activity actually were not different from the data obtained in all the fleet expedition. For the working period in Petropavlovsk-Kommander subzone surface water temperature varied in range 2.9-9.2?C. For the second half of May the temperature was about 3.3?C (2.9-3.6?C). By the first half of June the surface water has been warming intensively. Surface water temperature for this time in average was 4.0?C (2.7-5.1?C). In July in the course of further warming the temperature has got maximum 8.4?C (7.2-9.4?C). In this area the dynamics of water surface temperature during the expedition of STR "Izyskatel-1" has been represented in maximum range. In the other areas all hydrological observations were fragmental due to the expedition time limitation. In Karaginski subzone surface water temperature in June was 4.1?C (3.0-4.7?C). In West-Bering Sea zone in late June and early July water temperature was higher – 6.3?C approximately (5.7-6.9?C). In Kamchatka-Kuril subzone the most high for the period of observations in a whole water temperature was in July which in average was 7.9?C (6.9-11.0?C).

2.2. Ichthyological studies

2.2.1. Distribution of the Pacific Salmon from the data of all vessels

Sockeye salmon. It species of Pacific Salmon dominated in the catches in during of the period of research. In 2002 general dynamics of sockeye salmon prespawning migration in south-west part of Bering Sea and adjacent waters of Pacific Ocean was typical for the periods

when Ozernaya River sockeye salmon stock (West Kamchatka) has got abundant and Kamchatka River sockeye salmon stock (East Kamchatka) has got poor (Fig. 3). Similar situation was observed in 2001 (Bugaev A., Shaporev, 2002). Taking into account that Asian stock of this species consists almost in 80% of these stocks (Bugaev, 1995) the abundance of preanadromous conglomerations in the sea is expected to be determined by the abundance of these two stocks. Main peculiarity of the relation is the fact that sockeye salmon catches by second half of May northward from 53? latitude and westward from 165? longitude have were poor. The data represented demonstrate that in this period principal conglomerations have been concentrated within Petropavlovsk-Kommander subzone where sockeye salmon frequency has been 2.0-3.0 specimens per a net. Usually the situation like this appears when drifters harvest mostly Ozernaya River prespawning conglomerations which have been approaching the shore approximately one month later. Further development of migration processes in June and July confirms the suggestion. Principal conglomerations of sockeye salmon have been removed to the south-east coast of Kamchatka by extensive front. Local catches have been growing gradually up to 2.5-4.5 fish/tan. In June sockeye salmon concentration in the cores of the conglomerations has got maximum 5.0-11.0 fish/tan. In this period West Kamchatkan stocks to go in the Okhotsk Sea extensively. To this moment sockeye salmon prespawning migrations in the south-west part of Bering Sea have been almost finished. Remembering that in this area in a respect to scale criteria identification the contribution of East Kamchatkan stocks takes 90% in the catches (Bugaev A., 203) this is expected because majority adult of sockeye salmon from the east and north-east of Kamchatka have reached their spawning grounds in the rivers. Some increase of the catches relates, as a rule, to increased number of immature fish. Thus, 2002 should be characterised as abundant sockeye salmon year with dominating West Kamchatkan stocks.

Chum salmon. For the period of the expedition chum salmon frequency similar to sockeye salmon frequency in the catches demonstrated extensive variations (Fig. 4). In May the catches of chum salmon were poor: 0.4-0.8 fish/tan in the south-west part of Bering Sea and 0.8-1.6 fish/tan in adjacent waters of Pacific Ocean. Moreover CPUE in the south-west part of Petropavlovsk-Kommander subzone was some higher being compared to that throughout all the rest square of the subzone. That probably relates to North Okhotsk Sea stocks, migrating to the North Kuril Islands, the stocks according enzyme markers identification (Varnavskaya et al., 1999) being dominant for this period of prespawning migrations within economic zone of Russia. In June concentration of these stocks increases in the adjacent waters of south-eastern Kamchatka. For this time the catches in the core of principal aggregation varies in range 2-5 fish/tan. That probably has been formed at the expense of both East Kamchatkan and West

Kamchatkan chum salmon. Bering Sea component of the anadromous front has been less saturated – average frequency is 1 fish/tan approximately. In July some growth of the catches in the south-west part of Bering Sea appears – up to 1.5-3.5 fish/tan. In Petropavlovsk-Kommander subzone principal aggregation demonstrates clear bifurcation in northern and southern components. Northern component is poor – 12.5-2.5 fish/tan. Southern component demonstrates the frequency 3.5-5.5fish/tan. It is mostly evident that the northern component is represented by the East Kamchatkan chum salmon stocks, while the West Kamchtkan stocks representing the southern component. In a whole for the period of the expedition chum salmon catches were high to reckon 2002 as abundant.

Pink salmon. Pink salmon migration dynamics in the waters adjacent to Kamchatka relates directly to abundant generation in even or in odd years (Birman, 1985; Shuntov, 1994). In 2002 West Kamchatkan generation was domain. Therefore the dynamic catches of pink salmon demonstrated characteristic traits (Fig. 5). In May pink salmon can be met singularly 0.04-0.12 fish/tan. In June CPUE in the south-west part of Bering Sea has been growing up to 1-3 fish/tan what relates to poor runs in even years to the North-East Kamchatka. In July West Kamchatkan pink salmon to accomplished massive migration to the North Kuril Islands for further migration in the Okhotsk Sea. At this time the frequency varies in range 4-8 fish/tan. It should be noted that in 2002 the abundance of West Kamchatkan pink salmon was evidently less being compared to that in 1998 and 2000. Thus CPUE was not high. Moreover, weight migration of this species in vicinity of North Kurils longs in August when the fleet has totally finished activity. Therefore a part of prespawning migration has been omitted from observation. Nevertheless, from the catches in July in 2002 and previous years, in 2002 the abundance of West Kamchatkan pink salmon was relatively poor.

Chinook salmon. Frequency of chinook salmon in the catches in the south-west part of Bering Sea and adjacent waters of Pacific Ocean demonstrates poor interannual variations due to relatively low abundance of Asian chinook salmon stocks. In May in all zones the catches vary in range 0.01-0.03 fish/tan (Fig. 6). In June chinook salmon concentration in Kamchatsky Bay – in range 0.06-0.10 fish/net, what is quite reasonable because the most abundant chinook salmon stock in Asia reproduces in Kamchatka River. In July two conglomerations have been formed by 0.02-0.04 fish/tan. One aggregation is situated in vicinity of North Kuril Islands, another one – in the east part of Petropavlovsk-Kommander subzone. Probably first conglomeration consisted mostly of West Kamchatkan chinook salmon. That has been confirmed by previous results of local chinook salmon stock identification from scale criteria which indicated that in the Pacific subzone – 61.03.1 (North-Kuril zone – 61.03) this complex of stocks contributed approximately

70% in drift catches. Most probably another aggregation mostly has been formed at the expense of immature fish. In general chinook salmon distribution in 2002 is similar to average distribution for many years typical for Asian part of the areal of this species. In Kamchatsky Bay, nevertheless, CPUE registrated were less being compared to average ones what indicates of relatively high abundance of Kamchatka River stock.

Coho salmon. Among Asian Pacific Salmon this species, similar to chinook salmon, is less abundant. Therefore frequency in catch of coho salmon is extremely low frequent in the catches. Moreover, late summer as principal time of migration to the rivers influences coho salmon distribution in the course of prespawning migrations. In 2002 first cases of coho salmon catching were registrated only in July (Fig. 7). Visible conglomeration has been formed around North Kurils – 0.2-1.8 fish/tan. Most probably, if to estimate from regional stock abundance assessments of this species in Asia (Radchenko, Glebov, 2000), in this zone the stocks, reproducing throughout the west coast of Kamchatka and north part of the Okhotsk Sea, have been dominating. It should be noted that in 2002 the frequency of coho salmon within the south part of Karaginskaya subzone and north-west part of Petropavlovsk-Kommander subzone was less being compared to average annual level – less than 0.2 fish/tan. This fact indicates of decreasing abundance of largest Asian stock – Kamchatka River stock. Abundance of West Kamchatkan stocks is found relatively high from the catches.

