2027-31 FISS designs

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Outcome sought: *DISCUSS the 2027–31 design options and the 2027 modular add-ons; APPROVE a FISS design for 2027.*

PURPOSE

To present the Commission with proposed FISS designs for 2027-31, including a cost evaluation of the 2027 **Base Block design** and the **Supplemented Base Block design**. The latter includes Commissioner-selected modular add-ons funded by voluntary supplementary funding of US$749,000 by the US government. This document also provides an update on the balance within Fund 45 – FISS Reserve and the associated request to Contracting Parties.

The modular add-ons included in the Supplemented Base Block design have the following aims:

1) 'Catch up' on FISS regions that were part of the 2026 **Base Block design** but were not fished;
2) Reduce the heterogeneity in net revenue among future years by sampling in 2027 some of the more costly regions planned in future years
3) Fully clear the 'backlog' of uncertainty created by the reduced designs implemented in 2023-2026 to provide the most informative data in 2027 for the stock assessment and management decisions.

Other potential add-ons are also discussed that:

1) Reduce the projected net loss of the FISS in 2027;
2) Set the FISS station charter rate at a higher value to increase the chance of receiving bids for challenging charter regions (i.e. Adak in IPHC Regulatory Area 4B).
3) Further reduce heterogeneity in net revenue among future years.

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 81.3 cm in length) Pacific halibut estimated for all stations 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 selecting a subset of stations for sampling from the full 1,890-station FISS footprint (Figure 1).

The IPHC completed the FISS expansion series in 2019, sampling for the first time (over the 2011-2019 period) the full design grid of 1,890 stations. The cost of the FISS expansion resulted in the FISS reserve fund becoming fully expended.

In recent years, declining FISS catch rates, variability in vessel costs, fish sales price, and bait costs, along with a more complete accounting of FISS expenses, have all contributed to the difficulty of designing an annual FISS with optimal spatial coverage while maintaining cost effectiveness. This has led to the Commission's approval of FISS designs with reduced spatial footprints compared to optimal designs. A summary of FISS history and recent FISS designs is available in Appendix A. The most recent year of sampling for each station (not including 2026) is shown in Figure 2.

At AM100 (IPHC-2024-AM100-R, para. 72), AM101 (IPHC-2025-AM101-R, para. 67) and AM102 (IPHC-2026-AM102-R, para. 72) the Commission noted that "*the use of the Base Block Design will be the focus of future planning and annual FISS proposals from the Secretariat*". The **Base Block design** is considered the optimal long-term FISS design in terms of balancing scientific needs and cost-effectiveness (Appendix B). This design implements sampling of complete FISS charter regions (subsets of stations generally sampled by a single vessel via multiple trips), with sampled charter regions in the core of the stock (IPHC Regulatory Areas 2B, 2C, 3A and 3B) rotated over two or three years depending on IPHC Regulatory Area, and most others within a five-year period. In other IPHC Regulatory Areas, coverage is prioritised based on minimising the potential for bias and maintaining the coefficients of variation (CV, a relative measure of precision) of the O32 index of abundance below 25% for each IPHC Regulatory Area. The **Base Block design** includes some sampling in all IPHC Biological Regions (Figure 3) in each year, ensuring that trend and biological data from across the spatial range of Pacific halibut are available to the stock assessment and for stock distribution estimation. The **Base Block design** allows for a smaller annual FISS footprint relative to the historical design (pre-2011) while maintaining a similar level of precision and providing an unbiased estimate of relative density (over a 2-3 year period).

POTENTIAL DESIGNS FOR 2027-31

BASE BLOCK DESIGN

At AM102, the IPHC Secretariat presented the **Base Block design** proposed for 2026-28 (IPHC-2026-AM102-13). Except for a revision for IPHC Regulatory Area 2A in 2027, the Base Block designs in Figures 4 and 5 are the same as those presented at AM102. Potential designs for 2029-31 are shown in Figures 6-8.

Based on statistical modelling with simulated data, the Base Block design is expected to maintain precise estimates of indices of Pacific halibut density and abundance across the range of the stock in each of the next three years (Appendix C). At the same time, the rotating nature of the sampled blocks means that almost all FISS stations are sampled within a 5-year period (2-3 years within the core areas) resulting in low risk of missing important stock changes and therefore a low risk of large bias in estimates of trend and stock distribution.

SUPPLEMENTED BASE BLOCK DESIGN (2027)

Based on preliminary cost projections, Commissioners selected the following modular add-ons to the **Base Block design** (designated as **Option 1**) to be funded by US$749,000 of voluntary supplementary funding from the US government:

- **Options 2, 3 and 4:** Add charter regions from IPHC Regulatory Areas 3A and 4B that were included in the approved 2026 Base Block design but were not fished in 2026 for reasons of cost (3A) or a lack of charter bids (4B). In the case of IPHC Regulatory Area 4B, the region is split into two (2) components (west and east, 29 stations each) to allow more flexibility for those considering submitting a bid for 2027 FISS work.
- **Option 5:** Bring sampling in IPHC Regulatory Area 4A forward from 2028 to reduce costs in that year, which is otherwise projected to have a large net loss.
- **Options 6 and 7:** Bring sampling of the northern and central Bering Sea shelf edge (IPHC Regulatory Area 4CDE) forward from 2028 and 2029, respectively, potentially reducing net losses in those years. These options will result in complete sampling of standard FISS stations in IPHC Regulatory Area 4CDE in 2027.

The resulting **Supplemented Base Block design** is presented in Figure 9.

COST ESTIMATES (2027)

Cost and revenue projections for 2027 are based on the following assumptions:

1. Designs are optimised for numbers of skates, with sets of 4, 6 or 8 100-hook skates used, depending on projected catch rates and bait costs.
2. Projected Pacific halibut average sales price for 2027 in each charter region is unchanged from the 2026 FISS
3. Projected Pacific halibut average landings per station remain unchanged in each charter region from the most recent FISS values (based on the last time the region was sampled).

Cost projections account for the actual price of chum salmon bait already purchased for the 2027 FISS of US$4.09/lb (compared with US$2.40/lb in 2026). Changes in projected costs from those presented previously (Webster et al. 2026) are largely due to this large increase in bait cost from 2026.

Table 1. Preliminary projected costs and revenue for the proposed 2027 Base Block and Supplemented Base Block designs ($US). (Totals may not equal the sum of individual rows due to rounding.)

Design		2027 Base Block design	2027 Supplemented Base Block design
Income	**Pacific halibut sales**	3,819,000	4,305,000
	Byproduct sales	104,000	113,000
	Total	**3,923,000**	**4,418,000**
Expenses	**Base HQ (staff salary and wages, and benefits x 4)**	(547,000)	(547,000)
	Vessel contracts	(1,545,000)	(2,282,000)
	Field staff (salary and wages, and benefits)	(475,000)	(633,000)
	Bait	(867,000)	(1,067,000)
	Non-IPHC fish sales[@]	(430,000)	(485,000)
	Other expenses*	(612,000)	(766,000)
	Total	**(4,476,000)**	**(5,781,000)**
Net revenue		**($533,000)**	**($1,363,000)**

[@]Sales revenue from both byproduct and Pacific halibut that are paid to a third party (e.g. vessel share, ADF&G)
*Other costs include staff training, personnel expenses, mailing and shipping, travel, technology, gear replacement, customs fees, bait storage fees, field supplies and equipment, equipment maintenance fees, facility rental fees, and communication fees.

The proposed 2027 **Base Block design** is projected to result in an operating loss of approximately **US$533,000** (Table 1), while the 2027 **Supplemented Base Block design** is projected to have a loss of **US$1,363,000**. Accounting for the $749,000 in supplemental funding provided by the USA, the adjusted net loss for the Supplemented Base Block design is projected to be **US$614,000.**

MODULAR ADD-ONS

Ten modular add-ons to the proposed 2027 Base Block design were presented to Commissioners at the September Work Meeting and at the September SRB meeting (Webster et al. 2026) with the following aims:

1) Reduce the projected net loss of the FISS in 2027;
2) 'Catch up' on FISS regions that were part of the 2026 **Base Block design** but were not fished;

3) Reduce the heterogeneity in net revenue among future years by sampling in 2027 some of the more costly regions planned in future years;
4) Set the FISS station charter rate at a higher value to increase the chance of receiving bids for challenging charter regions (i.e. Adak in IPHC Regulatory Area 4B);
5) Fully clear the 'backlog' of uncertainty created by the reduced designs implemented in 2023-2026 to provide the most informative data in 2027 for the stock assessment and management decisions.

With updated cost projections, one of the two options (previous Option 3) that were expected to reduce the projected net loss is no longer projected to do so and has been removed from the list of modular add-ons presented previously. In addition to Options 2 through 7 described above (components of the Supplemented Base Block design), the remaining modular add-ons are as follows:

- **Option 8** adds a revenue-positive charter region in IPHC Regulatory Areas 2C to reduce the projected net loss.
- **Option 9** brings forward sampling of stations in IPHC Regulatory Area 2A from 2028, reducing costs in that year, along with stations in deep and shallow waters and the Salish Sea that have not been sampled since 2018 but were not planned until after 2031.
- **Option 10** fixes the charter rate at $5,500 per station in the Adak region of IPHC Regulatory Area 4B, which would be a 28% increase over the previous highest accepted bid. It expands sampling over Options 3 and 4 (58 stations combined) to include all 118 stations in the Adak charter region.

Figure 10 presents a map of stations included in Options 2 to 10.

Table 2. Modular changes to Option 1 (**2027 Base Block design**), including projected expenses, income, net revenue, and benefits to the IPHC. Each of modular Options 2 to 9 can be added in any combination to Option 1, with the net revenue of the resulting FISS design found by summing the revenue changes for the Base Block design and each selected option. Option 10 is an alternative to Options 3 and 4 combined. The **2027 Supplemented Base Block design** is comprised of **Options 1 through 7**.

