NPFC

North Pacific Fisheries Commission

**4th Scientific Committee Meeting
REPORT**

23-26 April 2019

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**North Pacific Fisheries Commission
4th Meeting of the Scientific Committee**

**23-26 April 2019
Jeju, Republic of Korea**

REPORT

Agenda Item 1. Opening of the Meeting

1. The 4th Meeting of the Scientific Committee (SC) took place in Jeju, Republic of Korea on 23-26 April 2019, 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. The European Union and the North Pacific Anadromous Fish Commission (NPAFC) attended as observers. The meeting was opened by Dr. Joji Morishita (Japan) who served as the SC Chair.

2. Mr. Dong Yeob Yang, Director-General, Ministry of Oceans and Fisheries of the Republic of Korea, welcomed the participants to Jeju on behalf of the host Member. He highlighted the important role played by the SC, as well as the scientific research and surveys conducted by the NPFC Members, for the sustainable use and conservation of fisheries resources in the North Pacific Ocean. Mr. Yang also commended the NPFC for the successful and constructive holding of the NPFC's small scientific committee (SSC) meetings over the past few days. Lastly, he expressed his hope that the SC meeting would yield fruitful outcomes that would lay the foundation for the development of management measures for the ecosystems in the North Pacific Ocean and contribute to the discussions of the upcoming Commission meeting.

Agenda Item 2. Adoption of Agenda

3. The agenda was adopted without revision (Annex A). The List of Documents and Participants List are attached (Annexes B, C).

Agenda Item 3. Meeting arrangements

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

Agenda Item 4.   Review of reports and recommendations from the Small Scientific Committees (SSCs), Technical Working Group on Chub Mackerel Stock Assessment and BRP/HCR/MSE Workshop

4.1 SSC on Vulnerable Marine Ecosystems (SSC VME)

5. The Chair of the SSC VME, Dr. Bai Li (China), summarized the outcomes and recommendations of the 4th SSC VME meeting (NPFC-2019-SSC VME04-Final Report).

6. The SC reviewed the recommendations of the SSC VME and endorsed the following recommendations:
   (a) Endorse a plan and timelines to determine the type and resolution of data to be shared for SAI assessment and a map of combined fishing footprint and effort.
   (b) Endorse a flowchart for VME post-encounter treatment in the NPFC and continue developing the details of the post-encounter measure intersessionally.
   (c) Conduct further research to define the range of the two VME sites identified in NPFC-2019-SSC VME04-WP02 and close them to fishing.
   (d) Endorse the revised CMM 2018-05.
   (e) Endorse the revised CMM 2017-06.
   (f) Consider using the FAO's publicly-available Vulnerable Marine Ecosystems Map as a template for developing the NPFC's own VME map.
   (g) Consider the holding of a course/school on VME indicator taxa identification as a new project.
   (h) Endorse the draft guide and a list of specifications regarding the design and content of the common VME taxa identification guide in the western North Pacific Ocean.
   (i) Endorse the updated 2017-2021 SSC VME Work Plan (NPFC-2019-SSC VME04-WP05 (Rev. 1)).

7. Based on recommendation (a) of the SSC VME, the SC observed that the SSC VME agreed to continue discussions about data sharing intersessionally, with the aim of reaching a consensus on the type and resolution of data by mid-June and sharing data by November 2019. The outcomes of this intersessional work will be reported by the SC Chair to the Commission for adoption, if needed.

8. Based on recommendation (c) of the SSC VME, the SC agreed to conduct further research to define the range of the two VME sites identified in NPFC-2019-SSC VME04-WP02 with the potential to close them to fishing.

9. The SC reviewed and endorsed the revisions proposed by the SSC VME to CMM 2018-05 (Annex D) and CMM 2017-06 (Annex E) in relation to the reporting of VME encounters to the NPFC Secretariat as soon as possible and also reporting of detailed information about VME encounters in the annual reports of the Members.

10. Based on recommendation (f) of the SSC VME, the SC considered and endorsed the use of the

FAO's publicly-available Vulnerable Marine Ecosystems Map as a template for developing the NPFC's own VME map.

11. The SC considered recommendation (g) of the SSC VME regarding the holding of an international course on VME indicator taxa identification as a new project, and requested more information. Russia provided further details including the aim, intended participants, course content, estimated duration, number of lecturers, and estimated costs. The SC endorsed the proposal and included it as part of its list of proposed scientific projects (Annex F). The SC also considered the possibility of conducting this course in collaboration with the North Pacific Marine Science Organization (PICES), which has extensive experience in holding such courses, or other organizations.

4.2 SSC on Bottom Fish (SSC BF)

12. The Chair of the SSC BF, Dr. Taro Ichii (Japan), summarized the outcomes and recommendations of the 2nd SSC BF meeting (NPFC-2019-SSC BF02-Final Report).

13. The SC reviewed the recommendations of the SSC BF and endorsed the following recommendations:
    (a) Endorse the Interim Guidance for Management of Scientific Data.
    (b) Endorse the updated draft template for collecting scientific observer data from NPFC bottom fisheries (NPFC-2019-SSC BF02-WP02 (Rev. 1)).
    (c) Endorse the revised CMM 2018-05.
    (d) Endorse the revised CMM 2017-06.
    (e) Endorse the updated 2017-2021 SSC BF Work Plan (NPFC-2019-SSC BF02-WP04 (Rev. 1)).
    (f) Consider using the FAO's publicly-available bottom fishing areas map as a template for developing the NPFC's own bottom fishing map.
    (g) Establish a small working group for the development of the combined bycatch taxa list for the Convention Area, and the development of the fish identification guide for scientific observers for the northwestern Pacific Ocean.
    (h) Combine the SSC BF and the SSC VME into one new SSC addressing VME and BF.
    (i) Select Dr. Chris Rooper (Canada) to serve as the Chair of the SSC addressing VME and BF, and Ms. Kari Fenske (United States) to serve as its Vice-Chair.

14. The SC reviewed and endorsed the revisions proposed by the SSC BF to CMM 2018-05 (Annex D) in relation to the monitoring survey for the adaptive management of North Pacific armorhead.

15. The SC reviewed and endorsed the revisions proposed by the SSC BF to CMM 2018-05 (Annex D) and CMM 2017-06 (Annex E) in relation to the type and format of scientific observer data to be collected in accordance with Annex 5 of each of the CMMs.

16. Based on recommendation (f) of the SSC BF, the SC considered and endorsed the use of the FAO's publicly-available bottom fishing areas map as a template for developing the NPFC's own bottom fishing map.

17. Based on recommendation (g) of the SSC BF, the SC agreed to establish a small working group for the development of the combined bycatch taxa list for the Convention Area, and the development of the fish identification guide for scientific observers for the northwestern Pacific Ocean. The SC included this work in its work plan (Annex G) and its list of scientific projects (Annex F).

18. Based on recommendation (h) of the SSC BF, the SC agreed to combine the SSC VME and the SSC BF into the new SSC for Bottom Fish & Marine Ecosystems (SSC BF-ME). The SC drafted and adopted the Terms of Reference (TOR) for the SSC BF-ME (Annex H).

4.3 SSC on Pacific Saury (SSC PS)

19. The Chair of the SSC PS, Dr. Toshihide Iwasaki (Japan), summarized the outcomes and recommendations of the 4th SSC PS meeting (NPFC-2019-SSC PS04-Final Report).

20. The SC reviewed the recommendations of the SSC PS and endorsed the following recommendations:

    (a)   The SSC PS recommends that the SC endorse the stock assessment report from the TWG PSSA04.

    (b)   According to the stock assessment results by TWG PSSA04, the SSC PS recommends that further measures should be taken effectively to avoid the increasing trend in the exploitation rate to sustain biomass.

    (c)   The SSC PS recommends that Members share more data (e.g. size-at-maturity measurements, catch-at-size data and catch-at-age data, etc.) for improving the current stock assessment and developing future stock assessments.

    (d)   The SSC PS recommends that the SC endorse the updated table for identification of scientific data which can be collected and/or validated by at-sea observers, fishermen, electronic reporting systems and other means for Pacific saury.

    (e)   The SSC PS recommends that the SC recommend that the Commission fund the participation of Dr. Larry Jacobson (or an expert with similar qualifications and experience) in the next Pacific saury meetings.

(f)   The SSC PS recommends that the SC endorse the updated 2017-2021 SSC PS Work Plan (NPFC-2019-SSC PS04-WP03 (Rev. 1)).

(g)   The SSC PS recommends that the SC combine the SSC PS and the TWG PSSA into one new SSC.

(h)   Select Dr. Toshihide Kitakado (Japan) to serve as the Chair of the new SSC.

(i)   The SSC PS recommends that the SC determine the Terms of Reference (TORs) for the new SSC which should include the TORs of the TWG PSSA.

(j)   The SSC PS recommends that the SC recommend that the Commission consider allowing more flexibility (i.e. multiple extensions) in the terms for the Chairs of the SC's subsidiary bodies.

(k)   The SSC PS noted the definitions of juvenile as it pertains to Pacific saury, its spawning season, its seasonal change in minimum length at maturity and areas where age-0 Pacific saury are abundant (NPFC-2019-SSC PS04-Final Report, paragraphs 20-24).

(l)   The SSC PS agreed to examine the amount of data available for maturity and length of Pacific saury, and fit a logistic curve to available maturity data considering all spatial or temporal combinations that are relevant and possible.

21. The SC recognized and commended the significant work done by the SSC PS and the Technical Working Group on Pacific Saury Stock Assessment (TWG PSSA) to produce a consensus stock assessment.

22. The SC endorsed the stock assessment report from the TWG PSSA and the estimates of reference quantities based on the stock assessment results provided by the TWG PSSA: Based on combined model estimates, B was below Bmsy (B/Bmsy during 2016-2018 = 0.82) and F was below Fmsy (F/Fmsy during 2015-2017 = 0.82). Results indicate that the stock declined from near carrying capacity in the mid-2000's after a period of high productivity to current levels. Exploitation rates were increasing slowly during this period but remained lower than Fmsy. Point estimates indicate that stock biomass fell to the lowest value since 1980 (B/Bmsy = 0.63) in 2017, then increased to Bmsy in 2018. Biomass estimates show long-term fluctuations and interannual variability.

23. The SC considered the results of the stock assessment conducted by the TWG PSSA and recommended that the Commission consider further management measures for avoiding an increasing trend in the exploitation rate of Pacific saury to sustain biomass.

24. The SC recognized the significant contributions made by Dr. Larry Jacobson to the work of the TWG PSSA and recommended that the Commission fund the participation of Dr. Larry

Jacobson (or an expert with similar qualifications and experience) in the next Pacific saury meetings.

25. Based on recommendations (g) – (i), the SC agreed to combine the SSC PS and the TWG PSSA as a new SSC PS. The SC held initial discussions on the development of the TOR for the new SSC PS and requested that the SSC PS develop a draft TOR at its next meeting for submission to and adoption at the SC05 meeting.

26. The SC recognized the specialized nature of the subjects and tasks that its subsidiary bodies deal with, and noted that allowing Chairs to serve more than two consecutive terms would provide greater consistency and continuity of expertise to its subsidiary bodies. The SC therefore recommended that the Commission allow multiple extensions of the terms of the Chairs of the SC's subsidiary bodies, if necessary.

27. The SC recognized the importance of defining juvenile as it pertains to Pacific saury and considered the initial review of available information conducted by the SSC PS. The SSC PS noted differences in the definition of juvenile among different organizations, seasonal observed minimum length at maturity, and minimum length at maturity between experimental and natural conditions. The SSC PS concluded that age-0 Pacific saury are abundant east of 165-170 degrees east during June to July, when age-0 fish have not reached sexual maturity, and most of them are unlikely to migrate into fishing grounds in the main fishing season (August to November) of the same year. Furthermore, the SSC PS concluded that both immature fish and adults are under fishing pressure. The SC recognized that further research is needed, and endorsed the work proposed by the SSC PS to further analyze maturity and length data for Pacific saury.

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

28. The Chair of the TWG CMSA, Dr. Oleg Katugin (Russia), summarized the outcomes and recommendations of the 2nd TWG CMSA meeting (NPFC-2019-TWG CMSA02-Final Report).

29. The SC reviewed the recommendations of the TWG CMSA and endorsed the following recommendations:
    (a) The TWG CMSA agreed to use abundance indices derived from Japan's summer recruitment survey, autumn recruitment survey, and dip-net fishery, as well as Russia's historical chub mackerel fisheries as candidate indices.
    (b) The TWG CMSA agreed to explore the possibility of using abundance indices derived from Japan's spring recruitment survey, Russia's resumed chub mackerel fisheries, China's chub mackerel fisheries, and Japan's purse seine fishery as candidate indices.

(c)   The TWG CMSA agreed to further discuss using three reference cases for natural mortality for operating models: the median value for M, the mean value for M, and age-specific mortality from NPFC-2019-TWG CMSA02-WP01 (Rev. 2).

(d)   The TWG CMSA agreed to test the following five stock assessment models using the operating model: a SAM model, a VPA model, an ASAP model, a KAFKA model, and a state-space production model.

(e)   The TWG CMSA recommended that the SC endorse the Protocol of the Operating Model Development.

(f)   The TWG CMSA agreed to use PopSim as the platform for the operating model.

(g)   The TWG CMSA agreed that the basic operating model has no spatial structure and agreed to consider spatially-structured models as future work.

(h)   The TWG CMSA agreed that the operating model has an age-based structure rather than length-based structure according to the availability of the existing data, and that the starting year of operating model is 1970.

(i)   The TWG CMSA agreed on the list of possible and compulsory performance measures for evaluating the candidate stock assessment models.

(j)   The TWG CMSA agreed to share data to estimate parameters for the operating model using the candidate stock assessment models.

(k)   The TWG CMSA recommended that the SC endorse the TWG CMSA's proposal of seeking an external expert to support the development of the operating model and inviting him/her to attend the next TWG CMSA meeting.

(l)   The TWG CMSA recommended that the SC endorse the updated TWG CMSA Work Plan.

(m)   The TWG CMSA agreed to extend the term of the current Chair, Dr. Oleg Katugin, for two more years.

(n)   The TWG CMSA recommended that the next TWG CMSA meeting should be held at the end of 2019 or in early 2020, and if necessary SWG OM CMSA will meet informally prior to TWG CMSA03.

30. Japan stated that chub mackerel is mainly distributed around Japan for most of its life history including its spawning grounds. Japan has been conducting responsible management of the species using TAC based on its own stock assessment. Chub mackerel catch has been increasing in the Convention Area due to increasing stock abundance because of recent high recruitment and appropriate management. The recent stock increase was a result of a single dominant year class, thus it is expected that stocks will decrease in the future. Following Convention Article 3i of the NPFC, management should be consistent with Japanese domestic management. In the BRP/HCR/MSE Workshop in March 2019, the Workshop recommended that the construction of MSE would be the highest priority for the stock assessment of chub

mackerel. It is also pointed out that uncertainty for the Japanese stock assessment of the species prevents the taking of appropriate management measures for the Convention Area based on stock assessment. Considering the current chub mackerel fisheries status and the stock assessment progress made by the TWG CMSA, Japan suggested that further increase of fishing effort in the Convention Area be avoided to be consistent with the precautionary principle until the stock assessment is completed and a recommended sustainable level of fishing is available.

31. Russia echoed the concern on a possible increase in fishing effort for chub mackerel in the Convention Area, and pointed out that, at this stage, the existing CMM 2018-07 For Chub Mackerel is sufficient to address this issue.

4.5 Biological Reference Point/Harvest Control Rule/Management Strategy Evaluation Workshop (BRP/HCR/MSE) Workshop

32. The Chair of the BRP/HCR/MSE Workshop, Mr. Luoliang Xu, summarized the outcomes and recommendations of the workshop.

33. The SC reviewed the recommendations of the BRP/HCR/MSE Workshop and endorsed the following recommendations:

    (a) The Workshop recommended conducting MSE for only one species at a time due to the resource-intensive and complex nature of the process. Because chub mackerel is a longer-lived species than Pacific saury and more stock assessment data are available, enabling the operating model to be conditioned, the Workshop recommended conducting MSE for chub mackerel as the first priority (See Punt et al. 2016 for best practices).

    (b) For Pacific saury, the Workshop recommended to consider developing an age-structured operating model for use in simulation work to identify and evaluate potential reference points (for example Blim and Ftarget). It is suggested that initial simulation work focus on constant F runs (e.g. to investigate MSY-based reference points, Blim and Ftarget) and empirical HCR (e.g. taking a constant proportion of the estimated survey biomass). Model-based and empirical HCR could both be considered when a full MSE is undertaken.

    (c) For chub mackerel, the Workshop recommended considering to conduct initial assessments with a range of models, which could be used in a subsequent MSE.

    (d) The Workshop recommended that the SC propose to the Commission to explore the possibility of creating an intermediary group consisting of scientists, managers and stakeholders, as needed, when conducting an MSE.