2.2.2. Dynamics of catches and biological features of Pacific Salmon from the data of STR "Izyskatel-1"

Three Pacific Salmon species dominated in the catches of STR "Izyskatel-1": sockeye salmon, chum salmon and pink salmon, they being dominant in the abundance in Asia. Chinook salmon and coho salmon in the catches were single instance. Therefore in this part we have analyzed the dynamics of the catches and biological parameters of three weight species mentioned only which sample sized were representative (Table 4-6).

Petropavlovsk-Kommander subzone – 61.02.2. As it was noted the work was accomplished in two steps. The first step was from May 20 to June 13, next one – for July 14-20. For the period mentioned the data which we represented in our report have been the most complete. In May-June the area of observation was restricted within 52?50'-54?13' N and 163?34'-168?55'E. In the east part of Petropavlovsk-Kommander subzone 11 driftnets have been accomplished (eastward from 165? latitude). The rest 9 driftnets were made in the west part of the subzone. In July the work was carried out in the south-west part of the subzone within

51?26'-51?31'N and 158?24'-163?00'E. There were 4 driftnets were set there.

Sockeye salmon. Daily dynamics of sockeye salmon catches observed for the second half of May demonstrated average CPUE of 2.38 fish/tan (1.20-4.25 fish/tan). Percent expression of the frequency was 57% (31-71%) in total control catch of Pacific Salmon. In the first half of June sockeye salmon frequency in the catches has been growing insufficiently in average up to 2.6 fish/tan (1.20-6.15 fish/tan). In the same time the percent in the catches has been decreased at the expense of chum salmon came. Sockeye salmon percent in the catches for this period has been about 55 (10-57). In July the catches were maximum high, 6.18 fish/tan in average (3.90-10.50 fish/tan) what in the percent expression was 57 (43-79).

For the second half of May and first half of June males dominated in the catches, in average their contribution was 63% (44-90%). Main biological parameters measured were: male length – 56.8 cm (54.6-59.0 cm), female length – 55.3 cm (54.2-56.7 cm); male weight – 2.55 kg (2.25-2.86 kg), female weight – 2.30 kg (2.14-2.55 kg); male GSI – 0.90 (0.46-1.80), female GSI – 3.87 (2.94-5.00); male feeding intensity – 2.16 balls(0-4 balls), female feeding intensity – 2.21 balls (0-4 balls); immature males – 0%, immature females – 0%. In July the percent of males has been decreased to 44 (24-60). The parameters measured have been: male length –55.7 cm (52.9-59.7 cm), female length – 56.7 cm (56.0-57.7 cm); male weight – 2.54 kg (2.13-3.28 kg), female weight – 2.69 kg (2.55-2.90 kg); male GSI – 1.60 (1.11-2.51), female GSI – 3.77 (3.06-4.90); male feeding intensity – 1.34 balls(0-3 balls), female feeding intensity – 1.46 balls (0-4 balls); immature males – 22%, immature females – 4%.

Chum salmon. Chum salmon frequency in the catches, as well as sockeye salmon frequency, was quite high. In the second half of May chum salmon frequency was 1.55 fish/tan in average (0.65-3.65 fish/tan). In percent expression it was 43% (29-69%). In the first half of June the frequency has been decreased to 1.44 fish/tan (0.30-2.95 fish/tan), what has 31% (10-57%). In July chum salmon frequency reached the maximum of 2.83 fish/tan (1.60-5.00 fish/tan), also the percent has been reduced to 27 (12-41).

For May-June the percent of males in the catches was about 50 (39-80). Biological parameters measured were: male length – 59.3 cm (57.6-62.6 cm), female length – 57.5 cm (56.3-59.7 cm); male weight – 2.70 kg (2.39-3.45 kg), female weight – 2.38 kg (2.12-2.85 kg); male GSI – 0.75 (0.43-1.41), female GSI – 2.54 (2.03-3.07); male feeding intensity – 2.12 balls(0-4 balls), female feeding intensity – 2.23 balls (0-4 balls); immature males – 8%, immature females – 7%. In July the percent of males has been decreased to 40 in average (24-56). The parameters measured have been: male length –58.5 cm (56.2-60.8 cm), female length – 58.3 cm (53.1-60.4 cm); male weight – 2.84 kg (2.33-3.22 kg), female weight – 2.77 kg (1.92-

3.26 kg); male GSI – 1.79 (1.35-2.16), female GSI – 4.47 (1.21-5.89); male feeding intensity – 1.88 balls(0-4 balls), female feeding intensity – 2.12 balls (0-4 balls); immature males – 33%, immature females – 14%.

Pink salmon. Pink salmon in the control catches has been met by singles since early June. In this time the frequency was 0.79 fish/tan in average (0.35-1.55 fish/tan) or 17% (7-30%). In mid July the frequency reached 1.55 fish/tan (0.30-3.40 fish/tan). In the percent expression it was 14 (4-23).

For the first step of work the percent of males in the catches was about 76 (67-100). Biological parameters measured were: male length – 46.4 cm (45.9-47.5 cm), female length – 44.2 cm (43.4-45.3 cm); male weight – 1.20 kg (1.15-1.32 kg), female weight – 1.03 kg (0.93-1.15 kg); male GSI – 2.66 (1.48-3.27), female GSI – 6.88 (6.28-8.38); male feeding intensity – 2.01 balls(0-4 balls), female feeding intensity – 2.14 balls (0-4 balls); immature males – 0%, immature females – 0%. In July the percent of males has been at the same level of 76% (60-100%). The parameters measured have been: male length –48.3 cm (47.7-49.3 cm), female length – 47.1 cm (46.0-50.5 cm); male weight – 1.52 kg (1.26-1.72 kg), female weight – 1.22 kg (1.01-1.46 kg); male GSI – 5.67 (4.91-6.43), female GSI – 9.38 (7.16-10.14); male feeding intensity – 1.48 balls (0-4 balls), female feeding intensity – 1.73 balls (0-3 balls); immature males – 0%, immature females – 0%.

Karaginski subzone – 61.02.1. In this subzone the work has been accomplished from 16.06 to 23.06. The area of observations was restricted within 56?01'-56?54' N and 163?58'-169?09'E. In total there were 7 driftnets set.

Sockeye salmon. For the period studied sockeye salmon catches were low - 0.59 fish/tan (0.20-1.05 fish/tan). Percent expression of the frequency was 12% (4-28%). For the period the percent of males was relatively low - 27% in average (44-90%). Main biological parameters measured were: male length – 57.9 cm (53.5-62.4 cm), female length – 56.8 cm (56.0-57.6 cm); male weight – 2.73 kg (2.07-3.44 kg), female weight – 2.45 kg (2.27-2.55 kg); male GSI – 2.68 (1.98-3.51), female GSI – 7.10 (5.80-9.25); male feeding intensity – 2.95 balls(1-4 balls), female feeding intensity – 2.41 balls (0-4 balls); immature males – 0%, immature females – 0%.

