NPFC
North Pacific Fisheries Commission

Species Summary for Blue Mackerel

Blue mackerel (*Scomber australasicus*)

澳洲鮐 [ao-zhou-tai] (Chinese), ゴマサバ [gomasaba] (Japanese), 망치고등어 [Mang-chi-go-deung-eo] (Korean), пятнистая скумбрия [pyatnistaya skumbriya] (Russian), 花腹鯖 [Hua-Fu-Ching] (Chinese Taipei)

Other common names: Spotted mackerel

Management

Active NPFC Management Measures

None

Management Summary

- ✓ Conservation and Management Measure has not been set for blue mackerel in the NPFC.
- ✓ In Japan, total allowable catch (TAC) has been introduced to management of mackerels (blue mackerel and chub mackerel) since 1997.

Convention/Management Principle	Status	Comment/Consideration
Biological reference point(s)	● (red)	Not established.
Stock status	○	Status determination criteria not established.
Catch limit	● (yellow)	Recommended catch, effort limits.
Harvest control rule	● (red)	Not established.
Other	● (yellow)	No expansion of fishing beyond established areas.

● (green) OK ● (yellow) Intermediate ● (red) Not accomplished ○ Unknown

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Stock Assessment

No stock assessment has been conducted by NPFC.

Japan conducts stock assessments on the Pacific stock and the East China Sea stock of blue mackerel (BM) using tuned virtual population analysis (VPA) and MSY-based reference points (Yukami et al. 2019a, Hayashi et al. 2019). Only the Pacific stock is distributed in the NPFC convention area. The latest stock assessment in Japan included overseas catch from China under a few assumptions on the compositions of mackerel species and ages (Fig. 1a). The Russian catch was excluded from the stock assessment, as there was no blue mackerel catch reported by Russia. Estimated recruitment, biomass, and spawning stock biomass (SSB) drastically decreased since the 2010s (Fig. 1b). A Ricker-type stock-recruitment curve was applied. In the most recent fishing year (2023), spawning stock biomass (SSB) was estimated lower than SSBmsy and F was lower than Fmsy (Fig. 1d).

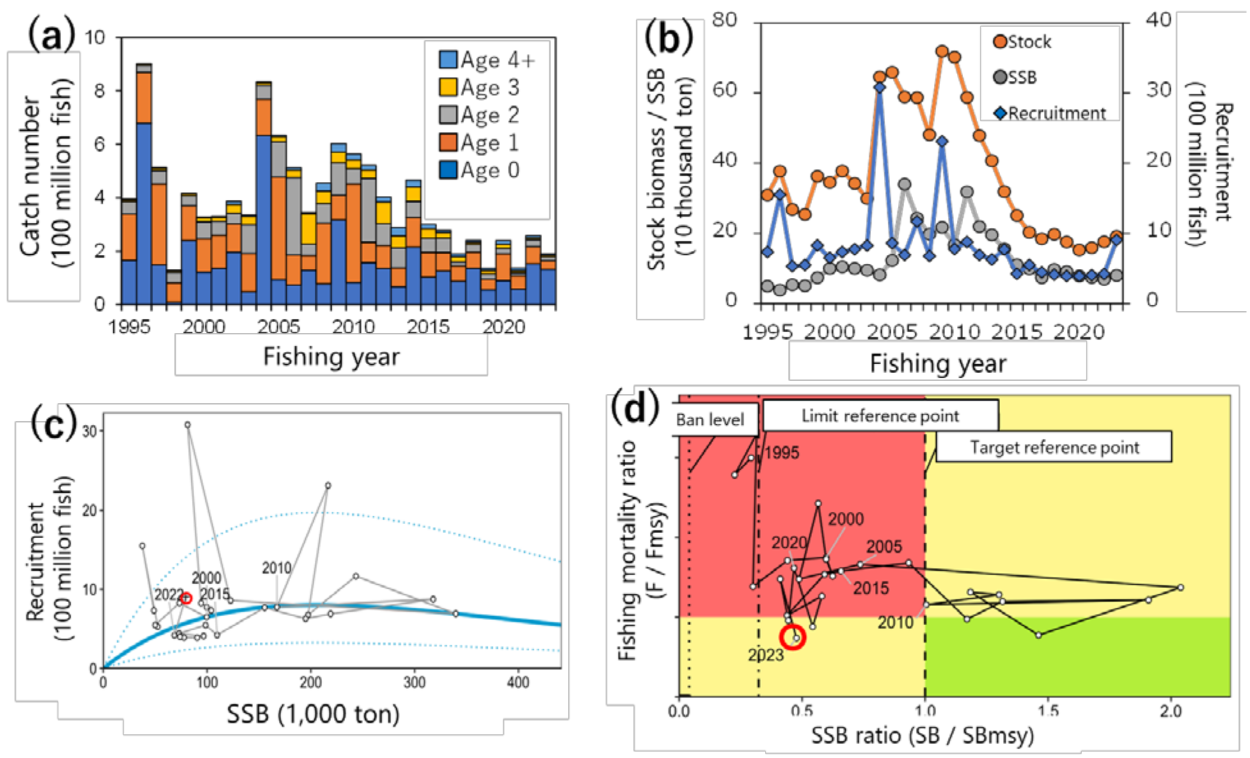


Figure 1: Summary of the stock assessment for the Pacific stock of BM in Japan (Kamimura et al. 2025). (a) Time series of catch number by age. (b) Estimated biomass, SSB, and recruitment. (c) Stock-recruitment relationship. The cross with a red circle indicates the value in 2023 fishing year. (d) Kobe plot.

