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# Early life history of Japanese horse mackerel *Trachurus japonicus* in the north Satsunan area, southern Japan

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## Introduction

- Main spawning ground of *Trachurus japonicus* is located in southern East China Sea.
- It is assumed that *T. japonicus* spawns in southern East China Sea and larvae and juveniles abundantly recruit into the fishery grounds around Japan (Sassa *et al*. 2006).
- Meanwhile, Hattori (1964) suggested that the north Satsunan sub-populaton may recruit into the fishery grounds in Pacific coast of Japan and substantially support the fishery resources of *T. japonicus*.
- In this study, we clarified the early life history of *T. japonicus* and evaluated the importance of the north Satsunan area as the nursery grounds for *T. japonicus*.

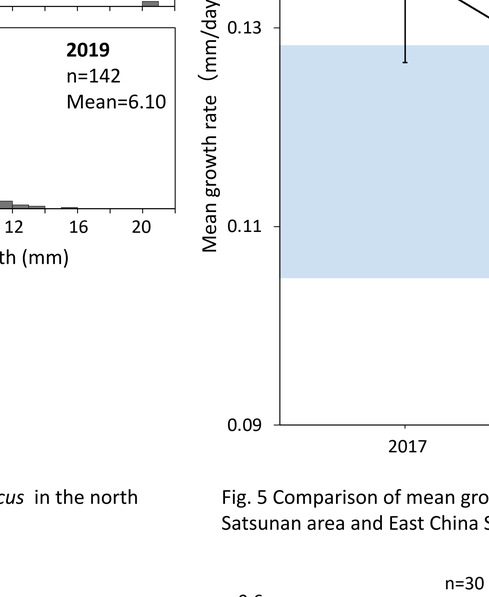


Fig. 1 Red and blue areas are the spawning grounds of the Tsushima and Pacific *Trachurus japonicus* populations, respectively.

## Materials and methods

### Survey

Period: January-May in 2015-2019

Study area: Inner part KB1-6; Outer part SK1-9

Sample collection:

- ORI net was obliquely towed from the bottom to the surface at approximately 2 knots for 30 min.
- Water temperature and salinity was recorded by CTD.
- Zooplankton samples were collected by towing a twin-type NORPAC vertically from 200 m or near bottom to sea surface at each station.

### Analysis

- Spatiotemporal occurrence
- Growth and dietary analyses

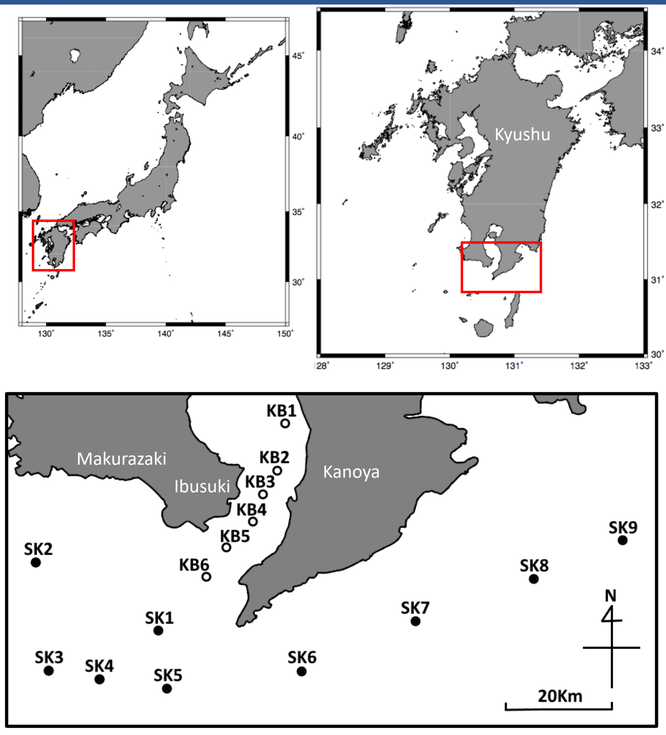


Fig. 2 Sampling stations in the north Satsunan area.

