



Report of the 29th Session of the IPHC Scientific Review Board (SRB029)

Meeting held in Seattle, WA, USA, 22-24 September 2026

Commissioners

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BIBLIOGRAPHIC ENTRY

IPHC 2026. Report of the 29th Session of the IPHC Scientific Review Board (SRB029). Meeting held in Seattle, WA, USA, 22-24 September 2026.
IPHC-2026-SRB029-R, 17 pp.



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ACRONYMS

AI	Artificial Intelligence	MSAB	Management Strategy Advisory Board
AM	Annual Meeting	MSE	Management Strategy Evaluation
CEATTLE	Climate-Enhanced, Age-based model with Temperature-specific Trophic Linkages and Energetics	PDO	Pacific Decadal Oscillation
FISS	Fishery-Independent Setline Survey	SPoRC	Stochastic Population Model Over Regional Components
IPHC	International Pacific Halibut Commission	SRB	Scientific Review Board
		USA	United States of America
IRMP	Integrated Research and Monitoring Plan	WHAM	Woods Hole Assessment Model

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; ACCEPTED** (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.



TABLE OF CONTENTS

REPORT OF THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)	1
TABLE OF CONTENTS	4
EXECUTIVE SUMMARY	5
1. OPENING OF THE SESSION	6
2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION	6
3. IPHC PROCESS	6
3.1 <i>SRB annual workflow</i>	6
3.2 <i>Update on the actions arising from the 28th Session of the SRB (SRB028)</i>	6
3.3 <i>Outcomes of the 102nd Session of the IPHC Annual Meeting (AM102)</i>	6
3.4 <i>Observer updates</i>	7
4. INTERNATIONAL PACIFIC HALIBUT COMMISSION INTEGRATED RESEARCH AND MONITORING PLAN	7
4.1 <i>Research</i>	7
4.1.1 <i>Biology and ecology</i>	7
4.1.2 <i>Pacific halibut stock assessment</i>	8
4.1.3 <i>Management strategy evaluation</i>	8
4.2 <i>Monitoring</i>	9
4.2.1 <i>Fishery-dependent data</i>	9
4.2.2 <i>Fishery-independent data</i>	9
4.2.2.1 <i>2027 FISS design evaluation</i>	9
4.2.2.2 <i>Updates to space-time modelling</i>	9
4.2.3 <i>Age composition data (both fishery-dependent and fishery-independent)</i>	9
5. OTHER BUSINESS	9
6. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)	10
APPENDIX I LIST OF PARTICIPANTS FOR THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)	11
APPENDIX II AGENDA FOR THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)	13
APPENDIX III LIST OF DOCUMENTS FOR THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)	14
APPENDIX IV CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)	15



EXECUTIVE SUMMARY

The 29th Session of the International Pacific Halibut Commission (IPHC) Scientific Review Board (SRB029) was held in a hybrid format, with in-person attendance in Seattle, WA, USA, from 22 to 24 September 2026. The Chairperson, Dr Olaf Jensen (USA), opened the meeting and welcomed participants to Seattle.

The following are a subset of the complete recommendations/requests for action from the SRB029, which are provided in full at [Appendix IV](#).

RECOMMENDATIONS

Biology and ecology

SRB029–Rec.01 ([para. 16](#)) The SRB **RECOMMENDED** that the Secretariat evaluate the feasibility of collecting data on the energetic condition of Pacific halibut collected in the FISS, for example, liver weights and liver lipid composition and present a discussion of a potential pilot project at SRB030.

Pacific halibut stock assessment

SRB029–Rec.02 ([para. 22](#)) **NOTING** the value of data on the sex composition of fishery landings, the SRB **RECOMMENDED** that the Secretariat continue collecting this information.

Management strategy evaluation

SRB029–Rec.03 ([para. 28](#)) The SRB **RECOMMENDED** that the Secretariat evaluate the *feasibility* of using MSE to evaluate scenarios of increasing whale depredation to determine whether current FISS and stock assessment approaches to addressing depredation are robust to potential future increases in depredation. The SRB **NOTED** that there are many other items on the MSE Program of Work and suggested that fully *implementing* this recommendation is likely to be a lower priority.