Option	Design	Sampled IPHC Regulatory Areas (with number of FISS charter regions)	Projected expenses (US$)	Projected income (US$)	Projected net revenue	Benefit/rationale
1	Base Block	2A(3), 2B(2), 2C(2), 3A(4), 3B(2), 4B(1), 4CDE(1)	($4,476,000)	$3,923,000	($533,000)	Optimal long-term design
	Design change	**Change in sampling**	**Projected change in expenses ($US)**	**Projected change in income ($US)**	**Projected change in net revenue**	
2	Add Shelikof	3A(+1)	($277,000)	$226,000	($51,000)	3A catch-up. Last sampled 2024.
3	Add Adak West	4B(+1)	($211,000)	$101,000	($110,000)	4B catch-up. Last sampled 2021.
4	Add Adak East	4B(+1)	($211,000)	$101,000	($110,000)	4B catch-up. Last sampled 2025.
5	Add Unalaska	4A(+1)	($389,000)	$66,000	($323,000)	Reduces costs in 2028.
6	Add 4CDE North	4CDE(+1)	($178,000)	$12,000	($166,000)	Reduces costs in 2029. Last sampled 2021.
7	Add 4CDE Central	4CDE(+1)	($184,000)	$44,000	($140,000)	Potential to reduce costs in 2030. Last sampled 2022.
8	Add Sitka	2C(+1)	($253,000)	$385,000	$112,000	Revenue positive: reduces overall net loss.
9	Expand 2A sampling to include all stations north of 40°N	2A(+2)	($273,000)	$89,000	($185,000)	Reduces costs in 2028. Includes deep, shallow, and Salish Sea stations not sampled since 2018.
10	Fixed Contract rate[1] for expanded Adak (alternative to Options 3-4)	4B(+2)	($996,000)	$411,000	($585,000)	Reduces probability of receiving no bids for this region (as occurred in 2023 and 2026)

[1] This option provides for a fixed 28% increase in inflation-adjusted charter costs paid to the contracting vessel over previous accepted bids.

COST PROJECTIONS FOR 2028-31 BASE BLOCK DESIGNS

Table 3 summarises preliminary projected income and expenses for the 2028-31 Base Block designs, with the 2027 design included for comparison. These projections rely on the assumption of no change in average landings or price relative to 2027, or changes in the bait price from 2027. Note that three (3) charter regions are not included in the five-year rotational Base Block designs (2027-31):

- Bowers Ridge in the western Aleutians (central IPHC Regulatory Area 4B, last sampled in 2022);
- The inside waters of the Salish Sea in Washington and British Columbia (last sampled in 2018);
- The stations in Californian waters south of 40°N (sampled in 2017).

All three (3) regions have very low density of Pacific halibut and can be sampled less frequently (less than once every five years) than elsewhere without impacting the quality of estimates derived from FISS data. It is expected that most of these waters will be included in Base Block designs for 2032-36.

Projections of total net revenue vary widely, depending on which charter regions are fished (Table 3). In years with more revenue-positive regions from IPHC Regulatory Areas 2B and 2C in the design (2027, 2029, 2031), net revenue is projected to range from a net loss of US$451,000 to a net loss of US$626,000. In 2028 and 2030, net losses are projected to be US$1.495 million and US$1.585 million respectively. As noted above, there is high uncertainty in these projections, particularly for later years. The high cost in 2028 and 2030 could be reduced by shifting one or more revenue-negative regions (such as IPHC Regulatory Area 4A, Option 5 in Table 2) to odd-numbered years. Another option is to add sampling in revenue-positive regions that are not part of the Base Block design for those years, as has been done in recent years to reduce losses.

Table 3. Preliminary projected income and expenses for the 2027-31 Base Block designs (US$). (Totals may not equal the sum of individual rows due to rounding.)

Design		2027 Base Block design	2028 Base Block design	2029 Base Block design	2030 Base Block design	2031 Base Block design
Income	**Pacific halibut sales**	3,819,000	2,585,000	3,627,000	2,673,000	3,823,000
	Byproduct sales	104,000	100,000	100,000	85,000	119,000
	Total	**3,923,000**	**2,685,000**	**3,727,000**	**2,758,000**	**3,943,000**
Expenses	**Base HQ (staff salary and wages, and benefits x 4)**	(547,000)	(547,000)	(547,000)	(547,000)	(547,000)
	Vessel contracts	(1,545,000)	(1,557,000)	(1,582,000)	(1,650,000)	(1,754,000)
	Field staff (salary and wages, and benefits)	(475,000)	(443,000)	(380,000)	(475,000)	(412,000)
	Bait	(867,000)	(735,000)	(740,000)	(743,000)	(864,000)
	Non-IPHC fish sales@	(430,000)	(316,000)	(409,000)	(315,000)	(441,000)
	Other expenses*	(612,000)	(582,000)	(520,000)	(612,000)	(551,000)
	Total	**(4,476,000)**	**(4,180,000)**	**(4,178,000)**	**(4,343,000)**	**(4,569,000)**
Net revenue		**($533,000)**	**($1,495,000)**	**($451,000)**	**($1,585,000)**	**($626,000)**

@Sales revenue from both byproduct and Pacific halibut that are paid to a third party (e.g. vessel share, ADF&G)

*Other costs include training, personnel expenses, mailing and shipping, travel, technology, gear replacement, customs fees, bait storage fees, field supplies and equipment, equipment maintenance fees, facility rental fees, and communication fees.

FISS RESERVE (FUND 45): STATUS AND FUNDING REQUEST

At the 102nd Session of the IPHC Annual Meeting (AM102), the Commission adopted an aspirational target of **US$4,000,000** for the FISS Reserve (Fund 45) (IPHC-2026-AM102-R, para 39). This target reflects the Commission's judgment on the reserve level needed to achieve cost-effectiveness without compromising the scientific integrity of the FISS design — balancing operational feasibility, cost and revenue pressures, and scientific requirements.

> 39. The Commission **ADOPTED** the following aspirational targets for reserve funds: *[Canada: In favour=2; against=0; abstain=0; absent=1; USA: In favour=3; against=0; abstain=0; absent=0]*
>
> a) Fund 50 – Reserve: **US$4,000,000** (~50% of the annual budget for Funds 10, 20, 30, 35);
>
> b) Fund 40 – FISS: **US$4,000,000** (~50% of the annual budget for Fund 40 over two (2) years of the Base-Block design).

Current status: As of the end of FY2026 (30 September 2026), the FISS Reserve stands at **US$1,161,964.91** — approximately **29%** of the aspirational target (US$4,000,000) leaving a shortfall of roughly **US$2,850,000**. However, with the surplus from the 40 - FISS Fund expected to be approximately **US$2,476,356.27** from FY2026, the shortfall is expected to be less than **US$400,000** (<10% of the aspirational 45 – FISS Reserve target).

Purpose of the Reserve

The FISS Reserve exists to protect the FISS against future contingencies. Specifically, it ensures the IPHC can absorb cost fluctuations without curtailing the FISS in years when:

- operating costs are unusually high, and/or
- revenues are lower than projected.

Without an adequately funded reserve, the Commission risks having to scale back FISS coverage in precisely the years when maintaining it matters most — undermining the scientific continuity the FISS is designed to protect.

Request to Contracting Parties

The Commission has previously requested that Contracting Parties provide annual supplementary contributions to build the FISS Reserve to its target level within a relatively short timeframe. Recognising that funding availability varies by Party, contributions may be scaled to individual circumstances:

Contribution level	**Amount**
Nominal contribution	US$200,000
Full remaining balance to reach target	<US$400,000

Contracting Parties are invited to contribute at whatever level is feasible within this range, with the understanding that closing the gap sooner reduces the Commission's exposure to cost/revenue volatility in the interim.

The United States of America has agreed to voluntarily provide US$749,000 in supplementary funding for the 2027 FISS in order to fund modular Options 2 to 7 of Table 2 as additions to the 2027 Base Block design (Figure 4).

DISCUSSION

The **Base Block design** has a projected net loss of US$533,000 for 2027 and could be implemented using FISS reserves without the need for further supplementary funding. The **Supplemented Base Block** design has a projected adjusted net loss of US$614,000 inclusive of the voluntary US contribution of $749,000 intended to fund several add-ons to the Base Block design. These add-ons include charter regions in IPHC Regulatory Areas 3A and 4B that were part of the approved 2026 Base Block design but were not fished this year, and charter regions in IPHC Regulatory Areas 4A and 4CDE brought forward to reduce projected costs in 2028. The Supplemented Base Block design can also be implemented using FISS reserves to cover the projected loss.

Taken together, the 2027–31 Base Block designs in Table 3 carry a cumulative projected net loss of US$4.69 million over the five years. On these projections the Reserve would be exhausted during the five-year period without supplementary contributions, and the aspirational target of US$4,000,000 adopted at AM102 is of a similar order to the cumulative projected loss. We note that there is a high degree of uncertainty in future cost projections, as highlighted by the unanticipated 70% increase in bait price from 2026 to 2027. Such changes in costs are almost impossible to predict from one year to the next, let alone several years into the future.

The Commission may also wish to note that modular Options 3 and 4 (Adak West and Adak East) are included in the funded package at the standard charter rate, whereas Option 10 was developed because that rate failed to attract bids for the Adak region in 2023 and again in 2026. Funding Options 3 and 4 therefore carries a risk that the stations remain unfished, and the Commission may wish to consider whether the difference between Options 3 and 4 combined (US$220,000) and Option 10 (US$585,000) is warranted to secure the coverage.

