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Agenda Item 7

Distribution and migration, growth, and biological parameters for Japanese sardine *Sardinops melanostictus* from Japan

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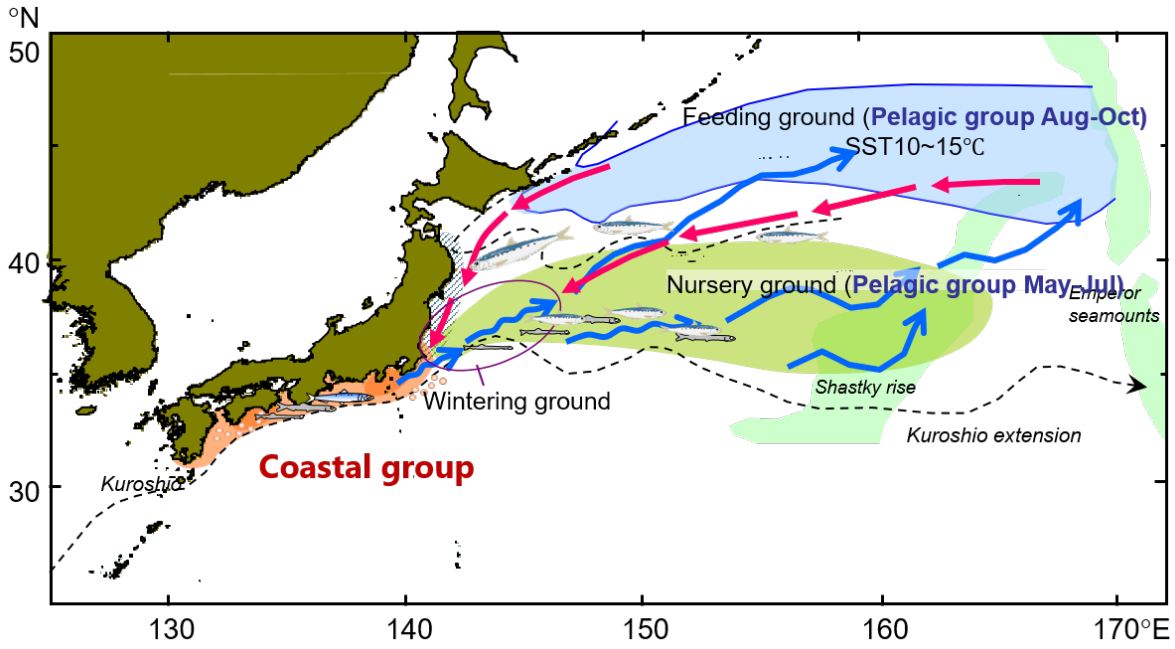
Introduction

- Biological data plays a fundamental role for understanding the stock
- Japanese sardine (*Sardinops melanostictus*) in the NW Pacific has experienced substantial stock fluctuation and changes in biological characteristics
- This IP reviews *recent* biological data of JS obtained/reviewed by Japan on
  - Distribution and migration
  - Growth
  - Weight
  - Natural mortality
  - Maturity

