Report of the 16th Session of the IPHC Management Strategy Advisory Board (MSAB016)

Meeting held electronically, 19-22 October 2020

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BIBLIOGRAPHIC ENTRY
IPHC 2020. Report of the 16th Session of the IPHC Management Strategy Advisory Board (MSAB016). Meeting held electronically, 19-22 October 2020. *IPHC–2020–MSAB016–R, 25 pp.*

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ACRONYMS

AK	Alaska
AM	Annual Meeting
ADFG	Alaska Department of Fish & Game
CDN	Canada/Canadian
CPUE	Catch-per-unit-effort
DFO	Fisheries and Oceans Canada
IPHC	International Pacific Halibut Commission
Mlbs	Millions of pounds
MP	Management Procedure
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
NWIFC	Northwest Indian Fisheries Commission
OM	Operating Model
SRB	Scientific Review Board
SPR	Spawning Potential Ratio
SS	Special Session
TCEY	Total Constant Exploitation Yield
U26	Under 26 inches
USA	United States of America
WPUE	Weight-per-unit-effort

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 16th Session of the International Pacific Halibut Commission (IPHC) Management Strategy Advisory Board (MSAB016) was held in an electronic format (remote participation), from 19-22 October 2020. The MSAB consists of 24 board members, 21 of which attended the Session from the two (2) Contracting Parties. A total of 5 individuals attended the Session as Observers. In addition, one (1) IPHC Commissioner was in attendance, Mr Peter DeGreef (Canada). The list of participants is provided at Appendix I.

The following are a subset of the complete recommendations/requests for action from the MSAB016, which are provided in full at Appendix IX.

RECOMMENDATIONS

MSAB016-Rec.1 (para. 35) The MSAB **RECOMMENDED** that the performance metrics related to the current primary objectives (Appendix VI) be considered when evaluating MPs.

MSAB016-Rec.2 (para. 53) The MSAB **RECOMMENDED** the following MPs for analysis and consideration in 2021:

a) MP-J in combination with a fixed TCEY of 1.65 Mlbs in Regulatory Area 2A, as in paragraph 97 b) of IPHC-2020-AM096-R, with total mortality rebalanced among remaining U.S.A. IPHC Regulatory Areas to maintain a constant SPR;

b) MP-J in combination with a minimum TCEY of 1.65 Mlbs in Regulatory Area 2A which allows the TCEY to exceed 1.65 in IPHC Regulatory Area 2A with total mortality rebalanced among remaining U.S.A. IPHC Regulatory Areas to maintain a constant SPR.

(para. 47) The MSAB **ENDORSED** Tier 1 MPs, that were ranked highest in the MSE results using the tools available, for consideration. These MPs are MP-D, MP-H, MP-I, MP-J, MP-K as specified in Appendix V.

1. OPENING OF THE SESSION

1. The 16th Session of the International Pacific Halibut Commission (IPHC) Management Strategy Advisory Board (MSAB016) was held in an electronic format (remote participation), from 19-22 October 2020. The MSAB consists of 24 board members, 21 of which attended the Session from the two (2) Contracting Parties. A total of 5 individuals attended the Session as Observers. In addition, one (1) IPHC Commissioner was in attendance, Mr Peter DeGreef (Canada). The list of participants is provided at Appendix I.
2. The MSAB **NOTED** that no apologies were received by the IPHC Secretariat and/or the Co-Chairpersons from absent board members (Appendix I).
3. The MSAB **RECALLED** that the primary role of the MSAB is to advise the Commission on the Management Strategy Evaluation (MSE) process. To meet this advisory role, the Commission has articulated the following specific objectives for the MSAB, as described in Appendix V, para. 2 of the IPHC Rules of Procedure (2020):

   a) *define clear measurable objectives and performance measures for the fishery;*

   b) *define candidate management strategies, which include aspects of the fishery that can be managed (e.g. regulatory requirements);*

   c) *advise the IPHC Secretariat about plausible scenarios for investigation, which include aspects of the fishery that cannot be managed by the IPHC (e.g. environmental conditions and removals under the management authority of a domestic management agency);*

   d) *Gather and clearly articulate the interests and concerns of constituents and incorporate them into the MSAB's discussions;*

   e) *encourage and allow members to test tentative ideas and exploratory suggestions without prejudice to future discussions;*

   f) *represent information, views, and outcomes of the MSAB discussions to external parties accurately and appropriately;*

   g) *encourage the understanding and support of their constituencies for the MSAB process and for consensus positions developed by MSAB.*
4. **NOTING** paragraph 3, the MSAB **RECALLED** that the Management Strategy Evaluation process is a stakeholder informed, scientifically driven process.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

5. The MSAB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the MSAB016 are listed at Appendix III.

3. IPHC PROCESS

3.1 MSAB Membership

6. The MSAB **NOTED** paper IPHC-2020-MSAB016-03 which provided the current membership list and term expirations for the MSAB. The current full membership list is provided at Appendix IV.

3.2 Update on the actions arising from the 15th Session of the MSAB (MSAB015)

7. The MSAB **NOTED** paper IPHC-2020-MSAB016-04 which provided the MSAB with an opportunity to consider the progress made during the inter-sessional period in relation to the recommendations and requests of the 15th Session of the IPHC Management Strategy Advisory Board (MSAB015).
8. The MSAB **AGREED** to consider and revise as necessary, the actions arising from the MSAB015, and for these to be combined with any new actions arising from the MSAB016.

