

# 2024-28 FISS Design Evaluation

Agenda item: 8.1

IPHC-2023-IM099-13

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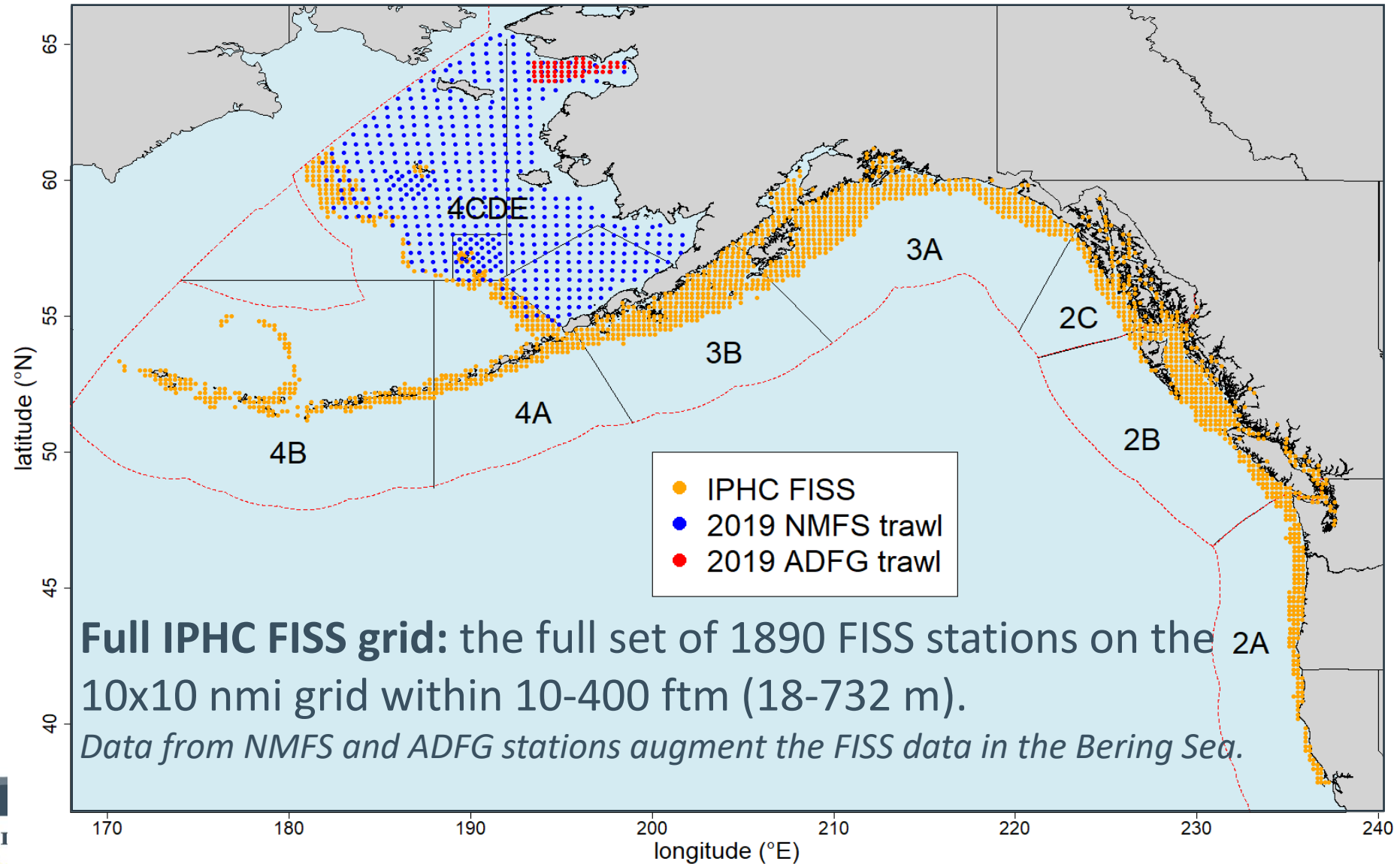


# Part 1: Potential 2024-26 designs

# 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
- An annual FISS has been undertaken since 1993
  - Design expanded during 2011-2019 period

