Progress report on the study of maturity at age of Chub mackerel

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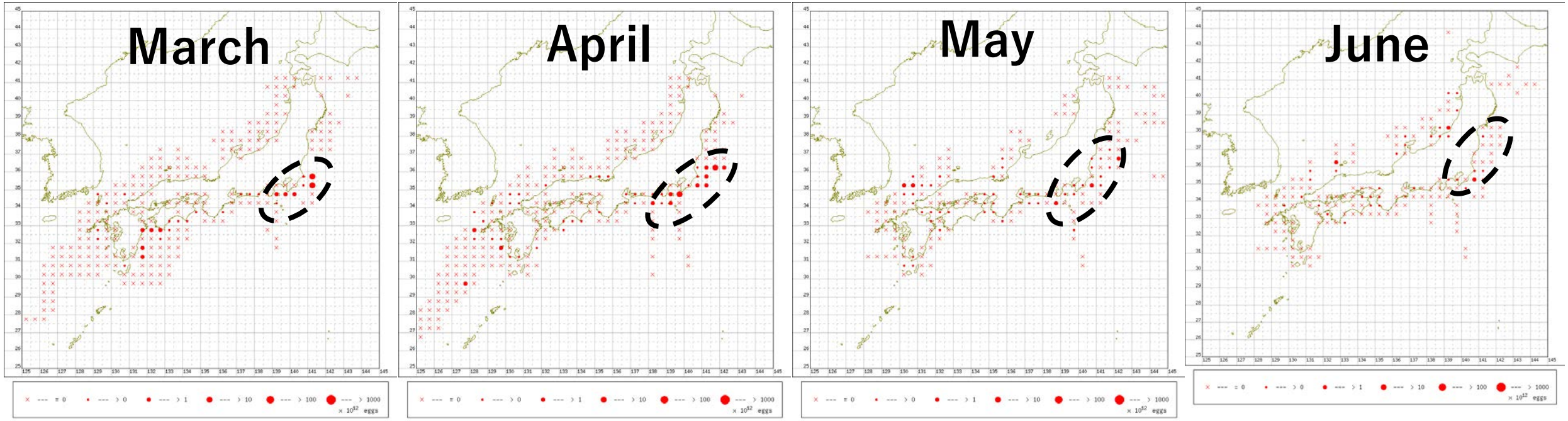
Egg distribution in 2022