RECOMMENDATIONS

That the Commission:

1) **NOTE** paper IPHC-2026-IM102-12, which presents FISS design options for 2027-31, including a cost evaluation of the 2027 Base Block design and the Supplemented Base Block design;
2) **APPROVE** the Supplemented Base Block design (Figure 9) for implementation in 2027;
3) **NOTE** the offer of the United States of America to provide US$749,000 in supplementary funding for 2027 to fund modular Options 2 to 7 (Table 2) included in the 2027 Supplemented Base block design;
4) **PROVIDE GUIDANCE** on the preferred direction for the 2028–31 FISS designs.

References

IPHC (2024). Report of the 100th Session of the IPHC Annual Meeting (AM100) IPHC-2024-AM100-R. 55 p.

IPHC (2025). Report of the 101st Session of the IPHC Annual Meeting (AM101) IPHC-2025-AM101-R. 52 p.

IPHC (2026). Report of the 102nd Session of the IPHC Annual Meeting (AM102) IPHC-2026-AM102-R. 54 p.

Webster, R., Stewart, I., Ualesi, K., Jack, T. and Wilson, D. (2025). 2026 and 2027-29 FISS Designs. IPHC-2026-AM102-13. 23 p.

Webster, R., Stewart, I., Ualesi, K., and Wilson, D. (2026). 2027-31 FISS design evaluation and modelling updates. IPHC-2026-SRB029-08. 27 p.

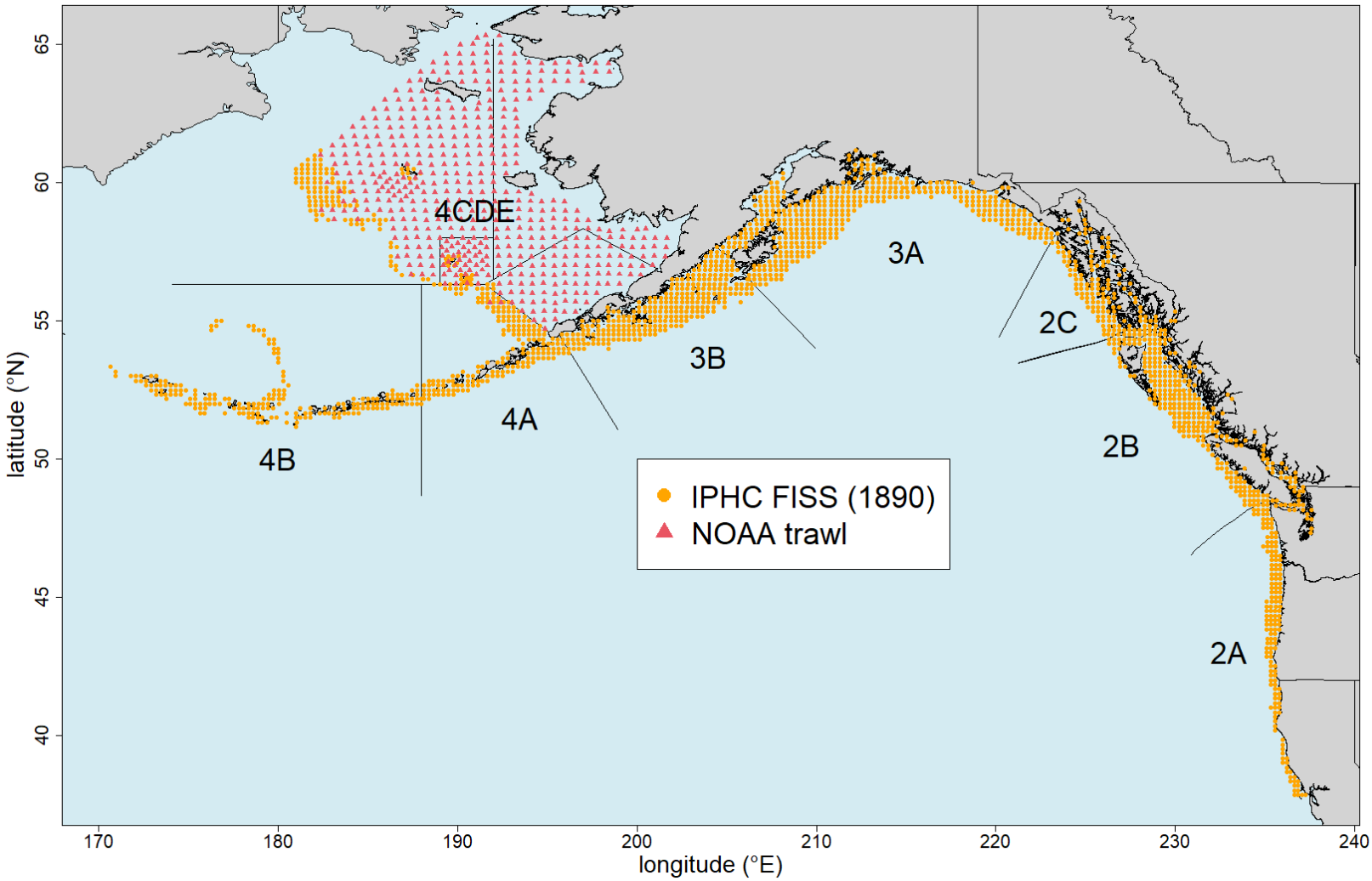


Figure 1. Map of the full 1890 station FISS design, with orange circles representing stations available for inclusion in annual sampling designs. Red triangles represent standard locations of NOAA trawl stations used to provide complementary data for Bering Sea modelling (actual NOAA trawl design can vary year-to-year).

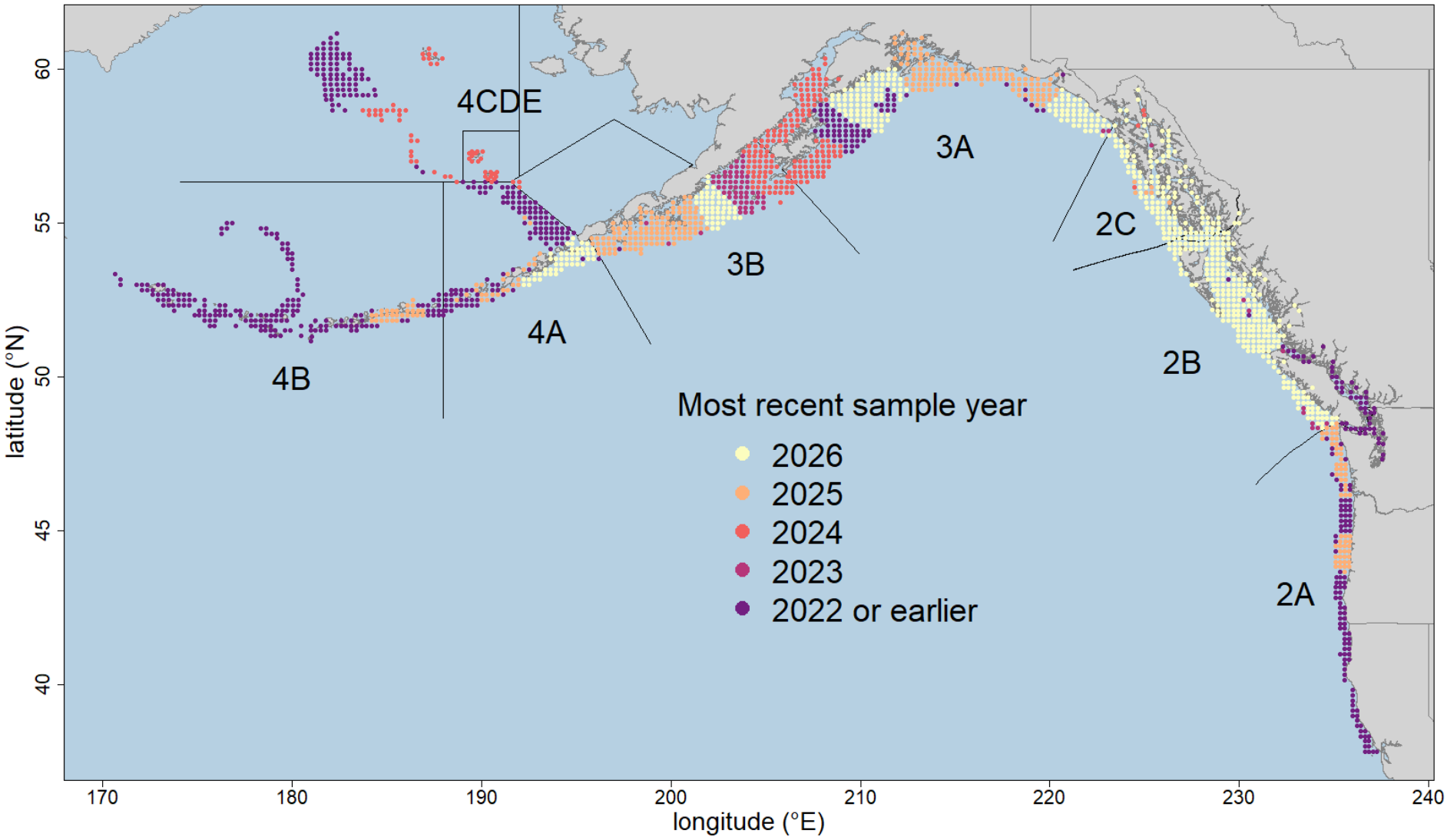


Figure 2. Map showing the most recent sample year of each station on the full FISS grid.

