



North Pacific Fisheries Commission

Stock assessment report for Pacific saury – 2025

EXECUTIVE SUMMARY

Data used in the assessment modeling

Data are included from the NPFC Convention Area and Members' Exclusive Economic Zones (EEZs). Pacific saury (*Cololabis saira*) is widely distributed from the subarctic to the subtropical regions of the North Pacific Ocean. The fishing grounds are west of 180° E but differ among Members (China, Japan, Korea, Russia, Chinese Taipei, and Vanuatu). Figure 1 shows the historical catches of Pacific saury by Member. Figure 2 shows CPUE and Japanese survey biomass indices used in the stock assessment. Appendix 1 shows data used for the updated stock assessment.

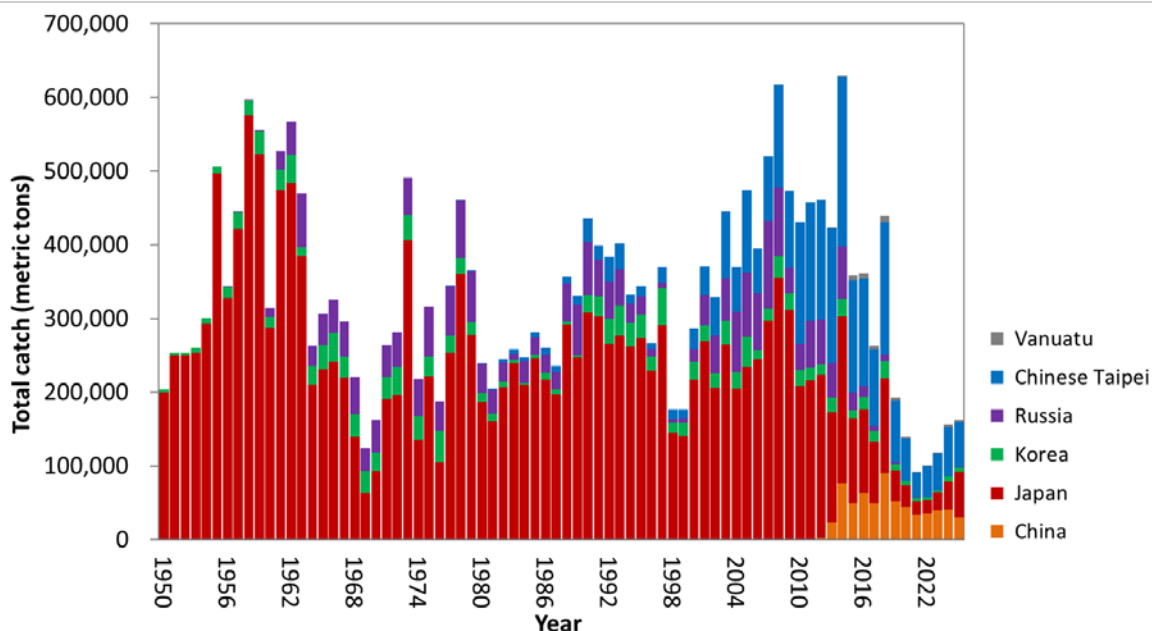


Figure 1. Time series of catch by Member during 1950-2025. The catch data for 1950-1979 are shown but not used in stock assessment modeling. Catch data in 2025 are preliminary (as of 28 November 2025) and not used in the assessment.

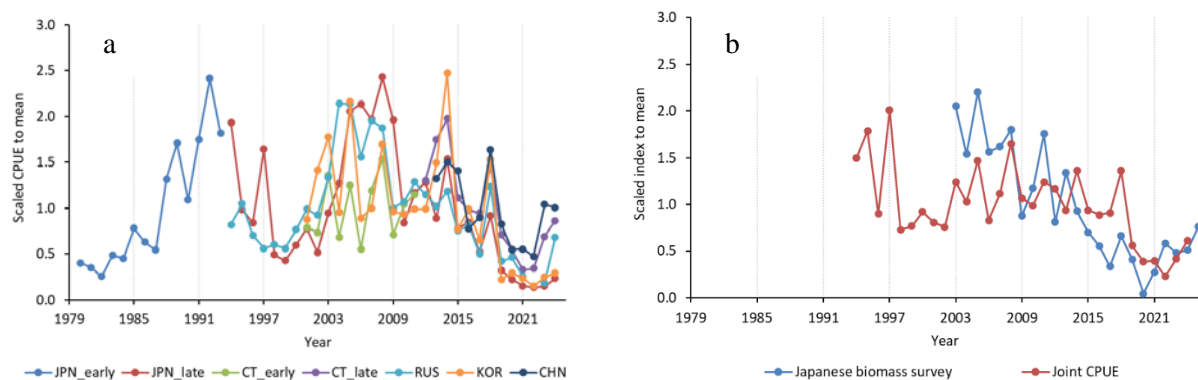


Figure 2. Time series of (a) Japanese survey biomass index and joint CPUE and (b) Member's standardized CPUE indices used in the assessment modeling.

Brief description of specification of analysis and models

A Bayesian state-space production model (BSSPM) used in previous stock assessments was employed as an agreed provisional stock assessment model for Pacific saury during 1980-2025. Scientists from two Members (Japan and Chinese Taipei) each conducted analyses following the agreed specification which called for two base case scenarios and two sensitivity scenarios (see Annex F, SSC PS15 report for more details). The two base case scenarios differ in using each Member's standardized CPUEs (base case B1) or standardized joint CPUEs (base case B2). The CPUE data were modeled as nonlinear indices of biomass. Members used similar approaches with some differences in the assumption of prior distributions for the free parameters in the model.

Summary of stock assessment results

The SSC PS considered the BSSPM results and noted the agreement in trends among Members' results for each base case model. However, there was a marked difference in the biomass level between B1 and B2 due to the different CPUE trends used. The SSC PS discussed and recognized that the results covered a wide range of uncertainties in data, model and estimation, and it therefore concluded the outcomes of MCMC runs could be aggregated over the 4 models (2 base case models x 2 Members) as in the previous assessments. The aggregated results from Japan and Chinese Taipei for assessing the overall median values and their associated 80% credible intervals are shown in Table 1a (the aggregated results for 2024 are shown in Table 1b). The graphical presentations for times series of a) biomass (B), b) B-ratio ($=B/B_{MSY}$), c) harvest rate (F), d) F-ratio (F/F_{MSY}) and e) B/K are shown in Figure 3. The Kobe plot with time trajectory using aggregated model outcomes is shown in Figure 4. Time series of median estimated values for biomass, harvest rate, B-ratio, F-ratio and depletion level relative to K are shown in Table 2.