    (e) Consideration could be given to the role of small pelagic fish in the ecosystem as key low trophic level stocks and also to climate variability when setting the reference points.

Agenda Item 5. Progress in data collection, management and security

34. The Science Manager provided a summary of the status of Members' annual reports for 2018 (NPFC-2019-SC04-IP01 (Rev. 2)) and informed the SC that annual summary footprints for bottom fish, Pacific saury, chub and spotted mackerels, Japanese sardine, and squids are available on the NPFC website.

35. The SC discussed the need to report data for measuring effort and analyzing trends in effort as accurately as possible. In particular, the SC noted that it would be useful to report information on the number of vessels licensed to fish for the priority species of the NPFC as this would enable the measurement of latent effort. At the same time, the SC recognized that there are various factors that make it difficult to report such data for certain species, for example because they are caught within and outside Members' exclusive economic zones or by several types of gear. The SC noted that the reporting of information on the number of licensed vessels may also facilitate the work of the Technical and Compliance Committee (TCC).

5.1 Data reporting templates

36. The Science Manager reported on the progress in developing standardized templates for data collection and reporting for bottom fish (complete), Pacific saury (complete), chub and spotted mackerels (not yet started; to be developed when the stock assessment model and corresponding data requirements are decided), Japanese sardine (not yet started), and squids (not yet started).

5.2 Observer Program

37. The Science Manager presented a template for collecting scientific observer data from NPFC bottom fisheries and a table for identification of scientific data which can be collected and/or validated by at-sea observers, fishermen, electronic reporting systems and other means for Pacific saury (Annex I).

38. The SC reviewed the work done and agreed to continue to develop the scientific aspects of the regional observer program, while recognizing the need to distinguish between the scientific and compliance aspects of the program.

5.3 Information management and security regulations

5.3.1 Interim Guidance for Management of Scientific Data

5.3.2 Regulations for management of scientific meeting documents

39. The Science Manager presented the Interim Regulations for Management of Scientific Data and Information (NPFC-2019-SC04-WP01 (Rev. 1)), which includes the Interim Guidance for Management of Scientific Data and regulations for management of scientific meeting

documents, meeting reports and intersessional communications on the NPFC website.

40. The SC reviewed and revised the Interim Regulations for Management of Scientific Data and Information (Annex J). The SC recommended that the Commission endorse the regulations for use by the SC and its subsidiary bodies on an interim basis.

5.4 NPFC data management system
5.4.1 Update on the developments since the previous SC meeting
5.4.2 Electronic Annual Report

41. The Data Coordinator, Mr. Mervin Ogawa, reported on the progress in the development of the SC-related data management system (NPFC-2019-SC04-WP03). This includes improvement of the user interface of the NPFC Collaboration site; launch of a new Meeting Management System; development of preliminary spatial maps for VME and bottom fisheries, and Pacific saury catch and effort; and development of a prototype Electronic Annual Report.

42. The SC recognized the good progress made by the Secretariat and requested that the Secretariat continue developing the SC-related data management system, with comments and advice to be provided by Members.

43. The SC discussed the development of preliminary spatial maps for VME and bottom fisheries, and Pacific saury catch and effort, and made the following recommendations:
    (a) The SC recommends that Pacific saury catch and effort data be displayed on a publicly accessible map on the NPFC website in 1x1 degree cells for each month for both the national waters and for NPFC Convention Area cells. The map should show a small, medium, or large circle in each monthly 1x1 degree cell representing the catch or effort (different layers) for data from all Members. The size of the circle to be shown in each grid cell and month will be as follows: The small circles will represent catch (or effort) values equal to or smaller than the median catch (or effort) for that month from all Members' data minus the median absolute deviation. The large circles will represent catch values equal to or larger than the median plus the median absolute deviation. A medium circle will represent median catch levels that fall between the small and large circles.
    (b) Months and cells with no catch or with no effort will have no symbol. This will allow for the public to see relative catch and effort data for Pacific saury, without revealing specific catch or effort data values or identifying which Members are represented.
    (c) Catch and effort map specifications for other species will be determined on a case-by-case basis.

Agenda Item 6. Scientific projects for 2019 and 2020

6.1 Ongoing/planned projects

6.2 New projects

6.3 Review and prioritization of projects

44. The Science Manager presented a draft list of scientific projects that were discussed above and during the SSC meetings.

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

46. As the SC noted at its previous meeting, the scope of the scientific activities of the NPFC continues and will continue to grow, as illustrated by the intensive schedule of scientific meetings and projects planned for the end of 2019 and the beginning of 2020. In light of this, the SC recognized the potential need to provide greater support for the Secretariat in the future, for example through the enhanced capacity of the Secretariat itself, support from external suppliers, or assistance from Members.

Agenda Item 7. 2017-2021 Research Plan and Work Plan

47. The SC reviewed and revised its Work Plan (Annex G), which shall be included in the 2017-2021 Research Plan.

48. The SC agreed to transition to five-year rolling research and work plans from 2020 onwards, and requested that each of its subsidiary bodies prepare corresponding five-year rolling work plans (i.e. 2020-2024) for the relevant priority areas, for submission to the SC05 meeting.

Agenda Item 8. Cooperation with other organizations

49. The Science Manager presented a compiled list of cooperation opportunities and requests from other organizations, for consideration by the SC (NPFC-2019-SC04-IP05).

8.1 Joint PICES-NPFC Study Group (PICES-NPFC SG)

50. The Co-Chair of the PICES-NPFC SG, Dr. Vladimir Kulik (Russia), presented an update on the intersessional work of the SG, including a draft NPFC-PICES Framework for Enhanced Scientific Collaboration in the North Pacific (NPFC-2019-SC04-WP02).

51. The SC recognized the merits of cooperation between the NPFC and PICES in the areas of their joint interest which are (i) support for stock assessment for priority species; (ii) vulnerable marine ecosystems; and (iii) ecosystem approach to fisheries.

52. The SC reviewed and endorsed the framework (Annex K). The SC thanked the Co-Chairs, Dr.

11

Vladimir Kulik and Mr. Eddy Kennedy, for their leadership in advancing the work of the SG.

53. Canada presented a proposal from PICES to hold a joint PICES-NPFC workshop on *The influence of environmental changes on the potential for species distributional shifts and subsequent consequences for estimating abundance of Pacific saury* at the PICES Annual Meeting in Victoria, Canada, in October 2019 (NPFC-2019-SC04-WP02).

54. The SC endorsed the holding of the joint PICES-NPFC workshop mentioned above. The SC nominated Dr. Bai Li to attend the workshop on behalf of the NPFC as an invited speaker and give a presentation on a collaborative analysis of Member CPUE data with regards to environmental and distributional changes of Pacific saury, and recommended that the Commission provide travel support for Dr. Li's participation.

8.2 NPAFC's multinational survey in the North Pacific
55. NPAFC shared an update about the NPAFC's International Year of the Salmon (IYS) surveys in the high seas of the North Pacific (NPFC-2019-SC04-IP04). The IYS successfully conducted its first international research survey in the Gulf of Alaska in February-March 2019 and started drafting a program for a large-scale pan-Pacific multinational ecosystem survey in the high seas of the North Pacific in the near future.

56. The Science Manager informed the SC that the NPFC is invited to attend a NPAFC-PICES workshop on *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* in Victoria, Canada, in October 2019 and take part in the development of the program (NPFC-2019-SC04-IP04).

57. The SC recognized the benefits of the NPFC's continued participation in the IYS survey program and endorsed the NPFC's participation in the NPAFC-PICES workshop. The SC endorsed the participation of the Science Manager as the workshop convener and nominated Dr. Chris Rooper to attend on behalf of the NPFC.

8.3 Cooperation with other organizations
58. The Science Manager presented a draft concept note from the Areas Beyond National Jurisdiction (ABNJ) Deep-Sea Project of FAO for the promotion of work on ecological risk assessments for deep-water elasmobranchs caught in the high seas (NPFC-2019-SC04-IP02).

59. The SC expressed its interest in the proposed work and noted its relevance to the work of the SSC BF-ME, particularly in relation to bycatch issues.

60. The Science Manager presented an invitation for the NPFC to participate in and contribute to *the North Pacific Regional Consultative and Planning Workshop for the International Decade of Ocean Science in support of Sustainable Development Goals* in Tokyo, Japan, on 31 July – 2 August 2019 (NPFC-2019-SC04-IP03). The NPFC is invited to participate as a member of the International Steering Committee, a co-leader of one of the Working Group/Sub Themes, a participant, and/or a contributor to a list of important sustainability questions that need to be addressed on the Ocean Decade.

61. The SC encouraged any representatives from Members who are attending the workshop in a non-NPFC capacity to also consider attending as an NPFC observer and report on the workshop outcomes to the next SC meeting.

62. The Science Manager presented an invitation from FAO for the NPFC to join FAO's Fisheries and Resources Monitoring System (FIRMS) Partnership (NPFC-2019-SC04-OP01). The FIRMS Partnership aims to facilitate access to a wide range of high-quality information on the status and trends of global marine fishery resources, fisheries and their management, in order to provide decision-makers with necessary information to develop effective fisheries policies in accordance with the Code of Conduct for Responsible Fisheries.

63. The SC determined that it requires more information before it can make a recommendation regarding whether or not the NPFC should join the FIRMS Partnership. The SC suggested that a representative from FAO FIRMS could attend the next SC meeting to give a detailed explanation.

Agenda Item 9. Other matters
9.1 Selection of SC Chair
64. The SC selected Dr. Janelle Curtis (Canada) to serve as the new SC Chair and Dr. Jie Cao (China) as the new SC Vice Chair.

65. The SC thanked the Chair for his strong leadership and excellent chairing over the past four years, and hoped it would have the opportunity to continue to work with him in the future.

9.2 Structure of the Scientific Committee
66. Based on the discussion above, the SC has updated its structure, combining the SSC VME and the SSC BF into the new SSC BF-ME, and combining the SSC PS and the TWG PSSA as a new SSC PS (Annex L).

9.3 MCS related issues from SC to TCC

67. Based on the discussion above, the SC identifies the following matters as MCS related issues for consideration by TCC:

    (a) Revisions of CMMs 2018-05 and 2017-06.

    (b) As described under Agenda Item 5, the SC discussed the need to report data for measuring effort and analyzing trends in effort as accurately as possible and noted that it would be useful to report information on the number of vessels licensed to fish for the priority species of the NPFC. The SC noted that the reporting of information on the number of vessels licensed to fish each priority species may also facilitate the work of the TCC.

    (c) The SC has continued to work on the scientific aspects of the development of an NPFC observer program and encourages the TCC to continue collaboration with the SC for the development of the NPFC observer program.

9.4 Other issues

68. No other issues were discussed.

Agenda Item 10.   Advice and recommendations to the Commission

69. Based on the recommendations from its SSCs, TWG CMSA, and the BRP/HCR/MSE Workshop, the SC recommends that the Commission:

    (a) Endorse the revised Work Plan (Annex G).

    (b) Endorse the proposed scientific projects (Annex F).

    (c) Allow multiple extensions of the terms of the Chairs of the SC's subsidiary bodies, if necessary.

    (d) Endorse the Interim Regulations for Management of Scientific Data and Information for use by the SC and its subsidiary bodies on an interim basis (Annex J).

    VME & Bottom Fish

    (e) Adopt the proposed revisions to CMM 2018-05 as described in Annex D, with editorial revisions to Annexes 6-1, 6-2 and 6-3 which will be done by Japan intersessionally.

    (f) Adopt the proposed revisions to CMM 2017-06 as described in Annex E.

    Pacific Saury

    (g) Consider summary stock assessment results for Pacific saury (paragraph 22).

    (h) Consider further management measures for avoiding an increasing trend in the exploitation rate of Pacific saury to sustain biomass.

    (i) Fund the participation of Dr. Larry Jacobson (or an expert with similar qualifications and experience) in the next Pacific saury meetings.

    Chub Mackerel

    (j) Contract an external expert to support the development of the operating model for chub mackerel stock assessment and fund his/her participation in the next TWG CMSA

meeting.

BRP/HCR/MSE

(k) Adopt the proposal of the SC to conduct MSE for only one species at a time due to the resource-intensive and complex nature of the process. Because chub mackerel is a longer-lived species than Pacific saury and more stock assessment data are available, enabling the operating model to be conditioned, conduct MSE for chub mackerel as the first priority (See Punt et al. 2016 for best practices).

(l) Adopt the proposal of the SC for Pacific saury to develop an age-structured operating model for use in simulation work to identify and evaluate potential reference points (for example Blim and Ftarget). It is suggested that initial simulation work focus on constant F runs (e.g. to investigate MSY-based reference points, Blim and Ftarget) and empirical HCR (e.g. taking a constant proportion of the estimated survey biomass). Model-based and empirical HCR could both be considered when a full MSE is undertaken.

(m) Adopt the proposal of the SC for chub mackerel to conduct initial assessments with a range of models, which could be used in a subsequent MSE.

(n) Adopt the proposal of the SC to give consideration to the role of small pelagic fish in the ecosystem as key low trophic level stocks and also to climate variability when setting the reference points

(o) Explore the possibility of creating an intermediary group consisting of scientists, managers and stakeholders, as needed, when conducting an MSE.

Data Sharing

(p) Share data for the assessment of SAI of bottom fisheries on VME and creation of a map of combined fishing footprint and effort after the SSC BF-ME agrees upon the type and resolution of data.

(q) Share more data of Pacific saury (e.g. size-at-maturity measurements, catch-at-size data and catch-at-age data, etc.) for improving the current stock assessment and developing future stock assessments after the SSC PS agrees upon the type and resolution of data.

(r) Display Pacific saury catch and effort data on a publicly accessible map on the NPFC website according to the specifications described in paragraph 43.

(s) Share data of chub mackerel to estimate parameters for the operating model using the candidate stock assessment models, as specified in Annexes G and H of the TWG CMSA02 report.

Cooperation with Other Organizations

(t) Endorse the NPFC-PICES Framework for Enhanced Scientific Collaboration in the North Pacific (Annex K).

(u) Hold a joint PICES-NPFC workshop on *The influence of environmental changes on the potential for species distributional shifts and subsequent consequences for estimating*

abundance of Pacific saury at the PICES Annual Meeting in Victoria, Canada, in October 2019. Provide travel support for Dr. Bai Li's participation on behalf of the NPFC as an invited speaker to give a presentation on the subject described in paragraph 54.

(v) Endorse the participation of Dr. Chris Rooper on behalf of the NPFC in the NPAFC-PICES workshop on *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* in Victoria, Canada, in October 2019 as described in paragraph 57.

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

VME

(a) For VME indicator taxa, the SC noted a comprehensive SAI assessment conducted by Japan in the Emperor Seamounts and a proposal from Japan to revise the list of VME indicator taxa from Gorgonacea, Scleractinia, Antipatharia, and Alcyonacea to Gorgonacea, Scleractinia, Antipatharia, and Porifera. The SC recognized the value of the work done by Japan but determined that further research is needed.

(b) The SC agreed to conduct further research to define the range of the two VME sites identified in NPFC-2019-SSC VME04-WP02 with the potential to close them to fishing.

Bottom Fish

(c) The SC advises the Commission to consider the SC's discussions under Agenda Item 4.

Pacific Saury

(d) For juvenile Pacific saury, the SC recognized the importance of defining juvenile and considered the initial review of available information conducted by the SSC PS. The SC recognized that further research is needed, and endorsed the work proposed by the SSC PS to further analyze maturity and length data for Pacific saury.

(e) Regarding distribution of juvenile Pacific saury, the SC concluded that age-0 Pacific saury are abundant east of 165-170 degrees east during June to July, when age-0 fish have not reached sexual maturity, and most of them are unlikely to migrate into fishing grounds in the main fishing season (August to November) of the same year.

Chub Mackerel

(f) The SC advises the Commission to consider the current chub mackerel fisheries status, the stock assessment progress made by the TWG CMSA and the SC's discussions under Agenda Item 4.

Observer Program

(g) The SC has identified a number of types of scientific data for Pacific saury which can only be collected and/or validated by at-sea observers (Annex I). It will continue to develop the

scientific aspects of the regional observer program.

Cooperation with Other Organizations

(h) The SC considered an invitation for the NPFC to participate in and contribute to *the North Pacific Regional Consultative and Planning Workshop for the International Decade of Ocean Science in support of Sustainable Development Goals* in Tokyo, Japan, on 31 July – 2 August 2019. The SC encouraged any representatives from Members who are attending the workshop in a non-NPFC capacity to also consider attending as an NPFC observer and report on the workshop outcomes to the next SC meeting.

(i) The SC considered a concept note from the Areas Beyond National Jurisdiction (ABNJ) Deep-Sea Project of FAO for the promotion of work on ecological risk assessments for deep-water elasmobranchs caught in the high seas. The SC expressed its interest in the proposed work and noted its relevance to the work of the SSC BF-ME, particularly in relation to bycatch issues.