# Full FISS grid

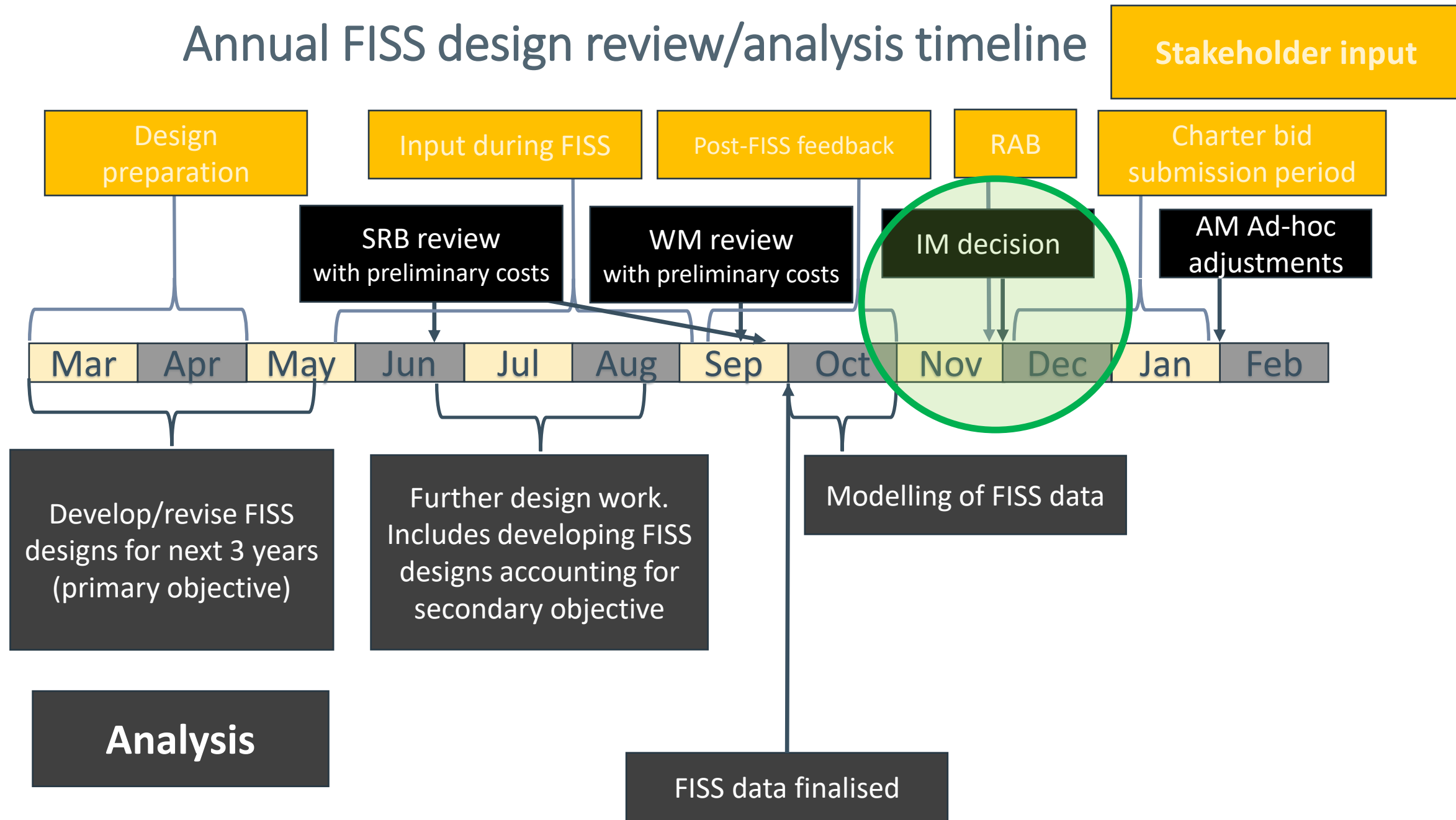


# FISS objectives and design layers

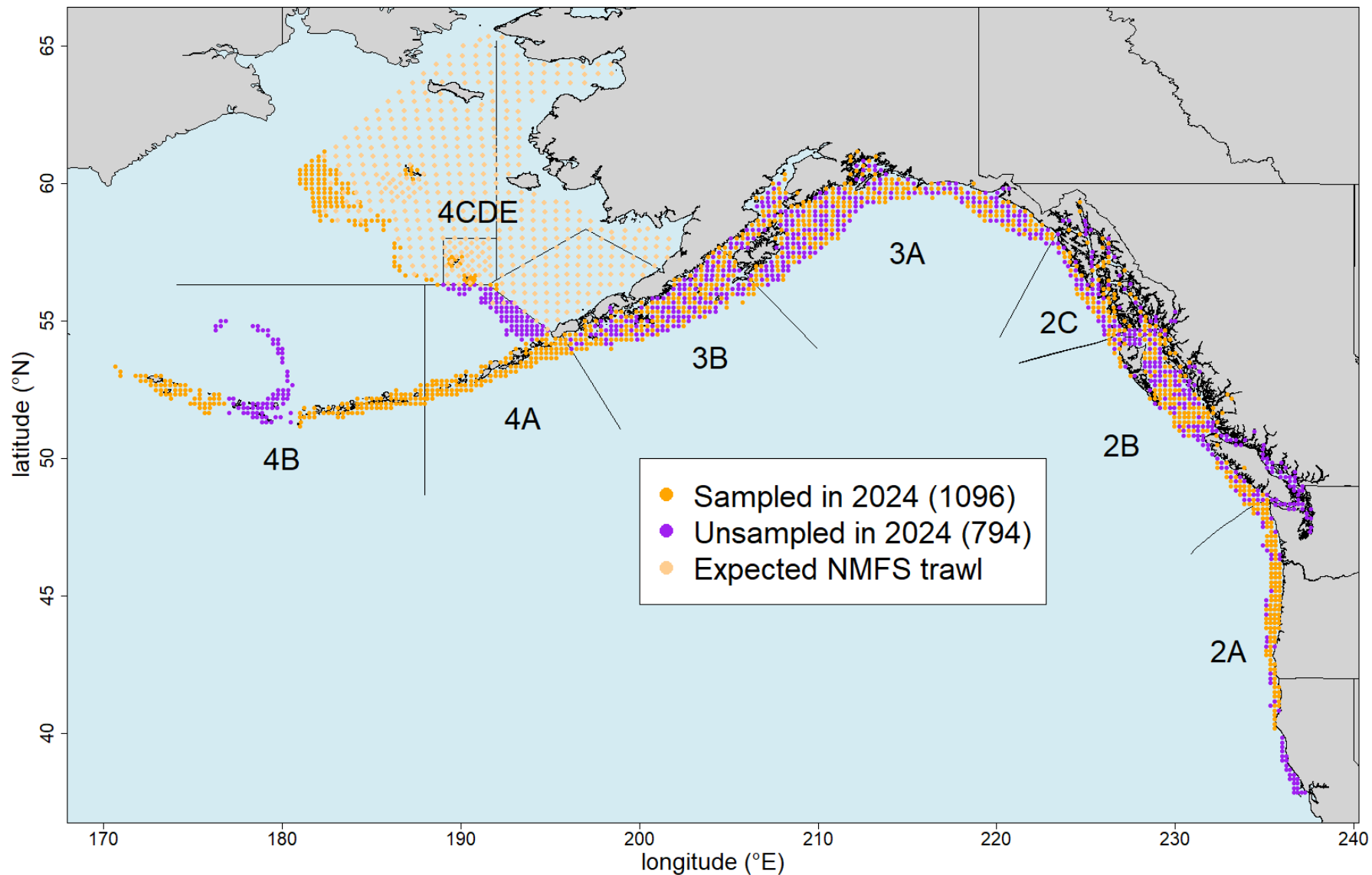
Priority	Objective	Design Layer
Primary	Sample <u>Pacific halibut</u> for stock assessment and stock distribution estimation	Minimum sampling requirements in terms of: <ul style="list-style-type: none"><li>• Station distribution</li><li>• Station count</li><li>• Skates per station</li></ul>
Secondary	Long term <u>revenue neutrality</u>	Logistics and cost: operational feasibility and cost/revenue neutrality
Tertiary	<u>Minimize removals</u> , and <u>assist others where feasible</u> 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