Data

Survey

Japan conducts three surveys: (1) egg distribution survey (every month), (2) juvenile survey (May-Jul from 2001), and (3) pre-recruit fish survey (Sep-Oct from 2001). The egg survey has been used as an abundance index for SSB in the Japan's domestic stock assessment (Figs. 2, 3). Other members do not conduct any survey on blue mackerel.

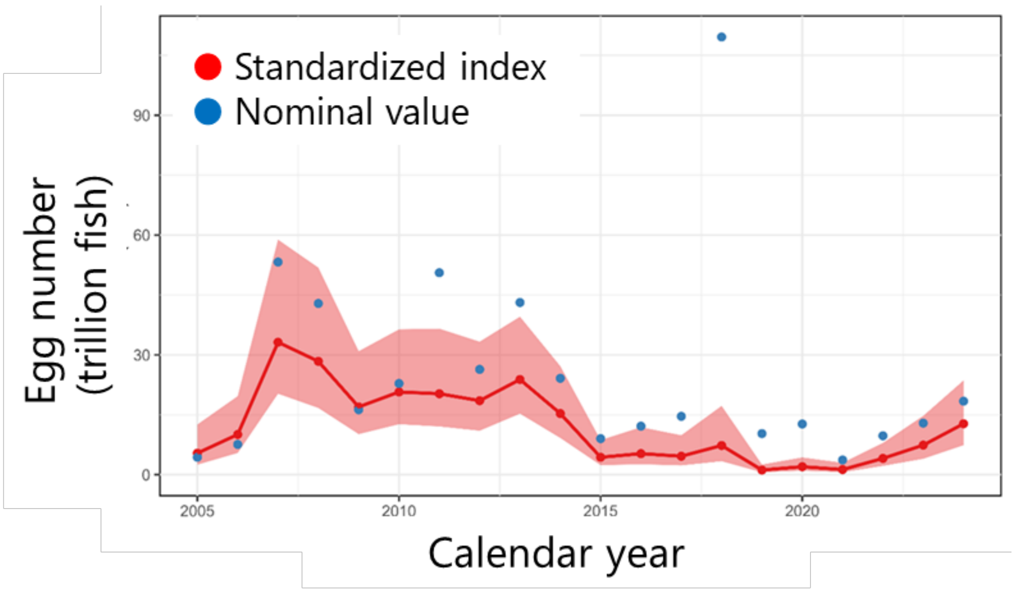


Figure 2: Time series of egg abundance indices. Nominal value and standardized index are shown. This standardization incorporates the effect of species misidentification of chub mackerel as blue mackerel, which is a reason why standardized values are lower than nominal values in most years typically 2018. See Kanamori et al. (2021) for details.