Distribution and migration of age-0 fish

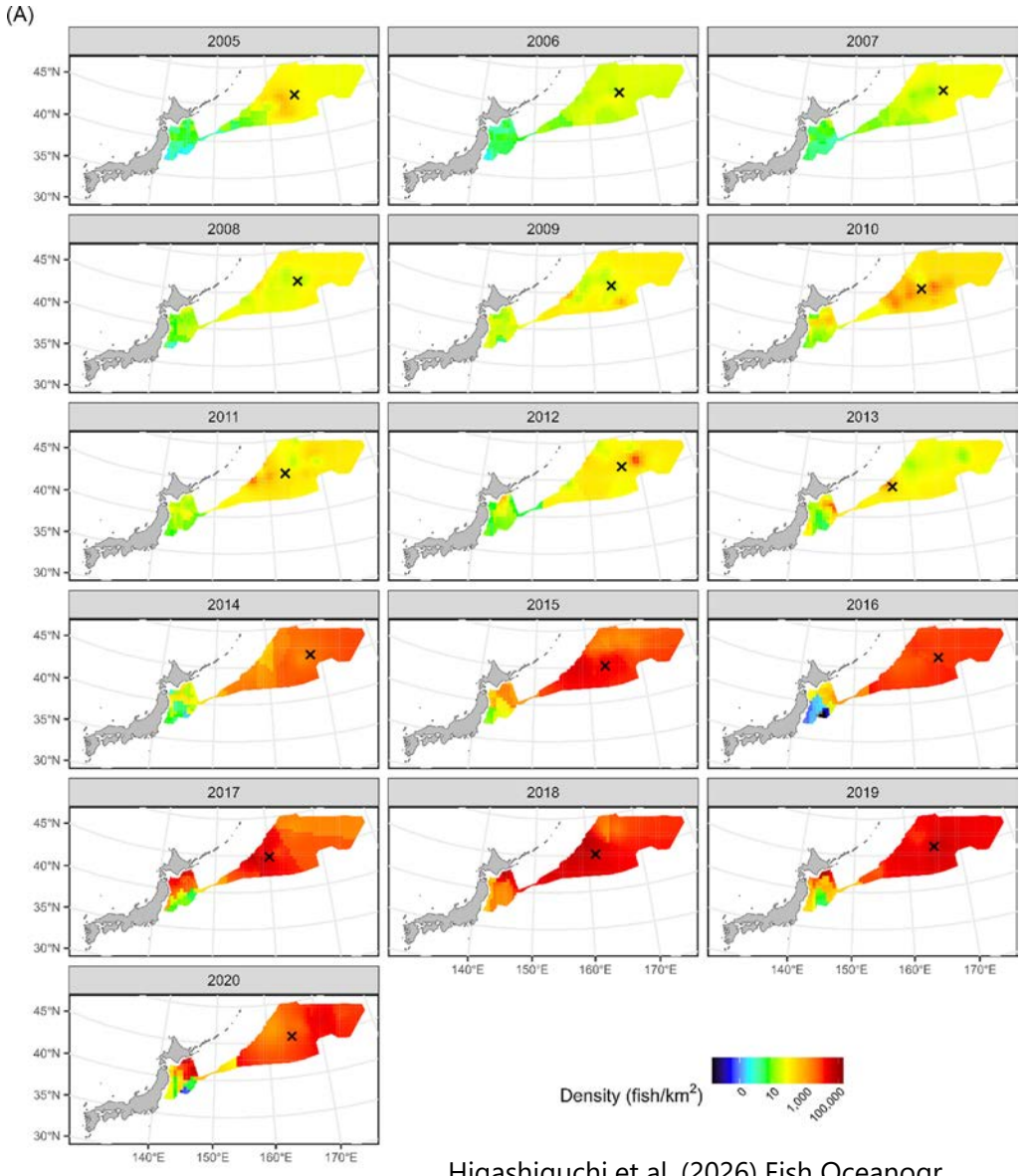


- JS distribution in NW Pacific is strongly influenced by transport during the early stages
- Two major recruitment groups; **Offshore (Pelagic)** and **Coastal**
- These groups are not independent populations but reflect differences in spawning timing and nursery habitat

Changes in recent distribution

- Age-0 JS generally exhibits broad distribution
- Recent study shows distribution expanded with high recruitment

(Higashiguchi et al. 2026)



