

# Importance of wild and hatchery-reared salmon in forming commercial pink and chum salmon stocks in Sakhalin-Kuril Region

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Sakhalin-Kuril Region occupies a leading place in Russia in pink and chum salmon catch sizes and their hatchery releases. For the recent 10 years, the annual capture averaged 98000 tons of pink and 12100 tons of chum salmon. The average annual release was 298 million of fry pink and 275 million of fry chum salmon from 33 hatcheries. However, still there is no clear concept on significance of wild and hatchery populations in forming commercial stocks. Response to this question is a priority choice for planning further fishery development. As far as we have no reliable data on tagging, we tried to compare available data on juvenile and adult fish numbers in principal pink and chum salmon reproduction areas (Fig. 1).

**Chum salmon.** Currently, its fishery exists due to hatchery rearing. However, a relationship between the number of fry released and subsequent catches is ambiguous (Fig. 2). It is weak on eastern Sakhalin. Correlation is negative on southwestern Sakhalin and positive on Iturup Island. Such contradiction is related with inefficiency of planned economy and occurrence of wild chum salmon in the 1970s catches. The program of improving chum salmon rearing has resulted in the recent ten years in catch increase due mainly to better survival of fry

released. This is clearly observed in all areas (Fig. 3). At present, the proportion of hatchery-reared stocks in catches is about 90%. In recent years it continues increasing even in spite of the improved state of some wild chum salmon populations.

**Pink salmon.** At first glance, pink salmon catches are higher in areas where a lot of fry are released from hatcheries. These are southern part of eastern Sakhalin and Iturup Island among the southern Kuril Islands. However, a level of natural pink salmon reproduction is highest just in these areas. Since the late 1980s, pink salmon catches have increased in all areas (Fig. 4). The top figure shows areas with well-developed hatchery culture and the bottom figure presents areas where hatchery rearing is less-developed (northern part of east Sakhalin) or absent (Kunashir Island). The relative increase in catches was observed to be lower in areas with developed hatchery culture. Our estimates show 1.8 times increase on Iturup Island and 2.4 times in the southern part of east Sakhalin against 3.5 times in the northern part and 3 times on Kunashir Island. Significance of wild pink salmon populations for maintaining fishery is clearly seen when grouping the data in accordance with different levels of return (low –

mid – high). In each group the mean numbers of hatchery and wild fry migrants were compared with mean returns of adult fish from these generations (Fig. 5). In all cases large returns correlated with high abundances of wild fry, whereas the abundance of hatchery fry in this range appeared to be even lower. This comparison showed that decline or increase in catches depended on changes in abundance for naturally reproduced fish all over the region areas (even in areas where hatchery fry composed 40%). At the same time, a recent-year trend of reduction in pink salmon escapement for spawning grounds is rather alarm. In 2002–2008, the adult fish abundance declined from 3,880,000 to 2,600,000 fish on spawning grounds of the Aniva Bay rivers, that is 1.5 times less, and from 4,390,000 to 1,630,000 fish in the southeastern Sakhalin rivers, that is 2.7 times less, compared to the previous ten-year period.

**Resume.** Taking into account an expected deterioration of salmon marine habitat, measures on maintaining fishery need to be developed. Chum salmon fishery could be maintained based on further development of hatchery rearing. To support pink salmon fishery, the improvement of spawning conditions is a very important factor.

