North Pacific Fisheries Commission

NPFC-2020-SC05-Final Report

5th Scientific Committee Meeting
REPORT

24-27 November 2020

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North Pacific Fisheries Commission
5th Meeting of the Scientific Committee

24-27 November 2020
Video conference

REPORT

Agenda Item 1. Opening of the meeting

1. The 5th Meeting of the Scientific Committee (SC) took place in the format of video conferencing via WebEx, and was attended by Members from Canada, China, Japan, the Republic of Korea, the Russian Federation, Chinese Taipei, the United States of America and Vanuatu. Dr. Tom Carruthers attended the meeting as an invited expert. The Deep-Sea Conservation Coalition (DSCC), the European Union, the United Nations Food and Agriculture Organization (FAO), the North Pacific Anadromous Fish Commission (NPAFC), the North Pacific Marine Science Organization (PICES) and the Pew Charitable Trusts (Pew) attended as observers. The meeting was opened by Dr. Janelle Curtis (Canada), who served as the SC Chair.

2. The Executive Secretary, Dr. Dae Yeon Moon, welcomed the participants to the meeting. He expressed his gratitude to Vanuatu, who had originally offered to host the meetings of the SC and its three subsidiary bodies, before the outbreak of the COVID-19 pandemic, and hoped that the participants would be able to meet in person in Vanuatu at some point in the future. Lastly, Dr. Moon expressed his hope for a successful and productive meeting.

3. Mr. Alex Meyer was selected as rapporteur.

Agenda Item 2. Adoption of Agenda

4. The SC noted the intention of Dr. Oleg Katugin (Russia) to resign from his position as the Chair of the Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA) and agreed to add a new agenda item, 4.3.3, "Selection of TWG CMSA Chair and Vice-Chair."

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

Agenda Item 3. Meeting arrangements

6. The Science Manager, Dr. Aleksandr Zavolokin, outlined the meeting arrangements.

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

4.1 SSC on Bottom Fish and Marine Ecosystems

7. 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 1st SSC BF-ME meeting (NPFC-2020-SSC BFME01-Final Report).

8. The SC reviewed the recommendations of the SSC BF-ME and endorsed the following recommendations:
   (a) Endorse the revised CMM 2019-05 (Annex D)
   (b) Revise CMM 2019-05 to protect the two areas identified as potential VME sites in NPFC-2020-SSC BFME01-WP03
   (c) Endorse the revised requirements for reporting of an encounter of VME indicator taxa and the collection of supplementary information in CMM 2019-06 in accordance with paragraph 41 of the SSC BF-ME01 report
   (d) Adopt the VME taxa identification guide for the Western North Pacific: https://www.npfc.int/system/files/2020-09/NPFC%20VME%20taxa%20ID%20guide.pdf
   (e) Endorse the updated 2020-2024 SSC BF-ME 5-Year Rolling Work Plan (NPFC-2020-SSC BFME01-WP01 (Rev. 1))
   (f) Hold a 3-day meeting of the SSC BF-ME in 2021
   (g) Hold intersessional meetings of the SWG NPA&SA and SWG VME

4.2 SSC on Pacific Saury

9. The Chair of the SSC on Pacific Saury (SSC PS), Dr. Toshihide Kitakado (Japan), summarized the outcomes and recommendations of the 5th and 6th SSC PS meetings (NPFC-2019-SSC PS05-Final Report, NPFC-2020-SSC PS06-Final Report).

10. The SC reviewed the recommendations of the SSC PS and endorsed the following recommendations:
    (a) Endorse the Terms of Reference for the SSC PS proposed at the SSC PS05 meeting.
    (b) Endorse the CPUE Standardization Protocol revised at the SSC PS05 meeting.
    (c) Endorse the stock assessment report produced during the SSC PS06 meeting (Annex E).
    (d) Further measures should be taken to effectively avoid the decreasing trend identified by:

(i) Stock assessment conducted by China, Japan and Chinese Taipei (Annex E)
(ii) Members' and joint standardized CPUEs up to 2019 (Annex F)
(iii) Japan's fishery-independent biomass index up to 2020 (Annex G)
(iv) Members' catch up to 2019 and preliminary 2020 catch as of 14 November 2020 (Annex H)
(v) Members' preliminary estimates of nominal CPUEs up to 2020

(e) Endorse the SSC PS 5-year rolling Work Plan (NPFC-2020-SSC PS06-WP01 (Rev. 1)).
(f) Allocate funds for the participation of an invited expert in the next SSC PS meetings.
(g) Hold two four-day SSC PS meetings in 2021, in October and December.

11. The SC noted the status of the Pacific saury stock and the stock assessment results based on fishery-dependent indices up to 2018 and fishery-independent index up to 2019 as follows:
    (a) All six base case model runs indicate that recent Pacific saury stock size in 2019 was less than Bmsy.
    (b) A majority of base case model comparisons indicate that recent harvest rates for Pacific saury were higher than Fmsy.
    (c) Additional data for 2019-2020 indicate Pacific saury biomass continued to decline after 2019 to a relatively low level in 2020. In particular, CPUE and catch data for 2019, preliminary fishery data through mid-November 2020 and Japanese survey data for 2020 were presented and discussed but could not be included in BSSPM analysis due to time constraints and concerns about the plausibility of the very low survey biomass estimate.
    (d) The current stock assessment uses a CPUE series of up to 2018, thereby producing assessment results with a 3-year time lag between the data and the report to the Commission meeting planned to be held in early 2021.
    (e) Noting that the CPUE data for 2019 have become available and recognizing the importance of using all available scientific information for the stock assessment, it is suggested, subject to approval from Members' governments, to hold a special meeting for conducting an updated Pacific saury stock assessment in January 2021 using the 2019 CPUE data after cross-checking the computer code of Members' stock assessment analyses. This would reduce the time lag between data availability and report to the Commission and also enhance the transparency and reproducibility of the analyses.

12. Russia stated that, in view of the existing negative trend in the Pacific saury stock abundance, and taking into account the emerging issues during discussions on the Pacific saury stock assessment, Russia will consider, in 2021, the possibility to collect, using national observers, additional information on the Pacific saury distribution and biology, which may provide deeper understanding of the Pacific saury stock fluctuations.

13. The SC noted that Vanuatu is a small island developing state which is still developing its fishery, and that Vanuatu urges the SC to consider its aspirations when making recommendations to the Commission.

4.3 Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA)

14. The TWG CMSA Chair, Dr. Oleg Katugin, summarized the outcomes and recommendations of the 3rd TWG CMSA meeting (NPFC-2020-TWG CMSA03-Final Report).

15. The SC expressed its gratitude to Dr. Katugin for his thoughtful guidance and influence within the NPFC, in particular his leadership during the past three years as the Chair of the TWG CMSA.

16. The SC reviewed the recommendations of the TWG CMSA and endorsed the following recommendations:
    (a) The TWG CMSA recommended hiring an external expert to continue the work to develop an operating model and simulation test chub mackerel stock assessment models using PopSim.
    (b) The TWG CMSA recommended the adoption of the final report on PopSim-A operating models for chub mackerel.
    (c) The TWG CMSA recommended the 5-year rolling Work Plan of the TWG CMSA (NPFC-2020-TWG CMSA03-WP01 (Rev. 1)).
    (d) The TWG CMSA recommended that reporting requirements be changed such that Convention Area chub mackerel fisheries be required to report bycatch of pelagic species (in weight or numbers, by species).
    (e) The TWG CMSA recommended holding meetings in spring 2021 and winter 2021/2022, with the specific dates and meeting format to be determined intersessionally via correspondence.
    (f) The TWG CMSA requested the SC to elect a new Chair and a Vice-Chair.

17. The SC noted that:
    (a) The TWG CMSA will hold intersessional web meetings of the SWG OM to assess progress on its development.
    (b) Members will communicate their views to the Secretariat on the establishment of an observer program for chub mackerel.

4.3.1 Management Strategy Evaluation (MSE) for chub mackerel

18. The SC reviewed the recommendations of the TWG CMSA regarding MSE for chub mackerel and endorsed the following recommendations:
    (a) The TWG CMSA recommended to request the Commission to give guidance on how to move forward, including setting management objectives for the development of the MSE.
    (b) The TWG CMSA recommended hiring an external expert for the development of the MSE.

19. The SC recommended that the Commission itself also hire an external expert to support the Commission with the development of the MSE process including setting objectives, stages and timelines and overseeing the implementation of the framework.

4.3.2 EU application for accession to NPFC

20. The SC noted that the EU had updated its Fisheries Operation Plan in accordance with the requests of TWG CMSA03.

21. The SC requested the EU to further update its Fisheries Operation Plan to revise the description of the Japanese domestic stock assessment for chub mackerel, specifically the section on future projections.

22. The SC noted that the EU's Fisheries Operation Plan included plans to fish not only for chub mackerel but also other NPFC priority species. The SC noted that the current CMM for chub mackerel, CMM 2019-07, as well as CMMs for most NPFC priority species, are effort-based rather than catch-based, and that the EU's accession to the NPFC could result in increased fishing effort for these species. The SC suggested that catch-based measures may be more effective for ensuring the long-term sustainability of chub mackerel and other priority species, but recognized that it had not made enough progress in its stock assessment work to provide advice on such measures.

23. The SC concluded that it currently does not have enough information to determine how a potential expansion of fishing effort or catch arising from the EU's accession to the NPFC would affect the long-term sustainability of chub mackerel and other NPFC priority species.

4.3.3 Selection of TWG CMSA Chair and Vice-Chair

24. The SC selected Dr. Vladimir Kulik (Russia) to serve as the new TWG CMSA Chair and Dr. Kazuhiro Oshima (Japan) to serve as the TWG CMSA Vice-Chair.

Agenda Item 5. Priority species

5.1 Summary of progress on the other four priority species (Neon flying squid, Japanese flying squid,

Japanese Sardine, Spotted Mackerel)

25. No updates were provided.

5.2 Identification of data needs and data gaps and discussion on an observer program and other ways to fill data gaps

26. Ms. Raiana McKinney (Pew) outlined the key elements for the NPFC to consider when developing an electronic monitoring (EM) program (NPFC-2020-SC05-OP03). These are stakeholder engagement, outreach and communication; program objectives and coverage levels; program structure; standards for data collection, transmission, and storage; and data review and privacy. Pew recommended that the NPFC support and prioritize the continued development of a regional observer program, and include supporting language to develop minimum standards for the implementation of EM and a work plan for making progress.

27. The SC noted the potential value of an EM system, while recognizing the need to conduct further research and reviews to understand the potential capabilities of an EM system, the potential scientific need for it, the feasibility of its application, and other relevant questions.

28. The SC requested that its subsidiary bodies provide advice to the SC regarding the types of data that would be relevant to their work and could be collected by an EM system or an observer program.

5.3 Establishment of a new SSC on these four priority species

29. The Science Manager presented a partial list of participants for small working groups (SWG) for working towards stock assessment of priority species not addressed by SSC BF-ME, SSC PS, or TWG CMSA (NPFC-2020-SC05-IP01).

30. The SC established four SWGs for the priority species: SWG on Neon Flying Squid (SWG NFS) led by Dr. Luoliang Xu (China), SWG on Japanese Flying Squid (SWG JFS) led by Ms. Kari Fenske (USA), SWG on Japanese Sardine (SWG JS) led by Dr. Chris Rooper (Canada), and SWG on Spotted Mackerel (SWG SM) led by Dr. Shota Nishijima (Japan). Members reviewed the list of participants for the SWGs and agreed to complete it through correspondence. The SC requested that the SWGs compile information on the aforementioned priority species intersessionally and report to the next SC meeting. The SC agreed to revisit the issues of the establishment of a new SSC for other priority species at its next meeting.

5.4 Development of summary sheets for all priority species

31. The United States presented a proposed template for a series of "species summary" documents

using North Pacific armorhead as an example (NPFC-2020-SSC BFME01-WP02). Such documents would provide a concise summary of information on the NPFC priority species, identify potential data gaps, and track progress towards establishing management targets or limits to determine stock status.

32. The SC reviewed the proposed template and agreed to develop it further, making the following suggestions:
    (a) Include information on biological characteristics and behavior, if needed
    (b) Divide the species summary into two components: A species profile and a data report for that species

33. The SC requested that the United States, the Chairs of the SC subsidiary bodies and the leads of the SWGs for neon flying squid, Japanese flying squid, Japanese sardine, and spotted mackerel use the template to prepare summaries for those species and, in doing so, identify ways to further improve the template.

Agenda Item 6. Progress in data collection, management and security

6.1 Information management and security regulations

6.1.1 Review of the Interim Regulations for Management of Scientific Data and Information

34. The SC reviewed the Interim Regulations for Management of Scientific Data and Information. The SC recommended that the Commission endorse them as formal regulations ("Regulations for Management of Scientific Data and Information") of the SC and its subsidiary bodies. The SC requested that the Technical and Compliance Committee (TCC) consider the inclusion of the regulations as an annex in the NPFC Data Sharing and Data Security Protocols that the TCC is developing as an overarching data policy for the Commission.

6.1.2 NPFC Data Sharing and Data Security Protocols

6.1.3 NPFC Data-Sharing and Data-Security Protocols for Vessel Monitoring System (VMS) Data
Information management and security regulations

35. The Compliance Manager, Mr. Peter Flewwelling, reported on the ongoing work to draft the NPFC Data Sharing and Data Security Protocol (NPFC-2020-SC05-WP06) and the NPFC Data-Sharing and Data-Security Protocol for Vessel Monitoring System (VMS) Data (NPFC-2020-SC05-WP07), highlighting the sections that were relevant to the SC.

36. The SC noted that VMS data may be useful for scientific analyses and agreed with the proposed definition of "Scientific purposes" which may include estimating distribution of fishing effort for use in the Commission's research activities; planning for and implementing tagging

programs; modelling fishing effort for use in fisheries management activities, including management strategy evaluation (MSE); estimating abundance indices or undertaking stock assessments; validating logbook data; and, any other scientific purposes agreed to by the Commission.

6.2 NPFC data management system (DMS)

37. The Data Coordinator, Mr. Mervin Ogawa, reported on the progress in the development of the SC-related data management system (NPFC-2020-SC05-WP08). Quick links have been added to the front page of the NPFC website for easier access to pages that Members need to visit regularly, such as significant dates/events, Pacific Saury Weekly Report, collaboration, and e-annual reports. In addition, the NPFC GIS Map has been updated to include Pacific Saury Catch and Effort data, including sea surface temperature per grid from 1994 to 2018. The Data Coordinator informed the participants that from 2021 Members are requested to submit their annual reports through the e-annual report system on the NPFC website.

Agenda Item 7. Scientific projects for 2021 and 2022

7.1 Ongoing/planned projects

7.2 New projects

7.3 Review and prioritization of projects

38. The Science Manager presented a draft list of scientific projects that were discussed during the meetings of the SC and its subsidiary bodies.

39. The SC reviewed and revised the list of proposed scientific projects and endorsed it for consideration by the Commission (Annex I).

Agenda Item 8. Cooperation with other organizations

40. The Science Manager presented a compiled list of cooperation opportunities and requests from other organizations, for consideration by the SC (NPFC-2020-SC05-IP02).

8.1 Reports on the joint NPFC-PICES activities since the SC04 meeting, including a report from PICES Secretariat

41. The Executive Secretary of PICES, Dr. Sonia Batten, reported on recent and upcoming PICES activities of relevance to the NPFC:
    (a) Two joint workshops were held at the PICES-2019 Annual Meeting (PICES-NPFC: influence of the environment on Pacific saury; PICES-NPAFC-NPFC: developing a collaborative, integrated ecosystem survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic

fishes across the North Pacific Ocean).

(b) At the PICES-2020 virtual Annual Meeting, a virtual workshop on research priorities for understanding the population dynamics of small pelagic fish in the North Pacific and a virtual theme session on implementing a collaborative, integrated ecosystem high seas survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean were held.

(c) Small Pelagic Fish: New Frontiers in Science for Sustainable Management, a joint PICES-ICES SPF symposium, is planned to be held in Lisbon, Portugal, from 21 to 25 February 2022, and PICES has made a formal request to NPFC for support for the symposium.

(d) PICES has approved the establishment of a new Working Group on Ecology of Seamounts, which should offer opportunities for collaboration between PICES and NPFC.

(e) An NPFC-PICES co-sponsored course on VME indicator taxa identification is planned to be held in fall 2021, for which PICES has decided to provide 15,000 US dollars as financial support.

42. The SC considered the invitation from PICES to provide support for PICES-ICES small pelagic fish (SPF) symposium (NPFC-2020-SC05-OP04) and recommended that the Commission provide financial support of 15,000 US dollars for the symposium, as well as travel support for three members of the SC or its subsidiary bodies to attend the symposium.

8.2 Joint PICES-ICES WGSPF, PICES topic session on small pelagic fish and PICES-ICES SPF symposium

43. Dr. Toshihide Kitakado provided an update on the work of the Joint ICES/PICES WGSPF, outlining the WGSPF's Terms of Reference and the activities of its task forces. Two NPFC representatives, Dr. Toshihide Kitakado and Dr. Oleg Katugin, have been designated as the NPFC's representatives to the WGSPF.

44. Dr. Toshihide Kitakado reported that he has been designated as NPFC representative to serve on the Scientific Steering Committee of the PICES-ICES SPF symposium, Small Pelagic Fish: New Frontiers in Science for Sustainable Management.

8.3 Joint NPFC-PICES workshop/course on VME indicator identification

45. Russia provided an update on the proposed joint NPFC-PICES course on VME indicator taxa identification. Russia reiterated its intention to host the course but explained that, due to the COVID-19 pandemic, there are uncertainties about its ability to do so. Russia hoped to be able to provide an update to Members in early 2021.

46. The Science Manager informed the SC that updated details about the course can be found in NPFC-2020-SSC BFME01-IP02 (Rev. 1).

8.4 SC representation at PICES meetings

47. The SC recommended that the Commission financially support the travel of two members of the SC or its subsidiary bodies to participate in the PICES Annual Meetings in 2021, if financial support is necessary.

8.5 Memorandum of Cooperation between NPFC and NPAFC

8.5.1 Work plan to implement NPFC/NPAFC Memorandum of Cooperation

48. The Science Manager presented the draft Work plan to implement NPAFC/NPFC Memorandum of Cooperation, 2021-2025 (NPFC-2020-SC05-WP04) for the consideration of the SC.

49. The SC reviewed the work plan and did not propose any revisions.

8.5.2 NPAFC's multinational survey in the North Pacific Ocean

50. The Executive Director of the NPAFC, Dr. Vladimir Radchenko, provided an update on the NPAFC's multinational survey in the North Pacific Ocean (NPFC-2020-SC05-OP06). NPAFC is planning to conduct a comprehensive pan-Pacific survey of pelagic ecosystems to estimate abundance, distribution, migration, growth, fitness and survival of Pacific salmon and ecologically related species. The NPAFC invites the NPFC to provide financial support for chartering a research vessel, engage NPFC scientists in expedition planning, and consider a joint NPAFC/NPFC/PICES/ICES proposal for the UN Decade of Ocean Science.

51. The SC recognized the importance of the NPAFC's multinational survey and the scientific knowledge it will generate, particularly data that would provide greater insight into the distribution and migration of NPFC's six pelagic priority species, all of which have been reported as bycatch in historical salmon research surveys in the planned survey area. The SC recommended that the Commission provide financial support of 10,000 US dollars for the survey and encouraged Member scientists to collaborate with the survey. Furthermore, the SC requested the Finance and Administration Committee (FAC) to consider providing further financial support for the survey, in light of the great scientific value of the project. The SC requested the Secretariat to work with the NPAFC to prepare further detailed information about the planned survey to facilitate the discussions of the FAC.

8.6 UN Decade of Ocean Science

52. Dr. Sonia Batten reported on the ongoing work to develop a scientific program for the UN Decade of Ocean Science for Sustainable Development, in collaboration with partner organizations.

53. The SC looked forward to hearing more about PICES' participation in the UN Decade of Ocean Science and how the NPFC may be able to cooperate.

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

54. Mr. Aureliano Gentile (FAO) presented a proposal for NPFC's participation in the FIRMS Partnership (NPFC-2020-SC05-OP01). FIRMS is aimed at facilitating access to information on the status and trends of marine resources and fisheries to develop effective fisheries policies and management plans. The NPFC is invited to join the FIRMS Partnership, under either a Partnership Arrangement or a Collaborative Arrangement.

55. The SC recognized the value of FIRMS and the overlap between the goals of the NPFC and that of FIRMS. However, as the NPFC is in the process of developing scientific knowledge, the SC agreed to continue to learn more about FIRMS and reconsider whether to participate in the FIRMS Partnership at the next SC meeting.

8.8 Cooperation with other organizations

56. Dr. William Emerson (FAO) provided an update on Areas Beyond National Jurisdiction (ABNJ) Deep Seas Fisheries Project (NPFC-2020-SC05-OP05). The project is now in the development of its second phase and has four components: governance, legal, enforcement, compliance; science and science-management interface; cross-sectoral activities affecting deep seas fisheries; and knowledge management and communication. Among the expected outcomes of the project, those of particular relevance to the SC are the project's contributions to more effective decision-making, improved advice, better understanding of the impacts of deep sea fisheries on biodiversity, and cross-sector integration. The Secretariat informed that the FAO questionnaire on project outputs and activities has been circulated to Members for feedback.

57. The SC reaffirmed its support for the ABNJ Deep Seas Fisheries Project and recognized the great value of the contribution made by the Project to the NPFC.

58. Mr. Marc Taconet (FAO) presented a proposal for NPFC to participate in research collaboration with FAO and Global Fishing Watch (GFW) on the use of Automatic Identification System (AIS) data technology to improve monitoring of high seas fisheries

(NPFC-2020-SC05-OP02). Possible research objectives would be identifying gaps in fishing activity monitoring, analyzing fishing interactions among RFMO mandates, improving classification of AIS fishing activity by gear, providing refined measurements of fishing effort to improve estimates of effort and CPUEs, addressing the feasibility of producing near-to-real-time indications of aggregated catch, contributing to ecosystem assessments, and contributing to monitoring and prediction of the effects of climate change.

59. The SC recommended that the NPFC collaborate with FAO and GFW on the proposed project on the use of AIS data technology for scientific analyses and requested the Secretariat to liaise with Members and FAO to determine the process for moving forward with such collaboration.

60. Dr. Chris Rooper reported that he recently attended an International Seabed Authority workshop on seabed mining in the northwestern Pacific. The workshop identified potential maps and datasets, attempted to model cumulative effects of mining on ecosystems, and overlaid maps of ecosystem features to identify areas of particular environmental concern.

Agenda Item 9. 2020-2024 Research Plan and Work Plan

9.1 Five-year Research Plan

9.2 Five-year Work Plan

61. The SC reviewed its 2020-2024 Five-Year Rolling Research Plan and Work Plan. The Research Plan and the Work Plan of the SC and its subsidiary bodies are attached as Annex J.

Agenda Item 10. Other matters

10.1 Review of the Scientific Committee Terms of Reference (TOR)

62. The SC revised its TOR to:
    (a) allow Chairs of the SC subsidiary bodies to 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, in accordance with the decision made by the Commission at its 5th meeting,
    (b) allow the Chair of the SC to be reelected for two additional terms of two years, with a maximum of three successive terms of two years each, and
    (c) clarify that in the case that the SC Chair is unable or unwilling to serve a full term, the Vice-Chair would assume the Chair's position for the balance of the vacated term or until the Commission elects a new Chairperson, in accordance with paragraph 4.5 of the Rules of Procedure.

63. The revised SC TOR is attached as Annex K.

10.2 Coordination between SC and TCC

64. Based on the discussion above, the SC identifies the following as matters for coordination between SC and TCC:
    (a) Revision of CMM 2019-05.
    (b) Revisions to the requirements for reporting of an encounter of VME indicator taxa and the collection of supplementary information in CMM 2019-06.
    (c) Proposal for revisions to pelagic species bycatch reporting requirements for Convention Area chub mackerel fisheries.
    (d) Proposal for revision of CMM 2019-05 to protect the two areas identified as potential VME sites in NPFC-2020-SSC BFME01-WP03.
    (e) Proposal for inclusion of the Regulations for Management of Scientific Data and Information in the NPFC Data Sharing and Data Security Protocols.
    (f) Request to the Commission to give guidance on MSE process for chub mackerel including setting objectives, stages and timelines and overseeing the implementation of the framework.

10.3 Other issues

65. No other issues were discussed.

Agenda Item 11. Advice and recommendations to the Commission

66. Based on the recommendations from its SSCs and TWG CMSA, the SC recommends that the Commission:
    (a) Endorse the revised Research Plan and Work Plan (Annex J).
    (b) Endorse the proposed scientific projects (Annex I).
    (c) Endorse the Regulations for Management of Scientific Data and Information as formal regulations for the SC.
    (d) Endorse the revised SC TOR (Annex K).
    (e) Consider the scientific meetings schedule for 2021 as described in paragraph 68.

    Bottom Fish and Marine Ecosystems

    (f) Endorse the revised CMM 2019-05 as described in Annex D.
    (g) Revise CMM 2019-05 to protect the two areas identified as potential VME sites in NPFC-2020-SSC BFME01-WP03
    (h) Endorse the revised requirements for reporting of an encounter of VME indicator taxa and the collection of supplementary information in CMM 2019-06 in accordance with paragraph 41 of NPFC-2020-SSC BFME01-Final Report.

(i) Adopt the VME taxa identification guide for the Western North Pacific

Pacific Saury

(j) Consider the stock assessment results for Pacific saury (paragraph 11, Annex E).

(k) Consider further measures to effectively avoid the decreasing trend identified by:

  (i) Stock assessment conducted by China, Japan and Chinese Taipei (Annex E)

  (ii) Members' and joint standardized CPUEs up to 2019 (Annex F)

  (iii) Japan's fishery-independent biomass index up to 2020 (Annex G)

  (iv) Members' catch up to 2019 and preliminary 2020 catch as of 14 November 2020 (Annex H)

  (v) Members' preliminary estimates of nominal CPUEs up to 2020

(l) Fund the participation of an invited expert in the next SSC PS meetings.

Chub Mackerel

(m) Contract an external expert to continue the work of the TWG CMSA to develop an operating model and simulation test chub mackerel stock assessment models using PopSim.

(n) Revise reporting requirements such that Convention Area chub mackerel fisheries be required to report bycatch of pelagic species (in weight or numbers, by species).

(o) Contract an external expert to support the TWG CMSA in developing the MSE.

(p) Give guidance on how to move forward, including setting management objectives for the development of the MSE.