## Result and discussion

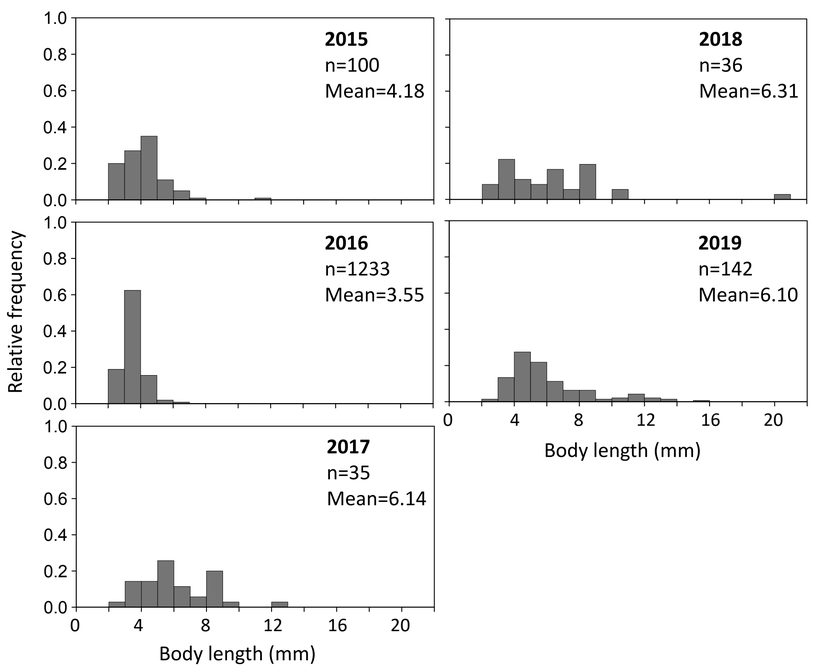


Fig. 3 Length-relative frequency of larval and juvenile *Trachurus japonicus* in the north Satsunan area from 2015 to 2019.

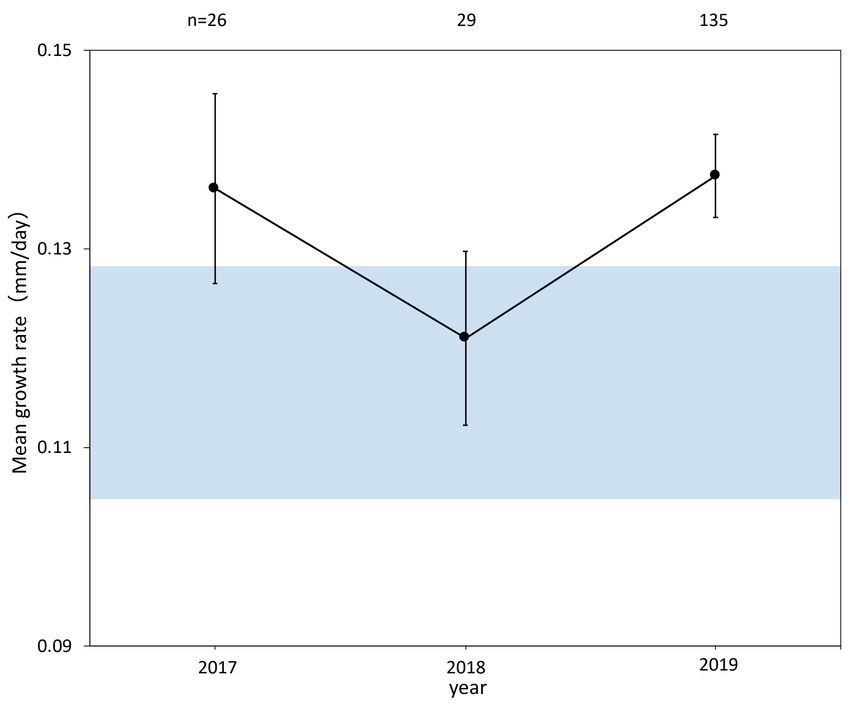


Fig. 5 Comparison of mean growth rate of *Trachurus japonicus* larvae in the north Satsunan area and East China Sea (bluish area: Takahashi et al. 2014).

