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**STR “Katunino” Eastern Sea of Okhotsk Survey,  
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by

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## Abstract

The trawl survey and daily 24-hours survey in the Eastern Sea of Okhotsk was conducted from September 9 to October 6, 1997. Totally there were accomplished 52 control trawls. There were carried out the complex to give a work-out and to improve the method of juvenile catching with using midwater rope trawl 54,4/192 m.

There were undertaken attempts to differentiate juvenile pink and chum salmon through out of the area where reproduction of these species takes place (including the North coast of the Sea of Okhotsk and Shelikhov Bay, West Kamchatka, Sakhalin). It was found that juvenile salmon, generally, used to feed within plots regular for each species in the area examined in 1997. Juvenile pink salmon aboriginal type has distribution. West Kamchatkan juvenile pink salmon took 80 % of total abundance estimated to be in the area investigated. Run of West Kamchatkan pink salmon in 1998 was preliminary estimated as 110-135 mln. fishes.

## Introduction

A survey of the distribution and abundance of juvenile salmon in the fall time of their first year of life in the sea was conducted using a pelagic 54.4/192 m trawl on the STR "Katunino" in the Eastern Sea of Okhotsk. This report details the findings of our survey from September 9 to October, 1997. The fall survey had the following objectives: 1 - to improve the method of juvenile Pacific salmon catching with using 54.4/192 m trawl; 2 - to establish the distribution and abundance of juvenile pink, chum, sockeye, coho, chinook, and masu salmon, and others species in the Eastern Sea of Okhotsk near the first time of sea life in fall 1997; 3 - to collect data characterizing biological characteristics, growth, and feeding of juveniles, biotical and environmental factors to form production of broods.

Fig. 1 shows the investigation area for the STR "Katunino" September-October, 1997 survey. It consisted at the east part of the Sea of Okhotsk within area between 51-58 N, 148-156 E. A total of 52 oceanographic stations and 52 fishing tows were completed.

## Materials and methods

The STR "Katunino" is a middle trawler-refrigerator: a 1202 gross tonnes, 53.7 m in length, 10.5 m in beam, powered by a 1320 H.P. (970 T.W.) diesel engine by Petropavlovsk-Kamchatsky Trawl Company.

The work was accomplished at the east part of the Sea of Okhotsk within the area between 51-58 N, 148-156 E (figure 1). Trawl survey by squares (43 fishing tows) was carried out for the period September from 15 to 30. Daily 24-hours trawl survey was done on October 2-3 at the area within 51-52° N and 155°09' - 155°15' E. The implement used was midwater rope trawl 54,4/192 m with introduction of small-size mesh (12 mm mesh) net insight its sack. Length of cables took 70 m, of free ends and of wire cables - 40 and 150 m respectively. The trawl was pooled out in 250 m astern. The trawl was equipped with spherical trawl plates having 3.3 square m. Fishery procedures were accomplished near the water surface at being watched white whirlpool-track clear there, at 4.3-5.2 knots (4.8 knots in average), and achieved a measured mouth opening of approximately 45-50 m horizontal by 27-35 m vertical. Control fishing was carried out during 60

min since wire cables had been locked until their release within water layer 0-35 m. Time of trawling when accomplishing daily station survey was shortened up to 15 minutes. Survey consisted of 2-4 fisheries carried out daily, it being consisted of 9 fisheries at daily station in 06 - 9.5 - 13 - 15 - 19.5 - 21 - 0.5 - 3.5 - 6.5 o'clock. Totally there were 52 control fisheries carried out. Results of each fishery were entered in the fisheries cards.

There were made quantitative and qualitative (by species) assessment of the catches (table 1-2). Juvenile salmon separated by species were measured and analyzed. Biological analysis of fish implied: 1 - to determine AC and AD length, body weight of safe and gutted fish, 2 - to estimate the ball of stomach filling, to fix some stomachs in formaline solution, 3 - to determine sex and stage of maturation, 4 - to collect scale samples and muscle tissues with using Folch solution for the following biochemical analysis (table 3). There were made visually observations of water surface, weather conditions; water temperature near the surface was measured by CTD-complex.

## RESULTS

### Meteorological conditions and thermal regime.

Meteorological observations were made since September 15 to October 3 1997. Mentioned period of the year, if to compare it to the summer season, was characterized by some transformation of atmosphere processes related to intensification of cyclone activity. Air masses generally flowed in from the west and south-west. The winds of mentioned rumbas were noted in 47% of observations. Wind strength reached up to 5.4-10.7 m/sec in 76% of the cases. Wind strengt h in 5% reached risky level to trawl or the process was challenging or problematical, 10.8 and more m/sec. Surface water temperature varied from 8.1 to 12.5°C. Maximum warm water zone was determined to the west from 151°E in the area between 51 and 54°N. Northern part of the observation area was characterized by average temperature 8.1-8.9°C (figure 1).