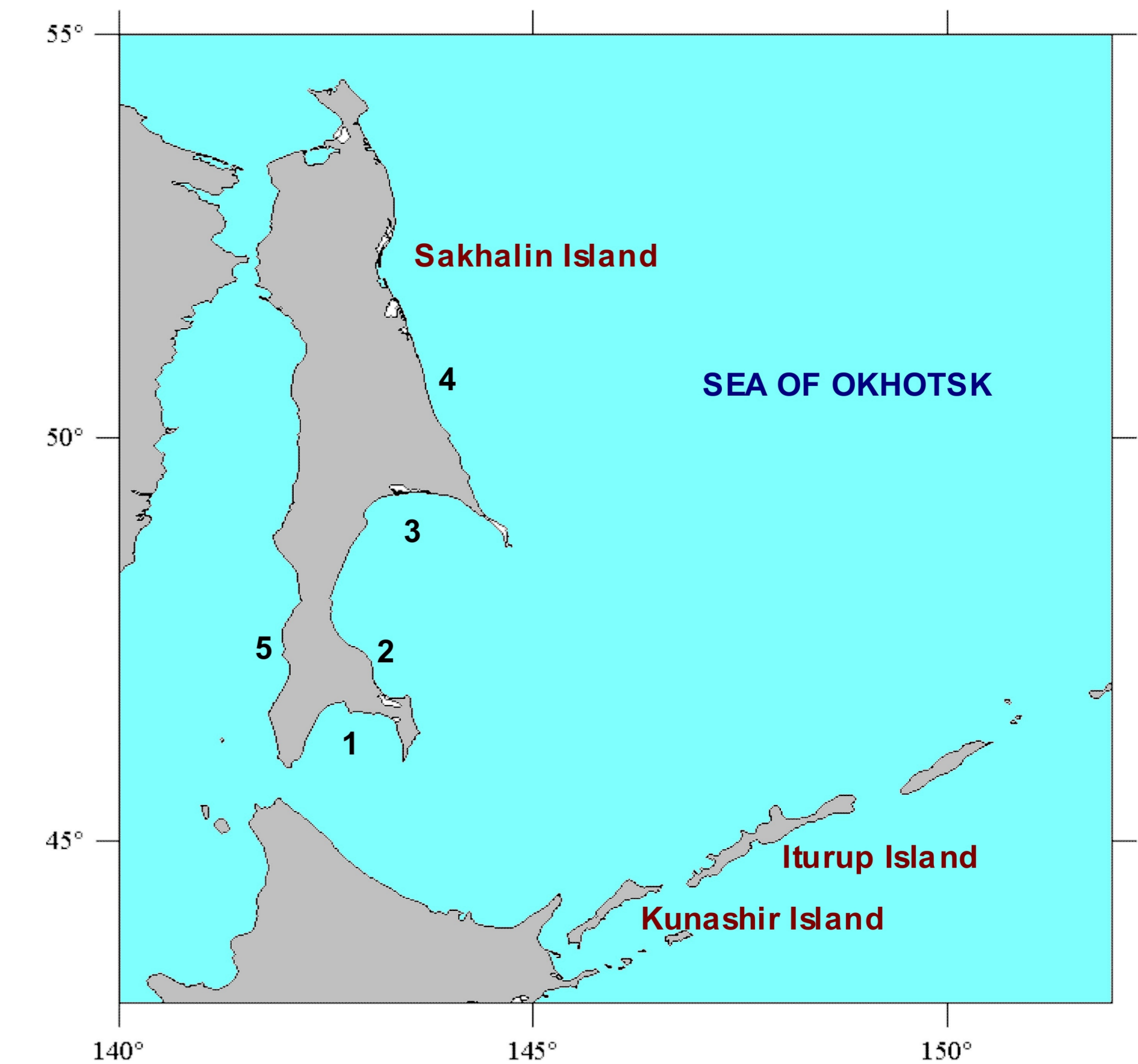


Fig. 1. Study regions for pink and chum salmon: Sakhalin Island (1 – Aniva Bay, 2 – southeastern coast, 3 – Terpeniya Bay, 4 – northeastern coast, 5 – southwestern coast), Iturup Island and Kunashir Island.

