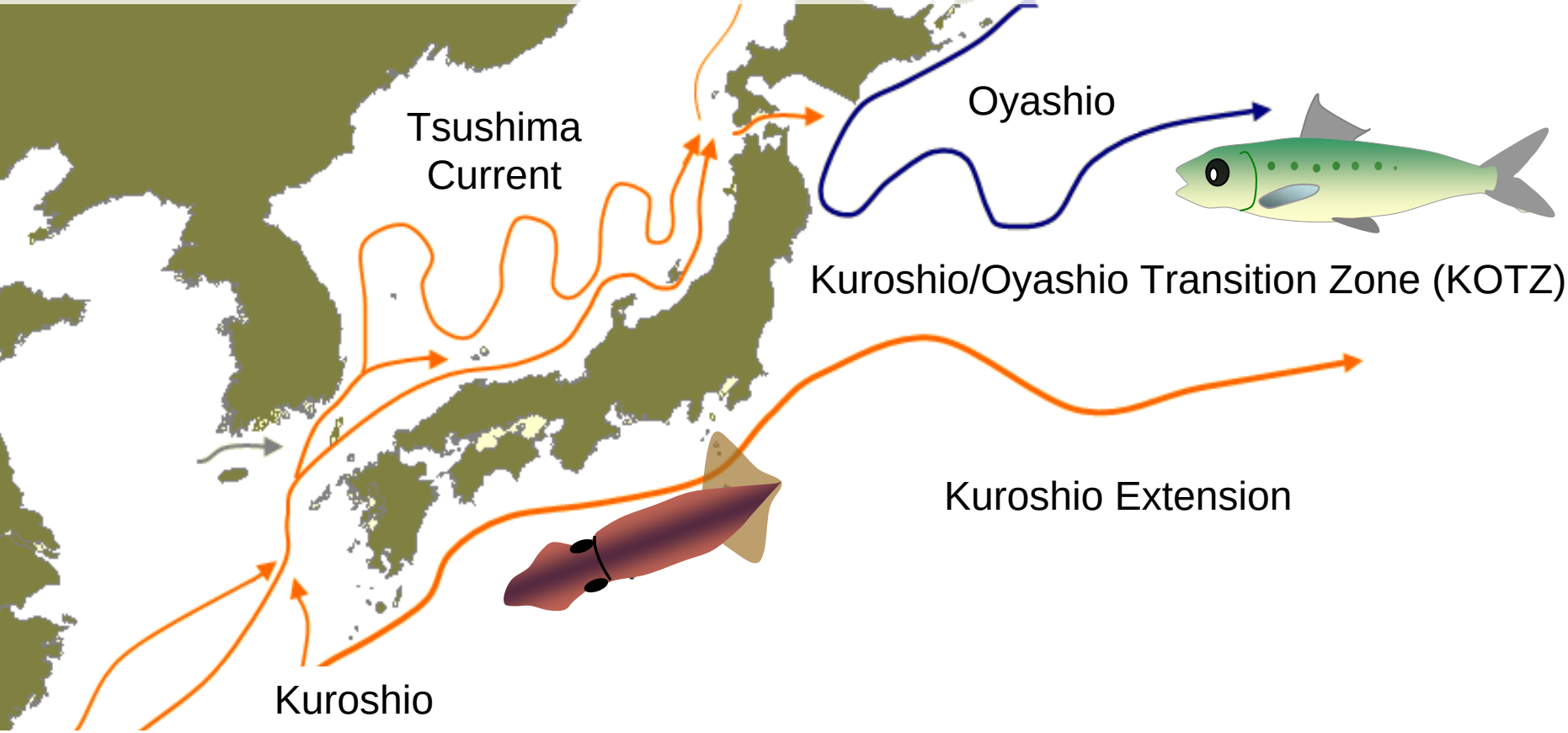
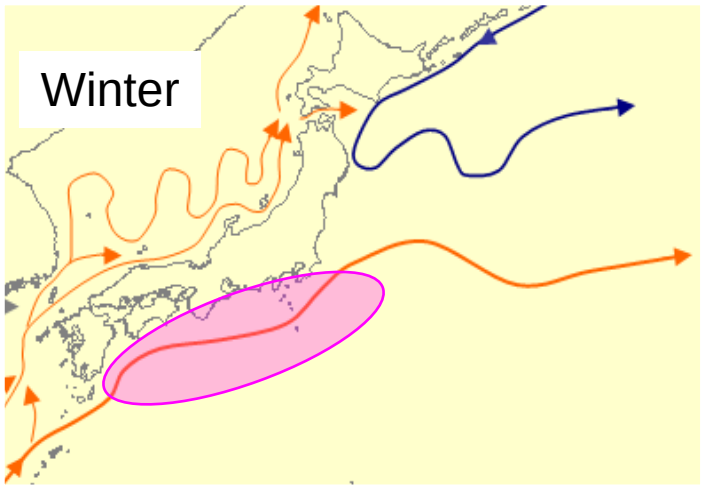
Mechanisms of population dynamics of Japanese sardine and Japanese common squid in the Kuroshio/Oyashio Current System, with a speculation on their future

