MONITORING OF SST IN THE AREAS OF SAKHALIN RIVERS' MOUTHS APPLIDE TO THE PROBLEM OF FRY SALMON RELEASE

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Introduction

The problem of determining comfortable conditions formation for fry salmon in the rivers' mouths (water temperature 6-7ºC or more) is very important for Sakhalin salmon hatcheries because of a strong water temperature variability in the nearshore zones of Sakhalin Island in spring. Sakhalin Institute of Fisheries & Oceanography has been carrying out SST monitoring in the areas adjacent to Sakhalin and Kuril islands using TeraScan station.

Data

The spring satellite SST data (April-May-June) have been collected since 1996. Mean ten-day values were used in this report. Fig. 1 shows 12 areas where water temperature was analyzed. A total of 5 areas occupy the southeastern Sakhalin shelf; almost a half of Sakhalin hatcheries are located there. There are different conditions in these areas: usually, a shallow and relatively closed northern part of Terpeniya Bay is warmed up earlier than the southern one which is deeper and more open for the off-shore winds.

We determined two different areas in the Aniva Bay (eastern and northwestern parts) and an area on the southwestern shelf of Sakhalin Island. Three areas were determined on the shelf of Iturup Island (mouths of Kuibyshevka and Kurilka rivers from one side of the Chirip Peninsula and a mouth of Udobnaya River in the Prostor Bay from the other side).

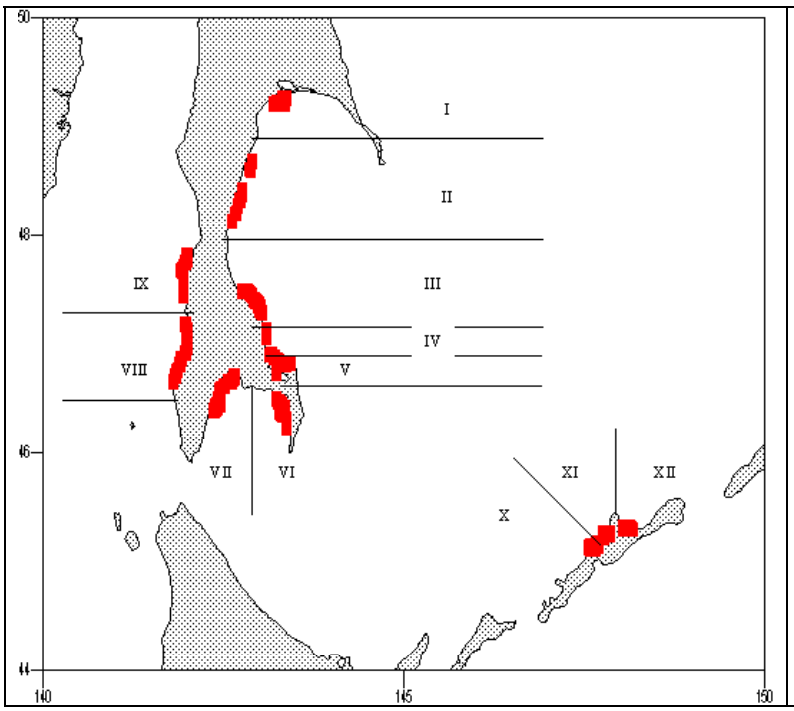

Fig.1 Areas adjacent to Sakhalin rivers' mouths.

An idea of our monitoring is very simple.

- We calculate multiyear ten-day mean SST values (April-June) for 12 areas adjacent to Sakhalin rivers' mouths.
- We determine mean terms of SST mounting 6 or 7ºC for each area.
- We calculate SST anomalies for a current season and give recommendations relating to the fry salmon release depending on the anomaly sign and value.

This idea is not very interesting, and it is not a goal of our report. We present the analysis of the unusual situation in this year (spring 2005) as a goal of our report.

Determination of the term when SST reaching 6-7 degC.