Agenda Item 11.   Next meeting

71. The SSC PS05 meeting will be held in Japan in November 2019. The TWG CMSA03 meeting will be held in Japan in February 2020. The SC05, SSC PS06 and SSC-BF-ME01 meetings will be held in Vanuatu in April 2020. Members will be notified of the exact dates and locations by the Secretariat via correspondence.

Agenda Item 12.   Adoption of the Report

72. The SC04 Report was adopted by consensus.

Agenda Item 13.   Close of the Meeting

73. The meeting closed at 12:50 on 26 April 2019.

Annex A – Agenda

Annex B – List of documents

Annex C – List of participants

Annex D – Revised CMM 2018-05 - Conservation and Management Measure for Bottom Fisheries and Protection of Vulnerable Marine Ecosystems in the Northwestern Pacific Ocean

Annex E – Revised CMM 2017-06 - Conservation and Management Measure for Bottom Fisheries and Protection of Vulnerable Marine Ecosystems in the Northeastern Pacific Ocean

Annex F – Scientific projects for 2017-2021

Annex G – 2017-2021 Work Plan of Scientific Committee

Annex H – Terms of Reference for the Small Scientific Committee on Bottom Fish and Marine

Ecosystems (SSC BF-ME)

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 (SSCs), Technical Working Group on Chub Mackerel Stock Assessment and BRP/HCR/MSE Workshop
>   4.1 SSC on Vulnerable Marine Ecosystems
>   4.2 SSC on Bottom Fish
>   4.3 SSC on Pacific Saury
>   4.4 Technical Working Group on Chub Mackerel Stock Assessment
>   4.5 BRP/HCR/MSE Workshop

Agenda Item 5.   Progress in data collection, management and security
>   5.1 Data reporting templates
>   5.2 Observer Program
>   5.3 Information management and security regulations
>   5.3.1 Interim Guidance for Management of Scientific Data
>   5.3.2 Regulations for management of scientific meeting documents
>   5.4 NPFC data management system
>   5.4.1 Update on the developments since the previous SC meeting
>   5.4.2 Electronic Annual Report

Agenda Item 6.   Scientific projects for 2019 and 2020
>   6.1 Ongoing/planned projects
>   6.2 New projects
>   6.3 Review and prioritization of projects

Agenda Item 7.   2017-2021 Research Plan and Work Plan

Agenda Item 8.   Cooperation with other organizations
>   8.1 Joint PICES-NPFC Study Group

8.2 NPAFC's multinational survey in the North Pacific

8.3 Cooperation with other organizations

Agenda Item 9. Other matters

9.1 Selection of SC Chair

9.2 Structure of the Scientific Committee

9.3 MCS related issues from SC to TCC

9.4 Other issues

Agenda Item 10. Advice and recommendations to the Commission

Agenda Item 11. Next meeting

Agenda Item 12. Adoption of the Report

Agenda Item 13. Close of the Meeting

List of documents

MEETING INFORMATION PAPERS

Document Number	Title
NPFC-2019-SC04-MIP01 (Rev. 3)	Details for the Meetings of the Scientific Committee and Small Scientific Committees
NPFC-2019-SC04-MIP02	Provisional Agenda
NPFC-2019-SC04-MIP03	Provisional Annotated Agenda
NPFC-2019-SC04-MIP04	Indicative Schedule

REFERENCE DOCUMENTS

Document Number	Title
NPFC-2019-AR-Annual Summary Footprint - Squids	2018 – Annual summary footprint for squids in the NPFC Area of Competence
NPFC-2019-AR-Annual Summary Footprint - Chub&Spotted Mackerels(Rev 1)	2018 – Annual summary footprint for chub mackerel and spotted mackerels in the NPFC Area of Competence
NPFC-2019-AR-Annual Summary Footprint - Japanese Sardine	2018 – Annual summary footprint for Japanese sardine in the NPFC Area of Competence
	2017-2021 Research Plan
	Five-year work plan for each priority area of the Research Plan
	Data information template for Pacific Saury
	Scientific projects for 2017-2021

WORKING PAPERS

Document Number	Title
NPFC-2019-SC04-WP01 (Rev. 2)	Interim Regulations for Management of Scientific Data and Information
NPFC-2019-SC04-WP02	NPFC–PICES Framework for Enhanced Scientific Collaboration in the North Pacific
NPFC-2019-SC04-WP03	NPFC Data Management System
NPFC-2019-SSC BF02-WP02	Data collection templates for bottom fish
NPFC-2019-SSC PS04-WP02 (Rev. 1)	Scientific data which can be collected and/or validated by at-sea observers, fishermen, electronic reporting systems and other means for Pacific saury

INFORMATION PAPERS

Document Number	Title
NPFC-2019-SC04-IP01 (Rev. 2)	Status of Members' Annual Reports for 2018
NPFC-2019-SC04-IP02	Ecological Risk Assessments for deep-water elasmobranchs caught in the high seas
NPFC-2019-SC04-IP03	North Pacific Regional Consultative and Planning Workshop for the International Decade of Ocean Science in support of Sustainable Development Goals
NPFC-2019-SC04-IP04	Cooperation with NPAFC: IYS surveys in the high seas of the North Pacific
NPFC-2019-SC04-IP05	A compiled list of cooperation opportunities and requests from other organizations

OBSERVER PAPERS

Document Number	Title
NPFC-2019-SC04-OP01	Cooperation with other organizations: NPFC - FIRMS Partnership

MEETING REPORTS

Document number	Title
NPFC-2019-TWG CMSA02-Final Report	Report of the 2nd TWG CMSA meeting
NPFC-2019-WS BRP_HCR_MSE01-Final Report	Report of the BRP/HCR/MSE workshop
NPFC-2019-SSC VME04-Final Report	Report of the 4th SSC VME meeting
NPFC-2019-SSC BF02-Final Report	Report of the 2nd SSC BF meeting
NPFC-2019-SSC PS04-Final Report	Report of the 4th SSC PS meeting

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CMM 2018-05 (Rev. 3)

(Entered into force on 17 November 2018)

**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 and the species in question, shall be reported to the Secretariat as soon as possible, who shall 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 6-1), 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 under-ages 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 Annexes 6-1 and 6-3, 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 under-ages 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 6-3).   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 6-2.

N.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.

O.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.

P.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.

Q.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 Annexes 6-1 ,and 6-2 and 6.3 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 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 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.

(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.

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

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:

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[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.

The fisheries are conducted in the Convention Area;

(a) The total catch (everything brought up by the fishing gear) includes species that can only sustain low exploitation rates; and

(b) 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. <u>Template for assessment report</u>

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

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 or 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).

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)

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.

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).

~~D~~E. Tag Return Monitoring
  • Number of tags returns observed, by fish size class and area.

~~F~~E. 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.

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 vessel data are to be collected for each observed trip:
    Current vessel flag.
    (a) Name of vessel.
    (b) Name of the Captain.
    (c) Name of the Fishing Master.
    (d) Registration number.
    (e) International radio call sign (if any).
    (f) Lloyd's / IMO number (if allocated). (h) Previous Names (if known).
    (i) Port of registry.
    (j) Previous flag (if any).
    (k) Type of vessel.
    (l) Type of fishing method(s).
    (m) Length (m).
    (n) Beam (m).
    (o) Gross register tonnage (international tonnage).
    (p) Power of main engine(s) (kilowatts).
    (q) Hold capacity (cubic metres).
    (r) Record of the equipment on board which may affect fishing power factors (navigational equipment, radar, sonar systems, weather fax or satellite weather receiver, sea-surface temperature image receiver, Doppler current monitor, radio direction finder).
    Total number of crew (all staff, excluding observers).

3. 2. The following observer data are to be collected for each observed trip:

    (a) NPFC vessel ID.

(a)(b)   Observer's name.

(b)(c)   Observer's organisation.

(c)(d)   Date observer embarked (UTC date).

(d)(e)   Port of embarkation.

(e)(f)   Date observer disembarked (UTC date).

(f)(g)   (f) 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.

(v) ~~Record of sensitive benthic species in the trawl catch, particularly vulnerable or habitat forming species such as sponges, sea-fans or corals.~~

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~~immature~~, not examined~~unsexed~~)

   (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.

Monitoring survey plan for the detection of strong recruitment of North Pacific armorhead

➢ **Monitoring period and location**

Nishida et al. (2016) estimated the recruitment period of North Pacific armorhead (NPA) based on the temporal variation in CPUE and fatness index (FI) from 2010 to 2014. Recruitment of this species probably started in between January and March, because the percentage of higher FI individuals (FI ≥ 0.3) increased in these months. Nominal CPUEs increased between February and early May following the rise of the percentage of individuals with higher FI in years of strong recruitments. Generally, sea condition is not appropriate in February. Therefore, the monitoring period is set from March to June every year.

Miyamoto et al. (2017) identified fished seamounts in the Emperor Seamounts region on the basis of historical data sets currently available for commercial bottom fisheries in the area. They also analyzed recent Japanese scientific observer data to demonstrate the fine-scale distribution of fishing efforts and to characterize the current fishing area within the fished seamounts. Based on these results, seamounts which are frequently used as fishing grounds for NPA were extracted and sea areas with high fishing efforts for trawl fishing were set as monitoring blocks (Table 1, Figs. 1-1 and 1-2).

Table 1. The location of monitoring blocks.

Survey Gear	Seamount	Latitude	Longitude	Fig. No.	Remarks
Trawl	Koko (South eastern)	34°51′ N -35°04′ N	171°49′ E -172°00′ E	Fig. 1-1	Except closed area precautionary for potential VME conservation (this CMM, paragraph 4H)
Trawl	Kammu (North western)	32°10′ N -32°21′ N	172°44′ E -172°57′ E	Fig. 1-2	

➢ **Monitoring surveys methods**

In each monitoring block, vessels conduct monitoring surveys with bottom trawl from March to

June. For one monitoring survey, trawl net is towed for one hour. Respective surveys should be conducted at least one week apart.

➢ **Collecting data and samples**

Monitoring survey data are recorded according to the scientific observer manual of NPFC (Annex 4).

✓ North Pacific armorhead (NPA)

For each survey operation, the total weight of NPA is measured. Nominal-CPUE (Trawl; kg / hour) is calculated. From NPA samples, 100 individuals are randomly extracted, the individuals are measured for fork lengths (FL) and body heights (BH). The composition of FL and FI (BH / FL) are determined for each survey operation.

✓ Splendid alfonsino (SA)

For each survey operation, the total weight of SA is measured. Nominal-CPUE (Trawl; kg / hour) is calculated. From SA samples, 100 individuals are randomly extracted, the individuals are measured for fork lengths (FL). The composition of FL is determined for each survey operation.

➢ **Reporting**

Scientific observer transmits the collected data immediately after the respective survey to the NPFC secretariat via flag Members.

➢ **Criteria for strong recruitment of NPA**

The criteria for one monitoring survey by trawl is as follows based on the best scientific knowledge available on trawl fishery (Nishida et al. (2016)): trawl nominal CPUE > 10 t/ h and individuals of FI > 0.3 account for 80% or more.

It is considered that a strong recruitment is occurring if the above criteria are met in four consecutive surveys by trawl in two seamounts. The four consecutive surveys that meet the criteria need to be located in different months, and if all of the four surveys are conducted within a same month, it will not be considered that a strong recruitment is occurring.

➢ **Future use and contribution to the Adaptive Management process**

The survey is conducted as part of the Adaptive Management process for NPA under the management objective that sufficient spawning stocks will be left uncaught to let them spawn at least once. The results will be used for recruitment strength and are expected to contribute to the setting of more concrete management objectives for the Adaptive Management process for NPA.

References

Miyamoto M, Okuda T, and Kiyota M. 2017. Identification of existing fishing grounds and unfished areas in the Emperor Seamounts region. NPFC-2017-SSC VME02WP01.

Nishida, K., Kiyota, M., Yonezaki, S., and Okuda, T. 2016. Estimation of recruitment period of North Pacific armorhead, *Pentaceros wheeleri* based on CPUE and fatness index. NPFC01-2016-SSC NPA01-WP02.
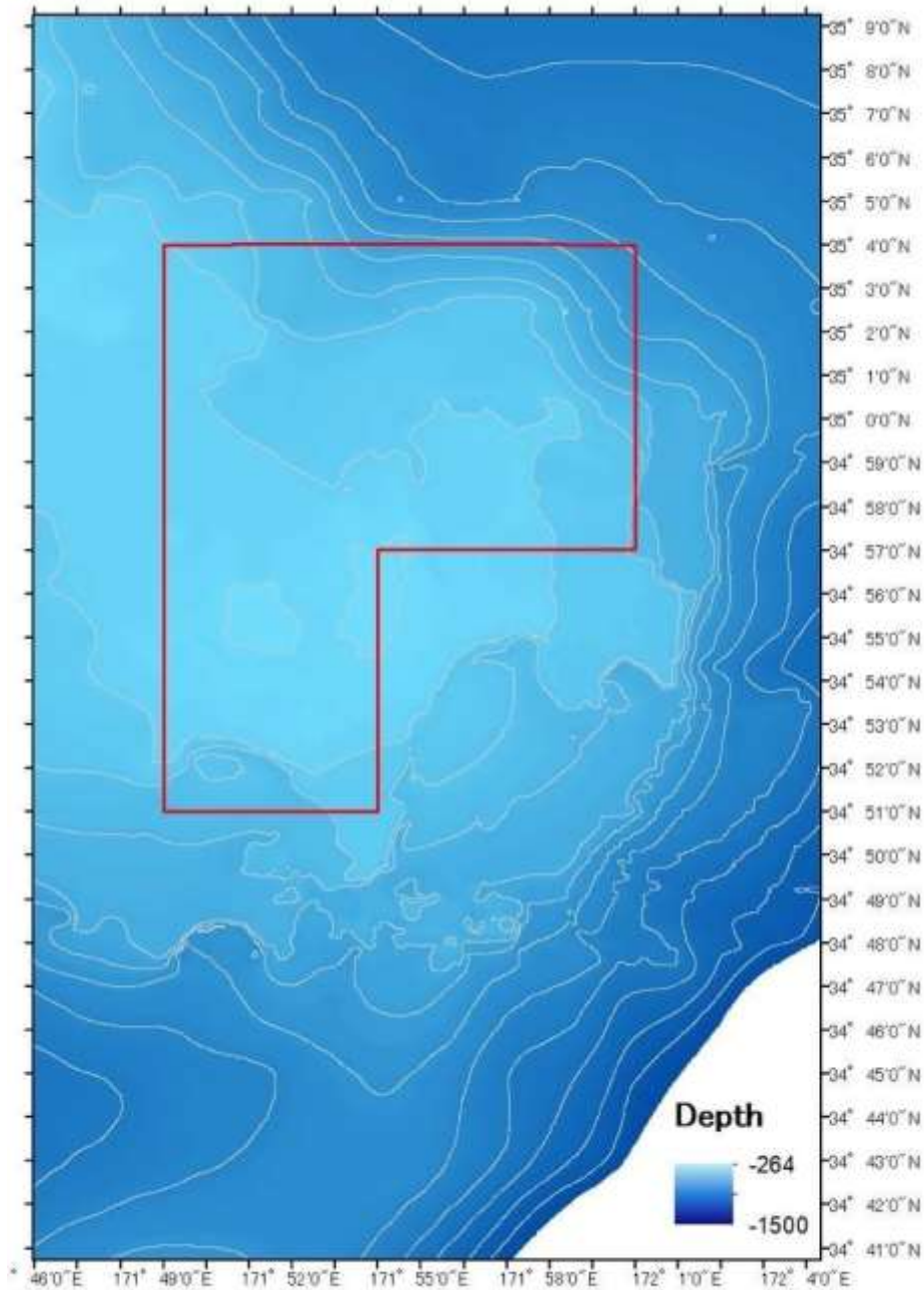
Fig. 1-1. Monitoring block by trawl fishery in the southeastern part of Koko Seamount. Except closed area precautionary for potential VME conservation (this CMM, paragraph 4H).
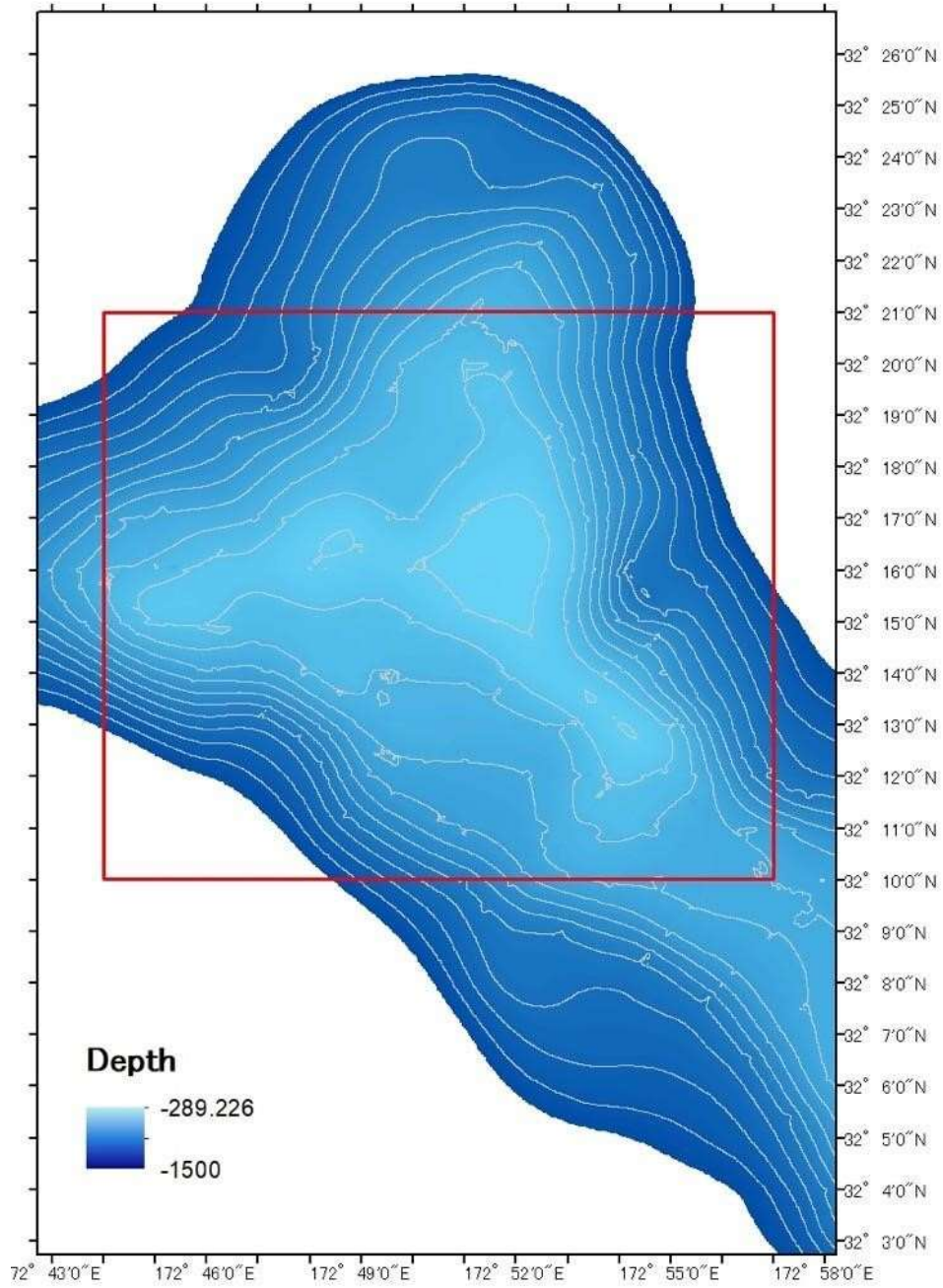
Fig. 1-2. Monitoring block by trawl fishery in the north western part of Kammu Seamount.

