INTERNATIONAL PACIFIC HALIBUT COMMISSION

2022-24 FISS design evaluation

Agenda item: 5.3
IPHC-2022-AM098-09
(R. Webster)

Summary

- Background
  - IPHC history of FISS, 1993-2019
  - Space-time modelling
  - FISS design objectives
  - Review process
- Proposed FISS designs for 2022-24
- Consideration of cost
- Optimised FISS designs for 2022

IPHC FISS

- Our most important source of data on Pacific halibut
- Provides data for estimating weight and numbers per unit effort (WPUE and NPUE) indices of density and abundance of Pacific halibut
  - Used to estimate stock trends
  - Used to estimate stock distribution
  - Important input in the IPHC stock assessment
- Provides biological data for use in the stock assessment

FISS history 1993-2019

- A standardised FISS has been conducted by the IPHC each year since 1993
  - Standardised for bait and fishing gear
- From 1993-97 coverage was limited and generally restricted to IPHC Regulatory Areas 2B, 2C, 3A and 3B
- The modern FISS design on a 10 nmi grid began in 1998
- By 2001, annual coverage occurred in all IPHC Regulatory Areas
  - Depth range 20-275 fathoms in Gulf of Alaska and Aleutian Islands
  - Depth range 75-275 fathoms along Bering Sea shelf edge

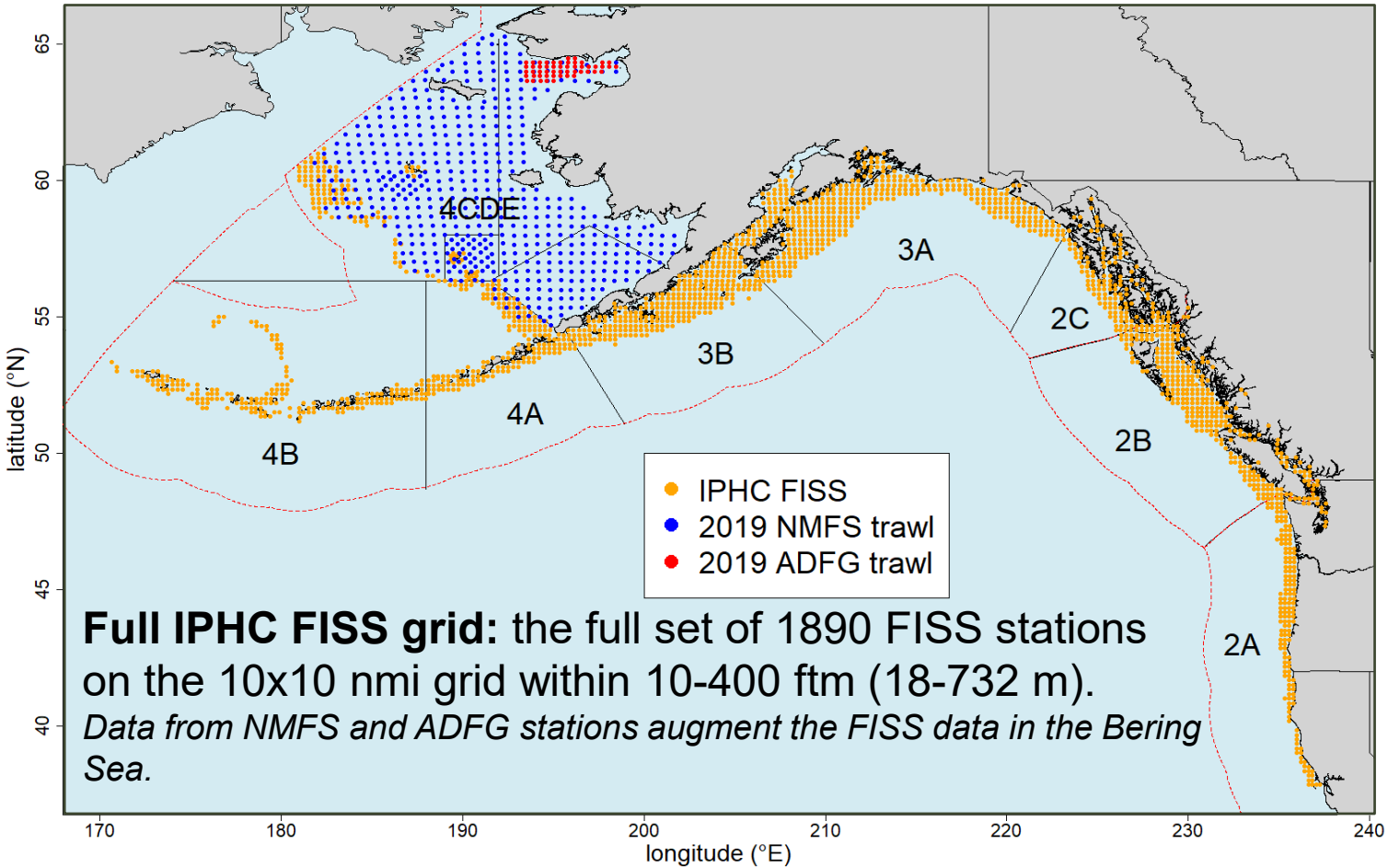
FISS history 1993-2019

- By 2010, data from other sources showed that not all Pacific halibut habitat was covered by the FISS
  - Pacific halibut were present outside the FISS depth range, in both deep and shallow waters
  - All IPHC Regulatory Areas had coverage gaps, even within the standard depth range
- Such unsampled habitat meant there was the potential for bias in estimates derived from FISS data
- Therefore, a series of FISS expansions from 2011 to 2019 were undertaken covering previously unsampled habitat in all IPHC Regulatory Areas