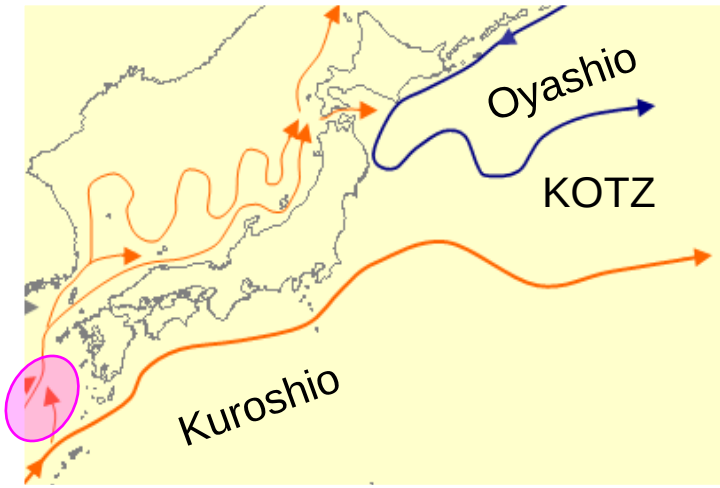


Akihiko Yatsu, Hiroshi Nishida, Ken Mori (FRA, Japan), Yasunori Sakurai (Hokkaido Univ, Japan), and Sanae Chiba (JAMSTEC)

