

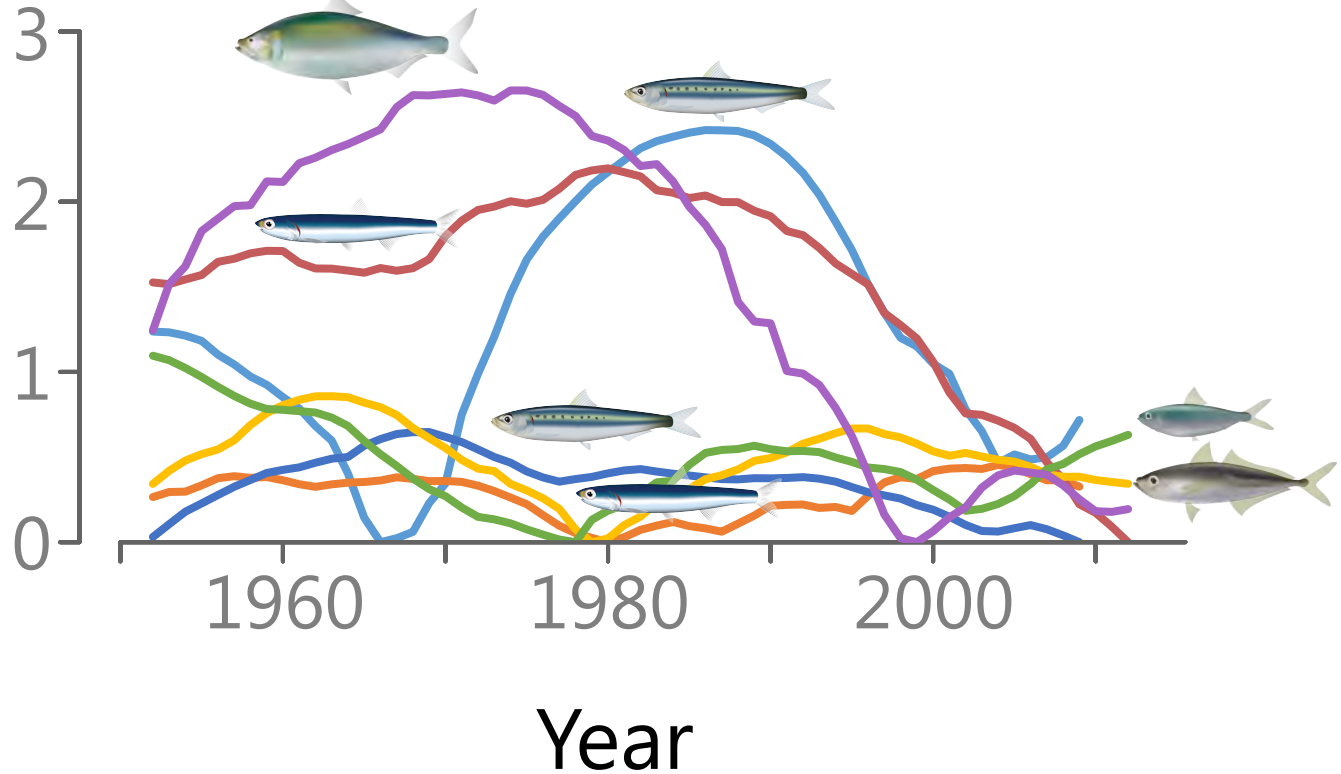
Combination of **income-** and **capital-** breeder type stocks of Japanese anchovy population

