

Agenda Item 7: Review of biological information for JS

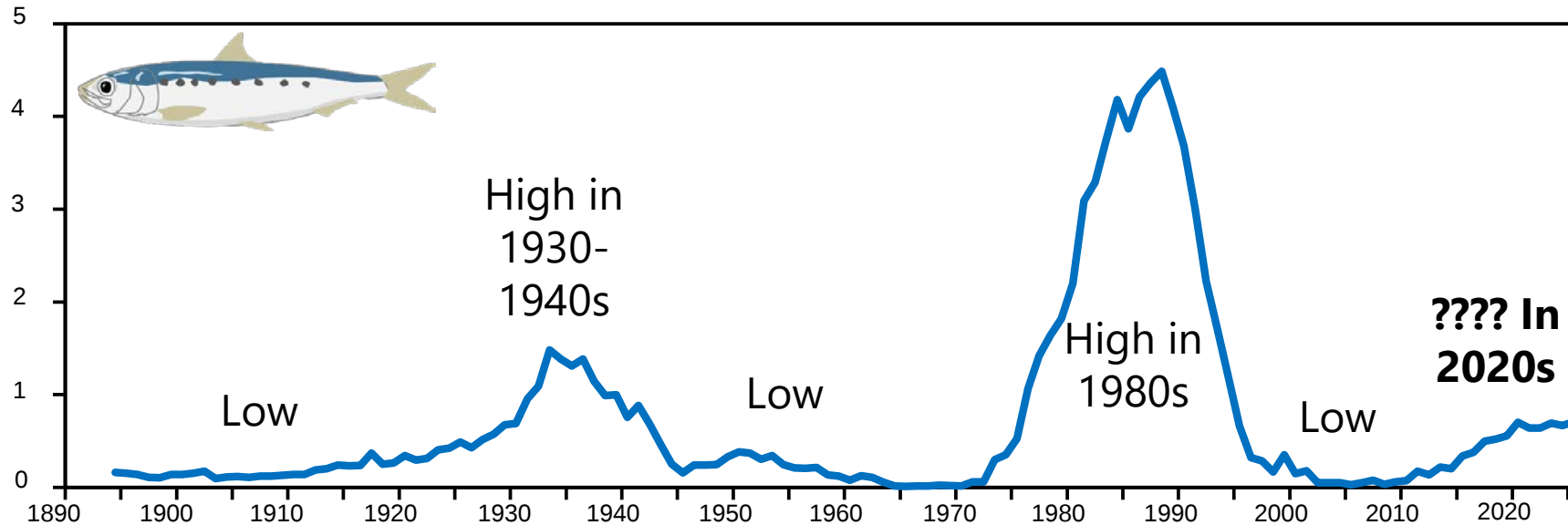
Review of population dynamics of Japanese sardine

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"Regime shifts" in Japanese sardine

- Japanese sardine abundance has shown large multi-decadal fluctuations in the northwestern Pacific
- Periods of high and low abundance have alternated repeated over the last century
- These large-scale transitions are widely recognized as regime shifts



When did regime shifts occur?

- Major transitions have been reported around
 - The early 1940s
 - The Mid-1970s (increase)
 - The late 1980s to early 1990s (decline)
- The exact timing varies among studies, but the overall pattern is consistent
- We do not know whether 2020s is under transition or not