Chum salmon. Chum salmon frequency in the control catches in Karaginski subzone was higher being compared to sockeye salmon one. For the period of observation the frequency was 1.13 fish/tan in average (0.60-2.00 fish/tan). In percent expression it was 22% (12-40%). For the period mentioned the percent of males in the catches was about 58 (47-75). Biological parameters measured were: male length – 60.4cm (58.4-62.3 cm), female length – 59.2 cm (56.4-63.0 cm); male weight – 2.93 kg (2.75-3.15 kg), female weight – 2.71 kg (2.50-3.32 kg); male

GSI – 0.85 (0.74-0.95), female GSI – 2.57 (1.68-3.67); male feeding intensity – 2.77 balls(1-4 balls), female feeding intensity – 2.58 balls (1-4 balls); immature males – 17%, immature females – 26%.

Pink salmon. This species in Karaginski subzone was dominating in the catches. For the period of observations pink salmon frequency was 4.59 fish/tan in average (1.30-12.20 fish/tan). In percent expression it was 66% (41-87%). For the first step of work the percent of males in the catches was about 58 (56-60). Biological parameters measured were: male length – 46.9 cm (46.1-47.8 cm), female length – 45.5 cm (45.1-45.7 cm); male weight – 1.24 kg (1.20-1.30 kg), female weight – 1.09 kg (1.02-1.15 kg); male GSI – 3.92 (3.53-4.44), female GSI – 8.58 (7.78-9.16); male feeding intensity – 2.75 balls(0-4 balls), female feeding intensity – 2.29 balls (0-4 balls); immature males – 0%, immature females – 0%.

West-Bering zone – 61.01. In this zone the work was carried out from 26.06 to 2.07. The area of observations was restricted within 54?41'-55?15' N and 170?05'-170?43'E. In total there were 5 driftnets set up.

Sockeye salmon. For the period of the work within West-Bering zone sockeye salmon catches were higher being compared to those within Karaginski subzone - 1.45 fish/tan (0.95-2.70 fish/tan). Percent expression of the frequency was 23% (15-36%).

For the period the percent of males was relatively high - 57% in average (47-64%). Main biological parameters measured were: male length – 53.2 cm (50.6-54.9 cm), female length – 54.5 cm (52.2-58.3 cm); male weight – 2.07 kg (1.66-2.58 kg), female weight – 2.31 kg (1.74-3.19 kg); male GSI – 0.48 (0.33-0.79), female GSI – 2.69 (1.85-3.54); male feeding intensity – 1.46 balls(0-4 balls), female feeding intensity – 1.93 balls (0-4 balls); immature males – 68%, immature females – 50%.

Chum salmon. Chum salmon frequency in the control catches in West-Bering zone was higher being compared to sockeye salmon one. For the period of observation the frequency was 3.97 fish/tan in average (2.75-6.70 fish/tan). In percent expression it was 62% (58-71%). For the period mentioned the percent of males in the catches was relatively low - about 41% (32-54%). Biological parameters measured were: male length – 55.6cm (54.0-58.7 cm), female length – 55.2 cm (52.3-57.4 cm); male weight – 2.19 kg (1.98-2.57 kg), female weight – 2.17 kg (1.91-2.36 kg); male GSI – 0.54 (0.34-0.93), female GSI – 2.45 (1.88-3.39); male feeding intensity – 1.82 balls (0-4 balls), female feeding intensity – 1.99 balls (0-4 balls); immature males – 63%, immature females – 49%.

Pink salmon. This species in West-Bering zone was third in frequency after chum salmon and sockeye salmon. For the period of observations pink salmon frequency was 0.85 fish/tan in

average (0.40-1.40 fish/tan). In percent expression it was 14% (5-21%). For the first step of work the percent of males in the catches was about 44 (36-62). Biological parameters measured were: male length – 47.9 cm (47.4-49.0 cm), female length – 46.6 cm (46.0-47.1 cm); male weight – 1.40 kg (1.23-1.59 kg), female weight – 1.23 kg (1.12-1.37 kg); male GSI – 5.01 (4.55-5.49), female GSI – 9.11 (8.49-9.65); male feeding intensity – 2.14 balls(0-4 balls), female feeding intensity – 1.95 balls (0-4 balls); immature males – 0%, immature females – 0%.

Kamchatka-Kuril subzone – 61.05.4. In this zone the work was carried out from 5.07 to 13.07. The area of observations was restricted within 50?37'-51?52' N and 154?50'-155?59'E. In total there were 8 driftnets set up.

Sockeye salmon. In Kamchatka-Kuril subzone sockeye salmon catches were very low for this area – in average 0.90 fish/tan (0.37-1.40 fish/tan). Percent expression of the frequency was 6% (3-10%). For the period the percent of males varied extensively being in average about 50% (17-58%). Main biological parameters measured were: male length – 55.1 cm (48.0-55.9 cm), female length – 54.7 cm (53.6-57.0 cm); male weight – 2.36 kg (1.20-2.49 kg), female weight – 2.22 kg (2.08-2.47 kg); male GSI – 2.63 (2.21-3.92), female GSI – 5.48 (4.66-7.97); male feeding intensity – 1.14 balls(0-3 balls), female feeding intensity – 1.09 balls (0-4 balls); immature males – 0%, immature females – 0%.

Chum salmon. Chum salmon frequency in the control catches in Kamchatka-Kuril subzone was relatively high – about 6.11 fish/tan (1.40-12.00 fish/tan). In percent expression it was 38% (7-80%). The dynamics of catches was unstable.

For the period mentioned the percent of males in the catches was relatively low - about 41% (32-46%). Biological parameters measured were: male length – 59.5cm (56.6-61.9 cm), female length – 58.8 cm (56.9-60.2 cm); male weight – 3.08 kg (2.46-3.47 kg), female weight – 2.86 kg (2.55-3.05 kg); male GSI – 1.83 (0.98-2.80), female GSI – 4.19 (3.42-5.36); male feeding intensity – 1.40 balls(0-3 balls), female feeding intensity – 1.29 balls (0-4 balls); immature males – 6%, immature females – 1%.

Pink salmon. For the period of work within Kamchatka-Kuril subzone the catches of pink salmon were maximum high, the catches being unstable similar to the dynamics in chum salmon catches. For this period pink salmon frequency was 11.89 fish/tan in average (2.30-32.20 fish/tan). In percent expression it was 56% (16-89%). The percent of males in the catches was high, about 72 (66-78). Biological parameters measured were: male length – 49.8 cm (49.0-50.5 cm), female length – 48.2 cm (47.0-48.7 cm); male weight – 1.79 kg (1.61-1.87 kg), female weight – 1.59 kg (1.41-1.63 kg); male GSI – 3.24 (3.00-3.63), female GSI – 6.54 (6.04-8.87); male feeding intensity – 1.04 balls(0-4 balls), female feeding intensity – 0.79 balls (0-3 balls);

immature males – 0%, immature females – 0%.

Conclusions

Results of observations of hydrological dynamics in 2002 indicated that this year can be reckoned as relatively "warm". Dynamics of spring-summer prespawning migrations of sockeye and chum salmons was similar to that in 2001. In both cases relatively high catches were typical what indicates of principally normal state of Asian stocks of these species. On the migration dynamics of Kamchatkan pink salmon in this year it should be noted that the dynamics answered the logic of stock abundance fluctuations in even and odd generations. From this logic principal spawning stock was in west coast of Kamchatka. The catches of chinook and coho salmon in the course of expedition were low. Nevertheless, from the character of distribution of these species it is clear that the abundance of these species in Kamchatka River has been changed, an increase and a decrease have been registrated respectively for chinook salmon and coho salmon. The dynamics of drift catches observed in "Izyskatel-1" rather confirms the conclusion above.

