North Pacific Fisheries Commission

NPFC-2025-SC10-Final Report

10th Meeting of the Scientific Committee
REPORT

16–19 December 2025

This paper may be cited in the following manner:

Scientific Committee. 2025. 10th Meeting Report. NPFC-2025-SC10-Final Report. 274 pp. (Available at www.npfc.int)

2nd Floor Hakuyo Hall,
Tokyo University of Marine Science and Technology,
4-5-7 Konan, Minato-ku, Tokyo
108-8477, JAPAN

TEL +81-3-5479-8717
FAX +81-3-5479-8718
Email secretariat@npfc.int
Web www.npfc.int

Contents

North Pacific Fisheries Commission
10th Meeting of the Scientific Committee

16–19 December 2025
Nagoya, Japan

REPORT

Agenda Item 1. Opening of the Meeting

1.1 Welcome address and introductions

1. The 10th Meeting of the Scientific Committee (SC) was held in a hybrid format, with participants attending in-person in Nagoya, Japan, or online via WebEx, on 16–19 December 2025. The meeting was attended by Members from Canada, China, the European Union (EU), Japan, the Republic of Korea, the Russian Federation, Chinese Taipei, the United States of America, and the Republic of Vanuatu. The Deep Sea Conservation Coalition (DSCC), the United Nations Food and Agriculture Organization (FAO), the Marine Stewardship Council, the North Pacific Anadromous Fish Commission (NPAFC), the Ocean Governance Institute, the Pew Charitable Trusts (Pew), the North Pacific Marine Science Organization (PICES), and the World Wide Fund for Nature (WWF) attended as observers.

2. The meeting was opened by Dr. Janelle Curtis (Canada), who served as the SC Chair. She reflected on her time as the SC Chair and the nature of the collaboration and partnership at the SC. She expressed her special thanks to the Chairs of the SC's subsidiary bodies and members of the Secretariat for their support and expressed her appreciation to Members and observers for their contributions. The Chair emphasized that science forms the basis of sound fisheries management and expressed her confidence that the SC and its subsidiary bodies will continue to make progress towards the NPFC's objective of ensuring the long-term conservation and sustainable use of fisheries resources in the Convention Area.

3. Dr. Hiroshi Nishida, Director General of the Fisheries Resources Institute, Japan Fisheries Research and Education Agency, welcomed the participants to Nagoya and expressed his appreciation to the SC Chair and the Secretariat for organizing the meeting. He noted that the meeting would provide an invaluable opportunity for participants to share their visions for promoting the optimal utilization and long-term sustainability of resources in the Convention Area by engaging in forward-looking discussions and sharing their expertise, particularly in light of the changing marine environment in the Pacific Ocean in recent years. Lastly, Dr. Nishida expressed his hope for fruitful discussions and wished the participants a memorable stay in Nagoya.

1.2 Appointment of Rapporteur

4. Mr. Alex Meyer was selected as rapporteur.

1.3 Meeting arrangements

5. The Science Manager, Dr. Aleksandr Zavolokin, outlined the meeting procedures and logistics.

Agenda Item 2. Adoption of Agenda

6. The SC agreed to add two agenda items: "6.3.5 Draft Terms of Reference for a Small Scientific Committee on Japanese Sardine" and "6.4 Review of tasks for SWG JFS, SWG BM, and SWG JS (or SSC JS)."

7. The agenda was adopted as revised (Annex A). The List of Documents and List of Participants are attached (Annexes B, C).

Agenda Item 3. Provision of advice to the Commission

3.1 Structure and content of the SC reports

8. The SC discussed ways in which to improve the structure and content of the SC reports so as to provide clearer advice from the SC to the Commission.

9. The SC noted that in the past, recommendations from the SC's subsidiary bodies have been described twice in SC reports, with the SC endorsing each recommendation from these bodies individually and then repeating them in its own recommendations to the Commission. The SC agreed to simplify this by endorsing each subsidiary body's meeting report as a whole and then to only describe a combination of the SC's recommendations and those of the subsidiary bodies to the Commission once in the SC report.

10. The SC agreed to add a table of activities and timeline to meeting reports of SC subsidiary bodies to more clearly convey the subsidiary body's progress and planned work. The SC also requested the Secretariat to make these tables of activities and timelines available on the NPFC website.

11. The SC also discussed the presentation of summaries of stock assessments, the development of species status templates, and the treatment of species summary documents in agenda items 3.1.1–3.1.3 below.

3.1.1 Summary of stock assessments

12. The SC agreed that SC reports should have independent sections for summarizing SC subsidiary bodies' stock assessments, separate from the sections summarizing SC subsidiary

bodies' other activities. The SC agreed that for species for which an NPFC stock assessment has yet to be conducted, this section would summarize activities that could eventually contribute to conducting a stock assessment.

3.1.2 Species status templates

13. The Chair recalled that the Commission has requested that the SC consider standardizing how stock status is presented across species to enhance consistencies as much as possible.

14. Canada presented a proposal for developing a standardized template for presenting species statuses. The goals of the template would be to convey necessary information on stock status for priority species to the Commission via the SC report in an efficient manner, while still containing the key basic information. The template should also be able to convey information on priority species without an assessment. Consideration should be given to making it easy to update the document, for example with code for automation.

15. The SC agreed that it would be valuable to work towards standardizing the way in which stock status information is presented, while recognizing the need to maintain a degree of flexibility across species.

16. The SC considered examples from other organizations. Some Members expressed initial support for developing a modified version of the International Council for the Exploration of the Sea (ICES) stock assessment executive summary. The usefulness of the stock status table presented at the start of the Indian Ocean Tuna Commission's (IOTC's) stock status executive summaries was also noted.

17. The SC agreed to reinstate the Small Working Group (SWG) Milestones, to select Dr. Chris Rooper (Canada) as its Lead, and to request the SWG Milestones Lead to progress the work to develop a standardized template for presenting species status in coordination with the Chairs of the SC and its subsidiary bodies.

18. The SC agreed that in the interim, the SC Chair could work with the Chairs and Leads of the SC subsidiary bodies to develop simple status summary PowerPoint slides for presentation to the Commission and the SC Chair requested that drafts be submitted to her by 15 February 2026.

3.1.3 Species summary documents

19. The SC noted that if the SC develops a species status template, there would be some overlap between information in the species status document and the species summary document for species with an NPFC stock assessment. The SC noted that the species status document could

potentially replace the species summary document. The SC noted, however, that species summary documents also contain biological and fisheries information that would not be contained in the species status document. The SC noted that unlike stock status information, biological and fisheries information is not regularly updated and could perhaps be given dedicated pages on the NPFC website. The species summary document or species status document could then simply contain a link to the relevant page on the NPFC website.

20. The Deep-sea Fisheries (DSF) Project (FAO) pointed out that species summary documents are also of interest to the public and encouraged the NPFC to use language that is accessible not only to scientists and managers but also the general public.

3.2 SC workflow and meetings

3.2.1 Review of SC workflow

21. The Science Manager presented a review of the SC structure and workflow that have been developed over the past ten years, including potential issues and proposals for improvement (NPFC-2025-SC10-WP07 (Rev. 1)). The substantial increase of the SC workload and growing budgetary pressure, including the number of meetings, projects and additional tasks/requests from the Commission, may require further revision of the SC procedures and workflow.

22. The SC reviewed and revised the proposed amendment to the SC structure and workflow (Annex D).

23. The SC agreed to task the SWG Milestones to discuss the future structure of SC subsidiary groups around stock assessment and report progress in a working paper to SC11.

3.2.2 Meeting schedule for SC and its subsidiary groups

24. The Science Manager presented draft options for the meeting schedule for the SC and its subsidiary groups in the 2026 operational year (NPFC-2025-SC10-WP01 (Rev. 2)).

25. The SC reviewed and revised the draft options and recommended that the Commission endorse the meeting schedule described in Annex E.

3.2.3 Review of guidelines for SC SWGs

26. The Chair presented proposed revisions to the Guidelines for the SC’s SWGs (NPFC-2025-SC10-WP08).

27. The SC reviewed the proposal and made further revisions (NPFC-2025-SC10-WP08 (Rev. 1)). The SC adopted the revised Guidelines for the SC’s SWGs (Annex F).

3.3 Standards of 'best available science' (PR Recommendation 3.4.1)

28. China presented a proposal for the adoption of an NPFC Resolution on the Best Available Science (NPFC-2025-SC10-WP16).

29. The SC expressed its appreciation to China for preparing the proposal and offered initial feedback. The SC encouraged Members to share any additional feedback they have with China in the intersessional period and encouraged China to present an updated proposal to the Commission.

30. The DSCC and Pew thanked China for its proposal and drew the SC's attention to discussions at the 18th session of the Informal Consultations of States Parties of the United Nations Fish Stocks Agreement (UNFSA), which highlighted that peer-reviewed science can complement regional fisheries management organization (RFMO) scientific processes by enhancing transparency, credibility, and accessibility of scientific information. Furthermore, its value extends beyond traditional stock assessments and can cost-effectively support understanding of broader ecosystem considerations. It can also contribute to frameworks and methodologies to identify vulnerable marine ecosystems and prevent significant adverse impacts.

3.4 Frequency of benchmark and annual stock assessments

31. The SC considered the frequency of benchmark and data update stock assessments for priority species.

32. For Pacific saury, the SC recommended that the data update stock assessment be conducted annually because of their short lifespan. Regarding the frequency of benchmark stock assessments, the SC recommended that this be determined at a future date as the work to develop a new age-structured model is still ongoing.

33. For chub mackerel, the SC recommended that the benchmark stock assessment be conducted every 3 years, again because of its relatively short lifespan, with the next benchmark stock assessment to be conducted in 2028, and that the data update stock assessment be conducted annually.

34. For neon flying squid (NFS), the SC recommended that the benchmark stock assessment be conducted every 3–5 years and that the data update stock assessment be conducted annually.

35. The SC recommended that in general, benchmark stock assessments should be conducted every 3–5 years and that the data update stock assessments should be conducted annually.

3.5 Fisheries-dependent and fisheries-independent indicators of trend for stocks without NPFC stock assessments

36. The SC discussed fisheries-dependent and fisheries-independent indicators of trend for stocks without NPFC stock assessments.

37. The SC recommended the following indicators of trend for North Pacific armorhead (NPA):
    (a) Fisheries-dependent indicators:
        i. Catch
        ii. Depletion analysis estimates
    (b) Fisheries-independent indicators:
        i. Monitoring survey catch per unit effort (CPUE)
        ii. Monitoring survey fatness index

38. The SC recommended the following indicators of trend for splendid alfonsino (SA):
    (a) Fisheries-dependent indicators:
        i. Trawl and gillnet CPUE (standardization in progress)

39. The SC recommended the following indicators of trend for NFS:
    (a) Fisheries-dependent indicators:
        i. Standardized CPUE
        ii. Mean size at catch
        iii. Total catch
    (b) Fisheries-independent indicators:
        i. Abundance index
        ii. Size composition
        iii. Driftnet survey during summer

40. The SC recommended the following indicators of trend for Japanese flying squid (JFS):
    (a) Fisheries-dependent indicators:
        i. Standardized CPUE from the coastal squid jigging fisheries (Jul-Dec)

41. The SC recommended the following indicators of trend for blue mackerel (BM):
    (a) Fisheries-dependent indicators:
        i. Standardized CPUE from Stick-held dip net in Shizuoka prefecture
        ii. Total catch
        iii. Nominal CPUE
    (b) Fisheries-independent indicators:
        i. Egg abundance in East of Miyazaki prefecture

42. The SC recommended the following indicators of trend for Japanese sardine (JS):
   (a) Fisheries-independent indicators:
      i. Egg abundance in East Japan
      ii. Acoustic survey in autumn (Sep-Oct) (abundance of age 0 fish)
      iii. Trawling survey in summer (Jun-Jul) (abundance of age 0 fish)
      iv. Trawling survey in summer (Jun-Jul) (abundance of age 1 fish)
      v. Standardized CPUE from China's summer survey

43. The SC recommended the following indicators of trend for sablefish:
   (a) Fisheries-dependent indicators:
      i. CPUE from longline traps

3.6 Process for selection of external experts and contract renewal

44. The Chair presented a proposed policy for the selection and extension of invited experts for supporting the SC and its subsidiary bodies (NPFC-2025-SC10-WP05 (Rev. 1)).

45. The SC reviewed and revised the proposal (NPFC-2025-SC10-WP05 (Rev. 2)). The SC adopted the policy for the selection and extension of invited experts for supporting the Scientific Committee and its expert groups (Annex G).

3.7 Independent reviews of scientific advice (PR Recommendation 3.4.2.)

46. China presented a proposal to establish a formal peer-review process for stock assessments (NPFC-2025-SC10-WP17) and a proposed Terms of Reference (TOR) for the external peer review process (NPFC-2025-SC10-WP18). Noting the request from the Commission to explore the potential benefits of a peer review system and the high-priority recommendation from the 2022 Performance Review Panel to establish a peer review process, China urged the SC to initiate such a process.

47. The SC thanked China for the proposal and expressed general support for moving towards the establishment of a formal peer-review process for stock assessments.

48. The SC requested China to work intersessionally with other interested Members through the SWG Milestones to develop the proposal further with a detailed description of the proposed process for NPFC, and the potential cost implications, and to present an updated proposal to SC11.

49. The SC requested the EU to work intersessionally with other interested Members through the SWG Milestones to conduct a review of best practices from other organizations for implementing peer-reviews for stock assessments to support the development of the NPFC's

own peer-review process.

50. The SC also tasked coordination of external peer-reviews to its subsidiary bodies, noting the limited capacity within the Secretariat to coordinate an external review process.

3.8 Advice on science-based management options for operationalizing the precautionary approach (PR Recommendation 4.1.2)

3.8.1 Summary of NPFC workshop on "Science-based management options available for operationalizing the precautionary approach as outlined in the Convention for NPFC priority species"

51. The Chair presented a brief summary of the NPFC workshop on *Science-based management options available for operationalizing the precautionary approach as outlined in the Convention for NPFC priority species* (NPFC-2025-SC10-RP04).

3.8.2 Science-based management options for NPFC

52. The SC Vice-Chair, Dr. Jie Cao (China), led the discussion on science-based management options for NPFC.

53. For operationalizing the precautionary approach (PA) where stock assessments are not available according to the NPFC Performance Review, the SC reminds the Commission that it can take action according to the best available science (for example, using catch and effort data, peer-reviewed literature or domestic stock assessments).

54. The SC recommends that as a longer-term goal, the Commission should develop a general framework for the application of the PA. The SC recommends that this work be conducted by a small working group established under the Commission. The SC recommends that this small working group be composed of managers and scientists and that it be led by managers.

55. The EU highlighted the need to develop a general framework for the application of the PA as promptly as possible in light of the condition of several NPFC priority stocks.

56. The SC agreed, as an interim measure, to task its subsidiary bodies that do not have stock assessments in place to provide science-based options for operationalizing the PA. The SC agreed that subsidiary bodies could provide multiple options and that these do not necessarily need to be consensus options, but they should be accompanied by clear descriptions of the scientific rationale to facilitate the Commission's decision-making. The SC agreed to review these options and present them to the Commission.

57. Pew expressed its support for the NPFC's ongoing management strategy evaluation (MSE) efforts, noting that MSE is designed to work under uncertainty, especially in circumstances where stock assessments are uncertain or unreliable. Pew suggested that the NPFC consider engaging in broader coordination for applying the PA, including MSE, across species and provide funding for that work.

58. WWF suggested that for stocks that are in decline, in the absence of an agreed stock assessment, the PA calls for the implementation of measures based on the best available science to avoid the collapse of the stock.

59. The DSCC pointed out that the PA applies not only to fish stocks but also to the protection of vulnerable marine ecosystems (VMEs). The DSCC pointed out that there are published scientific papers indicating that significant adverse impacts have occurred and are likely to continue to occur on VMEs in the Convention Area.

Agenda Item 4. Review of stock assessments, reports, and recommendations from the Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA) and the Small Scientific Committees (SSC BF-ME, SSC NFS, and SSC PS)

4.1 Technical Working Group on Chub Mackerel Stock Assessment

4.1.1 Summary of TWG CMSA activities, tasks, and recommendations

60. The TWG CMSA Chair, Dr. Kazuhiro Oshima (Japan), summarized the outcomes and recommendations of the 10th and 11th TWG CMSA meetings (NPFC-2025-TWG CMSA10-Final Report & NPFC-2025-TWG CMSA11-Final Report).

61. The SC endorsed the reports of the 10th and 11th TWG CMSA meetings.

62. The TWG CMSA Chair presented a summary of the TWG CMSA's responses to the taskings from the 9th Commission Meeting (NPFC-2025-SC10-WP22 (Rev. 2)). The tasks are 1. Provision and analysis of gear specific data to explore whether there is a need to protect the immature portion of the stock and advice on options for achieving that, as appropriate, 2. Clarification of the correspondence of fishing days and the level of catch in relevant fleets, such as the purse seine fleet, and 3. Based on the next stock assessment, provide projections and associated probabilities, based on constant catch scenarios (e.g. increments of 5000 MT) or constant F scenarios, aiming at reaching an appropriate MSY proxy (SSB and F) within 5 to 10 years (with a probability higher than 50%).
    (a) For Task 1, the TWG CMSA examined various model outputs available from the SAM assessment model in an attempt to address the issue of whether more protections were needed for the immature portions of the stock. However, after extensive discussion and preliminary analyses, it was determined that none of the model outputs were alone

sufficient to address this issue. In order to respond to this Task thoroughly, the TWG CMSA needs gear specific catch-at-age / catch-at-length data by all Members, which is currently not submitted through the data submission requirement. Should the Commission wish this Task to be completed, the TWG CMSA and SC recommend that the Commission require the Members to submit such data including accessory devices used for fishing purposes for both the Convention Area and exclusive economic zones (EEZs).

(b) For Task 2, as a first step, the TWG CMSA prepared a description of how each Member defines and calculates "fishing day" and presented this information to SC10, and, in the longer-term, agreed to work towards a common methodology for defining and calculating "fishing day."

(c) For Task 3, the TWG CMSA has addressed this through the future projections as part of the 2025 chub mackerel stock assessment. For the projections and associated probabilities, based on constant catch scenarios, the TWG CMSA considered the appropriate increment levels and agreed to use increments of 10,000 MT.

4.1.2 Summary of CM stock assessment

63. The TWG CMSA Chair presented the chub mackerel stock assessment report (NPFC-2025-SC10-WP10).

64. The TWG CMSA Chair explained that when Japan conducted its domestic stock assessment meeting for chub mackerel, it identified a calculation error in the input catch-at-age data used for the 2025 domestic stock assessment. Unfortunately, the same error was also included in the input data for the 2025 NPFC chub mackerel stock assessment. The input data for Japan's 2025 domestic stock assessment were constructed based on the data used for the NPFC stock assessment this year. Japan conducted the necessary data corrections and re-ran the SAM using the revised data. The updated results indicate that although the catch-at-age data for the 2014–2017 fishing years were substantially revised, the estimated biomass, spawning stock biomass (SSB), and recruitment did not change substantially. This correction does not affect the management-related reference points or the overall conclusions of the 2025 stock assessment.

65. The SC reviewed and endorsed the chub mackerel stock assessment report (Annex H).

66. The SC noted that given the uncertainty in biological parameters in future, which has a large impact on the projection results, it is not appropriate to provide long-term harvesting recommendations at this time. However, in response to the request from COM09, 10 year projection was undertaken to assess the effects of varying catch and F levels based on the most recent eight years' biological data (Figures E-10 and E-11, Tables E-2 to E-5, Annex H). Projections indicate that current fishing mortality is unsustainable, and probabilities of

achieving various reference levels under catch-constant as well as F-constant scenarios are provided in Tables E-2 and E-3 of Annex H. It is recommended to reduce fishing mortality to recover SSB to the reference levels.

67. The SC noted that the TWG CMSA recommended 50th percentile of the estimated historical SSB (1970–2023) and 70th percentile of the estimated historical SSB (1970–2023) as reference levels and the 25th percentile of estimated historical SSB as a limit reference point. The SC recommended that in light of uncertainties around the biological parameters, these reference levels and limit reference point should be treated as interim. The SC noted that Members have differing views on which of the reference levels should be treated as the target.

68. The SC noted that effort is currently not comparable among Members fishing for chub mackerel, as each Member defines "fishing days" differently and Japan has shared data for its purse seine fishery, which is its main fishery, and its bottom trawl fishery. The SC noted Japan's explanation that its other chub mackerel fisheries operate in its EEZ, that many of these fisheries are artisanal and multi-species in nature, and that it would be very difficult to develop a meaningful indicator of chub mackerel effort for the NPFC from these fisheries. The SC tasked the TWG CMSA to hold further discussions on how best to measure and compare chub mackerel fishing effort among Members.

4.2 Small Scientific Committee on Bottom Fish and Marine Ecosystems

4.2.1 Summary of SSC BF-ME activities, tasks, and recommendations

69. The Chair of the SSC on Bottom Fish and Marine Ecosystems (SSC BF-ME), Dr. Chris Rooper (Canada), summarized the outcomes and recommendations of the 6th SSC BF-ME meeting (NPFC-2025-SSC BFME06-Final Report).

70. The SC endorsed the report of the 6th SSC BF-ME meeting.

4.2.2 Summary of stock assessments for bottom fish

71. For NPA, the SC noted that no strong recruitment has been detected in recent years (since 2013), stock status remains low, and harvest rate is likely to be high. Potential caveats include the possible effect of a target shift, uncertainty in the estimation of the recruitment season, estimates of harvest rate (>1) in some years and seamounts, and potential bias caused by the removal of zero-catch operations. The SSC BF-ME recommended to keep monitoring possible recruitment events and avoid high harvest rates for recruited fish as specified in CMM 2025-05. Furthermore, since recruitment has been weak, the SSC BF-ME recommended reducing the harvest rates as much as possible. The SSC BF-ME also recognized the effort of Japanese fishers to avoid harvest of NPA since 2019.

72. For SA, the SC noted that there has been no new stock status advice, that there is a high likelihood that growth overfishing is occurring (harvest before the size that maximizes yield-per-recruit (YPR)), and that SA are being captured before they are mature, likely reducing the spawning potential. A potential caveat is that the trawl fishery has dome shaped selectivity, which may make the analyses pessimistic about the status of the stock. The SC noted that the SSC BF-ME is aiming to conduct a preliminary stock assessment of SA in 2026.

73. For sablefish, the SC noted that domestic stock assessments conducted in three regions (Alaska, Canada, and US West Coast) all indicate that the sablefish stock is healthy and not subject to overfishing. The SC noted that Canada has not fished for sablefish since 2020 as the fishery has not been economically profitable, and that there will likely be some fishing in 2026.

74. For skilfish, the SC noted that there are currently no assessments available and that conducting an assessment for this species is a low priority as fishing is not consistent and data are limited.

75. The DSCC and Pew urged the SC to recommend the suspension of the NPA and SA fisheries until formal stock assessments are completed, a recovery plan is established, the stocks are firmly on the path to being rebuilt, and comprehensive impact assessments consistent with United Nations General Assembly (UNGA) resolutions and relevant provisions of international law have been conducted and confirm that continuous bottom fishing on the Emperor Seamount Chain is not causing significant adverse impacts to VMEs.

4.3 Small Scientific Committee on Neon Flying Squid

4.3.1 Summary of SSC NFS activities, tasks, and recommendations

76. The Chair of the SSC on Neon Flying Squid (SSC NFS), Dr. Luoliang Xu (China), summarized the outcomes and recommendations of the 2nd SSC NFS meeting (NPFC-2025-SSC NFS02-Final Report).

77. The SC endorsed the report of the 2nd SSC NFS meeting.

4.3.2 Summary of NFS stock assessment

78. The SC noted that China and Japan have conducted preliminary stock assessments of NFS using Just Another Bayesian Biomass Assessment (JABBA) and the stochastic surplus production model in continuous time (SPiCT), respectively. The SC noted that the SSC NFS intends to conduct a preliminary stock assessment of NFS using Members' standardized CPUEs in 2026.

4.4 Small Scientific Committee on Pacific Saury

4.4.1 Summary of SSC PS activities, tasks, and recommendations

79. The Chair of the SSC on Pacific Saury (SSC PS), Dr. Toshihide Kitakado (Japan), summarized the outcomes and recommendations of the 15th and 16th SSC PS meetings (NPFC-2025-SSC PS15-Final Report, NPFC-2025-SSC PS16-Final Report).

80. The SC endorsed the reports of the 15th and 16th SSC PS meetings.

4.4.2 Summary of PS stock assessment

81. The SC noted that the SSC PS reviewed the stock assessments conducted by Members and could not reach consensus on the treatment of the results.

82. The SC noted that China expressed concerns that the current Bayesian State-Space Production Model (BSSPM) used for the Pacific saury stock assessment exhibits instability and considerable uncertainty in key parameter estimates and that it does not adequately capture non-stationary population dynamics. China noted that an increasing body of scientific evidence indicates that key biological processes of Pacific saury, including growth, survival, and maturation, are closely linked to environmental variability. China is therefore concerned that the assumption of stationary stock productivity is not appropriate for this small pelagic species and is inconsistent with current scientific understanding. In light of these concerns, China considers that the model specification should be improved by incorporating non-stationary formulations for key population parameters, such as the intrinsic growth rate (r) and carrying capacity (K), and that the assumption of hyperstability should be further evaluated.

83. The SC noted that China also expressed concern regarding the scaling uncertainty in the current BSSPM stock assessments for Pacific saury. China noted that the scales of some key assessment outputs such as estimated biomass, biological reference points, and stock status fluctuate across assessment years as newly updated input data are incorporated into the model. Such instability hampers the ability to consistently evaluate management effectiveness and obscures a clear understanding of the true stock status. China noted that until these concerns and limitations are adequately addressed, and to minimize the risk of inappropriate management decisions, China considers that the current assessment results are not sufficiently robust to serve as the basis for developing management advice.

84. The SC noted that other Members noted China's reservations and recognized that there continue to be some uncertainties in the stock assessment. However, they considered the stock assessment to be the best scientific information available and believed it would be appropriate to aggregate the results, recognizing the agreement in trends among them. They also noted that, even though Pacific saury stock has been recovering in recent years, the stock has yet to

reach past abundance levels and a precautionary approach as incorporated in the interim harvest control rule (HCR) is warranted given the uncertainty of the stock assessment.

85. The SC noted that to provide the calculations requested by CMM 2025-08 For Pacific Saury, input values from Japan and Chinese Taipei's stock assessments were used rather than assessment results from all contributing SSC PS Members.

86. The SC noted that the interim HCR for Pacific saury under CMM 2025-08 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 x 202,500 = 182,250 MT.

87. The SC noted that in the SSC PS16 report, Chinese Taipei stated that based on thorough comparisons of recent stock assessment results across years and alternative model scenarios, contributing Members' assessments indicate substantial uncertainties in the estimation of key stock status indicators, including biomass, fishing mortality, and reference points F_{MSY} and B_{MSY}. In this regard, the estimated annual catch level derived from the interim HCR is subject to considerable uncertainty and potential error. While the HCR provides a consistent framework for translating stock status into management advice, the resulting calculated annual catch level should be interpreted with caution.

88. The SC discussed future work on the Pacific saury stock assessment. The SC noted that the SSC PS should continue working both to improve the BSSPM and to develop new age-structured models, but noted that a new age-structured model would not be guaranteed to perform perfectly. It should be noted that the age-structure models can be used in the future as a basis for operating models in the MSE framework. In addition, a simpler assessment model such as the BSSPM might be used as an internal assessment method when developing model-based management procedures, as has been used in other RFMOs.

89. The WWF expressed appreciation for the hard work of the SSC PS but expressed deep concern about the future of the Pacific saury stock as the SSC PS could not reach consensus on a Pacific saury stock assessment. The WWF stated that, generally, when the uncertainty is high, it is necessary to reduce total allowable catch (TAC) in accordance with the precautionary principle. The WWF noted that the current HCR requires a 10% reduction in TAC, but suggested that the SC recommend a TAC reduction of greater than 10% and that, if possible, the SSC PS should hold additional meetings to reach consensus on stock assessment results next year.

Agenda Item 5. Update from the Joint SC-TCC-COM Small Working Group on Management Strategy Evaluation for Pacific Saury (SWG MSE PS)

90. The co-Chair of the joint SC-TCC-COM Small Working Group on Management Strategy Evaluation for Pacific saury (SWG MSE PS), Dr. Toshihide Kitakado (Japan), informed participants about progress of the SWG MSE PS including the outcomes and recommendations of its 6th meeting (NPFC-2025-SWG MSE PS06-Final Report).

Agenda Item 6. Summary of progress on the remaining three priority species

91. The Leads of the Small Working Groups (SWGs) on Japanese sardine (JS), Japanese flying squid (JFS), and blue mackerel (BM) reported on the SWGs' intersessional activities, including the relevant outcomes of the 1st and 2nd joint virtual meetings of these SWGs in 2025, in the respective sections below (6.1–6.3). Detailed summaries of the joint SWG meetings are available in NPFC-2025-SC10-RP01 (1st meeting) and NPFC-2025-SC10-RP02 (2nd meeting).

6.1 Blue mackerel (BM)

6.1.1 Review of tasks and recommendations

92. The SWG BM Lead, Dr. Kazunari Higashiguchi (Japan), reported on the SWG BM's intersessional activities (NPFC-2025-SC10-IP05). The SWG BM has met twice intersessionally (as part of the joint meetings of the SWGs on JFS, JS, and BM). It updated Members' estimated catch and effort, updated BM length-weight relationship and catch-at-length data, updated the ratio of BM in the total mackerel catch by China and Japan, reviewed China's fishery data and research activities, and updated the species summary.

6.1.2 Observation of domestic stock assessment

93. Japan presented its 2023 domestic stock assessment of BM (NPFC-2025-SC10-IP06). The assessment is conducted using tuned Virtual Population Analysis (VPA) with two abundance indices. The MSY-based reference points were estimated from the stochastic simulation from the Ricker stock-recruitment relationship. Total biomass and SSB have been decreasing since the 2010s. Fishing mortality and exploitation rate are decreasing. SSB was lower than SSB_{MSY} and F was lower than F_{MSY} in 2023.

94. Japan informed the SC that its 2024 domestic stock assessment of BM is currently being finalized.

6.1.3 Review of species summary

95. The SC reviewed the updated species summary document for BM (NPFC-2025-SC10-WP21). The SC endorsed the updated species summary document for BM (https://www.npfc.int/species-summaries).

6.2 Japanese flying squid (JFS)

6.2.1 Review of tasks and recommendations

96. The SWG JFS Lead, Dr. Hajime Matsui (Japan), reported on the SWG JFS' intersessional activities (NPFC-2025-SC10-IP04). The SWG JFS has met twice intersessionally (as part of the joint meetings of the SWGs on JFS, JS, and BM). It updated Members' catch and effort data; evaluated the influence of environmental variables on the life history, biology, and population dynamics of JFS; and updated the species summary.

6.2.2 Observation of domestic stock assessment

97. Japan presented its 2024 domestic stock assessment of JFS (NPFC-2025-COM09-IP05). The estimated total biomass of the winter spawning stock decreased largely from 2015 to 2016 and has remained at a low level since then. The MSY-based reference points were estimated by a stochastic simulation with the Beverton-Holt stock-recruitment relationship. In 2024, the estimated total biomass was 135,000 MT and the estimate of SSB was 57,000 MT. SSB was below SSB_{MSY} and F was below F_{MSY} in 2023.

6.2.3 Review of species summary

98. The SC reviewed the updated species summary document for JFS (NPFC-2025-SC10-WP14). The SC endorsed the updated species summary document for JFS (https://www.npfc.int/species-summaries).

6.3 Japanese sardine (JS)

6.3.1 Review of tasks and recommendations

99. The SWG JS Lead, Dr. Shuya Nakatsuka (Japan), reported on the intersessional activities of the SWG JS. The SWG JS has met twice intersessionally (as part of the joint meetings of the SWGs on JFS, JS, and BM). The SWG JS updated Members' catch and effort data; reviewed China's JS fishery data and research activities; reviewed Japan's domestic stock assessment methodology; discussed approaches for the development of one or more collaborative stock assessment models; evaluated the influence of environmental variables on the life history, biology, and population dynamics of JS; reviewed a draft TOR for a new Small Scientific Committee on Japanese Sardine (SSC JS); and updated the species summary.

100. Dr. Chris Rooper (Canada) informed the SC that he presented a literature review of studies relating environmental conditions to JS in the North Pacific Ocean at the PICES-2025 Annual Meeting. The paper is available as NPFC-2025-SC10-WP11.

6.3.2 Observation of domestic stock assessment

101. Japan presented its domestic stock assessment of JS (NPFC-2025-SC10-IP07). The assessment is conducted using a tuned VPA with ridge penalty. The MSY-based reference points were estimated from a stochastic simulation from the normal-regime stock-recruitment relationship of the hockey stick function. In 2024, estimated total biomass was 4.0 million MT and SSB was 2.7 million MT. SSB in 2024 exceeded SSB_{MSY}. F in 2024 exceeded F_{MSY}.

6.3.3 Review of species summary

102. The SC reviewed the updated species summary document for JS (NPFC-2025-SC10-WP23). The SC endorsed the updated species summary document for JS (https://www.npfc.int/species-summaries).

6.3.4 Potential establishment of a new formal SC subsidiary body to focus on collaborative NPFC stock assessment of JS

103. The SC agreed to establish a new formal SC subsidiary body, SSC JS, to focus on collaborative NPFC stock assessment of JS and that this new SSC JS would supersede the SWG JS.

6.3.5 Draft Terms of Reference for a Small Scientific Committee on Japanese Sardine

104. The SWG JS Lead presented the draft ToR for the established SSC JS (NPFC-2025-SC10-WP09). The SC reviewed and endorsed the ToR (Annex I).

105. The SC agreed to select Dr. Shuya Nakatsuka (Japan) to serve as the Chair of the SSC JS and Dr. Libin Dai (China) to serve as its Vice-Chair.

106. The SC recommended the hiring of an invited expert to support the work by SSC JS to conduct an NPFC stock assessment of JS.

107. The SC requested Members to share relevant data for the conducting of a JS stock assessment using the data templates developed by SWG Data in advance of the first meeting of the SSC JS.

6.4 Review of tasks for SWG JFS, SWG BM, and SWG JS (or SSC JS)

108. The SC developed a table of future tasks for the SWG BM, SWG JFS, and the SSC JS (Annex J).

Agenda Item 7. Climate change effects on NPFC's priority species and associated ecosystems

7.1 Tools for incorporating climate change considerations into scientific advice

109. Pew presented a review of recent progress by selected RFMOs towards climate-informed

governance (NPFC-2025-SC10-OP03). Based on its review, Pew suggested that the NPFC develop a dedicated and more detailed work plan, indicative of timelines, to integrate climate change considerations in NPFC scientific processes and develop climate-informed management approaches for NPFC species; evaluate data requirements for climate-related monitoring as part of ecosystem-based fisheries management (EBFM) implementation; and cooperate with other relevant RFMOs in the Pacific Ocean and intergovernmental scientific organizations regarding climate-ready management approaches, research, and advice for transboundary species whose distribution or migrations are likely to be affected by climate change.

110. The Chair expressed her appreciation for the information presented and suggestions for the NPFC.

7.2 Current knowledge

111. No new information was presented.

7.3 Ongoing research activities

7.3.1 PICES' Basin-scale Events to Coastal Impacts (BECI) project

112. The Science Director of the Basin-scale Events to Coastal Impacts (BECI) project, Dr. Kathryn Berry, provided an overview and an update on the project (NPFC-2025-SC10-OP05). The BECI project is intended to serve as a North Pacific Ocean knowledge network that identifies and collates existing data, research, monitoring, management efforts, and operational tools across the North Pacific, and synthesizes this information into accessible products, such as interactive maps, dynamic dashboards, and collaboration platforms, to support climate-resilient fisheries and conservation decisions. The BECI project can support the NPFC by enhancing access to environmental information, facilitating NPFC's coordination with other RFMOs, providing comprehensive environmental information about migratory species, and support the NPFC with developing and implementing its climate workplan.

113. The SC thanked Dr. Berry for the update on the BECI project and noted the significant progress made to date. The SC noted the potential value of the BECI project for informing the SC's analyses, including those related to climate change, and looked forward to the project's continued development.

114. The Chair encouraged Members, especially the Chairs and Leads of SC's subsidiary bodies, to review the information in the BECI species cards, including with regard to climate change-related impacts, and consider how some of this information could be incorporated into the NPFC's species summaries. She also encouraged Members to explore the BECI website and

consider how its resources could benefit their own work and analyses.

7.4 Detailed work plan to produce climate-resilient scientific advice

115. The SC encouraged the SC subsidiary bodies to incorporate more detailed climate and climate change-related tasks into their work plans. Specifically, the SC tasked the SC subsidiary bodies with considering including in the workplans identification of possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on NPFC fisheries resources (e.g., through meta-analysis and/or review of published papers; analysis of the relationship between key vulnerabilities and changing environmental conditions (e.g., by drawing on BECI data); if feasible, integration of information about how a changing climate affects biological or fisheries-related parameters into analyses used for stock assessments; and recommendation of ways to help adapt to climate change and promote resilience in NPFC fisheries.

116. The SC agreed that as part of its workplan it would consider possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on species belonging to the same ecosystem or dependent upon or associated with target stocks, as well as make recommendations to help adapt to climate change and promote resilience in NPFC fisheries.

7.5 Research priorities and potential scientific projects

117. There were no proposals for additional research priorities or scientific projects.

Agenda Item 8. Data Collection and Management

8.1 Data Management System

8.1.1 Update for NPFC

118. The Data Coordinator, Mr. Sungkuk Kang, reported on the progress in the development of the SC-related data management system (NPFC-2025-SC10-IP01). The Data Coordinator explained updates to the Members Home, Significant dates/Events, Pacific Saury Weekly Report, Chub Mackerel Monthly/Weekly Report, GIS Maps, Collaboration Site, and Annual Reports sections. In addition, the Data Coordinator reported on the ongoing development of an NFS Map for NFS catch and effort data and progress on the Scientific Data Management System Development project.

119. The SC expressed its appreciation to the Secretariat for continuing to update and enhance the NPFC data management system.

120. The SC suggested that the Secretariat explore the possibility to add a layer to the Bottom

Fishing Map to visualize areas closed to bottom fishing and fished areas in the Emperor Seamounts and Cobb Seamount Chain under NPFC CMM 2025-05 and CMM 2025-06, or alternatively, to consider a separate map visualization if integration into the existing map is not feasible.

8.1.2 Data inventory update

121. The Data Coordinator presented an updated data inventory table summarizing information about data submitted by Members (NPFC-2025-SC10-IP03). The Data Coordinator requested Members to review the updated inventory and provide feedback or corrections to the Secretariat for further improvement.

8.1.3 Data submission deadlines for stock assessment analyses

122. The Chair proposed a template prepared by the SWG Data Lead, Ms. Karolina Molla Gazi, for making regular, centralized SC data calls (NPFC-2025-SC10-WP15). A data call is essential to ensure that the SC and its subsidiary bodies have access to the most complete, consistent, and up-to-date information needed to conduct robust stock assessments and provide sound scientific advice to the Commission. Regular and standardized data submissions allow the SC subsidiary bodies to integrate fishery-dependent and fishery-independent information from all Members and CNCPs, assess trends across the Convention Area, and evaluate stock status against agreed reference points. This process not only supports transparency and comparability among datasets but also fulfils Members' data-provision obligations under the relevant NPFC CMMs. A centralized request for data ensures coherence, transparency, and equity in how Members and CNCPs are asked to contribute information. It provides all parties with the same guidance, deadlines, and specifications, reducing the risk of inconsistent interpretations or selective participation. It also helps align the timing of submissions with the scientific and management calendar, ensuring that the SC subsidiary bodies have the necessary inputs well in advance of analyses and meetings.

123. The SC reviewed and adopted the template for SC data calls (Annex K).

124. The SC agreed to work towards operationalizing the use of the template for SC data calls in 2027. The SC tasked each of its subsidiary bodies to identify appropriate data requirements and deadlines, the Chairs of the subsidiary bodies to communicate these data requirements and deadlines to the Secretariat by SC11, and the Secretariat to compile a document with the data requirements and deadlines for all subsidiary bodies and circulate this to Members. The SC agreed to discuss the timing and frequency of data calls as necessary. The SC agreed that the use of the template for SC data calls would not prevent the SC and its subsidiary bodies from conducting more frequent, ad hoc data calls, such as for exploratory analyses.

8.1.4 SWG Data

125. The SWG Data Lead presented the report of SWG Data (NPFC-2025-SC10-WP12). SWG Data met four times in 2025 via WebEx. It advanced the development of the NPFC SC database, including database architecture, user roles, confidentiality provisions, and harmonized templates. The SWG also reviewed the draft CMM on Minimum Data Standards, consolidating feedback from Members. It achieved significant progress on defining data types, developing reference code lists, and outlining implementation steps.

126. The SC endorsed the SWG Data report (Annex L).

127. The SC agreed to adopt the common terminology discussed by the group regarding effort and the definitions of live and gutted weight.

128. The SC agreed to share information regarding the maturity scales and corresponding stages used at a national scale in order to develop the reference code list.

129. The Executive Secretary, Dr. Robert Day, informed the SC that the Secretariat has been updating its data records to ensure the standardized use of the FAO 3-alpha species codes, as was recommended by SWG Data.

130. The SC noted that there is currently no FAO 3-alpha species code for Japanese sardine (*Sardinops melanostictus*) and that the Secretariat has had to classify Japanese sardine under the FAO code for Pacific sardine (*Sardinops sagax*, CHP). The SC agreed that Japanese sardine should have its own FAO 3-alpha species code. The SC requested that the Chair make a formal request to the FAO to assign a species code to Japanese sardine. The SC suggested that the Chair could cite https://doi.org/10.1111/mec.17561, among other studies, as part of the rationale.

8.1.4.1 Establishment of a new database to manage and archive scientific data

131. The SC noted the progress made by SWG Data on establishing a new database to manage and archive scientific data. The SC endorsed the holding of a 4-hour training workshop in January 2026 on the use of the database. The SC noted that, based on the outcomes of the workshop, the next steps would be to develop a full manual on the use of the database and hold a further training workshop.

132. The SC thanked the EU for providing a voluntary contribution to support the development of the SC database.

8.1.4.2 Review of the proposed CMM on Minimum Standards for NPFC Data

133. The SC noted that SWG Data has reviewed the proposed CMM on Minimum Standards for NPFC Data and consolidated feedback from Members (Annex L).

8.1.4.3 Potential renewal of term for SWG Data

134. The SC agreed to extend the SWG Data's term for one more year to finalize the development of the SC database.

8.2 NPFC Data Sharing and Data Security Protocol

135. Japan presented a proposal on the re-publication of catch and fishing effort information in the Annual Summary Footprints on the public domain of the NPFC website (NPFC-2025-SC10-WP13). Japan explained that although all Members submit annual information on catch and fishing effort to the NPFC, these data are currently not publicly available due to restrictions in the NPFC Data Sharing and Data Security Protocol. Japan proposed that annual catch and effort information presented in the Annual Summary Footprint, including annual catch, annual number of vessels, and annual number of fishing days, by Member, species, area, and gear type, be re-published, with values derived from fewer than three vessels masked to ensure compliance with the Protocol. Japan explained that it annually conducts domestic stock assessments for JS and BM and that being able to access and include the annual catch amounts of these two species by Member as input data for the assessments would enhance scientific reliability and reduce uncertainty in total catch information. Furthermore, making annual catch and effort data by species and by Member publicly available is a fundamental element of transparency in RFMOs.

136. The SC agreed that it would be preferable if there were greater transparency around Members' catch and effort data, even if these data are from fewer than three vessels, as this would help facilitate the SC's scientific work, while recognizing that there are legal and other restrictions that may make this difficult.

137. The SC noted that in accordance with the NPFC Data Sharing and Data Security Protocol, catch and effort data made up of observations from fewer than three vessels can be made public at the decision of the data owner. The SC noted that this has enabled the sharing of data for conducting NPFC analyses, including as part of the SSC BF-ME's work.

138. The SC seeks guidance from the Commission on making these data publicly available to enhance its transparency and make the data more accessible for domestic stock assessments.

8.2.1 Revision of Regulations for Management of Scientific Data and Information

139. There were no proposed revisions to the Regulations for Management of Scientific Data and Information.

8.3 Data needs, data gaps and strategies to fill gaps

8.3.1 Information about species belonging to same ecosystem or dependent/associated with target stocks

140. Pew presented a rapid literature review on where operational ecological objectives exist in fisheries policies (NPFC-2025-SC10-OP04). Pew found that the importance of the ecosystem approach to fisheries management (EAFM) and ecosystem-based management (EBM) has been recognized but implementation is highly diverse and plans often lack clear means of operationalization. Conversely, operational measures to tackle biodiversity impacts are often outside a single action-oriented EAFM policy. It is necessary to incorporate ecosystem considerations directly into stock management. For the NPFC, Pew suggested that it review existing CMMs and align them with the FAO EAFM monitoring tool; consider how a process of ecological objective setting could be developed; focus on small pelagic target species, endangered, threatened and protected (ETP) species, and ecosystem structure/function; and explore ways to operationalize ecological objectives.

141. China presented an overview of the 2025 survey by the Chinese fishery research vessel Song Hang in the NPFC Convention Area (NPFC-2025-SC10-WP20). The improved survey program in 2025 continues to cover fisheries resources, larval and juvenile stages of marine species, plankton, and environmental surveys, consistent with previous years. Based on the five-year survey, China is conducting a series of research studies to support the NPFC's stock assessment and management of CM, BM, JS, and NFS. Research areas include biological parameters (such as growth and mortality), standardization of abundance indices, biodiversity, and ecosystem modeling. China will submit the resulting outputs to the specific SWG, TWG, or SSC of each priority species.

142. The SC thanked China for the presentation and encouraged it to continue to conduct this survey in the future. The SC noted that the data collected from the survey and resulting analyses could be very valuable for supporting the SC's scientific work.

143. The SC requested that China present more detailed information about the specifications of the gear used in its survey at the next SC meeting.

Agenda Item 9. Potential roles of a regional observer program

9.1 Scientific objectives of an observer program

144. The SC agreed that, in accordance with the NPFC Convention, Article 10, paragraph 4(b), one of the scientific objectives of an observer program could be to collect more data to support the stock assessments of NPFC's priority species.

9.2 Review and revision of SC responses to five TCC Chair's questions

145. The SC Chair presented the draft responses from the SC to five questions from the TCC Chair regarding the scientific aspects of an NPFC regional observer programme (ROP; NPFC-2025-SC10-WP03). The initial responses were prepared by the Small Working Group on Observer Program (SWG OP) and a summary of the intersessional meeting of the SWG OP is available in NPFC-2025-SC10-RP01. NPFC-2025-SC10-WP03 was drafted intersessionally and the SC reviewed and revised its responses to the questions as well as data types that could be collected as part of an ROP to help improve its stock assessments of priority species (one of the six TCC Chair's questions regarding the scientific aspects of an ROP posed to the SC in 2024).

146. The SC reviewed and revised the draft responses (NPFC-2025-SC10-WP03 (Rev. 2)). The SC requested that the SC Chair forward the responses to the TCC Chair.

147. The FAO noted that many RFMOs do not consistently collect data regarding the discard of bycatch and suggested that this could be improved with an ROP.

148. Japan noted that CMM 2025-05 and CMM 2025-06 For Bottom Fisheries and Protection of VMEs in the NW Pacific Ocean and the NE Pacific Ocean require 100% observer coverage for bottom fisheries, which should provide high confidence that rare events could be detected in these fisheries.

149. Canada suggested that the Commission could provide a requirement in CMMs to report bycatch data to the SC.

150. Pew noted that the current Shark CMM 2024-14 does not obligate fishing vessels to record shark catches at the species level and suggested that the SC should consider what level or granularity of data (i.e., species level reporting) would be useful for ETP species, particularly sharks found in the Convention Area that are also noted in other international agreements such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora and the Convention on Highly Migratory Species.

151. The WWF suggested that the SC should encourage managers to implement e-monitoring (EM) and e-reporting (ER) to collect updated information more promptly for stock assessments and understanding of ecosystem impacts. The WWF noted that observer coverage in the NPFC is lower than in many other RFMOs, particularly tuna RFMOs. The WWF suggested that if it is

difficult for the NPFC to increase human monitoring coverage, it should consider the use of EM and ER, which has been implemented successfully in many tuna RFMOs. The WWF also noted that this would also assist with the collection and reporting of data on bycatch, which occurs frequently in many NPFC fisheries.

152. The EU acknowledged that, depending on the stock assessment model, EM could perhaps collect some information useful for stock assessment, but pointed out that many types of data would still need to be collected by human observers. The EU agreed that EM could be used for collecting information on rare events and ETP species.

153. Chinese Taipei acknowledged the usefulness of EM and ER but pointed out that, other than for bottom fisheries, the NPFC has not established a human ROP so it would be premature to discuss the establishment of EM. Chinese Taipei pointed out that EM is supposed to supplement a human observer programme by collecting data that human observers could not, but the NPFC has not yet agreed on what data human observers could collect.

154. Canada pointed out that while it may not be possible to collect age-structure data with EM alone, Canada has been able to collect such data by combining EM with port sampling. Canada suggested that the NPFC should be open to using EM for the collection of some types of data if it would be faster to implement EM than to establish a human ROP.

155. The United States echoed the comments by Canada and added that although EM has often been used as a tool to replace existing human observer programmes in the past, the NPFC should be open to developing both in parallel and that human observer programmes and EM could be complementary.

156. Pew suggested that when considering the implementation of EM, the SC could first identify the minimum data requirements for its stock assessments and then identify whether human observers or EM would be the best means of collecting those data, taking into account factors such as cost, accuracy, capacity, etc.

157. The DSF Project informed the SC that it is planning to potentially conduct a review of the state of the implementation of EM at other RFMOs, which could inform the SC's discussions on this topic.

9.3 Tool for observers/fishers to distinguish between CM and BM

158. The SC noted that the SWG BM has been tasked with the development of a tool for observers/fishers to distinguish between CM and BM.

9.4 Future intersessional work of SWG Observer Program (SWG OP)

159. The SC noted that there is no future work planned for SWG OP and agreed to disband SWG OP.

Agenda Item 10. Scientific projects for 2026 and 2027

10.1 Ongoing/planned projects

10.2 New projects

10.2.1 Potential project(s) for NPFC priority species

10.2.2 Independent review of stock assessments

10.2.3 Other potential projects – capacity building, cooperation with other organizations

10.3 Review, prioritization and funding of projects

160. The Science Manager presented a draft list of scientific activities and projects that were discussed during the meetings of the SC and its subsidiary bodies (NPFC-2025-SC10-WP04 (Rev. 1)).

161. The SC reviewed and finalized the list of proposed scientific activities and projects (NPFC-2025-SC10-WP04 (Rev. 3)). The SC prioritized and endorsed the list of scientific activities and projects for consideration by the Commission (Annex M).

162. The SC noted that while the SC's increased workload and planned projects have resulted in increased funding requests, the SC has sought to offset these increases through measures such as adopting a new structure and workflow that would make data preparatory meetings virtual and informal by default.

163. The SC acknowledged that holding meetings at the Tokyo University of Marine Science and Technology, where the NPFC headquarters are located, would result in potential cost savings, but noted that this is not always feasible given limited availability for meeting spaces. The SC reiterated its call for Members to consider hosting meetings.

Agenda Item 11. Cooperation with other organizations

11.1 Reports on the joint NPFC-PICES activities since the SC09 meeting, including a report from the PICES Secretariat

164. The Executive Secretary of the North Pacific Marine Science Organization (PICES), Dr. Sonia Batten, reported on recent and upcoming planned joint activities between PICES and NPFC (NPFC-2025-SC10-OP06). Dr. Batten highlighted the development of the second NPFC–PICES Framework for Enhanced Scientific Collaboration in the North Pacific (2025–2029), which retains the three priority areas of the previous framework (support for stock assessment

of priority species, VMEs, ecosystem approach to fisheries), and adds consideration of climate change impacts across priority areas. Recent joint activities include NPFC representation in the PICES-ICES joint Working Group on Small Pelagic Fish (WG43) and its successor-WG on Sustainable Pelagic Forage Communities (WG53), NPFC support for Small Pelagic Fish Symposium (SPF)-2022 Symposium and next years' SPF-2026, involvement and co-Chairing of WG47 on the Ecology of Seamounts by NPFC scientists, establishment of a new WG56 to focus on deep-sea connectivity among seamounts, NPFC endorsement for the BECI project, and NPFC and PICES representation at each other's annual meetings. In addition, PICES underwent an External Review in 2023/24 and has established a new Mission Statement, which it will deliver by engaging with NPFC and other RFMOs.

11.2 SC representation at scientific meetings

11.2.1 Yang Zi SC representation at PICES 2025

165. The Chair explained that the SC had originally selected Ms. Yang Zi (China) to represent the SC at PICES 2025 but that she was not able to travel to attend the meeting due to logistics challenges. Because most sessions were not hybrid, she was not able to participate in them. However, she was able to give her presentation on preliminary projection of distribution shift for Pacific saury in the Northwest Pacific Ocean under climate change, via a recording to Session 4: Responses of Small Pelagic Fish Communities to Recent Climate Regime Shifts and Climate Extremes.

11.2.2 Chris Rooper representation at PICES 2025

166. The Chair explained that as Ms. Yang Zi was unable to attend PICES 2025, Dr. Chris Rooper was selected as an alternative representative of the SC to attend in her place.

167. Dr. Chris Rooper reported on his attendance of the PICES 2025 Annual Meeting. Dr. Rooper highlighted several sessions of relevance to the NPFC, focusing on Session 4: Responses of Small Pelagic Fish Communities to Recent Climate Regime Shifts and Climate Extremes, which he co-convened. During Session 4, in addition to the presentation by Yang Zi, Dr. Rooper also gave his own presentation on a literature review of studies relating environmental conditions to JS in the North Pacific Ocean. Both presentations were the result of joint work conducted by Members at NPFC. Dr. Rooper also highlighted the work of the Joint PICES/ICES WG on Sustainable Pelagic Forage Communities (WG53), which he co-chairs and which Dr. Toshihide Kitakado and Dr. Kazuhiro Oshima, the Chairs of the SSC PS and TWG CMSA, respectively, participate in. Many of WG53's activities are of relevance to the NPFC, particularly work related to changing species distribution, stock assessment and environment, MSE, and economic impacts of climate/environment/fisheries.

11.3 Report on cooperation between NPFC and NPAFC

168. The NPAFC Executive Director, Mr. Yoshikiyo Kondo, reported the updates in the implementation of the NPAFC/NPFC Five-year Work Plan (NPFC-2025-SC10-OP07). The NPAFC and the NPFC have been making progress on core aspects of the Five-year Work Plan. On the exchange of data and information, the two organizations have agreed on a ToR for an NPAFC/NPFC SharePoint in 2025. For the coordination of research activities for enhanced scientific cooperation in the North Pacific Ocean, the NPAFC will contribute to BECI activities with scientific research on salmon. For expanding cooperation to collect and share information relating to species of special interest for each Commission, the NPAFC will hold a Workshop on Interactions between Fisheries and Anadromous Fish in the North Pacific High Seas and a Workshop on Interactions Between Salmon, Ecosystems, and Climate: From Mechanisms to Predictive Models in May 2026, and issue an invitation to the NPFC for the former.

11.4 FAO ABNJ Deep-sea fisheries project

169. Dr. Tony Thompson, the DSF Project (FAO), presented an update on its activities (NPFC-2025-SC10-OP01). Highlights in 2025 include the holding of an EAFM symposium, conservation of deepwater sharks, mapping of deep-sea fisheries, data-limited stock assessments, climate change consultancies, and workshops on the precautionary approach. Planned activities in 2026 include a VME identification methods publication; a precautionary approach publication; an in-person workshop on EAFM, climate change, and the precautionary approach; and the development of data-limited assessment methods. The DSF Project seeks continued support from NPFC to contribute to and review the publication on VME identification by commercial vessels; contribute to and review the publication on the precautionary approach; participate in person at the workshop on EAFM, climate change and the precautionary approach in mid- to late-2026; participate in the data-limited stock assessments methods development; support the deepwater shark work, including guidance on an NPFC Convention Area digital identification key; and support the work on mapping deepwater fisheries.

170. The DSF Project (FAO) discussed the acquisition of spatial data from NPFC to map bottom fisheries in a new format that is compatible with that provided by other RFMOs. The DSF Project (FAO) will draft a letter detailing the new request and forward it to the Executive Secretary for distribution to NPFC Commission Heads of Delegation.

171. The SC welcomed the offer from the DSF Project (FAO) to develop a digital deepwater shark identification guide for the NPFC Convention Area. The SC encouraged the DSF Project (FAO) to give consideration to translating the guide into Members’ languages.

11.4.1 Report from the NPFC Representative at the FAO Workshop on Cross-Sectoral Interactions with Deep-Sea Fisheries

172. The Chair reported on her participation at the Common Oceans Program DSF Project Workshop on Cross-Sectoral Interactions with Deep-Sea Fisheries in Areas Beyond National Jurisdiction. The key topics of discussion were the meaning of the Agreement on Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ Agreement) "not undermining the effectiveness and objectives" of RFMOs and potential interactions between deep-sea mining and deep-sea fishing. As a representative of the NPFC, the Chair emphasized the importance of coordination with NPFC and the value of applying spatial-optimization software for identifying key areas to protect biodiversity while allowing deep-sea fisheries and potentially deep-seas mining in the NPFC Convention Area.

173. Pew noted that the new BBNJ Agreement encourages stronger coordination between fisheries bodies and other relevant sectors. As such, several tuna and general RFMO Secretariats attended the second Preparatory Commission of the BBNJ Agreement to provide additional context of their Conventional mandates, CMMs, and existing ABNJ datasets with respect to marine biodiversity. Pew suggested that the NPFC consider increased engagement with the BBNJ Agreement and contribute submissions, particularly those invited by United Nations Division for Ocean Affairs and the Law of the Sea who is serving as the interim Secretariat.

11.5 Partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)

174. Dr. Rishi Sharma and Mr. Aureliano Gentile (FAO) provided an update on the partnership between the Fisheries Resources Monitoring System (FIRMS) and the NPFC (NPFC-2025-SC10-OP08). The 14th Session of the FIRMS Steering Committee was held and key outcomes include continued strategic expansion of FIRMS, review of the State of Stocks Index (SoSI), continued progress on the development of the Global Record of Stocks and Fisheries (GRSF) and the Global Tuna Atlas (GTA), standardization of reference points, plans to establish a Working Group to develop guidelines for the responsible use of artificial intelligence within FIRMS, and governance matters. NPFC has updated its stocks and fisheries inventory on FIRMS, and has published 10 stock fact sheets and 8 fisheries fact sheets. The NPFC is requested to continue to support the FAO State of World Fisheries and Aquaculture (SOFIA) State of Stocks Index (SoSI) biennial updates using the improved methodology and data flow. The FAO has also published an updated review of the state of world marine fishery resources and is conducting periodic collation of stock-by-stock status.

11.6 Partnership with WCPFC, SPRFMO and ISC

175. No updates were provided.

11.7 Cooperation with other organizations

176. There was no discussion of cooperation with any other organizations.

Agenda Item 12. SC Terms of Reference (TOR) and 2025-2029 Research Plan and Work Plan

12.1 Review of the Scientific Committee TOR

177. The Chair presented a proposal to revise the SC ToR to clarify the process for the selection of the SC Chair and Chairs of SC's subsidiary groups (NPFC-2025-SC10-WP02).

178. The SC reviewed and revised the proposal (NPFC-2025-SC10-WP02 (Rev. 1)). The SC recommended that the Commission adopt the revised SC ToR (Annex N).

12.2 Five-year Research Plan

12.3 Five-year Work Plan

179. The SC reviewed its 2025-2029 Five-Year Rolling Research Plan (NPFC-2025-SC10-WP19) and Work Plan (NPFC-2025-SC10-WP06). The Research Plan and the Work Plan of the SC and its subsidiary bodies are attached as Annex O.

180. Members agreed to share data for scientific activities in accordance with the agreed SC Research Plan and SC Work Plan. The SC tasked the Secretariat to send an official call for data to Members.

12.4 Progress on addressing NPFC PR recommendations for SC

181. The SC noted that it has continued to make progress on addressing the NPFC Performance Review Panel's recommendations.

182. The Executive Secretary reminded the SC that the Commission is exchanging perspectives on the NPFC's progress on addressing the NPFC Performance Review Panel's recommendations through intersessional correspondence and will hold further discussion at the next Commission meeting. He explained that the Commission may provide the SC with a more specific tasking based on those discussions. The Executive Secretary also reported that the Secretariat's analyses indicate that the NPFC is generally making good progress on addressing the recommendations.

Agenda Item 13. Other matters

13.1 Coordination between SC and TCC

183. The Compliance Manager, Ms. Judy Dwyer, provided an update on coordination between the TCC and the SC (NPFC-2025-SC10-IP02). The TCC has been developing a draft port inspection measure and working with the FAO Global Information Exchange System (GIES)

team on data transfer options, discussing the definition and process to establish "historic existing level," preparing for mandatory entry/exit notifications within the NPFC Vessel Monitoring System, processing transshipment data and preparing for the transition away from emailed data forms, having initial discussions toward the development of an ROP, preparing to discuss the TCC-related aspects of the establishment of NPFC data standards, and correcting data collected for several species using incorrect FAO 3-alpha codes.

184. As matters for coordination between the SC and the TCC, the SC requested that the SC Chair/Secretariat forward to the TCC the SC responses to the questions from the TCC Chair about SC's data needs to inform COM decisions on the development of an ROP (NPFC-2025-SC10-WP03 (Rev. 2)).

185. The SC requested Members to present information about their sampling programs for transshipped catch at the relevant SC subsidiary body meetings.

13.2 Other issues

186. During SC discussions there were differing opinions on whether the SC provided "advice" or "information" to the Commission on the status of stocks. In particular this issue was relevant to the 2025 Pacific Saury Stock Assessment, where there was no consensus on the suitability of the existing BSSPM model. The Pacific Saury CMM 2025-08 requests the SSC PS to calculate the annual catch level and apply the interim HCR specified in the CMM. This was done, but it was not clear whether the lack of consensus meant that the application of the interim HCR constituted "advice" or "information." Some Members of the SC request clarity from the Commission on whether the SC can provide "advice" while capturing the majority and minority views of Members consistent with Article 10 (3) of the NPFC Convention.

Agenda Item 14. Advice and recommendations to the Commission

187. Based on the recommendations from its SSCs, the TWG CMSA, and its SWGs, the SC recommends that the Commission:
   (a) Endorse the revised Scientific Committee Terms of Reference (Annex N).
   (b) Endorse the SC's 5-Year Rolling Research and Work Plans (Annex O).
   (c) Endorse the proposed scientific activities and projects (Annex M).
   (d) Endorse Dr. Jie Cao (China) as SC Chair.
   (e) Consider the species summary documents (https://www.npfc.int/species-summaries) and stock status summaries as reference information when taking decisions on the management of the NPFC priority species.
   (f) Consider the scientific meetings schedule for 2026–2027 as described in Annex E.

   SC Structure and Workflow

   (g) Endorse the streamlined SC workflow to respond to the substantial increase of the SC workload and growing budgetary pressure as described in Annex D.

Frequency of Benchmark and Annual Stock Assessments

(h) In general, conduct benchmark stock assessments every 3–5 years and conduct the data update stock assessments annually (see paragraphs 32–35 for details).

Precautionary Approach

(i) Develop a general framework for the application of the PA and conduct this work through a small working group that is established under the Commission, is composed of managers and scientists, and is led by managers.

Chub Mackerel

(j) Endorse the stock assessment report for chub mackerel (Annex H).

(k) Consider the following interim reference levels:

i. 50th percentile of the estimated historical SSB (1970–2023 fishing years)

ii. 70th percentile of the estimated historical SSB (1970–2023 fishing years)

(l) Consider the 25th percentile of estimated historical SSB as an interim limit reference point.

(m) Reduce fishing mortality to recover SSB to the reference levels.

(n) Continue to hire an invited expert to support the TWG CMSA in 2026.

Taskings from the 9th Commission Meeting to the TWG CMSA

(o) Should the Commission wish Task 1 from the Commission to TWG CMSA to be completed, require Members to submit gear specific catch-at-age / catch-at-length data by all Members including accessory devices used for fishing purposes for both the Convention Area and EEZs.

(p) Note that the SC has reviewed the TWG CMSA's responses to the taskings from the Commission and Dr. Kazuhiro Oshima, Chair of TWG CMSA, will submit a working paper to the 10th Commission meeting.

Bottom Fish and Marine Ecosystems

(q) Continue to hire an invited expert to support the work of the SWG NPA-SA.

(r) Endorse the following indicators of trend for NPA:

i. Fisheries-dependent indicators:
   a. Catch
   b. Depletion analysis estimates

ii. Fisheries-independent indicators:
   a. Monitoring survey CPUE
   b. Monitoring survey fatness index

(s) Endorse the following indicators of trend for SA:

i. Fisheries-dependent indicators:
   a. Trawl and gillnet CPUE (standardization in progress)
   b. Depletion analysis estimates

(t) Endorse the following indicators of trend for sablefish:

i. Fisheries-dependent indicators:
    a. CPUE from longline traps

(u) Note that for SA there continues to be a high likelihood that growth overfishing is occurring (harvest before the size that maximizes yield-per-recruit), and that SA are being captured before they are mature, likely reducing the spawning potential.

(v) Note that for NPA, no strong recruitment has been detected in recent years (since 2013), stock status remains low, and harvest rate is likely to be high. Since NPA recruitment has been weak, the SC recommends reducing the harvest rates as much as possible, but the SC recognizes the effort of Japanese fishers to avoid harvest of NPA since 2019.

(w) Note that domestic stock assessments conducted in three regions (Alaska, Canada, and US West Coast) all indicate that the sablefish stock is healthy and not subject to overfishing.

(x) Note that for skilfish, there are currently no assessments available and no current or planned fishing.

Neon Flying Squid

(y) Continue to hire an invited expert in 2026 to support the SSC NFS during its meetings and conduct other work to support the SSC NFS as appropriate.

(z) Endorse the following indicators of trend for NFS:

i. Fisheries-dependent indicators:
    a. Standardized CPUE
    b. Mean size at catch
    c. Total catch

ii. Fisheries-independent indicators:
    a. Abundance index
    b. Size composition
    c. Driftnet survey during summer

Pacific Saury

(aa) Consider the stock assessment report, while noting that one Member did not endorse the stock assessment results (Annex P), and the SC's discussions in summary of Pacific saury stock assessment (paragraphs 81–88).

(bb) Continue to hire an invited expert to support the work of the SSC PS and SWG NSAM by conducting the tasks described in Annex G, NPFC-2025-SSC PS16-Final Report.

Other Priority Species

(cc) Endorse the following indicators of trend for JFS:

i. Fisheries-dependent indicators:
    a. Standardized CPUE from the coastal squid jigging fisheries (Jul-Dec)

(dd) Endorse the following indicators of trend for BM:

i. Fisheries-dependent indicators:
    a. Standardized CPUE from stick-held dip net in Shizuoka prefecture

b. Total catch
c. Nominal CPUE

ii. Fisheries-independent indicators:

a. Egg abundance in East of Miyazaki prefecture

(ee) Endorse the following indicators of trend for JS:

i. Fisheries-independent indicators:

a. Egg abundance in East Japan
b. Acoustic survey in autumn (Sep-Oct) (abundance of age 0 fish)
c. Trawling survey in summer (Jun-Jul) (abundance of age 0 fish)
d. Trawling survey in summer (Jun-Jul) (abundance of age 1 fish)
e. Standardized CPUE from China's summer survey

(ff) Hire an invited expert to support the work by SSC JS to conduct an NPFC stock assessment of JS.

Data Collection and Sharing

(gg) Update the data shared by the SC, TWG CMSA, SSC BF-ME, SSC PS, SSC NFS, and SSC JS in accordance with their Work Plans.

(hh) Further develop the draft CMM on Minimum Data Standards while taking into consideration SWG Data's review of the CMM and Members' consolidated feedback as summarized in the SWG Data report (Annex L).

188. In relation to other tasks for the SC specified in CMMs and the Convention, the SC informs the Commission of the following:

(a) The SC agreed to reinstate the Small Working Group on Milestones, to select Dr. Chris Rooper (Canada) as its Lead, and to request the SWG Milestones Lead to (1) progress the work to develop a standardized template for presenting species status in coordination with the Chairs of the SC and its subsidiary bodies; (2) support Members in further development of the proposal for a formal peer-review process with a detailed description of the process and the potential cost implications; (3) support Members in conducting a review of best practices from other organizations for implementing peer-reviews for stock assessments, and (4) discuss SC subsidiary groups' structure.

Precautionary Approach

(b) The SC agreed to task its subsidiary bodies that do not have stock assessments in place to provide science-based options for operationalizing the PA and agreed to review these options and present them to the Commission (paragraph 56).

Neon Flying Squid

(c) The SC endorsed the updated CPUE standardization protocol for NFS (Annex D, NPFC-2025-SSC NFS02-Final Report).

(d) The SC noted that the SSC NFS intends to conduct a preliminary stock assessment of NFS using Members' standardized CPUEs in 2026.

Pacific Saury

(e) The SC noted the plans of the SWG NSAM to continue developing the Stock Synthesis model.

Other Priority Species

(f) The SC agreed to establish a new SSC JS to supersede the SWG JS and to select Dr. Shuya Nakatsuka (Japan) as the SSC JS Chair and Dr. Libin Dai (China) as its Vice-Chair.

(g) The SC endorsed the Terms of Reference for the SSC JS (Annex I).

Data Collection and Sharing

(h) The SC agreed to adopt the common terminology discussed by the SWG Data regarding effort and the definitions of live and gutted weight.

(i) The SC agreed to share information regarding the maturity scales and corresponding stages used at a national scale in order to develop the reference code list.

(j) The SC endorsed the holding of a 4-hour training workshop in January 2026 on the use of the database.

(k) The SC agreed to extend the term of SWG Data for one more year to finalize the development of the SC database.

(l) The SC seeks guidance from the Commission on making catch and fishing effort information in the Annual Summary Footprints publicly available.

Selection and extension of invited experts

(m) The SC adopted the policy for the selection and extension of invited experts for supporting the Scientific Committee and its expert groups (Annex G).

Climate Change

(n) The SC noted the analyses on climate change effects conducted by Members and Observers.

Cooperation with Other Organizations

(o) The SC reaffirmed its support for the development and implementation of the BECI project, which will provide valuable information for the SC's analyses, including those related to climate change.

189. The SC recommends that the SWG MSE PS invite Dr. Quang Huynh as an invited expert to SWG MSE PS07.

Agenda Item 15. Next meetings of SC and its subsidiary bodies

15.1 Meeting schedule for 2026/2027

15.2 Meeting format and location

190. The SC agreed to forward to the Commission the provisional meeting schedule for the 2026 operational year described in Annex E, subject to further update before COM10.

Agenda Item 16. Selection of SC chairs, vice-chairs and leads

16.1 SC Chair and SC Vice-Chair

191. The SC selected Dr. Jie Cao (China) to serve as the next SC Chair.

192. There were no nominations for a new SC Vice-Chair.

16.2 Chairs, Vice-Chairs, and leads of SC subsidiary bodies

193. The Chairs, Vice-Chairs, and leads of the SC subsidiary bodies are as follows:
   (a) SSC BF-ME
      i. Chair: Chris Rooper (Canada)
      ii. Vice-Chair: Kota Sawada (Japan)
   (b) SSC PS
      i. Chair: Toshihide Kitakado (Japan)
      ii. Vice-Chair: Libin Dai (China)
   (c) SSC JS
      i. Chair: Shuya Nakatsuka (Japan)
      ii. Vice-Chair: Libin Dai (China)
   (d) SSC NFS
      i. Chair: Luoliang Xu (China)
      ii. Vice-Chair: Bungo Nishizawa (Japan)
   (e) TWG CMSA
      i. Chair: Kazuhiro Oshima (Japan)
      ii. Vice-Chair: Qiuyun Ma (China)
   (f) SWG BM
      i. Lead: Kazunari Higashiguchi (Japan)
   (g) SWG JFS
      i. Lead: Hajime Matsui (Japan)
   (h) SWG Data
      i. Lead: Karolina Molla Gazi (EU)
   (i) SWG Milestones
      i. Lead: Chris Rooper (Canada)

Agenda Item 17. Press release

194. The SC endorsed the press release for publication on the NPFC website after the meeting (NPFC-2025-SC10-IP08 (Rev. 1)).

Agenda Item 18. Adoption of Meeting Report

195. The report was adopted by consensus.

Agenda Item 19. Close of the Meeting

196. The SC expressed its gratitude and appreciation to the outgoing Chair, Dr. Janelle Curtis, for her hard work, warm leadership, and many years of service to the NPFC.

197. The Chair extended her heartfelt thanks to Japan for hosting the meetings, the Secretariat for organizing the meetings, and the participants for their constructive contributions.