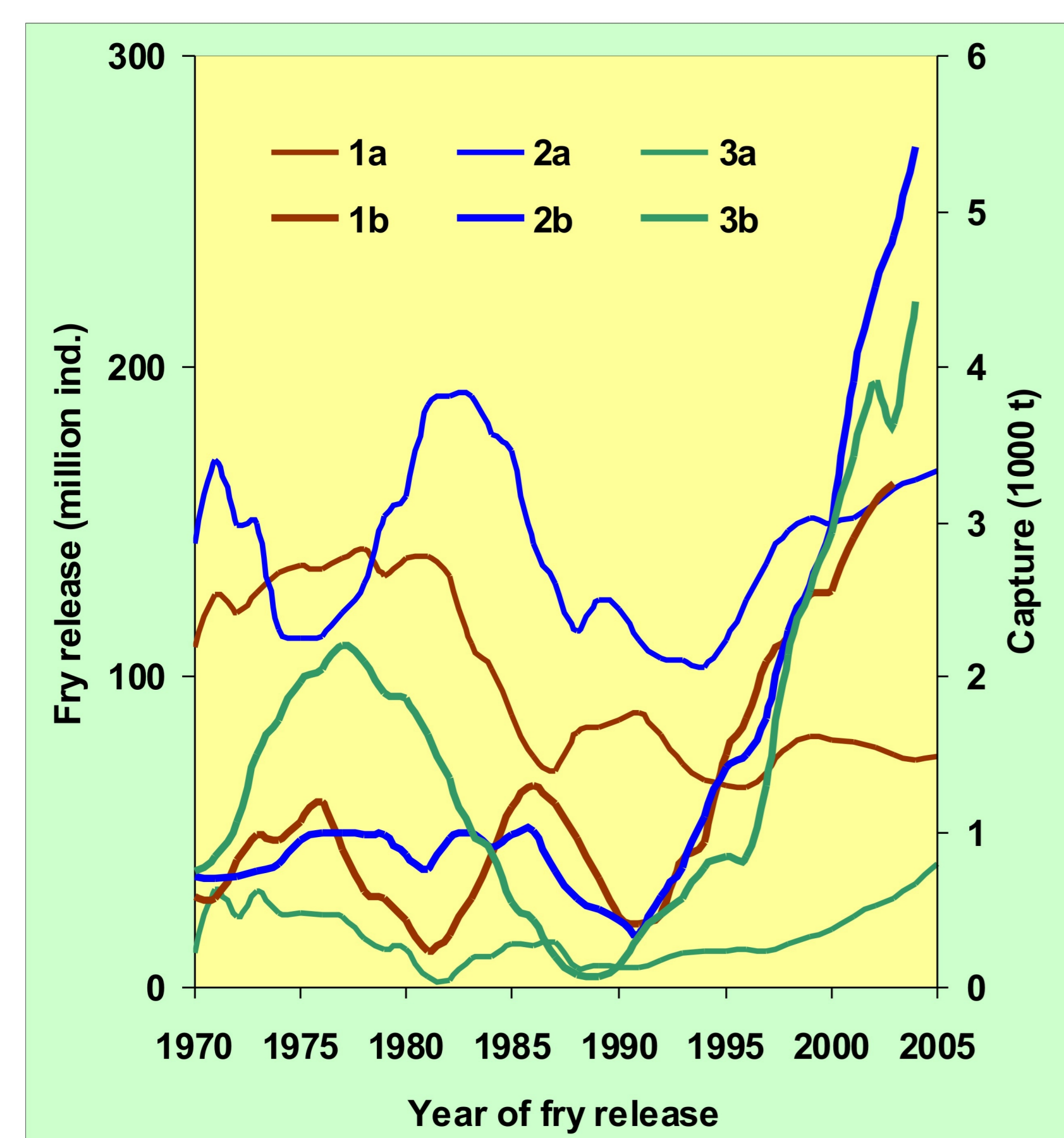


Fig. 2. Dynamics of fry release (a) and posterior catches (b) of chum salmon: 1 – southwestern Sakhalin ( $R = -0.53$ ), 2 – eastern Sakhalin ( $0.27$ ), 3 – Iturup Island ( $0.64$ ).