Table 1. Summary of estimates of reference quantities. Medians and credible intervals for the aggregated results are presented. In addition, median values of Member's combined results (over B1 and B2) are shown.

a. 2025 assessment

	Median	Lower10%	Upper10%	Median_JPN	Median_CT
C_2024 (10000 t)	15.556	15.556	15.556	15.556	15.556
AveC_2022_2024	12.463	12.463	12.463	12.463	12.463
AveF_2022_2024	0.258	0.137	0.414	0.276	0.246
F_2024	0.272	0.150	0.431	0.292	0.258
FMSY	0.269	0.130	0.444	0.271	0.268
MSY (10000 t)	38.165	30.860	45.319	38.064	38.250
F_2024/FMSY	1.027	0.719	1.526	1.085	0.972
AveF_2022_2024/FMSY	0.971	0.712	1.371	1.015	0.927
K (10000 t)	294.397	178.813	593.103	304.173	287.900
B_2024 (10000 t)	57.200	36.107	103.568	53.309	60.330
B_2025 (10000 t)	69.460	45.090	119.897	66.099	72.620
AveB_2023_2025	58.238	37.756	103.933	54.625	61.302
BMSY (10000 t)	142.100	91.670	266.603	141.938	142.200
BMSY/K	0.486	0.385	0.617	0.470	0.503
B_2024/K	0.197	0.127	0.282	0.182	0.211
B_2025/K	0.238	0.143	0.364	0.221	0.254
AveB_2023_2025/K	0.202	0.128	0.288	0.188	0.215
B_2024/BMSY	0.403	0.280	0.562	0.383	0.423
B_2025/BMSY	0.488	0.314	0.725	0.466	0.510
AveB_2023_2025/BMSY	0.411	0.285	0.573	0.394	0.429

b. 2024 assessment

	Median	Lower10%	Upper10%	Median_CHN	Median_JPN	Median_CT
C_2023 (10000 t)	11.836	11.836	11.836	11.836	11.836	11.836
AveC_2021_2023	10.352	10.352	10.352	10.352	10.352	10.352
AveF_2021_2023	0.328	0.158	0.528	0.352	0.339	0.302
F_2023	0.297	0.155	0.469	0.313	0.307	0.277
FMSY	0.330	0.139	0.543	0.357	0.336	0.310
MSY (10000 t)	39.440	32.021	47.010	40.155	39.284	39.010
F_2023/FMSY	0.920	0.656	1.411	0.915	0.942	0.903
AveF_2021_2023/FMSY	1.008	0.755	1.435	1.013	1.026	0.988
K (10000 t)	248.067	151.766	565.726	234.100	253.396	254.500
B_2023 (10000 t)	39.875	25.214	76.394	37.830	38.599	42.720
B_2024 (10000 t)	52.763	35.130	91.631	50.920	52.120	55.155
AveB_2022_2024	41.563	27.387	77.406	39.705	40.555	44.165
BMSY (10000 t)	120.100	78.060	253.481	113.800	119.008	125.100
BMSY/K	0.485	0.392	0.604	0.480	0.471	0.505
B_2023/K	0.161	0.101	0.228	0.158	0.154	0.169
B_2024/K	0.212	0.122	0.315	0.212	0.206	0.219
AveB_2022_2024/K	0.169	0.106	0.236	0.168	0.163	0.175
B_2023/BMSY	0.328	0.225	0.452	0.323	0.322	0.339
B_2024/BMSY	0.435	0.270	0.628	0.433	0.431	0.440
AveB_2022_2024/BMSY	0.345	0.235	0.470	0.341	0.341	0.352

Table 2. Time series of median estimated values for biomass, harvest rate, B-ratio, F-ratio and depletion level relative to K. The unit of biomass is 10,000 tons.

Year	Biomass	HarvestRate	Bratio	Fratio	Depletion
1981	167.600	0.122	1.214	0.453	0.593
1982	178.358	0.137	1.310	0.504	0.641
1983	183.284	0.141	1.348	0.513	0.662
1984	186.400	0.133	1.371	0.483	0.675
1985	191.142	0.147	1.399	0.541	0.689
1986	191.001	0.136	1.395	0.500	0.687
1987	193.900	0.121	1.410	0.447	0.695
1988	198.900	0.180	1.439	0.663	0.708
1989	189.862	0.174	1.365	0.647	0.674
1990	186.600	0.234	1.342	0.872	0.660
1991	173.013	0.231	1.236	0.866	0.608
1992	165.400	0.232	1.188	0.875	0.581
1993	159.471	0.252	1.147	0.955	0.559
1994	152.100	0.219	1.091	0.836	0.529
1995	149.829	0.229	1.064	0.893	0.513
1996	142.400	0.187	1.007	0.736	0.485
1997	146.840	0.252	1.016	1.016	0.488
1998	134.022	0.132	0.928	0.530	0.446
1999	144.800	0.122	0.990	0.496	0.477
2000	158.548	0.180	1.091	0.729	0.526
2001	162.200	0.229	1.134	0.897	0.550
2002	163.300	0.201	1.156	0.772	0.563
2003	179.470	0.248	1.276	0.937	0.624
2004	173.522	0.213	1.234	0.799	0.606
2005	187.152	0.253	1.315	0.955	0.648
2006	171.900	0.229	1.209	0.864	0.596
2007	175.900	0.296	1.240	1.112	0.611
2008	166.127	0.372	1.166	1.398	0.576
2009	132.997	0.355	0.939	1.335	0.462
2010	129.900	0.331	0.912	1.249	0.449
2011	130.989	0.348	0.919	1.314	0.454
2012	118.321	0.389	0.834	1.463	0.411
2013	114.364	0.371	0.804	1.390	0.397
2014	107.500	0.586	0.765	2.163	0.377
2015	76.938	0.466	0.545	1.736	0.269
2016	68.550	0.528	0.487	1.959	0.240
2017	58.251	0.451	0.415	1.672	0.205
2018	58.691	0.743	0.422	2.701	0.208
2019	37.030	0.527	0.264	1.946	0.131
2020	31.915	0.438	0.227	1.629	0.112
2021	32.395	0.284	0.230	1.068	0.113
2022	39.852	0.251	0.282	0.944	0.139
2023	47.687	0.248	0.335	0.937	0.165
2024	57.200	0.272	0.403	1.027	0.197
2025	69.460		0.488		0.238