198. The meeting closed at 17:20 on 19 December 2025, Nagoya time.

LIST OF ANNEXES

Annex A – Agenda
Annex B – List of Documents
Annex C – List of Participants
Annex D – Streamlined workflow of the Scientific Committee
Annex E – Provisional meeting schedule for 2026-2027
Annex F – Guidelines for Scientific Committee's Small Working Groups
Annex G – Policy for the selection and extension of invited experts for supporting the Scientific Committee and its subsidiary groups
Annex H – Stock assessment report for chub mackerel
Annex I – Terms of Reference for the Small Scientific Committee on Japanese Sardine (SSC JS)
Annex J – Tasks for the SSC JS, SWG JFS, and SWG BM the from SC10
Annex K – Template for SC data calls
Annex L – Report of the Small Working Group on Data (SWG Data)
Annex M – Scientific activities and projects in 2026
Annex N – Revised Terms of Reference for the Scientific Committee
Annex O – Five-Year Research Plan and Work Plan of the Scientific Committee
Annex P – Stock assessment report for Pacific saury

Annex A:

Agenda

Agenda Item 1. Opening of the Meeting

- 1.1 Welcome address and introductions
- 1.2 Appointment of rapporteur
- 1.3 Meeting arrangements

Agenda Item 2. Adoption of agenda

Agenda Item 3. Provision of advice to the Commission

- 3.1 Structure and content of the SC reports
  - 3.1.1 Summary of stock assessments
  - 3.1.2 Species status templates
  - 3.1.3 Species summary documents
- 3.2 SC workflow and meetings
  - 3.2.1 Review of SC workflow
  - 3.2.2 Meeting schedule for SC and its subsidiary groups
  - 3.2.3 Review of guidelines for SC SWGs
- 3.3 Standards of 'best available science' (PR Recommendation 3.4.1)
- 3.4 Frequency of benchmark and annual stock assessments
- 3.5 Fisheries-dependent and fisheries-independent indicators of trend for stocks without NPFC stock assessments
- 3.6 Process for selection of external experts and contract renewal
- 3.7 Independent reviews of scientific advice (PR Recommendation 3.4.2.)
- 3.8 Advice on science-based management options for operationalizing the precautionary approach (PR Recommendation 4.1.2)
  - 3.8.1 Summary of NPFC workshop on "Science-based management options available for operationalizing the precautionary approach as outlined in the Convention for NPFC priority species"
  - 3.8.2 Science-based management options for NPFC

Agenda Item 4. Review of stock assessments, reports, and recommendations from the Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA) and the Small Scientific Committees (SSC BF-ME, SSC NFS, and SSC PS)

- 4.1 Technical Working Group on Chub Mackerel Stock Assessment
  - 4.1.1 Summary of TWG CMSA activities, tasks, and recommendations
  - 4.1.2 Summary of CM stock assessment
- 4.2 Small Scientific Committee on Bottom Fish and Marine Ecosystems

4.2.1 Summary of SSC BF-ME activities, tasks, and recommendations

4.2.2 Summary of stock assessments for bottom fish

4.3 Small Scientific Committee on Neon Flying Squid

4.3.1 Summary of SSC NFS activities, tasks, and recommendations

4.3.2 Summary of NFS stock assessment

4.4 Small Scientific Committee on Pacific Saury

4.4.1 Summary of SSC PS activities, tasks, and recommendations

4.4.2 Summary of PS stock assessment

Agenda Item 5. Update from the Joint SC-TCC-COM Small Working Group on Management Strategy Evaluation for Pacific Saury (SWG MSE PS)

Agenda Item 6. Summary of progress on the remaining three priority species

6.1 Blue mackerel (BM)

6.1.1 Review of tasks and recommendations

6.1.2 Observation of domestic stock assessment

6.1.3 Review of species summary

6.2 Japanese flying squid (JFS)

6.2.1 Review of tasks and recommendations

6.2.2 Observation of domestic stock assessment

6.2.3 Review of species summary

6.3 Japanese sardine (JS)

6.3.1 Review of tasks and recommendations

6.3.2 Observation of domestic stock assessment

6.3.3 Review of species summary

6.3.4 Potential establishment of a new formal SC subsidiary body to focus on collaborative NPFC stock assessment of JS

6.3.5 Draft Terms of Reference for a Small Scientific Committee on Japanese Sardine

6.4 Review of tasks for SWG JFS, SWG BM, and SWG JS (or SSC JS)

Agenda Item 7. Climate change effects on NPFC's priority species and associated ecosystems

7.1 Tools for incorporating climate change considerations into scientific advice

7.2 Current knowledge

7.3 Ongoing research activities

7.3.1 PICES' Basin-scale Events to Coastal Impacts (BECI) project

7.4 Detailed work plan to produce climate-resilient scientific advice

7.5 Research priorities and potential scientific projects

Agenda Item 8. Data Collection and Management

8.1 Data Management System

8.1.1 Update for NPFC

8.1.2 Data inventory update

8.1.3 Data submission deadlines for stock assessment analyses

8.1.4 SWG Data

8.1.4.1 Establishment of a new database to manage and archive scientific data

8.1.4.2 Review of the proposed CMM on Minimum Standards for NPFC Data

8.1.4.3 Potential renewal of term for SWG Data

8.2 NPFC Data Sharing and Data Security Protocol

8.2.1 Revision of Regulations for Management of Scientific Data and Information

8.3 Data needs, data gaps and strategies to fill gaps

8.3.1 Information about species belonging to same ecosystem or dependent/associated with target stocks

Agenda Item 9. Potential roles of a regional observer program

9.1 Scientific objectives of an observer program

9.2 Review and revision of SC responses to five TCC questions

9.3 Tool for observers/fishers to distinguish between CM and BM

9.4 Future intersessional work of SWG Observer Program (SWG OP)

Agenda Item 10. Scientific projects for 2026 and 2027

10.1 Ongoing/planned projects

10.2 New projects

10.2.1 Potential project(s) for NPFC priority species

10.2.2 Independent review of stock assessments

10.2.3 Other potential projects – capacity building, cooperation with other organizations

10.3 Review, prioritization and funding of projects

Agenda Item 11. Cooperation with other organizations

11.1 Reports on the joint NPFC-PICES activities since the SC09 meeting, including a report from the PICES Secretariat

11.2 SC representation at scientific meetings

11.2.1 Yang Zi SC representation at PICES 2025

11.2.2 Chris Rooper representation at PICES 2025

11.3 Report on cooperation between NPFC and NPAFC

11.4 FAO ABNJ Deep-sea fisheries project

11.4.1 Report from the NPFC Representative at the FAO Workshop on Cross-Sectoral Interactions with Deep-Sea Fisheries

11.5 Partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)
11.6 Partnership with WCPFC, SPRFMO and ISC
11.7 Cooperation with other organizations

Agenda Item 12. SC Terms of Reference (TOR) and 2025-2029 Research Plan and Work Plan
12.1 Review of the Scientific Committee TOR
12.2 Five-year Research Plan
12.3 Five-year Work Plan
12.4 Progress on addressing NPFC PR recommendations for SC

Agenda Item 13. Other matters
13.1 Coordination between SC and TCC
13.2 Other issues

Agenda Item 14. Advice and recommendations to the Commission

Agenda Item 15. Next meetings of SC and its subsidiary bodies
15.1 Meeting schedule for 2026/2027
15.2 Meeting format and location

Agenda Item 16. Selection of SC chairs, vice-chairs and leads
16.1 SC Chair and SC Vice-Chair
16.2 Chairs, Vice-Chairs, and leads of SC subsidiary bodies

Agenda Item 17. Press release

Agenda Item 18. Adoption of the Report

Agenda Item 19. Close of the Meeting

Annex B:

List of documents

MEETING INFORMATION PAPERS

Number	Title
NPFC-2025-SC10-MIP01(Rev1)	Meeting Information
NPFC-2025-SC10-MIP02	Provisional Agenda
NPFC-2025-SC10-MIP03	Annotated Indicative Schedule

WORKING PAPERS

Number	Title
NPFC-2025-SC10-WP01 (Rev. 5)	SC meeting schedule 2026-2027
NPFC-2025-SC10-WP02 (Rev. 1)	Revised Terms of Reference for the Scientific Committee
NPFC-2025-SC10-WP03 (Rev. 2)	NPFC At-Sea Regional Observer Program: potential scientific components
NPFC-2025-SC10-WP04 (Rev. 2)	Scientific activities and projects in 2026
NPFC-2025-SC10-WP05 (Rev. 2)	Policy for the selection and extension of invited experts for supporting the Scientific Committee and its expert groups
NPFC-2025-SC10-WP06 (Rev. 1)	Five-Year Work Plan of the Scientific Committee
NPFC-2025-SC10-WP07 (Rev. 2)	Review of the Scientific Committee structure and workflow
NPFC-2025-SC10-WP08 (Rev. 1)	Guidelines for Scientific Committee’s Small Working Groups
NPFC-2025-SC10-WP09	Terms of Reference for the Small Scientific Committee on Japanese Sardine (SSC JS)
NPFC-2025-SC10-WP10	Stock assessment report for chub mackerel
NPFC-2025-SC10-WP11	A literature review of studies relating environmental conditions to Japanese Sardine (*Sardinops melanosticta*) in the North Pacific Ocean
NPFC-2025-SC10-WP12	Final report of the Small Working Group on Data (SWG Data)
NPFC-2025-SC10-WP13	Proposal on Re-publication of Catch and Fishing Effort Information in the Annual Summary Footprints
NPFC-2025-SC10-WP14	Species summary for Japanese flying squid
NPFC-2025-SC10-WP15	Scientific Committee Data Call – 202X
NPFC-2025-SC10-WP16	China proposal for a resolution on the best available science
NPFC-2025-SC10-WP17	Proposal to Establish a Formal Peer-Review

	Process for Stock Assessments
NPFC-2025-SC10-WP18	Proposal for Terms of Reference for the external peer review of NPFC stock assessment
NPFC-2025-SC10-WP19	Scientific Committee 2025-2029 Research Plan
NPFC-2025-SC10-WP20	An overview of 2025 Chinese survey by fishery research vessel "Song Hang" in the NPFC convention area
NPFC-2025-SC10-WP21	Species summary for blue mackerel
NPFC-2025-SC10-WP22 (Rev. 2)	Response to Tasks from COM9 to TWG CMSA
NPFC-2025-SC10-WP23	Species summary for Japanese sardine

INFORMATION PAPERS

Number	Title
NPFC-2025-SC10-IP01	NPFC Data Management Systems: Progress and Operational Guidelines
NPFC-2025-SC10-IP02	TCC Update to SC10
NPFC-2025-SC10-IP03	Updated Data Inventory Table
NPFC-2025-SC10-IP04	Summary of progress on JFS
NPFC-2025-SC10-IP05	Summary of progress on BM
NPFC-2025-SC10-IP06	Observation of Domestic Stock Assessment of Blue Mackerel in Japan in 2023 FY (July-June)
NPFC-2025-SC10-IP07	Observation of Domestic Stock Assessment of Japanese Sardine in Japan in 2024 FY (January-December)
NPFC-2025-SC10-IP08 (Rev. 1)	SC10 Press Release
NPFC-2025-COM09-IP05	Japanese Flying Squid Stock Assessment

OBSERVER PAPERS

Number	Title
NPFC-2025-SC10-OP01 (Rev. 1)	FAO Deep-sea Fisheries (DSF) Project – Overview of activities 2025-2026
NPFC-2025-SC10-OP02	Review of the pelagic sharks known or likely to occur in the Convention Area of the North Pacific Fisheries Commission
NPFC-2025-SC10-OP03	An Overview of Recent Progress by Selected RFMOs Towards Climate-Informed Governance
NPFC-2025-SC10-OP04	Ecological Objectives in Fisheries Management
NPFC-2025-SSC BFME06-OP04, 05 & 06	Observer papers from the Deep Sea Conservation Coalition
NPFC-2025-SC10-OP05	Basin-Scale Events & Coastal Impacts Project - BECI North Pacific Ocean Knowledge Network
NPFC-2025-SC10-OP06	PICES-NPFC Cooperation

NPFC-2025-SC10-OP07	NPAFC-NPFC cooperation
NPFC-2025-SC10-OP08	Status of the NPFC – FIRMS partnership

REFERENCE DOCUMENTS

Number	Title
NPFC-2025-SC10-RP01	SWG Observer Program 2025-01 meeting summary
NPFC-2025-SC10-RP02	Summary of the 1st joint meeting of the Small Working Groups on JFS, JS, and BM
NPFC-2025-SC10-RP03	Summary of the 2nd joint meeting of the Small Working Groups on JFS, JS, and BM
NPFC-2025-SC10-RP04	Summary of NPFC workshop on "Science-based management options available for operationalizing the precautionary approach as outlined in the Convention for NPFC priority species"

REPORTS

Number	Title
NPFC-2025-TWG CMSA10-Final Report NPFC-2025-TWG CMSA11-Final Report	TWG CMSA10&11 meeting reports
NPFC-2025-SSC NFS02-Final Report	SSC NFS02 meeting report
NPFC-2025-SSC PS15-Final Report	SSC PS15 meeting report
NPFC-2025-SSC PS16-Final Report	SSC PS16 meeting report
NPFC-2025-SSC BFME06-Final Report	SSC BFME06 meeting report
NPFC-2025-SWG MSE PS06-Final Report	SWG MSE PS06 report
	Draft NPFC Performance Review template with comments from Members

Annex C:

List of participants

CHAIR

Janelle CURTIS
Janelle.Curtis@dfo-mpo.gc.ca

CANADA

Chris ROOPER
chris.rooper@dfo-mpo.gc.ca

Susanna FULLER *
susannafuller@oceansnorth.ca

Mackenzie MAZUR *
mackenzie.mazur@dfo-mpo.gc.ca

CHINA

Libin DAI
libin.dai@qq.com

Qiuyun MA
qyma@shou.edu.cn

Jie CAO
jcao22@ncsu.edu

Luoliang XU
luoliang.xu@maine.edu

Yufei ZHOU *
787715502@qq.com

Zhengyang JIANG *
Jungle_jiang@189.cn

Yi SHANG *
sy1138674288@163.com

EUROPEAN UNION

Karolina MOLLA GAZI
karolina.mollagazi@wur.nl

JAPAN

Kazuhiro OSHIMA
oshima_kazuhiro28@fra.go.jp

Shuya NAKATSUKA
nakatsuka_shuya49@fra.go.jp

Naohiko AKIMOTO
naohiko@sol.dti.ne.jp

Satoi ARAI
arai_satoi36@fra.go.jp

Koji BATORI*
koji_batori820@maff.go.jp

So FUKAZAWA*
so_fukazawa330@maff.go.jp

Takumi FUKUDA*
takumi_fukuda720@maff.go.jp

Midori HASHIMOTO
hashimoto_midori91@fra.go.jp

Kazunari HIGASHIGUCHI
higashiguchi_kazunari34@fra.go.jp

Yuga KISARA*
kisara_yuga83@fra.go.jp

Toshihide KITAKADO
kitakado@kaiyodai.ac.jp

Hiroshi KUBOTA*
kubota_hiroshi89@fra.go.jp

Akihiro MANABE
manabe_akihiro97@fra.go.jp

Hajime MATSUI
matsui_hajime90@fra.go.jp

Shingo MINAMIKAWA*
minamikawa_shingo69@fra.go.jp

Shin-Ichiro NAKAYAMA*
nakayama_shinichiro16@fra.go.jp

Hiroshi NISHIDA
nishida_hiroshi55@fra.go.jp

Shota NISHIJIMA*
nishijima_shota02@fra.go.jp

Bungo NISHIZAWA
nishizawa_bungo05@fra.go.jp

Suguru OKAMOTO*
okamoto_suguru05@fra.go.jp

Ryotaro OKAZAKI
ryotaro_okazaki770@maff.go.jp

Takehiro OKUDA*
okuda_takehiro83@fra.go.jp

Yumiko OSAWA
oosawa_yumiko93@fra.go.jp

Kota SAWADA
sawada_kota27@fra.go.jp

Haruo TOMINAGA
haruo_tominaga170@maff.go.jp

Yuuho YAMASHITA*
yamashita_yuuho23@fra.go.jp

KOREA
Jeongseok PARK
jeongseokpark@korea.kr

Hyejin SONG
hyejinsong@korea.kr

Eunhee KIM
eunhee.kim@cori.re.kr

RUSSIA
Oleg KATUGIN
oleg.katugin@tinro.vniro.ru

Igor CHERNIENKO *
igor.chernienko@tinro.vniro.ru

Vladimir KULIK *
vladimir.kulik@tinro.vniro.ru

CHINESE TAIPEI
Shih-Chi HUANG
shihchi1030@ms1.fa.gov.tw

Yi-Jay CHANG
yjchang@ntu.edu.tw

Wen-Bin HUANG
bruce@gms.ndhu.edu.tw

Tung-hsieh CHIANG
chiangdon@ofdc.org.tw

Kevin Pranata GINTING
811254007@gms.ndhu.edu.tw

Wei-Yang LIU
weiyang@ofdc.org.tw

Chiao-Chih SHIH
hennessy@squid.org.tw

Chih-Yi CHENG *
chihyi910504@gmail.com

UNITED STATES
Erin BOHABOY
erin.bohaboy@noaa.gov

Donald KOBAYASHI
donald.kobayashi@noaa.gov

Alisha FALBERG *
alisha.falberg@noaa.gov

Jon BRODZIAK *
jon.brodziak@noaa.gov

VANUATU
Rocky KAKU *
rky.kaku@gmail.com

OBSERVERS

Deep Sea Conservation Coalition (DSCC)
Matthew GIANNI *
matthewgianni@gmail.com

Amy BACO-TAYLOR *
abacotaylor@fsu.edu

Bronwen GOLDER *
bronwen@savethehighseas.org

Food and Agriculture Organization (FAO)
Anthony THOMPSON
Anthony.Thompson@fao.org

Aureliano GENTILE *
Aureliano.Gentile@fao.org

Eszter HIDAS *
eszter.hidas@fao.org

Rishi SHARMA*
Rishi.Sharma@fao.org

Marine Stewardship Council (MSC)
Sayuri ICHIKAWA *
sayuri.Ichikawa@msc.org

Asami TAKAHASHI *
asami.takahashi@msc.org

North Pacific Anadromous Fish Commission (NPAFC)
Yoshikiyo KONDO *
ykondo@npafc.org

North Pacific Marine Science Organization (PICES)
Sonia BATTEN *
sonia.batten@pices.int

Kathryn BERRY
kathryn.berry@pices.int

Ocean Governance Institute (OGI)
Mari KOYANO *
marichan@fc4.so-net.ne.jp

The Pew Charitable Trusts
Raiana MCKINNEY
rmckinney@pewtrusts.org

Brittany CROLL *
bcroll@pewtrusts.org

Gunther ERRHALT
errhalt.consulting@gmail.com

Ingrid BANSHCHIKOVA *
ibanshchikova@pewtrusts.org

Emily KLEIN *
eklein@pewtrusts.org

Ellen WARD *
eward@pewtrusts.org

Ashley WILSON *
awilson@pewtrusts.org

World Wildlife Fund
Shuhei UEMATSU
uematsu@wwf.or.jp

Kyoko OKUYAMA
kyoko.okuyama@wwf.or.jp

RAPPORTEUR
Alex MEYER
meyer@urbanconnections.jp

NPFC SECRETARIAT
Robert DAY
rday@npfc.int

Alex ZAVOLOKIN
azavolokin@npfc.int

Judy DWYER *
jdwyer@npfc.int

Yuko YOSHIMURA-TAKAMIYA
ytakamiya@npfc.int

Sungkuk KANG
skang@npfc.int

Junpei HINATA *
jhinata@npfc.int

* Online participants

Annex D:
Streamlined workflow of the Scientific Committee

SC10 reviewed and streamlined the SC workflow to respond to the substantial increase of the workload and growing budgetary pressure (Table 1). See NPFC-2025-SC10-WP07 (Rev. 2) for details.

Table 1: SC workflow. Red text shows the changes in the workflow agreed at SC10

Stage of work	Preparation			Formalization	Formalization	
Area of work: **(1) Assessments (stocks, VME and SAI)**	Inputs: data, indices, biological information	Methods: SA models, other methods	Assessment, review of results, improvement	Final review Finalization: scientific advice, recommendations, SA reports, species summaries, revised CMMs/TOR/Protocols etc	SC review and endorsement: *scientific advice, projects and funding proposals to COM *directions to expert groups	COM: review and decision, directions to SC
(2) General / supplementary	Fisheries overview, research activities (new models/methods, climate change impact, etc)				SC policies, cooperation with other organizations, etc	
Responsible expert group/body	Relevant expert groups (SSC, TWG, SWG)			SSC, TWG	SC	COM
Meeting type	Informal, including data preparatory meetings			One formal "stock assessment" meeting to formalize recommendations	Formal	Formal
Funding	Not needed (or Members' voluntary/in-kind contributions)			From NPFC	From NPFC	From NPFC
Report and rapporteur	Meeting summary (for tracking progress); *Chair manages workflow *Members provide presentations and/or informal meeting papers *Secretariat drafts a meeting summary with support from the Chair and/or an invited expert			Meeting report; NPFC contracts a rapporteur (one meeting per year for each SSC/TWG)	Meeting report; NPFC contracts a rapporteur	
Meeting documents	*Informal meeting documents for Members only (and observers if authorized) *Meeting agenda and summary to be posted on the website; *For SWGs, ppt slides, meeting papers and data for exploratory analyses to be uploaded on the Collaboration site; For SSC/TWG, meeting documents shall be posted on the website *Document upload: 2 weeks before meeting *SC database for the submission and dissemination of data used for routine/recurring assessments			Meeting documents and reports are posted on the public domain of the website (except confidential/sensitive documents) *Document submission: 2 weeks before meeting for SSCs and TWGs	Meeting documents and reports are posted on the public domain of the website (except confidential/sensitive documents)	
Leadership	*Chair and vice-Chair are selected by expert group (SSC, TWG, SWG). Approval by SC/COM is not required *No limits on Chair's and vice-Chair's terms			*Chair and vice-Chair are selected by expert group (SSC, TWG). Approval by SC/COM is not required *No limits on Chair's and vice-Chair's terms	*Chair and vice-Chair selected by SC require approval by COM *Vice-Chair assumes Chair's position if Chair is unable to fulfil his/her functions *Chair serves not more than 3 terms	

1. Separate preparatory work from the formalization of recommendations and scientific advice by turning the status of data preparatory meetings from formal to informal.
2. Hold one formal meeting of each SSC and TWG per year for formalizing scientific advice.

3. Fund formal meetings including SC's annual session by the NPFC, unless Members volunteer to host and sponsor them. Informal meetings should be virtual by default but may be organized in a hybrid format if funded by Members (e.g. through their voluntary contributions (e.g. SWG NSAM hybrid meetings in 2024 and 2025)).
4. Task the Science Manager to draft meeting summaries for data preparatory meetings, subject to nonmonetary compensation in line with Staff Regulation 3.2. The Secretariat shall continue to post on the NPFC website meeting documents submitted to SSCs/TWG's informal data preparatory meetings.
5. Task the Science Manager to post agendas and summaries of informal meetings on the website (available to Members, CNCP, invited experts and authorized observers only).
6. Use the new SC database for the submission and dissemination of data shared for routine/recurring assessments.
7. Shorten the deadline for document submission to meetings of SSCs, TWG and SWGs from one month to two weeks.

Table 2 differentiates formal and informal SC meetings.

Table 2: Two types of NPFC SC meetings

	Formal meeting	Informal meeting
Purpose	Formalize agreements, endorse assessments, make recommendations	Facilitate intersessional work, prepare for formal meetings
Approval by COM	Yes	No
Funding for meeting costs	NPFC (and maybe Host Member)	Not needed if virtual, Host Member if hybrid/in-person
Meeting format	In-person/hybrid by default (but maybe virtual)	Virtual by default (hybrid if funding from Members is available)
Agenda (draft/final)	90/60 days before meeting; Review by COM (NPFC Doc Policy)	30 days before meeting
Rapporteur	Contractor	Secretariat (with support from Chair and, if needed, invited expert)
Meeting records	Meeting report: Adopted during meeting, Reviewed by COM, Posted on public domain	Meeting summary: Drafted after meeting, Reviewed by Chair&participants, Posted on Members' domain after meeting and submitted to SSC/TWG as a Reference Paper
Meeting documents	1 month before SC meeting, 2 weeks before SSC/TWG meeting, Posted on the public domain (NPFC Document Policy)	2 weeks before meeting, SSC/TWG data preparation documents: posted on the public domain (NPFC Document Policy), SWG documents: uploaded on the Collaboration site (ppt slides and informal/draft meeting papers)

Annex E:

Provisional meeting schedule for 2026-2027

Year	Date	Meeting	Format	# days	Location
2026	Apr 8-17	TCC09 / FAC08 / COM10	hybrid		Osaka, Japan
	Feb 3-4	SWG MSE PS07	virtual	2	
	Mar 4-6	SSC NFS03 (data preparation)	virtual	3	
	Jul 27-29 Mon-Wed	SSC JS01 (kick-off meeting)	hybrid	3	Tokyo, Japan
	Jul 30-Aug 1 Thu-Sat	SSC NFS04 (stock assessment)	hybrid	3	Tokyo, Japan
	Early Nov	TWG CMSA12 (data preparation)	virtual	2-3	
	Dec 15-17	SSC PS17 (data preparation)	virtual	3	
	Oct-Dec?	SSC JS02 *	virtual	3-4	
2027	Jan 11-14 Mon-Thu	TWG CMSA13 (stock assessment)	hybrid	4	TBD
	Jan 15-17 Fri-Sun	SSC BFME07 (stock assessment and VME)	hybrid	2.5	TBD
	Jan 18-21 Mon-Thu**	SSC PS18 (stock assessment)	hybrid	3.5	TBD
	Jan 22-25 Fri-Mon	SC11	hybrid	4	TBD
	Feb-Mar	SWG MSE PS08	virtual?	2	
	Apr 6-15	TCC10 / FAC09/ COM11	hybrid		Fukuoka, Japan

* If needed

** A day off may be added in case the Secretariat has to move meetings to another venue

Annex F:

Guidelines for Scientific Committee's Small Working Groups

(December 2025)

Context:

The Scientific Committee (SC) and its standing subsidiary bodies currently have 8 informal Small Working Groups (SWG) to intersessionally address specific tasks identified in the SC Work Plan and the List of Scientific Activities and Projects. All these SWGs hold periodic virtual meetings. NPFC regulations are silent about rules and procedures for such informal meetings. This document lays out the guidelines for SC's SWGs. It is a living document and will be revised, when necessary, by SWGs or their parent SSC/TWG and SC.

Purpose:

The purpose of SC SWGs is to facilitate intersessional work of the SC, SSCs and TWGs and support the SC in the implementation of its Work Plan.

Functions:

a) Providing a forum for the exchange of information and expertise and for collaboration on the development of agreed work plan deliverables;
b) Providing a forum to monitor and assess progress specific to work plan items;
c) Reporting to the SC/SSC/TWG the status of work plan deliverables, including advising on any possible recommendations.

Structure:

Membership in each of the SWGs is to include Commission Members and invited experts. Observers may generally participate in SC SWG meetings subject to Rule 9 of the Commission's Rules of Procedure. Participating observers may not disclose information from SC SWG meetings or associated documentation, as per Rule 9.7, including data and information as per the Regulations for Management of Scientific Data and Information. Should a Member object to an accredited observer's participation in a SC SWG meeting, that Member must submit a rationale to the Secretariat, to be distributed to Members, at least 14 days before the SWG meeting in question. A simple majority of Members must concur, through email correspondence, with the exclusion of an accredited observer from the SWG meeting at least 7 days prior to the meeting, otherwise the observer may attend.

Each SWG will be managed by a Lead. The Lead, supported by the Science Manager, will be responsible for developing meeting agendas, chairing meetings and liaising with its parent SC/SSC/TWG Chair when required.

The SWG Lead will:

- Develop the meeting agenda in consultation with Members;

- Lead SWG meetings and finalize summaries of the meetings;
- Foster constructive and active dialogue at SWG meetings;
- Coordinate the development of specific deliverables identified in the SC work plan and regularly report on their status to the parent SC/SSC/TWG Chair;
- Upload ppt slides used to facilitate the meeting and relevant documentation on the Collaboration site;
- Liaise with the parent SC/SSC/TWG Chair as appropriate to enhance the quality of SWG activities; and
- Report the outcomes of SWG's intersessional meetings to a parent SSC, TWG or SC.

The NPFC Science Manager will:
- Coordinate SWG meeting schedules;
- Schedule SWG meetings and participate in their proceedings;
- Compile, in consultation with Lead, Member input into the draft agenda and post it on the website;
- Support the preparation of meeting documents with the SWG Lead;
- Provide a rapporteur function at meetings, draft a meeting summary, distribute it to Members and upload it on the website;
- Provide technical advice, where appropriate, on scientific matters specific to deliverables;
- Monitor and document the status of all SWG deliverables;
- Ensure information is shared between the SWGs/TWG/SSCs/SC to support integrated planning and achievement of overall SC work plan objectives; and,
- Liaise and share information with relevant NPFC working bodies.

SWG Members will:
- Prepare for and participate in the meetings of the SWGs;
- Upload their ppt slides and/or meeting papers on the Collaboration site;
- Provide input into the content, design and preparations of SWG work plan deliverables; and,
- Liaise, where required, with other SWGs and NPFC subsidiary bodies in support of implementing the SC integrated work plan.

Meetings

SWGs will meet as determined by the SWG Lead. In the interest of accommodating participation in different time zones, SWG meetings will be held at a consistent time agreed upon by the SWG.

Recommendations

The SC SWGs are not expected to give formal recommendations to the SC or its standing subsidiary bodies. However, advice of the SWGs to the SC/SSC/TWG will be agreed by consensus as needed. Where consensus is not possible at the working level, differences in opinion will be reported to the SC/SSC/TWG.

Meeting records

After each SWG meeting, the Science Manager will draft a concise summary of the work of the SWG. Draft summaries will be circulated by the Science Manager to the SWG Members within one week of the SWG meeting. Members will have one week to review and comment on the draft meeting summary. Thereafter, the Science Manager, in consultation with the SWG Lead, will finalize the summary and circulate it to Members.

Meeting papers are treated as informal documents and shall not be released to the public website. The meeting summary will be posted after the meeting on the website, under Meeting, and shall be available to Members and accredited observers only. The meeting summary will then be submitted to a parent formal SSC/TWG/SC meeting as a reference paper posted on the public domain.

Work environment

Meeting papers and ppt presentations are to be posted on the Collaboration website. Intersessional discussions and scientific activities agreed upon at the SWG meetings may be done by email correspondence or through the Collaboration website, with designated groups. Access to each group on the Collaboration website is restricted to the Members of this group.

Annex G:

Policy for the selection and extension of invited experts for supporting the Scientific Committee and its subsidiary groups

(December 2025)

Background

Since the first years of the Commission, the NPFC has hired invited experts to support and facilitate scientific activities. Starting in 2018 with a consultant for SSC PS, this practice has expanded to TWG CMSA, SSC BF-ME, SSC NFS and SC. Invited experts take part in scientific meetings, contribute to stock assessments of the NPFC priority species, make overviews and reports, assist in the development of SC subsidiary groups' procedural documents and templates and, if requested, provide an expert opinion on stock status and management.

Contracting invited experts allows for enhanced capacity of SC's subsidiary groups and, to some extent, peer-review of stock assessment results. It has proved its efficiency and can be expected to be continued in future. This policy outlines the process currently in place for selection of invited experts hired by NPFC to support the Scientific Committee and its subsidiary groups and also proposes a procedure for the extension of expert's contract.

Selection of invited experts

The procedure for the selection of invited experts involves the following steps:

1. After the Commission endorses SC's recommendation to hire an invited expert, the Secretariat circulates a call for nominations to an SC subsidiary group (TWG, SSC or SC) for which the invited expert will be hired.
   Each Member may nominate one or several experts. The nomination shall include expert's name, affiliation, email address and CV or a weblink to his/her professional profile.
   Before submitting a nomination, Members are advised to ensure that the nominated expert(s) is available for and willing to work for the NPFC. In case that a nominated expert has different citizenship from a nominating Member, that Member is encouraged to coordinate with the SC's Head of Delegation (HOD) of the country/member of expert's citizenship.
2. The Secretariat collects nominations, compiles them and circulates them to SC's HODs for ranking.
3. The HODs rank nominated invited experts, from the most to the least preferred, and send their rankings to the Secretariat.
4. The Secretariat sums up rankings and provides a summary table to the HODs. Individual rankings from Members shall not be released.

5. The Secretariat reaches out to the most preferred expert with an offer for a consultancy. If the expert rejects it, the Secretariat offers consultancy to the next expert in the ranking and repeats this until the offer is accepted.
6. The Secretariat and SC subsidiary group Chair draft a consultancy agreement based on the roles and tasks for an invited expert identified by the expert group (for consultancy fee, see NPFC Policy on Support to Specialist Experts to the Secretariat or Commission adopted by COM03 in 2017).
7. The Secretariat informs the relevant SC subsidiary group members about the contracted expert, creates his/her NPFC account and adds him/her to the SC subsidiary group's Collaboration site and GitHub, if needed.
8. The SC subsidiary group Chair and Secretariat organize a kick-off meeting with the contracted expert.

Extension of invited experts

An invited expert is to be selected for up to one year and may be extended, subject to performance review of his/her work conducted by the SC in accordance with the following procedure:

1. Two months before an SC meeting, the Secretariat circulates a survey to SC's HODs for performance review of experts hired by the NPFC in the current year.
   The survey shall include the list of tasks assigned to the expert that will serve as the basis for evaluating his/her performance.
   The HODs will be asked if they are satisfied with the work of each invited expert, if they have any suggestions and/or concerns and if they support extension of the expert's consultancy if suggestions or concerns can be addressed before the next SC meeting or during the coming year.
2. The HODs fill in the survey by one month before an SC meeting.
3. The Secretariat compiles the surveys and provides a summary report to the HODs and Chairs of SC and its subsidiary groups two weeks before an SC meeting. Individual surveys conducted by each Member shall not be released.
4. At an SC meeting, the HODs+1 hold a closed session to discuss invited experts' performance and take decision to either extend incumbent experts for one more operational year or hire new experts.
5. Chairs of SC subsidiary groups communicate SC's HODs' suggestions and/or concerns, as collective, anonymized feedback, to the extended invited experts in a constructive and forward-looking way.

Annex H:

Stock assessment report for chub mackerel

EXECUTIVE SUMMARY

Background information

Chub mackerel (*Scomber japonicus*) in the Northwest Pacific Ocean (NWPO) are distributed from the coast of southern Japan to offshore waters of Kuril Islands. It is considered that both adults and juveniles are distributed as far east as the 170-degree East longitude line. The feeding migration of adults has expanded to the northeast recently, and since 2018 the distribution of adults during summer and fall has reached 47-degree North, 166-degree East, east offshore of Kuril Island. The spawning ground is known to be located within the range of the Japanese Exclusive Economic Zone (EEZ), with the main spawning ground located in Izu Island waters.

Chub mackerel are harvested by China, Japan and Russia (Figure E-1). Chinese light purse seine and pelagic trawl fisheries operate in the NPFC Convention Area, while Japanese chub mackerel fisheries consist mainly of purse seine and set net fisheries within the Japanese national waters. Russian chub mackerel fisheries mainly operate in the Russian national waters and consist of mid-water trawl and purse seine gears. Russian fisheries also operate bottom trawl gears in the Japanese national waters. The historical total landings have fluctuated largely and recently decreased from approximately 514,000 mt in 2018 to 135,000 mt in the most recent calendar year (CY) 2024. The Conservation and Management Measure for chub mackerel (CMM 2025-07) includes a catch limit of 66,740 mt set in the Convention Area for the 2025 fishing seasons.

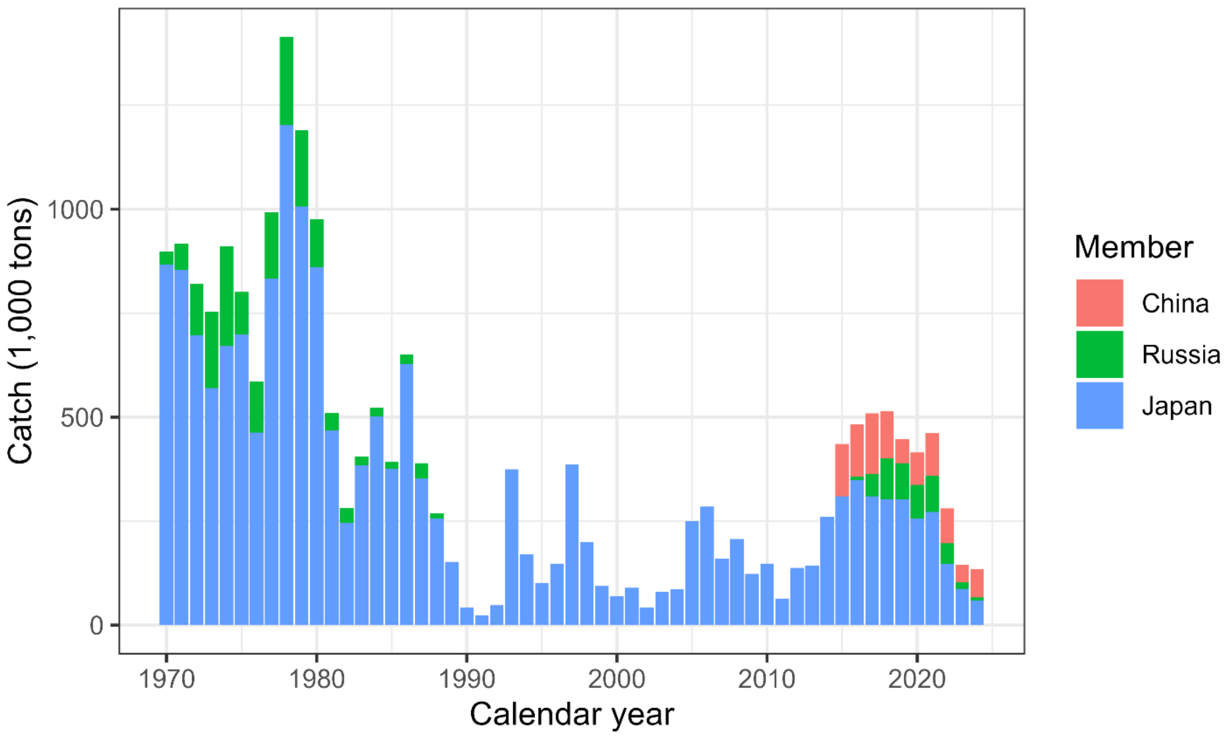


Figure E-1. Historical chub mackerel catch in weight by Member.

Stock assessment model

A state-space stock assessment model (SAM) was agreed to be used for the chub mackerel stock assessment by the Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA). SAM accounts for observation errors in catch-at-age data and abundance indices. It uses age-specific data on catch numbers, stock weight, and maturity rate in each year. Recruitment was defined as numbers at age 0, and spawning stock biomass (SSB) was calculated through multiplication of numbers-at-age by maturity-at-age and weight-at-age. SAM consists of two subparts: a population dynamics model and an observation model.

Age-structured population dynamics for chub mackerel estimated by SAM are driven through survival processes such as natural and fishing mortalities, as well as process errors. Reproduction is calculated by a Beverton-Holt stock recruitment relationship. Fishing mortality coefficients by year and age group are assumed to follow a multivariate random walk, consequently allowing estimation of time-varying selectivity.

In the observation model of SAM, the catch-at-age is estimated though the fitting of the Baranov equation to the observed catch-at-age under a lognormal error distribution. SAM also fits to abundance indices with a lognormal error assumption. Non-linear relationships to population abundance estimates were estimated for the three abundance indices specific to ages 0 and 1, linear relationships were applied to the other abundance indices.

Data and biological parameters used in the assessment model

Data are included from the NPFC Convention Area and Members' EEZs.

A fishing year (FY) starting from July and ending in June of the following year was applied in the stock assessment of chub mackerel. The TWG CMSA agreed for the stock assessment period to be FY1970 to FY2023. Seven age groups of ages 0 to 5 and 6+ were defined in the stock assessment. The historical catch-at-age, which was constructed from the quarterly data from each Member, is shown in Figure E-2. Time series of mean weight-at-age are illustrated in Figure E-3. Annual maturity-at-age with decadal time-varying changes is shown in Figure E-4. These data were available up to FY2023.

Seven time series of the relative indices of abundance were used during model development (Figure E-5): relative number of age 0 fish from the summer survey by Japan; relative number of age 0 fish from the autumn survey by Japan; relative number of age 1 fish from the autumn survey by Japan; relative SSB from the egg survey by Japan; relative SSB from the dip-net fishery by Japan; relative vulnerable stock biomass from the light purse-seine fishery by China; and relative vulnerable stock biomass from the trawl fishery by Russia. The indices from Japan and Russia were available until FY2024 and until FY2023 for China.

An age-specific natural mortality (M), corresponding to 0.80 for age 0, 0.60 for age 1, 0.51 for age 2, 0.46 for age 3,0.43 for age 4, 0.41 for age 5, and 0.40 for age 6+, was applied for the stock assessment by the TWG CMSA.

Overall, the available data show 1) recent decreases in the relative abundance trends, 2) a shift to older average age at maturity, 3) changes in weight at age, and 4) declining catch trends.

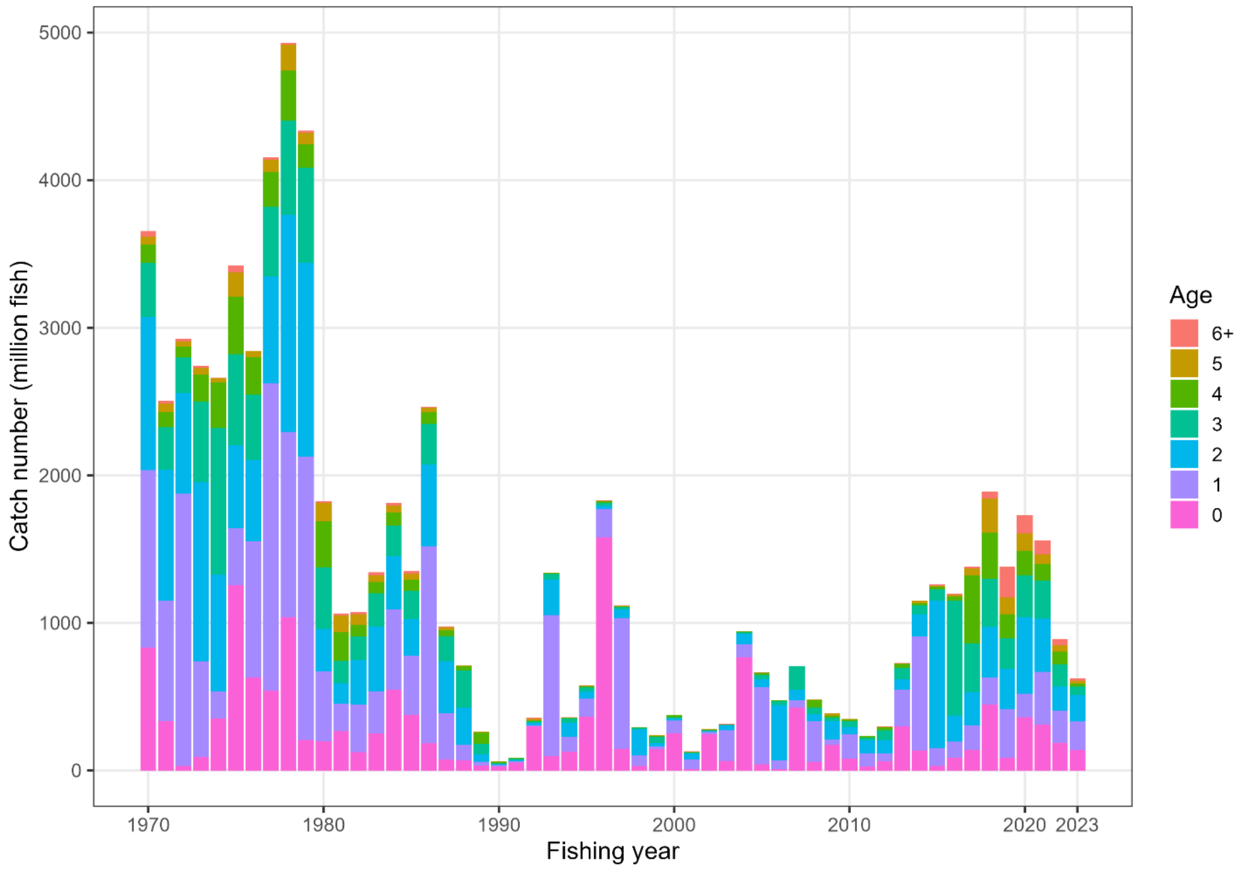


Figure E-2. Historical observed catch-at-age.

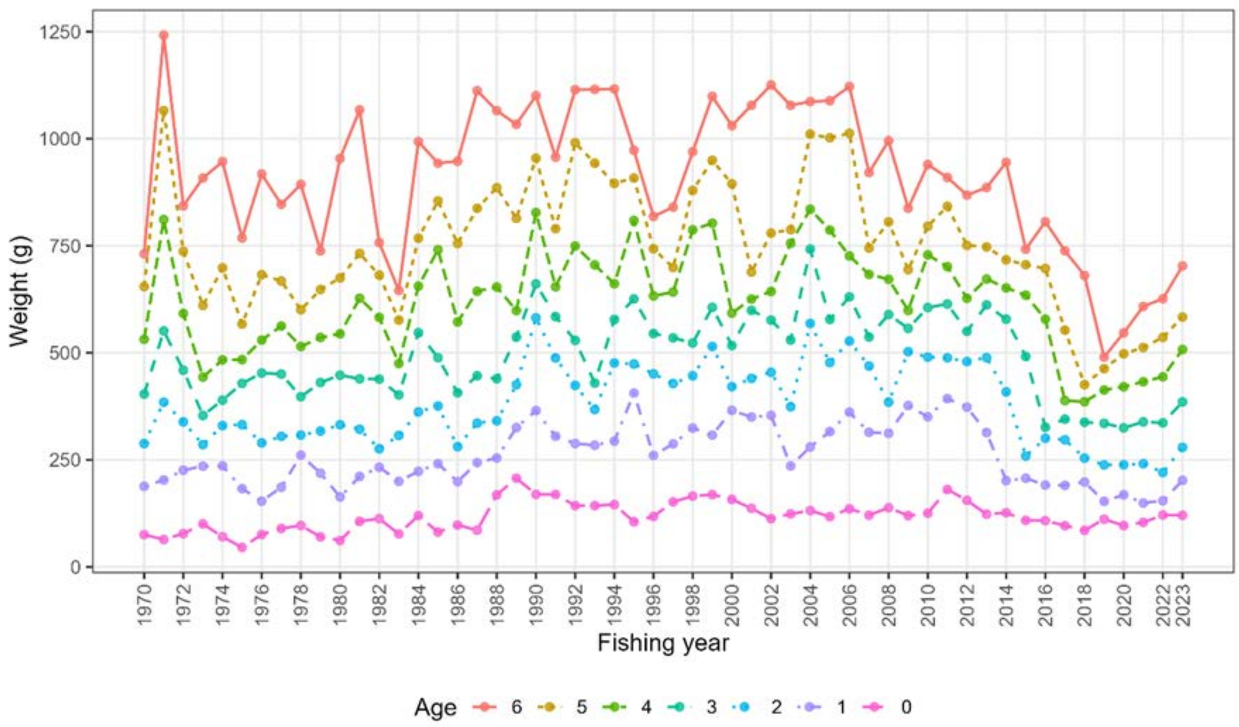


Figure E-3. Time series of weight-at-age.

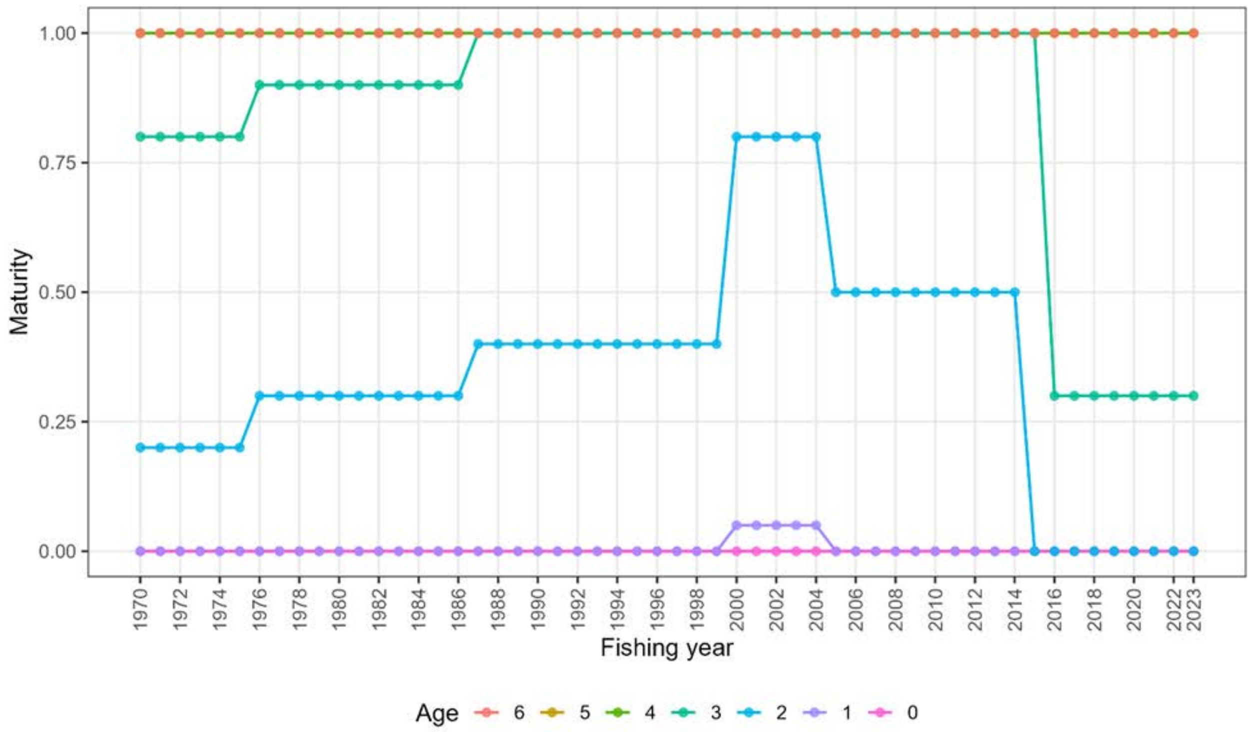


Figure E-4. Time series of maturity-at-age.

Figure E-5. Time series of abundance indices, note that the y- scales differ.

Main stock assessment scenarios

The TWG CMSA based this year's stock assessment on the previous assessment and included the following scenarios as candidate base cases:

- **S01-InitBase.** This scenario is based on the TWG CMSA 09 base case (S28-Proc Est), which excluded the latest abundance indices. Therefore, the abundance indices up to FY2023 were used as input in this scenario (FY2024 indices were excluded).

- **S02-Index24_1.** This scenario included the FY2024 abundance indices from Japanese and Russian fisheries and Japanese surveys. The weight and maturity at age for FY2024 were assumed to be their averages throughout FY2016–FY2023. The proportion of Russian catch out of the total catch was assumed to be its average over FY2021–FY2023. Although the catch in FY2024 is not available, stock status at the start of FY2024 is able to be calculated because stock status is determined before exploitation.

Seventeen other sensitivities were used to investigate the effect of alternative assumptions regarding the biological parameters in FY2024, Russian catch proportion in FY2024, nonlinearity for abundance indices, stock-recruit relationship, maturity processes and assumptions regarding process error in numbers at age. TWG CMSA agreed to select S02-Index24_1 as a base case scenario because of its robustness and better diagnostic performance.

F-based reference points

The TWG CMSA calculated these reference points along with commonly used biological reference points such as F%SPR (30%, 40%, 50%, 60% and 70%), F0.1, with mean biological parameters and selectivity of the current fishing mortality (F_{cur}, average in FY2021 to FY2023) (Table E-1). In particular, the biological parameters such as weight-at-age and maturity-at-age used for calculation of biological reference points are assumed as the average values during the most recent 8 years (FY2016 to FY2023), which represents the recent shift in biological parameters. As a comparable, the average of the biological parameters over the stock assessment period is used for the calculation of these reference points.

B-based reference points

While the F-based reference points are relatively robust to the time-varying biological parameters, commonly used B-based reference points such as SSB_{MSY} and SSB0 are found to be significantly affected by the changes of biological parameters in this stock as well as by the assumptions of stock recruitment relationships and model configurations. Owing to the uncertainty, the TWG CMSA explored some empirical reference points based on percentiles of historical SSB in FY1970–FY2023 (Figure E-6). The 25th percentile of SSB could be regarded as the limit, being above the SSB levels when the stock has been severely depleted during the 1990's and early 2000's. The remaining two reference points ($SSB_{REFERENCE\_A}$ and $SSB_{REFERENCE\_B}$) are the 50th and 70th percentiles of historical estimated SSB.

Although these levels of SSB are significantly lower than the theoretically calculated SSB_{MSY} under the assumption of Beverton-Holt type SR relationship without considering the time-varying nature of biological parameters, the two SSB reference points are about 20% of $SSB_{F=0\_RECENT}$ and about 40% of $SSB_{F=0\_RECENT}$, respectively, which is calculated as the multiplier between average lifetime contribution to the spawning stock biomass per fish assuming no fishing (SPR0) and average number of recruitment during the most recent 8 years. The quantity roughly approximates the level of SSB that could have been attained on average over the last decade if there had been no fishing.

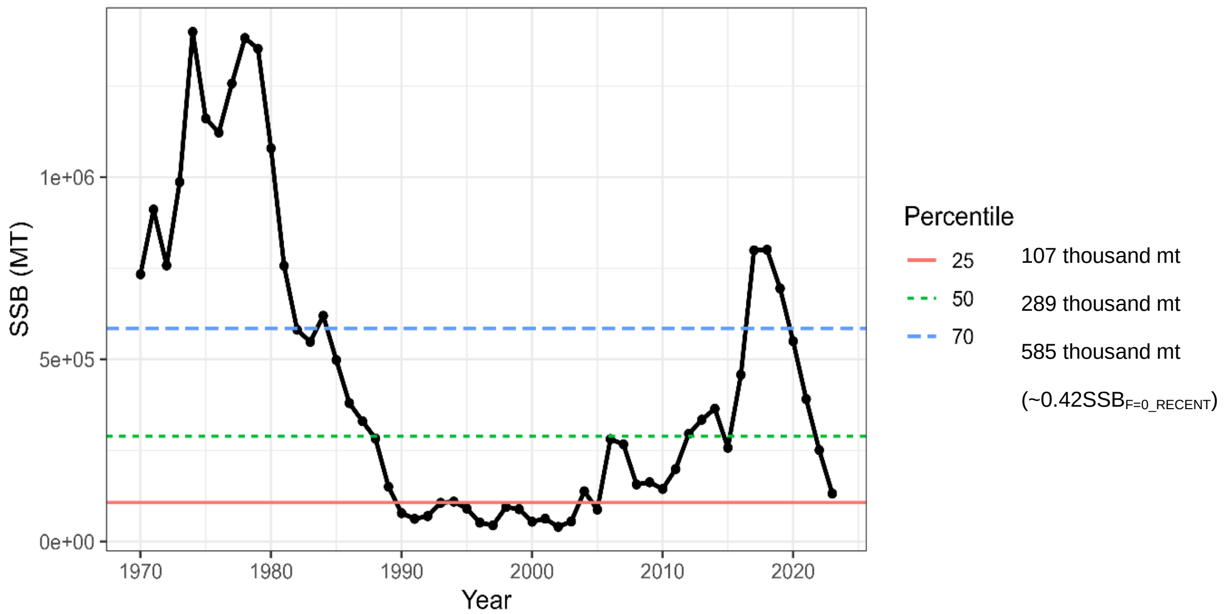


Figure E-6. Estimated spawning stock biomass and its 25th, 50th and 70th percentiles.

Description of specification of future projections

The population dynamics model for stochastic future projections is the same as is used in SAM. Future projections were conducted assuming a constant catch a fixed amount (ranging from 0 to 200 thousand mt in increments of 10 thousand mt) each year from FY2026 to FY2036. Constant F projections were also conducted under F_{cur} and Constant-F scenarios where the catch was calculated by a fixed fishing mortality (ranging from F30%SPR to F70%SPR in increments of 5%SPR) each year since FY2026. For all scenarios the catch in FY2024 and FY2025 is based on the assumption that the fishing mortality in FY2024 and FY2025 would be the same as the FY2023 fishing mortality estimated by SAM.

Two assumptions regarding biological parameters were used for the calculation of reference points, one where the future biological parameters are assumed to equal the average of the recent eight (FY 2016–FY2023) years, and another where the mean biological parameters for the entire model time period (FY1970–FY2023) are used to calculate the reference points. The TWG CMSA recommends the use of the recent average based on the assumption that the prevailing conditions will likely persist for the near future.

Stock status overview

Total biomass, Spawning Stock Biomass

The time series of estimated chub mackerel total biomass and SSB generally declined from the 1970s through the 1990s (Figure E-8). The stock began to recover in the early 2000s, peaking in FY2018, then SSB has declined to 16% of that peak in 2023. The spawning stock biomass in 2023 is slightly higher than SSB_{LIM} (SSB_{2023}/SSB_{LIM}=1.23) but lower than $SSB_{REFERENCE\_A}$ and $SSB_{REFERENCE\_B}$ (Table E-1).

Recruitment

The level of recruitment in the 1970s was estimated to be high (~15 billion individuals on average) and reached a low period between the 1990s and the 2010s (Figure E-8). Recruitment in the most recent decade (FY2014–FY2023) was also high on average (~7.4 billion), but not as high as in the 1970s and had a decreasing trend since the last peak in 2018. The estimated Beverton-Holt stock recruitment relationship was slightly concave (Figure E-9), suggesting that the density-dependent effect in recruitment is not strong.

Exploitation status

Estimated exploitation rate generally fluctuated between 10% and 35%, with over 40% and below 10% in several years, following the estimated F dynamics. No clear temporal trend was observed (Figure E-8). The current fishing mortality (F_{cur}) corresponds to 16% SPR, and higher than the commonly used F-based reference points such as F0.1 and F30–70%SPR (Table E-1). Fishing mortality related reference points indicate that the stock is at approximately 16% SPR, indicating that current fishing mortality are also reported for percent FSPR values, in relation to the current F (F_{cur}, average FY2021–FY2023) for FSPR from the recent period (FY2016–FY2023) as well as over the entire time period (FY1970–FY2023; Table E-1).

Conclusions and recommendations

The chub mackerel stock in the NWPO has experienced large changes in biological parameters over the time period of the model. The main temporal changes are a recent decrease in maturity at age, along with a recent change in the weight at age, both of which were observed to impact the model time period to cause temporal impacts on biological reference points. MSY-based reference points are highly variable over the time series of the assessment because the weight- and maturity- at age of chub mackerel have varied widely (Figures E-3 and E-4), which impacts the productivity of the stock. Unfished spawning biomass per recruit (SPR0) has varied remarkably over time (Figure E-7).

Besides such uncertainty, the current fishing mortality (average FY2021–FY2023) is higher than the commonly used reference points such as F%30–60%, and SSB in FY2024 is lower than the reference levels of median and 70th percentiles ($SSB_{REFERENCE\_A}$ & $SSB_{REFERENCE\_B}$, respectively), but slightly above the SSB_{LIM}.

Harvest Recommendations

Given the uncertainty in biological parameters in future, which has a large impact on the projection results, the TWG CMSA considers it is not appropriate to provide long-term harvesting recommendations at this time. However, in response to the request from COM09, 10 year projection was undertaken to assess the effects of varying catch and F levels based on the most recent eight years' biological data (Figures E-10 and E-11, Tables E-2 to E-5). Projections indicate that current fishing mortality is unsustainable, and probabilities of achieving various reference levels under catch-constant as well as F-constant scenarios are provided in Tables E-2 and E-3. It is recommended to reduce fishing mortality to recover SSB to the reference levels.

Data and Research needs

The assessment results, including projections, are dependent on biological parameters and processes which are uncertain. Therefore, future studies should be focused on collecting and analyzing biological information, e.g., maturity-at-age and weight-at-age, which would improve the assessment. Fisheries-dependent data, such as fleet-specific catch-at-age, are also critical to develop Member-specific fishing fleet and age-specific abundance indices. It is also important to explore the factors that contributed to the lower-than-expected presence of the 2018 year class in catch-at-age data, despite strong signals in survey indices.

A critically important recommendation that should be carried out in 2-3 years is to develop a harvest control rule (HCR) specific to this stock via a Management Strategy Evaluation (MSE) process. This HCR should be dynamic and able to adjust annual total catches depending on the stock abundance as well as the target and limit reference points. During the process of the development of MSE, uncertainties in parameter estimates, time-varying or density-dependent biological parameters, stock-recruitment assumptions, process errors, and selectivity should be considered.

Timely collection of biological information and further research on biological parameters and processes, including the effect of environment and climate change, are critically important to facilitate the accurate estimation of reference points.

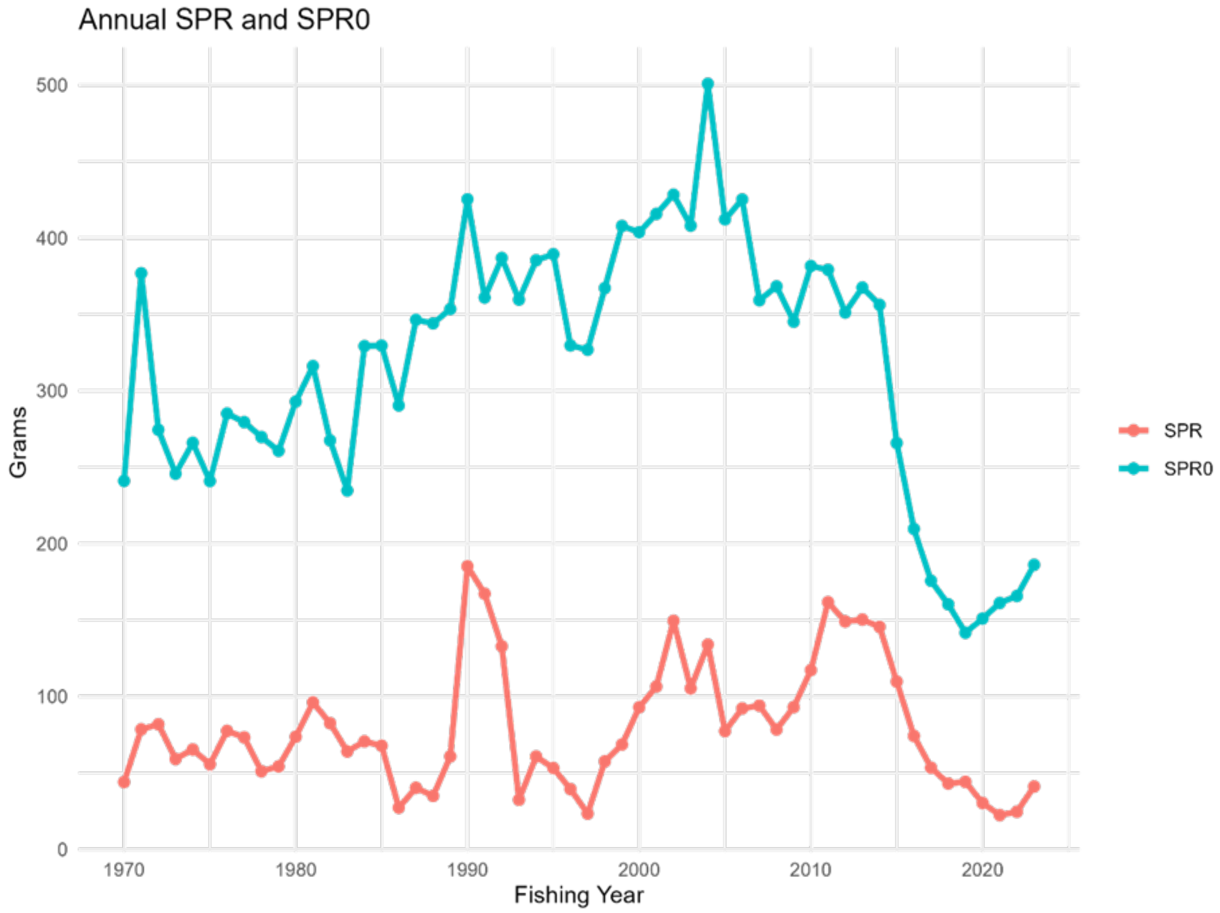


Figure E-7. Trajectories of spawners per recruit with (SPR) and without fishing (SPR0).

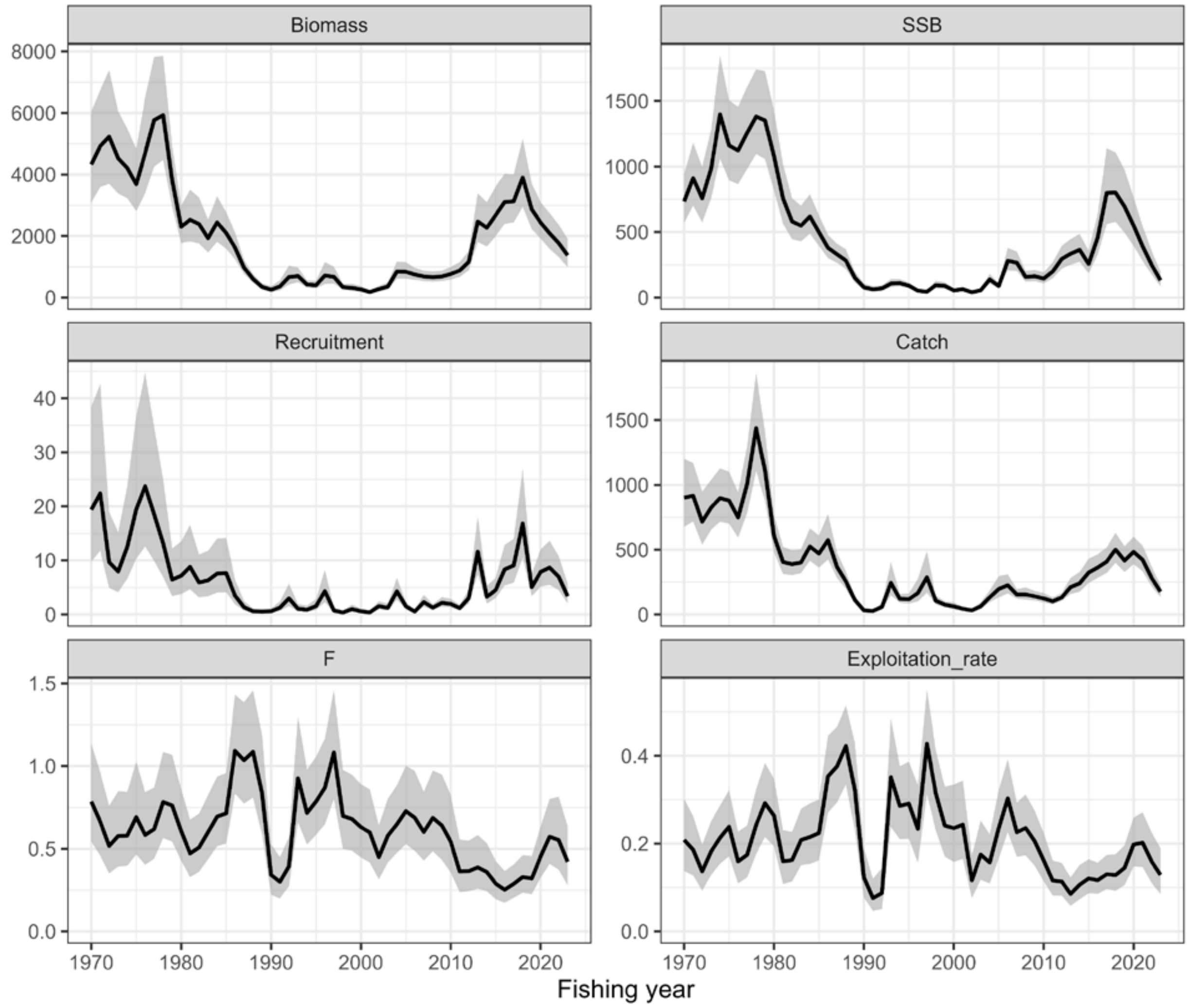


Figure E-8. Time series of estimates of total biomass (thousand mt), SSB (thousand mt), recruitment (billion fish), catch (thousand mt), mean fishing mortality (F) and exploitation rate (catch divided by total biomass) from the base case (S02-Index24_1).

Table E-1. Reference points for the base case scenario (S02-Index24_1). F-based reference point values that are dependent on time varying parameters are calculated by holding F_{cur} the same for all calculations, but by varying the time period (either FY2016–FY2023 or FY1970–FY2023) over which the biological parameters are estimated. Refer to Glossary in the stock assessment report for the definitions.

Reference Points	Biological parameters	
	FY2016–FY2023	FY1970–FY2023
F-based reference points		
Current%SPR	**16.2**	27.8
F0.1/F_{cur}	**0.838**	0.838
FpSPR.30.SPR/F_{cur}	**0.580**	0.911
FpSPR.40.SPR/F_{cur}	**0.412**	0.609
FpSPR.50.SPR/F_{cur}	**0.295**	0.416
FpSPR.60.SPR/F_{cur}	**0.207**	0.282
FpSPR.70.SPR/F_{cur}	**0.139**	0.184
Biomass-based reference points		
$SSB_{F=0\_RECENT}$	**1399**	–
25th Percentile Historical SSB (SSB_{LIM}) (thousand mt)	**107**	
50th Percentile Historical SSB ($SSB_{REFERENCE\_A}$) (thousand mt)	**289**	
70th Percentile Historical SSB ($SSB_{REFERENCE\_B}$) (thousand mt)	**585**	
SSB_{2023}/ SSB_{LIM}	**1.23**	
SSB_{2023}/ $SSB_{REFERENCE\_A}$	**0.46**	
SSB_{2023}/ $SSB_{REFERENCE\_B}$	**0.23**	
SSB_{LIM} / $SSB_{F=0\_RECENT}$	**0.08**	–
$SSB_{REFERENCE\_A}$ / $SSB_{F=0\_RECENT}$	**0.21**	–
$SSB_{REFERENCE\_B}$ / $SSB_{F=0\_RECENT}$	**0.42**	–

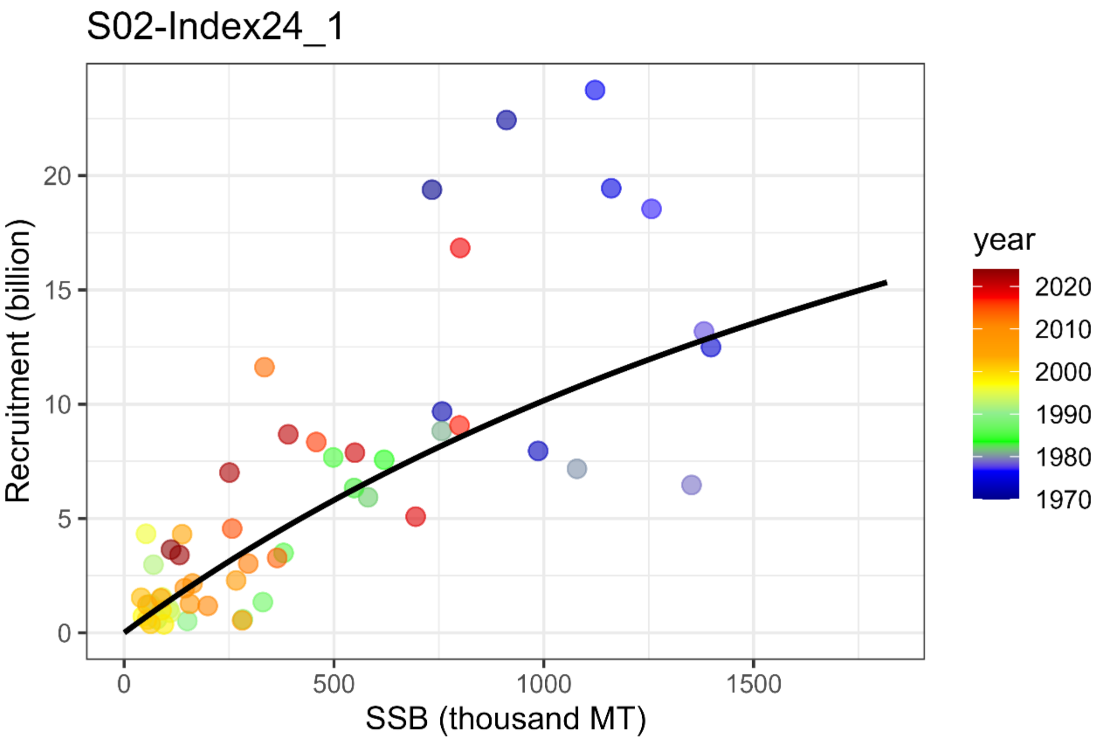


Figure E-9. Estimated stock-recruitment curve (black line) and estimated SSB and number of recruits (circles colored by decade), from the selected base case (S02_Index24_1).

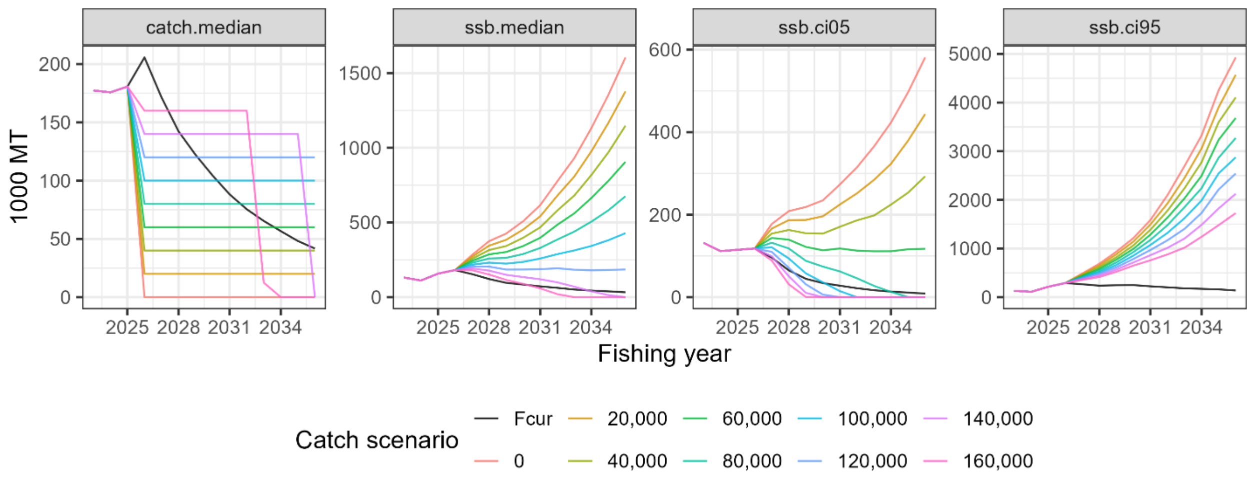


Figure E-10. Future trajectories of median catch (left), median SSB (second from left), 5% lower limit of predictive interval for SSB (third from left) and 95% SSB (right) with mean biological parameters in recent 8 years. Numbers and "F_{cur}" in "Catch scenarios" indicate total amount of catches (mt) in constant catch scenarios of 0 to 160 thousand mt in increments of 20 thousand mt and current fishing morality, respectively.

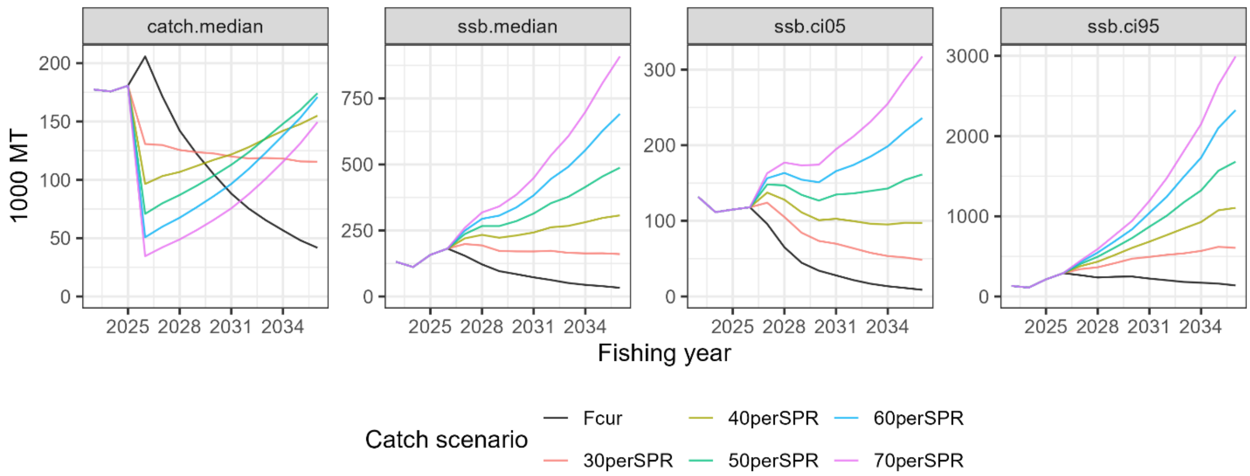


Figure E-11. Future trajectories median catch (left), median SSB (second from left), 5% lower limit of predictive interval for SSB (third from left) and 95% SSB (right) with mean biological parameters for the entire time series. 30–70%SPR and "F_{cur}" in "Catch scenarios" indicate total amount of catches (mt) in constant fishing mortality scenarios of F30–70%SPR in increments of 10% and current fishing morality, respectively.

Table E-2. Probability that future SSB on July 1, at the beginning of the fishing year, is above $SSB_{REFERENCE\_B}$, $SSB_{REFERENCE\_A}$, and SSB_{LIMIT} (70th percentile, 50th percentile and 25th percentile, respectively) under constant catch projections for the base case scenario. The projection towards FY2036 is shown below.