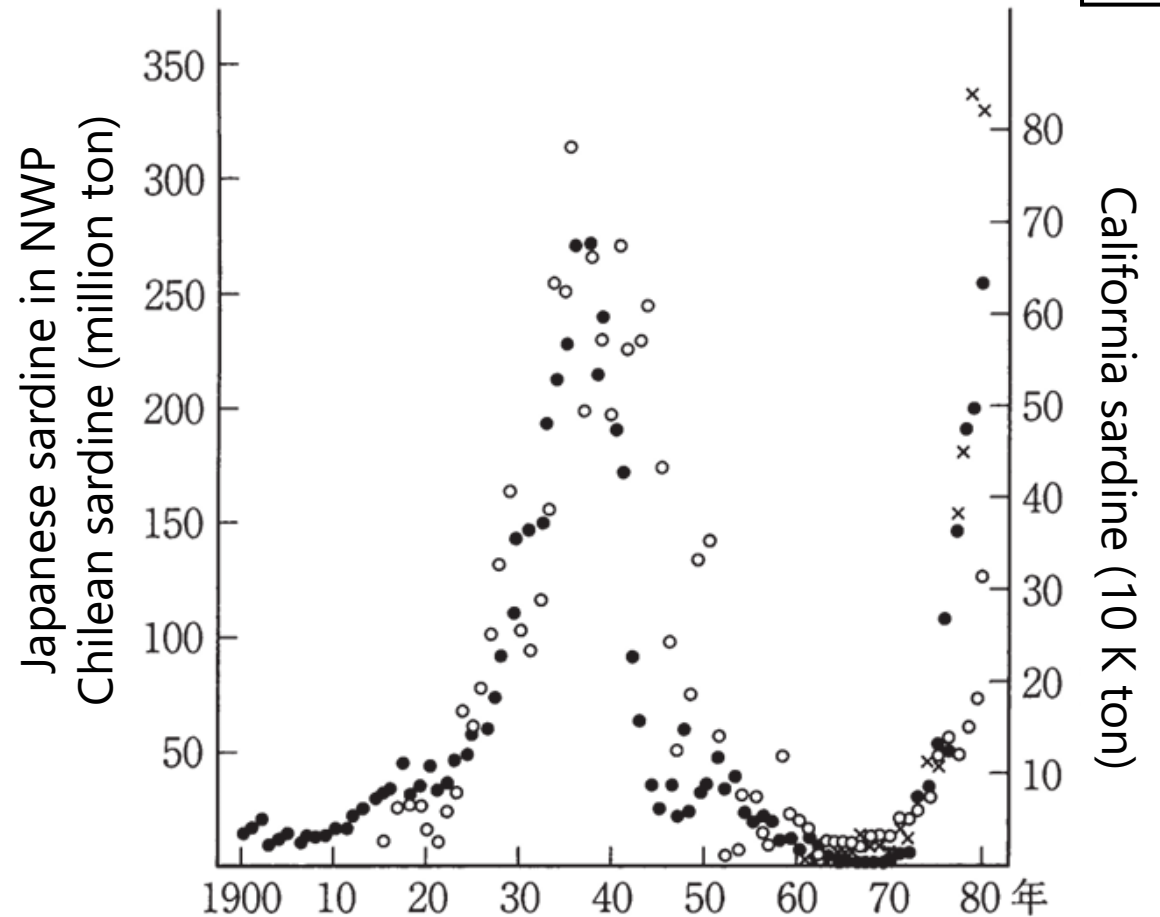
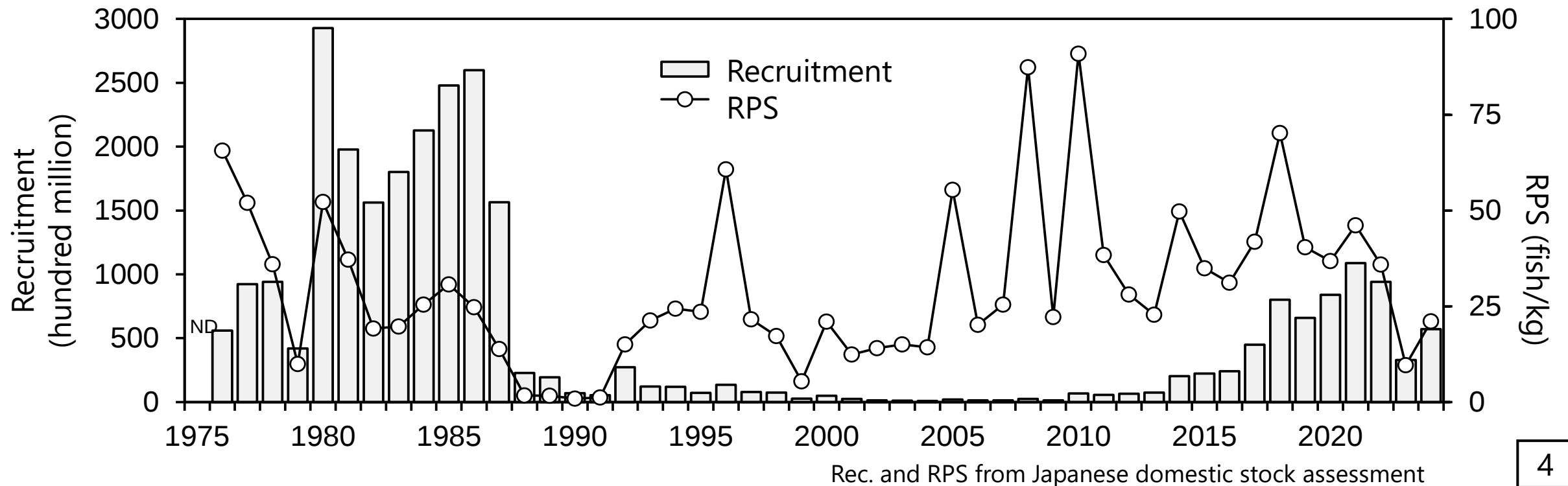


Fig. 1 Variations in catches of the three sardine populations in the Pacific (Far Eastern sardine, California sardine and Chilean sardine) between 1900 and 1980 (Kawasaki, 1983).