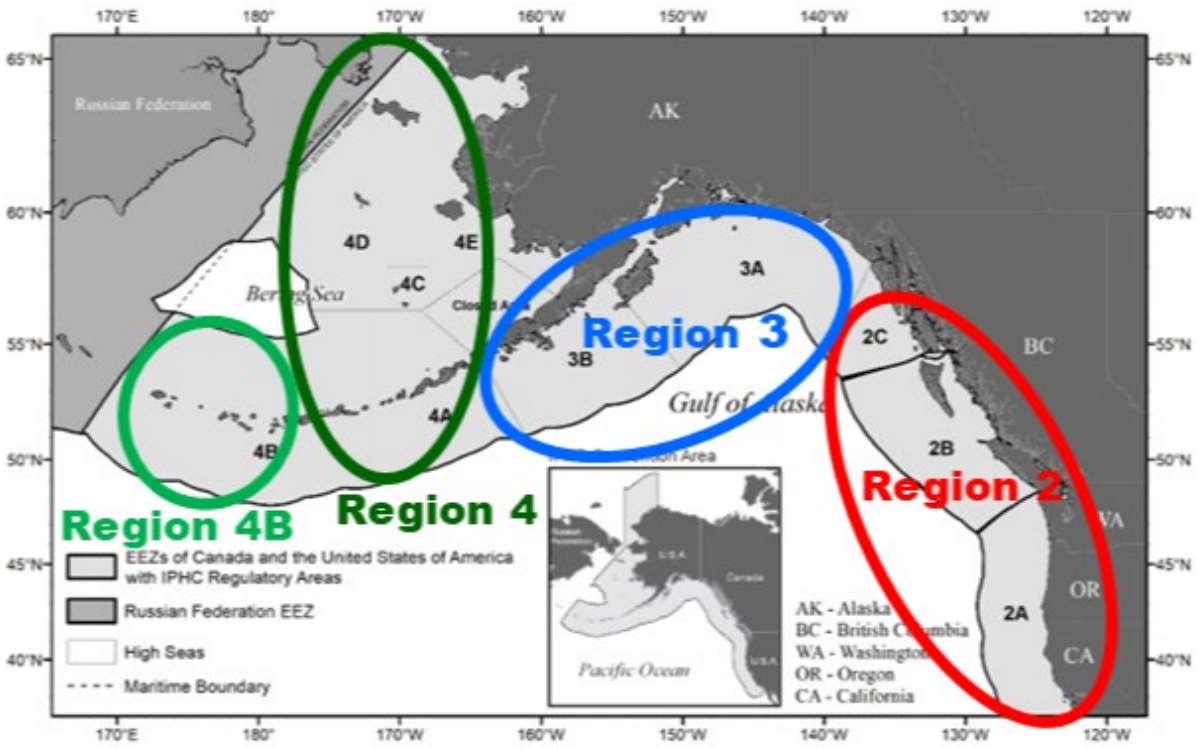


Figure 3. IPHC Biological Regions.

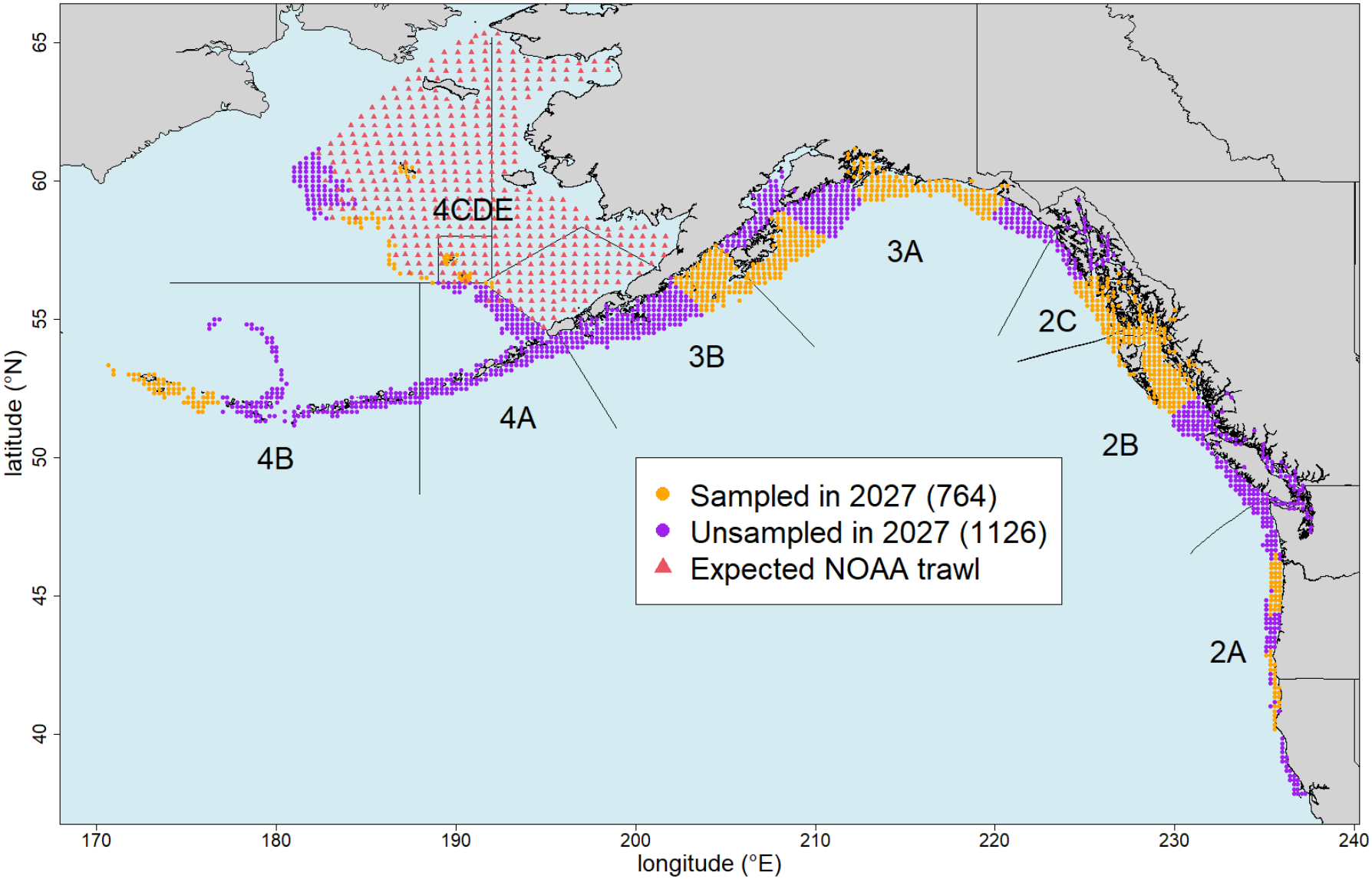


Figure 4. Base Block design for 2027 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

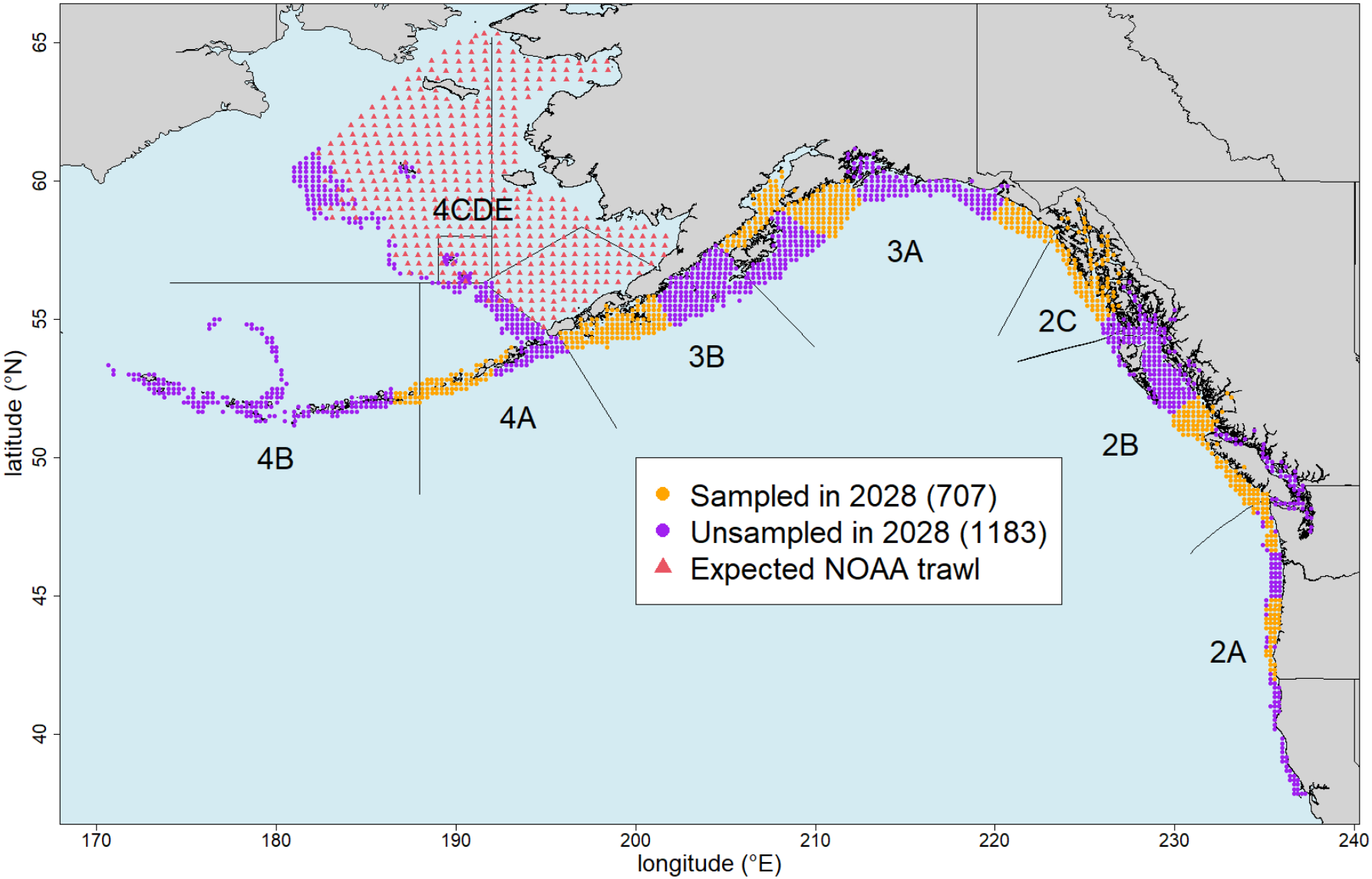


Figure 5. Base Block design for 2028 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