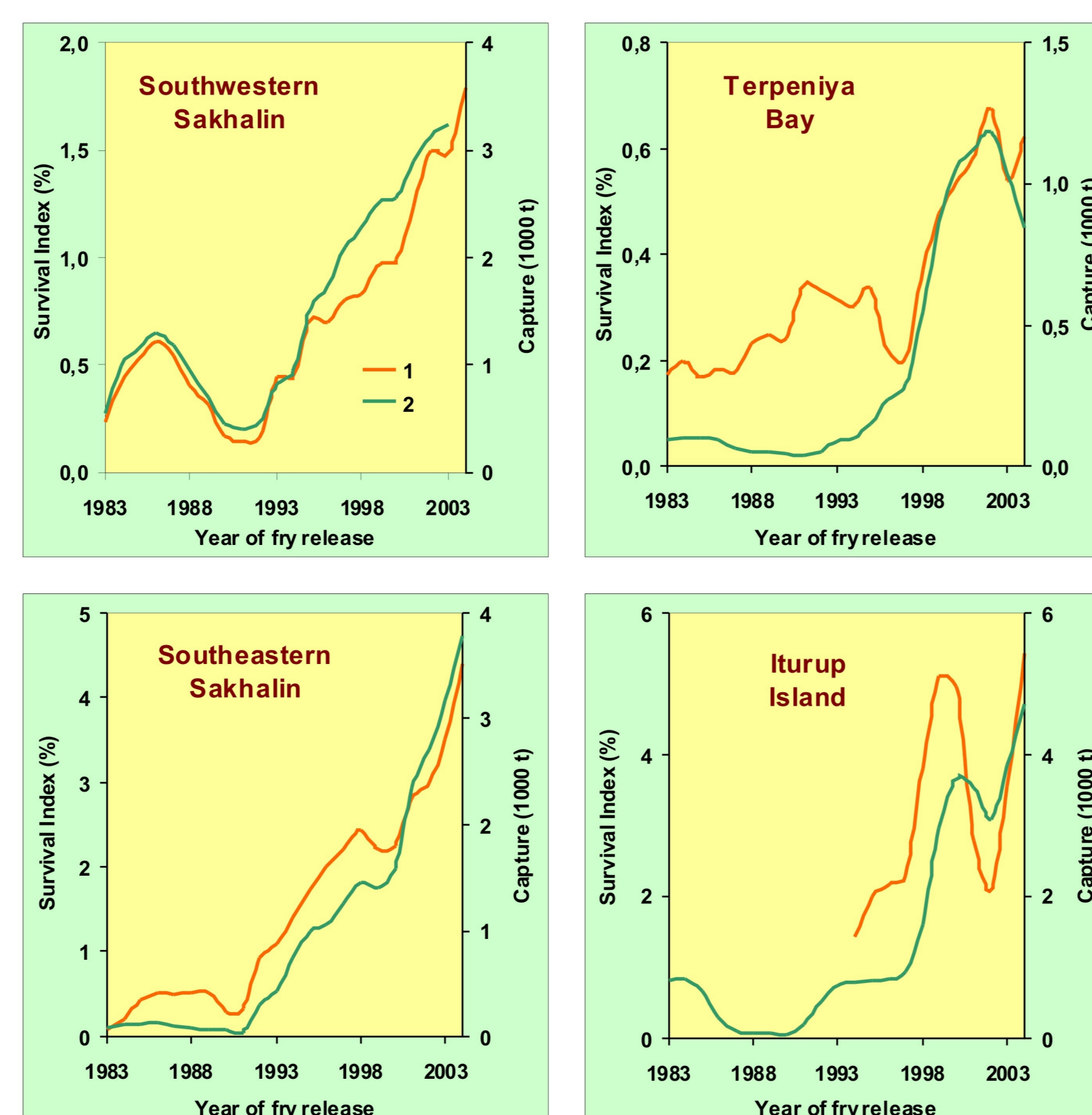


Fig. 3. Dynamics of chum salmon survival index (SI) at salmon hatcheries (1) and catches of this species (2) in different areas of Sakhalin-Kuril Region.