Protocol for the detection of strong recruitment of North Pacific armorhead

1.   Purpose

This protocol is 1) to specify transmission of data obtained in the monitoring survey and a protocol for circulating the detection of strong recruitment of North Pacific armorhead, and 2) to specify areas closed in the Emperor seamounts when the strong recruitment is detected.

2. Transmission of data

Data obtained in the monitoring survey is transmitted from observers on the vessels participating in the survey to the Science Manager of NPFC Secretariat via the flag Member with appropriate manners. Data should be transmitted as soon as possible after being obtained.

3. Announcement of detecting strong recruitment

The Science Manager analyzes the data based on the pre-determined process in the monitoring survey plan (Annex 6-1). If the criteria for detecting strong recruitment are met based on the analysis, the Executive Secretary circulates the detection of strong recruitment to all the Members and announces that paragraph 4-N of this CMM is applied for North Pacific armorhead as a management measure, as soon as possible after the analysis is completed. Members immediately notify the vessels with its own flags of the announcement by the Executive Secretary (Fig. 1).

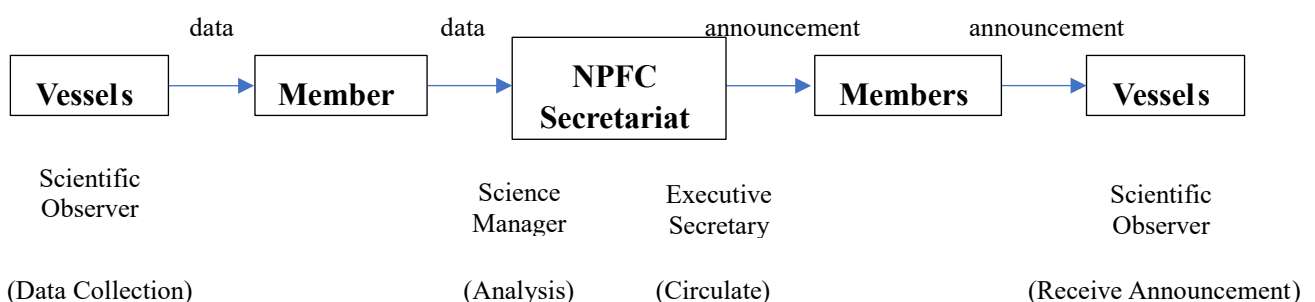|	data		data		announcement		announcement	
Vessels	→	**Member**	→	**NPFC Secretariat**	→	**Members**	→	**Vessels**
Scientific Observer		Science Manager		Executive Secretary				Scientific Observer
(Data Collection)		(Analysis)		(Circulate)				(Receive Announcement)

Fig. 1 Diagram for the announcement of strong recruitment

Implementation Plan of the Adaptive Management for North Pacific Armorhead [in 2019]

1 Monitoring survey

Monitoring surveys for the detection of strong recruitment of North Pacific Armorhead (NPA) will be conducted by trawl fishing vessels in accordance with CMM 2018-05, Annex 6-1 (attached). Monitoring surveys will be conducted in the pre-determined monitoring blocks of (1) Koko (South eastern) and (2) Kammu (North western) from March 1st to June 30th, 2019.   For each monitoring survey, a trawl net is towed for one-hour or shorter.   Monitoring surveys in the same monitoring block need to be scheduled at least one week apart.

Monitoring blocks (CMM 2018-05, Annex 6-1)

Survey Gear	Seamount	Latitude	Longitude	Fig. No.	Remarks
Trawl	Koko (South eastern)	34°51′ N -35°04′ N	171°49′ E -172°00′ E	Fig. 1-1	Except for the closed area set in paragraph 4.H, CMM 2018-05)
Trawl	Kammu (North western)	32°10′ N -32°21′ N	172°44′ E -172°57′ E	Fig. 1-2	
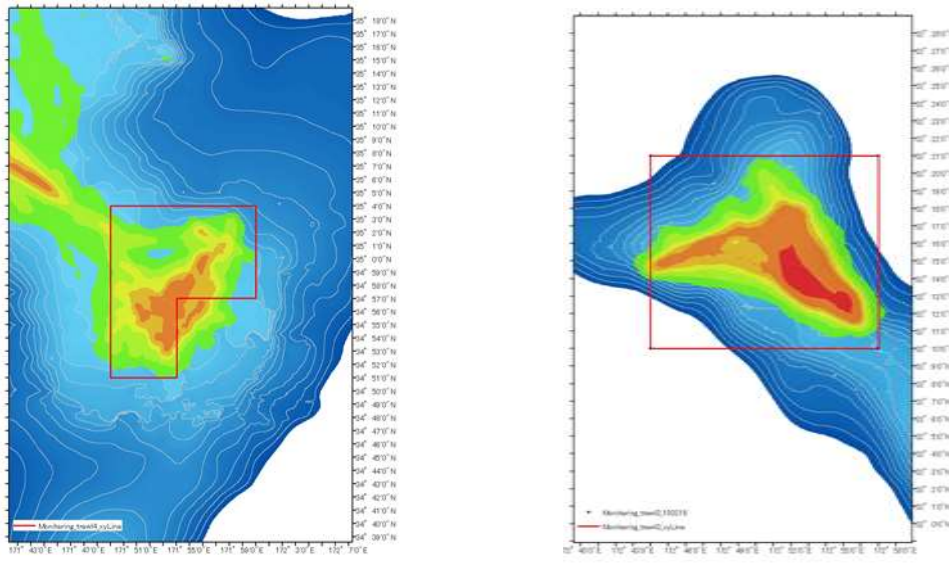
The base schedule for the monitoring surveys [for 2019] is shown in the following table. In total, 16 (sixteen) monitoring surveys will be conducted in the monitoring blocks. The base schedule may be revised depending on the level of detected recruitment of NPA. In such a case, revised schedule will be immediately notified to the Secretariat.

Schedule for the Monitoring survey

Month	Period	Monitoring block in Koko (South eastern)	Monitoring block in Kammu (North western)
March	First half	○	○
	Latter half	○	○
April	First half	○	○
	Latter half	○	○
May	First half	○	○
	Latter half	○	○
June	First half	○	○
	Latter half	○	○

Specific information for each monitoring survey, including date/time and vessel name will be notified to the NPFC Secretariat at least 3 (three) days prior to the survey. Monitoring survey data collected by a scientific observer from each monitoring survey, including starting and ending times/locations of the survey, nominal-CPUE (kg/hour) and FI (body height(BH) / fork length(FL)) will be transmitted to the NPFC Secretariat within 3 (three) days of the survey.

63

2 Specific areas where bottom fishing with trawl gear will be prohibited when high recruitment is detected

CMM 2018-05, Annex 6-1 sets the criteria for strong recruitment of NPA. It is considered that a strong recruitment has occurred if the following criteria are met in 4 (four) consecutive monitoring surveys both in 2 (two) monitoring blocks.
   - Nominal CPUE > 10t/h
   - Individuals of FI > 0.3 account for 80% or more

CMM 2018-05, paragraph 4. N stipulates that 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.
Bottom fishing with trawl gear will be prohibited in the following seamounts during the year of 2019 when high recruitment is detected.
   - Northern part of Kammu seamount (north of 32-10.0N)
   - 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.

Share (%) of North Pacific armorhead catch in the Yuryaku and the northern part of Kammu seamounts against that in the overall Emperor Seamounts (average in 2010 and 2012)

	Yuryaku (A)	Northern part of Kammu (B)	(A) + (B)
Korea	21%	25%	46%
Japan	11%	37%	48%

CMM 2017-06 (Rev. 3)

(Entered Into Force 28 November 2017)

Conservation and Management Measure
for Bottom Fisheries and Protection of Vulnerable Marine Ecosystems in the Northeastern
Pacific Ocean

The North Pacific Fisheries Commission (NPFC):

Seeking to ensure the long term conservation and sustainable use of the fishery resources of the Northeastern Pacific Ocean and, in so doing, protect the vulnerable marine ecosystems that occur there, in accordance with the Sustainable Fisheries Resolutions adopted by the United Nations General Assembly (UNGA) including, in particular, paragraphs 66 to 71 of the UNGA59/25 in 2004, paragraphs 69 to 74 of UNGA60/31 in 2005, paragraphs 69 and 80 to 91 of UNGA61/105 in 2006, and paragraphs 113 to 124 of UNGA64/72 in 2009;

Recalling that paragraph 85 of UNGA 61/105 calls upon participants in negotiations to establish regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries to adopt permanent measures in respect of the area of application of the instruments under negotiation;

Noting that North Pacific Fisheries Commission has previously adopted interim measures for the Northeastern Pacific Ocean;

Conscious of the need to adopt permanent measures for the Northeastern Pacific Ocean to ensure that this area is not left as the only major area of the Pacific Ocean where no such measures are in place;

Hereby adopt the following Conservation and Management Measure (CMM) for bottom fisheries of the Northeastern Pacific Ocean while working to develop and implement other permanent management arrangements to govern these and other fisheries in the North Pacific Ocean.

Scope
1. These Measures are to be applied to all bottom fishing activities throughout the high seas areas of the Northeastern 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 east of the line of 175 degrees W longitude (here in after called "the eastern 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.

    For the purpose of these Measures, the term vulnerable marine ecosystems is to be interpreted and applied in a manner consistent with the International Guidelines on the Management of Deep Sea Fisheries on the High Seas adopted by the FAO on 29 August 2008 (see Annex 2 for further details).

2. The implementation of these Measures shall:
    a. be based on the best scientific information available in accordance with existing international laws and agreements including UNCLOS and other relevant international instruments,
    b. establish appropriate and effective conservation and management measures,

c. be in accordance with the precautionary approach, and

d. incorporate an ecosystem approach to fisheries management.

3. Actions by Members of the Commission

Members of the Commission will take the following actions in respect of vessels operating under its Flag or authority in the area covered by these Measures:

a. Conduct the assessments called for in paragraph 83(a) of UNGA Resolution 61/105, in a manner consistent with the FAO Guidelines and the Standards and Criteria included in Annex 2;

b. Submit to the SC their assessments conducted pursuant to subparagraph (a) of this paragraph, including all relevant data and information in support of any such assessment, and receive advice and recommendations from the SC, in accordance with the procedures in Annex 3;

c. Taking into account all advice and recommendations received from the SC, determine whether the fishing activity or operations of the vessel in question are likely to have a significant adverse impact on any vulnerable marine ecosystem;

d. If it is determined that the fishing activity or operations of the vessel or vessels in question would have a significant adverse impact on vulnerable marine ecosystems, adopt conservation and management measures to prevent such impacts on the basis of advice and recommendations of the SC, which are subject to adoption by the Commission;

e. Ensure that if any vessels are already engaged in bottom fishing, that such assessments have been carried out in accordance with paragraph 119(a)/UNGA RES 2009, the determination called for in subparagraph (c) of this paragraph has been rendered and, where appropriate, managements measures have been implemented in accordance with the advice and recommendations of the SC, which are subject to adoption by the Commission;

f. Further ensure that they will only authorize fishing activities on the basis of such assessments and any comments and recommendations from the SC;

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

h. In respect of areas where vulnerable marine ecosystems are known to occur or are likely to occur, based on the best available scientific information, ensure that bottom fishing activities do not proceed unless conservation and management measures have been established to prevent significant adverse impacts on vulnerable marine ecosystems;

i. Limit fishing effort in bottom fisheries on the Eastern part of the Convention Area to the level of a historical average (baseline to be determined through consensus in the SC based on information to be provided by Members) 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 dependent on new SC advice;

j. Further, considering accumulated information regarding fishing activities in the Eastern part of the Convention Area, in areas where, in the course of fishing operations, cold water corals or other indicator species as identified by the SC that exceed 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 and the species in question, shall be reported to the Secretariat as soon as possible, who shall 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,* as well as any other indicator species for vulnerable marine ecosystems as may be identified from time to time by the SC and approved by the Commission.

4. All assessments and determinations by any Member as to whether fishing activity would have

significant adverse impacts on vulnerable marine ecosystems, as well as measures adopted in order to prevent such impacts, will be made publicly available through agreed means.

Control of Bottom Fishing Vessels

5. Members will exercise full and effective control over each of their bottom fishing vessels operating in the high seas of the Northeastern Pacific Ocean, including by means of fishing licenses, authorizations or permits, and maintenance of a record of these vessels as outlined in the Convention and applicable CMM.

6. New and exploratory fishing will be subject to the exploratory fishery protocol included as Annex 1.

Scientific Committee (SC)

7. Scientific Committee will provide scientific support for the implementation of these CMMs.

Scientific Information

8. The Members shall provide all available information as required by the Commission for any current or historical fishing activity by their flag vessels, including 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, areas fished (names or coordinates of seamounts), and information from scientific observer programmes (see Annexes 4 and 5) to the NPFC Secretariat as soon as possible and no later than one month prior to SC meeting. The Secretariat will make such information available to SC.

9. Scientific research activities for stock assessment purposes are to be conducted in accordance with a research plan that has been provided to SC prior to the commencement of such activities.

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:

(1) 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.

(2) The assessment in (1) 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.

(3) The SC is to review the information and the assessment submitted in (1) above in accordance with "SC Assessment Review Procedures for Bottom Fishing Activities (Annex 3)."

(4) 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.

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

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[2] 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;

      (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

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[2] "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.

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.　For example, whether the ecological unit is a group of seamounts, or an individual seamount in the Convention 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 two types of fishing gear are currently used by members of the Commission in the NE area, namely long-line hook and long-line trap.　The footprint of the bottom fisheries (fished seamounts) is identified based on the available fishing record.　The following seamounts have been identified as fished seamounts at some point in the past: Brown Bear, Cobb, Warwick, Eickelberg, Pathfinder, Miller, Murray, Cowie, Surveyor, Pratt, and Durgin. 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.

**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 coldwater 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, 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).

**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)

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.

