How biophysical dynamics affect juvenile chum salmon (*Oncorhynchus keta*) physiology

Michael Kohan[1]*, Megan McPhee[1], Joe Orsi[2], Franz Mueter[1] and Phil Mundy[2]

[1]University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, 17101 Point Lena Loop Rd, Juneau, Ak 99801
[2]NMFS, Alaska Fisheries Science Center, TSMRI, Auke Bay Laboratories, 17109 Point Lena Loop Rd, Juneau, AK 99801

Introduction

- Chum salmon returns are highly variable in Southeast Alaska. As an important commercial fishery, further explanation of mechanisms affecting chum salmon survival is needed.
- Juvenile chum salmon experience high mortality rates during early marine residency when migrating offshore.
- Biophysical marine factors that juvenile salmon encounter during offshore migrations may influence physiological status and marine survival.

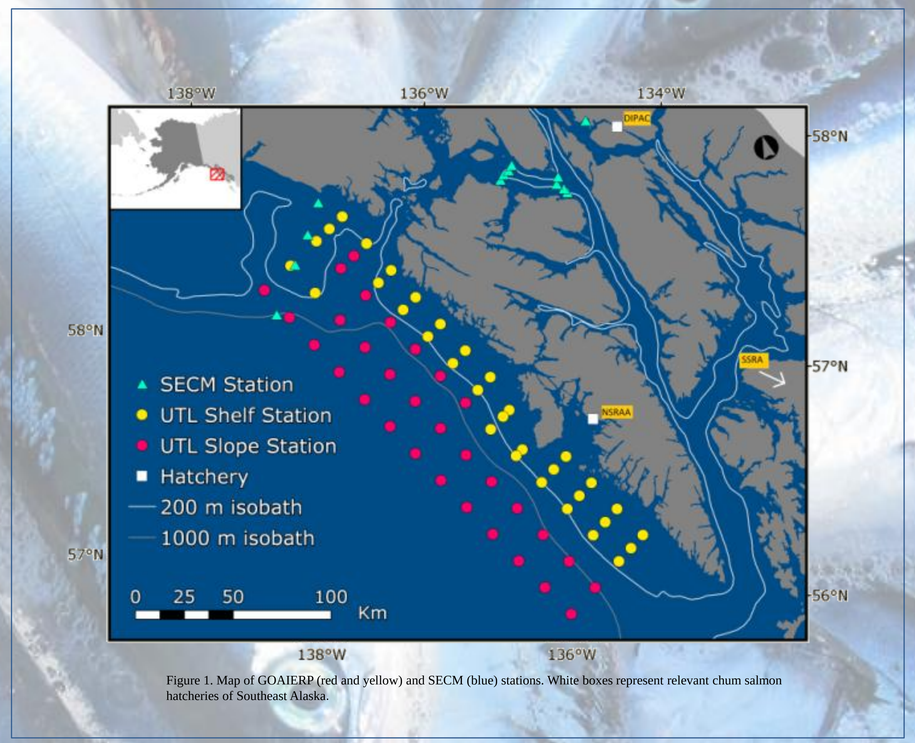


Figure 1. Map of GOAIERP (red and yellow) and SECM (blue) stations. White boxes represent relevant chum salmon hatcheries of Southeast Alaska.

Data

Physiological variables
- Length
- Weight
- Whole body energy content

Stock-of-origin
- Otoliths

Biophysical variables
- Chl-a
- SST/SSS/SSH
- mixed layer depth
- diet samples
- zooplankton composition/density
- CPUE

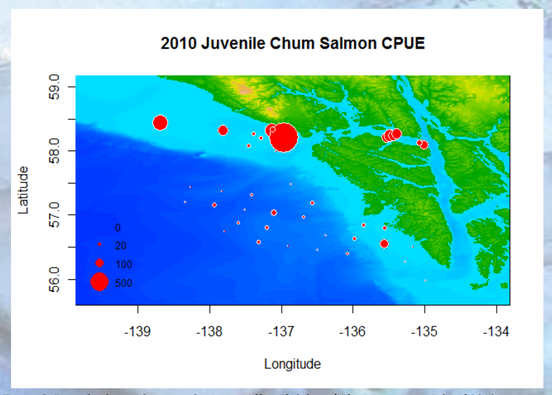


Figure 6. Juvenile chum salmon catch per unit effort (fish hour^{-1}) from stations in July of 2010.

