A new integrated method to elucidate climate variability impacts on living marine resources

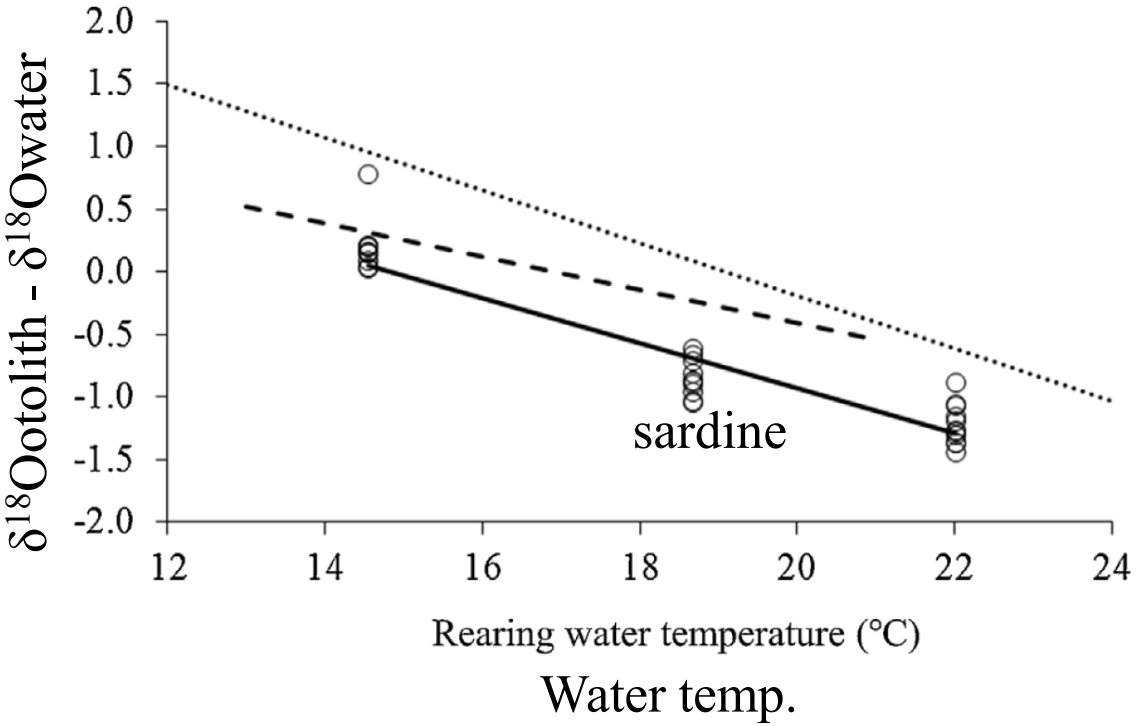
Shin-ichi Ito, Tetsuichiro Funamoto, Osamu Shida,
Yasuhiro Kamimura, Motomitsu Takahashi, Kotaro Shirai,
Tomihiko Higuchi, Kosei Komatsu, Takaaki Yokoi,
Tatsuya Sakamoto, Chenying Guo and Toyoho Ishimura

Today's contents

1. review on studies for climate variability impacts on living marine resources
2. breakthrough points
3. a new integrated approach

2. breakthrough

Stable oxygen isotope ratio in otolith



Water temp.

Sakamoto et al. (2017)

$\delta^{18}O$ ($^{18}O/^{16}O$) in otolith

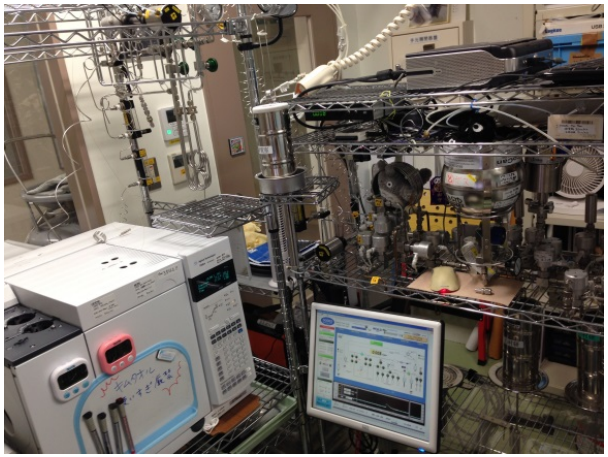
- Depends both on water temperature and water $\delta^{18}O$.
- Water $\delta^{18}O$ depends on salinity through evaporation and precipitation processes.

Division of salinity and temp. effects is important.