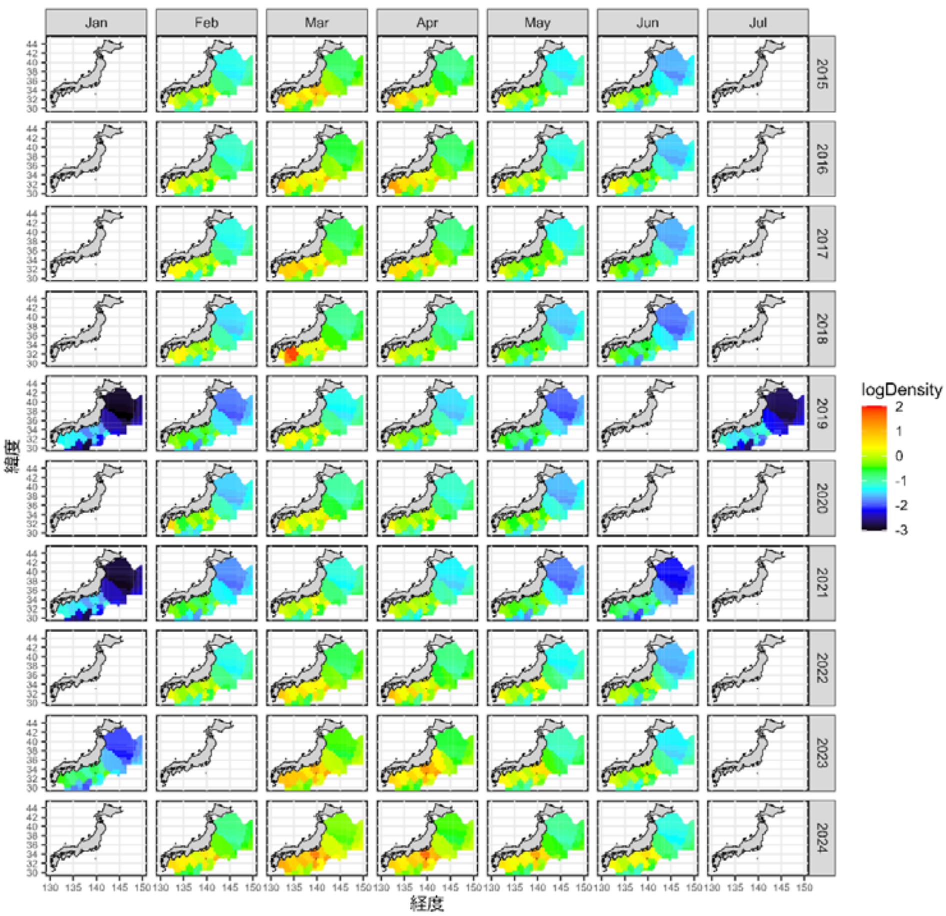


Figure 3: Spatial distributions of blue mackerel eggs on the Pacific coast of Japan by month (column) by year (row), estimated from the seasonal VAST model (Thorson et al. 2020) with the egg survey data.

Fishery

In Japan, the fishing grounds are located in the water on continental shelves and slopes, around water of Islands within Japan's EEZ. The primary fishing gears of Japan are purse-seine (large-scale >40GRT and small-scale <40GRT vessels), set net and dip net. Chub and blue mackerels are caught together by the fisheries and summed together as "mackerels" in fishery statistics of Japan. The blue mackerel catch was estimated from the mixing ratio survey of landing. Japan conducts the identification of each species by external form; blue mackerel has clear black spots on both sides of body, and the interval between splines of first dorsal fin of blue mackerel is narrower than that of chub mackerel. The proportion of blue mackerel catch in the total mackerel catch was around 10% from 2016 to 2021, although the proportion of blue mackerel was 24.5% in 2024.

China operates a blue mackerel fishery in the NPFC Convention Area only, on the same fishing grounds as for chub mackerel. China takes samples to determine the composition of mackerel species in the catch and collects biological information.

In Russia, there are no accurate catch statistics on the proportion of blue and chub mackerels. However, the portion of blue mackerel is very small and probably comprises less than 1% of the total mackerel catch by Russia.

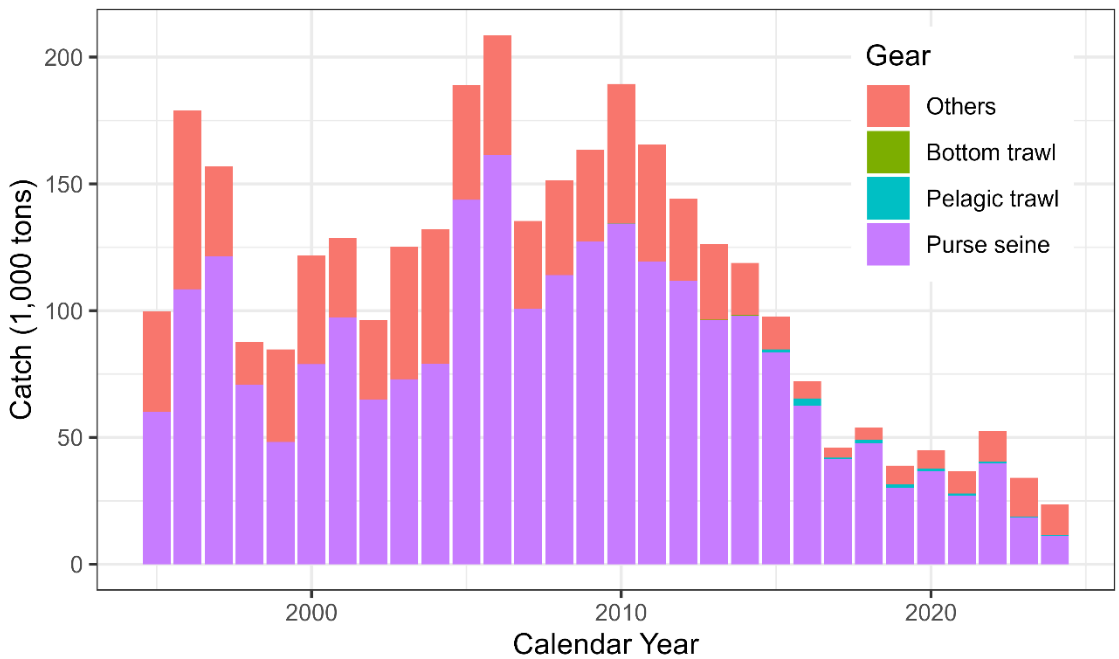


Figure 4: Time series of blue mackerel catch weight in the North Pacific from 1995 to 2024. Colors indicate different fisheries. Catches by China and Japan are included, whereas Russian catch is excluded due to its negligible amount. The catch of blue mackerel was estimated by multiplying the proportion of blue mackerel in the total mackerel catch for each fishing gear and year, owing to data limitations.

