Long-term fluctuations of chum salmon and Pacific herring populations in Hokkaido during 1870-2000



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Herring & Chum salmon in Hokkaido



Annual change in catch of chum salmon and Pacific herring in Hokkaido during 1883-2004.

TOPICS

Long-term population dynamics of chum salmon and Pacific herring in Hokkaido relating to:

✓ Inter-specific interaction✓ Impacts of climate trends

✓Inter-specific interaction



Growth curves of chum salmon and Pacific herring juveniles in the Ishikari Bay.

Data from Ito et al. (1980), Kato and Mayama (1980), Mayama et al. (1982) in chum salmon; Sasaki et al. (2000), Sasaki and Ishida (2002) in Pacific herring.

Interspecific Competition for Food? No!





Stomach contents of chum salmon and Pacific herring juveniles in the Ishikari Bay. (Data from Seki et al. 1981 in chum salmon juvenile; Sasaki & Ishida 2002 in Pacific herring)



Relationship of catch between chum salmon (S) and Pacific herring (H) in Hokkaido from 1883 to 2004. Curves show non linear competitive interaction between 2 species by Ayala et al. (1973)

✓Impacts of climate trends

Chum salmon



Correlation map between 1° gridded sea sea-surface temperature in July-September and growth anomaly of Ishikari River chum salmon.



Annual changes in the sea surface temperature (SST) during summer and fall, and anomaly of growth at the Okhotsk Sea (Lo) of the age-4 chum salmon returning to the Ishikari River.



Increase in Hokkaido chum salmon population size since the 1980s will be caused by the increments in body size at seaward migration and the growth at the first ocean life in the coastal water of Hokkaido and the Okhotsk Sea.

Immediately after the seaward migration



Changes in body size of juvenile at release from hatchery and return rate of Hokkaido chum salmon populations.

The First Marine Life Period r=0.542, n=20, F=7.894, P=0.01



Pacific Herring



SST Correlation map with herring biomass in winter





Decrease in Hokkaido Pacific herring population size may be caused by the increase in the winter SST in the northern Japan Sea and the Okhotsk Sea?

Conclusion

Factors affecting the dynamics of chum salmon and Pacific herring in Hokkaido:

- Climate trend and ocean environment > Inter-specific interaction
- Especially, the SST in the Okhotsk Sea (for salmon and herring) and the northern Japan Sea (for herring)