Western Sea of Japan and East China Sea stock of Japanese seabream *Pagrus major*

Peer Review Meeting for Japanese Fish Stock Assessment
7-10 November 2023

Comments from Reviewers and **replies**

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- Stock boundary
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- Fishery
- Data set (catch at age)
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- Models & parameters
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Stock boundary

・What is the evidence for distribution area highlighted in Fig 2-1? (Teo 10)
・What is the authors' sense of the proportion of seabream data in this model to its full potential spatial distribution (outside of Japanese waters)? (Kuriyama 2a)
・Are there Japanese seabream in the waters further east, like Tottori, Hyogo, and Kyoto and Prefectures or the waters of eastern Kyushu? If so, how are these fish connected to this stock? (Teo 11)

> No clear evidence for distribution range of this stock.
> No information on the connectivity of this stock to other regions.

・Are there Japanese seabream in the waters of Korea? If so, how are these fish connected to this stock? (Teo 12)
・Why was non-Japanese catch not included in the assessment? (Teo 17)

> There is a possibility that the connection between this and Korean populations exists, but it is not included for now.
> Details on the current assumption of stock range is NEXT SLIDE:

The red line (rough distribution of the stock) is derived from the operating area of fishers.

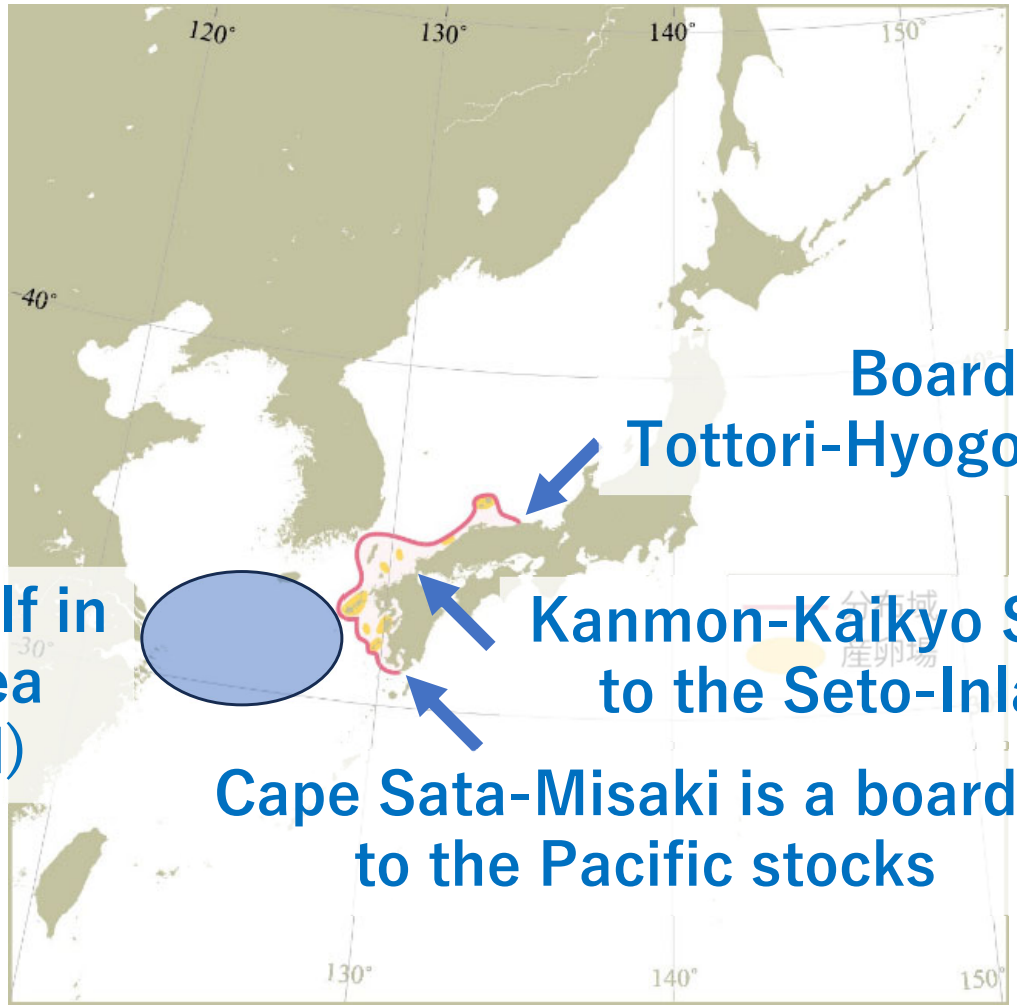


Fig. 2-1

・Why was recreational catch not included in the assessment? (Teo 16)

> The detailed data on catch by recreational angling is currently unavailable, therefore not be included in the assessment.

Biology/Ecology

・Fig 2-2 shows the average length-at-age and weight-at-length for this stock. However, there is no reference to any studies or data to support these relationships. Please show and describe the data that supports these relationships, especially from the age and growth studies. (Teo 13)

> There is no citable info on age and growth for this stock. Growth parameters and lines on Fig. 2-2 are based on the old reports of this stock assessment. We are currently preparing to revise this age-length-weight relationships considering seasonal fluctuations.

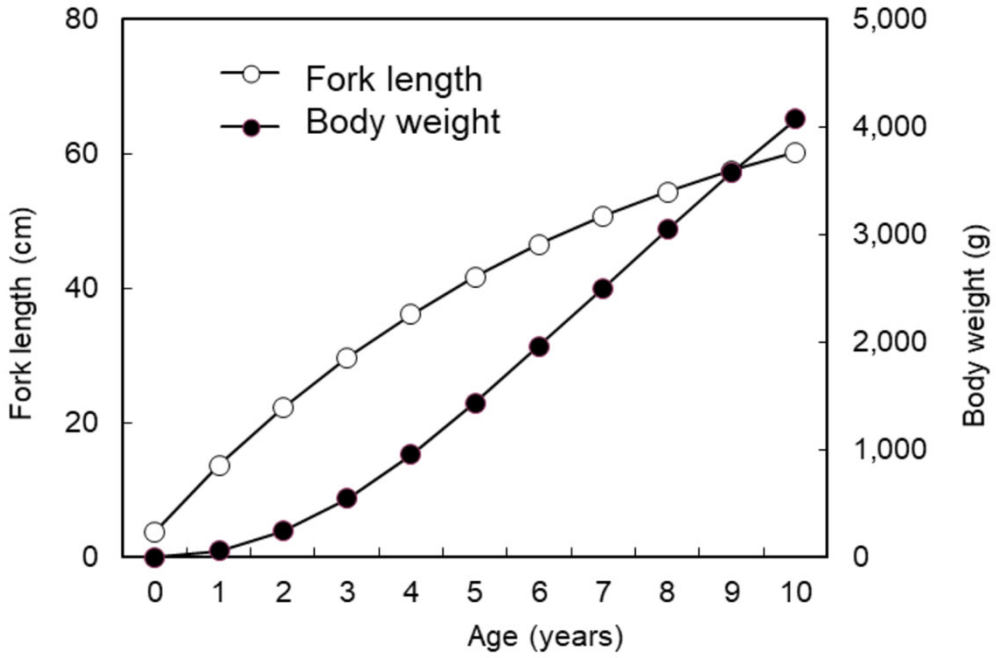


Fig. 2-2

・Biological parameters, like growth, of fish often changes year to year, and season to season. Have there been studies on the variability of growth for this stock? (Teo 14)

> Currently, no information on the interannual or multi-decadal variability of growth for this stock. Area-specific growth is also not considered.

・ What was the maturity curve (and basis for selecting this curve) used for this assessment? I see it is in Fig. 2-3 but not mentioned in the text. Please include this section in the document. (Kuriyama 2d)

> Mentioned in the end of "(3) maturation / spawning" section. "Half of fish at age 3 and all fish at age 4 and older reproduce (Fig. 2-3)."

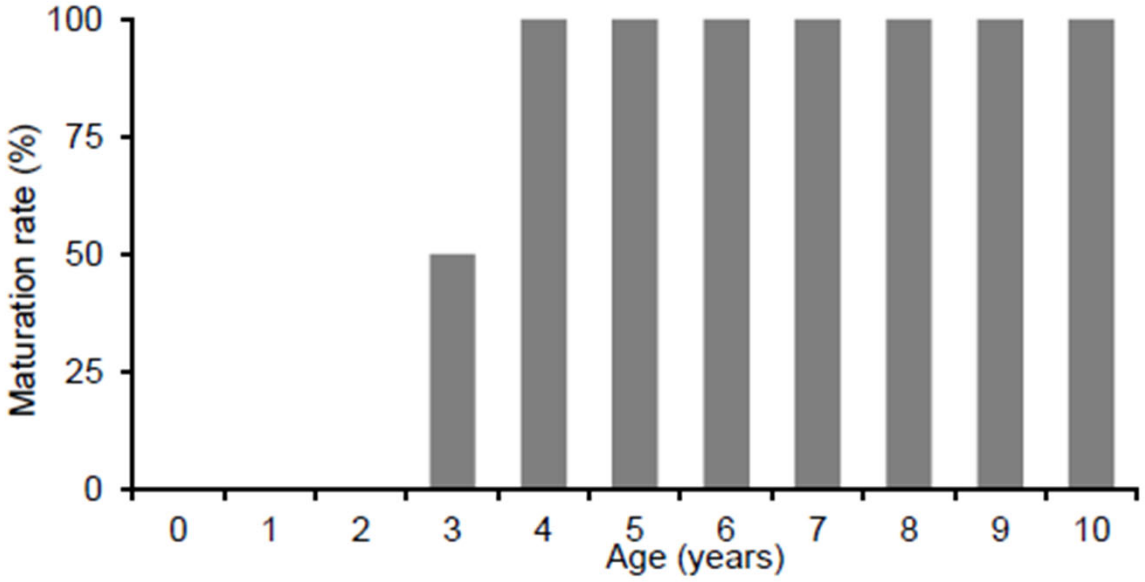


Fig. 2-3

・How were the values of M obtained in Shimamoto1999? (Teo 15)

> Shimamoto (1999) considered various information of M and decided as: M = 0.39, 0.24, and 0.17 for 0, 1, and ≥2 years old.