Within Petropavlovsk-Kommander subzone the research was carried out in two steps. First step was accomplished for the period 20.05-14.06, second step – for the period 14.07-20.07. In the course of all the time sockeye and chum salmon dominated in the catches. In May and June sockeye salmon frequency in control nets in average took 2.49 fish/tan what was 56%. Chum salmon took second place in harvesting. For the time mentioned chum salmon catches in average took 1.61 fish/tan or 37%. Pink salmon during the first step of the research was met individually - 0.79fish/tan or 17%. In July sockeye salmon was rather dominating in control catches. Sockeye salmon frequency was 6.18 fish/tan. Although the percent almost was not changed – 57%. Chum salmon frequency for the period was 2.83 fish/tan in average, what was 27%. Pink salmon frequency have been increased up to 1.55 fish/tan , also the percent has been reduced to 14%. Chinook salmon and coho salmon in Petropavlovsk-Kommander subzone were met individually.

The research period within Karaginski subzone was from 16.06 to 23.06, therefore a complete analysis of the dynamics of anadromous migrations in this subzone is impossible. Chum salmon and pink salmon dominated – in average the frequencies were 1.13 and 4.59 fish/tan respectively. The frequency of these species varied in wide range. The percent of these species was 22 and 66% respectively. Sockeye salmon frequency was less, 0.59 fish/tan in average or 12%. Neither chinook salmon nor coho salmon were met in the catches.

The research period within Kamchatka-Kuril subzone was from 27.06 to 2.07, i.e. the

observation was fragmental like within Karaginski subzone. Chum salmon and sockeye salmon dominated in the catches – 3.97 and 1.45 fish/tan respectively. In the percent expression that was 62 and 23. Pink salmon was met in the catches less frequent. In average pink salmon frequency was 0.85 fish/tan or 14%. Neither chinook salmon nor coho salmon were met in the catches.

Within Kamchatka-Kuril subzone the period of research was from 5.07 to 13.07, i.e. when migrating the west Kamchatkan Pacific Salmon to this subzone. Pink salmon catches were most high being compared to those of other species – 11.89 fish/tan or 56%. Moreover, it should be noted that pink salmon size-weight characteristics in 2002 were highest for recent 10 years. Next frequent in control catches was chum salmon – about 6.11 fish/tan or 38%. Sockeye salmon frequency for this time was relatively low – 0.90 fish/tan or 6% what indicated of a delay in the course of migration of West Kamchatkan stocks through Kuril straits. The delays like this are typical for the years of high sockeye salmon abundance in Ozernaya River (Bugaev A., 2002). Chinook salmon and coho salmon were met single.

Instant data obtained from the expedition of "Izyskayel-1"on dynamics of pre-spawn migrations of the Pacific Salmon within Russian economic zone were a part of general monitoring of anadromous migration of West and East Kamchatkan stocks to the rivers. Every day data on the dynamics of fishery, biological and hydrological parameters estimated being generalised with the data from the other vessels provided an assessment of the start and the strength of the weight run of the most valuable of Pacific Salmon species.

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Appendix tables and figures

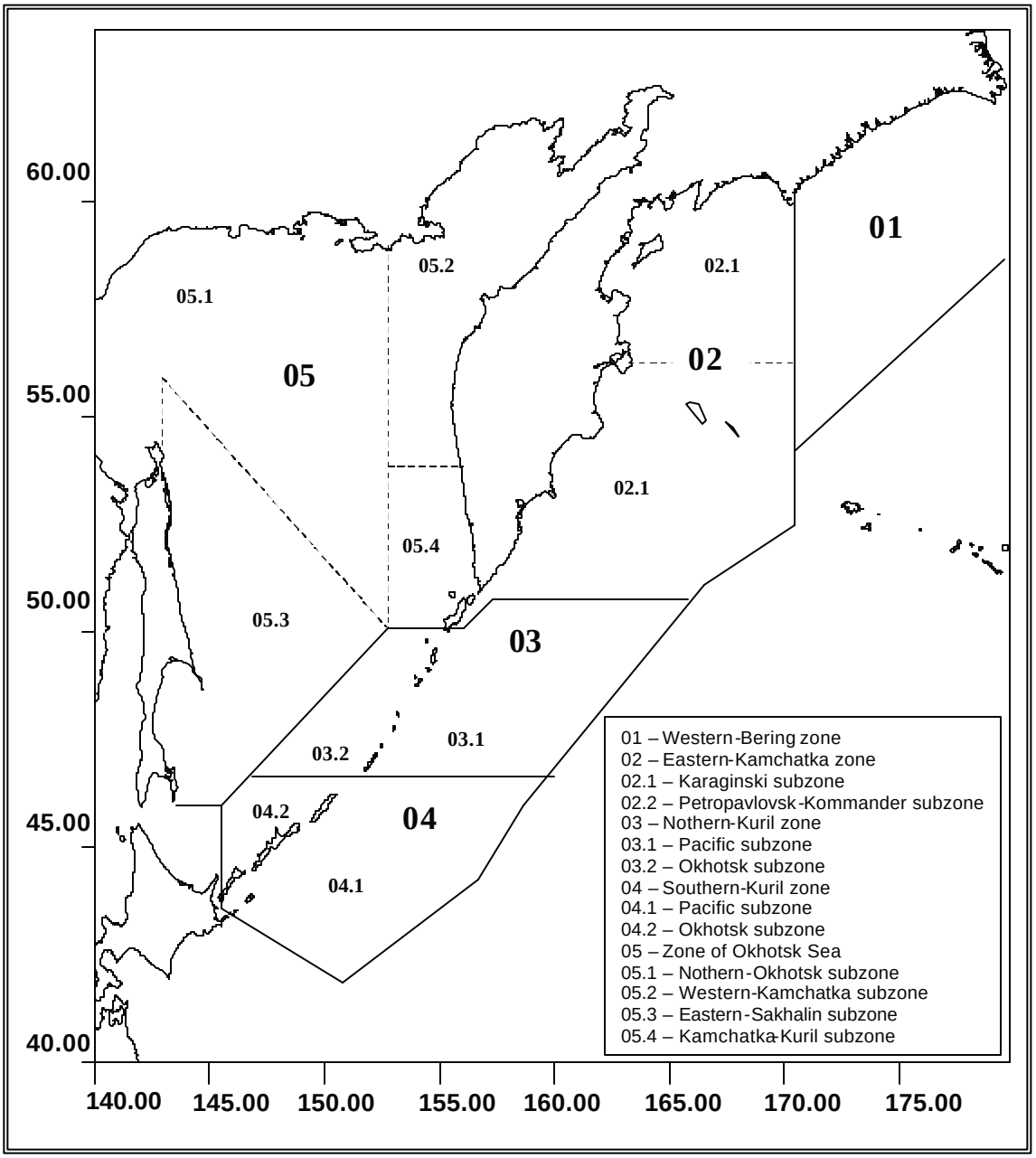

Figure 1. The scheme of fishery zones within Economic Zone of Russia (region .61).

