2024-26 FISS design evaluation

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PURPOSE

To present the Research Advisory Board with potential design options for the IPHC's Fishery-Independent Setline Survey (FISS) for the 2024-26.

BACKGROUND

The IPHC's Fishery-Independent Setline Survey (FISS) provides data used to compute indices of Pacific halibut density for use in monitoring stock trends, estimating stock distribution, and as an important input in the stock assessment. Stock distribution estimates are based on the annual mean weight per unit effort (WPUE) for each IPHC Regulatory Area, computed as the average of WPUE of all Pacific halibut and for O32 (greater than or equal to 32" or 81.3cm in length) Pacific halibut estimated at each station in an area. Mean numbers per unit effort (NPUE) is used to index the trend in Pacific halibut density for use in the stock assessment models. Annual FISS designs are developed by sampling a subset of stations from the full 1890-station FISS footprint (Figure 1).

FISS DESIGN OBJECTIVES

Primary objective: *To sample Pacific halibut for stock assessment and stock distribution estimation.*

The primary purpose of the annual FISS is to sample Pacific halibut to provide data for the stock assessment (abundance indices, biological data) and estimates of stock distribution for use in the IPHC's management procedure. The priority of the current rationalized FISS is therefore to maintain or enhance data quality (precision and bias) by establishing baseline sampling requirements in terms of station count, station distribution and skates per station.

Secondary objective: *Long-term revenue neutrality.*

The FISS is intended to have long-term revenue neutrality, and therefore any implemented design must consider both logistical and cost considerations.

Tertiary objective: *Minimize removals and assist others where feasible on a cost-recovery basis.*

Consideration is also given to the total expected FISS removals (impact on the stock), data collection assistance for other agencies, and IPHC policies.

Table 1 Prioritization of FISS objectives and corresponding 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

POTENTIAL DESIGNS FOR 2024-26

The IPHC Secretariat began the design process in early 2023 with the development of design options based on the Primary Objective (Table 1) for 2024 (Figure 2) and 2025-26 (see IPHC-2023-SRB022-06). These designs were presented to the Scientific Review Board (SRB) at their SRB022 in June 2023.

During the operation of the 2023 FISS, it became apparent that low prices for Pacific halibut and lower than expected catches in some charter regions were likely to result in a substantial net operating loss for the FISS in 2023. Preliminary estimates of net revenue for the 2024 design in Figure 2 projected a net operating loss of over $3 million. Optimizing the design for revenue by adding stations in revenue-positive charter regions and adjusting the number of skates still led to a projected loss of almost $3 million. For this reason, neither version of the design was considered feasible (IPHC-2023-SRB023-06).

Projected revenue-positive design for 2024

The IPHC Secretariat developed a series of designs that improved revenue and reduced cost to different degrees and presented these to the SRB (IPHC-2023-SRB023-06) and at the September Commissioner Work Meeting (WM2023). Included in these potential designs was a design that was projected to be slightly revenue positive. An updated version of this design includes sampling only in IPHC Regulatory Areas 2B, 2C and one charter region in IPHC Regulatory 3A (Figure 3).

In order to achieve a revenue-positive design, several aspects of the standard FISS procedures were removed:

- No oceanographic monitoring will take place;
- NOAA Fisheries trawl surveys are not 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.

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 pending further evaluation these stations will achieve 120% of the average catch rate of the usual fixed-station design stations

Further, the following assumptions regarding FISS bait were made:

- That the price of chum salmon is projected to be US$2.00/lb in 2024 and pink salmon US$1.30/lb.

With these modifications and assumptions, this design (Figure 3) has **a projected net operating profit of $3,000**.

Base HQ Secretariat costs (incurred even if no survey is conducted) are projected to be US$490,000 for 2024. These costs are fully offset, along with all variable costs, in the revised revenue-positive design (Table 2 and Figure 3).

Modular add-ons to revenue-positive design

Due to concerns about the implications of the reduced sampling in the revenue-positive design, IPHC Secretariat staff 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 (Table 2, options 2-6) 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.

Table 2. Comparison of design alternative costs for the 2024 FISS; see text for additional details on each design. Each of options 2-8 can be added in any combination by summing the additional costs for each option selected.