Followings are some sources cited in Shimamoto (1999):

Okada (1974): M = 0.38

Shimamoto (1987): survivorship is ca. 0.8 and M = 0.223

This is based on Wang (1937)

Wang (1937): Catch curve-based survivorship in Seto-Inland Sea is 0.82-0.83 (age was determined by using scale). Regarded it as initial stock, and M was calculated as 0.19-0.20.

Shimamoto & Watanabe (1994): M in age 0 and 1 year must be higher than age 1 and ≥2 years based on feeding condition etc.

Nagai (1995): M = 2.5/longevity(max age =18) ≒0.14

> We are currently preparing internal study about M along with other species/stocks.

Hatchery release

・Similar to the other demersal stocks, please clarify the general aim for the assessment and management of this stock with regards to hatchery releases versus wild-origin fish. For example, is the primary aim to assess and manage the wild-origin fish? Or is it important to manage the hatchery releases as well? (Teo 1)

・What is the goal of the hatchling release program? (Kuriyama 1b)

・What are the factors that affect hatchling release? Is it based on success of the aquaculture facility? Or are more fish released when wild biomass appears to be low? (Kuriyama 4a)

＞ Purpose of this program is simple stock enhancement.

＞ Hatchery released fish are considered as the same with wild once recruited, but excluded from “recruitment number” in S-R relationship estimation.

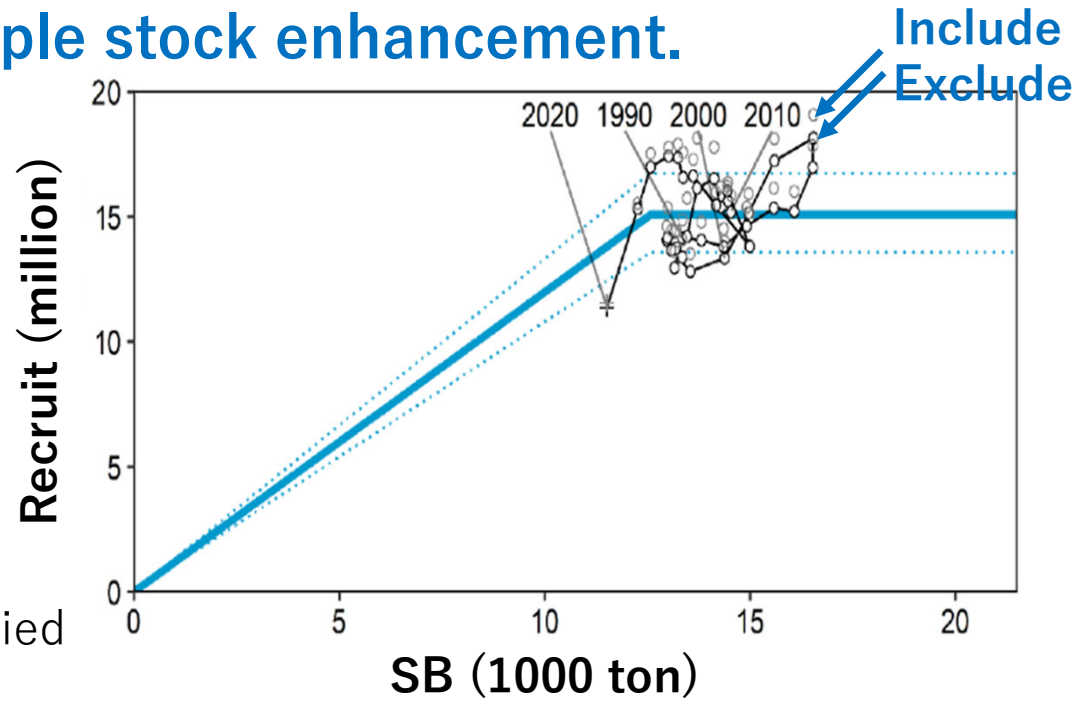


Figure 1 in “FRA-SA2021-BRP05-001” modified

・How were the contribution and survival rates estimated? Also please provide the uncertainties of these estimated rates. (Teo 2)

>

$$\text{Contribution rate} = \frac{\text{Number of hatchery released fish landed}}{\text{Number of all fish landed}}$$

Port/market survey is conducted by four prefectures (Current data is not age specific)

$$\text{Survival rate} = \frac{\text{Stock number of age 1-year hatchery released fish}}{\text{Number of hatchery released fish in previous year}}$$

Stock number is estimated in VPA

> **Uncertainty is not considered in these rates.**

・How are hatchery releases identified? (Teo 3)

> **By the observation of deformity of the inter-nostril epidermis.**

Wild-origin fish

Hatchery released fish

***In recent years, not all seedling exhibit this deformity. Certain proportion of seedlings have deformation.**

Original photographs

・Were the hatchery-origin recruits considered to be the same as wild-origin recruits? (Teo 4)
・Is the recruitment contribution for hatchery releases considered part of the stock and after maturity, part of the SSB? (Teo 5)
・Hatchery releases, if not captured, can be assumed to contribute to the SSB and future recruitment. Is the per capita contribution of hatchery-origin fish similar to wild-origin fish? How does this affect the assessment and management for this stock? (Teo 6)
・When estimating the SRR, only wild-origin recruits were used. Was the SSB is there a distinction between SSB of hatchery-origin versus wild-origin? (Teo 35)
・Are the hatchery-released fish included in the analysis? (Fig. 4-6, Kuriyama 7a)

> The ability of hatchery released fish are considered as the same with wild once recruited and included in the analysis.

> For SRR estimation, hatchery-release is removed from the total recruitment to evaluate the wild-origins.

・What is the age and size of the fish that are released? How does this compare to the age and size of recruits? (Teo 7)

> 90-120 mm total length at release (ca. 0.5 years old), which is almost the same size with the equivalent wild fish

・Are there any regulations on the hatchery releases? (Teo 8)

> There is no regulation specific to the hatchery releases. Fishers catch hatchery released fish along with wild fish.

・Japanese seabream is an important aquaculture species and likely have been subject to strong selective pressure in aquaculture. Are the hatchery releases the same fish as the aquacultured fish? (Teo 9)

> Hatchery released fish is not same as the aquaculture fish. Spawning adults used for hatchery release program are collected from wild on a periodic basis to ensure genetic diversity of wild population.

Fishery

・How is the age-0 fishing ban enforced? Is it based on sizes or preventing fishing on spawning grounds? (Kuriyama 3a)

> Size regulations (<13cmFL) exist in some prefectures and catch of 0-year-old size can be considered as rare in those prefectures. Small number of 0-year-old size are still landed in other prefectures but not considered in the VPA analysis.

・Is there strong preference for age 2 and age 3 fish? Do these have the most value in fish markets? (Fig. 4-4, Kuriyama 5a)

> Although average market values (yen/kg) are higher in 4-7 years old fish (1-2 kg), 2-3 years old fish (200-500 g) are more preferable in some stores and supermarket due to easiness of handling (pers. comm.).

・I don’t think the proportion landed by the large set net fishery is reported in the text in (1) Fishery overview. (Kuriyama 3b)

> Because of small amount of catch by setnet fishery (Fig. 3-1). But the setnet fishery data in Shimane Prefecture is only available for CPUE calculation.

・Are the boat seine fishery data available? (Kuriyama 3d)

> Simple catch data by boat seine is available (as in Fig. 3-1), but detailed information on this fishery is currently not available.