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~~D~~.   Tag Return Monitoring
- Number of tags returns observed, by fish size class and area.

F~~E~~.   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.

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 vessel data are to be collected for each observed trip:~~
    a) ~~Current vessel flag.~~
    b) ~~Name of vessel.~~
    c) ~~Name of the Captain.~~
    d) ~~Name of the Fishing Master.~~
    e) ~~Registration number.~~
    f) ~~International radio call sign (if any).~~
    g) ~~Lloyd's / IMO number (if allocated).~~
    h) ~~Previous Names (if known).~~
    i) ~~Port of registry.~~
    j) ~~Previous flag (if any).~~
    k) ~~Type of vessel.~~
    l) ~~Type of fishing method(s).~~
    m) ~~Length (m).~~
    n) ~~Beam (m).~~
    o) ~~Gross register tonnage (international tonnage).~~
    p) ~~Power of main engine(s) (kilowatts).~~
    q) ~~Hold capacity (cubic metres).~~
    r) ~~Record of the equipment on board which may affect fishing power factors (navigational equipment, radar, sonar systems, weather fax or satellite weather receiver, sea surface temperature image receiver, Doppler current monitor, radio direction finder).~~
        ~~Total number of crew (all staff, excluding observers).~~

~~3.~~2. The following observer data are to be collected for each observed trip:
    a) NPFC vessel ID
    ~~a)~~b)   Observer's name.

b)c)   Observer's organisation.

c)d)   Date observer embarked (UTC date).

d)e)   Port of embarkation.

e)f)   Date observer disembarked (UTC date).

f)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.
   v) Record of sensitive benthic species in the trawl catch, particularly vulnerable or habitat-forming species such as sponges, sea-fans or corals.

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, indeterminateimmature, not examinedunsexed)
   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.

Scientific projects for 2017-2021

(updated at SC04, Apr 2019, for adoption by COM05, Jul 2019)

#	Project	Time	Status	Next step: activities, required funds
1	VME taxa identification guide	2017-2020	*In progress* SSC VME04 agreed on the format and content of the VME taxa ID guide.	2019: Prepare a draft VME taxa ID guide and review it by the SSC. 2020: Complete editing the guide and test it out by observers and fishers. *2019 FY: No funds required.* *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	2018-2019	*In progress* Fished seamounts and closed areas have been added to the map on the website.	Use FAO publicly-available VME map as a template for developing the NPFC's own VME map; Improvement of the interface of the map and the way of accessing of database (intersessionally). *2019 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 for testing on the UAT website.	Improvement of the interface of the map and the way of accessing of database (intersessionally). *2019 FY: 0,55mln JPY (5,000USD).* *Source: SC fund.*

3	Pacific saury stock assessment meeting (meeting costs)	Every year, 2017-2021	*TWG PSSA meetings: Feb 2017, Dec 2017, Nov 2018, Mar 2019.*	SSC PS05 meeting, Nov 2019 (4 days), Japan. *2.2mln JPY (20,000USD) Source: SC fund.*
4	Chub mackerel stock assessment meeting (meeting costs)	Every year	*TWG CMSA meetings: Dec 2017, Mar 2019.*	TWG CMSA03 meeting, Feb 2020 (4 days), Japan. *2.2mln JPY (20,000USD) Source: SC fund.*
5	Expert to review Pacific saury stock assessment (consultant fee and travel cost)	TBD later	Under consideration. SSC PS: to determine time and format.	*2019 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.	Identify data gaps which can be fulfilled by an observer program. *2019 FY: No funds required.*

7	Promotion of cooperation with NPAFC including macro-scale multinational survey in the North Pacific in 2021	2021	*In progress.*	NPAFC-PICES workshop 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 (Victoria, Canada, October 2019). *2019 FY: 0.3mln JPY (travel costs of Science Manager who will attend as a convener).*
8	Invited expert for the development of the operating model for chub mackerel stock assessment (consultant fee and travel cost)	2020	*Proposed.*	Select and contract an expert. *2019 FY: 1,1mln JPY (10,000USD).*
9	Invited expert to stock assessment meetings of Pacific saury (consultant fee and travel cost)	2019-	*Proposed.*	*2019 FY: 1.1mln JPY (10,000USD) for two meetings.*
10	International Course for NPFC observers for VME indicator taxa identification (consultant fees and travel costs for two lecturers, meeting costs)	2020	*Proposed.*	3-4 days. Time and location: TBD. *2019 FY: No funds required. 2020 FY: 1,65mln JPY (15,000USD).*

11	Standardization of bycatch species list and fish species identification guides (translation of the existing fish ID guide from Japan to additional languages)	2019-2020	*Proposed.*	*2019 FY: No funds required.* *2020 FY: 1.1mln JPY (10,000USD).*
12	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	*Proposed.*	*2019 FY: 0.3mln JPY (travel costs of invited expert who will represent NPFC)*

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.*	

2017-2021 Work Plan of Scientific Committee

(updated at SC04, Apr 2019, for adoption by the Commission)

1. STOCK ASSESSMENTS FOR TARGET FISHERIES AND BYCATCH SPECIES

PACIFIC SAURY

Year	Tasks	Progress/Comment	Meeting/Activity
2017	Conduct stock assessment (provisional).	Done.	TWG PSSA01, Feb 2017; SSC PS02 Apr 2017.
	Present outputs for adoption	Done. *SC was tasked to improve PSSA by July 2018.*	SC02 meeting, Apr 2017; COM03 meeting, Jul 2017.
	Update the provisional stock assessment.	In progress.	TWG PSSA02, Dec 2017.
2018	Evaluate the quality of the data for stock assessment.	In progress.	Intersessional work; SSC PS03, Apr 2018.
	Update stock assessment and recommendations to Commission to improve conservation and management of Pacific saury.	In progress.	SSC PS03, Apr 2018.
	Present outputs for adoption	Done.	SC03 meeting, COM04 meeting
	Initiate the task of setting limit and target reference points and develop harvest control rules in conjunction with managers	Review of target and limit reference points by Dr. Kell.	Intersessionally: literature review, by Sep-Oct 2018.
	Data preparation to finalize data set for BSSPM/try to draw a joint CPUE index	SA data and specifications were agreed. Work on joint CPUE index was started.	TWG PSSA03, Nov 2018.

2019	Joint spatial/temporal map of Members' catch and effort on Pacific saury	Data were shared and a draft map was deployed on the test website.	Intersessionally.
	Continue setting limit and target reference points, harvest control rules and management strategy evaluation in conjunction with managers	BRP/HCR/MSE workshop reviewed the approaches and practices of other regional fisheries bodies and how it can be applied to NPFC.	Workshop, Mar 2019.
	Conduct benchmark stock assessment and recommendations to Commission to improve conservation and management of Pacific saury.	Stock assessment was improved and considered as a benchmark by the TWG PSSA04.	TWG PSSA04, Mar 2019. SSC PS04, Apr 2019.
	Regular update of inputs (data and indices) and existing stock assessments/ Work towards age-structured models/ Work towards development of reference points/ Initial discussions towards development of MSE (See detailed work plan).		SSC PS05, fall 2019.

2020	Update stock assessment and recommendations to Commission to improve conservation and management of Pacific saury		SSC PS06, spring 2020.
	Regular update of inputs (data and indices) and existing stock assessments/ Work towards age-structured models/ Work towards development of reference points/ Work towards development of MSE (See detailed work plan).		SSC PS07, fall 2020.
2021	Update stock assessment and recommendations to Commission to improve conservation and management of Pacific saury. Regular update of inputs (data and indices) and existing stock assessments/ Work towards age-structured models/ Work towards development of reference points/ Work towards development of MSE (See detailed work plan).		SSC PS08, spring 2021.

Detailed work plan for 2019-2021

Priority list
1. Conduct a stock assessment update with base case model 2 (q_biomass=1)
2. Further investigate improvements to the BSSPM
3. Develop an age-structured model
4. Continue joint CPUE work to incorporate broader spatial and temporal coverage
5. Update the biomass estimate using the existing method
6. Explore the possibility of developing a spatio-temporal model for the biomass estimate
7. Further investigate the coefficient of variation for the catchability coefficient in the Japanese survey. This variance should be included in the variance of the biomass data. If possible, refine

the catchability estimate for the survey
8. Develop a longer-term roadmap for work related to Pacific saury stock assessment
9. Identify target and limit reference points for stock biomass and fishing mortality

Detailed work plan

ITEM	SSC PS05 (2019 Fall)	SSC PS06 (2020 Spring)	SSC PS07 (2020 Fall)	SSC PS08 (2021 Spring)
Regular update of inputs				
Update & improvement of biomass survey index	• Review 2019 survey outcomes • Investigate/refine q_biomass • Review a spatio-temporal modelling • Review simulation results [H]	• Review 2020 survey plan [H] • Continue review of analytical works [H]	Review 2020 survey outcomes	Review 2021 survey plan
Update & improvement of CPUE indices	Review CPUEs up to 2018 fisheries [H]		Review CPUEs up to 2019 fisheries	
Development of joint CPUE index	Review results and choose some initial sets of series for trial use in BSSPM [M]	Review further results [M]	Continue review of any further results	Continue review of any further results
Regular update of the existing SA				
Routine update BSSPM as a benchmark	Set up data and modify specification (if necessary) [H]	• Update with base case 2 and draft BSSPM SA report • Write a report [H]	Update with base case 2 and draft BSSPM SA report unless there are any particular reasons	Review BSSPM report
Improvement and further investigation of BSSPM	Review any outcomes of improvements (see Para 29 in TWG04 report) [L]	Continue [L]	Continue	Continue
Toward age-structured models				
Data inventory (CPUE and size in space and time)	• Review data availability for each member • Discuss data sharing process [H]	Finalize an initial data set for initial trials of conditioning [H] (intersessionally)	Finalize data for 2020 SA	
Summarizing available information on PS biology	Review comprehensive reports (*inter alia* maturity) [H]	Finalize an initial list of assumptions for initial trials of conditioning [H] (intersessionally)	Finalize assumptions for 2020 SA	Continue

ITEM	SSC PS05 (2019 Fall)	SSC PS06 (2020 Spring)	SSC PS07 (2020 Fall)	SSC PS08 (2021 Spring)
Development of models	Review proposal and discuss evaluation methods (including simulation) [H]	● Start conditioning and review results [M] ● Compare with BSSPM results [M]	Develop base and robustness scenarios	● Review results of analyses by an agreed initial set of SA models ● Write an SA report?
Uncertainty in models (possible link with OM grid under MSE)	Grid of uncertainty and information gaps [L]	Continue [L]	(see above)	Continue
Examination of estimation performance and finalize an initial set of SA models	Develop simulation specification [M]	● Continue discussion about simulation specifications [M] ● Start conducting simulation [M] (intersessionally)	● Review initial simulation works ● Refine simulation framework	● Review further simulation works ● Finalize an initial set of SA models (if necessary, continue further evaluation)
Toward development of reference points				
Identify target and limit reference points for stock biomass and fishing mortality	Review intensively RPs report Start investigating reasonable options [H]	● Identify candidate RPs for simulation [H] ● Evaluate candidate RPs [H] (intersessionally)	Continue discussion and recommend BRPs, if possible [H]	
Toward development of MSE (work formally start in 2020)				
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 of candidate MPs				
Simulation performance tests				
Comparison of MPs and finalize advice				

Note: H, M and L indicate high, medium and low priority, respectively.

CHUB MACKEREL

Year	Tasks	Progress/Comment	Meeting/Activity
2017	Review of Members' national research on stock status and fisheries	Done	Chub mackerel workshop, 16-17 Feb
	Establishment of TWG CMSA	Done/Adopted by the Commission	SC02 meeting (proposal), COM03 meeting
	Development of TORs, Work Plan and Data List	TORs are done. Work Plan and Data List are reviewed on the annual basis.	Proposal at the 3rd Commission meeting; Intersessional work on the TORs; TWG CMSA meeting, 4-5 Dec
2018	Report outputs by TWG CMSA01		SC03 meeting, COM04 meeting;
	Discussion of the framework for the operating model (OM), list of data required for stock assessment (SA)	Protocol of Operating Model Development has been drafted. Some existing models and tools for data simulation have been reviewed.	Intersessional work and informal meeting of SWG OM on 27 Feb 2019
2019	Present results of the intersessional work on the OM and organize the OM structure/ proposal of SA model candidates/ agreement on the platform of OM (PopSim)	Done.	TWG CMSA02, Mar 2019.
	Present outputs by TWG to SC		SC04 meeting, COM05 meeting;
	Data preparation and data sharing for OM; development and conditioning of OM		Intersessional
	Describe and review all data for OM/ Show the results of conditioning OM / Setting OM scenarios		TWG CMSA03

2020	Generate pseudo data to be fitted to the stock assessment models		Intersessional
	Present outputs by TWG to SC		SC05 meeting, COM06 meeting;
	Compare stock assessment model candidates and choose the best SA model(s) / finalize the data used for the stock assessment /do preliminary assessment and recommendations to the SC		TWG CMSA04
2021	Present outputs by TWG to SC and provide preliminary recommendations		SC06 meeting, COM07 meeting;
	Complete stock assessment with the selected SA model(s) and provide recommendations to SC		TWG CMSA05

Detailed work plan for the operating model development [to be replaced by the flowchart for OM development]

2018

1. Identification of all available data
2. Specification of objectives and determination of performance measures
3. Discussion of the framework for the operating model (OM)
    a. Draft a protocol for the OM development
    b. Specification of model structure
        i. Important biological processes to be incorporated into the OM
        ii. Specification of uncertainties to be incorporated in the OM
        iii. Population dynamics model/data-generating model
        iv. Determine the population and fishing constant (mortality, fertility, growth, maturation, catchability)
        v. The method for conditioning the data (what parameters are estimated or not?; what data are used for conditioning?)
        vi. Develop a flowchart for OM
4. Present the progress and organize the structure of the OMs [TWG CMSA02]
5. Identification and collection of required data [TWG CMSA02]

2019

6. Conditioning the OMs on data [intersessional]
7. Presents and compares the results of conditioning [TWG CMSA03]
8. Setting of scenarios of OMs (reference case(s) and sensitivity case(s)) [TWG CMSA03]

2020-2021

9. Generate the pseudo data to be fitted to the stock assessment models
10. Compare stock assessment model candidates according to the pre-determined performance measures and choose the best SA model from the candidates [TWGCMSA04]
11. Evaluate the quality of data and finalize the data used for the stock assessment [TWG CMSA04]
12. Complete stock assessment with the selected SA model(s) and management advice [TGWCMSA05]

Flowchart for the development of the operating model

1. Real data for stock assessment ┄┄┄┄
Data available
- Each member will submit available data (*by SC04 meeting, April 2019*)
- SWG will format the data and compile the data *by 1st July 2019*

↓

2. Fit with several models ┄┄┄┄
Some stock assessment models (VPA, ASAP, KAFKA, SAM) **proposed as the candidates for the stock assessment are used**
- Start from 1st July 2019

↓

3. Estimated parameters ┄┄┄┄
- Members will submit working papers (WP) on results of each stock assessment model and WPs with description of data submitted (no later than one month before TWG CMSA03 meeting)
- SWG will present and compare the estimated results and TWG will review them
- SWG will make a table of assumptions and parameters used in the SA models
- TWG will review data submitted
- TWG will determine scenarios for operating models (for free assumption cases)

by the end of TWG CMSA03

↓

4. Produce pseudo data sets ┄┄┄┄
Generate the pseudo data*
- Secretariat will seek an external expert intersessionally and invite her/him to the next TWG CMSA03 meeting
- The expert will generate the pseudo data according to the scenarios determined

↓

┄┄┄┄
Exclude extremely unrealistic pseudo data (crash or outburst...) *
(according to the paragraph 7 of the protocol of OM Development)

↓

5. Fit with several models ┄┄┄┄
The candidates of the stock assessment models
- VPA, ASAP, KAFKA, SAM, State-space production model

↓

6. Estimates in the SA models ┄┄┄┄
Check the performance of the candidates stock assessment models*
- performance measure (Annex F)
- bias, variance, robustness

TGW CMSA04 will review the results

* By an external expert

SPOTTED MACKEREL, JAPANESE SARDINE, NEON FLYING SQUID AND JAPANESE FLYING SQUID

Year	Tasks	Progress/Comment	Meeting/Activity
2017			
2018	Collect data and monitor situation for further analyses	Catch and effort summary tables	
2019	Collect data and monitor situation for further analyses		
2020	Collect data and monitor situation for further analyses		
2021	Collect data and monitor situation for further analyses		