May 2008 Gijon

Migration and interactions of Japanese sardine and common squid



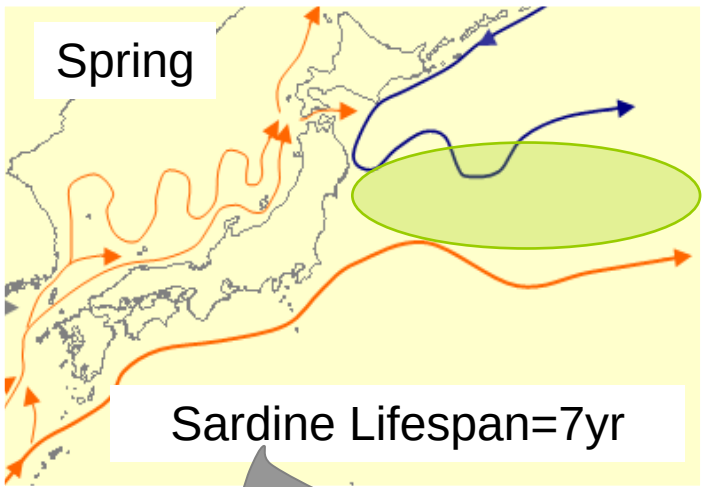


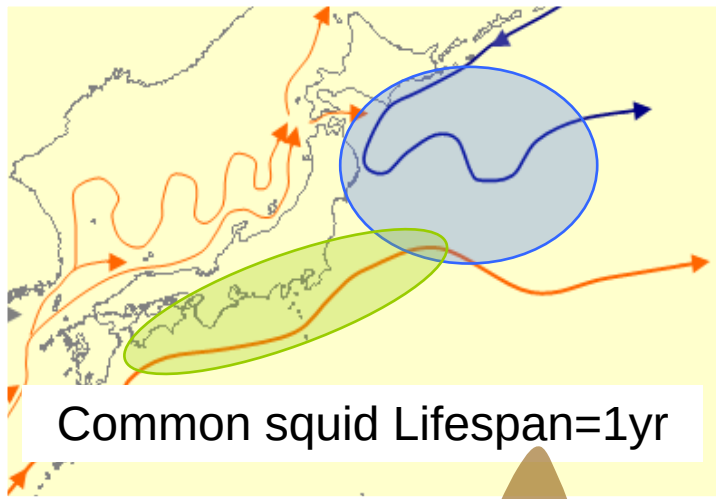
Legends

Spawning

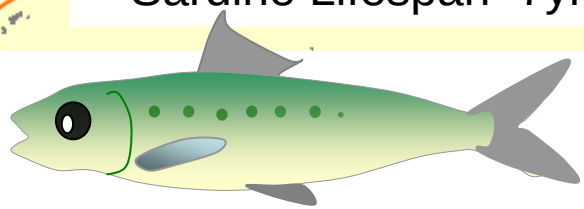
Nursery

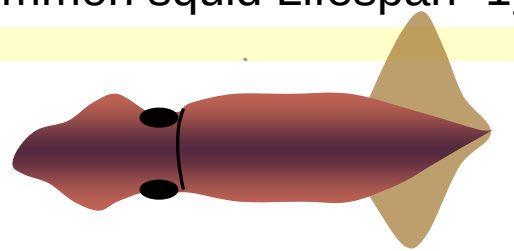
Feeding



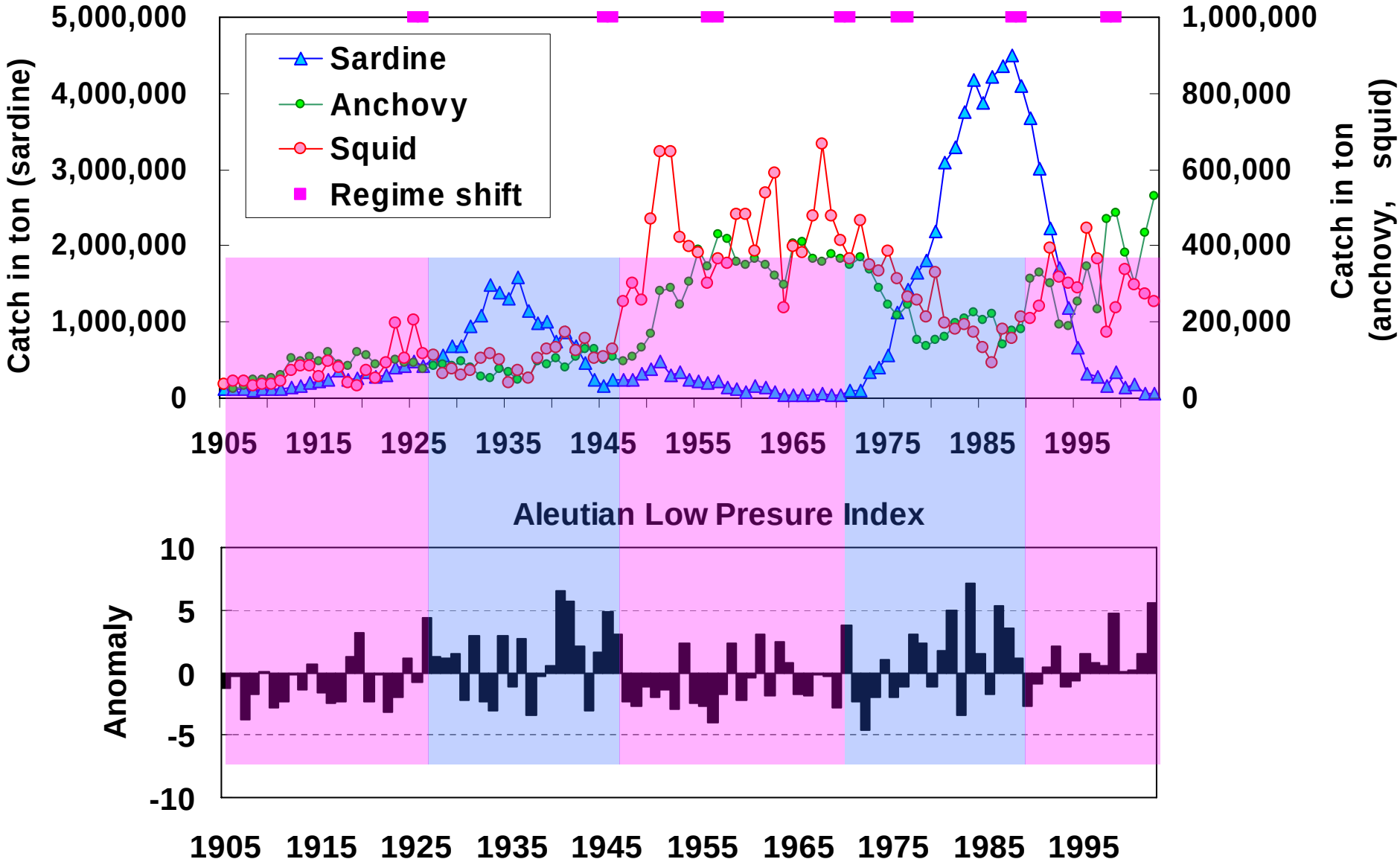