The full recording of the SRB029 is available at the following link, under Meeting Outcomes: [IPHC-2026-SRB029-Audio recordings](#)



1. OPENING OF THE SESSION

1. The 29th Session of the International Pacific Halibut Commission (IPHC) Scientific Review Board (SRB029) was held in a hybrid format, with in-person attendance in Seattle, WA, USA, from 22 to 24 September 2026. The Chairperson, Dr Olaf Jensen (USA), opened the meeting and welcomed participants to Seattle. The list of participants is provided at [Appendix I](#).
2. The SRB **RECALLED** its mandate, as detailed in Appendix VIII, Sect. I, para. 1-3 of the IPHC Rules of Procedure (2025):
 1. *The Scientific Review Board (SRB) shall provide an independent scientific peer review of Commission science/research proposals, programs, and products, including but not limited to:*
 - a. *Data collection;*
 - b. *Historical data sets;*
 - c. *Stock assessment;*
 - d. *Management Strategy Evaluation;*
 - e. *Migration;*
 - f. *Reproduction;*
 - g. *Growth;*
 - h. *Discard survival;*
 - i. *Genetics and Genomics.*
 2. *Undertake periodic reviews of science/research strategy, progress, and overall performance.*
 3. *Review the recommendations arising from the MSAB and the RAB.*

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. The SRB **ADOPTED** the Agenda as provided at [Appendix II](#). The documents provided to the SRB are listed in [Appendix III](#). Participants were reminded that in accordance with the [IPHC Rules of Procedure \(2025\)](#), all documents and presentations for the meeting were published on the IPHC website 30 days and 10 days prior to the Session, respectively: <https://www.iphc.int/meetings/29th-session-of-the-iphc-scientific-review-board-srb029/>.

3. IPHC PROCESS

3.1 *SRB annual workflow*

4. The SRB **RECALLED** that the core purpose of the SRB029 is to review progress on the IPHC research and monitoring activities, including specific products, and to provide guidance for the delivery of products to the Commission at its Interim Meeting (IM102) in December 2026, and Annual Meeting (AM103) in January 2027.

3.2 *Update on the actions arising from the 28th Session of the SRB (SRB028)*

5. The SRB **NOTED** paper [IPHC-2026-SRB029-03](#) that provided the SRB with an opportunity to consider the progress made during the intersessional period on the recommendations/requests arising from the SRB028, and **AGREED** to consider and revise the actions as necessary, and to combine them with any new actions arising from SRB029 into a consolidated list for future reporting.

3.3 *Outcomes of the 102nd Session of the IPHC Annual Meeting (AM102)*

6. The SRB **NOTED** paper [IPHC-2026-SRB029-04](#) that detailed the outcomes of the 102nd Session of the IPHC Annual Meeting (AM102), relevant to the mandate of the SRB, and **AGREED** to consider how best to provide the Commission with the information it has requested, throughout the course of the current SRB meeting.



3.4 *Observer updates*

7. The SRB **NOTED** the following comments and questions from the Canadian science advisor:
 - a) Has the depleted reference point been re-estimated with the new OM? How do we use these concepts of overfished and depleted?
 - b) How do bottom type and tide state impact FISS catchability? Can these factors be included in the analysis?
 - c) Can whale depredation be included in the FISS analysis?
 - d) Comparison of the three aging methods is useful.
 - e) How will verification be conducted for the AI aging models?
8. The SRB **NOTED** the following updates from the USA science advisor:
 - a) Nil

4. INTERNATIONAL PACIFIC HALIBUT COMMISSION INTEGRATED RESEARCH AND MONITORING PLAN

9. The SRB **NOTED** paper [IPHC-2026-SRB029-INF01](#) that provided the SRB with the IPHC Integrated Research and Monitoring Plan (IRMP) ([IPHC-2026-IRMP](#)) published on 17 March 2026, and the iterative review and revision process moving forward.