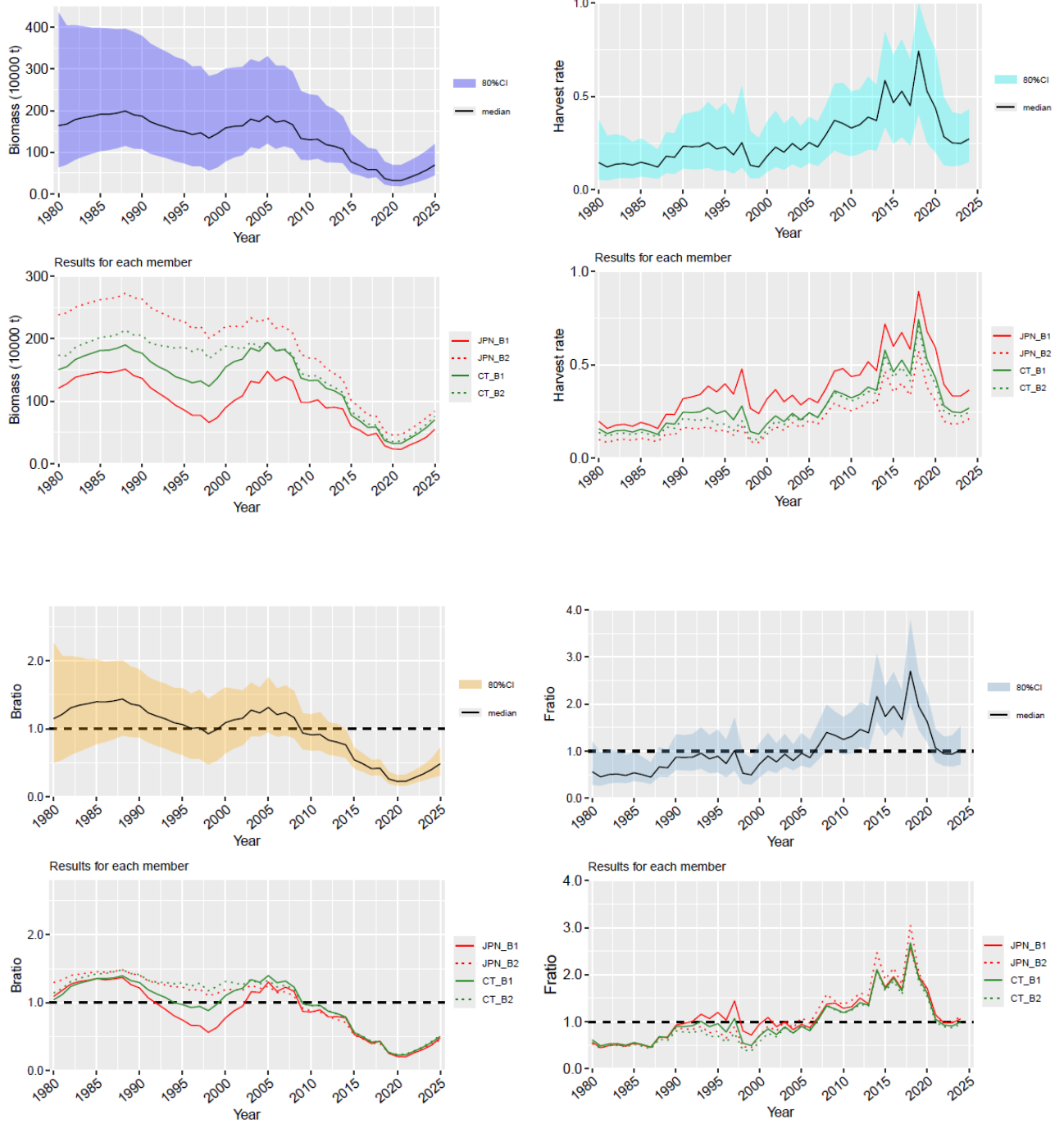


Figure 3. Time series of median estimated values of four runs for biomass, harvest rate, B-ratio, F-ratio and depletion level relative to K. The solid and shaded lines correspond to B1 and B2, respectively.

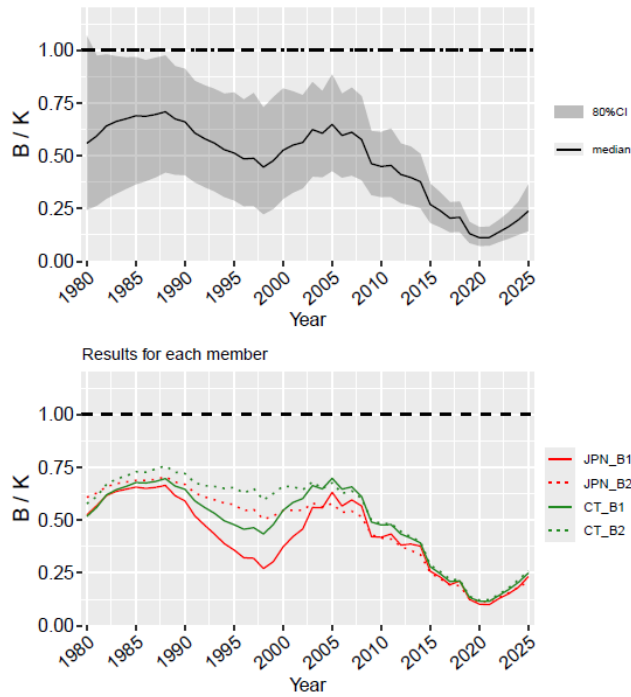
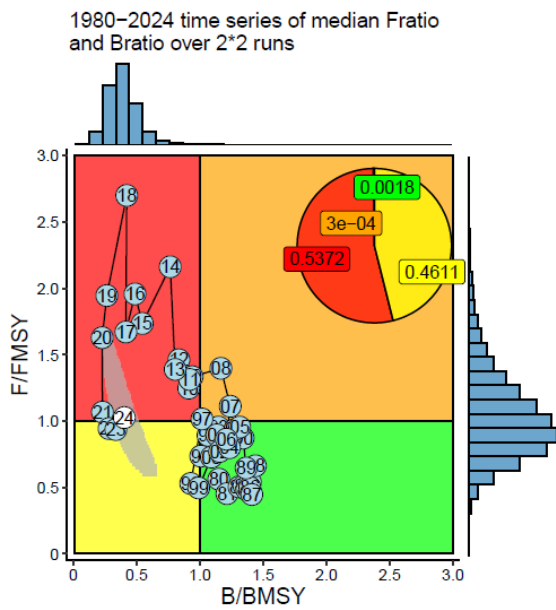


Figure 3 (Continued).

2025 assessment



2024 assessment

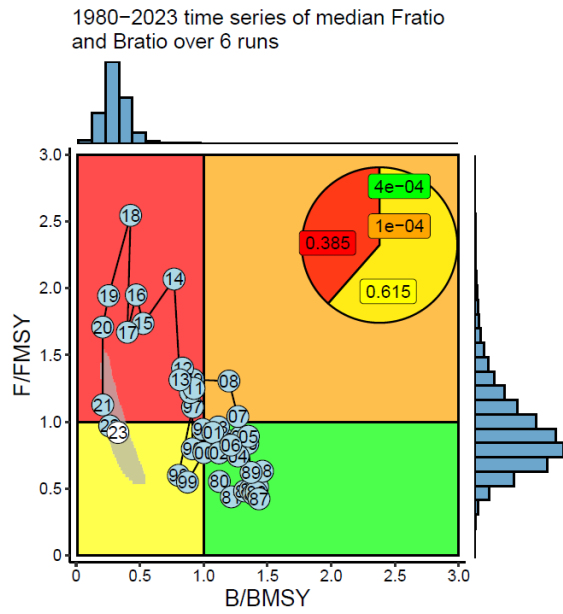


Figure 4. Kobe plot with time trajectory in 2025 (left) and 2024 (right) assessments.