Option	Design	IPHC Regulatory Areas sampled (charter regions)	Additional net cost
1	Revenue-positive 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), **3B (1)**	($62,000)
4	Add 4A/4B to Option 1	2B (2), 2C (3), 3A (1), **4A+4B (1)**	($245,000)
5	Add 2A to Option 1	2B (2), 2C (3), 3A (1), **2A (1)**	($134,000)
6	Add additional 2B to Option 1	2B (**3**), 2C (3), 3A (1)	($68,000)
7	Add oceanographic monitoring to Option 1	2B (2), 2C (3), 3A (1)	($55,000)[1]
8	Add trawl survey staffing to Option 1	2B (2), 2C (3), 3A (1)	($120,000)

[1] The estimated expense for adding oceanographic monitoring would scale according to the number of regions included in the design. It is projected that with each additional region, expenses would increase by approximately $10,000.

Individual charter regions were added to the revenue-positive design one at a time, selecting the charter region that was closest to net revenue neutrality for each IPHC Regulatory Area (Table 2). The exceptions to this were in IPHC Regulatory Area 2A, where 60 stations were selected to encompass higher catch-rate areas in both Washington and Oregon, and in IPHC Regulatory Areas 4A/4B where 60 adjacent stations were clustered around the boundary between these areas. The choice of 60 stations was motivated by the lack of bids for the 32 stations proposed in 2023 and intended 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.

The net cost projected for each of these additional charter regions ranged from $47,000 for IPHC Regulatory Area 3A (Shelikof), to $245,000 for the 60 stations IPHC Regulatory Areas 4A/4B.

Staffing of the NOAA Fisheries trawl survey allows for much more extensive biological sampling (age, length, and weight) of Pacific halibut than is possible otherwise, and also provides a platform for wire-tagging of juvenile halibut in this area to provide long-term monitoring of migratory pathways. These data are used in the annual stock assessment to inform weight-at-age for young Pacific halibut (up to approximately age 6) that are not captured in large numbers by the FISS. As there is not considerable variability in weight-at-age, missing a year of this sampling (as was the case when the NOAA Fisheries trawl survey was cancelled in 2020) would not be a critical problem for subsequent analyses.

Oceanographic monitoring during FISS operations provides a valuable long-term monitoring data set that is used by both IPHC and external fisheries scientists. In some years (e.g., 2017) it has provided valuable supporting information for better interpreting anomalous catch-rates due to hypoxic events (observed periodically, primarily off the coasts of Oregon and Washington).

Missing a single year of this time series, although unfortunate for long-term monitoring, would not be problematic for standard stock assessment and management supporting analyses provided for the Commission unless unexpected oceanographic conditions were encountered.

Block designs for 2024-26

Commissioners directed IPHC Secretariat staff to examine block-designs as an alternative to the random station selection used in current designs in the core areas of the stock (2B, 2C, 3A and 3B). The expectation is that such designs may be more efficient as the footprint covered by sampled stations is more compact and therefore overall vessel running time is reduced. A disadvantage is that FISS coverage is less spatially comprehensive as gaps are created when some blocks are unsampled.

As a starting point for evaluation and discussion, Secretariat staff prepared the rotational block designs shown in Figures 4-6 for 2024-26. Designs include some annual sampling in each IPHC Biological Region as it is considered important to provide data from each Region for the IPHC stock assessment. IPHC FISS charter regions form the blocks of stations in core areas, while subareas currently in use elsewhere are generally maintained.

The unsampled charter regions are rotated within each IPHC Regulatory Area over a 2-3 year period, ensuring comprehensive sampling in the core of the stock over that time frame. As a result, the precision of time series and stock distribution estimates is projected to be only slightly poorer than that resulting from recent years' FISS designs. Bias should also remain low given the high spatial coverage over a relatively short period of time.

While increases in the annual proportion of unsampled blocks above that shown in Figures 4-6 may maintain acceptable levels of precision in estimates, there will be a decrease in the representativeness of data used to estimate stock trends and as input into the assessment (including biological data). This will potentially lead to increased bias in estimates and make it more difficult for the assessment to detect a major change in year class abundance, either up or down.