FISS history 2011-2019

- During the expansions, the FISS occupied for the first time 34% of the stations on the full 10 nmi FISS grid that had been previously unsampled
- The result was an improved understanding of Pacific halibut density and distribution
  - Bias was reduced, with indices for several Regulatory Areas being revised upwards or downwards
  - Uncertainty in estimates of WPUE and NPUE was reduced in most Regulatory Areas
  - These improvements were apparent throughout the time series, not only in the year of the expansion
- The resulting expanded grid of 1890 stations has provided a full FISS design from which stations can be selected for sampling in each annual FISS

Full FISS grid



Full IPHC FISS grid: the full set of 1890 FISS stations on the 10x10 nmi grid within 10-400 ftm (18-732 m).

Data from NMFS and ADFG stations augment the FISS data in the Bering Sea.

Space-time modelling

- Space-time modelling of survey data has been used since 2016 to produce WPUE and NPUE estimates
- The modelling has two key purposes:
  - It smooths the data in time and space
    - Makes use of information on spatial and temporal relationships among survey stations to “sort the signal from the noise”
  - It fills in gaps in survey coverage using model predictions, while accounting for uncertainty
    - Gaps previously filled using ad hoc scaling factors based on ratio of averages in surveyed and unsurveyed habitat

FISS objectives and design layers

Priority	Objective	Design Layer
Primary	Sample Pacific halibut for stock assessment and stock distribution estimation	Minimum sampling requirements in terms of: • Station distribution • Station count • Skates per station
Secondary	Long term revenue neutrality	Logistics and cost: operational feasibility and cost/revenue neutrality
Tertiary	Minimize removals, and assist others where feasible on a cost-recovery basis.	Removals: minimize impact on the stock while meeting primary priority Assist: assist others to collect data on a cost-recovery basis IPHC policies: ad-hoc decisions of the Commission regarding the FISS design

Review process

- The Secretariat presents design proposals based only on primary objectives to the SRB for three subsequent years at the June meeting
- These design proposals, revised (if necessary) based on June SRB input, are then reviewed by Commissioners at the September work meeting;
- At their September meeting, the SRB reviews revisions to the design proposals made to account for secondary and tertiary objectives
  - Note that data from the current summer FISS will not be available for analysis prior to the September SRB meeting