Data table

Data availability tables which include information about catch, abundance indices and biological data from China and Japan are respectively shown below (Tables 1, 2). For Russia, no relevant data are available due to its negligible amount of blue mackerel catch.

Table 1: Data availability table from China.

Category and data sources	**Description**	**Years with available data**	**Average sample size/ year or data coverage**	**Potential issues to be reviewed**
CHINA				
Catch statistics				
Purse seine fishery Trawl fishery	Official statistics, reports from annual report	Official statistics: 2015-2024	Coverage=100 %	The blue mackerel and Japanese sardine catches are from the fishing catch provided by the fishery company
Size composition data				
Length measurements	Port sampling by Institute and technology group.	2018-2024	550-800 fish/year	Details to be reviewed
Aging	Sampling during research surveys and from commercial fishing vessels	2020-2024	30-180 fish/year	Details to be reviewed
Catch at age (CAA)	Estimate CAA from the above data	2020-2024	Age-length keys are to be developed	Evaluate uncertainty of catch at age, especially on changes of growth depending on recruitment abundance
Abundance indices (survey)				

Abundance indices (commercial)				
Purse seine fishery	Purse seine logbook	2015-2024	10-60/year	Should separate blue mackerel and chub mackerel Will conduct standardization

Table 2: Data availability table from Japan.

Category and data sources	**Description**	**Years with available data**	**Average sample size/ year or data coverage**	**Potential issues to be reviewed**
JAPAN				
Catch statistics				
Purse seine fishery	Official statistics; reports from fisheries associations and markets	Official statistics: 1950-2024, other reports: 1982-2024	Coverage=100 %	The blue mackerel catches are estimated from chub and blue mackerel catches based on port sampling data
Dip net fishery				
Set net				
Size composition data				
Length measurements	Port sampling by 17 local fishery institutes in 17 prefectures	1995-2024	4,000-40,000 (average 10,000) fish/year (ca. 100 measurements per sampling)	Data coverage review
Aging	Port sampling by 17 local fishery institutes in 17 prefectures	1995-2024	500-1000 fish/year	Data coverage review

Catch at age (CAA)	CAA is estimated with length measurement and aging data	1995-2024	Age-length keys are created approximately by quarter and local regions	Evaluation of uncertainty in catch at age, especially on changes in growth depending on recruitment abundance
Abundance indices (survey)				
Year-round for egg density	Almost all local fisheries research bodies join this survey program. NORPAC net is sampling gear. This survey is conducted for small pelagic species.	2005-2024	ca. 6000 stations in total, 1000-4000 stations with blue mackerel eggs/year	Review survey protocol and conduct standardization
Abundance indices (commercial)				
Stick-held dip net fishery	Logbook data are collected from fishermen in Shizuoka prefecture since 1995	1995-2024	100-500/year	Standardization

Special Comments

Although the Small Working Group (SWG) previously used ‘spotted mackerel’ as the common name of this species, the SWG recommended to SC to change the common name to ‘blue mackerel’ for consistency with the FAO database of fish species.

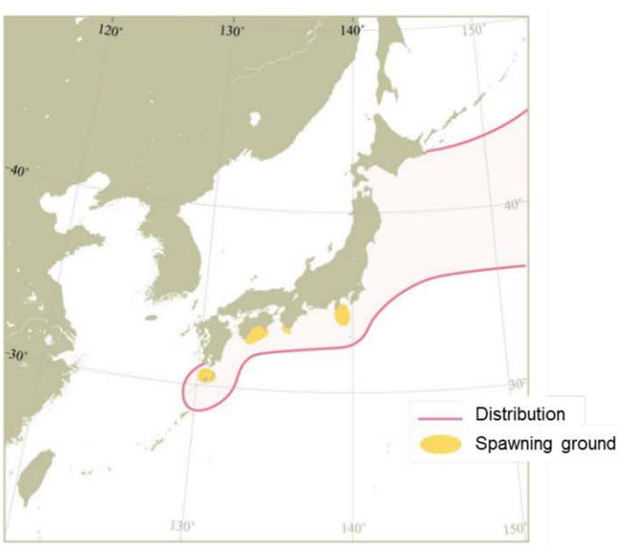
Biological Information

The below descriptions are mostly extracted from Yukami et al. (2019b).

Distribution and migration

Blue mackerel is distributed from Japan to Australia and New Zealand in the Indo-West Pacific (Frose and Pauly 2022). Blue mackerel around Japan is divided into two stocks by spatial distributions in Japanese stock assessments: Pacific stock and East China Sea stock (Hayashi et al. 2019, Yukami et al. 2019; Fig. 5). Below we describe biological information based on the Pacific stock of blue mackerel.

