



IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2020

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PURPOSE

To provide results of the 2020 IPHC Fishery-Independent Setline Survey (FISS).

BACKGROUND

The annual IPHC Fishery-Independent Setline Survey (FISS) of the Pacific halibut stock was augmented from 2014-2019 with expansion stations that filled in gaps in coverage in the annual FISS. Prior to 2020, the standard grid of stations comprised 1,200 stations. Following the completion in 2019, expansion stations were added to the standard grid in all IPHC Regulatory Areas, now totaling 1,890 stations for the full FISS design ([Figure 1](#)).

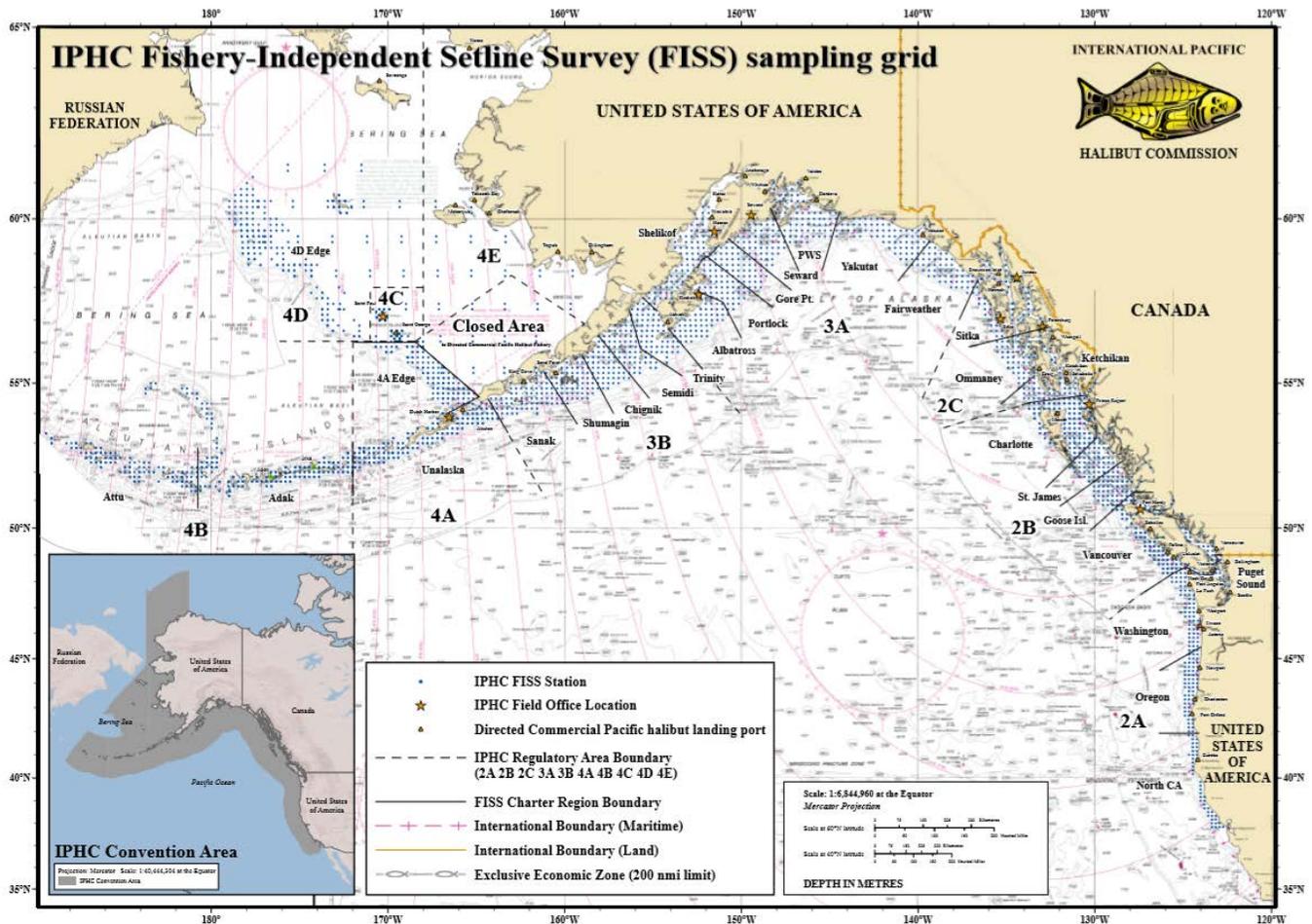


Figure 1. IPHC Fishery-Independent Setline Survey (FISS) with full sampling grid shown.

Prior to 2019, only fixed gear was used to fish FISS sets. With increasing use of snap gear in the commercial fishery, this restriction has limited the number of vessels available for the FISS. Further, any differences between snap and fixed gears (including catch rate differences and

differences in fishing locations) may affect our understanding of trends in commercial fishery indices. This has motivated the need for a study comparing the two gear types with this work being done in 2019 and again in 2020.