3.3 Review of the outcomes of the 17th Session of the IPHC Scientific Review Board (SRB017)

9. The MSAB **NOTED** paper IPHC-2020-MSAB016-05 which provided the outcomes of the 17th Session of the IPHC Scientific Review Board (SRB017) relevant to the mandate of the MSAB, which were provided for reference.

3.4 Outcomes of the 96th Session of the IPHC Annual Meeting (AM096) and the 6th Special Session of the IPHC (SS06)

10. The MSAB **NOTED** paper IPHC-2020-MSAB016-06 which detailed the outcomes of the 96th Session of the IPHC Annual Meeting (AM096), and the 6th Special Session of the IPHC (SS06), relevant to the mandate of the MSAB.

11. The MSAB **RECALLED** the two (2) inter-sessional decisions relevant to the MSAB from the Commission as follows:

IPHC-2020-ID001: The Commission RECOMMENDED that the primary coastwide and area-specific objectives outlined in Table 1 of Appendix A be used for evaluating MSE results conditional on future consideration of the objectives;

IPHC-2020-ID002: The Commission RECOMMENDED a reference SPR fishing intensity of 43% with a 30:20 control rule be used as an updated interim harvest policy consistent with MSE results pending delivery of the final MSE results at AM097, noting the additional components intended to apply for a period of 2020 to 2022 as defined in IPHC-2020-AM096-R paragraphs 97 b, c, d, and e. Specifically, these additional components are allocations to 2A and 2B, accounting for some impacts of U26 non-directed discard mortality, and the use of a rolling three-year average for projecting non-directed fishery discard mortality.

4. A REVIEW OF MANAGEMENT PROCEDURES TO DETERMINE THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) BY IPHC REGULATORY AREAS FOR PACIFIC HALIBUT FISHERIES

12. The MSAB **NOTED** paper IPHC-2020-MSAB016-07 which provided an update on management procedures (MPs) related to distributing the TCEY for use in the MSE process.

4.1 Management procedures for coastwide scale

13. The MSAB **RECALLED** paragraph IPHC-2020-ID002 as noted in paragraph 11 above and **NOTED** that an SPR of 43% was justified from results based on the coastwide MSE, and is subject to further evaluation using the multi-region MSE.

14. The MSAB **NOTED** that coastwide scale is determined from a procedural SPR that is modified based on stock status to determine the coastwide fishing intensity and total mortality.

4.2 Management procedures for distributing the TCEY

15. The MSAB **RECALLED** that eleven MPs were identified by the MSAB for evaluation at MSAB016, as listed in Appendix V.

16. The MSAB **NOTED** that descriptions of the eleven management procedures identified by the MSAB at MSAB015 (Appendix V) are in IPHC-2020-MSAB016-INF03.

17. The MSAB **RECALLED** paragraph 97 a) and b) of IPHC 2020-AM096-R:

IPHC-2020-AM096-R, para 97: *"The Commission ADOPTED:*

a) a coastwide mortality limit (TCEY) of 36.6 million pounds; and

b) a fixed TCEY for IPHC Regulatory Area 2A of 1.65 million pounds is intended to apply for a period from 2019-2022, subject to any substantive conservation concerns;"

18. The MSAB **NOTED** that the fixed TCEY of 1.65 Mlbs for IPHC Regulatory Area 2A was used in MP15-A through MP15-E following paragraph 97 b) of IPHC-2020-AM096-R, although the intent of the proposed MP was to implement a minimum TCEY of 1.65 Mlbs that may increase for evaluation in the MSE process.

19. The MSAB **RECALLED** paragraphs 55, 57, and 58 from IPHC-2019-MSAB014-R:

IPHC-2019-MSAB014-R, para 55. The MSAB REQUESTED that a number of elements in distribution management procedures be included for evaluation at MSAB015:

a) *A coastwide constraint using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;*

b) *evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions;*

c) *distributing the TCEY directly to IPHC Regulatory Area;*

d) *A fixed shares concept for all or some IPHC Regulatory Areas, Biological Regions, or Management Zones with options to distribute the TCEY to the areas without a fixed share. The determination of these shares may be fixed or varying over time; and*

e) *A maximum fishing intensity defined by an SPR of 36% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas.*

IPHC-2019-MSAB014-R, para 57. The MSAB NOTED additional elements for distribution procedures to consider as sensitivities when developing management procedures for evaluation at MSAB015 as follows:

a) *a constraint applied to the TCEY for each IPHC Regulatory Area using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;*

b) *using O32 estimates of stock distribution or "all sizes" estimates of stock distribution from the modelled survey results;*

c) *evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions (e.g. harvest rates for Biological Region 2, IPHC Regulatory Areas 2A and/or 4CDE);*

d) *calculating shares across Biological Regions, Management Zones, or IPHC Regulatory Areas using approaches that blend multiple sources of information (e.g., using historical TCEYs and stock distribution results for all IPHC Regulatory Area, a 5-year window of estimated stock distribution, etc.);*

e) *the importance the order of applying elements in the distribution procedure when limiting the maximum SPR (i.e. using a buffer).*

IPHC-2019-MSAB014-R, para 58. The MSAB NOTED additional elements for distribution procedures to consider when developing management procedures for evaluation at MSAB016 as follows:

a) *a constraint applied to the TCEY for each IPHC Regulatory Area using a slow-up, fast-down approach;*

b) *a constraint applied to the TCEY for each IPHC Regulatory Area implementing a maximum change in the TCEY of 15%;*

c) *a maximum fishing intensity defined by an SPR of 40% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas;*

d) *adjusting relative harvest rates to reflect current stock productivity (note that this will be explored before MSAB015);*

e) *using trends in fishery CPUE to adjust allocation percentages by IPHC Regulatory Area (note that this will be explored before MSAB015);*

f) *additional approaches to first distribute the TCEY to Biological Region or Management Zone.*

20. The MSAB **NOTED** that results from additional MPs are available for informational purposes and comparison to the eleven MPs identified by the MSAB at MSAB015 (Appendix V) that incorporate other elements of interest.