Blue mackerel tends to distribute in warm offshore waters. The main distribution area for adults is around water of the Kuroshio current. The larvae hatch around the Kuroshio current and are distributed from the coastal water of southern Honsyu to the transition water between Kuroshio and Oyashio currents located 165 to 170 East longitude, the same as the chub mackerel larvae. The juveniles sized at 5 to 15cm fork length (FL) transferred to transition water, migrate to north as they grow, feed at the area from coastal water of eastern Hokkaido and Kurill Islands to the subarctic water around 165 degree East longitude where the surface temperature around 13°C in summer to fall. They reach 20 to 25cm FL in fall to winter, and migrate south to the coastal waters of Joban and Boso to offshore water around Kuroshio current for wintering. A wintering ground in the water near Emperor Seamounts was observed for 2004 year class which had high recruitment. Age 1 fish did not appear in the water north of Sanriku district after wintering until 1980, but they have migrated to the water from Tohoku to Hokkaido with the increase of surface temperature since 2001. They return south for wintering and migrate to the Izu Islands water for spawning in spring. Many schools distribute near Kuroshio current at the coastal water of southern Honshu all the year and are targeted by many fisheries. These are different from the schools that largely migrate from near the Kuroshio current at the Izu Island to Tohoku and Hokkaido waters. It is suggested that many fish above age 3 do not migrate north of Sanriku district and stay at the western water near the cape Ashizuri with small migrations or stay near the spawning grounds. Furthermore, it is considered that the observation of schools mainly consisting of age 8 fish at the Emperor seamounts area in 2008 to 2015 were due to the dominant recruitment spawned at the water south of Hachijo Island.



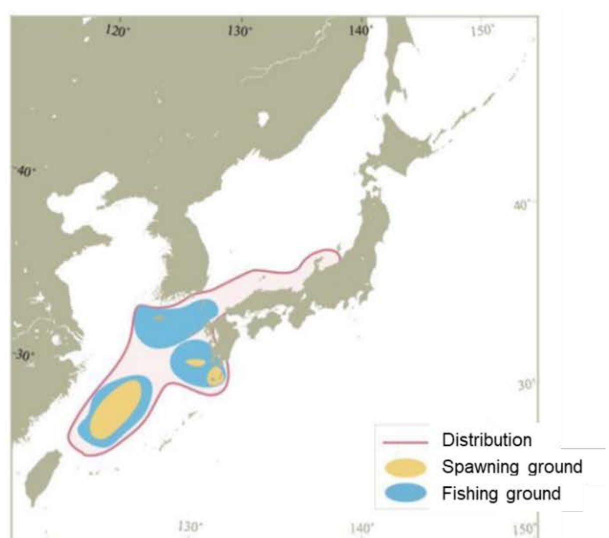


Figure 5: Distribution and spawning ground of the Pacific stock (left) and the East China Sea stock (right) of blue mackerel.

Age and growth

The larvae grow 1mm per day until 5cm FL after hatching observed by otolith reading, then it grows 15cm after 80days, and over 20cm of 120 days after hatching. The scale annuli reading is practical for the fish after subadult stage, it is used for the survey. Otolith annuli and daily ring readings are also effective for age determination. It is suggested that fish becoming 20-25cm FL at age 0 in fall, 28-31cm at age 1 in summer, 30-34cm at age 2, 33-36cm at age 3, around 37cm at age 4, and 45cm at the maximum. The longevity was estimated around age 6 from size composition of catch, but the oldest age 11 was reported. The growth at younger ages is different by area, and in the western area of offshore Kumano there is a tendency for faster growth than fish occur in the water north of Izu Islands. The average length (FL), weight (the averages in caught fish in 2017 to 2021) by age are shown in Fig. 6.

The length-weight (LW) relationships in Japan and China are shown in Fig. 7 (see also Furuichi et al. 2021). Although the estimated parameters from Chinese samples in 2021 and 2022 were different from the others probably due to the small sample sizes and narrow sampling ranges of length (Table 3), their forms are almost identical. This suggests that the degrees of obesity for BM were little different between Chinese and Japanese fishing grounds.