Beginning in 2019, individual weight data were collected coastwide from Pacific halibut caught on the FISS to eliminate questions that have arisen regarding the accuracy of estimates that depend on these weights, including weight per unit effort (WPUE) indices of density. Data from IPHC collections from commercial landings and other sources had provided evidence that the current standard length-net weight curve used for estimating Pacific halibut weights on the FISS may have been over-estimating weights on average in most IPHC Regulatory Areas, and that the relationship between weight and length may vary spatially.

Interactive views of some of the FISS results were provided via the IPHC website and can be found here:

<https://www.iphc.int/data/setline-survey-catch-per-unit-effort>

Evolution of the 2020 FISS designs

At the [96th Session of the IPHC Annual Meeting \(AM096\)](#), the Commission recommended an annual FISS design for 2020 that included 1,232 stations coastwide ([Figure 2](#)). That annual design comprised sampling of subareas within IPHC Regulatory Areas 2A, 4A (including a snap-fixed gear comparison), and 4B intended to reduce potential bias (relative to historical observed changes year-to-year) and to achieve a level of precision comparable to or better than recent surveys. Proposed 2020 sampling in IPHC Regulatory Areas 2B (except inside waters), 3A, and 3B included random subsampling from the full design to provide for unbiased estimates, while increasing precision relative to recent surveys. Proposed sampling in IPHC Regulatory Area 4CDE included 100% of the full FISS design.