Discarded head and fin of sardine by common squid

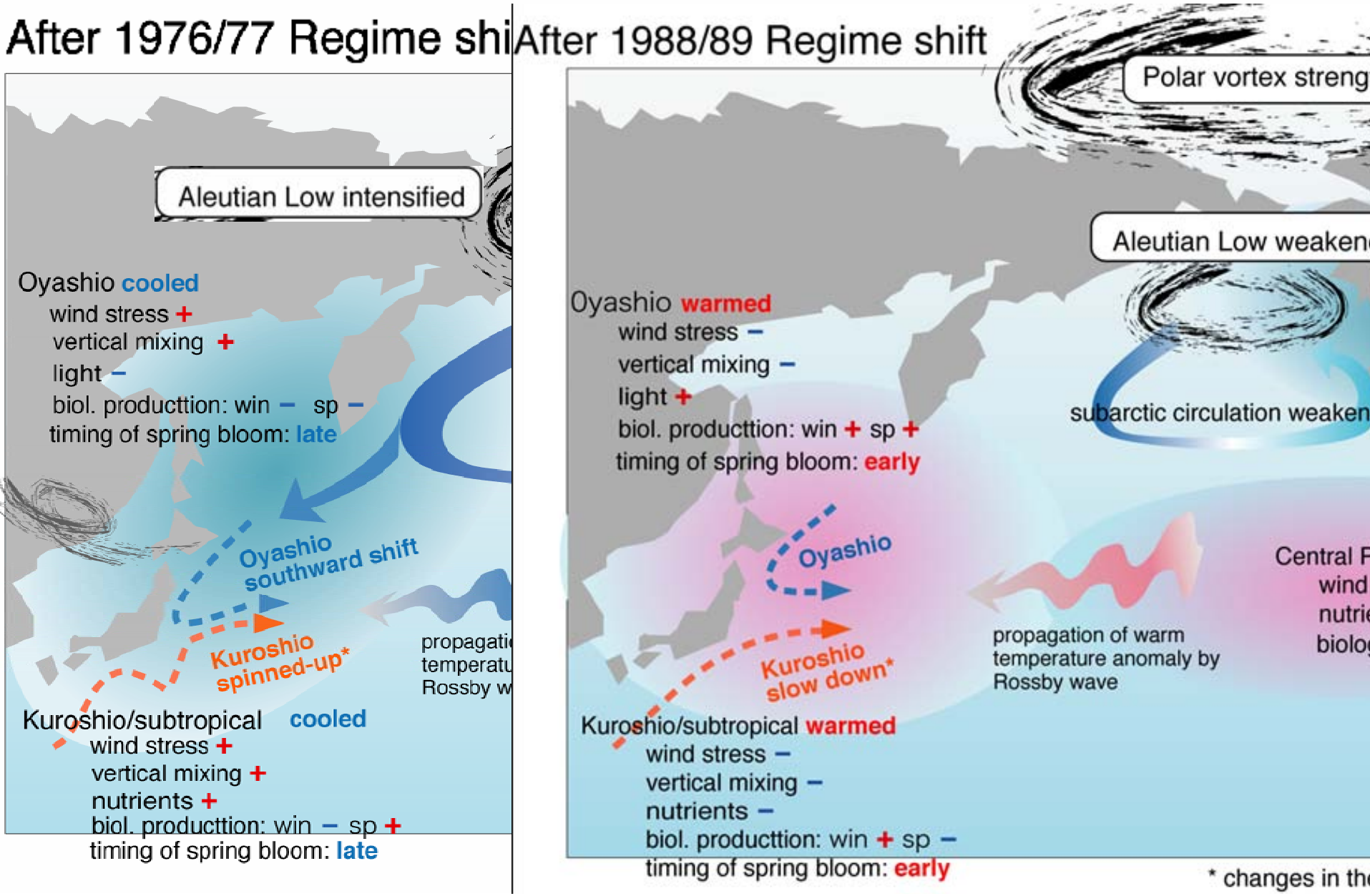




Japanese catch of Japanese sardine, anchovy, and common squid during 1905-2003



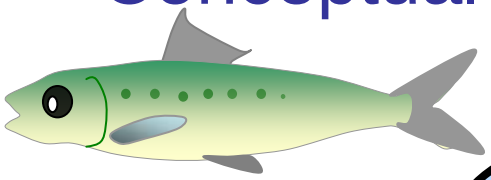
Wintertime climate and production in Oyashio and Kuroshio



(modified from Chavez et al 2003. * information of the western North Pacific added by Chiba)

Conceptual Model Diagram for Japanese Sardine

(Japanese Pacific Stock, Yatsu 2004)



Positive SOI, etc.

Aleutian Low Intensification

Winter MLD Deepening in Kuroshio, Expansion of Oyashio area

Lower SST of Kuroshio and Oyashio

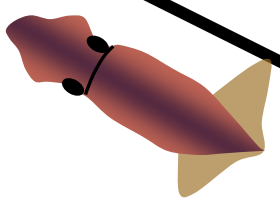
Less Arrival of Subtropical Predators (Common Squid, etc.)