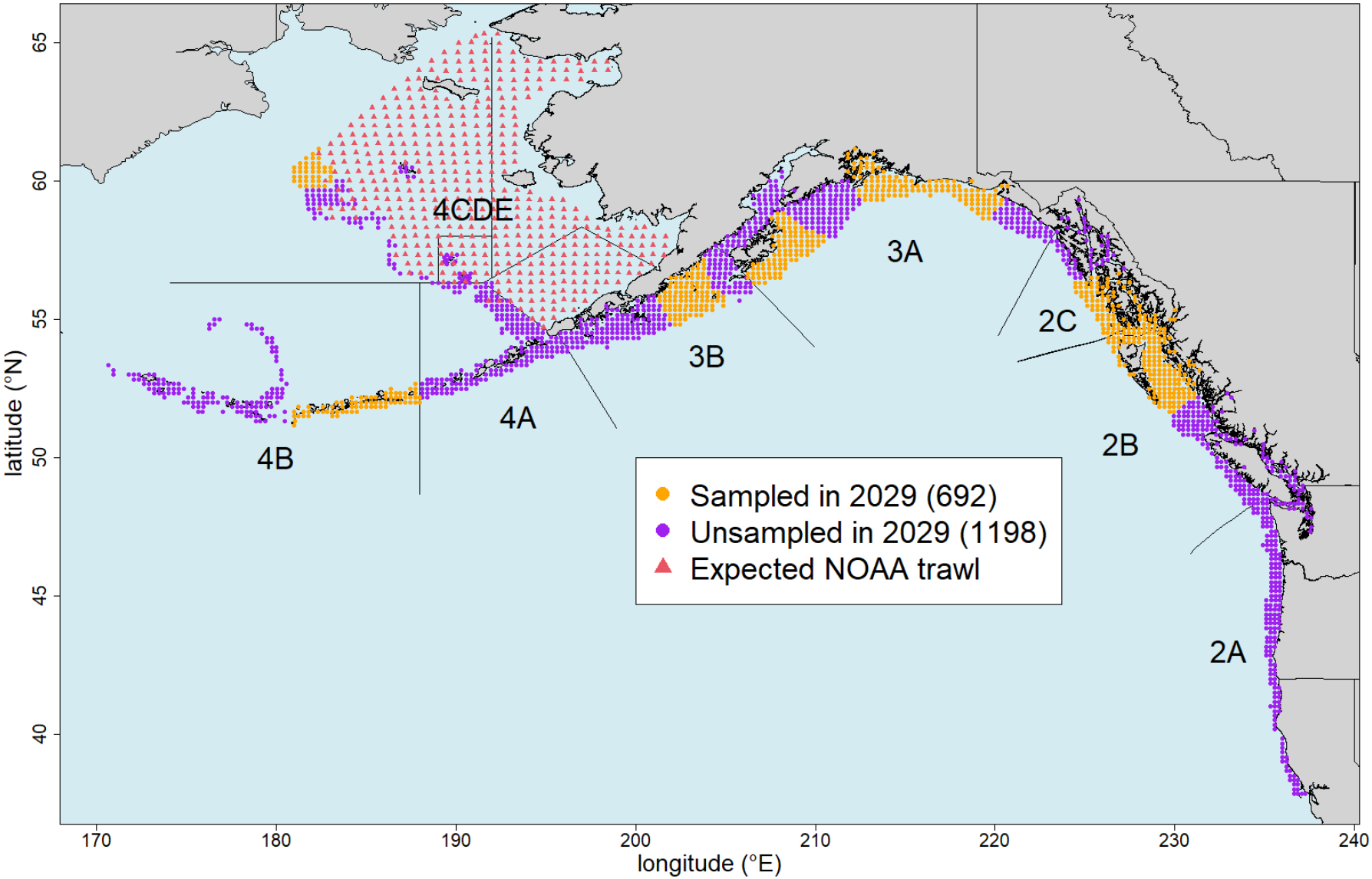


Figure 6. Base Block design for 2029 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

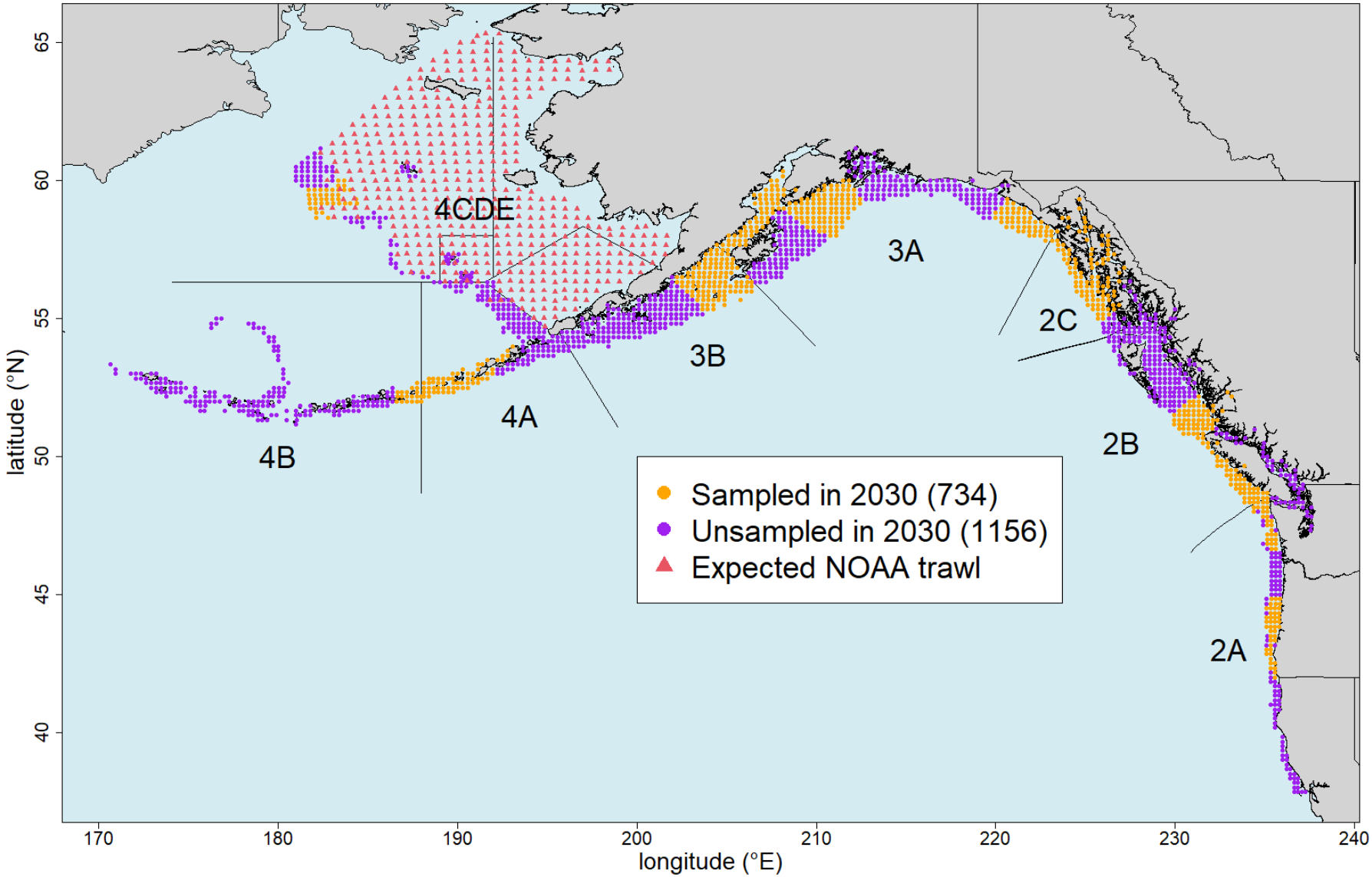


Figure 7. Base Block design for 2030 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