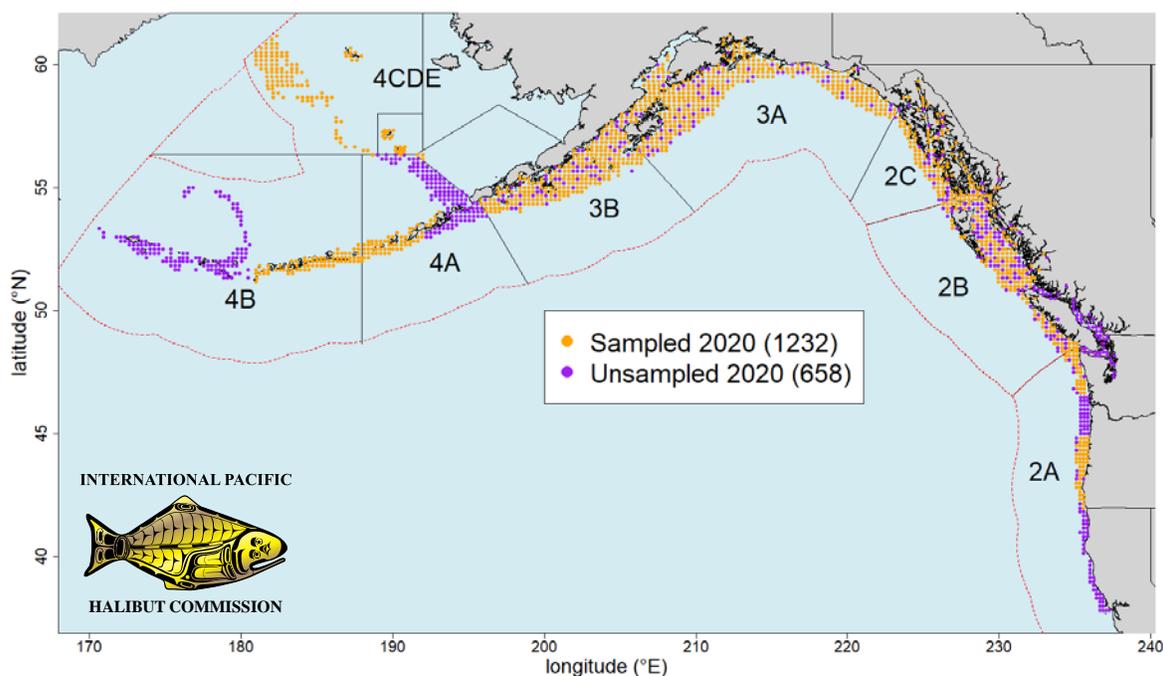


Figure 2. The IPHC Fishery-Independent Setline Survey (FISS) proposed design for 2020 from the 96th Session of the IPHC Annual Meeting (AM096).

At the [6th Special Session of the IPHC \(SS06\)](#), the Commission endorsed a revised annual FISS design for 2020 that included 1,283 stations coastwide ([Figure 3](#)). The changes from the

previous design included random subsampling of stations in IPHC Regulatory Area 4CDE, 100% sampling in IPHC Regulatory Areas 3A, 2C, and 2B (except inside waters), reduced random sampling in IPHC Regulatory Area 3B, a reduced subarea in IPHC Regulatory Area 2A and a relocation of the snap-fixed gear comparison to 2B.