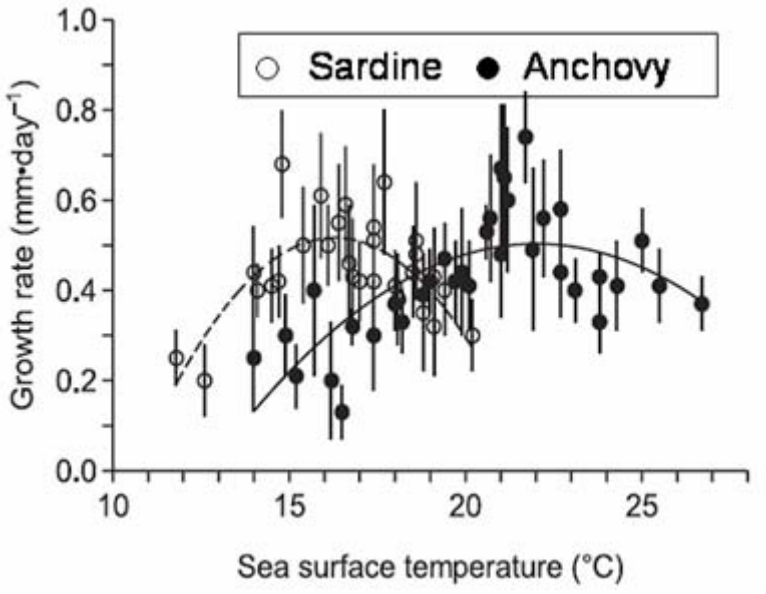
Improved Early Growth

Improved Early Surv

Accumulation of Bio

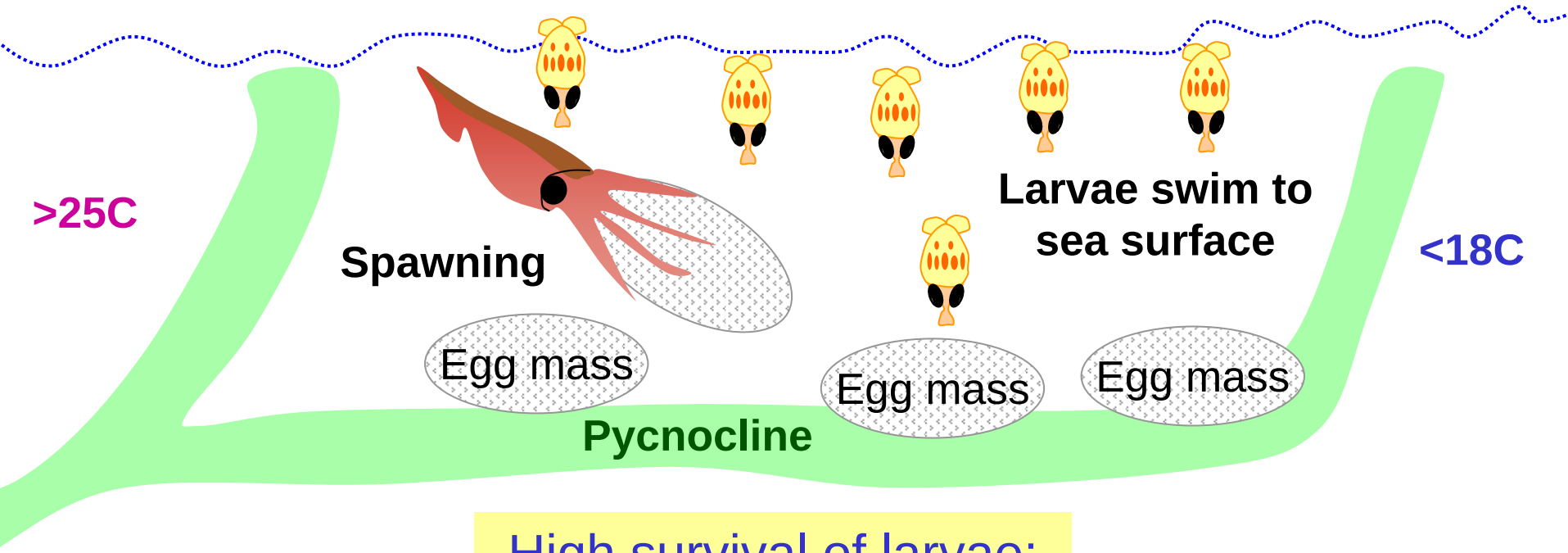
Alternate to Ancho





Optimum temperature for early growth of sardine and anchovy (Takasuka et al., 2007)