Akira Hayashi, Tomoaki Goto
Yuka Sasaki & Yoshiro Watanabe



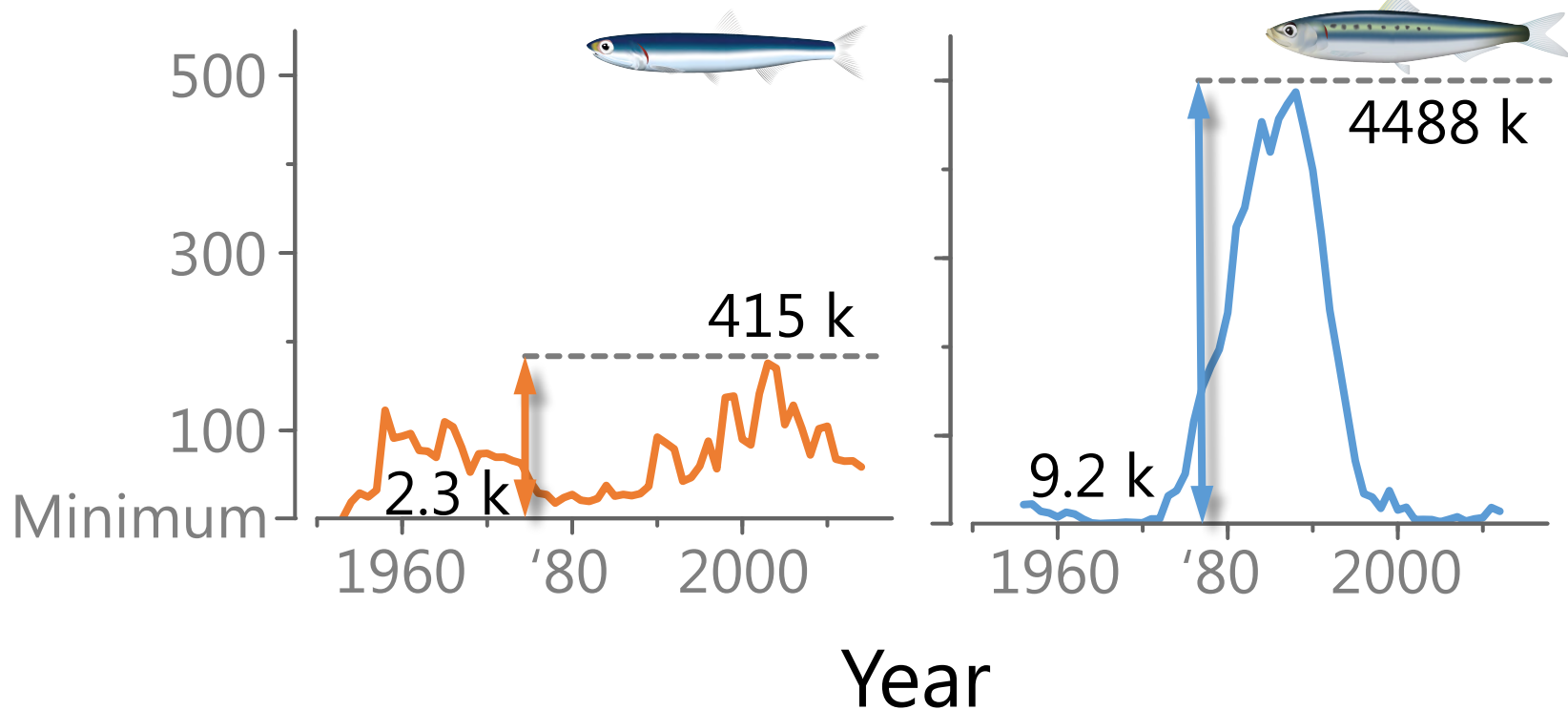
"Magnitude" of catch fluctuation

$\text{Log}_{10}(\text{Relative catch})$

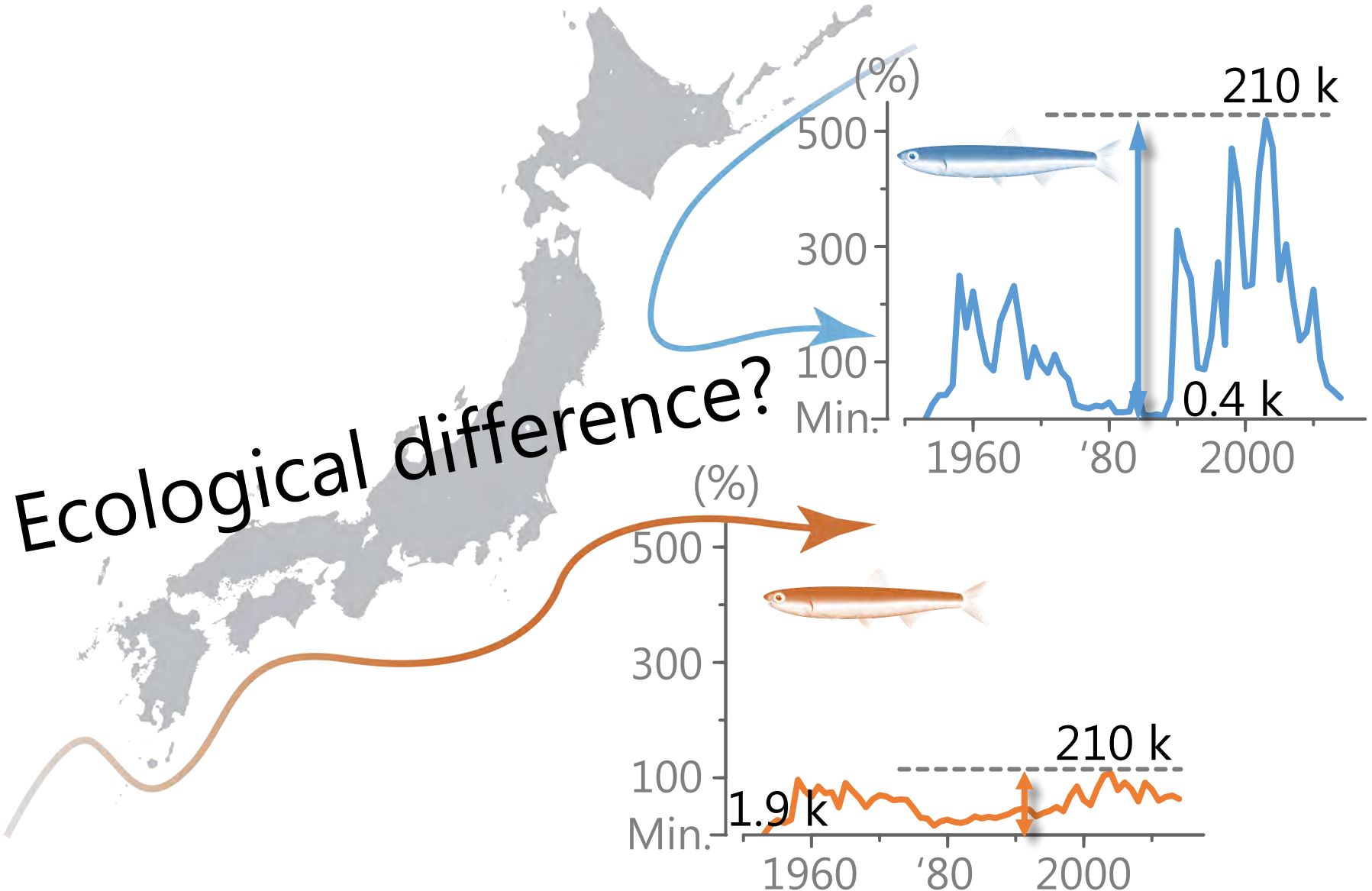