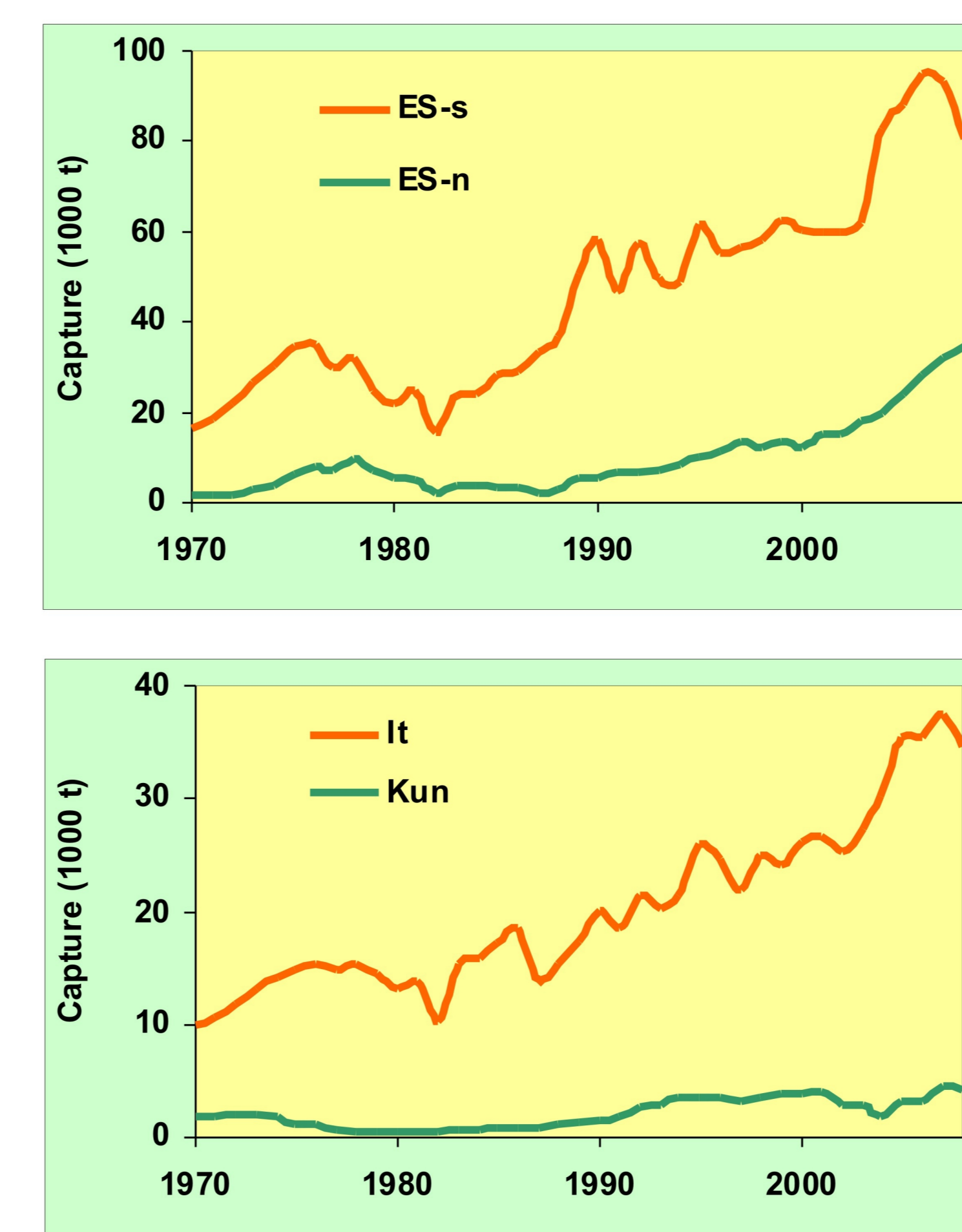


Fig. 4. Dynamics of pink salmon catches (sliding average by 4 points) in principal fishery areas of Sakhalin-Kuril Region in 1970–2008: ES – east coast of Sakhalin Island («s» and «n» denote its southern and northern parts), It – Iturup Island, Kun – Kunashir Island