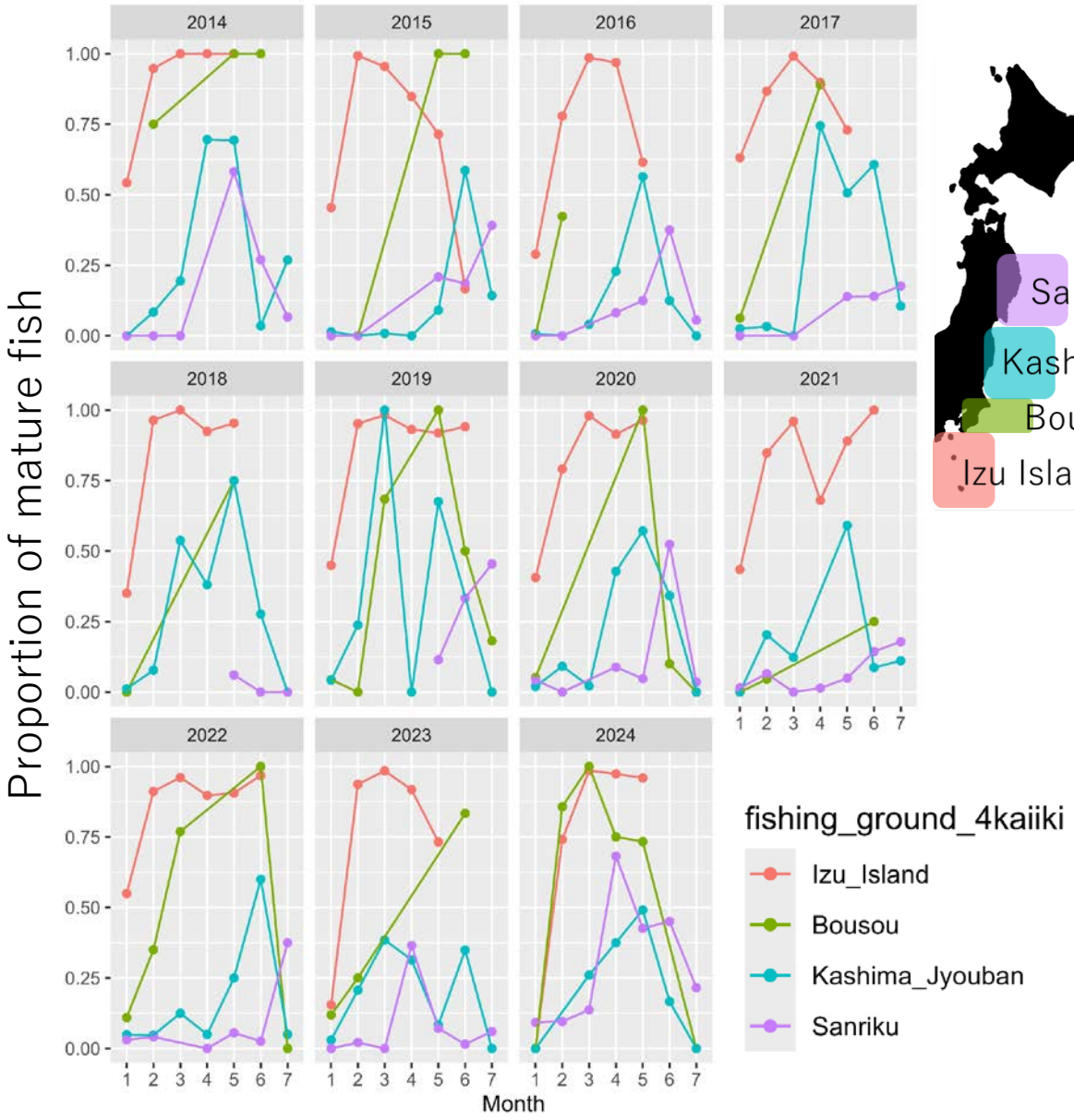
Survey conducted by FRA and local institutions

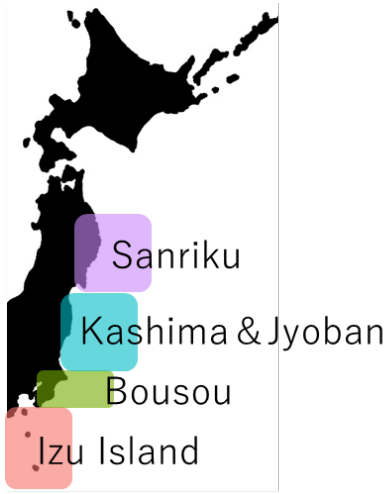
Egg density in 30 minutes mesh
June



Chub mackerel eggs are found mainly in the Pacific coastal areas from March to June.