Fig. 2 shows the plots of SST multiyear means with the 10-day time interval and SST for 2005 and 2000 (significant negative anomalies were observed along the southeastern shelf of Sakhalin Island too). The mean term of water temperature reaching 6-7ºC was determined. For the mouths of Poronai and Lazovaya rivers, this mean term is about May 20. Significant negative anomalies were observed in May 2005 and during the first ten days of June. In the second half of June, significant positive SST anomalies were found. Water temperature anomalies in 2000 were insignificant in these areas.

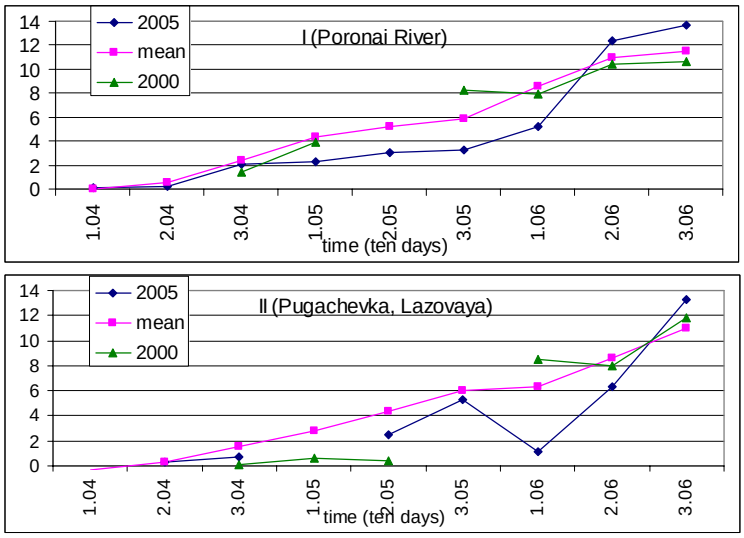

Fig.2 Ten-day mean SST in a spring time – SE Sakhalin

Fig. 3 shows the same parameters for two other areas on the southeastern shelf of Sakhalin Island located southward of that considered above. The mean term of the 6-degree mounting in the area # 3 is very close to areas # 1 and # 2. However, for the area # 4 (Bakhura River) this term was observed about 5 days later (May 24-25).

We observed significant negative anomalies (3 and 4 degrees) in May 2005 and 2000. Both in 2000 and 2005 significant positive water temperature anomalies were found after June 10.

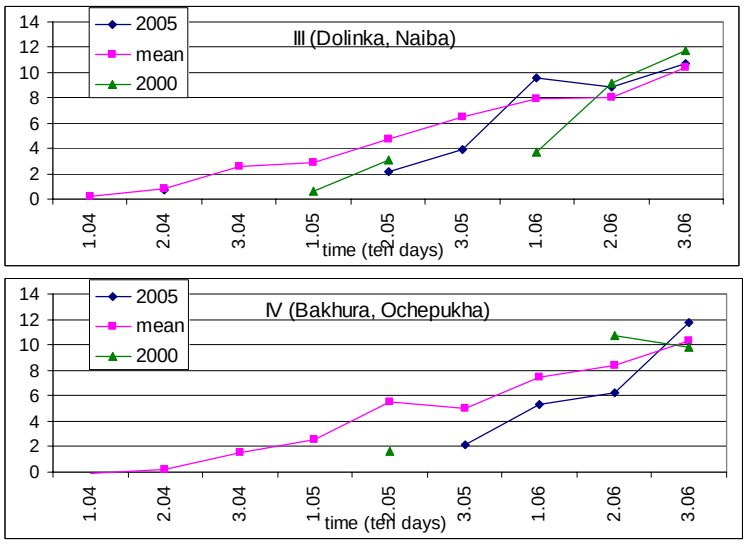

Fig.3 Ten-day mean SST in a spring time – SE Sakhalin

We found almost the same conditions in the Aniva Bay (Fig. 4). Here the term of the 6-degree reaching was occurred earlier than on the southeastern shelf (May 8-9 in the western part of the bay, and May 11-12 in the eastern part). Significant negative anomalies in May (especially in the area # 6) exchanged for the positive anomalies in June as before.