Toyoho Ishimura

New Equipment for Analyses

Micro-scale isotopic analytical system



MICAL3c by Toyoho Ishimura

High-precision micromill

http://www.g326.com

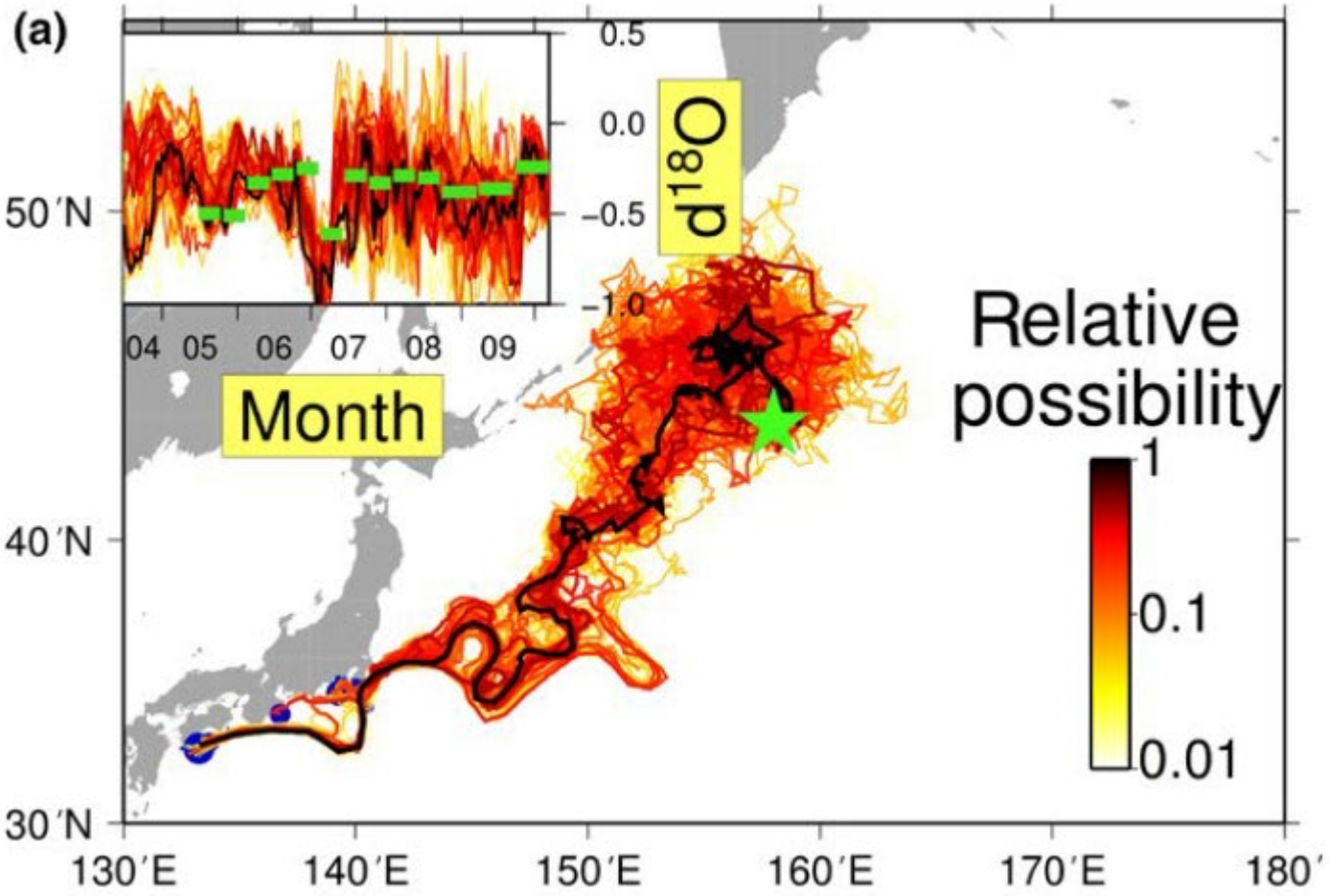
- **Ishimura et al. (2004; 2008) developed a high detection system "MICAL3" to analyze $\delta^{18}O$ from calcium carbonates with a 0.2 µg sample.**
- **A high-precision micromill "Geomill326" (Sakai, 2009) has enabled drilling of otolith with 1 µm precision.**
- **Those combination enable us to investigate $\delta^{18}O$ history of otolith with weekly time resolution**

On going and future perspectives

- **Weekly to daily resolution measurements of otolith $\delta^{18}O$ for larvae and juveniles.**
- **Improve fish growth and migration models by comparing with observed otolith estimated growth and otolith $\delta^{18}O$.**
- **Direct comparison between experienced environmental history & growth, and hence survival of fish.**

Reference: Ito et al. (2018, Oceanogr. Japan)

