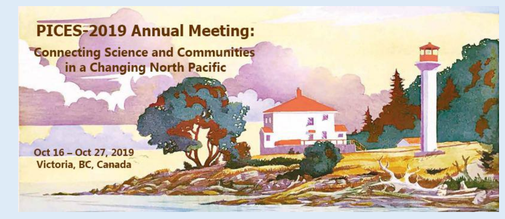
A retrospective study on spatio-temporal dynamics of pacific herring (*Clupea pallasii*) spawning groups in East Bering Sea

Shohei SASABE [1] and Naoki TOJO[2]

1.Graduate School of Fisheries Sciences, Hokkaido University, 3-1-1, Minato Cho, Hakodate, Japan 041-8611
(sparrowclub18@eis.hokudai.ac.jp)
2. Assistant Professor, Faculty of Fisheries Sciences, Hokkaido University, 3-1-1, Minato Cho, Hakodate, Japan 041-8611



Abstract

The spawning activities of Pacific herring (*Clupea pallasii*) in Bristol Bay, Alaska, is socio-economically important as both commercial and subsistence fisheries resources.In this paper, we aimed to scientifically understand and conceptualize the spatial relationship between spawning activities and the environmental variables in Bristol Bay. There were three findings: (1) the activities was often started only from the eastern areas in coastal area of Bristol Bay when the peak of spawning activities was small (S-Years), and the activities was often started from both areas in Bristol Bay when it was large (L-Years) , (2) the total concentration of sea ice(TC) in the area of pre-spawning migration passage in April was low in S-Years and high in L-Years and (3)the sea level pressure in April was low on the west side of the Alaska Peninsula in S-Year and low on the east side of it in L-Year. Our study implied the importance to investigate spatial dynamics of spawning activities in the given environmental change in the arctic and subarctic coasts.

Introduction

The spawning activities of Pacific herring (*Clupea pallasii*) in Bristol Bay, Alaska, is socio-economically important as both commercial and subsistence fisheries resources.

Commercial fisheries
Harvests have approx. 34,000 metric tons/yr. with a value of approx. $10 million/yr.

Subsistence fisheries
Herring have played a role as local livelihoods and traditional cultures for more than 8000 years.

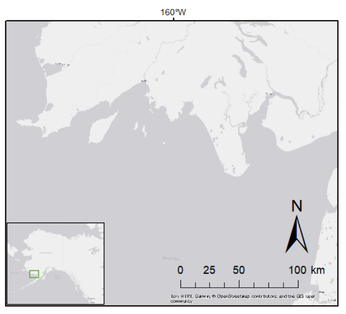
The size of the herring spawning activities and the spatio-temporal pattern of them influence to the value of products as well as the efficiency of the fishing activities.

Purpose

Scientifically understand and conceptualize the spatial relationship between spawning activities and the environmental variables in Bristol Bay.

Study area

Study area is Bristol Bay.



Data

Data	Period	Data source
Aerial survey data on spawning activities	1978-2004	Alaska Department of Fish and Game (ADF&G)
Ice chart	1978-1994	National Snow and Ice Data Center(NSIDC)
Concentration of sea ice	1995-2004	National Ice Center(NIC)
Sea level pressure (SLP)	1978-2004	NCEP/NCAR* NCEP(National Center for Environmental Prediction) NCAR(National Center for Atmospheric Research

Method

Ⅰ. Define consecutive 4 days with the largest spawning activities in each year as “Peak period”
→ Define smallest 1/3 peak period as **“S-Years”** , largest 1/3 peak period as **“L-Years”**

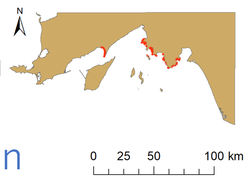
Ⅱ. Visualize spawning activities on ArcGIS
→ Analyze spread pattern of herring spawning acuities

Ⅲ. Conduct composite analysis for finding spatial relationship between spawning activities and environmental variables (TC and SLP)

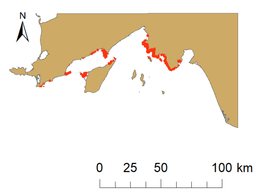
Result

Where spawning activities started

S-Years, the activities were often (7 of 9yrs) started only from the eastern areas in coastal area of Bristol Bay

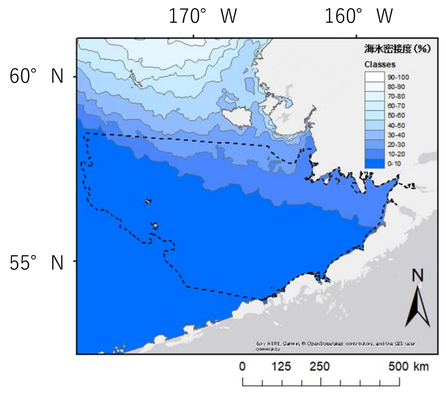


L-Years, the activities were often (7 of 9yrs) started from both areas in Bristol Bay

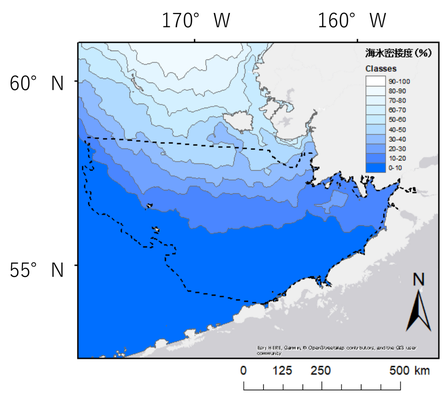


The total concentration of sea ice(TC)

S-Years, TC in the area of pre-spawning migration passage in April was low

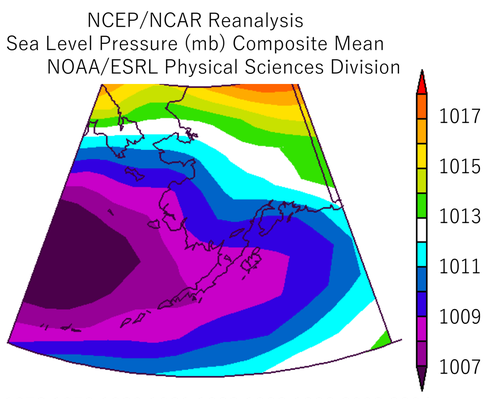


L-Years, TC in the area of pre-spawning migration passage in April was high



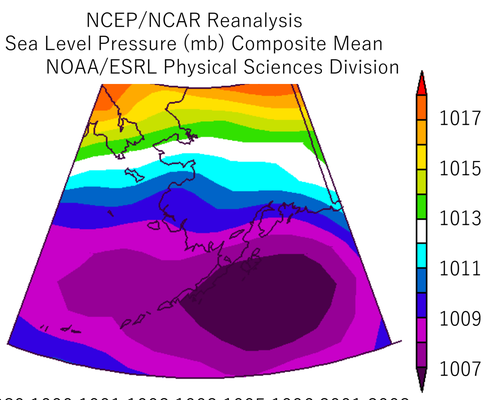
Sea level pressure (SLP) in April

S-Years, SLP in April was low on the west side of the Alaska Peninsula



Apr. 1978,1979,1980,1981,1982,1983,1998,2002,2004

L-Years, SLP in April was low on the east side of the Alaska Peninsula



Apr. 1989,1990,1991,1992,1993,1995,1996,2001,2003

Discussion

Our study implied that the change of sea ice influences to the spawning activities, especially its peak. Sea ice expanse changes year by year. It is meaningful to investigate spatial dynamics of spawning activities in the given environmental change in the arctic and subarctic coasts.