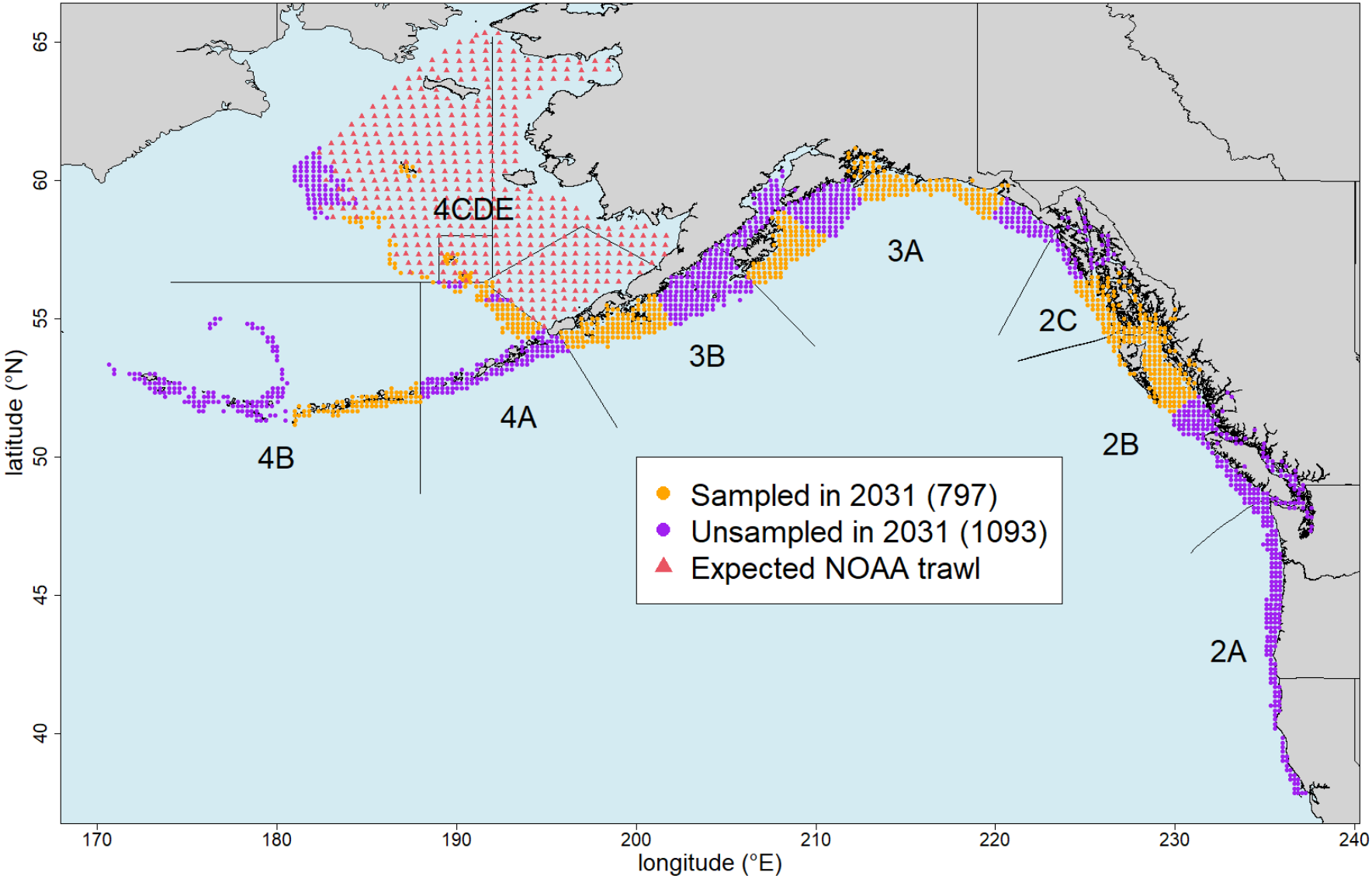


Figure 8. Base Block design for 2031 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

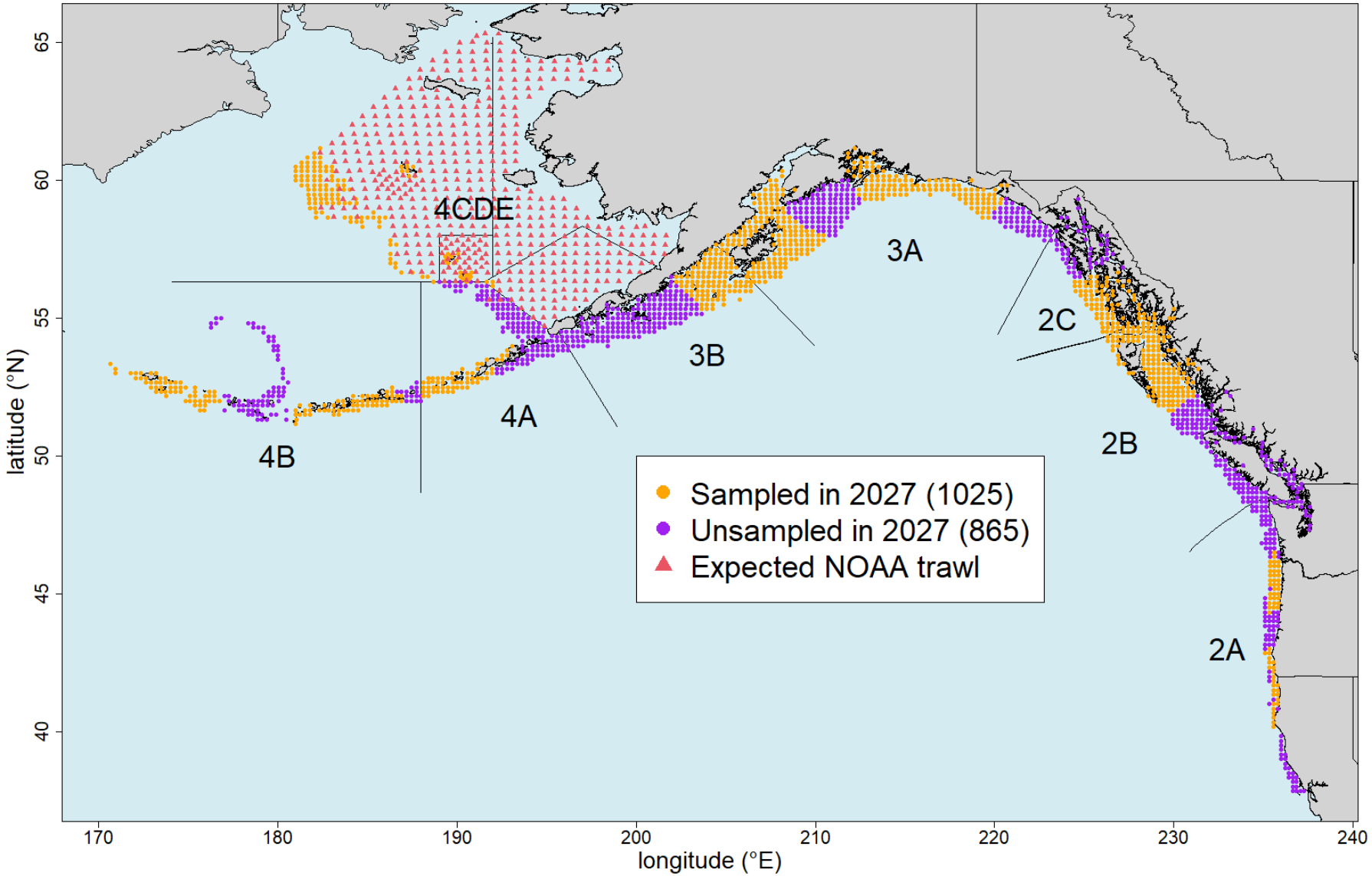


Figure 9. Supplemented Base Block design for 2027 (orange circles).

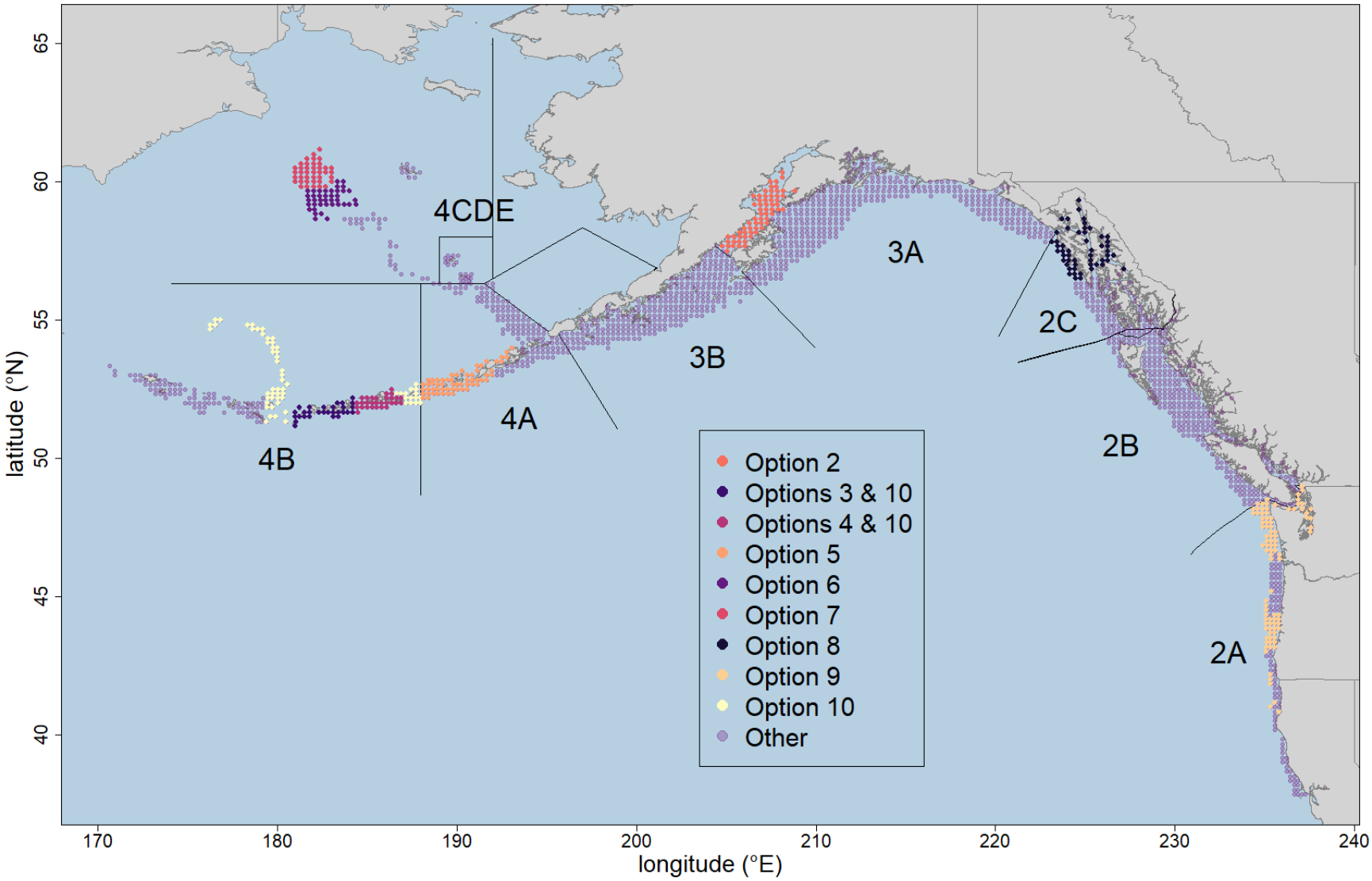


Figure 10. IPHC FISS modular Options 2 to 10 (Table 2) for 2027.