Current stock condition and management advice

Summary of stock status

Results of Japan and Chinese Taipei and combined model estimates indicate the stock declined with high interannual variability from a high biomass level in the mid-2000's after a period of high productivity to the current low biomass levels. The combined results (Table 1a) show that average B was below B_{MSY} during 2023–2025 (median average B/B_{MSY} during 2023–2025 = 0.411, 80% CI = 0.285–0.573) and average F was around F_{MSY} (average F/F_{MSY} during 2022–2024 = 1.027, 80% CI = 0.719–1.526). Thus, stock biomass remained at low levels in recent years. Biomass may have increased during 2020–2025 based on the abundance indices and higher recruitment that may be evident in the Japanese fishery size composition. Based on CPUE, survey data, and model results, the condition of the Pacific saury stock and fishery improved in recent years although biomass remains below B_{MSY} . The improvement could be due to at least in part to reductions in catch since 2020 and potentially due to unidentified environmental variability.

Uncertainty in assessment

See discussion in Section 8 in the main report.

Management advice

The interim HCR for Pacific saury under CMM 2025-08 For Pacific Saury was used to calculate the annual catch level in the 2026 fishing year, while noting the lack of endorsement from China. Based on assessment inputs from Japan and Chinese Taipei, the unconstrained annual catch level for 2026 = $(B_{2025} * F_{MSY} * (B_{2025}/B_{MSY})) = 91,180$ MT. Based on the adopted HCR, the constrained 2026 catch level would be $0.9 \times 202,500 = 182,250$ MT.

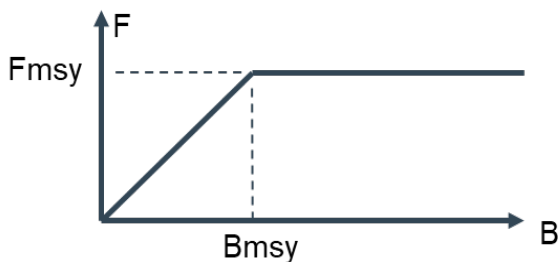


Figure 5. Shapes of the function used in the harvest control rule adopted in 2024 Commission meeting.

Special comments regarding the procedures and stock assessment results

The SSC PS worked collaboratively to produce this stock assessment, incorporating some technical improvements, while noting that China did not endorse the assessment results. This section highlights several important aspects of the stock assessment procedure and results.

- 1) Standardized CPUE data were assumed to be hyperstable and thus less likely to react to changes in biomass. Thus, standardized CPUE were down-weighted relative to the Japanese survey in the first base case (B1), which used CPUE from individual Members. In B1, a single non-linear parameter was used for the CPUEs for each Member.
- 2) Estimated trends in relative stock size measures and reference points from Chinese Taipei (CT), Japan (JPN) and combined models were similar to one another. CPUE, survey trends and model results suggest that stock size is still low but increased since 2020.
- 3) Oceanographic or biological factors responsible for changes in Pacific saury productivity have not yet

been determined. Development of modeling procedures to incorporate environmental change is an important area for future research. The work should include refinements to stock assessment models to better reflect and estimate environmental effects on recruitment and biology. This work should be coordinated among Members and folded into the development of age-structured and improved BSSPM models.

- 4) Experience with the HCR rule this year suggests that the use of more current data might improve management advice. Currently, the HCR calculation for 2026 is based on CPUE and catch data through 2024 and survey data through 2025. However, catch data are nearly complete for the most recent year when the assessment for that year is completed and reasonably precise CPUE standardization could probably be completed early as well. It would be advisable for the SSC PS to consider approaches to using the most recent data in the assessment. One approach to demonstrating potential benefits would be to do a retrospective analysis of HCR calculations based on the actual terminal year and the year before.

STOCK ASSESSMENT REPORT FOR PACIFIC SAURY

1. INTRODUCTION

1.1 Distribution

Pacific saury (*Cololabis saira* Brevoort, 1856) has a wide distribution extending in the subarctic and subtropical North Pacific Ocean from inshore waters of Japan and the Kuril Islands to eastward to the Gulf of Alaska and southward to Mexico. Pacific saury is a commercially important fish in the western North Pacific Ocean (Parin 1968; Hubbs and Wisner 1980).

1.2 Migration

Pacific saury migrates extensively between the northern feeding grounds in the Oyashio waters around Hokkaido and the Kuril Islands in summer and the spawning areas in the Kuroshio waters off southern Japan in winter (Fukushima 1979; Kosaka 2000). Pacific saury in offshore regions (east of 160°E) also migrate westward toward the coast of Japan after October every year (Suyama et al. 2012).

1.3 Population structure

Genetic evidence suggests there are no distinct stocks in the Pacific saury population based on 141 individuals collected from five distant locales (East China Sea, Sea of Okhotsk, northwest Pacific, central North Pacific, and northeast Pacific) (Chow et al. 2009).

1.4 Spawning season and grounds

The spawning season of Pacific saury is relatively long, beginning in September and ending in June of the following year (Watanabe and Lo 1989). Pacific saury spawns over a vast area from the Japanese coastal waters to eastern offshore waters (Baitaliuk et al. 2013). The main spawning grounds are considered to be located in the Kuroshio-Oyashio transition region in fall and spring and in the Kuroshio waters and the Kuroshio Extension waters in winter (Watanabe and Lo 1989).

1.5 Food and feeding

The Pacific saury larvae prey on the nauplii of copepods and other small-sized zooplankton. As they grow, they begin to prey on larger zooplankton such as krill (Odate 1977). The Pacific saury is preyed on by large fish ranked higher in the food chain, such as *Thunnus alalunga* (Nihira 1988) and coho salmon, *Oncorhynchus kisutch* (Sato and Hirakawa 1976) as well as by animals such as minke whales *Balaenoptera acutorostrata* (Konishi et al. 2009) and sea birds (Ogi 1984).

1.6 Age and growth

Based on analysis of daily otolith increments, Pacific saury reaches approximately 20 cm in knob length (distance from the tip of lower jaw to the posterior end of the muscular knob at the base of a caudal peduncle; hereafter as body length) in 6 or 7 months after hatching (Watanabe et al. 1988; Suyama et al. 1992). There is some variation in growth rate depending on the hatching month during this long spawning season (Kurita et al. 2004) and geographical differences (Suyama et al. 2012b). The maximum lifespan is 2 years (Suyama et al. 2006). The age 1 fish grow to over 27 cm in body length in June and July when Japanese research surveys are conducted and reach over 29 cm in the fishing season between August and December (Suyama et al. 2006).

1.7 Reproduction

The minimum size of maturity of Pacific saury has been estimated at about 25 cm in the field (Hatanaka 1956) or rearing experiments (Nakaya et al. 2010). Under rearing experiments, Pacific saury begins spawning 8 months after hatching, and spawning activity continues for about 3 months (Suyama et al. 2016). Batch fecundity is about 1,000 to 3,000 eggs per saury (Kosaka 2000).