Pr(SSB > 70th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Catch000	0	0	0	0	1	12	24	39	54	69	79	85	91	95
Catch010	0	0	0	0	1	10	21	35	49	64	75	81	88	92
Catch020	0	0	0	0	1	9	19	32	45	59	69	77	84	88
Catch030	0	0	0	0	1	7	17	28	41	54	64	73	79	84
Catch040	0	0	0	0	1	6	15	26	38	50	59	67	74	79
Catch050	0	0	0	0	1	6	14	23	34	45	53	62	68	74
Catch060	0	0	0	0	1	5	12	20	30	40	48	56	62	68
Catch070	0	0	0	0	1	4	10	18	27	36	43	50	56	61
Catch080	0	0	0	0	1	4	9	16	24	32	38	44	50	54
Catch090	0	0	0	0	1	3	8	14	21	28	33	39	45	48
Catch100	0	0	0	0	1	3	7	12	18	25	29	34	39	42
Catch110	0	0	0	0	1	2	6	11	16	21	26	29	33	37
Catch120	0	0	0	0	0	2	6	10	14	18	22	25	28	31
Catch130	0	0	0	0	0	2	5	9	12	16	19	21	25	27
Catch140	0	0	0	0	0	1	5	8	11	13	16	19	20	24
Catch150	0	0	0	0	0	1	4	7	9	11	14	16	18	20

Fishing year

Pr(SSB > 50th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Catch000	0	0	0	5	47	76	82	88	94	97	98	99	99	99
Catch010	0	0	0	5	44	72	78	84	91	95	97	98	98	99
Catch020	0	0	0	5	40	67	73	80	87	92	95	96	98	99
Catch030	0	0	0	5	37	63	68	76	84	89	92	94	96	98
Catch040	0	0	0	5	34	58	64	71	80	85	88	91	93	95
Catch050	0	0	0	5	32	54	58	66	74	80	83	86	90	91
Catch060	0	0	0	5	29	49	53	61	68	74	78	81	84	86
Catch070	0	0	0	5	27	45	48	55	62	68	72	75	77	80
Catch080	0	0	0	5	25	40	44	50	56	61	65	69	71	73
Catch090	0	0	0	5	22	36	39	45	51	56	58	61	63	65
Catch100	0	0	0	5	21	32	34	41	45	50	53	55	56	58
Catch110	0	0	0	5	19	29	31	36	40	44	46	48	50	51
Catch120	0	0	0	5	18	26	27	33	36	39	40	42	44	44
Catch130	0	0	0	5	16	23	25	30	32	34	35	36	37	38
Catch140	0	0	0	5	15	21	22	26	29	30	30	31	32	32
Catch150	0	0	0	5	13	18	20	23	25	26	26	26	27	27

Fishing year

Percent: 0, 25, 50, 75, 100

Pr(SSB > 25th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Catch000	100	100	98	98	100	100	100	100	100	100	100	100	100	100
Catch010	100	100	98	98	100	100	100	100	100	100	100	100	100	100
Catch020	100	100	98	98	100	100	100	100	100	100	100	100	100	100
Catch030	100	100	98	98	100	100	99	99	100	100	100	100	100	100
Catch040	100	100	98	98	100	100	99	99	99	99	99	99	99	99
Catch050	100	100	98	98	100	99	98	97	98	98	98	98	98	98
Catch060	100	100	98	98	99	98	96	96	96	95	95	95	95	95
Catch070	100	100	98	98	99	97	95	93	93	92	92	92	92	92
Catch080	100	100	98	98	99	96	92	90	89	88	87	87	86	85
Catch090	100	100	98	98	98	95	89	85	84	83	81	80	79	79
Catch100	100	100	98	98	98	92	84	80	78	76	74	73	72	71
Catch110	100	100	98	98	97	90	80	74	72	69	67	65	63	62
Catch120	100	100	98	98	96	86	75	68	65	62	60	58	56	55
Catch130	100	100	98	98	94	82	69	62	59	55	52	50	49	47
Catch140	100	100	98	98	92	78	63	57	52	49	45	43	42	41
Catch150	100	100	98	98	91	74	58	51	47	43	40	38	36	34

Fishing year

Table E-3. Probability that future SSB on July 1, at the beginning of the fishing year, is above $SSB_{REFERENCE\_B}$, $SSB_{REFERENCE\_A}$, and SSB_{LIMIT} (70^{th} percentile, 50^{th} percentile and 25^{th} percentile, respectively) under constant fishing mortality projections for the base case scenario. The projection towards FY2036 is shown below.

Pr(SSB > 70th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	0	0	0	0	1	5	13	21	32	44	52	61	68	74
F65pSPR	0	0	0	0	1	4	11	18	28	38	46	54	62	67
F60pSPR	0	0	0	0	1	4	9	15	23	33	40	47	54	59
F55pSPR	0	0	0	0	1	3	7	13	19	27	33	39	45	50
F50pSPR	0	0	0	0	1	2	6	10	16	22	26	31	35	40
F45pSPR	0	0	0	0	0	2	4	8	11	15	19	23	26	31
F40pSPR	0	0	0	0	0	1	3	6	8	11	13	16	18	20
F35pSPR	0	0	0	0	0	1	2	4	5	6	8	10	10	12
F30pSPR	0	0	0	0	0	0	2	2	3	4	4	5	6	5
F2021-2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fishing year

Pr(SSB > 50th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	0	0	0	5	36	60	65	71	80	86	89	92	95	96
F65pSPR	0	0	0	5	33	56	60	67	75	82	85	89	92	94
F60pSPR	0	0	0	5	31	52	55	62	70	77	81	84	88	90
F55pSPR	0	0	0	5	28	47	49	56	64	70	75	78	82	84
F50pSPR	0	0	0	5	25	41	43	49	55	63	67	70	73	77
F45pSPR	0	0	0	5	22	34	36	42	48	54	56	61	64	66
F40pSPR	0	0	0	5	19	28	28	34	39	44	45	48	52	53
F35pSPR	0	0	0	5	16	22	21	25	29	32	33	35	37	38
F30pSPR	0	0	0	5	12	16	15	18	20	21	22	22	23	24
F2021-2023	0	0	0	5	3	2	3	3	3	1	2	1	1	1

Fishing year

Percent: 0, 25, 50, 75, 100

Pr(SSB > 25th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	100	100	98	98	100	100	100	100	100	100	100	100	100	100
F65pSPR	100	100	98	98	100	100	100	100	100	100	100	100	100	100
F60pSPR	100	100	98	98	100	100	99	99	100	100	100	99	100	100
F55pSPR	100	100	98	98	100	100	99	99	99	99	99	99	99	99
F50pSPR	100	100	98	98	100	100	98	98	98	98	98	98	98	99
F45pSPR	100	100	98	98	100	99	98	96	97	97	96	96	97	97
F40pSPR	100	100	98	98	99	98	96	93	94	94	93	93	93	93
F35pSPR	100	100	98	98	99	97	92	89	89	88	86	86	85	84
F30pSPR	100	100	98	98	99	95	86	81	79	77	75	72	71	70
F2021-2023	100	100	98	98	88	63	41	35	27	21	17	14	11	9

Fishing year

Table E-4. Median catch and median SSB based on constant-catch scenarios (ranging from 0 mt to 150 thousand mt).

Median Catch

Catch000	177	176	181	0	0	0	0	0	0	0	0	0	0	0
Catch010	177	176	181	10	10	10	10	10	10	10	10	10	10	10
Catch020	177	176	181	20	20	20	20	20	20	20	20	20	20	20
Catch030	177	176	181	30	30	30	30	30	30	30	30	30	30	30
Catch040	177	176	181	40	40	40	40	40	40	40	40	40	40	40
Catch050	177	176	181	50	50	50	50	50	50	50	50	50	50	50
Catch060	177	176	181	60	60	60	60	60	60	60	60	60	60	60
Catch070	177	176	181	70	70	70	70	70	70	70	70	70	70	70
Catch080	177	176	181	80	80	80	80	80	80	80	80	80	80	80
Catch090	177	176	181	90	90	90	90	90	90	90	90	90	90	90
Catch100	177	176	181	100	100	100	100	100	100	100	100	100	100	100
Catch110	177	176	181	110	110	110	110	110	110	110	110	110	110	110
Catch120	177	176	181	120	120	120	120	120	120	120	120	120	120	120
Catch130	177	176	181	130	130	130	130	130	130	130	130	130	130	130
Catch140	177	176	181	140	140	140	140	140	140	140	140	140	140	0
Catch150	177	176	181	150	150	150	150	150	150	150	150	26	0	0

Scenario; Fishing year: 2022, 2026, 2030, 2034

1,000 MT: 150, 100, 50, 0

Median SSB

Catch000	132	112	158	181	283	375	426	509	617	776	932	1132	1355	1605
Catch010	132	112	158	181	277	360	405	481	578	728	870	1054	1263	1491
Catch020	132	112	158	181	270	345	384	453	542	679	808	977	1168	1378
Catch030	132	112	158	181	264	330	364	424	506	630	747	895	1069	1265
Catch040	132	112	158	181	257	316	342	398	468	580	681	818	970	1148
Catch050	132	112	158	181	251	301	322	370	432	535	622	743	878	1017
Catch060	132	112	158	181	243	287	303	342	398	485	562	664	779	906
Catch070	132	112	158	181	237	273	283	314	363	434	501	583	684	790
Catch080	132	112	158	181	231	259	263	289	330	386	439	506	582	676
Catch090	132	112	158	181	224	245	243	262	295	338	377	422	479	559
Catch100	132	112	158	181	218	231	225	236	259	288	313	343	382	428
Catch110	132	112	158	181	211	218	205	211	222	240	248	265	283	305
Catch120	132	112	158	181	205	205	185	185	187	194	184	180	182	186
Catch130	132	112	158	181	199	191	167	160	155	144	122	104	89	66
Catch140	132	112	158	181	193	178	150	135	120	99	70	39	14	0
Catch150	132	112	158	181	187	165	131	112	88	57	23	0	0	0

Scenario; Fishing year: 2022, 2026, 2030, 2034

1,000 MT: 1600, 1200, 800, 400

Table E-5. Median catch and median SSB based on projections using constant F scenarios.

Median Catch

(1,000 MT)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	177	176	181	35	42	49	57	66	76	88	101	116	131	149
F65pSPR	177	176	181	42	51	58	67	76	87	99	113	128	144	163
F60pSPR	177	176	181	51	60	68	77	86	97	109	123	138	153	171
F55pSPR	177	176	181	60	70	77	86	95	105	118	131	145	159	175
F50pSPR	177	176	181	71	80	87	95	104	113	124	136	148	160	174
F45pSPR	177	176	181	83	91	97	104	111	118	127	137	147	156	168
F40pSPR	177	176	181	96	103	107	112	117	122	128	135	142	148	155
F35pSPR	177	176	181	112	116	116	119	121	123	125	129	133	134	138
F30pSPR	177	176	181	131	130	126	124	123	120	118	119	118	116	116
F2021-2023	177	176	181	206	171	142	122	104	88	75	65	57	48	42

Fishing year

Median SSB

(1,000 MT)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	132	112	158	181	260	318	341	386	449	534	606	699	809	909
F65pSPR	132	112	158	181	255	307	325	362	416	490	548	626	717	797
F60pSPR	132	112	158	181	249	294	306	338	383	445	491	554	628	691
F55pSPR	132	112	158	181	243	281	287	312	349	399	434	485	540	587
F50pSPR	132	112	158	181	236	267	267	286	314	353	377	415	455	488
F45pSPR	132	112	158	181	229	251	245	259	279	308	322	346	372	393
F40pSPR	132	112	158	181	220	233	222	231	242	262	267	281	297	307
F35pSPR	132	112	158	181	210	215	198	201	207	217	214	220	227	229
F30pSPR	132	112	158	181	199	194	173	171	171	173	165	163	164	161
F2021-2023	132	112	158	181	154	122	96	84	73	63	51	44	39	33

Fishing year

INTRODUCTION

1.1 Distribution and population structure

Chub mackerel (*Scomber japonicus*) is widely distributed throughout in the northwest Pacific, including in the waters of Japan, Korea, China, and Russia. The species exhibits highly migratory behavior, with distinct spawning, feeding, and wintering grounds. Spawning occurs primarily from spring to early summer in the subtropical waters, and the larvae and juveniles are often carried by ocean currents to feeding grounds further north. This migration pattern leads to a dynamic population structure that varies seasonally and spatially, reflecting the species' adaptation to environmental conditions.

In the northwest Pacific, two stocks of chub mackerel are recognized. Although there are no clear genetic differences between the two stocks, they are treated as different stocks due to their biological differences, distribution and spawning grounds. The first is the Tsushima Warm Current stock, which is distributed in the East China Sea and the Sea of Japan, and the latter is the Pacific stock, which can be defined as a straddling stock and is harvested in both national waters of Japan and Russia and the NPFC Convention Area. The Pacific stock, hereafter called chub mackerel in this report, is distributed from the coast of southern Japan to offshore waters of Kuril Islands (Figure 1). It is considered that both adults and juveniles are distributed as far east as 170°E longitude in periods of high abundance. During the low abundance period of 1990s-2000s, juvenile distributes from Japan to around 170°E, but adults were only found to 150°E due to the possible contraction of the feeding ground. The feeding migration of adult extends northeast, with the recent (since 2010) increase of stock abundance, the distribution of adult during the summer to fall season has expanded to 47° N, 166° E, east offshore of Kuril Island, after 2018. Adult fish spawn in Izu Islands waters in spring and then engage northward feeding migration to waters of Sanriku to east Hokkaido from summer to autumn.

1.2 Migration

Adults move to north (March to June) after spawning at Izu Islands area, which is the main spawning ground, and migrate to offshore area of Northeast of Japan (Sanriku and Hokkaido) from summer to fall for feeding (Meguro et al., 2002) (Figs. 1 & 2). Larvae distribute broadly from the Pacific side of southern Japan to Kuroshio extension and Kuroshio-Oyashio transition area in spring. Larvae occurred at Kuroshio-Oyashio transition area and move to offshore of Kuril Island in summer and subadults migrate down south in fall to offshore of Chiba and Ibaraki prefecture for wintering (Kawasaki, 1968; Iizuka, 2002; Nishida et al., 2001; Kawabata et al., 2006). Portion of adult and subadult migrate to Kii strait, Bungo strait and Seto inland sea, while the main spawning adults migrate to waters around Izu Islands area. Because of the occurrence of larvae originated upstream of Kuroshio current at the spawning ground of Izu Islands (Koizumi, 1992), spawning ground extended from offshore of southern Japan to northern Japan (Kuroda, 1992).

1.3 Reproduction

Chub mackerel mature at about age 2 or 3 and all fish at age 4 and above are supposed to be fully matured (Watanabe and Yatsu, 2006). One functional matured female produces 30–90 thousand eggs several times during a spawning season (Murayama et al., 1995; Watanabe et al., 1999; Yamada et al., 1999). The main spawning grounds are in the Japanese Exclusive Economic Zone (EEZ), in waters around the Izu Islands but also in areas off the Pacific coast of southern Japan, including the Kinan area, Cape Muroto and Cape Ashizuri (Fig. 1). The waters around the Izu Islands are considered the main spawning ground (Watanabe, 1970; Usami, 1973). Although spawning occurs from offshore of southern Japan to northern Japan (Kuroda, 1992) and it has also been observed in the Tohoku waters (Kanamori et al., 2019).

The spawning season for chub mackerel is from January to June. In the main spawning ground of Izu Islands, spawning occurs in March and April, which historically are the peak spawning months (Fig. 2). In the 2000s, the peak spawning timing has shifted to May and June because of the high fraction of younger adults, which tend to spawn eggs at later season (Watanabe, 2010). Additionally, the spawning ground is reported to exhibit northward shifting with extended spawning period associated with climate change (Kanamori et al., 2019).

1.4 Prey and predators

Larvae feed on the eggs of copepods and nauplii, whereas juvenile prey on small zooplankton such as small copepods, noctilucines, cercariae, and salpae (Kato and Watanabe, 2002). The feeding behaviors of immature and adult fish differ depending on the waters and lifecycle, but they mainly prey on other fishes (e.g., anchovies and lantern fish), crustaceans (e.g., krill and copepods) and salpae. In the Sanriku waters, the main prey are mysid shrimp and anchovies.

Before the 1980s, when stock abundances were high, chub mackerel were often observed to be eaten by large fishes such as the mackerel shark, blue shark, pomfret, albacore, and skipjack tuna (Kawasaki, 1965; Nagasawa, 1999), as well as the minke whale (Kasamatsu and Tanaka, 1992). In the 1990s, the lower abundance period, predation of minke whales was not reported (Tamura et al., 1998). From the research report of baleen whale predations, composition of anchovy decreased in the stomach contents after 2012, but mackerels and sardine increased. Especially in the case of sei whale, the main prey item shifted from anchovy in early 2000s to mackerel and sardine in late 2000s and after 2010 (Tamura et al., 2016; Konishi et al., 2016). When the abundance of mackerels is high, they appear to be main prey items for whales.

1.5 Age and growth

Longevity of chub mackerel is estimated to be approximately 8 years, based on age determination of sampled catch, and maximum age was recorded at 11year-old (Iizuka, 2002). Fish at age 6 and above are very rare in the catches in recent years. There is no significant difference in growth between sex. Growth of chub mackerel is density dependent, and the parameters of growth function are variable among the year classes. According to Kamimura et al. (2021), the asymptotic body length *Linf* and growth coefficient *k* of von Bertalanffy growth function varied between 339.9 to 440.5 mm and 0.25 to 0.55 (/year), respectively, for each year class of 2006-2016.

Average size (fork length) and weight of catch in 2018 are shown in Fig. 3, with comparison of those at 2011-2014 which did not show any slow growth. Average weight of 2018 was low comparing with those of 2011-2014 and 1970s, especially for age 5 (extremely high recruitment in the 2013 year class). It is considered that density dependence may be the cause for this change. (Kamimura et al., 2021). However, slower growth has been observed at periods of high abundance, this may be due to poor environmental conditions (i.e. lower temperatures due to range expansion), or feeding competition with Japanese sardine, or other factors (Kamimura et al., 2021).

The growth of chub mackerel is density dependent, and may also be influenced by changes in the ocean environment and recent recruitment (Watanabe and Yatsu, 2004). Maturity at age has changed depending on changes in growth (Watanabe and Yatsu, 2006). The maturity at age for chub mackerel has changed over time, for example the maturity rate of age 3 fish has decreased from 100% to 30% since 2015 (Fig. 4).

FISHERIES AND SCIENTIFIC SURVEYS

2.1 Overview of fisheries

Chub mackerel are harvested by China, Japan and Russia (Figs. 5 & 6). Chinese light purse seine and pelagic trawl fisheries are operated in the NPFC Convention Area. Japanese chub mackerel fisheries consist mainly of purse seine and set net fisheries within the Japanese national waters. The Russian chub mackerel fisheries consist of mid-water trawl, purse seine and bottom trawl gears. They operate in the Russian national waters and the NPFC Convention Area. Some of these fisheries occur in the Japanese national waters. The historical total landings have largely fluctuated. In last decade, the total catch was stable at higher level and subsequently decreased from 516 thousand mt in 2018 to 129 thousand mt in the most recent calendar year (CY) 2024. The Conservation and Management Measure for chub mackerel (CMM 2025-07) includes a catch limit of 66,740 mt set in the Convention Area for the 2025 fishing season (1 June to 31 May).

China harvests this species dominantly by the light purse seine fishery in the NPFC Convention Area. A smaller component of the catch is taken by pelagic trawl. Chinese catch statistics on mackerels in the NPFC Convention Area are available since 2015. The Chinese mackerel fisheries in the NPFC Convention Area initiated in 2014 and mainly caught chub mackerel, blue mackerel, and Japanese sardine (Zhang et al., 2023). The fishing season of Chinese fleet is from April to

December.

The major Japanese fisheries for chub mackerel are purse seine, set net, dip-net fishing, and stick-held dip-net fishing. Large-scale purse seiners, historically the primary source to the total catch in Japan, operate all the year over during the main fishing season from September to February in the offshore waters off Joban and Sanriku coasts on the Pacific side of Japanese main island. Small-scale purse seiners operate year-round in the coastal waters south of Chiba Prefecture. Set net fisheries are deployed extensively along the Japanese coast and yield a large catch from Sanriku coast. Dip-net and stick-held dip-net fisheries which target adult fish in spawning season (age 2 to 4 fish) are mainly operated from January to June in the Izu Islands waters, which is the major spawning ground. Chub mackerel is also caught by angling all over Japan.

Russian fisheries targeting mackerel species and sardine operate in the NW area of the NPFC Convention Area and operate both purse seine vessels and pelagic trawl vessels. Russian fisheries first exploited mackerel in the Far East in the early 1960s and harvested it until the late 1980s, when its stocks in areas accessible to the domestic fleet were completely depleted (Baryshko, 2009, Pozdnyakov and Vasilenko 1994, Pyrkov et al. 2015). Out of 26 years of mackerel fishery for 13 years more than 50 thousand tonnes per year was harvested, including 9 years when the catch was more than 100 thousand mt. Commercial fishing of mackerel in the North-West Pacific Ocean by vessels under the Russian (Soviet) flag began in 1968 (Vasilenko 1990). Since the second half of the 1980s, due to a sharp decline in mackerel abundance, its commercial fishing for mackerel in the Russian EEZ has been rare. Until recently, there has been no target fishing for mackerel by Russia in the Northwest Pacific. Russian fisheries resumed fishing in 2015. In 2021, the chub mackerel catch by the Russian fleet totaled to 87 thousand mt.

2.2 Overview of scientific surveys

China has been conducting a scientific survey program using its fishery research vessel "Song Hang" in the NPFC convention area since 2021 (Ma et al., 2023). The survey is conducted during June-August, with methods of mid-trawling, acoustic and squid jigging, covering about 70 stations per year. The results indicated that Chub mackerel is one of the dominant species in the four years survey.

In Japan, monthly egg surveys have been intensively conducted off the Pacific coast of Japan in the western North Pacific since 1978 by a historical cooperative system among many national and regional fisheries research bodies (Nishijima et al., 2025a). The survey protocol can be found at Oozeki et al. (2007). The objective of this egg survey is to monitor egg abundance of major small pelagic fish species such as Japanese sardine, Japanese anchovy, chub mackerel, etc. The survey area roughly covered the major spawning grounds of small pelagic fish off the Pacific coast, mainly inshore waters but also offshore waters related to the warm Kuroshio and cold Oyashio currents. In addition, Japan has conducted the surface trawl net surveys in summer (June to July) and autumn (September to October) to monitor abundance of ages 0 and 1 (Nishijima et al., 2025b; 2025c; Yukami et al., 2024). The summer survey has been initiated in 2001 and annually carried out, covering the waters approximately from 141.5º E to 170.0º W and from 32.0º to 45.0º N. It provides information on abundance of age 0 fish. The autumn survey was started in 2005 and has been conducted annually, covering the area approximately of 141.5º–175º E and 37.0º–50.0º N. This survey provides abundance information on ages 0 and 1.

Russia has conducted a summertime acoustic-trawl survey since 2010 that examines mid-water and upper epipelagic species including chub mackerel. This survey completes 60-80 stations per year and aims to assess changes in abundance and migration patterns. Data collected include catch and effort, catch at length, and data for ageing.

DATA

3.1 Data preparation for stock assessment model

The Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA) agreed to apply a State-space Stock Assessment Model (SAM; Nielsen and Berg, 2014) for its stock assessment (TWG CMSA, 2023). It requires age-specific input data such as catch-at-age, maturity-at-age and weigh-at-age and abundance indices. A fishing year (FY) starting from July and ending in June of the following year was applied in the stock assessment of chub mackerel. The TWG CMSA agreed for the stock assessment period to be FY1970 (CY1970/quarter 3 (Q3)) to FY2023 (CY2024/Q2) (TWG CMSA, 2024). Seven age groups of ages 0 to 5 and 6+ were defined in the stock assessment. The Members submitted their data on quarter basis and then, they were compiled for construction the input data based on the fishing year. Manabe et al. (2025) comprehended the age-specific input data.

China has collected length frequency data of commercial catch through onboard and port samplings since CY2016, and aging of the samples has been started since CY2017. Japan also collects length, weight, maturity and age data from the survey and fishery to support their stock assessment. Russian length frequency and aging data of commercial catch are available since CY2016. The length frequency data obtained through research surveys are available since CY2010.

3.2 Catch-at-age

The catch-at-age is prepared for each Member on quarterly-basis for China and Russia. Japanese catch-at-age is prepared for Eastern Japan and Western Japan due to its difference in catch, size, and season in which the border of two regions is located at Mie-Shizuoka prefectural border.

The Members provided their quarterly catch-at-length data on calendar year basis as follows:

1) China, CY2016 to CY2024/Q2 ;
2) Eastern and Western Japan, CY2014 to CY2024/Q2;
3) Russia, CY2016/Q3 to CY2024/Q2.

The Members provided their quarterly age-length key (ALK) on calendar year basis as follows:

1) China, CY2018 to CY2024/Q2;
2) Eastern and Western Japan, CY2014 to CY2024/Q2.

For the catch-at-age prior to CY2014, Japan provided fishing year-based catch-at-age data for FY1970-FY2013 from the Japanese domestic stock assessment (Yukami et al. 2024). The data contains Russian catch in FY1967-1988 however due to the difficulty of separation into two Members, the catch is incorporated as Japanese catch. For the period of CY2014-2023/Q2, the TWG CMSA has agreed to calculate catch-at-age based on the catch-at-length data and corresponding ALK data of each quarter and region, which the detailed procedures are described in Manabe et al. (2024). The ALK of Russia is substituted by the Eastern Japanese ALK due to the similarity in the area of catch.

For the period with missing catch-at-length, the procedures to supplement the data are as follows:

1) For China CY2015, use mean catch-at-length of China of CY2016-2018 for equivalent quarter;
2) For Russia CY2014-2015, use mean catch-at-length of Russia of CY2016-2018 for equivalent quarter;
3) For Russia CY2022-2023/Q2, use Eastern Japanese catch-at-length of the equivalent quarter/year.

For the period with missing ALK, Eastern Japanese ALK of the equivalent quarter/year is applied to calculate catch-at-length. The calculated catch-at-length from each quarter is converted to fishing year basis by setting the data of age incrementation as July 1st. Ages are subtracted by 1 for the first and second quarters and early caught age 0 fish in those quarters, which are calculated as age -1, are incorporated into the third quarter as age 0. The detailed procedures are described in Manabe et al. (2024, 2025).

Through the procedures described above, catch-at-age data had been prepared for the stock assessment (Figure 4a). Chub mackerel catch was historically composed mainly of fish younger than age 3. In the periods of FY1970s, FY1980s and late-FY2010s to beginning of FY2020s, the catch of fish older than age 3 was prominent. There were differences in age compositions in catch by year and by member from FY2014 to FY2023 (Fig. 6). Catches of ages 1 to 3 were prominent in FY2014 to FY2016, respectively. In addition, dominant age classes of catch were different among China and Japan.

3.3 Weight-at-age

The Members provided their quarterly weight-at-age data on calendar year basis as follows:

1) China, CY2018 to CY2023/Q2;

2) Eastern and Western Japan, CY2014 to CY2023/Q2;
3) Russia, CY2016 to CY2022.

The TWG CMSA has agreed to calculate a single weight value for each age to convert stock number into biomass (TWG CMSA, 2024). The single weight-at-age were calculated through the following procedure, as described in Manabe et al. (2024, 2025). The proportion of catch number for each quarter is calculated for four regions: China, Eastern Japan, Western Japan, and Russia, using the following equation, where P is proportion of catch number, Na,t,r represents the catch number of age a at year t, and region r.

$$P_{a,t,r} = \frac{N_{a,t,r}}{\sum N_{a,t,r}} \tag{1}$$

The yearly catch number ratio for each region is then averaged between FY2014-2023 to calculate the constant ratio of catch number across the members.

$$P_{a,r} = \frac{\sum_{t=2014}^{2023} P_{a,t,r}}{10} \tag{2}$$

The weighted mean of weight W at age a at quarter q of year t is then calculated as:

$$W_{a,q,t} = P_{china}W_{a,q,t,china} + P_{japan}W_{a,q,t,japan} + P_{russia}W_{a,q,t,russia} \tag{3}$$

The quarterly weight-at-age within a single fishing year is taken an arithmetic mean to calculate the annual weight-at-age, which is used for the stock assessment.

$$W_{a,t} = \frac{\sum W_{a,q,t}}{4} \tag{4}$$

Through this procedure, annual weight-at-age were calculated for FY2014 to FY2023 (Fig. 4b). Since the weight-at-age prior to FY2014 was not reported by other members, the weight-at-age of CM in FY1970 to FY2013 was sourced from the Japanese domestic stock assessment of the Pacific stock of chub mackerel. Historical weight-at-age showed time-varying attributes and decreased obviously in last decade in age groups older than age 0.

3.4 Maturity-at-age

The TWG CMSA has agreed to use the annual maturity-at-age data from Japanese domestic stock assessment (TWG CMSA, 2024) (Fig. 4c). The Japanese maturity-at-age data is derived from the observation of catch from the spawning area, and based on previous studies (Watanabe and Yatsu, 2006; Watanabe, 2010). Chinese maturity-at-age data submitted on a quarterly basis were not included in the base-case maturity-at-age however the alternative maturity-at-age data are prepared for the sensitivity analysis, which the data preparation and data are described in NPFC-2024-TWG CMSA9-WP02.

Annual maturity-at-age used for base case showed decadal time-varying changes from FY1970 to FY2023 (Fig. 4c). The maturity rate of age 2 and 3 fish is expected to be lower after FY2015 than in the period before FY2014, due to the slow growth of the 2013-year class. In the recent years, maturity rate of age 2 is zero, and that of age 3 is 0.3 in the Japanese national waters.

3.5 Natural mortality

Initially the assessment investigated set two cases of natural mortality (TWG CMSA, 2024). One is M = 0.5 for all age classes while the other is age-specific M (0.80 for age 0, 0.60 for age 1, 0.51 for age 2, 0.46 for age 3,0.43 for age 4, 0.41 for age 5, and 0.40 for age 6+) (Fig. 7). These natural mortality coefficients have been determined according to different natural mortality estimators with biological parameters from various samples (Nishijima et al., 2021). It is assumed that the natural mortalities are time-invariant throughout all years. The TWG CMSA agreed to use the age specific natural mortality estimates for all models at its 9th meeting.

3.6 Abundance indices

The inventory of abundance indices time series shown in Fig. 4d was as follows.

1) Relative number of age 0 fish from the summer survey by Japan from FY2002 to FY2024 (Nishijima et al., 2025a (NPFC-2025-TWG CMSA10-WP08))
2) Relative number of age 0 fish from the autumn survey by Japan from FY2005 to FY 2024 (Higashiguchi et al., 2025 (NPFC-2025-TWG CMSA10-WP05))
3) Relative number of age 1 fish from the autumn survey by Japan from FY2005 to FY 2024 (Higashiguchi et al., 2025 (NPFC-2025-TWG CMSA10-WP05))
4) Relative spawning stock biomass (SSB) from the egg survey by Japan from FY2005 to FY2024 (Nishijima et al., 2025b (NPFC-2024-TWG CMSA10-WP07 (Rev.1)))
5) Relative SSB from the dip-net fishery by Japan from FY2003 to FY2024 (Nishijima et al. 2025c (NPFC-2025-TWG CMSA10-WP06))
6) Relative vulnerable stock biomass from the light purse seine fishery by China from FY2014 to FY2022 (Shi et al., 2025 (NPFC-2025-TWG CMSA10-WP09))
7) Relative vulnerable stock biomass from the trawl fishery by Russia from FY2016 to FY2024 (Chernienko and Chernienko, 2025 (NPFC-2025-TWG CMSA11-WP15))

The seven time series were used during model development and applied for the base case. The abundance indices from Japan and Russia were available until FY2024 and until FY2023 for China.

SPECIFICATION OF STOCK ASSESSMENT

4.1 State-space Stock Assessment Model (SAM)

SAM is a statistical catch-at-age model that accounts for observation errors in catch at age, which was originally developed by Nielsen and Berg (2014). Furthermore, in order to match the nature of data of this stock, improvements have been made to allow more flexible settings (Nishijima and Ichinokawa, 2023), and this assessment used the modified version. The detailed settings are described as follows. SAM consists of two subparts: population dynamics model and observation model.

4.1.1 Population dynamics model

The population dynamics of chub mackerel in SAM basically follows an age-structured model:

$$\log(N_{0,y}) = \log[f(SSB_y)] + \eta_{0,y}, \qquad a = 0 \qquad (5)$$

$$\log(N_{a,y}) = \log(N_{a-1,y-1}) - F_{a-1,y-1} - M_{a-1,y-1} + \eta_{a,y}, \qquad 1 \le a \le 5 \qquad (6)$$

$$\log(N_{6+,y}) = \log(N_{5,y-1}e^{-F_{5,y-1}-M_{5,y-1}} + N_{6+,y-1}e^{-F_{6+,y-1}-M_{6+,y-1}}) + \eta_{6+,y}\ , \qquad a = 6+ \qquad (7)$$

where $\eta_{a,y}$ is the process error at age a in year y following $\eta_{a,y} \sim N(0, \omega_a^2)$. The recruitment of chub mackerel occurs at age 0, described by a function of SSB and process errors (Eqn. 1). We use a Beverton-Holt stock-recruitment relationship (Beverton and Holt, 1957):

$$f(SSB_y) = \frac{\alpha \times SSB_y}{1 + \beta \times SSB_y}, \qquad (8)$$

where SSB_y is the sum-product of number (N), weight (w), and maturity (g) at age:

$$SSB_y = \sum_{a=0}^{6+} g_{a,y} w_{a,y} N_{a,y}\ . \qquad (9)$$

For fish older than age 0, the number of each cohort decreases by fishing mortality coefficient ($F_{a,y}$) and natural mortality coefficient ($M_{a,y}$) from the previous year and also be affected by process errors $\eta_{a,y}$ (Eqn. 2). For the plus-age group (6+), the number is described as the sum of surviving numbers of age 5 and age 6+ from the previous year (Eqn. 3).

In SAM, fishing mortality coefficients are assumed to follow a multivariate random walk:

$$\log(\boldsymbol{F_y}) = \log(\boldsymbol{F_{y-1}}) + \boldsymbol{\xi}_y\ , \qquad (10)$$

where $\boldsymbol{F_y} = (F_{1,y}, \dots, F_{A+,y})^T$, $\boldsymbol{\xi_y} \sim \text{MVN}(0, \boldsymbol{\Sigma})$, and $\boldsymbol{\Sigma}$ is the variance-covariance matrix of multivariate normal distribution (MVN). The diagonal elements of matrix $\boldsymbol{\Sigma}$ were σ_a^2, while off-diagonal elements represent covariance of F process errors between age classes. This assumption of F random walk allows us to estimate time-varying selectivity (Nielsen and Berg 2014). For the covariance of MVN, we assume that the correlation coefficient of F between ages a and a' decreases along with their age differences: $\rho^{|a-a'|}\sigma_a\sigma_{a'}$ ($a \neq a'$).

4.1.2 Observation model

SAM is fitted to the data of catch-at-age and abundance indices. SAM uses the Baranov equation for estimates in catch-at-age:

$$\hat{C}_{a,y} = \frac{F_{a,y}}{F_{a,y} + M_{a,y}}\left(1 - \exp(-F_{a,y} - M_{a,y})\right)N_{a,y}\ . \qquad (11)$$

In this equation, $F_{a,y}$ and $\underline{N_{a,y}}$ are estimated parameters by random effects, while $\underline{M_{a,y}}$ is the natural mortality coefficient. That is, the predicted catch at age in number ($\hat{C}_{a,y}$) is a derived parameter. SAM then fit to observed catch-at-age in a lognormal assumption:

$$\log(C_{a,y}) = \log(\hat{C}_{a,y}) + \varepsilon_{a,y} \ , \tag{12}$$

where $\varepsilon_{a,y} \sim \mathrm{N}(0, \tau_a^2)$.

We have agreed to use seven abundance indices (Fig. 5d) which represent, respectively,

1. Relative number of age 0 fish from the summer survey by Japan,
2. Relative number of age 0 fish from the autumn survey by Japan,
3. Relative number of age 1 fish from the autumn survey by Japan,
4. Relative spawning stock biomass (SSB) from the egg survey by Japan,
5. Relative SSB from the dip-net fishery by Japan,
6. Relative vulnerable stock biomass to Chinese fleet from the light purse-seine fishery by China, and
7. Relative vulnerable stock biomass from the trawl fishery by Russia.

The predicted values of these abundance indices can be expressed in the following general equation:

$$\hat{I}_{k,y} = q_k \left[\sum_{a=0}^{6+} \left(\chi_{a,y,k} N_{a,y}\right)\right]^{b_k} . \tag{13}$$

The subscripts *k*, *y*, *a* represent index, year, and age, respectively. q_k and b_k are the proportionality constant and the nonlinear coefficient, respectively, for index *k*. Note that this equation does not mean that all the abundance indices are all nonlinear against abundance but includes a linear case (b_k =1). The parameter $\chi_{a,y,k}$ is a multiplier on the number of fish in age *a* and year *y* ($N_{a,y}$) for index *k*. For the abundance indices for age 0 fish number (*k*=1,2),

$$\chi_{a,y,k} = \begin{cases} 1, & a = 0 \\ 0, & \text{otherwise} \end{cases} . \tag{14}$$

For the abundance index for age 1 fish number (*k*=3),

$$\chi_{a,y,k} = \begin{cases} 1, & a = 1 \\ 0, & \text{otherwise} \end{cases} . \tag{15}$$

For the abundance indices for SSB (*k*=4,5),

$$\chi_{a,y,k} = g_{a,y} w_{a,y} \ . \tag{16}$$

The abundance indices for vulnerable stock biomass to Chinese and Russian fleets (*k*=6,7) would represent a part of the stock for each fleet or each member's fishery. For the abundance indices for vulnerable stock biomass (*k*=6,7), therefore,

$$\chi_{a,y,k} = \hat{s}_{a,y,k} w_{a,y,k} \ , \tag{17}$$

where $\hat{s}_{a,y,k}$ is the estimated fishery selectivity in age *a* and year *y* for index (or fleet) *k*. We cannot estimate fleet-specific *F* in the current setting of SAM or, therefore, derive fleet-specific predicted catch at age (see Eqn. 14). Since the fleet-specific catch-at-age data is available (Fig. 5a), however, we can approximate the fleet-specific *F* as follows:

$$F_{a,y,k} \fallingdotseq \frac{C_{a,y,k}}{\sum_f C_{a,y,f}} F_{a,y} \ , \tag{18}$$

where $C_{a,y,k}$ are the observed catch number in age a and year y for fleet k. This approximation assumes that the fleet-specific F is proportional to fleet-specific "observed" catch at age in number. We then obtain the fleet-specific selectivity:

$$\hat{s}_{a,y,k} = \frac{F_{a,y,k}}{\mathrm{E}[\boldsymbol{F_{y,k}}]}, \quad (19)$$

where $\boldsymbol{F_{y,k}} = (F_{0,y,k}, F_{1,y,k}, \ldots, F_{6+,y,k})^{\boldsymbol{T}}$. It is important to note that $\chi_{k,a,y}$ for k=6 include the estimated parameters ($F_{a,y,k}$), whereas $\chi_{k,a,y}$ for k=1-5 are provided from input data. We used the ratios of catch numbers of China and Russia to the total catch numbers as input data to fit the CPUEs of Chinese light purse seine fishery and Russian trawl fishery. In calculating the vulnerable biomass, fleet- and age- specific weight ($w_{a,y,k}$ in Eqn. 12) is needed. However, since there are no agreed data of fleet- and age- specific weights in fishing year, we took a simpler approach to using the stock weights for biomass calculation: $w_{a,y,k} = w_{a,y}$ (Fig. 4b).

The list of fixed-effect and random-effect parameters is shown in Table 1. The parameters are estimated to maximize the marginal likelihood of summing process-error components and observation error components. The marginal likelihood is computed by the numerical integration using the Laplace approximation via Template Model Builder (TMB: Kristensen et al., 2016). We applied a generic bias-correction estimator for derived quantities calculated as a nonlinear function of random effects (e.g., $N_{a,y}$ is a derived quantity calculated from the random effect of log($N_{a,y}$)), which is implemented in TMB (Thorson and Kristensen, 2016). Estimation uncertainties including standard errors (SEs) and confidence intervals were computed from the delta method in TMB. In this stock of chub mackerel, the period from July to the following June is treated as a fishing year (NPFC-2025-TWG CMSA09-WP01), and the estimated abundance is that at the beginning of the fishing year (i.e., July).

4.2 Model selection

SAM estimates age-specific process errors for F and N and age-specific observation error for C (σ_a, ω_a and τ_a, respectively: Table 1). Estimating these errors for all ages without any restriction may cause the failure to converge and/or over-parameterization. Estimating the nonlinearity parameters (b_k) for all of the abundance indices also may lead to the same problem. Because some abundance indices might respond linearly to the stock abundance, absence of the nonlinearity parameter of the abundance indices can lead to overestimation or underestimation of resources (Nishijima et al., 2019; Rose and Kulka, 1999). However, at the same time, estimation of nonlinear parameters for indices that actually react linearly to the abundance dynamics might cause overparameterization or even non-convergent estimation.

To address these problems, we conducted a series of model selections. We first focused on the optimization of the settings of the observation and process errors, fixing the relationship of the abundance dynamics and the abundance indices linear (b_k = 1). We introduced restrictions to these errors: For example, the process error for F can be restricted to be identical among ages 0–2 and among ages 3–6+. Because there are huge number of the restriction pattern, we applied a stepwise approach, rather than trying all the possible restriction patterns. We started from the simplest model in which σ_a, ω_a and τ_a were common among all age classes. We assume that the seven abundance indices have different SDs of the measurement errors even in the simplest model because each abundance index is derived from different sources and/or age classes. Then we chose the best between-age breakpoints at which the values of σ_a, ω_a and τ_a changed based on AIC. In this step, one breakpoint was set to each of σ_a, ω_a and τ_a. This process was iterated until no further reduction in AIC was observed. Exceptionally, the N process error (ω_a) breakpoints were not placed between ages 2 and 3 in order to avoid setting independent process errors for each of them. This is because the maturities for ages 2 and 3 have declined to 0 and 0.3, respectively, after 2015 and we suspect that the SSB index does not have sufficient recent information corresponding to these ages.

In the second step, we consider which nonlinear coefficients of abundance indices should be estimated. We classified the seven abundance indices into five categories:

1. Trawl surveys by Japan (summer for age 0 and autumn for ages 0 and 1)
2. Egg survey for SSB by Japan
3. Dipnet fishery CPUE for SSB by Japan
4. Light purse-seine fishery CPUE by China
5. Trawl fishery CPUE by Russia.

We analyzed 32 (= 2^5) cases of all combinations in which the nonlinear coefficients of abundance indices in each category were either estimated or fixed at 1, with the selected restrictions of the errors above. We filtered out models without convergence, models that did not output SE due to non-positive definite of Hessian matrix, or models having very large SE of any of the fixed-effect parameters (>10). Among models meeting these criteria, the simplest model with ΔAIC < 2.0 was selected.

4.3 Agreed base case scenario

In this assessment, we consider two scenarios as candidates for the base case analysis. The difference between these two base case scenarios is exclusion or inclusion of the latest abundance indices. The first scenario, namely S01-InitBase, excludes the six abundance indices in 2024 (Note that Chinese light purse-seine fishery CPUE has no 2024 data). The other scenario, S02-Index24_1, includes the 2024 indices. Because SAM requires biological parameters (weight at age and maturity at age) in 2024 and the proportion of Russian catch number in 2024 to estimate the 2024 population status, we assume they are the averages of themselves over 2016–2023 and 2021–2023, respectively. The sensitivity analysis for these settings confirmed that the assumption has a minor effect on the stock assessment results (NPFC-2025-TWG CMSA11-WP07).

The TWG CMSA based this year’s stock assessment on the previous assessment and included the following scenarios as candidate base cases:

- **S01-InitBase.** This scenario is based on the TWG CMSA 09 base case (S28-Proc Est), which excluded the latest abundance indices. Therefore, the abundance indices up to FY2023 were used as input in this scenario (FY2024 indices were excluded).

- **S02-Index24_1.** This scenario included the FY2024 abundance indices from Japanese and Russian fisheries and Japanese surveys. The weight and maturity at age for FY2024 were assumed to be their averages throughout FY2016–FY2023. The proportion of Russian catch out of the total catch was assumed to be its average over FY2021–FY2023. Although the catch in FY2024 is not available, stock status at the beginning of FY2024 can be calculated because stock status is determined before exploitation.

Seventeen other sensitivities were used to investigate the effect of alternative assumptions regarding the biological parameters in FY2024, Russian catch proportion in FY2024, nonlinearity for abundance indices, stock-recruit relationship, maturity processes and assumptions regarding process error in numbers at age.

The TWG CMSA agreed to select S02-Index24_1 as the base case scenario because it showed a smaller Mohn's rho in both the retrospective analysis and retrospective forecasting, as well as better performance in hindcasting cross-validation compared with S01-InitBase (Nakayama et a. 2025, Nishijima et al. 2025e). The selection also reflected the robustness of the stock assessment results to the assumptions about the FY2024 biological and catch composition data (, Nishijima et al. 2025e).

4.4 Model diagnostics

For the selected base case models, we applied several model diagnostics to check the reliability from a statistical point of view. Firstly, we performed a jitter analysis in which the initial values of the parameters were varied and re-estimated to confirm that the estimated parameters reach the global optimum. We checked whether the final gradients of the fixed effect parameters are close to zero, which is a necessary condition for model convergence.

We then plotted residuals in the catch number by age and in abundance indices to examine whether the residuals have temporal patterns. We also examined residuals in process errors for numbers by age ($\eta_{a,y}$ in Eqns. 1-3) and F by age (diagonal components of ξ_y in Eqn. 6). to show the stock abundance historically changed by these process errors. To visualize the effect of the process errors for numbers by age on the biomass-at-age, we plotted the deviances between the biomass-at-age estimated with the process error and the biomass-at-age expected with *no* process error. The deviances were calculated by $\hat{N}_{a,y} \times \omega_{a,y} \times [\exp(\hat{\eta}_{a,y}) - 1]$. Furthermore, we performed one-step-ahead (OSA) projections using the parameters estimated with full data and visualized the residuals between observation and projection to check whether there are temporal patterns in the OSA residuals in catch-at-age and the abundance indices.

A five-year retrospective analysis was performed to examine if the estimates had systematic bias for the removal (updating) of data. Mohn's rho was calculated for total biomass, SSB, recruitment, and mean F. We also performed a retrospective forecasting, which excludes the stock index values and catch number by age from the latest year and compares the results of a one-year-ahead forecasting from the terminal year of those data (in which age-specific weight and maturity rates were used) with estimates from the model using all data. We fixed the nonlinear coefficients (b_k) at the estimates with the full data in the retrospective analysis.

The leave-one-out (LOO) index analysis was next conducted by excluding the seven abundance indices one by one and comparing the estimates with the results obtained when all indices were used. This analysis allows us to examine the impact of each index on abundance estimates and check their robustness.

To evaluate whether the parameters converged to the maximum likelihood estimate (MLE) and the uncertainty of the estimate, we lastly examined the log-likelihood when the parameters were varied around the estimate. The parameters profiled are those related to the stock-recruitment relationship and proportionality constants for the abundance indices. For the indices for which nonlinear coefficients were estimated, the likelihood profile was obtained by fixing the nonlinear coefficients to the estimated values, because it was shown that the likelihood did not change much if the value of the proportionality constant was changed, and it was unclear whether the index had sufficient information on stock abundance. We also change the value of natural mortality coefficient (M), given as input data, and its effects on the likelihood and abundance estimates.

4.5 Setting and equations for biological reference points and future projections

The population dynamics model for stochastic future projections is the same as is used in SAM. Future projections were conducted assuming a constant catch a fixed amount (ranging from 0 to 200 thousand mt in increments of 10 thousand mt) each year from FY2026 to FY2036. Constant F projections were also conducted under Fcur and Constant-F scenarios where the catch was calculated by a fixed fishing mortality (ranging from F30%SPR to F70%SPR in increments of

5%SPR) each year since FY2026. For all scenarios the catch in FY2024 and FY2025 is based on the assumption that the fishing mortality in FY2024 and FY2025 would be the same as the FY2023 fishing mortality estimated by SAM.

Two assumptions regarding biological parameters were used for the calculation of reference points, one where the future biological parameters are assumed to equal the average of the recent eight (FY 2016–FY2023) years, and another where the mean biological parameters for the entire model time period (FY1970–FY2023) are used to calculate the reference points. The TWG CMSA recommends the use of the recent average based on the assumption that the prevailing conditions will likely persist for the near future.

4.5.1 Reference points

F-based reference points

The TWG CMSA calculated these reference points along with commonly used biological reference points such as F%SPR (30%, 40%, 50%, 60% and 70%), F0.1, with mean biological parameters and selectivity of the current fishing mortality (F_{cur}, average in FY2021 to FY2023). In particular, the biological parameters such as weight-at-age and maturity-at-age used for calculation of biological reference points are assumed as the average values during the most recent 8 years (FY2016 to FY2023), which represents the recent shift in biological parameters. As a comparable, the average of the biological parameters over the stock assessment period is used for the calculation of these reference points.

B-based reference points

While the F-based reference points are relatively robust to the time-varying biological parameters, commonly used B-based reference points such as SSB_{MSY} and SSB0 are found to be significantly affected by the changes of biological parameters in this stock as well as by the assumptions of stock recruitment relationships and model configurations. Owing to the uncertainty, the TWG CMSA explored some empirical reference points based on percentiles of historical SSB in FY1970–FY2023. The 25th percentile of SSB could be regarded as the limit, being above the SSB levels when the stock has been severely depleted during the 1990's and early 2000's. The remaining two reference points ($SSB_{REFERENCE\_A}$ and $SSB_{REFERENCE\_B}$) are the 50th and 70th percentiles of historical estimated SSB.

Although these levels of SSB are significantly lower than the theoretically calculated SSB_{MSY} under the assumption of Beverton-Holt type SR relationship without considering the time-varying nature of biological parameters, the two SSB reference points are about 20% of $SSB_{F=0\_RECENT}$ and about 40% of $SSB_{F=0\_RECENT}$, respectively, which is calculated as the multiplier between average lifetime contribution to the spawning stock biomass per fish assuming no fishing (SPR0) and average number of recruitment during the most recent 8 years. The quantity roughly approximates the level of SSB that could have been attained on average over the last decade if there had been no fishing.

4.5.2 Equations for calculating and population dynamics in future projection

The population dynamics model for future projections is the same as that used in SAM. The calculation was conducted by an R package named *frasyr* (https://github.com/ichimomo/frasyr), which has been developed for the stock assessment of Japanese domestic fisheries resources. In particular, we used the functions for future projection and the calculation of biological reference points in *frasyr*. The general equations of the forward calculation of the population dynamics are

$$N_{a,y}^{i} = \begin{cases} \dfrac{\hat{\alpha} SSB_y^i}{1+\hat{\beta} SSB_y^i} \exp\left(\eta_{0,y}^i\right) \quad (a=0) \\ N_{a-1,y-1}^{i} \exp\left(-M_{a-1} - F_{a-1,y-1}^{i}\right) \exp\left(\eta_{a,y}^{i}\right) \ (0 < a < 6) \\ N_{a-1,y-1}^{i} \exp\left(-M_{a-1} - F_{a-1,y-1}^{i}\right) \exp\left(\eta_{a,y}^{i}\right) + N_{a,y}^{i} \exp\left(-M_a - F_{a,y}^{i}\right) \exp\left(\eta_{a,y}^{i}\right) \ (a = 6+) \end{cases} \quad (24)$$

where $\hat{\alpha}$ and $\hat{\beta}$ are stock recruitment parameters estimated by SAM, $N_{a,y}^i$ is the number of fish in year y and age a at ith iteration, $F_{a,y}^i$ is fishing mortality coefficient in year y and age a at ith iteration, $\eta_{a,y}^i \sim \mathrm{N}(0, \hat{\omega}^2)$ where $\hat{\omega}^2$ is the variance of process error at recruitment estimated by SAM, and SSB_y^i is SSB defined as $\sum_{a=0}^{6} N_{a,y}^i w_{a,y} g_{a,y}$. The equations are generally applied from the end year of the stock assessment period with the initial conditions of $N_{a,2024}^i = \hat{N}_{a,2024}$ in the base case scenario S02-Index24_1, where $\hat{N}_{a,y}$ is the point estimates by SAM. Before management measures are implemented in 2026, we assumed that the fishing mortality in FY2024 and FY2025 would be the same as the 2023 fishing mortality estimated by SAM. If we were to assume the average fishing mortality for FY2021–2023 (F_{CUR}) during this period, the projected catch in the FY2024 would exceed 200,000 tons, which is unrealistically high considering current fishing situation. The fishing mortality in FY2023 was lower than in FY2021–2022, and using F2023 results in projected catches for FY2024–2025 that are similar to FY2023 (170,000 –180,000 tons), so we adopted this assumption. The future biological parameters of w_a and m_a are the averages of the most recent 8 years.

Two types of future harvesting methods were considered: constant-catch scenarios and constant-F scenarios. In the constant-catch scenarios, a total catch (*CC*) was predetermined ranging from 0 to 200,000 tons. Catch number at age $C_{y,a}^i$ in year y and age a is calculated with the Baranov catch equation

$$C_{y,a}^i = \frac{F_{y,a}^i}{F_{y,a}^i + M_a}\left(1 - \exp\left(-F_{y,a}^i - M_a\right)\right) N_{y,a}^i , \quad (25)$$

where $F_{y,a}^{i}$ is equal to x_y^iFcur with the same selectivity as Fcur and adjustment factor of x_y^i that is determined to satisfy the equation of $\sum_{a=0}^{6+} w_a C_{y,a}^{i} = CC$. If we cannot find x_y^i to satisfy the equation because of too small number of fishes, we took the smaller of the two numbers, $x_i =$ exp (10) or fishing mortality corresponding to 99% of total catches when $x_i =$ exp (100).

In the constant-F scenarios, we examined F ranging from F30%SPR to F70%SPR in 5% increments. In the Baranov equation above, $F_{y,a}^{i}$ was set as xF_{CUR}, where x used the values obtained when calculating the biological reference points. The constant-catch and constant-F scenarios were initiated in FY2026, and population dynamics were projected through to 2036, ten years later. We also conducted a future scenario in which the stock is exploited with current F since FY2026 to inform the current fishing impact on the stock in the future. The stochastic simulations were conducted 3,000 times for each model and scenario.

STOCK ASSESSMENT RESULTS

5.1 Base case model results

The TWG CMSA based this year's stock assessment on the previous assessment and included the following scenarios as base cases:

- **S01-InitBase.** This scenario is based on the TWG CMSA 09 base case (S28-Proc Est), which excluded the latest abundance indices. Therefore, the abundance indices up to FY2023 were used as input in this scenario (FY2024 indices were excluded).
- **S02-Index24_1.** This scenario included the FY2024 abundance indices from Japanese and Russian fisheries and Japanese surveys. The weight and maturity at age for FY2024 were assumed to be their averages throughout FY2016–FY2023. The proportion of Russian catch out of the total catch was assumed to be its average over FY2021–FY2023.

For both scenarios the model estimates the nonlinear coefficients only for the three trawl surveys by Japan which was identified by the lowest AIC in S01-InitBase and obtained the second lowest AIC in S02-Index24_1, the difference of AIC under this setting and the lowest AIC was only 0.48 and this was the simplest setting among those with ΔAIC < 2.0.

The chub mackerel stock in the NWPO has experienced large changes in biological parameters over the time period of the model. The main temporal changes are a recent decrease in maturity at age, along with a recent decrease in the weight at age, both of which were observed to change over the model time period to cause temporal changes of biological reference points. Fixed Effects parameter estimates are shown in Table 2, and the management related quantities are listed in Table 3.

5.1.1 Parameter estimates

The estimated fixed effects parameters for the base-case scenario (S02-Index24_1) are shown in Table 2. For all parameters, the final gradient values were very close to 0 and the SE values were less than 2.5. We found no problems in jitter analysis (results not shown). Correlation coefficients from the covariance matrices of the fixed effects parameters showed that q_k and b_k for age-0 and age-1 fish in the Japanese trawl surveys were highly negatively correlated (Fig. 8). In addition, the parameters α and β of the Beverton-Holt stock-recruitment relationship were highly positively correlated. However, since β is a function of α, this is to be expected (Beverton & Holt 1957). These strong correlations between α and β are explained by the scales of abundance and SSB (for details, see Discussion in TWG CMSA 2025), and there were no problems with model convergence, as indicated by the absolute values of the final gradients approaching zero and sufficiently small SEs for these parameters (Table 2). The nonlinear coefficients in the Japanese trawl survey indices were estimated in the range of 1.7−2.4 (Table 2), suggesting that they have a tendency of hyperdepletion (Fig. 9).

5.1.2 Time-series estimates for abundances and fishing impacts

The two scenarios obtained almost identical population dynamics. Since 1970, total biomass, SSB, and recruitment of chub mackerel have drastically fluctuated (Table 4, Fig.10). Specifically, stock levels were historically high in the 1970s, but declined in the 1980s, were maintained at fairly low levels from the 1990s to the early 2000s; stock levels gradually recovered in the late 2000s and increased rapidly after the occurrence of the strong year class in 2013. However, after peaking in 2018, the stock levels rapidly dropped again. In 2023, the spawning stock biomass was only 16% of the respective peak levels. Neither of the peaks in 2017 in 2018 reached the stock levels observed in the 1970s. In addition, the spawning stock biomass in 2024 further declined from 2023, to 14% of the peak in 2018. Exploitation rate (estimated catch biomass / total biomass) and mean F remained constant, with some fluctuations, until the 2000s, but decreased thereafter (Fig. 10).

5.1.3 Stock-recruitment relationship

The estimated Beverton-Holt stock-recruitment relationship is shown in Fig. 11 for the final base case (S02-Index24_1). The estimated stock-recruitment relationships were slightly convex, suggesting that the density-dependent effect in the stock-recruitment relationship is not strong in the chub mackerel population dynamics. The SD of recruitment variability was 0.78 in S02-Index24_1 (Table 2).

5.2 Model diagnostics

5.2.1 Residual plots

In this assessment, the predicted catch and the observed catch do not match because of the assumption of observation error in the age-specific catch numbers, but the difference between these values was small, except in some years (Fig. 12). Observation errors for catch-at-age were larger in the young and old age (ages 0, 1, and 6+) groups than those in the intermediate age (ages 2–5) groups which resulted in larger estimates of expected catch than the observed catches (Figs. 12 and 13). The time-series trend of the residuals was weak.

For the abundance indices, observation error was notably high in the Russian trawl fishery CPUE (Figs. 14 &15). The summer age-0, and autumn age-1 indices tended to have positive residuals in recent years, except for the 2023 autumn (Figs. 14 & 15).

The process errors in log(*N*) for age-0 fish fluctuated strongly, and those for age 1 and 2 fish fluctuated moderately, compared to those for older ages (Fig. 16, top, and Fig. 17). The recruitment residual has been positive after 2020. In addition, the first seven years from 1971 had positive recruitment residuals (except 1974), but for the next 13 years through 1990, the residuals were negative in all years except 1985. A large positive process error was observed in age 2 in 2015, resulting in a large positive deviance in the same year and age (Fig. 17).

Process errors for log(*F*) (deviation from random walk) were larger in ages 0 and 1 than in the other ages (Fig. 17, bottom). The pattern of random walks for each age was very similar, as evidenced by the very high correlation coefficient of 0.98 between the closely adjacent ages (Tables 5 and 6).

5.2.2 Retrospective analysis

In the retrospective analysis, the biomass and recruitment tended to be revised downward as the data were updated and as a result, F shows negative retrospective pattens in the base-case scenario S02-Index24_1 (Fig. 18). SSB had much smaller retrospective pattern compared to biomass and recruitment.

The same tendencies, the positive retrospective patterns in the biomass, recruitment and SSB were obtained in the retrospective forecasting (Fig. 19), but the Mohn's rho values were expanded relative to those in the retrospective analyses.

5.2.3 Leave-one-out index analysis

In the LOO index analysis, although the abundance, SSB, recruitment, and exploitation rate somewhat varied in recent years depending on the index removed, the patterns observed were largely consistent, indicating that the stock estimates are robust (Fig. 20). Among the abundance indices, the absence of summer Japanese trawl survey for age 0 had relatively large effect on the recruitment. This is natural because this index was slightly inconsistent with the autumn Japanese trawl survey index for age 0 (e.g., 2021 year class). The absence of Japanese trawl surveys for age 0 in summer and for age 1 in autumn also led to the increase of the recent exploitation rate, presumably because of the smaller estimated recruitment.

5.2.4 Evaluation of the One Step Ahead residuals

OSA residuals were calculated for the age composition data the indices of abundance (Figs. 21 & 22). Absolute values of residuals for catch-at-age were larger between the late 1980s and the mid 2000s. In general, the catch-at-age OSA residuals tended to be small and lacked any consistent patterning. The OSA residuals from the fits to the indices of abundance showed a similar lack of patterning and did not suggest systematic model deficiencies such as underfitting or overfitting. Overall, the OSA residuals indicate no issues with the model's performance. In the one-step-ahead projection, we observed no clear temporal tendencies in the residuals for catch-at-age and the indices except that the Japanese dipnet fishery's standardized CPUE (Fig. 22). The residuals almost followed a normal distribution (Fig. 23).

5.2.5 Likelihood profiling

To evaluate whether the recruitment parameters converged to the maximum likelihood estimate (MLE) and the uncertainty of the estimate, we examined the log-likelihood when the parameters were varied around the estimate. The negative log-likelihood had a convex shape against the parameters, with the MLE as the smallest, indicating convergence to the optimal value (Fig. 24). The dip of the negative log-likelihood of β was not as sharp as those of other parameters, suggesting a greater uncertainty in the density-dependent parameter. We also investigated likelihood profiles for proportionality constants for the seven abundance indices, indicating converged estimation of these parameters (Fig. 25).

Finally, the effect of the natural mortality coefficient (M), given as input data, was examined: the change in log likelihood was examined by adding values of -0.3 to 0.5 simultaneously from the values of M in the two scenarios. The results revealed that the negative log-likelihood monotonically decreases (i.e., the likelihood increases) as M is decreased (Fig. 26). This suggests that it is difficult to estimate M from these data inside SAM.

5.2.6 Comparison with previous assessments

Comparing the current two scenarios (S01-InitBase, S02-Index24_1) with the previous base case (S28-ProcEst, TWG CMSA 2024a), the estimated historical population dynamics were also almost consistent (Fig. 27). However, focusing on the recent population dynamics, inclusion of 2023 indices revised the biomass, SSB, and recruitment downward considerably (Fig. 28). This is presumably because all abundance indices consistently decreased in 2023 and this information was not included in the previous base case. The decrease in the 2023 indices contributed to the increase in the retrospective patten this year from last year (NPFC-2025-TWG CMSA11-WP08. Some degree of revision to stock estimates due to data updates is an essential part of the annual assessment process.

5.3 Reference points

5.3.1 Historical change in spawning potential of SPR0

SPR0 has changed annually according to the biological parameters that changed each year (Fig. 29). In particular, SPR0 decreased significantly from FY2015 onwards, reaching a minimum in 2019 and remaining low during the FY2020-2023 period. The average SPR0 for the 2020s (FY2020-2023) was 166 g in Scenario S02-Index24_1 which is about half of the SPR0 averaged for other decades.

5.3.2 Reference Points

F-based reference points

The TWG CMSA calculated these reference points along with commonly used biological reference points such as F%SPR (30%, 40%, 50%, 60% and 70%), F0.1, with mean biological parameters and selectivity of the current fishing mortality (F_{cur}, average in FY2021 to FY2023) (Table 3). In particular, the biological parameters such as weight-at-age and maturity-at-age used for calculation of biological reference points are assumed as the average values during the most recent 8 years (FY2016 to FY2023), which represents the recent shift in biological parameters. As a comparable, the average of the biological parameters over the stock assessment period is used for the calculation of these reference points.

B-based reference points

While the F-based reference points are relatively robust to the time-varying biological parameters, commonly used B-based reference points such as SSB_{MSY} and SSB0 are found to be significantly affected by the changes of biological parameters in this stock as well as by the assumptions of stock recruitment relationships and model configurations. Owing to the uncertainty, the TWG CMSA explored some empirical reference points based on percentiles of historical SSB in FY1970–FY2023 (Fig. 24). The 25th percentile of SSB could be regarded as the limit, being above the SSB levels when the stock has been severely depleted during the 1990’s and early 2000’s. The remaining two reference points ($SSB_{REFERENCE\_A}$ and $SSB_{REFERENCE\_B}$) are the 50th and 70th percentiles of historical estimated SSB (Fig. 29).

Although these levels of SSB are significantly lower than the theoretically calculated SSB_{MSY} under the assumption of Beverton-Holt type SR relationship without considering the time-varying nature of biological parameters, the two SSB reference points are about 20% of $SSB_{F=0\_RECENT}$ and about 40% of $SSB_{F=0\_RECENT}$, respectively, which is calculated as the multiplier between average lifetime contribution to the spawning stock biomass per fish assuming no fishing (SPR0) and average number of recruitment during the most recent 8 years. The quantity roughly approximates the level of SSB that could have been attained on average over the last decade if there had been no fishing (Fig. 30).

5.4 Future projections

Constant F projections were conducted under F_{cur} and Constant-F scenarios where the catch was calculated by a fixed fishing mortality (ranging from F30%SPR to F70%SPR in increments of 5%SPR) each year since FY2026 (Fig. 31). Future projections were also conducted under constant catch scenarios (i.e. a fixed amount ranging from 0 to 200 thousand mt in increments of 10 thousand mt) each year from FY2026 to FY2036 (Fig. 32). The probability that future SSB on July 1, at the beginning of the fishing year, is above $SSB_{REFERENCE\_B}$, $SSB_{REFERENCE\_A}$, and SSB_{LIMIT} (70^{th} percentile, 50^{th} percentile and 25^{th} percentile, respectively) under constant catch and fishing mortality projections for the base case scenario S02_24_Index1 are shown in Tables 5 & 6.

Two assumptions regarding biological parameters were used for the calculation of reference points, one where the future biological parameters are assumed to equal the average of the recent eight (FY 2016–FY2023) years, and another where the mean biological parameters for the entire model time period (FY1970–FY2023) are used to calculate the reference points. The TWG CMSA recommends the use of the recent average based on the assumption that the prevailing conditions will likely persist for the near future.

DISCUSSION

In this working paper, a stock assessment of Northwestern Pacific chub mackerel was conducted using SAM with existing agreed data. SSB gradually decreased from the high period in the 1970s to the 1980s, and SSB remained at a low level from the 1990s to the early 2000s; the beginning of the decreasing trend in SSB in the 1980s can be explained by a reversal from the positive recruitment residuals that often appeared until FY1977 to negative residuals that often appeared thereafter, shown in the plot for process errors (Fig. 17). High fishing mortalities were found since FY1986 thorough the 1990s, causing the extremely low levels of SSB for this time period. In the late 2000s, SSB gradually recovered as fishing pressure slowly decreased, and after the occurrence of the strong year class in FY2013. Although SSB recovered in the 2010s, it was still lower than in the late 1970s. Recent declines in the estimated biomass and recruitment trends (Fig. 10) correspond with both the CPUE (Fig. 14) series as well as a shift to lower SPR0 (Fig. 30). This may be due to the overall effect of the change in weight and maturity at age (Fig. 4).

Retrospective analysis revealed a negative pattern in fishing mortality, which was related to a small positive bias in recruitment and total biomass. These retrospective patterns are consistent with the catch history and the available data on maturity and catch at age. The LOO index analysis showed that the effect of excluding one index was small, suggesting that the age-0 and age-1 fish indices have similar information to each other and the SSB indices have similar information to each other.

For this stock, the choice of the stock-recruitment relationship is a difficult issue. In this case, we used the Beverton-Holt model, which is the simplest model and fits well with chub mackerel, but recruitment shows almost proportional relationship with SSB and the density-dependent effect is very small. Therefore, the uncertainty of the parameters related to the density dependence was large.

Estimating stock recruitment relationships in an assessment model is inherently challenging due to the complex interplay of biological and environmental factors that influence fish population dynamics. Variability in recruitment can result from factors such as fluctuating environmental conditions, changes in predator-prey interactions, and genetic diversity within the stock (Myers, 1998). Additionally, data limitations, such as insufficient time series data, measurement errors, and biases in sampling methods, further complicate the estimation process (Maunder & Deriso, 2013). These difficulties are exacerbated by the non-linear and often unpredictable nature of recruitment, making it hard to develop reliable models that accurately capture the true dynamics of fish populations (Hilborn & Walters, 1992). From the viewpoint of stock assessment and management for chub mackerel, it will be necessary to consider how the stock-recruitment relationship should be characterized in the future.

The chub mackerel stock in the NWPO has experienced large changes in biological parameters over the time period of the model. The main temporal changes are a recent decrease in maturity at age, along with a recent decrease in the weight at age, both of which were observed to change over the model time period to cause temporal changes of biological reference points. Maximum sustainable yield (MSY)-based reference points are highly variable over the time series of the assessment because the weight- and maturity- at age of chub mackerel has varied widely which impacts the productivity of the stock. Unfished spawning biomass per recruit (SPR0) represents the theoretical equilibrium productivity per fish assuming no fishing. SPR0 has varied remarkably over time (Fig. 27).

In addition, as there is little recruitment compensation in the stock-recruitment relationship within the range of historically observed SSB and recruitment (Fig. 11), estimates of biomass-based MSY reference points are extreme explorations that are highly sensitive to model configuration.

Because of the above reasons, commonly used reference points such as MSY-related or SPR-related reference points vary over time and are uncertain, and do not take into account non-stationarity of key population dynamics parameters. are potentially misleading with respect to stock status. The TWG CMSA explored empirical biomass-based reference points based on percentiles of historical SSB in FY1970–FY2023. These empirical reference points attempt to account for the non-stationarity in key population parameters, future research on this topic is recommended.

SUMMARY

Stock status overview

Total biomass, Spawning Stock Biomass

The time series of estimated chub mackerel total biomass and SSB generally declined from the 1970s through the 1990s (Fig. 10). The stock began to recover in the early 2000s, peaking in FY2018, then SSB has declined to 16% of that peak in 2023. The spawning stock biomass in 2023 is slightly higher than SSB_{LIM} (SSB_{2023}/SSB_{LIM}=1.23) but lower than $SSB_{REFERENCE\_A}$ and $SSB_{REFERENCE\_B}$ (Table 3).

Recruitment

The level of recruitment in the 1970s was estimated to be high (~15 billion individuals on average) and reached a low period between the 1990s and the 2010s (Fig. 10). Recruitment in the most recent decade (FY2014–FY2023) was also high on average (~7.4 billion), but not as high as in the 1970s and had a decreasing trend since the last peak in 2018. The estimated Beverton-Holt stock recruitment relationship was slightly concave (Fig. 11), suggesting that the density-dependent effect in recruitment is not strong.

Exploitation status

Estimated exploitation rate generally fluctuated between 10% and 35%, with over 40% and below 10% in several years, following the estimated F dynamics. No clear temporal trend was observed (Fig. 10). The current fishing mortality (F_{cur}) corresponds to 16% SPR, and higher than the commonly used F-based reference points such as F0.1 and F30–70%SPR (Table 3). Fishing mortality related reference points indicate that the stock is at approximately 16% SPR, indicating that current fishing mortality are also reported for percent FSPR values, in relation to the current F (Fcur, average FY2021–FY2023) for FSPR from the recent period (FY2016–FY2023) as well as over the entire time period (FY1970–FY2023; Table 3).

Conclusions and recommendations

The chub mackerel stock in the NWPO has experienced large changes in biological parameters over the time period of the model. The main temporal changes are a recent decrease in maturity at age, along with a recent change in the weight at age, both of which were observed to impact the model time period to cause temporal impacts on biological reference points. MSY-based reference points are highly variable over the time series of the assessment because the weight- and maturity- at age of chub mackerel have varied widely (Fig 4.), which impacts the productivity of the stock. Unfished spawning biomass per recruit (SPR0) has varied remarkably over time (Fig. 30).

Besides such uncertainty, the current fishing mortality (average FY2021–FY2023) is higher than the commonly used reference points such as F%30–60%, and SSB in FY2024 is lower than the reference levels of median and 70th percentiles ($SSB_{REFERENCE\_A}$ & $SSB_{REFERENCE\_B}$, respectively), but slightly above the SSB_{LIM}.

Harvest Recommendations

Given the uncertainty in biological parameters in future, which has a large impact on the projection results, the TWG CMSA considers it is not appropriate to provide long-term harvesting recommendations at this time. However, in response to the request from COM09, 10 year projection was undertaken to assess the effects of varying catch and F levels based on the most recent eight years' biological data (Figs. 31 & 32, Tables 7 & 9). Projections indicate that current fishing mortality is unsustainable, and probabilities of achieving various reference levels under catch-constant as well as F-constant scenarios are provided in Tables 5 & 6. It is recommended to reduce fishing mortality to recover SSB to the reference levels.

Data and Research needs

The assessment results, including projections, are dependent on biological parameters and processes which are uncertain. Therefore, future studies should be focused on collecting and analyzing biological information, e.g., maturity-at-age and weight-at-age, which would improve the assessment. Fisheries-dependent data, such as fleet-specific catch-at-age, are also critical to develop Member-specific fishing fleet and age-specific abundance indices. It is also important to explore the factors that contributed to the lower-than-expected presence of the 2018 year class in catch-at-age data, despite strong signals in survey indices.

A critically important recommendation that should be carried out in 2-3 years is to develop a harvest control rule (HCR) specific to this stock via a Management Strategy Evaluation (MSE) process. This HCR should be dynamic and able to adjust annual total catches depending on the stock abundance as well as the target and limit reference points. During the process of the development of MSE, uncertainties in parameter estimates, time-varying or density-dependent biological parameters, stock-recruitment assumptions, process errors, and selectivity should be considered.

Timely collection of biological information and further research on biological parameters and processes, including the effect of environment and climate change, are critically important to facilitate the accurate estimation of reference points.

REREFENCES

Baryshko M.E. 2009. Fisheries of mackerel and sardine-Ivasi in the Far East. Vladivostok DGTRU. 472 c.

Beverton, R. J. H., & Holt, S. J. (1957). On the dynamics of exploited fish populations. Chapman and Hall, London, Fish and Fisheries Series No. 11, fascimile reprint 1993.

Chernienko, I. and Chernienko E. (2025). Standardized CPUE of Russian commercial trawl fishery of chub mackerel in the Northwest Pacific up to 2024. NPFC-2025-TWG CMSA11-WP05.

Higashiguchi, K., Nishijima, S., Ichinokawa, M. and Yukami, R. (2025). Standardized Abundance Indices for Ages 0 and 1 Fish of Chub Mackerel from Northwest Pacific Autumn Surveys up to 2024. NPFC-2025-TWG CMSA10-WP05.

Hilborn, R., & Walters, C. J. (1992). Quantitative Fisheries Stock Assessment: Choice, Dynamics, and Uncertainty. Springer.

Iizuka, K. (2002). Stock and fishing grounds of chub mackerel in 1960s and 1970s. *Gekkan Kaiyo*, 34, 273–279 (in Japanese).

Kasamatsu, F. & Tanaka, S., 1992. Annual changes in prey species of minke whales taken off Japan, 1948–1987. Nippon Suisan Gakkaishi (Japanese Society of Fisheries Science), 54, pp.637–651.

Kamimura, Y., Taga, M., Yukami, R., Watanabe C. and Furuichi S. (2021). Intra- and inter specific density dependence of body condition, growth, and habitat temperature in chub mackerel (*Scomber japonicus*). ICES J. Mar. Sci., 78, 3254-3264.

Kanamori, Y., Takasuka, A., Nishijima, S., and Okamura, H. (2019). Climate change shifts the spawning ground northward and extends the spawning period of chub mackerel in the western North Pacific. Marine Ecology Progress Series. 624, 155-166. https://doi.org/10.3354/meps13037

Kawabata, A., Nakagami, M., Suyama, T., Yatsu, A., Takagi, K. & Takeda, Y., 2006. [Seasonal distribution and migration of mackerel and sardine species estimated from recent large-scale research vessel surveys.] Abstracts of the 2006 Annual Meeting of the Japanese Society of Fisheries Oceanography, p.94.

Kawasaki, T., 1965. [Ecology and resources of skipjack tuna (I).] Fisheries Research Series, 8, p.148.

Kawasaki, T., 1968. [Ecology of immature chub mackerel of the Pacific stock.] Bulletin of the Tokai Regional Fisheries Research Laboratory, 55, pp.59–113.

Koizumi, M., 1992. [Observations on eggs, larvae, and juvenile chub mackerel collected around the Izu Islands.] Fisheries Oceanography, 56, pp.57–64.

Kato, M. and Watanabe, C., (2002). Maturation, spawning and feeding habitat of chub and blue mackerels. *Gekkan Kaiyo*, 34, 366–272 (in Japanese).