### Distribution and biological characteristics of salmon juveniles.

Juvenile pink salmon was seen throughout of the whole observation area and met in 40 (93%) from 43 cases. Catches were from 6 to 1380 individuals per tow (table 1). High stocks (600 individuals per tow) were figured as a 60-80-mile stripe spread along the first north-west branch of Pacific current which enters the Sea of Okhotsk through the northern Kuril Straites between 51°30'-52° N, 154°-156°E and 55-56°N, 150-152°E (figure 2). Stocks the same density were observed within the south-west part of the observation area, which formed of migrants from the off-shore of Kamchatka, Sakhalin and Ithurup Island. Like in previous years pink salmon was absent closely to the Northern Kuril Islands.

Body length of pink salmon varied from 11 to 27 cm, average length and weight varied in range 16,6-22 cm and 46-121,4 g respectively. Generally, body size of fish was increasing from the offshore area to the west periphery of the area (figure 2). The most large pink was found at the area bounded by 52-54N and 148-151 E. Majority of pink juveniles (74%) had body length of 18-22 cm, approximately 20% of fishes were less than 19 cm (table 4).

Between 54° and 58°N there were found individuals infested by *Cryptocotyle* sp. Infestation

percentage to the respective of latitude took: up to 54°N - 0.2%, up to 55°N - 1.7, up to 56°N - 22.5%, up to 57°N - 3.1 and up to 58°N - 10.2%. Infested juveniles were to some extent smaller comparing them to the healthy ones. For example, average size in infested juveniles for the trawling number 32 were 19.1 cm and 70 g, meanwhile that were 20.2 cm and 83.8 g in healthy juveniles. The analysis of *Cryptocotyle*

> > sp. infestation percentage made possible to identify pink salmon emerged from the Shelikhova Bay and pink arrived from the Northern coast of the Sea of Okhotsk. Distribution of the juveniles within the area of observation has been shown at the figure 3.

Juvenile chum salmon were met in 42 (98%) tows. Number of chum salmon individuals varied in the catches from 1 to 708 per tows. High catches - more than 200 individuals per tows, were noted along the 51°N longitude (figure 4). Less abundant stocks were found in the offshore at 57°N. Like in previous years of observation the most concentrated stocks of juvenile pink and chum salmon persisted separately.

Body length of chum salmon in the area varied at range 14-31cm, average meanings - within 18-29 cm and weight - 62.1-135.1 g. Actually, body size of fishes increased from the sea shore to the west periphery of the observation area (figure 4). The largest pink salmon were met at the area bounded by 54-55°N and 148-150°E. Most juveniles (66.3%) had body length of 19-23 cm, approximately 18% of fishes were less than 19 cm (table 5).

Between 55°N and 58°N there were met individuals infected with *Cryptocotyle* sp. Percent of the infectious fishes amounted 4.4% along the longitude 55°, 12.3% - 56° and summary 32.5% along 57 and 58 longitudes unitedly. Infested juveniles were smaller than healthy ones. For example, average length and weight in unhealthy juvenile chum salmon at the fishing No 31 were 19,7 cm 80 g, and healthy specimens - 23,1 cm 132,6 g respectively. Parasitological analysis revealed juvenile chum emerged from the rivers of the Shelikhov Bay and migrants from the northern offshore of the Sea of Okhotsk. The distribution of the juveniles has been showed at the figure 5.

Juvenile sockeye were met in 23% tows accomplished within 51-58° N to the eastward from 153°E (figure 6). Maximum catch of 391 individuals was noted at the point 52°N, 156°E. Abundant juvenile sockeye salmon stock was met on September 30, when 185 individuals were caught at the point 57°N, 155°E. Length of juvenile sockeye salmon varied from 15.3 to 25.8 cm (average from 19.3 to 23.4 cm) and weight - from 39 to 195 g (average from 87.3 to 150g)(table 6).

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> > Juvenile coho salmon was met in 46.5% tows accomplished within 51-58°N near the coast of Kamchatka up to 148°E, although it was met regularly until 153°E (figure 6). Maximum stock density was figured out in the south-west offshore of Kamchatka (51-52°N) where catch of juveniles at the point 52°N, 156°E consisted of 185 individuals. Body length of juvenile coho salmon varied at range 23.5-35.5 cm (average 25.6-31 cm) and weight - 160-5890 g (average 215-435 g)(table 7).

Juvenile chinook salmon was met in 23% tows within 51-58°N from the coast of Kamchatka until 153°E (figure 6). The most dense stock was found in the south-west offshore of Kamchatka (51-52°N), it being the maximum catch at the point at 52°N, 156°E consisting of 84 individuals. Body length of juvenile chinook salmon varied at range 18.4-26 cm (21.9-23.8 cm in average) and weight

- 75-245 g (141.6-188.8 g in average)(table 7).