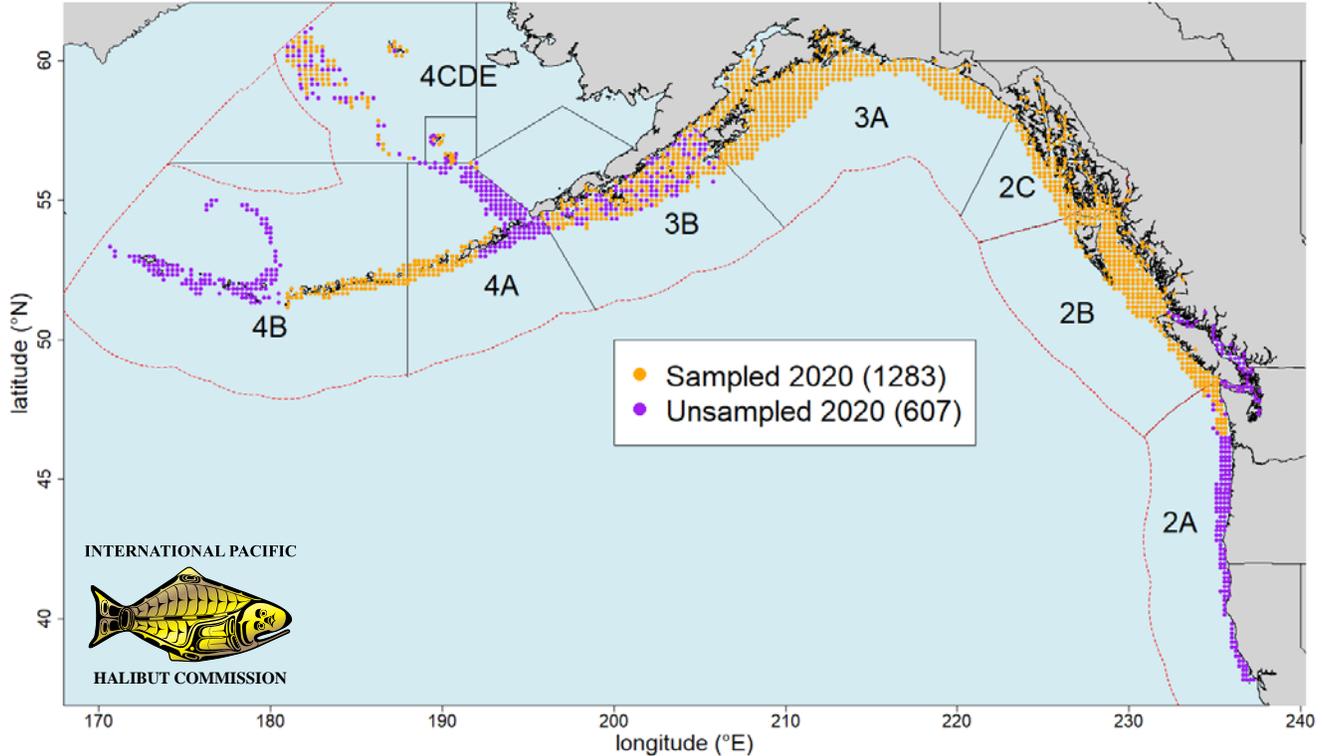


Figure 3. Map of the revised 2020 FISS design endorsed by the Commission at the 6th Special Session of the IPHC (SS06).

In light of the COVID-19 Pandemic and its impacts, on 29 May 2020, the Commission [adopted \(endorsed\) a reduced 2020 FISS design](#) consisting of 898 stations coastwide ([Figure 4](#)). This design included 100% sampling in IPHC Regulatory Areas 3A, 2C, and 2B (except inside waters and the outside of Vancouver Island), and random subsampling from the eastern half of IPHC Regulatory Area 3B. Additional details and a more in-depth review of the rationale leading to the evolution of the 2020 FISS designs and their implications may be found in the following document [IPHC-2020-IM096-08](#) – Summary of data and stock assessment.

