BIO-P 14270

The utilization of cold-water zooplankton as prey for chum salmon fry (*Oncorhynchus keta*) in Yamada Bay, Iwate, Pacific coast of northern Japan

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Background

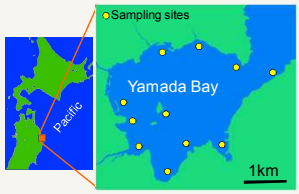
Early life history of chum salmon

After the migration into the sea from the river, chum salmon fry stay in the coastal area during spring to early summer, subsequently migrate to the northern North Pacific Ocean. The availability of prey organisms in this early marine period is one of the most important factors affecting growth and survival of salmon fry. The magnitude of the Oyashio significantly affects the zooplankton community structure in nearshore waters in this period. Therefore, we expect that feeding habits and prey selectivity of chum fry might vary in response to fluctuations in coastal environmental conditions.

Aim

In order to clarify these relationships, we analyzed the stomach contents composition of chum salmon fry and in situ zooplankton community structure during their coastal residence period using samples collected at the Sanriku coastal area for four years. Our ultimate goal is to clarify the relationship between the nearshore environment of chum fry and the adult return rate, and to subsequently develop a salmon fry release strategy to improve returns of adult salmon.

Materials & Methods



◆ Chum salmon fry

Sampling • Purse seine (day)

Measuring • Fork length • Body weight

Stomach contents analysis

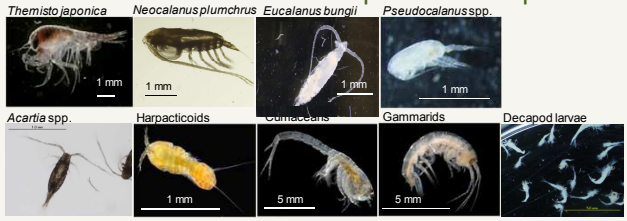
◆ Field zooplanktons

Sampling • NORPAC net

◆ Identification of stomach contents / field plankton samples

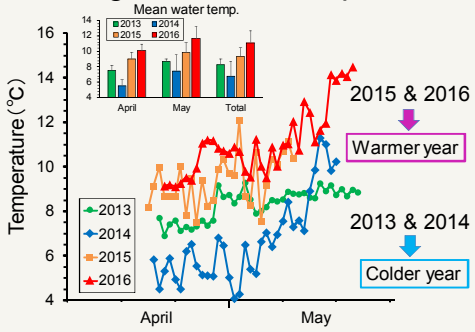
• Cold water species (Transferred by Oyashio water)