2. FISHERY

2.1 Overview of fisheries

Western North Pacific

In Japan, the stick-held dip net fishery for Pacific saury was developed in the 1940s. Since then, the stick-held dip net gears have become the dominant fishing technique to catch Pacific saury in the northwest Pacific Ocean. Since 1995, more than 97% of Japan's total catch is caught by the stick-held dip net. The annual catch of Pacific saury for stick-held dip net fishery has fluctuated. Maximum and minimum catches of 355 thousand tons and 18 thousand tons were recorded in 2008 and 2022, respectively.

Pacific saury fisheries in Korea have been operated with gillnet since the late 1950s in Tsushima Warm Current region. Korean stick-held dip net fishery started from 1985 in the Northwest Pacific Ocean. The largest catch of 50 thousand tons was recorded in 1997 (Gong and Suh 2013).

Russian fishery for Pacific saury has been conducted using stick-held dip nets in the northwest Pacific Ocean in the area that includes national waters (mainly within the Russian EEZ) and adjacent NPFC Convention Areas. Russian catch statistics for saury fishery exists, beginning from 1956, and standardized CPUE indices from that fishery were calculated since 1994. Saury fishery traditionally occurred from August to November; however, in recent years, the onset of fishing for saury shifted to the early summer period. Peak catch of saury of over 100 thousand tons was in 2007.

China commenced its exploratory saury fishing using stick-held dip nets in the high seas in 2003, but only started to develop this fishery in 2012. The fishing seasons mainly cover the period from June-November.

Chinese Taipei's Pacific saury fishery can date back to 1975 and had its first commercial catch in 1977. Over the past decade, the number of active Pacific saury fishing vessels has been increasing from 68 to 91 and the catch has fluctuated between 39,750 tons and 229,937 tons since 2001. Aside from Pacific saury fishery, most of the Pacific saury fishing vessels also conduct flying squid jigging operations in the Northwest Pacific Ocean.

Vanuatu commenced its development of Pacific saury fishery by using stick-held dip net in the high seas in 2004. Currently there are four vessels operating in the Northwest Pacific targeting saury, but the total accumulative number of its authorized Pacific saury fishing vessels from 2004 to 2020 is 16. The fishing season mainly covers the period from July to November each year.

Eastern North Pacific

Although Pacific saury occur in the Canada EEZ, there is no targeted fishery for the species. There is no historical record of Canadian participation in international fisheries for saury. Domestic fisheries sometimes capture saury as bycatch in pelagic and bottom trawls and there are a handful of records from other gear types including commercial longlines. The most recently compiled estimates indicate around 300 kg of saury were captured by Canadian commercial fisheries over 17 years from 1997-2013 (Wade and Curtis 2015; NPFC-2022-SSC PS09-IP01). There are also records of saury catches from research trawls (surface, pelagic and bottom trawls) in Canadian waters, but the catches have been minimal.

Management plans developed by the United States' National Marine Fisheries Service currently prohibit targeted fishing on marine forage species including the Pacific saury. In the 1950's to mid-1970's there were sporadic attempts to commercially fish for Pacific saury off of California with limited success using purse seines and light attraction (Kato 1992). Catches from 1969-1972 averaged 450 tons. Currently landings are only "occasionally" reported as bycatch in fisheries on the US west coast. Landings of Pacific saury as bycatch on the US west coast averaged 5.5 kg per year from 2011-2015 (NOAA Fisheries National Bycatch Report Database System, <https://www.st.nmfs.noaa.gov/>, accessed March 8, 2019)

Historically, Japanese and Russian vessels operated mainly within their own EEZs, but they have shifted into the Convention Area in recent years. Chinese, Korean and Chinese Taipei vessels operate mainly in the high seas of the North Pacific <https://www.npfc.int/science/gis/catch-effort/saury>.

2.2 Catch records

Figure 2 shows the historical catches of Pacific saury in the northwest Pacific Ocean by Member.

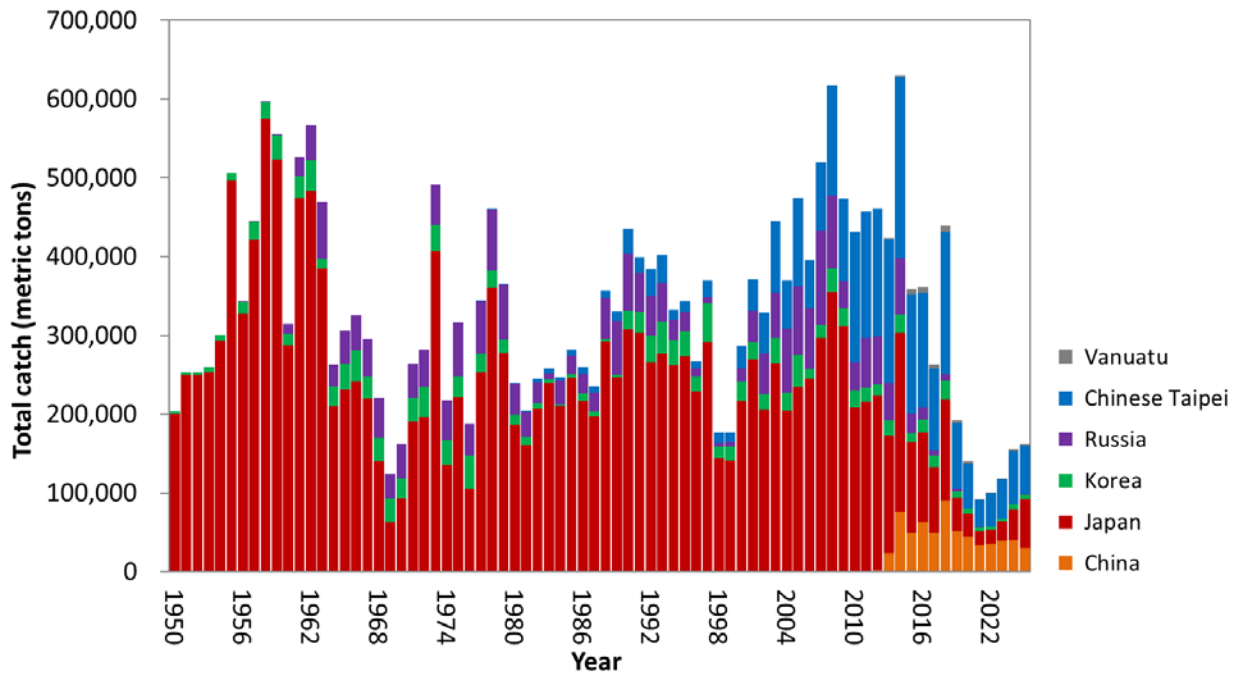


Figure 2. Time series of catch by Member during 1950-2025. The catch data for 1950-1979 are shown but not used in stock assessment modeling. Catch data in 2025 are preliminary (as of 28 November 2025) and not used in the assessment.