(q) Contract an external expert to support the Commission in developing the MSE process including setting objectives, stages and timelines and overseeing the implementation of the framework.

Data Sharing

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

Cooperation with Other Organizations

(s) Provide financial support of 15,000 US dollars for the joint PICES-ICES SPF symposium, as well as travel support for three members of the SC or its subsidiary bodies to attend the symposium.

(t) Financially support the travel of two participants of the SC or its subsidiary bodies to participate in the 2021 PICES Annual Meeting, if necessary.

(u) Provide financial support of 10,000 US dollars for the NPAFC pan-Pacific multinational survey.

(v) Consider collaboration with FAO and GFW on the use of AIS data technology to improve monitoring of high sea fisheries for scientific analyses.

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

Species Summary Documents

(a) The SC is working to develop a template for species summary documents for NPFC priority species that would provide a concise summary of information on the species, identify potential data gaps, and track progress towards establishing management targets or limits to determine stock status.

Bottom Fish and Marine Ecosystems

(b) The SSC BF-ME will hold informal web meetings of the SWG NPA&SA and SWG VME to check their progress and plan intersessional work.

Pacific Saury

(c) The SSC PS suggested, subject to approval from Members' governments, to hold a special meeting for conducting an updated Pacific saury stock assessment in January 2021 using the 2019 CPUE data after cross-checking the computer code of Members' stock assessment analyses.

Chub Mackerel

(d) The TWG CMSA will hold informal web meetings of the SWG OM to assess progress on operating model development.

Other priority species

(e) The SC established four SWGs for priority species: SWG on Neon Flying Squid (SWG NFS), SWG on Japanese Flying Squid (SWG JFS), SWG on Japanese Sardine (SWG JS), and SWG on Spotted Mackerel (SWG SM) to work intersessionally on data collation and species summaries.

EU Application for Accession to NPFC

(f) The SC concluded that it currently does not have enough information to determine how a potential expansion of fishing effort or catch arising from the EU's accession to the NPFC would affect the long-term sustainability of chub mackerel and other NPFC priority species.

Observer Program

(g) The SC noted the potential value of an Electronic Monitoring (EM) system, while recognizing the need to conduct further research and reviews to understand the potential capabilities of an EM system, the potential scientific need for it, the feasibility of introducing it, and other relevant questions.

(h) The SC will continue discussions on the establishment of an observer program, including regarding the types of data that would be relevant to their work and could be collected by a human observer program and/or electronic monitoring system.

Cooperation with Other Organizations

(i) The SC requested the FAC to consider providing further financial support for the NPAFC multinational survey, in light of the great scientific value of the project.

(j) The SC agreed to continue to learn more about FIRMS and reconsider whether to participate in the FIRMS Partnership at the next SC meeting.

Agenda Item 12. Next meeting

68. The SC suggested the following meeting schedule for 2021:

(a) TWG CMSA04: Spring 2021

(b) SSC PS07: Autumn 2021

(c) SSC-BF-ME02, SSC PS08, SC06: December 2021

(d) TWG CMSA05: Winter 2021/2022

Agenda Item 13. Press release

69. The SC endorsed the press release for the publication on the NPFC website after the meeting.

Agenda Item 14. Adoption of the Report

70. The SC05 Report was adopted by consensus.

Agenda Item 15. Close of the Meeting

71. The meeting closed at 10:03 on 27 November 2020, Tokyo time.

Annexes:

Annex A – Agenda

Annex B – List of documents

Annex C – List of participants

Annex D – Revised CMM 2019-05 - Conservation and Management Measure for Bottom Fisheries and Protection of Vulnerable Marine Ecosystems in the Northwestern Pacific Ocean

Annex E – Stock Assessment Report for Pacific Saury

Annex F – Updated total catch, CPUE standardizations and survey biomass indices for the stock assessment of Pacific saury

Annex G – Japan's fishery-independent biomass index from 2003 to 2020

Annex H – Members' Pacific saury catches up to 2020, with preliminary catch statistics as of 14 November 2020

Annex I – Scientific projects for 2017-2021

Annex J – Five-Year Research Plan and Work Plan of the Scientific Committee

Annex K – Scientific Committee Terms of Reference

Annex A

Agenda

Agenda Item 1. Opening of the Meeting

Agenda Item 2. Adoption of Agenda

Agenda Item 3. Meeting arrangements

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

- 4.1 SSC on Bottom Fish and Marine Ecosystems
- 4.2 SSC on Pacific Saury
- 4.3 Technical Working Group on Chub Mackerel Stock Assessment
  - 4.3.1 Management Strategy Evaluation (MSE) for chub mackerel
  - 4.3.2 EU application for accession to NPFC
  - 4.3.3 Selection of TWG CMSA Chair and Vice-Chair

Agenda Item 5. Priority species

- 5.1 Summary of progress on other four priority species (Neon flying squid, Japanese flying squid, Japanese Sardine, Spotted Mackerel)
- 5.2 Identification of data needs and data gaps and discussion on an observer program and other ways to fill data gaps
- 5.3 Establishment of a new SSC on these four priority species
- 5.4 Development of summary sheets for all priority species

Agenda Item 6. Progress in data collection, management and security

- 6.1 Information management and security regulations
  - 6.1.1 Review of the Interim Regulations for Management of Scientific Data and Information
  - 6.1.2 NPFC Data Sharing and Data Security Protocols
  - 6.1.3 NPFC Data-Sharing and Data-Security Protocols for Vessel Monitoring System (VMS) Data
- 6.2 NPFC data management system (DMS)

Agenda Item 7. Scientific projects for 2021 and 2022

- 7.1 Ongoing/planned projects
- 7.2 New projects

7.3 Review and prioritization of projects

Agenda Item 8. Cooperation with other organizations

8.1 Reports on the joint NPFC-PICES activities since the SC04 meeting, including a report from PICES Secretariat

8.2 Joint PICES-ICES WGSPF, PICES topic session on small pelagic fish (SPF) and PICES-ICES SPF symposium

8.3 Joint NPFC-PICES workshop/course on VME indicator identification

8.4 SC representation at PICES meetings

8.5 Memorandum of Cooperation between NPFC and NPAFC

8.5.1 Work plan to implement NPFC/NPAFC Memorandum of Cooperation

8.5.2 NPAFC's multinational survey in the North Pacific Ocean

8.6 UN Decade of Ocean Science

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

8.8 Cooperation with other organizations

Agenda Item 9. 2020-2024 Research Plan and Work Plan

9.1 Five-year Research Plan

9.2 Five-year Work Plan

Agenda Item 10. Other matters

10.1 Review of the Scientific Committee Terms of Reference (TOR)

10.2 Coordination between SC and TCC

10.3 Other issues

Agenda Item 11. Advice and recommendations to the Commission

Agenda Item 12. Next meeting

Agenda Item 13. Press release

Agenda Item 14. Adoption of the Report

Agenda Item 15. Close of the Meeting

Annex B

List of documents

MEETING INFORMATION PAPERS

Document Number	Title
NPFC-2020-SC05-MIP01 (Rev. 1)	Details for the virtual meetings of the Scientific Committee and its subsidiary bodies
NPFC-2020-SC05-MIP02	Provisional Agenda
NPFC-2020-SC05-MIP03 (Rev. 1)	Annotated Indicative Schedule

REFERENCE DOCUMENTS

Document Number	Title
NPFC-2020-SSC BFME01-WP02	A proposal to develop 'Species Summary' documents for the NPFC priority species
NPFC-2020-TWG CMSA03-WP11	Demonstration Management Strategy Evaluation for Chub Mackerel Using Open-Source Tools
NPFC-2020-SSC BFME01-IP02 (Rev. 1)	NPFC SC Project #10: International Course for NPFC Observers for VME Indicator Taxa Identification
NPFC CIRCULAR #006/2020	NPFC Circular #006/2020 Application of the EU to accede to the NPFC Convention
	Letter to Mr. V. Belyaev Ares 587988 of 30.01.20
	Annex 1 - EU Fisheries Operation Plan and impact assessment for Chub mackerel fishery in NPFC
	Interim Regulations for Management of Scientific Data and Information

WORKING PAPERS

Document Number	Title
NPFC-2020-SC05-WP01	North Pacific Fisheries Commission Scientific Committee 2021-2025 Research Plan
NPFC-2020-SC05-WP02	SC Five-Year Rolling Work Plan, 2020-2021 to 2024-2025
NPFC-2020-SC05-WP03	Revision of the Scientific Committee Terms of Reference
NPFC-2020-SC05-WP04	Cooperation between NPFC and NPAFC
NPFC-2020-SC05-WP05 (Rev. 1)	Scientific projects for 2017-2021
NPFC-2020-SC05-WP06	Draft - NPFC Data Sharing and Data Security Protocols

NPFC-2020-SC05-WP07	NPFC Data-Sharing and Data-Security Protocol for Vessel Monitoring System (VMS) Data
NPFC-2020-SC05-WP08	NPFC Data Management System

INFORMATION PAPERS

Document Number	Title
NPFC-2020-SC05-IP01	Participants for priority species groups
NPFC-2020-SC05-IP02	A compiled list of cooperation opportunities and requests from other organizations

OBSERVER PAPERS

Document Number	Title
NPFC-2020-SC05-OP01	Partnership with the Fisheries and Resources Monitoring System of FAO (FIRMS)
NPFC-2020-SC05-OP02	Concept note – a research collaboration proposal between FAO-NPFC-GFW on the use of AIS data technology to improve monitoring of high sea fisheries
NPFC-2020-SC05-OP03	Electronic Monitoring Toolkit
NPFC-2020-SC05-OP04	A proposal from PICES for support of 2022 SPF symposium by NPFC
NPFC-2020-SC05-OP05	ABNJ Deep- Sea Fisheries Project update for the NPFC 5th Scientific Committee Meeting
NPFC-2020-SC05-OP06	The International Year Of The Salmon Pan Pacific High Seas Expedition 2022: A Collaborative International Approach To Understanding How A Rapidly Changing Ocean Affects Pacific Salmon And High Seas Ecosystems

Annex C

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Annex D

CMM 2019-05 (Rev. 1)
(Entered into force 29 November 2019)

CONSERVATION AND MANAGEMENT MEASURE FOR BOTTOM FISHERIES AND PROTECTION OF VULNERABLE MARINE ECOSYSTEMS IN THE NORTHWESTERN PACIFIC OCEAN

The North Pacific Fisheries Commission (NPFC),
Strongly supporting protection of vulnerable marine ecosystems (VMEs) and sustainable management of fish stocks based on the best scientific information available;

Recalling the United Nations General Assembly Resolutions (UNGA) on Sustainable Fisheries, particularly paragraphs 66 to 71 of the UNGA59/25 in 2004, paragraphs 69 to 74 of UNGA60/31 in 2005, and paragraphs 69 and 80 to 91 of UNGA61/105 in 2006;

Noting, in particular, paragraphs 66 and 69 of UNGA59/25 that call upon States to take action urgently to address the issue of bottom trawl fisheries on VMEs and to cooperate in the establishment of new regional fisheries management organizations or arrangements;

Recognizing further that fishing activities, including bottom fisheries, are an important contributor to the global food supply and that this must be taken into account when seeking to achieve sustainable fisheries and to protect VMEs;

Recognizing the importance of collecting scientific data to assess the impacts of these fisheries on marine species and VMEs;

Concerned about possible adverse impacts of unregulated expansion of bottom fisheries on marine species and VMEs in the western part of the Convention Area.

Adopts the following Conservation and Management Measure:

1. Scope

A. Coverage
These Measures are to be applied to all bottom fishing activities throughout the high seas

areas of the Northwestern Pacific Ocean, defined, for the purposes of this document, as those occurring in the Convention Area as set out in Article 4 of the Convention text to the west of the line of 175 degrees W longitude (here in after called “the western part of the Convention Area”) including all such areas and marine species other than those species already covered by existing international fisheries management instruments, including bilateral agreements and Regional Fisheries Management Organizations or Arrangements.

B. Management target

Bottom fisheries conducted by vessels operating in the western part of the Convention Area.

2. General purpose

Sustainable management of fish stocks and protection of VMEs in the western part of the Convention Area.

The objective of these Measures 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.

These measures shall set out to prevent significant adverse impacts on VMEs in the Convention Area of the North Pacific Ocean, acknowledging the complex dependency of fishing resources and species belonging to the same ecosystem within VMEs.

The Commission shall re-evaluate, and as appropriate, revise, the definition based on further consideration of the work done through FAO and by NPFC.

3. Principles

The implementation of this CMM shall:

(a) be based on the best scientific information available,
(b) be in accordance with existing international laws and agreements including UNCLOS and other relevant international instruments,
(c) establish appropriate and effective conservation and management measures,
(d) be in accordance with the precautionary approach, and
(e) incorporate an ecosystem approach to fisheries management.

4. Measures

Members of the Commission shall take the following measures in order to achieve sustainable management of fish stocks and protection of VMEs in the western part of the Convention

Area:

A. Limit fishing effort in bottom fisheries on the western part of the Convention Area to the level agreed in February 2007 in terms of the number of fishing vessels and other parameters which reflect the level of fishing effort, fishing capacity or potential impacts on marine ecosystems.

B. Not allow bottom fisheries to expand into the western part of the Convention Area where no such fishing is currently occurring, in particular, by limiting such bottom fisheries to seamounts located south of 45 degrees North Latitude and refrain from bottom fisheries in other areas of the western part of the Convention Area covered by these measures and also not allow bottom fisheries to conduct fishing operation in areas deeper than 1,500m.

C. Notwithstanding subparagraphs A and B above, exceptions to these restrictions may be provided in cases where it can be shown that any fishing activity beyond such limits or in any new areas would not have significant adverse impacts (SAIs) on marine species or any VME. Such fishing activity is subject to an exploratory fishery protocol (Annex 1).

D. Any determinations pursuant to subparagraph C that any proposed fishing activity will not have SAIs on marine species or any VME are to be in accordance with the Science-based Standards and Criteria (Annex 2), which are consistent with the FAO International Guidelines for the Management of Deepsea Fisheries in the High Seas.

E. Any determinations, by any flag State or pursuant to any subsequent arrangement for the management of the bottom fisheries in the areas covered by these measures, that fishing activity would not have SAIs on marine species or any VMEs, shall be made publicly available through agreed means.

F. Prohibit its vessels from engaging in directed fishing on the following taxa: *Alcyonacea, Antipatharia, Gorgonacea,* and *Scleractinia* as well as any other indicator species for VMEs as may be identified from time to time by the SC and approved by the Commission.

G. Further, considering accumulated information regarding fishing activities in the western part of the Convention Area, in areas where, in the course of fishing operations, cold water corals more than 50Kg are encountered in one gear retrieval, Members of the Commission shall require vessels flying their flag to cease bottom fishing activities in

that location. In such cases, the vessel shall not resume fishing activities until it has relocated a sufficient distance, which shall be no less than 2 nautical miles, so that additional encounters with VMEs are unlikely. All such encounters, including the location, gear type, date, time and ~~the species~~name and weight of the VME indicator species ~~in question~~, shall be reported to the Secretariat, through the Member, ~~as soon as possible~~[within one business day], who shall immediately notify the other Members of the Commission so that appropriate measures can be adopted in respect of the relevant site. It is agreed that the cold water corals include: *Alcyonacea, Antipatharia, Gorgonacea*, and *Scleractinia*.

H. C-H seamount and Southeastern part of Koko seamount, specifically for the latter seamount, the area South of 34 degrees 57 minutes North, East of the 400m isobaths, East of 171 degrees 54 minutes East, North of 34 degrees 50 minutes North, are closed precautionary for potential VME conservation. Fishing in these areas requires exploratory fishery protocol (Annex 1).

I. Ensure that the distance between the footrope of the gill net and sea floor is greater than 70 cm.

J. Apply a bottom fisheries closure from November to December.

K. Limit annual catch of North Pacific armorhead to 15,000 tons for Japan.

L. Development of new fishing activity for the North Pacific armorhead and splendid alfonsino in the Convention Area by Members without documented historical catch for North Pacific armorhead and splendid alfonsino in the Convention Area shall be determined in accordance with relevant provisions, including but not limited to Article 3, paragraph (h) and Article 7, subparagraphs 1(g) and (h) of the Convention.

M. In years when strong recruitment of North Pacific armorhead is not detected (Annex 6), the Commission encourages Japan to limit the annual catch of North Pacific armorhead by vessels flying its flag to 500 tons, and encourages Korea to limit the annual catch of North Pacific armorhead by vessels flying its flag to 200 tons. The Commission encourages that catch overages for any given year be subtracted from the applicable annual catch limit in the following year, and that catch underages during any given year not be added to the applicable annual catch limit during the following year.

N. Notwithstanding subparagraph K, when a strong recruitment of North Pacific armorhead is detected through the monitoring surveys as specified in Annex 6, the Commission encourages that Japan limit the annual catch of North Pacific armorhead by vessels flying its flag to 10,000 tons, and that Korea limit the annual catch of North Pacific armorhead by vessels flying its flag to 2,000 tons. The Commission encourages that catch overages for any given year be subtracted from the applicable annual catch limit in the following year, and that catch underages during any given year not be added to the applicable annual catch limit during the following year. During a year when high recruitment is detected, bottom fishing with trawl gear shall be prohibited in specific areas in the Emperor seamounts where half of the catch occurred in 2010 and 2012 (Annex 6). Determination of a strong recruitment year and of the specific areas where bottom fishing with trawl gear is prohibited shall be communicated to all Members and Cooperating Non-Contracting parties following the procedure specified in Annex 6.

O. Catch in the monitoring surveys shall not be included in the catch limits specified in paragraphs M and N but shall be reported to the Secretariat.

P. Fishing activity for the North Pacific armorhead and splendid alfonsino in the Convention Area by Members with documented historical catch for North Pacific armorhead and splendid alfonsino in the Convention Area is not precluded.

Q. Members shall require vessels flying their flags to use trawl nets with mesh size greater than or equal to 130mm of stretched mesh with 5kg tension in the codend when conducting fishing activities for North Pacific armorhead or splendid alfonsino.

R. Task the Scientific Committee with reviewing the appropriate methods for establishing catch limits, and the adequacy and practicability of the adaptive management plan described in subparagraphs K, L, M, N, O, P, Q and Annex 6 from time to time and recommending revisions and actions, if necessary.

5. Contingent Action

Members of the Commission shall submit to the SC their assessments of the impacts of fishing activity on marine species or any VMEs, including the proposed management measures to prevent such impact. Such submissions shall include all relevant data and information in support of any such assessment. Procedures for such reviews including procedures for the provision of advice and recommendations from the SC to the submitting Member are attached (Annex 3). Members will only authorize bottom fishing activity pursuant to para 4 (C).

6. Scientific Information

To facilitate the scientific work associated with the implementation of these measures, each Member of the Commission shall undertake:

A. ~~Collection~~ Reporting of information for purposes of defining the footprint

In implementing paragraphs 4A and 4B, the Members of the Commission shall provide for each year, the number of vessels by gear type, size of vessels (tons), number of fishing days or days on the fishing grounds, total catch by species, and areas fished (names of seamounts) to the Secretariat. The Secretariat shall circulate the information received to the other Members consistent with the approved Regulations for Management of Scientific Data and Information~~Interim Data Handling and Data Sharing Protocol~~. To support assessments of the fisheries and refinement of conservation and management measures, Members of the Commission are to provide update information on an annual basis.

B. Collection of information

(i) Collection of scientific information from each bottom fishing vessel operating in the western part of the Convention Area.

(a) Catch and effort data

(b) Related information such as time, location, depth, temperature, etc.

(ii) As appropriate the collection of information from research vessels operating in the western part of the Convention Area.

(a) Physical, chemical, biological, oceanographic, meteorological, etc.

(b) Ecosystem surveys.

(c) Seabed mapping (e.g. multibeam or other echosounder); seafloor images by drop camera, remotely operated underwater vehicle (ROV) and/or autonomous underwater vehicle (AUV).

(iii) Collection of observer data

Duly designated observers from the flag member shall collect information from bottom fishing vessels operating in the western part of the Convention Area. Observers shall collect data in accordance with Annex 5. Each Member of the Commission shall submit the reports to the Secretariat in accordance with Annex 4. The Secretariat shall compile this information on an annual basis and make it available to the Members of the Commission.

7. Control of bottom fishing vessels

To strengthen its control over bottom fishing vessels flying its flag, each Member of the

Commission shall ensure that all such vessels operating in the western part of the Convention Area be equipped with an operational vessel monitoring system.

8. Observers

All vessels authorized to bottom fishing in the western part of the Convention Area shall carry an observer on board.

Annex 1

EXPLORATORY FISHERY PROTOCOL IN THE NORTH PACIFIC OCEAN

1. From 1 January 2009, all bottom fishing activities in new fishing areas and areas where fishing is prohibited in a precautionary manner or with bottom gear not previously used in the existing fishing areas, are to be considered as "exploratory fisheries" and to be conducted in accordance with this protocol.

2. Precautionary conservation and management measures, including catch and effort controls, are essential during the exploratory phase of deep sea fisheries. Implementation of a precautionary approach to sustainable exploitation of deep sea fisheries shall include the following measures:
   (i) precautionary effort limits, particularly where reliable assessments of sustainable exploitation rates of target and main by-catch species are not available;
   (ii) precautionary measures, including precautionary spatial catch limits where appropriate, to prevent serial depletion of low-productivity stocks;
   (iii) regular review of appropriate indices of stock status and revision downwards of the limits listed above when significant declines are detected;
   (iv) measures to prevent significant adverse impacts on vulnerable marine ecosystems; and
   (v) comprehensive monitoring of all fishing effort, capture of all species and interactions with VMEs.

3. When a member of the Commission would like to conduct exploratory fisheries, it is to follow the following procedure:
   (i) Prior to the commencement of fishing, the member of the Commission is to circulate the information and assessment in Appendix 1.1 to the members of the Scientific Committee (SC) for review and to all members of the Commission for information, together with the impact assessment. Such information is to be provided to the other members at least 30 days in advance of the meeting at which the information shall be reviewed.
   (ii) The assessment in (i) above is to be conducted in accordance with the procedure set forth in "Science-based Standards and Criteria for Identification of VMEs and Assessment of Significant Adverse Impacts on VMEs and Marine Species (Annex 2)", with the understanding that particular care shall be taken in the evaluation of risks of the significant adverse impact on vulnerable marine ecosystems (VMEs), in line with the precautionary approach.
   (iii) The SC is to review the information and the assessment submitted in (i) above in accordance with "SC Assessment Review Procedures for Bottom Fishing Activities (Annex 3)."
   (iv) The exploratory fisheries are to be permitted only where the assessment concludes that they would not have significant adverse impacts (SAIs) on marine species or any VMEs and on the

basis of comments and recommendations of SC. Any determinations, by any Member of the Commission or the SC, that the exploratory fishing activities would not have SAIs on marine species or any VMEs, shall be made publicly available through the NPFC website.

4. The member of the Commission is to ensure that all vessels flying its flag conducting exploratory fisheries are equipped with a satellite monitoring device and have an observer on board at all times.

5. Within 3 months of the end of the exploratory fishing activities or within 12 months of the commencement of fishing, whichever occurs first, the member of the Commission is to provide a report of the results of such activities to the members of the SC and all members of the Commission. If the SC meets prior to the end of this 12-month period, the member of the Commission is to provide an interim report 30 days in advance of the SC meeting. The information to be included in the report is specified in Appendix 1.2.

6. The SC is to review the report in 5 above and decide whether the exploratory fishing activities had SAIs on marine species or any VME. The SC then is to send its recommendations to the Commission on whether the exploratory fisheries can continue and whether additional management measures shall be required if they are to continue. The Commission is to strive to adopt conservation and management measures to prevent SAIs on marine species or any VMEs. If the Commission is not able to reach consensus on any such measures, each fishing member of the Commission is to adopt measures to avoid any SAIs on VMEs.

7. Members of the Commission shall only authorize continuation of exploratory fishing activity, or commencement of commercial fishing activity, under this protocol on the basis of comments and recommendations of the SC.

Appendix 1.1

Information to be provided before exploratory fisheries start

1. A harvesting plan
   - Name of vessel
   - Flag member of vessel
   - Description of area to be fished (location and depth)
   - Fishing dates
   - Anticipated effort
   - Target species

- Bottom fishing gear-type used
- Area and effort restrictions to ensure that fisheries occur on a gradual basis in a limited geographical area.

2. A mitigation plan
   - Measures to prevent SAIs to VMEs that may be encountered during the fishery

3. A catch monitoring plan
   - Recording/reporting of all species brought onboard to the lowest possible taxonomic level
   - 100% satellite monitoring
   - 100% observer coverage

4. A data collection plan
   - Data is to be collected in accordance with "Type and Format of Scientific Observer Data to be Collected" (Annex 5)

Appendix 1.2

Information to be included in the report

- Name of vessel
- Flag member of vessel
- Description of area fished (location and depth)
- Fishing dates
- Total effort
- Bottom fishing gear-type used
- List of VME encountered (the amount of VME indicator species for each encounter specifying the location: longitude and latitude)
- Mitigation measures taken in response to the encounter of VME
- List of all organisms brought onboard
- List of VMEs indicator species brought onboard by location: longitude and latitude

Annex 2

SCIENCE-BASED STANDARDS AND CRITERIA FOR IDENTIFICATION OF VMES AND ASSESSMENT OF SIGNIFICANT ADVERSE IMPACTS ON VMES AND MARINE SPECIES

1. Introduction

Members of the Commission have hereby established science-based standards and criteria to guide their implementation of United Nations General Assembly (UNGA) Resolution 61/105 and the measures adopted by the Members in respect of bottom fishing activities in the North Pacific Ocean (NPO). In this regard, these science-based standards and criteria are to be applied to identify vulnerable marine ecosystems (VMEs) and assess significant adverse impacts (SAIs) of bottom fishing activities on such VMEs or marine species and to promote the long-term sustainability of deep sea fisheries in the Convention Area. The science-based standards and criteria are consistent with the FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas, taking into account the work of other RFMOs implementing management of deep-sea bottom fisheries in accordance with UNGA Resolution 61/105. The standards and criteria are to be modified from time to time as more data are collected through research activities and monitoring of fishing operations.

2. Purpose

(1) The purpose of the standards and criteria is to provide guidelines for each member of the Commission in identifying VMEs and assessing SAIs of individual bottom fishing activities[1] on VMEs or marine species in the Convention Area. Each member of the Commission, using the best information available, is to decide which species or areas are to be categorized as VMEs, identify areas where VMEs are known or likely to occur, and assess whether individual bottom fishing activities would have SAIs on such VMEs or marine species. The results of these tasks are to be submitted to and reviewed by the Scientific Committee with a view to reaching a common understanding among the members of the Commission.