Appendix A: History of modern FISS and modelling

FISS history 1993-2019

The IPHC has undertaken FISS activity since the 1960s. However, methods were not standardized to a degree (e.g., the bait and gear used) that allows for simple combined analyses until 1993. From 1993 to 1997, the annual design was a modification of a design developed and implemented in the 1960s, and involved fishing triangular clusters of stations, with clusters located on a grid (IPHC 2012). Coverage was limited in most years and was generally restricted to IPHC Regulatory Areas 2B through 3B. The modern FISS design, based on a grid with 10 nmi (18.5 km) spacing, was introduced in 1998, and over the subsequent two years was expanded to include annual coverage in parts of all IPHC Regulatory Areas within the depth ranges of 20-275 fathoms (37-503 m) in the Gulf of Alaska and Aleutian Islands, and 75-275 fathoms (137-503 m) in the Bering Sea (IPHC 2012). Annually-fished stations were added around islands in the Bering Sea in 2006, and in the same year, a less dense grid of paired stations was fished in shallower waters of the southeastern Bering Sea, providing data for a calibration with data from the annual National Marine Fishery Service (NMFS) bottom trawl survey (Webster et al. 2020).

Through examination of commercial logbook data and information from other sources, it became clear by 2010 that the historical FISS design had gaps in coverage of Pacific halibut habitat that had the potential to lead to bias in estimates derived from its data. These gaps included deep and shallow waters outside the FISS depth range (0-20 fathoms and 275-400 fathoms), and unsurveyed stations on the 10 nmi grid within the 20-275 fathom depth range within each IPHC Regulatory Area. This led the IPHC Secretariat to propose expanding the FISS to provide coverage of the unsurveyed habitat in United States and Canadian waters. In 2011 a pilot expansion was undertaken in IPHC Regulatory Area 2A, with stations on the 10 nmi grid added to deep (275-400 fathoms) and shallow (10-20 fathoms) waters, the Salish Sea, and other, smaller gaps in coverage. The 10-fathom limit in shallow waters was due to logistical difficulties in standardized fishing of longline gear in shallower waters. The 400-fathom maximum depth is understood to cover the vast majority of Pacific halibut summer habitat. A second expansion in IPHC Regulatory Area 2A was completed in 2013, with a pilot survey in California waters between the latitudes of 40 and 42°N.

The full expansion program began in 2014 and continued through 2019, resulting in the sampling of the entire FISS design of 1890 stations in the shortest time logistically possible. The FISS expansion program allowed us to build a consistent and complete picture of Pacific halibut density throughout its range in Convention waters. Sampling the full FISS design has reduced bias , and, in conjunction with space-time modelling of survey data (see below), has improved precision and fully quantified the uncertainty associated with estimates based on partial annual sampling of the species range. It has also provided us with a complete set of observations over the full FISS design (Figure 1) from which an optimal subset of stations can be selected when devising annual FISS designs. This station selection process began in 2019 for the 2020 FISS and continues with the current review of design proposals for 2024-26. Note that in the Bering

Sea, the full FISS design does not provide complete spatial coverage, and FISS data are augmented with calibrated data from NOAA and Alaska Department of Fish and Game (ADFG) trawl surveys (stations can vary by year – 2019 designs are shown in Figure 1). Both supplementary surveys have been conducted approximately annually in recent years.

Rationalized FISS, 2020-26

Following the 2011-2019 program of FISS expansions, rationalized FISS designs were approved for 2020 based on random selection of over 50% of stations in the core of the stock (IPHC Regulatory Areas 2B, 2C, 3A and 3B) and sampling of all stations in selected subareas of the remaining IPHC Regulatory Areas. For the latter areas, sampling priorities were determined based on maintaining precise estimates of area-specific indices of density and ensuring low bias in index estimators. That year, the COVID19 pandemic led to a reduced FISS with sampling only in the core areas. The 2021-22 FISS sampling proceeded largely as designed, although planned stations in western IPHC Regulatory 4B in 2022 were unsampled due to a lack of viable charter bids. In some charter regions in the core areas, 100% of stations were sampled in order to achieve revenue goals.

Four years of spatially-reduced designs followed the 2022 FISS:

2023 (IPHC-2023-AM099-R)

- Little sampling outside of the core areas due to large projected revenue losses from designs that included extensive sampling in IPHC Regulatory Areas 2A, 4A, 4B and 4CDE
- Limited sampling in northern IPHC Regulatory 2A
- Planned stations around the IPHC Regulatory Area 4A/4B boundary not sampled due to a lack of charter bids

2024 (IPHC-2024-AM100-R)

- High sampling rates in IPHC Regulatory Areas 2B and 2C
- A small number of charter regions in IPHC Regulatory Areas 3A and 3B
- Sampling of the southern shelf edge and Bering Sea islands in IPHC Regulatory Area 4CDE

2025 (Figure A.1, IPHC-2025-AM101-R)

- Charter regions in IPHC Regulatory Areas 3A and 3B selected to complement coverage in recent years
- Sampled stations in IPHC Regulatory Areas 2A, 4A and 4B that had not been sampled for three or more years

2026 (Figure A.2)

- Increases spatial coverage relative to 2023-25
- Complements the 2025 design by including ten charter regions not sampled last year

Space-time modelling

In 2016, a space-time modelling approach was introduced to estimate time series of weight and numbers-per-unit-effort (WPUE and NPUE), and to estimate the stock distribution of Pacific halibut among IPHC Regulatory Areas. This represented an improvement over the largely empirical approach used previously, as it made use of additional information within the survey data regarding the degree of spatial and temporal correlation in Pacific halibut density, along with information from covariates such as depth (see Webster 2016, 2017). It also allowed a more complete accounting of uncertainty; for example, prior to the use of space-time modelling, uncertainty due to unsurveyed regions in each year was ignored in the estimation. Prior to the application of the space-time modelling, these unsampled regions were either imputed using independently estimated scalar calibrations (if fished at least once) or catch-rates at unsampled stations were assumed to be equal to the mean for the entire Regulatory Area. The IPHC's Scientific Review Board (SRB) has provided supportive reviews of the space-time modelling approach (e.g., IPHC-2018-SRB013-R), and the methods have been published in a peer-review journal (Webster et al. 2020). Similar geostatistical models are now routinely used to standardize fishery-independent trawl surveys for groundfish on the West Coast of the U.S. and in Alaskan waters (e.g., Thorson et al. 2015 and Thorson 2019) and to integrate multiple surveys off the Pacific coast of Canada (e.g., Thompson et al. 2023). The IPHC space-time models are fitted through the R-INLA package in the R software (R Core Team, 2024).

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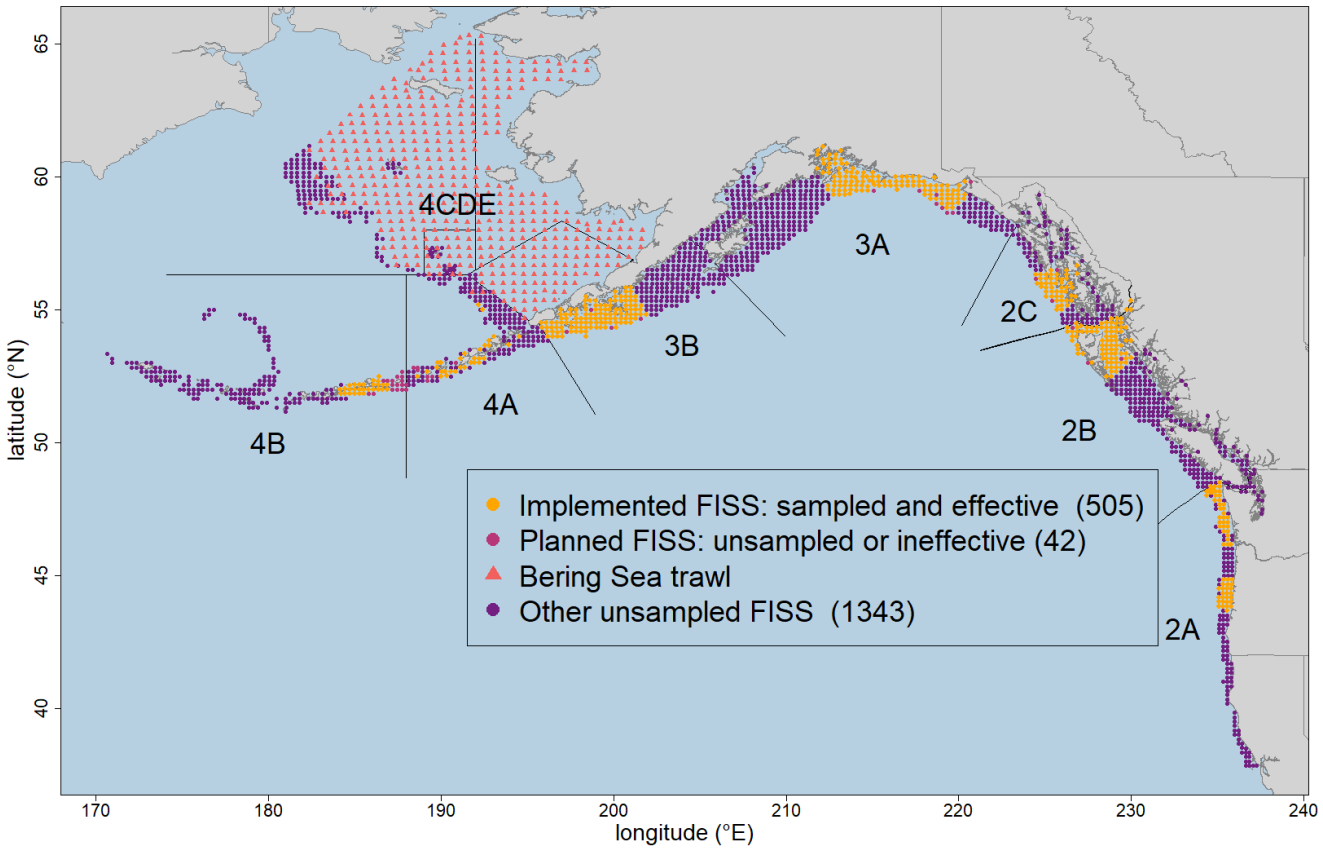


Figure A.1. Map of implemented 2025 sampled FISS design showing sampled stations with data used in modelling (orange circles for FISS, red triangles for NOAA trawl), along with planned but ineffective FISS stations.