Stable- and Catastrophic-fishes around Japan

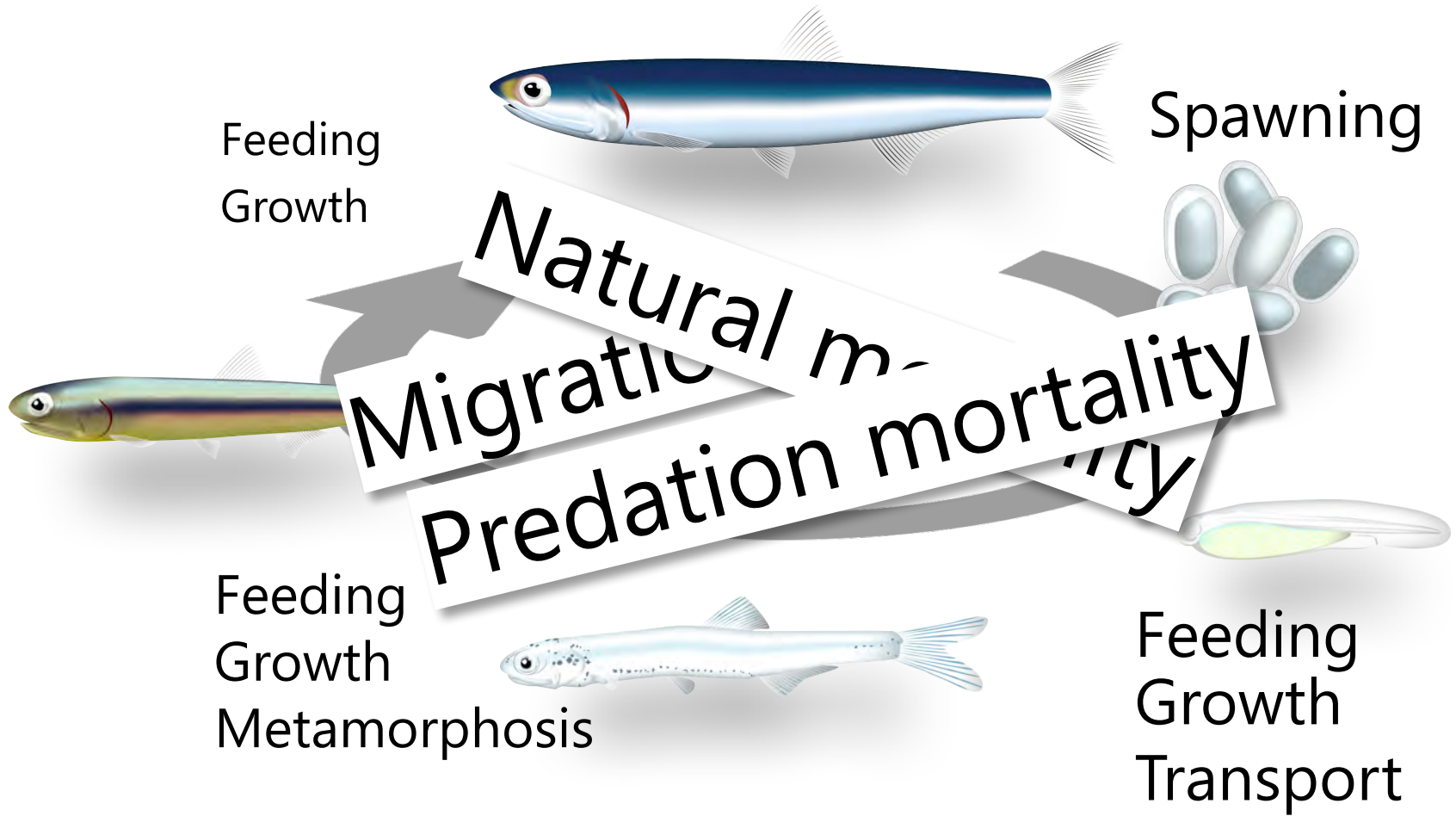
Relative catch
(%)



Stable south and Catastrophic north



Ecological...?

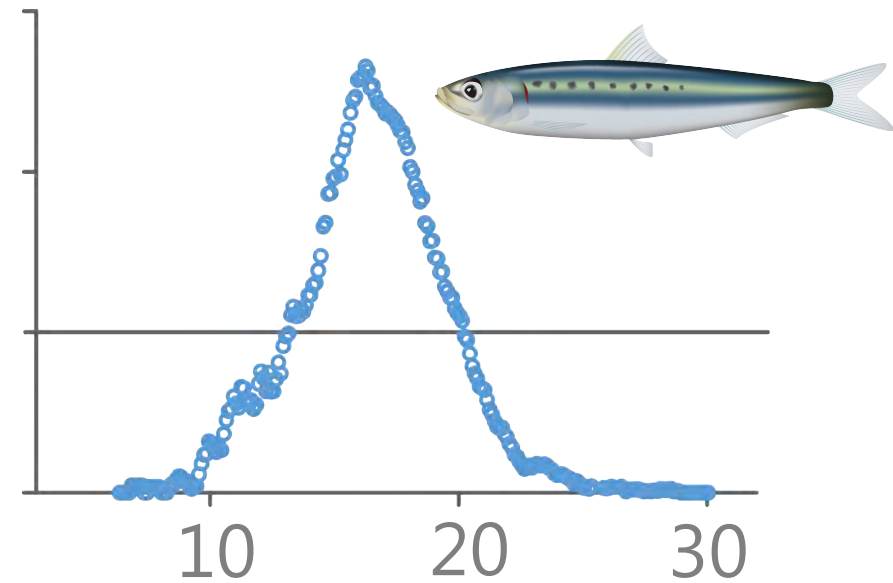
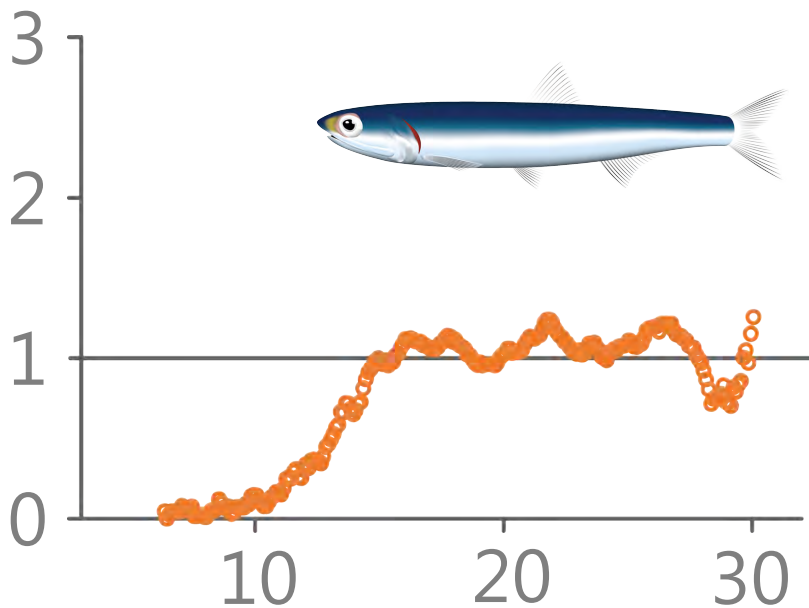