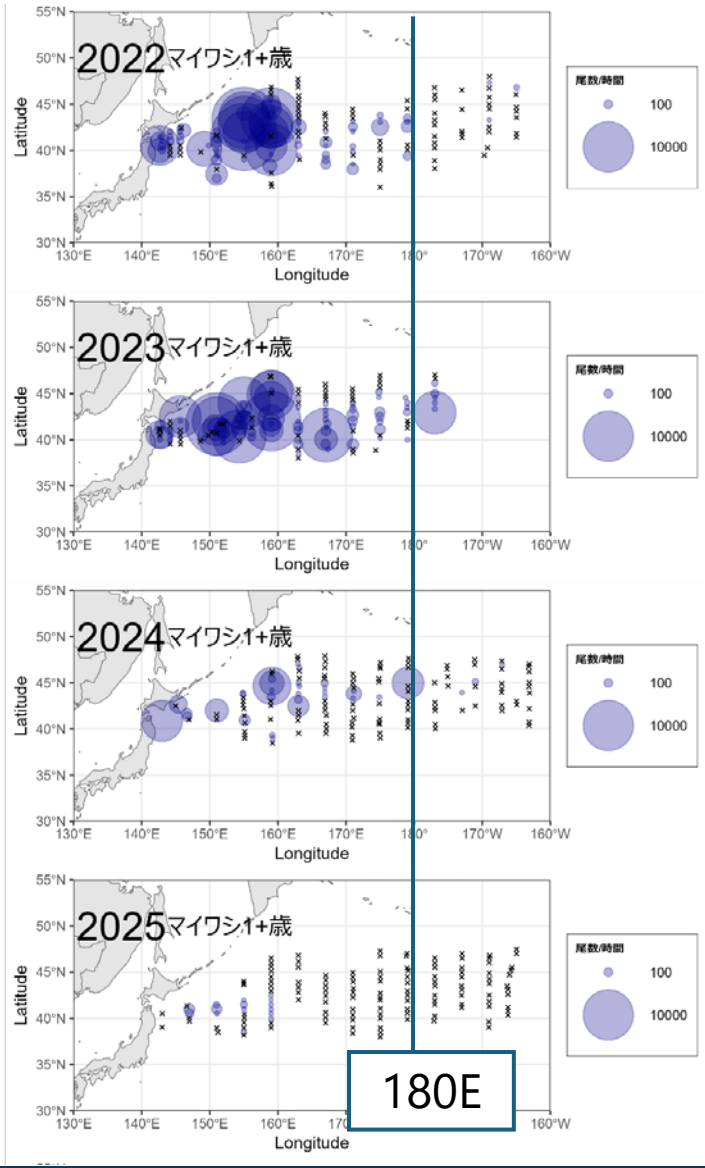
Higashiguchi et al. (2026) Fish Oceanogr. . https://doi.org/10.1111/fog.70050. Fig 4 A

Changes in recent distribution

- Age-0 JS generally exhibits broad distribution
- Recent study shows distribution expanded with high recruitment

  (Higashiguchi et al. 2026)
- Distribution of Age-1+ expanded to 180E after 2021, but shrank dramatically after 2024

Distribution of age-1 from the summer survey



Growth

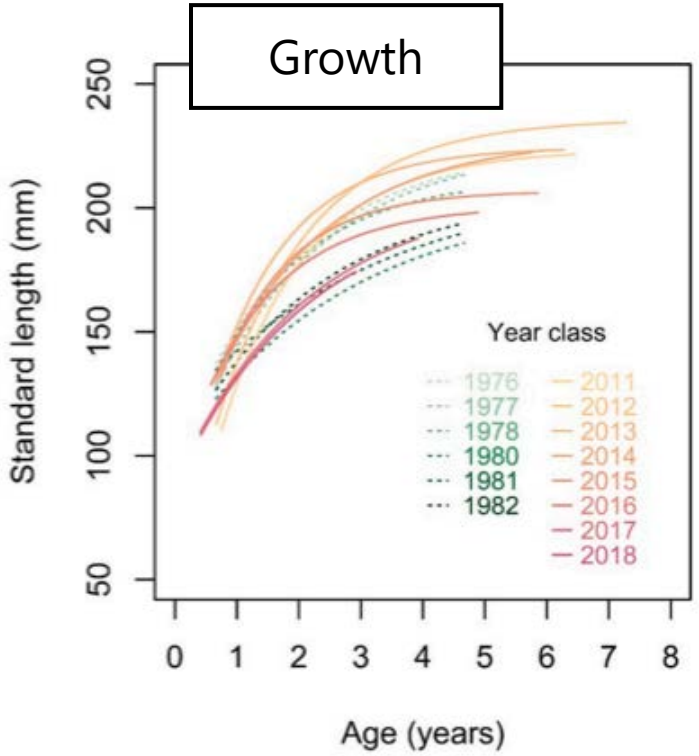


Fig. 3. Comparison of von Bertalanffy growth formulas of Japanese sardine among 14 year-classes. Formulas from 1976 to 1978 and 1980–1982 are based on parameters modified from Wada and Kashiwai (1991a, 1991b).