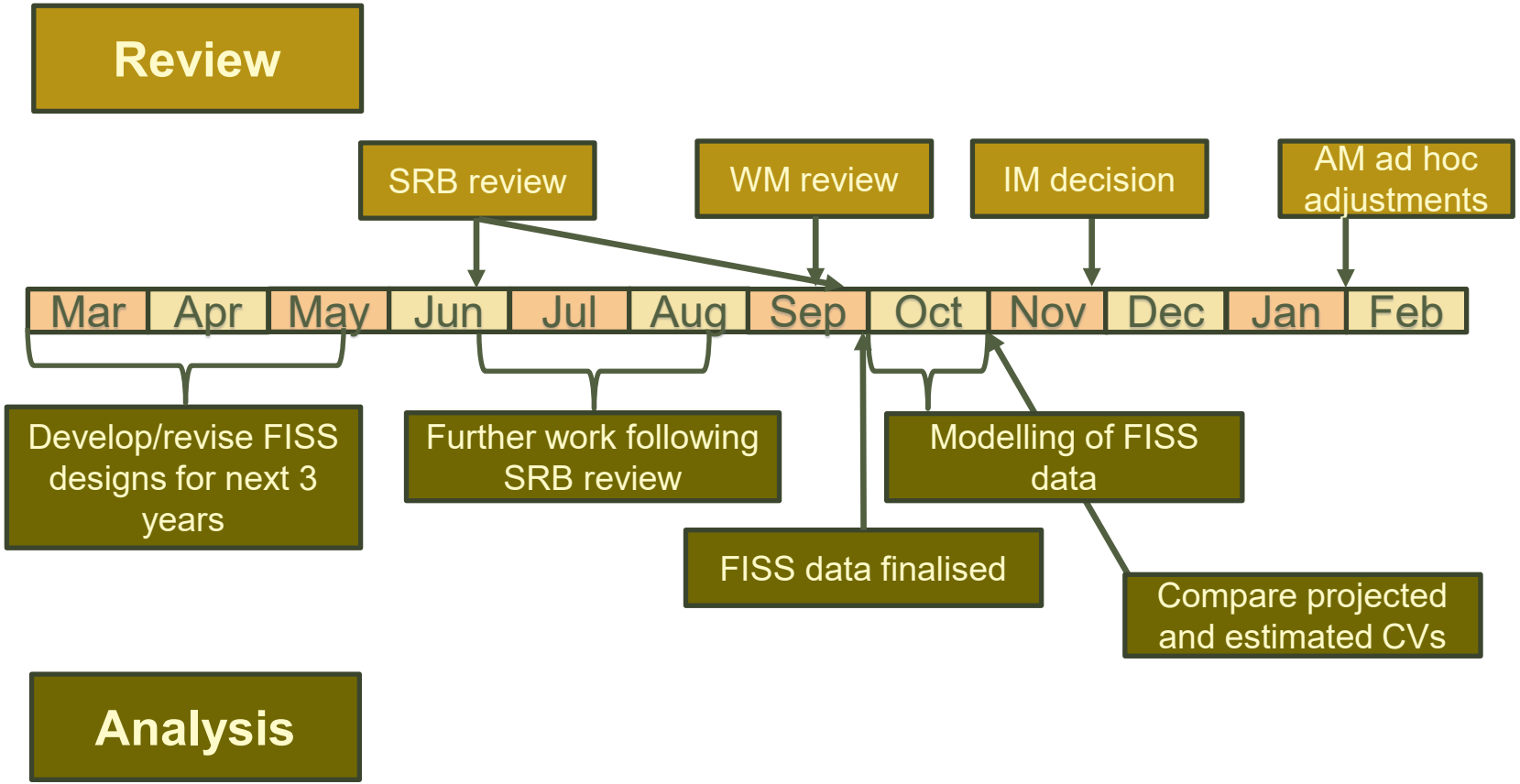
Design finalisation

- Presentation of FISS designs for endorsement by the Commission occurs at the November Interim Meeting;
- Ad hoc modifications to the design for the current year (due to unforeseen issues arising) are possible at the Annual Meeting;
- The endorsed design for current year is then modified (if necessary) to account for any additional tertiary objectives prior to summer implementation (February-April).