RECOMMENDATION

That the Research Advisory Board:

1) **NOTE** paper IPHC-2023-RAB024-08 that presents potential FISS designs for 2024-26.

REFERENCES

Webster, R. A. (2023) 2023-26 FISS design evaluation. IPHC-2023-SRB022-06. 22 p.

Webster, R., Stewart, I., Ualesi, K. and Wilson, D. (2023) 2023-26 FISS design evaluation. IPHC-2023-SRB023-09. 24 p.

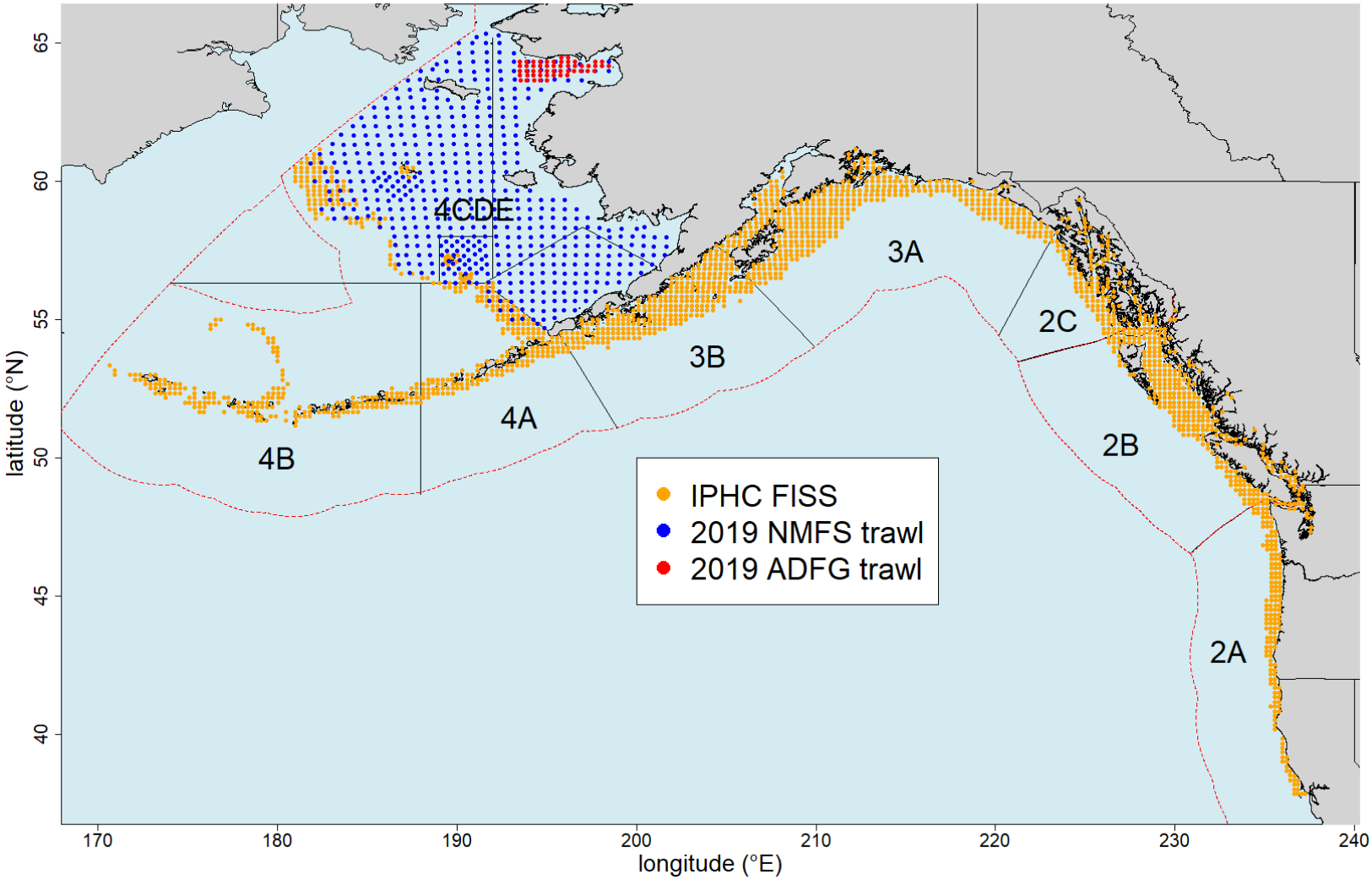

Figure 1. Map of the full 1890 station FISS design, with orange circles representing stations available for inclusion in annual sampling designs, and other colours representing trawl stations from 2019 NMFS and ADFG surveys used to provide complementary data for Bering Sea modelling.