3. SPECIFICATION OF STOCK ASSESSMENT

A Bayesian state-space production model (BSSPM) used in previous stock assessments was employed as an agreed provisional stock assessment model for Pacific saury during 1980-2025. Scientists from two Members (Japan and Chinese Taipei) each conducted analyses following the agreed specification which called for two base case scenarios and two sensitivity scenarios (see Annex F, SSC PS15 report for more details). The two base case scenarios differ in using each Member's standardized CPUEs (base case B1) or standardized joint CPUEs (base case B2). The CPUE data were modeled as nonlinear indices of biomass. Members used similar approaches with some differences in the assumption of prior distributions for the free parameters in the model.

3.1 Bayesian state-space production model

The population dynamics is modelled by the following equations:

$$B_t = \{B_{t-1} + B_{t-1}f(B_{t-1}) - C_{t-1}\} e^{u_t}, \quad u_t \sim N(0, \tau^2)$$

$$f(B_t) = r \left[1 - \left(\frac{B_t}{K} \right)^z \right]$$

where

B_t : the biomass at the beginning of year t

C_t : the total catch of year t

u_t : the process error in year t

$f(B)$: the production function (Pella-Tomlinson)

r : the intrinsic rate of natural increase

K : the carrying capacity

z : the degree of compensation (shape parameter; different symbols were used by the 3 members)

The multiple biomass indices are modelled as follows:

Survey biomass estimate

$$I_{t,biomass} = q_{biomass} B_t \exp(v_{t,biomass}), \quad \text{where } v_{t,biomass} \sim N(0, \sigma_{biomass}^2)$$

where

$q_{biomass}$: the relative bias in biomass estimate

$v_{t,biomass}$: the observation error term in year t for survey biomass estimate

$\sigma_{biomass}^2$: the observation error variance for survey biomass estimate

CPUE series

$$I_{t,f} = q_f B_t^b \exp(v_{t,f}), \quad \text{where } v_{t,f} \sim N(0, \sigma_f^2)$$

where

$I_{t,f}$: the biomass index in year t for biomass index f

q_f : the catchability coefficient for biomass index f

b : the hyper-stability/depletion parameter

$v_{t,f}$: the observation error term in year t for biomass index f

σ_f^2 : the observation error in year t for biomass index f

For the estimation of parameters, Bayesian methods were used with Member-specific differences in preferred assumptions for the prior distributions for the free parameters. MCMC methods were employed for simulating the posterior distributions. For the assumptions of uniform priors used in Japan, see documents NPFC-2025-SSC PS16-WP06; for the non-uniform priors used in Chinese Taipei, see document NPFC-2025-SSC PS16-WP05.

3.2 Agreed scenarios

Table 1. Definition of scenarios

	Base case (NB1)	Base case (NB2)	Sensitivity case (NS1)	Sensitivity case (NS2)
Initial year	1980	1980	1980	1980
Biomass survey	$I_{t,bio} = q_{bio} B_t e^{v_{t,bio}}$ $v_{t,bio} \sim N(0, cv_{t,bio}^2 + \sigma^2)$ $q_{bio} \sim U(0,1)$ (2003-2025)	Same as left	Same as left	Same as left
CPUE	CHN(2013-2024) JPN_late(1994-2024) KOR(2001-2024) RUS(1994-2024) CT(2001-2011, 2012-2024) $I_{t,f} = q_f B_t^b e^{v_{t,f}}$ $v_{t,f} \sim N(0, \sigma_f^2)$ $\sigma_f^2 = c \cdot (ave(cv_{t,bio}^2) + \sigma^2)$, where $ave(cv_{t,bio}^2)$ is computed except for 2020 survey ($c = 5$)	Joint CPUE (1994-2024) $I_{t,joint} = q_{joint} B_t^b e^{v_{t,joint}}$ $v_{t,joint} \sim N(0, cv_{t,joint}^2 + \sigma^2)$	CHN(2013-2024) JPN_early(1980-1993, time-varying q) JPN_late(1994-2024) KOR(2001-2024) RUS(1994-2024) CT(2001-2011, 2012-2024) $I_{t,f} = q_f B_t^b e^{v_{t,f}}$ $v_{t,f} \sim N(0, \sigma_f^2)$ $\sigma_f^2 = c \cdot (ave(cv_{t,bio}^2) + \sigma^2)$, where $ave(cv_{t,bio}^2)$ is computed except for 2020 survey ($c = 6$)	JPN_early(1980-1993, time-varying q) $I_{t,JE} = q_{t,JE} B_t^b e^{v_{t,JE}}$ $v_{t,JE} \sim N(0, \sigma_{JE}^2)$ $\sigma_{JE}^2 = c \cdot ave(cv_{t,joint}^2 + \sigma^2)$ Joint CPUE (1994-2024) $I_{t,joint} = q_{joint} B_t^b e^{v_{t,joint}}$ $v_{t,joint} \sim N(0, cv_{t,joint}^2 + \sigma^2)$
Hyper-depletion / stability	A common parameter for all fisheries with a prior distribution, $b \sim U(0, 1)$	$b \sim U(0, 1)$	A common parameter for all fisheries but JPN_early, with a prior distribution, $b \sim U(0, 1)$ [b for JPN_early is fixed at 1]	$b \sim U(0, 1)$ for joint CPUE. [b for JPN_early is fixed at 1]
Prior for other than q_{bio}	Own preferred options	Own preferred options	Own preferred options	Own preferred options

Table 2. Description of symbols used in the stock assessment

Symbol	Description
C_{2024}	Catch in 2024
$AveC_{2022-2024}$	Average catch for a recent period (2023–2024)
$AveF_{2022-2024}$	Average harvest rate for a recent period (2022–2024)
F_{2024}	Harvest rate in 2024
F_{MSY}	Annual harvest rate producing the maximum sustainable yield (MSY)
MSY	Equilibrium yield at F_{MSY}
F_{2024}/F_{MSY}	Average harvest rate in 2024 relative to F_{MSY}
$AveF_{2022-2024}/F_{MSY}$	Average harvest rate for a recent period (2022–2024) relative to F_{MSY}
K	Equilibrium unexploited biomass (carrying capacity)
B_{2024}	Stock biomass in 2024 estimated in the model
B_{2025}	Stock biomass in 2025 estimated in the model
$AveB_{2023-2025}$	Stock biomass for a recent period (2023–2025) estimated in the model
B_{MSY}	Stock biomass that will produce the maximum sustainable yield (MSY)
B_{MSY}/K	Stock biomass that produces the maximum sustainable yield (MSY) relative to the equilibrium unexploited biomass ^a
B_{2024}/K	Stock biomass in 2024 relative to K^a
B_{2025}/K	Stock biomass in 2025 relative to K^a
$B_{2023-2025}/K$	Stock biomass in the latest time period (2023–2025) relative to the equilibrium unexploited stock biomass ^a
B_{2024}/B_{MSY}	Stock biomass in 2024 relative to B_{MSY}^a
B_{2025}/B_{MSY}	Stock biomass in 2025 relative to B_{MSY}^a
$B_{2023-2025}/B_{MSY}$	Stock biomass for a recent period (2023–2025) relative to the stock biomass that produces maximum sustainable yield (MSY) ^a