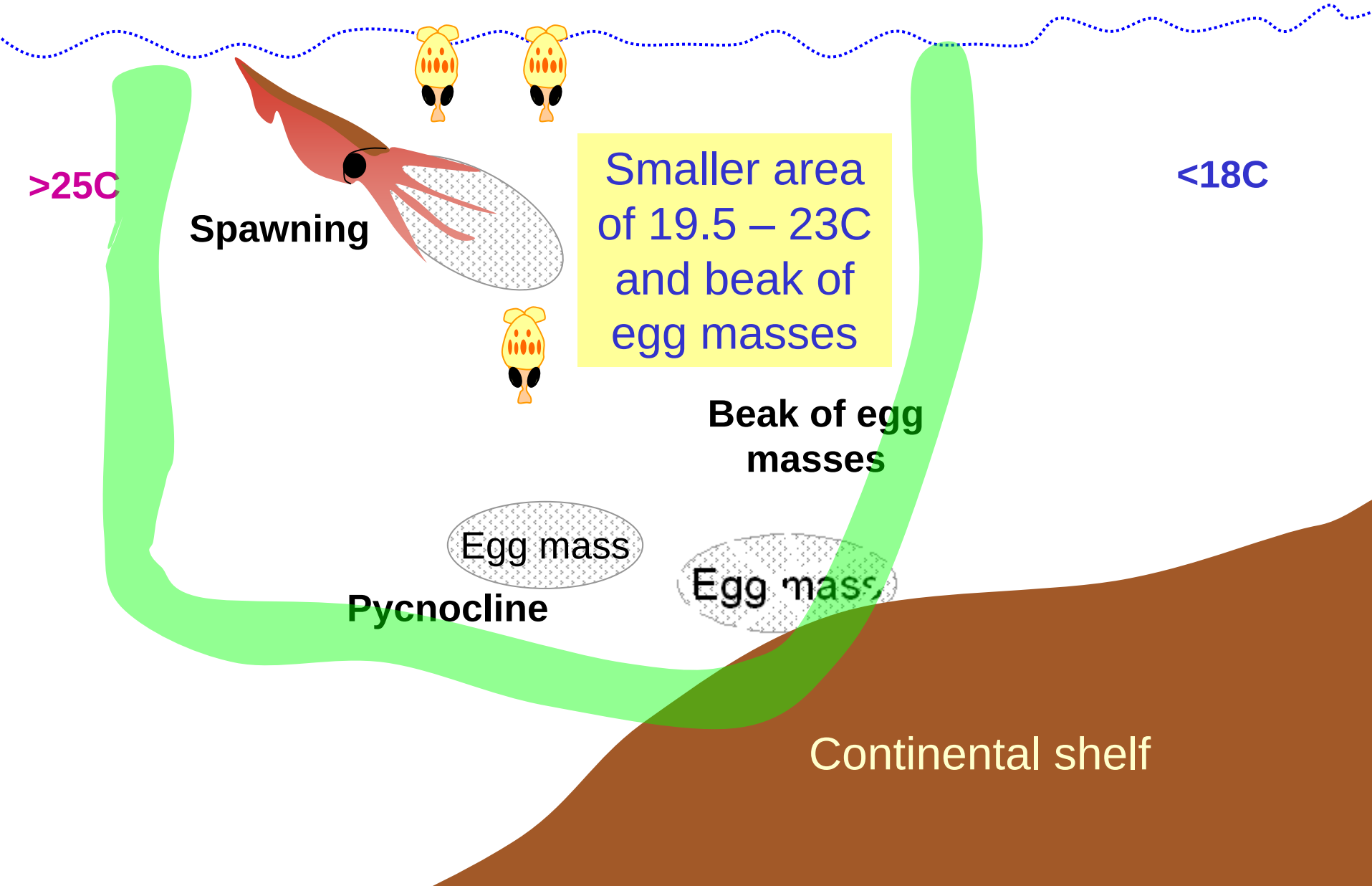
Conceptual reproductive model of common squid in East China Sea – warm winter (Sakurai, in prep)