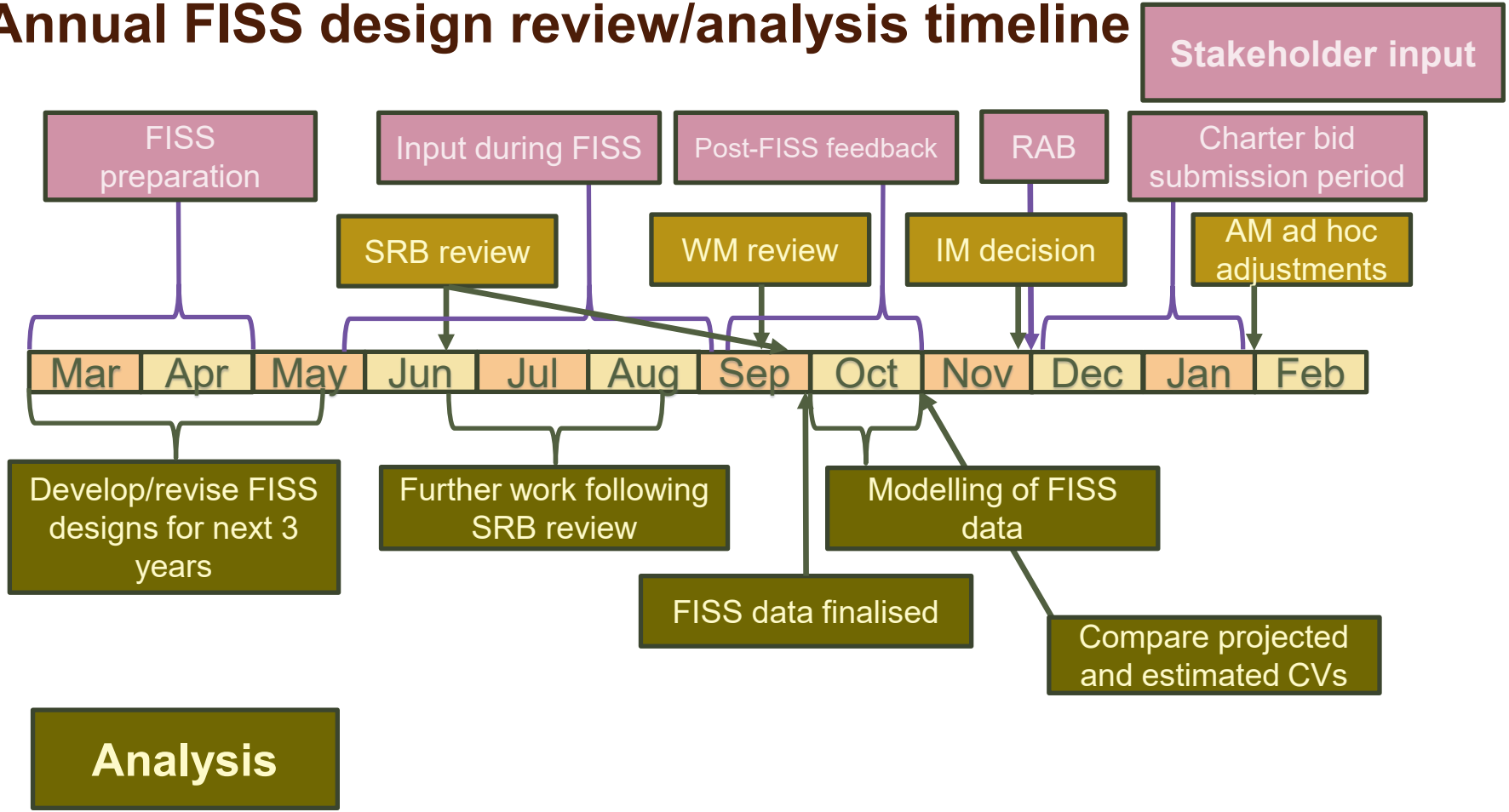
Stakeholder input

- Consultation with industry and stakeholders occurs throughout the FISS planning process
  - Input is particularly valuable in finalizing design details as part of the FISS charter bid process
- The Secretariat reviews input from the previous year and implements changes where possible (e.g., limiting stations or skates in deep waters or other logistically challenging areas where not critical for scientific objectives)
- The IPHC's Research Advisory Board provides input into the FISS design implementation at their November meeting, just prior to the Interim Meeting

Annual FISS design review/analysis timeline



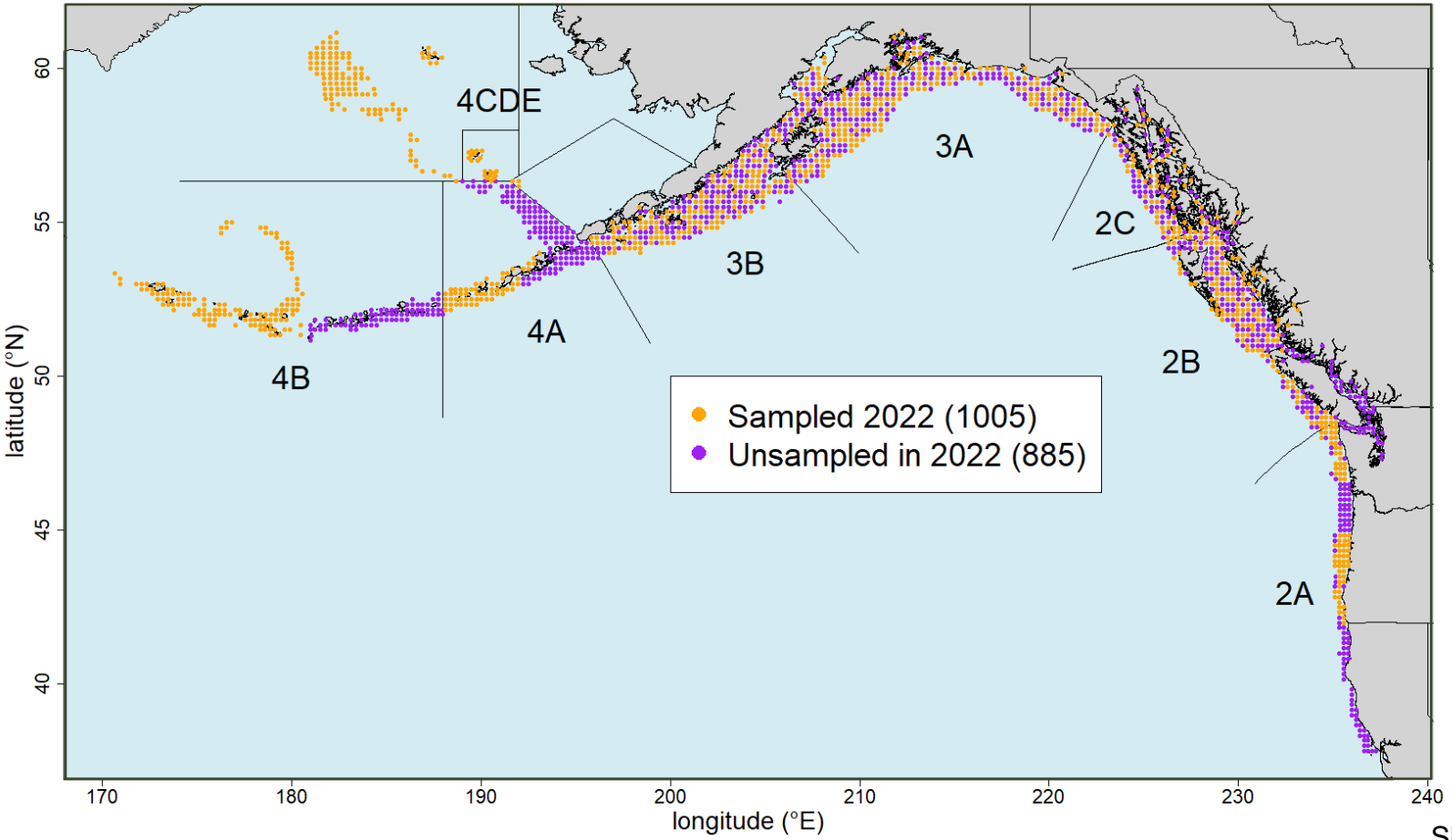
Annual FISS design review/analysis timeline