NORTH PACIFIC ARMORHEAD

Year	Tasks	Progress/Comment	Meeting/Activity
2017	1. Adopt Adaptive Management process 2. Develop work plan to implement the Adaptive Management process 3. Assess and monitor the status of the stock 4. Conduct acoustic survey and other affiliated research	In progress. *COM03 requested further work on the Adaptive Management process.*	SC02 meeting, Apr 2017; COM03 meeting, Jul 2017.
2018	1. Develop harvest control rules to conserve stock 2. Assess and monitor the status of the stock 3. Review data requirements and identify data gaps 4. Conduct affiliated research	In progress. In progress. In progress.	SSC BF01, Apr 2018. SSC BF01, Apr 2018. SSC BF01, Apr 2018. Data workshop, Nov 2018
2019	1. Improve adaptive management plan and implement harvest control rules 2. Assess and monitor the status of the stock 3. Review data requirements and identify data gaps 4. Conduct acoustic survey and other affiliated research	In progress. In progress. Done. Japan will conduct survey in 2019.	SSC BF02
2020	1. Review monitoring and survey designs 2. Assess and monitor the status of the stock 3. Conduct acoustic survey and other affiliated research		SSC BF-ME01

Year	Tasks	Progress/Comment	Meeting/Activity
2021	1. Evaluate Adaptive Management process and refine harvest control rules 2. Assess and monitor the status of the stock 3. Conduct acoustic survey and other affiliated research		SSC BF-ME02

SPLENDID ALFONSINO

Year	Tasks	Progress/Comment	Meeting/Activity
2017	No tasks.		
2018	1. Review monitoring and assessment of the stock	Done.	SSC BF01, Apr 2018.
	2. Review data requirements and identify data gaps	In progress.	SSC BF01, Apr 2018. Data workshop, Nov 2018.
	3. Conduct affiliated research		
2019	1. Conduct comprehensive stock assessment	In progress.	SSC BF02
	2. Continue developing Adaptive Management process	In progress.	
2020	1. Develop harvest control rules and management advice 2. Adopt Adaptive Management process 3. Assess and monitor the status of the stock		SSC BF-ME01
2021	1. Assess and monitor the status of the stock 2. Evaluate Adaptive Management process and refine harvest control rules 3. Conduct affiliated research		SSC BF-ME02

2. ECOSYSTEM APPROACH TO FISHERIES

Year	Tasks	Progress/Comment	Meeting/Activity
2017	Review Encounter protocol and Exploratory fishing protocol, Revise CMMs 2017-05 and 06	Done	SSC VME02
2018	Address data, knowledge, performance, gaps and identify further steps to improve our assessments and protection of VMEs in the Convention Area	Done.	NPFC/FAO VME workshop; SSC VME03.
	Develop ID guides for VME indicators	In progress	Intersessional meeting, March 2018; further intersessional work
	Determine minimum data requirements and data resolution for combined SAI assessment, review data availability, and consolidate the data required;	In progress: Data availability was reviewed.	Intersessional communication Data workshop, Nov 2018
	Contribute to data sharing protocols and creation of a central data repository	Done.	

2019	Map a combined fishing footprint and effort	In progress.	SSC VME04
	Refine the exploratory fishing protocol and consider banning exploratory fishing in VME closed areas	Deferred to future meetings.	
	Development of standardized approach for SAI assessments	In progress.	
	Refine the encounter protocol if necessary	In progress.	
	Develop management objectives for recovering VME sites	Deferred to future meetings.	
	Develop timely reporting and action protocol when VME sites or recovering sites are identified.	In progress; Flowchart of post-encounter measure was agreed.	
	ID guides for VME indicators: 1. finalize the format and collect all images on the designated web drive	In progress; Design and content of the Guide was agreed.	1. SSC VME04
	2. Update the format by the discussion from the SSC and review the image & id with other coral taxonomists.	In progress.	2. Intersessionally

2020	Apply the standardized approach for SAI assessments and conduct integrated SAI assessment Refine the encounter protocol if necessary ID guides for VME indicators: Complete editing the id guide and test it out by observers and fishers.		SSC BF-ME01
2021	Start discussions on quantitative definition of VME based on observations or modelling Introduce periodic internal review processes for VME management ID guides for VME indicators: Revisit taxonomy according CMM updates and finalize the id guide.		SSC BF-ME02

3. DATA COLLECTION, MANAGEMENT AND SECURITY

DATA STANDARDS

Year	Tasks	Progress/Comment	Meeting/Activity
2017	Finalize data collection templates Pacific saury and continue development for bottom fisheries (trawl, gillnet, longline)	Presented and discussed. Done for Pacific saury. Others in progress.	SSC PS02 & SC02 meetings, Apr 2017. Intersessional work by SWGs.
2018	Develop data collection templates for chub mackerel and squids	In progress.	SSC BF01, SC03 meetings.
2019	Complete data collection templates for bottom fish, chub mackerel and squids	Data collection templates for bottom fish has been completed. [Templates for chub mackerel and squids will be developed when the relevant subsidiary bodies of SC identify data needs.]	SSC BF02, SC04 meetings.
2020	Revision of data collection templates if necessary		
2021	Revision of data collection templates if necessary		

DATA COLLECTION

Year	Tasks	Progress/Comment	Meeting/Activity
2017	Identifying data needs and data gaps	In progress.	SSCs & SC02 meetings, Apr 2017; TWGs CMSA&PSSA meetings, Dec 2017.
2018	Identifying data needs and data gaps;	In progress.	VME workshop, Mar 2018, VME&BF Data workshop, Nov 2018.
	Enhancement of data collection: fisheries, surveys, Observer program	In progress. *Review of the existing observer programs of Members and those of other RFMOs is completed.*	SC03 meeting.
2019	Identifying data needs and data gaps; Enhancement of data collection: fisheries, surveys, Observer program	In progress. *Identification of scientific data which can be collected and/or validated by at-sea observers, fishermen, electronic reporting systems and other means for Pacific saury.*	Intersessional work. TWG PSSA03, TWG CMSA02, SSC PS04, SC04.
2020	Identifying data needs and data gaps; Enhancement of data collection: fisheries, surveys, Observer program Development of the combined bycatch taxa list and fish ID guide for scientific observers for the northwestern Pacific Ocean		
2021	Identifying data needs and data gaps; Enhancement of data collection: fisheries, surveys, Observer program		

DATA SECURITY

Year	Tasks	Progress/Comment	Meeting/Activity
2017	Information Security Guidelines	In progress. *Development of the Information Security Guidelines (ISG) for both SC and TCC.* *Adoption of the Interim Guidance for Management of Scientific Data Used in Stock Assessments*	SC02 meeting, Apr 2017; Intersessional work by the SWG. COM03meeting, Jul 2017.
2018	Prioritization of areas of the Information Security and Management System and development of Information Security and Management regulations	In progress.	SC03 meeting
2019	Adoption of Information Security and Management regulations	Draft Interim Regulations for Management of Scientific Data and Information	SC04 meeting.
2020	Improvement of Information Security and Management regulations if necessary		
2021	Improvement of Information Security and Management regulations if necessary		

Terms of Reference for the Small Scientific Committee on Bottom Fish and Marine Ecosystems (SSC BF-ME)

The SSC BF-ME shall work to ensure the long-term sustainable use of the bottom fisheries resources in the Convention Area while conserving the associated marine ecosystems (including vulnerable marine ecosystems (VME)) of the North Pacific Ocean in which these resources occur. The SSC BF-ME shall also help the Scientific Committee fulfill its functions as specified in the Convention.

1. Review fishery and research data
    a. Annually compile and share target catch and bycatch data (including VME indicator taxa) as required by Conservation and Management Measures for Bottom Fisheries and Protection of Vulnerable Marine Ecosystems in the Northwestern and Northeastern Pacific Ocean
        i. Define list and spatial resolution of catch data to be shared
        ii. Define list and spatial resolution of multibeam bathymetry to be shared
        iii. Define list and spatial resolution of visual observations or other relevant data to be shared
        iv. Map the combined fishing footprint and annual effort for bottom fisheries
        v. Define data sharing protocols and develop a shared data repository
    b. Annually review members research activities regarding benthic ecosystems (including VME)
2. Develop shared ID guides for bottom fish and for VME indicator species in the western Pacific Ocean
    a. Review and update NPFC VME indicator taxa and bycatch lists on a routine basis
3. Review approaches applicable for stock assessment of target bottom species and investigate various management strategies
    a. Identification of data needs and establishment of activities to fill data gaps
    b. Further development of the Adaptive Management approach for North Pacific armorhead and splendid alfonsino and mechanism for its implementation
        i. Assess and monitor the status of the priority species stocks
        ii. Develop harvest control rules to conserve priority species abundance
4. Assess significant and adverse impacts (SAI) on VMEs

a. Explore a data or model-based approach for defining VME's

b. Undertake research to determine the gear-specific effects of bottom fishing on benthic ecosystems

c. Define post-encounter measures for VME for both routine fishing activities (within the current fishery footprint) and exploratory fishing (outside the current fishery footprint)

d. Explore a data or model-based approach for assessing SAI on VMEs

    i. Explore the design of model and data based approaches to spatial management strategies to maximize bottom fish harvest while minimizing impacts to VMEs (e.g. analyses of trade-off between potentially competing objectives)

    ii. If appropriate define management objectives for recovering VME sites

5. Assess the ecology and ecosystem considerations of bottom fisheries resources and other benthic organisms including both hard-bottom and soft-bottom seafloor

a. Examine relationships between environmental conditions and recruitment for bottom fisheries resources

b. Conduct other research that may be useful to adaptive management or indicating future population status of bottom fisheries resources (e.g. alternative survey methodologies such as acoustic surveys)

c. Conduct relevant research on benthic ecology as it pertains to bottom fisheries resources

Scientific data which can be collected and/or validated by at-sea observers, fishermen, electronic reporting systems and other means for Pacific saury

#	Items	Example	Data collection	Data validation
Stick-held-dip net fishing information format - Pacific saury				
0	Operational day ID			
1	Vessel flag	KR	*	
2	Vessel name	77Dongnam	*	
3	Vessel call sign (if allocated)	1ABC	*	
4	Vessel Reg No	xxxxxx-xx	*	
5	Lloyd's/ IMO Number (if allocated)	xxxxxxx	*	
6	Light bulb types (traditional/ LED)	traditional	xx	
7	Total light power (kW)	xxx kW	xx	
8	Date of Fishing	14-Apr-18	xx	
9	Fishing position (midnight): latitude (DD,MM.mm)	44, 10.10	xx	X
10	Fishing position (midnight): longitude (DD,MM.mm)	153, 10.10	xx	X
11	Sea Temperature (°C)	15	v	X
12	Number of hauls	3	xx	X
13	Species code (FAO 3-alpha code)	SAP		
14	Retained: Live weight (kg)	3000		X
15	Discarded: Live weight (kg)	0	X	
16	(Bycatch) Species code (FAO 3-alpha code)	OFJ		
17	Retained: Live weight (kg)	0	X	
18	Discarded: Live weight (kg)	10	X	
Biological data - Pacific saury				
0	Operational day ID			
1	Sampled location (fleet/port/lab)	fleet	v	X
2	Fishing Date or Fishing position	14-Apr-18	v	X
3	Length (FL,BL,TL, KL in mm)	FL 15	v	
4	Sex	Male	X	
5	Maturity Stage	Immature	X	
6	Age (if possible)	1	X	

X - data that can ONLY be collected by observers AT SEA;

xx - data that can be collected by fishermen AT SEA;

v - data which are preferably collected by observers but a degree of cover can be achieved by other means (in-port collection, EM, ERS etc);

* - data which can be collected equally well by other means.

Interim Regulations for Management of Scientific Data and Information

This Interim Regulations are intended to apply while the NPFC develops comprehensive rules and procedures governing the security of, exchange of, access to and dissemination of data held by, or accessed by Members of the Commission, its subsidiary bodies, the Secretariat, and by service providers, contractors, or consultants acting on their behalf or others so authorized for access by the Secretariat.

I. Interim Guidance for Management of Scientific Data

1.   Objectives

The objectives of this Interim Guidance are (1) to support stock assessments, ecosystem assessments and accumulation of scientific knowledge of fisheries resources under the Commission's jurisdiction, (2) to encourage cooperation on scientific analyses among Members, and (3) to establish an interim guidance on handling scientific data.

2.   Scientific Data included in Members' Annual Reports

Scientific data (e.g., catch amount, number of vessels, number of fishing days and so on) included in Members' Annual Reports should be uploaded to the public section of the NPFC website for public access and use.

3.   Other scientific data, not included in Members' Annual Reports, submitted for use in stock assessments and ecosystem assessments

The Secretariat should not disclose Members' scientific data submitted by means other than Members' Annual Reports or meeting documents open for the public in accordance with paragraph 4.

Members may cite and/or use such data when working on matters under consideration by the Scientific Committee/SSCs.

If a Member or cooperating non-Member wishes to cite and/or use these data for work that is intended to be conducted or shared outside of the NPFC, such Member or non-Member should consult with the data provider(s) through the Secretariat, stating 1) the data subject to the request, and 2) the purpose for which the data is intended to be used. The Secretariat should immediately notify the data provider(s) of the request. The data provider(s) should inform the Secretariat within 30 calendar days whether to accept or reject the request. If the data provider(s) reject the request, the data provider(s) should state the reason(s) for the rejection. If the data provider(s) accept the request, the data provider(s) may request an agreed-upon credit line in any subsequently-created product. Those who cited/used data should not distribute the data further nor use it for the purpose not declared.

II. Regulations for management of scientific meeting documents, meeting reports and intersessional communications on the NPFC website

4. Working Papers, Meeting Info Papers, Information Papers, Reference Documents/Papers, Observer Papers

To enhance and encourage collaborations with researchers, scientists, RFMOs, and science organizations, and to encourage transparency of the NPFC processes, the SC recommends making the above named documents available to the public through the NPFC website. The default rule would be that all the above named documents would be released to the public 45 days (inclusive of weekends and holidays) following the closure of the meeting to which they were submitted. All meeting papers submitted to any NPFC scientific meetings through the Secretariat should indicate how they should be cited in accordance with the NPFC Document Rules. If the document author(s) or submitting Member do not authorize the release of the document, they must indicate that clearly on the cover page or first page of the document, OR they may request to the Secretariat in writing of their desire to not release the document during the 44 days prior to document publication on the website.

5. SC Meeting Reports, SC Subsidiary Body Reports (SSC, TWG) and Other Scientific Reports (Workshop)

5.1. The SC recommends that the above named documents be released to the public after acceptance by the Commission Members within 45 days in accordance with the procedures stated in Paragraph 8.2 of Rules of Procedure.

5.2. For SC subsidiary body reports: If there are portions of the report which are deemed by the subsidiary body to be too sensitive to release prior to the SC report, the specific sensitive portions may be redacted, and the report released as described in #5.1 above. Following the SC meeting, the entire report (inclusive of redacted portions) will be released in conjunction with the SC report. If the report as a whole is deemed too sensitive to release, the report may be held and released to the public in conjunction with the SC Meeting Report. Decisions about which portion or whether the whole report is to be redacted shall be made during the subsidiary body meeting.

6. Intersessional Communication using the NPFC Collaboration website

The NPFC has made available a web-based tool to facilitate discussion of its subsidiary bodies, informal working groups, discussion groups, and other temporary groups on a project-by-project basis. Access to this tool is restricted to members of a specific project/topic. Following the completion of the discussion, the group facilitator/chair may summarize the discussions to make them available and accessible to the appropriate Commission body (SCC, SC, Commission). At the conclusion of the discussions of the group and after summary is complete, the discussion text and documents will be archived by the Secretariat but not maintained on the website except for a summary made by the group facilitator/chair.

7. Redaction or withdrawal of Working Papers, Meeting Info Papers, Information Papers, Reference Documents/Papers, Observer Papers which were submitted to workshop or meeting

Documents of the types listed above may not be redacted or withdrawn from the public or Member-only area of the website by a Member or the Secretariat once it has been published unless notification is provided to all Members which details the reason for the withdrawal request. If an error is identified in a publicly available document, the member responsible for the document submission can submit a cover letter or document text which describes the error and the resolution to be prepended to the original document. Errors identified in documents prior to publication on the public website or during meetings or workshops can be revised or documents withdrawn before or during the meeting, but other members or meeting participants must be notified of the specifics of the changes as soon as possible.

NPFC–PICES Framework for Enhanced Scientific Collaboration in the North Pacific

Executive Summary

The North Pacific Fisheries Commission (NPFC) and the North Pacific Marine Science Organisation (PICES) are inter-governmental organisations with overlapping geographical areas and common scientific interests in the sub-Arctic regions of the North Pacific Ocean. The joint PICES-NPFC Study Group for Scientific Cooperation in the North Pacific Ocean (PICES-NPFC SG) developed a framework that strives to enhance collaboration between the two organisations.

This Framework identified three broad areas of joint interest to PICES and the NPFC on which progress could be made over the next five years. These areas were (i) support for stock assessment for priority species; (ii) vulnerable marine ecosystems; and (iii) ecosystem approach to fisheries. The first two areas were ranked highest for both PICES and NPFC, and the third area was ranked lower. There were other areas that were discussed, but it was recommended not to pursue these areas due to being a lower priority when the framework was developed or they were not aligned with the organisation's research plans and priorities. Some areas (e.g., climate change) were incorporated into the three high priority areas above. As areas of interest and priorities change over time, the joint areas for collaboration may be updated.