Eury- and Steno-thermal spawning

Takasuka et al. 2008

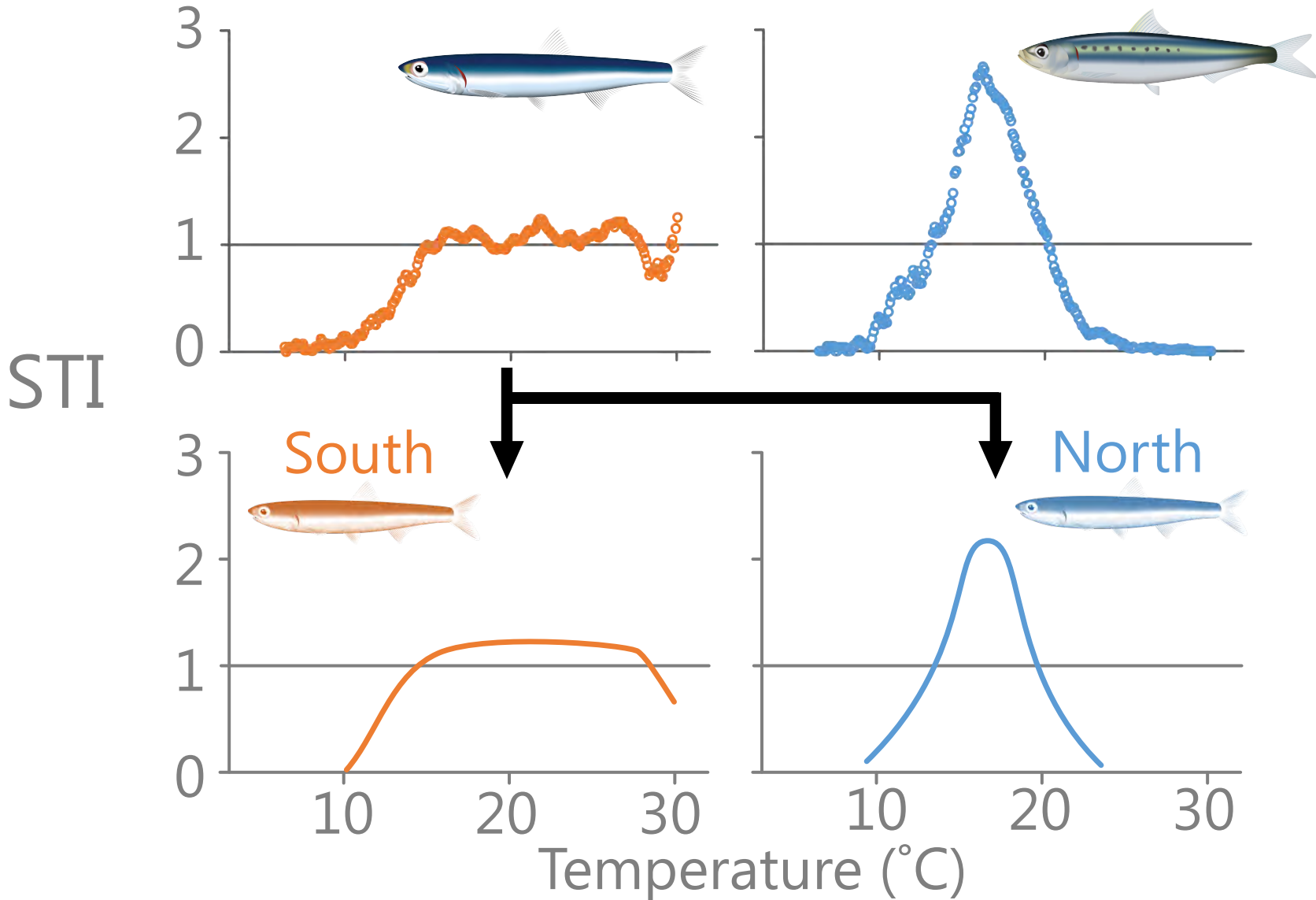
Spawning Temperature Index

Lluch-Belda et al. 1991




Temperature (°C)

STI differ between regions?