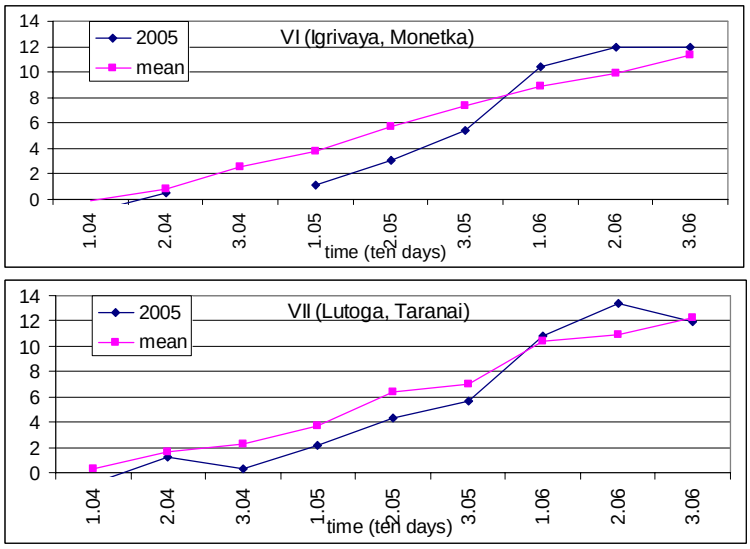

Fig.4 Ten-day mean SST in a spring time – Aniva Bay

The same term of the 6-degree mounting (close to May 10) was observed on the southwestern shelf of Sakhalin Island (Fig. 5). The more significant anomalies were found in May 2005 in the area # 8 located southerly.

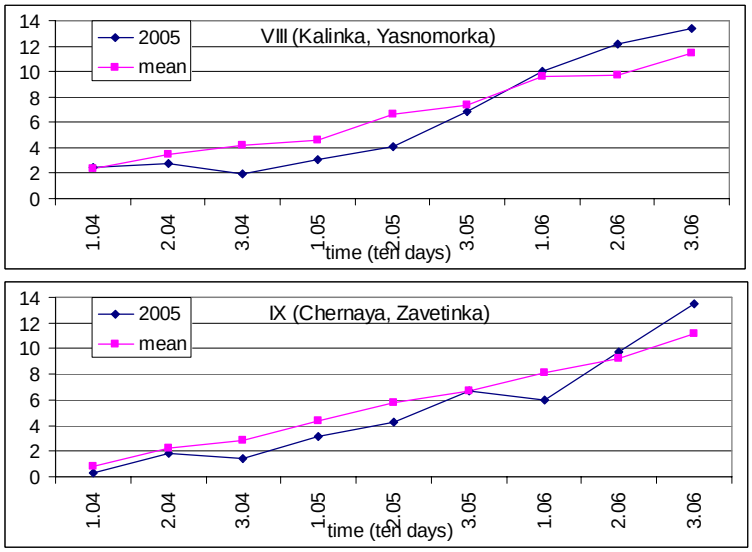

Fig.5 Ten-day mean SST in a spring time – SW Sakhalin

We found the latest term of the 6-degree mounting on the shelf of Iturup Island in early June (Fig. 6). There the negative anomalies in May 2005 were smaller than near the Sakhalin coast, especially in the Prostor Bay, where the situation was close to a norm. Positive anomalies in June were more significant.