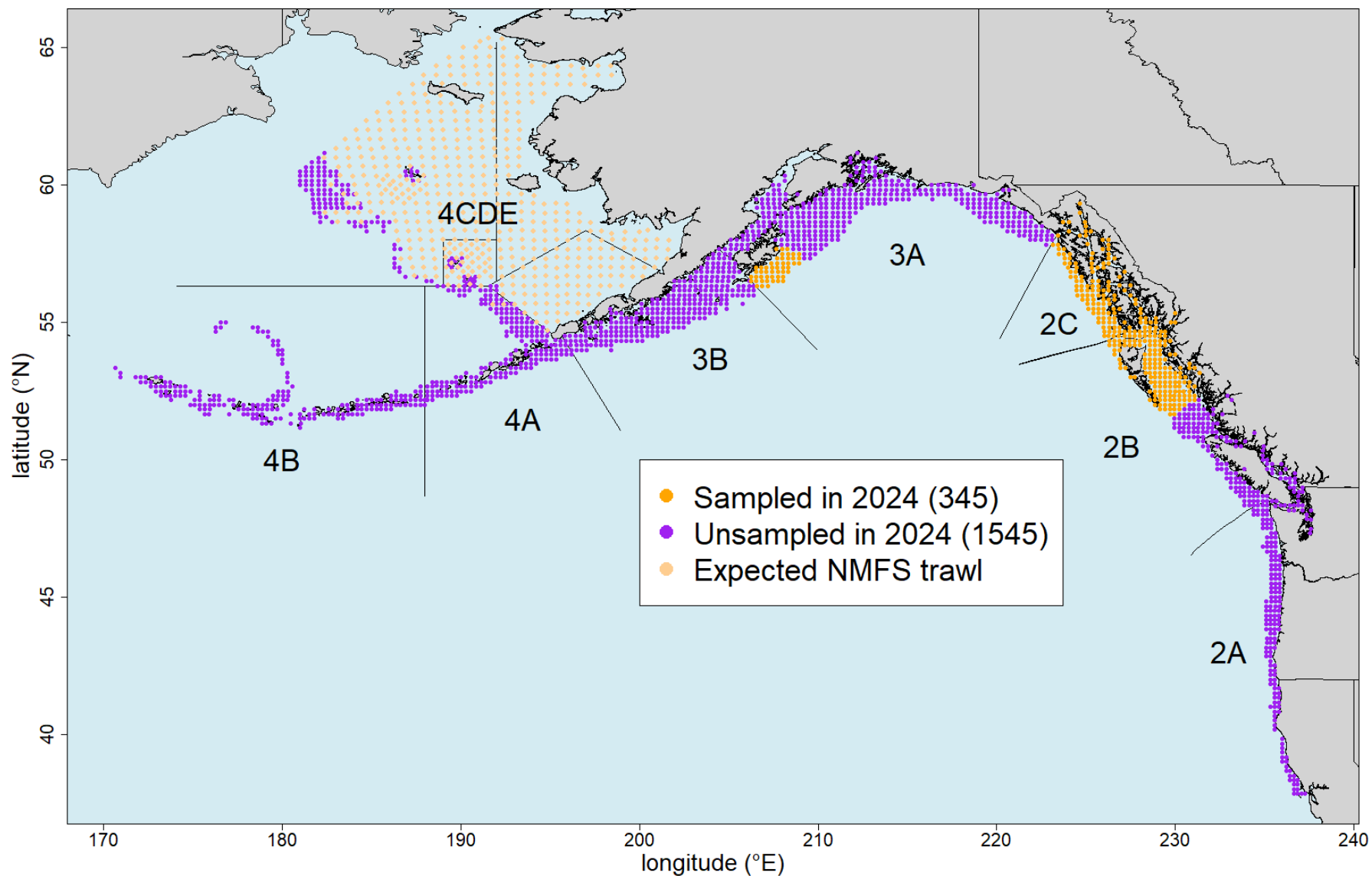
# Annual FISS design review/analysis timeline



# Design 1: Presented to SRB in June (primary objective)



# Design 2: Revenue positive (with added efficiencies)





# Design 2: added efficiencies

Several aspects of the standard FISS procedures were removed to achieve a revenue-positive design:

- No oceanographic monitoring will take place;
- NOAA Fisheries trawl surveys will not be staffed by IPHC;
- All FISS training will be conducted virtually;
- Reduce field staff on each vessel from two to one in two charter regions; only basic biological information (length, weight and sex) would be collected.

# Design 2: added efficiencies

Additional changes were required to the standard FISS design in sampled areas:

- Allow for “vessel captain stations”, in which vessel captains can choose to fish up to one third of their sets at a location that is optimal in terms of catch rates or revenue. It is assumed that these stations will achieve 120% of the average catch rate of the usual fixed-station design stations
- Use less expensive pink salmon baits on 50% of sets

# Add-on options

- IPHC Secretariat also projected costs of additional sampling and monitoring effort should supplementary funding become available.
- These are presented as a series of modular options that can be added to the revenue positive design
  - All modular options were designed to include an entire charter region or comprise at least 60 stations to increase the likelihood of obtaining one or more competitive bids.
- Individual charter regions were added to the revenue neutral design one at a time, selecting the charter region that was closest to net revenue neutrality for each IPHC Regulatory Area.