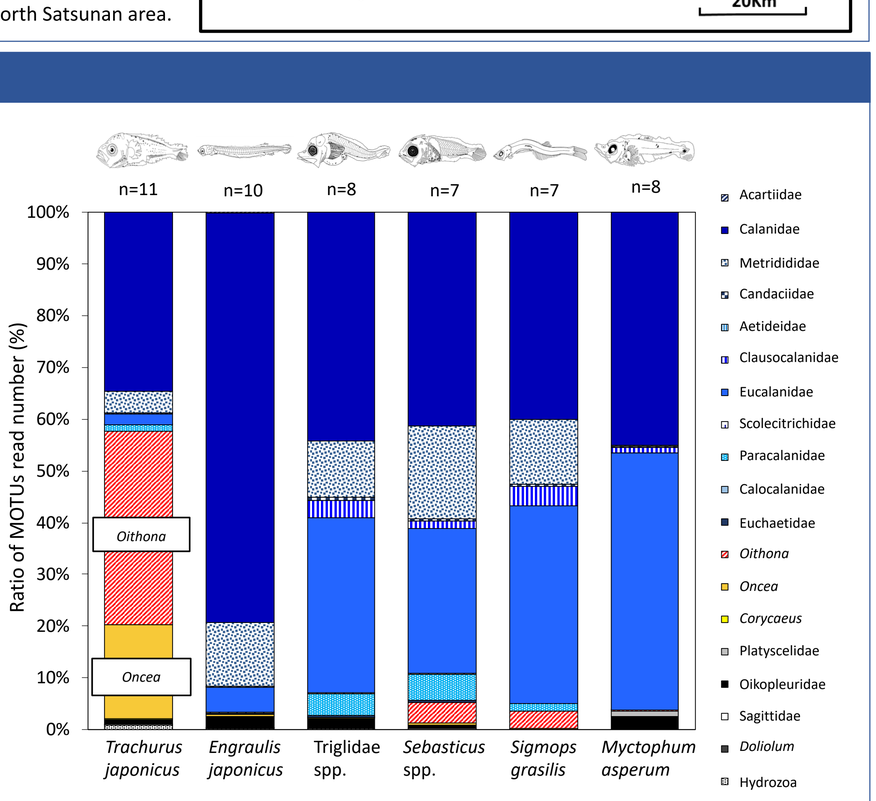


Fig. 7 Prey composition of *Trachurus japonicus* and other five dominant species larvae by DNA meta-barcoding analysis.

