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

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Yuka Sasaki & Yoshiro Watanabe
"Magnitude" of catch fluctuation

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

Year

1960 1980 2000
Stable- and Catastrophic-fishes around Japan

Relative catch (%)

Year

Minimum

1960  ’80  2000

1960  9.2 k

2.3 k

415 k

4488 k
Stable south and Catastrophic north
Ecological...?
Eury- and Steno-thermal spawning

Spawning Temperature Index

Takasuka et al. 2008

Lluch-Belda et al. 1991
STI differ between regions?
Survey

May–Oct
1980–2015
Survey


2 knot 10 mins
How to calculate STI

STI

Occurrence (%)
Sardine-like STI in North

Takasuka et al. 2008

Are you also capital breeder?
Capital breeders in North

Fecundity ($10^3$/female)

Suhara et al. 2013
STI decrease — due to SST warming?

Probably NO.

STI

Takasuka et al. 2008
Importance of photoperiod in

Spring–summer spawning fishes  Lam 1983
Japanese anchovy  Tsuruta 1992

Temperature warming
Long DL  Sun
High temperature
Short DL  Moon
Suitable SST but insufficient DL after mid August

Hayashi (unpublished)

1 Jun 2 Aug 3 Oct

SST (°C)

Day length (h)

Spawning

Hayashi (unpublished)
Mechanism **differs** but sardine-like!