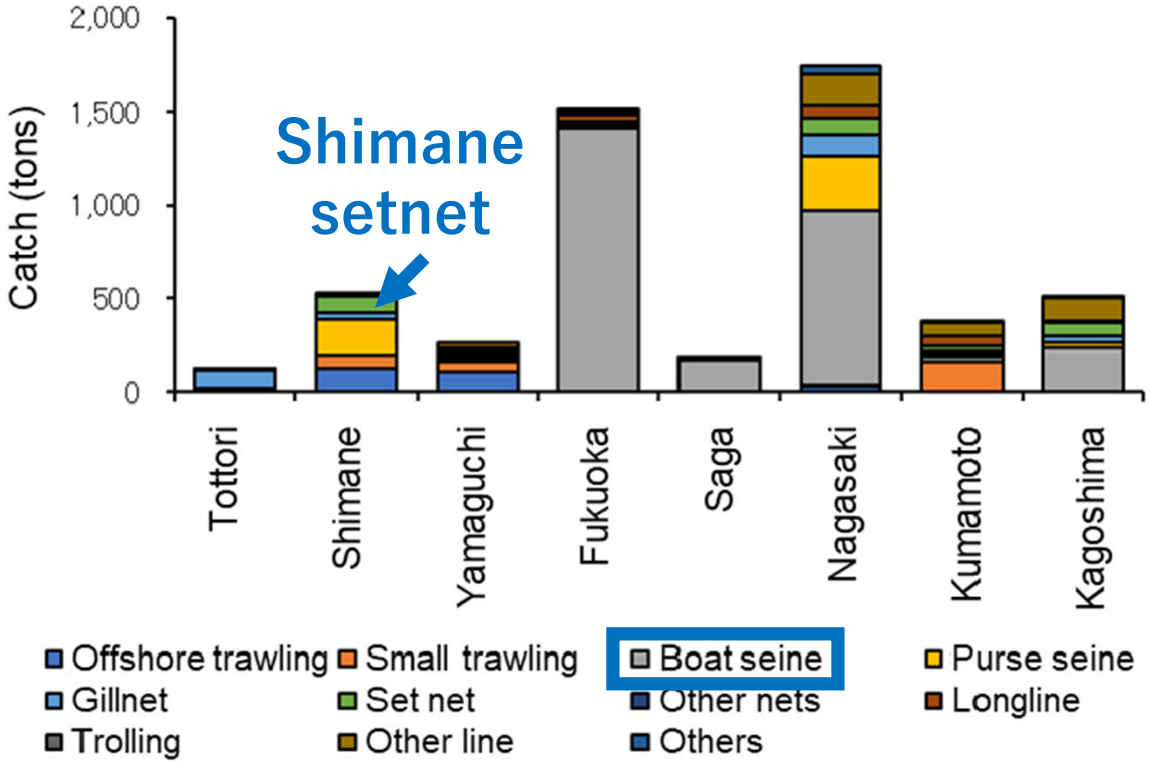


Fig. 3-1

Data sets (catch at age)

・For a cohort analysis, it is assumed that catch-at-age is known and is typically considered to be an important assumption. Therefore, it is important to understand how the catch-at-age time series was developed. However, it is not clear in the provided documentation how the catch-at-age data was developed. Please explain in detail how the catch-at-age in numbers time series was developed. (Teo 18)

・Which data were the age-fork length and fork length-weight relationships estimated to? Please provide some details of the sample sizes and sampling protocol for these data. (Kuriyama 2b)

・In the supplementary material 2, growth equation and length-weight relationship are described, however there is no information how catch-at-age is calculated from those equations. (Yamakawa 6)

> We apologize for the lack of info on the derivation of catch-at-age.

> Related comments continued…

・Was there operational aging done for this stock? If not, was there some sort of length or weight sampling? (Teo 19)
・Please explain how the age distributions were obtained. Were ALKs used to convert length to ages? If so, please show the ALKs. If not, was cohort slicing or some other method used? (Teo 20)
・It was reported that “the accuracy of the age compositions is inconsistent and retroactively scrutinizing the data is impossible”. Please explain this statement in more detail. (Teo 22)
・Based on Fig. 3-3 it seems that the fish age 7+ make up a small proportion of the catch. I think this point should be included in the text to provide context around the decision to start the plus group at 7. (Kuriyama 2c)

> Age compositions and ALK are provided by each of eight prefectures. Our institution collects the data and sums up the data.
> The effort on data sampling, aging methods, and ALKs are different among prefectures. Also, resolution, precision, and duration of the data are different among prefectures.
> We will consider describing the context of plus group in the report next year.
> Basic protocols in 8 prefectures are explained in the NEXT SLIDE:

Catch-at-age preparation protocol for each prefecture

Tottori and Shimane
- Length composition obtained by fishing port survey
- Half-year-based ALK based on Hasselblad's method

Yamaguchi and Saga
- Length composition obtained by fishing port survey
- Quarterly ALK (Murayama & Kanamaru 2007)

Fukuoka
- Age-brand (size rank) key specific to Fukuoka

Nagasaki
- Quarterly ALK specific to Nagasaki

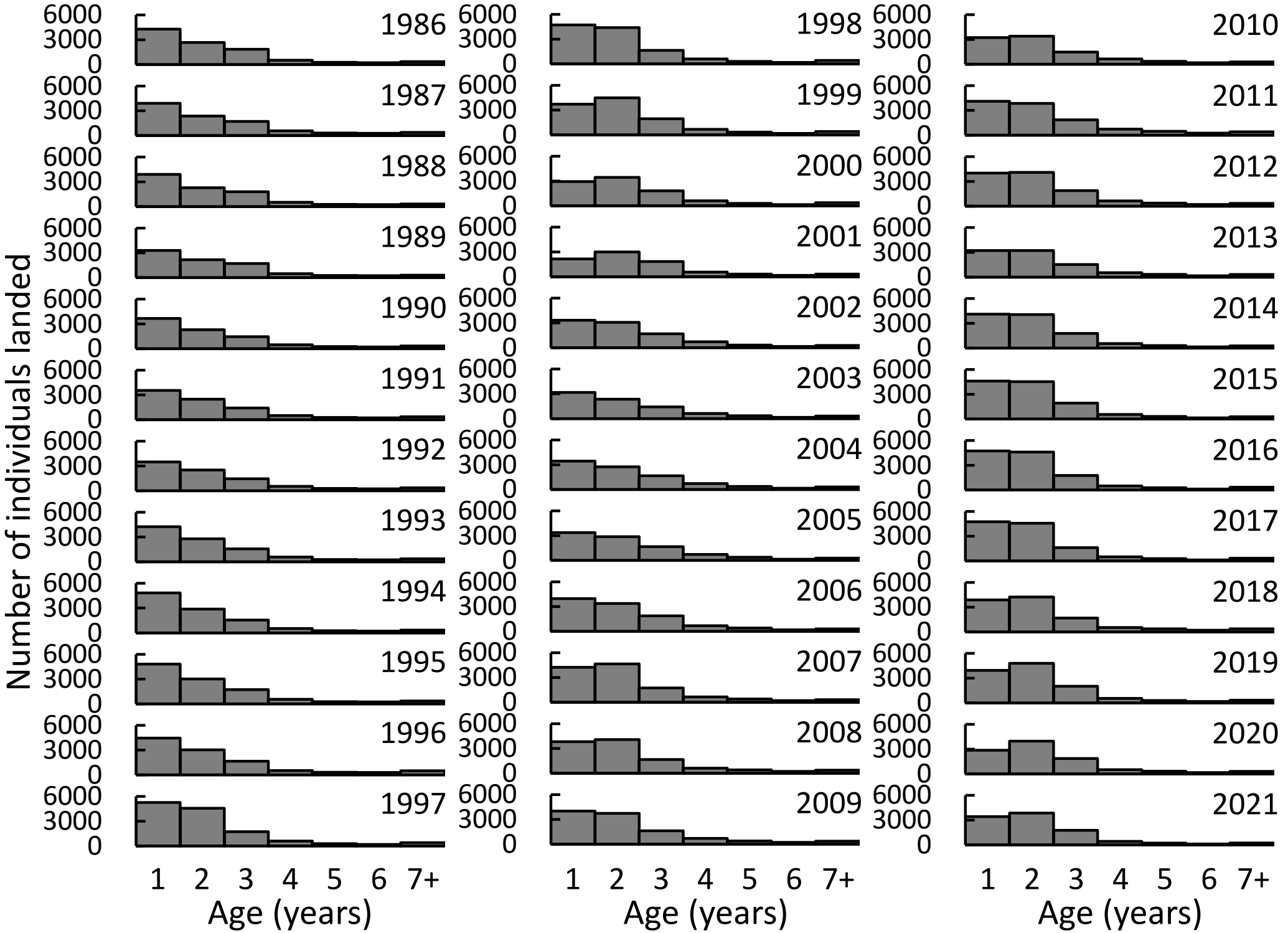
Kumamoto
- Determinate ALK specific to fishery specific to Kumamoto

Kagoshima
- Age-weight key (Kameda 2003)

・Can you please plot the fishery age composition data by year as opposed to a stacked bar plot (I think these are Figure 3-2 in all the documents)? See this figure from a recent US West coast Pacific mackerel stock assessment in which proportion of fish at each age is on the y-axis and age is the x-axis. Each of the panels corresponds to a year.

A benefit of these plots is that I think they make it easier to identify cohorts over time. (Kuriyama GQ4)

> **NEXT SLIDE:**



Original figure

Data sets (CPUE)

・The period from 2007 – 2021 has relatively little contrast in catch and CPUE, and hence may not be highly informative. There appears to be some contrast in catch during 1969 – 1990. Is there CPUE data available for the 1969 – 1990 period? (Teo 30)

> Currently, data before 1986 is not available.

・CPUE comes from the large set net fishery in Shimane since 2007. Based on Fig. 3-1 this data set represents a relatively small fraction of the total catch. Where there years in which this sector made up a larger proportion of the total catch? Are there data available from the boat seine sector which makes up roughly 53% of the total catch? (Kuriyama 1a)

> Unfortunately, no any other CPUE information for this stock is available so far. We are searching for other information which can be utilized for CPUE calculation including boat seine fishery.

・Is the amount of fishing time (i.e., time between removing fish) for each set net the same? Are the fish in the set nets removed every day? (Teo 22)

> Exact days is unknown but each landing is treated as a single day catch.

・It was stated that “catch (kg/day・vessel) of Japanese seabream from January to December 2007 to 2021 was aggregated by day and by vessel (= management entity)”. Does this mean that each line of data is the catch in kg from 1 day of fishing from 1 set net? If not, please explain in more detail. (Teo 23)

> Each line data is the “catch in kg from 1 day by single management entity”. Twenty companies are used as factor in GLM analysis.