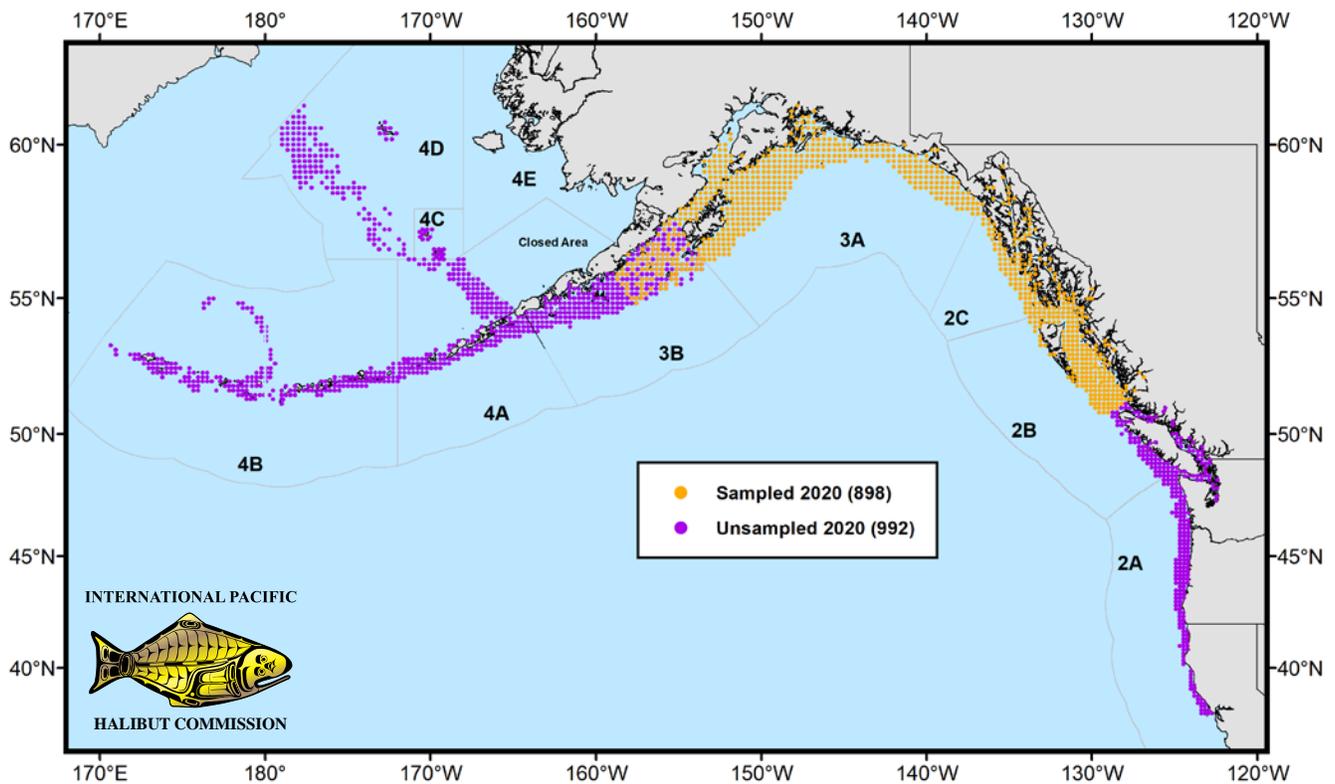


Figure 4. Map of the revised and final 2020 FISS design endorsed by the Commission on 29 May 2020.

INTRODUCTION

In most IPHC Regulatory Areas, the previous (prior to 2020), annual FISS fished waters within the 37-503 m (20-275 fm) depth range. Information from commercial fishery data and other fishery-independent sources showed the presence of Pacific halibut down to depths of 732 m (400 fm) and in waters shallower than 37 m. Further, most IPHC Regulatory Areas had significant gaps in coverage within the standard 37-503 m depth range. The incomplete coverage of Pacific halibut habitat by the FISS had the potential to create bias in estimates of the weight per unit effort and numbers per unit effort (NPUE) density indices used in the stock assessment modelling and for stock distribution estimation. For this reason, the IPHC expanded the FISS to encompass these areas with stations added to cover habitat not previously sampled on the FISS. As a result, the 2020 FISS design was a selection of stations from the full FISS design of 1,890 stations. The 2020 FISS was to comprise a random subsample of 1,232 stations following decisions made at the 96th Session of the IPHC Annual Meeting (AM096). However, due to the impact of COVID-19, a reduced FISS was implemented totaling 898 stations with stations in IPHC Regulatory Areas 2B, 2C, 3A and 3B.

In 2020, a comparison of the use of snap gear to the use of fixed gear on the FISS was conducted in the St. James charter region (IPHC Regulatory Area 2B) to expand on data collected in 2019 in IPHC Regulatory Area 2C. The design featured each station being fished twice, once with fixed gear and once with snap gear, with randomisation of the order of the two gear types for each station. The comparison will provide data on any differences between catch (e.g. Pacific halibut catch rates, age and size distribution, bycatch species) on the two gears.

Beginning in 2019, individual Pacific halibut are weighed at sea throughout the FISS in order to improve the quality of estimates based on Pacific halibut weight. The use of direct weight measurements will lead to more accurate estimates of WPUE and other quantities based on weights, allow estimation of length-weight curves based on all sizes available to longline gear

(whereas collections from directed commercial landings only measure fish greater than or equal to 81.3 cm in length) and provide additional information on biases in the standard curve and spatial differences in the length-weight relationship.