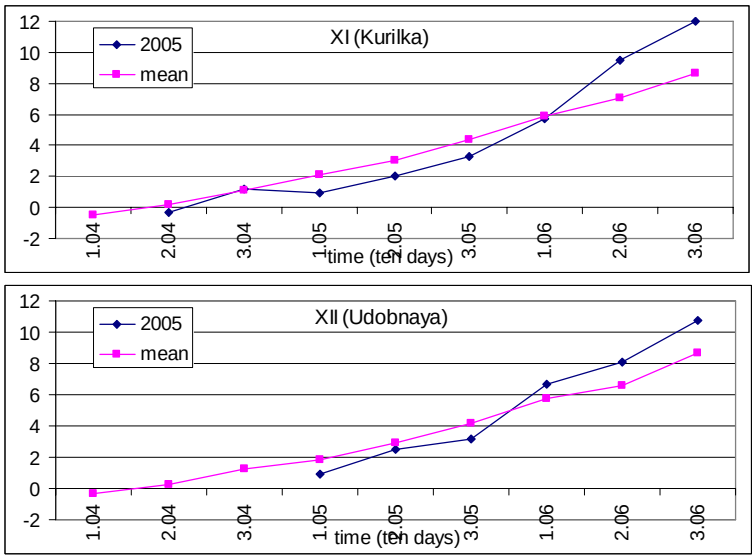

Fig.6 Ten-day mean SST in a spring time – Iturup Island

If we consider a spatial distribution of actual SST (left figure) and its anomaly (right figure) in April 2005 (Fig. 7), we can see a lot of sea ice in the southern part of the Okhotsk Sea transported by the East Sakhalin Current.

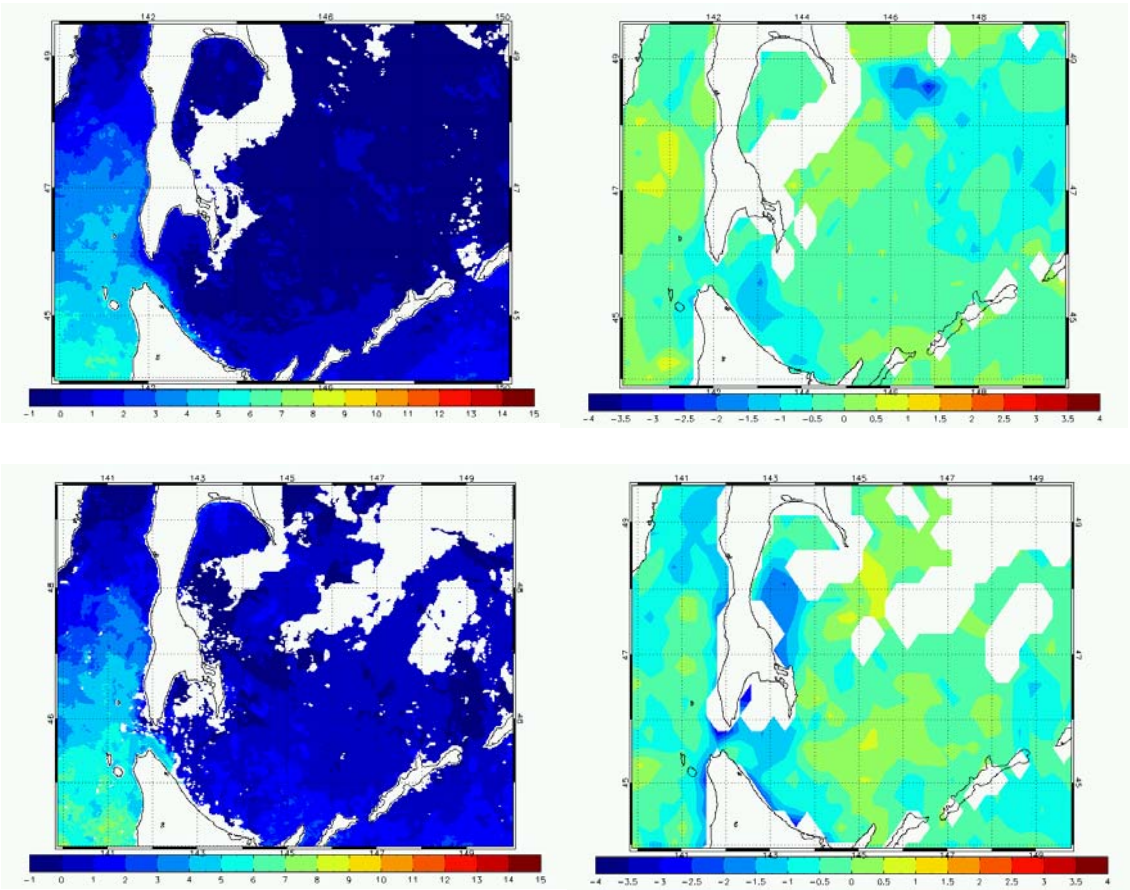

Fig.7. SST distribution (left figures) and its anomaly (right figures) in April 11-20, and April 21-30, 2005

Sea ice increased in mass during the last ten days of April; larger ice fields were observed in the eastern part of the study area. Negative water temperature anomalies appeared near the Sakhalin coastline.