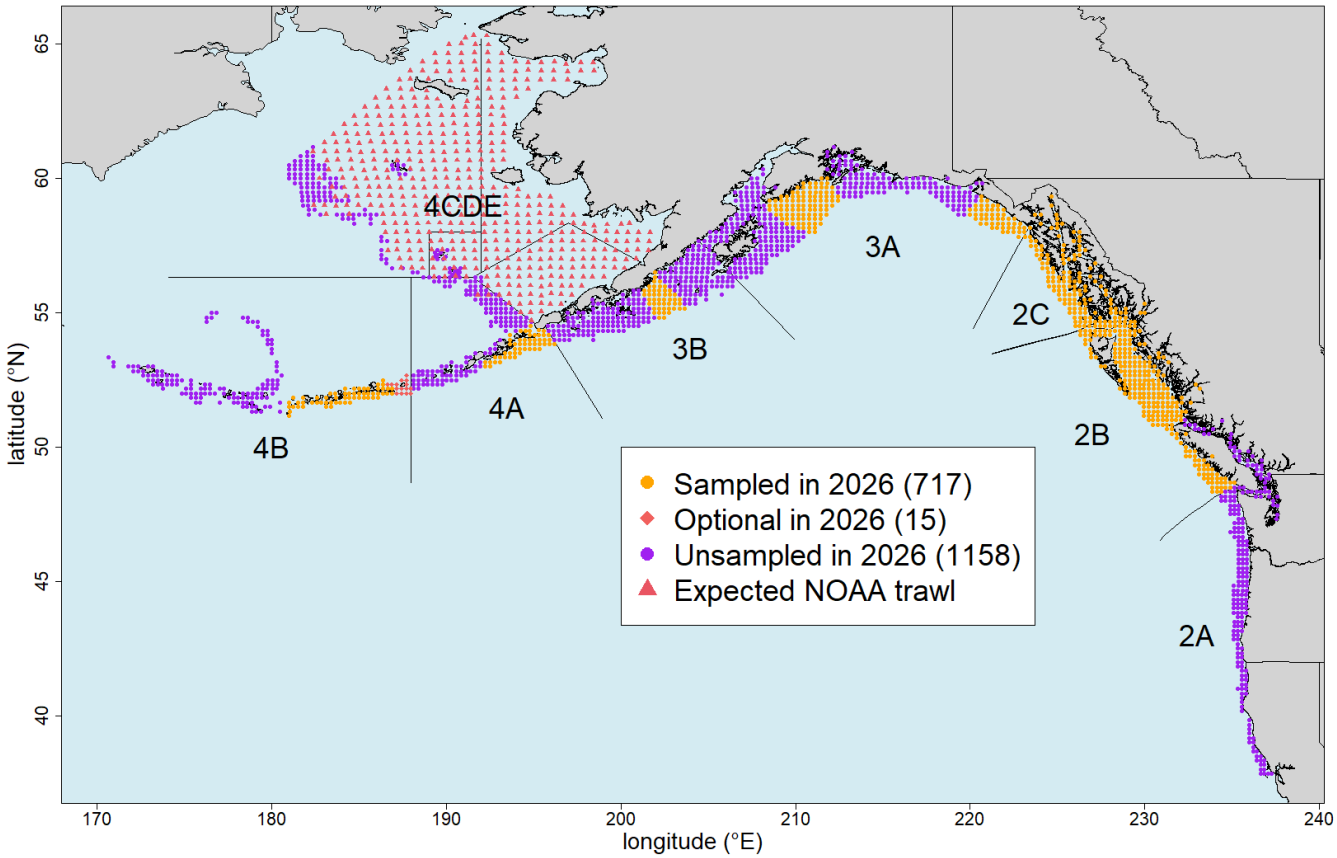


Figure A.2. Adopted 2026 FISS design, with planned FISS stations shown as orange circles. Planned stations in IPHC Regulatory Area 4B are not expected to be sampled in 2026 due to lack of charter bids.

Appendix B: FISS design objectives and review process

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 management. 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: *Cost effectiveness.*

The FISS is intended to be cost-effective without compromising the scientific integrity of the design. Any implemented design must consider logistics and cost together with scientific integrity.

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 emerging IPHC informational needs.

Table B.1 Prioritized 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	Cost effectiveness without compromising the scientific integrity of the FISS design.	Balance operational feasibility/logistics, cost/revenue, and scientific needs. Includes an aspirational target reserve of US$4,000,000
Tertiary	Minimize removals, assist others where feasible on a cost-recovery basis, address specific Commission informational needs.	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 design review, endorsement, and finalisation process

Since completion of the FISS expansions in 2019, a review process has been developed for annual FISS designs created according to the above objectives:

- Step 1: The Secretariat presents preliminary design options based on the primary objective (Table B.1) to the SRB for three subsequent years at the June meeting based on analysis of prior years' data. Commencing in 2024, this has included preliminary cost

projections based on prior year fiscal details (revenue) and current year vessel contract cost updates;

- Step 2: Updated design options for the following year that account for both primary and secondary objectives (Table B.1) are reviewed by Commissioners at the September work meeting, recognising that revenue and cost data from the current year's FISS are still preliminary at this time;
- Step 3: At their September meeting, the SRB reviews design options accounting for both primary and secondary objectives (Table B.1) for comment and advice to the Commission (recommendation). FISS revenue and cost information from the current year is near-final at this time;
- Step 4: Designs are further modified to account for updates based on secondary and tertiary objectives before being finalized during the Interim and Annual meetings and the period prior to implementation:
    - Presentation of FISS designs for 'endorsement' by the Commission occurs at the annual November/December Interim Meeting;
    - Ad-hoc modifications to the design for the current year (due to unforeseen issues arising) are possible at the Annual Meeting of the Commission;
    - The endorsed design for current year is then modified (if necessary) to account for any additional tertiary objectives or revision to inputs into the evaluation of secondary objectives prior (i.e. updated cost estimates) and logistical considerations raised by the operators of contracted vessels prior to summer implementation (February-April).

Consultation with industry and stakeholders occurs throughout the FISS planning process, at the Research Advisory Board meeting (late November) and particularly in finalizing design details as part of the FISS charter bid process, when stations can be added and other adjustments made to provide for improved logistical efficiency. We also note the opportunities for direct stakeholder input during public meetings (Interim and Annual Meetings).

Although the review process examines designs for the next three years, revisions to designs for the second and third years are expected during subsequent review periods as additional data are collected. Having design proposals available for three years instead of the next year only assists the Secretariat with medium-term planning of the FISS, and allows reviewers (SRB, Commissioners) and stakeholders to see more clearly the planning process for sampling the entire FISS footprint over multiple years.

Appendix C: Statistical evaluation of Base Block designs 2027-29

For the Base Block designs proposed at AM102, the IPHC Secretariat used samples generated from the fitted 2025 space-time models (see Appendix A) as simulated data for 2026-29 and projected the coefficient of variation (CV, a relative measure of precision) for mean O32 WPUE for each year of the design by area. As CVs are generally greater in the terminal year of the time series and that year is usually the most relevant for informing management, the CV values in Table 1 are for the final year of the modelled time series. For example, the values for 2027 were found by fitting the model to the data for 1993-2027, with simulated data used for 2026-27.

Table C.1. Projected coefficients of variation (CVs, %) of mean O32 WPUE for the potential 2027-29 Base Block designs by terminal year of time series and IPHC Regulatory Area and Biological Region.

Regulatory Area	**Year** 2027	2028	2029
2A	26	16	22
2B	5	10	7
2C	6	6	6
3A	8	7	7
3B	14	12	9
4A	24	12	19
4B	16	17	14
4CDE	9	9	8
Region 2	5	5	4
Region 3	7	6	6
Region 4	11	7	9
Region 4B	16	17	14
Coastwide	4	4	4

Projected terminal year CVs for the Base Block design were 25% or less for all IPHC Regulatory Areas except IPHC Regulatory Area 2A in 2027. In the core areas (2B, 2C, 3A and 3B), CVs are projected to be 15% or less (Table C.1). All Biological Region CVs, except that of Region 4B, are at most 10%, while the coastwide CV is projected to be 4% in all years.

Due to the CV for IPHC Regulatory Area 2A exceeding the target range of 25% or less, the 2027 Base Block design (Figure 4) was revised from the version presented at AM102 through the addition of 20 stations off the Oregon coast.