Monthly trends of the proportion of mature fish by sea area

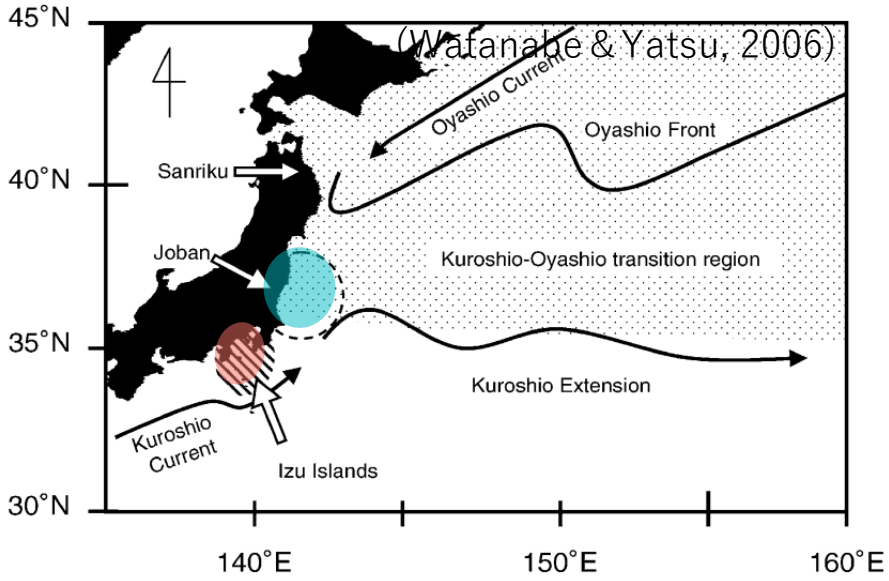




Higher proportion and earlier appearance of matured fish are observed in the southern waters (**Izu Islands** and **Bousou**) compared to the northern waters (**Kashima-Jyoban**, and **Sanriku**) in all studied years.
Nearly all fish in **Izu Islands** in spawning season are matured.
Northern waters include wintering younger fish.

It should be noted maturity at age varies region-wide and so it's important to consider the age specific distribution of fish and their maturity at each region.

Maturity at age for 1970-2007 (Watanabe & Yatsu 2006, Watanabe 2010)



Area Izu Islands and Jyoban area

data

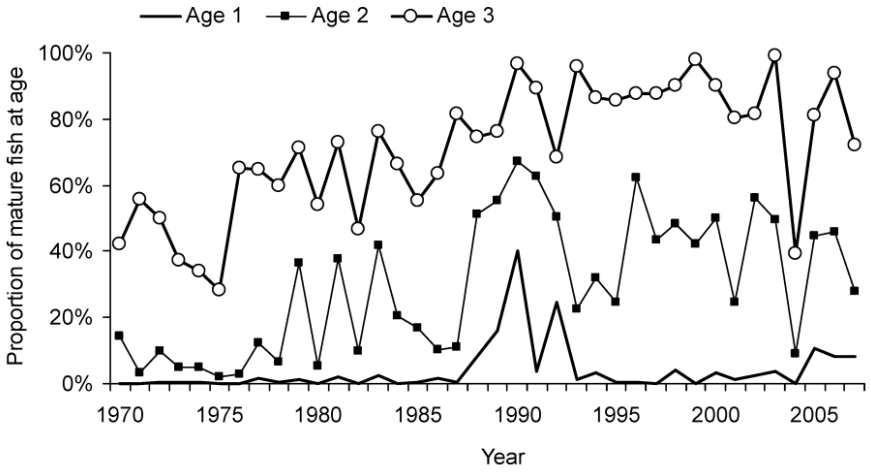
- Chub mackerel biological data
  FL（cm）,KG=(GW/FL^3)×10000
- Fishing catch data (Catch at length, total catch)
- ALK

Peak spawning period

Period when monthly mean KG exceeds 5 around Izu Islands (generally, from March to June)

Method

- Determine the maturity status of each indiv. using KG criterion.
- Maturity at age for each area were weighted by catch of the equivalent areas and integrated.



(Watanabe, 2010)

Current considerations

- Re-examination of criteria for mature fish

  Is it appropriate to use KG3 of Watanabe & Yatsu (2006) in recent years?

- What should be used to weight the maturity at age by sea area?