5. A FRAMEWORK TO INVESTIGATE FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES

21. The MSAB **NOTED** paper IPHC-2020-MSAB016-08 which provided an update on Management Strategy Evaluation (MSE) activities relating to the definition and development of a framework to evaluate MPs for distributing the TCEY.

22. The MSAB **ACKNOWLEDGED** the significant effort of the IPHC Secretariat to develop and implement the MSE framework for simulation of MPs related to coastwide scale and distribution of the TCEY.

5.1 Multi-area operating model

23. The MSAB **NOTED** that a multi-area OM capable of modelling movement between four Biological Regions with thirty-three fisheries was used in the MSE framework.

5.2 Framework to investigate distributing the TCEY among IPHC Regulatory Areas

24. The MSAB **AGREED** that the simulation of domestic allocation mimicked the domestic catch-sharing agreements to the extent possible, but may not reflect realised allocations at low TCEYs.

25. The MSAB **NOTED** various categories of implementation variability: 1) departures from the MP due to the decision-making process (i.e. the adopted mortality limit), and 2) differences in the realized fishing mortality (not due to estimation error) from the adopted mortality limit (as modelled in the operating model). Furthermore, estimated fishing mortality may differ from realised fishing mortality due to uncertainty in reported landings and other sources of fishing mortality, which would be used by the estimation model.

26. The MSAB **RECALLED** paragraph 59 of IPHC-2020-SRB017-R:

> IPHC-2020-SRB017-R, para. 59 "*The SRB **RECOMMENDED** using the current MSE results to compare and contrast management procedures incorporating scale and distribution elements, but **NOTED** that, current results are conditional on some parameters and processes that remain uncertain. The uncertainty in applying the untested current approach potentially creates greater risk than adopting a repeatable management procedure that has been simulation tested under a wide range of uncertainties.*"

27. The MSAB **AGREED** that the MSE framework is useful to test the eleven MPs from MSAB015 (Appendix V) and that the following are some of the parameters and processes that remain uncertain and are a priority to be further developed:

a) implementation variability including decision-making variability, realized fishing mortality (some of which is currently implemented), and catch estimation uncertainty;

b) movement parameterization including uncertainty and time-varying properties;

c) recruitment distribution including uncertainty and time-varying properties;

d) estimated O32 stock distribution in IPHC Regulatory Areas, which is partly due to the proportion of biomass in each IPHC Regulatory Area within a Biological Region defined as a static value over

time determined from the last 10 years of estimated stock distribution, as well as other assumptions in the OM;

e) determination of size structure (e.g. O32 biomass), which should be linked to variable size-at-age over time.

28. The MSAB **RECALLED** paragraph 37 from IPHC-2020-MSAB014-R:

> (para. 37) "*The MSAB **AGREED** to an objective to conserve spatial population structure that is defined as a minimum proportion of the spawning biomass in each Biological Region as 5% in Region 2, 33% in Region 3, 10% in Region 4, and 2% in Region 4B. These proportions were proposed by the IPHC Secretariat after qualitatively investigating the modelled survey proportion of O32 stock distribution in each Biological Region since 1993 and may be updated following further review.*"

29. The MSAB **NOTED** the simulated percentage of spawning biomass in IPHC Regulatory Area 4B is less than 2% in more than 5% of the simulations in the long-term with zero fishing mortality, which is a result of the OM specifications rather than an effect of an MP.

30. The MSAB **NOTED** that there is research currently being conducted by the IPHC Secretariat investigating movement, stock structure, and other pertinent topics for future MSE, noted in IPHC-2020-IM096-10. This research will be useful for addressing the points in paragraphs 25 and 27.

31. The MSAB **AGREED** that sensitivity analyses exploring alternative hypotheses about connectivity between all Biological Regions in addition hypotheses of other aspects of population dynamics would help to evaluate the robustness of MPs.

32. **NOTING** paragraph 29, the MSAB **AGREED** that sensitivity analyses exploring alternative hypotheses about connectivity between Biological Region 4B and other areas, including outside of the IPHC Convention Area, in addition to hypotheses of other aspects of population dynamics in Biological Region 4B would help to evaluate the robustness of MPs.

33. The MSAB **AGREED** that the strength of the model is to rank MPs against one another, and is likely less informative of specific predictions for metrics such as the TCEY in a particular IPHC Regulatory Area. For example, predictions of O32 stock distribution departed from the observations in recent years and did not fully cover the range or patterns over time of past observations. Similarly, the OM did not encompass the full range of possible variability from many components, and thus some performance metrics may not be completely characterized (e.g. yield stability).

6. RESULTS INVESTIGATING FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES

6.1 Performance metrics for evaluation

34. The MSAB **NOTED** paper IPHC-2020-MSAB015-09 Rev_1 which provided results for the evaluation of MPs for distributing the TCEY in the form of performance metrics related to the current primary objectives.

35. The MSAB **RECOMMENDED** that the performance metrics related to the current primary objectives (Appendix VI) be considered when evaluating MPs.