4.1 *Research*

4.1.1 *Biology and ecology*

10. The SRB **NOTED** paper [IPHC-2026-SRB029-05](#) that provided a description of progress towards research activities described in the IPHC Integrated Research and Monitoring Plan (IRMP) ([IPHC-2026-IRMP](#)), and plans moving forward.
11. The SRB **NOTED** Table 5 in paper [IPHC-2026-SRB029-05](#) and a similar table in paper [IPHC-2026-SRB029-INF02](#) and appreciated the value of having the costs and benefits of epigenetic aging and AI aging listed. Thus, the SRB **REQUESTED** that these approaches be presented in a single table to facilitate comparison.
12. **NOTING** that existing data sources have limited utility for estimating the geographic extent or temporal trends in whale depredation, the SRB **REQUESTED** that for SRB030, the Secretariat provide:
 - a) options for using the ‘sentiment survey’ to assess whale depredation;
 - b) a preliminary analysis of any available cetacean surveys to determine whether whale abundance indices have changed in different Biological Regions.
13. The SRB **REQUESTED** that the Secretariat evaluate, by SRB030, the benefits of developing sex-specific epigenetic age clocks.
14. The SRB **REQUESTED** that the Secretariat use an elastic net model to reduce the number of candidate CpG sites to something more manageable and then develop the models further using a GAM framework, by SRB030.
15. The SRB **REQUESTED** that future presentations of the fecundity work describe the planned analysis to test the BOFF hypothesis (hyperallometry).
16. The SRB **RECOMMENDED** that the Secretariat evaluate the feasibility of collecting data on the energetic condition of Pacific halibut collected in the FISS, for example, liver weights and liver lipid composition and present a discussion of a potential pilot project at SRB030.



17. The SRB **REQUESTED** that the Secretariat present, at SRB030, a preliminary investigation of the feasibility of:

- a) Using otolith growth increments to back-calculate individual growth of Pacific halibut, particularly in younger fish;
- b) Using otolith microchemistry to identify the natal origin of adult Pacific halibut.

4.1.2 Pacific halibut stock assessment

18. The SRB **NOTED** paper [IPHC-2026-SRB029-06](#), that provided a response to recommendations and requests made during SRB028 ([IPHC-2026-SRB028-R](#)), and also provided an update on the 2026 stock assessment development.

19. **NOTING** the impressive progress with developing a CEATTLE model for Pacific halibut, the SRB **REQUESTED** further exploration of CEATTLE and investigation of WHAM and SPoRC (two additional state space stock assessment platforms)

20. The SRB **REQUESTED** that the Secretariat continue to display uncertainty along with the point estimates in working documents.

21. The SRB **REQUESTED** that uncertainty about assessment output be analysed to detect if changes in stock status and abundance might vary in time, particularly as the stock declines.

22. **NOTING** the value of data on the sex composition of fishery landings, the SRB **RECOMMENDED** that the Secretariat continue collecting this information.

4.1.3 Management strategy evaluation

23. The SRB **NOTED** paper [IPHC-2026-SRB029-07](#) that provided the MSE Program of Work for 2026–2028, and an overview of work done since the SRB028, using the IPHC Management Strategy Evaluation (MSE) framework.

24. **NOTING** that “recovery” is part of the depleted definition, but is not defined itself, the SRB **REQUESTED** that the Secretariat review how these reference points are defined within other management systems and present, at SRB030, some potential recovery thresholds or definitions that recognise the difference between short (e.g. positive trend) and long-term (e.g. persistent high biomass) aspects of recovery. Alternatively, the Secretariat could redefine “depleted” based on the avoidance of further declines in biomass.

25. **NOTING** that the stability of the projections depends on the assumed levels of assessment and implementation uncertainty, the SRB **REQUESTED** that at SRB030 the Secretariat present materials describing how assessment and implementation uncertainty are included in the MSE and potential alternative approaches.

26. **RECALLING** the following recommendation from SRB027:

SRB027–Rec.09 (para. 24) *The SRB RECOMMENDED considering the development of an assessment model within the MSE framework. This would have multiple benefits including: a) facilitating analysis of the economic consequences of reduced FISS sampling and the associated increased potential for bias in assessment-relevant metrics such as WPUE, the maturity schedule, size-at-age, and age composition. b) Understanding the impacts of uncertainty in natural mortality on management performance.*

the SRB **REQUESTED** that the Secretariat present options for implementing an assessment model within the MSE, including investigating potential state-space options which can run faster.