(2) For the purpose of applying the standards and criteria, the bottom fisheries are defined as follows:

(a) The fisheries are conducted in the Convention Area;

[1] "individual bottom fishing activities" means fishing activities by each fishing gear. For example, if ten fishing vessels operate bottom trawl fishing in a certain area, the impacts of the fishing activities of these vessels on the ecosystem are to be assessed as a whole rather than on a vessel-by-vessel basis. It should be noted that if the total number or capacity of the vessels using the same fishing gear has increased, the impacts of the fishing activities are to be assessed again.

(b) The total catch (everything brought up by the fishing gear) includes species that can only sustain low exploitation rates; and
(c) The fishing gear is likely to contact the seafloor during the normal course of fishing operations.

3. Definition of VMEs

(1) Although Paragraph 83 of UNGA Resolution 61/105 refers to seamounts, hydrothermal vents and cold-water corals as examples of VMEs, there is no definitive list of specific species or areas that are to be regarded as VMEs.

(2) Vulnerability is related to the likelihood that a population, community or habitat will experience substantial alteration by fishing activities and how much time will be required for its recovery from such alteration. The most vulnerable ecosystems are those that are both easily disturbed and are very slow to recover or may never recover. The vulnerabilities of populations, communities and habitats are to be assessed relative to specific threats. Some features, particularly ones that are physically fragile or inherently rare may be vulnerable to most forms of disturbance, but the vulnerability of some populations, communities and habitats may vary greatly depending on the type of fishing gear used or the kind of disturbance experienced. The risks to a marine ecosystem are determined by its vulnerability, the probability of a threat occurring and the mitigation means applied to the threat. Accordingly, the FAO Guidelines only provide examples of potential vulnerable species groups, communities and habitats as well as features that potentially support them (Annex 2.1).

(3) A marine ecosystem is to be classified as vulnerable based on its characteristics. The following list of characteristics is used as criteria in the identification of VMEs.

(a) Uniqueness or rarity - an area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by other similar areas. These include:
(i) Habitats that contain endemic species;
(ii) Habitats of rare, threatened or endangered species that occur in discrete areas;
(iii)Nurseries or discrete feeding, breeding, or spawning areas.

(b) Functional significance of the habitat – discrete areas or habitats that are necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species.

(c) Fragility – an ecosystem that is highly susceptible to degradation by anthropogenic activities

(d) Life-history traits of component species that make recovery difficult – ecosystems that are characterized by populations or assemblages of species with one or more of

the following characteristics:

(i) Slow growth rates

(ii) Late age of maturity

(iii) Low or unpredictable recruitment

(iv) Long-lived

(e) Structural complexity – an ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms.

(4) Management response may vary, depending on the size of the ecological unit in the Convention Area. Therefore, the spatial extent of the ecological unit is to be decided first. That is, whether the ecological unit is the entire Area, or the current fishing ground, namely, the Emperor Seamount and Northern Hawaiian Ridge area (hereinafter called "the ES-NHR area"), or a group of the seamounts within the ESNHR area, or each seamount in the ES-NHR area, is to be decided using the above criteria.

4. Identification of potential VMEs

(1) Fished seamounts

(a) Identification of fished seamounts

It is reported that four types of fishing gear are currently used by the members of the Commission in the ES-NHR area, namely, bottom trawl, bottom gillnet, bottom longline and pot. A fifth type of fishing gear (coral drag) was used in the ES-NHR area from the mid-1960s to the late 1980s and is possibly still used by non-members of the Commission. These types of fishing gear are usually used on the top or slope of seamounts, which could be considered VMEs. It is therefore necessary to identify the footprint of the bottom fisheries (fished seamounts) based on the available fishing record. The following seamounts have been identified as fished seamounts: Suiko, Showa, Youmei, Nintoku, Jingu, Ojin, Northern Koko, Koko, Kinmei, Yuryaku, Kammu, Colahan, and CH. Since the use of most of these gears in the ES-NHR area dates back to the late 1960s and 1970s, it is important to establish, to the extent practicable, a time series of where and when these gears have been used in order to assess potential long-term effects on any existing VMEs.

Fishing effort may not be evenly distributed on each seamount since fish aggregation may occur only at certain points of the seamount and some parts of the seamount may be physically unsuitable for certain fishing gears. Thus, it is important to know actual fished areas within the same seamount so as to know the gravity of the impact

of fishing activities on the entire seamount.

Due consideration is to be given to the protection of commercial confidentiality when identifying actual fishing grounds.

(b) Assessment on whether a specific seamount that has been fished is a VME

After identifying the fished seamounts or fished areas of seamounts, it is necessary to assess whether each fished seamount is a VME or contains VMEs in accordance with the criteria in 3 above, individually or in combination using the best available scientific and technical information as well as Annex 2.1. A variety of data would be required to conduct such assessment, including pictures of seamounts taken by an ROV camera or drop camera, biological samples collected through research activities and observer programs, and detailed bathymetry map. Where site-specific information is lacking, other information that is relevant to inferring the likely presence of VMEs is to be used.

(2) New fishing areas

Any place other than the fished seamounts above is to be regarded as a new fishing area. If a member of the Commission is considering fishing in a new fishing area, such a fishing area is to be subject to, in addition to these standards and criteria, an exploratory fishery protocol (Annex 1).

5. Assessment of SAIs on VMEs or marine species

(1) Significant adverse impacts are those that compromise ecosystem integrity (i.e., ecosystem structure or function) in a manner that: (i) impairs the ability of affected populations to replace themselves; (ii) degrades the long-term natural productivity of habitats; or (iii) causes, on more than a temporary basis, significant loss of species richness, habitat or community types. Impacts are to be evaluated individually, in combination and cumulatively.

(2) When determining the scale and significance of an impact, the following six factors are to be considered:

(a) The intensity or severity of the impact at the specific site being affected;

(b) The spatial extent of the impact relative to the availability of the habitat type affected;

(c) The sensitivity/vulnerability of the ecosystem to the impact;

(d) The ability of an ecosystem to recover from harm, and the rate of such recovery;

(e) The extent to which ecosystem functions may be altered by the impact; and

(f) The timing and duration of the impact relative to the period in which a species needs the habitat during one or more life-history stages.

(3) Temporary impacts are those that are limited in duration and that allow the particular ecosystem to recover over an acceptable timeframe. Such timeframes are to be decided on a case-by-case basis and be on the order of 5-20 years, taking into account the specific features

of the populations and ecosystems.

(4) In determining whether an impact is temporary, both the duration and the frequency with which an impact is repeated is to be considered. If the interval between the expected disturbances of a habitat is shorter than the recovery time, the impact is to be considered more than temporary.

(5) Each member of the Commission is to conduct assessments to establish if bottom fishing activities are likely to produce SAIs in a given seamount or other VMEs. Such an impact assessment is to address, *inter alia*:

(a) Type of fishing conducted or contemplated, including vessel and gear types, fishing areas, target and potential bycatch species, fishing effort levels and duration of fishing;

(b) Best available scientific and technical information on the current state of fishery resources, and baseline information on the ecosystems, habitats and communities in the fishing area, against which future changes are to be compared;

(c) Identification, description and mapping of VMEs known or likely to occur in the fishing area;

(d) The data and methods used to identify, describe and assess the impacts of the activity, identification of gaps in knowledge, and an evaluation of uncertainties in the information presented in the assessment;

(e) Identification, description and evaluation of the occurrence, scale and duration of likely impacts, including cumulative impacts of activities covered by the assessment on VMEs and low-productivity fishery resources in the fishing area;

(f) Risk assessment of likely impacts by the fishing operations to determine which impacts are likely to be SAIs, particularly impacts on VMEs and low-productivity fishery resources (Risk assessments are to take into account, as appropriate, differing conditions prevailing in areas where fisheries are well established and in areas where fisheries have not taken place or only occur occasionally);

(g) The proposed mitigation and management measures to be used to prevent SAIs on VMEs and ensure long-term conservation and sustainable utilization of low-productivity fishery resources, and the measures to be used to monitor effects of the fishing operations.

(6) Impact assessments are to consider, as appropriate, the information referred to in these Standards and Criteria, as well as relevant information from similar or related fisheries, species and ecosystems.

(7) Where an assessment concludes that the area does not contain VMEs or that significant adverse impacts on VMEs or marine species are not likely, such assessments are to be repeated when there have been significant changes to the fishery or other activities in the area, or when natural processes are thought to have undergone significant changes.

6. Proposed conservation and management measures to prevent SAIs

As a result of the assessment in 5 above, if it is considered that individual fishing activities are causing or likely to cause SAIs on VMEs or marine species, the member of the Commission is to adopt appropriate conservation and management measures to prevent such SAIs. The member of the Commission is to clearly indicate how such impacts are expected to be prevented or mitigated by the measures.

7. Precautionary approach

If after assessing all available scientific and technical information, the presence of VMEs or the likelihood that individual bottom fishing activities would cause SAIs on VMEs or marine species cannot be adequately determined, members of the Commission are only to authorize individual bottom fishing activities to proceed in accordance with:

(a) Precautionary, conservation and management measures to prevent SAIs;
(b) Measures to address unexpected encounters with VMEs in the course of fishing operations;
(c) Measures, including ongoing scientific research, monitoring and data collection, to reduce the uncertainty; and
(d) Measures to ensure long-term sustainability of deep sea fisheries.

8. Template for assessment report

Annex 2.2 is a template for individual member of the Commission to formulate reports on identification of VMEs and impact assessment.

Annex 2.1

Examples of potential vulnerable species groups, communities and habitats as well as features that potentially support them

The following examples of species groups, communities, habitats and features often display characteristics consistent with possible VMEs. Merely detecting the presence of an element itself is not sufficient to identify a VME. That identification is to be made on a case-by-case basis through application of relevant provisions of the Standards and Criteria, particularly Sections 3, 4 and 5.

Examples of species groups, communities and habitat forming species that are documented or considered sensitive and potentially vulnerable to deep-sea fisheries

in the high-seas, and which may contribute to forming VMEs:	
a.	certain cold-water corals, e.g., reef builders and coral forest including: stony corals (scleractinia), alcyonaceans and gorgonians (octocorallia), black corals (antipatharia), and hydrocorals (stylasteridae),
b.	Some types of sponge dominated communities,
c.	communities composed of dense emergent fauna where large sessile protozoans (xenophyophores) and invertebrates (e.g., hydroids and bryozoans) form an important structural component of habitat, and
d.	seep and vent communities comprised of invertebrate and microbial species found nowhere else (i.e., endemic).

Examples of topographical, hydrophysical or geological features, including fragile geological structures, that potentially support the species groups or communities referred to above:

a. submerged edges and slopes (e.g., corals and sponges)
b. summits and flanks of seamounts, guyots, banks, knolls, and hills (e.g., corals, sponges and xenophyphores)
c. canyons and trenches (e.g., burrowed clay outcrops, corals),
d. hydrothermal vents (e.g., microbial communities and endemic invertebrates), and
e. cold seeps (e.g., mud volcanoes, microbes, hard substrates for sessile invertebrates).

Annex 2.2

Template for reports on identification of VMEs and assessment of impacts caused by individual fishing activities on VMEs or marine species

1. Name of the member of the Commission
2. Name of the fishery (e.g., bottom trawl, bottom gillnet, bottom longline, pot)
3. Status of the fishery (existing fishery or exploratory fishery)
4. Target species
5. Bycatch species
6. Recent level of fishing effort (every year at least since 2002)
   (1) Number of fishing vessels
   (2) Tonnage of each fishing vessel
   (3) Number of fishing days or days on the fishing ground

(4) Fishing effort (total operating hours for trawl, # of hooks per day for long-line, # of pots per day for pot, total length of net per day for gillnet)
(5) Total catch by species
(6) Names of seamounts fished or to be fished

7. Fishing period
8. Analysis of status of fishery resources
(1) Data and methods used for analysis
(2) Results of analysis
(3) Identification of uncertainties in data and methods, and measures to overcome such uncertainties
9. Analysis of status of bycatch species resources
(1) Data and methods used for analysis
(2) Results of analysis
(3) Identification of uncertainties in data and methods, and measures to overcome such uncertainties
10. Analysis of existence of VMEs in the fishing ground
(1) Data and methods used for analysis
(2) Results of analysis
(3) Identification of uncertainties in data and methods, and measures to overcome such uncertainties
11. Impact assessment of fishing activities on VMEs or marine species including cumulative impacts, and identification of SAIs on VMEs or marine species, as detailed in Section 5 above, Assessment of SAIs on VMEs or marine species
12. Other points to be addressed
13. Conclusion (whether to continue or start fishing with what measures, or stop fishing).

Annex 3

SCIENTIFIC COMMITTEE ASSESSMENT REVIEW PROCEDURES FOR BOTTOM FISHING ACTIVITIES

1. The Scientific Committee (SC) is to review identifications of vulnerable marine ecosystems (VMEs) and assessments of significant adverse impact on VMEs, including proposed management measures intended to prevent such impacts submitted by individual Members.

2. Members of the Commission shall submit their identifications and assessments to members of the SC at least 21 days prior to the SC meeting at which the review is to take place. Such submissions shall include all relevant data and information in support of such determinations.

3. The SC will review the data and information in each assessment in accordance with the Science-based Standards and Criteria for Identification of VMEs and Assessment of Significant Adverse Impacts on VMEs and Marine Species (Annex 2), previous decisions of the Commission, and the FAO Technical Guidelines for the Management of Deep Sea Fisheries in the High Seas, paying special attention to the assessment process and criteria specified in paragraphs 47-49 of the Guidelines.

4. In conducting the review above, the SC will give particular attention to whether the deep-sea bottom fishing activity would have a significant adverse impact on VMEs and marine species and, if so, whether the proposed management measures would prevent such impacts.

5. Based on the above review, the SC will provide advice and recommendations to the submitting Members on the extent to which the assessments and related determinations are consistent with the procedures and criteria established in the documents identified above; and whether additional management measures will be required to prevent SAIs on VMEs.

6. Such recommendations will be reflected in the report of the SC meeting at which the assessments are considered.

Annex 4

FORMAT OF NATIONAL REPORT SECTIONS ON DEVELOPMENT AND IMPLEMENTATION OF SCIENTIFIC OBSERVER PROGRAMMES

Report Components

Annual Observer Programme implementation reports should form a component of annual National Reports submitted by members to the Scientific Committee. These reports should provide a brief overview of observer programmes conducted in the NPFC Convention Area. Observer programme reports should include the following sections:

A. Observer Training

An overview of observer training conducted, including:

- Overview of training programme provided to scientific observers.
- Number of observers trained.

B. Scientific Observer Programme Design and Coverage

Details of the design of the observer programme, including:

- Which fleets, fleet components or fishery components were covered by the programme.
- How vessels were selected to carry observers within the above fleets or components.
- How was observer coverage stratified: by fleets, fisheries components, vessel types, vessel sizes, vessel ages, fishing areas and seasons.

Details of observer coverage of the above fleets, including:

- Components, areas, seasons and proportion of total catches of target species, specifying units used to determine coverage.
- Total number of observer employment days, and number of actual days deployed on observation work.

C. Observer Data Collected

List of observer data collected against the agreed range of data set out in Annex 5, including:

- Effort Data: Amount of effort observed (vessel days, net panels, hooks, etc), by area and season and % observed out of total by area and seasons
- Catch Data: Amount of catch observed of target and by-catch species, by area and season, and % observed out of total estimated catch by species, area and seasons
- Length Frequency Data: Number of fish measured per species, by area and season.
- Biological Data: Type and quantity of other biological data or samples (otoliths, sex, maturity, etc.) collected per species.

- The size of length-frequency and biological sub-samples relative to unobserved quantities.

D. Detection of Fishing in Association with Vulnerable Marine Ecosystems

- Information about VME encounters (species and quantity in accordance with Annex 5, H, 2).

E. Tag Return Monitoring

- Number of tags returns observed, by fish size class and area.

F. Problems Experienced

- Summary of problems encountered by observers and observer managers that could affect the NPFC Observer Programme Standards and/or each member's national observer programme developed under the NPFC standards.

Annex 5

NPFC BOTTOM FISHERIES OBSERVER PROGRAMME STANDARDS: SCIENTIFIC COMPONENT

TYPE AND FORMAT OF SCIENTIFIC OBSERVER DATA TO BE COLLECTED

A. Vessel & Observer Data to be collected for Each Trip

1. Vessel and observer details are to be recorded only once for each observed trip.
2. The following observer data are to be collected for each observed trip:
   (a) NPFC vessel ID.
   (b) Observer's name.
   (c) Observer's organisation.
   (d) Date observer embarked (UTC date).
   (e) Port of embarkation.
   (f) Date observer disembarked (UTC date).
   (g) Port of disembarkation.

B. Catch & Effort Data to be collected for Trawl Fishing Activity

1. Data are to be collected on an un-aggregated (tow by tow) basis for all observed trawls.
2. The following data are to be collected for each observed trawl tow:
   (a) Tow start date (UTC).
   (b) Tow start time (UTC).
   (c) Tow end date (UTC).
   (d) Tow end time (UTC).
   (e) Tow start position (Lat/Lon, 1 minute resolution).
   (f) Tow end position (Lat/Lon, 1 minute resolution).
   (g) Type of trawl, bottom or mid-water.
   (h) Type of trawl, single, double or triple.
   (i) Height of net opening (m).
   (j) Width of net opening (m).
   (k) Mesh size of the cod-end net (stretched mesh, mm) and mesh type (diamond, square, etc).
   (l) Gear depth (of footrope) at start of fishing (m).
   (m) Bottom (seabed) depth at start of fishing (m).
   (n) Gear depth (of footrope) at end of fishing (m).
   (o) Bottom (seabed) depth at end of fishing (m).

(p) Status of the trawl operation (no damage, lightly damaged*, heavily damaged*, other (specify)).
*Degree may be evaluated by time for repairing (<=1hr or >1hr).
(q) Duration of estimated period of seabed contact (minute)
(r) Intended target species.
(s) Catch of all species retained on board, split by species, in weight (to the nearest kg).
(t) Estimate of the amount (weight or volume) of all living marine resources discarded, split by species.
(u) Record of the numbers by species of all marine mammals, seabirds or reptiles caught.

C. Catch & Effort Data to be collected for Bottom Gillnet Fishing Activity

1. Data are to be collected on an un-aggregated (set by set) basis for all observed bottom gillnet sets.
2. The following data are to be collected for each observed bottom gillnet set:
   (a) Set start date (UTC).
   (b) Set start time (UTC).
   (c) Set end date (UTC).
   (d) Set end time (UTC).
   (e) Set start position (Lat/Lon, 1 minute resolution).
   (f) Set end position (Lat/Lon, 1 minute resolution).
   (g) Net panel ("tan") length (m).
   (h) Net panel ("tan") height (m).
   (i) Net mesh size (stretched mesh, mm) and mesh type (diamond, square, etc)
   (j) Bottom depth at start of setting (m).
   (k) Bottom depth at end of setting (m).
   (l) Number of net panels for the set.
   (m) Number of net panels retrieved.
   (n) Number of net panels actually observed during the haul.
   (o) Actually observed catch of all species retained on board, split by species, in weight (to the nearest kg).
   (p) An estimation of the amount (numbers or weight) of marine resources discarded, split by species, during the actual observation.
   (q) Record of the actually observed numbers by species of all marine mammals, seabirds or reptiles caught.
   (r) Intended target species.
   (s) Catch of all species retained on board, split by species, in weight (to the nearest kg).

(t) Estimate of the amount (weight or volume) of all marine resources discarded* and dropped off, split by species. * Including those retained for scientific samples.
(u) Record of the numbers by species of all marine mammals, seabirds or reptiles caught (including those discarded and dropped-off).

D. Catch & Effort Data to be collected for Bottom Long Line Fishing Activity

1. Data are to be collected on an un-aggregated (set by set) basis for all observed longline sets.
2. The following fields of data are to be collected for each set:
   (a) Set start date (UTC).
   (b) Set start time (UTC).
   (c) Set end date (UTC).
   (d) Set end time (UTC).
   (e) Set start position (Lat/Lon, 1 minute resolution).
   (f) Set end position (Lat/Lon, 1 minute resolution).
   (g) Total length of longline set (m).
   (h) Number of hooks or traps for the set.
   (i) Bottom (seabed) depth at start of set.
   (j) Bottom (seabed) depth at end of set.
   (k) Number of hooks or traps actually observed during the haul.
   (l) Intended target species.
   (m) Actually observed catch of all species retained on board, split by species, in weight (to the nearest kg).
   (n) An estimation of the amount (numbers or weight) of marine resources discarded* or dropped-off, split by species, during the actual observation. * Including those retained for scientific samples.
   (o) Record of the actually observed numbers by species of all marine mammals, seabirds or reptiles caught (including those discarded and dropped-off).

E. Length-Frequency Data to Be Collected

1. Representative and randomly distributed length-frequency data (to the nearest mm, with record of the type of length measurement taken) are to be collected for representative samples of the target species and other main by-catch species. Total weight of length-frequency samples should be recorded, and observers may be required to also determine sex of measured fish to generate length-frequency data stratified by sex. The length-frequency data may be used as potential indicators of ecosystem changes (for example, see: Gislason, H. et al. (2000. ICES J Mar Sci 57: 468-475), Yamane et al. (2005. ICES J Mar Sci, 62: 374-379), and Shin, Y-J. et al. (2005. ICES J Mar Sci, 62: 384-396)).

2. The numbers of fish to be measured for each species and distribution of samples across area and month strata should be determined, to ensure that samples are properly representative of species distributions and size ranges.

F. Biological sampling to be conducted (optional for gillnet and long line fisheries)

1. The following biological data are to be collected for representative samples of the main target species and, time permitting, for other main by-catch species contributing to the catch:
   (a) Species
   (b) Length (to the nearest mm), with record of the type of length measurement used.
   (c) Length and depth in case of North Pacific armorhead.
   (d) Sex (male, female, indeterminate, not examined)
   (e) Maturity stage (immature, mature, ripe, ripe-running, spent)
2. Representative stratified samples of otoliths are to be collected from the main target species and, time permitting, from other main by-catch species regularly occurring in catches. All otoliths to be collected are to be labelled with the information listed in 1 above, as well as the date, vessel name, observer name and catch position.
3. Where specific trophic relationship projects are being conducted, observers may be requested to also collect stomach samples from certain species. Any such samples collected are also to be labelled with the information listed in 1 above, as well as the date, vessel name, observer name and catch position.
4. Observers may also be required to collect tissue samples as part of specific genetic research programmes implemented by the SC.
5. Observers are to be briefed and provided with written length-frequency and biological sampling protocols and priorities for the above sampling specific to each observer trip.

G. Data to be collected on Incidental Captures of Protected Species

1. Flag members operating observer programs are to develop, in cooperation with the SC, lists and identification guides of protected species or species of concern (seabirds, marine mammals or marine reptiles) to be monitored by observers.
2. The following data are to be collected for all protected species caught in fishing operations:
   (a) Species (identified as far as possible, or accompanied by photographs if identification is difficult).
   (b) Count of the number caught per tow or set.
   (c) Life status (vigorous, alive, lethargic, dead) upon release.
   (d) Whole specimens (where possible) for onshore identification. Where this is not possible, observers may be required to collect sub-samples of identifying parts, as specified in biological sampling protocols.

H. Detection of Fishing in Association with Vulnerable Marine Ecosystems

1. The SC is to develop a guideline, species list and identification guide for benthic species (e.g. sponges, sea fans, corals) whose presence in a catch will indicate that fishing occurred in association with a vulnerable marine ecosystem (VME). All observers on vessels are to be provided with copies of this guideline, species list and ID guide.
2. For each observed fishing operation, the following data are to be collected for all species caught, which appear on the list of vulnerable benthic species:
   (a) Species (identified as far as possible or accompanied by a photograph where identification is difficult).
   (b) An estimate of the quantity (weight (kg) or volume (m^3)) of each listed benthic species caught in the fishing operation.
   (c) An overall estimate of the total quantity (weight (kg) or volume (m^3)) of all invertebrate benthic species caught in the fishing operation.
   (d) Where possible, and particularly for new or scarce benthic species which do not appear in ID guides, whole samples should be collected and suitable preserved for identification on shore.

I. Data to be collected for all Tag Recoveries

1. The following data are to be collected for all recovered fish, seabird, mammal or reptile tags:
   (a) Observer name.
   (b) Vessel name.
   (c) Vessel call sign.
   (d) Vessel flag.
   (e) Collect, label (with all details below) and store the actual tags for later return to the tagging agency.
   (f) Species from which tag recovered.
   (g) Tag colour and type (spaghetti, archival).
   (h) Tag numbers (The tag number is to be provided for all tags when multiple tags were attached to one fish. If only one tag was recorded, a statement is required that specifies whether or not the other tag was missing)
   (i) Date and time of capture (UTC).
   (j) Location of capture (Lat/Lon, to the nearest 1 minute)
   (k) Animal length / size (to the nearest cm) with description of what measurement was taken (such as total length, fork length, etc).
   (l) Sex (F=female, M=male, I=indeterminate, D=not examined)
   (m) Whether the tags were found during a period of fishing that was being observed (Y/N)

(n) Reward information (e.g. name and address where to send reward)

(It is recognised that some of the data recorded here duplicates data that already exists in the previous categories of information. This is necessary because tag recovery information may be sent separately to other observer data.)

J. Hierarchies for Observer Data Collection

1. Trip-specific or programme-specific observer task priorities may be developed in response to specific research programme requirements, in which case such priorities should be followed by observers.
2. In the absence of trip- or programme-specific priorities, the following generalised priorities should be followed by observers:
   (a) Fishing Operation Information
      - All vessel and tow / set / effort information.
   (b) Monitoring of Catches
      - Record time, proportion of catch (e.g. proportion of trawl landing) or effort (e.g. number of hooks), and total numbers of each species caught.
      - Record numbers or proportions of each species retained or discarded.
   (c) Biological Sampling
      - Length-frequency data for target species.
      - Length-frequency data for main by-catch species.
      - Identification and counts of protected species.
      - Basic biological data (sex, maturity) for target species.
      - Check for presence of tags.
      - Otoliths (and stomach samples, if being collected) for target species.
      - Basic biological data for by-catch species.
      - Biological samples of by-catch species (if being collected)
      - Photos
3. The monitoring of catches and biological sampling procedures should be prioritised among species groups as follows:

Species	**Priority (1 highest)**
Primary target species (such as North Pacific armorhead and splendid alfonsino)	1
Other species typically within top 10 in the fishery (such as mirror dory, and oreos)	2

Protected species	3
All other species	4

The allocation of observer effort among these activities will depend on the type of operation and setting. The size of sub-samples relative to unobserved quantities (e.g. number of hooks/panels examined for species composition relative to the number of hooks/panels retrieved) should be explicitly recorded under the guidance of member country observer programmes.