Kristensen, K., Nielsen, A., Berg, C. W., Skaug, H., and Bell, B. M. (2016). TMB: Automatic differentiation and laplace approximation. Journal of Statistical Software, 70(5), 1–21.

https://doi.org/10.18637/jss.v070.i05
Kuroda, K., 1992. [Trends in spawning season, spawning grounds, and spawning intensity of Scomber species along the Pacific coast of Japan.] Fisheries Oceanography, 56, pp.65–72.
Konishi, K., Isoda, T. & Tamura, T., 2016. Decadal change of feeding ecology in sei, Bryde's, and common minke whales in the offshore western North Pacific. Paper SC/F16/JR23 submitted to the JARPNII Review Workshop, Tokyo, February 2016, 19 pp
Ma, Q., Liu, B. and Dai, L. (2023) Overview surveys from 2021 to 2023 by Chinese research vessel "Song Hang" in the NPFC convention area. NPFC-2023-SC08-WP12.
Manabe, A., Higashiguchi, K., Yukami, R. and Oshima, K. (2024). The data description for the base case stock assessment of chub mackerel Scomber japonicus in the northwestern Pacific Ocean. NPFC-2024-TWG CMSA09-WP01.
Manabe, A., Mora Gazi, K. and Oshima, K. (2025). The data description for the base case stock assessment of chub mackerel *Scomber japonicus* in the northwestern Pacific Ocean for 2025 assessment. NPFC-2025-TWG CMSA11-WP03 Rev. 1.
Maunder, M. N., & Deriso, R. B. (2013). A stock–recruitment model for highly fecund species based on temporal and spatial extent of spawning. Fisheries Research, 146, 96-101.
Meguro, K., Nashida, K., Mitani, T., Nishida, H. & Kawabata, A., 2002. [Distribution and migration of chub mackerel and spotted mackerel—Adults.] Kaiyō Monthly (Ocean), 34, pp.256–260.
Murayama, T., Mitani, I., Aoki, I. (1995) Estimation of the spawning period of the Pacific mackerel Scomber japonicus based on the changes in gonad index and the ovarian histology. Bull .Jpn. Soc. Fish. Oceanogr. 59, 11-17 (in Japanese, with English abstract).
Myers, R. A. (1998). When do environment-recruitment correlations work? Reviews in Fish Biology and Fisheries, 8(3), 285-305.
Nagasawa, K., 1999. [Distribution and ecology of piscivorous fishes in the Kuroshio–Oyashio transition region.] Kaiyō Monthly (Ocean), 34, pp.245–250.
Nakayama, S., Nishijima, S., Ichinokawa, M., Manabe A., Oshima K. and Rice, J. (2025) Candidate Base Case Scenarios for the 2025 Chub Mackerel Stock Assessment in the Northwest Pacific Ocean. NPFC-2025-TWG CMSA11-WP06.
Nielsen, A., and Berg, C. W. (2014). Estimation of time-varying selectivity in stock assessments using state-space models. Fisheries Research, 158, 96–101. https://doi.org/10.1016/j.fishres.2014.01.014
Nishida, H., Kawabata, A., Meguro, K., Nashida, K. & Mitani, T., (2001). [Distribution and migration of chub mackerel and spotted mackerel—Juveniles.] Fisheries Oceanography, 65, p.201.
Nishijima, S., Kamimura, Y., Yukami, R., Manabe, A., Oshima, K., and Ichinokawa, M. (2021). Update on natural mortality estimators for chub mackerel in the Northwest Pacific Ocean. NPFC-2021-TWG CMSA04-WP05.
Nishijima, S., Suzuki, S., Ichinokawa, M., and Okamura, H. (2019). Integrated multi-timescale

modeling untangles anthropogenic, environmental, and biological effects on catchability. Canadian Journal of Fisheries and Aquatic Sciences, 76(11), 2045–2056. https://doi.org/https://doi.org/10.1139/cjfas-2018-0114.

Nishijima, S., and Ichinokawa, M. (2023). On the description and flexibility of state-space assessment model. NPFC-2023-TWG CMSA07-WP07.

Nishijima, S., Kamimura, Y., Ichinokawa, M. and Yukami, R. (2025a). Standardized abundance index for recruitment of chub mackerel from Northwest Pacific summer surveys up to 2024. NPFC-2025-TWG CMSA10-WP08.

Nishijima, S., Ichinokawa, M. and Yukami, R. (2025b). Standardizing monthly egg survey data as an abundance index for spawning stock biomass of chub mackerel in the Northwest Pacific. NPFC-2024-TWG CMSA10-WP07 (Rev.1).

Nishijima, S., Yukami, R. and Ichinokawa, M. (2025c). Standardized CPUE of Japanese commercial dip-net fishery targeting spawners of chub mackerel in the Northwest Pacific up to 2024. NPFC-2025-TWG CMSA10-WP06.

Nishijima, S., Ichinokawa M., Oshima K., and Rice, J. (2025d) Biological reference points and future projections in the 2025 stock assessment for the Northwestern Pacific chub. NPFC-2025-TWG CMSA11-WP09.

Nishijima, S., Ichinokawa M., Manabe, A., Nakayama, S., Oshima, K., and Rice, J. (2025e) Sensitivity analyses of the 2025 chub mackerel stock assessment in the Northwest Pacific Ocean. NPFC-2025-TWG CMSA11-WP07.

Oozeki, Y., A. Takasuka, H. Kubota and M. Barange (2007) Characterizing spawning habitats of Japanese sardine (*Sardinops melanostictus*), Japanese anchovy (*Engraulis japonicus*), and Pacific round herring (*Etrumeus teres*) in the northwestern Pacific. CalCOFI Reports, 48, 191-203

Pozdnyakov S. E., Vasilenko A.V. (1994). Distribution, migration routes and helminth fauna of the Japanese mackerel *Scomber japonicus* in the north-western part of the Pacific Ocean // Vopr. ichthyol. T. 34. №1, C. 22-34.

Pyrkov V.N., Solodilov A.V., Degaj A.Yu. (2015) Sozdanie i vnedrenie novyh sputnikovyh tekhnologij v sisteme monitoringa rybolovstva // Sovremennye problemy distancionnogo zondirovaniya Zemli iz kosmosa. —. — T. 12, No 5. — S. 251–262.

Rose, G., and Kulka, D. (1999). Hyperaggregation of fish and fisheries: how catch-per-unit-effort increased as the northern cod (*Gadus morhua*) declined. Canadian Journal of Fisheries and Aquatic Sciences, 56(S1), 118–127. https://doi.org/10.1139/cjfas-56-S1-118

Shi, Y., Zhang, H. and Han, H. (2025). Standardized CPUE of Chub mackerel (*Scomber japonicus*) caught by the China's lighting purse seine fishery up to 2023. NPFC-2025-TWG CMSA10-WP09.

Tamura, T., Fujise, Y. & Shimazaki, K., (1998). Diet of minke whales Balaenoptera acutorostrata in the northwestern North Pacific in summer, 1994 and 1995. Fisheries Science, 64, pp.71–76.

Tamura, T., Konishi, K. & Isoda, T., (2016). Updated estimation of prey consumption by common minke, Bryde's, and sei whales in the western North Pacific. Paper SC/F16/JR15 submitted to the JARPNII Review Workshop, Tokyo, February 2016, 58 pp.

Thorson, J. T., and Kristensen, K. (2016). Implementing a generic method for bias correction in statistical models using random effects, with spatial and population dynamics examples. Fisheries Research, 175, 66–74. https://doi.org/10.1016/j.fishres.2015.11.016

Technical Working Group on Chub Mackerel Stock Assessment (2023) 7th Meeting Report. NPFC-2023-TWG CMSA07-Final Report. 53 pp. (Available at www.npfc.int)

Technical Working Group on Chub Mackerel Stock Assessment. (2024) 8th Meeting Report. NPFC-2023-TWG CMSA08-Final Report. 32 pp. (Available at www.npfc.int)

Technical Working Group on Chub Mackerel Stock Assessment. (2025) 10th Meeting Report. NPFC-2025-TWG CMSA10-Final Report. 30 pp. (Available at www.npfc.int)

Usami, S. (1973) Ecological studies of life patter of the Japanese mackerel *Scomber japonicus* HOUTTUYN on the adult of the Pacific subpopulation. Bull. Tokai. Reg. Fish. Res. Lab., 76, 71-178 (in Japanese, with English abstract).

Vasilenko A.V. Intraspecific structure and commercial value of Japanese mackerel populations. 1990. Avtoref. diss.... candidate of biological sciences. Vladivostok, 24 p.

Watanabe, T. (1970) Morphology and ecology of early stages of life in Japanese common mackerel, *Scomber japonicus* HOUTTUYN, with special reference to fluctuation of population. Bull. Tokai. Reg. Fish. Res. Lab., 62, 1-283 (in Japanese, with English abstract).

Watanabe, C., Hanai, T., Meguro, K., Ogino, R., Kimura, R. (1999) Spawning biomass estimates of chub mackerel *Scomber japonicus* of Pacific subpopulation off central Japan by a daily egg production method. Bull. Jpn. Soc. Sci. Fish., 65(4),695-702 (in Japanese, with English abstract).

Watanabe, C. and A. Yatsu (2004) Effects of density-dependence and sea surface temperature on inter-annual variation in length-at-age of chub mackerel (*Scomber japonicus*) in the Kuroshio-Oyashio area during 1970–1997. Fish. Bull., 102, 196-206.

Watanabe, C. and A. Yatsu (2006) Long-term changes in maturity at age of chub mackerel (Scomber japonicus) in relation to population declines in the waters off northeastern Japan. Fish. Res., 78, 323-332.

Watanabe, C. (2010). Changes in the reproductive taraits of the Pacific stock of chub mackerel Scomber japonicus and their effects on the population dynamics. Bull. Jpn. Soc. Fish. Oceanogr., 76, 46-50.

Yamada, T., Aoki, I., Mitani, I. (1999) Spawning time, spawning frequency and fecundity of Japanese chub mackerel, *Scomber japonicus* in the waters around the Izu Islands, Japan. Fisheries Research., 38, 83-89.

Yukami, R., Nishijima, S., Kamimura, Y., Isu, S., Furuichi, S., Watanabe, R., Higashiguchi, K., Saito, R. and Ishikawa, K. (2024). Stock assessment and evaluation for Chub Mackerel Pacific stock (fiscal year 2023). FRA-SA2024-AC005. In Marine fisheries stock assessment and evaluation for Japanese waters (fiscal year 2023/2024). Japan Fisheries Agency and

Fisheries Research and Education Agency of Japan. Tokyo, 71pp. https://abchan.fra.go.jp/wpt/wp-content/uploads/2024/03/details_2023_05.pdf

Zhang, H., Han, H., Sun, Y., Xiang, X., Li, Y. and Shi, Y. (2023) Data description on fisheries bycatch in the chub mackerel fisheries in China. NPFC-2023-TWG CMSA07-WP12 (Rev. 1). 3pp. https://www.npfc.int/system/files/2023-09/NPFC-2023-TWG%20CMSA07-WP12%28Rev%201%29%20Data%20description%20on%20fisheries%20bycatch%20in%20CM%20fisheries%20in%20China.pdf

TABLES

Table 1

The list of mathematical notations for SAM, including the symbol used, its type (Index, Data, random effects: RE, fixed effects: FE, and derived quantities: DQ, and its description).

Symbol	Type	Description
a	Index	Age class (from 0 to 6+)
y	Index	Fishing year (from 1970 to 2022)
k	Index	Fleet ID for abundance index (from 1 to 6)
$C_{a,y}$	Data	Observed catch number at age *a* in a year *y*
$w_{a,y}$	Data	Stock weight at age *a* in a year *y* (also used as catch weight for simplicity)
$g_{a,y}$	Data	Maturity at age *a* in a year *y*
$M_{a,y}$	Data	Natural mortality coefficient at age *a* in a year *y*
$N_{a,y}$	RE	Number at age *a* in a year *y*
$F_{a,y}$	RE	Fishing mortality coefficient at age *a* in a year *y*
ω_a	FE	SD for the process error in number at age *a*
σ_a	FE	SD for the process error in F at age *a*
ρ	FE	Correlation coefficient in MVN of F random walk between adjacent age classes
τ_a	FE	SD for the measurement error in catch at age *a*
q_k	FE	Catchability coefficient for abundance index *k*
ν_k	FE	SD for the measurement error in abundance index *k*
b_k	FE	Nonlinear coefficient for abundance index *k*
α	FE	Slope of stock-recruitment relationship at the origin
β	FE	Strength of density dependence in stock-recruitment relationship
$\hat{C}_{a,y}$	DQ	Predicted catch number at age *a* in a year *y*
$\hat{s}_{a,y}$	DQ	Selectivity at age *a* in a year *y*

Table 2

Fixed-effect parameters (FE), their maximum likelihood estimates (MLE), their standard errors (SE), their final gradients, symbols including the information on age class and index fleet, and unlinked value (inverse link function of MLE) under Scenario S02-Index24_1.

FE	**MLE**	**SE**	**Gradient**	**Unlinked value**
logQ (JPN summer survey)	-15.6792	2.30289004	-7.62E-06	1.55E-07
logQ (JPN autumn survey age 0)	-14.504035	2.31148929	1.79E-05	5.02E-07
logQ (JPN autumn survey age 1)	-10.55497	1.60459597	1.43E-05	2.61E-05
logQ (JPN egg survey)	-0.2258006	0.12389846	8.10E-06	0.79787717
logQ (JPN dipnet)	-2.4622594	0.15433565	-1.21E-05	0.08524213
logQ (CHN purse sein)	-5.4552764	0.13437866	-3.17E-05	0.0042737
logQ (RUS trawl)	-4.1736122	0.24869381	1.02E-05	0.01539654
logB (JPN summer survey)	0.86975	0.11907331	-9.39E-05	2.3863142
logB (JPN autumn survey age 0)	0.8151345	0.12543536	0.00033094	2.25947956
logB (JPN autumn survey age 1)	0.5671192	0.12302012	0.00020807	1.76318035
logσ (age 0–1)	-0.7204778	0.18383944	-9.29E-07	0.48651976
logσ (age 2)	-1.0075574	0.19443062	-3.99E-05	0.36510972
logσ (age 3–)	-1.2833983	0.17074541	2.87E-05	0.27709406
logω (age 0)	-0.2462263	0.12565032	3.35E-05	0.78174529
logω (age 1–)	-1.1454601	0.13351863	-3.37E-05	0.31807753
logτ (age 0)	-0.254829	0.13671048	-1.85E-05	0.77504905
logτ (age 1)	-0.6482389	0.16962969	-1.94E-05	0.52296595
logτ (age 2–3)	-1.6101614	0.33527145	-2.33E-05	0.19985535
logτ (age 4–5)	-0.9270467	0.13953189	1.34E-05	0.39572066
logτ (age 6+)	-0.1216399	0.13187202	3.20E-05	0.88546719
log$v$ (JPN summer survey)	-0.3178417	0.2609826	-1.23E-05	0.72771799
log$v$ (JPN autumn survey age 0)	-0.4051246	0.27451485	-2.19E-05	0.66689369
log$v$ (JPN autumn survey age 1)	-0.4699654	0.24942735	1.47E-06	0.6250239
log$v$ (JPN egg survey)	-1.0565971	0.18352748	1.24E-05	0.34763676
log$v$ (JPN dipnet)	-0.5338454	0.16441418	-1.07E-05	0.58634587
log$v$ (CHN purse sein)	-1.278561	0.25989131	1.77E-06	0.27843769
log$v$ (RUS trawl)	-0.473255	0.24889304	5.76E-06	0.62297121
logα	-4.3024831	0.19719966	-8.53E-06	0.01353491
logβ	-8.0077947	1.33589477	9.39E-08	0.00033286
logitρ	4.06929803	0.83600232	-8.99E-06	0.98319776

Table 3

Reference points for the base case scenario (S02-Index24_1). F-based reference point values that are dependent on time varying parameters are calculated by holding F_{cur} the same for all calculations, but by varying the time period (either FY2016–FY2023 or FY1970–FY2023) over which the biological parameters are estimated. Refer to Glossary in the stock assessment report for the definitions. *For the description of the biological parameters, see Table ANNEX 3.*

Reference Points	**Biological parameters**	
	FY2016–FY2023	FY1970–FY2023
F-based reference points		
Current%SPR	**16.2**	27.8
F0.1/F_{cur}	**0.838**	0.838
FpSPR.30.SPR/F_{cur}	**0.580**	0.911
FpSPR.40.SPR/F_{cur}	**0.412**	0.609
FpSPR.50.SPR/F_{cur}	**0.295**	0.416
FpSPR.60.SPR/F_{cur}	**0.207**	0.282
FpSPR.70.SPR/F_{cur}	**0.139**	0.184
Biomass-based reference points		
$SSB_{F=0\_RECENT}$	**1399**	–
25th Percentile Historical SSB (SSB_{LIM}) (thousand mt)	**107**	
50th Percentile Historical SSB ($SSB_{REFERENCE\_A}$) (thousand mt)	**289**	
70th Percentile Historical SSB ($SSB_{REFERENCE\_B}$) (thousand mt)	**585**	
SSB_{2023}/ SSB_{LIM}	**1.23**	
SSB_{2023}/ $SSB_{REFERENCE\_A}$	**0.46**	
SSB_{2023}/ $SSB_{REFERENCE\_B}$	**0.23**	
SSB_{LIM} / $SSB_{F=0\_RECENT}$	**0.08**	–
$SSB_{REFERENCE\_A}$ / $SSB_{F=0\_RECENT}$	**0.21**	–
$SSB_{REFERENCE\_B}$ / $SSB_{F=0\_RECENT}$	**0.42**	–

Table 4

Time series of estimates of total biomass, spawning stock biomass, recruitment, catch, and exploitation rate (catch/biomass) and their standard error (SE) under Scenario ScenarioS02-Index24_1. *The SEs were derived using the delta method.*

Fishing	**Biomass (1000 MT)**		**SSB (1000 MT)**		**Recruitment (billion)**		**Catch (1000 MT)**		**Exploitation rate**	
year	**MLE**	**SE**	**MLE**	**SE**	**MLE**	**SE**	**MLE**	**SE**	**MLE**	**SE**
1970	4326.1	744.5	733.6	94.5	19.4	7.0	883.6	129.6	0.209	0.042
1971	4924.1	795.3	911.2	121.6	22.4	7.6	896.5	111.9	0.186	0.034
1972	5227.4	931.3	757.8	107.1	9.7	3.4	699.6	101.1	0.137	0.027
1973	4524.1	675.8	986.7	132.0	8.0	2.7	808.9	95.4	0.182	0.031
1974	4214.5	573.6	1398.7	198.4	12.5	4.2	882.7	102.4	0.212	0.033
1975	3685.5	512.2	1160.8	154.7	19.4	6.5	864.8	100.1	0.238	0.038
1976	4693.4	785.8	1122.3	149.4	23.7	7.9	735.3	87.2	0.160	0.030
1977	5768.0	899.8	1257.0	158.9	18.5	6.1	990.4	128.6	0.175	0.030
1978	5928.0	855.1	1382.0	164.1	13.2	4.4	1416.4	188.6	0.242	0.038
1979	3812.0	500.0	1352.3	170.0	6.5	2.2	1096.3	134.3	0.290	0.043
1980	2301.9	308.9	1079.1	154.0	7.2	2.4	596.8	71.6	0.262	0.039
1981	2531.6	423.6	756.8	114.8	8.8	2.9	396.6	52.3	0.160	0.031
1982	2389.7	377.8	581.2	79.2	5.9	1.9	380.8	47.5	0.162	0.029
1983	1928.2	270.6	548.1	69.1	6.3	2.1	394.4	46.0	0.208	0.033
1984	2443.7	373.9	619.7	76.2	7.6	2.4	517.4	62.4	0.215	0.035
1985	2098.1	301.7	498.3	59.5	7.7	2.5	463.6	62.2	0.224	0.035
1986	1626.0	221.0	379.9	44.7	3.5	1.1	569.5	87.9	0.352	0.045
1987	974.4	117.9	330.5	36.8	1.3	0.4	362.9	48.6	0.374	0.044
1988	604.2	71.8	282.7	38.2	0.6	0.2	253.0	33.0	0.420	0.046
1989	345.4	52.2	150.5	21.1	0.5	0.2	109.6	14.2	0.321	0.051
1990	255.7	49.1	78.0	13.1	0.6	0.2	30.6	4.0	0.123	0.028
1991	359.7	81.3	62.4	10.3	1.3	0.4	26.7	3.7	0.077	0.018
1992	665.3	153.7	69.9	10.4	3.0	1.0	57.2	11.7	0.089	0.024
1993	698.9	121.1	106.5	15.4	1.0	0.3	243.5	63.4	0.349	0.064
1994	421.6	59.2	109.6	14.0	0.9	0.3	119.1	17.1	0.285	0.043
1995	402.5	64.4	90.5	11.2	1.5	0.5	116.0	19.9	0.291	0.045
1996	712.8	177.5	52.0	6.1	4.3	1.5	165.2	43.4	0.235	0.046
1997	672.7	139.6	44.5	5.0	0.7	0.2	286.1	78.8	0.422	0.061
1998	337.3	46.4	94.6	14.7	0.4	0.1	104.7	17.0	0.312	0.046
1999	313.3	58.1	89.0	12.5	1.0	0.3	74.6	11.5	0.243	0.041
2000	263.3	47.8	54.5	6.9	0.6	0.2	61.1	12.6	0.234	0.045
2001	178.7	27.6	63.0	8.9	0.4	0.1	42.7	6.9	0.242	0.046
2002	273.4	46.3	40.4	5.9	1.5	0.4	31.3	6.0	0.116	0.025
2003	357.8	58.5	55.3	6.9	1.2	0.3	61.8	12.8	0.174	0.034
2004	845.3	142.9	138.0	18.8	4.3	1.0	131.4	22.9	0.157	0.029
2005	839.5	136.2	87.8	10.3	1.5	0.3	195.8	41.0	0.234	0.040
2006	747.4	99.2	281.1	43.1	0.5	0.1	223.9	36.4	0.301	0.043
2007	684.6	87.2	266.8	37.5	2.3	0.5	153.1	19.0	0.225	0.032
2008	657.5	85.2	156.7	21.2	1.3	0.3	153.3	23.8	0.234	0.036
2009	683.9	86.0	162.9	22.0	2.2	0.4	138.7	18.6	0.204	0.032
2010	765.7	105.4	144.4	21.1	1.9	0.4	122.2	18.2	0.161	0.028
2011	879.3	123.0	199.1	30.9	1.2	0.3	100.2	13.5	0.115	0.020
2012	1160.7	159.1	295.7	43.7	3.0	0.6	130.1	15.6	0.113	0.019
2013	2474.5	398.9	334.3	49.1	11.6	2.7	209.1	30.6	0.085	0.016
2014	2267.4	362.7	364.6	53.6	3.3	0.8	237.5	37.6	0.106	0.020
2015	2684.6	409.2	257.4	43.5	4.6	0.9	318.5	46.4	0.120	0.020
2016	3107.9	411.8	457.9	77.3	8.3	1.9	358.1	45.1	0.116	0.018
2017	3127.7	394.5	799.2	145.6	9.1	2.0	403.3	49.5	0.130	0.020
2018	3900.7	558.9	800.8	133.6	16.8	4.1	495.1	58.1	0.128	0.021
2019	2869.2	374.0	694.7	121.5	5.1	1.0	410.8	49.7	0.144	0.023
2020	2439.2	300.7	549.8	93.5	7.9	1.7	476.4	53.2	0.196	0.029
2021	2087.1	293.9	391.1	66.7	8.7	2.0	415.9	49.6	0.201	0.032
2022	1772.1	265.2	250.9	45.5	7.0	1.6	278.3	37.6	0.159	0.029
2023	1375.3	231.3	131.6	28.0	3.4	0.9	172.9	23.4	0.127	0.026
2024	1220.9	233	111.5	27.2	3.6	0.9	NA	NA	NA	NA

Table 5

Probability that future SSB on July 1, at the beginning of the fishing year, is above $SSB_{REFERENCE\_B}$, $SSB_{REFERENCE\_A}$, and SSB_{LIMIT} (70th percentile, 50th percentile and 25th percentile, respectively) under constant catch projections for the base case scenario. The projection towards FY2036 is shown below.

Pr(SSB > 70th percentile)

Scenario														
Catch000	0	0	0	0	1	12	24	39	54	69	79	85	91	95
Catch010	0	0	0	0	1	10	21	35	49	64	75	81	88	92
Catch020	0	0	0	0	1	9	19	32	45	59	69	77	84	88
Catch030	0	0	0	0	1	7	17	28	41	54	64	73	79	84
Catch040	0	0	0	0	1	6	15	26	38	50	59	67	74	79
Catch050	0	0	0	0	1	6	14	23	34	45	53	62	68	74
Catch060	0	0	0	0	1	5	12	20	30	40	48	56	62	68
Catch070	0	0	0	0	1	4	10	18	27	36	43	50	56	61
Catch080	0	0	0	0	1	4	9	16	24	32	38	44	50	54
Catch090	0	0	0	0	1	3	8	14	21	28	33	39	45	48
Catch100	0	0	0	0	1	3	7	12	18	25	29	34	39	42
Catch110	0	0	0	0	1	2	6	11	16	21	26	29	33	37
Catch120	0	0	0	0	0	2	6	10	14	18	22	25	28	31
Catch130	0	0	0	0	0	2	5	9	12	16	19	21	25	27
Catch140	0	0	0	0	0	1	5	8	11	13	16	19	20	24
Catch150	0	0	0	0	0	1	4	7	9	11	14	16	18	20

2022 2026 2030 2034

Fishing year

Pr(SSB > 50th percentile)

Scenario														
Catch000	0	0	0	5	47	76	82	88	94	97	98	99	99	99
Catch010	0	0	0	5	44	72	78	84	91	95	97	98	98	99
Catch020	0	0	0	5	40	67	73	80	87	92	95	96	98	99
Catch030	0	0	0	5	37	63	68	76	84	89	92	94	96	98
Catch040	0	0	0	5	34	58	64	71	80	85	88	91	93	95
Catch050	0	0	0	5	32	54	58	66	74	80	83	86	90	91
Catch060	0	0	0	5	29	49	53	61	68	74	78	81	84	86
Catch070	0	0	0	5	27	45	48	55	62	68	72	75	77	80
Catch080	0	0	0	5	25	40	44	50	56	61	65	69	71	73
Catch090	0	0	0	5	22	36	39	45	51	56	58	61	63	65
Catch100	0	0	0	5	21	32	34	41	45	50	53	55	56	58
Catch110	0	0	0	5	19	29	31	36	40	44	46	48	50	51
Catch120	0	0	0	5	18	26	27	33	36	39	40	42	44	44
Catch130	0	0	0	5	16	23	25	30	32	34	35	36	37	38
Catch140	0	0	0	5	15	21	22	26	29	30	30	31	32	32
Catch150	0	0	0	5	13	18	20	23	25	26	26	26	27	27

2022 2026 2030 2034

Fishing year

Percent: 100, 75, 50, 25, 0

Pr(SSB > 25th percentile)

Scenario														
Catch000	100	100	98	98	100	100	100	100	100	100	100	100	100	100
Catch010	100	100	98	98	100	100	100	100	100	100	100	100	100	100
Catch020	100	100	98	98	100	100	100	100	100	100	100	100	100	100
Catch030	100	100	98	98	100	100	99	99	100	100	100	100	100	100
Catch040	100	100	98	98	100	100	99	99	99	99	99	99	99	99
Catch050	100	100	98	98	100	99	98	97	98	98	98	98	98	98
Catch060	100	100	98	98	99	98	96	96	96	95	95	95	95	95
Catch070	100	100	98	98	99	97	95	93	93	92	92	92	92	92
Catch080	100	100	98	98	99	96	92	90	89	88	87	87	86	85
Catch090	100	100	98	98	98	95	89	85	84	83	81	80	79	79
Catch100	100	100	98	98	98	92	84	80	78	76	74	73	72	71
Catch110	100	100	98	98	97	90	80	74	72	69	67	65	63	62
Catch120	100	100	98	98	96	86	75	68	65	62	60	58	56	55
Catch130	100	100	98	98	94	82	69	62	59	55	52	50	49	47
Catch140	100	100	98	98	92	78	63	57	52	49	45	43	42	41
Catch150	100	100	98	98	91	74	58	51	47	43	40	38	36	34

2022 2026 2030 2034

Fishing year

Table 6

Probability that future SSB on July 1, at the beginning of the fishing year, is above $SSB_{REFERENCE\_B}$, $SSB_{REFERENCE\_A}$, and SSB_{LIMIT} (70th percentile, 50th percentile and 25th percentile, respectively) under constant fishing mortality projections for the base case scenario. The projection towards FY2036 is shown below.

Pr(SSB > 70th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	0	0	0	0	1	5	13	21	32	44	52	61	68	74
F65pSPR	0	0	0	0	1	4	11	18	28	38	46	54	62	67
F60pSPR	0	0	0	0	1	4	9	15	23	33	40	47	54	59
F55pSPR	0	0	0	0	1	3	7	13	19	27	33	39	45	50
F50pSPR	0	0	0	0	1	2	6	10	16	22	26	31	35	40
F45pSPR	0	0	0	0	0	2	4	8	11	15	19	23	26	31
F40pSPR	0	0	0	0	0	1	3	6	8	11	13	16	18	20
F35pSPR	0	0	0	0	0	1	2	4	5	6	8	10	10	12
F30pSPR	0	0	0	0	0	0	2	2	3	4	4	5	6	5
F2021-2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fishing year

Pr(SSB > 50th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	0	0	0	5	36	60	65	71	80	86	89	92	95	96
F65pSPR	0	0	0	5	33	56	60	67	75	82	85	89	92	94
F60pSPR	0	0	0	5	31	52	55	62	70	77	81	84	88	90
F55pSPR	0	0	0	5	28	47	49	56	64	70	75	78	82	84
F50pSPR	0	0	0	5	25	41	43	49	55	63	67	70	73	77
F45pSPR	0	0	0	5	22	34	36	42	48	54	56	61	64	66
F40pSPR	0	0	0	5	19	28	28	34	39	44	45	48	52	53
F35pSPR	0	0	0	5	16	22	21	25	29	32	33	35	37	38
F30pSPR	0	0	0	5	12	16	15	18	20	21	22	22	23	24
F2021-2023	0	0	0	5	3	2	3	3	3	1	2	1	1	1

Fishing year

Percent: 0, 25, 50, 75, 100

Pr(SSB > 25th percentile)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
F70pSPR	100	100	98	98	100	100	100	100	100	100	100	100	100	100
F65pSPR	100	100	98	98	100	100	100	100	100	100	100	100	100	100
F60pSPR	100	100	98	98	100	100	99	99	100	100	100	99	100	100
F55pSPR	100	100	98	98	100	100	99	99	99	99	99	99	99	99
F50pSPR	100	100	98	98	100	100	98	98	98	98	98	98	98	99
F45pSPR	100	100	98	98	100	99	98	96	97	97	96	96	97	97
F40pSPR	100	100	98	98	99	98	96	93	94	94	93	93	93	93
F35pSPR	100	100	98	98	99	97	92	89	89	88	86	86	85	84
F30pSPR	100	100	98	98	99	95	86	81	79	77	75	72	71	70
F2021-2023	100	100	98	98	88	63	41	35	27	21	17	14	11	9

Fishing year

Table 7

Median catch and median SSB based on constant-catch scenarios (ranging from 0 mt to 150 thousand mt).

Median Catch (1,000 MT)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Catch000	177	176	181	0	0	0	0	0	0	0	0	0	0	0
Catch010	177	176	181	10	10	10	10	10	10	10	10	10	10	10
Catch020	177	176	181	20	20	20	20	20	20	20	20	20	20	20
Catch030	177	176	181	30	30	30	30	30	30	30	30	30	30	30
Catch040	177	176	181	40	40	40	40	40	40	40	40	40	40	40
Catch050	177	176	181	50	50	50	50	50	50	50	50	50	50	50
Catch060	177	176	181	60	60	60	60	60	60	60	60	60	60	60
Catch070	177	176	181	70	70	70	70	70	70	70	70	70	70	70
Catch080	177	176	181	80	80	80	80	80	80	80	80	80	80	80
Catch090	177	176	181	90	90	90	90	90	90	90	90	90	90	90
Catch100	177	176	181	100	100	100	100	100	100	100	100	100	100	100
Catch110	177	176	181	110	110	110	110	110	110	110	110	110	110	110
Catch120	177	176	181	120	120	120	120	120	120	120	120	120	120	120
Catch130	177	176	181	130	130	130	130	130	130	130	130	130	130	130
Catch140	177	176	181	140	140	140	140	140	140	140	140	140	140	0
Catch150	177	176	181	150	150	150	150	150	150	150	150	26	0	0

Fishing year

Median SSB (1,000 MT)

Scenario	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Catch000	132	112	158	181	283	375	426	509	617	776	932	1132	1355	1605
Catch010	132	112	158	181	277	360	405	481	578	728	870	1054	1263	1491
Catch020	132	112	158	181	270	345	384	453	542	679	808	977	1168	1378
Catch030	132	112	158	181	264	330	364	424	506	630	747	895	1069	1265
Catch040	132	112	158	181	257	316	342	398	468	580	681	818	970	1148
Catch050	132	112	158	181	251	301	322	370	432	535	622	743	878	1017
Catch060	132	112	158	181	243	287	303	342	398	485	562	664	779	906
Catch070	132	112	158	181	237	273	283	314	363	434	501	583	684	790
Catch080	132	112	158	181	231	259	263	289	330	386	439	506	582	676
Catch090	132	112	158	181	224	245	243	262	295	338	377	422	479	559
Catch100	132	112	158	181	218	231	225	236	259	288	313	343	382	428
Catch110	132	112	158	181	211	218	205	211	222	240	248	265	283	305
Catch120	132	112	158	181	205	205	185	185	187	194	184	180	182	186
Catch130	132	112	158	181	199	191	167	160	155	144	122	104	89	66
Catch140	132	112	158	181	193	178	150	135	120	99	70	39	14	0
Catch150	132	112	158	181	187	165	131	112	88	57	23	0	0	0

Fishing year

Table 8

Median catch and median SSB based on projections using constant F scenarios.

Median Catch

Scenario														
F70pSPR	177	176	181	35	42	49	57	66	76	88	101	116	131	149
F65pSPR	177	176	181	42	51	58	67	76	87	99	113	128	144	163
F60pSPR	177	176	181	51	60	68	77	86	97	109	123	138	153	171
F55pSPR	177	176	181	60	70	77	86	95	105	118	131	145	159	175
F50pSPR	177	176	181	71	80	87	95	104	113	124	136	148	160	174
F45pSPR	177	176	181	83	91	97	104	111	118	127	137	147	156	168
F40pSPR	177	176	181	96	103	107	112	117	122	128	135	142	148	155
F35pSPR	177	176	181	112	116	116	119	121	123	125	129	133	134	138
F30pSPR	177	176	181	131	130	126	124	123	120	118	119	118	116	116
F2021-2023	177	176	181	206	171	142	122	104	88	75	65	57	48	42

2022 2026 2030 2034

Fishing year

1,000 MT: 200, 150, 100, 50

Median SSB

Scenario														
F70pSPR	132	112	158	181	260	318	341	386	449	534	606	699	809	909
F65pSPR	132	112	158	181	255	307	325	362	416	490	548	626	717	797
F60pSPR	132	112	158	181	249	294	306	338	383	445	491	554	628	691
F55pSPR	132	112	158	181	243	281	287	312	349	399	434	485	540	587
F50pSPR	132	112	158	181	236	267	267	286	314	353	377	415	455	488
F45pSPR	132	112	158	181	229	251	245	259	279	308	322	346	372	393
F40pSPR	132	112	158	181	220	233	222	231	242	262	267	281	297	307
F35pSPR	132	112	158	181	210	215	198	201	207	217	214	220	227	229
F30pSPR	132	112	158	181	199	194	173	171	171	173	165	163	164	161
F2021-2023	132	112	158	181	154	122	96	84	73	63	51	44	39	33

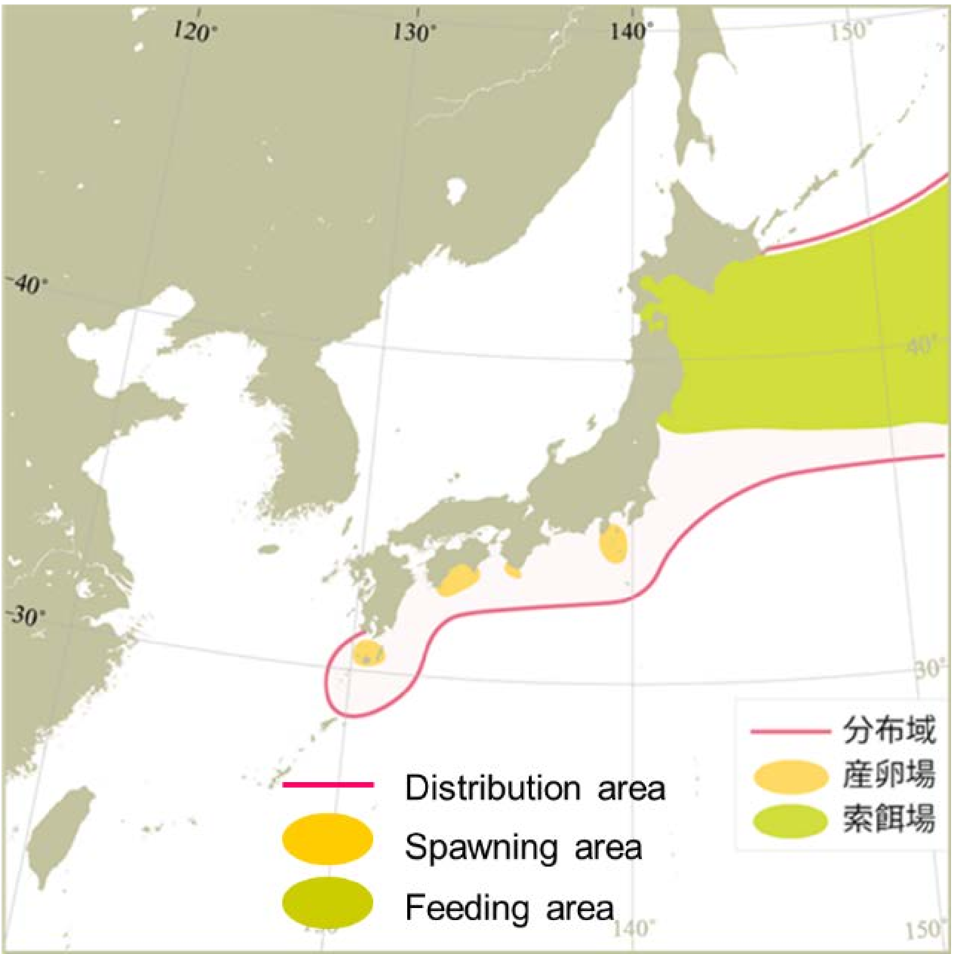
2022 2026 2030 2034

Fishing year

1,000 MT: 750, 500, 250

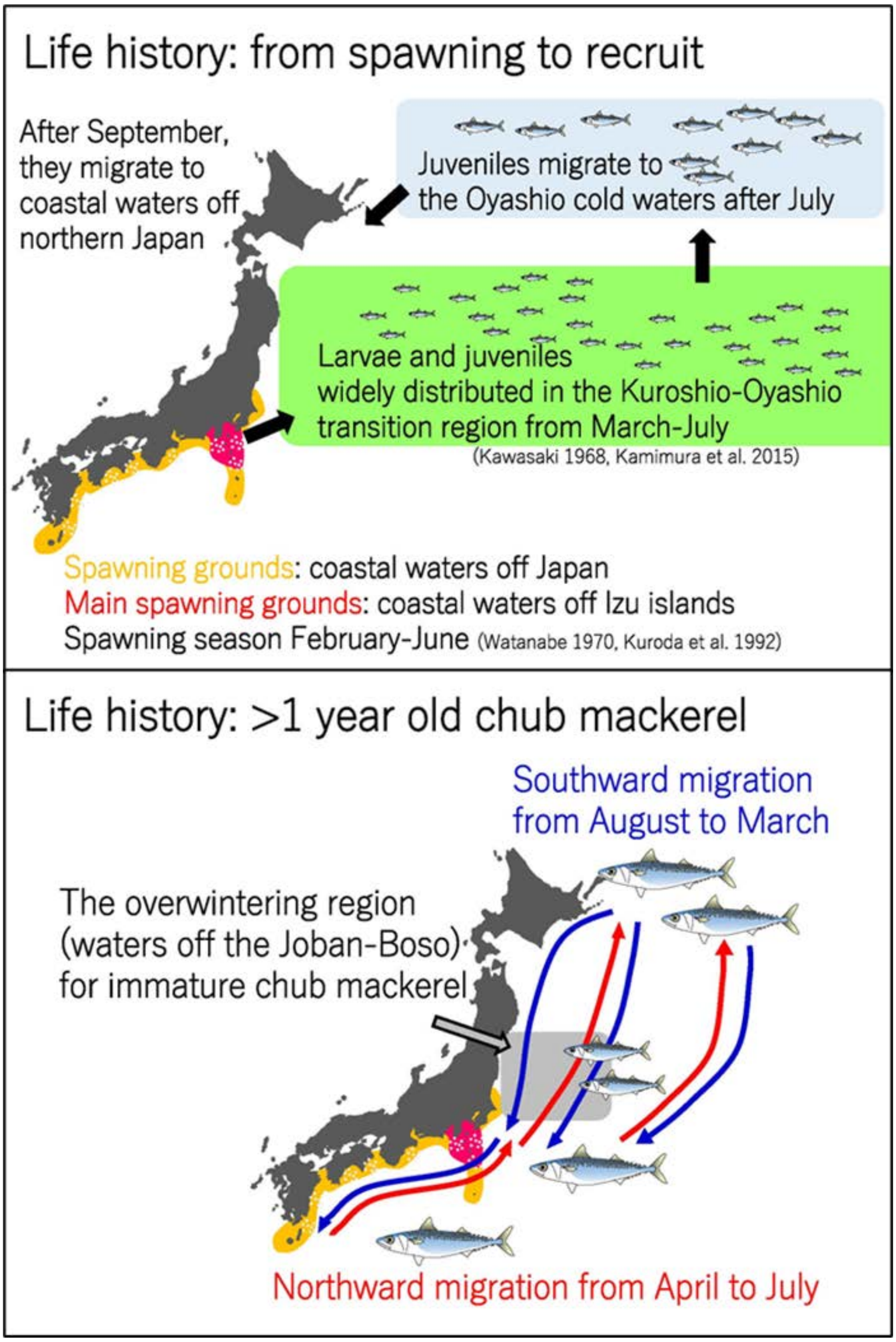
FIGURES

Figure 1



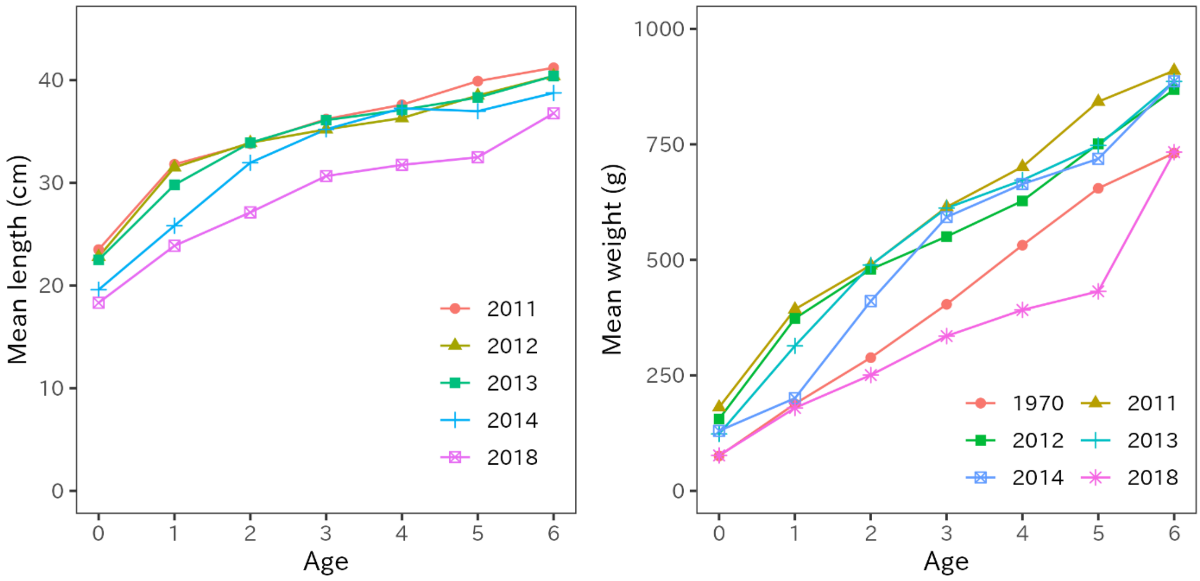
Map of distribution of chub mackerel in the North Pacific (Yukami et al. 2024).

Figure 2



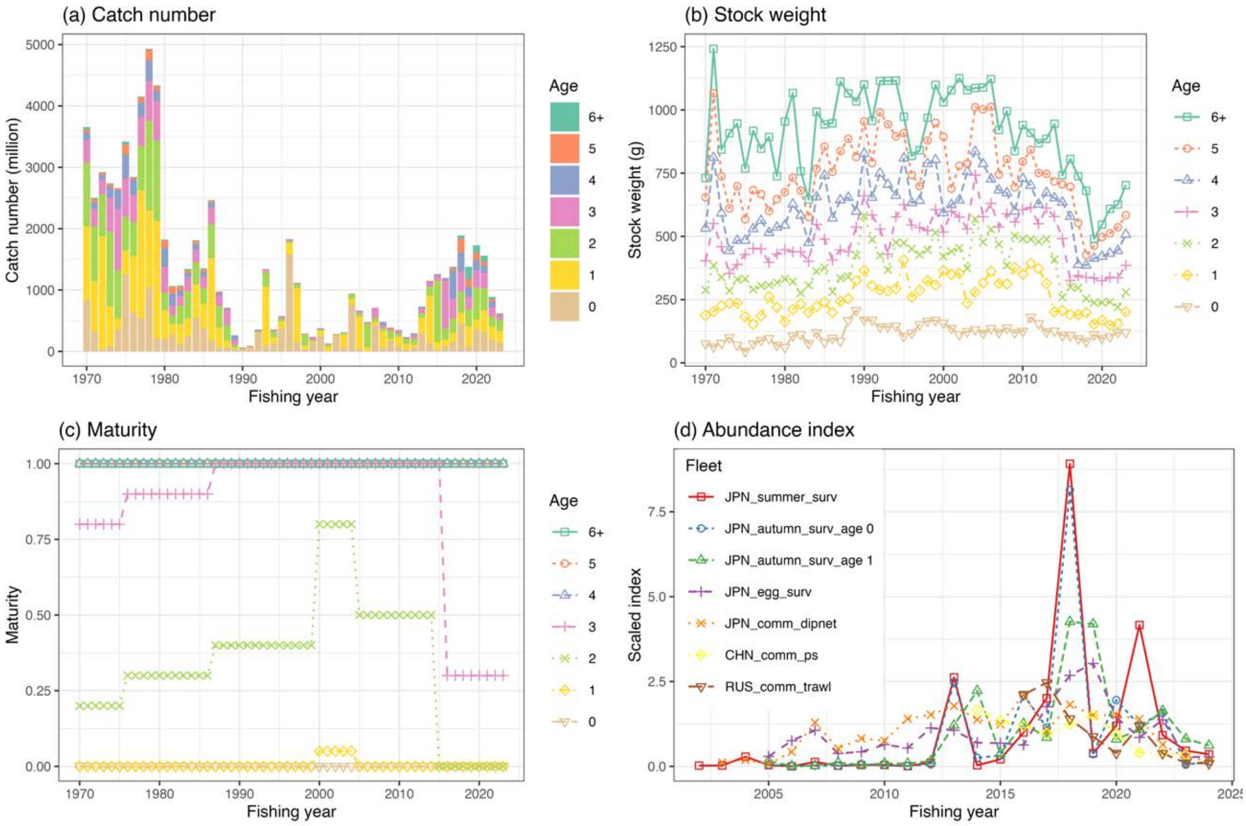
Migration pattern of chub mackerel by growth stage. The upper and bottom panels show seasonal movement of age 0 fish from spawning to recruitment and fish at age 1 and older, respectively (Kamimura, 2017).

Figure 3



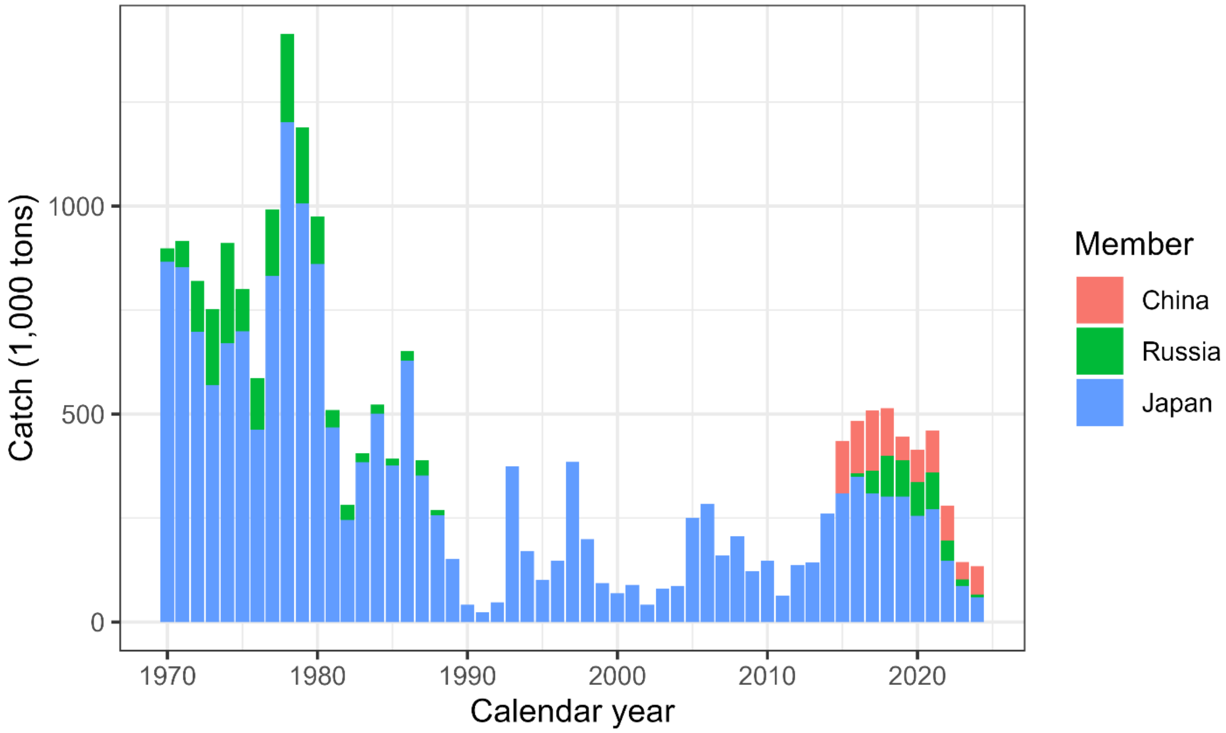
Mean fork lengths of chub mackerel at ages 0 to 6 in FY2011-2014 and FY2018 (left panel). Mean weight at age in FY1970s, FY2011-2014 and FY2018 (right panel).

Figure 4



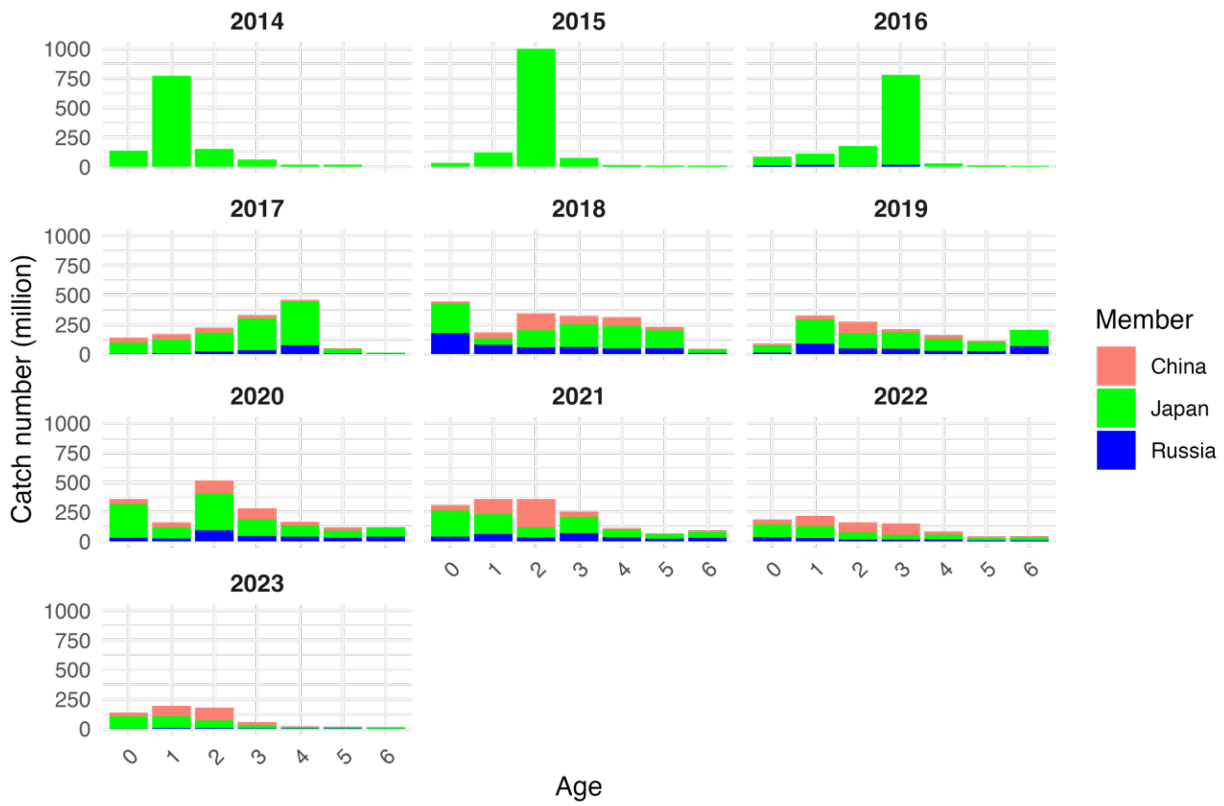
The time series data used for the base case scenario of chub mackerel stock assessment. (a) catch number by age, (b) weight by age, (c) maturity by age, (d) abundance index. Each abundance index is scaled by its mean value for visualization. Note that the Japanese and Russian abundance indices are included through FY2024.

Figure 5



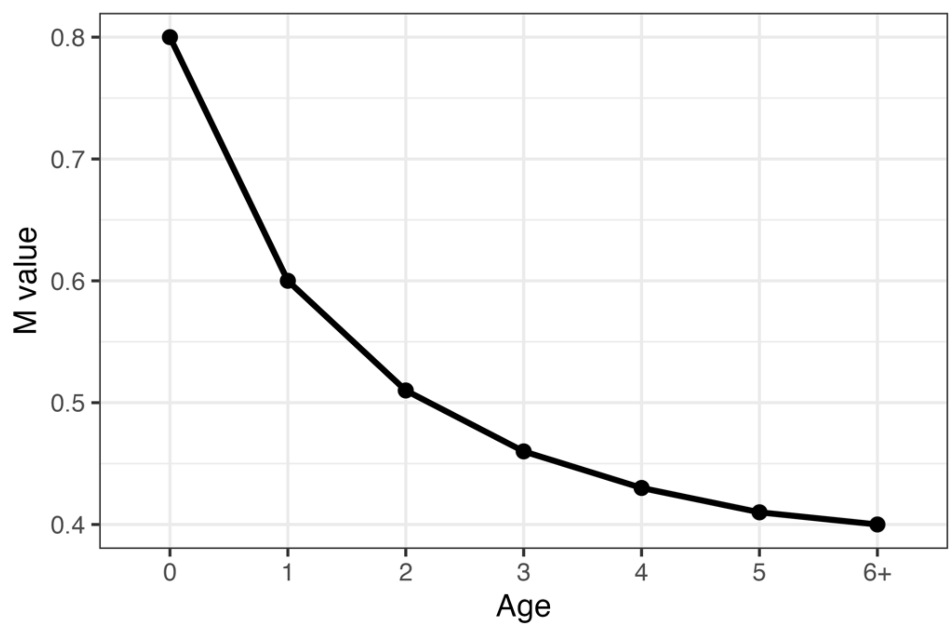
Historical chub mackerel catch in weight by Member. The provisional Chinese catch for CY2024 is estimated using the historical ratio for chub mackerel and blue mackerel. Blue mackerel has been excluded from the catch using the chub-to-blue-mackerel ratio. Catch data for China was obtained from the Annual Summary Footprint, which is available at https://www.npfc.int/summary-footprint-chub-mackerel-fisheries and adjusted using this ratio. Russia's catch data is sourced from the Annual Summary Footprint which reflects no blue mackerel catches. Japan's catch data was collected from coastal prefectures along the Pacific Ocean, where chub mackerel are typically captured. The catch data of this figure is different from the catch data described in the data section above.

Figure 6



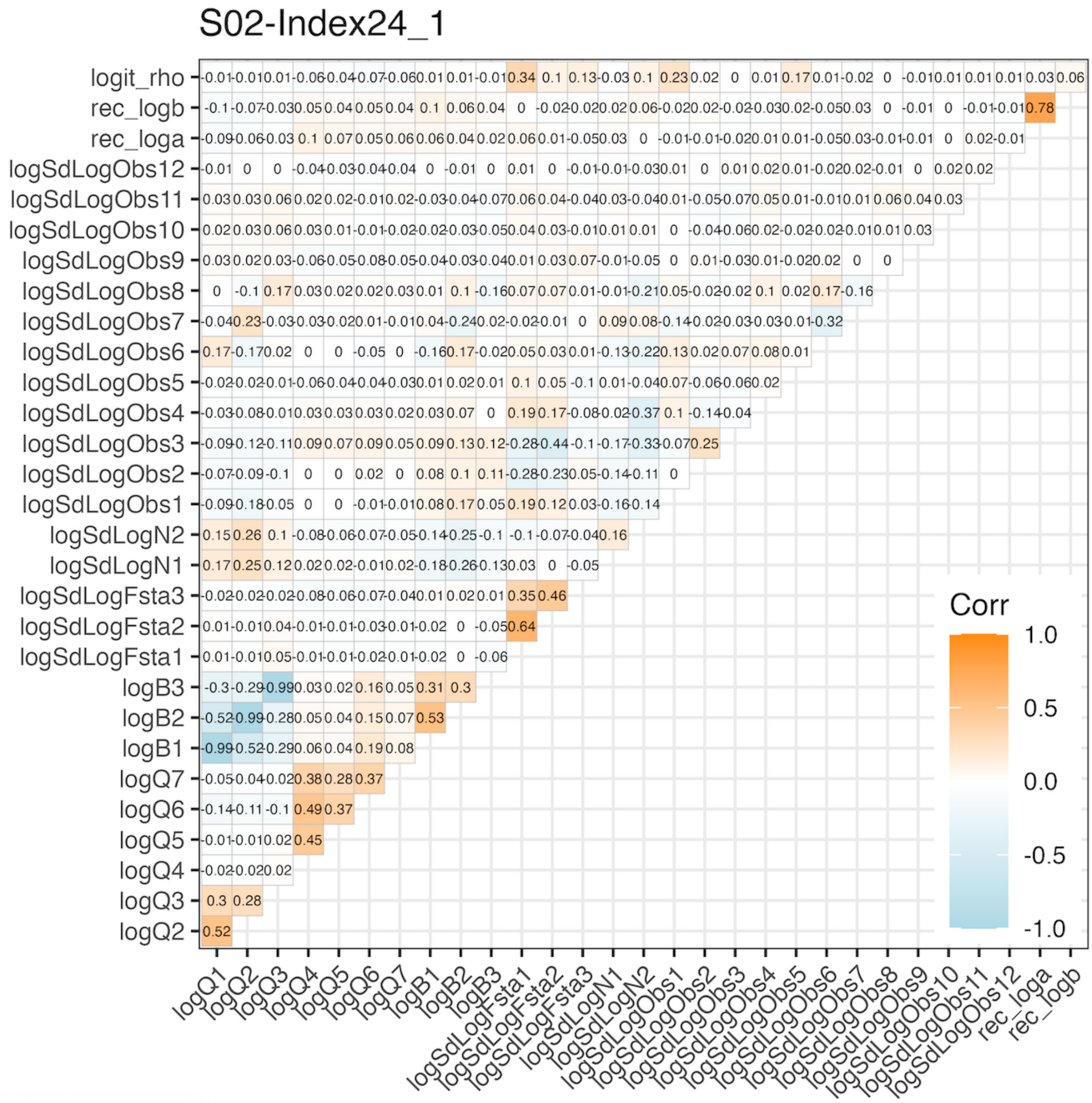
Catch number of chub mackerel by member by age by year from FY2014 to FY2023.

Figure 7



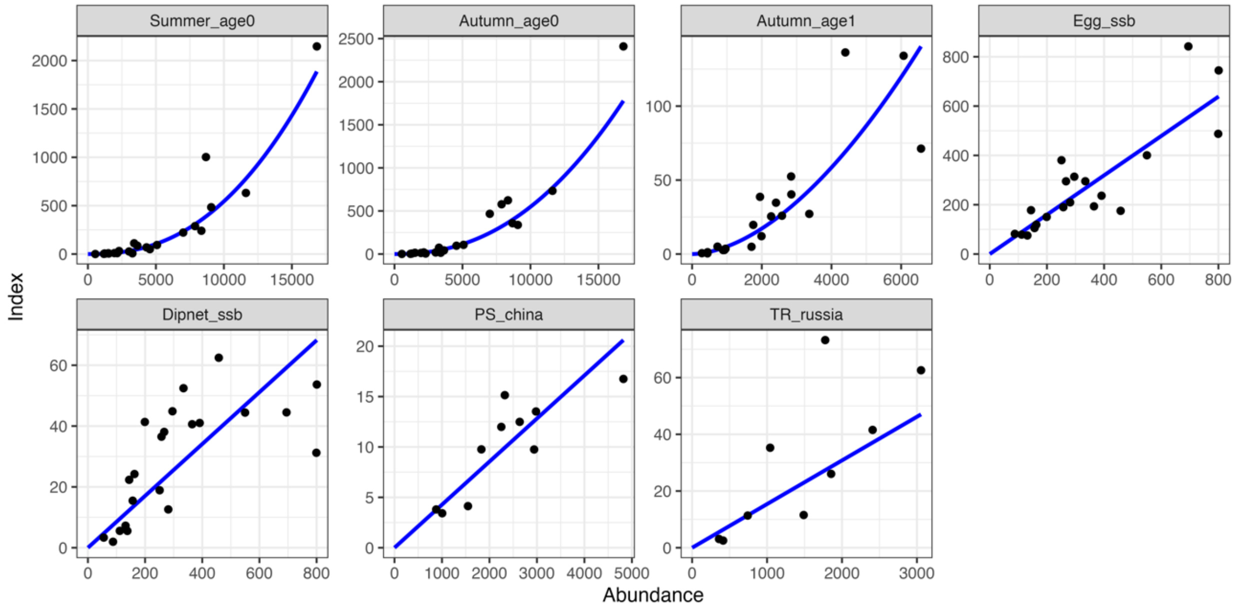
Natural mortality (M) values under the two candidate base case scenarios.

Figure 8



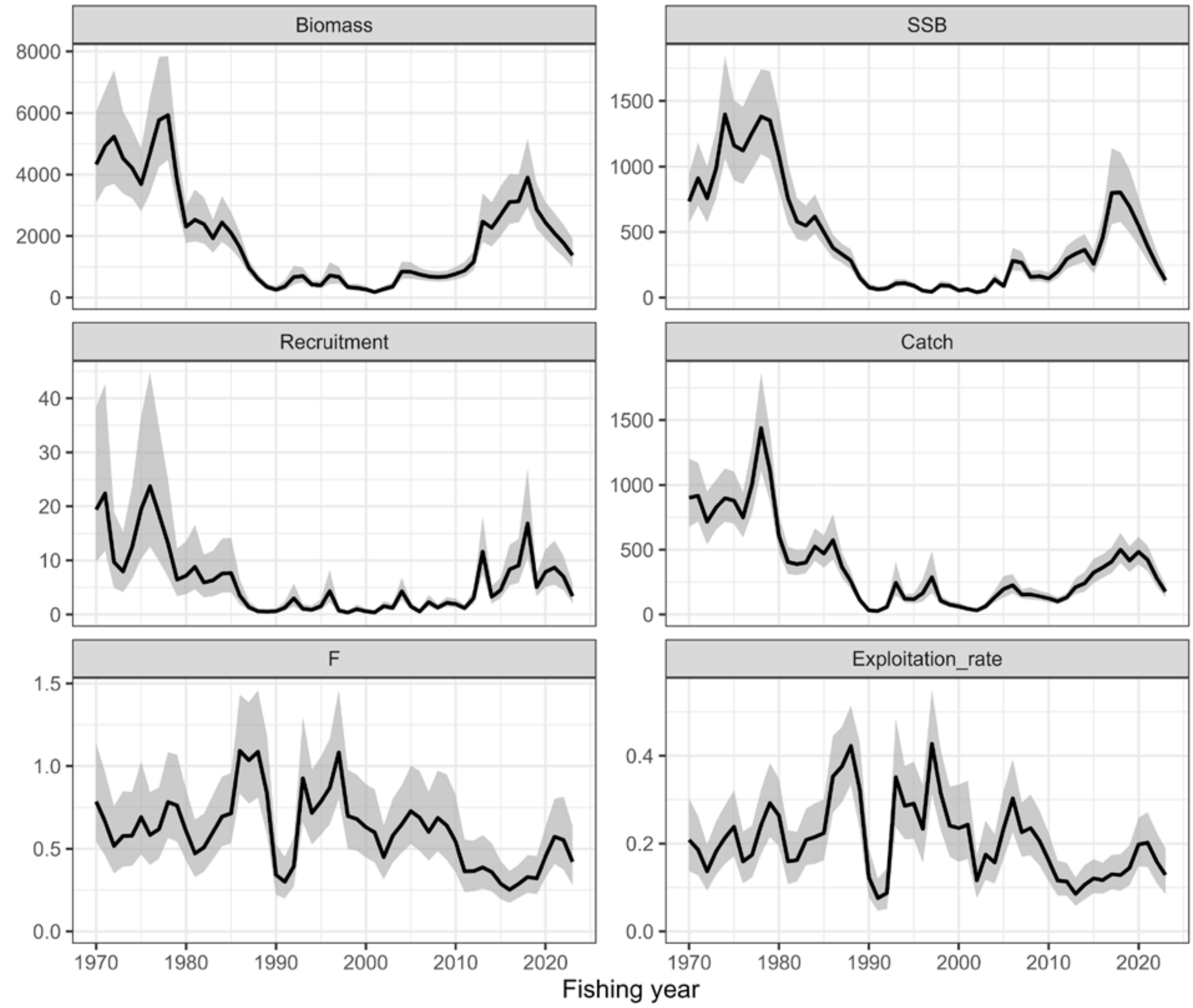
Plot of the correlation matrix obtained from the covariance matrix of the fixed effects parameter estimates, for the base case scenario (Scenario S02-Index24_1). Orange colors indicate positive correlation, while light blue indicates negative correlation.

Figure 9



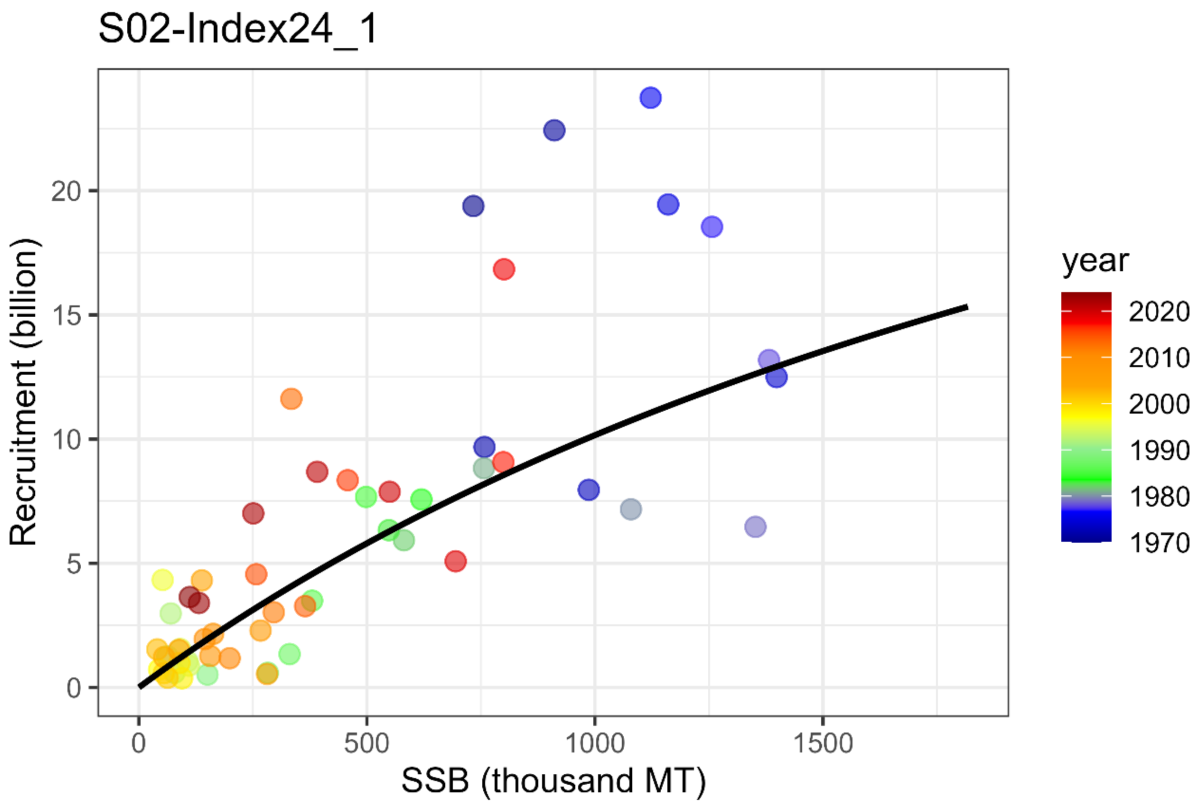
Relationship between seven abundance indices and their corresponding abundance estimates under the base case scenario (Scenario S02-Index24_1). The blue lines indicate the precited relationships.

Figure 10



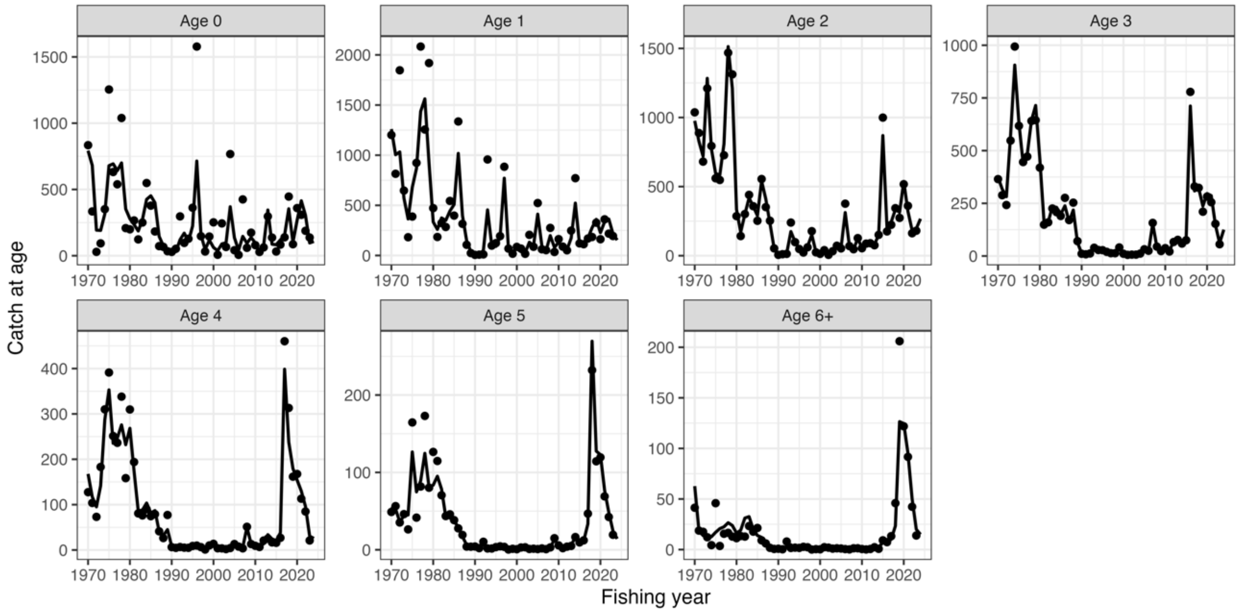
Time series of estimates of total biomass (1,000 MT), SSB (1,000 MT), recruitment (billion), catch (1,000 MT), mean F, and exploitation rate (catch divided by total biomass) of chub mackerel under the base case scenario (Scenario S02-Index24_1).

Figure 11



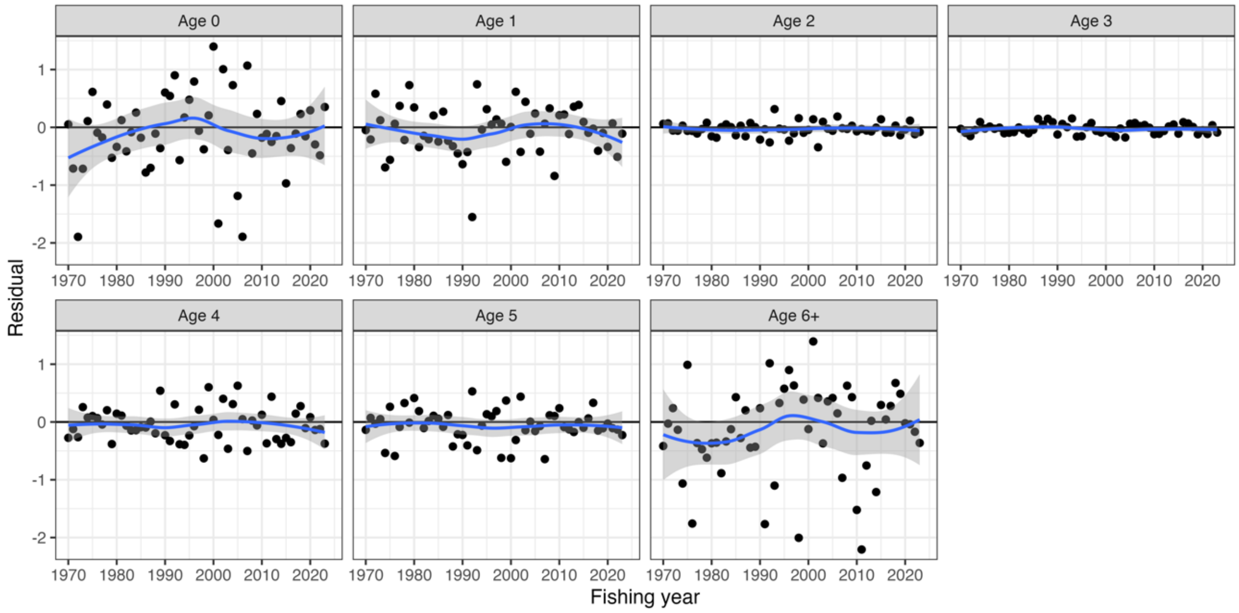
Estimated Beverton-Holt stock recruitment relationship of chub mackerel under the base case scenario (Scenario S02-Index24_1) (black line) and estimated past SSB and number of recruits (circles colored by decade).

Figure 12



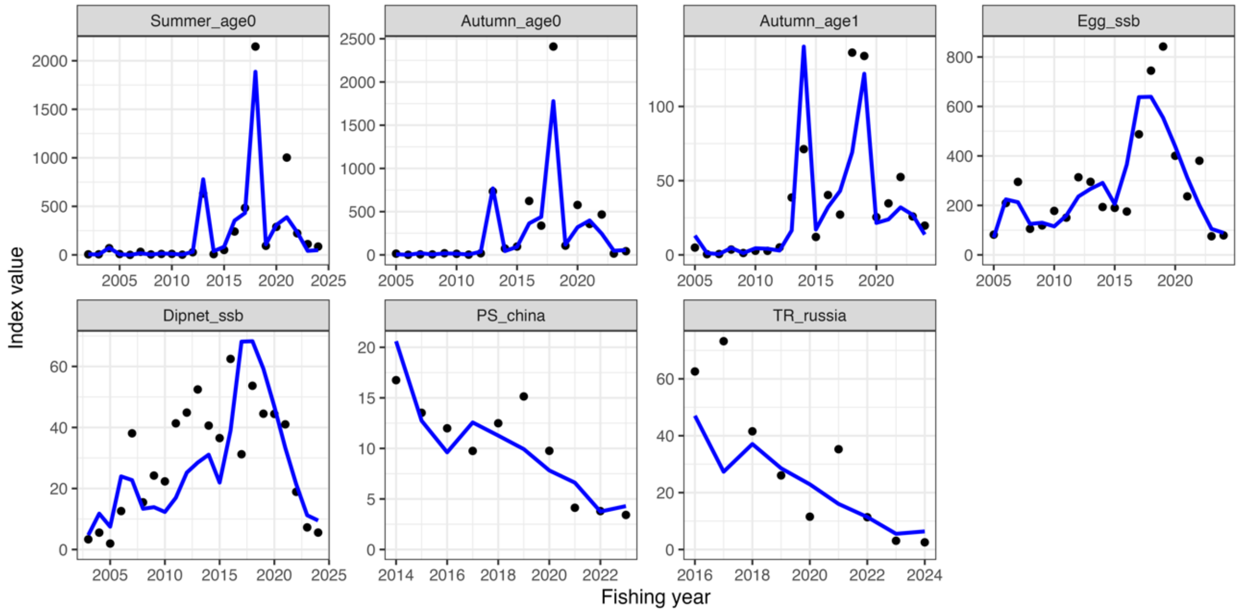
Observed catch numbers by age (dots) and their predicted values (lines)of chub mackerel under the base case scenario of Scenario S02-Index24_1.