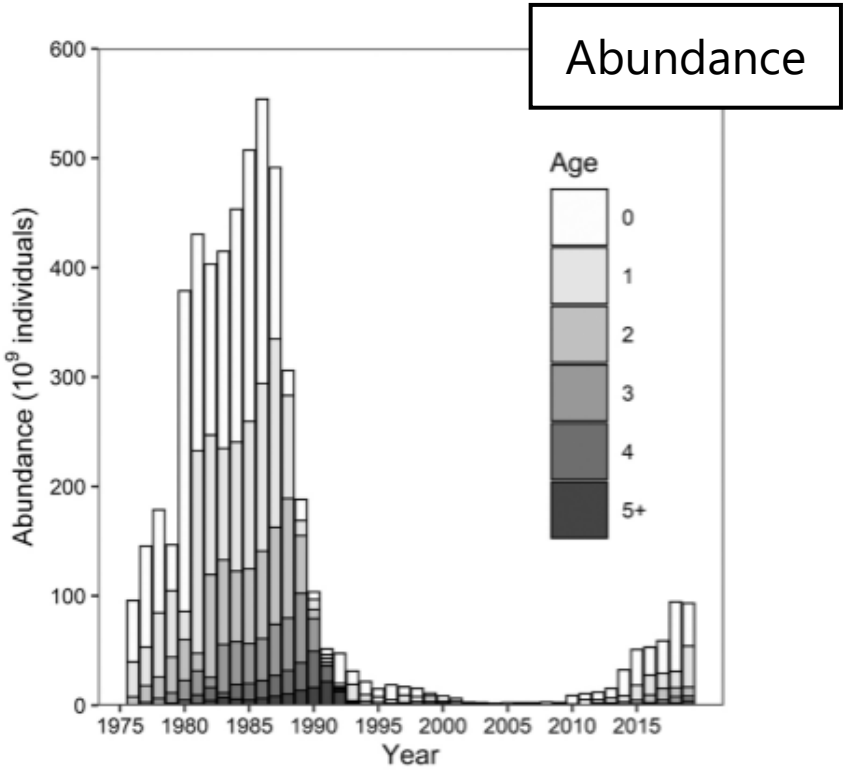
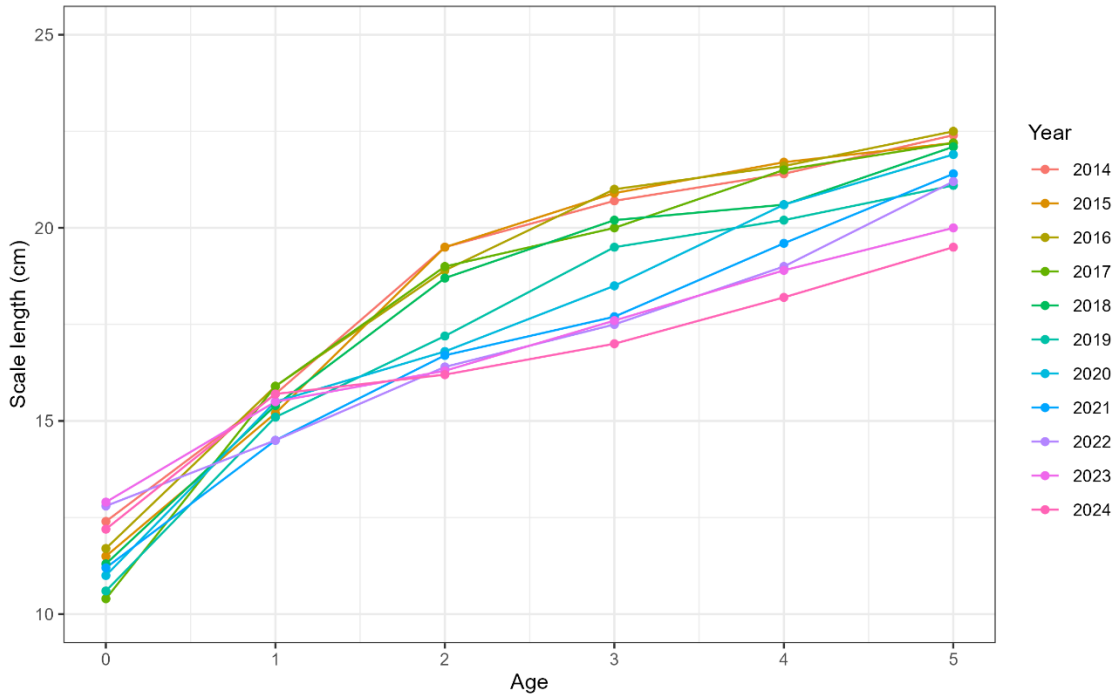


Fig. 1. Abundances (10^9 individuals) of the Pacific stock of Japanese sardine estimated by Furuichi et al. (2020a).