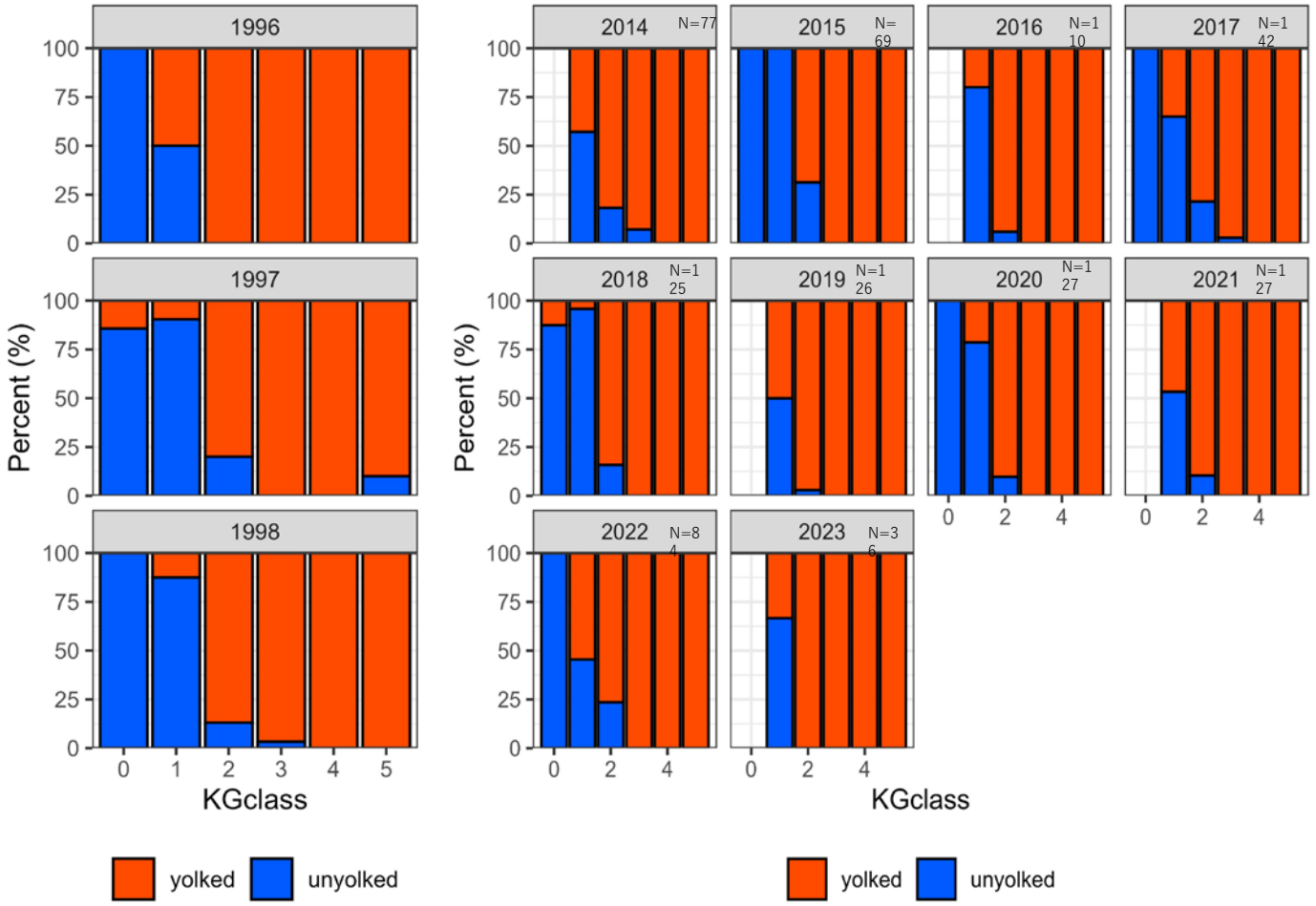
  Fishery catch by sea area cannot be used currently.
  (decline of fisheries around Izu Islands)

  Egg abundance data at each sea area obtained by scientific survey can be assumed to be the distribution of mature fish by sea area

Re-examination of criteria for mature fish (Watanabe & Yatsu 2006)

(Watanabe & Yatsu 2006 data)

1996-1998 2014-2023



Histological observations on the ovaries from 1996-1998

unyolked ⇒immature
yolked ⇒mature

KG≥3 criteria assumes 100% maturity for 1996-98 and 2014-23.

KG3 criteria works as sign of 100% maturity although KG3 criteria is very strict.

Percentages of mature fish by KG class in 2014-2023 were almost similar from 1996~1998.

Result of Re-examination of criteria for mature fish

If the same method as Watanabe＆Yatsu (2006) is used to determine the criteria, it was found that KG3 is usable in 2014~2023 as well, since maturity at KG are similar to ones from since 1996-1998.

- Since KG bin is set as 1, examination of maturity developed KG3 criteria however, it is also a rough and harsh criteria. (maybe some number between 2 and 3 can be used instead?)

Future task:

⇒**Calculate maturity criteria from maturity curve (e.g., logistic)**

⇒**Compare accuracy between KG and GSI**

Integrated MAA by sea area using egg abundance

Distribution of mature fish by sea area ∝ Egg abundance by sea area

By sea area
✓ **Biological data** (FL,mature/immature)
✓ **Catch data** (CAL,WAA, Age composition)
⇒ **Maturity at age**

Egg abundance by sea area

Relative age-specific distribution of fish by sea area

Integrated MAA