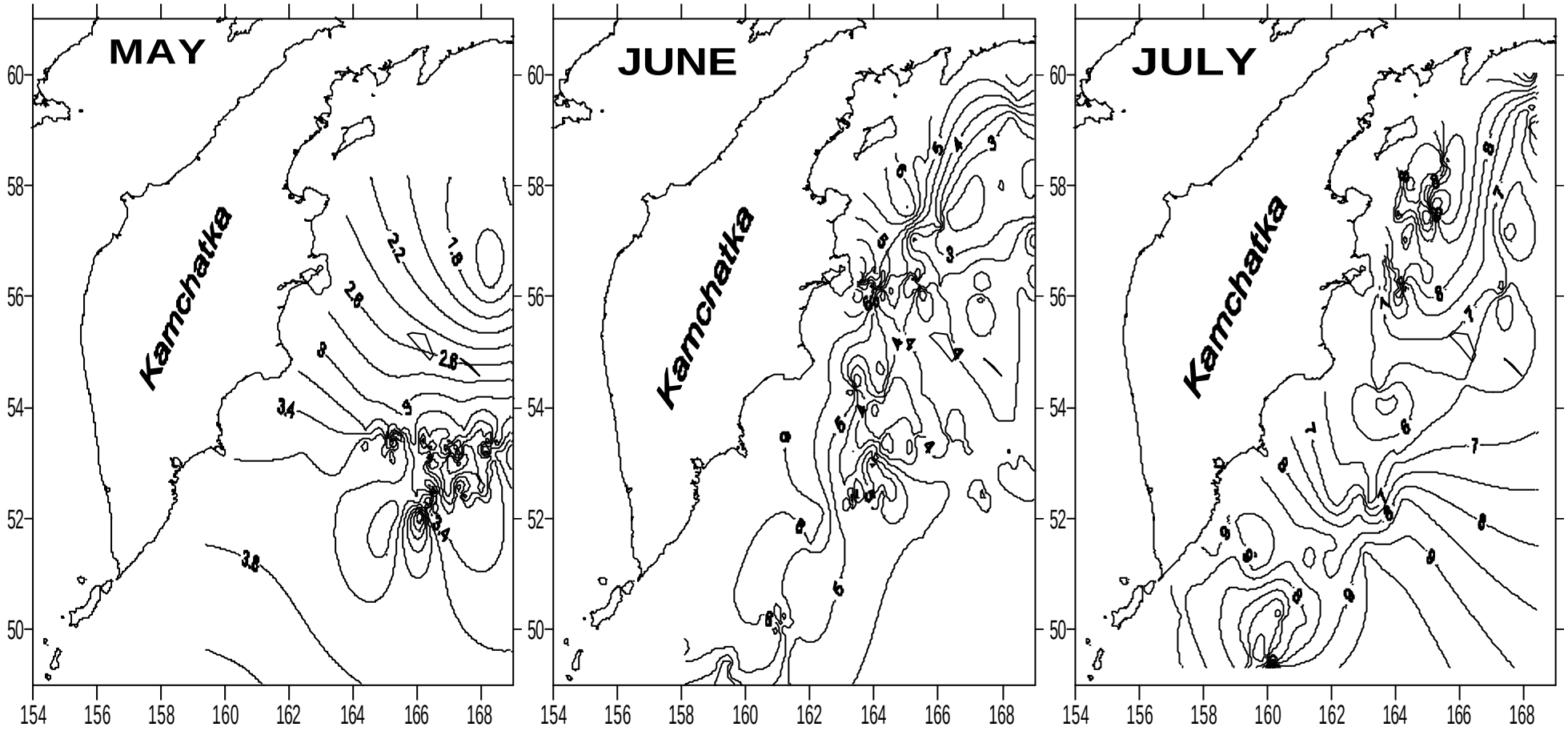

Figure 2. Distribution of water surface temperature on the data of all drift net vessels worked on the program of KamchatNIRO within south-west part of Bering Sea and adjacent waters of Pacific Ocean in 2002

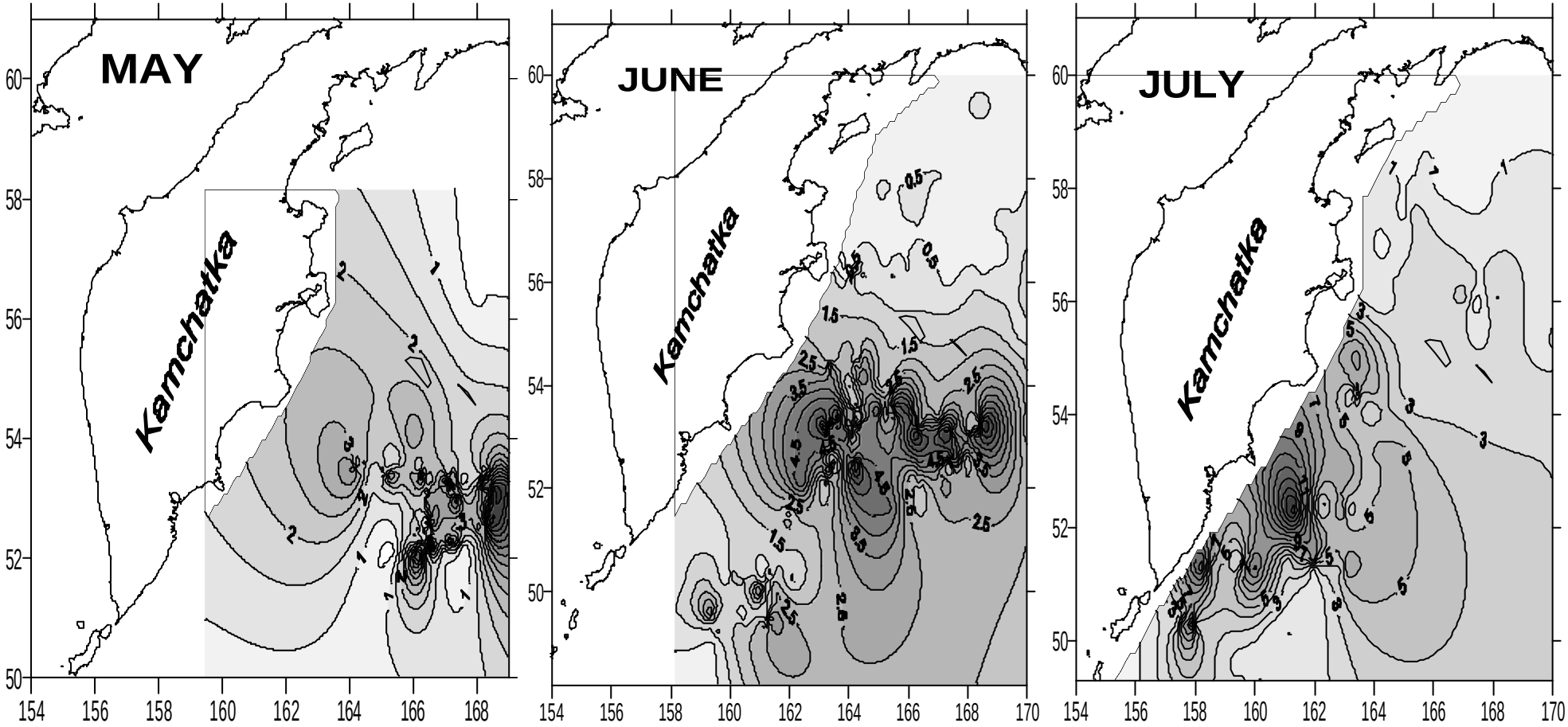

Figure 3. Sockeye salmon distribution (CPUE, fish/tan) on the data of control catches (55mm mesh) of all drift net vessels, worked on the program of KamchatNIRO within south-west part of Bering Sea and adjacent waters of Pacific Ocean in 2002