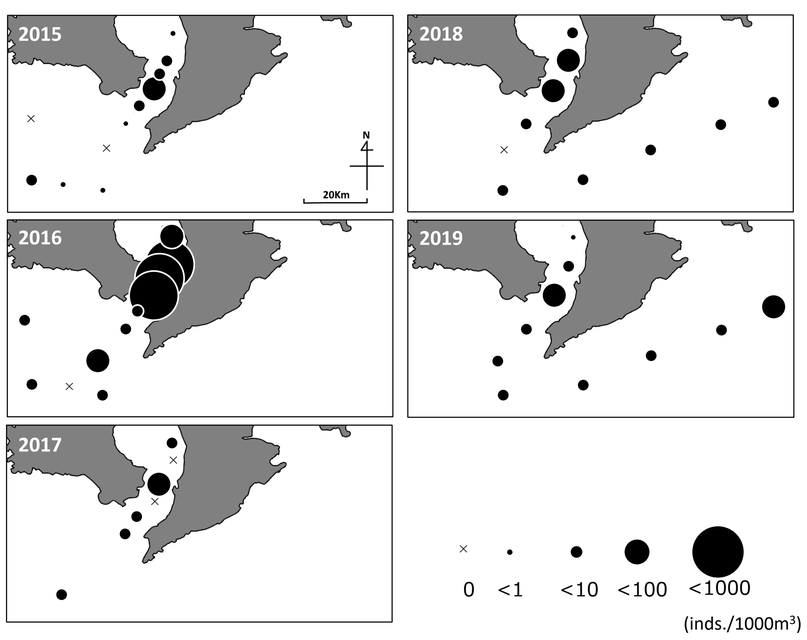


Fig. 4 Larval and juvenile density distribution of *Trachurus japonicus* at 15 stations in the north Satsunan area from 2015 to 2019.

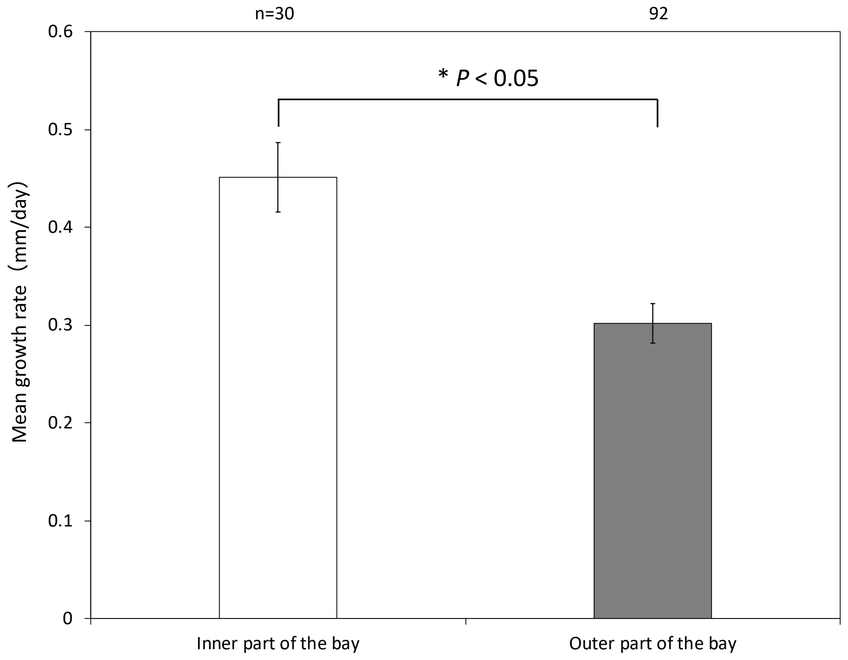


Fig. 6 Comparison of mean growth rate (3days before sampling) of *Trachurus japonicus* larvae in the inner and outer part of Kagoshima Bay in 2019.