# Add-on options

- Exceptions:
  - IPHC Regulatory Area 2A, where 60 stations were selected to encompass higher catch-rate areas in both Washington and Oregon
  - IPHC Regulatory Areas 4A/4B, where 60 adjacent stations were clustered around the boundary between these areas.
  - The choice of 60 stations was to provide sufficient work to make the travel required for most vessels to reach 4A/4B worthwhile.
- No charter regions were evaluated for IPHC Regulatory Area 4CDE as the NOAA Fisheries trawl surveys are anticipated to provide a solid baseline of Pacific halibut density information even in the absence of direct FISS sampling.

# Potential add-on options

Option	Design	IPHC Regulatory Areas sampled (charter regions)	Additional net cost
1	Revenue neutral with efficiencies	2B (2), 2C (3), 3A (1)	--
2	Add additional 3A to Option 1	2B (2), 2C (3), 3A (2)	(\$47,000)
3	Add 3B to Option 1	2B (2), 2C (3), 3A (1), <b>3B (1)</b>	(\$62,000)
4	Add 4A/4B to Option 1	2B (2), 2C (3), 3A (1), <b>4A+4B (1)</b>	(\$245,000)
5	Add 2A to Option 1	2B (2), 2C (3), 3A (1), <b>2A (1)</b>	(\$134,000)
6	Add additional 2B to Option 1	2B ( <b>3</b> ), 2C (3), 3A (1)	(\$68,000)
7	Add oceanographic monitoring to Option 1	2B (2), 2C (3), 3A (1)	(\$55,000)
8	Add trawl survey staffing to Option 1	2B (2), 2C (3), 3A (1)	(\$120,000)

# Implications of reduced FISS in 2024

- Estimates from unsampled IPHC Regulatory Areas will have high levels of uncertainty and increasing risk of bias due to the potential for unmonitored changes in abundance and stock distribution
- Uncertainty and bias risk also increase for Biological Regions and coastwide estimates



# Implications of reduced FISS in 2024

- Limited spatial designs such as Design 2 will result in much less information available for the annual stock assessment and management supporting calculations such as stock distribution.
- The increased uncertainty in the index of abundance is likely to cause the assessment model to rely much more heavily on the commercial fishery catch-per-unit-effort index.
- Given current variability and uncertainty in the magnitude of younger year classes (2012 and younger), missing biological information in the core of the stock distribution (Biological Region 3) makes it unlikely that the stock assessment will detect a major change in year class abundance, either up or down.
- Although the basic stock assessment methods can remain unchanged, a much greater portion of the actual uncertainty in stock trend and demographics will not be able to be quantified due to missing FISS data from such a large fraction of the Pacific halibut stock's geographic range.

# Recommendations

- That the Commission:
- 1) **NOTE** paper IPHC-2023-IM099-13 Rev\_1, (Part 1) that presents potential FISS design options for 2024-26 and preliminary cost evaluations of 2024 potential designs;
- 2) **ENDORSE** proceeding with the revenue neutral design for 2024 proposed here, in order to cover all fixed headquarters costs, and to provide data for basic trend estimation and biological data for use in the 2024 stock assessment. Specifically, the Secretariat recommends fishing two charter regions in IPHC Regulatory Area 2B, three regions in IPHC Regulatory Area 2C and one region in IPHC Regulatory Area 3A (Option 1, Table 1.2; Figure 1.5), with added efficiencies as described above.

# Recommendations

- In addition, a minimum of two extensions are also recommended, dependent on the Commission's weighting of the corresponding objectives:
- 1) Further prioritizing the collection of biological data representing all four biological regions and reducing the potential for bias in trend estimates: Add modular options 4 and 3, which would provide minimal sampling in 4A/4B and in 3B (supplementing the single charter region included for 3A). This extension would require supplemental funding of US\$307,000.
- 2) Further prioritizing reliable estimates of stock distribution for all IPHC Regulatory Areas, as well as biological data: Add modular options 2-5, which would allow for directly informed estimates of trend, demographics and stock distribution for all IPHC Regulatory Areas in 2024. This extension would require supplemental funding of US\$488,000.