The framework identifies various mechanisms for implementing enhanced collaboration between PICES and NPFC including workshops and joint working groups as the key ones in the near term, but also theme sessions at PICES annual meetings, representation at meetings and/or workshops, and coordination of science plans.

Following approval and implementation from both organisations, routine monitoring of the progress of activities will be completed jointly by the Secretariats of PICES and NPFC and reported to the PICES Science Board and the NPFC Scientific Committee on an annual basis during their respective annual meetings.

1.0 Background

The North Pacific Fisheries Commission (NPFC) and the North Pacific Marine Science Organisation (PICES) are inter-governmental organisations with overlapping geographical areas and common scientific interests in the sub-Arctic regions of the North Pacific Ocean.

NPFC is a Regional Fisheries Management Organisation (RFMO) which came into force on 19 July 2015 after ratification of the Convention on the Conservation and Management of the High Seas

Fisheries Resources in the North Pacific Ocean.   The objective of the Convention is to ensure the long-term conservation and sustainable use of the fisheries resources in the convention area (Figure 1) while protecting the marine ecosystems of the North Pacific Ocean in which those resources occur.   The fishery resources covered by the Convention are all fish, molluscs, crustaceans and other marine species caught by fishing vessels within the Convention area, excluding (i) sedentary species insofar as they are subject to the sovereign rights of coastal states, and indicator species of vulnerable marine ecosystems as listed in, or adopted pursuant to the NPFC Convention, (ii) catadromous species, (iii) marine mammals, marine reptiles, and seabirds, and (iv) other marine species already covered by pre-existing international fisheries management instruments within the area of competence of such instruments.   The Commission has several committees that provide information and advice to the Commission for decisions, and is supported by a Secretariat.   These committees include the Scientific Committee, the Technical and Compliance Committee, and the Finance and Administrative Committee.
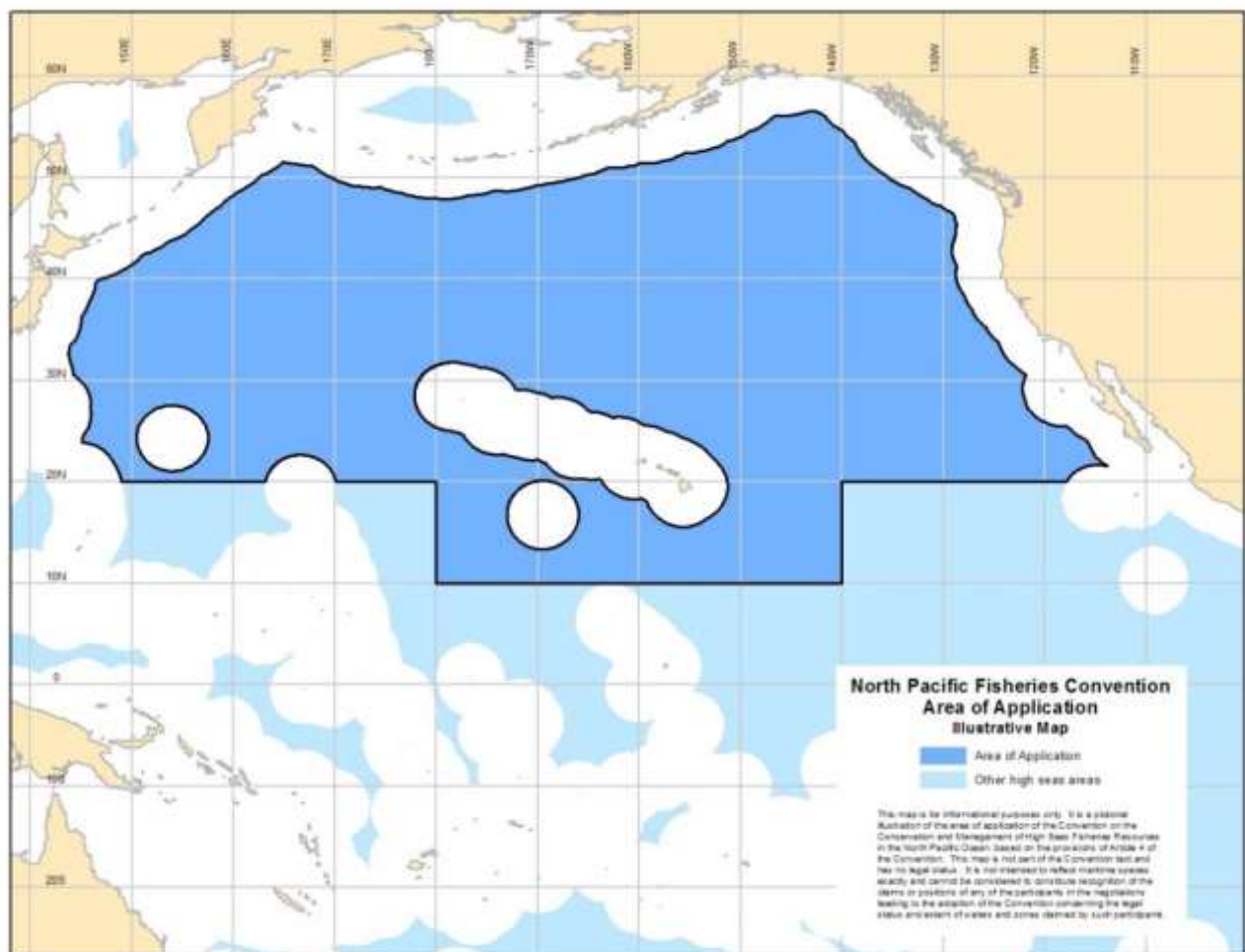

Figure 1: Illustrative Map of the NPFC Convention Area

PICES was established in 1992 to:

1) to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impacts upon it from human activities;

2) to promote the collection and exchange of information and data related to marine scientific research in the area concerned.

The Organization receives recommendations on the science program from the Science Board, which is supported by a number of permanent scientific and technical committees, along with an assemblage of "expert groups"

The PICES Convention Area is defines as "the temperate and sub-Arctic region of the North Pacific Ocean and its adjacent seas, especially northward from 30 degrees North Latitude, hereinafter referred to as the "area concerned". Activities of the Organization, for scientific reasons, may extend farther southward in the North Pacific Ocean."
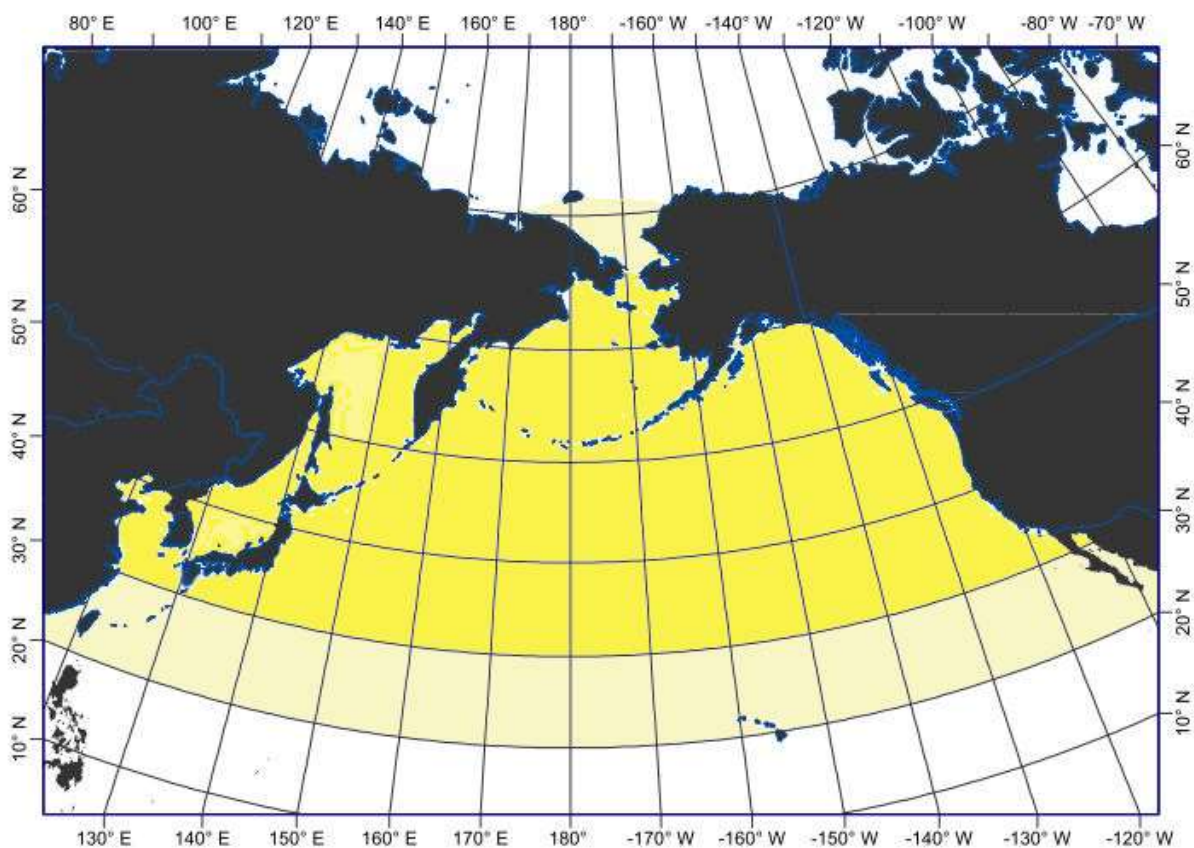

Figure 2: Illustrative Map of the PICES Convention Area

The present PICES members are Canada, Japan, People's Republic of China, Republic of Korea, the Russian Federation, and the United States of America, which are also members of NPFC (note: Chinese Taipei and Vanuatu are also members of NPFC).

Following a number of informal conversations between the two organisations, it was recognised that there was an opportunity to share and build upon each organisation's expertise and activities through enhanced collaboration in order to more efficiently and effectively meet work plans and priorities.   As a result, the joint PICES-NPFC Study Group for Scientific Cooperation in the North Pacific Ocean (PICES-NPFC SG) was established in 2017 to determine if there were scientific areas of mutual interest on which both organisations can collaborate, and if so, to identify mechanisms to jointly implement activities that produce desired products and outcomes for each organisation.

Membership of the PICES-NPFC SG comprised of Eddy Kennedy (Co-Chair), Yong Chen, Lisha Guan, Changan Xu, Wei Yu, Daisuke Hasegawa, Kazuaki Tadokoro, Eunjung Kim, Todd Miller, and Robin Brown representing PICES, and Vladimir Kulik (Co-Chair), Toshihide Iwasaki, Seok-Gwan Choi, Tatiana Semenova, Chih-Hao Hsieh, Kari Fenske, and Aleksandr Zavolokin representing NPFC.

The PICES-NPFC SG was formed in October 2017, but was delayed in initiating discussions among members.   There were some on-line discussions, and progress was provided to the Scientific Committee of the NPFC in April 2018.   As well, PICES participated in the NPFC/FAO Workshop on the Protection of Vulnerable Marine Ecosystems in the North Pacific Fisheries Commission Area: applying global experiences to regional assessments that took place from 12-15 March 2018. In this workshop, PICES provided expert input and shared information and experiences that were pertinent to achieving the workshop objectives, such as the usefulness of species distribution models for predicting the occurrence of VMEs which was advanced in PICES WG 32.   Also, NPFC contributed to and participated in the PICES International symposium "Understanding Changes in Transitional Areas of the Pacific" which was held in La Paz, Mexico from 24-26 April 2018. An NPFC expert presented recent situations with Pacific saury stock assessment and considered some marine environmental factors which are and could be included in stock assessment models.

The SG met face-to-face at PICES-2018 in Yokohama, Japan to develop a framework for collaboration that included identifying and prioritising areas of joint interest on which to collaborate, as well as various implementation mechanisms for these activities.   Most of the members of the PICES-NPFC SG were present at this meeting as well as the following observers: Anya Dunham

(Canada), Janelle Curtis (Canada), Hyewon Moon (Korea), Ric Brodeur (USA) and Jackson Chu (Canada).

The framework was drafted at the face-to-face meeting and the co-chairs presented progress to the PICES Science Board at PICES-2018.   The PICES-NPFC SG committed to continue to finalise the report by email correspondence during the Winter 2018/19, and present the Framework to the NPFC Science Committee in April 2019 and the PICES Science Board in May 2019.

1.1 NPFC Science Priorities

The NPFC Scientific Committee provides scientific advice and recommendations to the Commission.   The primary functions of the Scientific Committee are to (i) regularly plan, conduct, and review the scientific stock assessments of the relevant fisheries resources in the Convention Area; (ii) assess the impacts of the fishing activities on fisheries resources and species belonging to the same ecosystem or dependant upon or associated with the target stocks; (iii) develop a process to identify VMEs and areas of features where VMEs occur or are likely to occur; (iv) review effectiveness of management measures and make recommendations to meet Convention objectives; and (v) develop rules and standards for the collection and sharing of data on fisheries resources and associated ecosystems.

In response to these functions, the NPFC developed a 2017-2021 Research Plan which outlines priority research themes, including the rationale and more specific areas of work.   These theme areas include (i) stock assessments for target fisheries and bycatch species, (ii) ecosystem approach to fisheries, (iii) vulnerable marine ecosystems, and (iv) data collection, management and security.

Accurate stock assessments are critical in helping to ensure the long-term conservation and sustainable use of fisheries resources in the Convention Area.   In NPFC, stock assessments for both pelagic fish (e.g., Pacific saury and chub mackerel) and bottom fish (e.g., North Pacific armorhead, and splendid alfonsino) should strive to understand the current status and trends in production of populations of priority species as well as factors that may affect future trends.   Areas of work include developing baseline assessments, reaching consensus on data standards used in stock assessments, and developing a standardized method to provide advice to the Commission.

Making progress on adopting an ecosystem approach to fisheries addresses several articles in the Convention.   For example, the Convention makes reference to (i) adopting and implementing measures in accordance with the precautionary approach and an ecosystem approach to fisheries, (ii) adopting management strategies for any fisheries resources and for species belonging to the

same ecosystem or dependent upon or associated with the target stocks, and (iii) assessing 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 identified include vulnerable marine ecosystems and understanding ecological interactions among species.

1.2 PICES Science Plan

PICES engages scientists in trans-disciplinary, multi-national collaborations to further collective understanding of the North Pacific's natural systems and enhance ecological and social resilience of marine systems.   As part of its vision, PICES aspires to be a leading contributor to global marine science, sought as a valued collaborator to solve current and future management issues as they emerge, and to be recognised as the premier organisation for current research and understanding of North Pacific marine ecosystems.   The scientific leadership for the organisation is through the Governing Council and Science Board which are supported by the Secretariat.   The scientific work of PICES is conducted primarily by expert groups, which consist of (i) working groups, (ii) study groups with a one to three year duration to achieve the results described in their terms of reference, as well as (iii) advisory panels and (iv) sections which provide longer-lived expert groups to maintain specific expertise within PICES.   The Scientific and Technical Committees are responsible for the planning and direction of the major disciplinary themes, and for providing general supervision to the expert groups.

The PICES Strategic Plan (April 2016), outlines six specific goals to meet its vision and advance scientific knowledge.   These goals are:
1. Foster collaboration among scientists within PICES and with other multinational organisations, particularly with those that have common goals.
2. Understand the status and trends of marine ecosystems in the North Pacific, and improve assessment of the vulnerability and resilience of these ecosystems to pressures from climate and human activities.
3. Understand and quantify how marine ecosystems respond to natural forcing and human activities.
4. Advance methods and tools (e.g., oceanographic models, ecosystem indicators, etc.) to enable new knowledge and improved advice over seasonal to decadal timescales in support of ecosystem based management.
5. Provide relevant scientific information pertinent to North Pacific ecosystems that is timely and broadly accessible.
6. Engage with early career scientists to sustain a vibrant and cutting edge PICES scientific community.

PICES activities are further guided by its current 10-year integrated research program FUTURE: Forecasting and Understanding Trends Uncertainty and Responses of North Pacific Marine Ecosystems. FUTURE is an integrative science program with a goal to understand and communicate the future of North Pacific ecosystems and the potential impacts from human use. More specifically, the program seeks to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystems status based on contemporary understanding of how nature functions, and to communicate new insights to its members, governments, stakeholders, and the public.