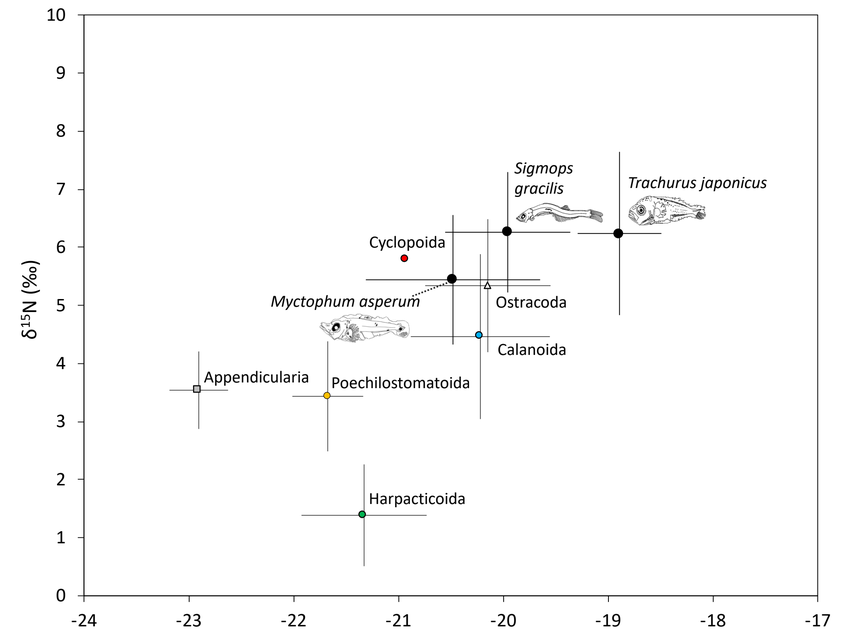


Fig. 8 Mean isotopic signatures of carbon ($\delta^{13}$C ± SD) and nitrogen ($\delta^{15}$N ± SD) of *Trachurus japonicus* and dominant mesopelagic fish larvae and their main preys.

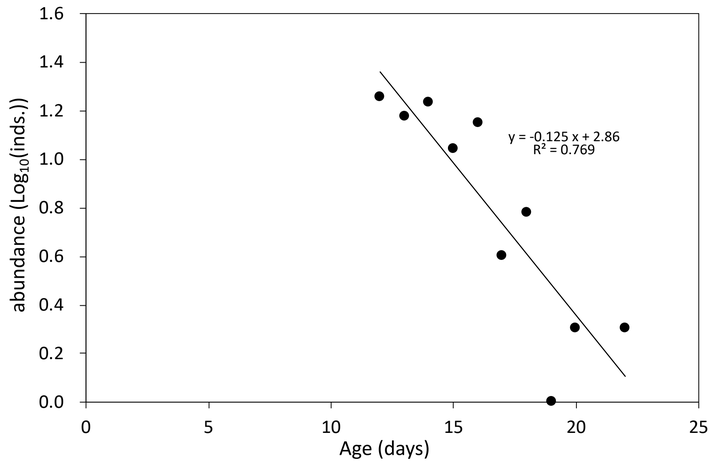


Fig. 9 Relationship of age and abundance of *Trachurus japonic*us larvae.

Table 1. Survival rate of *Trachurus japonicus* larvae in the East China Sea (Sassa et al. 2014) and the north Satsunan area (the present study).

| Survey year | Area | Survival rate （%） |
|---|---|---|
| 2005～2009 | East China Sea | 87.3～89.9 |
| 2019 | north Satsunan area | 88.3 |

### Is the north Satsunan area favorable as the nursery ground?

**Yes**: The values of abundance, mean growth rates and survival ratio were equivalent to the data of previous studies in East China Sea.

- ➢ Feeding habits were different between *T. japonicus* and the other dominant fish larvae.
- ➢ There are no strong competition for prey items between *T. japonicus* and the mesopelagic fishes.

### The importance of the mouth of Kagoshima Bay in the north Satsunan area

- ➢ Mean growth rate was significantly higher in the inner part than the outer part.
- ➢ Copepods density of the inner part is higher than outer part (not displayed data).
- ➢ The oceanic water sporadically inflows into Kagoshima Bay during the winter and spring months, leading to a massive upwelling and phytoplankton bloom (favorable feeding conditions).

References

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Sassa C, Konishi Y, Mori K (2006) Distribution of jack mackerel (*Trachurus japonicus*) larvae and juveniles in the East China Sea, with special reference to the larval transport by the Kuroshio Current. Fish Oceanogr 15: 612–619

Takahashi M, Sassa C, Nishiuchi K, Tsukamoto Y (2016) Interannual variations in rates of larval growth and development of jack mackerel (*Trachurus japonicus*) in the East China Sea: implictions for juvenile survival. Can J Aquat Sci 73: 155–162

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