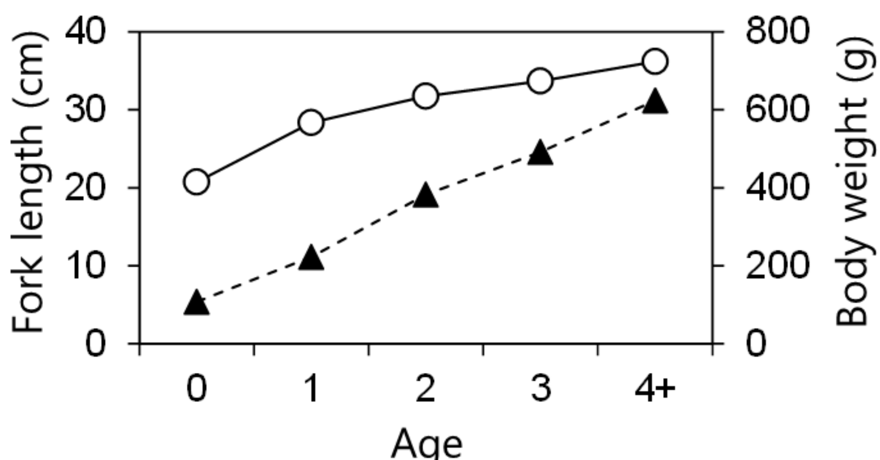


Figure 6: Relationship between age and fork length and relationship between age and body weight of BM (the averages of caught fish for the latest five years 2019-2023).

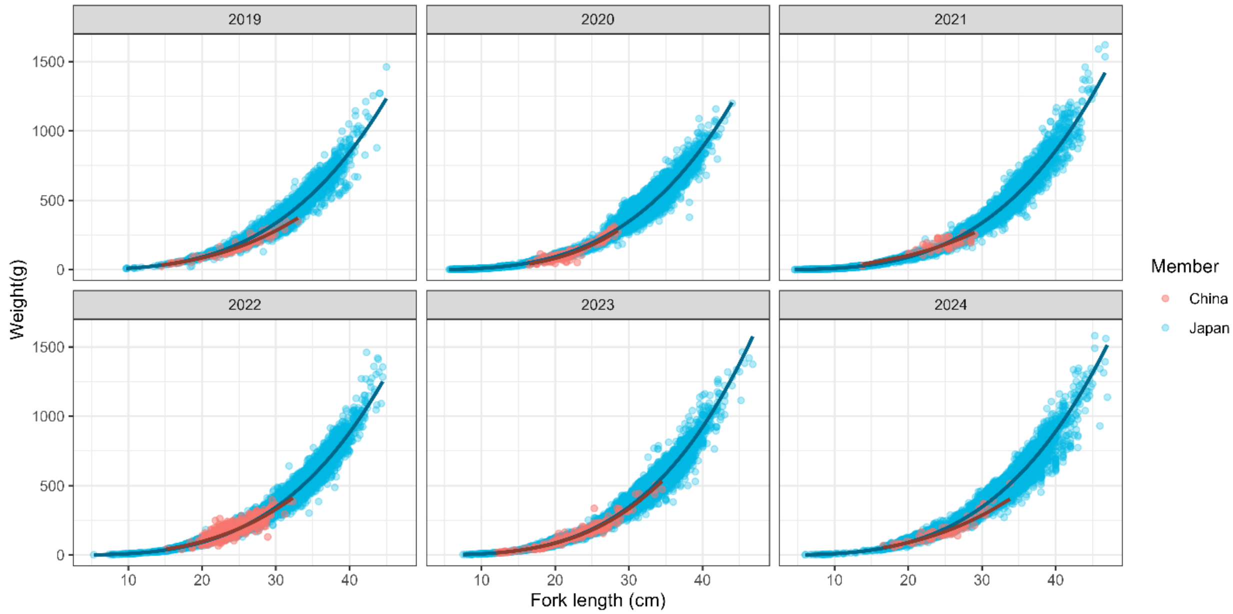


Figure 7: Relationships between fork length and weight from 2019 to 2024 of BM in Japan.

Table 3: Parameters of the relationship between fork length (cm) and weight (g) by Member from 2019 to 2024. The parameters are estimated by the least square method from the equation $W = aL^b$. N represents sample size.

Year	Member	a	b	N
2019	China	0.0125	2.95	102
2019	Japan	0.0061	3.21	5564
2020	China	0.0024	3.49	218
2020	Japan	0.0056	3.24	9125
2021	China	0.0398	2.62	56
2021	Japan	0.0053	3.25	6991
2022	China	0.0117	3.01	632
2022	Japan	0.0051	3.27	11108
2023	China	0.0035	3.37	244
2023	Japan	0.0032	3.41	11489
2024	China	0.0163	2.87	90
2024	Japan	0.0048	3.29	7761