• Resident species

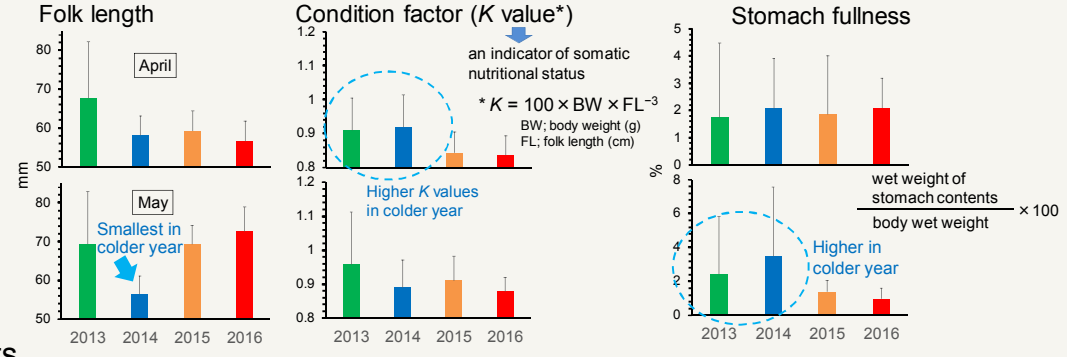


Result and Discussion

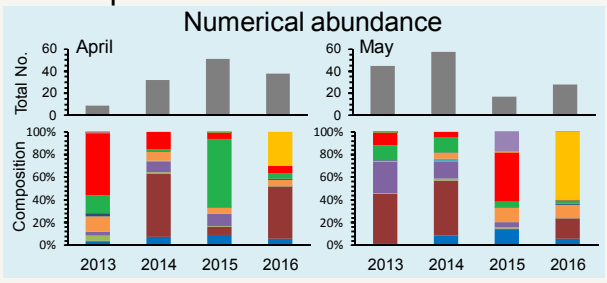
1. Changes in water temperature

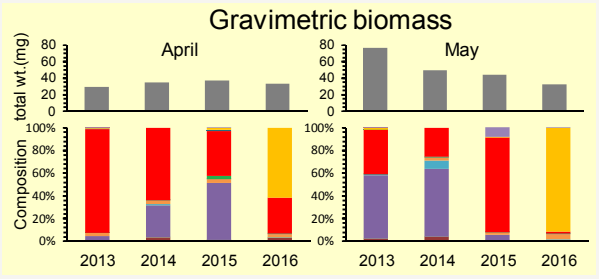


2. Yearly differences of somatic conditions of chum salmon fry



3. Composition of stomach contents



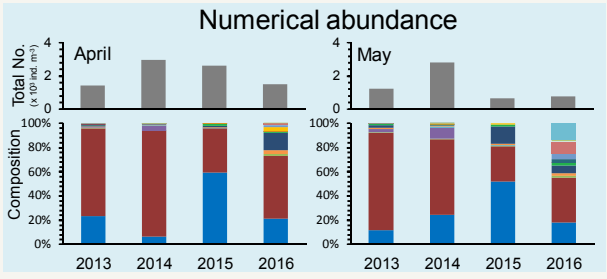


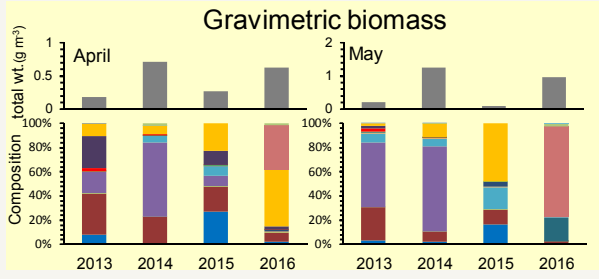
Dominated contents:

- Colder year (2013～2015)
  - ➡ Large cold water species (*Neocalanus*, *Themisto*)
- Warmer year (2016)
  - ➡ Decapod larvae

Acartia spp. | *Pseudocalanus* spp. | *Centropages* spp. | *Neocalanus plumchrus* | *Eucalanus bungii* | Other calanoids
Oithona spp. | Harpacticoids | *Themisto japonica* | Gammarids | Cumacean | Decapod larvae
Barnacle larvae | Cnidarian | Larvacean | Terrestrial insects | Cladocera

4. Composition of field zooplankton community

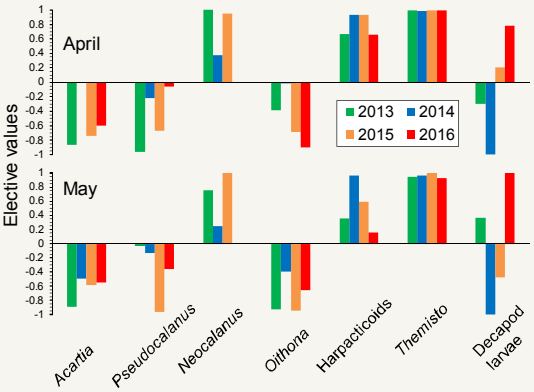




Dominated species:

- 2013～2014 Cold water copepods (*Neocalanus*、*Pseudocalanus*)
- 2015 Decapod larvae
- 2016 Cnidarian

5. Feeding selectivity of chum salmon fry

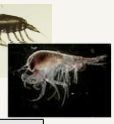


Ivlev's elective values $\frac{(d_i - e_i)}{(d_i + e_i)}$ numerical percentage for taxon i in the diet (d_i) and water column (e_i)

- *Themisto* & *Neocalanus*
  - ➡ always high selectivity
- Decapod larvae
  - ➡ hardly preyed during 2013 to 2015
  - ⇕ markedly preyed in 2016
- Small copepods (*Acartia*, *Pseudocalanus*)
  - ➡ always low selectivity
- Harpacticoids
  - ➡ always high selectivity
  - ⇓ potentially important prey items

Conclusion

The inflow of the Oyashio current into coastal area ➡ provides a favorable food for chum salmon fry



What is the impact on the adult return rate?

Costal retention year	Mean water temp. (°C)	*Neocalanus*+ *Themisto* biomass (mg m^{-3})	Adult return rate after 3 years (%)
2013	8.3	98.5	0.9
2014	6.7	606.9	0.6
2015	9.4	10.7	0.9
2016	11.1	0.5	?

Adult return rates did not necessary rise when the Oyashio influence and cold water zooplankton biomass of 3 years ago were large.

➡ Detailed studies are needed to elucidate the relationship between environmental conditions during the coastal residence periods and the adult return rates.

More details… Yamada et al. (2019) doi.org/10.1016/j.rsma.2019.100633