6.2 Results from the closed-loop simulations

36. The MSAB **NOTED** that results and the online tool called *MSE Explorer* is archived on the IPHC MSE webpage and includes all performance metrics and statistics of interest displayed in tables and various plots.

37. The MSAB **NOTED** that the IPHC Fishery-Independent Setline Survey (FISS) is currently the best scientific method for estimating stock distribution among Biological Regions and IPHC Regulatory Areas.

38. The MSAB **AGREED** that the use of FISS-derived distribution for distribution of the TCEY in an MP is a management decision.

39. The MSAB **RECALLED** IPHC-2020-MSAB015-R, para. 39:

    IPHC-2020-MSAB015-R, para. 39: *"The MSAB **NOTED** potential categories of elements for MPs (alone or in combination) includes:*

    a) *Modelled survey estimates (e.g. relative biomass estimates by Biological Region, IPHC Regulatory Areas or other scale, O32 WPUE, trend in O32 WPUE, etc.);*

    b) *Fishery dependent data (e.g. trend in CPUE by Biological Region, IPHC Regulatory Area or other scale);*

    c) *Other tools (e.g. relative harvest rate, percentage allocation to an IPHC Regulatory Areas, proportion of adopted TCEY, fixed allocations, minimum TCEY, etc.)."*

40. The MSAB **AGREED** that when developing MPs for evaluation, distribution of the TCEY to IPHC Regulatory Areas can have several components, that range from purely scientific, to describe the stock distribution and shifts in harvest rates due to differences in productivity, to policy driven, that modify the distribution based on additional considerations.

41. The MSAB **AGREED** that all eleven MPs evaluated met the current primary biological sustainability objectives and resulted in similar coastwide TCEYs on average for an SPR of 43% with a 30:20 control rule, notwithstanding objective 1.1 for IPHC Regulatory Area 4B, as described in paragraph 29.

42. The MSAB has evaluated MPs for distributing TCEYs as part of the scientifically driven MSE process and **AGREED** that MPs with components that are data-driven and/or policy-driven all satisfied biological sustainability objectives 1.1 and 2.1, notwithstanding objective 1.1 for IPHC Regulatory Area 4B, as described in paragraph 29.

43. The MSAB **NOTED** two summary ranking tables of MP performance metrics in Appendix VII and Appendix VIII. Appendix VIII describes the overall performance of MPs relative to each other within the general objective and Appendix VII describes rankings within measurable objectives (objectives are listed in Appendix VI).

44. The MSAB **NOTED** that an intent of MSE is to rank the performance of MPs relative to each other against defined objectives. However, there are many methods to determine quantitative rankings between the MPs, included weighting performance metrics when averaging. The preliminary ranking method used in the current evaluation may exaggerate differences between management procedures. Therefore, when considering these tables, the results (i.e. specific performance metrics) should be considered along with these summary ranking tables. The rank values do not indicate the magnitude of the difference in performance metrics between MPs.

45. The MSAB **AGREED** to categorize the eleven MPs into three ranked performance tiers.

46. The MSAB **NOTED** Tier 1 contained MPs that generally maintained the spawning biomass closer to the defined target (objective 2.1), limited catch variability for multiple IPHC Regulatory Areas (objective 2.2), and provided higher yield in multiple IPHC Regulatory Areas relative to Tier 2 and Tier 3. The following MPs are classified as Tier 1:

    a) MP-D: ranked 1st in maintaining spawning biomass near the biomass target, ranked 2nd to limit catch variability, and 3rd in providing yield, relative to all eleven MPs. This MP incorporated flexibility in the determination of the total mortality limit to allow for the current interim agreements for IPHC Regulatory Areas 2A and 2B without reducing the TCEY in other IPHC Regulatory Areas within

the defined buffer for fishing intensity, which resulted in higher and more stable mortality limits in IPHC Regulatory Areas in Alaska waters.

b) MP-H: tied 2nd in rank for maintaining spawning biomass near the biomass target, tied for 3rd to limit catch variability, and 7th in providing yield, relative to all eleven MPs. This MP increased relative harvest rates in IPHC Regulatory Areas 3B, 4A, and 4CDE relative to other MPs evaluated, which may be supported by recent analysis of productivity. However, it is uncertain if this MP is robust to alternative assumptions about movement, recruitment distribution, and productivity.

c) MP-I: tied 2nd in rank for maintaining spawning biomass near the biomass target, 4th in rank to limit catch variability, and 2nd in providing yield, relative to all eleven MPs. This MP uses all-sizes estimated stock distribution to distribute the TCEY among IPHC Regulatory Areas. There is uncertainty of how robust this MP is to assumptions in the OM to determine the proportion of O32 fish, which likely applies to all evaluated MPs.

d) MP-J: tied 4th in rank for maintaining spawning biomass near the biomass target, tied 3rd in rank to limit catch variability, and was 1st in providing yield, relative to all eleven MPs. A rolling five-year average of estimated O32 stock distribution for stock distribution among IPHC Regulatory Areas accomplished stability for the TCEY coastwide and within IPHC Regulatory Areas.

e) MP-K: tied 4th in rank for maintaining spawning biomass near the biomass target, 1st for limiting catch variability, and was 2nd in providing yield, relative to all eleven MPs. This MP uses a fixed proportion changing every fifth year to distribute the TCEY determined by averaging the previous five years of estimated stock distribution to achieve stability in mortality limits. However, there were concerns that the current performance metrics do not indicate the amount of change in yield or catch variability that may occur every fifth year, which may be undesirably high.