## Part 2: Evaluation of block-based designs for 2024-28

# Block designs

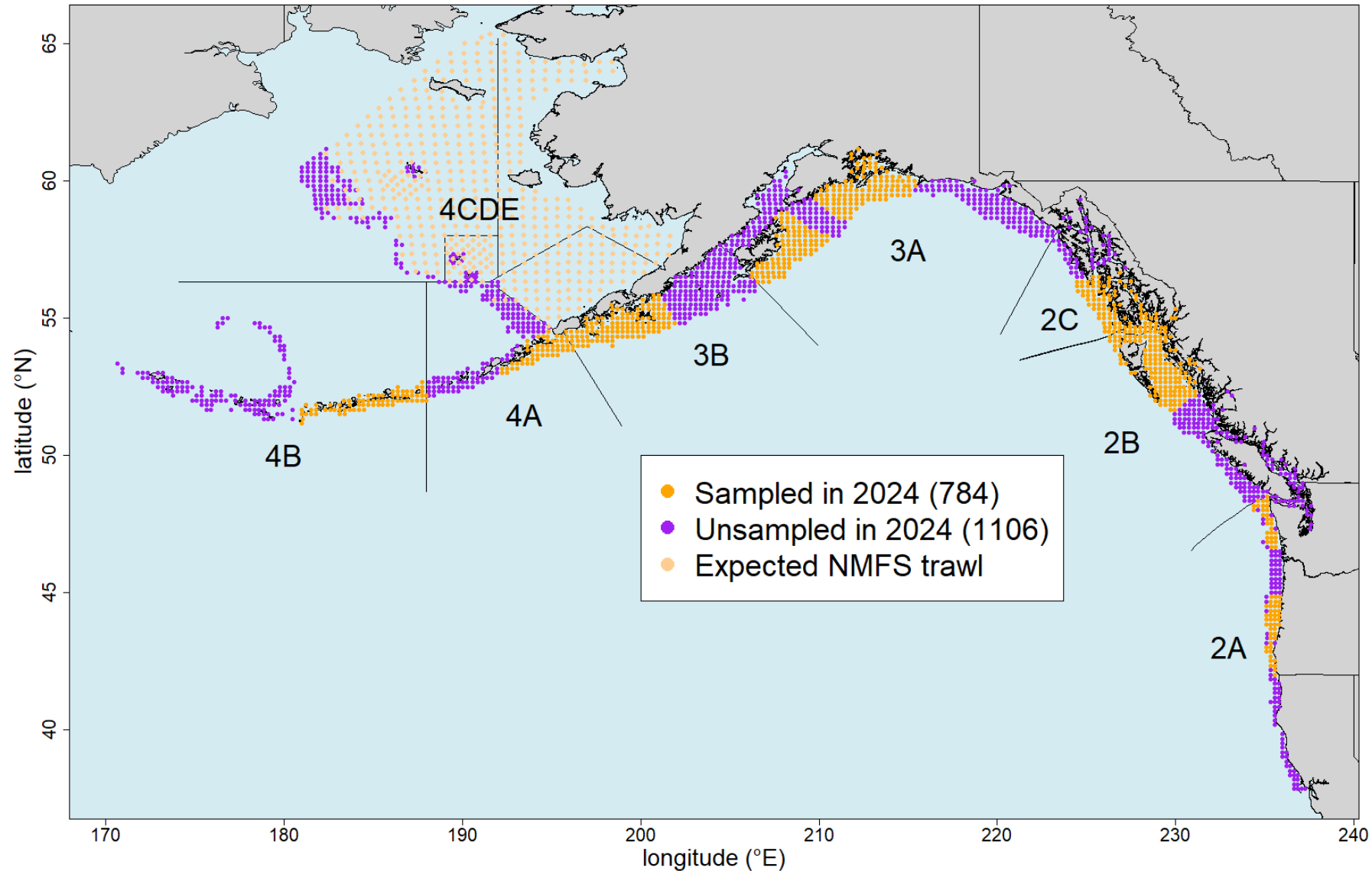
- In recent years, the FISS has fished a random selection of stations in the core IPHC Regulatory Areas (2B, 2C, 3A and 3B).
- This method for station selection was chosen in 2019 over a proposal to instead fish a selection of charter regions as blocks of stations.
- In September 2023, Commissioners directed IPHC Secretariat staff to evaluate potential block designs for future FISS sampling
  - Reduced running time between stations in a block design leads to greater operational efficiency, an important consideration in bringing these designs forward.