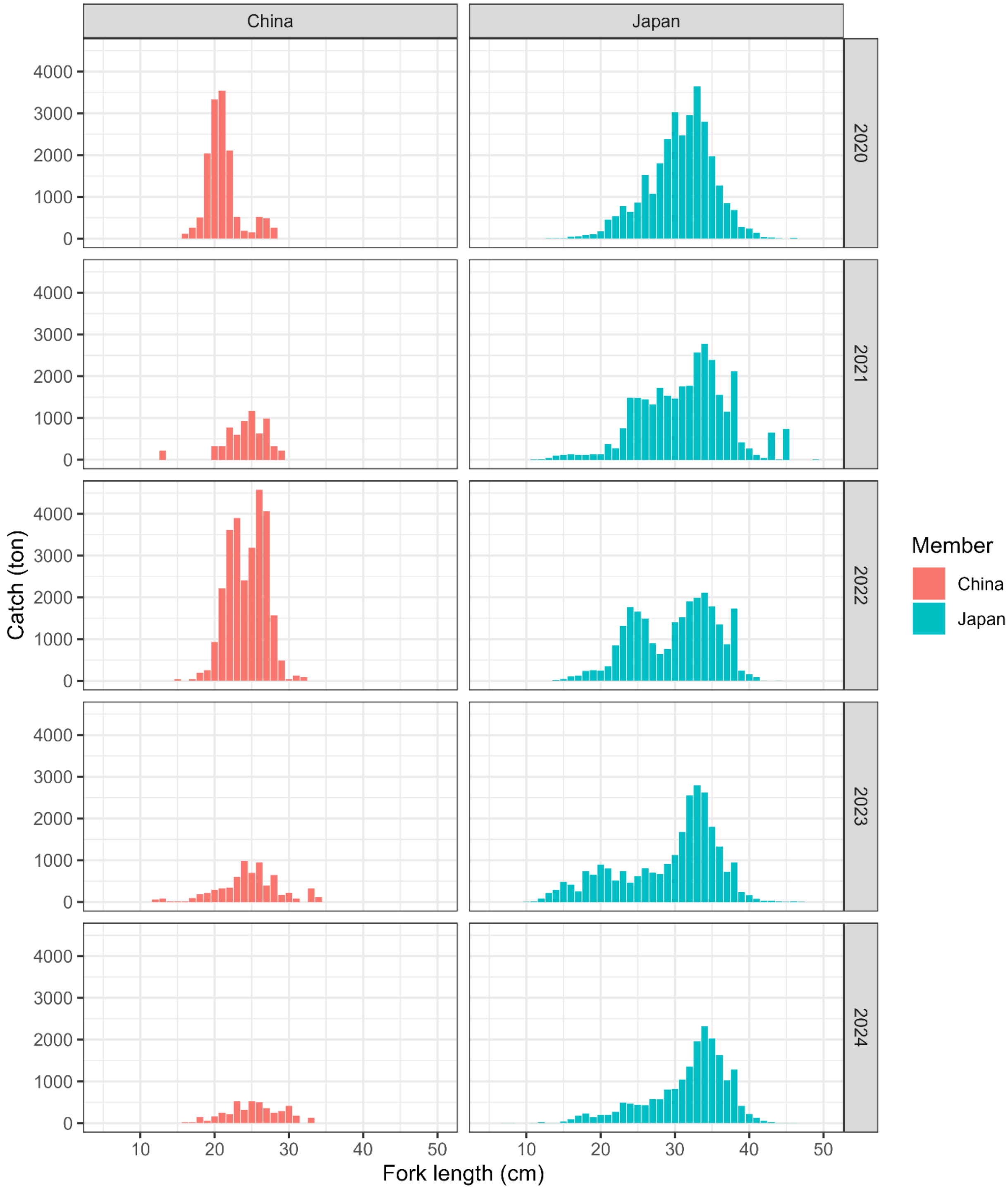


Figure 8: Frequency distribution of catch weight (tons) by fork length in Chinese (left) and Japanese (right) fisheries for blue mackerel.