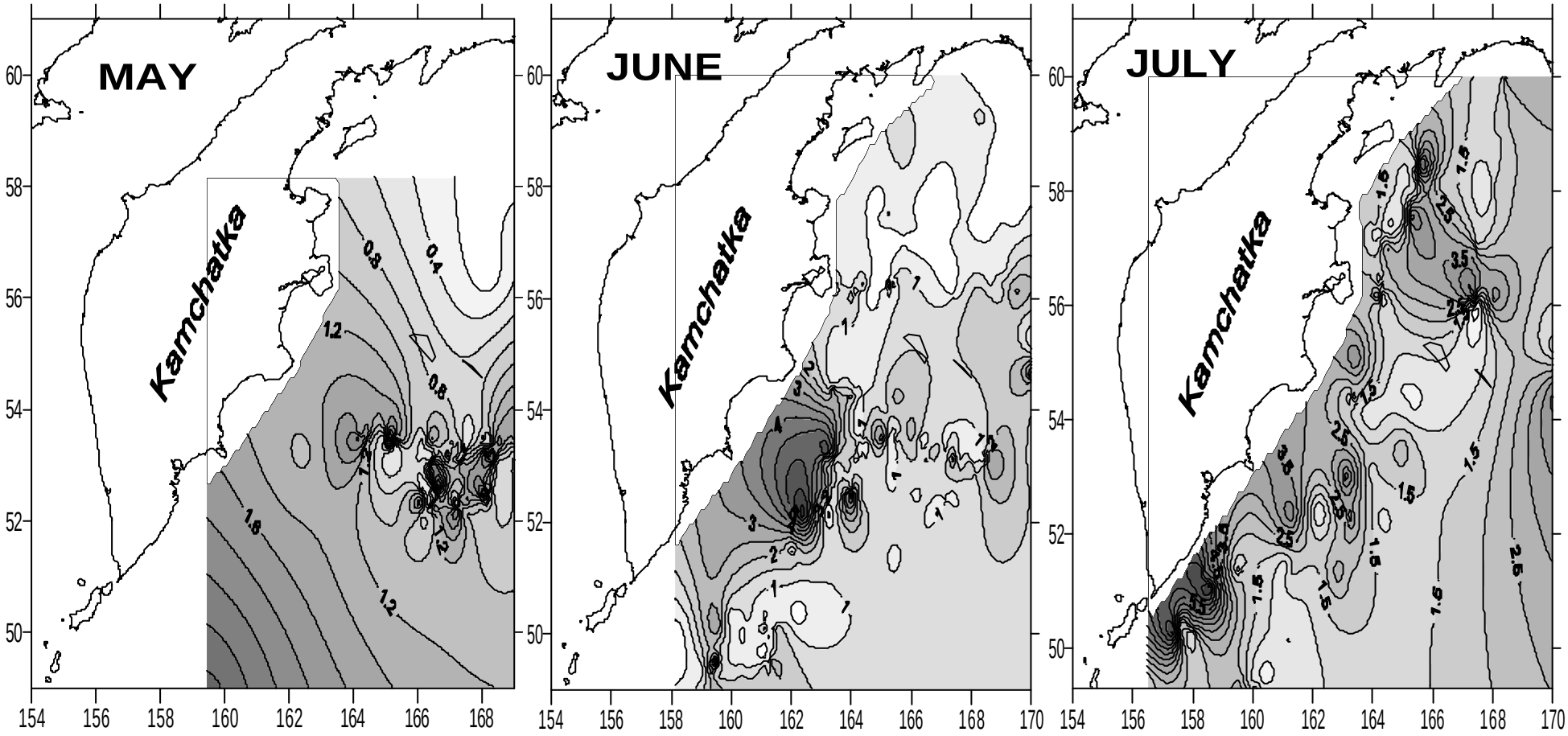

Figure 4. Chum salmon distribution (CPUE, fish/tan) on the data of control catches (55mm mesh) of all drift net vessels, worked on the program of KamchatNIRO within south-west part of Bering Sea and adjacent waters of Pacific Ocean in 2002

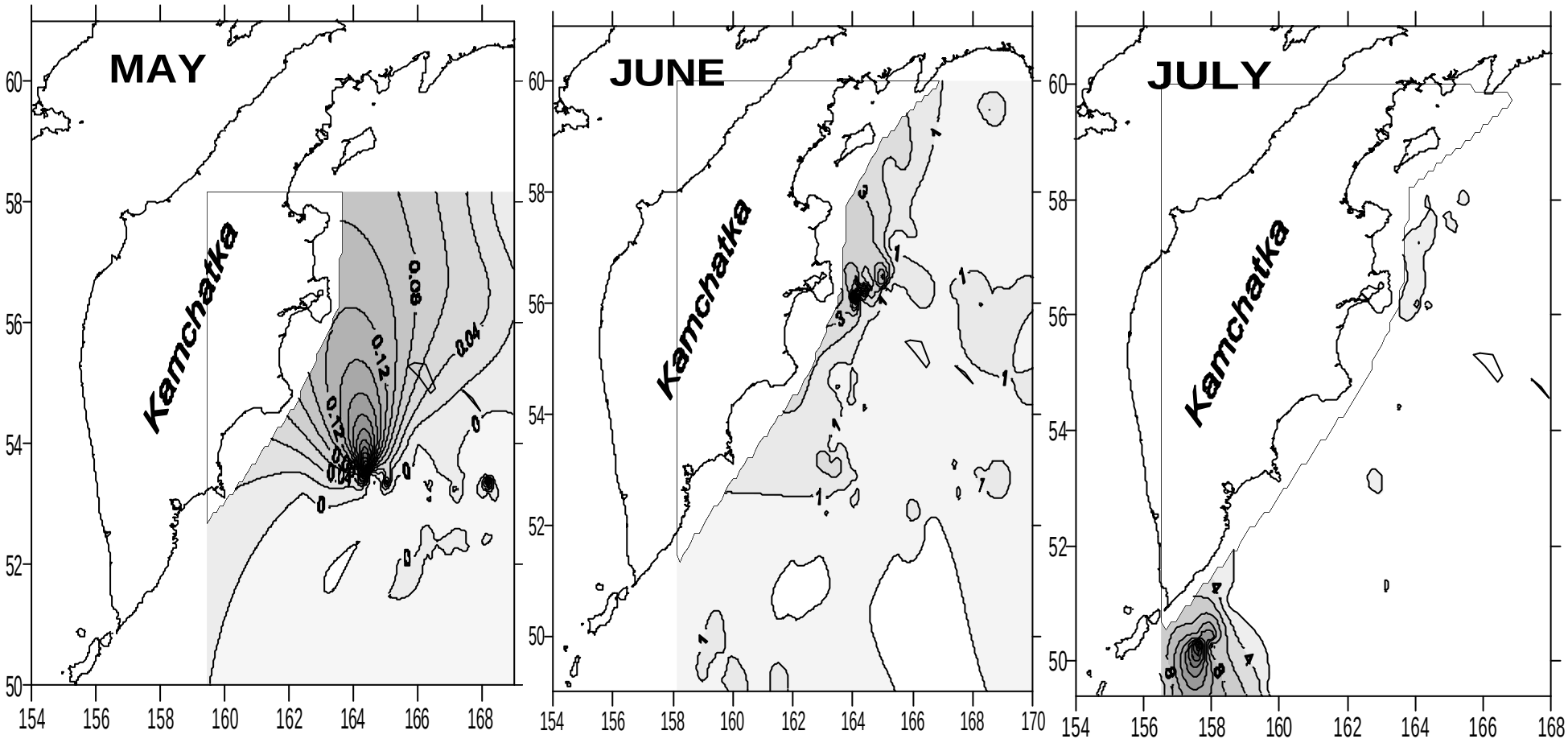

Figure 5. Pink salmon distribution (CPUE, fish/tan) on the data of control catches (55mm mesh) of all drift net vessels, worked on the program of KamchatNIRO within south-west part of Bering Sea and adjacent waters of Pacific Ocean in 2002