27. The SRB **REQUESTED** that PDO projections be developed that are based on time series analysis of the historical record. This will allow the projections to equilibrate at proportions that are consistent with the historical data rather than 50/50 (high/low phase).
28. The SRB **RECOMMENDED** that the Secretariat evaluate the *feasibility* of using MSE to evaluate scenarios of increasing whale depredation to determine whether current FISS and stock assessment approaches to addressing depredation are robust to potential future increases in depredation. The SRB **NOTED** that there are many other items on the MSE Program of Work and suggested that fully *implementing* this recommendation is likely to be a lower priority.

4.2 Monitoring

4.2.1 Fishery-dependent data

29. Nil.

4.2.2 Fishery-independent data

4.2.2.1 2027 FISS design evaluation

30. The SRB **NOTED** paper [IPHC-2026-SRB029-08](#) that proposed designs for the IPHC's Fishery-Independent Setline Survey (FISS) for 2027-31, including a preliminary cost evaluation of the 2027 Base Block design.
31. **NOTING** that the western portion of IPHC Regulatory Area 4B has not been sampled since 2019 and that costs and logistical constraints may result in no bids for sampling the portions of 4B presented in the 2027 Base Block design, the SRB **REQUESTED** that the Secretariat evaluate alternative options for gathering information about Pacific halibut abundance and size/age structure in area 4B.

4.2.2.2 Updates to space-time modelling

32. **NOTING** that a newer R package (SDMTMB) offers potential advantages to the current R-INLA framework, the SRB **REQUESTED** that the Secretariat evaluate the pros and cons of moving the space-time model to SDMTMB.
33. The SRB **REQUESTED** that future displays of space-time model outputs also include maps of uncertainty.

4.2.3 Age composition data (both fishery-dependent and fishery-independent)

34. The SRB **NOTED** paper [IPHC-2026-SRB029-INF02](#) that summarises current knowledge on the use of artificial intelligence (AI) for determining the age of fish from images of collected otoliths and provides an update on the ongoing exploratory work to develop an AI-based age determination model for Pacific halibut.
35. The SRB **NOTED** that the proposed 50/50 mix of break-and-bake manual aging and AI-based aging performs nearly as well as the current practice of 100% manual aging.
36. The SRB **REQUESTED** that the Secretariat develop assessment simulations to evaluate trade-offs and determine the optimal mix of manual and AI-based aging.
37. The SRB **REQUESTED** that the Secretariat present, at SRB030, an analysis of the multi-year cross-validation performance of the 100% AI-based and 50/50 models.

5. OTHER BUSINESS

38. The SRB **AGREED** on the following tentative dates for SRB meetings in 2027:
- a) SRB030: 1-3 June 2027 (hybrid format);
 - b) SRB031: 21-23 September 2027 (hybrid format).



6. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)

39. The Report of the 29th Session of the IPHC Scientific Review Board ([IPHC-2026-SRB029-R](#)) was **ADOPTED** on 24 September 2026, including the consolidated set of recommendations and/or requests arising from SRB029, provided at [Appendix IV](#).

APPENDIX I
LIST OF PARTICIPANTS FOR THE 29TH SESSION OF THE
IPHC SCIENTIFIC REVIEW BOARD (SRB029)

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APPENDIX II

AGENDA FOR THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)

Date: 22-24 September 2026

Location: Hybrid - Seattle, WA, USA & Electronic

Venue: IPHC HQ (for SRB and Science advisors only) & Adobe Connect (observers)

Time: 09:00-17:00 (22-23rd), 09:00-12:00 (24th) PDT

Chairperson: Dr. Olaf Jensen (USA)

- 1. OPENING OF THE SESSION**
- 2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION**
- 3. IPHC PROCESS**
 - 3.1. SRB annual workflow (D. Wilson)
 - 3.2. Update on the actions arising from the 28th Session of the SRB (SRB028) (D. Wilson)
 - 3.3. Outcomes of the 102nd Session of the IPHC Annual Meeting (AM102) (D. Wilson)
 - 3.4. Observer updates (e.g. Science Advisors)
- 4. INTERNATIONAL PACIFIC HALIBUT COMMISSION INTEGRATED RESEARCH AND MONITORING PLAN**
 - 4.1. RESEARCH**
 - 4.1.1. Biology and ecology
 - 4.1.2. Pacific halibut stock assessment
 - 4.1.3. Management strategy evaluation
 - 4.2. MONITORING**
 - 4.2.1. Fishery-dependent data
 - 4.2.2. Fishery-independent data
 - IPHC Fishery-Independent Setline Survey (FISS)
 - 2027 FISS design evaluation (R. Webster)
 - Updates to space-time modelling (R. Webster)
 - 4.2.3. Age composition data (both fishery-dependent and fishery-independent)
- 5. OTHER BUSINESS**
- 6. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 29th SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)**