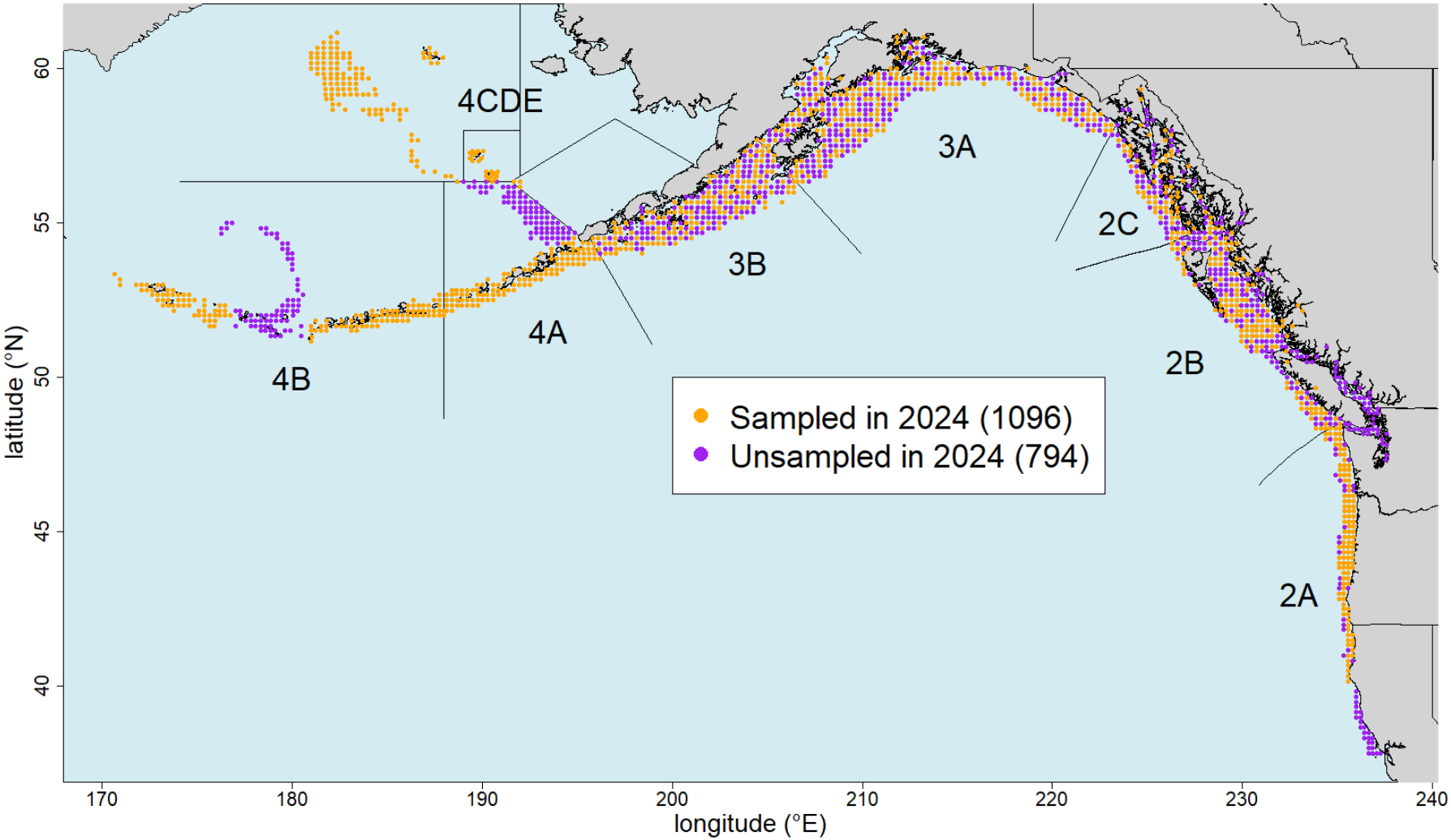

Figure 2. Potential FISS design in 2024 (orange circles) based on prioritization of the Primary Objective in Table 1. The design relies on randomized sampling in 2B-3B, and a subarea design elsewhere. Purple circles are optional for meeting data quality criteria.