# Block designs

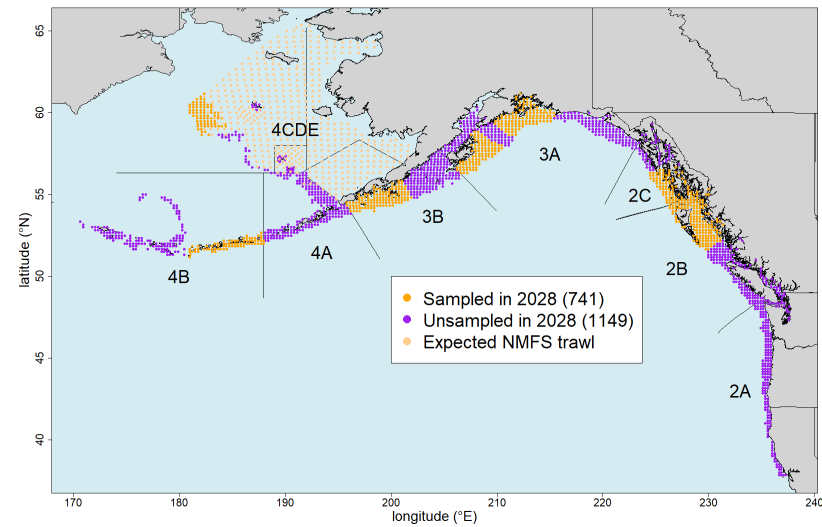
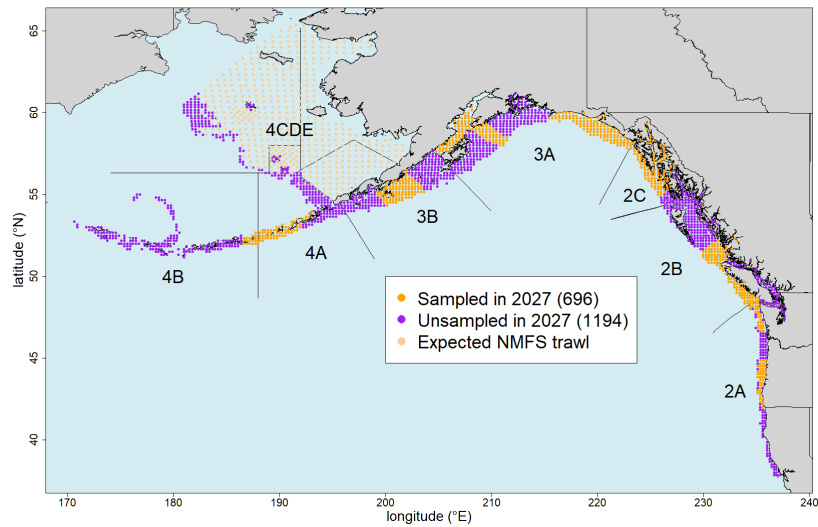
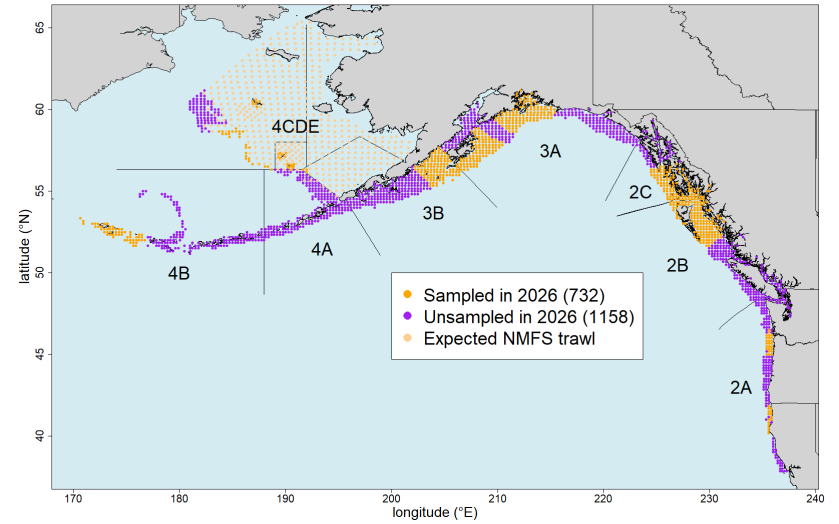
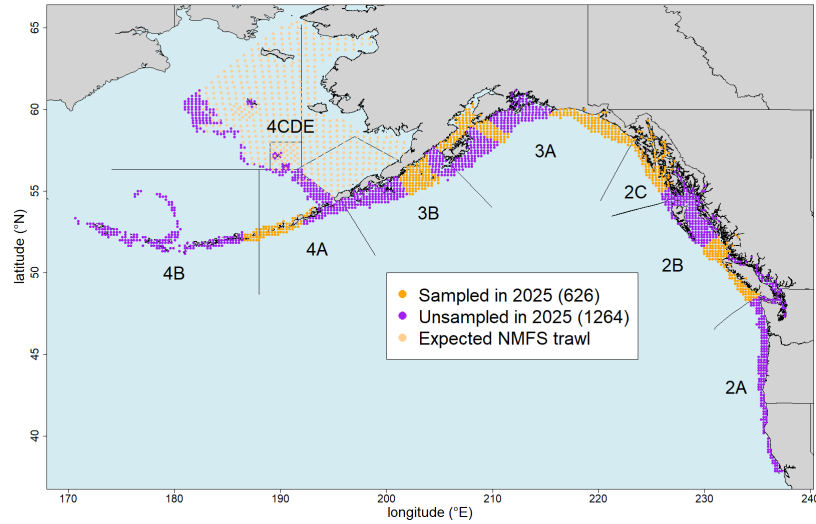
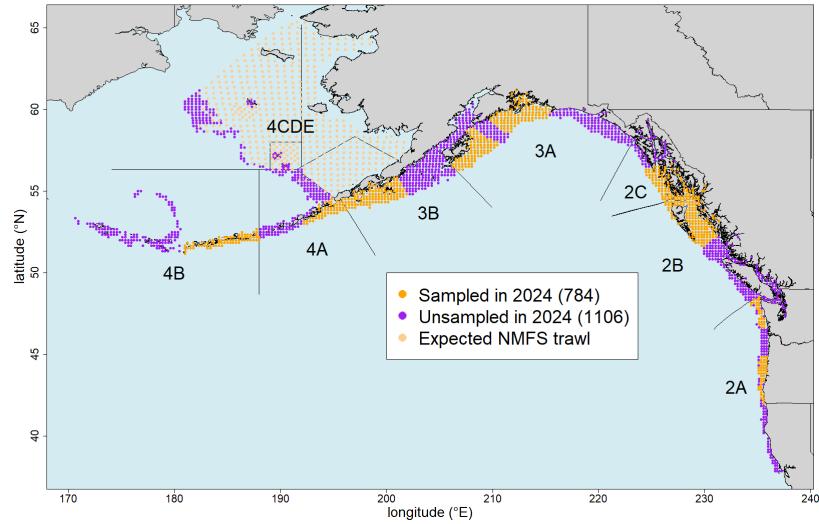
- Three block designs for 2024-28 were evaluated:
  - **Base block design**, in which all charter regions in the core are sampled over a two to three-year period
  - **Reduced block design**, in which all charter regions in the core are sampled over a four to five-year period
  - **Alternating year design**, in which the base block design is fish in alternate years, with years of no sampling between sampling years
- For both the base and reduced block designs, we prioritized some annual sampling in each Biological Region for stock assessment purposes.
- All designs rotate the selection of blocks for sampling.