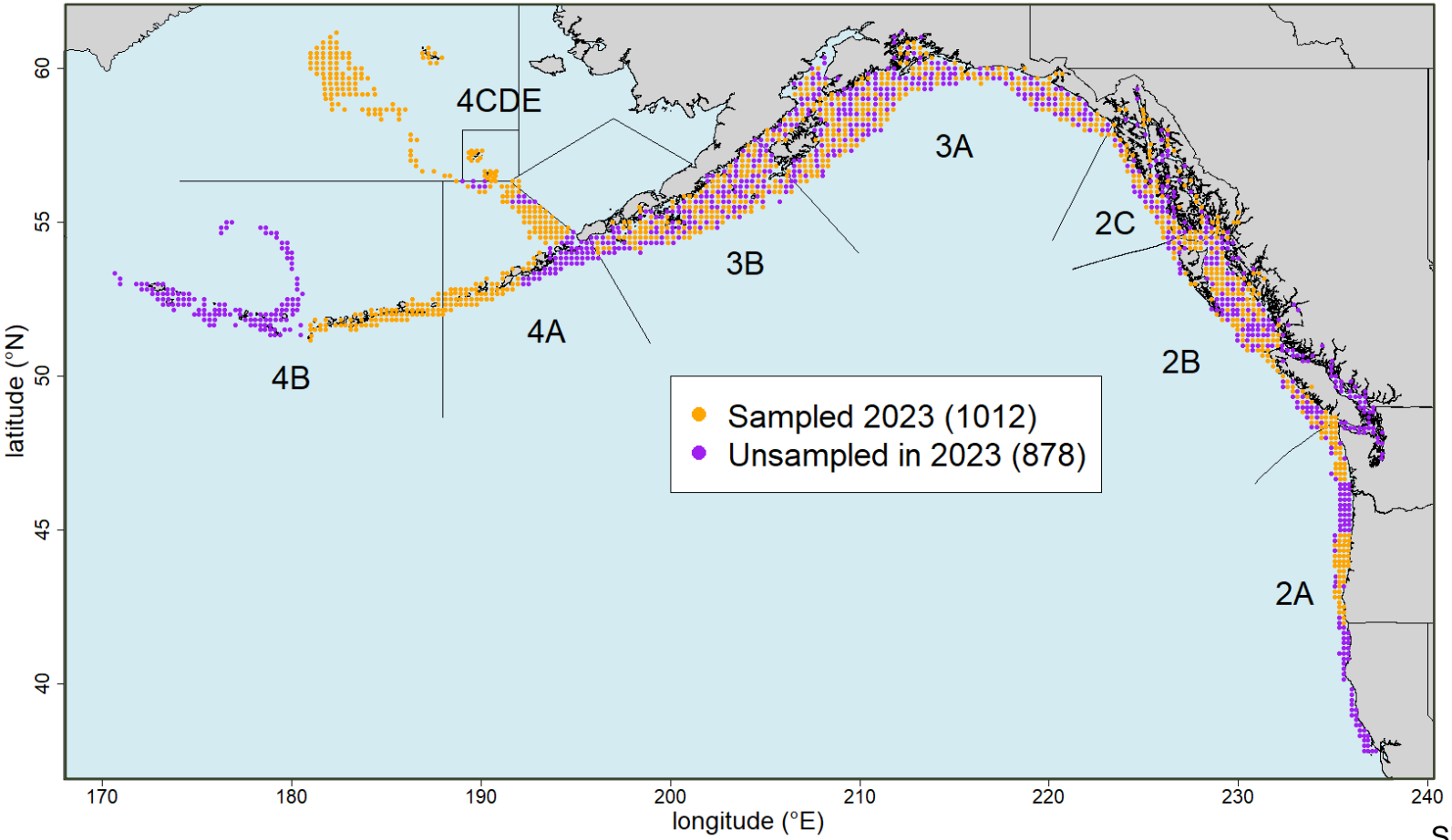
Proposed FISS designs for 2022-24

- As in 2021, the proposed designs use efficient subarea sampling in IPHC Regulatory Areas 2A, 4A and 4B, but incorporate a randomized design in IPHC Regulatory Areas 2B, 2C, 3A and 3B
- We continue to propose sampling all standard FISS stations in IPHC Regulatory Area 4CDE
  - A highly dynamic area with potentially northward-shifting distribution, and uncertainty regarding connectivity with populations near to and within in Russian waters
- It is likely that these designs represent the maximum effort that can be deployed outside the core areas in coming years, while still meeting the Secondary Objective.