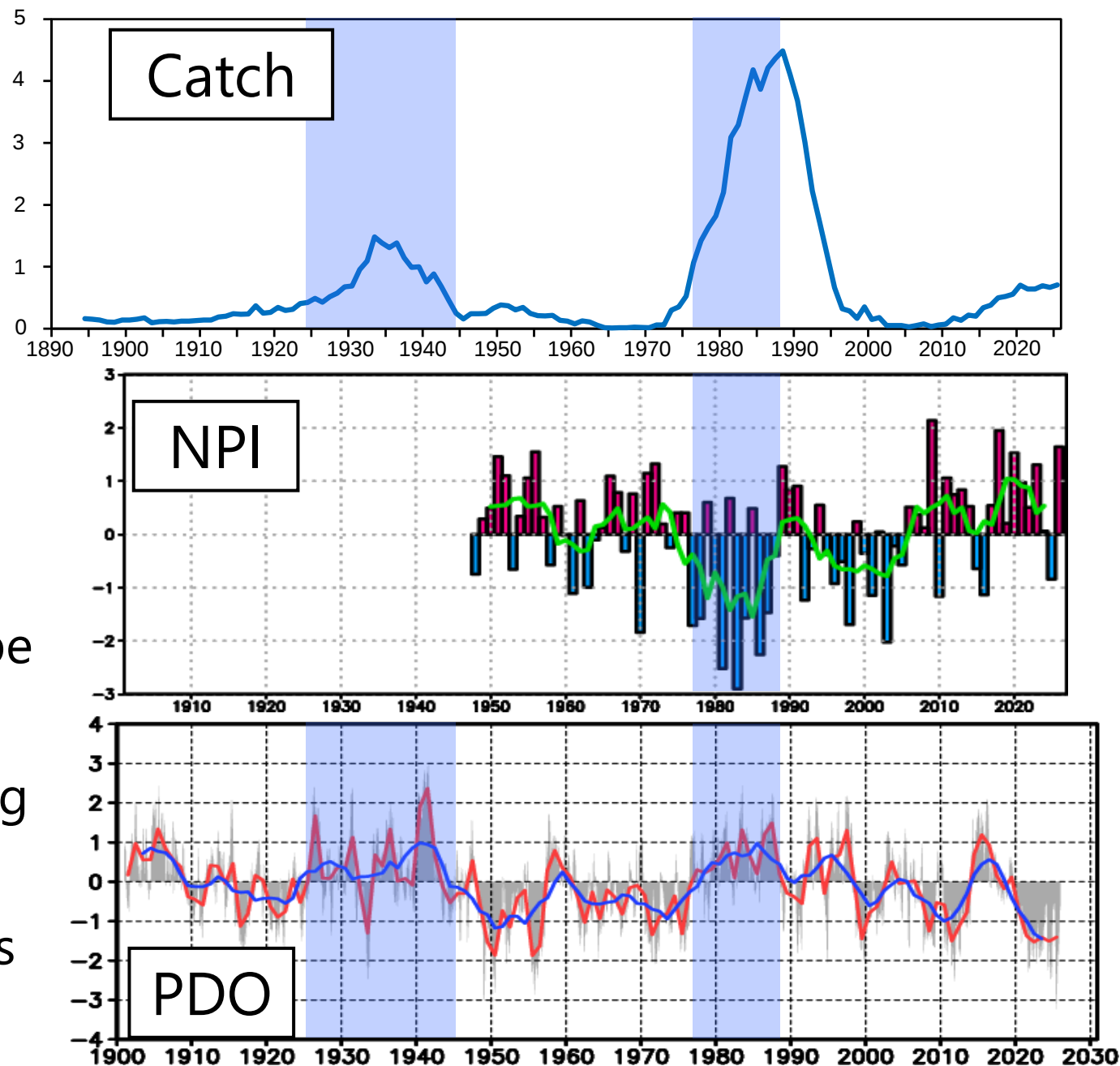
Changes in productivity across regimes

- Recruitment per spawning differs greatly among regimes
- Similar SSB produced substantially different recruitments
- Change in stock productivity and resilience



Possible drivers

- Regime shifts are associated with basin-scale climate variability
- Proposed drivers include:
 - Pacific Decadal Oscillation (PDO)
 - North Pacific Index (NPI)
- **Cold regime** and high regime may be associated
- Changes in larval survival and feeding conditions
- However, the underlying mechanisms remain incompletely understood



Why regime-shift matters?

- Stock productivity is not constant through time
- Interpretation of stock dynamics may be biased without considering regime shift.
- Recognizing regime shifts can improve stock assessment and fisheries management

Related studies

- Yatsu, A. (2019) Review of population dynamics and management of small pelagic fishes around the Japanese Archipelago. Fisheries Science, 85, 611-639.
<https://doi.org/10.1007/s12562-019-01305-3>
- Yatsu, A., and A. Kawabata (2017). Reconsidering Trans-Pacific “synchrony” in population fluctuations of sardines Bull. Jpn. Soc. Fish. Oceanogr. 81:4, 271-280.
https://doi.org/10.34423/jsfo.81.4_271
- Kawasaki, T. (1983) Why do some pelagic fishes have wide fluctuations in their numbers? FAO Fisheries Report, 291, 1065-1080.
- Kawasaki, T. (2010) Regime shift theory. Journal of Geography, 119:3, 482-488.
- Chavez, F. P., J. Ryan, S. E. Lluch-Cota. (2003). From anchovies to sardines and back: Multidecadal change in the Pacific Ocean, Science, 299:5604, 217-221. [DOI: 10.1126/science.1075880](https://doi.org/10.1126/science.1075880)