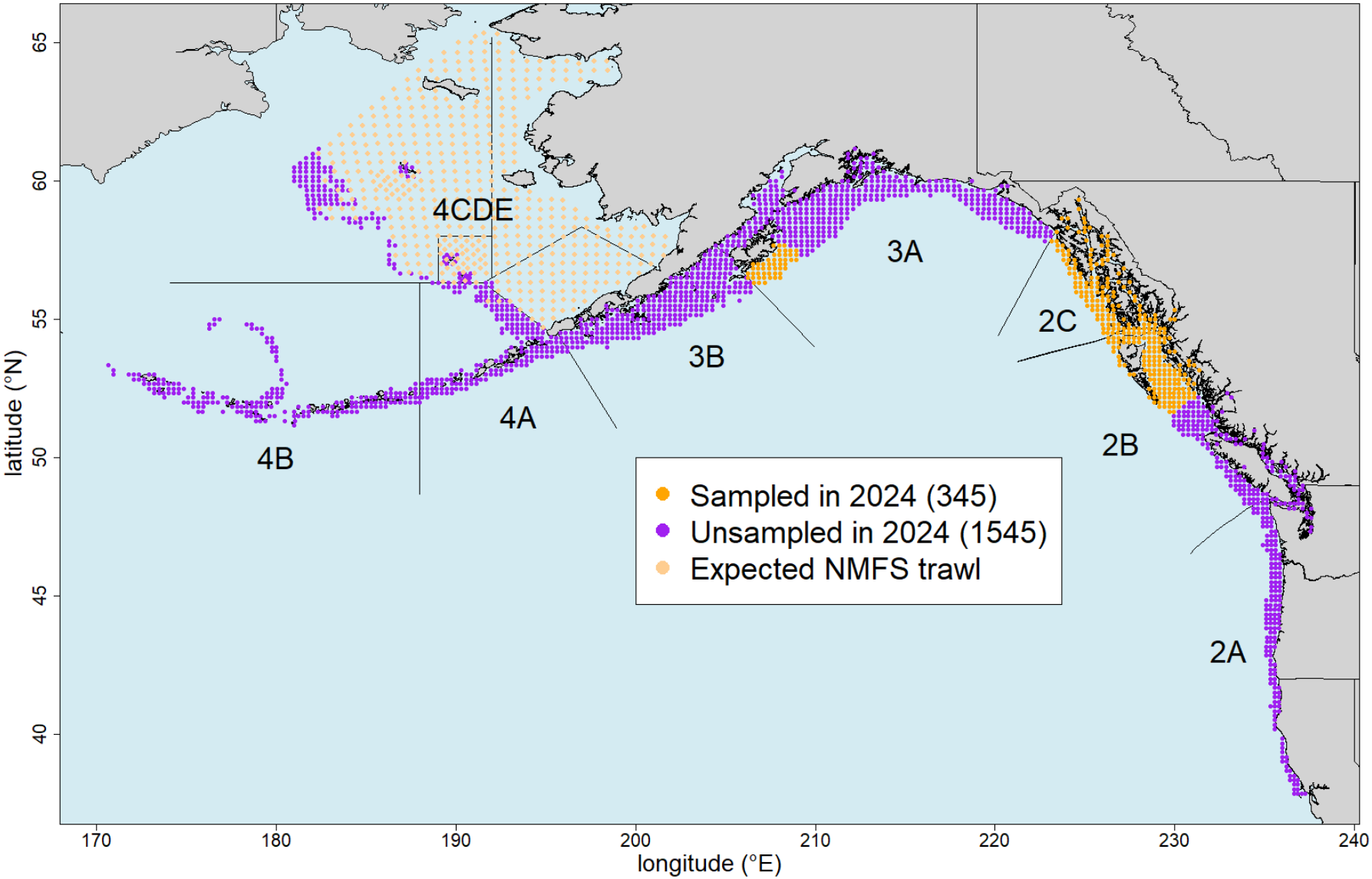

Figure 3. Preliminary FISS design in 2024 (orange circles) based on prioritization of the Secondary Objective in Table 1. See text for more information.