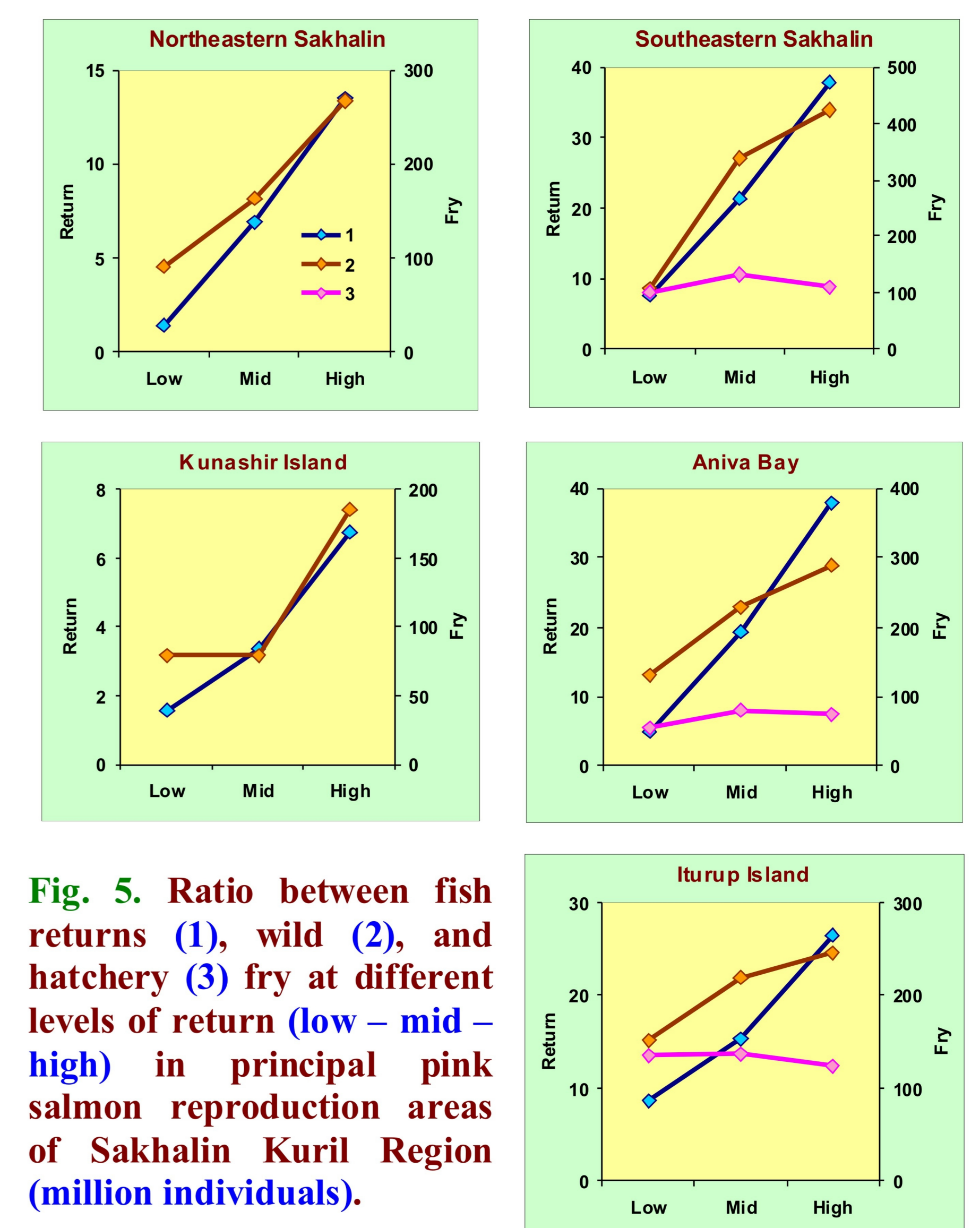


Fig. 5. Ratio between fish returns (1), wild (2), and hatchery (3) fry at different levels of return (low – mid – high) in principal pink salmon reproduction areas of Sakhalin Kuril Region (million individuals).