・Does “vessel” in the standardization model mean a single set net location? If not, what does it mean? (Teo 24)

> Actual meaning of “vessel” is “management entity (= company)” because fisheries cooperative records their catch by “management entity”. Some company operate plural (two or three) vessels and setnets but data can not be separated for now.

・Were there any important second-order interactions in the month, vessel, and year factors? (Teo 27)

> Interaction terms are not included in the current GLM analysis.

・Is there any kind of scientific survey for demersal fish in the area? (Teo 31)

> Small seine net is used to collect recruitment size bastard halibut off Tottori Prefecture for survey, but Japanese seabream rarely caught.

・Is there a table of all the estimated parameters and their uncertainty? (Teo 34)

> Estimated parameters are described in the appendix document "FRA-SA2022-SC07-02".

・What is the hypothesis behind including temperature in the standardization? Distribution is affected by temperature? (Teo 29)
・Temperature is included as an explanatory variable in the standardization of CPUE. The process needs to be careful because if temperature affects the stock variability, inclusion of temperature in the model may eliminates the yearly-effect of stock variability caused by the temperature variability. Basically, standardization of CPUE is to extract the trend of stock status precisely by eliminating the effects such as catchability and factors that cause spatial-distribution. So, catchability and such factors can be included within the model to eliminate the effect, however, factors that affect the stock variability should not be included in the model. I would suggest to double-check whether temperature does not affect the stock variability. (Yamakawa 4)

> Water temperature is thought to affect fish movement and its catchability by coastal setnet fishery which set at shallow coastal area. Stock biomass of long-lived demersal fish, including Japanese seabream, seems not significantly influenced by the water temperature in short time scale.

・Please show a map of the “vessels” used in the index in comparison to the spawning areas and distribution of the stock. (Teo 25)

>

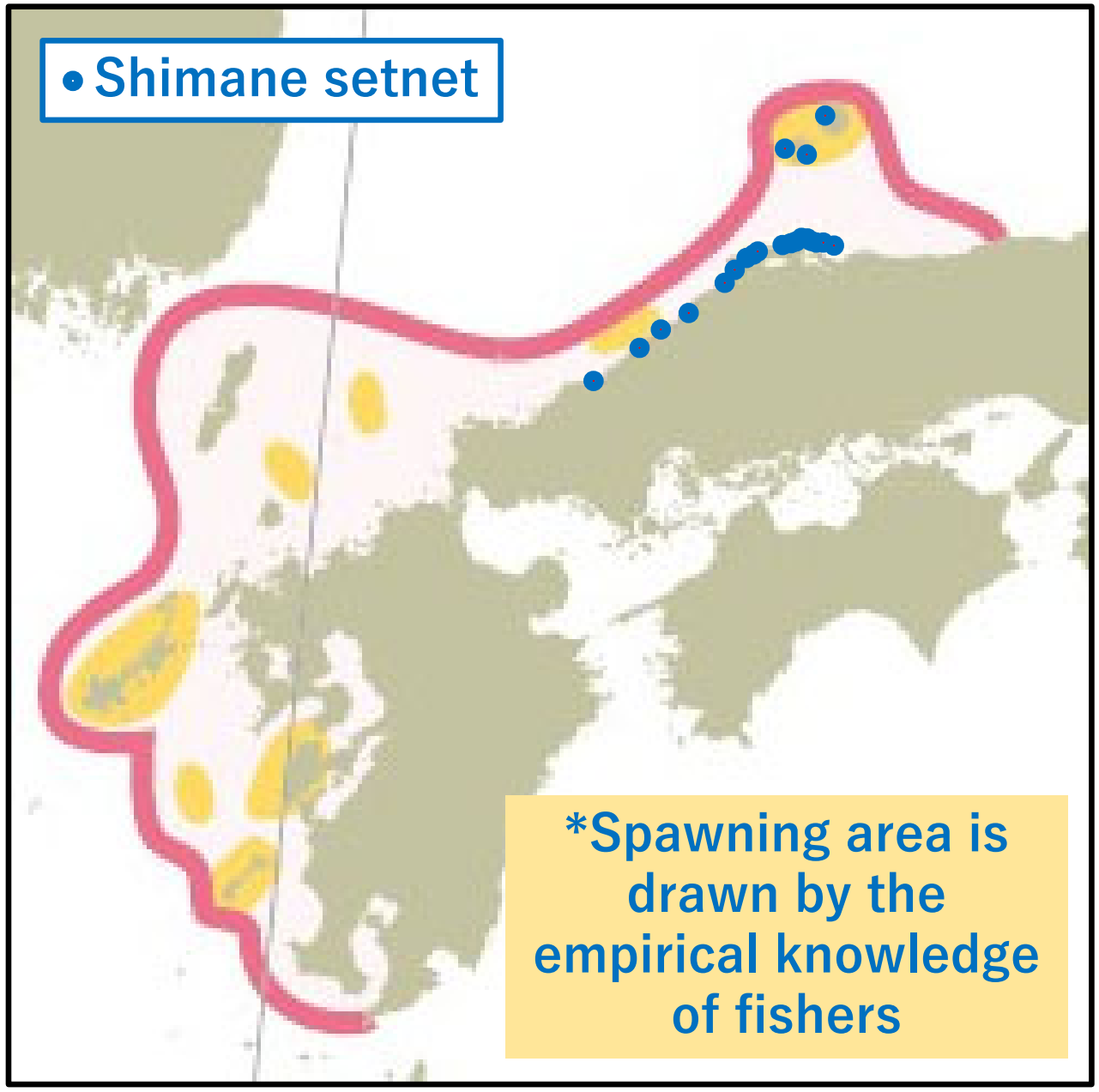
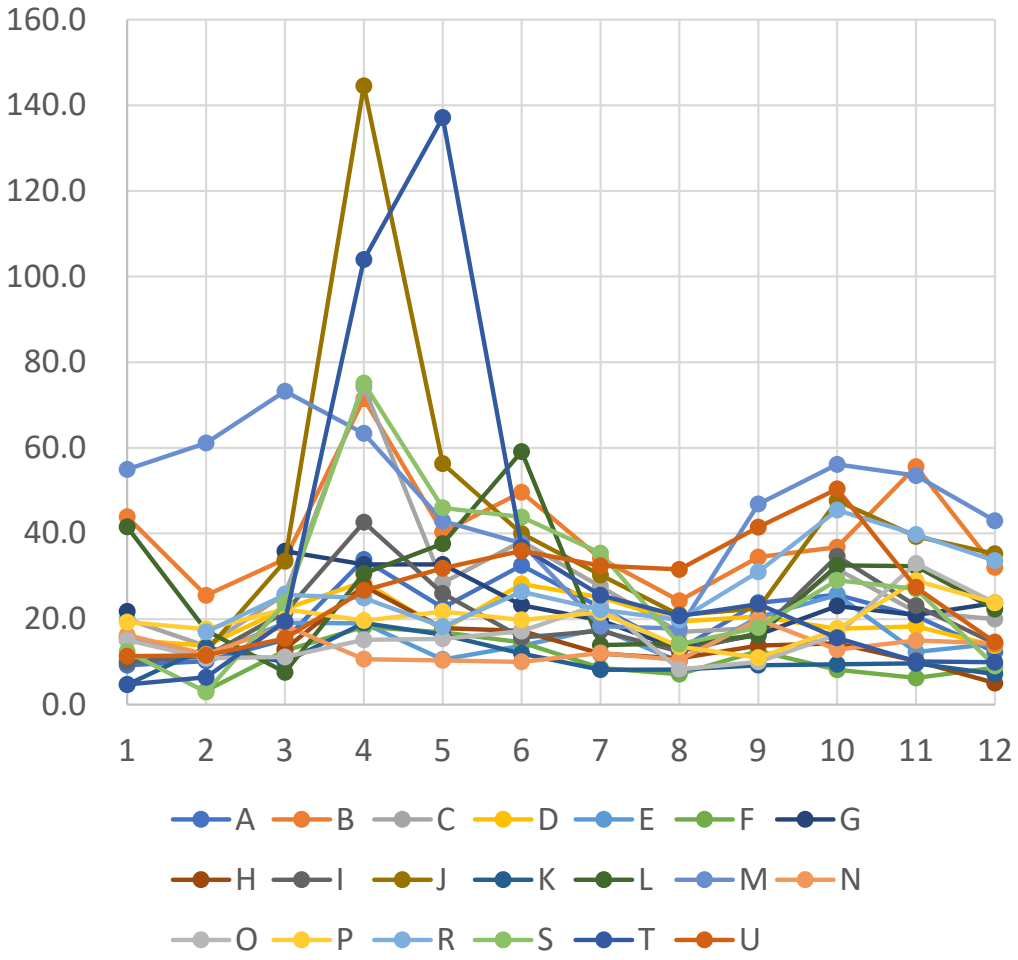
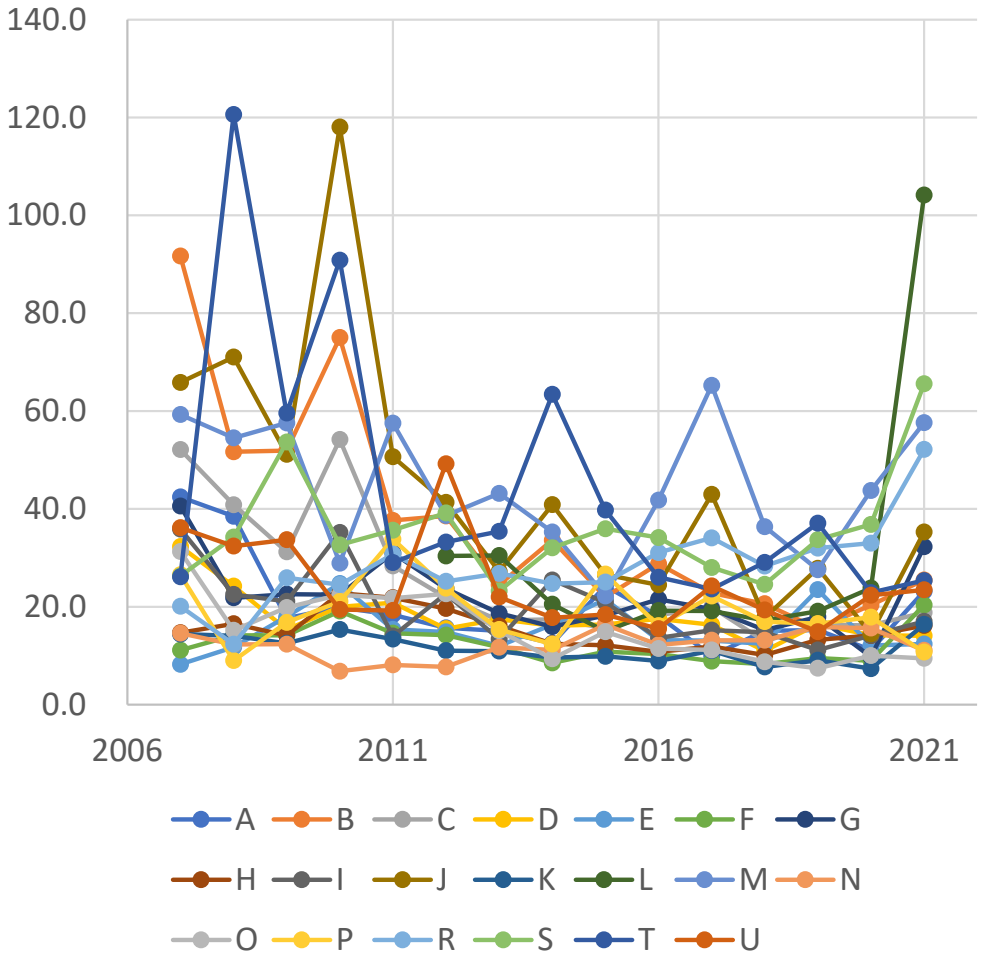