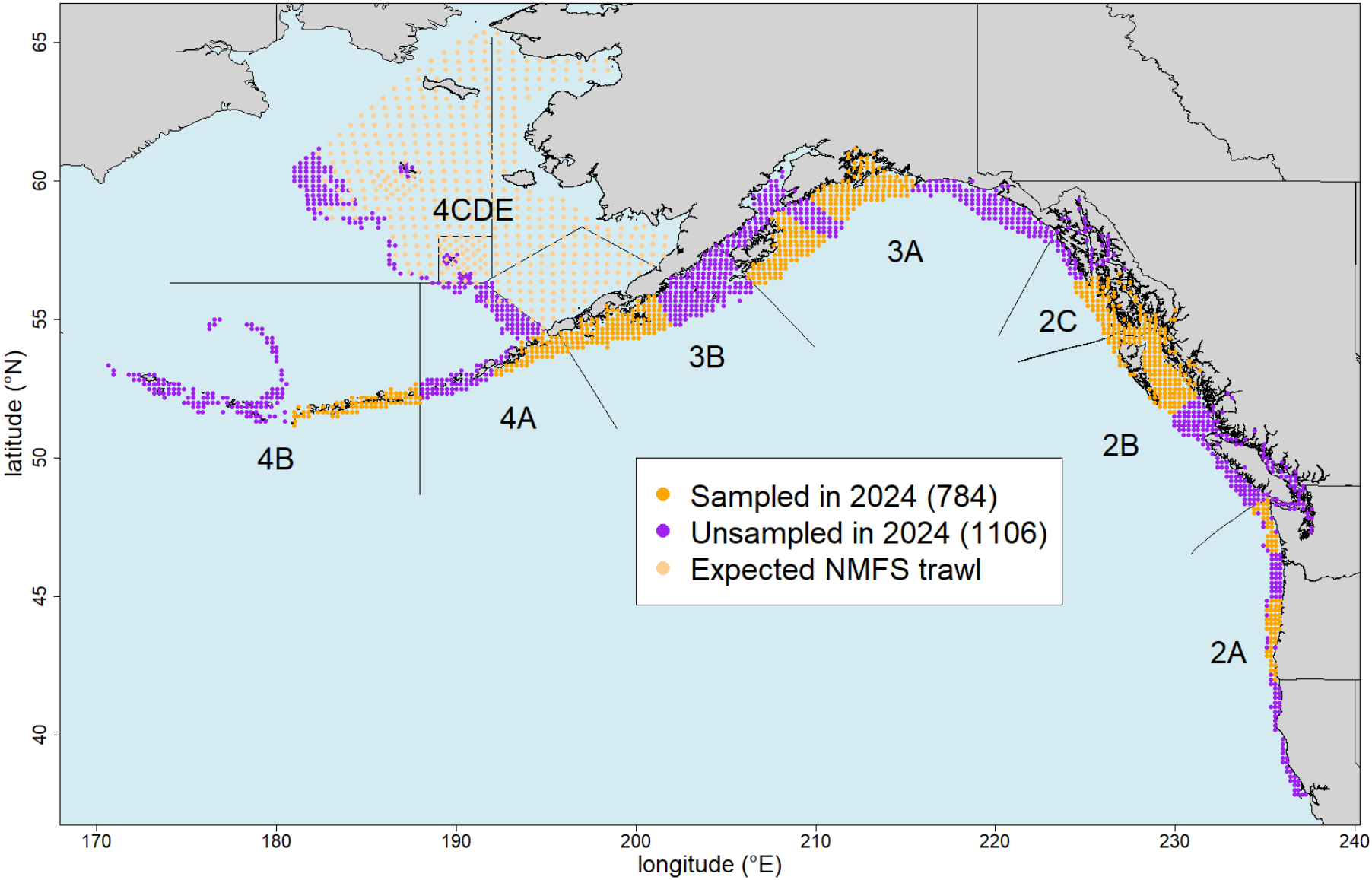

Figure 4. Potential block design in 2024 (orange circles). Design is based on fishing complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

