A Lagrangian modeling approach for Pacific saury migrations

Michio J. Kishi, Seokjin Yoon, Takeshi Terui, Satoshi Suyama, Masayasu Nakagami and Shin-ichi Ito
Pacific saury (Sanma) distribute widely in North Pacific. Otolith analysis 2005 year class
2005 year class

A  130E～160E  48
B  160E～170W  61

Otolith radius (μm)

Date after hatching
No relation! Between 180 days juvenile and adult
Saury caught in the “Eastern Pacific”: Growth until 300 days is better than those in Western.

HOWEVER

There is no co-relation between early growth and adult weight
So we use numerical simulation

Initial position 2002, Feb. 1st

- 130°E – 110°W, 18.5 ≤ T ≤ 20.0 °C (Iwahashi et al., 2006)
- Total 322 particles
Environmental data

<table>
<thead>
<tr>
<th>Velocity</th>
<th>SST</th>
<th>Prey density</th>
</tr>
</thead>
</table>

- Lagrangian model
- Bioenergetics model
- Migration module

Position
- Growth

Individual-Based Model (IBM)
① Environmental data

**Velocity:** Ambe08 (1/3°)  
estimated from satellite altimetry and drifting buoy  
(D. Ambe, FRA)

**SST:** MODIS/Terra (1/12°)  
(T. Kameda, FRA)

**Chlorophyll a:** SeaWiFS (1/12°)  
(T. Kameda, FRA)

1.0 [mg chl \(a\) m\(^{-3}\)] is converted into \(ZS\) 0.38 [g m\(^{-3}\)], \(ZL\) 0.75 [g m\(^{-3}\)], \(ZP\) 0.15 [g m\(^{-3}\)]  
(Ikeda et al., 2008)
Bioenergetics model

NEMURO.FISH

North Pacific Ecosystem Model for Understanding Regional Oceanography For Including Saury and Herring

\[ W = \left( \frac{KL}{6.13} \right)^3 \]

Ito et al. (2004), Megrey et al. (2007), Mukai et al. (2007)
③ Migration module

Feeding migration

Saury search for local optimal habitats.
(1) Optimal temperature for fish
(2) Maximum growth for fish

Spawning migration

Spawning migration starts 1 month before the spawning beginning date, depending on knob length (> 25 cm), and the duration is 2 months.
(1) Spawning temperature (17 – 25 °C)
(2) Maximum growth for larvae
Initial position 2002, Feb. 1st

- $130^\circ$E $-$ $110^\circ$W, $18.5 \leq T \leq 20.0 \, ^\circ$C  (Iwahashi et al., 2006)
- Total 322 particles
Born in 「A」, spawning in 「A」(130g〜) after 2yrs

Initial position
Feeding migration
Spawning migration
Final position
Born in “A” Begin spawning in “A”
Saury No. 37
Saury No.88
Thank you!!

Not saury but "SANMA"