# Block designs: base block design 2024

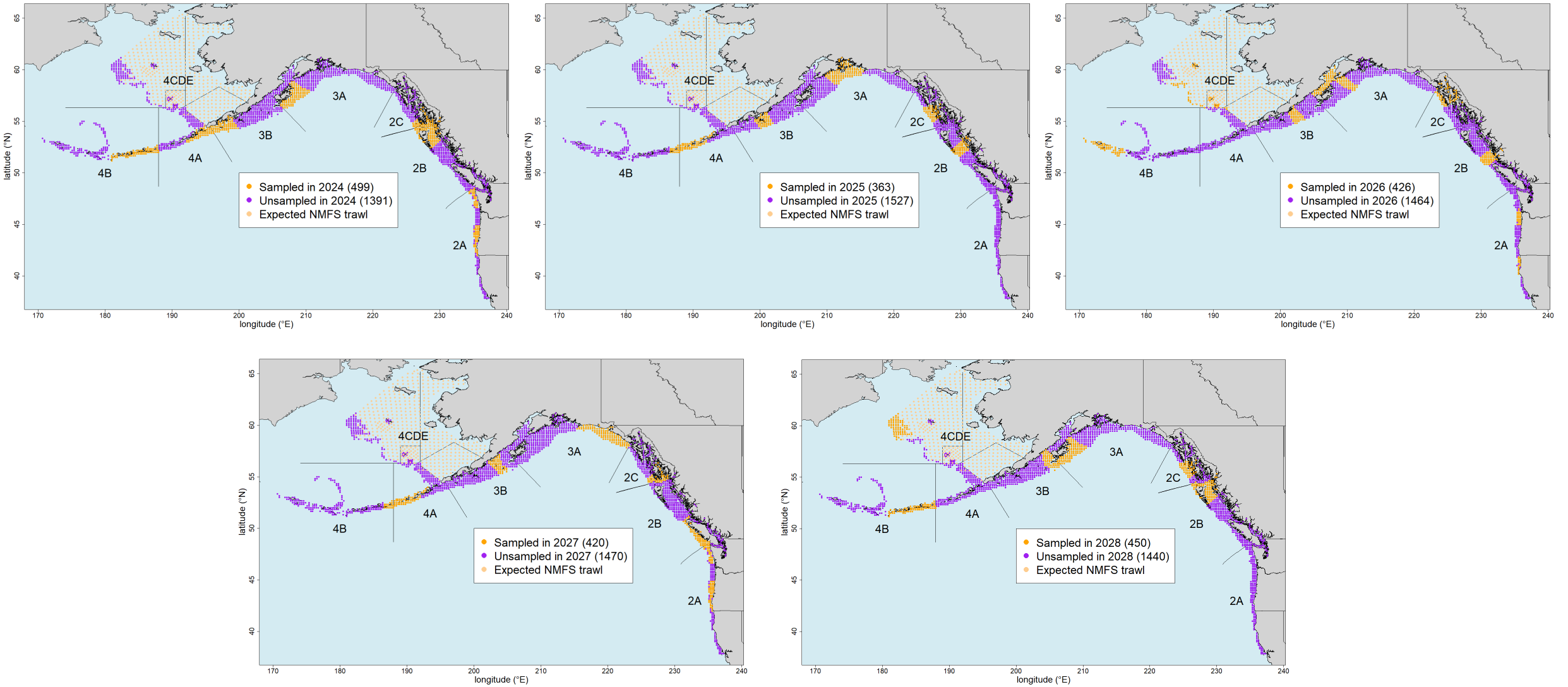


# Base block designs 2024-28



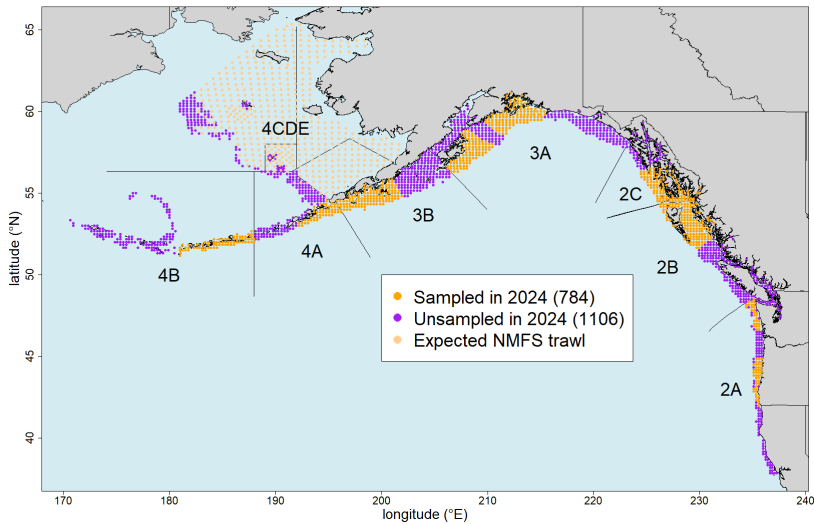
IPHC Regulatory Area	2019-23 CV (%)		Projected CV (%)		
	Range	Median	Base block design 2026	Reduced	Alternating
2A	13-22	18	19		
2B	6-7	6	7		
2C	4-6	5	6		
3A	4-8	4	7		
3B	7-14	8	16		
4A	14-20	18	18		
4B	16-26	19	16		
4CDE	10-12	10	10		

# Reduced block designs 2024-28

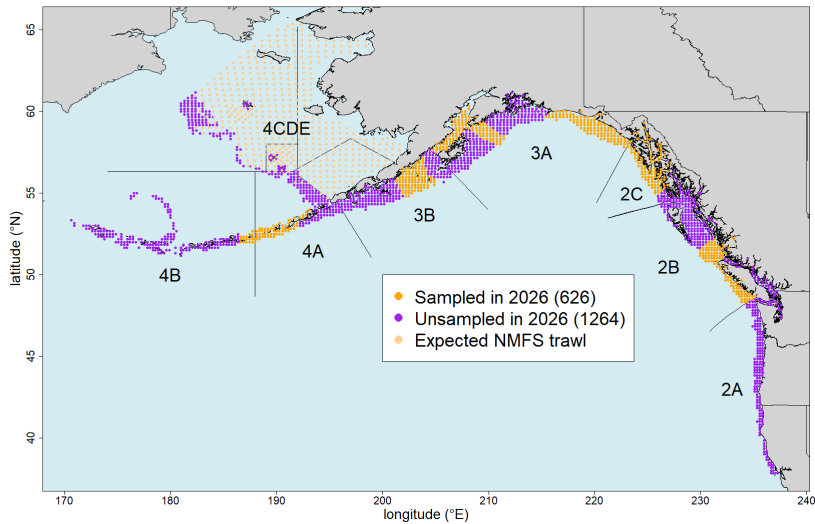


IPHC Regulatory Area	2019-23 CV (%)		Projected CV (%)		
	Range	Median	Base block design 2026	Reduced block design 2026	Alternating
2A	13-22	18	19	19	
2B	6-7	6	7	14	
2C	4-6	5	6	10	
3A	4-8	4	7	11	
3B	7-14	8	16	15	
4A	14-20	18	18	19	
4B	16-26	19	16	17	
4CDE	10-12	10	10	10	