We can see the larger ice field near the southeastern Sakhalin coast during the first ten days of May (Fig. 8). The relatively small ice fields were found in the La Perouse Strait and on the southwestern Sakhalin shelf. Low water temperature was observed all over the region. The well-expressed negative SST anomalies (-3 degrees and more) were formed in Terpeniya and Aniva bays. We can see warm waters of the Tsushima Current near the western Hokkaido coast; their transportation to the Tatar Strait was limited. Influence of the Soya Warm Current was weak, and we can see significant negative anomalies near the northern Hokkaido coast too.

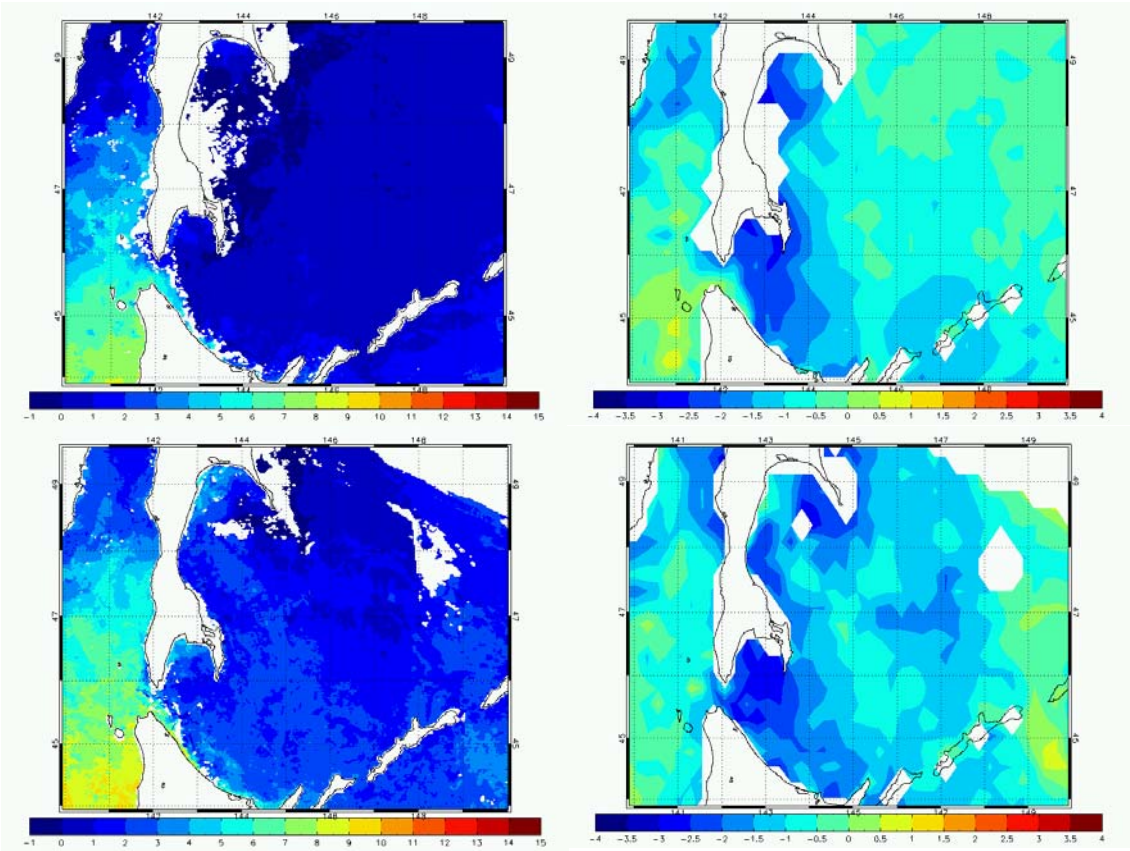

Fig.8. SST distribution (left figures) and its anomaly (right figures) in the May 11-20, and May 21-31, 2005

The situation began to change in late May and early June (Fig. 9).We can see the amplification of Tsushima Current and its warm waters in the Tatar Strait. Intensification of the Soya Warm Current is observed too. Warming-up in Aniva and Terpeniya bays was significant, and the areas with negative anomalies became smaller. Positive anomalies occurred in the eastern part of the study region.