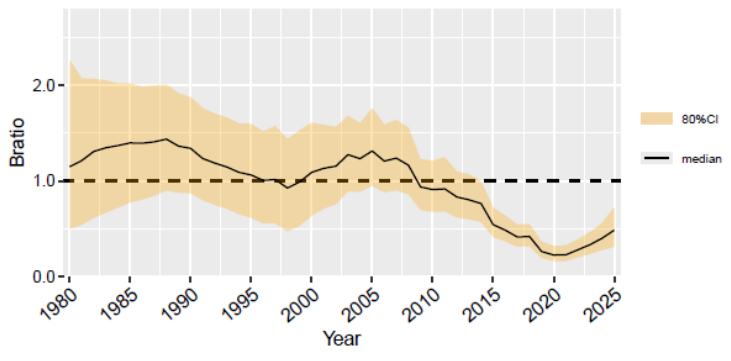
^acalculated as the average of the ratios.

4. SOME AGGREGATED RESULTS FROM JAPAN AND CHINESE TAIPEI FOR VISUALIZATION PURPOSE

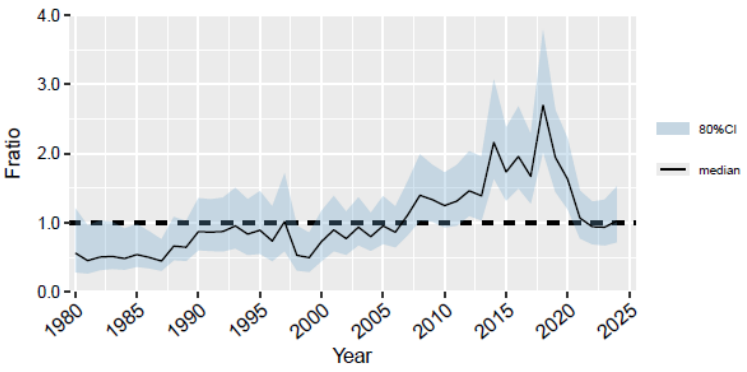
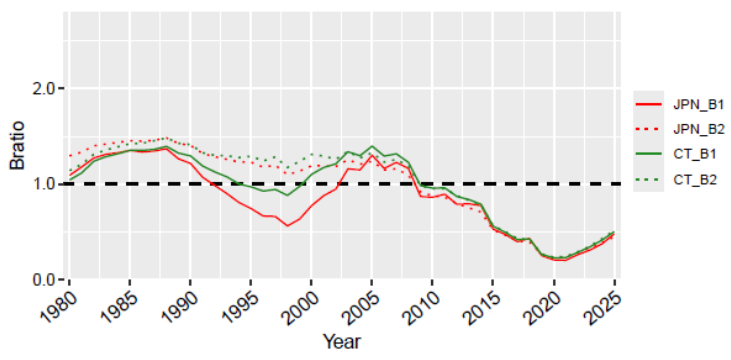
4.1 Visual presentation of results

The graphical presentations for times series of biomass (B), B-ratio (B/B_{MSY}), exploitation rate (F), F-ratio (F/F_{MSY}) and B/K are shown in Figure 3.





Results for each member



Results for each member

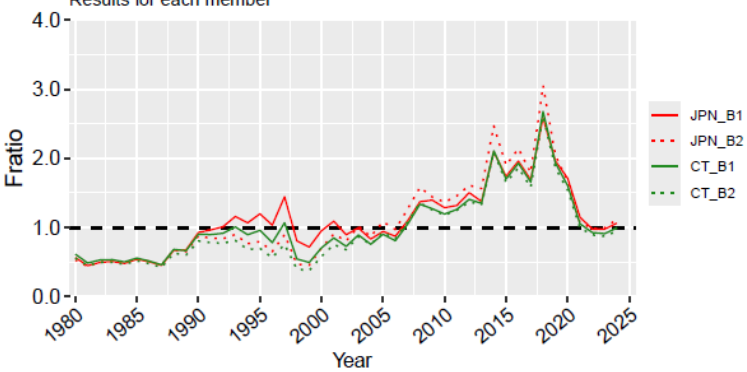


Figure 3. Time series of median estimated values of four runs for biomass, harvest rate, B-ratio, F-ratio and depletion level relative to K. The solid and shaded lines correspond to B1 and B2, respectively.

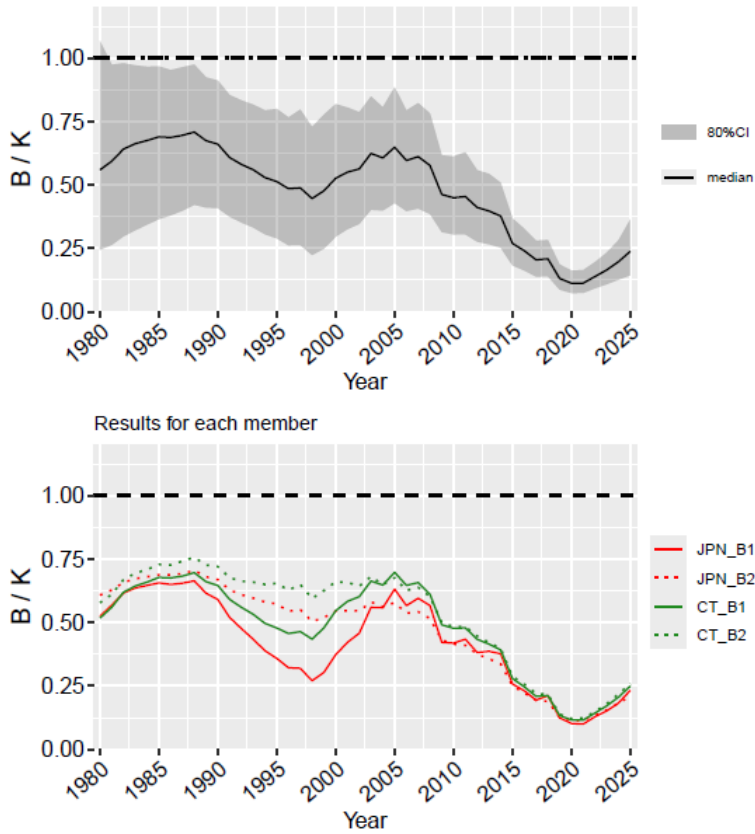


Figure 3 (Continued).