MATERIALS AND METHODS

The IPHC's FISS design encompasses nearshore and offshore waters of the IPHC Convention Area ([Figure 5](#)). The IPHC Regulatory Areas are divided into 31 regions, each requiring between 10 and 46 charter days to complete. FISS stations are located at the intersections of a 10 nmi by 10 nmi square grid within the depth range occupied by Pacific halibut during summer months (18 – 732 m [10 – 400 fm]). [Figure 6](#) depicts the 2020 FISS station positions, charter region divisions, and IPHC Regulatory Areas.

Fishing vessels are chosen through a competitive bid process each year where up to three (3) regions per vessel may be awarded and typically 10-15 vessels are chosen.

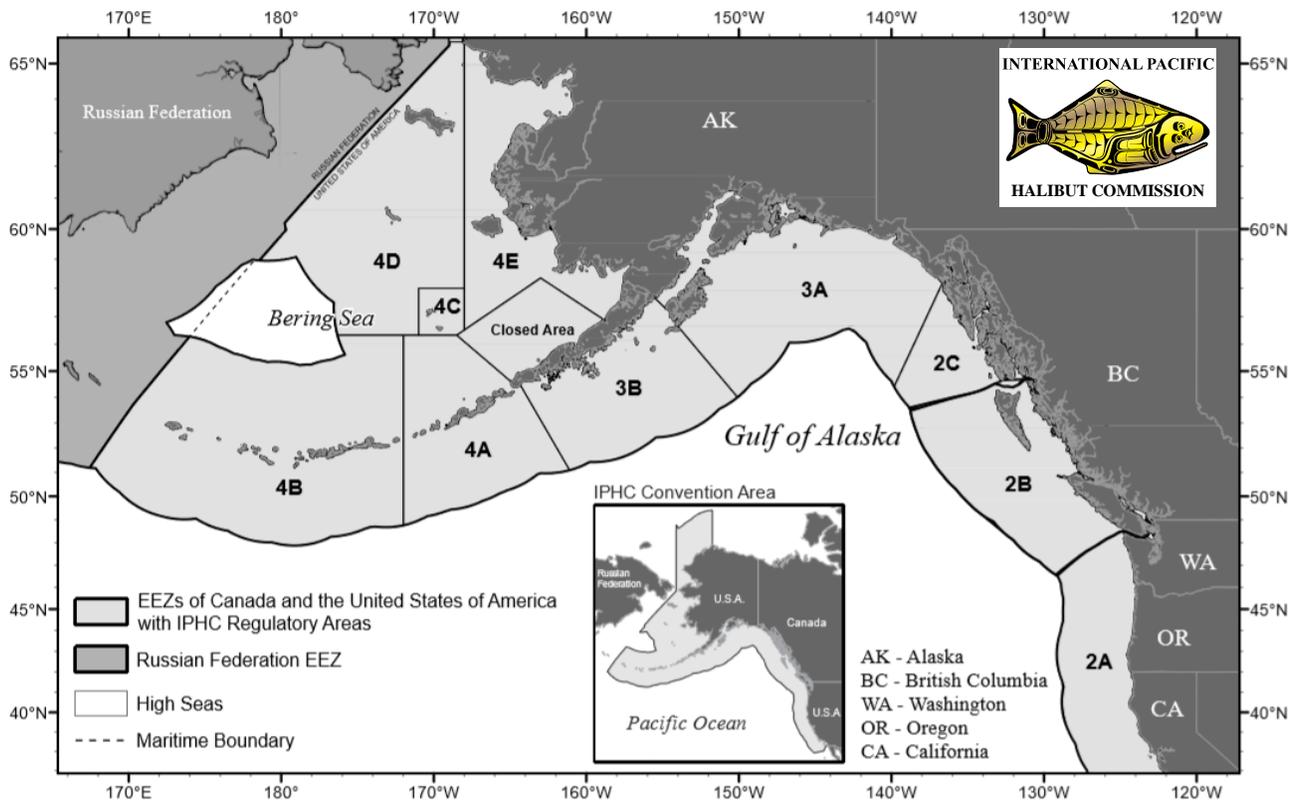


Figure 5. Map of the IPHC Convention Area (insert) and IPHC Regulatory Areas.