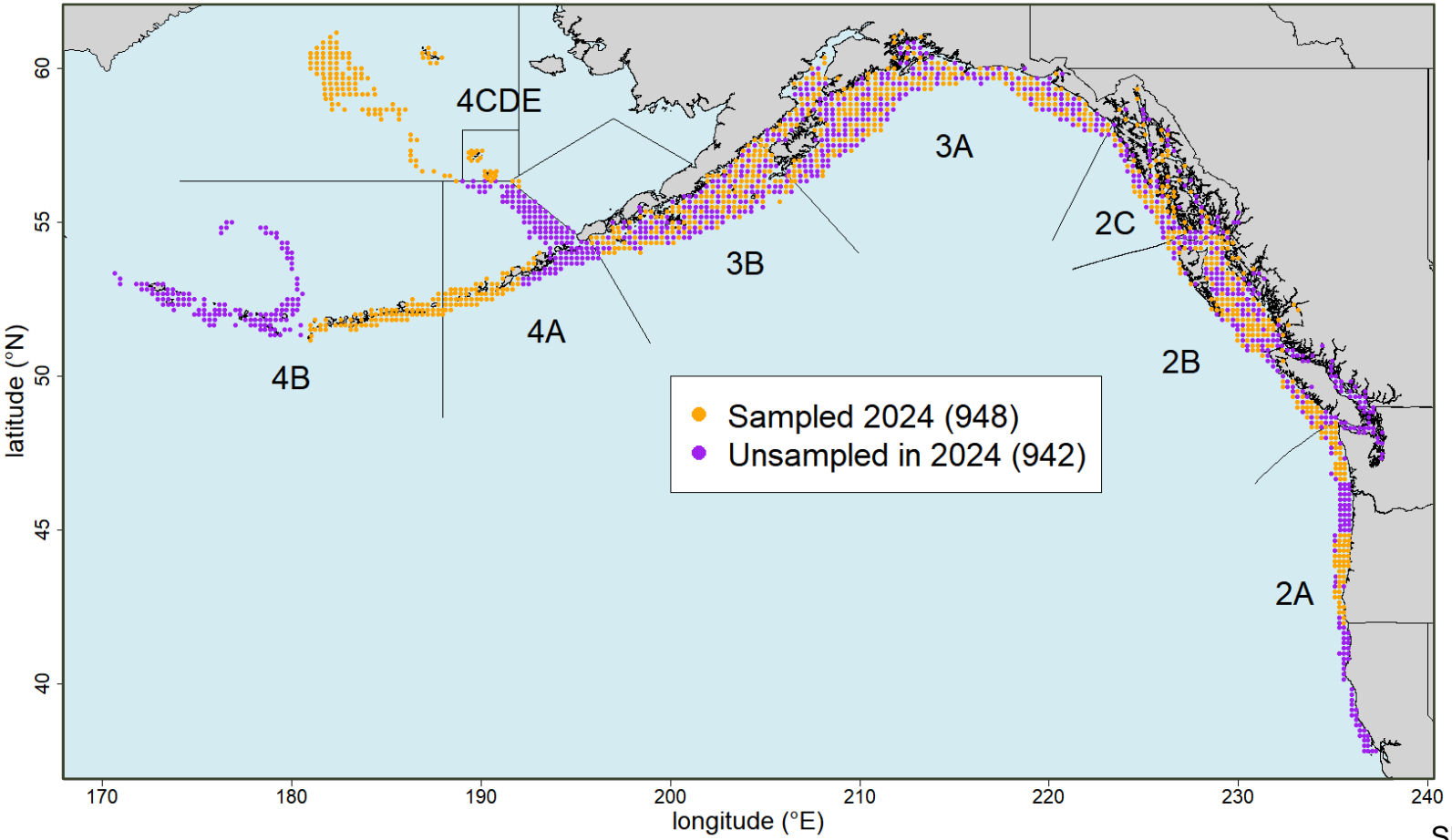
Proposed 2022 FISS minimum design



Proposed 2023 FISS minimum design



Proposed 2024 FISS minimum design



Scientific Review Board endorsement

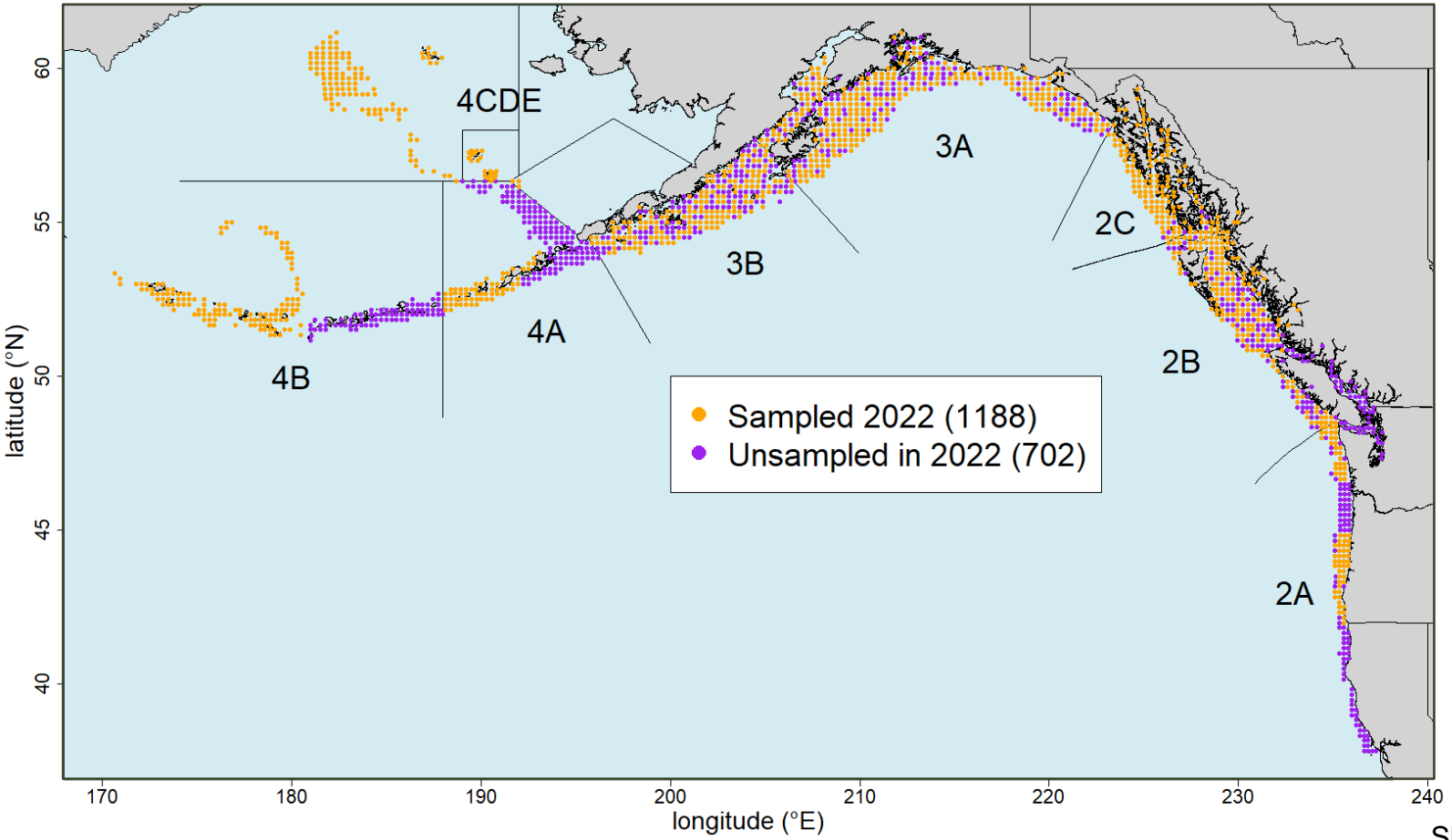
- At SRB018, the SRB endorsed the final 2022 FISS design and provisionally endorsed the 2023-24 designs presented above (IPHC-2021-SRB018-R paragraph 16).

Consideration of cost

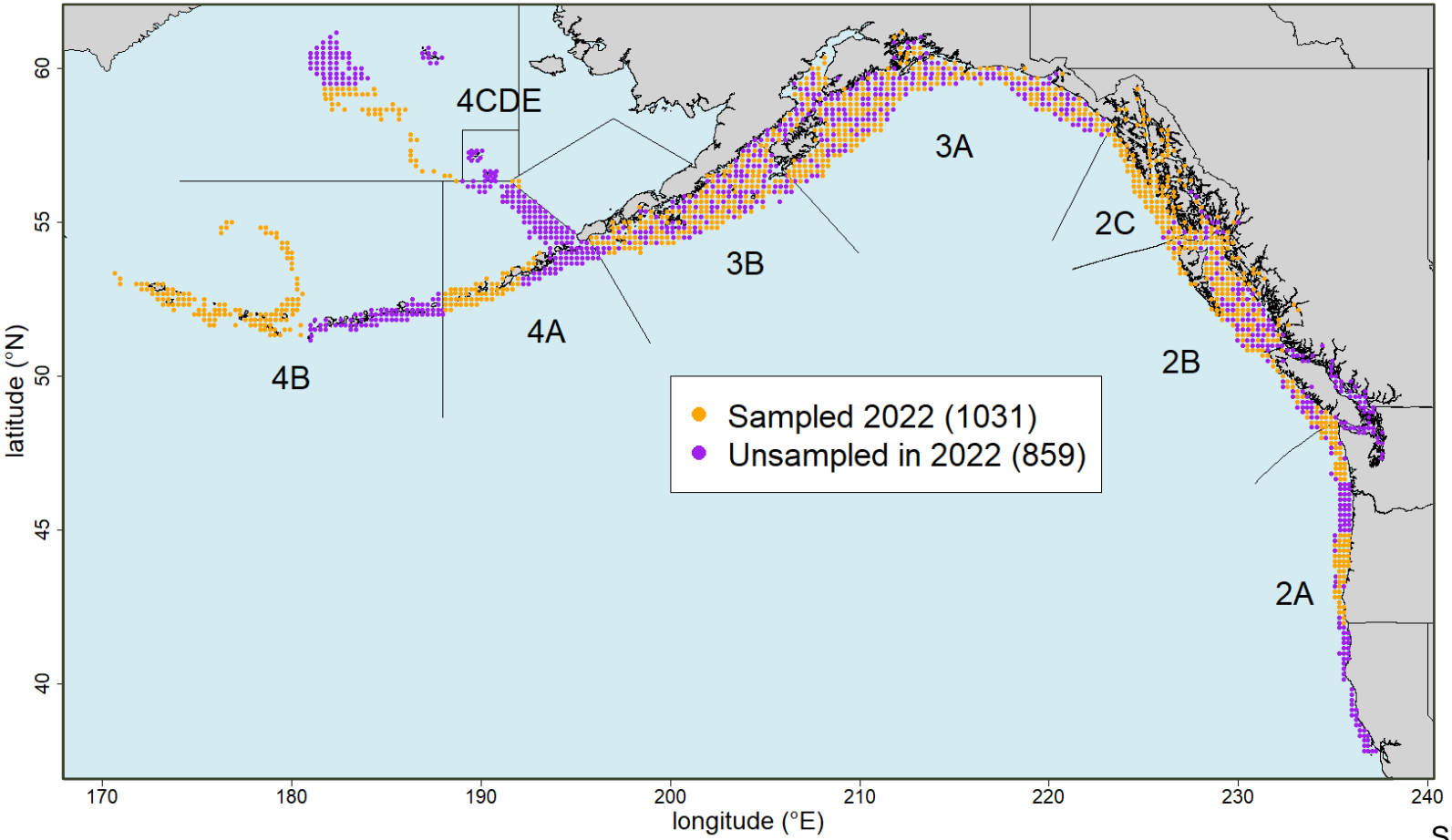
- The proposed FISS designs for 2022-24 incorporate some consideration of cost
  - Logistically efficient subarea designs are proposed in lower-density IPHC Regulatory Areas.
- The goal here was to provide statistically efficient and logistically feasible designs for consideration by the Commission
- The FISS is funded by sales of captured fish and is intended to have long-term revenue neutrality, meaning that any design must also be evaluated in terms of the following factors:
  - Expected catch of Pacific halibut
  - Expected Pacific halibut sale price
  - Charter vessel costs, including relative costs per skate and per station
  - Bait costs
  - IPHC Secretariat costs