High survival of larvae:
19.5 – 23C

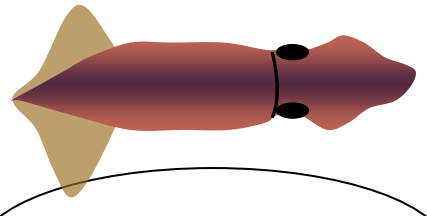
Continental shelf

Conceptual reproductive model of common squid in East China Sea – cool winter (Sakurai, in prep)



Conceptual Model Diagram for Common Squid

(Winter cohort)



Negative SOI

Aleutian Low Weakening

Reduced NW Wind in Winter

Higher SST of Tsushima Current, incl. East China Sea

Shallower Pycnocline in East China Sea

Slower Kuroshio Current

Expanded Spawning Area

More Retention of Larvae in Kuroshio Extension

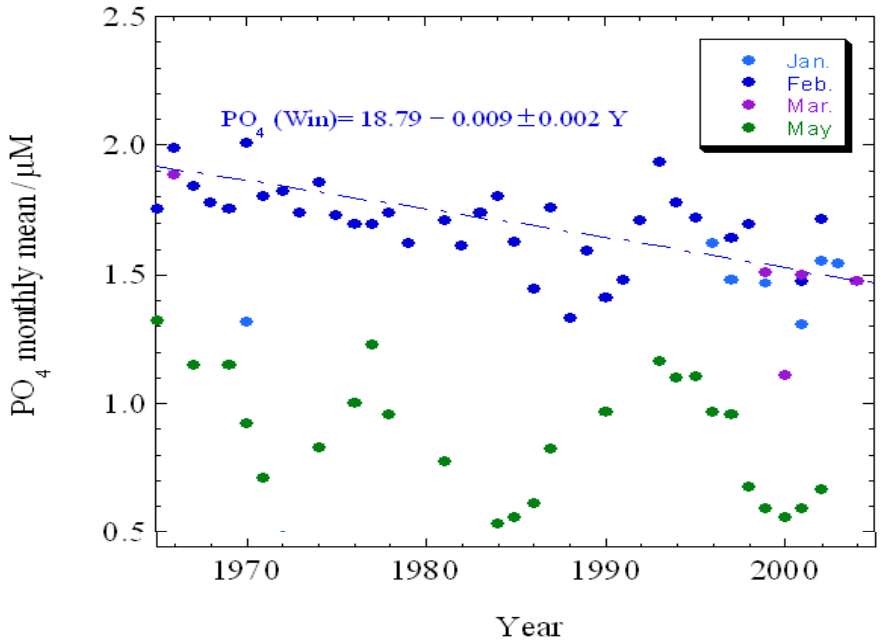
Improved Early Survival

Accumulation of Biomass

Possible effects of global warming in Kuroshio(Kr) and Oyashio (Oy)

Producutivity of area/species	Temperature rise	Spin-up of currents
Oyahsio	+	+ (Areal expansion)
Kuroshio	-	?
Sardine	+ (Oy), - (Kr)	+ (Oy), ? (Kr)
Squid	+?	-

- Productivity of Oyashio will decrease due to freshening
- More temperature rise will delay the spawning period of squid, and subsequently may cause a temporal mismatch with blooming



Phosphate concentration in Oyashio (Ono et al. 2002)

Problems in Predicting Changes

- Each species will react differently, according to the ability of tolerance and adaptation in terms of distribution, life-history and productivity.
- Such different responses of each species will increase uncertainties, through ecological interactions that have never been observed before.
- Therefore, predictions of resiliency of species and ecosystems with “newcomers” is difficult.