47. The MSAB **ENDORSED** Tier 1 MPs, that were ranked highest in the MSE results using the tools available, for consideration. These MPs are MP-D, MP-H, MP-I, MP-J, MP-K as specified in Appendix V.

48. The MSAB **NOTED** Tier 2 contained MPs that were all ranked lower in limiting catch variability relative to Tier 1. The MPs contained in this Tier are MP-B, C, E, F, G. Most were ranked lower for providing yield summarizing performance metrics across all IPHC Regulatory Areas, except MP-E and MP-G.

49. The MSAB **NOTED** Tier 3 contained MP-A, which ranked lowest for maintaining spawning biomass near the biomass target, limiting catch variability, and providing yield.

50. The MSAB **NOTED** that trade-offs exist between IPHC Regulatory Areas and objectives specific to each IPHC Regulatory Area, not specifically stated as a primary objective, are not met across all IPHC Regulatory Areas by any single MP evaluated. However, modifying some elements of Tier 1 MPs may better meet those unstated objectives, as specified in Section 7.1.

7. MSAB PROGRAM OF WORK

51. The MSAB **NOTED** paper IPHC-2020-MSAB015-10 which provided an update on the MSE Program of Work (2020-21), given current Commission directives.

7.1 MSAB Program of Work (2020-21)

52. The MSAB **NOTED** the fixed delivery date of January 2021 for the MSE results to the Commission, including Scale and Distribution components of the MP, for potential adoption by the Commission and subsequent implementation.

53. The MSAB **RECOMMENDED** the following MPs for analysis and consideration in 2021:

    a) MP-J in combination with a fixed TCEY of 1.65 Mlbs in Regulatory Area 2A, as in paragraph 97 b) of IPHC-2020-AM096-R, with total mortality rebalanced among remaining U.S.A. IPHC Regulatory Areas to maintain a constant SPR;

    b) MP-J in combination with a minimum TCEY of 1.65 Mlbs in Regulatory Area 2A which allows the TCEY to exceed 1.65 in IPHC Regulatory Area 2A with total mortality rebalanced among remaining U.S.A. IPHC Regulatory Areas to maintain a constant SPR.

54. The MSAB **AGREED** that MPs for evaluation, especially those with alternative relative harvest rates such as in MP-H, be evaluated against alternative hypotheses of migration, recruitment distribution, and productivity.

55. The MSAB **NOTED** paragraph 89 of IPHC-2020-AM096-R:

    IPHC-2020-AM096-R, para. 89: *"The Commission REQUESTED the MSAB to confirm the proposed topics of work beyond the 2021 deliverables in time for the Interim Meeting (IM096), including work to investigate and provide advice on approaches for accounting for the impacts of bycatch in one Regulatory Area on harvesting opportunities in other Regulatory Areas."*

56. The MSAB **AGREED** to incorporate additional MPs and analyses into the Program of Work following recommendations from the 97th Session of the IPHC Annual Meeting.

57. The MSAB **AGREED** that proposed topics of work beyond the 2021 deliverables include revisiting objectives, MPs, specifications of the MSE framework and operating model, improving estimation models and data generation (e.g. uncertainty), outreach and communication tools, as well as recommendations from the 2020 peer review of the MSE. Some examples include those items described in paragraphs 30 and 31.

58. The MSAB **REQUESTED** that an MSAB meeting be scheduled to discuss a Program of Work for 2021 and beyond.

8. OTHER BUSINESS

59. Nil

9. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 15TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB015)

60. The report of the 16th Session of the IPHC Management Strategy Advisory Board (IPHC-2020-MSAB016–R) was **ADOPTED** on 22 October 2020, including the consolidated set of recommendations and/or requests arising from MSAB016, provided at Appendix IX.

APPENDIX I
LIST OF PARTICIPANTS FOR THE 16TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB016)

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IPHC Secretariat

Name	Position and email
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APPENDIX II
AGENDA FOR THE 16TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB016)

Date: 19-22 October 2020
Location: Electronic
Venue: G-To-Meeting
Time: 09:00-17:00 PDT daily
Co-Chairpersons: Mr. Adam Keizer (Canada) and Dr. Carey McGilliard (U.S.A.)

1. OPENING OF THE SESSION

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

- *IPHC-2020-MSAB016-01: Agenda & Schedule for the 16th Session of the Management Strategy Advisory Board (MSAB016)*
- *IPHC-2020-MSAB016-02: List of Documents for the 16th Session of the Management Strategy Advisory Board (MSAB016)*

3. IPHC PROCESS

3.1. MSAB Membership (D. Wilson)
- *IPHC-2020-MSAB016-03: MSAB Membership (D. Wilson)*

3.2. Update on the actions arising from the 15th Session of the IPHC MSAB (MSAB015) (A. Hicks)
- *IPHC-2020-MSAB016-04: Update on the actions arising from the 15th Session of the MSAB (MSAB015) (A. Hicks)*

3.3. Outcomes of the 17th Session of the IPHC Scientific Review Board (SRB017) (D. Wilson)
- *IPHC-2020-MSAB016-05: Outcomes of the 17th Session of the IPHC Scientific Review Board (SRB017) (D. Wilson)*

3.4. Outcomes of the 96th Session of the IPHC Annual Meeting (AM096) and the 6th Special Session of the IPHC (SS06) (D. Wilson & A. Hicks)
- *IPHC-2020-MSAB016-06: Outcomes of the 96th Session of the IPHC Annual Meeting (AM096) and the 6th Special Session of the IPHC (SS06) (D. Wilson & A. Hicks)*