Figure 13



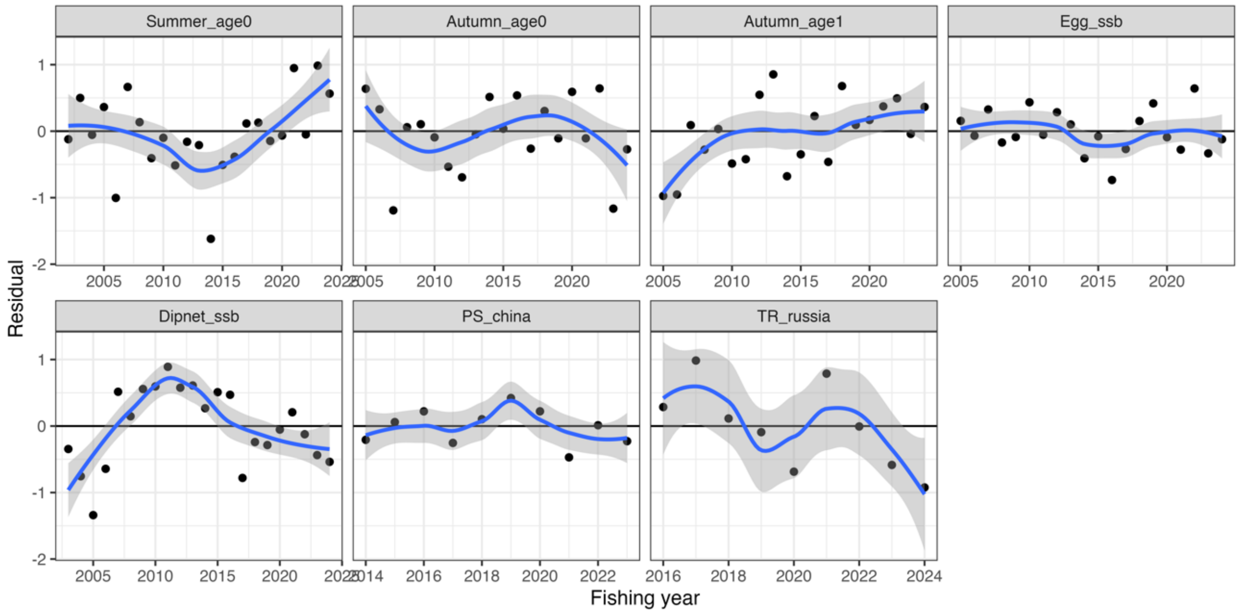
Residual plot for catch numbers of chub mackerel by age under the base case scenario of Scenario S02-Index24_1. Blue curves and shaded areas indicate smoothed curves estimated by LOESS and their 95% confidence intervals.

Figure 14



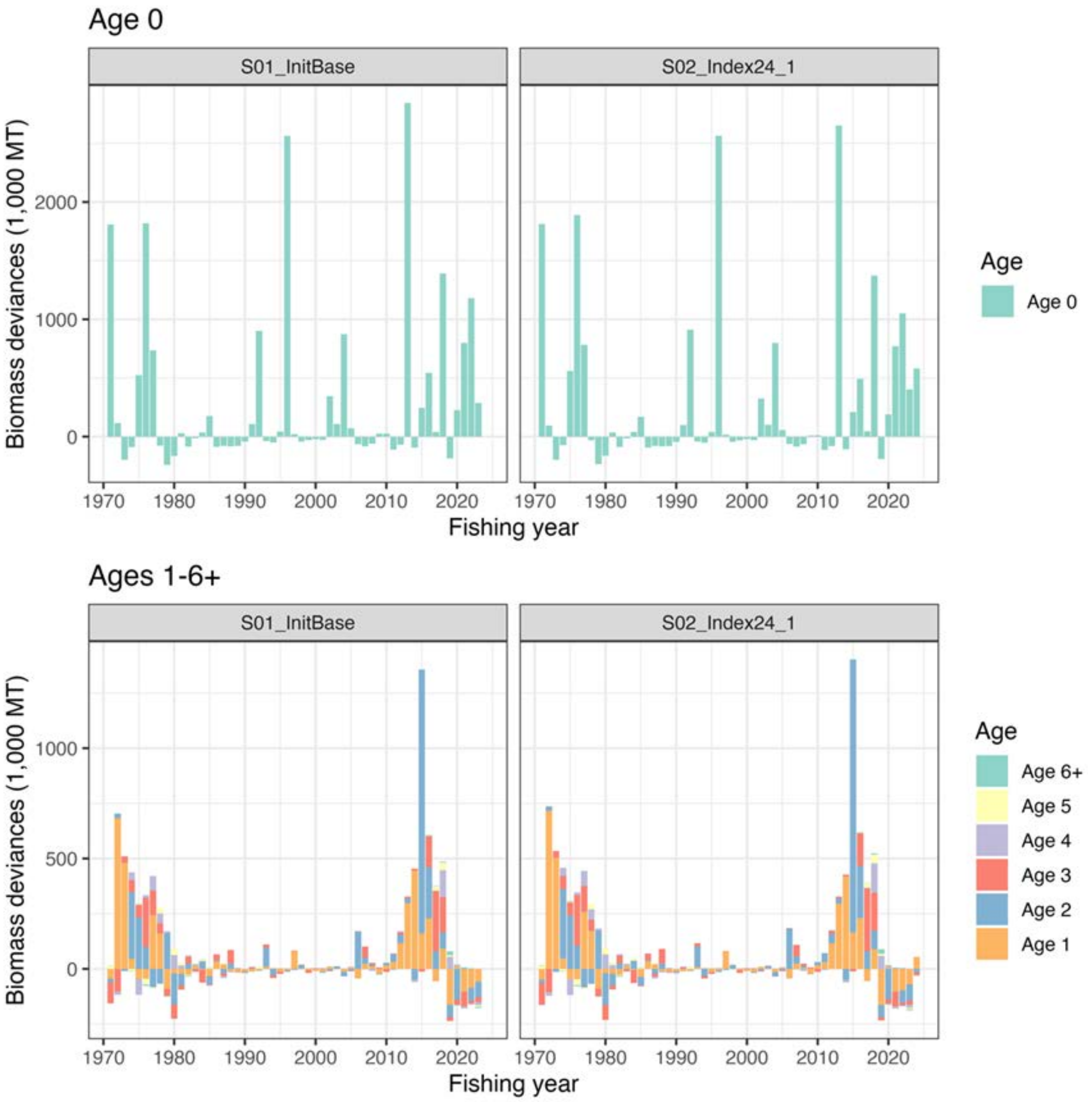
Trends of abundance indices used (dots) and their predicted values (lines) of chub mackerel under the base case scenario of Scenario S02-Index24_1.

Figure 15



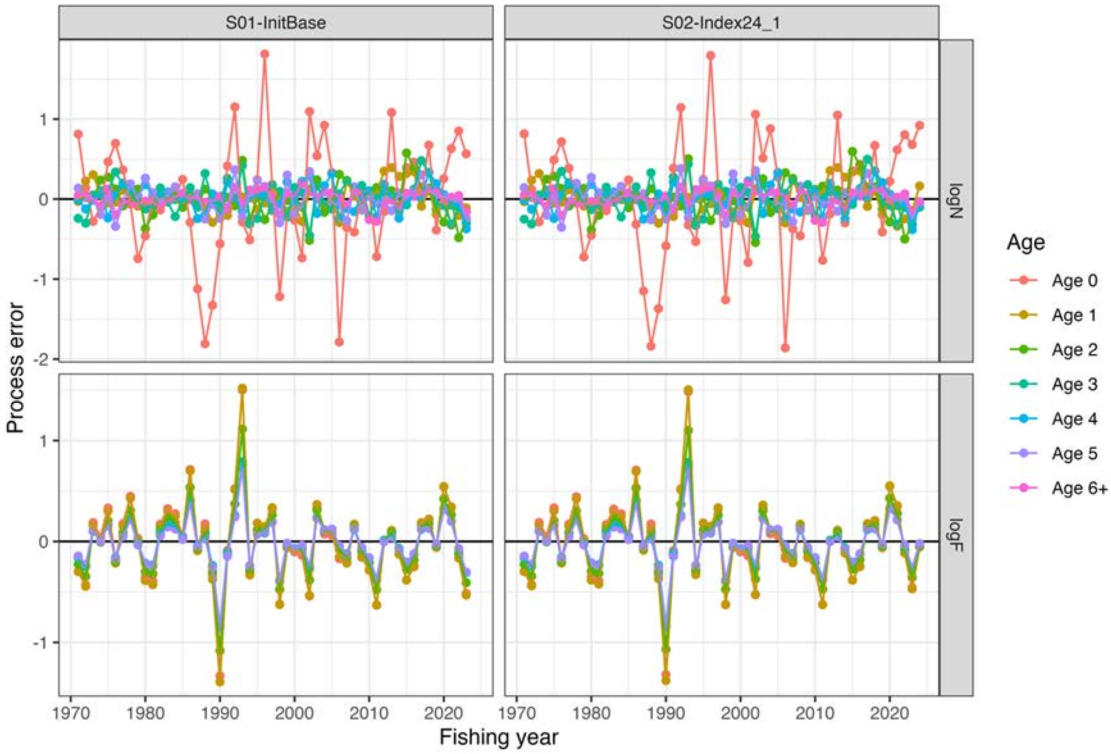
Residual plot for abundance indices of chub mackerel under the base case scenario of Scenario S02-Index24_1. Blue curves and shaded areas indicate smoothed curves estimated by LOESS and their 95% confidence intervals.

Figure 16



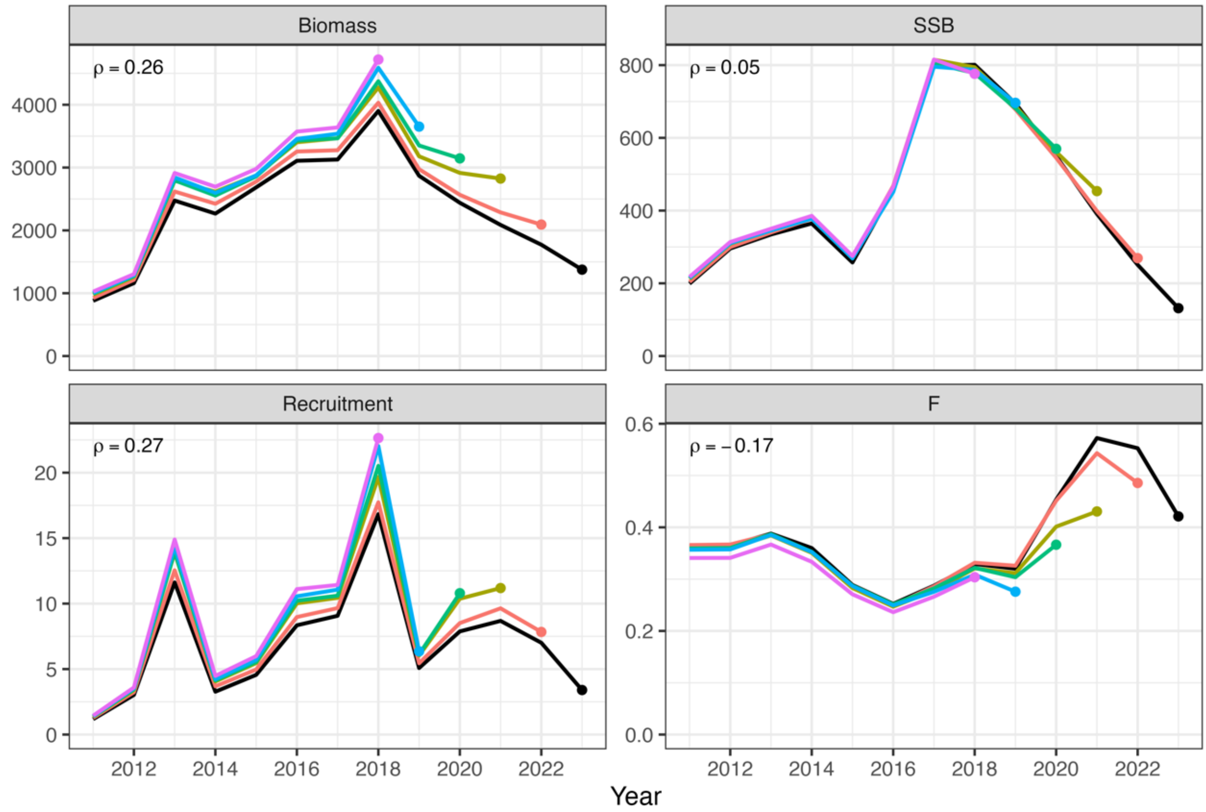
Deviances of abundances under S01-InitBase (left) and S02-Index24_1 (right) scenarios. Only Age 0 deviances are plotted separately (Top) because of the different scale of the observed deviances.

Figure 17



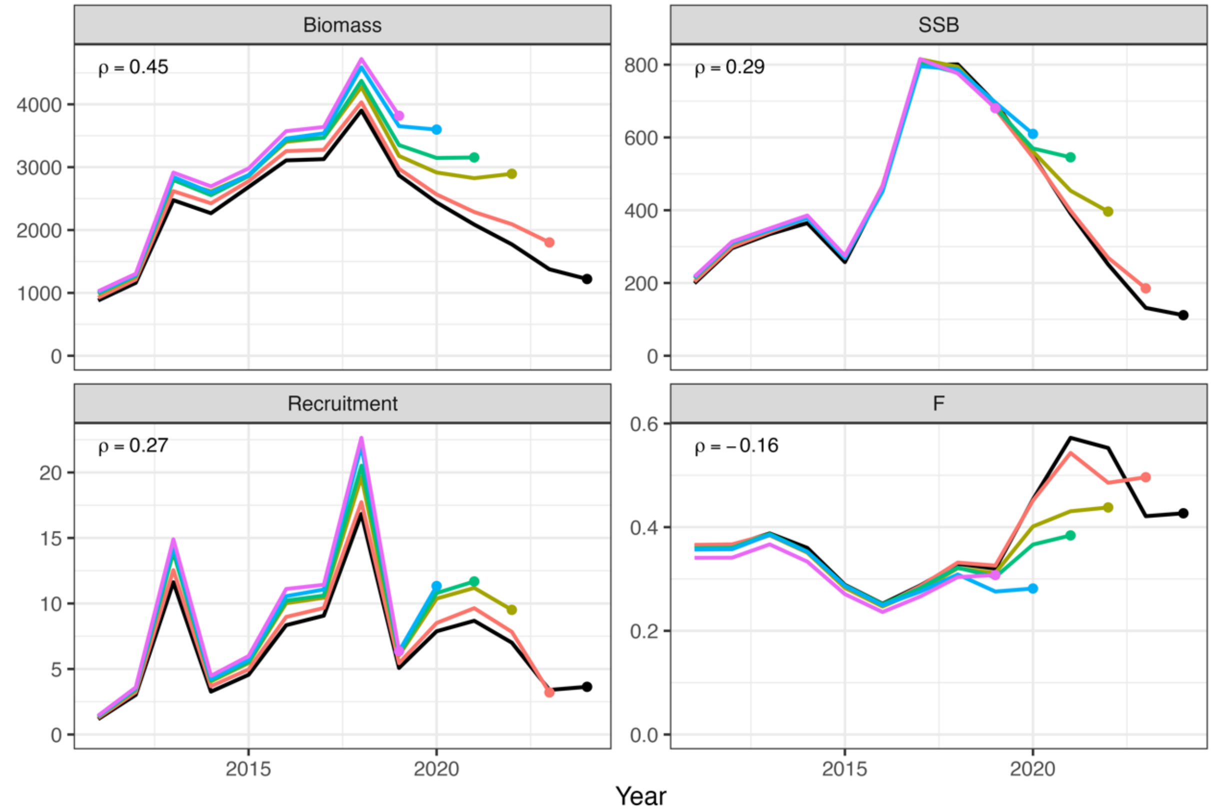
Process errors log(N) (top) and log(F) (bottom) under S01-InitBase (left) and S02-Index24_1 (right) scenarios.

Figure 18



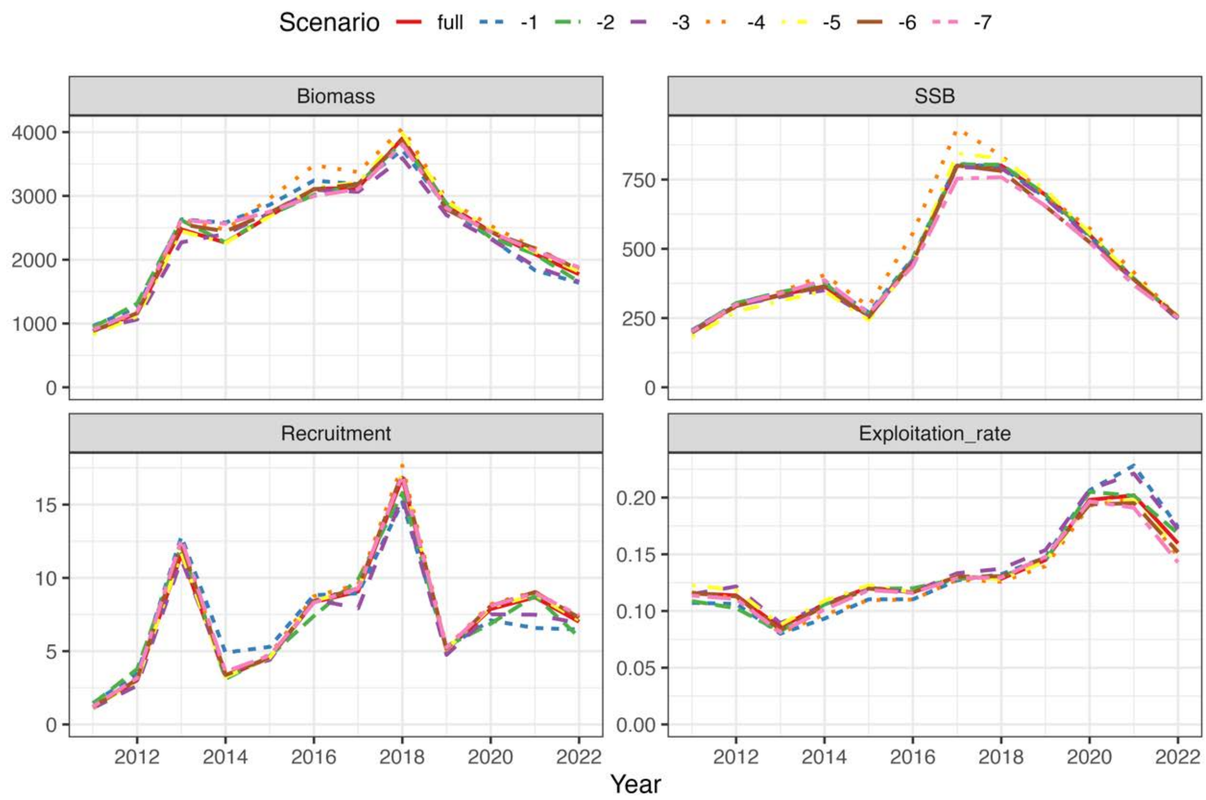
Retrospective patterns for total biomass (top left), SSB (top right), recruitment (bottom left), and mean F (bottom right) of chub mackerel under the base case scenario of Scenario S02-Index24_1. Black Lines represent models with all data, and colored lines represent models with the most recent data trimmed. Mohn's rho is shown in the upper left corner. The dots indicate the terminal year for the calculation of Mohn's rho.

Figure 19



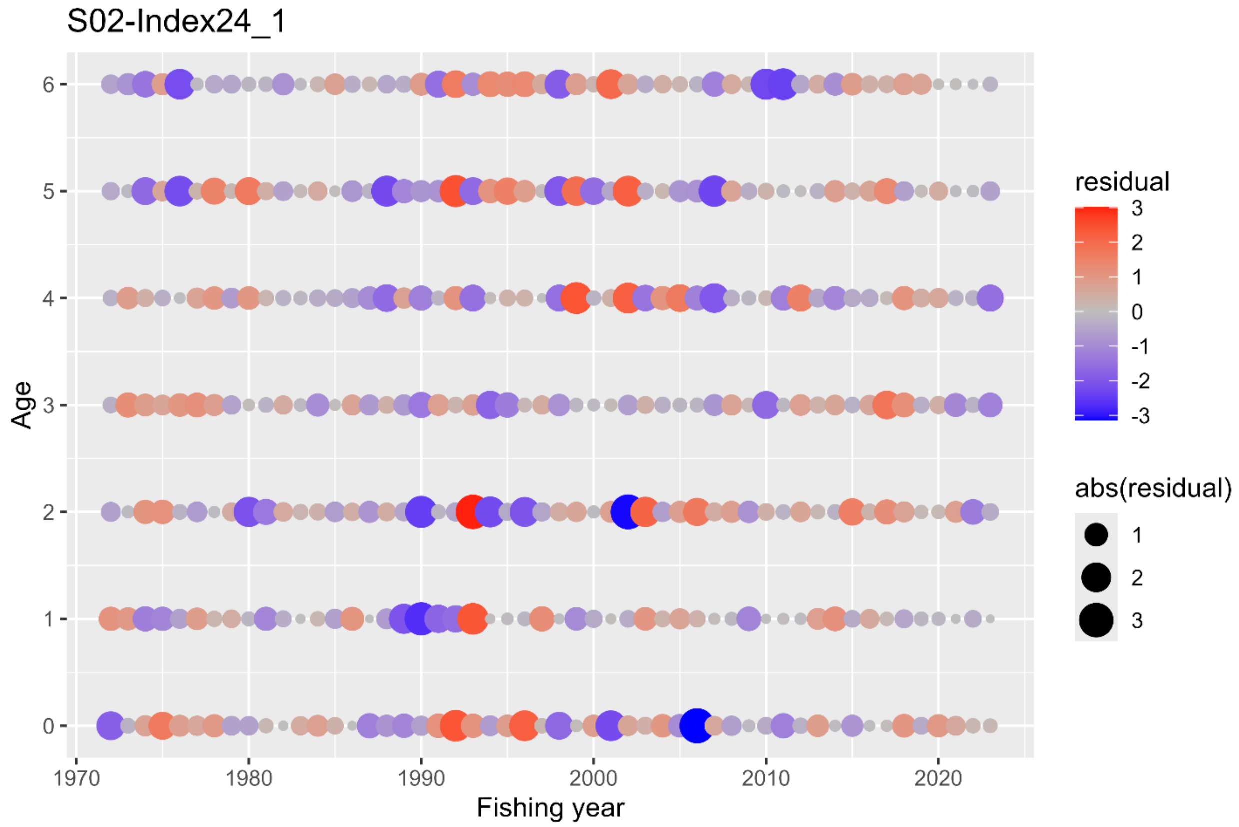
Patterns of retrospective forecasting for total biomass (top left), SSB (top right), recruitment (bottom left), and mean F (bottom right) of chub mackerel under the base case scenario of Scenario S02-Index24_1. Black Lines represent models with all data, and colored lines represent models with the most recent data trimmed. Mohn's rho is shown in the upper left corner. The dots indicate the year of one-year-ahead forecasting, used for the calculation of Mohn's rho.

Figure 20



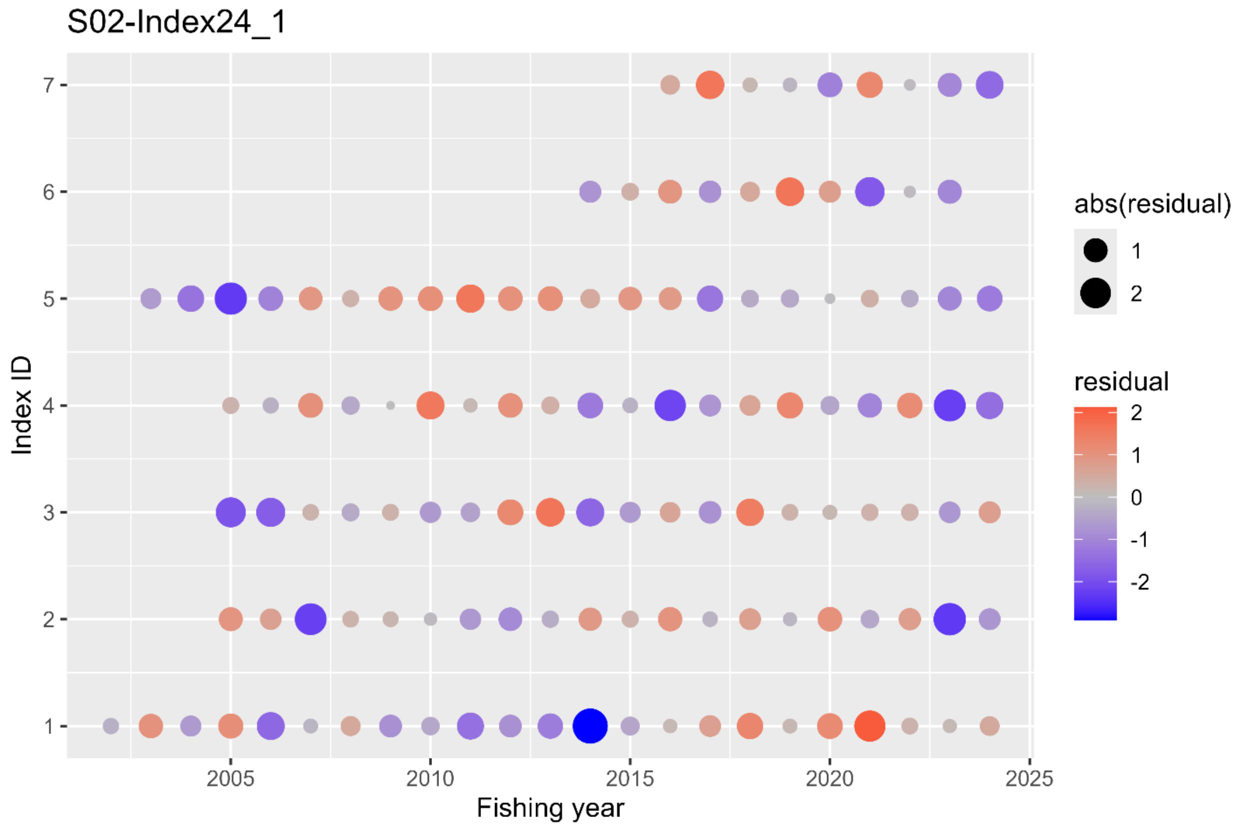
Comparison of the results of the estimates of chub mackerel when all index values are used and when each indicator is excluded for the base case scenario of Scenario S02-Index24_1. The IDs of the index are as follows: (1) relative stock number of age 0 from the summer survey by Japan, (2) relative stock number of age 0 from the autumn survey by Japan, (3) relative stock number of age 1 from the autumn survey by Japan, (4) relative SSB from the egg survey by Japan, (5) relative SSB from the dip-net fishery by Japan, and (6) relative vulnerable stock biomass from the light purse-seine fishery by China.

Figure 21



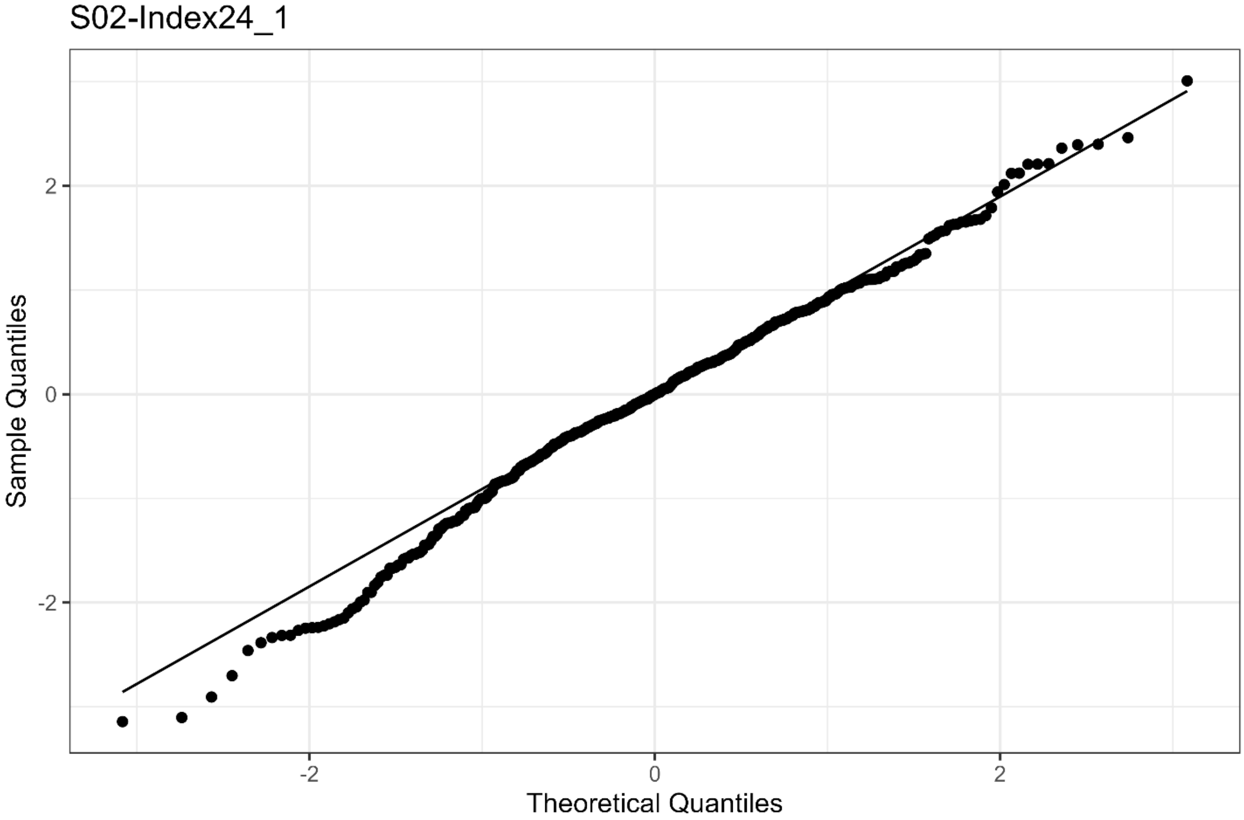
One-Step-Ahead residuals for the catch at age for the base case scenario S02-Index24_1.

Figure 22



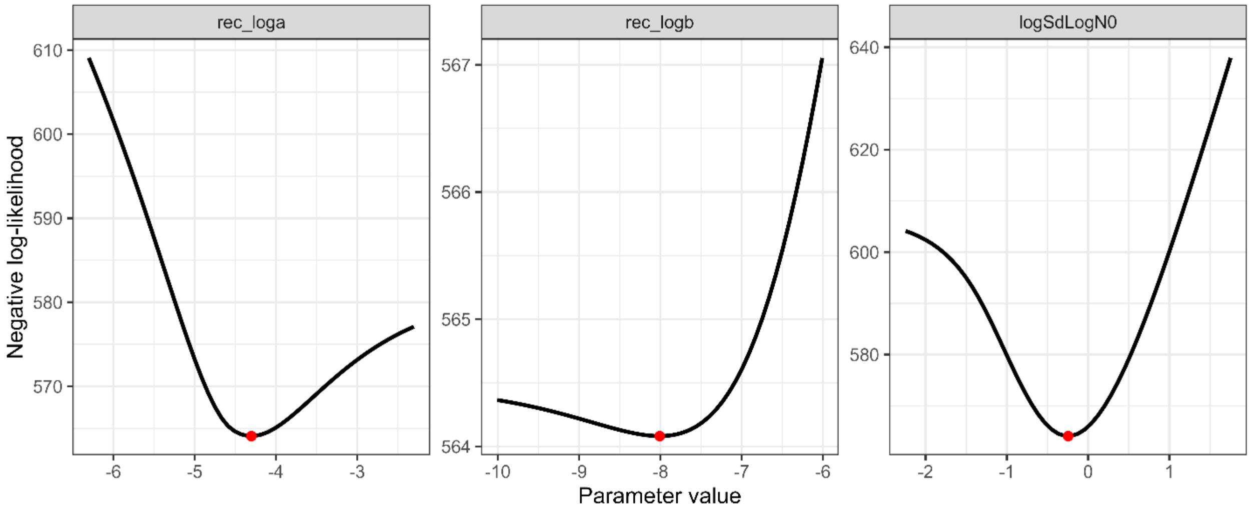
One-Step-Ahead residuals for the indices of abundance for the base case scenario S02-Index24_1. The IDs of the index are as follows: (1) relative stock number of age 0 from the summer survey by Japan, (2) relative stock number of age 0 from the autumn survey by Japan, (3) relative stock number of age 1 from the autumn survey by Japan, (4) relative SSB from the egg survey by Japan, (5) relative SSB from the dip-net fishery by Japan, and (6) relative vulnerable stock biomass from the light purse-seine fishery by China.

Figure 23



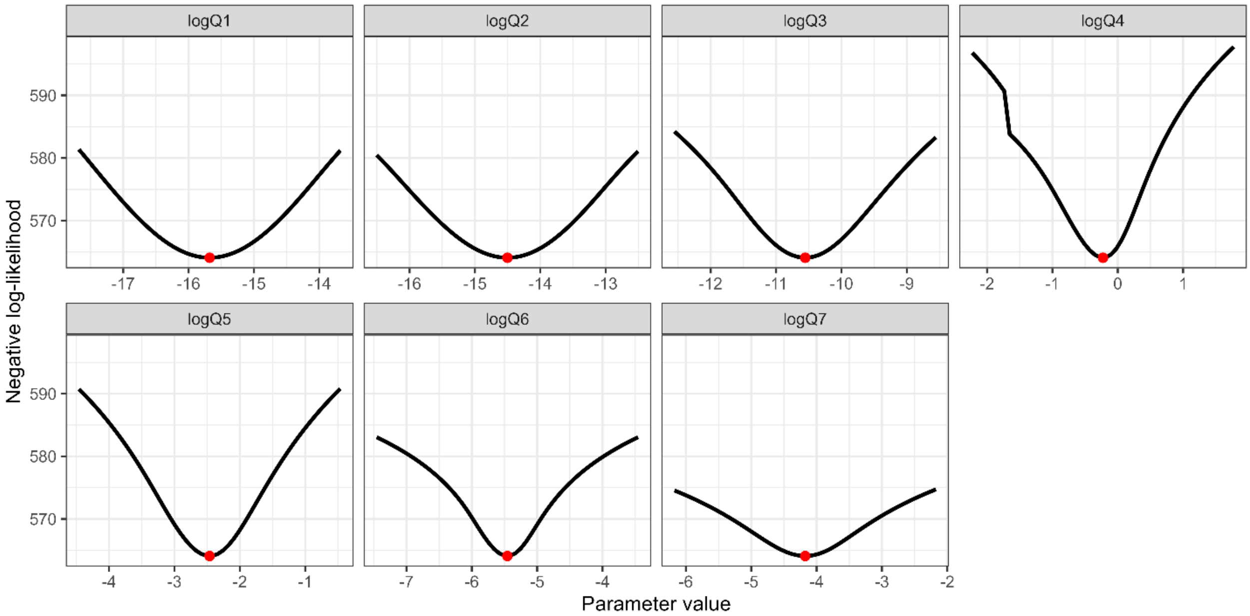
QQplot of the One-Step-Ahead residuals from the indices and catch-at-age for the base case scenario S02-Index24_1.

Figure 24



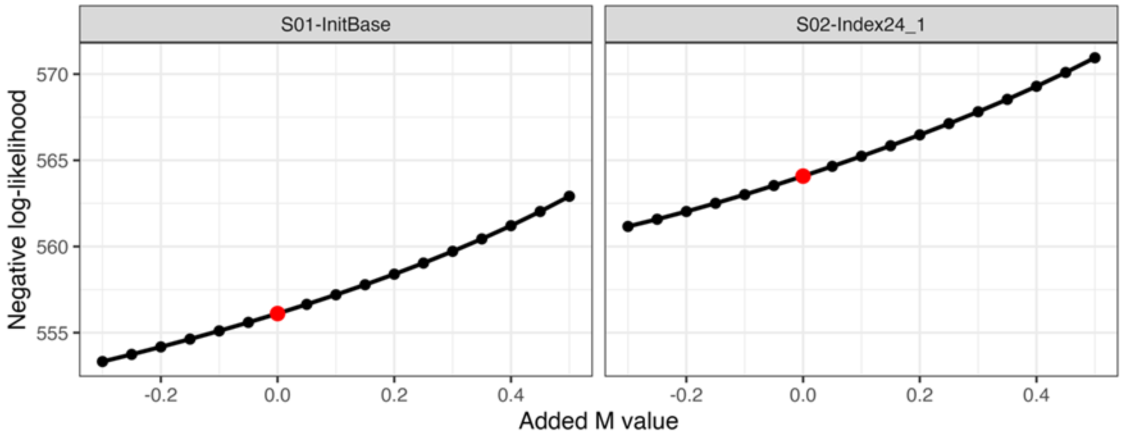
Changes in negative log-likelihoods by varying parameters related to the stock-recruitment relationship (α, β, ω_0 in log space).

Figure 25



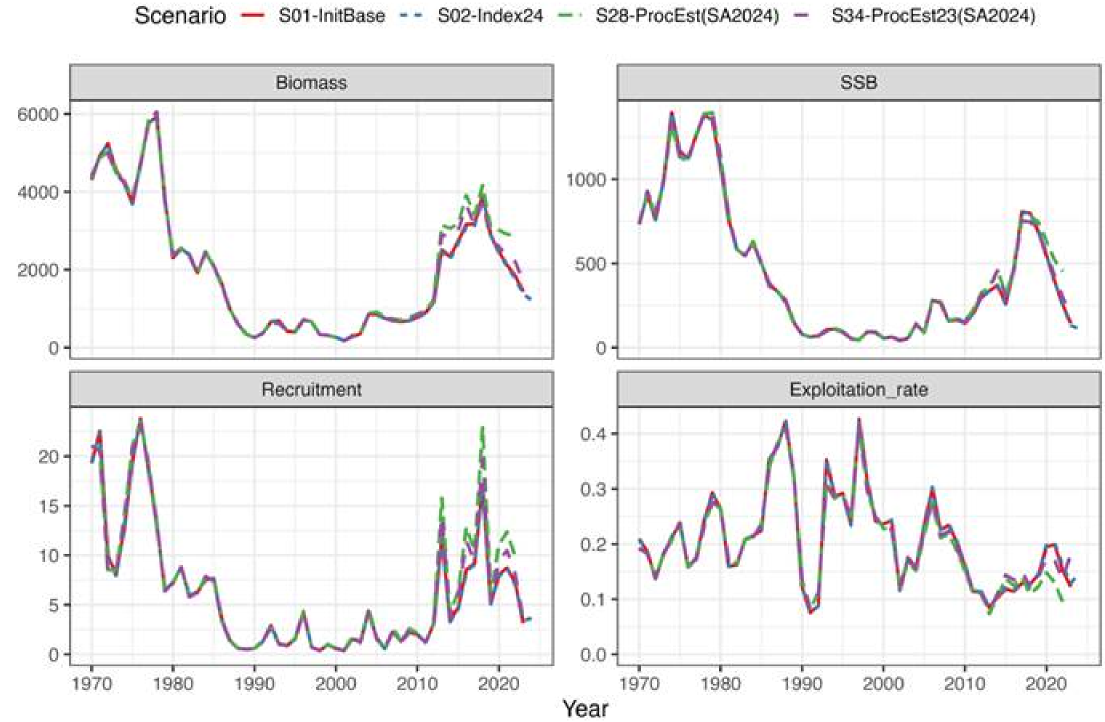
Changes in negative log-likelihoods by varying parameters of proportionality constants for abundance indices (q_k in log space). The red dotes indicate the input values for the base case scenarios.

Figure 26



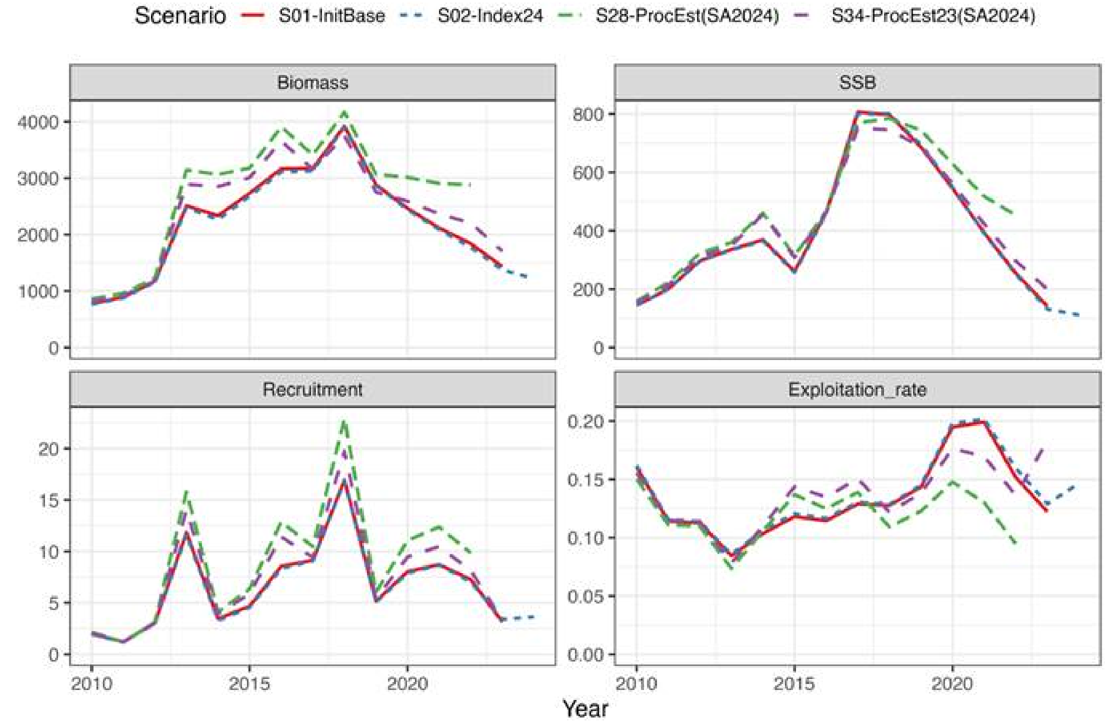
Changes in negative log-likelihood by adding different M values. The red dotes indicate the input values for the base case scenarios.

Figure 27



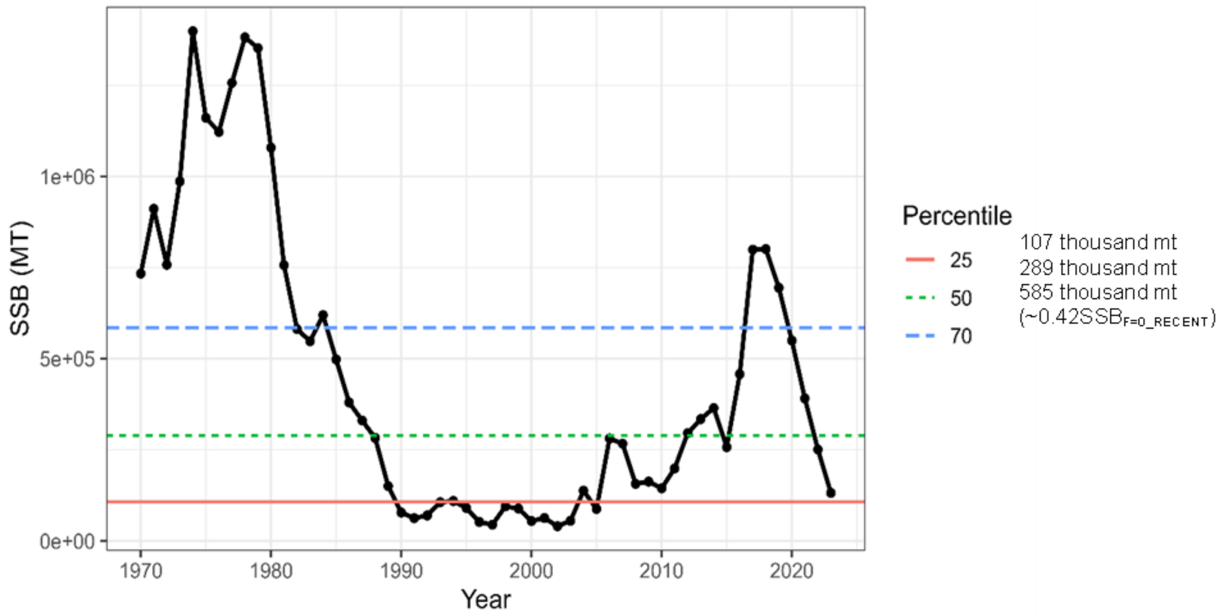
Comparison of the estimated population dynamics between current (red and blue for S01-InitBase and S02-Index24_1, respectively) and previous (S28ProcEst, denoted by green) stock assessments. Note that the purple line indicates S34-ProcEst23, a representative scenario in the previous stock assessment, in which the 2023 indices were used.

Figure 28



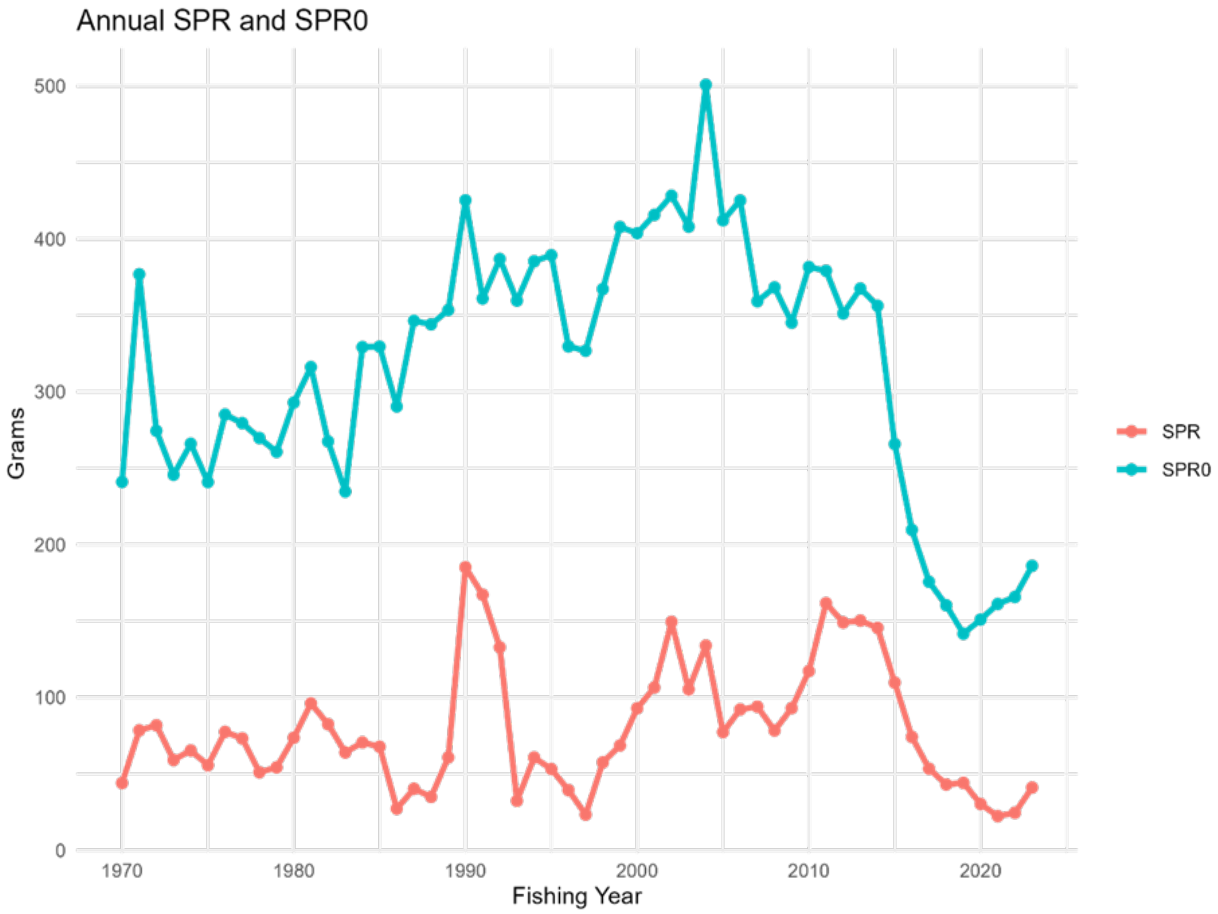
Same as Figure 27, but focusing on the recent years.

Figure 29



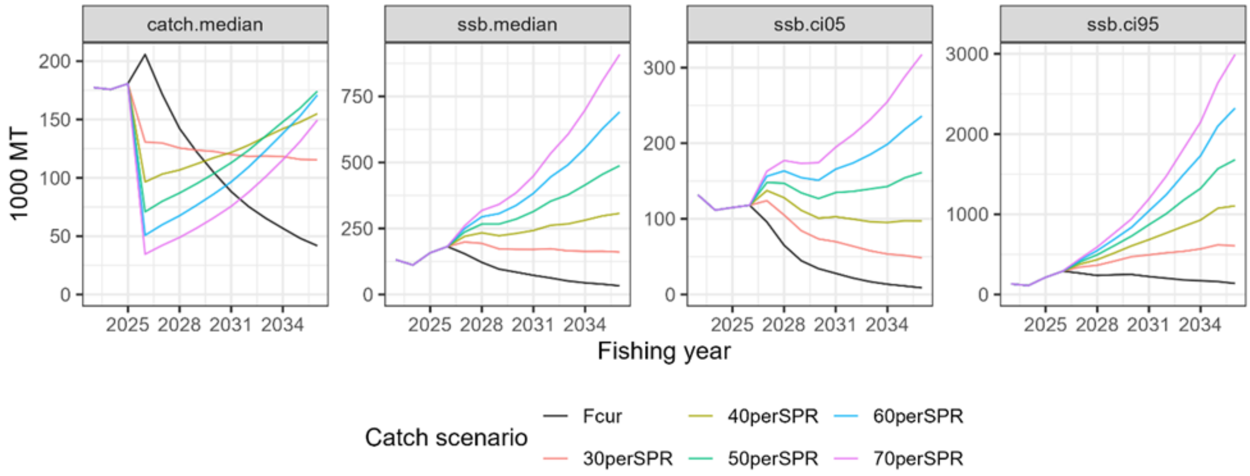
Estimated spawning stock biomass and its 25th, 50th and 70th percentiles.

Figure 30



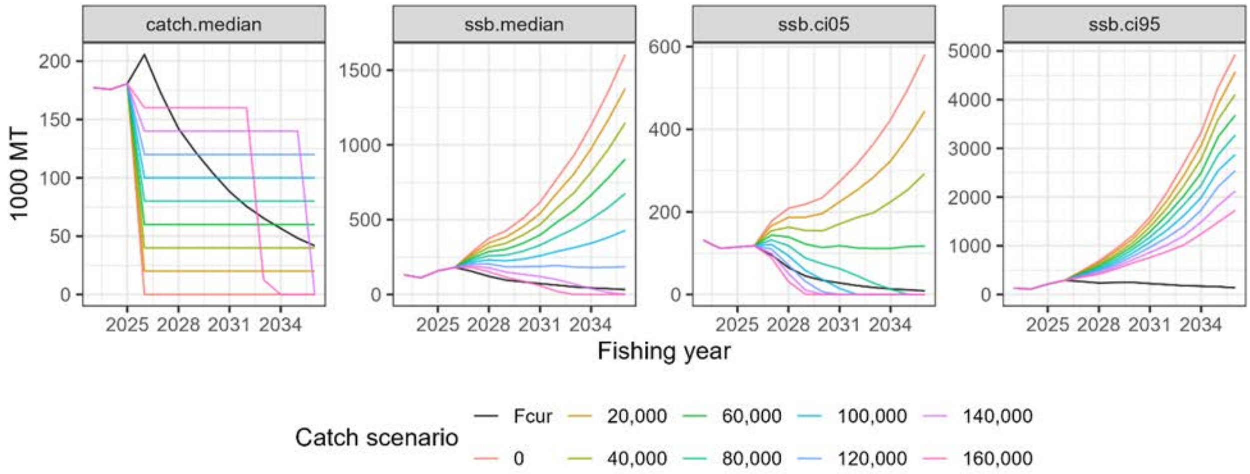
Trajectories of spawners per recruit with (SPR) and without fishing (SPR0).

Figure 31



Future trajectories median catch (left), median SSB (second from left), 5% lower limit of predictive interval for SSB (third from left) and 95% SSB (right) with mean biological parameters for the entire time series. 30–70%SPR and "F_{cur}" in "Catch scenarios" indicate total amount of catches (mt) in constant fishing mortality scenarios of F30–70%SPR in increments of 10% and current fishing morality, respectively.

Figure 32



Future trajectories of median catch (left), median SSB (second from left), 5% lower limit of predictive interval for SSB (third from left) and 95% SSB (right) with mean biological parameters in recent 8 years. Numbers and "F_{cur}" in "Catch scenarios" indicate total amount of catches (mt) in constant catch scenarios of 0 to 160 thousand mt in increments of 20 thousand mt and current fishing mortality, respectively.

ANNEX 1 Additional Tables

Table A1. Descriptions of common terms in the assessment. For terms that are time specific (either a year or a range of years), examples are given for 2023, although the text may refer to alternative years.

Term	**Description**
TBy2023	Total stock biomass in FY2023 (1,000 MT)
SSBy2023	Spawning stock biomass in FY2023 (1,000 MT)
Ry2023	The number of recruits in FY2023 (million)
AFy2023	Weighted average of F-at-age by estimated catch-at-age in FY2023
Ey2023	Exploitation rate (estimated catch divided by stock biomass) in FY2023
CurrentSPR/SPR0	Ratio of spawners per recruit (SPR) in the average of FY2021-2023 to that without fishing
SSBmedian	Median spawning biomass from FY1970 to 2023
F0.1/ F_{cur}	Ratio of F0.1 to current F (average F in FY2020-2023)
FpSPR.30.SPR/ F_{cur}	Ratio of F30%SPR to current F (average F in FY2020-2023)
FpSPR.40.SPR/ F_{cur}	Ratio of F40%SPR to current F (average F in FY2020-2023)
FpSPR.50.SPR/F_{cur}	Ratio of F50%SPR to current F (average F in FY2020-2023)
FpSPR.60.SPR/F_{cur}	Ratio of F60%SPR to current F (average F in FY2020-2023)
FpSPR.70.SPR/F_{cur}	Ratio of F70%SPR to current F (average F in FY2020-2023)
F_{MSY}/F_{cur}	Ratio of FMSY to current F (average F in FY2020-2023)
B_{MSY}	Deterministic MSY reference point for total biomass (1,000 MT)
SSB_{MSY}	Deterministic MSY reference point for spawning stock biomass (1,000 MT)
h	Steepness
SSB0	Virgin spawning stock biomass (1,000 MT)
SSB_{MSY}/SB_0	Ratio of SB_{MSY}Y to SB_0
F_{MSY}SPR	%SPR for F_{MSY}
B/B_{MSY}	Ratio of total biomass in FY2023 to B_{MSY}
SSB/SSB_{MSY}	Ratio of spawning biomass in FY2023 to SSB_{MSY}
SSB_{MSY}y/SSB_{MAX}	Ratio of SSB_{MSY} to the historical maximum of spawning biomass

Table A2. Settings and specifications of SAM for S02-Index24_1.

Model configuration	**Parameter**	**Option(s) addressed after input data fixed by TWG CMSA11(?)**
Recruitment	$N_{0,y}$	Parameterized Beverton-Holt stock-recruitment relationship with α and β estimated in the model (base case)
Catchability or proportionality constant for abundance indices	q_k	Assumed constant across years
Nonlinear coefficient for abundance indices	b_k	Searching the best option(s) about how constraints are imposed on which indices based on AIC etc. *b* is estimated for the three Japanese trawl surveys, whereas fixed at 1 for other indices.
Years of F random walk	-	Include the Markov process for all years as the base case
Correlation of age classes in F random walk	ρ	Using a simple function of age difference ($\rho^{\|a-a'\|}$)
Process errors in numbers older than age 0	ω_a $(a>0)$	Searching the best option(s) about how constraints are imposed on which age classes based on AIC etc., prohibiting setting breakpoints between ages 2 and 3 (base case).
SD in F random walk	σ_a	Searching the best option(s) about how constraints are imposed on which age classes based on AIC etc. Estimate SDs of F random walk for ages 0–1, 2, and above 3.
SD in measurement errors of catch at age	τ_a	Searching the best option(s) about how constraints are imposed on which age classes based on AIC etc. Estimate SDs in measurement errors of catch at age for age 0, 1, 2–3, 4–5, and 6+.
SD in measurement errors of abundance indices	v_a	Assuming different measurement errors among abundance indices
Number of fleets	-	Single fleet
Natural mortality	*M*	Age-specific M (0.80 for age 0, 0.60 for age 1, 0.51 for age 2, 0.46 for age 3, 0.43 for age 4, 0.41 for age 5, and 0.40 for age 6+) (base case)

Maturity-at-age		JPN Maturity-at-age (base case)
Catch-at-age	$C_{a.y}$	See Annex F, NPFC-2025-TWG CMSA11-WP03 Rev.1
Weight-at-age		To compute total biomass and SSB using an average, weighted by age-specific catch number with the same ratio across all years (FY2014–FY2023) by Member, of CHN, E/W JPN and RUS WAA
Summer survey index (age 0)		Used for SA (NPFC-2025-TWG CMSA10-WP08)
Autumn survey indices (ages 0, 1)		Used for SA (NPFC-2025-TWG CMSA10-WP05)
Egg abundance (SSB)		Used for SA (NPFC-2025-TWG CMSA10-WP07 (Rev. 1))
Dipnet fishery (SSB)		Used for SA (NPFC-2025-TWG CMSA10-WP06)
Chinese fishery CPUE		Used for SA (NPFC-2025-TWG CMSA10-WP09)
Russian fishery CPUE		Used for SA (NPFC-2025-TWG CMSA11-WP05)

Table A3. Future projection settings for the base case scenario, S02-Index2.

Projection Aspect	Future Projection Settings
Type of simulation	Stochastic (3,000 times)
Duration	10 years after introduction of management
Start year for incorporating management	2026
Catch or F levels	・Constant catch of 0 to 160 thousand mt in increments of 20 thousand mt ・Constant F, with values of F30–70%SPR in increments of 10% and current fishing mortality (F_{CUR}).
Estimation of catch from terminal year (FY 2024) to current year (FY 2025)	The most recent F (F2023)
Process error other than Age 0	Consider as random stochasticity with the estimated variances in SAM when it is estimated
Recruitment level	Model-based approach using S-R relationship
Error structure in recruitment	Parametric with process error.
Biological parameters	Recent 8-years average

Annex I:
Terms of Reference for the Small Scientific Committee on Japanese Sardine (SSC JS)

(December 2025)

1. To review and evaluate fishery data
    - Catch and efforts (including spatial-temporal distribution of landings and discards)
    - Age/size composition data
    - Evaluation of data quantity, data quality, sources of uncertainty
    - Others
    - Recommendation for future works

2. To review and evaluate fishery-dependent and fishery-independent indices
    - Evaluate/update sampling design for fishery-independent survey
    - Characterize the source of uncertainty for the fishery-dependent and fishery-independent data
    - Develop/review/update the CPUE standardization Protocol taking into account of characteristics of respective fisheries
    - Conduct CPUE standardization
    - Review and update fishery-dependent and fishery-independent indices
    - Recommendation for future works

3. To review, share, and update biological and other information/data relevant to stock assessment
    - Stock structure (including taxonomy of JS)
    - Growth
    - Reproduction and maturity schedule
    - Natural mortality
    - Migration pattern
    - Environmental influences (e.g. oceanographic, habitat, or species interactions)
    - Others
    - Evaluation of data quantity, data quality, sources of uncertainty
    - Recommendation for future works

4. To conduct the stock assessment
    - Identify and apply an appropriate stock assessment model
    - Develop/review/update the Stock Assessment Protocol
    - Conduct stock assessment following the Stock Assessment Protocol
    - Create the scientific advice on management based on the results of the stock assessment
    - Recommendation for future works

5. To facilitate data- and code- sharing processes

6. To review/improve presentation of stock assessment results (including stock status summary report in a format to be determined by the SSC)

Annex J:

Tasks for the SSC JS, SWG JFS, and SWG BM the from SC10

Tasks	SSC JS	SWG JFS	SWG BM
Fishery and biological information			
(a) Update species summary	X	X	X
(b) Share biological data, including unpublished data if possible	X		
(c) Update catch and effort data	X	X	X
(d) Discuss potential data sharing needs or data that could be collected through a regional observer program (ROP)	X		
(e) Evaluate the influence of environmental variables on the life history, biology, and population dynamics		X	X
Distinguish between CM and BM			
(f) Develop a tool to easily distinguish between CM and BM for observers or fishers at sea			X
Stock Assessment			
(g) Calculate nominal CPUE and develop a CPUE standardization protocol	X		
(h) Develop a stock assessment protocol	X		
(i) Explore the application of existing stock assessment models or develop new stock assessment models for JS	X		
(j) Conduct other research that may contribute to the provision of management advice	X		
(k) Share code for developing a stock assessment model for JS	X		
(l) Observe domestic stock assessments by Members unless there is a collaborative NPFC stock assessment	X	X	X
(m) Review terms of reference (TOR)	X		
(n) Draft a rolling 5 year work plan	X		

Annex K:
Template for SC data calls

Scientific Committee Data Call – 202X

Rationale

A data call is essential to ensure that the Scientific Committee and its subsidiary bodies have access to the most complete, consistent, and up-to-date information needed to conduct robust stock assessments and provide sound scientific advice to the Commission. Regular and standardized data submissions allow the SC subsidiary bodies to integrate fishery-dependent and fishery-independent information from all Members and CNCPs, assess trends across the Convention Area, and evaluate stock status against agreed reference points. This process not only supports transparency and comparability among datasets but also fulfils Members' obligations under the relevant NPFC Conservation and Management Measures (CMMs), which require the timely provision of scientific and catch data to underpin evidence-based management decisions.

A centralized request for data is preferable to fragmented intersessional requests because it ensures coherence, transparency, and equity in how Members and CNCPs are asked to contribute information. When data are requested through a single, coordinated call, all parties receive the same guidance, deadlines, and specifications, reducing the risk of inconsistent interpretations or selective participation. It also helps align the timing of submissions with the scientific and management calendar, ensuring that the SC subsidiary bodies have the necessary inputs well in advance of analyses and meetings.

1. Scope of the data call

NPFC Members and CNCPs are requested to submit the data specified in Section 4 and 5 in accordance with the present data call for year 202X. These data are essential to support the scientific analyses, assessments, and evaluations carried out by the Scientific Committee and its subsidiary bodies. The information provided will form the basis for robust and transparent stock assessments and related scientific work, which in turn underpin the development of sound management advice and recommendations to the Commission.

2. Regulatory basis

The exchange and provision of data for scientific purposes are explicitly grounded in the Convention on the Conservation and Management of High Seas Fishery Resources in the North Pacific Ocean. In addition to the Commission's functions under **Article 7(1)(f)** and Members' obligations under **Article 9(1)(a)** to provide data in accordance with adopted procedures, **Article 16 ("Data and Information")** sets out the guiding principles for data exchange. It requires that "*Members of the Commission shall provide to the Commission in a timely manner complete and* *accurate data concerning fishing activities and related scientific research in the Convention Area*" and further mandates that "*the Commission shall compile, maintain and make available such data as are necessary for the implementation of this Convention*." Moreover, **Article 16(2)** emphasizes that data and information "*shall be provided and used in accordance with procedures adopted by the Commission*," ensuring both transparency and consistency. Collectively, these provisions form the regulatory foundation for issuing coordinated data calls and for the scientific exchange of information essential to the work of the Scientific Committee and its subsidiary bodies.

Data shared by Members shall be used in accordance with the NPFC Data Sharing and Data Security Protocol and SC's Regulations for Management of Scientific Data and Information.

3. Deadlines

Example:

Subsidiary body	**Chair**	**Deadline**
TWGCMSA	Kazuhiro Oshima	15/02/2025

4. Data to report

a. TWG CMSA

Example:

Datatype (Fishery independent/dependent)	**Data source**	**Temporal Scope**	**Aggregation**
FI	Trawl survey	2021-2025	Annual
	Recruitment survey	2022-2023	Annual
FD	Catch at age	2000-2012	Quarter

5. Subsidiary bodies specifications

Specific data that SSC/TWG/SWG might require and are not routinely provided.

6. Submission

a. To the SC database

Reference will be made to the SC database once it is developed, including the accompanying user manual and any supporting documentation. This will ensure that all procedures, data flows, and validation steps are aligned with the finalized database structure and the guidance provided within its official documentation.

b. To the Collaboration site

Specific ad-hoc data requests that don't go into the SC database.

7. Contact information

Annex L:

Report of the Small Working Group on Data (SWG Data)

Executive summary

The Small Working Group on Data (SWG Data) met four times in 2025 (28 April, 4 June, and 12 August and 23 October 2025) via WebEx. The group, chaired by Karolina Molla Gazi (EU), advanced the development of the NPFC Scientific Committee (SC) database, including database architecture, user roles, confidentiality provisions, and harmonized templates. The SWG also reviewed the draft Conservation and Management Measure (CMM) on Minimum Data Standards, consolidating feedback from Members. Significant progress was achieved on defining data types, developing reference code lists, and outlining implementation steps.

1. Introduction

A database is a structured system for storing and managing large amounts of information in an organized and secure way. It ensures that all data are consistent, searchable, and easily accessible from a single location rather than scattered across multiple files and repositories. By maintaining standardized and up-to-date datasets, it promotes operational consistency, minimizes errors, and reduces redundant work. Built-in confidentiality controls (such as user roles and access permissions) enhance security, while documentation and tracking functions allow users to monitor modifications, imports, and exports. Overall, a database streamlines workflows, improves efficiency, and increases the overall quality and reliability of data management.

In the context of Regional Fisheries Management Organizations (RFMOs), a well-structured database is essential for effective scientific collaboration and credible stock assessment. RFMOs rely on data contributed by multiple Members, each with their own systems, formats, and standards. Without a common, centralized structure, data become fragmented, inconsistent, and difficult to integrate, eventually undermining the quality and comparability of analyses. A shared database provides a consistent framework for storing, managing, and accessing fisheries, and biological data, ensuring that all Members and expert groups work from the same verified and up-to-date information. This not only enhances transparency and reproducibility in stock assessments but also supports timely scientific advice by streamlining data preparation and reducing duplication of effort across working groups.

Confidentiality controls, such as user-based access levels, allow sensitive Member's data to be stored securely while still enabling their use in joint analytical work, such as standardized CPUE analyses, stock assessment, and MSE development. In addition, version tracking and documentation features improve traceability and accountability, allowing scientists to follow the history of each dataset and the methods applied.

2. SC database development

The starting point of the work was figure 1, which illustrates the transition from the current to the proposed process for data sharing and scientific analysis among Members and subsidiary groups. At present, data are prepared using separate templates for each SC subgroup (e.g., SSC PS, SSC NFS, TWG CMSA, and other species) and submitted either by email or uploaded to the collaboration site. There is no systematic validation step, and data storage is fragmented between the collaboration site and the data warehouse. Data consolidation is carried out manually before being used for analysis. Under the proposed system, a common data template by data type will be used across all groups and submitted through a dedicated database interface. Validation will occur automatically during import, checking formats and allowed field values. Data will then be stored in a centralized database, where automated extraction queries will enable streamlined data consolidation and facilitate more efficient and consistent analyses.

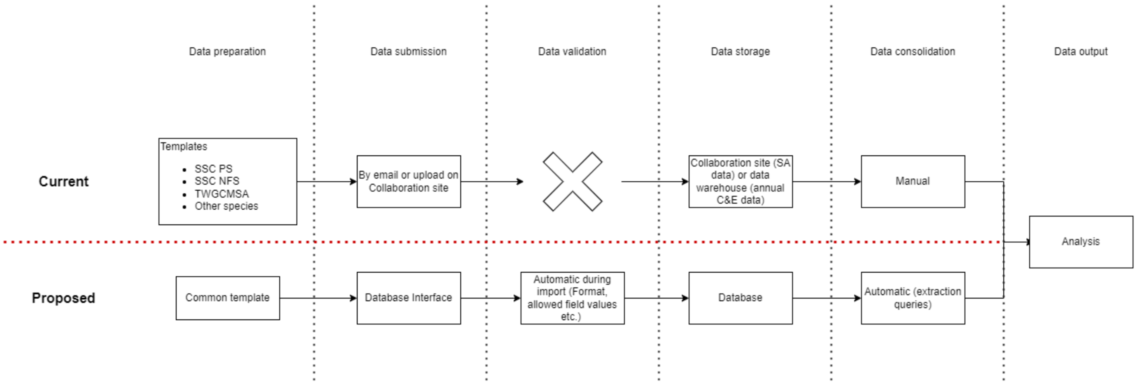


Figure 1: Current and proposed process for scientific data provision.

As a first step, the group discussed the types of data to be included in the database, based on a table of data categories previously compiled and circulated by the Secretariat (table 1).

It was agreed that a clear distinction should be made between raw (unprocessed) data and processed or estimated data products, as these categories would require different templates and potentially separate storage tables. Figure 2 illustrates the relationship between raw, processed, and estimated data. On the left, raw data originate from logbooks and observer records on board, capturing catch, effort, and biological sampling information. These datasets are then transformed into processed data, such as monthly catch and effort summaries, annual footprint overviews, and biological ratios derived from sampling. Finally, these processed products feed into estimated data used for analyses, including Catch Per Unit Effort (CPUE) indices and aggregated biological estimates.

Table 1: Data shared to support the NPFC stock assessments and scientific analyses.

Group	Data Type	Minimum Temporal Resolution	Minimum Spatial Resolution	Minimum Fleet Resolution
TWGCMSA	ALK	Quarter	EEZ areas and CA	Aggregated over all Member's fleets
TWGCMSA	Age composition	Quarter	EEZ areas and CA	Aggregated over all Member's fleets
TWGCMSA	Length composition	Quarter	EEZ areas and CA	Aggregated over all Member's fleets
TWGCMSA	Maturity ogive	Quarter	EEZ areas and CA	Aggregated over all Member's fleets
TWGCMSA	Chub and blue mackerel ratio	Annual	EEZ and CA	Aggregated over all Member's fleets
SSCBM	Chub and blue mackerel ratio	Annual		
SSCBM	Length composition	Month		
SSCBM	Length-weight	Annual		
SSCJS	Catch	Month	EEZ and CA	Gear
SSCJS	Effort	Month	EEZ and CA	Gear
SSCJS	Length composition	Month		Gear
SSCJS	Length-weight	Annual		Gear
SSCPS	Catch	Month	1 x 1 degree	Gear
SSCPS	Effort	Month	1 x 1 degree	Gear
SSCPS	Length composition	Month	1 x 1 degree	Gear
SSCPS	Age composition	Month	1 x 1 degree	Gear
SSCPS	ALK	Month		Gear
SSCBFME	Length composition	Month	Seamount	Gear
SSCBFME	Age composition	Month	Seamount	Gear
SSCBFME	Maturity ogive	Month	Seamount	Gear
SSCBFME	Effort	Decade	30" x 30"	Gear
SSCNFS	Catch	Month	1 x 1 degree	Gear
SSCNFS	Effort	Month	1 x 1 degree	Gear
SSCNFS	Length composition			Gear

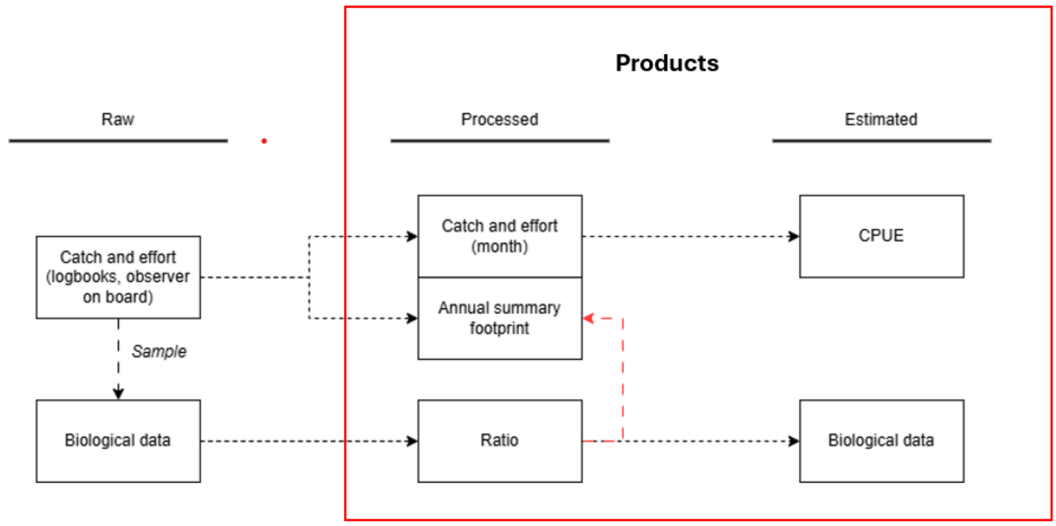


Figure 2: Schematic overview of the relationship between raw, processed, and estimated data types.

The Secretariat's analyses identified the need to harmonize existing data templates among SC subsidiary groups that handle similar data, ensuring compatibility and consistency. It was acknowledged that certain specialized datasets, such as 30x30 effort data from bottom fisheries and VME visual survey data, may not be incorporated in the initial development phase but could be accommodated in future versions. It was also noted that raw data from bottom fishery observer programs are currently not shared directly with the Secretariat, but may be provided to specific expert groups for analytical purposes. The group also discussed the potential inclusion of hyperlinks

within the database to relevant NPFC policies and protocols hosted on the NPFC website.
Table 2 shows the classification of different types of data according to their level of processing and analytical use.

Table 2: Classification of different types of data

Category	Examples
Raw data	Biological data
Processed data	Catch & effort (C&E), annual footprint, chub and blue mackerel ratio.
Estimated data	Standardized CPUE, ALK, length, age, maturity data

Criteria for inclusion in the SC database

When determining which data types should be included, the primary criterion is whether the data are used directly and routinely in stock assessments or other scientific analyses that inform management decisions. These datasets form the foundation of the SC's analytical work and must therefore be prioritized for inclusion. Additionally, data that may not currently be used in assessments but are commonly shared among Members because they provide valuable contextual or biological information could also be considered in the future.

User Roles and Confidentiality

User roles and confidentiality establish controlled access to data and system functions. Each user is assigned a specific role defining what actions they can perform, from uploading data to viewing restricted content. This role-based structure ensures data integrity, prevents unauthorized modifications, and maintains a clear audit trail of all activities. Confidentiality measures further protect sensitive or Member-specific data, allowing information to be shared securely while respecting data ownership and privacy agreements.

The access-control matrix in Annex 1 outlines user permissions following the standard CRUD model: Create, Read, Update, and Delete. These actions define what each user role can do within the various data domains, including Biological Estimates, Catch and Effort, and Ratio data. "Read" permissions allow users to view records, while "Create" and "Update" permissions enable them to add or modify data, generally restricted to information submitted by their own Member. "Delete" operations are implemented as soft deletes, meaning entries are archived rather than permanently removed, ensuring a complete audit trail. The use of the CRUD model provides a clear and consistent structure for managing data and maintaining transparency across user roles. The matrix also defines the roles within the system: Anonymous users have no access to Member-submitted data; Authenticated users can view publicly available reference information; Member Data Submitters can create, read, and update their own Member's datasets; Species Data Analysts can read data for the species assigned to them; and the Secretariat has full CRUD permissions across all domains.

Table 3: Defined user roles and access rights.

Role	Description	Permissions	Notes
Anonymous User	A user who is not logged into the system.	Read access only to publicly available reference data (e.g., gear codes, species lists).	No access to any Member-submitted datasets.
Authenticated User	A registered user with an account but not associated with a Member for data submission.	Read-only access to non-sensitive reference data synchronised from MaM or public websites.	Cannot view or modify Member-level data.
Member Data Submitter	A user designated by a Member to upload, edit, and manage their own data submissions.	Full CRUD (Create, Read, Update, Delete*) for their **own Member's data** in all required domains.	*Delete operations are soft deletes (archive mode) to maintain an audit trail.*
Species Data Analyst	A scientifically authorised user assigned specific species for analysis.	Read access to Member-submitted data **for the species assigned to them**.	No permission to create, update, or delete Member-submitted records.
Secretariat	Administrative users responsible for system oversight, coordination, and data governance.	Full CRUD across all data domains and Members.	Oversees system integrity, quality control, and administrative management.