K. Coding Specifications to be used for Recording Observer Data

1. Unless otherwise specified for specific data types, observer data are to be collected in accordance with the same coding specifications as specified in this Annex.
2. Coordinated Universal Time (UTC) is to be used to describe times.
3. Degrees and minutes are to be used to describe locations.
4. The following coding schemes are to be used:
   (a) Species are to be described using the FAO 3 letter species codes or, if species do not have a FAO code, using scientific names.
   (b) Fishing methods are to be described using the International Standard Classification of Fishing Gear (ISSCFG - 29 July 1980) codes.
   (c) Types of fishing vessel are to be described using the International Standard Classification of Fishery Vessels (ISSCFV) codes.
5. Metric units of measure are to be used, specifically:
   (a) Kilograms are to be used to describe catch weight.
   (b) Metres are to be used to describe height, width, depth, beam or length.
   (c) Cubic metres are to be used to describe volume.
   (d) Kilowatts are to be used to describe engine power.

Annex 6

Implementation of the Adaptive Management for North Pacific armorhead
(in ~~2019 and 2020~~2021)

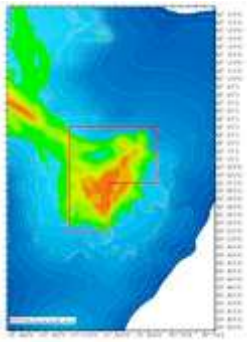
1. Monitoring survey for the detection of strong recruitment of North Pacific armorhead

(1) Location of monitoring surveys

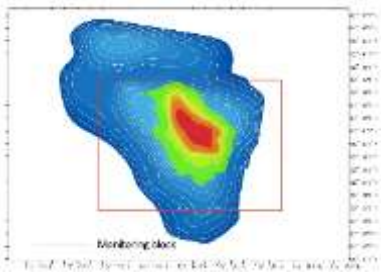
Monitoring surveys for the detection of strong recruitment of North Pacific armorhead will be conducted by trawl fishing vessels in the pre-determined ~~two~~four (~~2~~4) monitoring blocks of Koko (South eastern), Yuryaku, ~~and~~ Kammu (North western) and/or Colahan seamounts.

Monitoring blocks

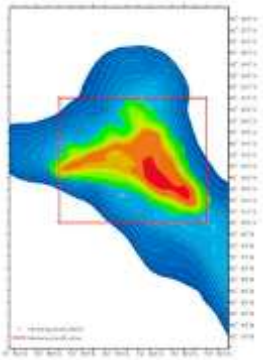
(1) Koko seamount (34°51' –35°04'N, 171°49' –172°00' E)



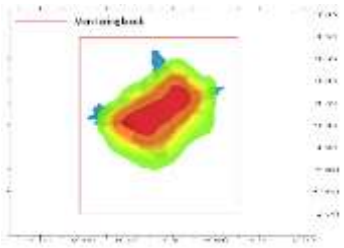
(2) Yuryaku seamount (32°35' –32°45'N, 172°10' –172°24'E)



(3) Kammu seamount (32°10'–32°21'N, 172°44'–172°57'E)



(4) Colahan seamount (30°57'–31°05'N, 175°50'–175°57'E)



(2) Schedule for monitoring surveys

Monitoring surveys will be conducted from March 1st to June 30th each year, with at least a one-week interval between monitoring surveys ~~in the same monitoring block~~. For each survey, a trawl fishing vessel will conduct a monitoring survey in one of the four monitoring blocks that is the nearest from the location of the trawl fishing vessel at the time of prior notification in (4) below. The base schedule for monitoring surveys will be notified to the Executive Secretary by the end of February of each year.~~is shown in the table below. In total, sixteen (16) monitoring surveys will be conducted each year.~~ The base schedule may be revised during the year subject to prior notification to the Executive Secretary.

(3) Data to be collected during monitoring surveys

For each monitoring survey, a trawl net will be towed for one hour. A scientific observer onboard the trawl fishing vessel will calculate nominal-CPUE (kg/hour) of North Pacific armorhead. The scientific observer will also calculate fat index* (FI) of randomly sampled 100 individuals of North Pacific armorhead by measuring fork length (FL) and body height (BH) of each individual.

(*fat index (FI) = body height (BH) / fork length (FL))

(4) Prior notifications and survey results

At least three (3) days before each survey, a prior notification with monitoring date/time, location and trawl fishing vessel name will be provided by the flag state of the trawl fishing vessel to the Executive Secretary.

No later than three (3) days after each survey, the survey result including date/time, location, catch, nominal-CPUE (kg/hour) and percentage of fish with fat index (FI)>0.3 will be provided by the flag state to the Executive Secretary.

The Executive Secretary will circulate these prior notifications and survey results to all Members of the Commission without delay.

2. Areas where bottom fishing with trawl gear is prohibited when high recruitment is detected

(1) Criteria for a high recruitment

It is considered that high recruitment has occurred if the following criteria are met in four (4) consecutive monitoring surveys ~~in each of the two (2) monitoring blocks~~.

- Nominal CPUE > 10t/h
- Individuals of fat index (FI)> 0.3 account for 80% or more

(2) Areas where bottom fishing with trawl gear is prohibited

Bottom fishing with trawl gear shall be prohibited in the following two (2) seamount areas (*) during the year when high recruitment is detected. In such a case, all monitoring surveys scheduled during the year will be cancelled.

- Northern part of Kammu seamount (north of 32°10.0′ N)
- Yuryaku seamount

(*) The catch of North Pacific armorhead in the above two seamounts accounts for a half of the total catch in the entire Emperor Seamounts area based on the catch records in 2010 and 2012.

(3) Notification by the Secretariat

When the criteria for high recruitment are met as defined in 2(1) above, the Executive Secretary will notify all Members of the Commission of the fact with a defined date/time from which bottom fishing with trawl gear is prohibited in the areas as defined in 2(2) above until the end of the year.

Annex E

Stock Assessment Report for Pacific Saury

Abstract:
This report presents results of stock assessment work at the 6th meeting of the Small Scientific Committee on Pacific Saury (SSC-PS), held virtually during November 19-23, 2020.

EXECUTIVE SUMMARY

Data

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

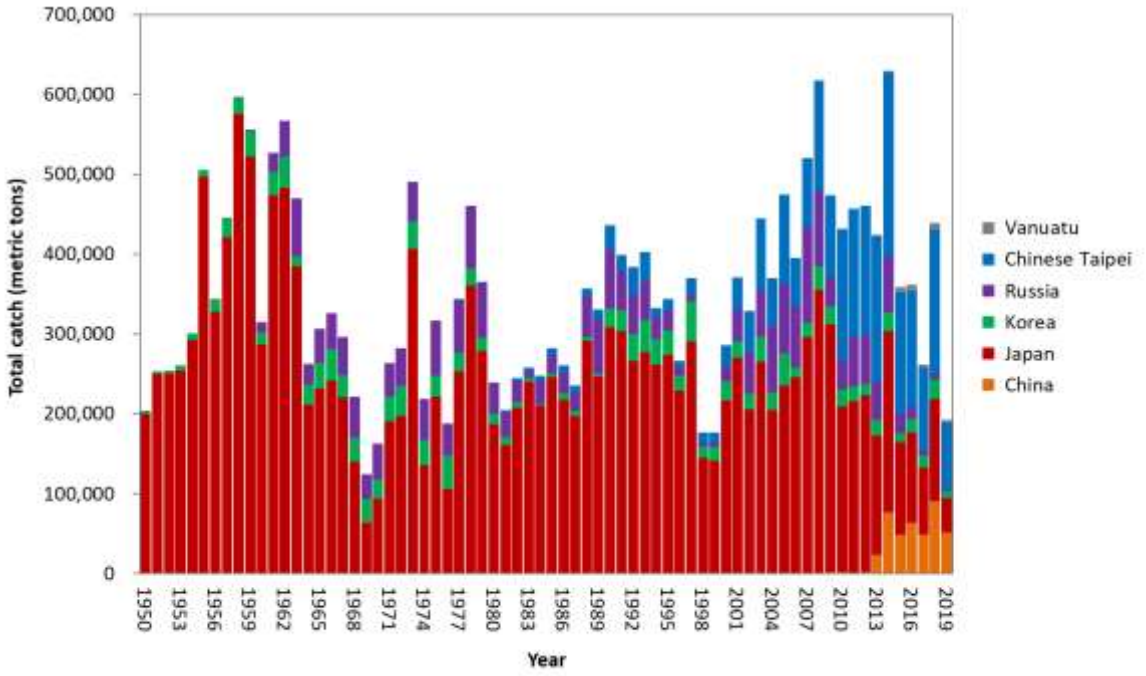


Figure 1. Time series of catch by Member during 1950-2019. The catch data for 1950-1979 and 2019 are shown but not used in stock assessment modeling.

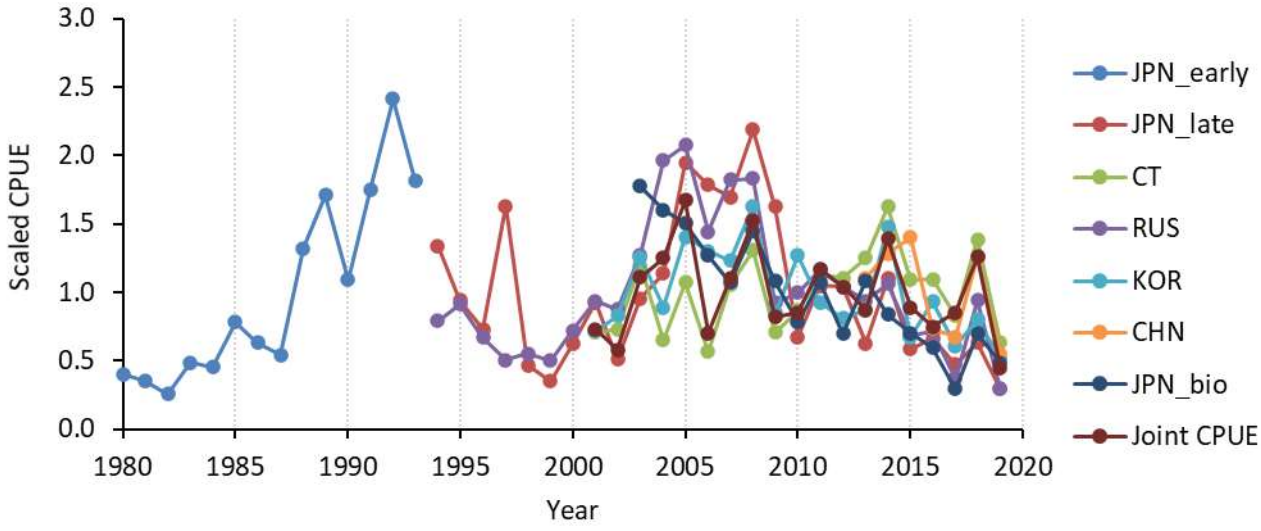


Figure 2. Time series of standardized CPUE and Japanese survey biomass indices (JPN_bio) during 1980-2019. Survey data for 2019 were used in assessment modeling but CPUE data for 2019 were not.

Brief description of specification of analysis and models

A Bayesian state-space production model used in previous stock assessments was employed as an agreed provisional stock assessment model for Pacific saury during 1980-2019. Scientists from three Members (China, Japan and Chinese Taipei) each conducted analyses following the agreed specification which called for two base case scenarios and four sensitivity scenarios (see Annex G, SSC PS05 report for more details). The two base case scenarios differ in using Japanese early CPUE (base case NB1) or not (base case NB2). Time-varying catchability for Japanese CPUE was assumed in NB1 to account for potential increases in catchability between 1980 and 1994. A higher weight was given to the Japanese survey biomass indices than to Members' CPUEs. The CPUE data were modeled as nonlinear indices of biomass. Members used similar approaches with some differences in the assumption of the time-varying catchability and prior distributions for the free parameters in the model.

Summary of stock assessment results

The SSC PS considered the BSSPM results and noted dissimilarities among Members' results for base case 2. The SSC PS was unable to clarify the reason for the dissimilarities and agreed that it would not be advisable to aggregate Members' stock results.

All six base case model runs (two scenarios from each of three members) indicate that recent Pacific saury stock size was less than Bmsy (Figure 3). In particular, median estimates from five out of six runs indicate that 2019 Pacific saury biomass was less than Bmsy. Results from all six model runs indicate that average 2017-2019 biomass was less than Bmsy (see also Figure 4).

A majority of base case model comparisons indicate that recent harvest rates for Pacific saury were higher than Fmsy (Figure 3). In particular, median estimates from five runs indicate that the harvest rate during 2019 and average rates during 2017-2019 were higher than Fmsy (see Figures 3 and 4).

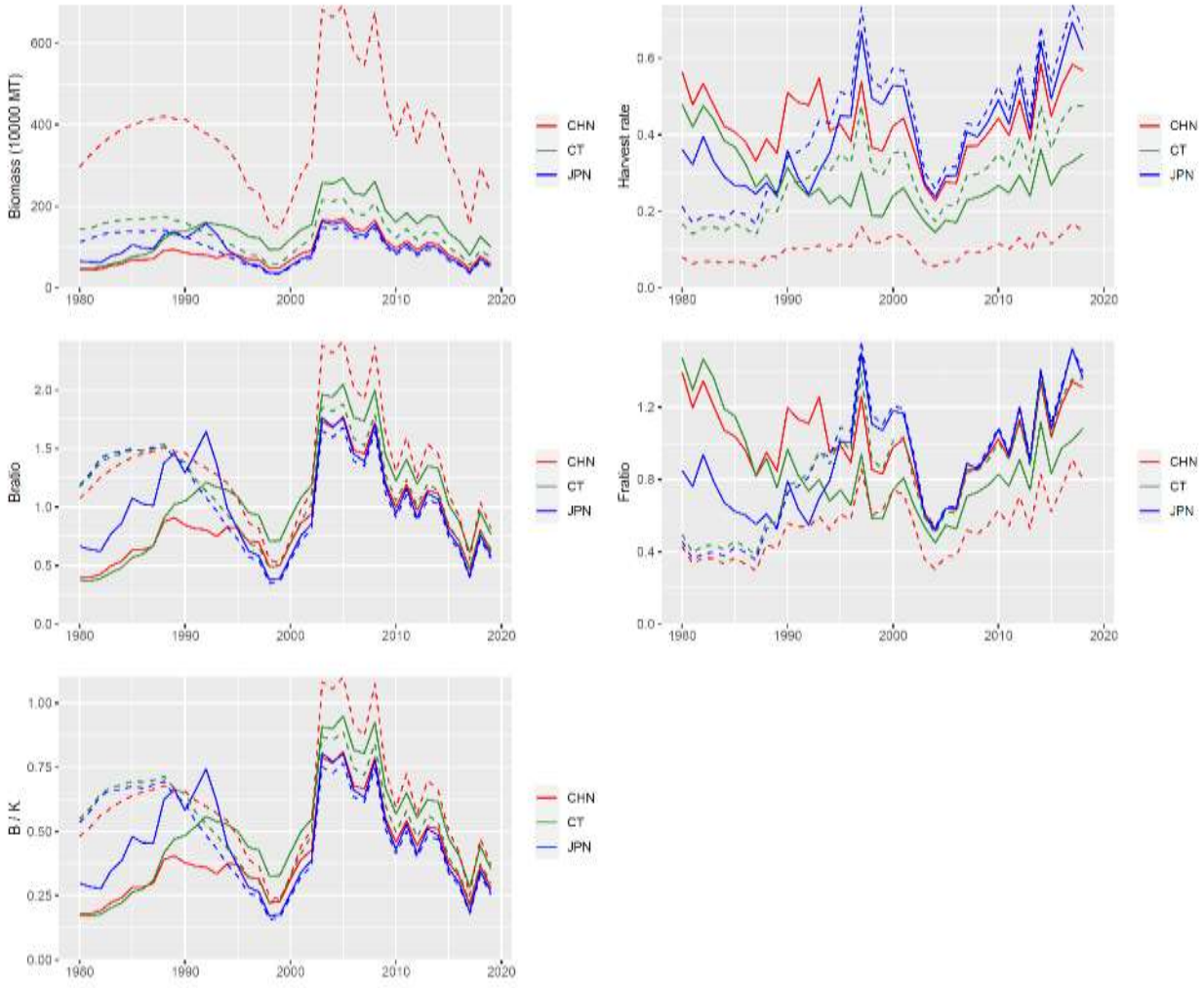


Figure 3. Time series of median estimated values of six runs for biomass, harvest rate, B-ratio, F-ratio, and depletion level relative to the carrying capacity. The solid and shaded lines correspond to NB1 and NB2, respectively.

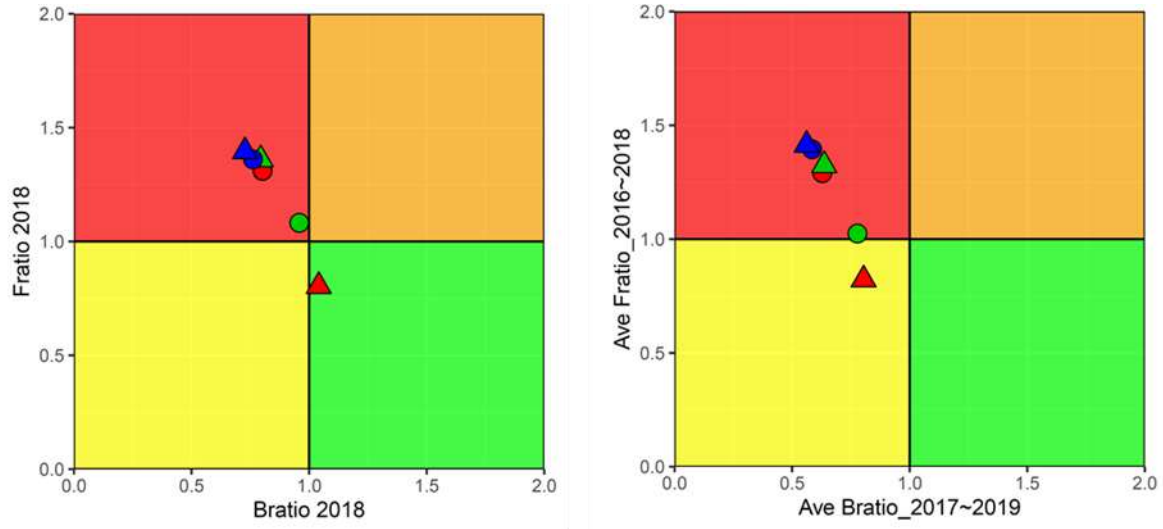


Figure 4. Kobe plots for six runs for NB1 (circle) and NB2 (triangle) by three members' scientists (red for China, blue for Japan and green for Chinese Taipei).

Additional data for 2019-2020 indicate Pacific saury biomass continued to decline after 2019 to a relatively low level in 2020. In particular, CPUE and catch data for 2019, preliminary fishery data through October 2020 and Japanese survey data for 2020 were presented and discussed but could not be included in BSSPM analysis (there were also concerns about the plausibility of the very low biomass estimate, see below). The additional fishery data for 2019 has no additional uncertainty but the 2020 fishery and survey data include increased uncertainty due to effects of Covid-19 which delayed the start of the commercial fishery for some members, may have affected commercial operations and reduced the Japanese survey to a smaller area and narrower SST range than usual. The additional uncertainty for 2020 must be clearly described and considered carefully.

SSC PS members indicate that Covid-19 effects on catches were likely stronger than effects on CPUE. Nominal CPUE for 2020 calculated by Members using data through October were not comparable to data for previous years based on the entire fishing season. For the sake of comparability, nominal CPUE was recalculated for all years based on fishing through October. Trends in the seasonally truncated data through were similar to original CPUE trends and to standardized CPUE used in assessment modeling (Figure xx). The adjusted data show that 2020 CPUE for each Member was at historical low levels. CPUE declines more slowly than stock biomass as demonstrated in all BSSPM results for Pacific saury. Thus, the decline in stock biomass was probably greater than the decline in CPUE.

Preliminary catch data for 2020 through the end of October totaled only about 67 thousand mt (CHECK). Fishing continues but most Members do not expect catch to increase substantially based on seasonal trends and low CPUE (Figure B=seasonal cumulative catch by Member). Thus, 2020 catches are expected to be low.

The Japanese fishery-independent survey is important in Pacific saury stock assessments. Survey catches during 2020 were very low and the original swept-area biomass estimate was only about 10 thousand mt (CHECK). However, sampling did not cover the traditional survey area outside the 13^{o} isotherm where one-year-old Pacific saury may be encountered in large numbers and east of 170^{o} W where zero-year-old fish are most common (about 50% of total biomass is typically in the area not sampled based on historical records). The SSC PS reviewed a result from VAST model to extrapolate over the unsampled area. VAST model estimates were similar to survey swept-area-biomass in recent years but appeared less accurate for early years when stock biomass was highest. The VAST model estimate for Pacific saury biomass in 2002 was only 51 thousand MT (CV 98%, 95% CI 7-180 thousand mt CHECK) compared to the average swept-area biomass of 383 thousand mt during 2015-2019. The SSC PS did not endorse the VAST point estimate in 2020 due to high uncertainty and some doubt about plausibility of the very low estimates. However, they agreed that the VAST estimates as a whole captured the declining trend in the stock during recent years.

Table 1. Summary of estimates of reference quantities. Median values are reported.

	China		Japan		Chinese Taipei	
	Base case 1	Base case 2	Base case 1	Base case 2	Base case 1	Base case 2
C2018 (10,000tons)	43.91	43.91	43.91	43.91	43.91	43.91
AveC2016-2018 (10,000tons)	35.45	35.45	35.45	35.45	35.45	35.45
AveF2016-2018	0.56	0.15	0.64	0.69	0.40	0.63
F2018	0.57	0.15	0.62	0.68	0.43	0.65
FMSY	0.44	0.21	0.46	0.48	0.40	0.45
MSY(10,000tons)	43.18	54.81	42.9	44.1	43.04	41.56
F2018/FMSY	1.31	0.80	1.36	1.40	1.11	1.55
AveF2016-2018/FMSY	1.30	0.83	1.40	1.42	1.04	1.52

K (10,000tons)	221.10	689.00	207.6	206.0	287.80	251.30
B2018 (10,000tons)	77.27	295.85	70.5	65.0	125.50	92.25
B2019 (10,000tons)	59.61	231.10	54.0	50.2	100.30	74.19
AveB2017-2019 (10,000tons)	60.81	228.73	55.9	51.8	102.29	74.07
BMSY (10,000tons)	98.05	305.70	92.9	91.7	131.60	116.35
BMSY/K	0.43	0.43	0.44	0.44	0.46	0.46
B2018/K	0.37	0.47	0.35	0.33	0.44	0.37
B2019/K	0.28	0.37	0.27	0.25	0.35	0.30
B2017-2019/K	0.29	0.37	0.28	0.27	0.36	0.30
B2018/BMSY	0.80	1.04	0.76	0.73	0.96	0.79
B2019/BMSY	0.62	0.82	0.58	0.56	0.77	0.64
B2017-2019/BMSY	0.63	0.81	0.61	0.58	0.78	0.64

Current stock condition

All six base case model runs (two scenarios from each of three members) indicate that recent Pacific saury stock size was less than Bmsy. In particular, median estimates from five out of six runs indicate that 2019 Pacific saury biomass was less than Bmsy. Results from all six model runs indicate that average 2017-2019 biomass was less than Bmsy. Relative abundance indices indicated that Pacific saury stock biomass may have been near record low levels during 2019 and 2020. The 2020 biomass index from the Japanese survey has large uncertainties but dropped to the historical lowest level.

A majority of base case model comparisons indicate that recent harvest rates for Pacific saury were higher than Fmsy. In particular, median estimates from five runs indicate that the harvest rate during 2019 and average rates during 2017-2019 were higher than Fmsy.

Special comments regarding the procedures and stock assessment results

The SSC-PS worked collaboratively to produce this consensus stock assessment, which includes significant technical improvements.

1) CPUE data were assumed to change more slowly than biomass and were down-weighted relative to the Japanese survey. The estimates of a nonlinear parameter in the assessment model support this modeling decision.
2) Retrospective analyses showed that BSSPM model projections for Pacific saury were less useful than expected and the SSC-PS agreed results were likely to be misinterpreted. The issue was discussed and further explained in the report. Additional research or age-structured assessment modelling may be required to provide projection results for use by managers, to enhance projection capability and support potential MSE (Management Strategy Evaluation) work.
3) The SSC-PS noted that an internal computation of q for the Japanese survey used in calculating predicted survey values and prior probability might improve model performance. However, there was no evidence of a problem in the current model formulation.
4) The SSC PS reviewed promising approach for spatial/temporal model-based survey biomass estimation using Japanese survey data and the VAST model. The SSC-PS agreed that the approach was useful and decided to continue work on the topic.
5) Certain key BSSPM parameter estimates (i.e. intrinsic growth rate and shape) reached the upper bound of their

prior ranges in some models indicating that their priors should be refined before the next assessment.