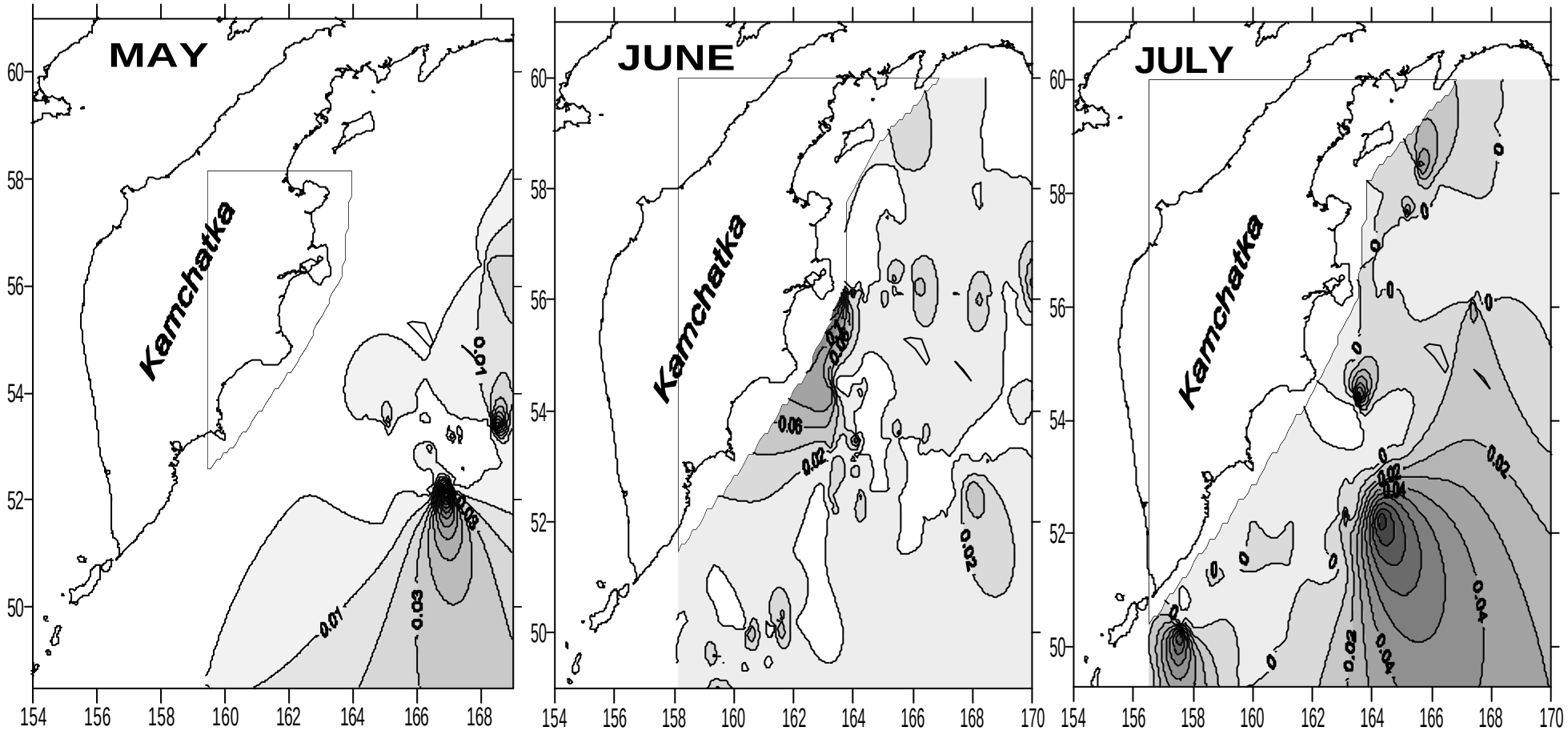

Figure 6. Chinook salmon distribution (CPUE, fish/tan) on the data of control catches (55mm mesh) of all drift net vessels, worked on the program of KamchatNIRO within south-west part of Bering Sea and adjacent waters of Pacific Ocean in 2002

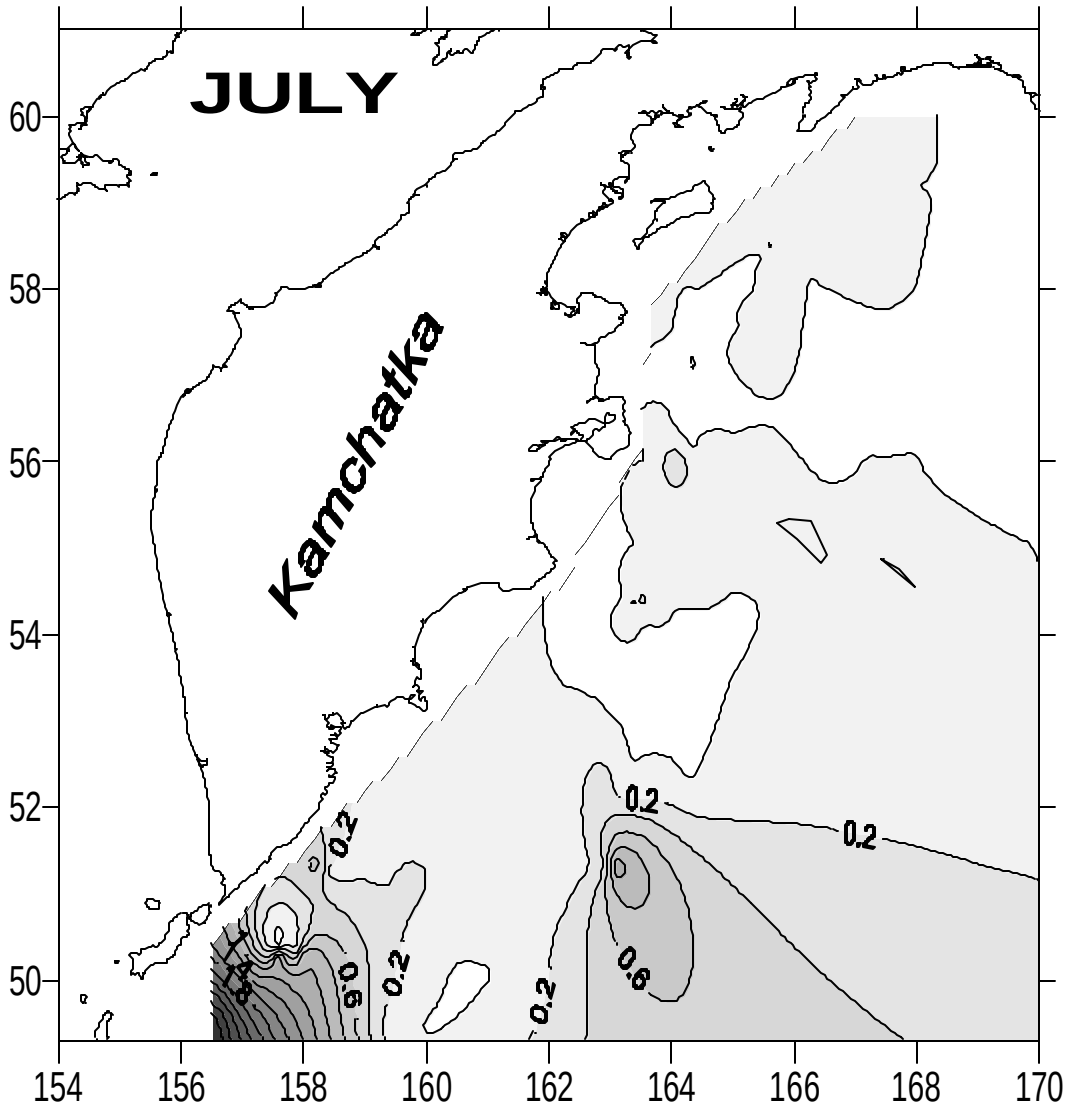

Figure 7. Coho salmon distribution (CPUE, fish/tan) on the data of control catches (55mm mesh) of all drift net vessels, worked on the program of KamchatNIRO within south-west part of Bering Sea and adjacent waters of Pacific Ocean in 2002