Data templates & reference lists

It was agreed that each data type should correspond to a single harmonized template, to be developed in close coordination with the relevant subsidiary groups. The SWG Data coordinated with SSCs, TWGs, and SWGs to ensure data harmonization and requested a focal point to be nominated in order to review the templates developed under SWG Data. This process went smoothly and the SC's subsidiary groups provided the necessary feedback which was incorporated to reflect their views.

This led to the creation of multiple templates capturing the different data types. For further information please refer to the collaboration site where they are stored. In addition, code reference lists in a database provide standardized sets of predefined values, such as species codes, gear types, or country identifiers, that ensure consistency and accuracy across datasets (table 3). They prevent discrepancies caused by variations in naming or formatting and make it easier to validate, compare, and integrate data from multiple sources.

Table 4: Illustrative example of reference lists.

Field	Description	Example(s)
SizeType	Measurement types and definitions	FL – Fork length; TL – Total length
NumbersUnit	Units for numbers of specimens	C – Count; K – Thousands; M – Millions
EffortUnits	Units for measuring fishing effort	kwd – Kilowatt-days; fd – Fishing days
Members	Codes and names of Members	CA – Canada; EU – European Union; JP – Japan
Species	Codes, names, and references	MAS – Scomber japonicus; SAP – Cololabis saira

Harmonizing and establishing definitions across all NPFC systems

During the meetings, the importance of adopting a common terminology to ensure consistency and comparability across the data submitted by Members was identified. Differences in terminology, such as variations in how effort, catch categories, or weight types are defined, can lead to misinterpretations and hinder the integration of datasets from different sources. Establishing standardized definitions and terms will make it possible to accurately compare, combine, and analyze data across Members. To that end, the SWG Data proposes to the SC that the following definitions are considered for adoption among all subsidiary bodies.

Table 5: Proposed definitions for weight and effort metrics.

Metric	Definition
Fishing days	Fishing days. Total time spent actively fishing (excludes transit, searching, or any other non-fishing activities) expressed in days.
Vessel days	Vessel days. Total days the vessel is at sea, including transit, searching and any other non-fishing activities.
Live weight	The weight of the whole fish as caught, prior to any processing (i.e. before gutting, heading, or removal of other parts).
Gutted weight	The weight of the fish after removal of internal organs (viscera), but before further processing such as heading, filleting, or skinning.

Coordination and Governance

It is important to establish a process for the inclusion of new codes in the official code lists is essential to ensure both flexibility and consistency in database management. A practical approach would be for each SC subsidiary group to propose new codes to the Secretariat whenever gaps or new needs are identified. The Subsidiary groups will bear the responsibility to verify the new proposed codes in terms of relevance, uniqueness, and alignment with the existing coding structure before formally integrating them into the master lists. This procedure ensures that the database can evolve to reflect emerging data requirements while maintaining a coherent and standardized system across all data submissions and analyses.

Deliverables and Timeline

Figure 3 illustrates the stepwise process for developing, testing, and releasing the SC database. The first draft of the templates was presented at SWG Data 03. These initial templates were then shared with Members and the SC subsidiary bodies for review under the Members Review Templates stage. Members provided feedback, which was compiled and circulated. Based on this input, the Prototype Development phase begins, during which the templates and database interface are further designed and adjusted.

Following prototype completion, Internal Testing will be conducted to verify functionality, consistency, and data handling. This stage may feed back into prototype development if issues or improvements are identified. It is expected that a manual will be developed at this phase to assist Members to populate the database. The process then moves to Training (expected in January 2026), where users are familiarized with the new system and templates, and finally to Release, marking the official deployment of the tested and approved database tools.

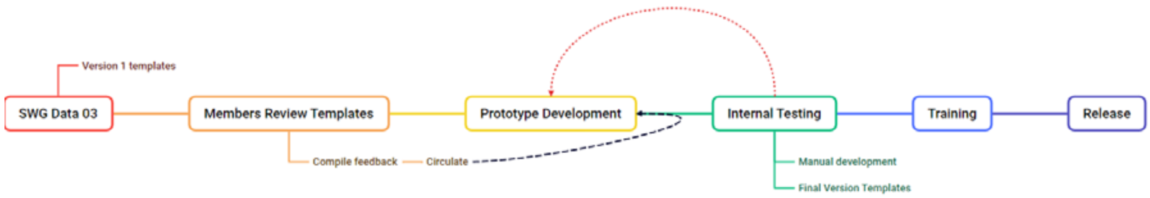


Figure 3: Process for developing, testing, and releasing the SC database.

Future developments

Further development of the database may include several enhancements to improve functionality, accessibility, and data transparency. These could involve the implementation of Data Dictionary tabs providing detailed field-level descriptions, and Charts tabs displaying Member submission coverage and other key visual summaries. Additional analytical charts and reports may also be developed to support more comprehensive data exploration. Technical improvements could include synchronization of data with the NPFC Data Warehouse to ensure consistency across systems, interface translation to support languages other than English, and interfaces for retrieving previous versions of updated records to enhance traceability. Together, these developments would strengthen usability and support broader participation and analytical capacity within the SC framework.

3. Review of the Draft CMM on Minimum Data Standards

The SWG Data was tasked with reviewing the EU-proposed draft CMM on Minimum Data Standards. Member feedback noted that many fields requested are not collected in logbooks, and detailed haul or tow data can only be realistically collected by observers. Fields for 'data source' (fisher or observer) and precise definitions of 'live weight' and 'fishing days' were recommended. A questionnaire was circulated after the second meeting to capture Members' data collection practices, with responses due by 15 September 2025 for compilation before SC10.

Feedback to the CMM questionnaire was submitted by Canada, China, Chinese Taipei, Japan, Korea, Russia and the EU using the NPFC Minimum Standards Questionnaire templates. Each file included multiple annexes corresponding to data domains, such as general data collection, gear-specific information, and annual catch data. The responses were reviewed to determine which fields were completed, which were left blank, and where Members added written comments. All Members completed most annexes. The majority of fields contained “Yes”, showing that Members were collecting the information. Blank or “NA” cells were primarily associated with annexes that were not relevant to a Member’s fisheries. Only a small number of “No” or “Yes/No” entries were found. Across all submissions, approximately 70–75% of all cells contained “Yes”, about 10–15% contained “No” or “Yes/No”, and the remainder were blank or “NA”.

Annex summaries

Annex 1 – All Fishing Activities

All Members completed this annex, and almost all fields were marked “Yes”. A few fields were left blank or marked “NA” where specific identifiers or vessel categories did not apply. Several Members added comments clarifying that some identifiers (for example owner names or internal vessel codes) are not publicly shared or that the data exist in national systems but are not transmitted in this exact format. In addition, private and confidential information (such as the address of the master), it is not needed for scientific purposes.

Annex 2 – Trawl

This annex was completed by all Members with trawl fisheries. Most responses were “Yes”, confirming that trawl activity, catch, and sampling data are available. Blank or “NA” cells mainly appeared in submissions from Members without trawl operations. A small number of “No” responses were found in fields related to discarded weight. Comments commonly stated that the information in the logbooks focuses on main target species.

Annex 3 – Purse Seine

Annex 3 was completed by Members operating purse-seine fleets, including Japan, Korea, and Chinese Taipei. Nearly all fields were filled with “Yes”. Occasional “No” or “Yes/No” responses appeared in data-storage and reporting sections. Comments indicated that these data are collected through national observer programmes and stored within existing national institutes. Overall, this annex showed consistently high completeness and clear data structure across Members.

Annex 4 – Jigging

Only some Members operate jigging fisheries, and this annex was therefore partially completed. Where applicable, most fields contained “Yes”, but a few “No” entries were recorded. Comments referred to manual data entry still being used for part of the data flow and to ongoing efforts to move to digital reporting systems. The annex shows that the required information exists but that electronic data capture is still being expanded.

Annex 5 – Stick-Held Dip Net

Few Members use this gear, so most submissions marked this annex as “NA”. Where it was completed, nearly all fields were “Yes”. No explanatory comments were recorded. The annex was generally considered not relevant for most Members’ fisheries.

Annex 6 – Bottom Gear (Longline, Trap, Gillnet)

This annex was relevant only for Members with bottom-fishing operations. It was filled in by a small number of Members and marked “NA” by others. The completed sections contained a mixture of “Yes” and blank cells. Comments mainly stated that no vessels operate these gear types under NPFC authorization or that such activities occur only domestically. Where applicable, Members provided information indicating that data exist for these gears but are limited in spatial scope. It should be noted that the Annex for the trap gear was not included initially and it was proposed to be added by a Member, given that there are fisheries using this type of gear in NPFC.

Annex 7 – Annual Catch Data

All Members completed Annex 7, and almost every field was marked “Yes”. This annex showed the highest overall consistency. Only a few “NA” or blank cells appeared, mostly in optional metadata sections. The structure and completeness of this annex indicate that annual catch information is available for all Members in the format requested.

Completion by annex

All Members completed Annex 1 (All Fishing Activities) and Annex 7 (Annual Catch Data). Annexes 2–6 were completed to varying degrees, depending on whether the described gear types or activities occurred in that Member’s fisheries. Blank or “NA” cells mainly reflected non-applicability rather than lack of information. Comments were found in specific fields across the questionnaires. These were typically used to describe implementation status, applicability, or the type of national system used. Annex 2 provides a summary of the fields where responses differed from “Yes,” including the associated comments and their general content.

4. Recommendations to the Scientific Committee (SC10)

- The SWG Data suggests that the Scientific Committee consider adopting the common terminology discussed by the group regarding effort, gears, and the definitions of live and gutted weight.
- The SWG Data suggests that the Scientific Committee and its subsidiary bodies share information regarding the maturity scales and corresponding stages used at a national scale in order to develop the code list.
- The SWG Data suggests that the Scientific Committee endorses a 4-hour training workshop in January 2026 on the use of the database.
- The SWG Data suggests that the Scientific Committee considers continuing the SWG Data for one more year to finalize the development of the SC database.
- The SWG Data suggests that the Scientific Committee considers the future of the group and it’s scope beyond the development of the database.

NPFC Scientific Data Repository System Design Specification

1 Objectives

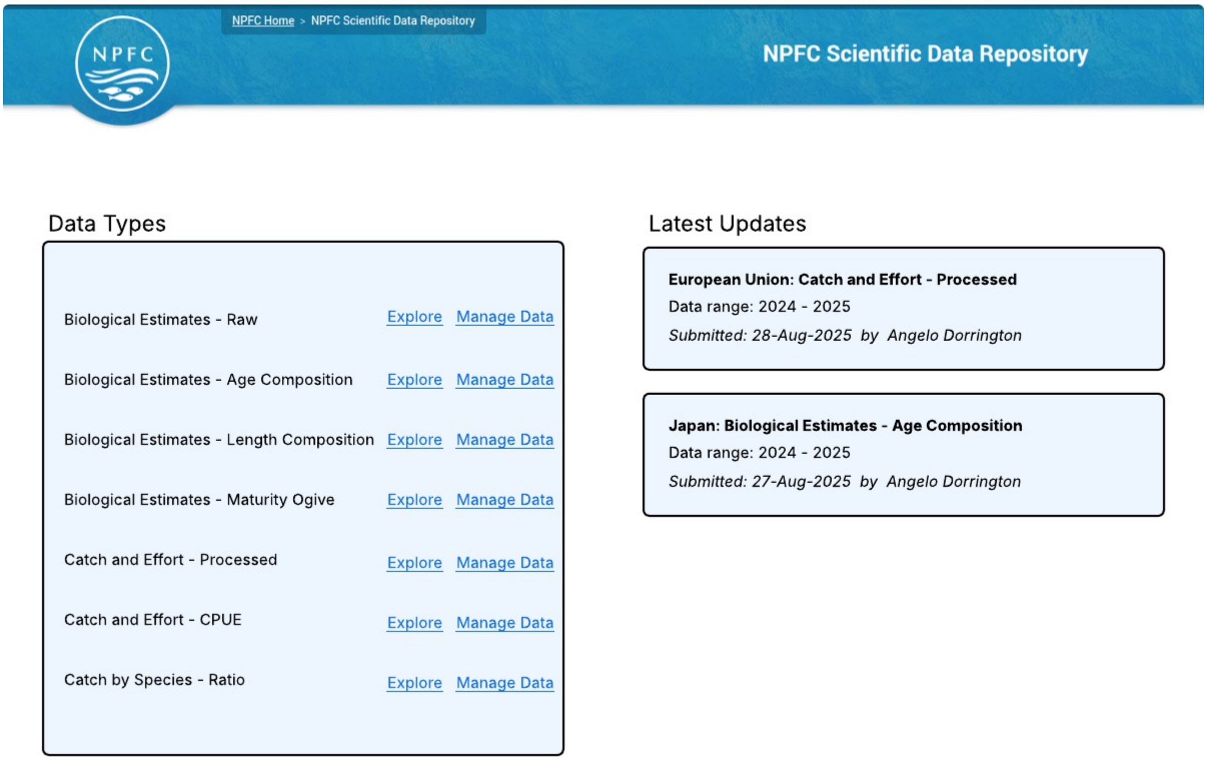
The aim of this web portal application is to establish a centralised repository of scientific datasets provided by NPFC Members. The repository is to enforce the use of standard data reporting templates for all Members and facilitate the extraction of data for analytical needs, with appropriate access controls.

Seven data types have been defined to be supported by the repository:
Biological Estimates - Raw
Biological Estimates - Age Composition
Biological Estimates - Length Composition
Biological Estimates - Maturity Ogive
Catch and Effort - Processes   Catch and Effort - CPUE
Catch by Species - Ratio

2 User Operation

2.1 Exploring and Extracting Data

After logging into the portal, users will be presented with a landing page where they can navigate to explore the data of any of the supported data types.



After selecting a data type the user will be presented with an ‘Explore Data’ page listing the 100 latest records for that dataset, with pagination to allow exploring through more data records. The explore data page will allow for:

Filtering data by year (defaulting to current year)

Filtering data by submitting Member

Filtering data by species

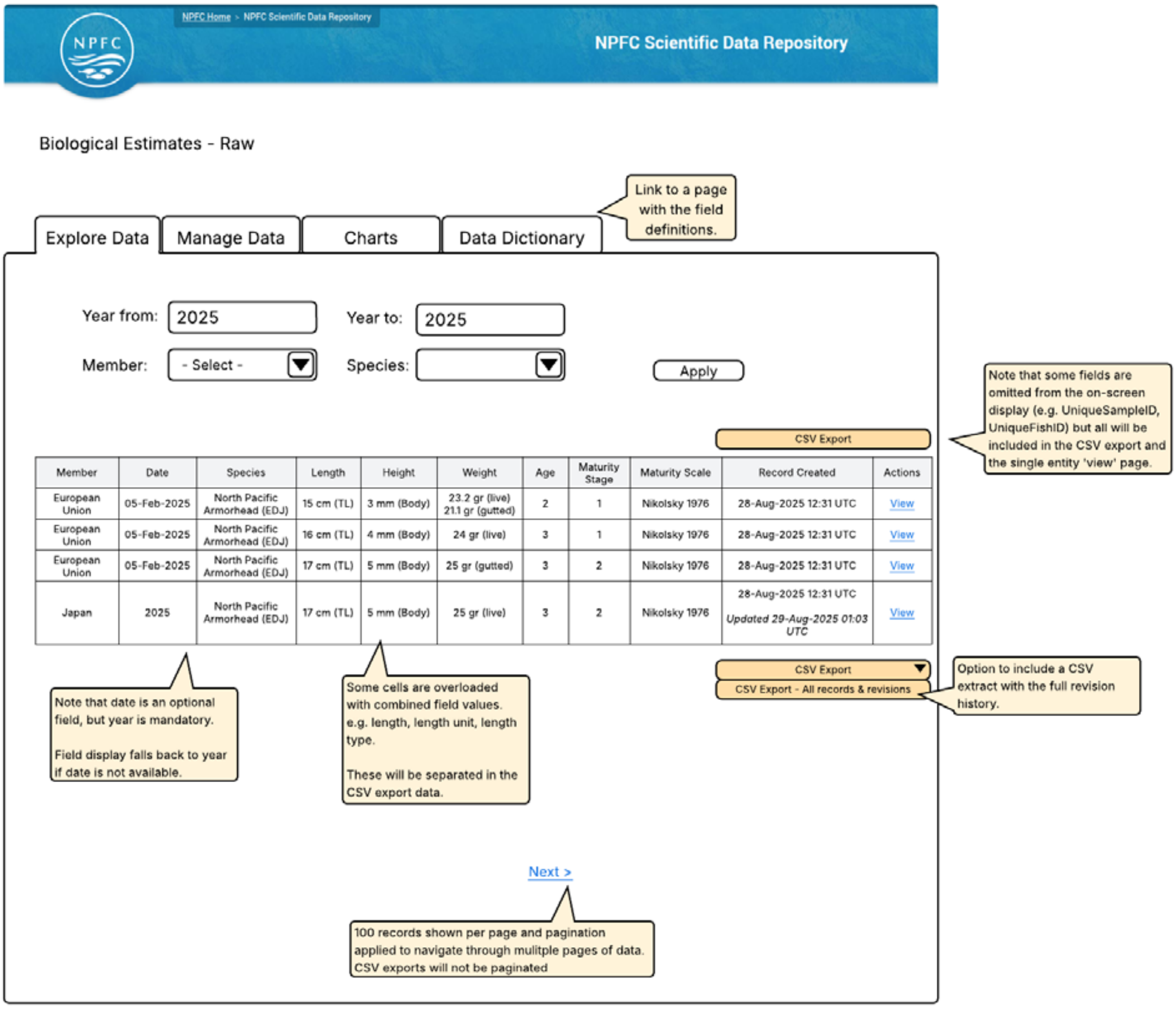
Exporting data records into CSV format spreadsheets

The CSV export will respect the applied filters.

The CSV export will include all data columns for the data record, even where the ‘Explore Data’ tab shows only a subset of data columns due to the restricted screen space on a webpage.

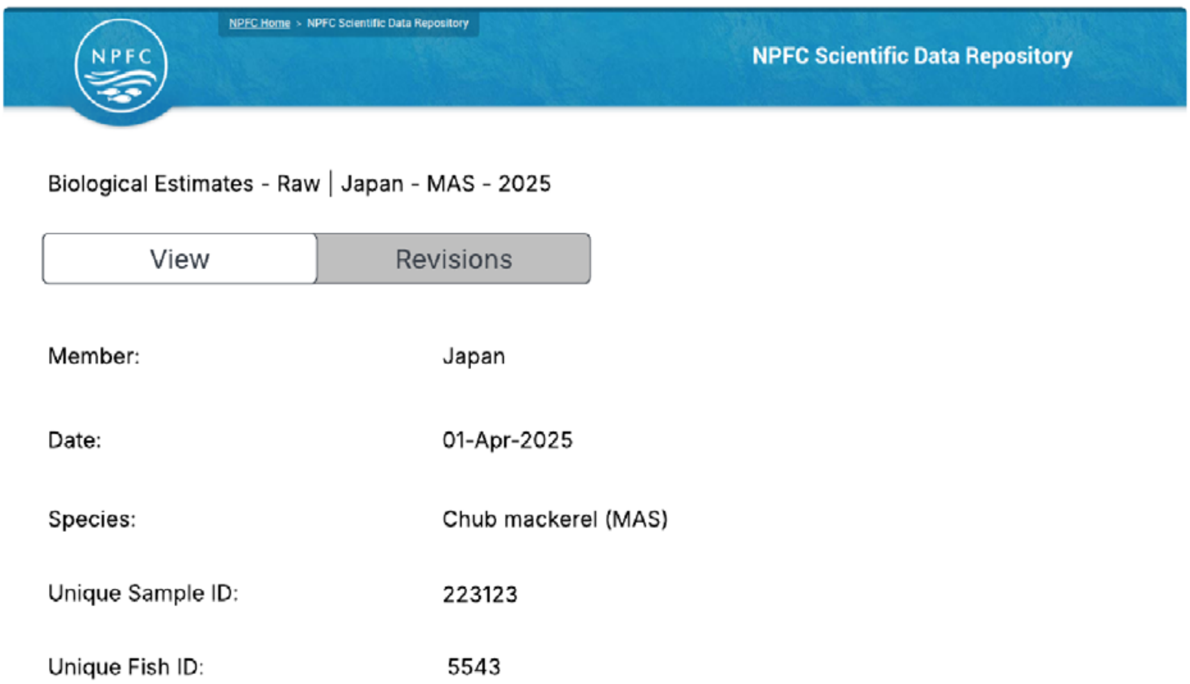
An additional CSV export that includes the data revision history, i.e. one row per revision of a record.

Viewing a single record page - this is particularly useful for viewing all data fields of a particular record where the ‘Explore Data’ tab shows only a subset of data columns due to the restricted screen space on a webpage.


NPFC Home > NPFC Scientific Data Repository
NPFC
NPFC Scientific Data Repository
Biological Estimates - Raw
Link to a page with the field definitions.
Explore Data
Manage Data
Charts
Data Dictionary
Year from: 2025
Year to: 2025
Member: - Select -
Species:
Apply
Note that some fields are omitted from the on-screen display (e.g. UniqueSampleID, UniqueFishID) but all will be included in the CSV export and the single entity 'view' page.
CSV Export

Member	Date	Species	Length	Height	Weight	Age	Maturity Stage	Maturity Scale	Record Created	Actions
European Union	05-Feb-2025	North Pacific Armorhead (EDJ)	15 cm (TL)	3 mm (Body)	23.2 gr (live) 21.1 gr (gutted)	2	1	Nikolsky 1976	28-Aug-2025 12:31 UTC	View
European Union	05-Feb-2025	North Pacific Armorhead (EDJ)	16 cm (TL)	4 mm (Body)	24 gr (live)	3	1	Nikolsky 1976	28-Aug-2025 12:31 UTC	View
European Union	05-Feb-2025	North Pacific Armorhead (EDJ)	17 cm (TL)	5 mm (Body)	25 gr (gutted)	3	2	Nikolsky 1976	28-Aug-2025 12:31 UTC	View
Japan	2025	North Pacific Armorhead (EDJ)	17 cm (TL)	5 mm (Body)	25 gr (live)	3	2	Nikolsky 1976	28-Aug-2025 12:31 UTC *Updated 29-Aug-2025 01:03 UTC*	View

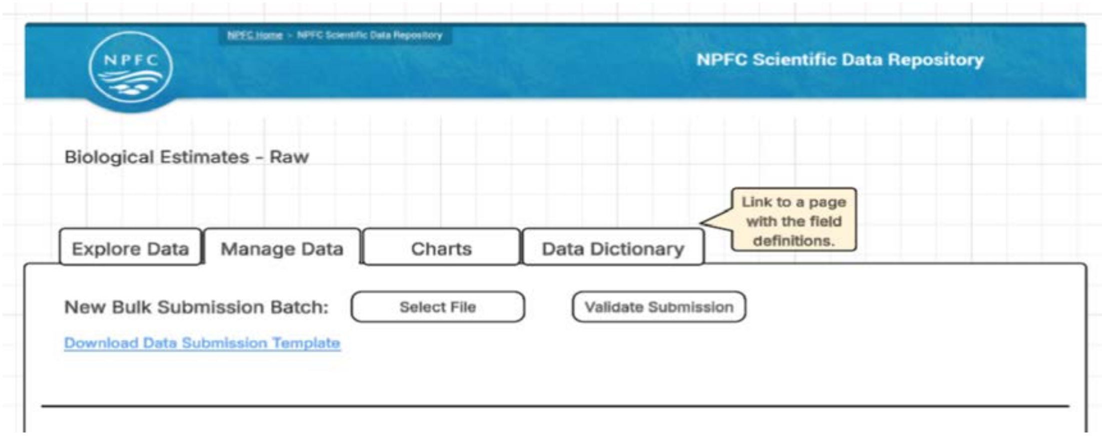
CSV Export
CSV Export - All records & revisions
Option to include a CSV extract with the full revision history.
Note that date is an optional field, but year is mandatory.
Field display falls back to year if date is not available.
Some cells are overloaded with combined field values. e.g. length, length unit, length type.
These will be separated in the CSV export data.
Next >
100 records shown per page and pagination applied to navigate through mulitple pages of data. CSV exports will not be paginated


NPFC Home > NPFC Scientific Data Repository
NPFC
NPFC Scientific Data Repository
Biological Estimates - Raw | Japan - MAS - 2025
View
Revisions
Member: Japan
Date: 01-Apr-2025
Species: Chub mackerel (MAS)
Unique Sample ID: 223123
Unique Fish ID: 5543

Length:	18
Length Unit:	Centimeters
Length Type:	Total Length (TL)
Height:	9
Height Unit:	Centimeters (cm)
Height Type:	Body (BH)
Live Weight:	-
Live Weight Unit:	-
Gutted Weight:	-
Gutted Weight Unit:	-
Age:	-
Maturity Stage:	-
Gonad Weight:	-
Gonad Weight Unit:	-

2.2 Loading Data

For each data type, users with sufficient access rights will be able to go to a 'Manage Data' tab. From here users will be able to bulk-load data by uploading a CSV spreadsheet of data records they wish to submit.



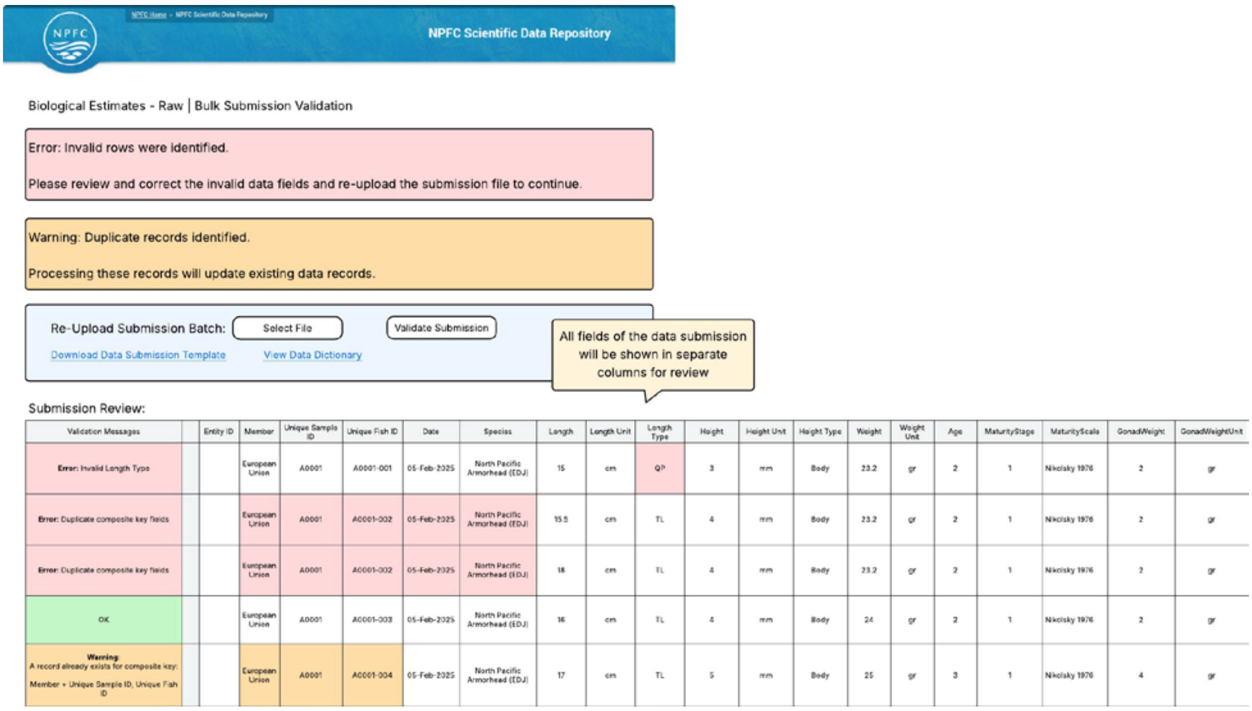
The uploaded spreadsheet will need to align with the template defined for that data type. An example template CSV file will be available for download, which will contain the correct column headers for data loading and some example records.

To further assist users to provide data in the correct format a ‘Data Dictionary’ tab will be available for each data type, which will contain detailed descriptions for each field.

After uploading a CSV file with data to load, the user will be taken to a validation / confirmation page.

If there are any validation errors that will restrict at least one row of data from being loaded then the user will be presented with information identifying which rows did not pass validation and they will not be able to proceed with the data load until they re-upload a file that successfully passes validation.
Examples of errors that will disallow the data batch to be loaded include:

- Missing mandatory fields.
- Fields with invalid options.
- Numeric values outside of allowed ranges.
- Multiple rows with identical composite key fields.

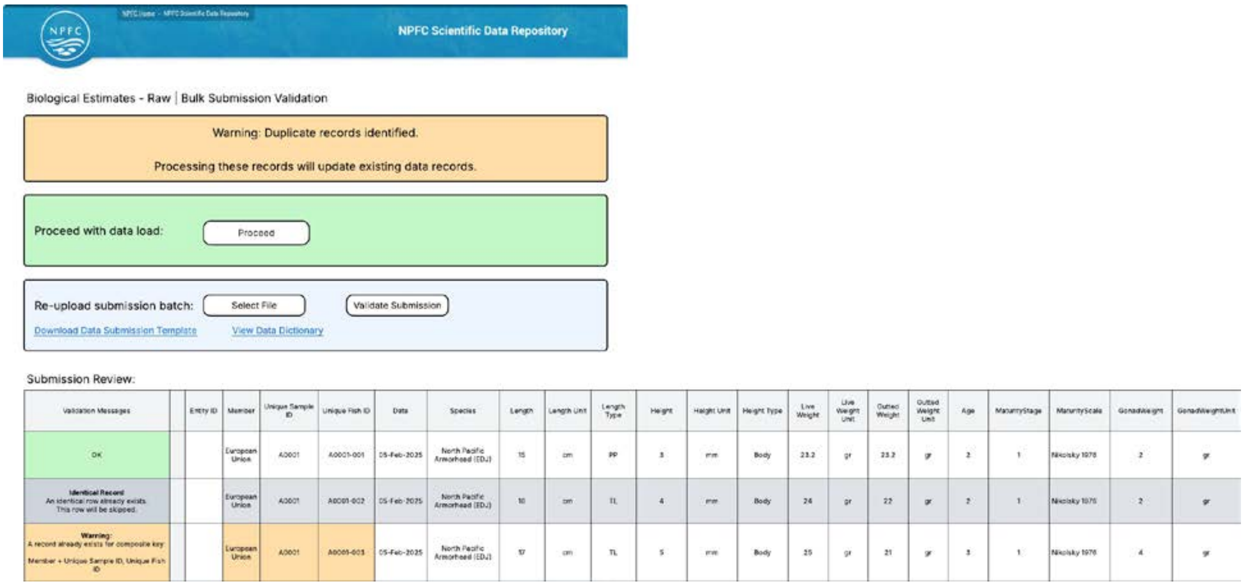


Validation Messages		Entity ID	Member	Unique Sample ID	Unique Fish ID	Date	Species	Length	Length Unit	Length Type	Height	Height Unit	Height Type	Weight	Weight Unit	Age	MaturityStage	MaturityScale	GonadWeight	GonadWeightUnit
Error: Invalid Length Type			European Union	A0001	A0001-001	05-Feb-2025	North Pacific Armorhead (EDJ)	15	cm	QP	3	mm	Body	23.2	gr	2	1	Nikolsky 1976	2	gr
Error: Duplicate composite key fields			European Union	A0001	A0001-002	05-Feb-2025	North Pacific Armorhead (EDJ)	15.5	cm	TL	4	mm	Body	23.2	gr	2	1	Nikolsky 1976	2	gr
Error: Duplicate composite key fields			European Union	A0001	A0001-002	05-Feb-2025	North Pacific Armorhead (EDJ)	18	cm	TL	4	mm	Body	23.2	gr	2	1	Nikolsky 1976	2	gr
OK			European Union	A0001	A0001-003	05-Feb-2025	North Pacific Armorhead (EDJ)	16	cm	TL	4	mm	Body	24	gr	2	1	Nikolsky 1976	2	gr
Warning: A record already exists for composite key: Member + Unique Sample ID, Unique Fish ID			European Union	A0001	A0001-004	05-Feb-2025	North Pacific Armorhead (EDJ)	17	cm	TL	5	mm	Body	25	gr	3	1	Nikolsky 1976	4	gr

If there are no strict validation errors there may still be some data issues that trigger the presentation of warnings to the user, but do not stop them from continuing with the data load.

An example of a warning scenario is where composite key fields on a submitted data record match with an existing data record, identifying that the submitted record is a duplicate. In this scenario the user can choose to continue with the data load, which will result in the existing record being updated rather than a new record being created.

However, if a row is an **exact match** with a record already in the database, this row will simply be skipped and the existing row will be left untouched.



If there are no errors or warnings identified during the validation process, all rows will be marked with a green "Ok" message and the user can proceed with the loading operation.

2.3 Updating Data

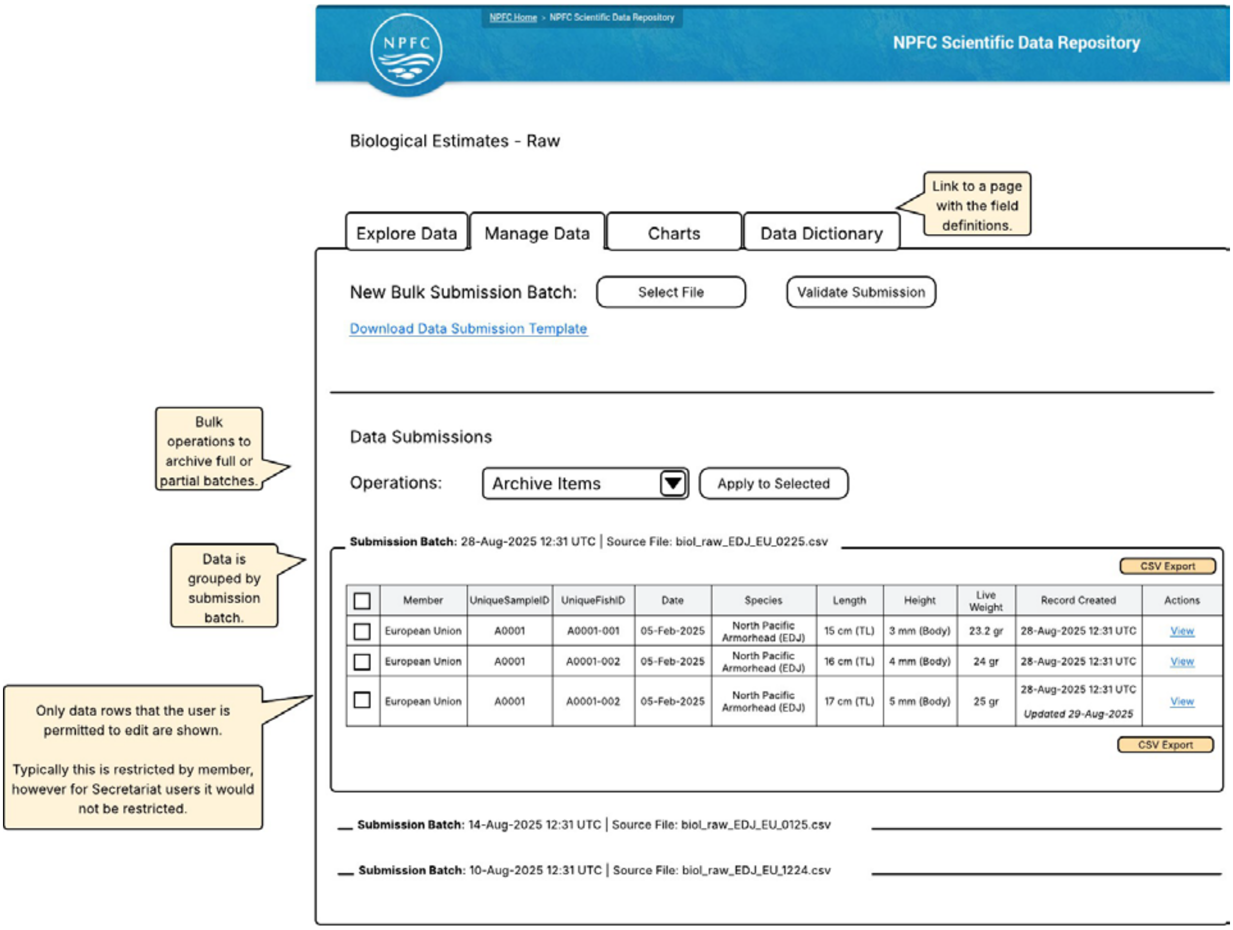
If previously submitted data is found to be incorrect, or otherwise needs to be revised, it can be updated in several different ways.

a) Archive the old records and then submit new records.

The 'Manage Data' tab will provide data submitter users with the option to archive previously submitted

records, either based on selecting an upload batch or by selecting individual records.

Note that on the 'Manage Data' tab, users will only be presented with the rows that they have permission to edit or archive, which in most cases will be the rows submitted by their own Member country.



After the old records are archived, corrected records can be submitted.

b) Update operation during bulk CSV submission.

If a data row in a CSV bulk submission batch contains a value in the Entity ID field, it will be interpreted as intending to update the existing row identified by that Entity ID.

Similarly, if composite key values in a data row match that of an existing data record it will be identified as a duplicate and handled as an update operation.

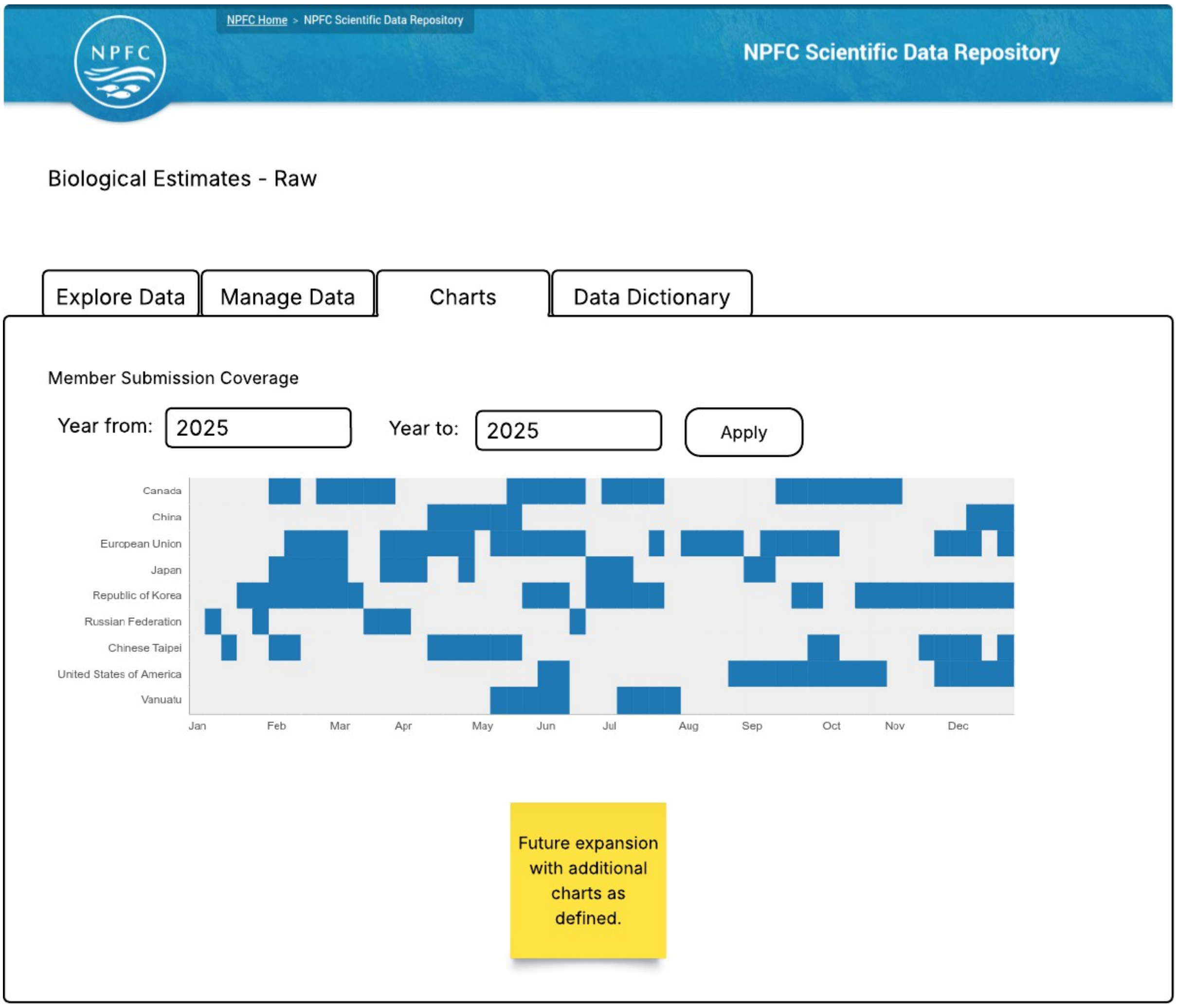
The validation process will check that the user has sufficient permission to update the identified record and a warning will be presented to the user, requiring the user to confirm to proceed with the update.

If an existing record is updated, the database will maintain a revision history such that an audit trail of changes is maintained in the database. At this stage it is however not expected for the revision history to be available through the application user interface.

2.4 Scientific Analysis

It is expected that most data analysis will occur external to this application. The data repository portal will facilitate users with sufficient access rights to extract data from the repository in CSV format for external processing.

The data repository portal can however contain a ‘Charts’ tab for each data type. A first step may be for this tab will contain only a single chart, which will summarise the member submission coverage of the stored data using the Member, Year, Season and Date fields.
The Charts tab may be an area for future enhancement through the inclusion of other analytical outputs such as data driven charts.



2.5 Data Dictionary

A Data Dictionary tab will be available for each data type and will present the definition of each data field included in that data type.

NPFC Home > NPFC Scientific Data Repository

NPFC Scientific Data Repository

Biological Estimates - Raw

Explore Data | Manage Data | Charts | Data Dictionary

Field	Mandatory	Description	Allowed Values
Member	Y	ISO 2-char code representing the Member	
Date	Y	01-Jan-2000 format.	
Species	Y	The species 3-alpha code	See NPFC species list
UniqueSampleID	Y	Unique identifier for the sample	
UniqueFishID	Y	Unique identifier for the individual measured	
Length		The length of the individual	
LengthType		The type of the length measured	FL | Fork length TL | Total length SL | Standard length ML | Mantle length CL | Carapace length
LengthUnit		The unit corresponding to the length	mm | Millimetres cm | Centimetres m | Metres
Height		The height of the individual	mm | Millimetres cm | Centimetres m | Metres
HeightType		The type of the height measured	BH | Body height
HeightUnit		The unit corresponding to the height measured	mm | Millimetres cm | Centimetres m | Metres
Weight		The weight of the individual measured	
WeightUnit		The unit corresponding to the weight measured	g | Gram kg | Kilogram t | Metric ton
Age		The age of the fish	
MaturityStage		Maturity stage depending on the scale (1-6, 1-5 etc)	
MaturityScale		The maturity scale used (e.g., Nikolsky, 1976, Yassien, 1992, national etc.)	Nikolsky, 1976 Yassien, 1992
GonadWeight		The weight of the gonad measured	
GonadWeightUnit		The unit corresponding to the gonad weight measured	g | Gram

3 User Management and Authentication

The NPFC Scientific Data Repository will allow for the following roles. Access rules are defined within the Access Control Matrix (see page 15).

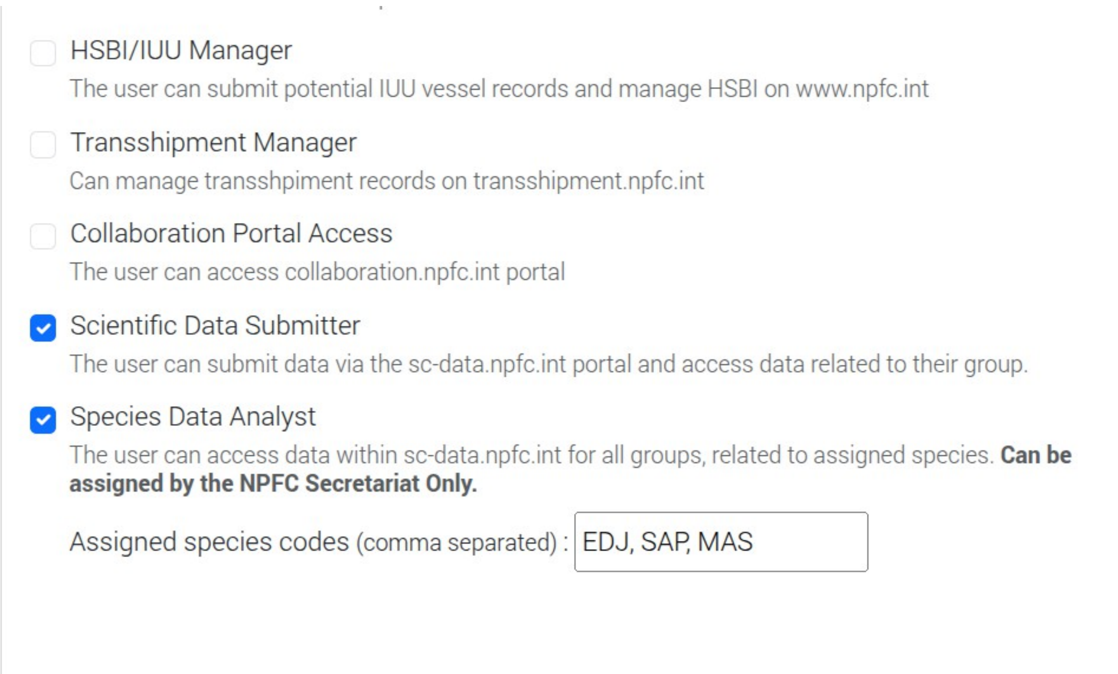
Member Data Submitter

Species Data Analyst
Secretariat

As per other NPFC web portals, user accounts will be managed through the NPFC Member Account Management (MaM) system, allowing users to access the system with a common set of credentials across different NPFC portals.

The NPFC MaM system will allow Group (Member) Admin users to delegate Member Data Submitter functional access to users within their group.

The Species Data Analyst functional role however will not be available for Group Admin users to assign themselves. This must be assigned by a NPFC User Admin. When a NPFC User Admin assigns the Species Data Analyst permission, they will also need to specify which species the user will be granted access. This is to be achieved by entering a comma separated list of species codes.



The following role mapping will be applied between the MaM system and the Scientific Data Repository.

MaM Group Security Access	SC Data Repository Role
Member : Scientific Data Submitter NEW CNCP : Scientific Data Submitter NEW	Member Data Submitter

MaM Group Security Access	SC Data Repository Role
Member : Species Data Analyst NEW CNCP : Species Data Analyst NEW Secretariat Guests: Species Data Analyst NEW (*To be assigned with relevant species codes*)	Species Data Analyst
Secretariat : Scientific Data Manager NEW	Secretariat

4 Access Control Matrix

	Anonymous	Authenticated	Member Data Submitter	Species Data Analyst	Secretariat
Group *(reference data synchronised from MaM)*			R	R	R
Species *(reference data synchronised from website)*			R	R	R
Gear Type *(reference data synchronised from website)*			R	R	R
Biological Estimates - Raw			CRUD (where data references own Member only)	R (for assigned species only)	CRUD
Biological Estimates - Age Composition			CRUD (where data references own Member only)	R (for assigned species only)	CRUD
Biological Estimates - Length Composition			CRUD (where data references own Member only)	R (for assigned species only)	CRUD
Biological Estimates - Maturity Ogive			CRUD (where data references own Member only)	R (for assigned species only)	CRUD

	Anonymous	Authenticated	Member Data Submitter	Species Data Analyst	Secretariat
Catch and Effort - Processed			CRUD (where data references own Member only)	R (for assigned species only)	CRUD
Catch and Effort - CPUE			CRUD (where data references own Member only)	R (for assigned species only)	CRUD
Catch by Species - Ratio			CRUD (where data references own Member only)	R (for assigned species only)	CRUD

C = Create, R = Read, U = Update, D = Delete

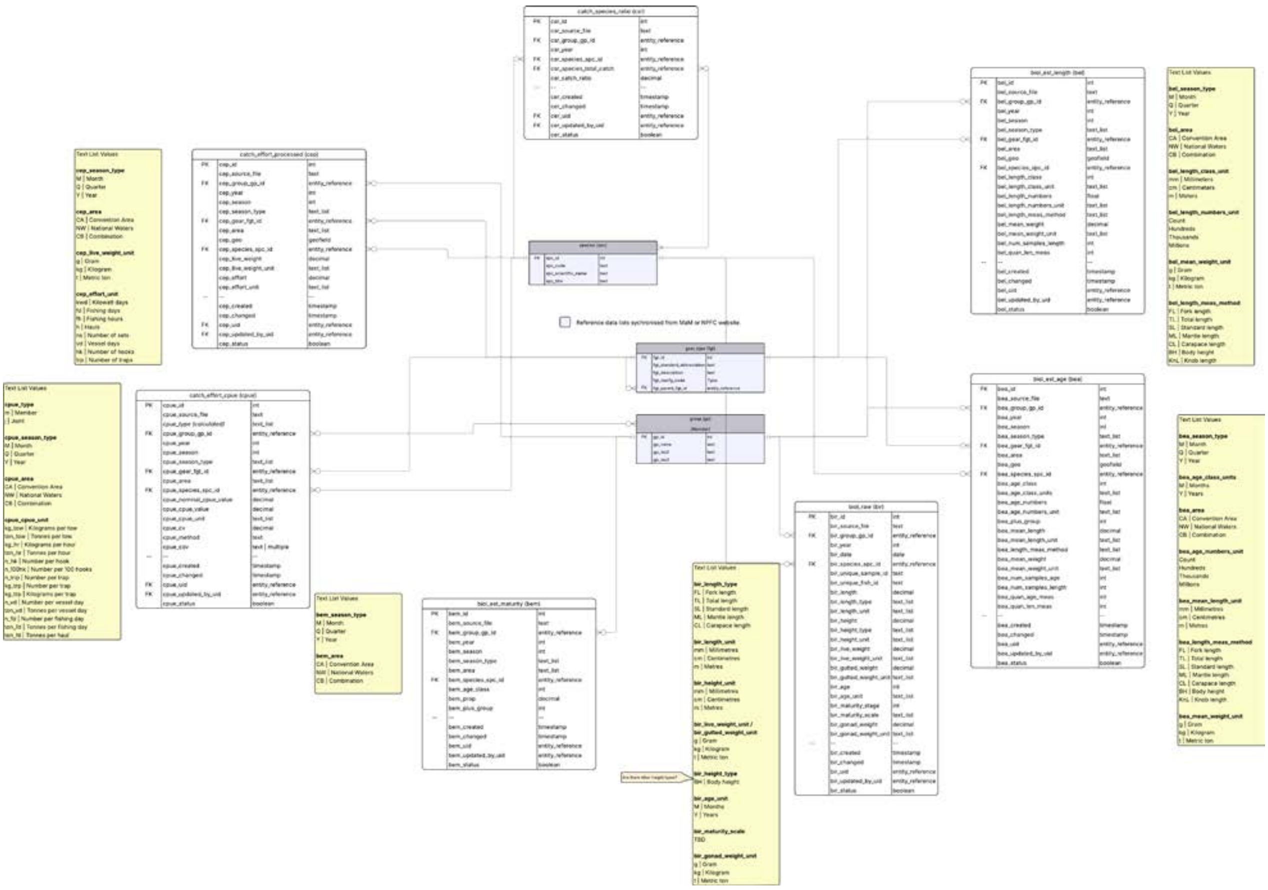
All Delete operations are to be implemented as soft delete / archive operations. Operationally this will be equivalent to a delete, but allows for an audit trail of data changes to be maintained in the back-end database.

5 Data Structure

5.1 Entity Relationships Diagram

The below entity relationships diagram details the data entities to be included in this application. The diagram includes three reference data entities. To ensure the consistency of reference data values used between different NPFC systems and datasets, the data for these three entities will be synchronised from the authoritative sources.

Dataset	Authoritative Source
Group *Note that Group is a broad term that encompasses Members, CNCPs, Observers, Secretariat. For the purposes of this application, Observer groups are not required and will not be synchronised into the scientific data repository application.*	Member Account Management (MaM) System
Gear Type	NPFC Website
Species	NPFC Website



5.2 Data Updates and Revisioning

An update operation on a data record will occur:

a) during a bulk data submission if the primary key Entity ID value is provided in a data row, identifying the row that is to be updated.

b) during a bulk data submission if a provided data row contains a composite key that matches an existing record.

During the validation step of the data loading process, primary key or composite key matches will display as a warning, making the user aware that existing records will be updated but allowing them to review and continue.

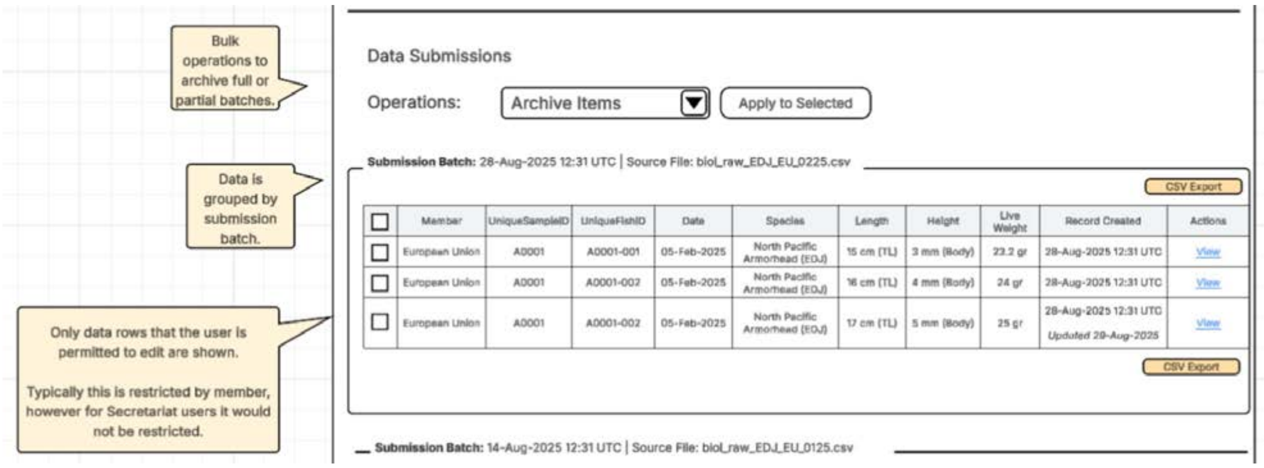
When an update operation occurs, the underlying database will maintain a revision history for that row. Each revision will also contain a timestamp and a reference to the user who performed that operation. This data revisioning strategy establishes an audit trail of data changes.

5.3 Delete (Archive) Operations

If data records have been loaded with mistakes, or a Member otherwise wishes to remove some data, this can be done from the Manage Data tab for the data type in question. Data Manager users will be able to select previously uploaded records either based on a whole submission batch or by selecting individual rows, and then select the 'Archive Items' bulk operation.

The archive operation will remove visibility of the selected records. Effectively this this akin to a delete, however the data will maintain in the database flagged as archived, which serves as an audit trail for the changes and allows for synchronisation of the archive operation to the data warehouse.

If a Member wishes to permanently purge (hard-delete) all of their records from the database, including the audit trail of changes, this would need to be handled as a special request to the Secretariat and performed as a manual task by the database maintainer.



6 Data Type: Biological Estimates - Raw

6.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
bir_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
bir_group_g p_id	entity_ref erence	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A
bir_date	date	Date	Date of the sample provided in format e.g. 01-Jan-2000	MANDATORY COMPOSITE KEY A
bir_species_ spc_id	entity_ref erence	Species	The species	MANDATORY COMPOSITE KEY A
bir_unique_ sample_id	text	Unique Sample ID	Unique identifier for the sample	MANDATORY COMPOSITE KEY A
bir_unique_f ish_id	text	Unique Fish ID	Unique identifier for the individual measured	MANDATORY COMPOSITE KEY A
bir_length	decimal (8,2)	Length	The length of the individual	OPTIONAL >0

Field	Data Type	Label	Definition	Validation Rules
bir_length_t ype	text_list	Length Type	The type of the length measured	OPTIONAL Valid Options: FL | Fork length TL | Total length SL | Standard length ML | Mantle length CL | Carapace length
bir_length_u nit	text_list	Length Unit	The unit corresponding to the length	OPTIONAL Valid Options: mm | Millimetres cm | Centimetres m | Metres
bir_height	decimal (8,2)	Height	The height of the individual	OPTIONAL >0
bir_height_t ype	text_list	Height Type	The type of the height measured	OPTIONAL Valid Options: BH | Body height
bir_height_u nit	text_list	Height Unit	The unit corresponding to the height measured	OPTIONAL Valid Options: mm | Millimetres cm | Centimetres m | Metres
bir_live_wei ght	decimal (8,3)	Live Weight	The "live" (ungutted, with head, tail, fins, gills and viscera intact.) weight of the individual measured	OPTIONAL >0
bir_live_wei ght_unit	text_list	Live Weight Unit	The unit corresponding to the live weight measured	OPTIONAL Valid Options: g | Gram kg | Kilogram t | Metric ton
bir_gutted_ weight	decimal (8,3)	Gutted Weight	The weight of the fish measured from which the viscera have been removed; head, tail, fins and skin remain.	OPTIONAL

Field	Data Type	Label	Definition	Validation Rules
bir_gutted_ weight_unit	text_list	Gutted Weight Unit	The unit corresponding to the gutted weight	OPTIONAL **Valid Options:** g | Gram kg | Kilogram t | Metric ton
bir_age	int	Age	The age of the fish	OPTIONAL >0
bir_age_unit	text_list	Age Unit	Unit of the age measurement, indicating the time increment used when reading growth structures.	OPTIONAL **Valid Options:** M | Months Y | Years
bir_maturity _stage	int	Maturity State	Maturity stage depending on the scale (1-6, 1-5 etc)	OPTIONAL TBD >0
bir_maturity _scale	text_list	Maturity Scale	The maturity scale used (e.g., Nikolsky, 1976, Yassien, 1992, national etc.)	OPTIONAL **Valid Options:** TBD
bir_gonad_ weight	decimal (8,3)	Gonad Weight	The weight of the gonad measured	OPTIONAL >0
bir_gonad_ weight_unit	text_list	Gonad Weight Unit	The unit corresponding to the gonad weight measured	OPTIONAL **Valid Options:** g | Gram kg | Kilogram t | Metric ton

COMPOSITE KEY A

bir_group_gp_id

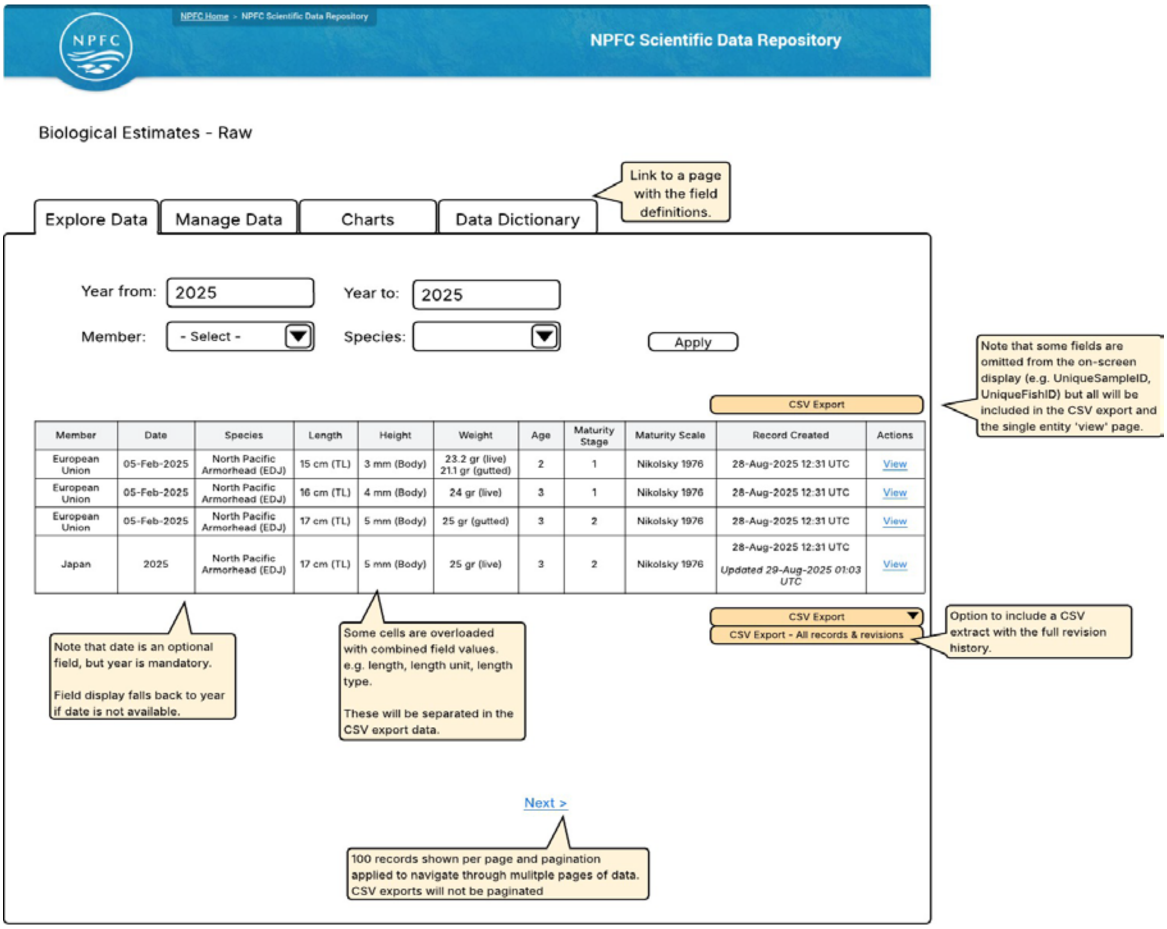
bir_unique_sample_id

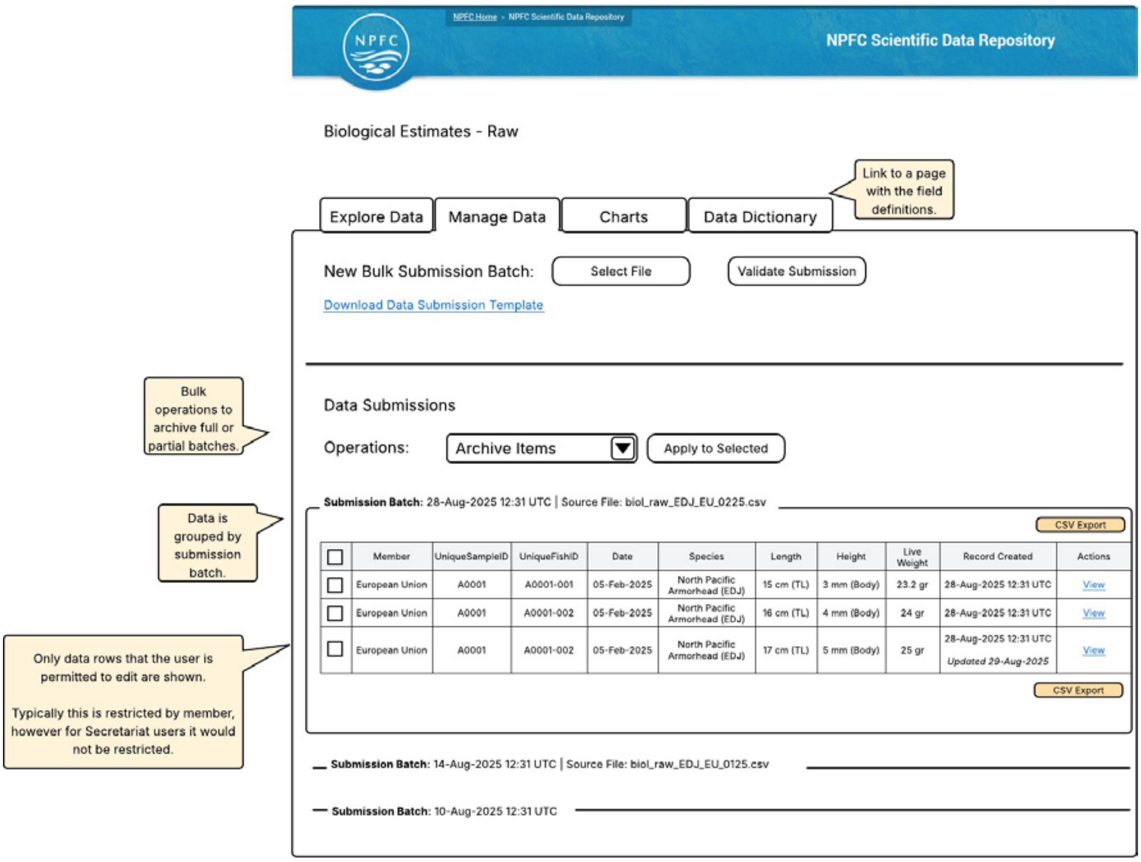
bir_unique_fish_id

bir_date

bir_species_spc_id

6.2 User Interface Wireframes





7 Data Type: Biological Estimates - Age Composition

7.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
bea_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
bea_group_gp_id	entity_reference	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A
bea_year	int	Year	The year of the data collection.	MANDATORY 4 digits > 2000 COMPOSITE KEY A
bea_season	int	Season	The temporal aggregation level of the data. Can be the same as the year of the data collection	MANDATORY If season_type is month, value must be between 1 and 12. If season_type is quarter, value must be between 1 and 4. If season_type is year, value must match the year field. COMPOSITE KEY A
bea_season_type	text_list	Season Type	The type of temporal aggregation level. E.g., if the estimation is done on a quarter basis, then the SeasonType is Quarter	MANDATORY **Valid Options** M | Month Q | Quarter Y | Year COMPOSITE KEY A
bea_gear_fgt_id	entity_reference	Gear Type	The fishing gear type based on the ISSCFG list.	MANDATORY COMPOSITE KEY A

Field	Data Type	Label	Definition	Validation Rules
bea_area	text_lis t	Area	The area	MANDATORY **Valid Options** CA | Convention Area NW | National Waters CB | Combination COMPOSITE KEY A
bea_geo	geofiel d	Latitude / Longitud e	Decimal degree coordinates	(MANDATORY COMPOSITE KEY A ONLY if bea_gear_fgt_id references PS or NFS, otherwise optional.)
bea_spe cies_spc _id	entity_r eferen ce	Species	The species	MANDATORY COMPOSITE KEY A
bea_age _class	int	Age	The age class	MANDATORY COMPOSITE KEY A Between 1 and 99
bea_age _class_u nit	text_lis t	Age Class Unit	Unit of the age measurement, indicating the time increment used when reading growth structures.	MANDATORY COMPOSITE KEY A **Valid Options:** M | Month Y | Year
bea_age _number s	float	Age Number s	The number of fish estimated in that age class	MANDATORY >0
bea_age _number s_unit	text_lis t	Age Number s Unit	Unit of the number of fish estimated in that age class	MANDATORY **Valid Options:** Count Hundreds Thousands Millions
bea_plus _group	int	Plus Group	The age where fish of a certain age and/or older are grouped at	OPTIONAL >0

Field	Data Type	Label	Definition	Validation Rules
bea_mean_length	decimal(8,2)	Mean Length	The mean length corresponding to the age class	OPTIONAL >0
bea_mean_length_unit	text_list	Mean Length Unit	The mean length unit corresponding to the MeanLength	OPTIONAL **Valid Options:** mm | Millimetres cm | Centimetres m | Metres
bea_length_meas_method	text_list	Length Measurement Method	The measurement method of the fish. E.g., fork length, total length	OPTIONAL **Valid Options:** FL | Fork length TL | Total length SL | Standard length ML | Mantle length CL | Carapace length BH | Body height KnL | Knob length
bea_mean_weight	decimal (8,3)	Mean Weight	The mean weight corresponding to the age class	OPTIONAL >0
bea_mean_weight_unit	text_list	Mean Weight Unit	The mean weight unit corresponding to the Mean Weight	OPTIONAL **Valid Options:** g | Gram kg | Kilogram t | Metric ton
bea_num_samples_age	int	Number of Age Samples	The number of age samples for the combination of fields defined by composite key A.	OPTIONAL Between 1 and 9999
bea_num_samples_length	int	Number of Length Samples	The number of length samples for the combination of fields defined by composite key A.	OPTIONAL Between 1 and 9999
bea_quan_age_meas	int	Number of Fish Aged	The number of fish aged for the combination of fields defined by composite key A.	OPTIONAL Between 1 and 999999

Field	Data Type	Label	Definition	Validation Rules
bea_quan_len_meas	int	Number of Fish Length Measure d	The number of fish length measured for the combination of fields defined by composite key A. Between 1 and 999999	

COMPOSITE KEY A

bea_group_gp_id bea_year

bea_season

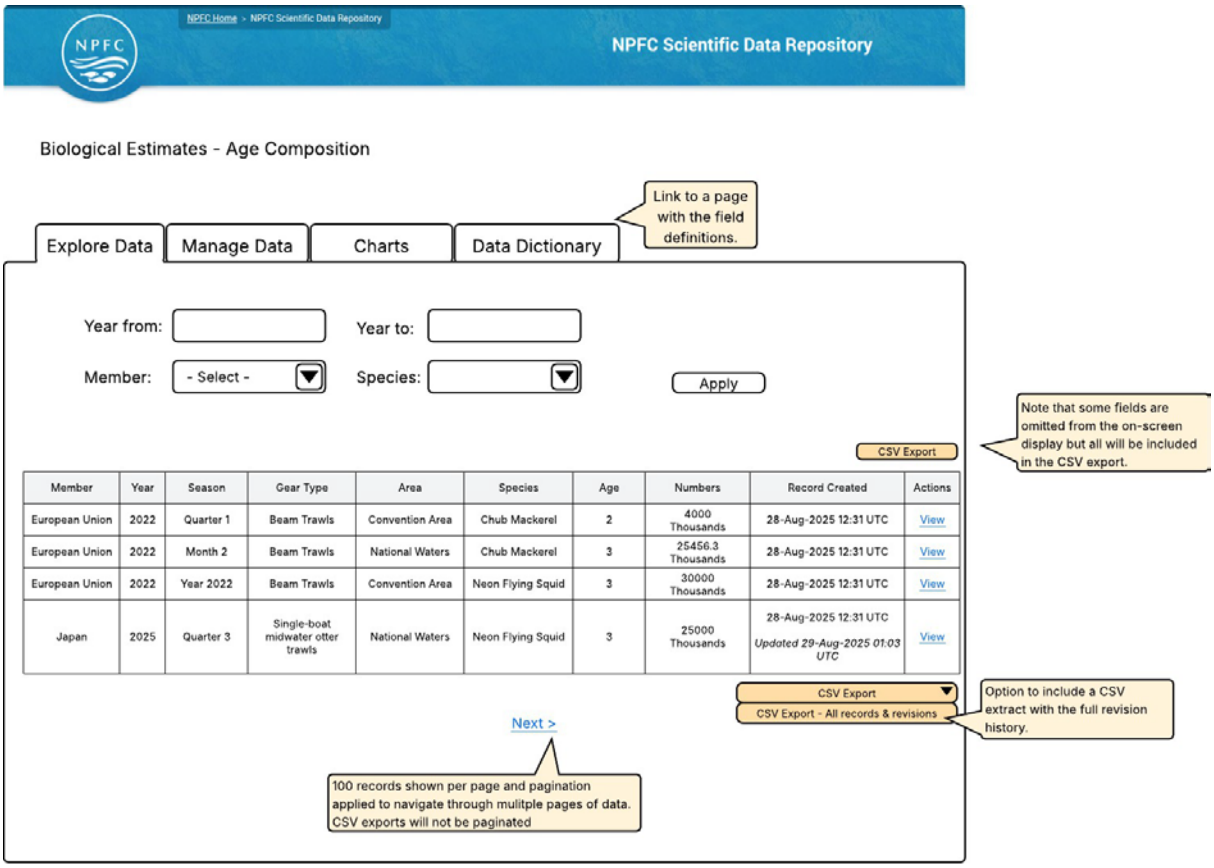
bea_season_type bea_gear_type

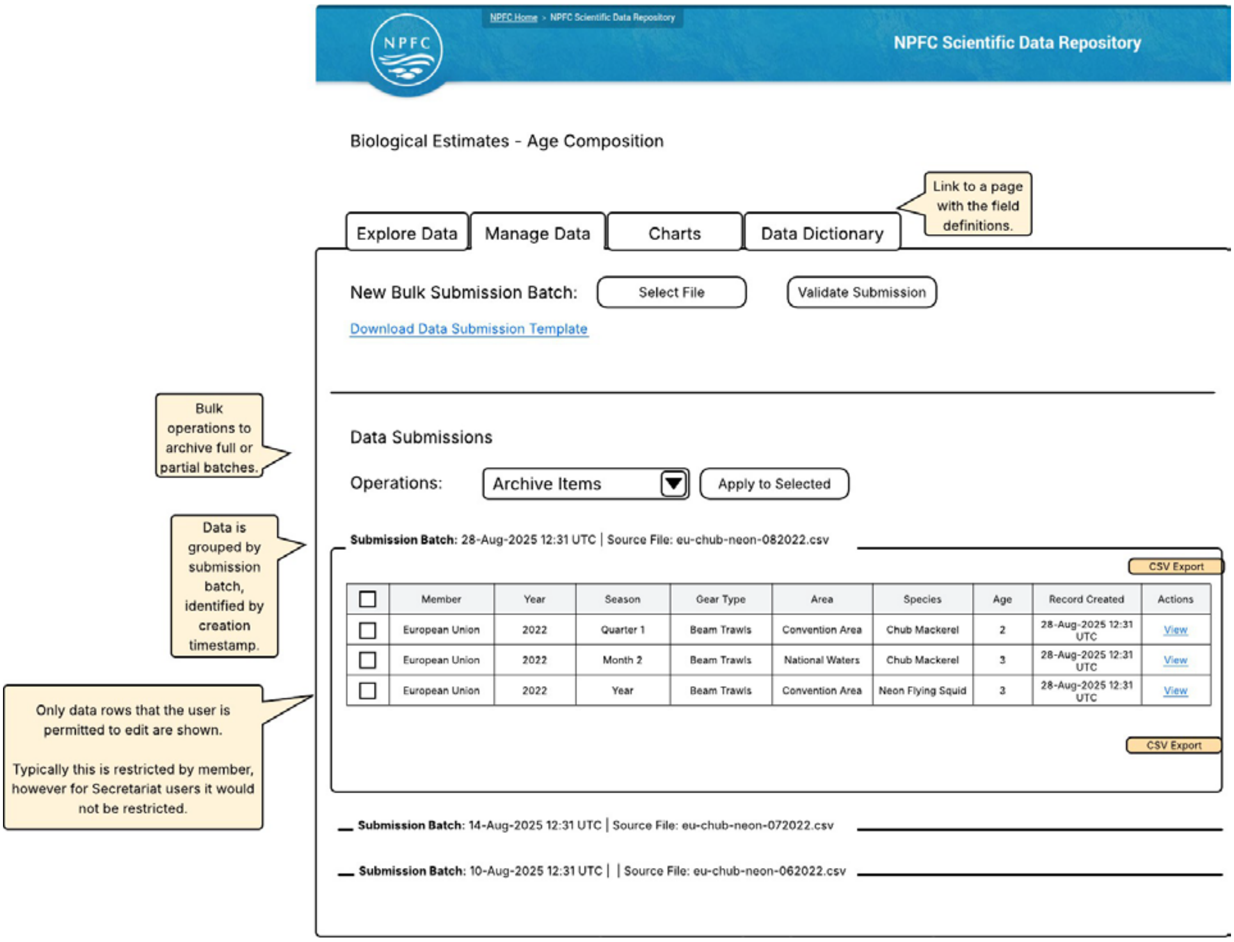
bea_area

bea_species_spc_id bea_age_class

bea_lat_lon (only included in composite key for PS and NFS)