6) Results for scenario NB2 in one Member's analysis were significantly higher than from results of other runs but the reason could not be determined given the time constraint and meeting format. The SSC PS noted that the scales of estimated biomass among previous base case scenarios from the three Members have shown some discrepancies.
7) The Invited Expert and some Members pointed out scale instability in the NB2 model run may have been due to or exacerbated by specification of prior distributions, computer code or other correctable problem in addition to lack of information about scale in the available data. All of these potential causes are very common and should be expected to occur from time to time in practical fishery work with statistically or computationally complex models and fishery data. In any case, it seems premature to conclude that the BSSPM is inherently or unusually unstable given that such pathological patterns were not observed in other base case models used in this assessment or previous assessments.
8) Member scientists agreed to exchange the code and input data files and work collaboratively to explain the differences.
9) Nominal and standardized CPUE data were available for 2019 but not used in assessment models because they were not included in the terms of reference. However, the data for 2019 indicate that Pacific saury biomass for all Members declined by an average of about 50% during 2018-2019. For example, the decline based on GLM standardized joint CPUE was 59%.
10) It would be easier to maintain computer code and ensure correct calculations if one program were used by all Members, particularly as more complicated age/size-structured models are introduced.
11) It may be possible to increase efficiency of stock assessment work by reducing duplicate work by Members. For example, CPUE standardization, model development and assessment modeling might be done by single subgroups. The time saved could be used to develop harvest control rules and implement age-structured models, for example.
12) Transparency and reproducibility could be enhanced by submitting computer programs, code and input data files used for assessment modeling and standardizing CPUE data by each Member.
13) This executive summary for Pacific saury stock assessment results is an attempt to enhance communication with managers, other scientists and interested persons who may not want to read the full assessment report with complete technical details. Such reports are typically short and include agreed sets of tables and figures in standard formats. The NPFC should discuss a common format of the executive summary over species with respect to information requirements and effective communication.
14) Members report that the fishing grounds have shifted further offshore over the last decade. Japanese survey results indicate possible changes in spatial distribution of Pacific saury habitat. Potential effects on productivity are unknown.
15) Pacific saury stock size has declined over the last two decades due to climatic and human factors acting together in a manner that is not understood. There is an urgent need to determine if ongoing environmental changes are likely to be reducing productivity of the fishery. The SSC-PS should routinely devote time to investigating the biological and ecological mechanisms linking population dynamics and the environment. The recent paper by Members (Hsu, J., Chang, Y.J., Kitakado, T., Kai, M., Li, B., Hashimoto, M., Hsieh, C.H, Kulik, V., Park, K. J. (2020). Evaluating the spatiotemporal dynamics of Pacific saury in the Northwestern Pacific Ocean by using a geostatistical modelling approach. Fisheries Research (accepted)) demonstrates the success and importance of working on this topic.
16) An Fmsy approach was used to calculate a TAC for 2020 and the SSC-PS recognizes this as an important step in management. However, it can be difficult to estimate current Fmsy from historical data when the environment is changing. It is therefore important to further evaluate the Fmsy approach for Pacific saury. For example, historical TAC values could be calculated using the Fmsy estimate and historical biomass estimates from the BSSPM for comparison to actual catches after 2000 while the stock was declining. Calculations of this sort could be completed this year as a prelude to a more extensive MSE effort

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 Kuril Islands to eastward to 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

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 160E) 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). In rare cases, saury have been found to mature at 22 cm (Sugama 1957; Hotta 1960). 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 technic 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 43 thousand tons were recorded in 2008 and 2019, 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. Since then, the annual catch has been decreasing, and was about 2 thousand tons in 2019.

China commenced its exploratory saury fishing using stick-held dip net 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.

The Pacific saury fishery of Chinese Taipei was first developed in 1975 by a research vessel, thereafter two commercial fishing vessels started operating in the Northwest Pacific Ocean in the next year. Between the 1980s and the early 1990s, the Pacific saury caught by some fishing fleets including trawlers, drift net fishing vessels, squid jiggers and tuna longliners. The number of fishing vessels reached 43 in 1985, 1986, and 1989. However, only the squid jiggers harvest the Pacific saury after 1996. Since the Pacific saury fishing season is mainly in the second half of the year, most fishing vessels typically fish for Atlantic shortfin squid (*Illex argentinus*) in the Southwest Atlantic Ocean for the first 4 or 5 months of the year. After the end of squid fishing season, the fishing vessels return to homeport to change fishing gear and then proceed to harvest Pacific saury in the Northwest Pacific Ocean. Before 2005, most of the fishing vessels engaged in the Pacific saury fishery also conducted neon flying squid jigging operations in the Northwest Pacific Ocean. After then, as the catch of Pacific saury exceeded that of neon flying squid, the fishing vessels changed their fishing practices to target Pacific saury only.

Vanuatu commenced its development of Pacific saury fishery by using stick-held dip net at 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 only 224 kg of saury were captured by Canadian commercial fisheries over 17 years from 1997-2013 (Wade and Curtis 2015). 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 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)

While Japanese and Russian vessels operate mainly within their EEZ, Chinese, Korean and Chinese Taipei vessels operate mainly in the high seas of the North Pacific (Figure 1).

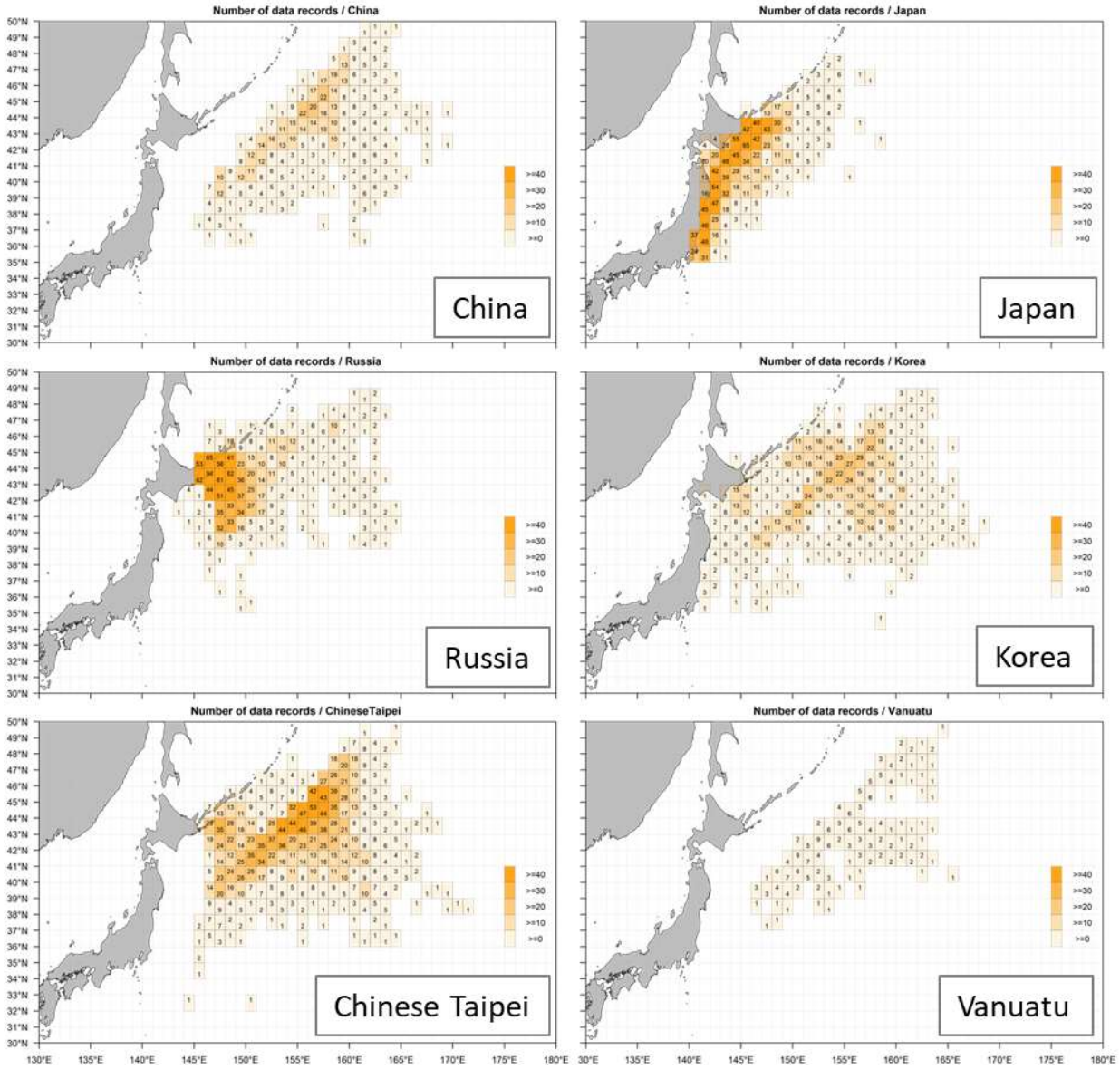


Figure 1. Main fishing grounds for Pacific saury by fishing members in the Western North Pacific Ocean. The legend shows the number of data records. This figure is based on the data shared by the Members for the development of a joint CPUE index (NPFC-2018-TWG PSSA03-WP02, NPFC-2018-TWG PSSA03-WP03, NPFC-2018-TWG PSSA03-WP04, NPFC-2018-TWG PSSA03-WP06b, NPFC-2018-TWG PSSA03-WP08, and NPFC-2018-TWG PSSA03-WP12; available at www.npfc.int).

2.2 Catch records

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

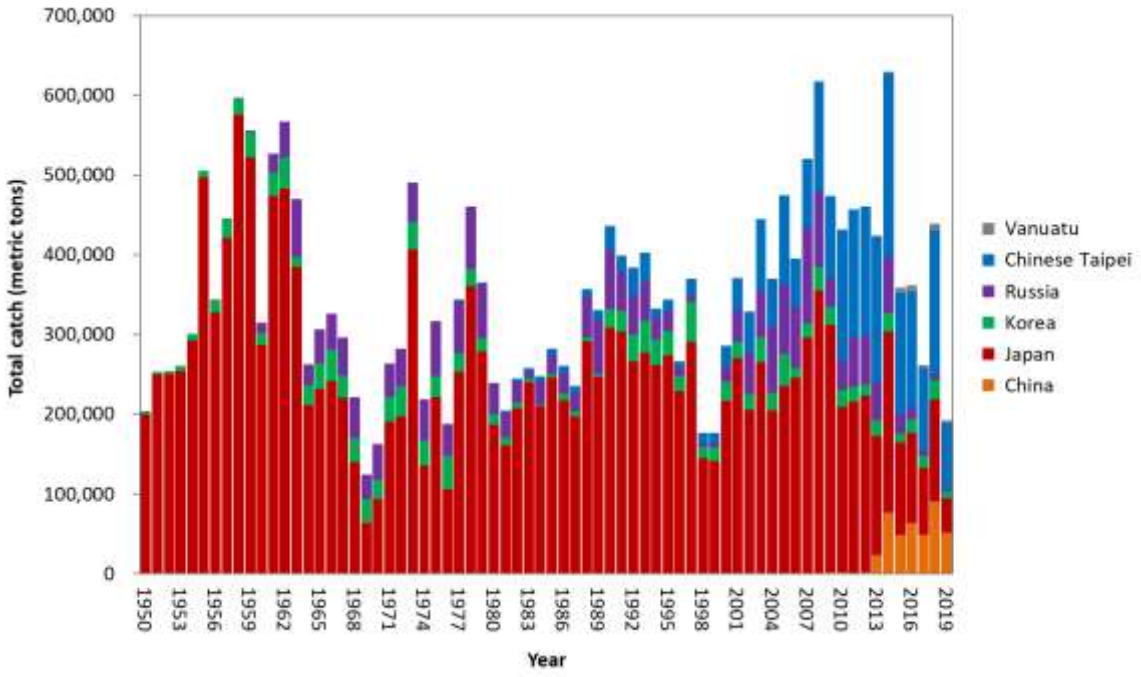


Figure 2. Time series of catch by Member during 1950-2019. The catch data for 1950-1979 and 2019 are shown but not used in stock assessment modeling.

3. SPECIFICATION OF STOCK ASSESSMENT

A Bayesian state-space production model used in previous stock assessments was employed as an agreed provisional stock assessment model for Pacific saury during 1980-2019. Scientists from three Members (China, Japan and Chinese Taipei) each conducted analyses following the agreed specification which called for two base case scenarios and four sensitivity scenarios (see Annex G, SSC PS05 report for more details). The two base case scenarios differ in using Japanese early CPUE (base case NB1) or not (base case NB2). Time-varying catchability for Japanese CPUE was assumed in NB1 to account for potential increases in catchability between 1980 and 1994. A higher weight was given to the Japanese biomass survey estimates than to Members' CPUEs. The CPUE data were modeled as nonlinear indices of biomass. Members used similar approaches with some differences in the assumption of the time-varying catchability and 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 3 members)

The multiple biomass indices are modelled as follows:

Survey biomass index

$$I_{t,biomass} = q_{biomass} B_t \, exp(v_{t,biomass}), \qquad \text{where} \quad v_{t,biomass} \sim N\left(0, \sigma^2_{biomass}\right)$$

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

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

where

$I_{t,f}$: the survey 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 different own preferred assumption 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 China and Japan, see documents NPFC-2020-SSC PS-WP08 and NPFC-2020-SSC PS-WP10; for the non-uniform priors used in Chinese Taipei, see document NPFC-2020-SSC PS-WP17.

3.2 Agreed scenarios

Table 1. Definition of scenarios

	New base case (NB1)	**New base case (NB2)**	**Sensitivity case (NS1, NS2)**	**Sensitivity case (NS3, NS4)**
Initial year	1980	1980	1980	1980/2001
Biomass survey	B_obs = B_est*q1 ~ LN(log(q*B), s^2) q~U(0, 1)	Same as left	q~U(0, 2)	q~U(0, 1) 2003-2019

CPUE	CHN(2013-2018) JPN_early(1980-1993) (with time-varying q) JPN_late(1994-2018) KOR(2001-2018) RUS(1994-2018) CT(2001-2018)	CHN(2013-2018) JPN_late(1994-2018) KOR(2001-2018) RUS(1994-2018) CT(2001-2018)	Two sets as on the left for NS1 and NS2 respectively	NS3: Joint CPUE 2001-2017 (no JPN_early) NS4: Joint CPUE 2001-2017 and JPN_early
Variance component	Variances of logCPUEs are assumed to be common and 6 times of that of logbiomass	Variances of logCPUEs are assumed to be common and 5 times of that of logbiomass	Same as base cases 1 and 2, respectively	Same weight between biomass and joint CPUE
Hyper-depletion/ stability	A common parameter for all fisheries but JPN_early, with a prior distribution, b ~ U(0, 1) but [b_JPN_early=1]	A common parameter for all fisheries with a prior distribution, b ~ U(0, 1)	Same as base cases 1 and 2, respectively	b ~ U(0, 1)
Prior for other than q_biomass	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_{2018}	Catch in 2018
$AveC_{2016\text{-}2018}$	Average catch for a recent period (2016–2018)
$AveF_{2016\text{-}2018}$	Average harvest rate for a recent period (2016–2018)
F_{2018}	Harvest rate in 2018
F_{MSY}	Annual harvest rate producing the maximum sustainable yield (MSY)
MSY	Equilibrium yield at FMSY
F_{2018}/F_{MSY}	Average harvest rate in 2018 relative to FMSY
$AveF_{2016\text{-}2018}/F_{MSY}$	Average harvest rate for a recent period (2016–2018) relative to FMSY
K	Equilibrium unexploited biomass (carrying capacity)
B_{2018}	Stock biomass in 2018 estimated in the model
B_{2019}	Stock biomass in 2019 estimated in the model[b]
$AveB_{2017\text{-}2019}$	Stock biomass for a recent period (2017–2019) estimated in the model[b]
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_{2018}/K	Stock biomass in 2018 relative to K[a]
B_{2019}/K	Stock biomass in 2019 relative to K[a,b]
$B_{2017\text{-}2019}/K$	Stock biomass in the latest time period (2017-2019) relative to the equilibrium unexploited stock biomass[a,b]
B_{2018}/B_{MSY}	Stock biomass in 2018 relative to BMSY[a]
B_{2019}/B_{MSY}	Stock biomass in 2019 relative to BMSY[a,b]
$B_{2017\text{-}2019}/B_{MSY}$	Stock biomass for a recent period (2017–2019) relative to the stock biomass that produces maximum sustainable yield (MSY) [a,b]

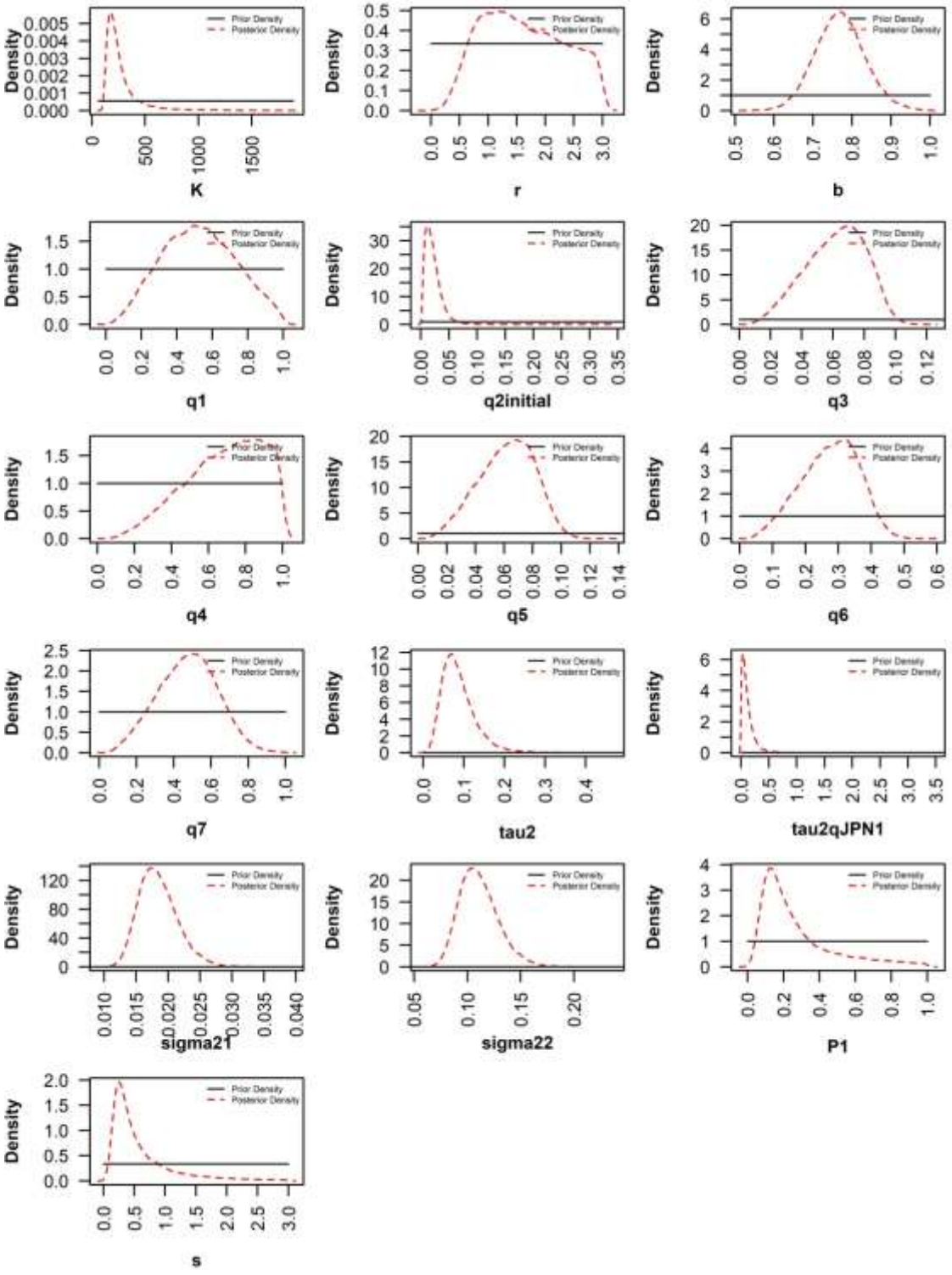
[a]calculated as the average of the ratios,

[b]Japanese biomass survey available but no CPUE available in 2019.

4. RESULTS by CHINA, JAPAN and CHINESE TAIPEI

4.1 CHINA

4.1.1 Prior and posterior distributions for Base case model 1 (as an illustrative example)

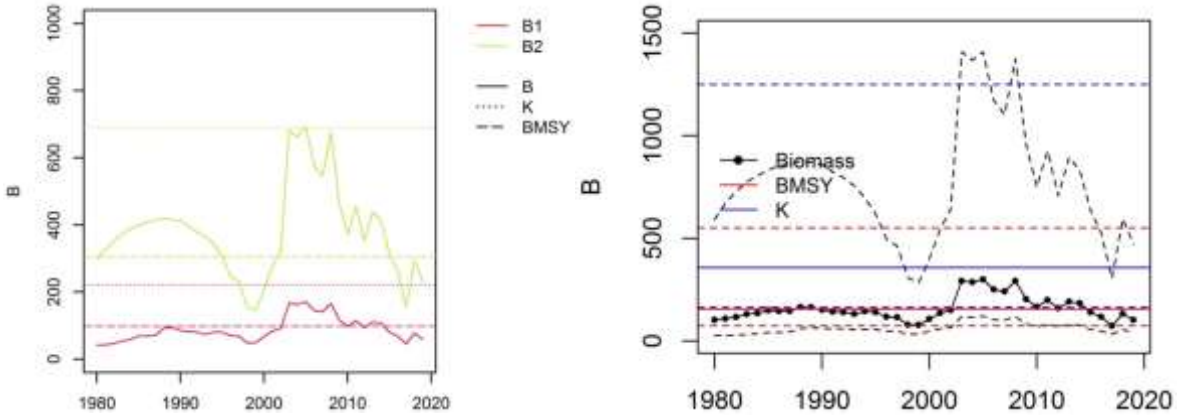


4.1.2 Summary of estimates of parameters and reference points

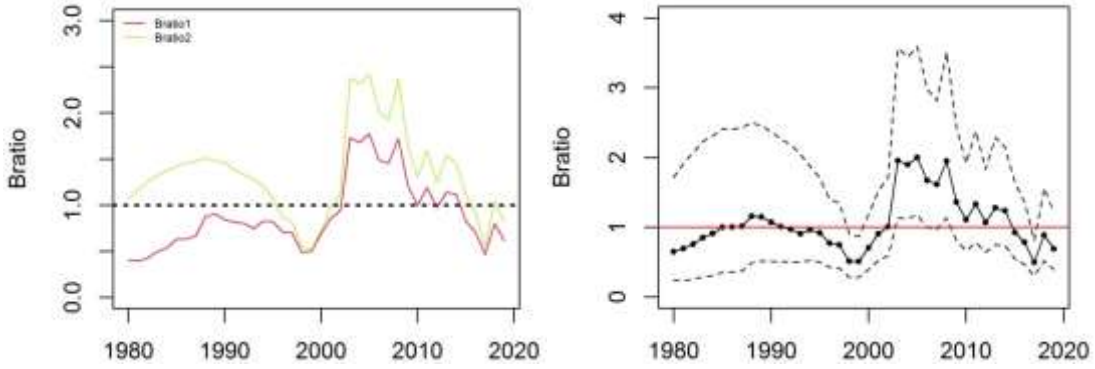
	Base case 1	Base case 2	Over all 2
C2018	43.91	43.91	43.91
AveC2016-2018	35.45	35.45	35.45
AveF2016-2018	0.56	0.15	0.33
F2018	0.57	0.15	0.33
FMSY	0.44	0.21	0.32
MSY	43.18	54.81	45.93
F2018/FMSY	1.31	0.80	1.13
AveF2016-2018/FMSY	1.30	0.83	1.13
K	221.10	689.00	357.10
B2018	77.27	295.85	132.90
B2019	59.61	231.10	103.00
AveB2017-2019	60.81	228.73	103.47
BMSY	98.05	305.70	155.95
BMSY/K	0.43	0.43	0.43
B2018/K	0.37	0.47	0.40
B2019/K	0.28	0.37	0.31
B2017-2019/K	0.29	0.37	0.32
B2018/BMSY	0.80	1.04	0.89
B2019/BMSY	0.62	0.82	0.69
B2017-2019/BMSY	0.63	0.81	0.69

4.1.3 Time series plots for base case models and aggregated results

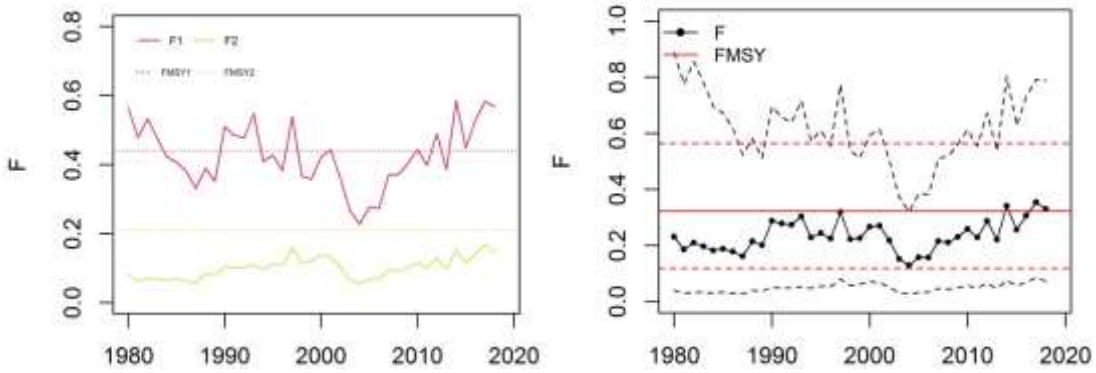
(a) Biomass



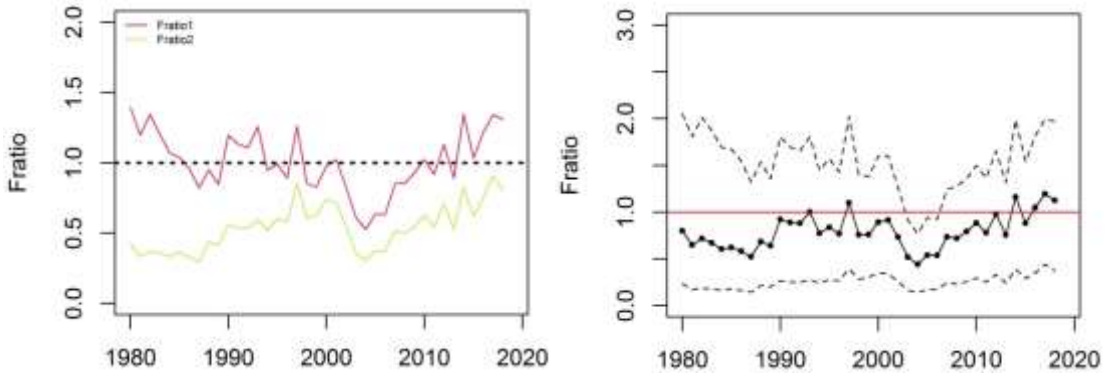
(b) B-ratio (B/Bmsy)