4. A REVIEW OF MANAGEMENT PROCEDURES TO DETERMINE THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) BY IPHC REGULATORY AREAS FOR PACIFIC HALIBUT FISHERIES

- *IPHC-2020-MSAB016-07: Potential management procedures to determine the total constant exploitation yield (TCEY) by IPHC Regulatory Areas for Pacific halibut fisheries (P. Carpi, A. Hicks, I. Stewart)*

4.1. Management procedures for coastwide scale (A. Hicks)
4.2. Management procedures for distributing the TCEY (P. Carpi)

5. A FRAMEWORK TO INVESTIGATE FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES

- *IPHC-2020-MSAB016-08: Development of a framework to investigate fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries. (A. Hicks, P. Carpi, S. Berukoff & I. Stewart)*

5.1. Multi-area operating model (A. Hicks)
5.2. Framework to investigate distributing the TCEY among IPHC Regulatory Areas (P. Carpi)

6. RESULTS INVESTIGATING FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES

- *IPHC-2020-MSAB016-09 Rev_1: Results investigating fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries (A. Hicks, P. Carpi, I. Stewart & S. Berukoff)*

6.1. Performance metrics for evaluation (P. Carpi)
6.2. Results from the closed-loop simulations (A. Hicks)

7. MSE PROGRAM OF WORK

- *IPHC-2020-MSAB016-10: IPHC Secretariat program of work for MSAB related activities in 2020–21 (A. Hicks, P. Carpi, S. Berukoff)*

7.1. MSAB program of work (2020-21) (A. Hicks)

8. OTHER BUSINESS

9. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 16TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB016)

APPENDIX III
LIST OF DOCUMENTS FOR THE 16TH SESSION OF THE MANAGEMENT STRATEGY ADVISORY BOARD (MSAB016)

Document	Title	Availability
IPHC-2020-MSAB016-01	Agenda & Schedule for the 16th Session of the IPHC Management Strategy Advisory Board (MSAB016)	✓ 21 Jul 2020 ✓ 28 Jul 2020 ✓ 18 Oct 2020
IPHC-2020-MSAB016-02	List of Documents for the 16th Session of the IPHC Management Strategy Advisory Board (MSAB016)	✓ 28 Jul 2020 ✓ 19 Sep 2020 ✓ 19 Oct 2020
IPHC-2020-MSAB016-03	MSAB Membership (D. Wilson)	✓ 19 Sep 2020
IPHC-2020-MSAB016-04	Update on the actions arising from the 15th Session of the MSAB (MSAB015) (A. Hicks)	✓ 19 Sep 2020
IPHC-2020-MSAB016-05	Outcomes of the 17th Session of the IPHC Scientific Review Board (SRB017) (D. Wilson)	✓ 25 Sep 2020
IPHC-2020-MSAB016-06	Outcomes of the 96th Session of the IPHC Annual meeting (AM096) and the 6th Special Session of the IPHC (SS06) (D. Wilson & A. Hicks)	✓ 19 Sep 2020
IPHC-2020-MSAB016-07	Potential management procedures to determine the total constant exploitation yield (TCEY) by IPHC Regulatory Areas for Pacific halibut fisheries (P. Carpi, A. Hicks, I. Stewart)	✓ 19 Sep 2020
IPHC-2020-MSAB016-08	Development of a framework to investigate fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries. (A. Hicks, P. Carpi, S. Berukoff & I. Stewart)	✓ 19 Sep 2020
IPHC-2020-MSAB016-09 Rev_1	Results investigating fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries (A. Hicks, P.Carpi, I. Stewart & S. Berukoff)	✓ 19 Sep 2020 ✓ 09 Oct 2020
IPHC-2020-MSAB016-10	IPHC Secretariat program of work for MSAB related activities in 2020-21 (A. Hicks, P. Carpi & S. Berukoff)	✓ 19 Sep 2020
Information papers		
IPHC-2020-MSAB016-INF01	Technical details of the IPHC MSE framework (A. Hicks, P. Carpi, S. Berukoff)	✓ 18 Oct 2020
IPHC-2020-MSAB016-INF02	Independent peer review of the 2020 IPHC Management Strategy Evaluation process (T. Branch)	✓ 25 Sep 2020
IPHC-2020-MSAB016-INF03	Description of management procedures proposed from MSAB015 (A. Hicks & P. Carpi)	✓ 19 Oct 2020

APPENDIX IV
MSAB MEMBERSHIP

(*as of 19 September 2020*)