- Substantial interannual variability in growth are observed (Kamimura et al. 2022)
- The growth changes dramatically between high and low abundance period
- 2017 and 2018-year classes exhibited decline in growth late similar to early 1980s

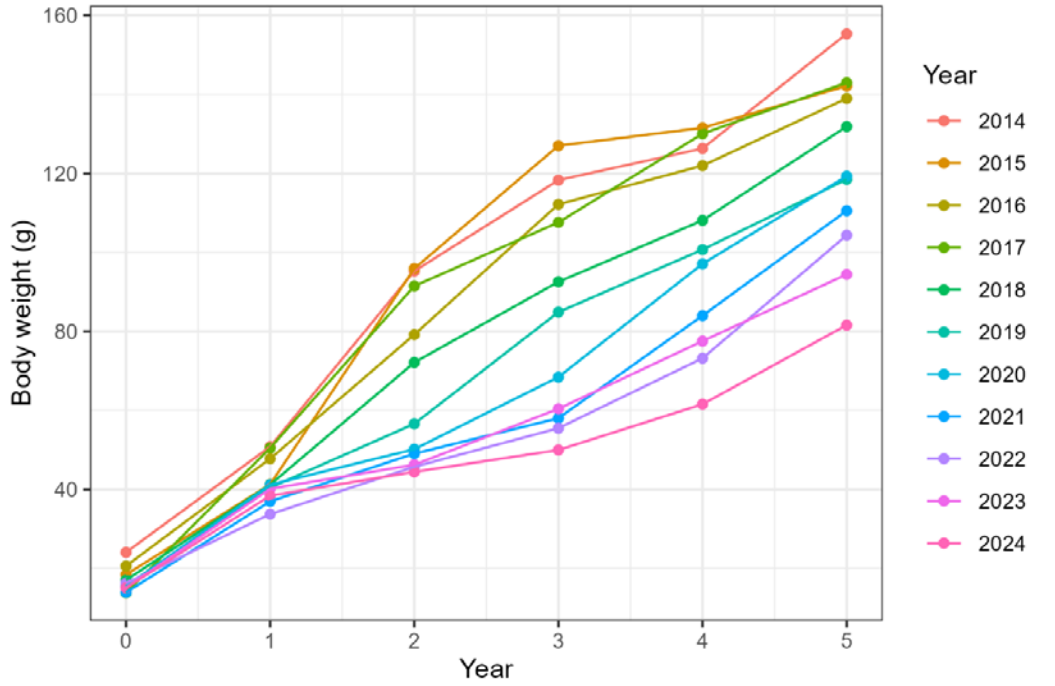
Recent mean length at age

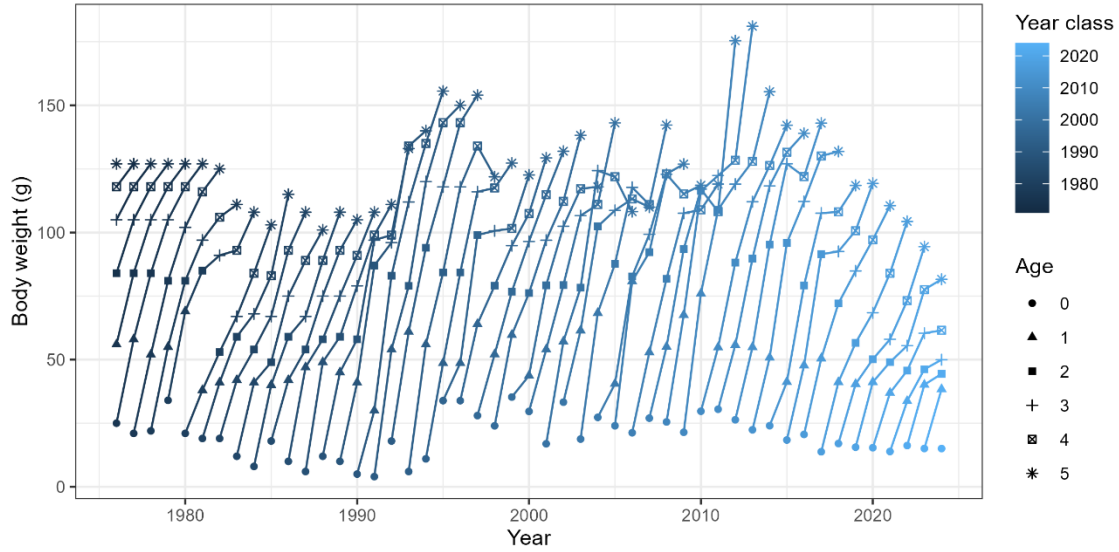
- Mean catch length at age of is calculated annually using catch-number-at-length and age-length-key
- Mean length is dramatically smaller in 2020s, supporting Kamimura et al. (2022)'s density-dependence
- Sizes of age-0 fish in 2022 onward are greater but not for older ages
- Note that mean length-at-age is not growth curve, it may reflect selectivity for age-0 fish