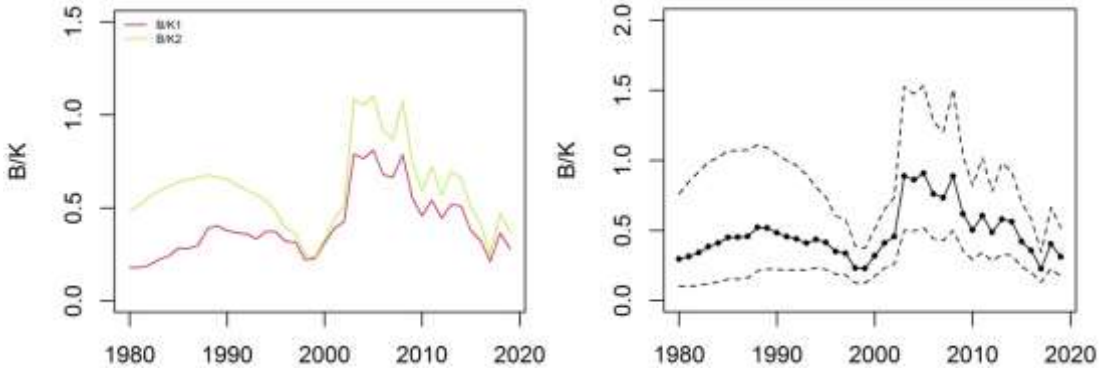
(c) Exploitation rate (F)



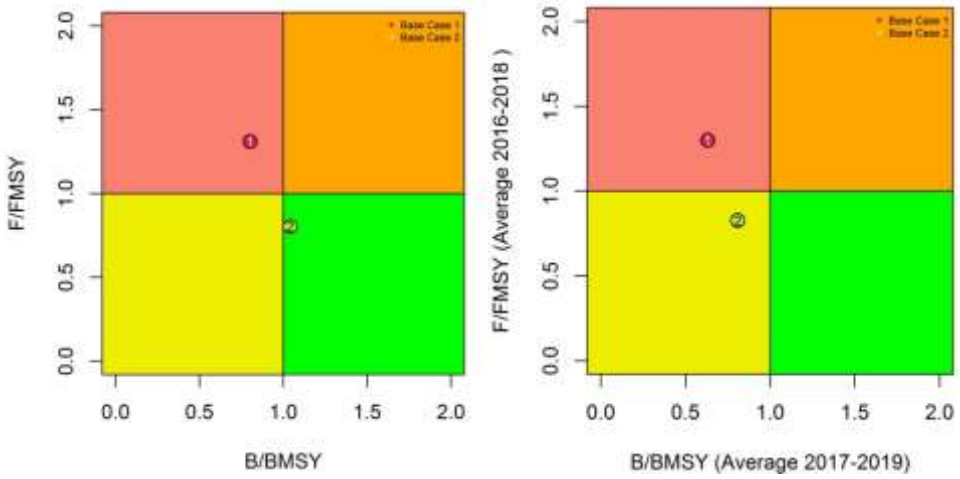
(d) F-ratio (F/Fmsy)

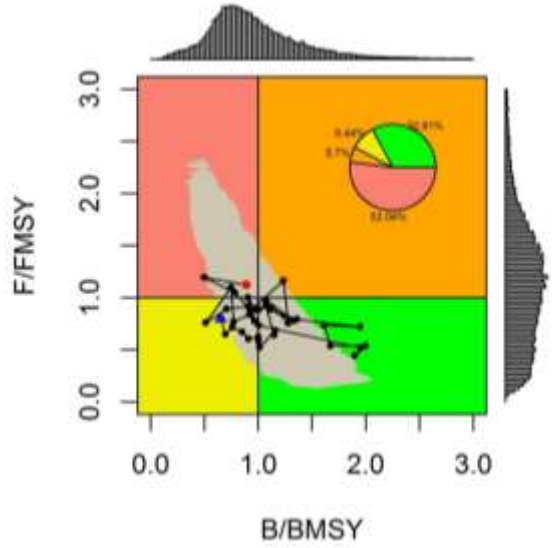


(d) B/K



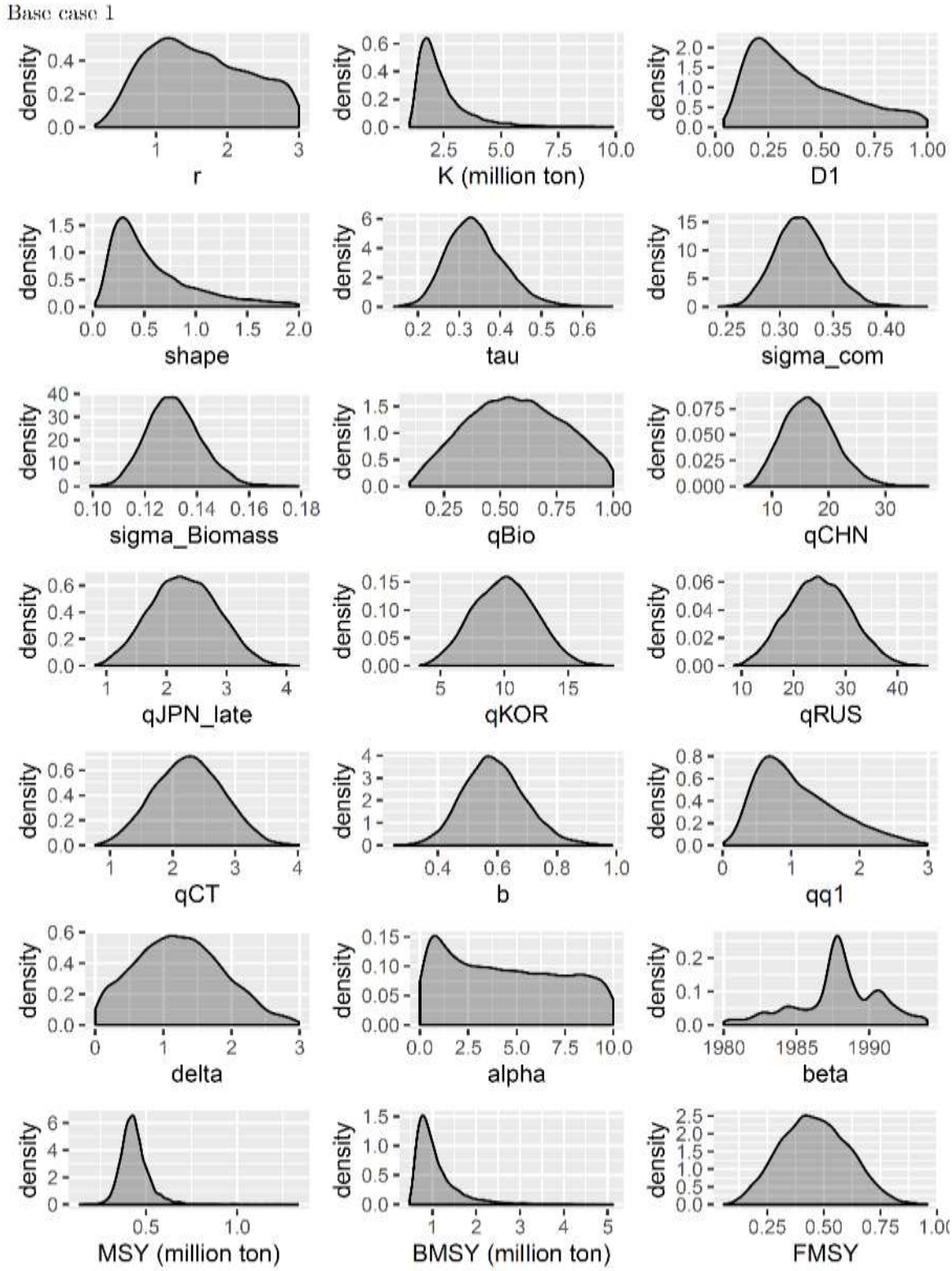
4.1.4 Kobe plots





4.2 JAPAN

4.2.1 Prior and posterior distributions for Base case model 1 (as an illustrative example)



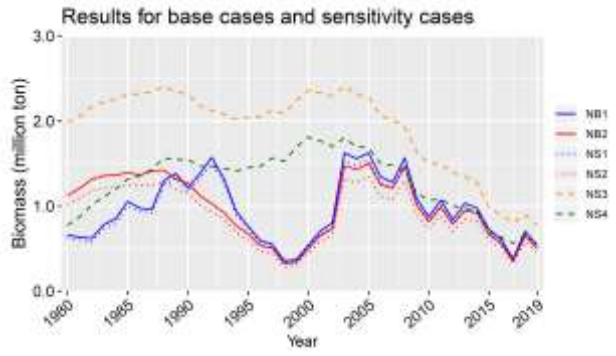
Note: Prior for each free parameter is assumed to be uniform over the shown horizontal range.

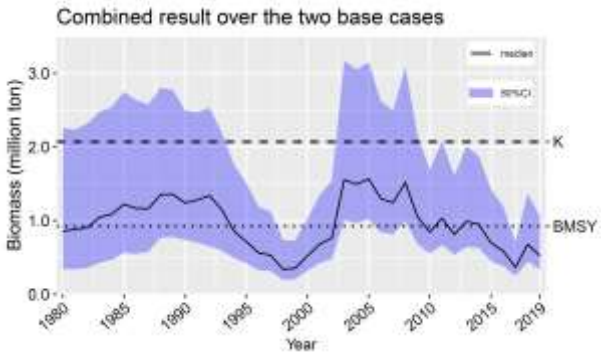
4.2.2 Summary of estimates of parameters and reference points

	NB1 Median	NB2 Median	Overall Median
C_2018	0.439	0.439	0.439
AveC_2016_2018	0.354	0.354	0.354
AveF_2016_2018	0.642	0.690	0.664
F_2018	0.623	0.676	0.649
FMSY	0.456	0.484	0.470
MSY	0.429	0.441	0.435
F_2018/FMSY	1.361	1.396	1.377
AveF_2016_2018/FMSY	1.402	1.422	1.412
K	2.076	2.06	2.070
B_2018	0.705	0.650	0.677
B_2019	0.540	0.502	0.521
AveB_2017_2019	0.559	0.518	0.539
BMSY	0.929	0.917	0.924
BMSY/K	0.438	0.439	0.439
B_2018/K	0.347	0.331	0.339
B_2019/K	0.265	0.254	0.26
AveB_2017_2019/K	0.277	0.265	0.271
B_2018/BMSY	0.761	0.727	0.745
B_2019/BMSY	0.584	0.560	0.572
AveB_2017_2019/BMSY	0.606	0.583	0.594

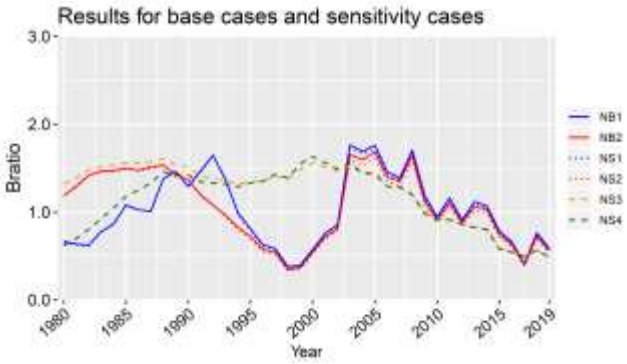
4.2.3 Time series plots for base case models and aggregated results

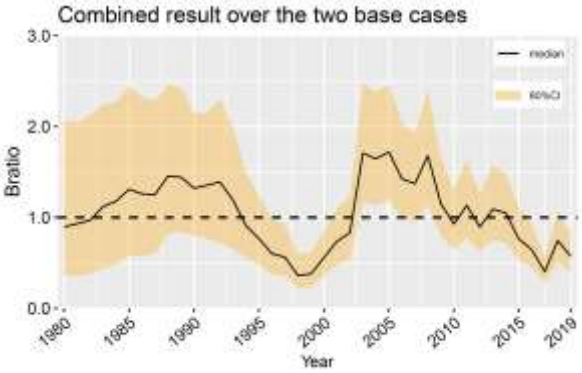
(a) Biomass



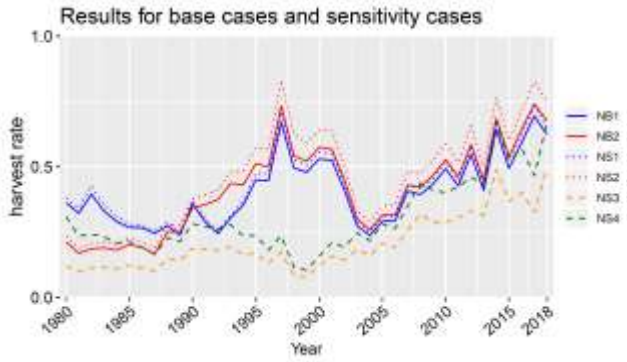


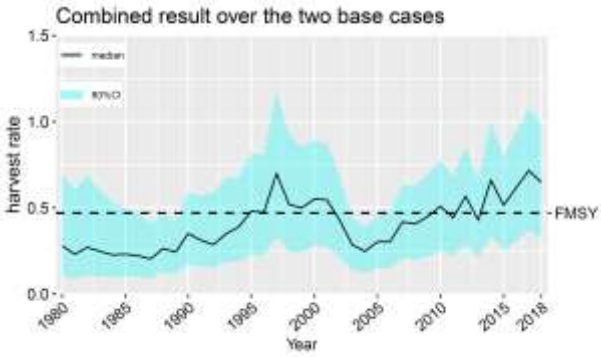
(b) B-ratio (B/Bmsy)



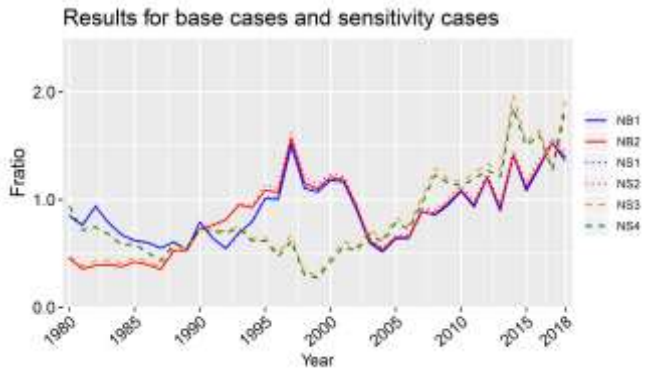


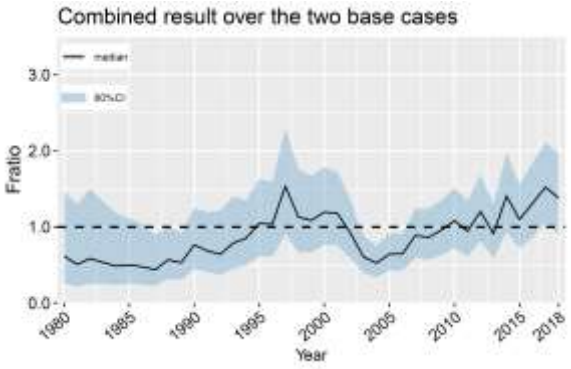
(c) Exploitation rate (F)



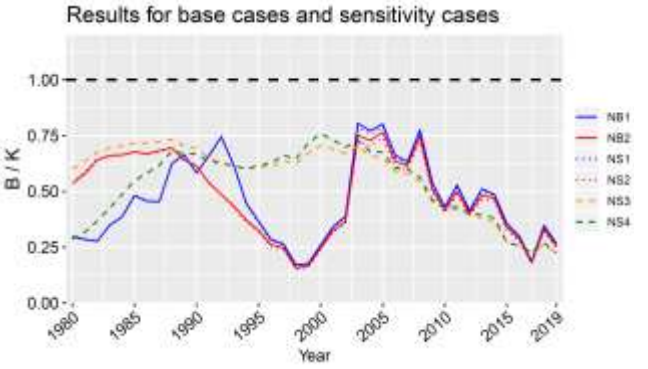


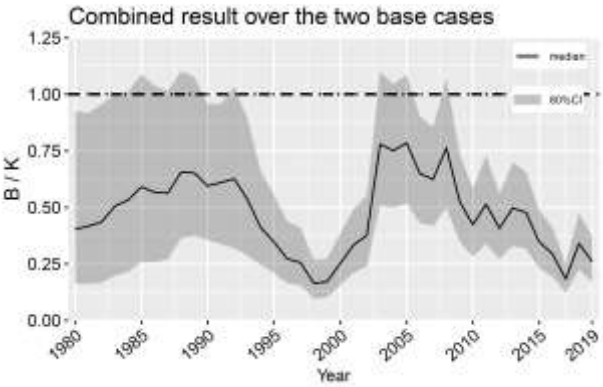
(d) F-ratio (F/Fmsy)



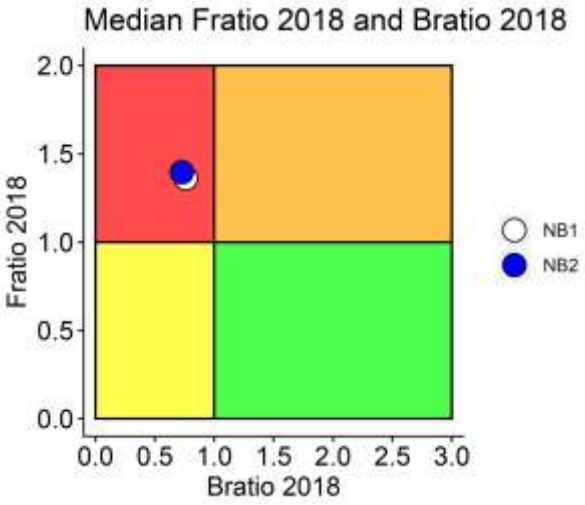


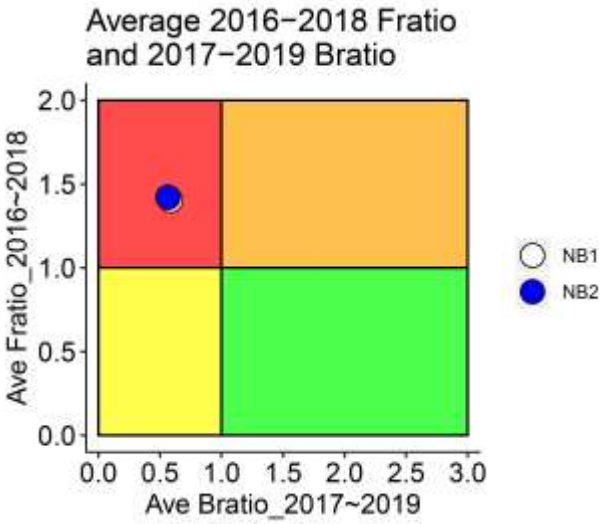
(e) B/K

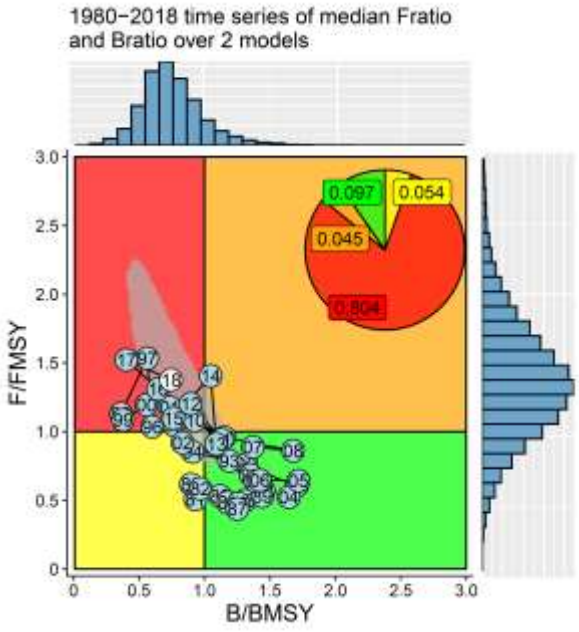




4.2.4 Kobe plots

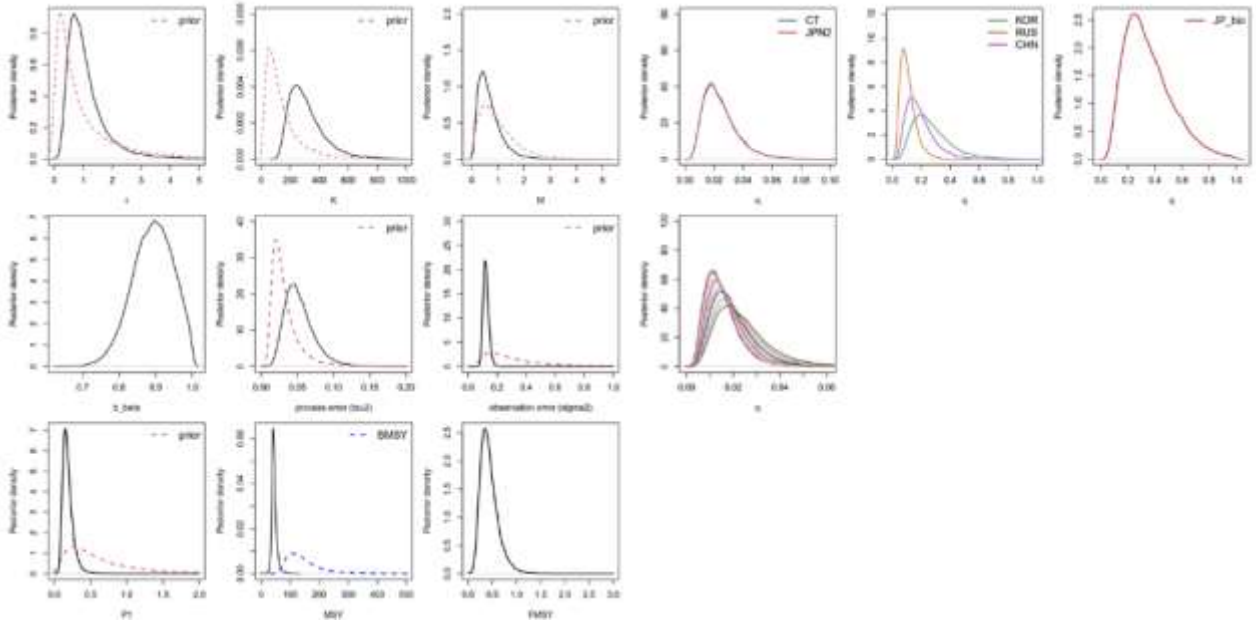






4.3 CHINESE TAIPEI

4.3.1 Prior and posterior distributions for Base case model 1 (as an illustrative example)

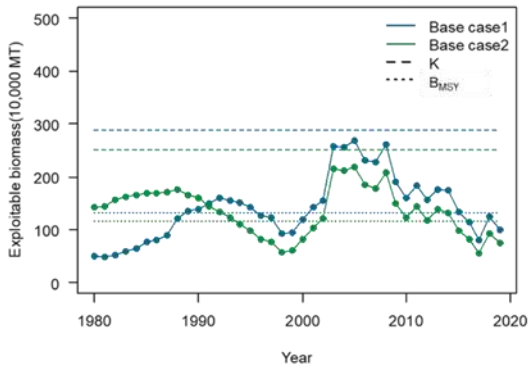


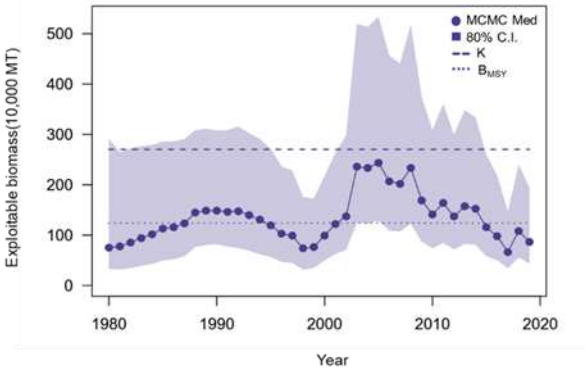
4.3.2 Summary of estimates of parameters and reference points

	Base case1	Base case2	Overall
	Median		
C_{2018}	43.91	43.91	43.91
$AveC_{2016\text{-}2018}$	35.45	35.45	35.45
$AveF_{2016\text{-}2018}$	0.40	0.63	0.50
F_{2018}	0.43	0.65	0.52
F_{MSY}	0.40	0.45	0.42
MSY	43.04	41.56	42.32
F_{2018}/F_{MSY}	1.11	1.55	1.31
$AveF_{2016\text{-}2018}/F_{MSY}$	1.04	1.52	1.26
K	287.80	251.30	270.20
B_{2018}	125.50	92.25	108.10
B_{2019}	100.30	74.19	86.96
$AveB_{2017\text{-}2019}$	102.29	74.07	87.57
B_{MSY}	131.60	116.35	124.10
B_{MSY}/K	0.46	0.46	0.46
B_{2018}/K	0.44	0.37	0.41
B_{2019}/K	0.35	0.30	0.35
$B_{2017\text{-}2019}/K$	0.36	0.30	0.33
B_{2017}/B_{MSY}	0.61	0.48	0.54
B_{2018}/B_{MSY}	0.96	0.79	0.87
B_{2019}/B_{MSY}	0.77	0.64	0.70
$B_{2017\text{-}2019}/B_{MSY}$	0.78	0.64	0.71

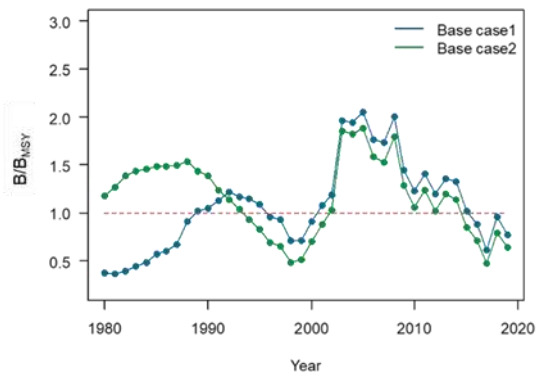
4.3.3 Time series plots for base case models and aggregated results