Fig. 2-1 modified

・Please show the nominal CPUE for each “vessel”. To see the seasonal effect on vessel, please average by month for all years. To see the annual changes, please average by year for all months. (Teo 26)

>

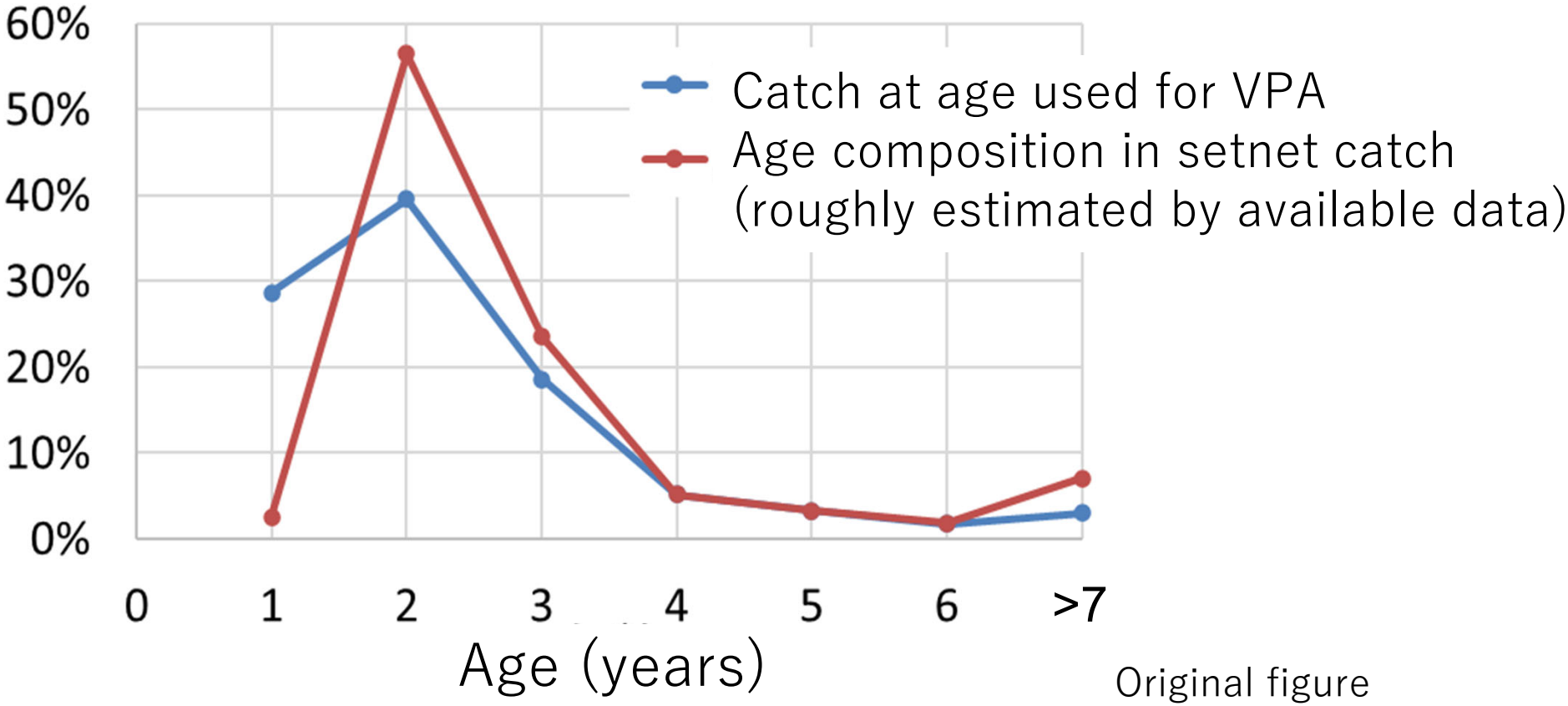




Original figures

・What are the age or size compositions for the index? (Teo 28)

> Roughly estimated age composition in the catch by setnet is not significantly deviated from the catch at age used for VPA.



Original figure

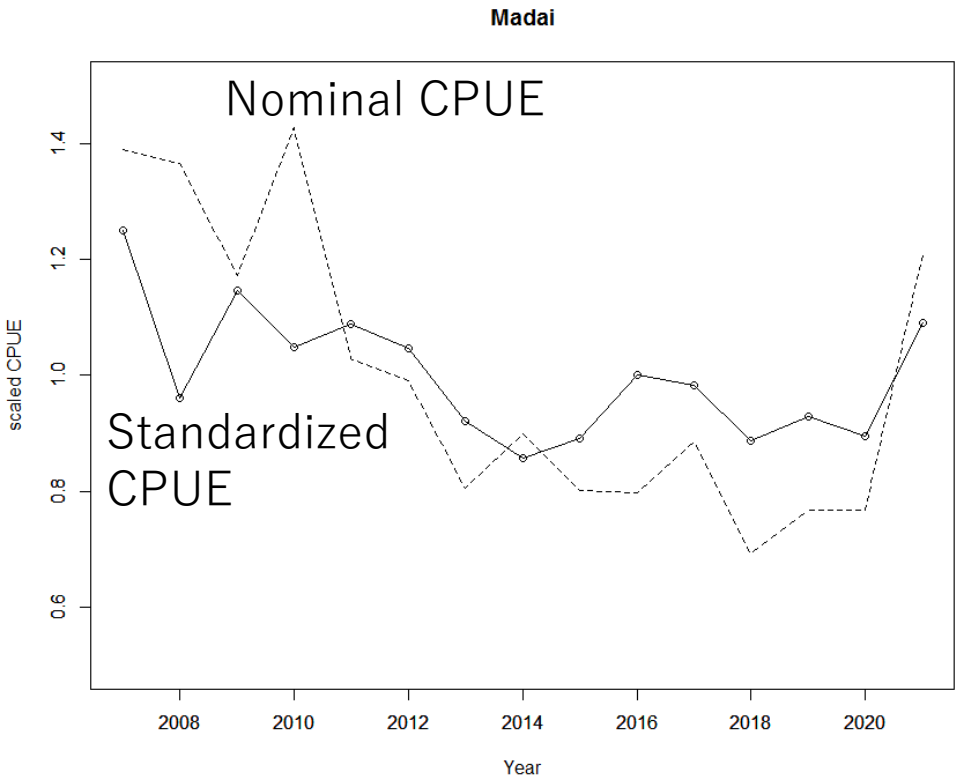
・For the cohort analyses that are tuned to indices of abundance, what were the catchability Q values used? What was the rationale for selecting these values? (Kuriyama GQ3)