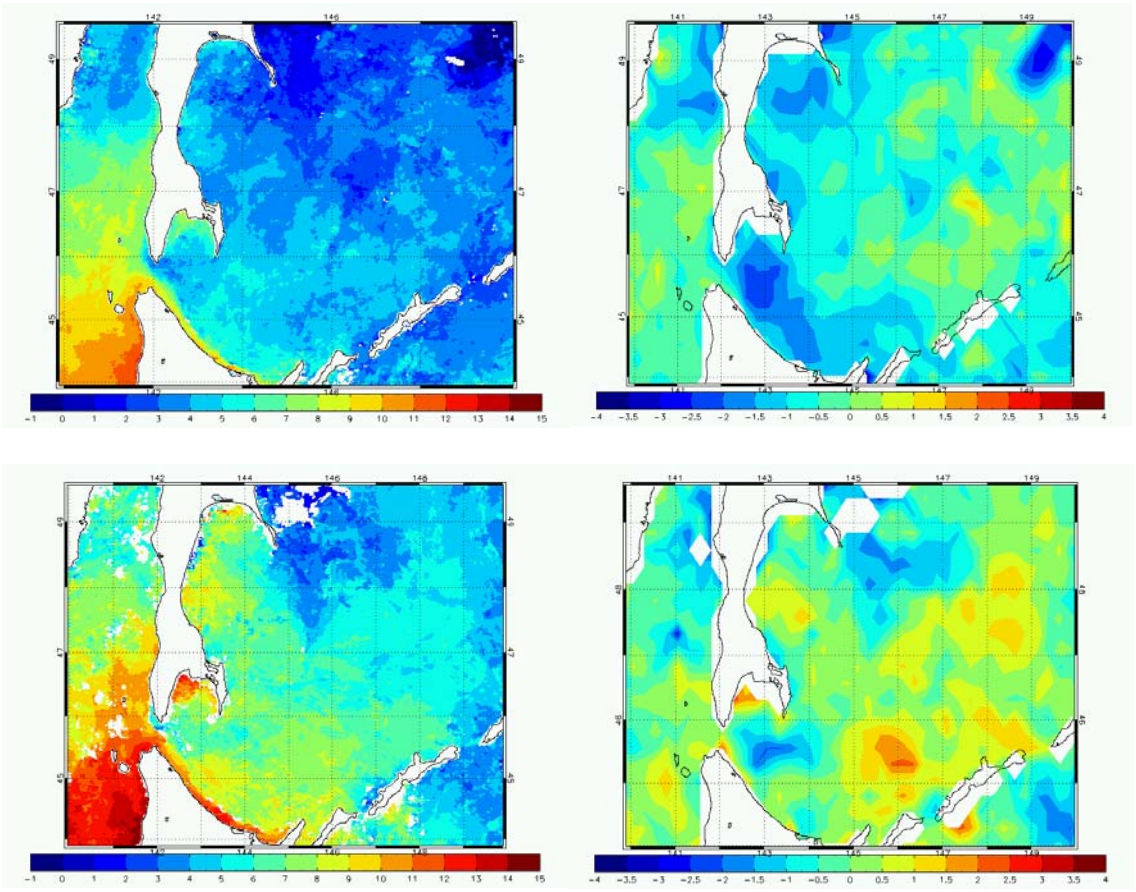

Fig.9. SST distribution (left figures) and its anomaly (right figures) in late of May and early of June 2005

The warm water and well-expressed positive anomalies can be observed in the second half of June all over the region (Fig. 10). Such a fast warming-up was caused by the unusually small influence of clouds, probably, a cloud band located southward of its common location (for example, the weather in Vladivostok City was unusually cloudy and rainy this year).

The above pictures show us that the temperature conditions in spring 2005 were unusual and not comfortable for salmon fry. Because of the great negative anomalies in May 2005, we recommended Sakhalin hatcheries to delay fry salmon release for 10-15 days, and Iturup hatcheries for 5-10 days.