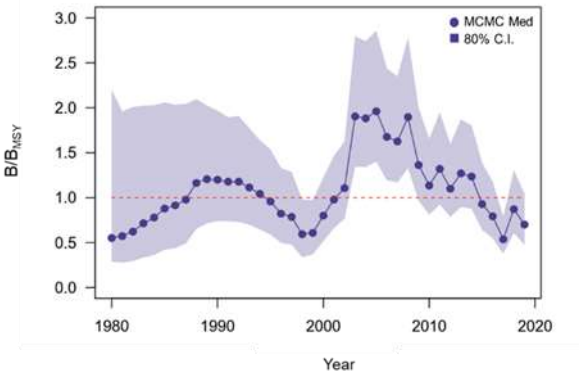
(a) Biomass



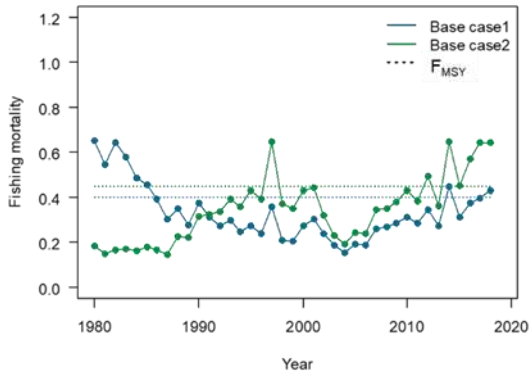


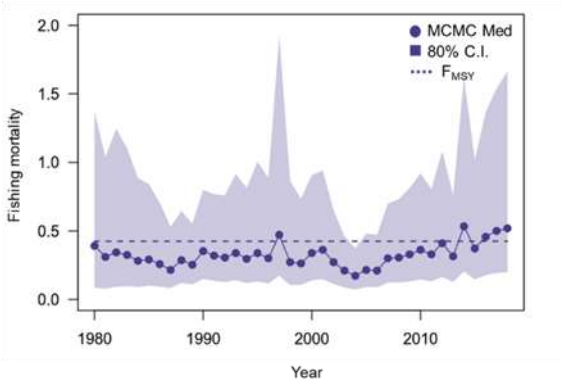
(b) B-ratio (B/Bmsy)



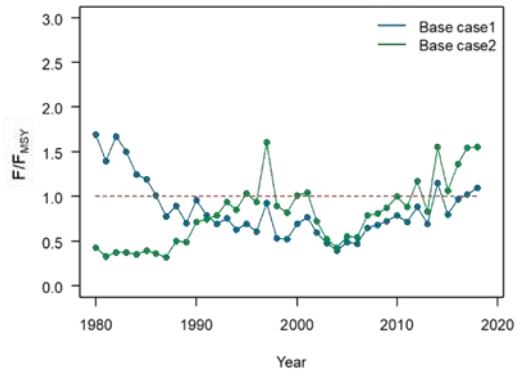


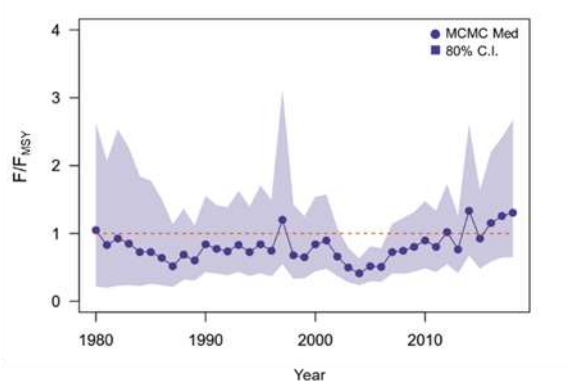
(c) Exploitation rate (F)



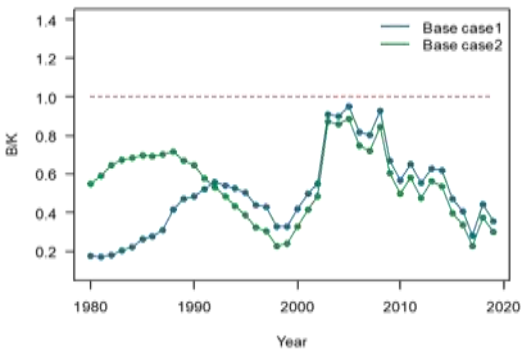


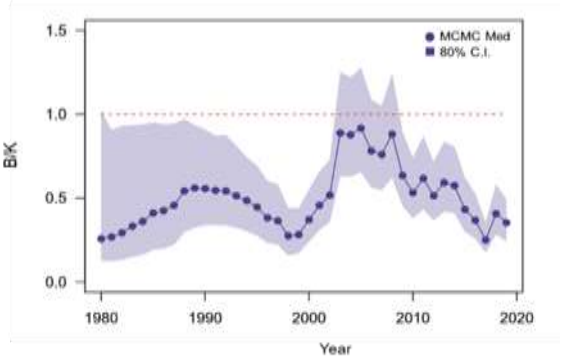
(d) F-ratio (F/Fmsy)



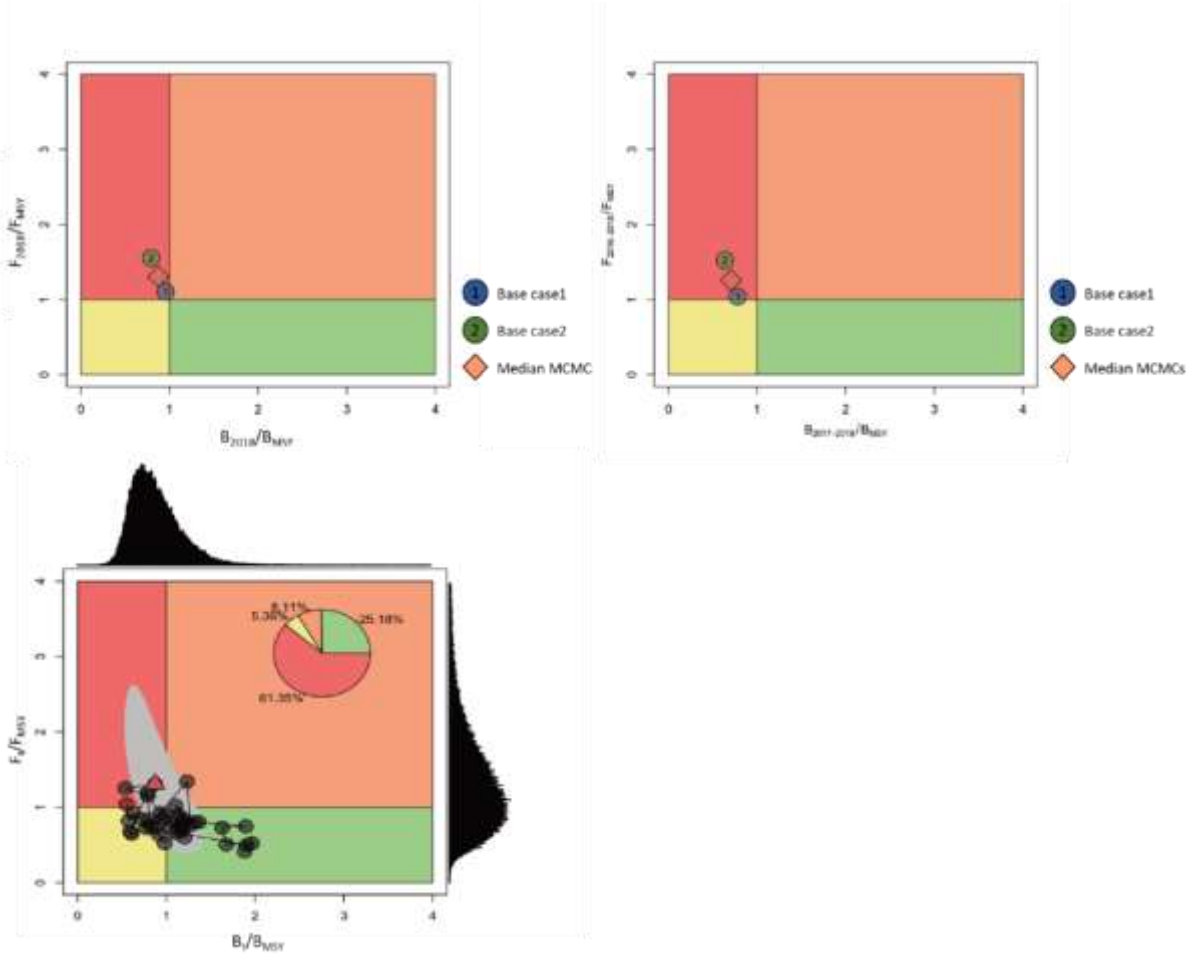


(e) B/K





4.3.4 Kobe plots



5 SOME AGGREGATED RESULTS FOR VISUALIZATION PURPOSE

5.1 Visual presentation of results

The graphical presentations for times series of biomass (B), B-ratio (=B/Bmsy), exploitation rate (F), F-ratio (F/Fmsy) and B/K are shown in Figure 3.

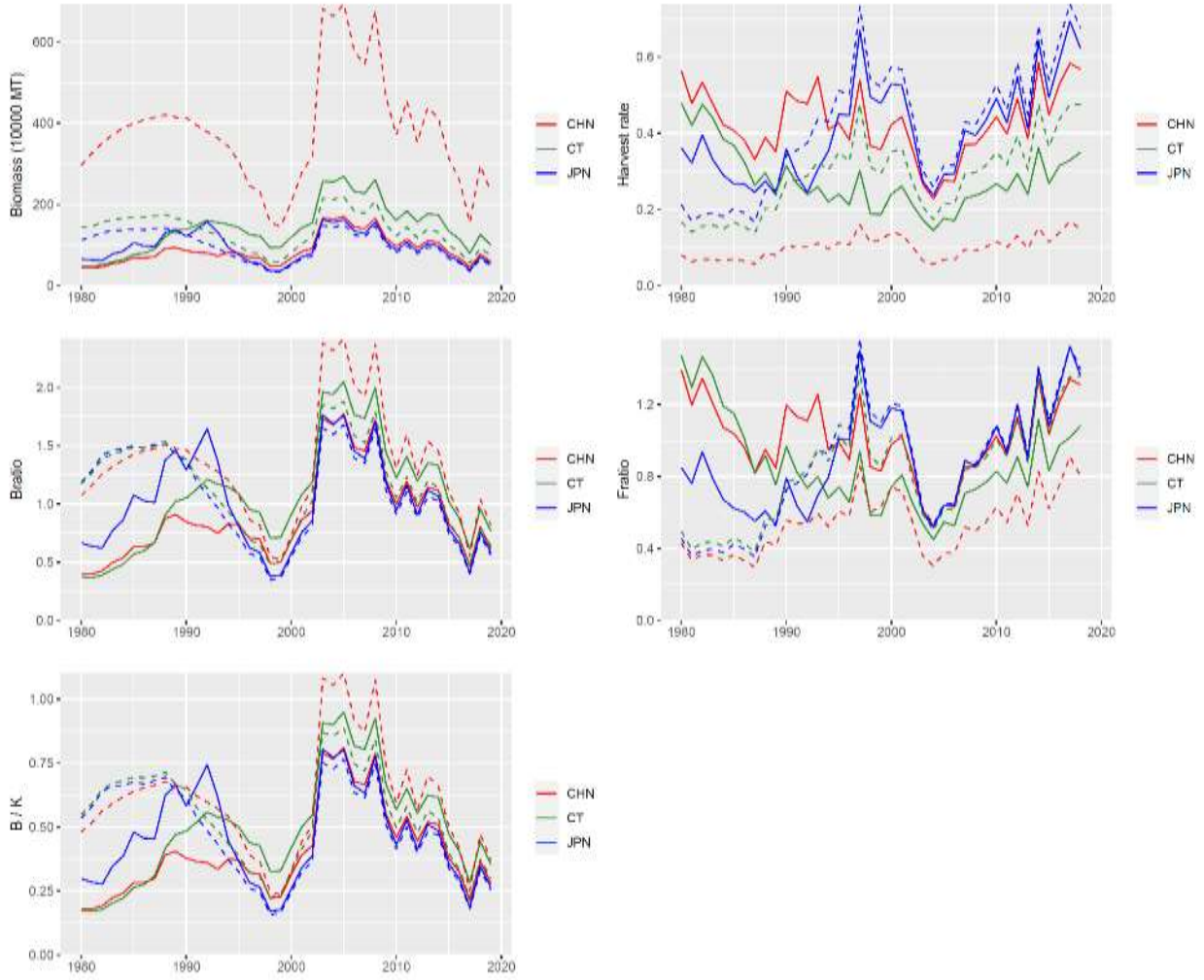


Figure 3. Time series of median estimated values of six runs for biomass, harvest rate, B-ratio, F-ratio, and depletion level relative to the carrying capacity. The solid and shaded lines correspond to NB1 and NB2, respectively.

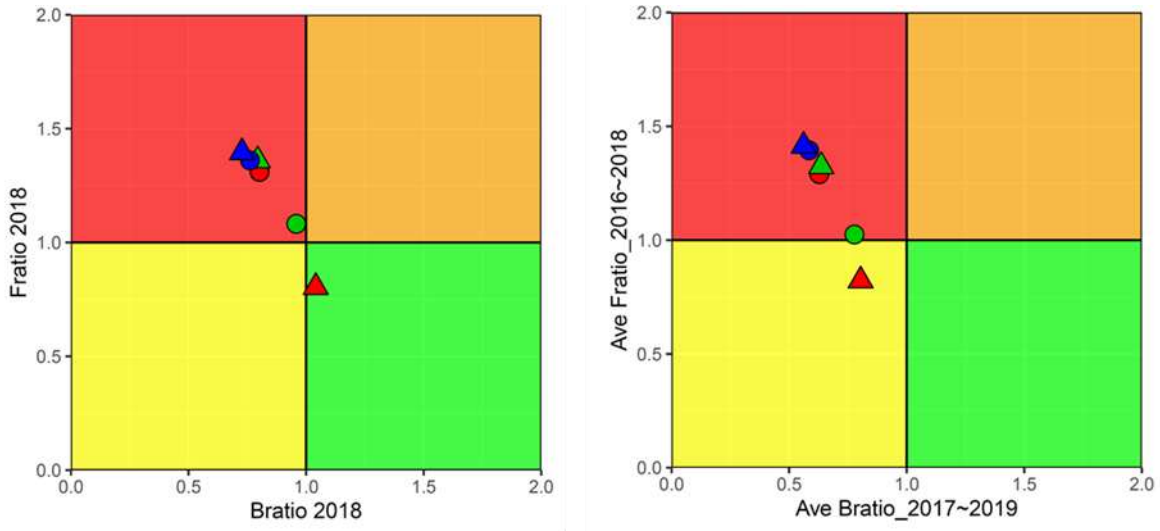


Figure 4. Kobe plots for six runs for NB1 (circle) and NB2 (triangle) by three members' scientists (red for China, blue for Japan and green for Chinese Taipei).

5.2 Summary table

Table 3. Summary of estimates of reference quantities. Median values are reported.

	China		Japan		Chinese Taipei	
	Base case 1	Base case 2	Base case 1	Base case 2	Base case 1	Base case 2
C2018 (10,000tons)	43.91	43.91	43.91	43.91	43.91	43.91
AveC2016-2018 (10,000tons)	35.45	35.45	35.45	35.45	35.45	35.45
AveF2016-2018	0.56	0.15	0.64	0.69	0.40	0.63
F2018	0.57	0.15	0.62	0.68	0.43	0.65
FMSY	0.44	0.21	0.46	0.48	0.40	0.45
MSY(10,000tons)	43.18	54.81	42.9	44.1	43.04	41.56
F2018/FMSY	1.31	0.80	1.36	1.40	1.11	1.55
AveF2016-2018/FMSY	1.30	0.83	1.40	1.42	1.04	1.52
K (10,000tons)	221.10	689.00	207.6	206.0	287.80	251.30
B2018 (10,000tons)	77.27	295.85	70.5	65.0	125.50	92.25
B2019 (10,000tons)	59.61	231.10	54.0	50.2	100.30	74.19
AveB2017-2019 (10,000tons)	60.81	228.73	55.9	51.8	102.29	74.07
BMSY (10,000tons)	98.05	305.70	92.9	91.7	131.60	116.35
BMSY/K	0.43	0.43	0.44	0.44	0.46	0.46
B2018/K	0.37	0.47	0.35	0.33	0.44	0.37

B2019/K	0.28	0.37	0.27	0.25	0.35	0.30
B2017-2019/K	0.29	0.37	0.28	0.27	0.36	0.30
B2018/BMSY	0.80	1.04	0.76	0.73	0.96	0.79
B2019/BMSY	0.62	0.82	0.58	0.56	0.77	0.64
B2017-2019/BMSY	0.63	0.81	0.61	0.58	0.78	0.64

6 CONCLUDING REMARKS

The SSC PS considered the BSSPM results and noted dissimilarities among Members' results for base case 2. The SSC PS was unable to clarify the reason for the dissimilarities and agreed that it would not be advisable to aggregate Members' stock results.

All six base case model runs (two scenarios from each of three members) indicate that recent Pacific saury stock size was less than Bmsy. In particular, median estimates from five out of six runs indicate that 2019 Pacific saury biomass was less than Bmsy. Results from all six model runs indicate that average 2017-2019 biomass was less than Bmsy.

A majority of base case model comparisons indicate that recent harvest rates for Pacific saury were higher than Fmsy. In particular, median estimates from five runs indicate that the harvest rate during 2019 and average rates during 2017-2019 were higher than Fmsy.

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Annex F

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

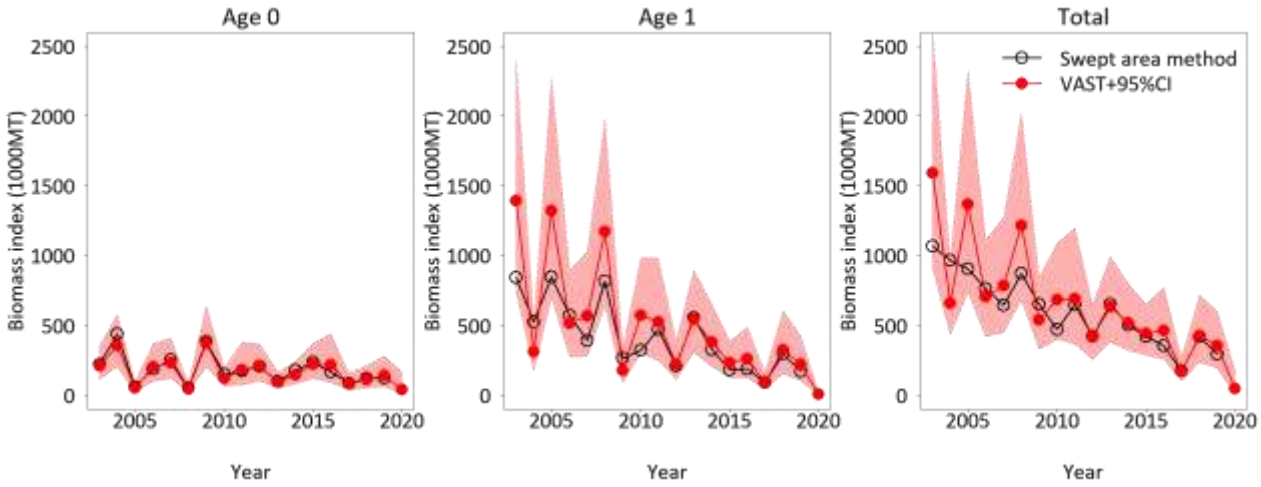
Year	Total catch (metric tons)	Biomass JPN (Observed biomass)*	CPUE_ CHN (metric tons per day)	CPUE JPN_early (metric ton: per net haul)	CPUE JPN_late (metric tons per net haul)	CPUE KOR (metric tons per day)	CPUE RUS (metric tons per day)	CPUE CT (metric tons per net haul)	Joint CPUE
1980	238510			0.72					
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				3.07		17.7		
1995	343743				2.16		20.4		
1996	266424				1.67		15.0		
1997	370017				3.74		11.3		
1998	176364				1.07		12.4		
1999	176498				0.80		11.2		
2000	286186				1.43		16.1		
2001	370823				2.12	7.29	20.9	1.58	0.73
2002	328362				1.17	8.43	19.6	1.63	0.58
2003	444642	1,068.6			2.19	12.75	28.5	2.68	1.11
2004	369400	965.4			2.61	9.05	43.9	1.46	1.25
2005	473907	905.9			4.47	14.27	46.4	2.40	1.67
2006	394093	764.0			4.09	13.23	32.3	1.27	0.70

2007	520207	647.1		3.89	12.50	40.7	2.36	1.10
2008	617509	871.8		5.02	16.54	41.0	2.92	1.52
2009	472177	651.7		3.73	8.63	20.6	1.58	0.82
2010	429808	471.0		1.55	12.88	22.3	1.94	0.85
2011	456263	648.6		2.40	9.40	26.1	2.51	1.17
2012	460544	421.6		2.39	8.21	23.2	2.47	1.04
2013	423790.3	654.1	13.96	1.44	8.89	20.9	2.80	0.87
2014	629576.4	505.5	16.22	2.52	15.01	23.8	3.64	1.39
2015	358882.7	422.0	17.74	1.34	6.86	15.3	2.44	0.89
2016	361687.6	357.5	9.31	1.52	9.47	15.9	2.45	0.75
2017	262639.4	176.6	8.53	1.08	6.16	8.3	1.85	0.85
2018	439079.0	420.0	15.90	1.45	8.12	21.0	3.10	1.26
2019	192377.0	294.7	6.91	0.68	5.30	6.6	1.41	0.45

* Observed biomass corresponds to $\sum_i^N (d_i \cdot A_i)$, where d_i and A_i denote mean density and area in stratum i.

Annex G

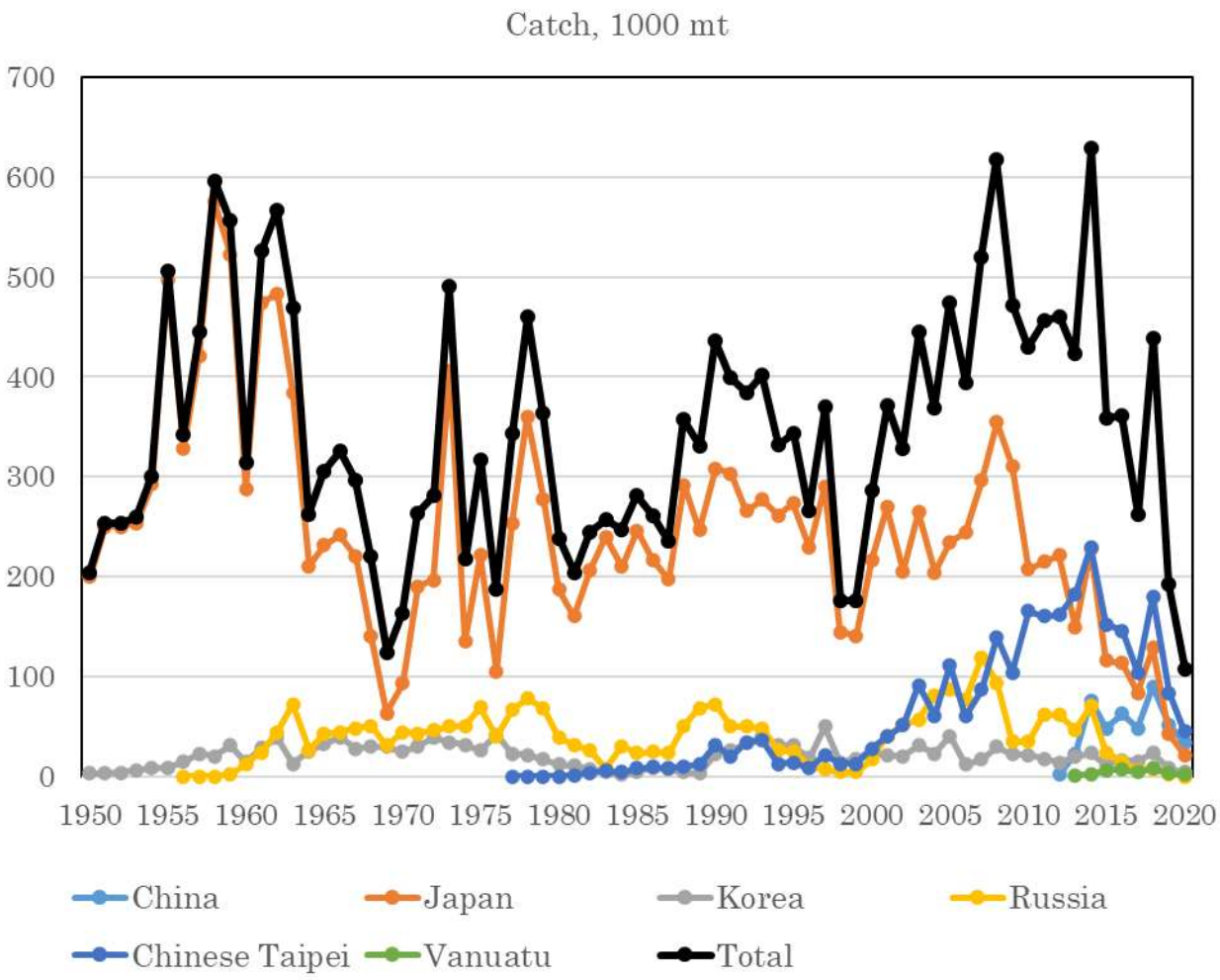
Japan's fishery-independent biomass index from 2003 to 2020



Note: red line shows year trends in estimated age 0, age 1 and total biomass index (with 95% confidence intervals shown by red polygons) derived from the VAST model incorporating a quadratic function of SST, compared to those from the swept area method (up to 2019).

Annex H

Members' Pacific saury catches up to 2020, with preliminary catch statistics as of 14 November 2020



2020 catch of Pacific saury, as of 14 November:						
China	Japan	Korea	Russia	Chinese Taipei	Vanuatu	TOTAL
34,386	21,618	4,313	249*	45,433	2,160	108,158

* Only in the Convention Area and does not include the catch in Russia's EEZ.