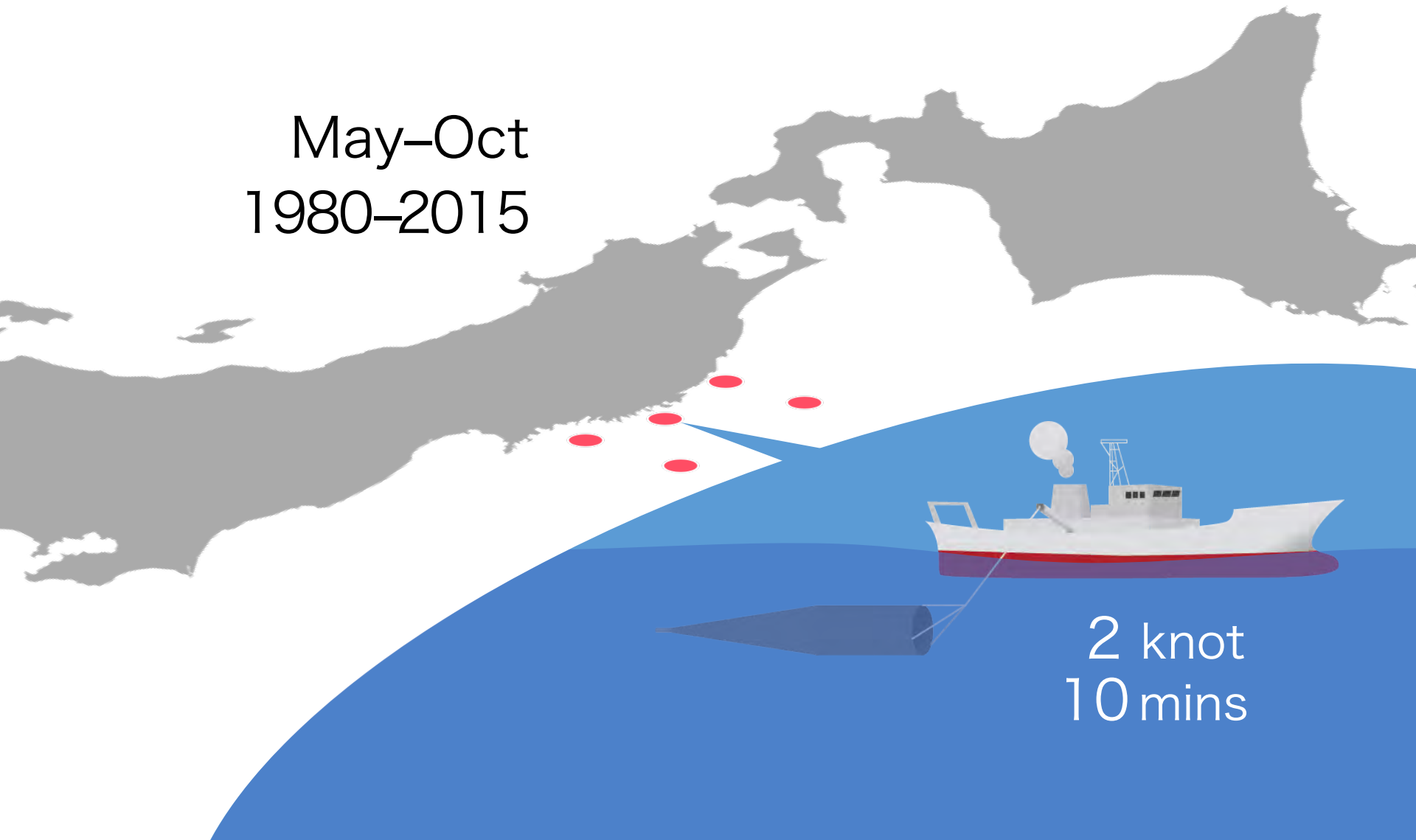
Survey



May-Oct
1980-2015

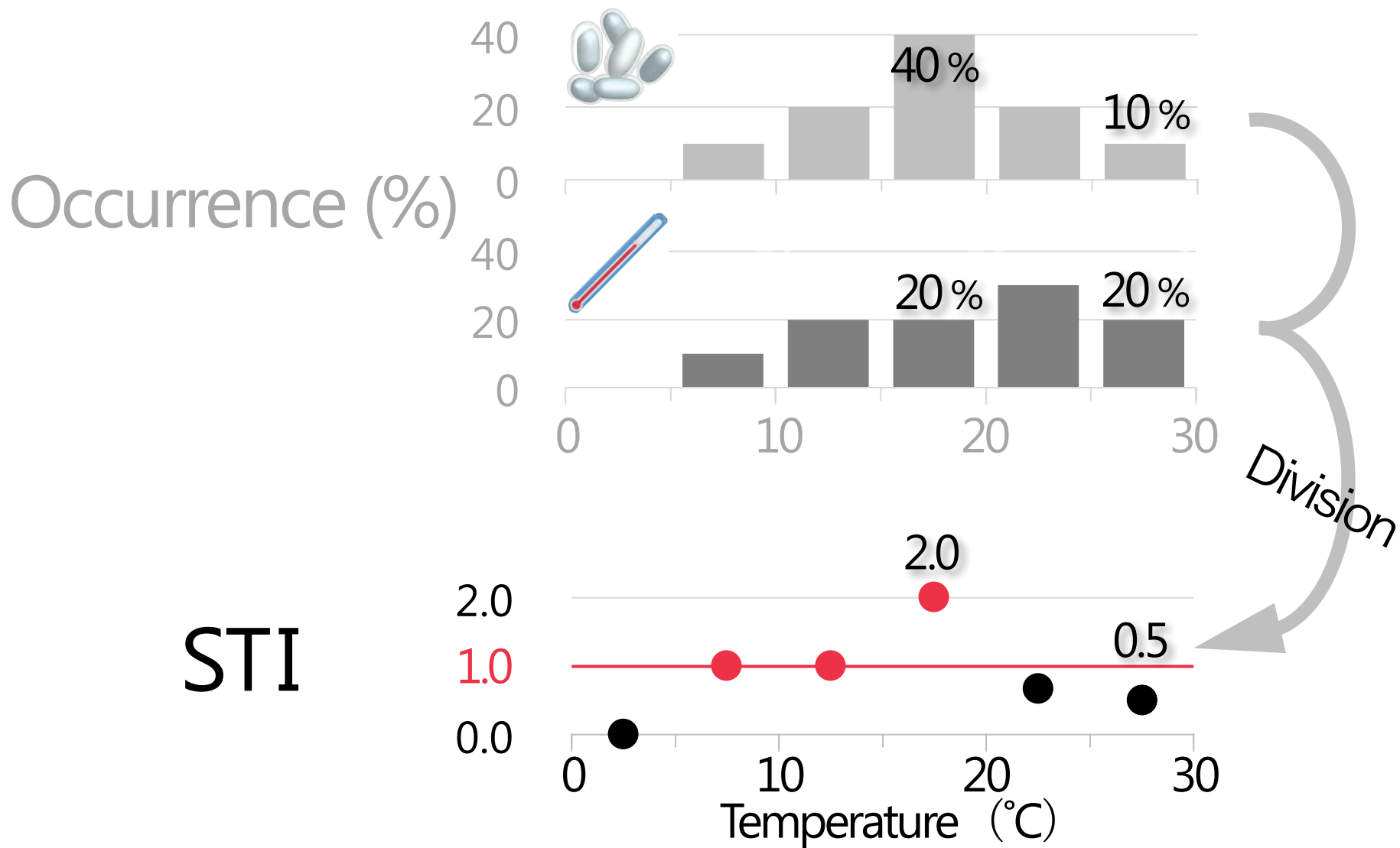
Survey

May–Oct
1980–2015

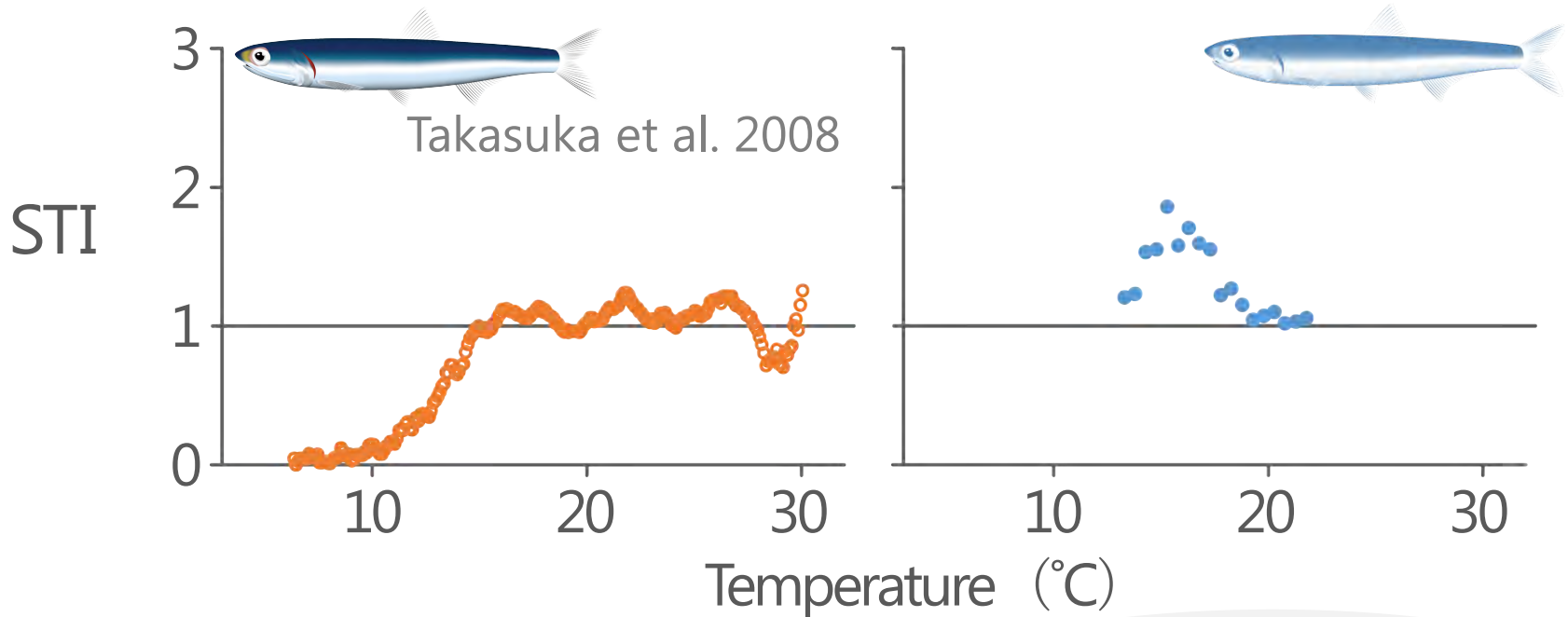