Objectives

- Describe the relationship between juvenile chum salmon distribution patterns and environmental variables.
- Describe the relationship between the physiological status of juvenile chum salmon and biophysical variables.
- Understand stock-of-origin differences in juvenile chum salmon physiology between inshore and offshore marine environments and between hatchery and wild populations.

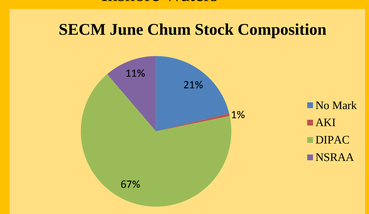
Figure 2. Using a Nordic 264 rope trawl to collect juvenile salmon.

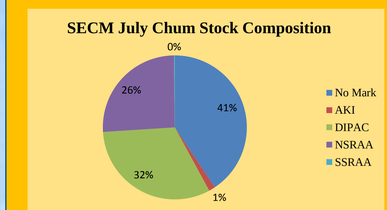
Figure 3. Zooplankton tow with 0.15 and 0.5 net mesh.

Figure 4. CTD cast to collect vertical profiles of water properties at stations.

2010 Preliminary Otolith Results

Inshore Waters





Offshore Waters

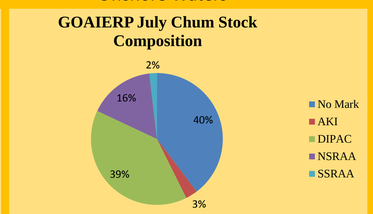


Figure 7. Chum salmon stock composition from SECM June and July surveys and GOAIERP July survey. No mark is presumed as wild chum stock. SECM stations are located inshore while GOAIERP stations are located offshore.

Sampling

- The Gulf of Alaska Integrated Research Project (GOAIERP) and Southeast Alaska Coastal Monitoring Project (SECM) sampled stations offshore and inshore Southeast Alaska in 2010 and 2011 collecting juvenile chum salmon and biophysical data (Fig. 1)
- Fish were collected using a surface trawl targeting the top 20 meters of water for 30 minutes at each station (Fig. 2)
- Zooplankton samples were collected using a 0.15m net mesh and a 0.5mm net mesh MARMAP bongo obliquely towed from a depth of 200m or 10m from the bottom (Fig. 3)
- Vertical profiles of water properties to within 10 m from the bottom were collected using a Seabird 911*Plus* CTD (Fig. 4)
- GOAIERP and SECM sampling stations are strategically located along the main migration corridor for juvenile salmon transiting from inshore waters of Northern Southeast Alaska to the Gulf of Alaska (Fig. 5)

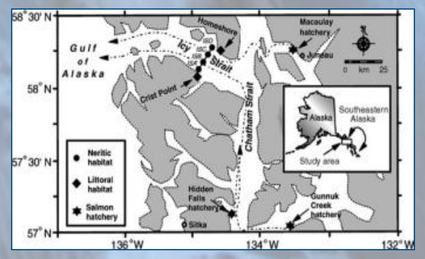


Figure 5. Map of northern region of Southeast Alaska illustrating principle migratory routes (dashed lines) for juvenile chum salmon. SECM sampling stations are located in Icy Strait.

Source: Orsi et al. 2005.

Impacts

Identifying biophysical indicators that affect recruitment will improve forecasts for hatchery and wild chum salmon as well as provide an ecosystem metric to refine forecasts of other salmon species in Southeast Alaska.

Next Steps

- Analyze spatial patterns of chum salmon and biophysical variables of study area (Fig. 6)
- Use cluster analyses to identify different habitats for chum salmon
- Process 2011 field data

Acknowledgements

- AKSSF, UAF for funding
- Auke Bay Labs/SECM contractors for processing data
- NSRAA/DIPAC/SSRAA for processing otoliths and stock data
- Photography : Michael Kohan & Joe Orsi
- Maps: Auke Bay Labs/NOAA