Membership category	Member	Canada	U.S.A.	Current Term commence-ment	Current Term expiration
Commercial harvesters (6-8)					
1	Sporer, Chris	CDN Commercial		09-May-17	08-May-21
2	Hauknes, Robert	CDN Commercial		09-May-17	08-May-21
3	Grout, Angus	CDN Commercial		03-Dec-19	02-Dec-21
4	Vacant	CDN Commercial			
5	Johnson, James		USA Commercial	17-Apr-19	16-Apr-23
6	Kauffman, Jeff		USA Commercial	09-May-19	08-May-23
7	Odegaard, Per		USA Commercial	09-May-17	08-May-21
8	Falvey, Dan		USA Commercial	09-May-17	08-May-21
First Nations/ Tribal fisheries (2-4)					
1	Lane, Jim	CDN First Nations		09-May-17	08-May-21
2	Vacant	CDN First Nations			
3	Mazzone, Scott		USA Treaty Tribes	09-May-19	08-May-23
4	Petersen, Joe		USA Treaty Tribes	7-May-20	6-May-22
Government Agencies (4-8)					
1	Keizer, Adam	DFO		09-May-19	08-May-23
2	Huang, Ann-Marie	CDN Science Advisor		10-May-18	09-May-22
3	Vacant	DFO			
4	Merrill, Glenn		NOAA-Fisheries	07-May-18	06-May-22
5	McGilliard, Carey		USA Science Advisor	09-May-17	08-May-21
6	Baker, Rachel		FMC rep.	23-Oct-19	22-Oct-21
7	Webster, Sarah		ADFG	24-Sep-19	23-Sep-23
8	Sommer, Maggie		FMC rep.	14-Apr-20	13-Apr-22
Processors (2-4)					
1	Parker, Peggy	US/CDN Processing	USA/CDN Processing	09-May-19	08-May-23
2	Mirau, Brad	CDN Processing		09-May-19	08-May-23
3	Morelli, Joseph		USA Processing	29-Aug-18	28-Aug-22
4	Drobnica, Angel		USA Processing	17-Apr-19	16-Apr-23
Recreational/ Sport fisheries (2-4)					

Membership category	Member	Canada	U.S.A.	Current Term commence-ment	Current Term expiration
1	Chuck Ashcroft	CDN Sport Fishing Advisory Board		17-Apr-19	16-Apr-23
2	Marking, Tom		USA Sportfishing (CA)	09-May-19	08-May-23
3	Braden, Forrest		USA sportfishing (AK)	17-Apr-19	16-Apr-23
4	Vacant		Open		

APPENDIX V
PROPOSED MANAGEMENT PROCEDURES FROM IPHC-2020-MSAB015-R

Management procedures to be evaluated by the MSAB in 2020 and the priority of investigation.

MP	Coastwide	Regional	IPHC Regulatory Area
MP 15-A	SPR 30:20		• O32 stock distribution • Proportional relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4) • 1.65 Mlbs floor in 2A[1] • Formula percentage for 2B[2]
MP 15-B	SPR 30:20 MaxChange15%		• O32 stock distribution • Proportional relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4) • 1.65 Mlbs floor in 2A[1] • Formula percentage for 2B[2]
MP 15-C	SPR 30:20 MaxChange15%	Biological Regions, O32 stock distribution Rel HRs[3]: R2=1, R3=1, R4=0.75, R4B=0.75	• O32 stock distribution • Relative harvest rates not applied • 1.65 Mlbs floor in 2A[1] • Formula percentage for 2B[2]
MP 15-D	SPR 30:20 MaxChange15% Max FI (36%)		First • O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4) Second within buffer (pro-rated if exceeds buffer) • 1.65 Mlbs floor in 2A[1] • Formula percentage for 2B[2]
MP 15-E	SPR 30:20 MaxChange15%		• O32 stock distribution • Proportional relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4) • 1.65 Mlbs floor in 2A[1]
MP 15-F	SPR 30:20 MaxChange15%	National Shares: 20% to 2B, 80% to other	• O32 stock distribution to areas other than 2B • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP 15-G	SPR 30:20 MaxChange15%		• O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP 15-H	SPR 30:20 MaxChange15%		• O32 stock distribution • Relative harvest rates (1 for 2-3, 4A, 4CDE, 0.75 for 4B)
MP 15-I	SPR 30:20 MaxChange15%		• All sizes stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP 15-J	SPR 30:20 MaxChange15%		• O32 stock distribution (5-year moving average) • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP 15-K	SPR 30:20 MaxChange15%		• 5-year shares determined from 5-year O32 stock distribution (vary over time but change only every 5th year)

[1] paragraph 97b IPHC-2020-AM096-R

[2] paragraph 97c of IPHC-2020-AM096-R

[3] R2 refers to Biological Region 2 (2A, 2B, 2C); R3 refers to Biological Region 3 (3A, 3B); R4 refers to Biological Region 4 (4A, 4CDE), and R4B refers to Biological Region 4B.

APPENDIX VI
PRIMARY OBJECTIVES AND PERFORMANCE METRICS

Primary measurable objectives, evaluated over a simulated ten-year period, accepted by the Commission at the 6th Special Session of the Commission (IPHC-2020-CR-007). Objective 1.1 is a biological sustainability (conservation) objective and objectives 2.1, 2.2, and 2.3 are fishery objectives.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
1.1. KEEP FEMALE SPAWNING BIOMASS ABOVE A LIMIT TO AVOID CRITICAL STOCK SIZES AND CONSERVE SPATIAL POPULATION STRUCTURE	Maintain a female spawning stock biomass above a biomass limit reference point at least 95% of the time	*SB* < Spawning Biomass Limit (SB_{Lim}) SB_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(SB < SB_{Lim})$
	Maintain a defined minimum proportion of female spawning biomass in each Biological Region	$p_{SB,2} > 5\%$ $p_{SB,3} > 33\%$ $p_{SB,2} > 10\%$ $p_{SB,2} > 2\%$	Long-term	0.05	$P(p_{SB,R} < p_{SB,R,min})$
2.1 MAINTAIN SPAWNING BIOMASS AROUND A LEVEL THAT OPTIMIZES FISHING ACTIVITIES	Maintain the coastwide female spawning biomass above a biomass target reference point at least 50% of the time	*SB*<Spawning Biomass Target (SB_{Targ}) SB_{Targ}=$SB_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(SB < SB_{Targ})$
2.2. LIMIT CATCH VARIABILITY	Limit annual changes in the coastwide TCEY	Annual Change (*AC*) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Median coastwide Average Annual Variability (AAV)	Short-term		*Median AAV*
	Limit annual changes in the Regulatory Area TCEY	Annual Change (*AC*) > 15% in any 3 years by Regulatory Area	Short-term		$P(AC_{3,A} > 15\%)$
		Average AAV by Regulatory Area (AAV_A)	Short-term		*Median* AAV_A
2.3. PROVIDE DIRECTED FISHING YIELD	Optimize average coastwide TCEY	Median coastwide TCEY	Short-term		*Median* $\overline{TCEY}$
	Optimize TCEY among Regulatory Areas	Median $TCEY_A$	Short-term		*Median* $\overline{TCEY_A}$
	Optimize the percentage of the coastwide TCEY among Regulatory Areas	Median $\%TCEY_A$	Short-term		*Median* $\left(\overline{\frac{TCEY_A}{TCEY}}\right)$
	Maintain a minimum TCEY for each Regulatory Area	Minimum $TCEY_A$	Short-term		*Median Min(TCEY)*
	Maintain a percentage of the coastwide TCEY for each Regulatory Area	Minimum $\%TCEY_A$	Short-term		*Median Min(%TCEY)*