If we consider water temperature distribution in spring 2000 (Fig. 11), we can see that five years ago cold waters appeared abruptly (under the influence of the relatively strong winds) near the southeastern Sakhalin coast. We found warm waters both in the upper part of the Terpeniya Bay, which is closed for the off-shore winds, and in Aniva Bay.

Negative water temperature anomalies in spring 2000 were almost the same as five years later, however, they were observed in a smaller area. In our opinion, the shown cooling in late May 2000 was one of the causes of low salmon catches in summer 2002. We hope that our recommendations will be useful for Sakhalin fishery industry.

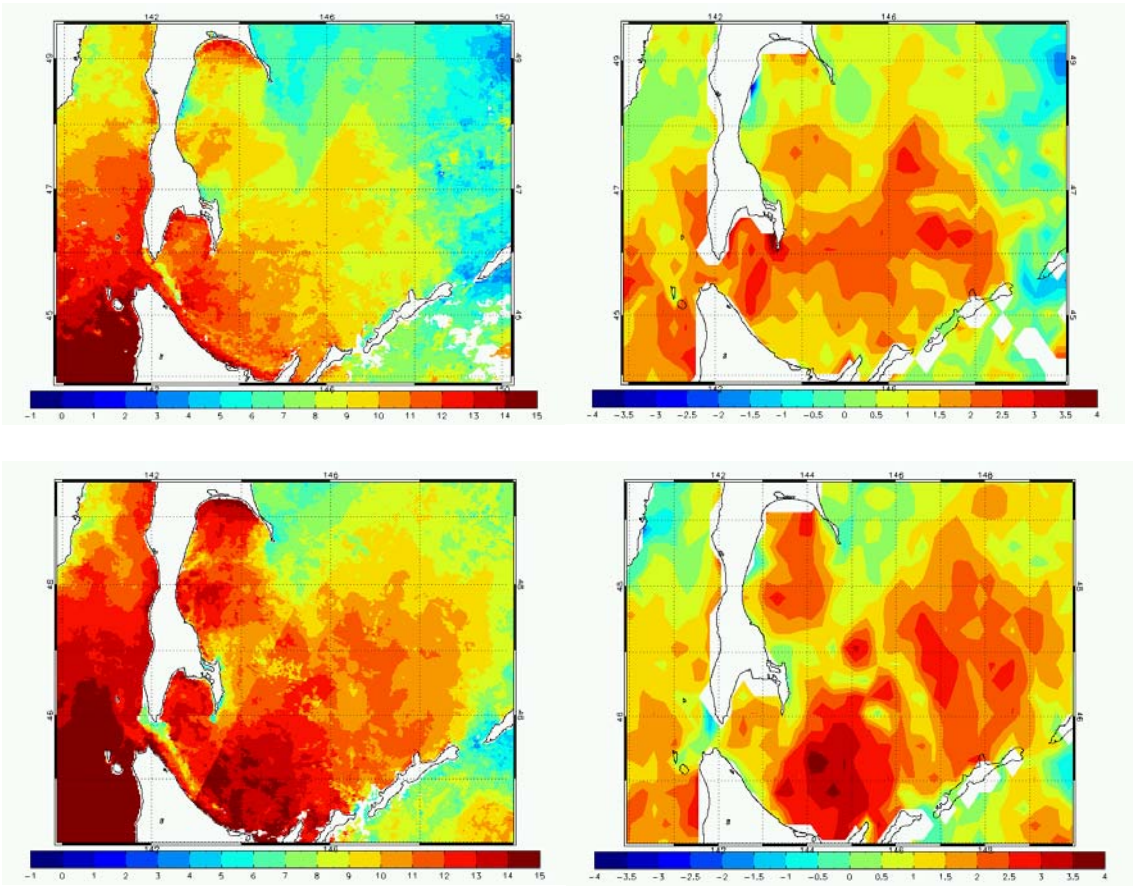

Fig.10 SST (left figure) and its anomaly (right figure) in the second half of June 2005