Annex I

Scientific projects for 2017-2021

#	Project	Time	Status	Next step: activities, required funds
1	VME taxa identification guide	2017-2021	*In progress* VME taxa ID guide has been printed out and distributed to Members.	Test the VME taxa ID guide by observers and revise if needed. *2020: 1,1mln JPY (10,000USD).* *Source: SC fund.*
2.1	GIS database/module as a part of NPFC database management system for spatial management of bottom fisheries and VMEs	2018-	*In progress* Fished seamounts and closed areas have been added to the map on the website. BF footprint data have been shared by Members.	Map bottom fishing footprint. *2020 FY: 0,55mln JPY (5,000USD).* *Source: SC fund.*
2.2	Joint spatial/temporal map of Members' catch and effort on Pacific saury with a spatial resolution of one-degree grids and a temporal resolution of one month	2018-	*In progress.* Spatial/temporal map of Members' Pacific saury catch and effort has been deployed.	Update the map. *2021 FY: 0,15mln JPY (1,500USD).*
3	Pacific saury stock assessment meeting (meeting costs)	Every year	*TWG PSSA meetings: Feb 2017, Dec 2017, Nov 2018, Mar 2019.* *SSC PS meetings: Nov 2019, Nov 2020.*	SSC PS07 meeting, TBD 2021. *2021 FY: 1.65mln JPY (15,000USD)* *Source: SC fund.*

4	Chub mackerel stock assessment meeting (meeting costs)	Every year	*TWG CMSA meetings: Dec 2017, Mar 2019, Nov 2020.*	TWG CMSA04 meeting, TBD 2021. *2020 FY: 1.65mln JPY (15,000USD)* *2021 FY: 1.65mln JPY (15,000USD)* *Source: SC fund.*
5	Expert to review Pacific saury stock assessment (consultant fee and travel costs)	TBD	Under consideration. SSC PS: to determine time and format.	*2020-2021 FY: No funds required.*
6	Observer Program	2018-	*In progress* A study on the existing observer programs of Members and those of other RFMOs has been done. Scientific data which can be collected and/or validated by at-sea observers, fishermen, electronic reporting systems and other means for Pacific saury have been reviewed.	Collect TWG CMSA Members' views regarding the necessity/objective of an observer program. Identify data gaps which can be fulfilled by an observer program. *2021 FY: No funds required.*
7	Promotion of cooperation with NPAFC including macro-scale multinational survey in the North Pacific in 2022	2021-2022	*In progress*. NPAFC-PICES-NPFC workshop Developing a collaborative, integrated ecosystem survey program … has been attended by NPFC representatives (Canada, Oct 2019).	*2020 FY: 1,1mln JPY (10,000USD).* *Source: SC fund.*

8	Invited expert for the development of the operating model for chub mackerel stock assessment (consultant fee and travel costs)	2020-	External expert to be contracted.	*2020 FY: 1,1mln JPY (10,000USD).* *2021 FY: 1,1mln JPY (10,000USD)* *Source: SC fund.*
9	Invited expert to stock assessment meetings of Pacific saury (consultant fee and travel costs)	2019-	*External expert attended TWG PSSA/SSC PS meetings in 2019 and 2020.*	*2020 FY: 1,1mln JPY (10,000USD).* *2021 FY: 1,1mln JPY (10,000USD)* *Source: SC fund.*
10	International Course for NPFC observers for VME indicator taxa identification (consultant fees and travel costs for two lecturers, meeting costs)	2021	*In preparation.* *PICES committed to 15,000USD to support the meeting logistics, travel support for 1-2 experts and travel support for ~10 students (subject to the format of the meeting).*	Time and location: 3-4 days. Russia, Vladivostok. *2021 FY: 1,65mln JPY (15,000USD).* *Source: SC fund.*
11	Standardization of bycatch species list and fish species identification guides (translation of the existing fish ID guide from Japanese to additional languages)	2019-2020	*In progress.*	*2020 FY: 1.1mln JPY (10,000USD).* *Source: SC fund.*
12	Invited expert to initiate the development of MSE for chub mackerel (consultant fee)	2020-	*Proposed.*	*2020 FY: 0.55mln JPY (5,000USD).* *2021 FY: 0.55mln JPY (5,000USD).* *Source: SC fund.*

13	PICES-ICES Small Pelagic Fish Symposium, February 21–24, 2022, Lisbon, Portugal.	2022	*Proposed.*	*2021 FY: 1.65mln JPY (15,000USD) to the organizers for the symposium logistics and 1.3mln JPY (12,000USD) for travel support for three NPFC experts to attend the symposium.]*
14	2021 PICES Annual meeting			*Travel support to two participants of the SC and/or its subsidiary bodies.* *2021 FY: 0.9mln JPY (8,000USD)*

Past projects

#	Project	Time	Status	Next step: activities, required funds
1	NPFC/FAO VME workshop	2018-2019	*Concluded.* *FAO report is in press.*	The FAO report has been finalized by the co-chairs and shall be published as FAO Fisheries and Aquaculture report.
2	Workshop to address data requirements and data sharing for SAI assessment and other tasks identified in the Work Plan by SSC VME and SSC BF	2018	*Concluded.*	

3	Workshop on biological reference points (BRP), harvest control rule (HCR) and management strategy evaluation (MSE) (meeting costs and invited experts)	2019	*Concluded.*	
4	Literature review of target and limit reference points used in pelagic species fisheries by other general RFMOs and other fishery management bodies	2018	*Done.* *Available on the NPFC website.*	
5	Joint PICES-NPFC workshop (W11) on *The influence of environmental changes on the potential for species distributional shifts and subsequent consequences for estimating abundance of Pacific saury*	2019	*Concluded.*	

Five-Year Research Plan and Work Plan of the Scientific Committee

North Pacific Fisheries Commission
Scientific Committee
2021-2025 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 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 to 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 each priority area are available in the attached Annex I.

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

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, future 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

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*, Spotted 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 management strategy evaluations (MSEs) for Chub Mackerel and Pacific Saury in collaboration with NPFC's Technical and Compliance Committee (TCC), fishery managers, fishers, and stakeholders.

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 last two decades. Two fish are recognized as priority species: North Pacific armorhead (NPA) *Pentaceros wheeleri*, Splendid alfonsino *Beryx splendens*.

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 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 2019-05 and CMM 2019-06), 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 2019-05 and CMM 2019-06)
- 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 the Science Working Group and 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 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 I

FIVE-YEAR WORK PLAN

Small Scientific Committee on Pacific Saury (SSC PS)

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. Further refine the catchability coefficient of the Japanese survey and characterize its variance
10. Develop a longer-term roadmap for work related to Pacific saury stock assessment
11. Set biological reference points
12. Develop a timeframe for MSE process

[H] and [M] indicate high and medium priorities. Cells with "TBD" depend on the progress of data preparation and analytical works.

ITEM	SSC-PS05 (2019 Fall)	SSC-PS virtual (2020 June)	Intersessional	SSC-PS06 (2020 Fall)	2021	2022	2023	2024
Regular update of inputs								
Update & improvement of biomass survey index	• Review 2019 survey outcomes • Investigate/refine q_biomass • Review spatio-temporal modelling • Review simulation results [H]	Review 2020 survey plan [H]	Review 2020 survey outcomes and finalize for use in BSSPM	Continue review of 2020 survey and analytical works, and then finalize for use in BSSPM [H]	Continue regular review [H] of 1) survey plan 2) analytical work 3) any related issues	Continue regular review [H] of 1) survey plan 2) analytical work 3) any related issues	Continue regular review [H] of 1) survey plan 2) analytical work 3) any related issues	Continue regular review [H] of 1) survey plan 2) analytical work 3) any related issues
Update & improvement of CPUE indices	Review CPUEs up to 2018 fisheries [H]		Review CPUEs up to 2019 fisheries and finalize for use in BSSPM	Continue review of CPUEs up to 2019 fisheries and finalize for use in BSSPM [H]	Continue review of outcomes of regular update and analytical works [H]	Continue review of outcomes of regular update and analytical works [H]	Continue review of outcomes of regular update and analytical works [H]	Continue review of outcomes of regular update and analytical works [H]
Development of joint CPUE index	Review results and choose some initial sets of series for trial use in BSSPM [M]	Review further results [M]	Review CPUEs up to 2019 fisheries and finalize for use in sensitivity test of BSSPM	Review CPUEs up to 2019 fisheries and finalize for use in sensitivity test of BSSPM [H]	Continue review of outcomes of regular update and analytical works [H]	Continue review of outcomes of regular update and analytical works [H]	Continue review of outcomes of regular update and analytical works [H]	Continue review of outcomes of regular update and analytical works [H]
Regular update of the existing SA								
Routine update BSSPM as a benchmark	Set up data and modify specification (if	Update with base case 2	Conduct BSSPM	Update with base and sensitivity cases	Continue review of outcomes of	Continue review of outcomes of	TBD	TBD

ITEM	SSC-PS05 (2019 Fall)	SSC-PS virtual (2020 June)	Intersessional	SSC-PS06 (2020 Fall)	2021	2022	2023	2024
	necessary) [H]		analyses using updated data	and draft BSSPM stock assessment report for review by SC and Commission [H]	regular BSSPM update [M]	regular BSSPM update [M]		
Improvement and further investigation of BSSPM	Review any outcomes of improvements (see Para 29 in TWG04 report) [L]	Continue [L]		Continue [L]	Review any outcomes of improvements (see Para 29 in TWG PSSA04 report) [M]	Review any outcomes of improvements (see Para 29 in TWG PSSA04 report) [M]	TBD	TBD
Toward age/size-structured models (ASSMs)								
Data inventory (CPUE and size/age in space and time)	• Review data availability for each member • Discuss data sharing process [H]	Review an initial data set for initial trials of conditioning (intersessionally)		Finalize an initial data set for initial trials of estimation [M]	Finalize data for 2021 stock assessment with ASSMs [H]	Continue update of data for stock assessment with ASSMs [H]	TBD	TBD
Summarizing available information on PS biology	Review comprehensive reports [H]			Finalize an initial list of assumptions for initial trials of estimation [M]	Finalize assumption for 2021 stock assessment with ASSMs [H]	Continue update of data for stock assessment with ASSMs [H]	TBD	TBD
Development of models	Review proposal and discuss evaluation methods (including simulation) [H]			After PS06 meeting [M]: • Start conditioning • Compare with BSSPM	Review results of analyses by an agreed initial set of ASSMs [H]	Finalize models and results of analyses by ASSMs [H]	TBD	TBD

ITEM	SSC-PS05 (2019 Fall)	SSC-PS virtual (2020 June)	Intersessional	SSC-PS06 (2020 Fall)	2021	2022	2023	2024
				results				
Uncertainty in models (possible link with OM grid under MSE)	Grid of uncertainty and information gaps [L]	Continue [L]			Start investigation [M]	Finalize the procedure of assessing model uncertainty [H]	TBD	TBD
Examination of estimation performance and finalization of models	Develop simulation specification [M]			Plan conducting simulation [M]	Review initial simulation works [H]	Finalize simulation works [H]	TBD	TBD
Toward development of reference points								
Set biological reference points (limit and target)	Review intensively RPs report Start investigating reasonable options [H]			Identify candidate RPs [M]	Continue discussion and adoption [H]	Continue discussion and amend if necessary [M]	TBD	TBD
Toward development of MSE (work formally starts in 2021)								
Development of management objectives	Review intensively RPs report [L]							
Definition of performance measures	Review intensively RPs report [L]							
Construction of OMs	See items in age-structured models [L]							
Development								

ITEM	SSC-PS05 (2019 Fall)	SSC-PS virtual (2020 June)	Intersessional	SSC-PS06 (2020 Fall)	2021	2022	2023	2024
of candidate MPs								
Simulation performance tests								
Comparison of MPs and finalize advice								

Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA)

Priority list:

1. Data preparation and review of biological information
2. Develop an operating model
3. Test stock assessment models (VPA, ASAP, KAFKA, SAM, state-space production model)
4. Conduct stock assessment of chub mackerel
5. Set biological reference points
6. Provide scientific advice on the management of chub mackerel stock to the Commission
7. Regularly update and refine inputs
8. Conduct MSE for chub mackerel

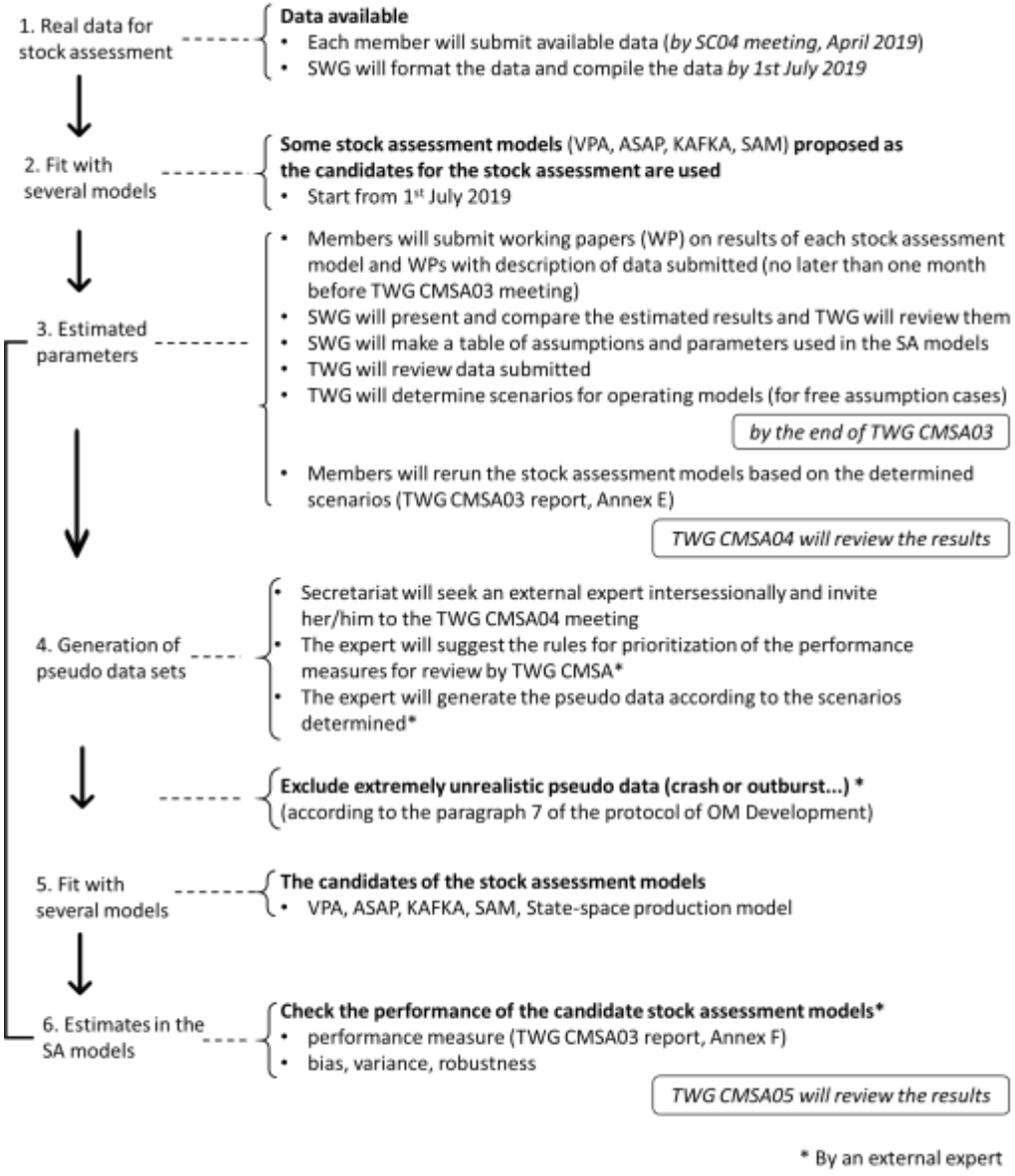
ITEM	2020 (TWG CMSA03)	2021 spring	2021-2022 winter	2022	2023	2024	2025
Regular update of inputs							
Research survey indices	Review survey indices to be used for stock assessment	• Standardize survey data (intersessional) • Review the data used for the stock assessment • Finalize the data used for the stock assessment	Update survey indices, if possible	Update	Update	Update	Update
CPUE indices	Review CPUE indices to be used for stock assessment	• Standardize CPUE (intersessional) • Review the data used for the stock	Update CPUE indices, if possible	Update	Update	Update	Update

ITEM	2020 (TWG CMSA03)	2021 spring	2021-2022 winter	2022	2023	2024	2025
		assessment • Finalize the data used for the stock assessment					
Catch data/catch composition	Compile and review data	• Review the data used for the stock assessment • Finalize the data used for the stock assessment	Update catch composition data, if possible	Update and revise, if needed	Update	Update	Update
Biological parameters (maturity, M, weight)	Review the three reference cases for natural mortality	• Review biological parameters • Finalize assumptions for the stock assessment	Review biological parameters	Review biological parameters	Review biological parameters	Review biological parameters	Review biological parameters
Operating model (OM)*							
Development of operating model	Describe and review all data for OM/ Set OM scenarios		Generate pseudo data to be fitted to the stock assessment models (intersessional)				
Testing stock assessment models	Condition the OM	Condition the OM	•Compare stock assessment model candidates •Choose the best SA model(s)				
Stock assessment							
Benchmark stock assessment			Conduct preliminary stock assessment	Complete stock assessment with the selected SA model(s) and	Update benchmark stock assessment	Update benchmark stock assessment	Update benchmark stock assessment

ITEM	2020 (TWG CMSA03)	2021 spring	2021-2022 winter	2022	2023	2024	2025
				provide recommendations to SC			
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
Toward development of reference points							
Set biological reference points (limit and target)		• Review RPs report • List candidate reference points	• Compare robustness of reference points • Choose reference points				
Toward development of MSE							
Development of management objectives			Liaise with the Commission and TCC to set management objectives	Finalize management objectives			
Definition of performance measures				List performance measures			
Construction of OMs	Discuss MSE approaches for chub mackerel	Continue	Discuss MSE approaches and frameworks for chub mackerel	Discuss ranges of uncertainties			
Development of candidate							

ITEM	2020 (TWG CMSA03)	2021 spring	2021-2022 winter	2022	2023	2024	2025
MPs							
Simulation performance tests							
Comparison of MPs and finalize advice							

Flowchart for the development of operating models and testing stock assessment models



Small Scientific Committee on Bottom Fish and Marine Ecosystems (SSC BF-ME)

Priority list:

1. NPA and SA: Develop catch and CPUE time series for commercial fisheries
2. NPA: Review survey
3. SA: Conduct comprehensive 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: Collect and share fishing footprint data
8. VME: Develop a process for establishing quantitative definitions of VMEs
9. VME: Develop standardized approach to SAI determination

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
North Pacific Armorhead					
Assess and monitor status of stock	Update catch data for NPA	Update catch data and CPUE index for NPA	Update catch data and CPUE index for NPA	Update catch data and CPUE index for NPA	Update catch data and CPUE index for NPA
	Develop CPUE index for NPA				
	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

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
	Complete review of data requirements to assess and monitor status of NPA and identify gaps	Integrate CPUE index and NPA surveys (acoustic and pre-fishery) into preliminary stock assessment or simulation approach using DLM tools	Update status of stock	Update status of stock	Update status of stock
	Conduct acoustic survey and research	Review acoustic survey and research			
		Conduct analysis of historical patterns in NPA recruitment and oceanography; 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
	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
Conserve stock		Develop conservation objective(s)			

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
	Develop work plan and TORs to implement adaptive management	Implement adaptive management			
		Refine harvest control rule if needed	Assess HCR against stock assessment	Refine HCR and implement	Update data and implement HCR
Splendid alfonsino					
Assess and monitor status of stock	Update catch data for SA	Update catch data and CPUE index for SA	Update catch data and CPUE index for SA	Update catch data and CPUE index for SA	Update catch data and CPUE index for SA
	Develop CPUE index for SA				
	Review data requirements to assess and monitor status of SA and identify gaps	Develop monitoring plan for SA	Implement monitoring plan for SA	Conduct monitoring plan for SA	Conduct monitoring plan for SA
		Conduct comprehensive stock assessment or data limited approach	Update comprehensive stock assessment or data limited approach, and provide management advice	Update comprehensive stock assessment or data limited approach, and provide management advice	Update comprehensive stock assessment or data limited approach, and provide management advice
	Report on efforts by other RFMO's to assess SA stock				

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
	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
Conserve stock		Develop conservation objective(s); Define and implement harvest control rule	Update data and implement HCR	Update data and implement HCR	Update data and implement HCR
Sablefish					
Assess and monitor status of stock	Update catch data and CPUE index	Update catch data and CPUE index	Update catch data and CPUE index	Update catch data and CPUE index	Update catch data and CPUE index
	Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish	Provide an update on USA-Canada stock assessment models for Sablefish and joint research on Sablefish
	Review fisheries observer program data collection for adequacy to produce data streams	Review fisheries observer program data collection for adequacy to produce data streams	Review fisheries observer program data collection for adequacy to produce data streams	Review fisheries observer program data collection for adequacy to produce data streams	Review fisheries observer program data collection for adequacy to produce data streams

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
	to support management advice	to support management advice	to support management advice	to support management advice	to support management advice
Conserve stock	Evaluate harvest relative to trip limits and historical catches	Evaluate catch limits relative to stock status	Evaluate catch limits relative to stock status	Evaluate catch limits relative to stock status	Evaluate catch limits relative to stock status
		Summarize harvest control rules and stock status			
Other research	Update analysis of tagging data - coastwide	Conduct analysis of sablefish associations with VME (intersessional)			
		Conduct trade-off analysis for Sablefish fishing and VME protection (intersessional)			
Vulnerable marine ecosystems					
Defining and Identifying VMEs	Approval of VME Indicator ID guide for observers				

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
		Map the distribution of VME indicator taxa (model, kernel density estimates, observation data); Determine a quantitative definition of VMEs	Review and apply quantitative definition of VMEs		
Identifying and defining SAI's		Determine data requirements and resolution for SAI assessment; Apply the standardized approach for SAI assessments and conduct integrated SAI assessment	Conduct integrated SAI assessment	Conduct integrated SAI assessment	Conduct integrated SAI assessment
	Continue development of standardized approach and encounter rules for SAI assessments				
Quantifying interactions between fisheries and VMEs	Map and share the data to define footprint of fisheries and effort within these footprints	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data	Update spatially explicit fishing effort data

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
	Develop timely reporting and action protocol when VME sites or recovering sites are identified	Implement timely reporting and action protocol when VME sites or recovering sites are identified			
	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
Conserving VMEs		Develop management objectives for recovering VME sites	Periodic review of VME management	Periodic review of VME management	Periodic review of VME management
		Refine the exploratory fishing protocol and consider banning exploratory fishing in VME closed areas			
	Review and refine the encounter protocol if necessary	Review and refine the encounter protocol if necessary			
Other ecosystem components					

ITEM	SSC BFME01 (2020)	SSC BFME02 (2021)	SSC BFME03 (2022)	SSC BFME04 (2023)	SSC BFME05 (2024)
	Develop combined bycatch taxa list for observers in NW Pacific Ocean	Approval of fish ID guide for scientific observers in the NW Pacific Ocean			
	Task development of fish ID guide for scientific observers in the NW Pacific Ocean				

Scientific Committee (SC)

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	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
Priority Species					
Summaries of priority species	Develop summary template	Draft summary sheet	Update summary sheets as needed	Update summary sheets as needed	Update summary sheets as needed
Assessment of Spotted Mackerel and associated bycatch	Identify lead Identify data sources, data gaps and strategies to fill gaps	Collate data Develop data collection templates and share data Determine spatial structure of stocks	Undertake baseline stock assessment and provide management advice including harvest control rules	Update baseline stock assessment as needed and provide management advice including harvest control rules	Update baseline stock assessment as needed and provide management advice including harvest control rules

ITEM	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
				Collate data on associated bycatch species	Develop baseline stock assessment of associated bycatch species
Assessment of Japanese Sardine and associated bycatch	Identify lead Identify data sources, data gaps and strategies to fill gaps	Collate data Develop data collection templates and share data Determine spatial structure of stocks	Undertake baseline stock assessment and provide management advice including harvest control rules	Update baseline stock assessment as needed and provide management advice including harvest control rules Collate data on associated bycatch species	Update baseline stock assessment as needed and provide management advice including harvest control rules Develop baseline stock assessment of associated bycatch species
Assessment of Neon Flying Squid and associated bycatch	Identify lead Identify data sources, data gaps and strategies to fill gaps	Collate data Develop data collection templates Determine spatial structure of stocks	Undertake baseline stock assessment and provide management advice including harvest control rules	Update baseline stock assessment as needed and provide management advice including harvest control rules Collate data on associated bycatch species	Update baseline stock assessment as needed and provide management advice including harvest control rules Develop baseline stock assessment of associated bycatch species
Assessment of Japanese Flying Squid and associated bycatch	Identify lead Identify data sources,	Collate data	Undertake baseline stock assessment and provide management advice	Update baseline stock assessment as needed and provide management	Update baseline stock assessment as needed and provide management

ITEM	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
	data gaps and strategies to fill gaps	Develop data collection templates Determine spatial structure of stocks	including harvest control rules	advice including harvest control rules Collate data on associated bycatch species	advice including harvest control rules Develop baseline stock assessment of associated bycatch species
Management Strategy Evaluation (MSE)					
Chub Mackerel	Describe MSE from a scientific perspective Establish a joint MSE Committee that includes members from SC, TCC, fishery managers, and stakeholders	Develop preliminary MSE tools for Chub Mackerel in consultation with TCC, fishery managers, and stakeholders	Update MSE tools for Chub Mackerel with input from TCC, fishery managers, and stakeholders	Update MSE tools for Chub Mackerel with input from TCC, fishery managers, and stakeholders	Update MSE tools for Chub Mackerel with input from TCC, fishery managers, and stakeholders
Pacific Saury				Develop preliminary MSE tools for Pacific Saury in consultation with TCC, fishery managers, and stakeholders	Update MSE tools for Pacific Saury with input from TCC, fishery managers, and stakeholders
Ecosystem approach to					

ITEM	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
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
Impacts of fishing on ecosystem component	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
Collaboration with other Organizations					
PICES	Review implementation of NPFC-PICES Framework for Collaboration Discuss SC representation at PICES Annual Meetings Review ICES-PICES WGSPF activities	Review implementation of NPFC-PICES Framework for Collaboration Review ICES-PICES WGSPF activities Review NPFC-PICES workshop on VME indicator identification	Review implementation of NPFC-PICES Framework for Collaboration Review ICES-PICES WGSPF activities Review NPFC-PICES workshop on VME indicator identification	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

ITEM	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
FAO	Review partnership with FIRMS	Review NPFC's involvement in the 2nd Phase of the GEF-FAO Common Oceans Programme			
NPAFC	Review work plan to implement NPFC/NPAFC Memorandum of Cooperation Review NPAFC- NPFC multinational survey program	Review work plan to implement NPFC/NPAFC Memorandum of Cooperation Review NPAFC- NPFC multinational survey program			
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	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

ITEM	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
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
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
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
Data Management					
	Review SC's Interim Regulations for Management of Scientific Data and Information Review and Endorse overarching policy for data management and security for TCC and SC Discuss need of VMS	Review data standards in relation to stock assessment of priority species	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	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	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

ITEM	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
	data for scientific analyses Review data management system (DMS) and Electronic Annual Report				
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
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

Annex K

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 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~~'s term will begin at his or her first Committee meeting~~ for two additional terms of two years~~in accordance with Article 5(5) of the Convention~~. In the case that the Chair is unable or unwilling to serve a full term, the Vice-Chair will assume the Chair's position ~~for a two-year term~~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 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.