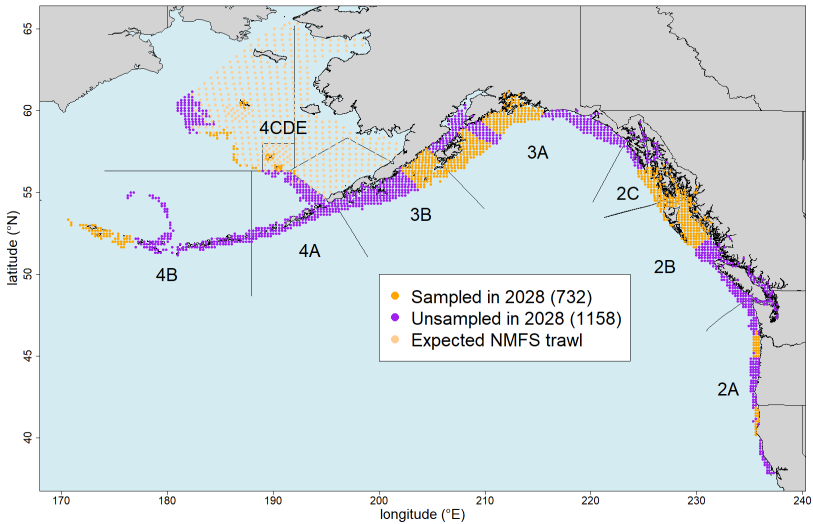
# Alternating year designs 2024-28



2025: No FISS sampling



2027: No FISS sampling





IPHC Regulatory Area	2019-23 CV (%)		Projected CV (%)		
	Range	Median	Base block design 2026	Reduced block design 2026	Alternating year design 2027
2A	13-22	18	19	19	31
2B	6-7	6	7	14	19
2C	4-6	5	6	10	16
3A	4-8	4	7	11	18
3B	7-14	8	16	15	21
4A	14-20	18	18	19	21
4B	16-26	19	16	17	26
4CDE	10-12	10	10	10	10

# CVs for Biological Regions, Coastwide

- For the **base block design**, 2026 CVs for mean O32 WPUE are projected to be 5-9% for Biological Regions 2-4, with a 5% CV for the coastwide mean.
- For the **reduced block design**, 2026 CVs for mean O32 WPUE are projected to be 8-10% for Biological Regions 2-4, with a 5% CV for the coastwide mean.
- For the **alternating year design**, 2027 CVs for mean O32 WPUE are projected to be 10-14% for Biological Regions 2-4, with an 8% CV for the coastwide mean.

# Comments on block designs

- The **base block designs** provides high spatial coverage over a two to three-year period, resulting in high precision and low bias for estimates obtained from the data (e.g. stock trends & distribution).
- **Reduced block designs** have poorer annual coverage and therefore greater bias risk and reduced precision.
- In unsampled years, the **alternating year designs** provide the least reliable estimates, with no information on stock changes from the previous year and no biological data for the annual stock assessment. Bias risk is greatest and precision poorest of the three block designs.
- In both reduced block and alternating year designs, reduced spatial coverage of the FISS makes it more difficult for the assessment to detect a major change in year class abundance, either up or down.

# Comparison with other survey CVs

- The 'global average' research survey CVs has been estimated to be approximately ~20%
- However, this includes estimated observation and process error and so is larger than the survey-only observation CVs projected in this report (Francis et al. 2003).
- In NOAA Fisheries trawl survey results in the Bering Sea (roughly analogous to one Biological Region for Pacific halibut), commercially important species showed a range of average annual model-based CVs over 1982-2019 (DeFilippo et al. 2023), including:
  - Pacific cod 5%
  - Walleye pollock 7%
  - Northern rock sole 6%
  - Yellowfin sole 5%
- These values are comparable to the projected 5-9% CVs for IPHC Biological Regions for the base block design (with the exception of Biological Region 4B), but lower than corresponding values for the reduced block and alternating year designs.

# Discussion

- The IPHC Secretariat staff recommends using block designs for all future planning as a viable alternative to the randomised sampling currently in use in the core of stock. Block designs will increase efficiency by reducing vessel travel time among stations.
- Sampling effort should not be lower than the levels presented in the base block design above.
- We note the need for a base level of funding to ensure a minimally adequate scientific design and therefore do not recommend alternating year surveys, instead deploying at a minimum the revenue-neutral design to cover fixed costs and maintain staff.
  - There may be additional data quality costs to an alternating year design due to higher anticipated turnover of staff and therefore reduced availability of highly experienced staff capable of training new samplers in the field.

# RECOMMENDATIONS

That the Commission:

- 1) **NOTE** paper IPHC-2023-IM099-13 Rev\_1, (Part 2) that presents evaluation and discussion of potential block designs for the FISS;
- 2) **ENDORSE** the use of the base block design (Figures 2.1 to 2.5) or a block design with similar sampling effort as an alternative to FISS designs based on random sampling in the core of the stock;
- 3) **ENDORSE** maintaining sufficient FISS sampling to ensure a maximum annual CV of 25% in each IPHC Regulatory Area, decreasing to 15% as financial considerations allow, and including FISS biological sampling in all Biological Regions each year;
- 4) **NOTE** that stock assessment and MSE simulation analyses will be conducted in 2024 to further explore the effect on annual tactical and strategic decision-making of reduced FISS designs in the future. The Secretariat also requests clarification on whether the Commission has interest in supporting FISS designs that would provide IPHC Regulatory Area CVs comparable to the historical target ( $\leq 15\%$ ) to inform potential management procedures that rely on annual stock distribution estimates.



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