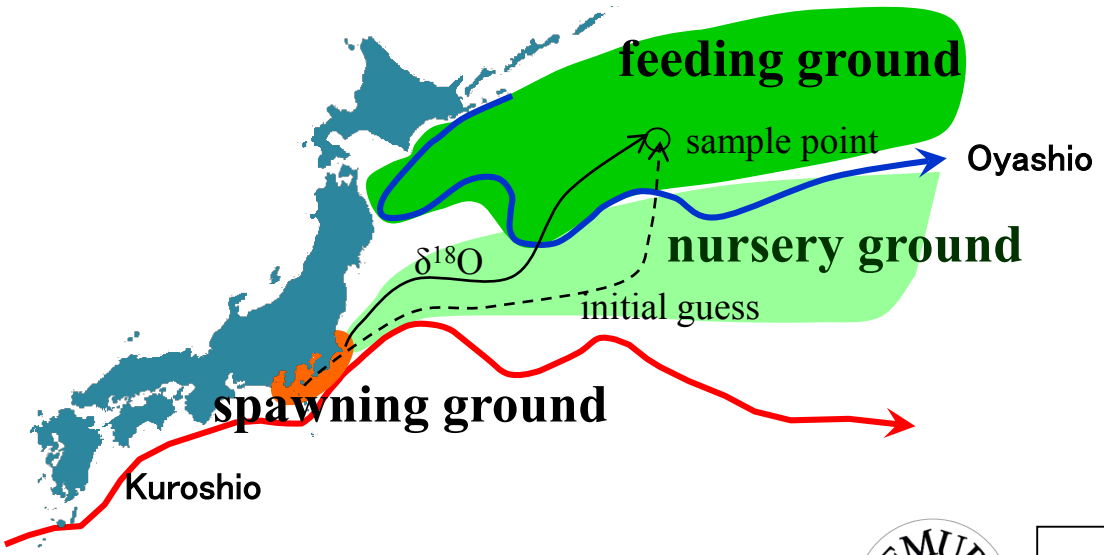
Application for Japanese sardine



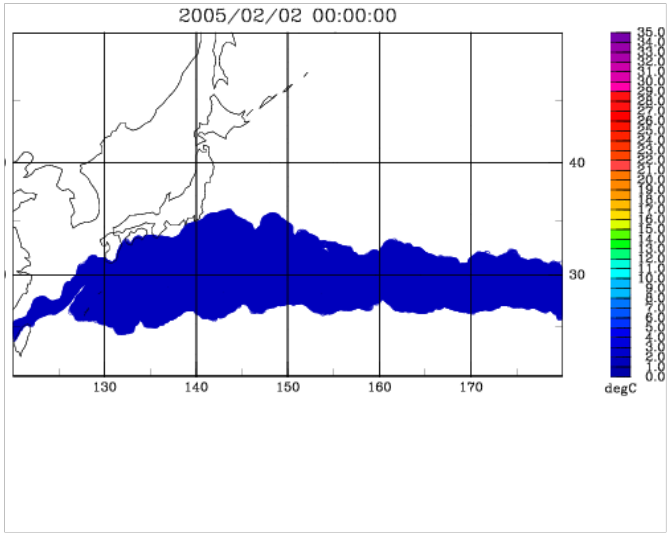
Reference: Sakamoto et al. (2018, Methods Ecol. & Evol.)

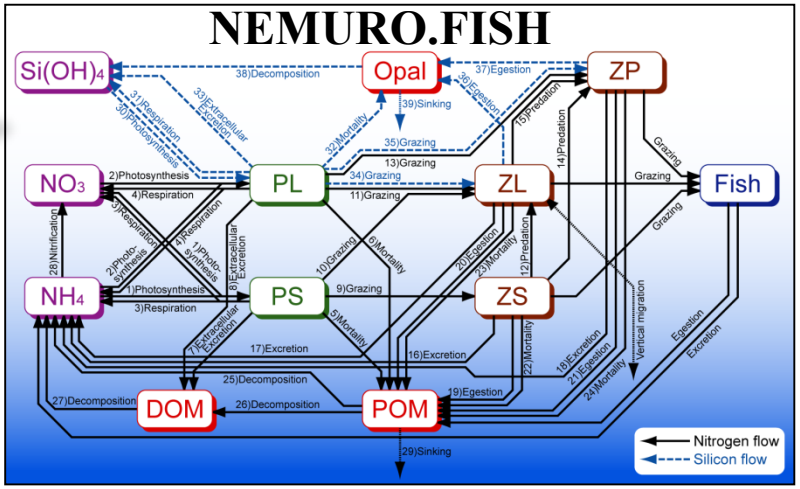
3. A new approach

Integrated method to reconstruct environmental histories of larvae and juveniles



Combination of a fish growth-migration model (NEMURO.FISH) with otolith chemical analysis enables precise estimation of migration routes and experienced environments.





Ito et al. (2004, 2007, 2010, 2013) etc.
Megrey et al. (2007),