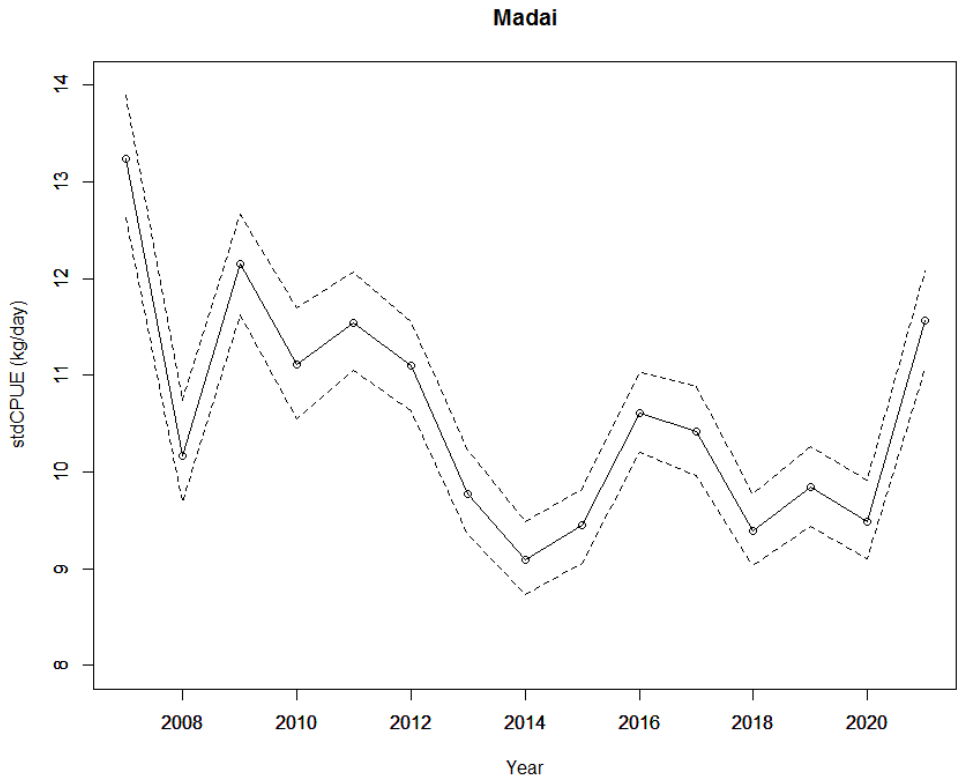
> Q is 0.48 (output value in rVPA).

・When plotting the tuned fits to the indices of abundance, is it possible to include the uncertainties around each of the index points? See the below example from the same recent Pacific mackerel assessment (Kuriyama GQ5)

・Are there uncertainty estimates for the indices of abundance? Could the uncertainty be plotted here? (Supp. Fig. 2-2, Kuriyama 8a)

> Uncertainty (95%CI) is shown in the appendix document "FRA-SA2022-SC07-02" (Figs. 4 & 5), but not considered in the tuned VPA.





Figures 4 & 5 in document "FRA-SA2022-SC07-02"

Models & Parameters

・Body weight at age 7+ fixed to 3,531 based on proportion of old fish with M of 0.5. Wouldn't it be more consistent to assume M of 0.17 as done for fish older than age 2? (Kuriyama 3c)

> Z (F+M)of Age-7+ fish is assumed to be 0.5.

・Please provide details behind increasing/decreasing M by 30% as a sensitivity. Is 30% considered to be the range of uncertainty in M? (Kuriyama 4b)

> No strict reason for the value "30%". Just showing results by assuming more and less M values.

・How do these different values of M used in the cohort analysis affect reference points and stock status? (Fig. 4-5, Kuriyama 6a)

> Currently, different M is not considered for further analysis. The approach to consider further is a communal issue among other stocks. Therefore we will review this issue internally first.

・My understanding is there are no age 0 data available because of the fishing ban on age 0 fish. Does the cohort analysis begin modeling with age 1 fish? Is there a way to start the cohort analysis at age 0, with F at age 0 = 0, and some age 0 M value? I think starting the model at age 1 might affect the recruitment estimates and subsequent reference points. In reality an age 1 fish has experienced one year of natural mortality, but in the model I think it may experience no years of natural mortality. (Kuriyama 4d)

> Even if age-0 is estimated backward from age-1 fish, the qualitative trend of age-0 and age-1 are the same since the M of age-0 is assumed consistently over the years. (Therefore, the overall shape of SR-relationship will not change.)

・What are some possible reasons why the stock continues to experience overfishing (F>Fmsy) and be overfished (B<Bmsy)? It seems that management might not be effective. (Kuriyama 4e)

> Current fisheries are harvesting mainly on 2-3 years old fish (still in the rapid growth period), and current result implies this stock is "growth overfishing". It is predicted that a reduction of F will increase stock biomass and future catch.

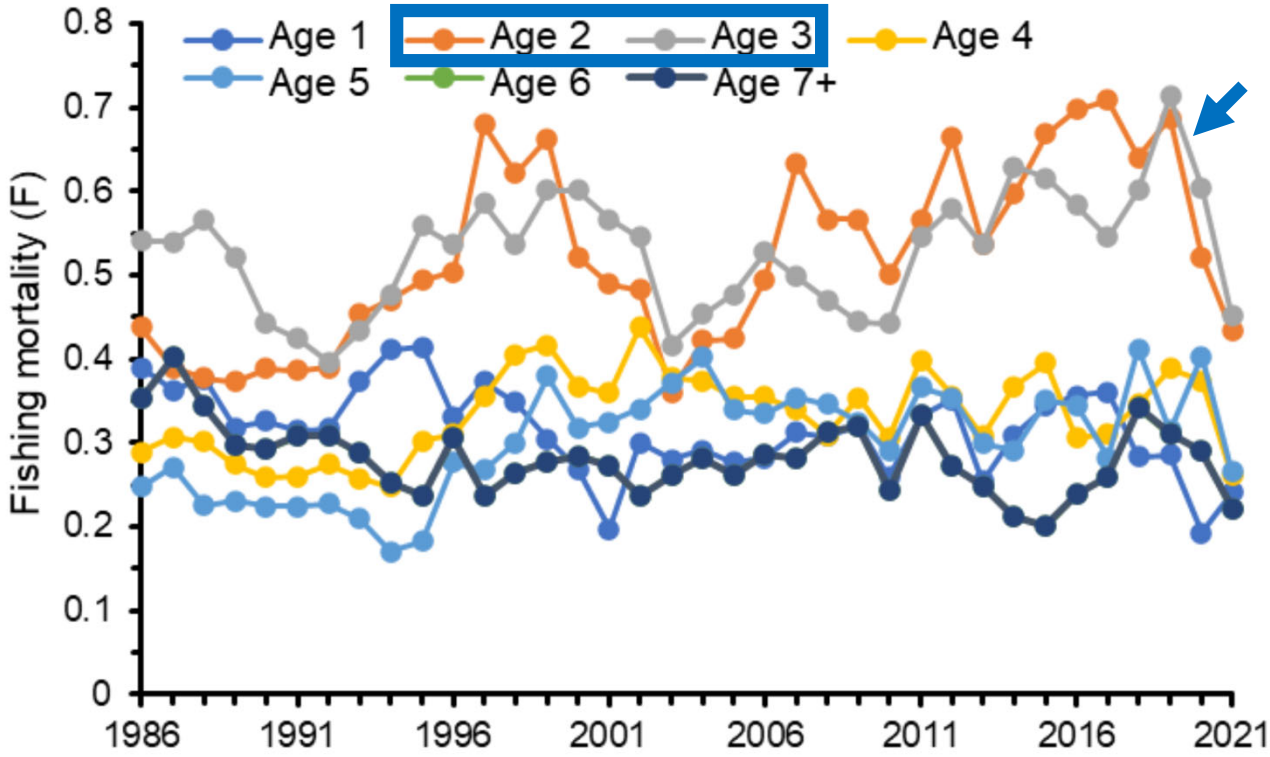


Fig. 4-4

・ One interesting feature of this stock and model is that it has been very stable during the modelling period (1986 – 2021) (Table 4-2). Catch during this period is around 5000 – 7000 tons, recruitment is around 14-18 million, and %SPR is very low. However, catch during the 1969 – 1985 period is much higher (Fig. 3-2). It would be interesting to run a model starting in 1969. Also would be interesting to run a model starting in 1969 but with recruitment during 1969 - 1985 randomly sampled from 1986 – 2021. This will tell you how high F must have been if recruitment was relatively stable during 1969 – 2021, and whether that is plausible. (Teo 32)