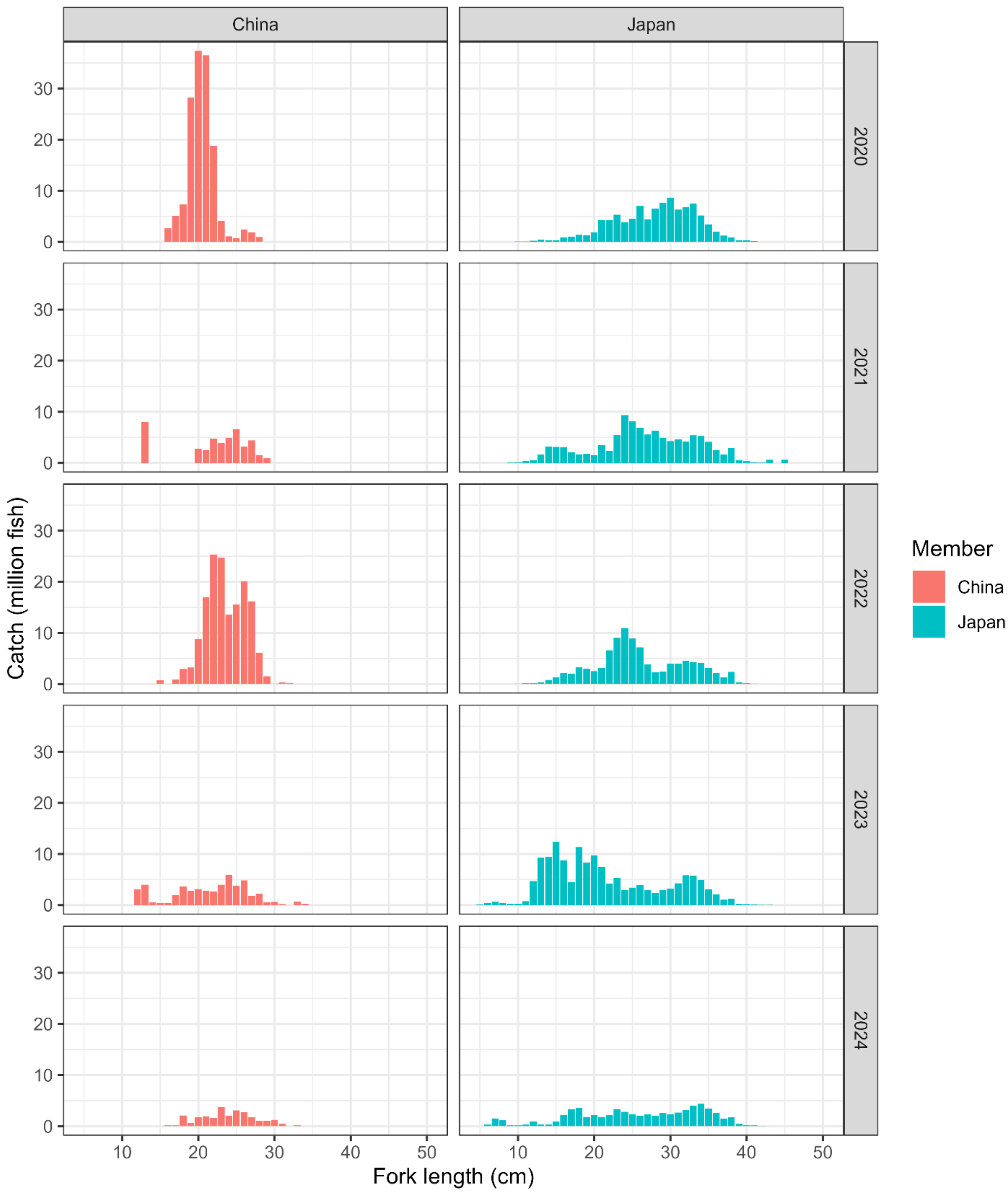


Figure 9: Frequency distribution of catch number (million fish) by fork length in Chinese (left) and Japanese (right) fisheries for blue mackerel.

Reproduction

The blue mackerel mature and spawn above 30cm FL from the observation of ovary tissue. The mature age was considered age 2 and above and it is assumed that all the fish age 2 and above are mature and spawn (Figs. 6. 8). The spawning grounds are found from the waters southern Kyusyu and cape Ashizuri to the Kuroshio current water near Izu Islands (Fig5). The recruitments hatched at the larger spawning ground in the East China sea supposed to migrate into the Pacific water. A spawning season are from December to June next year at the western waters of cape Ashizuri, January to March in the East China sea, and February to March near the water of cape Ashizuri. The spawning season of main spawning ground of blue mackerel near Izu Island are March to June, but it considered that it is not suitable as spawning grounds by the short spawning season from the ovary tissue observation and small amount of spawning eggs sampled. However, it is supposed that larvae and juvenile occurring in the north of transition area consist of the fish hatched at the Izu Island spawning grounds in March to June, same as chub mackerel.

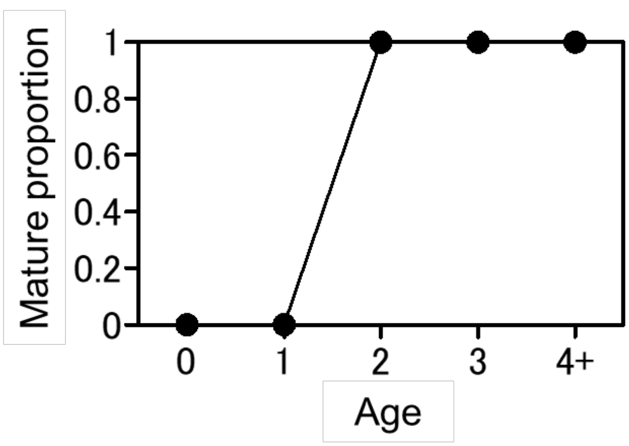


Figure 8: Mature proportion by age.

Predator-prey relationship

Larvae feed on planktonic crustaceans and larvae of anchovy or sardines. Juveniles feed on small teleost and cephalopods with preys mentioned above. It preys on fishes including anchovy, benttooth and lantern fishes, crustaceans like krill and cephalopods at the Kumano Nada fishing ground, horned krill and anchovy at Sanriku fishing ground and copepod, krill, anchovy, lantern fishes, cephalopod like Enoploteuthidae and salpa in the transition area between Kuroshio and Oyashio where located offshore of Joban and Sanriku. Predation on blue mackerel by whales is observed during periods of high abundance.

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