Table 4. Dynamics biological parameters of sockeye salmon

Period	CPUE, fish/tan	Sex	N	%	Immature, %	Length, sm	Weight, kg	GSI	Filling stomach	
									Mark	Empty, %
Petropavlovsk-Kommander subzone – 61.02.2										
21 - 25 May	1.74	?	90	70	0.0	57.4	2.55	0.80	2.29	3.3
		?	38	30	0.0	55.7	2.37	3.97	2.47	18.4
26-31 May	3.04	?	74	67	0.0	56.6	2.56	1.09	2.04	2.7
		?	37	33	0.0	55.1	2.30	4.74	2.13	2.7
1-5 June	3.22	?	37	50	0.0	55.7	2.46	1.15	2.38	5.4
		?	37	50	0.0	54.7	2.29	3.85	2.36	5.4
6-10 June	2.33	?	49	51	0.0	57.2	2.60	0.73	2.00	0.0
		?	48	49	0.0	55.3	2.26	3.93	1.88	4.2
11-15 June	2.35	?	34	57	0.0	57.3	2.59	0.75	2.09	2.9
		?	26	43	0.0	55.9	2.30	3.51	2.19	3.8
Karaginski subzone – 61.02.1										
16-20 June	0.51	?	6	19	0.0	56.4	2.50	2.91	3.17	0.0
		?	26	81	0.0	56.6	2.47	6.97	2.81	3.8
21 - 25 June	0.68	?	7	33	0.0	62.4	3.44	1.98	2.29	0.0
		?	14	67	0.0	57.4	2.55	5.80	1.79	14.3
Western-Bering zone - 61.01										
26 - 30 June	1.14	?	33	57	54.0	54.1	2.28	0.51	1.42	18.0
		?	25	43	32.0	56.1	2.57	3.11	1.92	16.0
1 - 5 June	2.70	?	33	61	82.0	50.6	1.66	0.33	1.82	15.0
		?	21	39	67.0	50.9	1.74	1.85	2.05	19.0
Kamchatka-Kuril subzone – 61.05.4										
6 - 10 July	0.92	?	21	54	0.0	55.4	2.41	2.56	1.15	29.0
		?	18	46	0.0	54.5	2.23	5.13	1.39	28.0
11 - 15 July	0.60	?	1	17	0.0	48.0	1.20	3.92	1.00	0.0
		?	5	83	0.0	55.4	2.20	6.73	0.00	100.0
Petropavlovsk-Kommander subzone – 61.02.2										
11 - 15 July	2.02	?	34	57	29.0	53.4	2.19	1.67	1.74	0.0
		?	26	43	4.0	56.2	2.6	4.17	1.57	0.00
16 - 20 July	6.20	?	56	41	13.0	57.1	2.75	1.45	1.26	18.0
		?	82	59	4.0	57.0	2.75	3.49	1.38	17.0

Table 5. Dynamics biological parameters of chum salmon

Period	CPUE, fish/tan	Sex	N	%	Immature, %	Length, sm	Weight, kg	GSI	Filling stomach	
									Mark	Empty, %
Petropavlovsk-Kommander subzone – 61.02.2										
21 - 25 May	1.41	?	56	53	0.0	59.5	2.81	0.68	2.59	3.6
		?	50	47	0.0	57.8	2.53	2.55	2.34	2.0
26 - 31 May	1.69	?	32	41	0.0	58.7	2.56	0.79	1.91	6.2
		?	46	59	0.0	58.0	2.49	2.81	2.32	8.7
1-5 June	2.08	?	45	62	13.3	58.0	2.45	0.48	2.07	11.0
		?	28	38	21.4	56.6	2.25	2.18	2.36	7.0
6-10 June	2.08	?	14	41	7.0	60.0	2.87	0.92	2.07	7.1
		?	20	59	0.0	57.7	2.26	2.53	2.25	10.0
11-15 June	2.59	?	37	51	18.9	60.4	2.81	0.86	1.95	8.1
		?	35	49	13.5	57.5	2.39	2.65	1.88	2.9
Karaginski subzone – 61.02.1										
16-20 June	1.19	?	38	58	28.9	59.70	2.93	0.84	2.63	0.0
		?	27	42	14.8	57.40	2.57	2.31	2.63	0.0
21 - 25 June	1.05	?	7	47	14.3	59.8	2.75	0.86	2.71	0.0
		?	8	53	37.5	59.2	2.48	2.73	2.25	0.0
Western-Bering zone - 61.01										
26 - 30 June	3.87	?	34	34	56.0	57.0	2.29	0.71	1.68	18.0
		?	66	66	39.0	56.2	2.26	2.65	1.95	16.0
1 - 5 July	4.35	?	27	54	74.0	54.0	2.07	0.34	2.00	4.0
		?	23	46	74.0	52.3	1.91	1.88	2.09	4.0
Kamchatka-Kuril subzone – 61.05.4										
6 -10 July	6.54	?	29	37	0.0	59.0	2.93	1.69	1.41	14.0
		?	49	63	0.0	58.6	2.80	4.40	1.47	20.0
11 - 15 July	6.00	?	23	46	13.0	60.0	3.27	2.00	1.39	17.0
		?	27	54	4.0	59.0	2.96	3.81	0.96	37.0
Petropavlovsk-Kommander subzone – 61.02.2										
11 - 15 July	2.17	?	24	44	29.0	59.7	3.10	1.92	1.87	0.0
		?	31	56	6.0	59.4	3.05	5.06	2.32	0.0
16 - 20 July	2.80	?	26	36	38.0	57.3	2.57	1.65	1.88	8.0
		?	46	64	22.0	57.1	2.49	3.88	1.91	9.0

Table 6. Dynamics biological parameters of pink salmon

Period	CPUE, fish/tan	Sex	N	%	Immature, %	Length, sm	Weight, kg	GSI	Filling stomach	
									Mark	Empty, %
Petropavlovsk-Kommander subzone – 61.02.2										
1-5 June	0.95	?	29	76	0.0	46.0	1.18	2.10	1.91	17.0
		?	9	24	0.0	45.1	1.08	6.65	2.83	0.0
6-10 June	0.60	?	12	71	0.0	46.6	1.19	2.62	2.25	8.3
		?	5	29	0.0	44.2	0.96	7.12	2.00	0.0
11 - 15 June	1.21	?	23	82	0.0	46.6	1.23	3.27	1.87	4.3
		?	5	18	0.0	43.4	1.05	6.88	1.60	0.0
Karaginski subzone – 61.02.1										
16 - 20 June	3.96	?	67	57	0.0	46.5	1.22	3.95	2.63	4.5
		?	50	43	0.0	45.3	1.10	8.36	2.26	4.0
21 - 25 June	5.43	?	24	60	0.0	47.8	1.28	3.91	2.83	8.3
		?	16	40	0.0	45.7	1.02	9.16	2.50	10.0
Western-Bering zone – 61.01										
26 - 30 June	0.96	?	17	39	0.0	47.6	1.34	5.07	2.11	6.0
		?	26	61	0.0	46.6	1.23	9.09	2.19	8.0
1 - 5 July	0.40	?	5	62	0.0	49.0	1.59	4.78	2.60	0.0
		?	3	38	0.0	46.3	1.22	9.35	1.67	0.0
Kamchatka-Kuril subzone – 61.05.4										
6 - 10 July	8.76	?	75	74	0.0	49.8	1.75	3.28	1.20	39.0
		?	26	26	0.0	48.3	1.58	6.69	1.23	42.0
11 - 15 July	24.80	?	33	66	0.0	49.70	1.87	3.13	0.67	51.0
		?	17	34	0.0	48.00	1.62	6.30	0.12	88.0
Petropavlovsk-Kommander subzone – 61.02.2										
11 - 15 July	1.12	?	33	72	0.0	48.6	1.52	5.66	1.42	18.0
		?	13	28	0.0	47.0	1.18	8.76	1.84	8.0
16 - 20 July	1.50	?	27	77	0.0	48.0	1.51	5.68	1.55	30.0
		?	8	23	0.0	47.1	1.26	9.99	1.62	12.0