> **Unfortunately, catch at age data is not available before 1986.**

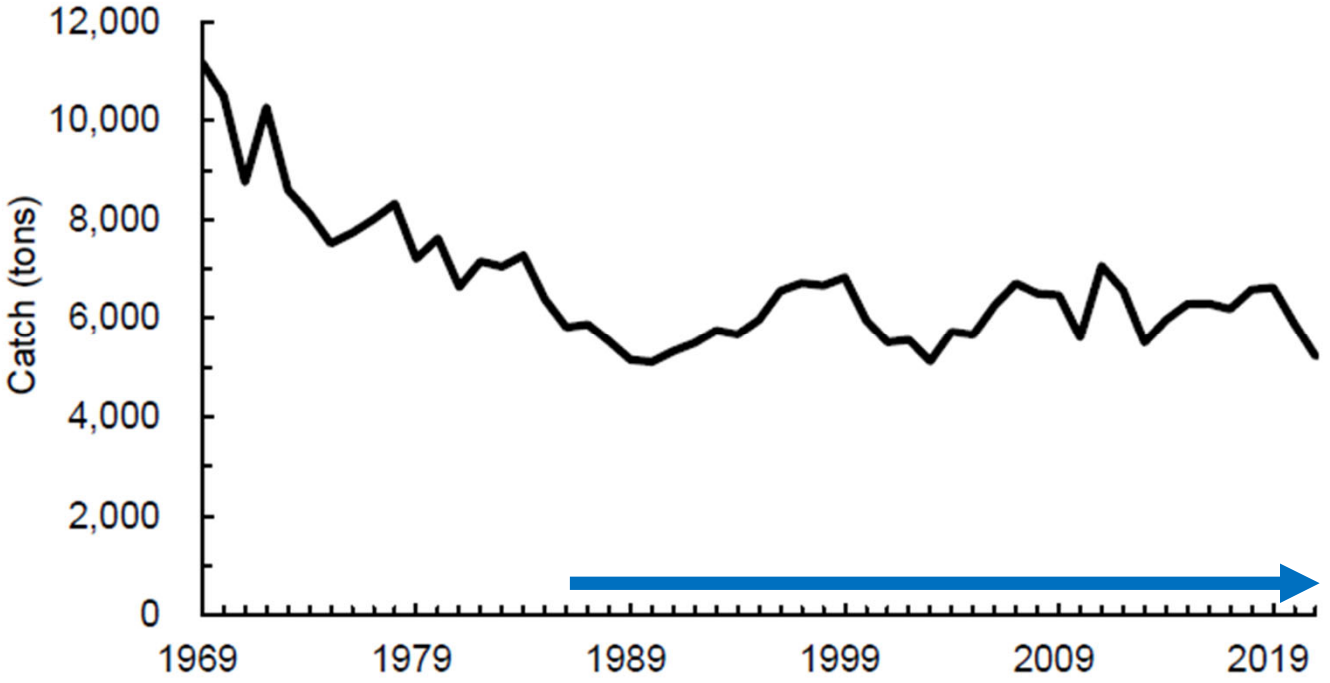
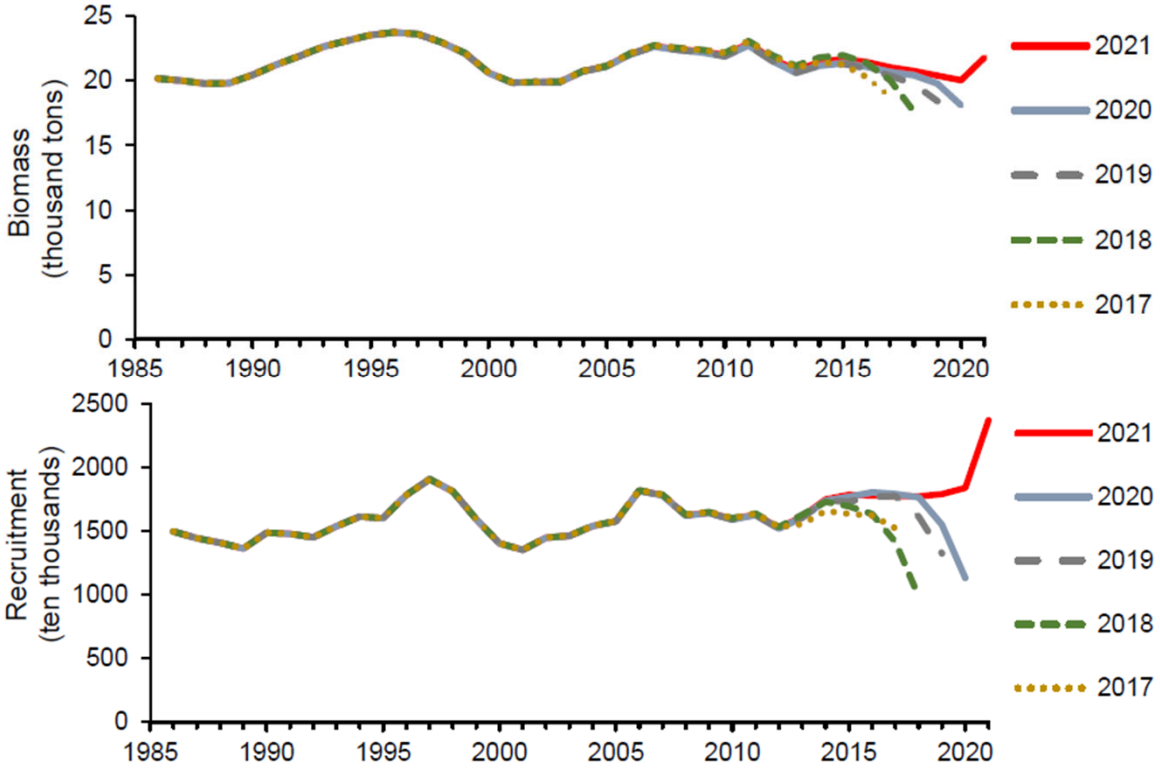


Fig. 3-2

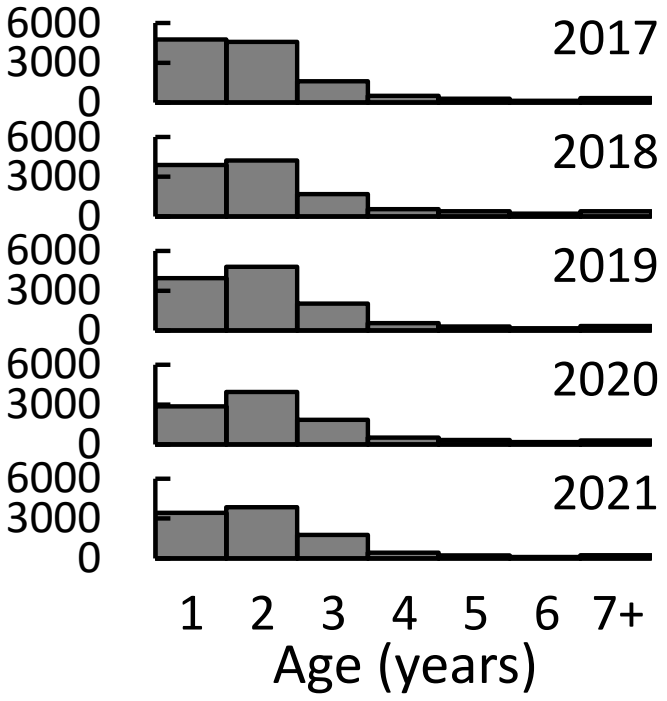
・There is a clear retrospective pattern in the recruitment and total biomass. Is there any understanding of the cause? (Teo 33)

・The retrospective pattern exhibit underestimating pattern the recruitment and total biomass. Is it possible to determine the cause? (Yamakawa 5)

> This may be due to annual shift of age composition from 2017 to 2020. Mode of catch composition shifted to older during the period, therefore presence of older fish affect backwards to younger fish (biomass and recruitment) in the previous years.



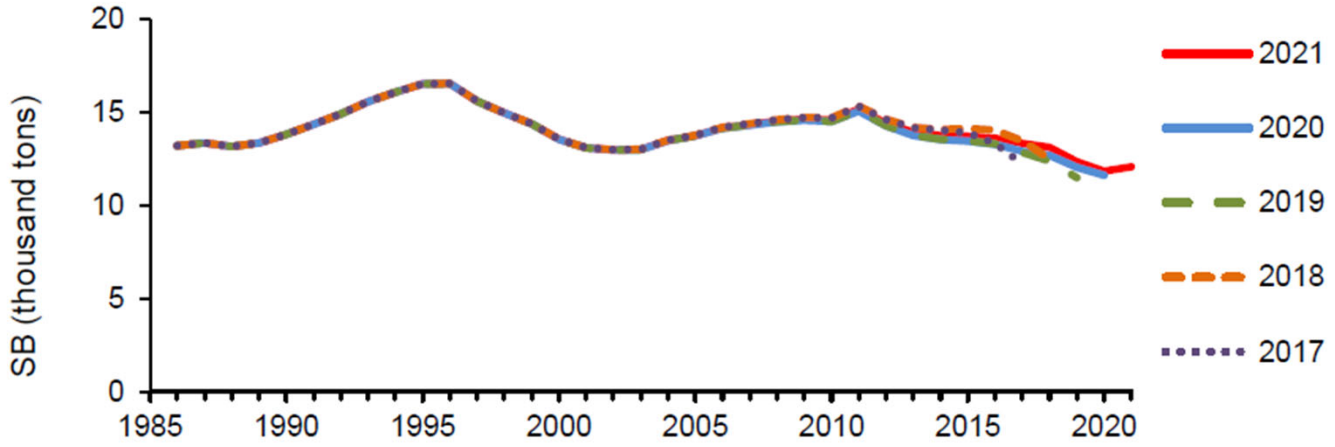
Supplementary Fig. 2-3



Original figure

・There is retrospective pattern in the recruitment but none for the SB which is an interesting occurrence. One explanation (please confirm if this makes sense) might be that there is high fishing mortality for age 2 fish, 50% of age 3 fish are mature, and the retrospective analysis goes back 5 years. So within this 5 year span, not enough fish have made it to the age at which they would contribute to the SB. I wonder if the retrospective analysis goes back more years if a pattern in SB will appear. (Supp. Fig. 2-3, Kuriyama 9a)

> Estimates of SB is more stable than younger fish due to the specification of VPA. And therefore, recruitment and biomass fluctuate more than SB.



Supplementary Fig. 2-3

・Please explain why the Hockey-stick SRR was chosen as the base case rather than the Ricker used for the Inland Sea stock. (Teo 36)

・Given the lack of contrast in estimated SSB and recruitment, it is very difficult to develop a SRR with any certainty. How was the SRR developed and how was the uncertainty in the SRR communicated? (Teo 37)

> There is no evidence that recruitment decrease as SB increase. If no clear trend was found for SRR, recruitment will be assumed as "historic mean and CI", and decreased when SB below historic level. Based on the guideline to determine a SRR in this institute, Hocky-stick SRR is considered as conservative and recommended when more suitable ones can not be assumed.