7.2 User Interface Wireframes





8 Data Type: Biological Estimates - Length Composition

8.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
bel_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
bel_group_gp_id	entity_reference	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A
bel_year	int	Year	The year of the data collection.	MANDATORY 4 digits > 2000 COMPOSITE KEY A

bel_sea son	int	Season	The temporal aggregation level of the data. Can be the same as the year of the data collection	MANDATORY If season_type is month, value must be between 1 and 12. If season_type is quarter, value must be between 1 and 4. If season_type is year, value must match the year field. COMPOSITE KEY A
bel_sea son_typ e	text_lis t	Season Type	The type of temporal aggregation level. E.g., if the estimation is done on a quarter basis, then the SeasonType is Quarter	MANDATORY **Valid Options** M | Month Q | Quarter Y | Year COMPOSITE KEY A
bel_gear _fgt_id	entity_ referen ce	Gear Type	The fishing gear type based on the ISSCFG list.	MANDATORY COMPOSITE KEY A

Field	Data Type	Label	Definition	Validation Rules
bel_area	text_lis t	Area	The area	MANDATORY **Valid Options** CA | Convention Area NW | National Waters CB | Combination COMPOSITE KEY A
bel_lat_l on	geofiel d	Latitude / Longitu de	Decimal degree coordinates	(MANDATORY if bea_gear_fgt_id references PS or NFS, otherwise optional)
bel_spe cies_sp c_id	entity_ referen ce	Species	The species	MANDATORY COMPOSITE KEY A
bel_leng th_class	int	Length Class	The length class of the fish (usually following a common method for rounding to the nearest length class in cm if measured to the nearest mm)	MANDATORY >0

bel_length_class_unit	text_list	Length Class Unit	The length unit corresponding to that length class	MANDATORY **Valid Options:** mm | Millimeters cm | Centimeters m | Meters
bel_length_numbers	float	Numbers	The number of fish estimated in that length class	MANDATORY >0
bel_length_numbers_unit	text_list	Numbers Unit	Unit of the number of fish estimated in that length class	MANDATORY **Valid Options:** Count Hundreds Thousands Millions

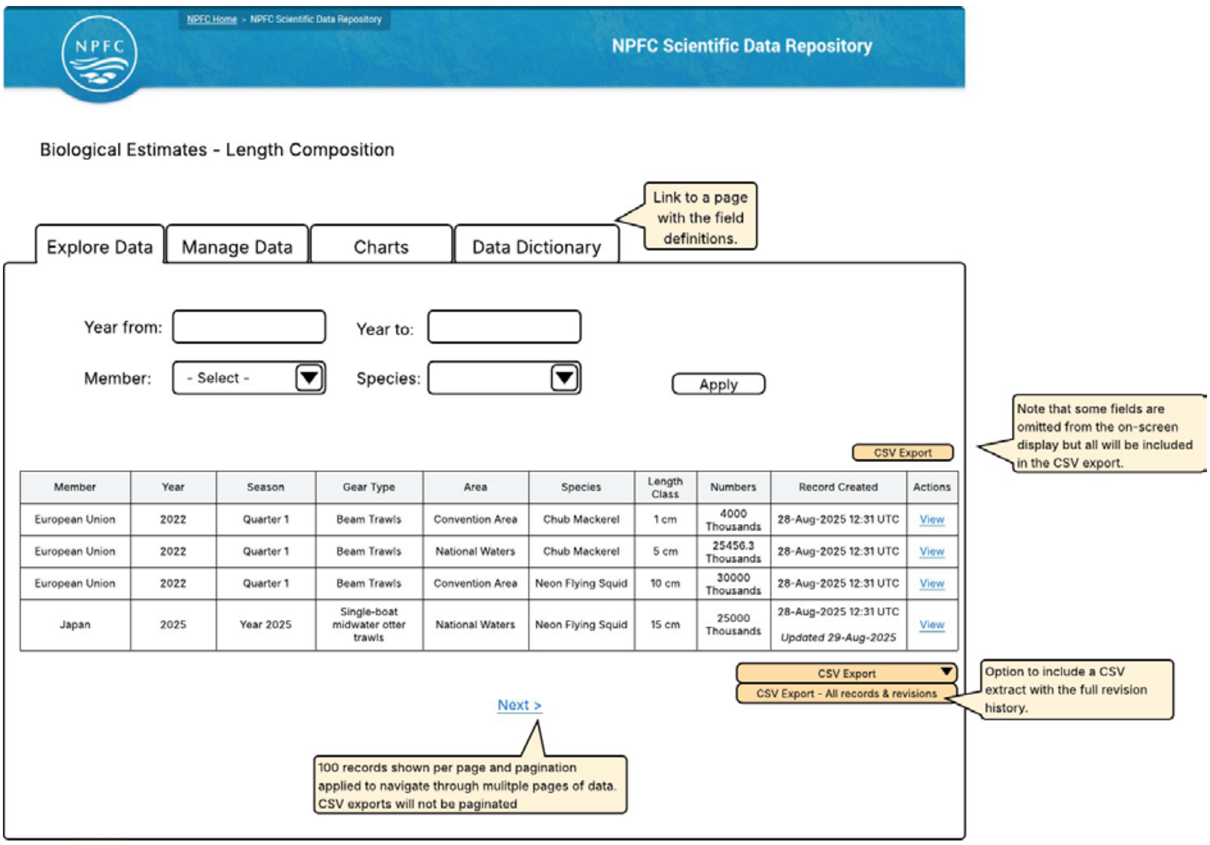
Field	Data Type	Label	Definition	Validation Rules
bel_length_meas_method	text_list	Length Measurement Method	The measurement method of the fish. E.g., fork length, total length	OPTIONAL **Valid Options:** FL | Fork length TL | Total length SL | Standard length ML | Mantle length CL | Carapace length BH | Body height KnL | Knob length
bel_mean_weight	decimal (8,3)	Mean Weight	The mean weight corresponding to the age class	OPTIONAL >0
bel_mean_weight_unit	text_list	Mean Weight Unit	The mean weight unit corresponding to the MeanWeight	OPTIONAL **Valid Options:** g | Gram kg | Kilogram t | Metric ton
bel_num_samples_length	int	Number of Length Samples	The number of age samples for the combination of Year*Season*SeasonType*Area*Fleet*Species	OPTIONAL Between 1 and 9999

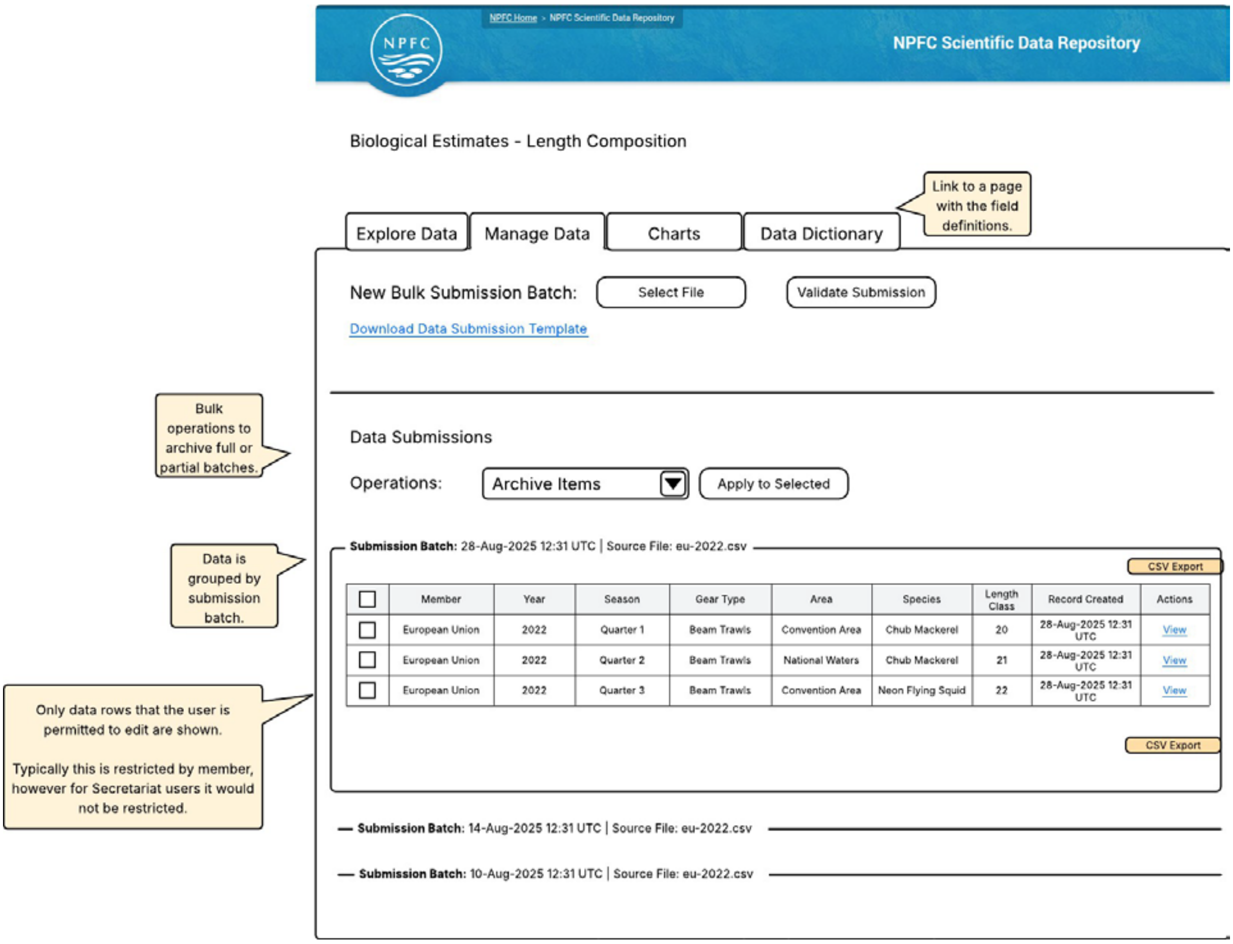
bel_quan_len_meas	int	Number of Fish Aged	The number of fish aged for the combination of Year*Season*SeasonType*Area*Fleet*Speci es	OPTIONAL Between 1 and 999999

COMPOSITE KEY A

bel_group_gp_id
bel_year bel_season
bel_season_type
bel_gear_type
bel_area
bel_species_spc_id
bea_lat_lon (only included in composite key for PS and NFS)

8.2 User Interface Wireframes





9 Data Type: Biological Estimates - Maturity Ogive

9.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
bem_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
bem_group_gp_id	entity_reference	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A
bem_year	int	Year	The year of the data collection.	MANDATORY 4 digits > 2000 COMPOSITE KEY A

bem_season	int	Season	The temporal aggregation level of the data. Can be the same as the year of the data collection	MANDATORY If season_type is month, value must be between 1 and 12. If season_type is quarter, value must be between 1 and 4. If season_type is year, value must match the year field. COMPOSITE KEY A
bem_season_type	text_list	Season Type	The type of temporal aggregation level. E.g., if the estimation is done on a quarter basis, then the SeasonType is Quarter	MANDATORY **Valid Options** M | Month Q | Quarter Y | Year COMPOSITE KEY A

Field	Data Type	Label	Definition	Validation Rules
bem_are a	text_list	Area	The area	MANDATORY **Valid Options** CA | Convention Area NW | National Waters CB | Combination COMPOSITE KEY A
bem_species_spc_id	entity_reference	Species	The species	MANDATORY COMPOSITE KEY A
bem_age_class	int	Age	The age class	MANDATORY 1 to 9999
bem_pro p	decimal (8,3)	Proportion	The proportion of mature fish in that age class	MANDATORY >0
bem_plus_group	int	Plug Group	The age where fish of a certain age and/or older are grouped at	OPTIONAL 1 to 9999

COMPOSITE KEY A

bel_group_gp_id

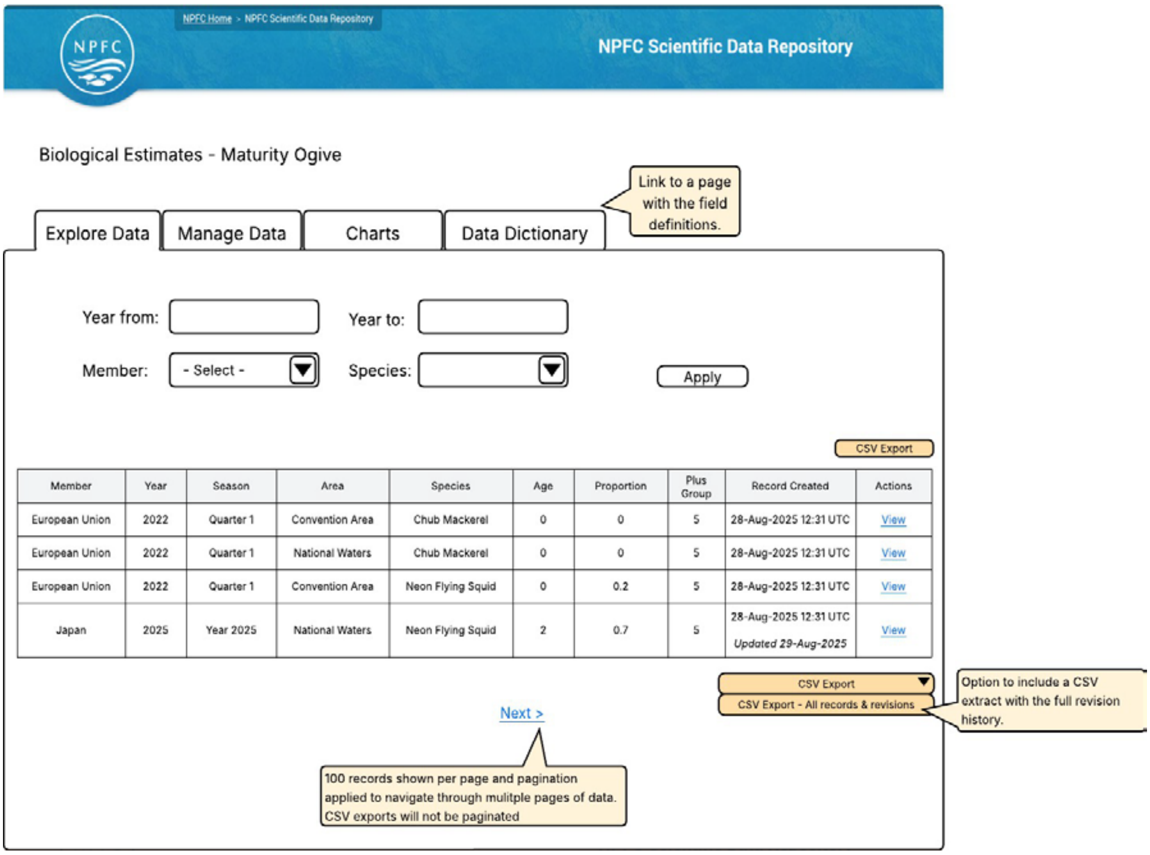
bel_year bel_season

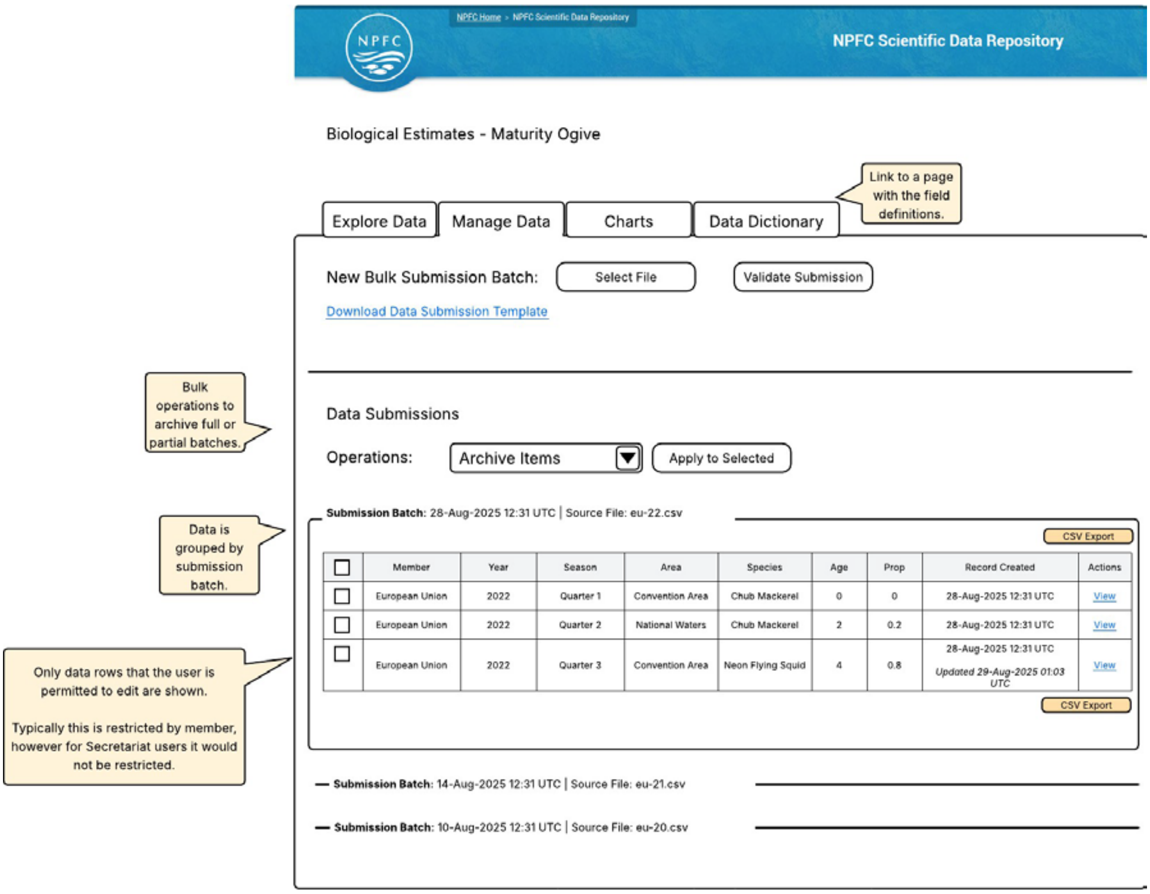
bel_season_type

bel_area

bel_species_spc_id

9.2 User Interface Wireframes





10 Data Type: Catch and Effort - Processed

10.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
cep_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
cep_group_gp_id	entity_reference	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A
cep_year	int	Year	The year of the data collection.	MANDATORY 4 digits > 2000 COMPOSITE KEY A
cep_season	int	Season	The temporal aggregation level of the data. Can be the same as the year of the data collection	MANDATORY If season_type is month, value must be between 1 and 12. If season_type is quarter, value must be between 1 and 4. If season_type is year, value must match the year field. COMPOSITE KEY A
cep_season_type	text_list	Season Type	The type of temporal aggregation level. E.g., if the estimation is done on a quarter basis, then the SeasonType is Quarter	MANDATORY **Valid Options** M | Month Q | Quarter Y | Year COMPOSITE KEY A
cep_gear_fgt_id	entity_reference	Gear Type	The fishing gear type based on the ISSCFG list.	MANDATORY COMPOSITE KEY A

Field	Data Type	Label	Definition	Validation Rules
cep_are a	text_list	Area	The area	MANDATORY **Valid Options** CA | Convention Area NW | National Waters CB | Combination COMPOSITE KEY A
cep_lat_ lon	geofiel d	Latitud e / Longit ude	Decimal degree coordinates	(MANDATORY if bea_gear_fgt_id references PS or NFS, otherwise optional.)
cep_spe cies_sp c_id	entity_r eferenc e	Specie s	The species	MANDATORY COMPOSITE KEY A
cep_live _weight	decima l (8,3)	Live Weight	The species weight at the time of capture, before any processing such as gutting, filleting, or freezing.	MANDATORY COMPOSITE KEY A > 0
cep_live _weight _unit	text_list	Live Weight Unit	The weight unit corresponding to the live weight	MANDATORY COMPOSITE KEY A **Valid Options:** g | Gram kg | Kilogram t | Metric ton
cep_eff ort	decima l (8,2)	Effort	The total amount of fishing activity	MANDATORY > 0
cep_eff ort_unit	text_list	Effort Unit	The effort units	MANDATORY **Valid Options:** kwd | Kilowatt days fd | Fishing days fh | Fishing hours h | Hauls ns | Number of sets vd | Vessel days hk | Number of hooks trp | Number of traps

COMPOSITE KEY A

cep_group_gp_id

cep_year

cep_season

cep_season_type   cep_gear_type

cep_area

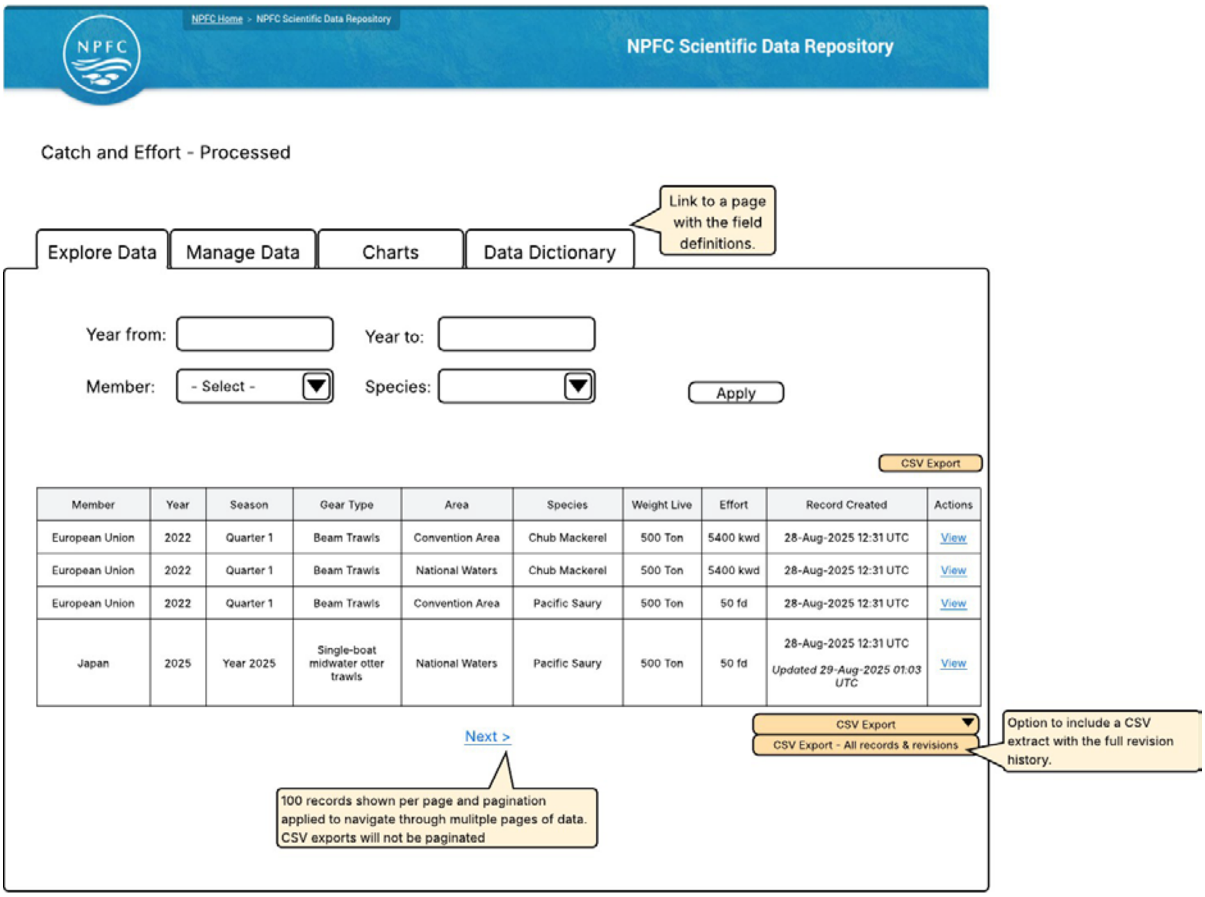
cep_species_spc_id

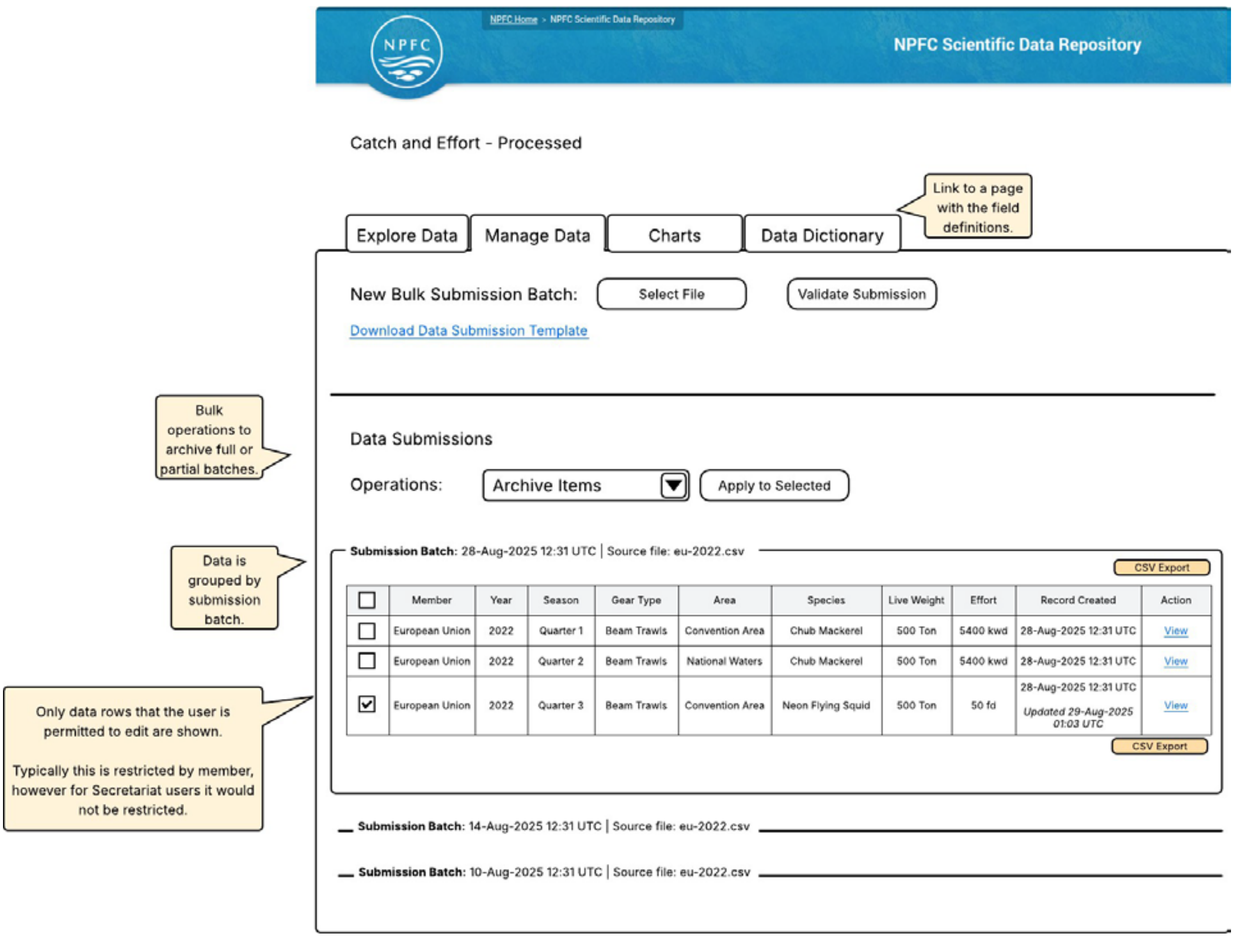
cep_lat_lon (only included in composite key for PS and NFS)

cep_live_weight

cep_live_weight_unit

10.2 User Interface Wireframes





11 Data Type: Catch and Effort - CPUE

11.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
cpue_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
cpue_type	text_list	CPUE Type	Member for single Member or Joint for multiple	Auto-calculated as M if one member is referenced or J if multiple members are referenced.

Field	Data Type	Label	Definition	Validation Rules
cpue_group_gp_id	entity_reference	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A MULTI-VALUED
cpue_year	int	Year	The year of the data collection.	MANDATORY COMPOSITE KEY A 4 digits > 2000
cpue_season	int	Season	The temporal aggregation level of the data. Can be the same as the year of the data collection	MANDATORY COMPOSITE KEY A If season_type is month, value must be between 1 and 12. If season_type is quarter, value must be between 1 and 4. If season_type is year, value must match the year field.
cpue_season_type	text_list	Season Type	The type of temporal aggregation level. E.g., if the estimation is done on a quarter basis, then the Season Type is Quarter	MANDATORY COMPOSITE KEY A **Valid Options** M | Month Q | Quarter Y | Year
cpue_gear_fgt_id	entity_reference	Gear Type	The fishing gear type based on the ISSCFG list.	OPTIONAL

cpue_area	text_list	Area	The area	OPTIONAL **Valid Options** CA | Convention Area NW | National Waters CB | Combination
cpue_species_spc_id	entity_reference	Species	The species	MANDATORY COMPOSITE KEY A

Field	**Data Type**	**Label**	**Definition**	**Validation Rules**
cpue_nominal_cpue_value	decimal (8.2)	Nominal Catch Per Unit of Effort	Catch per unit of effort calculated directly from raw data, without standardization for factors such as vessel, gear, or area.	OPTIONAL >0
cpue_cpue_value	decimal (8.2)	Catch Per Unit of Effort	Catch per unit of effort (standardized)	MANDATORY >0

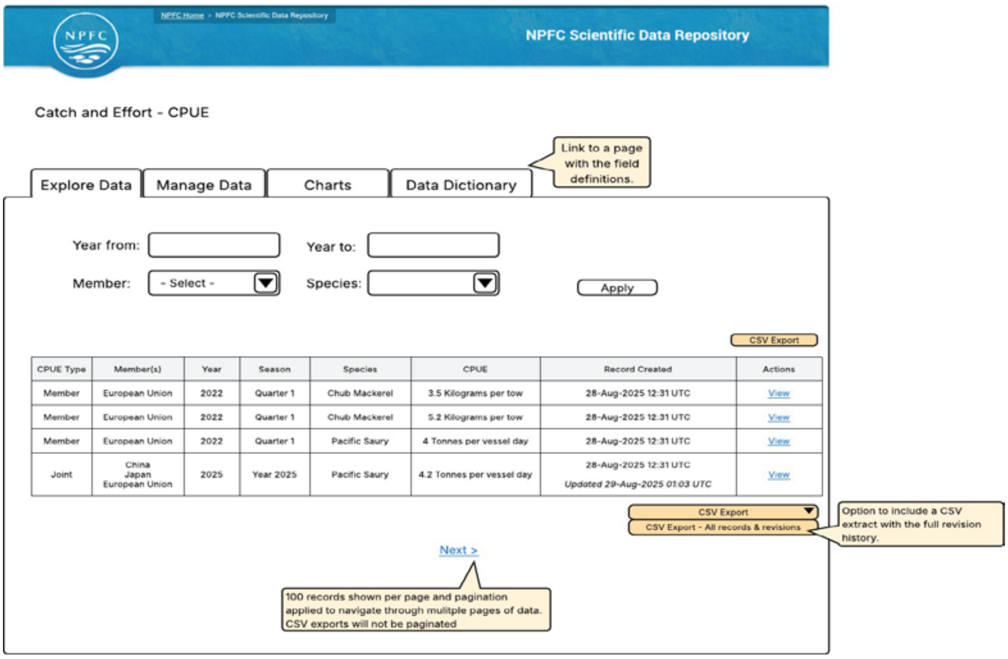
cpue_cpue_unit	text_list	CPUE Unit	Unit of measurement for the CPUE	MANDATORY **Valid Options:** kg_tow | Kilograms per tow ton_tow | Tonnes per tow kg_hr | Kilograms per hour ton_hr | Tonnes per hour n_hk | Number per hook n_100hk | Number per 100 hooks n_trip | Number per trap kg_trp | Number per trap kg_trp | Kilograms per trap n_vd | Number per vessel day ton_vd | Tonnes per vessel day n_fd | Number per fishing day ton_fd | Tonnes per fishing day ton_hl | Tonnes per haul >0

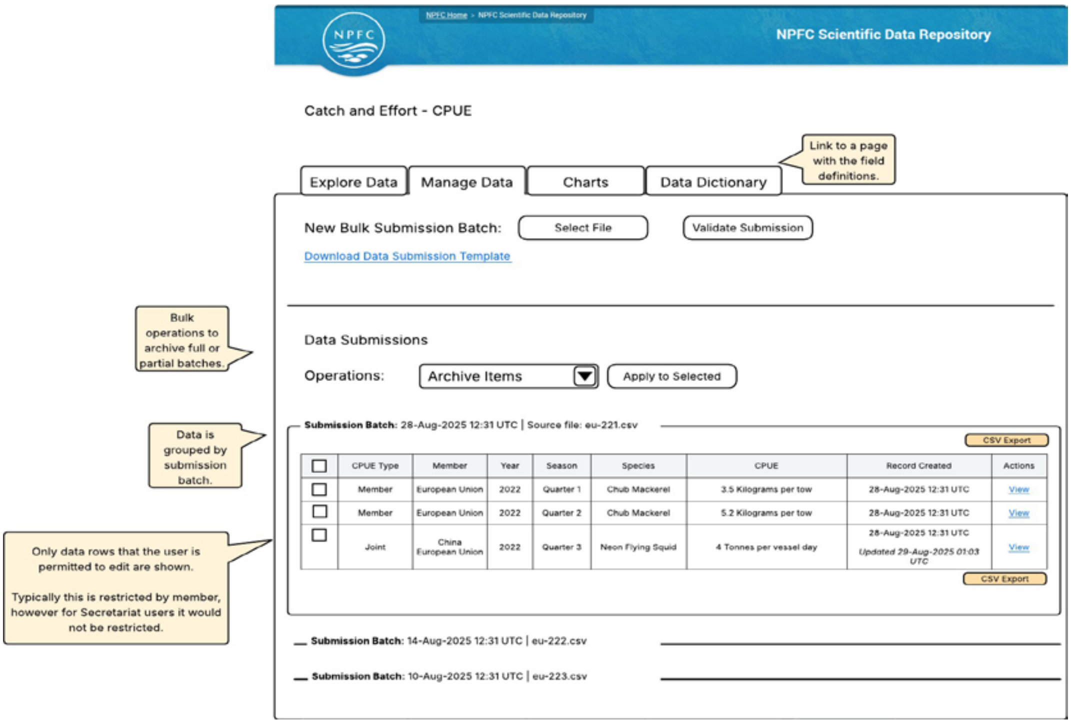
Field	**Data Type**	**Label**	**Definition**	**Validation Rules**
cpue_cv	decimal (8,2)	Cooefficient of Variation	Coefficient of variation of the CPUE value (unitless 0 to 1)	OPTIONAL >0
cpue_method	text	Method / Model Used	Method/model used (e.g., GLM, GAM, delta lognormal)	OPTIONAL >0
cpue_cov	text	Covariates	List of covariates used in the standardization separated by an underscore "_"	OPTIONAL MULTI-VALUED

COMPOSITE KEY A

cpue_group_gp_id
cpue_year cpue_season
cpue_season_type
cpue_species_spc_id

11.2 User Interface Wireframes





12 Data Type: Catch by Species - Ratio

12.1 Data Entity Definition and Validation Rules

Field	Data Type	Label	Definition	Validation Rules
cbsr_id	int	Entity ID	Primary key identifying the data record. System generated.	PRIMARY KEY MANDATORY
cbsr_group_gp_id	entity_reference	Member	The Member who has submitted the data.	FOREIGN KEY MANDATORY COMPOSITE KEY A
cbsr_year	int	Year	The year of the data collection.	MANDATORY COMPOSITE KEY A 4 digits > 2000
cbsr_species_spc_id	entity_reference	Species	The species	MANDATORY
cbsr_species_total_catch	entity_reference	Species Total Catch	Species that comprise the total catch group used in the catch ratio calculation. The total catch group includes all species with misidentification issues relevant to and including the species code indicated in the "Species" field.	MANDATORY MULTI-VALUED
cbsr_catch_ratio	decimal (4,3)	Catch Ratio	Ratio of the species catch to the total catch	MANDATORY 0 <= n <= 1

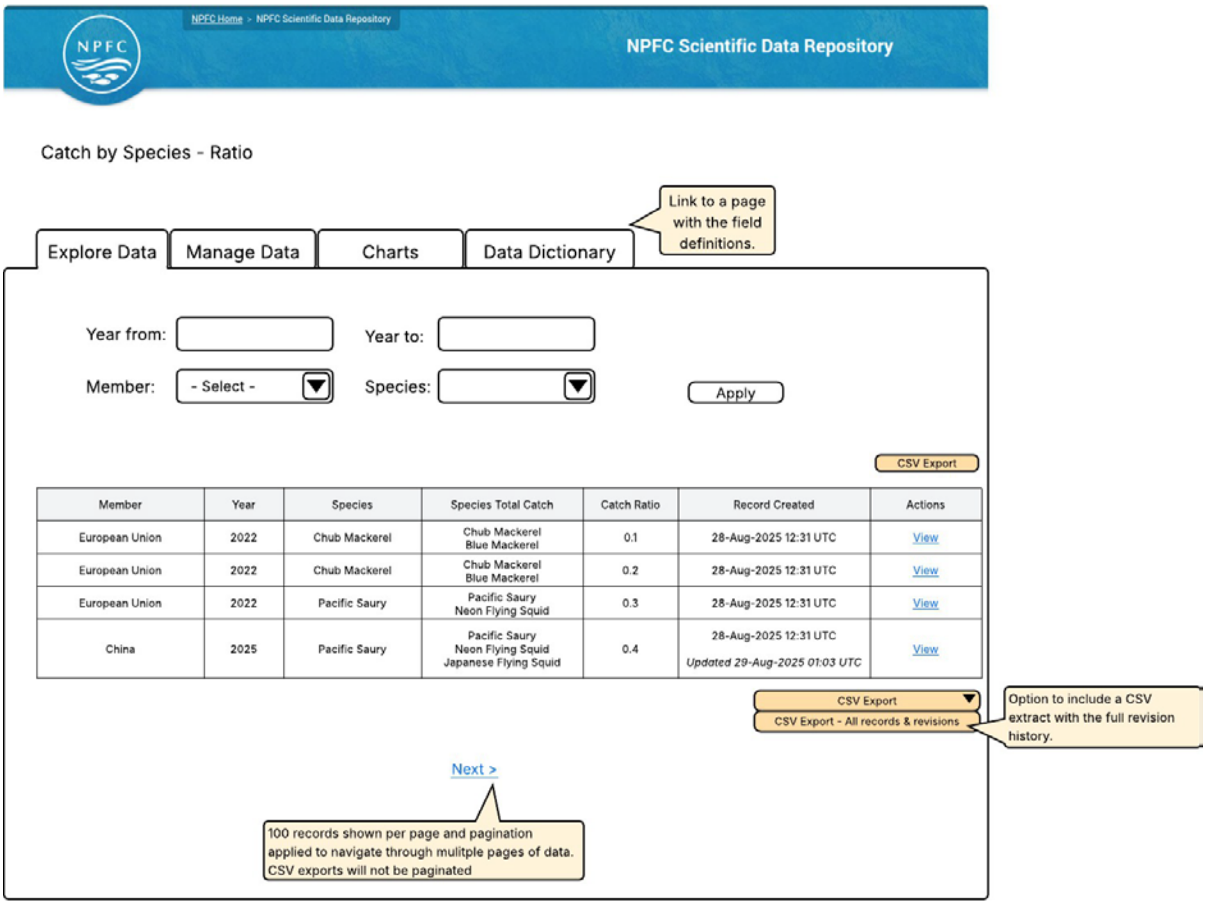
COMPOSITE KEY A

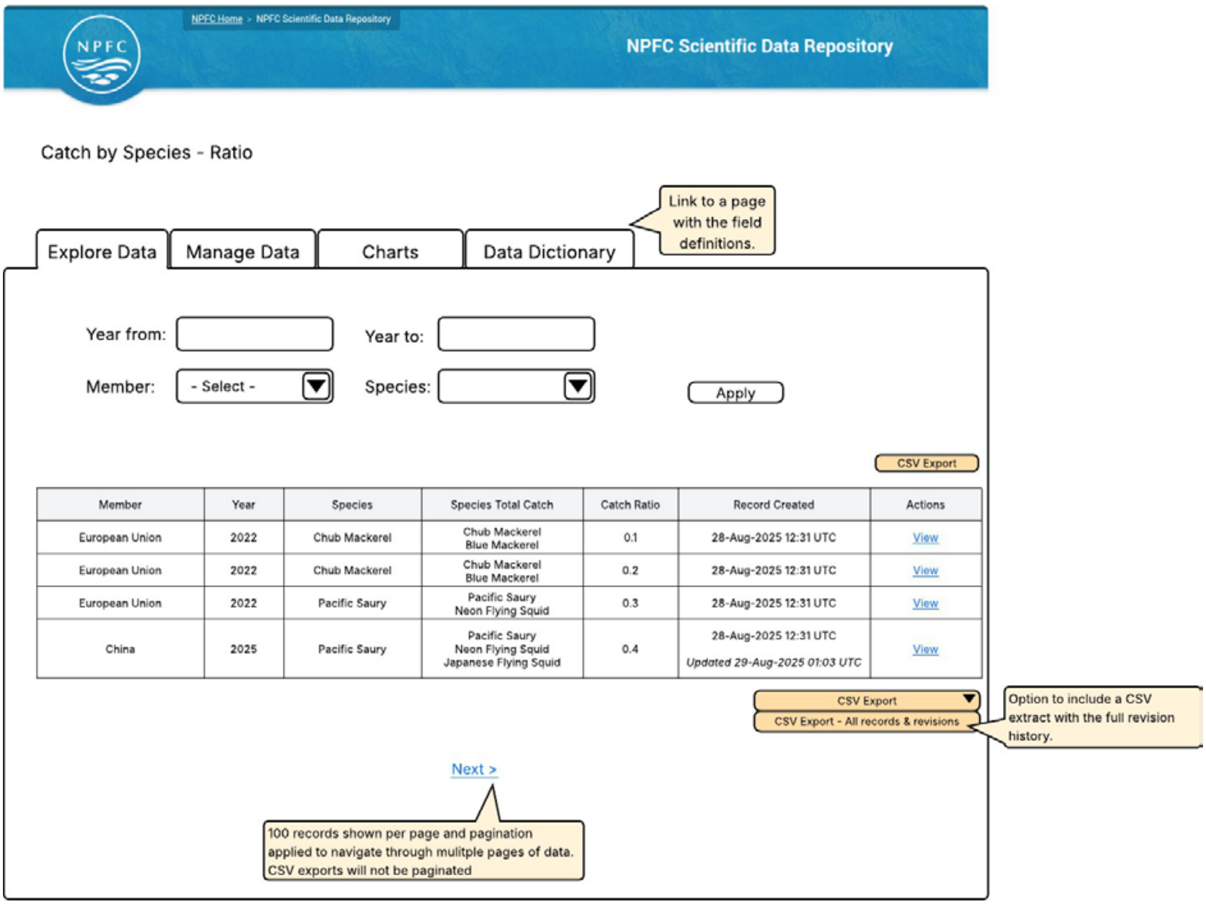
cbsr_group_gp_id

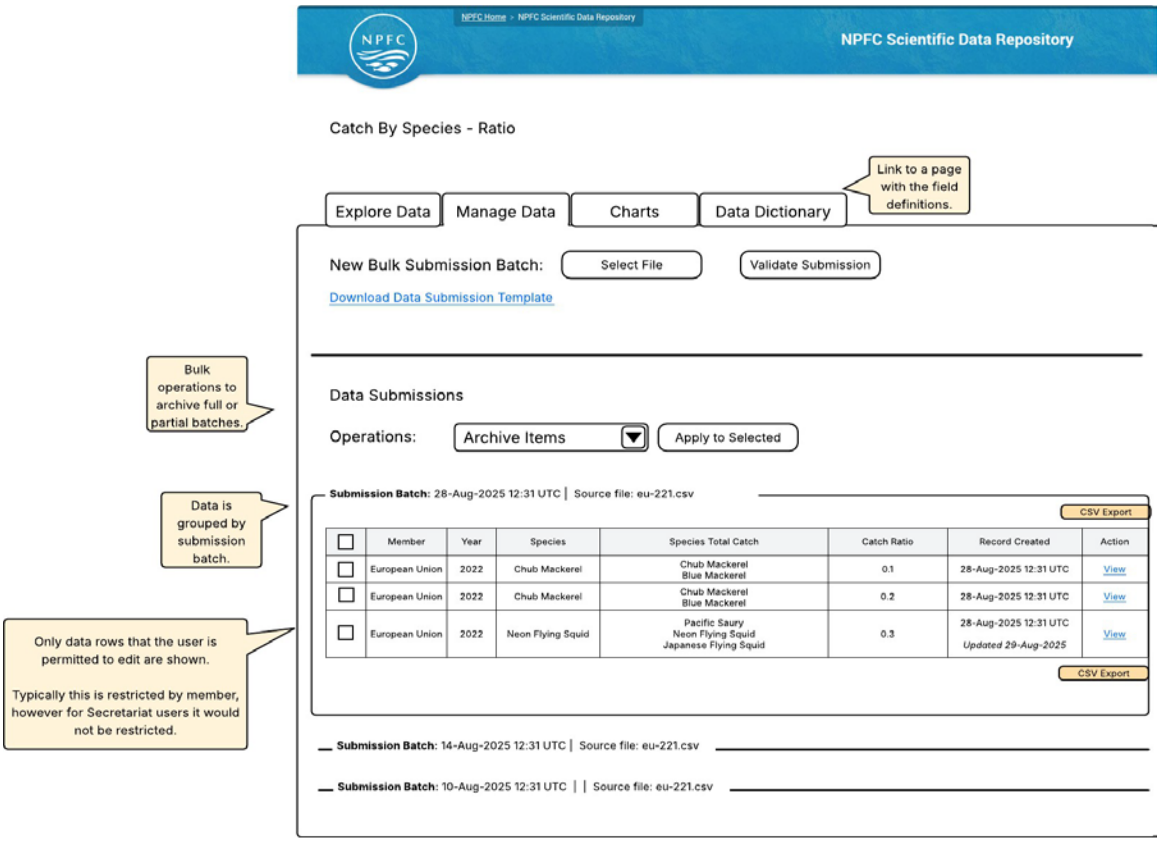
cbsr_year

cbsr_species_spc_id

12.2 User Interface Wireframes



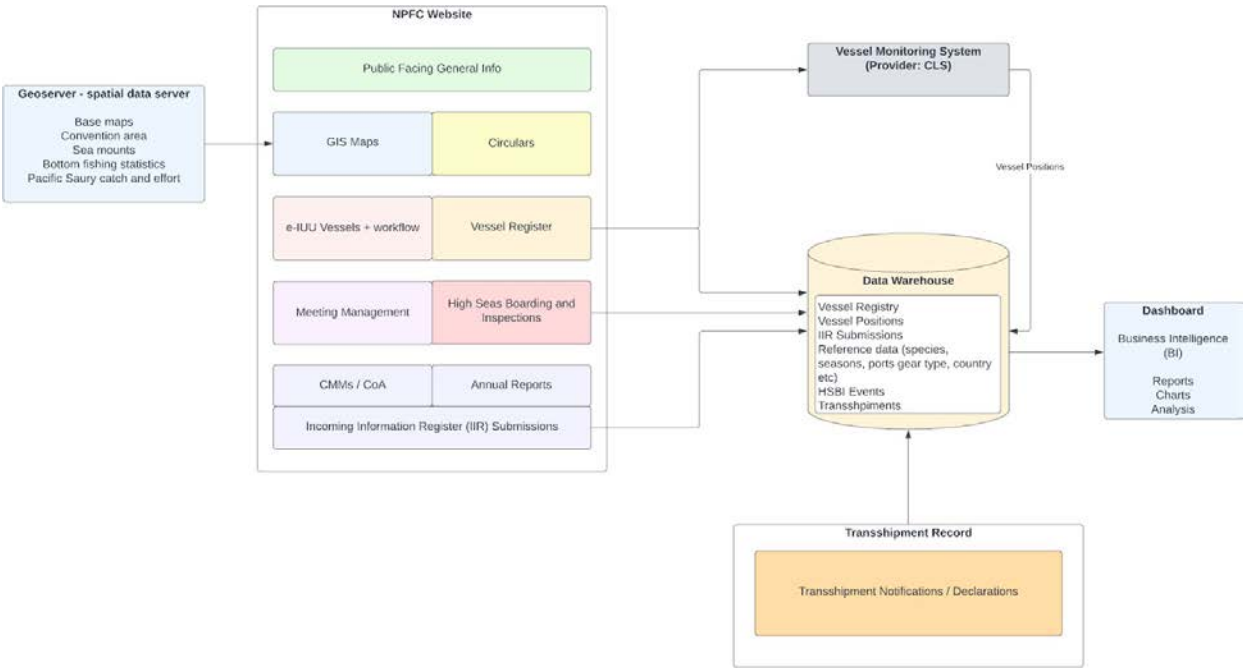

NPFC Home > NPFC Scientific Data Repository
NPFC Scientific Data Repository
Catch by Species - Ratio
Link to a page with the field definitions.
Explore Data
Manage Data
Charts
Data Dictionary
Year from:
Year to:
Member:
- Select -
Species:
Apply
CSV Export
Member | Year | Species | Species Total Catch | Catch Ratio | Record Created | Actions
European Union | 2022 | Chub Mackerel | Chub Mackerel Blue Mackerel | 0.1 | 28-Aug-2025 12:31 UTC | View
European Union | 2022 | Chub Mackerel | Chub Mackerel Blue Mackerel | 0.2 | 28-Aug-2025 12:31 UTC | View
European Union | 2022 | Pacific Saury | Pacific Saury Neon Flying Squid | 0.3 | 28-Aug-2025 12:31 UTC | View
China | 2025 | Pacific Saury | Pacific Saury Neon Flying Squid Japanese Flying Squid | 0.4 | 28-Aug-2025 12:31 UTC Updated 29-Aug-2025 01:03 UTC | View
CSV Export
CSV Export - All records & revisions
Option to include a CSV extract with the full revision history.
Next >
100 records shown per page and pagination applied to navigate through mulitple pages of data. CSV exports will not be paginated


NPFC Home > NPFC Scientific Data Repository
NPFC Scientific Data Repository
Catch By Species - Ratio
Link to a page with the field definitions.
Explore Data
Manage Data
Charts
Data Dictionary
New Bulk Submission Batch:
Select File
Validate Submission
Download Data Submission Template
Data Submissions
Operations:
Archive Items
Apply to Selected
Bulk operations to archive full or partial batches.
Data is grouped by submission batch.
Only data rows that the user is permitted to edit are shown.
Typically this is restricted by member, however for Secretariat users it would not be restricted.
Submission Batch: 28-Aug-2025 12:31 UTC | Source file: eu-221.csv
CSV Export
Member | Year | Species | Species Total Catch | Catch Ratio | Record Created | Action
European Union | 2022 | Chub Mackerel | Chub Mackerel Blue Mackerel | 0.1 | 28-Aug-2025 12:31 UTC | View
European Union | 2022 | Chub Mackerel | Chub Mackerel Blue Mackerel | 0.2 | 28-Aug-2025 12:31 UTC | View
European Union | 2022 | Neon Flying Squid | Pacific Saury Neon Flying Squid Japanese Flying Squid | 0.3 | 28-Aug-2025 12:31 UTC Updated 29-Aug-2025 | View
CSV Export
Submission Batch: 14-Aug-2025 12:31 UTC | Source file: eu-221.csv
Submission Batch: 10-Aug-2025 12:31 UTC | | Source file: eu-221.csv

13 Data Warehouse Integration

13.1 Data Management Infrastructure Background

NPFC currently operates several data-driven information systems with associated databases.



Operational applications such as the VMS, Transshipment Record and the NPFC website (containing Vessel Register etc) each contain a database that supports the operation of the application, data workflows and associated data access control rules.

A data warehouse (DWH) is also in place. The DWH ingests data from the various operational applications into a centralised relational database (PostresSQL with spatial data support). This centralised data repository aims to support data analysis and reporting in a number of ways:

- Datasets are in one location so can be combined and cross referenced for deeper and easier analysis.
- Application business logic is removed, leaving raw, finalised data for easier analysis.
- All datasets can be queried using standard SQL (Structure Query Language) syntax.

A rudimentary dashboard-building application (Re-Dash) is connected to the data warehouse for data analysis and report building. Other analysis tools may be connected to the DWH as data analysis needs expand in the future.

13.1.1 Data Warehouse Access Control

An important aspect to consider in regard to the data warehouse is that it does not apply fine-grained access control rules.

Operational application modules will often apply complex row-level or even field-level access control business rules. A common scenario is for records submitted by one Member to not be visible to users of other Member states.

Within the data warehouse, these access rules are removed, leaving only a single role level. Authentication is still required, but there are no table-level, row-level or field-level restrictions. This simplicity makes the data warehouse extremely usable for broad analytical purposes, but must be restricted to Secretariat staff or Secretariat representatives (e.g. data analyst consultants) only.

13.1.2 Scientific Data Synchronised to the Data Warehouse

The NPFC Scientific Data Repository will act as an operational application to facilitate Members to load and update datasets, plus view data and extract data as CSV outputs. This operational application will apply row- level access control logic as defined in the Access Control Matrix.

Synchronisation processes will be put in place so that the scientific data entities included in the operational application are also synchronised into the NPFC data warehouse, and kept up to date as scientific data is added, updated or archived. This will allow for these datasets to be combined with other related datasets within the data warehouse for combined data analysis.

To facilitate this synchronisation, the Scientific Data Repository will have API based read-access enabled, with security authentication.

14 Prototype Implementation Plan

The below development schedule details the deliverables of three sprints of software development with the aim to achieve a functional Minimum Viable Product (MVP) within existing contractual budgets designated towards prototype implementation.

Sprint	Weeks	Key Deliverables / User Acceptance Testing Checklist
Sprint 1 - Project Initialisation	Weeks 1 - 3	• Preparation of project code repositories, UAT/Staging/Production hosting environments and domain name configuration. • Implementation of data structures as per ER diagram, with validation constraints rules and revisioning support. • Setup of web portal branding / theme based on previous NPFC web portals. • Sample data generation scripts to facilitate automated test development. • Implementation of landing page with navigation and latest updates list. • Implementation of Explore Data tabs with filters and pagination. • Implementation of CSV Export functionality on Explore Data tabs.

Sprint 2 - Data loading, access control	Weeks 3 - 6	• Implementation of Manage Data tabs with CSV upload • Implementation of validation stage with error and warning display and row highlighting. • Implementation of bulk insert / update processing operations. Generation of • data submission templates based on data definitions. • Listing of data submissions by batch on the Manage Data tab, with Archive Items bulk operation. • Implementation of roles and access control rules, with test coverage.
Sprint 3 - Integration points and deployment	Week 7	• Addition of roles to NPFC MaM, including species assignment option. • Integration of Single Sign On (SSO). • Synchronisation of Member / CNCP groups from NPFC MaM. • Synchronisation of Species and Fishing Gear data from NFPC website. • Training / handover workshop Production • deployment

14.1 Future Development Items

The following items are considered beyond the scope of the prototype (MVP) implementation, but may be considered for future enhancements.

- Implementation of Data Dictionary tabs displaying field level descriptions.
- Implementation of Charts tabs with Member Submission Coverage chart.
- Additional charts / reports
- Synchronisation of data into the NPFC Data Warehouse
- Interface translation for languages other than English
- Interfaces to allow for the extraction of previous versions of updated data records.

15 Ongoing, Maintenance and Capacity Requirements

Post-implementation of the NPFC Scientific Data Repository portal there are a number of future considerations.

15.1 Ongoing hosting and maintenance

As with any online, web based application there will be a need for hosting, as well as maintenance such as application of software security updates.

It is proposed that this application will be developed using the Drupal content management framework. This framework is consistent with other NPFC data management systems, thus benefiting from some economies of scale for ongoing maintenance under the terms of NPFC's existing application support retainer agreement.

An expectation for approximately 10 hours per quarter of software developer time needed towards hosting and security maintenance is recommended.

15.2 Additional data types

This application has been designed in a way that allows for each of the seven data types to be managed in a consistent manner. This allows for the possibility that additional datasets may be required in the future and can be accommodated without major application refactoring.

15.3 Scientific reporting and analytical outputs

The scope of this application so far does not include analytical outputs. A possible future development enhancement would be to include additional output formats such as data driven charts, dashboards and reports.

15.4 Secretariat capacity

It is recommended that the NPFC Secretariat maintain capacity to undertake the following tasks:

Support end-users

- Provide guidance and assistance to Members on how to access and operate the application.
- Maintaining help guides / documentation on system usage.

System business owner role

While contracted software developers can implement technical changes and enhancements to the software, the Secretariat is better placed to understand the subject matter of the data and act as a conduit between end-users and developers.

As the business owner of the application the Secretariat should maintain the analytical capacity to guide future change management processes in order to maintain data integrity and support the data collection and analytical needs of the Members. This tasking should be responsible for ensuring that future change requests to modify data entity definitions, validation rules or access control rules do not compromise historically collected data or breach NPFC data security policies.

Responses to Annex 1 of the CMM on Minimum Data Standards – All fishing activities

FIELD	CANADA	CHINA	CHINESE TAIPEI	EU	JAPAN-JS	JAPAN-MA	JAPAN-JFS_NFS	JAPAN-PS	KOREA	RUSSIA
ADDRESS OF MASTER	Yes	No	Yes — We do not recommend providing such personal data.	No	Private information. Needed for scientific use?	Private information. Needed for scientific use?	Private information. Needed for scientific use?	Private information. Needed for scientific use?	Yes — The data field exists in the reporting system but is not a mandatory submission item.	No
AMOUNT OF FISH ONBOARD AFTER UNLOADING (MT)	No — This number should be zero according to licensing conditions, but I don't think it is recorded	No — For stock assessment purposes, these are likely unnecessary.	Yes	Yes	No	No	No	No	No — Domestic landings are managed by a different agency.	Yes
AMOUNT OF FISH ONBOARD AT START OF TRIP (MT)	No — This number should be zero according to licensing conditions, but I don't think it is recorded	No — For stock assessment purposes, these are likely unnecessary.	Yes	Yes	No	No	Yes	Yes — Usually, zero	No — Domestic landings are managed by a different agency.	Yes
DATE AND TIME OF ARRIVAL	Yes	No	Yes — Providing the arrival date should be sufficient. Propose to delete 'time'.	Yes	No	No	No	No	Yes — The data field exists in the reporting system but is not a mandatory submission item.	Yes
DATE AND TIME	Yes	No	Yes — Providing	Yes	No	No	No	No	Yes — The	Yes

OF DEPARTURE			the departure date should be sufficient. Propose to delete 'time'.						data field exists in the reporting system but is not a mandatory submission item.	
DATE AND TIME OF LANDING	Yes	No	Yes — If the master is required to submit Annex 1 at the end of a trip and, where applicable, after every transshipment at sea, then this annex should include additional fields for transshipment details.	Yes	No	No	No	No	No — Domestic landings are managed by a different agency.	Yes
EXTERNAL IDENTIFICATION	Yes	No	Yes	Yes	Yes/No	Yes/No	Yes	Yes	Yes	Yes
FISHING PERMIT OR LICENCE NUMBER(S)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INTERNATIONAL RADIO CALL SIGN	Yes	No	Yes	Yes	Yes	Yes	Yes/No	Yes	Yes	Yes
NAME OF MASTER	Yes	Yes	Yes	Yes	Private information. Needed for scientific use?	Private information. Needed for scientific use?	Private information. Needed for scientific use?	Private information. Needed for scientific use?	Yes	Yes, See NPFC Vessel ID
PORT OF ARRIVAL	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes — The data field exists in the reporting system but is not a mandatory submission item.	Yes
PORT OF LANDING (IF DIFFERENT FROM PORT OF ARRIVAL)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No — Domestic landings are managed by a different agency.	Yes
REGISTRATION NUMBER OF	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

VESSEL										
SPECIES (FAO 3-ALPHA CODE)	Yes	Yes	Yes	Yes	Almost Yes — S. melanostictus does not have a 3-alpha code in the ASFIS database	Almost Yes — CM and BM are not separated in the logbooks	Yes	Yes	Yes	Yes
TOTAL AMOUNT OF FISH DISCARDED (MT)	Yes	Yes	Yes	Yes — This is typically not considered reliable when it's coming from the logbooks	No	No	No	No — No discard of PS	Yes	Yes/No
TOTAL AMOUNT OF FISH KEPT (MT)	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
TRIP NUMBER THIS YEAR	Yes	Yes — Regardless of the fishery, most Chinese fishing vessels typically complete only one fishing trip per year, as they transit across several oceans to conduct different fisheries.	Yes	Yes	Yes	Yes	Yes	Yes	No — This information could be derived or collected additionally if required.	Yes

Responses to Annex 2 of the CMM on Minimum Data Standards - Trawl

FIELD	CANADA	CHINA	CHINESE TAIPEI	EU	JAPAN-JS	JAPAN-MA	JAPAN-JFS_NFS	JAPAN-PS	KOREA	RUSSIA
BOTTOM DEPTH AT START OF FISHING		No — Is this the water depth (seabed depth) or the depth of the footrope?		Yes		No				Yes
ESTIMATED DISCARDS BY SPECIES (FAO 3-ALPHA CODE)		Yes		Yes — This is typically not considered reliable when it's coming from the logbooks		No				Yes/No
GEAR DEPTH AT START OF FISHING		No — Does this refer to the depth of the headline or the footrope?		Yes		No				Yes
HEIGHT OF NET OPENING		No — This data is only available for some fishing vessels and not every year, as it depends on whether the vessel is equipped with a net sonde to measure gear parameters. It is also not feasible to take such measurements for every single haul.		Yes		No				Yes/No
INCIDENTAL CAPTURES OF SPECIES OF CONCERN OR BENTHIC TAXA? (YES/NO/UNKNOWN)		Yes		Yes		Unknown				Yes
INTENDED TARGET SPECIES (FAO 3-ALPHA CODE)		Yes		Yes		Almost Yes — Blue and chub mackerel is not				Yes

			distinguished in logbooks	
MESH SIZE	No — It's possible to include this in the future.	Yes	No	Yes
TOW END DATE AND TIME (UTC)	Yes	Yes	No	Yes
TOW END POSITION	Yes	Yes	No	Yes
TOW START DATE AND TIME (UTC)	Yes	Yes	No	Yes
TOW START POSITION	Yes	Yes	No	Yes
TYPE OF TRAWL (S/D/T)	Yes — Do the terms "single" and "double" here refer to the number of vessels involved—as in single-boat trawling versus pair (double-boat) trawling? It's also worth noting that trawling is further categorized as either midwater or bottom trawling.	Yes	No	Yes
WIDTH OF NET OPENING	No — This data is only available for some fishing vessels and not every year, as it depends on whether the vessel is equipped with a net sonde to measure gear parameters. It is also not feasible to take such measurements for every single haul.	Yes	No	Yes/No

Responses to Annex 3 of the CMM on Minimum Data Standards – Purse seine

FIELD	CANADA	CHINA	CHINESE TAIPEI	EU	JAPAN-JS	JAPAN-MA	JAPAN-NFS	JAPAN-PS	KOREA	RUSSIA
ESTIMATED DISCARDS BY SPECIES (FAO 3-ALPHA CODE)		Yes			No	No				Yes/No — Observers are not required for Purse Seine (Pelagic) fisheries
INCIDENTAL CAPTURES OF SPECIES OF CONCERN OR BENTHIC TAXA? (YES/NO/UNKNOWN)		Yes — Recording data for every haul is difficult. Please summarize it daily, based on the first net deployment and the last net retrieval.			Unknown	Unknown				Yes/No — Observers are not required for Purse Seine (Pelagic) fisheries
INTENDED TARGET SPECIES (FAO 3-ALPHA CODE)		Yes			Almost Yes — S. melanostictus does not have a 3-alpha code in the ASFIS database	Almost Yes — Blue and chub mackerel is not distinguished in logbooks				Yes
MESH SIZE		No			No	No				No
NET HEIGHT		No			No	No				No
NET LENGTH		No			No	No				No
SET END DATE AND TIME (UTC)		Yes			No	No				Yes
SET START DATE AND TIME (UTC)		Yes			No	No				Yes

Responses to Annex 4 of the CMM on Minimum Data Standards – Squid Jigging

FIELD	CANADA	CHINA	CHINESE TAIPEI	EU	JAPAN-JS	JAPAN-MA	JAPAN-NFS	JAPAN-PS	KOREA	RUSSIA
ECHO SOUNDER USED? (YES/NO)		Yes — It's available since 2024	Yes				No		Yes	
END POSITION OF DRIFT		Yes — It's available since 2024	Yes				No — Daily fishing position is available		Yes	
ESTIMATED DISCARDS BY SPECIES (FAO 3-ALPHA CODE)		Yes — It's available since 2024	Yes				No		Yes	
INCIDENTAL CAPTURES OF SPECIES OF CONCERN OR BENTHIC TAXA? (YES/NO/UNKNOWN)		Yes — It's available since 2024	Yes				No		Yes	
MAXIMUM OPERATING DEPTH		Yes — It's available since 2024	Yes				No		Yes — The data field exists in the reporting system but is not a mandatory submission item.	
NUMBER OF CREW		Yes — Does this number refer only to the crew members participating in handline fishing, or does it include the entire vessel crew? It's available since 2024	Yes				No		Yes — The data field exists in the reporting system but is not a mandatory submission item.	

NUMBER OF JIGS PER LINE		Yes — It's available since 2024	Yes	No	Yes — The data field exists in the reporting system but is not a mandatory submission item.
START POSITION OF DRIFT		Yes — It's available since 2024	Yes	No — Daily fishing position is available	Yes
TOTAL DECK LIGHT POWER (KW)		Yes — It's available since 2024	Yes	No	Yes
TOTAL HOURS FISHED		Yes — It's available since 2024	Yes	No	Yes

Responses to Annex 5 of the CMM on Minimum Data Standards – Stick held dip net

FIELD	CANADA	CHINA	CHINESE TAIPEI	EU	JAPAN-JS	JAPAN-MA	JAPAN-NFS	JAPAN-PS	KOREA	RUSSIA
ESTIMATED DISCARDS BY SPECIES (FAO 3-ALPHA CODE)		No — The CMM prohibits the discarding of Pacific saury; however, the discarding practices for other species remain unknown.	Yes					No	Yes	No
HAUL END DATE AND TIME (UTC)		No — Recording data for every haul is difficult. Please summarize it daily, based on the first net deployment and the last net retrieval.	No					No	Yes	Yes
HAUL END POSITION		No — Recording data for every haul is difficult. Please summarize it daily, based on the first net deployment and the last net retrieval.	No					No	Yes	Yes
HAUL START DATE AND TIME (UTC)		No — Recording data for every haul is difficult. Please summarize it daily, based on the first net deployment and the last net retrieval.	No — We would like to note that the time and position data of individual haul may not provide meaningful catch information. On the Taiwanese saury fishing vessels, once a haul is retrieved, the catch is immediately transferred to the					No	Yes	Yes

		processing cabin, where it undergoes a continuous workflow of sorting, packing, freezing, and storage. This process takes time to complete. During periods of high catch, the processing of one haul may not be finished before the next haul arrives, resulting in the mixing of successive catches. This makes it impossible to track the catch amount on a haul-by-haul basis. Therefore, collecting the haul start and end times and their positions is meaningless. Instead, we propose recording "Number of hauls", as this is essential for estimating CPUE on a per-haul basis.			
HAUL START POSITION	No — Recording data for every haul is difficult. Please summarize it daily, based on the first net deployment and the last net retrieval.	No	No	Yes	Yes
INCIDENTAL CAPTURES OF SPECIES OF CONCERN OR BENTHIC TAXA? (YES/NO/UNKNOWN)	Unknown — Stick-Held Dip Net rarely catch bycatch species, with squid constituting a very small proportion.	Yes	Unknown	Yes	No
MESH SIZE	No	Yes	No	No — This requires additional collection.	No

NET HEIGHT	No	Yes — We suggest revising the term 'Net height' to 'Operating depth' to reflect the actual deployment characteristics of the stick-held dip net. The term 'Net height' may be confusing, as it could be interpreted as the physical dimensions of the net, rather than its functional depth in the water column during fishing operations. In addition, since there may be several hauls operating per night, the term 'Maximum operating depth' is more appropriate than 'Operating depth'.		No	No — This requires additional collection.	No
NET LENGTH	No	Yes		No	No — This requires additional collection.	No
NUMBER OF CREW	Yes — For stock assessment purposes, these are likely unnecessary.	Yes		Yes	No — This requires additional collection.	Yes — In the NPFC register
TOTAL DECK LIGHT POWER (KW)	No	Yes		No	Yes	No
TOTAL HOURS FISHED	No — Recording data for every haul is difficult. Please summarize it daily, based on the first net deployment and the last net retrieval.	Yes		No	Yes	Yes

Annex M:

Scientific activities and projects in 2026

Stock assessment

#	Title	Time	Details	Funding
1.1	SSC JS: - Meeting costs - Rapporteur - Secretariat	Every year, 3 days	Stock assessment meeting; Tokyo, Japan	SC fund: 0.566 mil JPY 0.3 mil JPY Duty travel: 0 Overtime for GS: 0.1 mil JPY
1.2	SSC NFS: - Meeting costs - Rapporteur - Secretariat	Every year, 3 days	Stock assessment meeting; Tokyo, Japan	SC fund: 0.566 mil JPY 0.3 mil JPY Duty travel: 0 Overtime for GS: 0.1 mil JPY
1.3	TWG CMSA: - Meeting costs - Rapporteur - Secretariat	Every year, 4 days	Stock assessment meeting	SC fund: 1.5 mil JPY 0.62 mil JPY Duty travel: 0.64 mil JPY Overtime for GS: 0.1 mil JPY
1.4	SSC BF-ME: - Meeting costs - Rapporteur[1] - Secretariat[2]	Every year, 2.5 days	Stock assessment and VME	SC fund: 1.5 mil JPY 0.465 mil JPY Duty travel: 0.48 mil JPY Overtime for GS: 0.1 mil JPY
1.5	SSC PS: - Meeting costs - Rapporteur - Secretariat	Every year, 4 days	Stock assessment meeting	SC fund: 1.5 mil JPY 0.62 mil JPY Duty travel: 0.64 mil JPY Overtime for GS: 0.1 mil JPY
1.6	SC: - Meeting costs - Rapporteur - Secretariat	Every year, 4 days	Science advice and recommendations to Commission. Hybrid format	SC fund: 1.5 mil JPY 0.785 mil JPY Duty travel: 1,925 mil JPY Overtime for GS: 0.2 mil JPY
2.1	TWG CMSA: - Rapporteur	Every year, 3 days	Data preparation	SC fund: 0
2.2	SSC NFS:	Every year,	Data preparation	SC fund:

[1] Consultancy fee and travel costs for hybrid meetings

[2] Travel costs for hybrid meetings and overtime work for General Staff (GS: Data Coordinator and Executive Assistant)

	- Rapporteur	3 days		0
2.3	SSC JS: - Rapporteur	Every year, TBD	Data preparation	SC fund: 0
2.4	SSC PS: - Rapporteur	Every year, 3 days	Data preparation	SC fund: 0
3.1	TWG CMSA - Consultancy fee - Travel	Every year	Support to CM stock assessment	SC fund: 1.827 mil JPY (12,180 USD/21 days) 0.65 mil JPY
3.2	SSC NFS - Consultancy fee - Travel	Every year	Support to NFS stock assessment	SC fund: 2.25 mil JPY (15,000 USD/25 days) 0.6 mil JPY
3.3	SSC JS - Consultancy fee - Travel	Every year	Support to JS stock assessment	SC fund: 1.5 mil JPY (10,000 USD/17 days) 0.6 mil JPY
3.4	SSC PS - Consultancy fee - Travel	Every year	Support to PS stock assessment	SC fund: 2.25 mil JPY (15,000 USD/25 days) 0.65 mil JPY
3.5	SSC BF-ME - Consultancy fee - Travel	2024- 2026	Support to SA and NPA stock assessments	**SPF fund**: 1.827 mil JPY (12,180 USD/21 days) 0.65 mil JPY
3.6	External peer-review of stock assessments	Every 3-5 years for each species		SC fund: None in 2026
	Total			**SC fund:** **20.549 mil JPY** Duty travel: 3.685 mil JPY Overtime for GS: 0.7 mil JPY SPF: 2.477 mil JPY

SC projects

#	Title	Time	Details	Funding	Priority
1	SC database	2025-2026	Database for scientific data	**VCF fund**: Up to50,000 EUR (Or **SC fund**: Up to 9.2 mil JPY)*	Highest
2	PICES Annual meeting	Every year	Travel support to an SC participant to attend PICES Annual meeting	SC fund: 0.75 mil JPY (5,000 USD)	Medium
3	PICES/ICES/FAO Small Pelagic Fish Symposium	2025-2026	Co-sponsorship of the symposium (travel support for an SC	SC fund: 0.75 mil JPY (5,000 USD)	High

			participant)		
4	Other science meetings / capacity development	Every year	Training for capacity building or travel support to attend relevant science meetings	SC fund: 0.75 mil JPY (5,000 USD)	Lowest priority
	Total			**SC fund:** **2.250 mil JPY** **(+9.2 mil JPY*)** EU VCF: 50,000 EUR	

* This project may be funded either by a voluntary contribution from Members or by the SC fund

2025 SC projects for reference

#	Project	Time	Status	Next step: activities, required funds
1	Pacific saury stock assessment meetings (meeting costs)	Every year	*TWG PSSA meetings: Feb 2017, Dec 2017, Nov 2018, Mar 2019.* *SSC PS meetings: Nov 2019, Aug 2023.*	WG NSAM meeting. Jul 2025. *2025 FY: 2mil JPY* *Source: China's Voluntary Contribution Fund (VCF)* SSC PS15 meeting. Sep 2025. *2025 FY: virtual, no funds required.*
2	Chub mackerel stock assessment meeting (meeting costs)	Every year	*TWG CMSA meetings: Dec 2017, Mar 2019, Sep 2023, Jul 2024.*	TWG CMSA11 meeting. Jul 2025. *2025 FY: 1.5mil JPY (10,000USD)* *Source: SC fund.* TWG CMSA12. Early 2026. *2025 FY: virtual, no funds required.*
3	Neon flying squid stock assessment meeting (meeting costs)	Every year		SSC NFS02 meeting. Jul 2025. *2025 FY: 1.5mil JPY (10,000USD)* *Source: SC fund.*
4	Invited expert to support TWG CMSA (consultancy fee and travel costs for one in-person meeting)	2020-current	An external expert has been contracted to support TWG CMSA.	*2025 FY:* *0.6mil JPY - SC fund, and* *0.8mil JPY - US VCF.*
5	Invited expert to support SSC PS (consultancy fee and travel costs for two in-person meeting)	2019-current	An external expert has been contracted to support SSC PS and its subsidiary WG NSAM.	*2025 FY: 2.4mil JPY* *Source: SC fund.*
6	Invited expert to support WG NSAM (consultancy fee and travel costs for one in-person meeting)	2024-		*2025 FY: 3.3mil JPY* *Source: SC fund.*
7	Invited expert to support SSC NFS (consultancy fee and travel costs for two in-person meetings)	2024-current	An external expert has been contracted to support SSC NFS.	*2025 FY: 2.2mil JPY* *Source: SC fund.*
8	Invited expert to support SA and NPA stock assessments	2024-current	Two external experts were contracted in 2024 as a separate project covered by the SPF.	*2025 FY: 2.2mil JPY* *Source: SC fund.*

9	PICES Annual meeting	Every year	Travel support to a participant of the SC or its subsidiary bodies to attend PICES Annual meeting.	*2025 FY: 0.75mil JPY (5,000USD)* *Source: SC fund.*
10	Other science meetings / capacity development	2024	Training for capacity building or travel support to attend other relevant science meetings.	*2026 FY: 0.75mil JPY (5,000USD)* *Source: SC fund.*
11	PICES/ICES/FAO Small Pelagic Fish Symposium. 4-8 May 2026, La Paz, Mexico	2025& 2026	An invitation from PICES for co-sponsorship and participation in the symposium.	*2025 FY: 0.75mil JPY (5,000USD)* *2026 FY: 0.75mil JPY (5,000USD)* *Source: SC fund.*
12	Database for scientific data	2025-2026	A proposal to develop a database for scientific data.	*2025 FY: 10,000 EUR* *2026 FY: 20,000 EUR* *Source: EU's VCF and Members' in kind contribution*
	Total			*2025 FY: 15.2mil JPY* *Source: SC fund.*

Annex N:
Revised Terms of Reference for the Scientific Committee

NORTH PACIFIC FISHERIES COMMISSION
SCIENTIFIC COMMITTEE
TERMS OF REFERENCE

Context

Article 7(3b) of the Convention states that the Commission shall "adopt a plan of work and terms of reference for the Scientific Committee, for the Technical and Compliance Committee and, as necessary, for other subsidiary bodies."