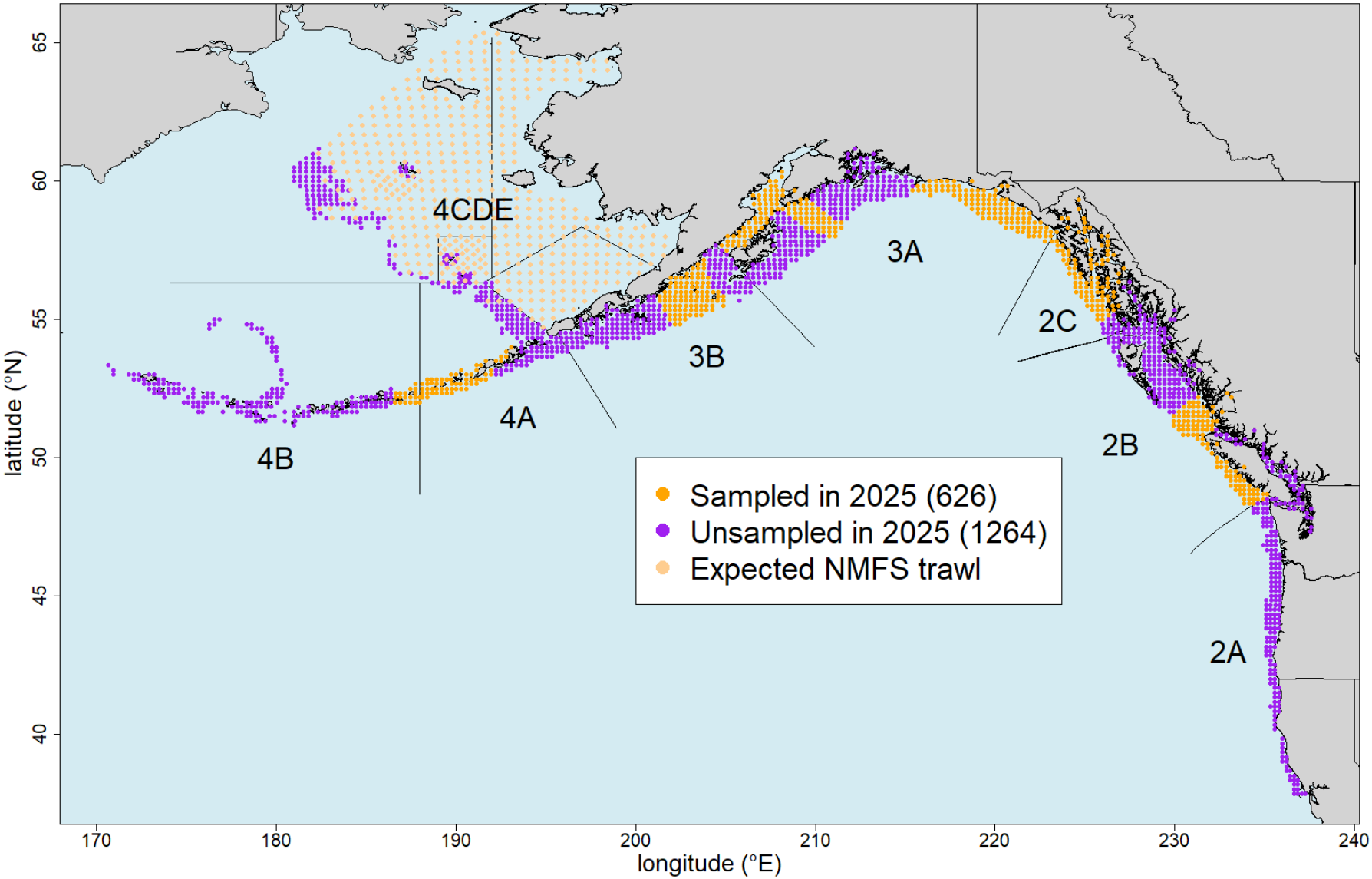

Figure 5. Potential block design in 2025 (orange circles). Design is based on fishing complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