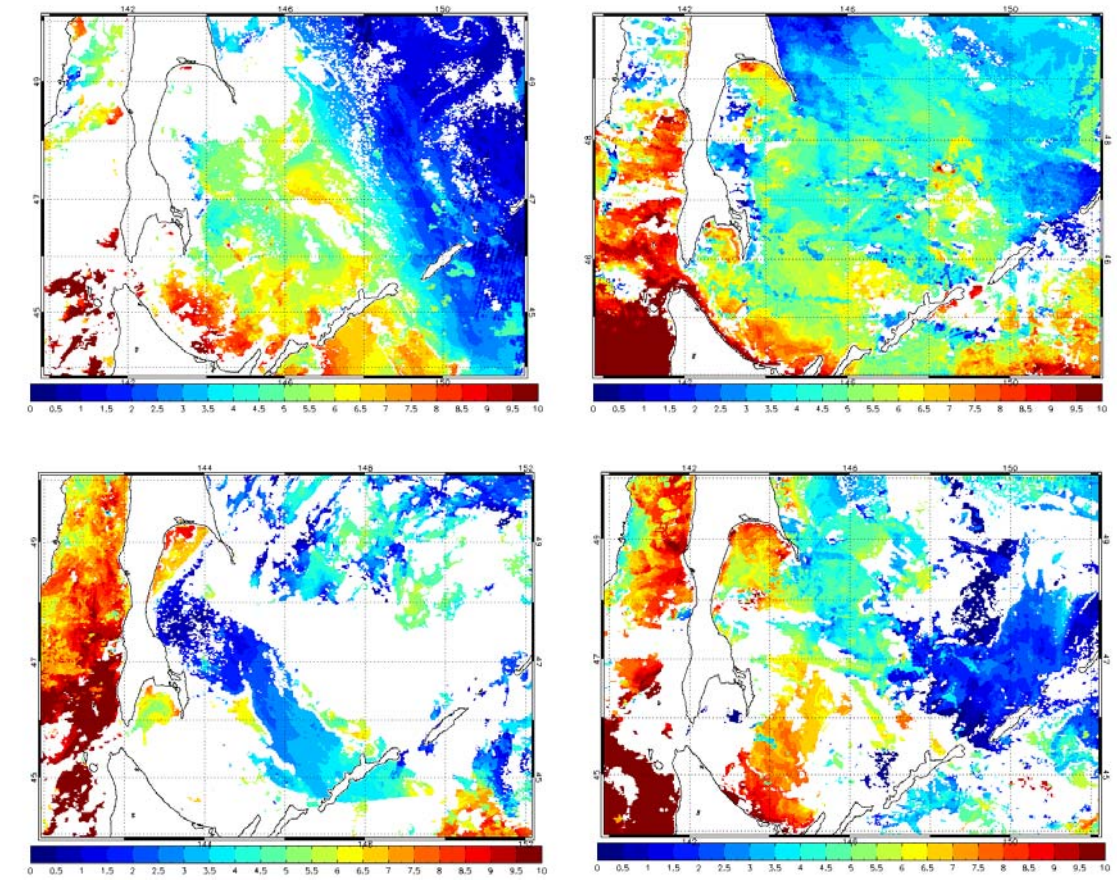

Fig.11. SST in spring 2000.

CONCLUSION

1. Temperature conditions in the areas of Sakhalin rivers' mouths in spring 2005 were negative for fry salmon. Great negative anomalies were found in May (our recommendations were to delay fry salmon release for 10-15 days). These negative anomalies gave a place for strong positive anomalies in June.
2. Such strong negative anomalies (-3ºC and more) near both sides of Sakhalin Island (in the Okhotsk and Japan seas) were first (?) observed since 1996.
3. Negative anomalies on the southern and southeastern Sakhalin shelf were caused by the great sea ice mass that was transported by the East Sakhalin Current.
4. The delay of Tsushima Warm Current (and Soya Warm Current too) was observed in May 2005. The cause of this delay is unclear.
5. Analogous negative water temperature anomalies near the southeastern Sakhalin coast in late May 2000 (caused by the wind), perhaps, were one of the causes resulted in the low salmon catches in 2002.