APPENDIX III
LIST OF DOCUMENTS FOR THE 29TH SESSION OF THE
IPHC SCIENTIFIC REVIEW BOARD (SRB029)

Document	Title	Availability
IPHC-2026-SRB029-01	Agenda & Schedule for the 29 th Session of the Scientific Review Board (SRB029)	✓ 28 May 2026
IPHC-2026-SRB029-02	List of Documents for the 29 th Session of the Scientific Review Board (SRB029)	✓ 28 May 2026 ✓ 22 Aug 2026
IPHC-2026-SRB029-03	Update on the actions arising from the 28 th Session of the SRB (SRB028) (IPHC Secretariat)	✓ 22 Aug 2026
IPHC-2026-SRB029-04	Outcomes of the 102 nd Session of the IPHC Annual Meeting (AM102) (D. Wilson)	✓ 28 May 2026
IPHC-2026-SRB029-05	Report on current and future biological and ecosystem science research activities (J. Planas, C. Dykstra, A. Jasonowicz, & C. Jones)	✓ 13 Aug 2026
IPHC-2026-SRB029-06	Development of the 2026 Pacific halibut (<i>Hippoglossus stenolepis</i>) stock assessment (I. Stewart & A. Hicks)	✓ 18 Aug 2026
IPHC-2026-SRB029-07	An update of the IPHC Secretariat MSE Program of Work for 2026-2028 (A. Hicks & I. Stewart)	✓ 20 Aug 2026
IPHC-2026-SRB029-08	2027-31 FISS design evaluation and modelling updates (R. Webster, I. Stewart, K. Ualesi, & D. Wilson)	✓ 22 Aug 2026
Information papers		
IPHC-2026-SRB029-INF01	International Pacific Halibut Commission Integrated Research and Monitoring Plan (D. Wilson, J. Planas, I. Stewart, A. Hicks, R. Webster, & B. Hutniczak)	✓ 28 May 2026
IPHC-2026-SRB029-INF02	Using artificial intelligence (AI) for supplementing Pacific halibut age determination from collected otoliths - project update (B. Hutniczak)	✓ 11 Sept 2026



APPENDIX IV

CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 29TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB029)

RECOMMENDATIONS

Biology and ecology

SRB029–Rec.01 ([para. 16](#)) The SRB **RECOMMENDED** that the Secretariat evaluate the feasibility of collecting data on the energetic condition of Pacific halibut collected in the FISS, for example, liver weights and liver lipid composition and present a discussion of a potential pilot project at SRB030.

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SRB029–Rec.03 ([para. 28](#)) The SRB **RECOMMENDED** that the Secretariat evaluate the *feasibility* of using MSE to evaluate scenarios of increasing whale depredation to determine whether current FISS and stock assessment approaches to addressing depredation are robust to potential future increases in depredation. The SRB **NOTED** that there are many other items on the MSE Program of Work and suggested that fully *implementing* this recommendation is likely to be a lower priority.

REQUESTS

Biology and ecology

SRB029–Req.01 ([para. 11](#)) The SRB **NOTED** Table 5 in paper [IPHC-2026-SRB029-05](#) and a similar table in paper [IPHC-2026-SRB029-INF02](#) and appreciated the value of having the costs and benefits of epigenetic aging and AI aging listed. Thus, the SRB **REQUESTED** that these approaches be presented in a single table to facilitate comparison.

SRB029–Req.02 ([para. 12](#)) **NOTING** that existing data sources have limited utility for estimating the geographic extent or temporal trends in whale depredation, the SRB **REQUESTED** that for SRB030, the Secretariat provide:

- a) options for using the ‘sentiment survey’ to assess whale depredation;
- b) a preliminary analysis of any available cetacean surveys to determine whether whale abundance indices have changed in different Biological Regions.

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SRB029–Req.04 ([para. 14](#)) The SRB **REQUESTED** that the Secretariat use an elastic net model to reduce the number of candidate CpG sites to something more manageable and then develop the models further using a GAM framework, by SRB030.