Optimised design 1 for 2022

Secretariat's recommendation



Optimised design 2 for 2022



SRB comment on optimised designs

- At SRB019, the optimised designs were noted by the SRB (IPHC-2021-SRB019-R), which also drew attention to the potential importance of increased sampling in the Bering Sea. SRB019–Rec.02 (para. 14):

NOTING the presentation of three alternative 2022 sampling designs (Figs. 1, 2, and 3) that optimize the SRB018-endorsed proposed 2022 design for cost, thereby meeting the goals of long-term revenue neutrality (Secondary Objective), without compromising the scientific goals of the FISS (Primary Objective), the SRB RECOMMENDED that the Secretariat prioritize 2022 sampling designs that include IPHC Regulatory Area 4CDE despite the relatively low contribution of this area to overall biomass and variance. This region is an important area to monitor for future range shifts and biological samples collected here are likely to be important for understanding the biology of Pacific halibut at their leading range edge.

Secretariat recommendation at IM097

- Based on the SRB's comments and the factors suggesting elevated priority for 4CDE:
  - Optimised Design 1 (all stations in IPHC Regulatory Area 4CDE) was recommended by the Secretariat at IM097
  - Optimised Design 2 is reserved as an alternative if bid availability and or other logistical challenges arise.

Commission endorsement

- At IM097, the Commission endorsed Optimised Design 1 for 2022, and Optimised Design 2 as an alternative. IM097 para. 31:

The Commission ENDORSED optimized design 1 for the 2022 FISS, with full sampling in IPHC Regulatory Area 4CDE (Appendix IV), and optimized design 2, reduced sampling in IPHC Regulatory Area 4CDE (Appendix V), as an alternative if necessary.

- The Commission also provisionally endorsed the proposed designs for 2023-24

Recommendations

That the Commission:

1) **NOTE** paper IPHC-2022-AM098-09 that presents the scientific FISS design proposals for 2022-24 together with 2022 designs optimised for the secondary objective of long-term revenue neutrality;

2) **RECOMMEND** ad hoc modifications to the design for 2022, if necessary.

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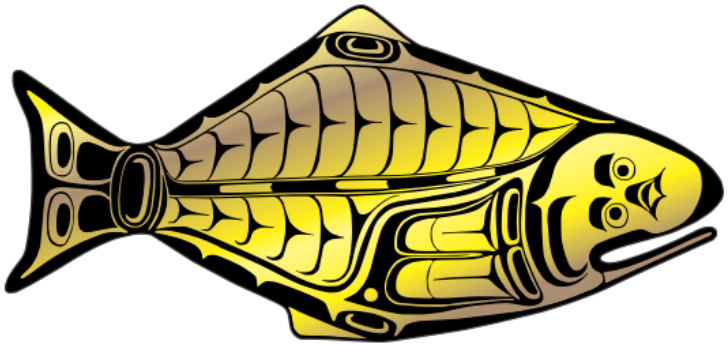

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