2 knot
10 mins

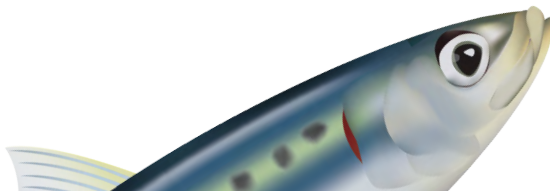
How to calculate STI



Sardine-like STI in North

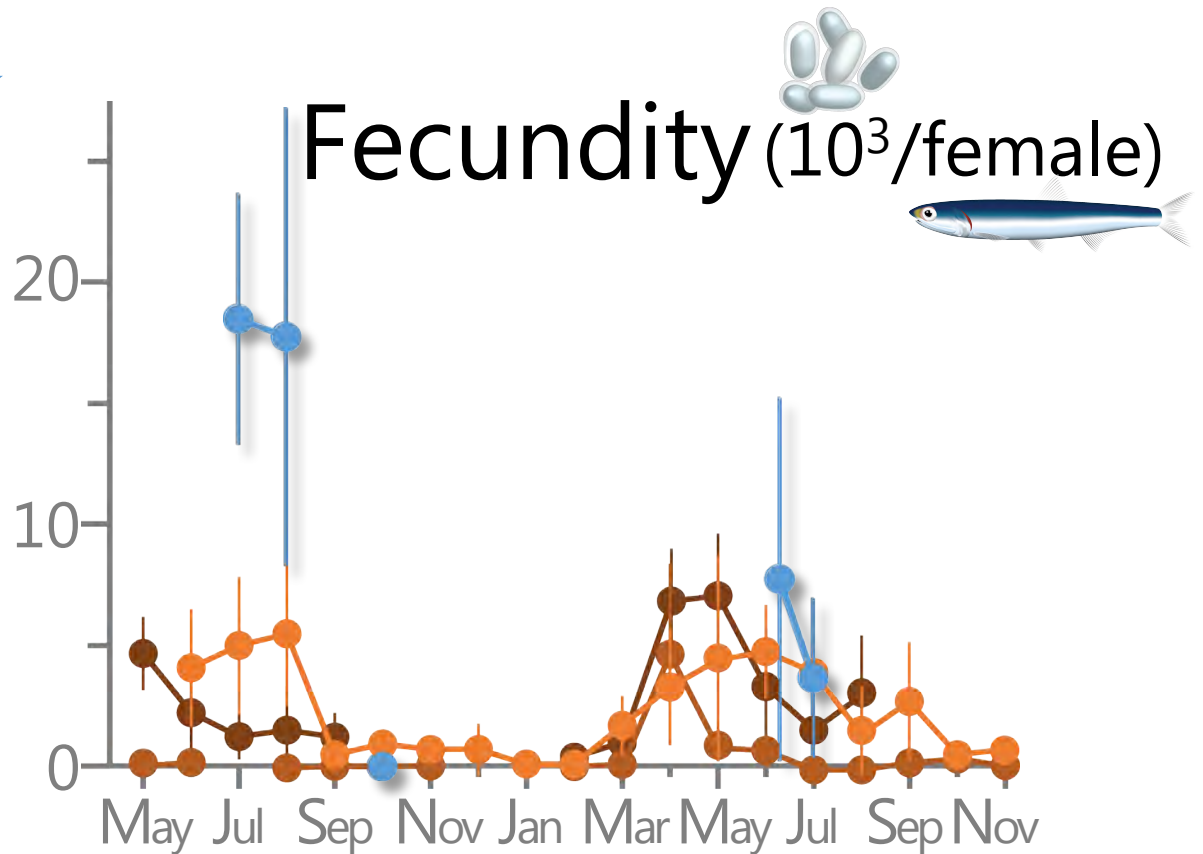


Are you also
capital breeder?