Article 10(1) of the Convention states that "the Scientific Committee shall provide scientific advice and recommendations in accordance with the terms of reference for the Committee to be adopted at the first regular meeting of the Commission and as may be amended from time to time."

Purpose

The Scientific Committee should provide a forum for consultation and cooperation among Contracting Parties and Fishing Entities (Members) with respect to the evaluation and exchange of scientific information relating to the fisheries of the Convention Area, and to encourage and promote cooperation among the members in scientific research designed to fill gaps in knowledge pertaining to these matters.

Functions

In accordance with Article 10(4) of the Convention, the functions of the Scientific Committee shall be to:

(a) Develop and maintain a research plan that would be presented to the Commission, including specific issues and items to be addressed by the scientific experts or by other organizations or individuals, as appropriate, and identify data needs and coordinate activities that meet those needs;

(b) regularly plan, conduct and review the scientific assessments of the status of fisheries resources in the Convention Area, identify actions required for their conservation and management, and provide advice and recommendations to the Commission;

(c) collect, analyze and disseminate relevant information;

(d) assess the impacts of fishing activities on fisheries resources and species belonging to the same ecosystem or dependent upon or associated with the target stocks;

(e) develop a process to identify vulnerable marine ecosystems, including relevant criteria for doing so, and identify, based on the best scientific information available, areas or features where these ecosystems are known to occur, or are likely to occur, and the location of bottom fisheries in relation to these areas or features, taking due account of the need to protect confidential information;

(f) identify and advise the Commission on additional indicator species for vulnerable marine ecosystems for which directed fishing shall be prohibited;

(g) establish science-based standards and criteria to determine if bottom fishing activities are likely to produce significant adverse impacts on vulnerable marine ecosystems or marine species in a given area based on international standards such as the FAO International Guidelines and make recommendation for measures to avoid such impacts;

(h) review any assessments, determinations and management measures and make any necessary recommendation in order to attain the objective of this Convention;

(i) develop rules and standards, for adoption by the Commission, for the collection, verification, reporting, and the security of, exchange of, access to and dissemination of data on fisheries resources, species belonging to the same ecosystem, or dependent upon or associated with the target stocks and fishing activities in the Convention Area;

(j) to the extent practicable, provide analysis to the Commission of alternative conservation and management measures that estimates the extent to which each alternative would achieve the objectives of any management strategy adopted or under consideration by the Commission; and

(k) provide such other scientific advice to the Commission as it considers appropriate or as may be required by the Commission.

Consistent with Article 7(3c), the Commission shall refer to the Scientific Committee any question pertaining to the scientific basis for the decisions the Commission may need to take concerning conserving and managing fisheries resources and species belonging to the same ecosystem or dependent upon or associated with the target stocks and assessing and addressing the impacts of fishing activities on vulnerable marine ecosystems.

In accordance with Article 10(6), the Scientific Committee "shall not duplicate the activities of other scientific organizations and arrangements that cover the Convention Area." Further, consistent with Article 21, the Committee shall seek, with the approval of the Commission, to develop cooperative working relationships with other intergovernmental organizations that can contribute to its work.

Structure

1. Membership

The Scientific Committee shall be composed of Members of the Commission. Members are encouraged to identify a focal point to facilitate the operations of the Committee. Scientific Committee participants would have a science background. Invitation and participation of non-members in the meetings and other activities of the Committee are subject to relevant provisions in Rule 9 of the Commission's Rules of Procedure.

2. Chair and Vice-Chair

i. Selection and Term

The Chair and Vice-Chair of the SC will be selected by consensus by SC Members, subject to approval by the Commission, in accordance with relevant provisions of the Convention and the Rules of Procedure of the Commission, unless the Commission decides otherwise.

The SC Chair shall be elected for a period of two years and shall be eligible for reelection for two additional terms of two years. The SC Chair's term shall continue until the Commission approves the elected Chair. The Chair's term shall begin after the approval by the Commission. In the case that the Chair is unable or unwilling to serve a full term, the Vice-Chair will assume the Chair's position in accordance with the Rules of Procedure. The Vice-Chair would succeed the Chair after the Chair's term expires and a new Vice- Chair would be identified.

The Chairs of the SC subsidiary bodies will be selected by Members of these subsidiary bodies, and the selection becomes effective immediately afterwards. They may serve more than two consecutive terms, recognizing the specialized nature of the subjects and tasks that its subsidiary bodies deal with, and noting the need to provide greater consistency and continuity of expertise to its subsidiary bodies.

ii. *Duties of the Chair*

- Coordinate the meeting schedule and agenda preparation;
- Chair Committee meetings as well as prepare reports of the meetings;
- Foster constructive and active dialogue at Committee meetings;
- Coordinate the development of specific deliverables identified in the Committee's functions, as per Article 10 in the Convention;
- Liaise with the Commission Chair, TCC Chair, and other relevant international organizations as appropriate to enhance the quality of activities;
- Represent or designate a competent person to represent the Committee to participate, as appropriate, in various regional and international meetings and fora; and,
- Invite, as appropriate, non-members to contribute to the Committee's meeting agendas and activities.

3. Meetings

Consistent with Article 10 in the Convention, the Scientific Committee shall meet, unless the Commission otherwise decides, at least once every two years, and prior to the regular meeting of the Commission.

4. Sub-Committees or Working Groups

Consistent with Article 6 in the Convention, the Committee may establish working groups and may seek external advice in accordance with any guidance provided by the Commission.

Agendas and Meeting Conduct

The Scientific Committee will endeavor to develop agendas and conduct its meetings in a manner that is consistent with Rule 5 in the Commission's Rules of Procedure.

Decisions

Decisions will be adopted in a manner that is consistent with Article 8 of the Convention and Rule 2 in the NPFC Rules of Procedure. Consistent with Article 8, as a general rule, the Committee shall strive to make its decisions by consensus.

Language

In accordance with Rule 7 in the Rules of Procedure, English shall be the working language of the Committee. Any other language may be used on condition that persons doing so will provide interpreters.

Records and Reports

In accordance with Article 6(2) in the Convention, after each meeting, the Committee will provide a report on its work to the Commission that includes, where appropriate, advice and recommendations to the Commission.

As per Article 10(3) in the Convention, the Committee shall make every effort to adopt its reports by consensus. If every effort to achieve consensus has failed, the report shall indicate the majority and minority views and may include the differing views of the representatives of the members on all or any part of the report.

These Terms of Reference are subject to approval by the Commission. They may be revised by the Committee based on consensus and subsequent approval by the Commission.

Annex O:

Five-Year Research Plan and Work Plan of the Scientific Committee

North Pacific Fisheries Commission
Scientific Committee
2025-2029 Research Plan

1.0 BACKGROUND

Article 10, Section 4(a) of the *Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean* states that the Scientific Committee (SC) will "recommend to the Commission a research plan including specific issues and items to be addressed by the scientific experts or by other organizations or individuals, as appropriate, and identify data needs and coordinate activities that meet those needs."

An initial draft of this research and accompanying work plan was presented for review during the 4th Preparatory Conference and a subsequent discussion was held by a small working group to establish science priorities for the NPFC. This plan draws on those discussions and was updated by the SC Chair based on the progress made by the NPFC since that Conference.

The development of multi-year science research or work plans is common across regional fisheries management organizations as well as domestic fisheries science agencies. This draft plan draws on such examples, and has been developed for consideration by the SC before it may be adopted by the Commission.

2.0 OBJECTIVES

The research plan is intended to guide the work of the Scientific Committee by identifying key research priorities and associated areas of work to be undertaken or maintained. The plan should also serve to: ensure efficient utilization of scarce resources within the Commission; inform Parties' domestic research planning as a means of complementing the Commission's science activities; and help the Commission identify potential sources of external funding.

It is not intended as an exhaustive plan describing all research activities that may be carried out by Parties, nor is it intended to preclude work already taking place. The plan should support the Commission's primary objective (*Article 2* in the Convention), which is to "ensure the long-term conservation and sustainable use of the fisheries resources in the Convention Area while protecting the marine ecosystems of the North Pacific Ocean in which these resources occur". The plan should also help the Scientific Committee fulfill its functions as specified in the Convention.

3.0 PRIORITY RESEARCH AREAS

In addition to discussions held during the Preparatory Conference (referenced above) followed by the Commission and Scientific Committee after their establishment, the identification of priority research areas draws largely from the Commission's Convention, which outlines specific functions for the Scientific Committee in *Article 10, Section 4*. These priority research areas are subject to the approval of the Commission, and may be revisited and/or revised as deemed appropriate by the Commission. Proposed rolling five-year work plans for the priority areas are available in the attached (Annex 1).

The proposed priority research areas are:
1. Stock assessments for target fisheries and bycatch species
2. Ecosystem approach to fisheries management
3. Data collection, management and security

At its 7th meeting, the Commission adopted a resolution on climate change and tasked the SC to identify relevant data availability and needs and integrate analyses of climate change relevant to NPFC fisheries into its work plan. The resolution also requires SC to include climate change as a standing agenda item of its meetings.

3.1 Stock Assessments

Rationale

Accurate stock assessments are critical in helping to ensure the long-term conservation and sustainable use of fisheries resources in the Convention Area. One of the primary functions of the Commission is setting total allowable catch or total allowable level of fishing effort, and as per *Article 7-1(b)*, this is to be in "accordance with the advice and recommendations of the Scientific Committee".

Consistent with this, *Article 10-4(b)* states that one of the functions of the Scientific Committee is to "regularly plan, conduct and review the scientific assessments of the status of fisheries resources in the Convention Area, identify actions required for their conservation and management, and provide advice and recommendations to the Commission".

Finally, *Article 10-4(i)* states that the Scientific Committee shall also "develop rules and standards, for adoption by the Commission, for the collection, verification, reporting, and the security of, exchange of, access to and dissemination of data on fisheries resources, species belonging to the same ecosystem, or dependent upon or associated with the target stocks and fishing activities in the Convention Area".

The Scientific Committee should endeavor to understand the current status and trends in production of populations of priority species as agreed by the 2nd Commission meeting in 2016, as well as factors that may affect future trends.

Areas of work

• Development of baseline assessment of the status of priority stocks
• Review of existing data standards in relation to stock assessments (e.g. Annual Report template, NPFC's vessel monitoring system)
• Stock delineation of important commercial species for the purpose of providing advice for the determination of management units
• For each commercial species, determination of data requirement, including data availability and data gaps; identification, where possible, of strategies to fill the data gaps, including for bycatch
• Development of a standardized method to provide advice to the Commission
• Development of assessment models by species and research as required to determine various assessment parameters
• Provide fisheries data to support Members' stock assessments of Japanese flying squid *Todarodes pacificus*, Japanese sardine *Sardinops melanostictus*, and blue mackerel *Scomber australasicus*.

3.1.1. Pelagic fish stock assessment

Rationale

Pelagic fish and squids are primary fisheries resources for NPFC Members. They comprised more than 99% of total catch of species covered by the Convention. Many of them are migratory species with wide geographical distributions which include both EEZs of the North Pacific Rim countries and High Seas. Management of such stocks requires close cooperation among Members concerned to ensure sustainable use and conservation of fisheries resources.

Four fish species and two squid species were recognized by the Scientific Committee as priority species: Pacific saury *Cololabis saira*, Chub mackerel *Scomber japonicus*, Blue mackerel *Scomber australasicus*, Japanese sardine *Sardinops melanostictus*, Neon flying squid *Ommastrephes bartramii*, Japanese flying squid *Todarodes pacificus*.

Areas of work

• Completion of stock assessment for Pacific saury and development of the framework and timeline

for its regular improvement and update
• Conducting stock assessment for Chub mackerel and other priority species considering their top-down prioritization (Spotted mackerel - Japanese sardine - Neon flying squid – Japanese flying squid) and available funds and capacity
• Identification of data gaps, determination of activities to address those gaps and development of standards and mechanisms for data collection and verification

• Develop a management strategy evaluation (MSE) for Pacific saury in collaboration with NPFC's Commission, Small Working Group on Management Strategy Evaluation for Pacific Saury (SWG MSE PS), Technical and Compliance Committee (TCC), fishery managers, fishers, stakeholders, and observers.

3.1.2. Bottom fish stock assessment

Rationale

Data used for traditional stock assessment are sparse for bottom fish, and it is unlikely that traditional methods will be applicable for most deepwater species in the Convention Area. In addition, some bottom species have unique life cycles, sporadic recruitment patterns and irregular spawning-recruitment relationships that also makes difficult accurate stock assessment. All these require specific approaches for management and sustainable use of bottom fisheries resources. More than ten bottom species have been exploited by fisheries in the Convention Area during the last two decades. Four fishes are recognized as priority species: North Pacific armorhead (NPA) *Pentaceros wheeleri,* splendid alfonsino (SA) *Beryx splendens,* sablefish *Anonoploma fimbria,* and skilfish *Erilepsis zonifer*.

Areas of work

• Review of approaches applicable for stock assessment of target bottom species and investigate various management strategies
• Further development of the Adaptive Management approach for NPA and mechanism for its implementation
• Identification of data needs and establishment of activities to fill data gaps

3.2 Ecosystem Approach to Fisheries Management

Rationale

Article 3 (c) in the Convention states that: "In giving effect to the objective of this Convention, the following actions shall be taken individually or collectively as appropriate: (c) adopting and implementing measures in accordance with the precautionary approach and an ecosystem approach to fisheries, and in accordance with the relevant rules of international law, in particular as reflected in the 1982 Convention, the 1995 Agreement and other relevant international instruments".

Article 7-1 (c,d) in the Convention states that the Commission shall: "adopt, where necessary, conservation and management measures for species belonging to the same ecosystem or dependent upon or associated with the target stocks"; and, "adopt, where necessary, management strategies for any fisheries resources and for species belonging to the same ecosystem or dependent upon or associated with the target stocks, as may be necessary to achieve the objective of this Convention."

Article 10-4 (d) states that the Scientific Committee shall "assess the impacts of fishing activities on fisheries resources and species belonging to the same ecosystem or dependent upon or associated with the target stocks."

Areas of work

• Formulation of a work plan on how to implement the ecosystem approach to fisheries management in the Convention Area
• Vulnerable Marine Ecosystems
• Understand ecological interactions among species
• Ecosystem modelling
• Evaluate impacts of fishing on fisheries resources and their ecosystem components, including bycatch species
• Other issues related to marine ecosystems including marine debris and pollution

3.2.1 Vulnerable Marine Ecosystems

Rationale

The identification of vulnerable marine ecosystems is a necessary precursor to implementing measures to protect these ecosystems, and such measures that are explicitly called for in the Convention (e.g. *Article 7-1(e)*).

Article 10-4 (e) states that the Scientific Committee shall "develop a process to identify vulnerable marine ecosystems, including relevant criteria for doing so, and identify, based on the best scientific information available, areas or features where these ecosystems are known to occur, or are likely to occur, and the location of bottom fisheries in relation to these areas or features, taking due account of the need to protect confidential information."

Article 7-1 (e) states that the Commission shall "adopt conservation and management measures to prevent significant adverse impacts on vulnerable marine ecosystems in the Convention Area, including but not limited to: measures for conducting and reviewing impact assessments to determine if fishing activities would produce such impacts on such ecosystems in a given area; measures to address unexpected encounters with vulnerable marine ecosystems in the course of normal bottom fishing activities; and as appropriate, measures that specify locations in which fishing activities shall not occur."

To date, Japan, Russia, Korea, the US and Canada have completed a report on identification of VMEs and an assessment of impacts caused by bottom fishing activities on VMEs and marine species. The Scientific Committee may build on these reports, which will be kept up to date by respective Parties.

Areas of work

• Review existing NPFC standards on VME data collection, including guidelines set forth in the CMMs for bottom fisheries and protection of vulnerable marine ecosystems in the northwestern and northeastern Pacific Ocean (CMM 2025-05 and CMM 2025-06), and determine if any modifications to these standards are needed in the short-term and/or longer term
• Review of Encounter Protocol for bottom fisheries on Vulnerable Marine Ecosystems
• Determination of data requirements and identification of what data may be collected through commercial fishing operations
• Develop consensus on criteria used to identify VMEs and how this might be applied in the NPFC (note that guidelines from the FAO are already referenced in Annex 2 of the CMM 2025-05 and CMM 2025-06)
• Analysis of known or suspected VMEs in the Convention Area
• Visual surveys of VMEs for data collection
• Development of a framework to conduct assessments of Impacts of Bottom Fishing Activities on Vulnerable Marine Ecosystems

3.2.1.1 Review of Encounter Protocol for bottom fisheries on Vulnerable Marine Ecosystems

Rationale

The purposes of VME encounter protocols in NPFC Convention Area include:
• Ensuring early detection and protection of potential VMEs within an existing fishing area;
• Ensuring early detection and protection of potential VME within an unfished area;

• Documenting information on known occurrences of VME indicators within the Convention Area.

Development of the Encounter Protocol progressed through Scientific Committee meetings as well as intersessional activities. VME encounter protocols are incorporated in the CMMs for bottom fisheries and protection of vulnerable marine ecosystems in the northwestern and northeastern Pacific Ocean, specifically in Para 4(g) and 3(j), respectively.

Areas of Work

Consideration of the following subjects of research and analyses are recommended to further refine encounter protocols in the Convention Area (as notified in Appendix C, NPFC01-2016-SSCVME01- Final Report):

• Other taxa, topographical, geographical and geological features that may indicate the presence of VMEs;
• Taxon-specific encounter thresholds and reporting;
• Framework for evaluating the effectiveness of encounter protocols;
• Tiered approach with different encounter protocols associated with different thresholds;
• Gear-specific thresholds to reflect differences in catchability;
• Gear-specific move-on distances to reflect type of gear;
• Different reporting requirements for different catches;
• Tiered approach to reporting bycatch of VME indicator taxa;
• Different encounter protocols for existing and new fishing areas

3.3 Data collection, management and security

Rationale

Article 10, paragraph 4 (i) in the Convention states that the functions of the Scientific Committee shall be to: "develop rules and standards, for adoption by the Commission, for the collection, verification, reporting, and the security of, exchange of, access to and dissemination of data on fisheries resources, species belonging to the same ecosystem, or dependent upon or associated with the target stocks and fishing activities in the Convention Area".

Areas of work

• Review of data standards related to stock assessments and other relevant data, including VME data collection and vessel monitoring systems
• Identify data sources to meet data needs for priority areas of work above and develop

programs for data collection
• Develop data security policy including data handling and sharing protocol, information confidentiality classification and access control security guideline

4.0 IMPLEMENTATION AND REVIEW

The SC will review the Research Plan and update it as necessary on an annual basis. The Research Plan will form the foundation of SC's rolling five-year Work Plan. Monitoring the implementation of this Research Plan will be the responsibility of the Chair of the Scientific Committee in collaboration with the Chairs of the Scientific Committees' subsidiary groups and the Executive Secretary. Members of the Commission and the Secretariat will share responsibility for implementation of the Research Plan.

Full implementation of the Research Plan will likely be beyond the means of the Commission's core budget. Extra-budgetary funds from voluntary contributions of Members and other sources will be required and actively sought by the Commission. Nevertheless, adoption of the Plan by the Scientific Committee and subsequent strong support from the Commission is a prerequisite to securing the necessary extra-budgetary funds.

An independent external review of the Plan may periodically be requested by the SC. The Scientific Committee will be responsible for preparing the terms of reference for the review. The Scientific Committee will present the report of the review to the next regular session of the Commission.

5.0 SCIENTIFIC COLLABORATION WITH OTHER ORGANIZATIONS

While not included as a priority, *Article 21* of the Convention addresses cooperation with other organizations or arrangements. It calls on the Commission to cooperate, as appropriate, on matters of mutual interest with the Food and Agriculture Organization (FAO), other specialized agencies of the FAO and relevant Regional Fisheries Management Organizations (RFMOs). Further, the Commission is called on to develop cooperative working relationships, including potential agreements, with intergovernmental organizations that can contribute to its work.

Article 10 also speaks to this issue in clauses five and six, stating that the Scientific Committee may exchange information on matters of mutual interest with other relevant scientific organizations or arrangements, and that the Committee shall not duplicate the activities of other scientific organizations and arrangements that cover the Convention Area.

The impetus to collaborate is made stronger by the prospect of limited research funding in the Commission, at least in the short-term, but it is also in the best interests of the Commission to seek synergies with other organizations with mutual interests and similar membership (e.g. North Pacific

Marine Science Organization (PICES) and North Pacific Anadromous Fish Commission (NPAFC)).

Activities could include:

- Evaluate reports of International Organizations that may be relevant to the functioning of the Scientific Committee
- Identify other organizations with relevant mandates and activities
- Formalize relationships with these organizations (e.g. MOUs, standing invitations to meetings)
- Identify potential funding opportunities

Annex 1

Five-Year Work Plan of the Scientific Committee and its subsidiary bodies

Priority list:

1. Conduct a stock assessment update based on BSSPM analyses
2. Further investigate improvements to the BSSPM
3. Develop an age/size-structured model
4. Develop a list of plausible ranges for biological parameters
5. Develop databases to support age/size-structured models
6. Continue joint CPUE work to incorporate broader spatial and temporal coverage
7. Update the biomass estimate using the existing method (swept area method)
8. Develop spatio-temporal model for the biomass estimate
9. Continue exploring climate indices to explain impacts on Pacific saury stock productivity
10. Support any technical work on MSE under SWG MSE PS

ITEM	**2025**	**2026**	**2027**	**2028**	**2029**	**Progress**
Regular update of inputs						
Update & improvement of biomass survey index	Continue regular review of 1) survey plan 2) analytical work 3) any related issues including experiments to produce absolute biomass index and additional surveys by other Members to increase coverage	Same as on the left	Same as on the left	Same as on the left	Same as on the left	Completed annually
Update & improvement of	Continue review of outcomes of regular	Continue review of outcomes of regular	Same as on the left	Same as on the left	Same as on the left	Completed annually

ITEM	2025	2026	2027	2028	2029	Progress
CPUE indices	update and analytical works	update and analytical works including spatio-temporal analysis				
Development of joint CPUE index	Continue review of outcomes of regular update and analytical works	Same as on the left	Same as on the left	Same as on the left	Same as on the left	Completed annually
Regular update of the existing SA						
Routine update BSSPM as a benchmark	Continue review of outcomes of regular BSSPM update [1)]	Same as on the left	Same as on the left	Same as on the left	Same as on the left	Completed annually
Improvement and further investigation of BSSPM	Review any outcomes of improvements, inter alia in light of possible incorporation of environmental information and reduction of retrospective pattern	Same as on the left	Same as on the left	Same as on the left	Same as on the left	Completed annually
Toward age/size-structured models (ASSMs)						
Data preparation/update	Explore age-specific abundance indices and recruitment indices. Conditional age at length information. Spatio-temporal variation of size composition.	TBD	TBD	TBD	TBD	Completed annually
Summarizing available information on PS biology	Update regularly, specifically maturity ogive and growth function	Continue	Continue	Continue	Continue	Collaboration between modelers and biologists has been done well and it will continue for updates.

ITEM	2025	2026	2027	2028	2029	Progress
Development of models	Finalize development of a new stock assessment model	Finalize development of a new stock assessment model				SS3 model was reviewed. WG NSAM will continue to work on the development of the SS3 model.
Uncertainty in models (possible link with OM grid under MSE)	Refine the plausible range of values of key biological parameters. Refine assumptions about prior distributions and the ranges for model parameters.	Continue	Continue	Continue	Continue	On going with in the work on new stock assessment
Other key matters						
Climate impact assessment	Explore models for assessing climate impacts on distribution and productivity	Continue	Continue	Continue	Continue	Modelling has been conducted and the work to be continued
HCR	Evaluate the performance of the interim HCR in the presence of retrospective pattern	Continue				Start in 2025

[1)] Until any new stock assessment models other than the BSSPM are accomplished, the outcome will produce key inputs for the Harvest Control Rule (HCR).

Small Scientific Committee on Bottom Fish and Marine Ecosystems

Priority list:

1. NPA: Review monitoring survey
2. NPA: Conduct stock assessment and provide management advice
3. SA: Conduct stock assessment and provide management advice
4. NPA, SA and Sablefish: Develop and implement harvest control rule
5. Sablefish: Evaluate historical harvest relative to trip limits and update trip limits if necessary
6. Sablefish and VME: Conduct trade-off analysis between commercial fishing and VME protection
7. VME: Assess the relative risk of SAI for VME as a step towards standardized approach to SAI

ITEM	SSC BFME06 (2025)	SSC BFME07 (2026)	SSC BFME08 (2027)	SSC BFME09 (2028)	SSC BFME10 (2029)	Progress
North Pacific Armorhead						
Assess and monitor status of stock	Update catch data for NPA	Update catch data for NPA	Update catch data for NPA	Update catch data for NPA	Update catch data for NPA	Completed annually
	Review results of NPA monitoring surveys	Review results of NPA monitoring surveys	Review results of NPA monitoring surveys	Review results of NPA monitoring surveys	Review results of NPA monitoring surveys	Completed annually
	Implement alternative methods for stock status	Implement alternative methods for stock status	Update status of stock	Update status of stock	Update status of stock	Exploring alternative methods for stock status
	Apply depletion method to assessing stock	Further develop and apply depletion method to estimate stock status				Currently underway
	Identify and conduct additional research on NPA	Identify and conduct additional research on NPA	Identify and conduct additional research on NPA	Identify and conduct additional research on NPA	Identify and conduct additional research on NPA	Completed annually

ITEM	SSC BFME06 (2025)	SSC BFME07 (2026)	SSC BFME08 (2027)	SSC BFME09 (2028)	SSC BFME10 (2029)	Progress
	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Completed annually
Conserve stock		Develop conservation objective(s)				Not completed
		Implement adaptive management				Not completed
	~~Update data and implement HCR~~	Develop HCR and implement	Update data and implement HCR	Update data and implement HCR		Not completed
Splendid alfonsino						
Assess and monitor status of stock	Update catch data and CPUE standardization for SA Update life history based approach and provide management advice if necessary	Update catch data and CPUE standardization for SA Update life history based approach and provide management advice if necessary	Update catch data and CPUE standardization for SA Update life history based approach and provide management advice if necessary	Update catch data and CPUE standardization for SA Update life history based approach and provide management advice if necessary	Update catch data and CPUE standardization for SA	Completed annually Completed life history based approach (to be presented at BFME05)
	Apply data-limited integrated approach	Complete data-limited integrated approach				On track for completion by BFME07
	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Completed annually

ITEM	SSC BFME06 (2025)	SSC BFME07 (2026)	SSC BFME08 (2027)	SSC BFME09 (2028)	SSC BFME10 (2029)	Progress
Conserve stock	~~Develop conservation objective(s); Define and implement harvest control rule based on stock synthesis approach~~	Develop HCR and implement	Update data and implement HCR	Update data and implement HCR	Update data and implement HCR	Not completed
Sablefish						
Assess and monitor status of stock	Update catch data and CPUE index Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Update catch data and CPUE index Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Update catch data and CPUE index Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Update catch data and CPUE index Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Update catch data and CPUE index Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Completed annually Completed annually
	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Completed annually
Conserve stock	[Design HCR specific to NPFC Sablefish (joint intersessional work with Canada and USA assessment authors]	[Design HCR specific to NPFC Sablefish (joint intersessional work with Canada and USA assessment authors]	Update data and implement HCR	Update data and implement HCR		Not completed
Other research		~~Update trade-off analysis for Sablefish fishing and VME protection (as new data is available)~~	-	-		~~Not updated (no new data available)~~

ITEM	SSC BFME06 (2025)	SSC BFME07 (2026)	SSC BFME08 (2027)	SSC BFME09 (2028)	SSC BFME10 (2029)	Progress
Vulnerable marine ecosystems						
Defining and Identifying VMEs		Consolidate other potential data sources and clarify gaps and deficiencies in VME data				Completed mapping (SWG VME report)
	Review and update quantitative definition of VMEs as needed	Review and update quantitative definition of VMEs as needed	Review and update quantitative definition of VMEs as needed	Review and update quantitative definition of VMEs as needed	Review and update quantitative definition of VMEs as needed	Completed annually
	Update identification of new VME and areas likely to be VMEs as new data becomes available	Update identification of new VME and areas likely to be VMEs as new data becomes available	Update identification of new VME and areas likely to be VMEs as new data becomes available	Update identification of new VME and areas likely to be VMEs as new data becomes available	Update identification of new VME and areas likely to be VMEs as new data becomes available	Completed annually
	Review updated taxonomy for corals and VME indicator taxa as needed	Review updated taxonomy for corals and VME indicator taxa as needed	Review updated taxonomy for corals and VME indicator taxa as needed	Review updated taxonomy for corals and VME indicator taxa as needed	Review updated taxonomy for corals and VME indicator taxa as needed	Completed annually
Identifying and defining SAI's	Determine data requirements and spatial/temporal resolution for SAI assessment and continue developing risk assessment for SAI	Assess risk of SAI for bottom fisheries	Conduct integrated SAI assessment	Conduct integrated SAI assessment	Conduct integrated SAI assessment	Work in progress
	Develop standardized and measurable metrics to assess cumulative impacts of fisheries on VME	Assess other threats to VME, such as climate change and lost fishing gear				
Quantifying interactions between fisheries and VMEs	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data	Completed annually

ITEM	SSC BFME06 (2025)	SSC BFME07 (2026)	SSC BFME08 (2027)	SSC BFME09 (2028)	SSC BFME10 (2029)	Progress
	Develop or research alternative methods to apply to Japan and Korea's indicator taxa bycatch to further refine encounter thresholds that are taxon and gear specific					Completed - To be presented at BFME06
	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Review fisheries observer program data collection for adequacy to produce data streams to support management advice	Completed annually
Conserving VMEs	Refine framework for future monitoring of recovering VMEs	Periodic review of VME management	Periodic review of VME management	Periodic review of VME management	Periodic review of VME management	Not completed
Other ecosystem components						
Assess the impact of fisheries on other ecosystem components		Work towards assessment of fishing impacts on other (non-target) ecosystem components				Completed - To be presented at BFME05
Climate Change						Progress
Preparing for climate change effect on bottom fish	Literature review for SA, NPA (SWG NPA&SA) or Sablefish (Canada)	Literature review for SA, NPA (SWG NPA&SA) or Sablefish (Canada)				NA

Small Scientific Committee on Neon Flying Squid

Priority list:

1. Conduct research to appropriately separate two cohorts using spatial and age/size characteristics
2. Continue CPUE standardization work
3. Conduct research and literature reviews to better understand the biological characteristic (e.g., growth rate, natural mortality), life history (e.g., cohorts associated with spawning timing and location, feeding and spawning migration) of the species and population structure (e.g. genetic analysis)
4. Conduct a stock assessment based on surplus production model
5. Further investigate improvements to the surplus production model
6. Explore and develop alternative approaches, such as the management strategy evaluation framework and data-limited management procedures, to provide effective management advice
7. Conduct research and literature reviews to better understand the factors driving abundance fluctuations (including climate change) in this short-lived species
8. Review other successful (or unsuccessful) stock assessment and management practices for squid or other short-lived species globally to inform SSC NFS work
9. Develop other models e.g., age/size-structured model
10. Develop databases to support age/size-structured models

ITEM	2025	2026	2027	2028	2029	Progress
Regular update of inputs						
Update & improvement of CPUE indices	Continue review of outcomes of regular update and analytical works	Submit standardized CPUE by each member	Update	Update	Update	Updated CPUE indices of Japanese survey and Chinese squid jigging fishery
Joint CPUE standardization		Conduct joint CPUE standardization	Update	Update	Update	No progress
Regular update of the surplus						

ITEM	2025	2026	2027	2028	2029	Progress
production model						
Update and review of surplus production model and other stock assessment models	Conduct preliminary stock assessment	Conduct preliminary stock assessment using standardized CPUE from each member	Same as on the left	Same as on the left	Same as on the left	Some Members (China and Japan) conducted preliminary stock assessment using JABBA and SPiCT
Improvement and further investigation of surplus production model	Review any outcomes of improvements, inter alia in light of possible incorporation of environmental information	Same as on the left	Same as on the left	Same as on the left	Same as on the left	No progress
Toward age/size-structured models						
Data inventory (CPUE and size/age in space and time)			Conditional age at length information. Spatio-temporal variation of size composition.	TBD	TBD	Information on size composition was shared by some Members
Summarizing available information on neon flying squid biology			Update regularly, specifically maturity ogive and growth function	Continue	Continue	Updated information on spawning ground and age composition
Development of models			Develop models to be evaluated	TBD	TBD	No progress
Toward other approaches to provide management advises						
MSE or data-limited			Develop framework	TBD	TBD	Libin Dai (China)

ITEM	2025	2026	2027	2028	2029	Progress
management procedures			to provide management advice (MSE or data-limited management procedures)			conducted MSE as part of SC capacity building and reported its outcome
Review other successful (or unsuccessful) stock assessment and management practices for squid or other short-lived species globally to inform SSC NFS work	Review by the invited expert	TBD	TBD	TBD	TBD	Invited expert reviewed stock assessment methods and management measures for squid and other short-lived species

Technical Working Group on Chub Mackerel Stock Assessment

Priority list:

1. Data preparation and review of biological information
2. Conduct stock assessment of chub mackerel
3. Set biological reference points
4. Provide scientific advice on the management of chub mackerel stock to the Commission
5. Explore the influence of climate changes on chub mackerel stock
6. Regularly update and refine inputs

ITEM	2025	2026	2027	2028	2029	Progress
Regular update of inputs						
Research survey indices	Update	Update	Update	Update		Research survey indices have been finalized and used for stock assessment.
CPUE indices	Update	Update	Update	Update		CPUE standardization has been finalized and used for stock assessment.
Catch data/catch composition	Update	Update	Update	Update		Catch data and catch composition have been finalized and used for stock assessment.
Biological parameters (maturity, M, weight)	Review biological parameters	Review biological parameters	Review biological parameters	Review biological parameters		Assumptions on biological parameters have been finalized and used for stock assessment.
Quarterly fishery data (CAA, WAA,	Update	Update	Update	Update		Quarterly fishery data has been submitted.

ITEM	2025	2026	2027	2028	2029	Progress
Maturity-at-age)						
Stock assessment						
Benchmark stock assessment	Update SA	Update SA	Update SA	Update SA		Benchmark stock assessment has been conducted.
Improvement and further investigation of the selected model	Review and improve, if needed, the SA model	Review and improve, if needed, the SA model	Review and improve, if needed, the SA model	Review and improve, if needed, the SA model		Done and ongoing.
New stock assessment models	Explore new stock assessment models, if available	Explore new stock assessment models, if available	Explore new stock assessment models, if available	Explore new stock assessment models, if available		
Reference points, HCR, future projections and MSE						
Set biological reference points (limit and target)	Review and calculate reference points	Review and calculate reference points	Review and calculate reference points	Review and calculate reference points		Commonly used reference points are reviewed, and calculation with the results of SA has been completed
Develop future projections		Candidates of HCR are tested in future projections	Selection of HCR	Improvement		Results of future projection have been provided.

Scientific Committee – other priority species and marine ecosystems

Priority list

As stipulated in the Convention, Article 10, the Scientific Committee shall provide scientific advice and recommendations to the Commission which is considered the highest priority task of the SC. The following priority areas have been identified for SC:

1. Priority species summaries and stock assessments for management advice
2. Management Strategy Evaluation (MSE) for priority species
3. Ecosystem approach to fisheries management: understand ecological interactions among species and impacts of fishing on fisheries resources and their ecosystem components
4. Collaboration with other organizations
5. Regular review of the research plan and work plan
6. Data collection, management, and security

ITEM	2025	2026	2027	2028	2029	Progress
Priority Species						
Summaries of priority species	Update summary sheets as needed	Update summary sheets as needed	Update summary sheets as needed	Update summary sheets as needed	Update summary sheets as needed	Summary sheets are complete for all priority species
Assessment of Blue (Spotted) Mackerel and associated bycatch	Update data on Blue Mackerel and provide relevant data for stock assessment Compile data on the catch composition of Chub Mackerel and Blue Mackerel and provide information to TWG CMSA and SWG BM	Update data on Blue Mackerel and provide relevant data for stock assessment	Update data on Blue Mackerel and provide relevant data for stock assessment	Update data on Blue Mackerel and provide relevant data for stock assessment	Update data on Blue Mackerel and provide relevant data for stock assessment	Data on Blue Mackerel have been collated and provided for stock assessment Data on catch composition are compiled and were provided to TWG CMSA and SWG BM

ITEM	2025	2026	2027	2028	2029	Progress
	Observe Japan's stock assessment of Blue Mackerel Provide management advice to the Commission as needed.	Observe Japan's stock assessment of Blue Mackerel Provide management advice to the Commission as needed. Develop data collection templates	Observe Japan's stock assessment of Blue Mackerel Provide management advice to the Commission as needed.	Observe Japan's stock assessment of Blue Mackerel Provide management advice to the Commission as needed. Collate data on associated bycatch species	Observe Japan's stock assessment of Blue Mackerel Provide management advice to the Commission as needed. Assess impacts of fishery on dependent or associated species	The SC observed Japan's stock assessment of Blue Mackerel Stock assessment results were communicated to the Commission Data templates were developed by SWG Data
Assessment of Japanese Sardine and associated bycatch	Update data on Japanese Sardine Observe Japan's stock assessment of Japanese sardine Provide management advice to the Commission as needed.					Data on Japanese Sardine have been collated The SC observed Japan's stock assessment of Japanese Sardine Stock assessment results were communicated to the Commission
Assessment of Japanese Flying Squid and associated bycatch	Update data on Japanese Flying Squid Observe Japan's stock assessment of Japanese Flying Squid Provide management advice to the Commission as	Update data on Japanese Flying Squid Observe Japan's stock assessment of Japanese Flying Squid Provide management advice to the Commission as	Update data on Japanese Flying Squid Observe Japan's stock assessment of Japanese Flying Squid Provide management advice to the	Update data on Japanese Flying Squid Observe Japan's stock assessment of Japanese Flying Squid Provide management advice to the	Update data on Japanese Flying Squid Observe Japan's stock assessment of Japanese Flying Squid Provide management advice to the	Data on Japanese Flying Squid have been collated The SC observed Japan's domestic stock assessment of Japanese Flying Squid Stock assessment results were

ITEM	2025	2026	2027	2028	2029	Progress
	needed.	needed. Develop data collection templates	Commission as needed. Collate data on associated bycatch species	Commission as needed. Collate data on associated bycatch species	Commission as needed. Assess impacts of fishery on dependent or associated species	communicated to the Commission Data templates were developed by SWG Data
Management Strategy Evaluation (MSE)						
Pacific Saury	Support NPFC's SWG MSE PS in achieving its goals	Support NPFC's SWG MSE PS in achieving its goals	Support NPFC's SWG MSE PS in achieving its goals	Support NPFC's SWG MSE PS in achieving its goals	Support NPFC's SWG MSE PS in achieving its goals	The SSC PS worked on developing a stock assessment model that will serve as an operating model for the MSE.
Ecosystem approach to fisheries management						
Ecological Interactions	Understand ecological interactions among species in the North Pacific Ocean	Understand ecological interactions among species in the North Pacific Ocean	Understand ecological interactions among species in the North Pacific Ocean	Understand ecological interactions among species in the North Pacific Ocean	Understand ecological interactions among species in the North Pacific Ocean	Canada reported a positive relationship between the density of NPFC's VME indicator taxa – which was updated with pennatulaceans - and the species richness of benthic taxa.
Impacts of fishing on ecosystem components	Evaluate impacts of fishing on fisheries resources and their ecosystem components, including bycatch species and discards	Evaluate impacts of fishing on fisheries resources and their ecosystem components, including bycatch species and discards	Evaluate impacts of fishing on fisheries resources and their ecosystem components, including bycatch species and discards	Evaluate impacts of fishing on fisheries resources and their ecosystem components, including bycatch species and discards	Evaluate impacts of fishing on fisheries resources and their ecosystem components, including bycatch species and discards	SSC BFME endorsed a synchronized approach for assessing and managing the risk of SAI; Japan and Canada presented their draft assessments of the relative risk of SAI on VMEs and potential

ITEM	2025	2026	2027	2028	2029	Progress
						VMEs.
Climate change	Consider possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on NPFC fisheries resources and species belonging to the same ecosystem or dependent upon or associated with target stocks. Make recommendations to help adapt to climate change and promote resilience in NPFC fisheries	Consider possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on NPFC fisheries resources and species belonging to the same ecosystem or dependent upon or associated with target stocks. Make recommendations to help adapt to climate change and promote resilience in NPFC fisheries	Consider possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on NPFC fisheries resources and species belonging to the same ecosystem or dependent upon or associated with target stocks. Make recommendations to help adapt to climate change and promote resilience in NPFC fisheries	Consider possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on NPFC fisheries resources and species belonging to the same ecosystem or dependent upon or associated with target stocks. Make recommendations to help adapt to climate change and promote resilience in NPFC fisheries	Consider possible key vulnerabilities and management implications of changing oceanographic conditions resulting from climate change on NPFC fisheries resources and species belonging to the same ecosystem or dependent upon or associated with target stocks. Make recommendations to help adapt to climate change and promote resilience in NPFC fisheries	SC discussed implications of climate change for managing priority species. Canada led the analysis of relationships between environmental conditions and Japanese Sardine The SC does not have specific recommendation for the Commission at this time.
Collaboration with other Organizations						
PICES	Review implementation of NPFC-PICES Framework for Collaboration Review ICES-PICES WGSPF activities (PICES WG53) Identify other opportunities for collaboration with PICES.	Review implementation of NPFC-PICES Framework for Collaboration Review ICES-PICES WGSPF activities (PICES WG53) Identify other opportunities for collaboration with PICES.	Review implementation of NPFC-PICES Framework for Collaboration Review ICES-PICES WGSPF activities (PICES WG53) Identify other opportunities for collaboration with PICES	Review implementation of NPFC-PICES Framework for Collaboration Identify other opportunities for collaboration with PICES	Review implementation of NPFC-PICES Framework for Collaboration Identify other opportunities for collaboration with PICES	SC reviewed implementation of NPFC-PICES Framework for Collaboration SC reviewed PICES WG53 activities

ITEM	2025	2026	2027	2028	2029	Progress
FAO	Review NPFC's involvement with the ABNJ Deep-sea fisheries project Review NPFC's partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)	Review NPFC's involvement with the ABNJ Deep-sea fisheries project Review NPFC's partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)	Review NPFC's involvement with the ABNJ Deep-sea fisheries project Review NPFC's partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)	Review NPFC's involvement with the ABNJ Deep-sea fisheries project Review NPFC's partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)	Review NPFC's involvement with the ABNJ Deep-sea fisheries project Review NPFC's partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)	SC reviewed its collaboration with the ABNJ Deep-sea fisheries project SC reviewed its partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)
NPAFC	Undertake scientific activities to achieve relevant deliverables of the NPFC/NPAFC work plan	Undertake scientific activities to achieve relevant deliverables of the NPFC/NPAFC work plan	Undertake scientific activities to achieve relevant deliverables of the NPFC/NPAFC work plan	Undertake scientific activities to achieve relevant deliverables of the NPFC/NPAFC work plan	Undertake scientific activities to achieve relevant deliverables of the NPFC/NPAFC work plan	SC reviewed NPFC/NPAFC activities
Other organizations	Review collaborations with other organizations	Review collaborations with other organizations	Review collaborations with other organizations	Review collaborations with other organizations	Review collaborations with other organizations	
Research and Work Plans						
Terms of Reference	Review SC's Terms of Reference, as needed	Review SC's Terms of Reference, as needed	Review SC's Terms of Reference, as needed	Review SC's Terms of Reference, as needed	Review SC's Terms of Reference, as needed	SC reviewed and revised its TOR
Research Plan	Update SC's rolling 5-year research plan	Update SC's rolling 5-year research plan	Update SC's rolling 5-year research plan	Update SC's rolling 5-year research plan	Update SC's rolling 5-year research plan	SC updated its rolling 5-year research plan
Work Plan	Update SC's rolling 5-year work plan	Update SC's rolling 5-year work plan	Update SC's rolling 5-year work plan	Update SC's rolling 5-year work plan	Update SC's rolling 5-year work plan	SC updated its rolling 5-year work plan
Projects	Review completed and ongoing projects Identify and prioritize new projects and recommend sources of funding	Review completed and ongoing projects Identify and prioritize new projects and recommend sources of funding	Review completed and ongoing projects Identify and prioritize new projects and recommend sources of funding	Review completed and ongoing projects Identify and prioritize new projects and recommend sources of funding	Review completed and ongoing projects Identify and prioritize new projects and recommend sources of funding	SC reviewed its completed and ongoing projects, and recommended new projects and sources of funding
Data Management						
	Review data inventories and the	Review data inventories and the	Review data inventories and the	Review data inventories and the	Review data inventories and the	SC discussed data needs, data gaps, and

ITEM	2025	2026	2027	2028	2029	Progress
	status of data gaps Review data standards in relation to stock assessment of priority species Discuss need for additional sources of data for scientific analyses and associated data management policy	status of data gaps Review data standards in relation to stock assessment of priority species Discuss need for additional sources of data for scientific analyses and associated data management policy	status of data gaps Review data standards in relation to stock assessment of priority species Discuss need for additional sources of data for scientific analyses and associated data management policy	status of data gaps Review data standards in relation to stock assessment of priority species Discuss need for additional sources of data for scientific analyses and associated data management policy	status of data gaps Review data standards in relation to stock assessment of priority species Discuss need for additional sources of data for scientific analyses and associated data management policy	strategies to fill gaps SC discussed data standards in relation to stock assessment of priority species, including the establishment of a centralized data call. SC discussed the need for additional sources of data for scientific analyses and associated data management policy
Recommendations						
Advice	Develop recommendations for the Commission, TCC, and FAC	Develop recommendations for the Commission, TCC, and FAC	Develop recommendations for the Commission, TCC, and FAC	Develop recommendations for the Commission, TCC, and FAC	Develop recommendations for the Commission, TCC, and FAC	SC made recommendations for the Commission, TCC, and FAC
Media Communication						
Press Release	Prepare and publish a press release about SC activities during its meeting	Prepare and publish a press release about SC activities during its meeting	Prepare and publish a press release about SC activities during its meeting	Prepare and publish a press release about SC activities during its meeting	Prepare and publish a press release about SC activities during its meeting	SC drafted and endorsed a press release about SC activities during its SC10 meeting

Annex P:
Stock assessment report for Pacific saury

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^{o} 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.

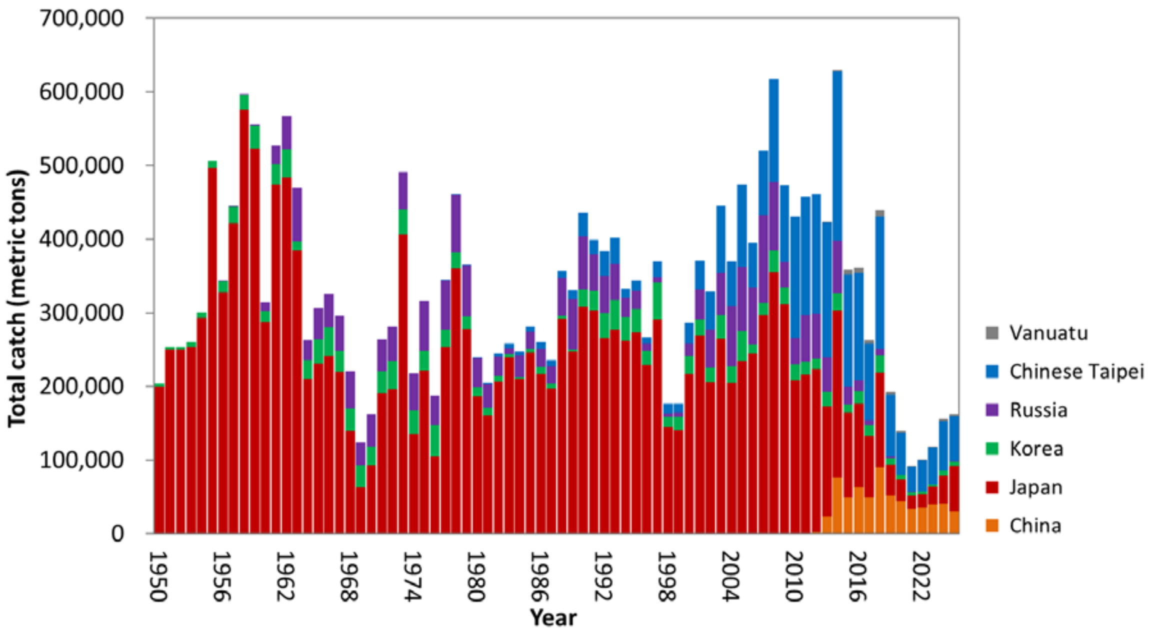


Figure 1. Time series of catch by Member during 1950-2025. The catch data for 1950-1979 are shown but not used in stock assessment modeling. Catch data in 2025 are preliminary (as of 28 November 2025) and not used in the assessment.

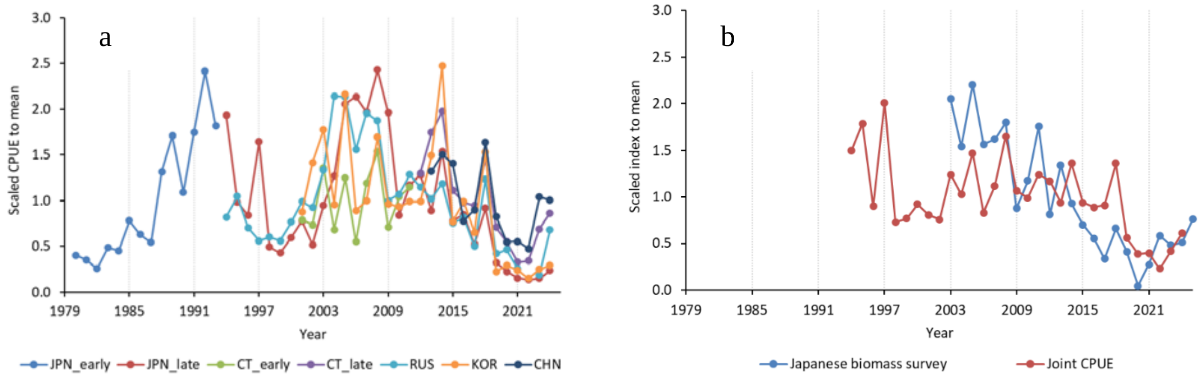


Figure 2. Time series of (a) Japanese survey biomass index and joint CPUE and (b) Member's standardized CPUE indices used in the assessment modeling.

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

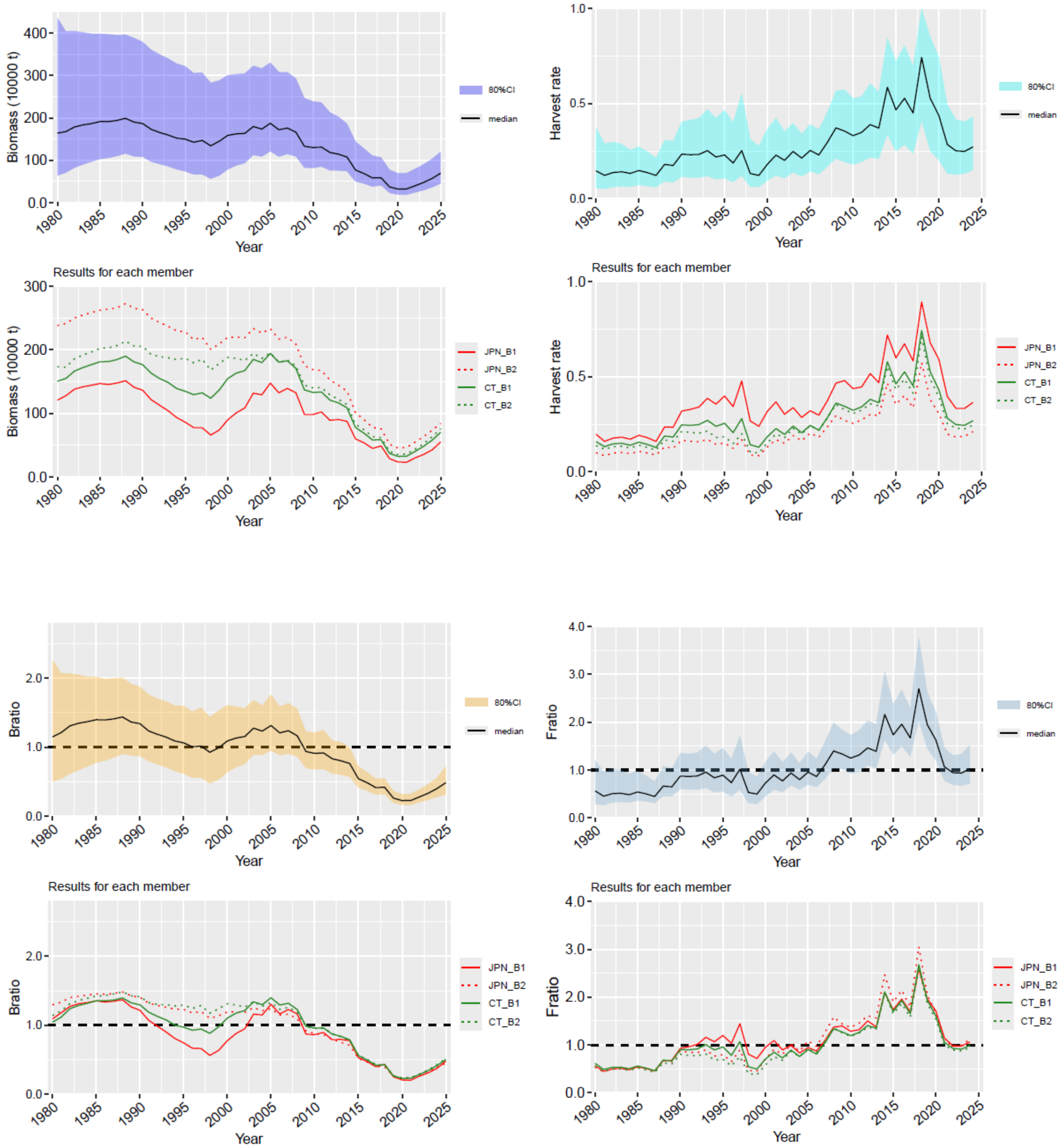


Figure 3. Time series of median estimated values of four runs for biomass, harvest rate, B-ratio, F-ratio and depletion level relative to K. The solid and shaded lines correspond to B1 and B2, respectively.

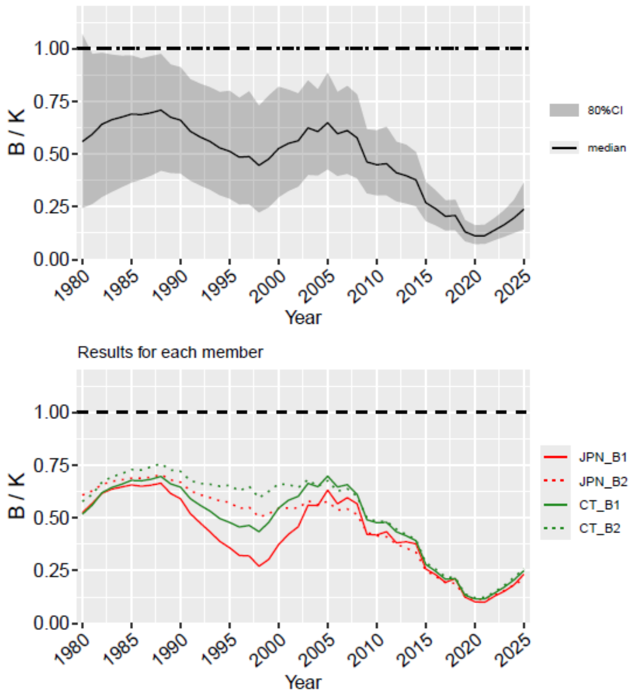


Figure 3 (Continued).

2025 assessment

2024 assessment

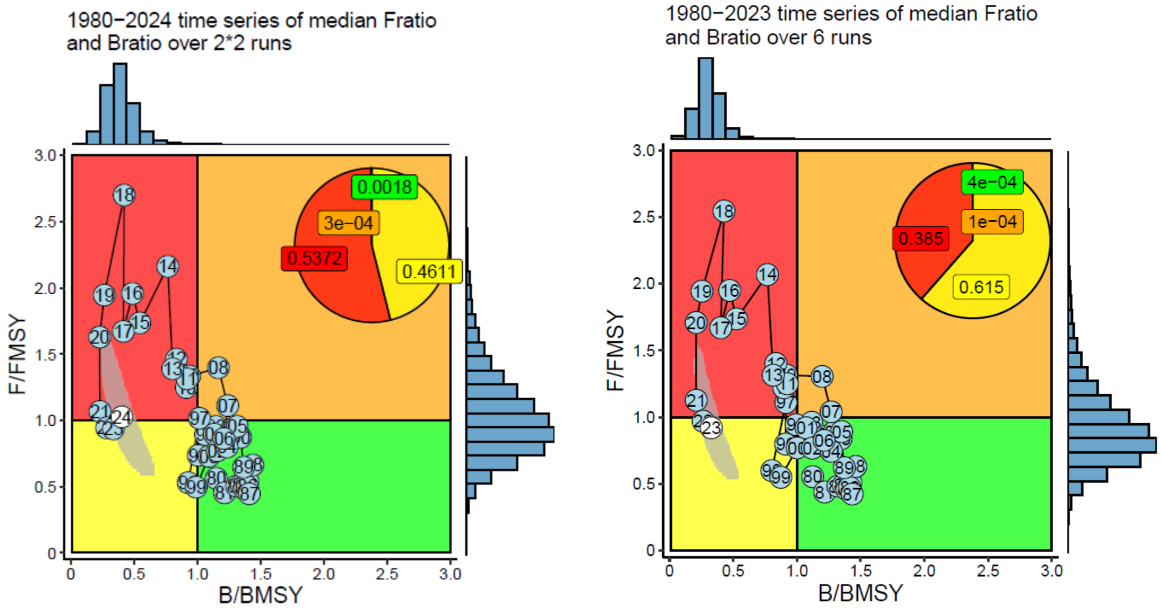


Figure 4. Kobe plot with time trajectory in 2025 (left) and 2024 (right) assessments.

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 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 x 202,500 = 182,250 MT.

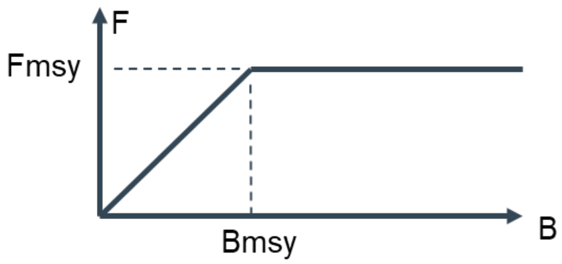


Figure 5. Shapes of the function used in the harvest control rule adopted in 2024 Commission meeting.

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 kisutsh* (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.

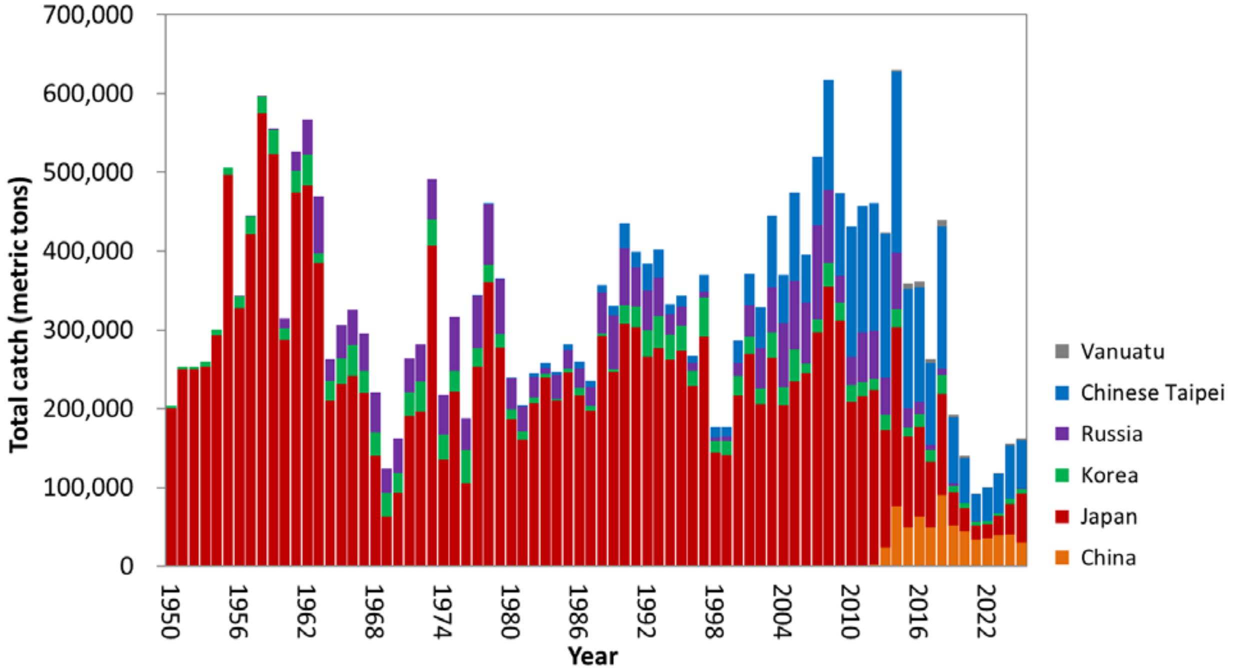


Figure 2. Time series of catch by Member during 1950-2025. The catch data for 1950-1979 are shown but not used in stock assessment modeling. Catch data in 2025 are preliminary (as of 28 November 2025) and not used in the assessment.

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

$$I_{t,biomass} = q_{biomass} B_t \, exp(\, v_{t,biomass}), \qquad \text{where} \;\; v_{t,biomass} \sim N\left(0, \sigma^2_{biomass}\right)$$

where

$q_{biomass}$: the relative bias in biomass estimate
$v_{t,biomass}$: the observation error term in year *t* for survey biomass estimate
$\sigma^2_{biomass}$: the observation error variance for survey biomass estimate

CPUE series

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

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	$I_{t,bio} = q_{bio}\, B_t e^{v_{t,bio}}$ $v_{t,bio} \sim N\left(0, cv_{t,bio}^2 + \sigma^2\right)$ q_{bio} ~ 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) $I_{t,f} = q_f B_t^b e^{v_{t,f}}$ $v_{t,f} \sim N(0, \sigma_f^2)$ σ_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) $I_{t,f} = q_f B_t^b e^{v_{t,f}}$ $v_{t,f} \sim N(0, \sigma_f^2)$ σ_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*) $I_{t,JE} = q_{t,JE} B_t^b e^{v_{t,JE}}$ $v_{t,JE} \sim N(0, \sigma_{JE}^2)$ σ_{JE}^2=$c\ ave(cv_{t,joint}^2 + \sigma^2)$ 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* ~ *U*(0, 1)	*b* ~ *U* (0, 1)	A common parameter for all fisheries but JPN_early, with a prior distribution, *b* ~ *U*(0, 1) [*b* for JPN_early is fixed at 1]	*b* ~ *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
$AveC_{2022\text{-}2024}$	Average catch for a recent period (2023–2024)
$AveF_{2022\text{-}2024}$	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}
$AveF_{2022\text{-}2024}/F_{MSY}$	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
$AveB_{2023\text{-}2025}$	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]
$B_{2023\text{-}2025}/K$	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]
$B_{2023\text{-}2025}/B_{MSY}$	Stock biomass for a recent period (2023–2025) relative to the stock biomass that produces maximum sustainable yield (MSY) [a]

[a]calculated 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.

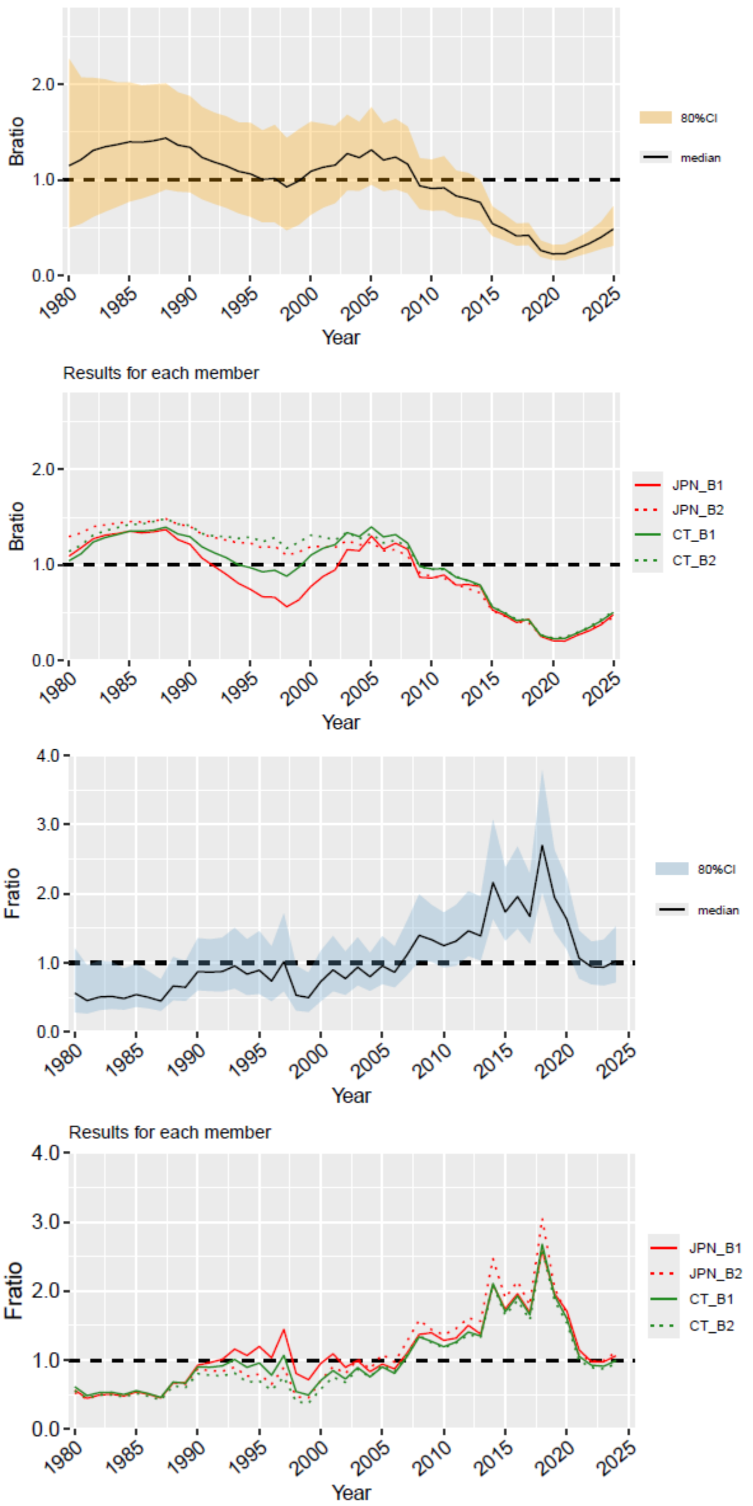


Figure 3. Time series of median estimated values of four runs for biomass, harvest rate, B-ratio, F-ratio and depletion level relative to K. The solid and shaded lines correspond to B1 and B2, respectively.

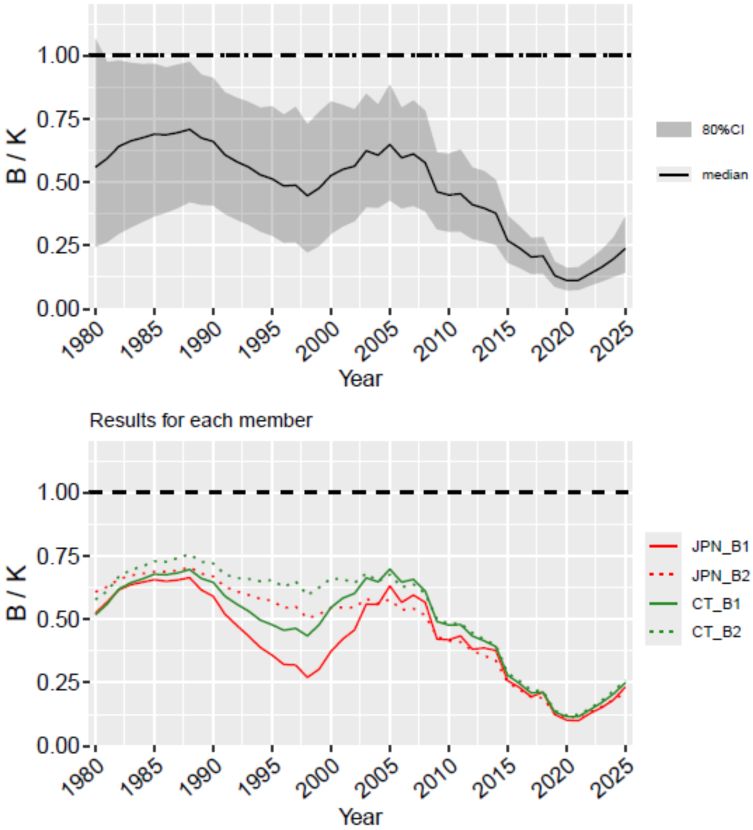


Figure 3 (Continued).

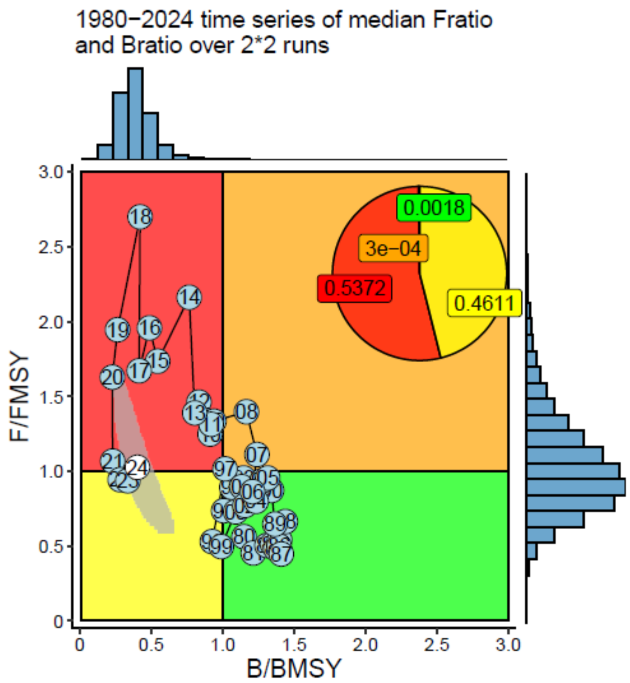


Figure 4. Kobe plot with time trajectory. The data are aggregated across 4 model results (2 base-case models by 2 Members).

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.

REFERENCES

Baitaliuk A.A., Orlov, A.M., & Ermakov, Y.K. 2013. Characteristic features of ecology of the Pacific saury *Cololabis saira* (Scomberesocidae, Beloniformes) in open waters and in the northeast Pacific Ocean. Journal of Ichthyology 53(11): 899-913.

Chow S., Suzuki N., Brodeur R.D., Ueno Y. 2009. Little population structuring and recent evolution of the Pacific saury (*Cololabis saira*) as indicated by mitochondrial and nuclear DNA sequence data. J Exp Mar Biol Ecol 369:17–21.

Fukushima S. 1979. Synoptic analysis of migration and fishing conditions of saury in northwest Pacific Ocean. Bull. Tohoku Reg. Fish. Res. Lab. 41, 1-70.

Gong Y., Suh Y.S. 2013. Effect of climate-ocean changes on the abundance of Pacific saury. J Environ Biol. 34(1): 23-30.

Hotta H. 1960. On the analysis of the population of the Pacific saury (*Cololabis saira*) based on the scales and the otolith characters, and their growth. Bull Tohoku Reg Fish Res Lab 16: 41–64.

Hubbs C.L., Wisner R.L. 1980. Revision of the sauries (Pisces, Scomberesocidae) with descriptions of two new genera and one new species. Fish Bull US 77: 521–566.

Kato S. 1992. Pacific saury. In W.S. Leet, C.M. Dewees, and C.W. Haugen (eds.). Californias living marine resources and their utilization. California Sea Grant Extension Publication UCSGEP-92-12, Davis, CA. P. 199-201.

Konishi K., Tamura T., Isoda T., Okamoto R., Hakamada T., Kiwada H., Matsuoka K. 2009. Feeding strategies and prey consumption of three baleen whale species within the Kuroshio-Current extension. J North Atl Fish Sci 42: 27-40.

Kosaka S. 2000. Life history of the Pacific saury *Cololabis saira* in the northwest Pacific and considerations on resource fluctuations based on it. Bulletin of Tohoku National Fisheries Research Institute 63: 1–96.

Kurita Y., Nemoto Y., Oozeki Y., Hayashizaki K., Ida H. 2004. Variations in patterns of daily changes in otolith increment widths of 0+ Pacific saury, *Cololabis saira*, off Japan by hatch date in relation to the northward feeding migration during spring and summer. Fish Oceanogr 13(Suppl. 1): 54–62.

Nakaya M., Morioka T., Fukunaga K., Murakami N., Ichikawa T., Sekiya S., Suyama S. 2010. Growth and maturation of Pacific saury *Cololabis saira* under laboratory conditions. Fish Sci 76: 45–53.

Nihira A. 1988. Predator－Prey interaction Between Albacore Thunnus alalunga (Bonne terre) and Pacific Saury *Cololabis saira*,　in the area of Emperor seamount Chain in the North Western Pacific Ocean. Bull. Ibaraki Pref. Fish. Exp. Stat. 26: 125-136.

Odate K. 1977. On the feeding habits of the Pacific saury, *Cololabis saira* (Brevoort). Bull. Tohoku Reg. Fish. Res. Lab. 38: 75–88.

Ogi H. 1984. Feeding ecology of the Sooty Shearwater in the western subarctic North Pacific Ocean. Marine Birds: Their Feeding Ecology and Commercial Fisheries Relationships, ed.by D.N. Nettleship et al. Canadian Wildlife Service Special Publication, Ottawa, 78-84.

Parin N.V. 1968. Scomberesocidae (Pisces, Synentognathi) of the eastern Atlantic Ocean. Atlantide Rep. 10: 275-290.

Sato T. and Hirakawa H. 1976. Studies on food habit of coho salmon in the Northwestern Pacific Ocean. Bull. Fukushima Pref. Fish. Exp. Stat. 4: 25-31.

Sugama K. 1957. Analysis of population of the saury (*Cololabis saira* Brevoort) on the basis of character of otolith-I. Bull Hokkaido Reg Fish Res Lab 16: 1–12.

Suyama S., Sakurai Y., Meguro T., and Shimazaki K. 1992. Estimation of the age and growth of Pacific saury *Cololabis saira* in the central North Pacific Ocean determined by otolith daily growth increments. Nippon Suisan Gakkaishi 58: 1607-1614.

Suyama S., Kurita Y., Ueno Y. 2006. Age structure of Pacific saury *Cololabis saira* based on observations of the hyaline zones in the otolith and length frequency distributions. Fish Sci 72: 742–749.

Suyama S., Nakagami M., Naya M., Ueno Y. 2012a. Migration route of Pacific saury *Cololabis saira* inferred from the otolith hyaline zone. Fisheries Science 78(6): 1179-1186.

Suyama S., Nakagami M., Naya M., Ueno Y. 2012b. Comparison of the growth of age-1 Pacific saury *Cololabis saira* in the Western and the Central North Pacific. Fisheries science 78(2): 277-285.

Suyama S., Shimizu A., Isu S., Ozawa H., Morioka T., Nakaya M., Nakagawa T.,·Murakami N., Ichikawa T., Ueno Y. 2016. Determination of the spawning history of Pacific saury *Cololabis saira* from rearing experiments: identification of post-spawning fish from histological observations of ovarian arterioles. Fisheries Science 82(3): 445-457.

Wade J., and Curtis J.M.R. 2015. A review of data sources and catch records for Pacific Saury (*Cololabis saira*) in Canada. Can. Manuscr. Rep. Fish. Aquat. Sci. 3058: iv + 20 p.

Watanabe Y., Butler J.L., Mori T. 1988. Growth of Pacific saury, *Cololabis saira*, in the northeastern and northwestern Pacific Ocean. Fish Bull US 86: 489–498.

Watanabe Y., Lo N.C.H. 1989. Larval production and mortality of Pacific saury, *Cololabis saira*, in the northwestern Pacific Ocean. Fish Bull US 87: 601–613.

Appendix 1

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 (sdmTMB)	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									