APPENDIX VII
RANKINGS OF MANAGEMENT PROCEDURES AGAINST MEASURABLE OUTCOMES

Management procedures ranked by measurable outcomes using the default MSE Explorer settings.

Objective	Performance Metric	A	B	C	D	E	F	G	H	I	J	K
Maintain the coastwide female SB above a target	$P(SB < SB_{Targ})$	11	4	4	1	4	4	4	2	2	4	4
Limit AC in coastwide TCEY	$P(AC_3 > 15\%)$	11	1	1	10	1	1	1	1	1	1	1
Limit AAV in coastwide TCEY	Median AAV TCEY	11	3	2	1	3	8	8	3	3	8	3
Limit AAV in Regulatory Areas TCEY	Median AAV TCEY Regulatory Areas	9.75	7.25	6.75	1.75	7	5.62	6	5.88	5.75	2.5	3.5
Limit AC in Regulatory Areas TCEY	$P(AC_3 > 15\%)$ Regulatory Areas	8.62	7	7.12	1.75	7.38	6.38	6	5.12	6.25	3.5	4
Optimize average coastwide TCEY	Median TCEY	1	3	3	1	3	3	3	3	3	3	3
Maintain minimum % TCEY by Regulatory Areas	Median Min(% TCEY) Regulatory Areas	8.5	6.62	7.5	6.12	5.25	7.62	4.88	5.38	4.25	3.62	4.12
Maintain minimum TCEY by Regulatory Areas	Median Min(TCEY) Regulatory Areas	6.38	4	3.75	1.75	2.62	4.5	3.25	3	2.88	2.5	3.12
Optimize Regulatory Areas TCEY	Median TCEY Regulatory Areas	3.62	4.75	4.25	3.12	3.75	5.5	3.5	4.5	3.12	3.5	3.88
Optimize TCEY percentage among Regulatory Areas	Median % TCEY Regulatory Areas	8.25	6.75	7.62	6.5	5	7.5	4.38	4.88	4	4.25	4.5

SB: Spawning Biomass
AC: Annual Change
AAV: Average Annual Variability
Regulatory Areas: IPHC Regulatory Areas
TCEY: Total mortality minus under 26" (U26) non-directed commercial discard mortality

APPENDIX VIII
RANKINGS OF MANAGEMENT PROCEDURES AGAINST GENERAL OBJECTIVES

Management procedures ranked by general objectives using the default MSE Explorer settings.

Objective	Performance Metric	A	B	C	D	E	F	G	H	I	J	K
2.1 Maintain the coastwide female SB above a target	$P(SB < SB_{Targ})$	11	4	4	1	4	4	4	2	2	4	4
2.2 Limit catch variability	Limit annual change	10.09	4.56	4.22	3.62	4.59	5.25	5.25	3.75	4	3.75	2.88
2.3 Provide directed fishing yield	Optimize TCEY and maintain minimum TCEY in Regulatory Areas	5.55	5.02	5.22	3.7	3.92	5.62	3.8	4.15	3.45	3.37	3.72

SB: Spawning Biomass

APPENDIX IX
CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 16TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB016)

RECOMMENDATIONS

Results investigating fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries

MSAB016-Rec.1 (para. 35) The MSAB **RECOMMENDED** that the performance metrics related to the current primary objectives (Appendix VI) be considered when evaluating MPs.

MSAB Program of work

MSAB016-Rec.2 (para. 53) The MSAB **RECOMMENDED** the following MPs for analysis and consideration in 2021:

a) MP-J in combination with a fixed TCEY of 1.65 Mlbs in Regulatory Area 2A, as in paragraph 97 b) of IPHC-2020-AM096-R, with total mortality rebalanced among remaining U.S.A. IPHC Regulatory Areas to maintain a constant SPR;

b) MP-J in combination with a minimum TCEY of 1.65 Mlbs in Regulatory Area 2A which allows the TCEY to exceed 1.65 in IPHC Regulatory Area 2A with total mortality rebalanced among remaining U.S.A. IPHC Regulatory Areas to maintain a constant SPR.

REQUESTS

MSAB Program of work

MSAB016-Req.1 (para. 58) The MSAB **REQUESTED** that an MSAB meeting be scheduled to discuss a Program of Work for 2021 and beyond.