Weight at age

- Mean body weight is calculated from length-at-age, length-weight-relationship, and ALKs.
- Recent weight-at-age had decreased especially in 2023 and 2024
- Weight-at-age changes dramatically with stock abundance
- Consistent with the density-dependent effect reported by Kamimura et al. (2022)





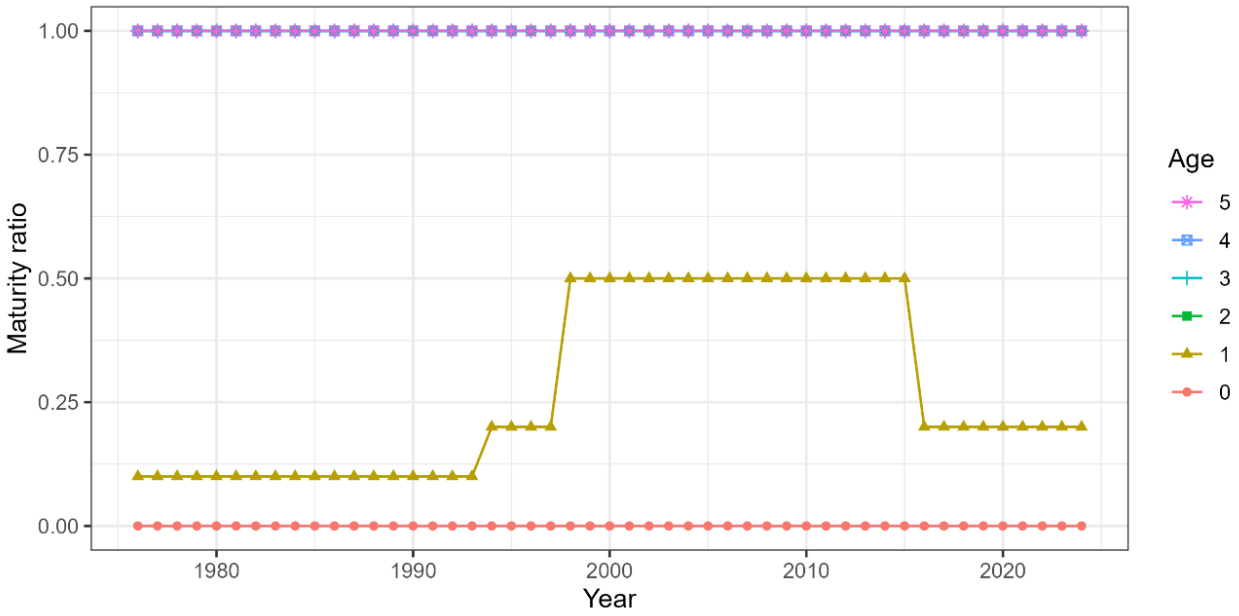
Natural mortality

- M is estimated to be 0.4
- Based on Tanaka (1960)'s estimator using longevity (M=2.5/Amax)
- Longevity is set as 7 years old based on observation of catch
- M = 0.4
- No age-dependent nor yearly M are considered

Maturity

Year group	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5+
1976-1993	0	0.1	1	1	1	1
1994-1997	0	0.2	1	1	1	1
1998-2015	0	0.5	1	1	1	1
2016-2024	0	0.2	1	1	1	1

High



- Based on the Japanese domestic stock assessment
- The maturity schedule is known to vary in response to density-dependent effect Morimoto (2010)
- Maturity of age-1 increases as stock abundance shifts to low period (1998-2015)
- Recent observation showed maturity schedule had slowed down Yukami et al. (2017)

Conclusion

- Biological parameters have been changing with changes in abundance
- Distribution spread into 180E during early 2020s but showed less-spread distribution in 2024 onward for age-1 fish
- Body growth (length and weight) has shown declining trends in recent years due to density-dependent effects
- Natural mortality is estimated with longevity of age-7 and M=0.4
- Maturity-at-age for age-1 fluctuates with stock abundance