Juvenile masu salmon was found in 16% tows; usually the species was occurring by number 1-2 individuals. Maximum catch found at the point 54°N, 154°E consisted of 4 fishes (table 1). Totally there were caught 13 fishes. Body length of the fishes varied from 22.8 to 30.5 cm and weight - from 160 to 390 g (table 7).

Distribution of other fish species.

Juvenile Atka mackerel (*Pleurogrammus monopterygius*) were met in 32% tows to the south from 55°N latitude. Maximum concentrated stocks were revealed at the south part of the observation area. For example, the catch at the point 51°N, 152°E consisted of 3000 individuals, also at the point 51°N, 149°E it was approximately 1000 individuals (figure 7). Average body length of the fish took 17.5 cm (varied from 15 to 20 cm).

Pacific herring *Clupea pallasii* was met in 23% tows since 55 until 58°N (figure 7). Maximum catch consisted of 1300 individuals per tow. Body length of the herring varied from 20 to 30 cm, average length was 23.8 cm. In the trawl number 40 there were 680 fishes, among from them 43 (6.3%) were infected with *Cryptocotyle* sp.

Juvenile walleye pollock *Theragra chalcogramma* by number of 1 ton approximately were caught over the trawling ü 42 at 57°40'N, 155°47'E. Length range amounted 5-10 cm. There was juvenile *Mallotus villosus socialis* found as well by number of 200 individuals having length of 8-12 cm. *Leuroglossus shmidti* by number of 3 tons was caught at the point 55°N, 154°E. In the southern part of the observation area until 55°N there was juvenile *Anarhichas orientalis* meet. Everywhere in the offshore (up to 100-150 miles) there were caught regularly, but in a scare number spiny lumpfishes *Eumicrotremus* sp. and butterfly sculpin *Melletes papilio*.

Differentiation of pink salmon juvenils in the east part of the Sea of Okhotsk.

Analysis of fall feeding migrations of juvenile salmon in 80-90th has found the shelf of the West Kamchatka and central part of the Sea of Okhotsk as an area of a great importance to the feeding of juvenile pink salmon emerged from the Shelikhov Bay, West Kamchatka and East Sakhalin. There have been determined three types of spatial distribution of juvenile pink salmon at the west coast of Kamchatka:

- 1) aboriginal - when these waters are mostly inhabited by western Kamchatka pink salmon;
- 2) 2) immigratory - western Kamchatkan pink stock abundance is very low, under 10 %;
- 3) 3) intermediate - most frequent type, where pink juveniles of Kamchatka origin rear jointly with visitor in the eastern Sea of Okhotsk (Karpenko et al., 1998).

Analysis of previous data (1986-1991) allowed to make next conclusions.

1. Aboriginal type of distribution have next characteristics of pink juveniles:
  - low average body size of fishes in the main part of feeding stock (17-21 cm and less than 70 g);
  - wide variability of body length (11-28 cm);

- significant group of fishes with body-size less than 19 cm (30-50% approximately);
  - an increase in body-size of fishes the more seaward from the offshore of Kamchatka.
2. Immigratory and intermediate type of distribution have next characteristics of pink juveniles:
- high average body size of fishes in general part of feeding stock - 20-23 cm and 80-120 g;
  - narrow variability of body length (15-26 cm), it being extreme meanings close to modal ones;
  - small group of fishes with body size less than 19 cm (a few percents);
  - a decrease in body size of fishes the more seaward from the offshore of Kamchatka.

Features of juvenile pink salmon distribution in the fall of 1997 indicated as aboriginal type of the distribution. Therefore large presence of pink salmon emerged from Sakhalin within the area investigated should be excluded. We have accepted that small number of that juveniles could occur at the west periphery of the area where fish was larger and less variable in size parameters. A number of juvenile salmon emerged from Iturup can feed within the area investigated and at the south of the area (Varnavskaya et al., 1998). It is suggested that approximately a half of pink salmon stock within the area bounded by 52-54° N, 148-151 E consisted of alien pink salmon yearlings (5.8% of total abundance in the area); united stock of juvenile salmon emerged from the Sakhalin and Iturup hardly could be over 10 (15) %.

Data of parasitologic analysis allowed to differentiate juvenile pink salmon migrated to the sea from the rivers located in Shelikhov Bay and from the northern coast of the Sea of Okhotsk (Figure 3.2). The number amounted 6.5% of total abundance. Pink salmon emerged from the west of Kamchatka took approximately 80% of the total stock described in the area. Return of West Kamchatkan pink salmon in 1998 was preliminary estimated as 110-135 mln. fishes. Actually run exceed about 120 mln. fishes (preliminary data).

## REFERENCES

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