1.3 Contributions to Other Science Initiatives

Future collaborations between PICES and NPFC would contribute to other international science initiatives. One in particular is the UN Decade of Ocean Science for Sustainable Development. This initiative came into being at the seventy-second session of the United Nations General Assembly (UNGA) within Part XI of the Omnibus Resolution for Oceans and the law of the sea relating to Marine Science. The resolution stated that the UN Decade of Ocean Science for Sustainable Development will be for the 10-year period beginning on 1 January 2021, within existing structures and available resources, and calls upon the Intergovernmental Oceanographic Commission to prepare an implementation plan for the Decade in consultation with Member states, specialized agencies, funds, programmes, and bodies of the United Nations, as well as other intergovernmental organisations, non-governmental organisations and relevant stakeholders. The endorsement by UNGA of the Decade highlights the need and role of ocean science data and information exchange for sustainable development. With the two main goals of (i) generating the scientific knowledge and underpinning infrastructure and partnerships needed for sustainable development of the oceans, and (ii) providing ocean science, data, and information to inform policies for a well-functioning ocean in support of Agenda 2030, this PICES-NPFC Framework for Collaboration is well aligned with contributing to UN Decade of Ocean Science for Sustainable Development. In 2019, there may be relevant regional workshops where both PICES and NPFC can participate to not only support the goals of the Decade but also to advance the areas of scientific collaboration identified in this framework.

2.0 Objectives

The objectives of this framework is to address the Terms of Reference of the PICES-NPFC SG which are:
   1. Review the scientific interests and objectives of each organization;

2. Identify potential areas and specific topics for scientific cooperation;
3. Identify potential collaborative methods (such as representation at each other's meetings, holding of joint workshops or symposia, development of a Memorandum of Understanding (MOU) between the organizations or other formal agreements, establishment of joint working groups);
4. Clarify practical steps to advance the cooperative activities identified above;
5. Provide advice on how information produced by PICES can be shared and applied in NPFC;
6. Make a specific proposal to each organization for further consideration.

Specifically for NPFC, some key objectives are to reduce duplication of effort, increase leveraging of time and resources with PICES, and to acquire impartial scientific information and advice to support policy and decision making within the North Pacific Convention area. PICES also share these objectives as well as the objective to be more relevant to Regional Fisheries Management Organisations (RFMOs), such as NPFC, by providing the needed objective scientific advice for decision making. Further, for both organisations, the intent is for productive, mutually beneficial collaborative initiatives, which is to say that the areas for collaboration need to make sense for both organisations. To support the success of this Framework for Enhanced Collaboration, efforts will be focused on areas that are high priority for both organisations to advance over the next five years.

3.0 Scientific Areas of Joint Interest

The PICES-NPFC SG identified several topics of joint interest, but came to consensus on three priority areas that are ranked according to making progress over the next five years. For each area identified, discussions focused on whether each organisation viewed the area to be a priority and the specific interests in the area for each organisation. Determining whether the research area was a priority for future collaborative work involved consideration of several criteria including:
- Aligns with organisation's goals and objectives and existing research plans and priorities
- Potential outputs/benefits from the work area well-defined and relevant
- The timelines for when scientific results and advice are required
- The level of impact and likelihood that the project outputs will be utilised
- Likelihood of success (i.e., are the project objectives likely to be achieved)

Table 1 in the Appendix summarizes all scientific areas for collaborations that were identified, the three areas that were recommended for joint activities, and potential activities that can be implemented over the next five years for each area. Below the three priority areas of joint interest are discussed in more detail.

3.1 Support for Stock Assessments for priority species

Stock assessments for target fisheries and bycatch species have the highest priority among the research areas of the NPFC. There are six fish species and two squid species which 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*), North Pacific armorhead (*Pentaceros wheeleri*), Splendid alfonsino (*Beryx splendens*), Neon flying squid (*Ommastrephes bartramii*), and Japanese flying squid (*Todarodes pacificus*). The highest priority belongs now to the species with decreasing catch (i.e., Pacific saury and North Pacific armorhead) and increasing catches (i.e., Chub mackerel and Japanese sardine). These species are also relevant for many PICES Committees and Working Groups since these squid and fish species are suspected to be very sensitive to environmental changes, in particular during early life history stages. Given that many of the priority species are short lived and their abundance fluctuates significantly year to year, recruitment rate may not be determined by the number of spawners in any deterministic one-way interaction. Rather, oceanography and climate are suggested to be main drivers not only for distribution patterns at different spatial scales but also for survival success. PICES participants have a long history of developing and validating saury, mackerel, sardine and squid distribution models, collecting ecosystem time series observations (ETSO), and using simulation studies to predict the consequences of changes / variability in key environmental parameters on populations in space and time. Thus, the common question to be resolved is what methodologies are most appropriate to incorporate environmental variables, which may affect stock status and distribution estimates, into stock assessments.

3.2 Vulnerable Marine Ecosystems (VMEs)

Internationally, steps have been taken to protect marine biodiversity of vulnerable marine ecosystems (VMEs). According to the International Guidelines for the Management of Deep Sea Fisheries in the High Seas (FAO 2009), the criteria for identifying VMEs are: uniqueness or rarity, functional significance of the habitat, fragility, life-history traits that make recovery difficult, and structural complexity. PICES and NPFC share a common objective of promoting marine research that helps ensure the long-term conservation and sustainable use of the fisheries resources while protecting the marine ecosystems in which these resources occur. There are several areas of possible collaboration between NPFC and PICES on VMEs. Focused research topics may include:

(1) Increasing scientific knowledge of biodiversity associated with known seamounts in the North Pacific, including identification of endemic species and distribution patterns of vulnerable taxa;

(2) Increasing scientific understanding of the functional relationships within the ecosystem, with a special focus on the complex dependency of fishing resources and benthic species within VMEs;

(3) Identification of suspected VMEs in the Convention Area through predictive modeling and empirical observations (visual survey tools, fishery-independent data, where possible, or landed bycatch).

These and other research projects on VMEs will (1) contribute towards PICES FUTURE goals to understand how marine ecosystems in the North Pacific respond to climate change and human activities, (2) support decision making regarding significant adverse impacts (SAIs) of bottom fisheries on VMEs, exploratory fisheries and encounter protocol, and (3) aid implementation of NPFC Conservation and Management Measures for bottom fisheries and protection of VMEs in the NW and NE Pacific Ocean.

3.3 Ecosystem Approach to fisheries

The NPFC is willing to adopt, where necessary, conservation and management measures for species belonging to the same ecosystem or dependent upon or associated with the target stocks. Based upon this, the NPFC's Scientific Committee shall assess the impacts of fishing activities on both the targeted fisheries resources as well as species belonging to the same ecosystem or dependent upon or associated with the target stocks. However, to date, with the exception of certain VME studies, no ecosystem considerations have been incorporated within science advice on fisheries. PICES integrates Scientific Programs undertaken by the member nations and affiliates of PICES to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystem status based on a contemporary understanding of how nature functions. There are four active PICES Working Groups (i.e., (i) Third North Pacific Ecosystem Status Report; (ii) Common Ecosystem Reference Points across PICES Member Countries; (iii) Climate and Ecosystem Predictability; and (iv) Marine Ecosystem Services) which could make a tremendous contribution in providing advice on the state of the art ecosystem modeling techniques and methods to estimate "health" of the North Pacific in particular in the areas where NPFC's priority species occur and co-occur. Realising that there is an endless scope for research direction in this area, the short-term goal for this collaboration would be to develop a research plan to enable ecosystem considerations to be incorporated into a fisheries management approach.

4.0 Collaboration Mechanisms

There are many potential mechanisms for enhancing collaboration and making progress in the priority areas identified in Table 1. Some of these, which have been identified in other Frameworks for joint collaboration with PICES, include:

- Workshops
- Joint working groups
- Theme sessions at PICES annual meetings
- Representation at meetings and/or workshops
- Coordination of science plans

In the short term, the preferred mechanism is workshops as a venue to identify knowledge gaps and discuss opportunities and research needs to address these gaps.   From these workshops, further recommendations could be made on joint activities (e.g., joint working groups) to enhance collaboration on specific activities.   In addition, the workshop could define a terms of reference for a joint working group.

4.1 Workshops

PICES and NPFC have been co-sponsoring and participating in each other's workshops throughout their mutual history.   New and emerging issues often demand innovative and multidisciplinary approaches.   The ability to deal with and resolve new concepts is likely to be enhanced by the bringing together of PICES and NPFC expertise in co-sponsored workshops.   NPFC held a joint workshop with FAO in March 2018 on *the Protection of Vulnerable Marine Ecosystems in the North Pacific Fisheries Commission Area: applying global experiences to regional assessments* where PICES experts were invited to provide expert input to the discussions.   The workshop made recommendations for future work, and these recommendations may be used to establish joint research activities or working groups that can focus on specific objectives.   Moreover, there is a 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* to be held at the 2019 PICES Annual Meeting.   This workshop was proposed by the PICES-NPFC SG on Enhanced Scientific Collaboration in the North Pacific.

4.2 Joint Working Groups

Joint working groups represent one of the most effective mechanisms for collaboration and cooperation when there is a need to focus on a specific topic with specific deliverables defined by a terms of reference.   In general, joint working groups would be formed following one or a series of meetings and/or workshops that are organised on a common theme.   Thus, effective planning is a crucial element of successfully establishing a new and productive working group.   Typically in PICES, a working group has a typical duration of three years.   Under this PICES-NPFC Framework, it is recommended that joint Working Groups can be of any duration that is necessary to complete the Terms of Reference, but not longer than three years, except on a case-by-case basis where extensions are required.

4.3 Theme sessions at PICES annual meetings

Joint topic sessions at PICES annual meetings could be a potential mechanism for collaboration between PICES and NPFC.   There are numerous past examples of sessions that PICES has co-convened with other organisations where the benefits of sharing research findings and expertise have been demonstrated, such as joint sessions with ICES (International Council for the Exploration of the Seas), NOWAP (Northwest Pacific Action Plan), and ISC (International Scientific Committee for Tuna and Tuna-like species in the North Pacific Ocean).   Convening topics sessions at NPFC Scientific Committee annual meetings is not a mechanism used by NPFC for the review of the science.   This is done via Small Scientific Committees (SSCs) and technical working groups focused on specific areas.

4.4 Representation at meetings and/or workshops

Both PICES and NPFC have a history of having representatives from other organisations participate in meeting and workshops where they can report on their organisation's activities of interest.   It is recommended that both organisations consider inviting one or more representatives from the other organisation to participate in the Scientific Committee (for NPFC) and Science Board (for PICES) to update the bodies on the research activities ongoing and research priorities for the future.   Many of the science experts that participate in the NPFC SSCs and Scientific Committee are also members of PICES expert groups, thus representation within each organisation is already strong.

4.5 Coordination of science plans

To further promote collaboration in many of the activities identified in Table 1, PICES and NPFC could include share elements in their respective science/research plans.

5.0 Monitoring and Reporting

Following the approval and implementation of this framework by the respective bodies of PICES and NPFC (i.e., the Science Board and the Scientific Committee), this Framework will continue for a period of five years at which time it will be reviewed to assess the progress on the areas identified in Table 1, and to identify new areas for collaborations.   The review should also assess the collaboration mechanisms by identifying which ones were employed, the utility of those mechanisms in achieving desired results, and identify new mechanisms for future joint collaboration.

On an annual basis, there will be a progress report prepared by the Secretariat for each organisation

that is available for members.   This progress report should be common for both, be a summary of all joint activities between PICES and NPFC (including status of each activities and actions required to progress on objectives), and be prepared in collaboration by both Secretariats.   Further, this progress report will be presented annually at the PICES Science Board and the NPFC Scientific Committee annual meetings as part of a standing item on their agendas. If modifications / alterations are required to joint activities to enable enhanced productivity and success, these recommendations will be approved by both the PICES SB and/or NPFC SC (via correspondence if necessary).

For any joint activity that is completed, the co-convenors will prepare a summary report of the activity and it will be available for all members of both organisations.

6.0 Other Considerations

When identifying recommendations for activities under the joint areas for scientific collaboration, other considerations need to be evaluated, including costs to the organisations in terms of financial as well as human capital and time.   Some recommendations to alleviate these costs include:
- Using existing travel opportunities to established events, such as PICES and NPFC annual meetings.   Economic efficiencies are realised even if the duration at a location must be extended by a day or two.
- Utilise on-line correspondence to the maximum extent to achieve deliverables, to prepare for face-to-face meetings, and to finalise reports.
- Minimise the number of annual meetings and create efficiencies within existing meeting as much as possible.

It is recognised that in certain cases where the work effort is intense (e.g., over a three day period) to get the desired result, it is more effective to host a separate meeting with the additional financial and human capital costs, since the ultimate goal is to deliver on an objective.   When additional costs are required, additional approvals also are likely required via the Governing Council for PICES and the Commission for NPFC.

TABLE 1: Recommended joint PICES-NPFC research areas and associated rank, interest, potential activities, and priority within next five years

Research Area	PICES Rank	NPFC Rank	PICES Interest	NPFC Interest	Potential Activities	Priority (5 years)
Support for Stock Assessments for priority species - How to include environmental variables that may affect stock status and distribution - Higher order modelling approaches that consider variability of multiple parameters	High	High	Methodologies incorporating multiple variables, such as ecosystem time-series observations under North Pacific Ecosystem Status Reports (NPESR)	Methodologies that can enhance estimation of stock status; provide scientific justification for breaks in time series based on regime shifts in indices; science advice on how to best incorporate available information	Joint workshop at PICES 2019 to identify specific areas on which to focus considering priority areas, data availability, desired outcomes, etc.; Joint WG(s) to address activities identified in the joint workshop; Sharing scientific results when they become available	High
Vulnerable Marine Ecosystems (VMEs)	High	High	Understanding biogenic habitat structure and function and importance to ecosystem services; WGs (e.g., WG 32)	Science support required for analysis of known and suspected VMEs in convention area; Use of SDM and HSM, particularly in unfished areas, to support	FAO-NPFC VME workshop in March 2018, with invited expert support from PICES, identified several recommendations for further science activities to advance assessment	High

			have completed work in these areas; Have participated in workshops with NPFC; future considerations on biodiversity of seamounts.	identifying where VMEs are located and to aid in identifying potential new areas for fishing; VMEs assessment part of Conservation and Management Measures (CMMs) for bottom fisheries and protection of VMEs; Small Scientific Committee (SSC) established on VMEs.	and analysis of VMEs in the North Pacific; Sharing scientific results when they become available;	
Ecosystem Approach to Fisheries - Scope to be defined but it was agreed to make progress in this area in incremental steps, for example the advice on fishing effort would include target stock status as well as impact of fishing effort on other key stocks, impacts of environmental	Med-high	Med	Incorporate environmental variables and biological linkages within ecosystem models; Effort ongoing on advancing ecosystem models to understand	Commitment to formulate a research plan to enable ecosystem considerations to be incorporated into a fisheries management approach; Support UN and FAO interests and commitments;	Joint workshop or session in 2020 or later to discuss options for advancing this area. Sharing scientific results when they become available;	Medium

variability on future target stock abundance, impacts of management decisions on human systems, etc. - There is high potential that activities under "Support for Stock Assessment" will address some of the initial objectives under this area.			impacts of stressors to ecosystem structure and function rather than assessing stock status;			
Climate change - Factors effecting distributional changes of fish stocks due to changes in the environmental parameters including teleconnections with factors outside of the CA of the NPFC such as melting ice - Impact of ocean acidification	High	Med	Impacts on species / habitats; oceanographic process changes; some activities completed or ongoing (e.g., POC and BIO).	Shifting of fishing areas due to habitat changes; impacts on targeted stocks and distribution; impact of ocean acidification on corals	Ranked medium-high as a priority, but it was decided to incorporate relevant project areas under the other three areas above.	Medium-High
Data management (collection and sharing and security)	High (for sharing scientific	Low	For PICES to provide advice, access to data and products is	Raw data is not accessible to external parties, and only used for the stock	Decided this was not an area where joint work was required. Important to encourage sharing of	

results)			required (similar to published NPAFC data).	assessments by Members of the NPFC; available data products are accessible on the website depending on the membership in different subsidiary bodies.	scientific results.	
Ocean Acidification (OA)					Decided this was an important consideration but not immediately relevant to NPFC priority fish species. Move area to be considered under VMEs.	
Management Strategy Evaluation (MSE)	Med	Med		NPFC has started activities on the MSE-based management approach for its priority species (BRP/HCR/MSE workshop in March 2019) and it may be something that NPFC would have interest in	Decided this was not an area that would be a priority for joint work over the next 5 years	

				pursuing through collaborative work with PICES, but not in the short term		
Microplastics	Med	Low			Decided this was not an area where joint work was required over the next 5 years	
Human activities pressures and impacts	Med	Med-low		Impacts of spatial management areas on other activities; engagement with other stakeholders	Recognised that the human dimension aspects of work needed to be considered in management actions, but it was decided that this area was not a priority over the next 5 years.	
Enhanced communications					Decided it was not a stand alone area, but needed to be incorporated within all areas for collaboration.	

North Pacific Fisheries Commission structure including proposed revision by the Scientific Committee