SRB029–Req.05 ([para. 15](#)) The SRB **REQUESTED** that future presentations of the fecundity work describe the planned analysis to test the BOFF hypothesis (hyperallometry).



SRB029–Req.06 ([para. 17](#)) The SRB **REQUESTED** that the Secretariat present, at SRB030, a preliminary investigation of the feasibility of:

- a) Using otolith growth increments to back-calculate individual growth of Pacific halibut, particularly in younger fish;
- b) Using otolith microchemistry to identify the natal origin of adult Pacific halibut.

Pacific halibut stock assessment

SRB029–Req.07 ([para. 19](#)) **NOTING** the impressive progress with developing a CEATTLE model for Pacific halibut, the SRB **REQUESTED** further exploration of CEATTLE and investigation of WHAM and SPoRC (two additional state space stock assessment platforms)

SRB029–Req.08 ([para. 20](#)) The SRB **REQUESTED** that the Secretariat continue to display uncertainty along with the point estimates in working documents.

SRB029–Req.09 ([para. 21](#)) The SRB **REQUESTED** that uncertainty about assessment output be analysed to detect if changes in stock status and abundance might vary in time, particularly as the stock declines.

Management strategy evaluation

SRB029–Req.10 ([para. 24](#)) **NOTING** that “recovery” is part of the depleted definition, but is not defined itself, the SRB **REQUESTED** that the Secretariat review how these reference points are defined within other management systems and present, at SRB030, some potential recovery thresholds or definitions that recognise the difference between short (e.g. positive trend) and long-term (e.g. persistent high biomass) aspects of recovery. Alternatively, the Secretariat could redefine “depleted” based on the avoidance of further declines in biomass.

SRB029–Req.11 ([para. 25](#)) **NOTING** that the stability of the projections depends on the assumed levels of assessment and implementation uncertainty, the SRB **REQUESTED** that at SRB030 the Secretariat present materials describing how assessment and implementation uncertainty are included in the MSE and potential alternative approaches.

SRB029–Req.12 ([para. 26](#)) **RECALLING** the following recommendation from SRB027:

SRB027–Rec.09 (para. 24) The SRB RECOMMENDED considering the development of an assessment model within the MSE framework. This would have multiple benefits including: a) facilitating analysis of the economic consequences of reduced FISS sampling and the associated increased potential for bias in assessment-relevant metrics such as WPUE, the maturity schedule, size-at-age, and age composition. b) Understanding the impacts of uncertainty in natural mortality on management performance.

the SRB **REQUESTED** that the Secretariat present options for implementing an assessment model within the MSE, including investigating potential state-space options which can run faster.

SRB029–Req.13 ([para. 27](#)) The SRB **REQUESTED** that PDO projections be developed that are based on time series analysis of the historical record. This will allow the projections to equilibrate at proportions that are consistent with the historical data rather than 50/50 (high/low phase).

2027 FISS design evaluation

SRB029–Req.14 ([para. 31](#)) **NOTING** that the western portion of IPHC Regulatory Area 4B has not been sampled since 2019 and that costs and logistical constraints may result in no bids for sampling the portions of 4B presented in the 2027 Base Block design, the SRB **REQUESTED** that the



Secretariat evaluate alternative options for gathering information about Pacific halibut abundance and size/age structure in area 4B.

Updates to space-time modelling

SRB029-Req.15 ([para. 32](#)) **NOTING** that a newer R package (SDMTMB) offers potential advantages to the current R-INLA framework, the SRB **REQUESTED** that the Secretariat evaluate the pros and cons of moving the space-time model to SDMTMB.

SRB029-Req.16 ([para. 33](#)) The SRB **REQUESTED** that future displays of space-time model outputs also include maps of uncertainty.

Age composition data (both fishery-dependent and fishery-independent)

SRB029-Req.17 ([para. 36](#)) The SRB **REQUESTED** that the Secretariat develop assessment simulations to evaluate trade-offs and determine the optimal mix of manual and AI-based aging.

SRB029-Req.18 ([para. 37](#)) The SRB **REQUESTED** that the Secretariat present, at SRB030, an analysis of the multi-year cross-validation performance of the 100% AI-based and 50/50 models.