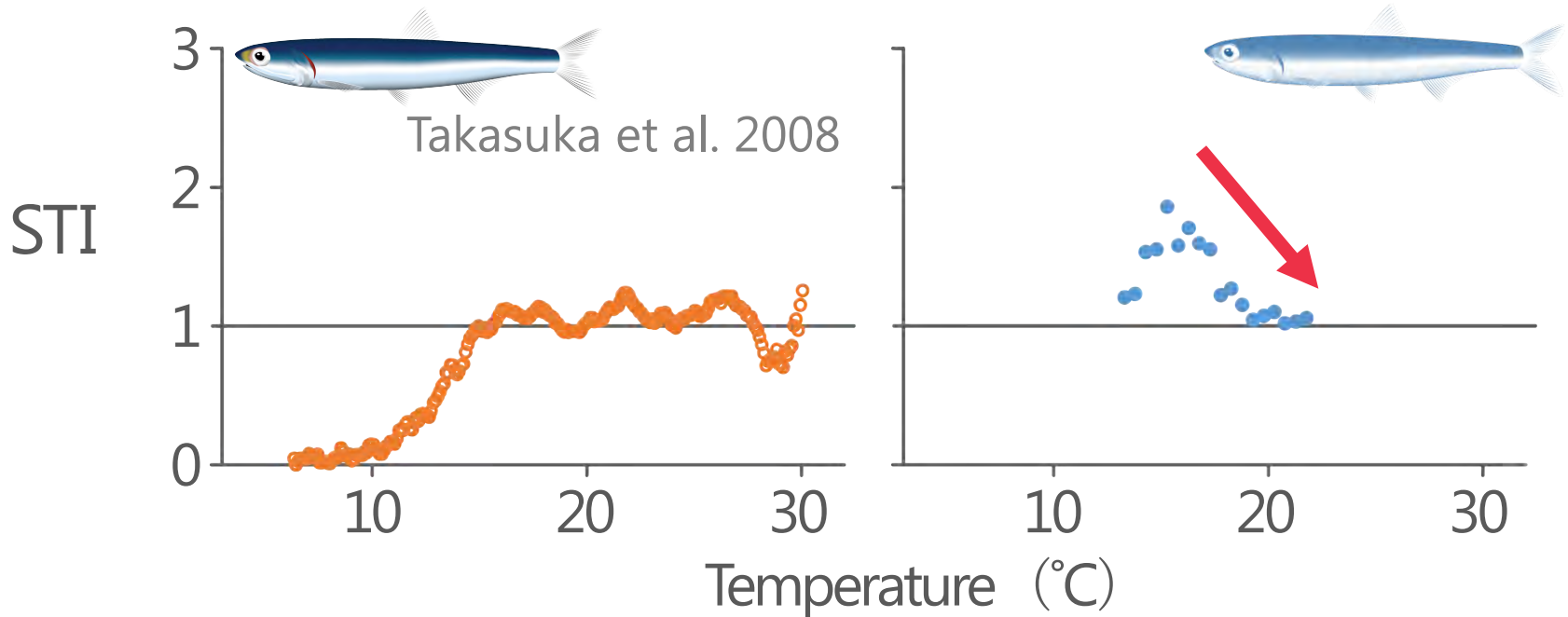
Capital breeders in North

Suhara et al. 2013

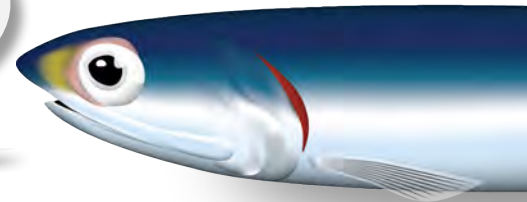


STI decrease

—due to SST warming?



Probably NO.