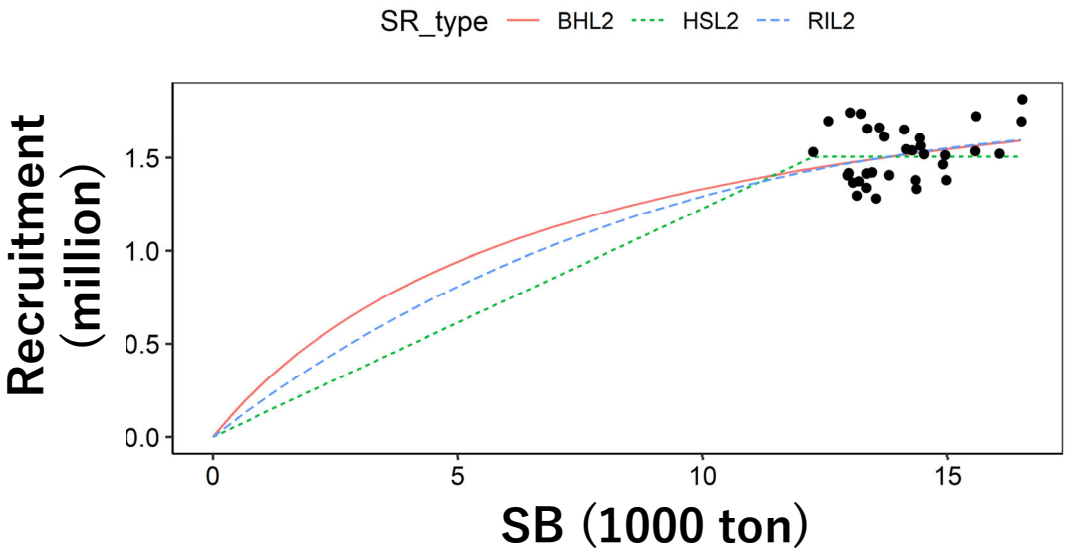


Figure from another meeting document

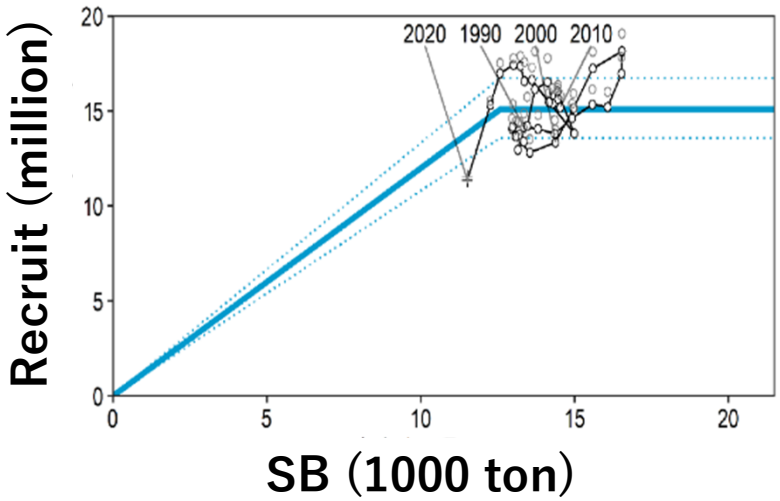


Figure 1 in "FRA-SA2021-BRP05-001" modified

・ Since the range of SSB used to estimate the S-R relationship is narrow, SBmsy and Fmsy are extrapolated, and considered to have great uncertainty. Especially considering the followings, SBmsy may be overestimated and Fmsy is underestimated. Therefore, these values need to be handled carefully and so as the explanation to the stakeholders. Shouldn't such explanation be included in the assessment report? (Yamakawa 1)

> Yes, we should explain to the stakeholders carefully.

- The stock biomass is currently stable and difficult to consider the stock is far away from the sustainable position.

> Our goal is not only for sustainable but also maximum yield.

- Hockey-Stick model (and Beverton-Holt model) tend to overestimate the recruitment at higher SSB (described in the paper below)
  Yang, Y. and T. Yamakawa (2022) Re-examination of stock–recruitment relationships: a meta-analysis. ICES J. Mar. Sci. 79: 1380–1393.

> Selection of the HS-SRR is explained before.

- Generally, density dependence effect increases the age of maturity and lowers the growth rate and survivability when the biomass increases, however, future forecast does not consider such effect.

> We have no evidence of such effect and not consider for now.

・Based on the document “Guidelines for HCRs and ABC calculations”, these calculations are supposed to be risk-based and incorporate the uncertainties in the assessment. However, the only uncertainty included in the projections appeared to be the uncertainty in future recruitment deviates. There did not appear to be any uncertainty in the reported stock assessment results. For example, the estimated SSB, recruitment, N-at-age, F-at-age, and SRR did not appear to have any uncertainties associated with them. Were these uncertainties not estimated or not reported? (Teo 38)

・How would incorporating more of the above uncertainties affect the assessment results and projections? (Teo 39)

> Currently no any other uncertainties are assumed except for SRR (Fig. 4-9). We will discuss about other uncertainties with other species/stocks.

・What was the selectivity curve used for the YPR/SPR analysis? (Kuriyama 4c)

・How were the selectivity values calculated? (Supp. Table 3-2, Kuriyama 10a)

・What is the interpretation of the selectivity values? They don't seem like they could be percentage of fish at each age removed by the fishery. (Kuriyama 10b)

> Selectivity is based on "F at age" in the Fcurrent (F2020), with F in 7+ year class as 1.00 ("FRA-SA2021-BRP05-001").

Table 2 in "FRA-SA2021-BRP05-001" modified

Age (years)	M	Maturity rate	Body weight (g)	Selectivity	Fcurrent
1	0.24	0.0	136	0.97	0.327
2	0.17	0.0	382	2.02	0.678
3	0.17	0.5	742	1.85	0.622
4	0.17	1.0	1,189	1.07	0.361
5	0.17	1.0	1,694	1.10	0.371
6	0.17	1.0	2,230	1.00	0.336
7+	0.17	1.0	3,531	1.00	0.336

Others

・What are the potential improvements for this assessment? (Teo 40)

> **Making a standard protocol to prepare proper catch at age data and developing new model. We are also searching data which can be utilized for another CPUE calculation.**

・Given the lack of contrast in the catch and CPUE of this stock during the recent period, it may be important to think about alternative ways to improve the assessment. Some potential suggestions: 1) Start the model in 1969 to get more contrast in catch and CPUE but not sure if you have the data; 2) Improve the catch-at-age data and develop age-specific CPUEs (ideally from survey); and 3) Design good mark-recapture experiments using either conventional tags or genetics. We can discuss during the meeting. (Teo 41)

> **1) No “catch at age” data before 1986 available.**
> **2) Agreed as replied above.**
> **3)**

・ Hockey-Stick SR assumes a constant recruitment at SSB above the break point, hence equals an approach that maximizes the YPR (= Fmax). However, the estimation of Fmax is typically highly uncertain since it is affected by M. Figure 4-5 shows the sensitivity analysis of M on biomass, SSB, and recruitment. How about performing further sensitivity analysis on S-R relationship, SBmsy, and Fmsy using the values on Fig 4-5? (Yamakawa 1-2)

> Agreed. We will discuss about the sensitivity run for SBmsy and Fmsy with other species/stocks.

・Based on the points, there may be high uncertainty on SBmsy and Fmsy estimates but uncertainty is not considered in the future forecast based on the HCRs. Shouldn't that be a problem? The future projection proposes the catch of 2023 is almost a half of 2022 but whether the stock increases or not after that is still highly uncertain. At the worst scenario, damages are made to fishers and industries as well as consumers by drastically decreasing the catch for 3-4 years since 2023 but the stock does not recover as expected, hence not obtaining enough merit. Such plan design fixes the loss but unsure about the benefit based upon and contradicts to the concept of "no regret policy".

・Under the concept of "no regret policy", adaptive management based on information updates via active learning may be safer and more acceptable by the stakeholders. The process is done via trying to increase the stock biomass by lowering the fishing pressure a little (at possible level) and reevaluating the S-R relationship using the updated SSB, which is above the current level. Then further management is performed based on the renewed S-R relationship and aim for the better level. What do you think of such tactics?

(Yamakawa 2)

> Agreed, but this issue is not for current meeting.

・At least, the level of recruitment and biomass seem to be stable under the current level of SSB. So, the necessity may be considered as low to decrease the catch both urgently and drastically.

・ Under the YPR management based on the Hockey-Stick SRR, the estimated result suggests F needs to be lowered greatly due to the growth overfishing. However, the tactics to solve growth overfishing can be achieved by increasing the age of recruitment to the fishery (tc) with substantial effect. Here, I would suggest to add an explanation with a Beverton-Holt YPR isopleth graph to visualize effect of difference in the age of recruitment to fishery to YPR in the section 6 “Others”. (Yamakawa 3)

> We will discuss this suggestion with other species/stocks.

・In this peer-reviewing session, the reports of scientific meeting to determine the BRPs are not included, and those reports are not provided to the reviewers. For the proper examination for future, shall those documents to be reviewed as well? (Yamakawa 7)

> **This issue may be considered.**