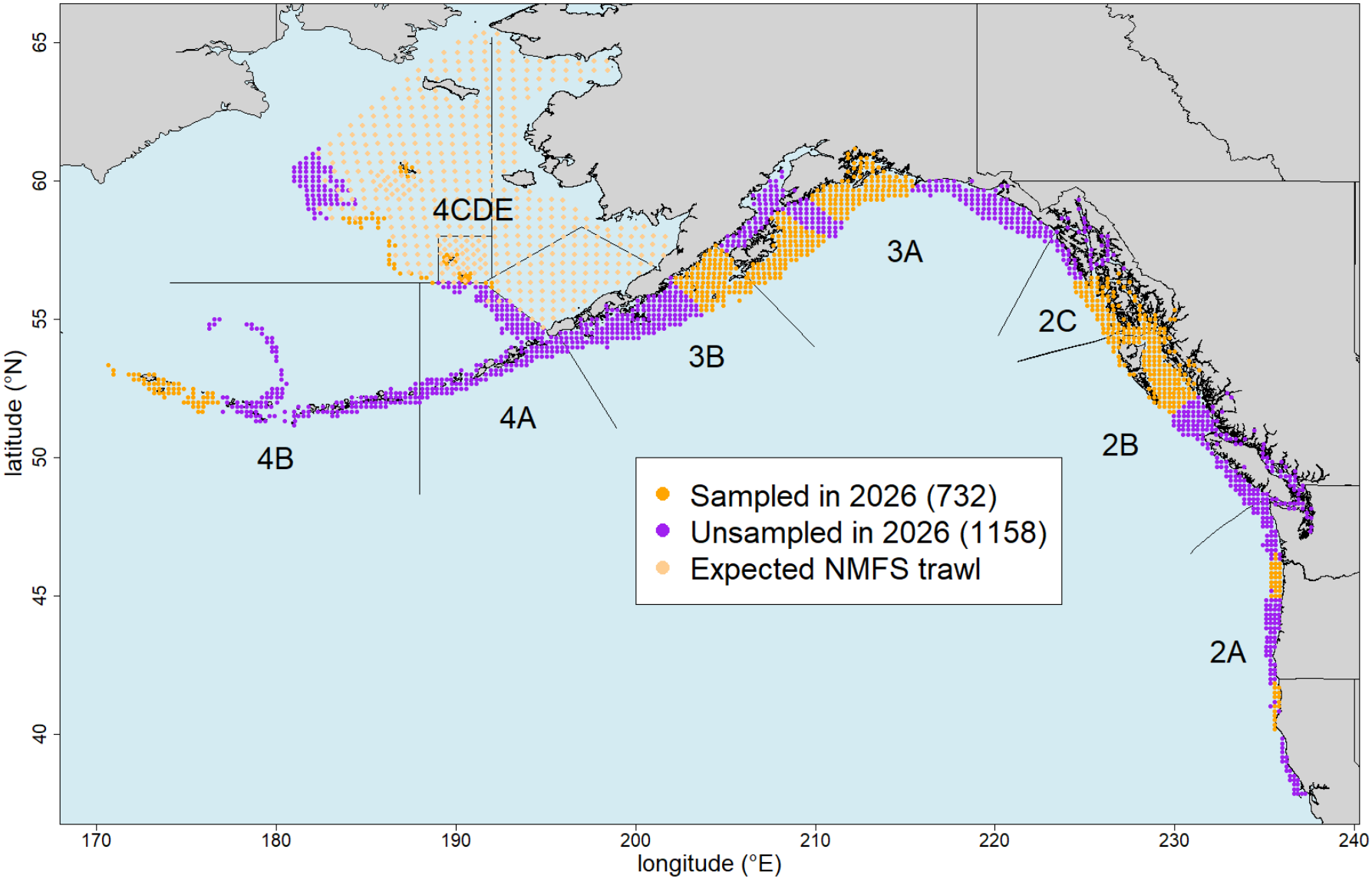

Figure 6. Potential block design in 2026 (orange circles). Design is based on fishing complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.