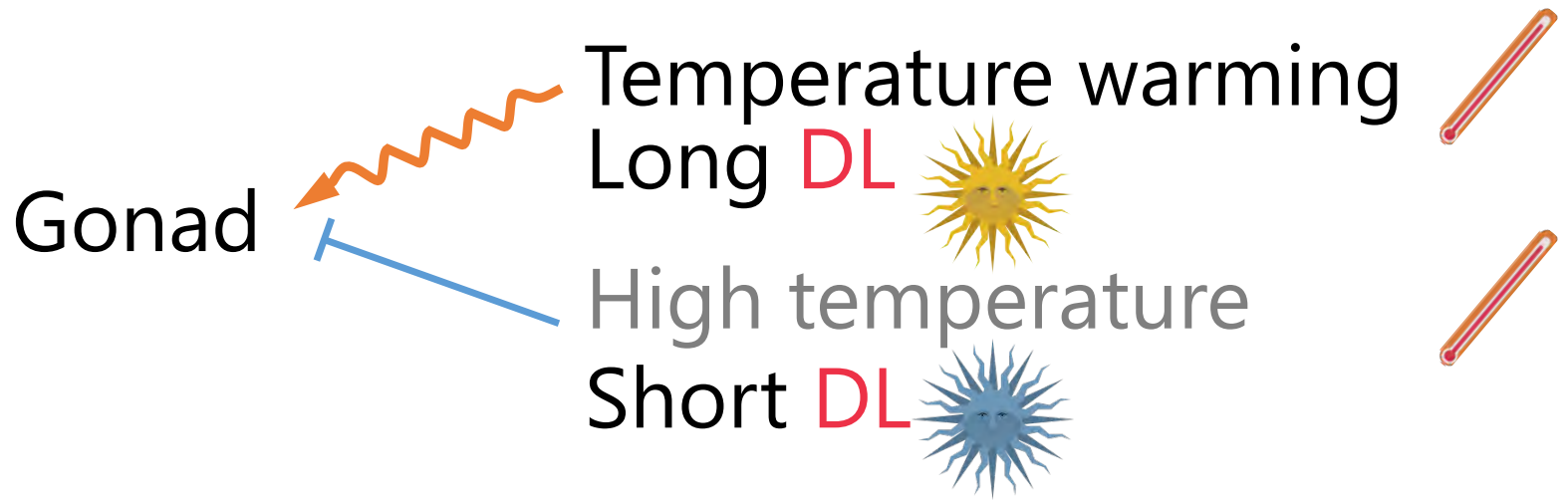


Importance of photoperiod in

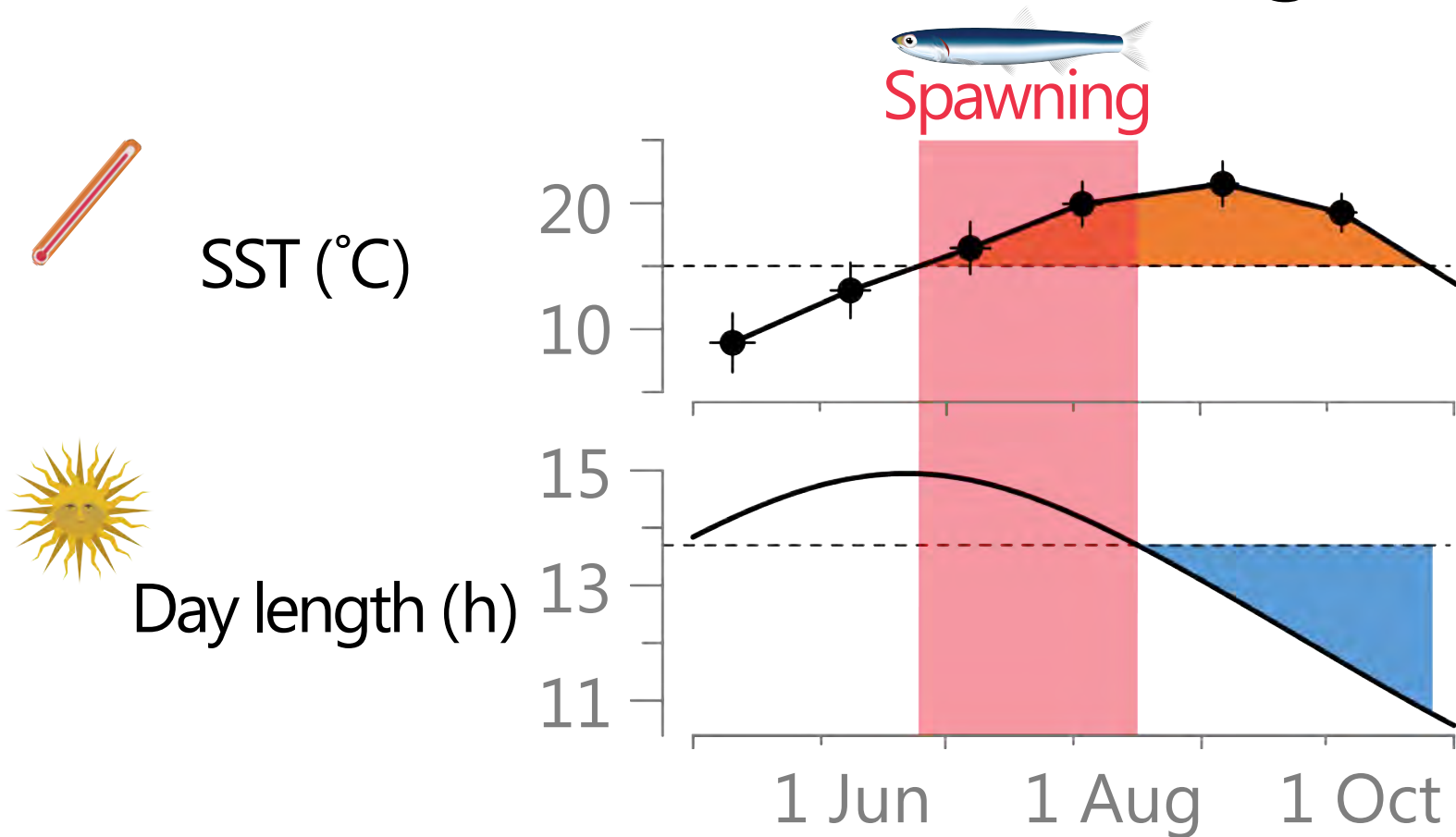
Spring–summer spawning fishes Lam 1983

Japanese anchovy

Tsuruta 1992



Suitable SST but insufficient DL after mid August



Hayashi (unpublished)

Mechanism **differs** but **sardine-like** !