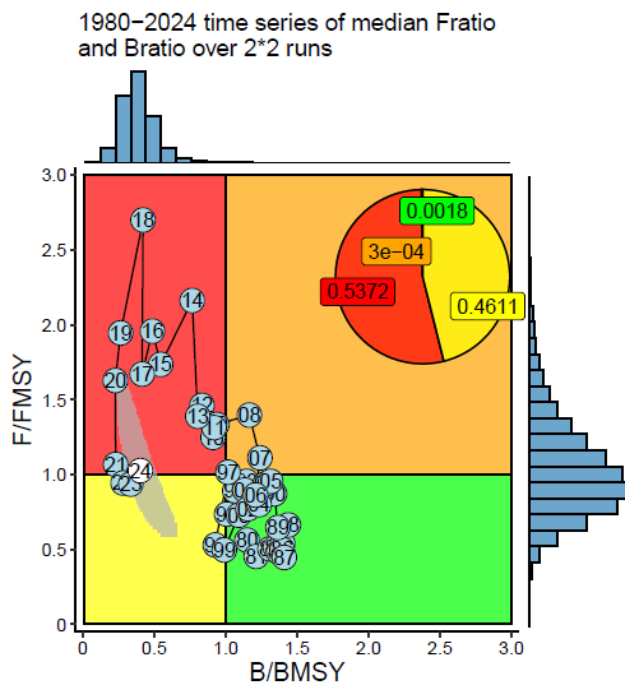


Figure 4. Kobe plot with time trajectory. The data are aggregated across 4 model results (2 base-case models by 2 Members).

4.2 Summary table

Table 3. Summary of estimates of reference quantities. Median and credible interval for the aggregated results are presented. In addition, median values of combined results (over B1 and B2) from Japanese and Chinese Taipei analyses are shown.

	Median	Lower10%	Upper10%	Median_JPN	Median_CT
C_2024 (10000 t)	15.556	15.556	15.556	15.556	15.556
AveC_2022_2024	12.463	12.463	12.463	12.463	12.463
AveF_2022_2024	0.258	0.137	0.414	0.276	0.246
F_2024	0.272	0.150	0.431	0.292	0.258
FMSY	0.269	0.130	0.444	0.271	0.268
MSY (10000 t)	38.165	30.860	45.319	38.064	38.250
F_2024/FMSY	1.027	0.719	1.526	1.085	0.972
AveF_2022_2024/FMSY	0.971	0.712	1.371	1.015	0.927
K (10000 t)	294.397	178.813	593.103	304.173	287.900
B_2024 (10000 t)	57.200	36.107	103.568	53.309	60.330
B_2025 (10000 t)	69.460	45.090	119.897	66.099	72.620
AveB_2023_2025	58.238	37.756	103.933	54.625	61.302
BMSY (10000 t)	142.100	91.670	266.603	141.938	142.200
BMSY/K	0.486	0.385	0.617	0.470	0.503
B_2024/K	0.197	0.127	0.282	0.182	0.211
B_2025/K	0.238	0.143	0.364	0.221	0.254
AveB_2023_2025/K	0.202	0.128	0.288	0.188	0.215
B_2024/BMSY	0.403	0.280	0.562	0.383	0.423
B_2025/BMSY	0.488	0.314	0.725	0.466	0.510
AveB_2023_2025/BMSY	0.411	0.285	0.573	0.394	0.429

5. CONCLUDING REMARKS

See the Executive Summary.

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Updated total catch, CPUE standardizations and biomass estimates for the stock assessment of Pacific saury

Year	Total catch (metric tons)	Biomass JPN (VAST, 1000 metric tons)	CV (%)	CPUE CHN (metric tons/vessel/day)	CPUE JPN_early (metric tons/net haul)	CPUE JPN_late (metric tons/net haul)	CPUE KOR (metric tons/vessel/day)	CPUE RUS (metric tons/vessel/day)	CPUE CT_early (metric tons/net haul)	CPUE CT_late (metric tons/net haul)	Joint CPUE (sdmT MB)	CV (%)
1980	238510				0.72							
1981	204263				0.63							
1982	244700				0.46							
1983	257861				0.87							
1984	247044				0.81							
1985	281860				1.4							
1986	260455				1.13							
1987	235510				0.97							
1988	356989				2.36							
1989	330592				3.06							
1990	435869				1.95							
1991	399017				3.13							
1992	383999				4.32							
1993	402185				3.25							
1994	332509					4.10		16.73			1.50	0.315
1995	343743					2.09		21.33			1.79	0.314
1996	266424					1.78		14.37			0.90	0.306
1997	370017					3.49		11.46			2.01	0.337
1998	176364					1.05		12.29			0.73	0.361
1999	176498					0.91		11.43			0.77	0.312
2000	286186					1.27		15.60			0.92	0.295
2001	370823					1.65	7.94	20.19	1.44		0.81	0.269
2002	328362					1.10	12.79	18.90	1.33		0.76	0.259
2003	444642	1147.8	31.7			2.02	16.09	27.25	2.47		1.24	0.258
2004	369400	862.1	22.0			2.70	8.66	43.73	1.24		1.03	0.251
2005	473907	1234.9	33.9			4.37	19.56	43.50	2.27		1.47	0.246
2006	394093	876.2	32.9			4.54	8.07	31.79	1.00		0.83	0.236
2007	520207	905.4	34.6			4.18	9.03	39.97	2.17		1.12	0.238
2008	617509	1006.6	28.5			5.16	15.34	38.26	2.79		1.65	0.224
2009	472177	490.6	22.3			4.16	8.74	20.43	1.29		1.07	0.237
2010	429808	655.7	30.5			1.79	8.43	21.85	1.89		0.99	0.230
2011	456263	981.8	33.2			2.48	8.95	26.24	2.09		1.24	0.248
2012	460544	453.8	21.0			2.72	8.96	23.42		2.60	1.17	0.256
2013	423790	751.2	31.5	11.34		1.89	13.52	20.86		3.48	0.94	0.233
2014	629576	519.2	24.1	12.93		3.27	22.38	24.26		3.94	1.36	0.210
2015	358883	391.5	24.4	12.11		1.66	6.97	15.31		2.22	0.94	0.247
2016	361688	312.2	31.1	6.67		1.80	8.96	16.64		1.95	0.89	0.224
2017	262640	188.5	30.8	7.73		1.11	5.91	10.18		1.89	0.91	0.22

2018	435881	370.6	31.5	14.11	1.95	13.87	25.15	2.90	1.36	0.238
2019	195251	230.7	23.4	7.10	0.69	2.03	8.60	1.41	0.56	0.176
2020	139779	25.2	105.8	4.71	0.47	2.63	9.45	1.10	0.39	0.228
2021	92117	154.8	30.5	4.77	0.32	2.16	5.18	0.65	0.40	0.262
2022	100085	327.1	20.3	4.09	0.28	1.33		0.68	0.23	0.250
2023	118250	270.2	32.4	8.94	0.31	2.23	3.81	1.38	0.42	0.308
2024	155558	284.6	19.0	8.67	0.50	2.63	13.88	1.72	0.61	0.262
2025		428.0	26.5							