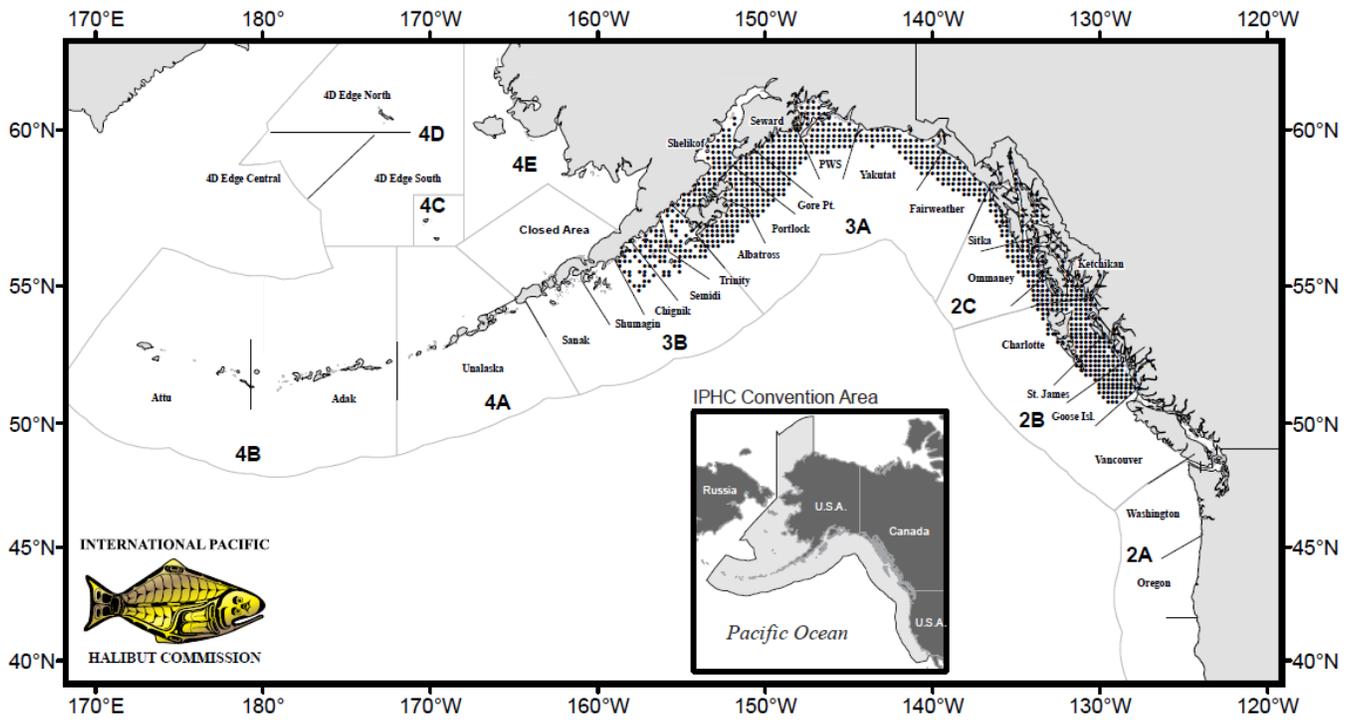


Figure 6. 2020 FISS station positions, charter region divisions, and IPHC Regulatory Areas.

Gear comparison

All stations in the St James charter region in IPHC Regulatory Area 2B were fished twice, once by the FISS standard of fixed-hook gear and once by snap gear. To accomplish this work, this charter region was divided into early and late stations by gear type. The stations for both gear types are shown in [Figure 7](#) with the fixed-gear timing.

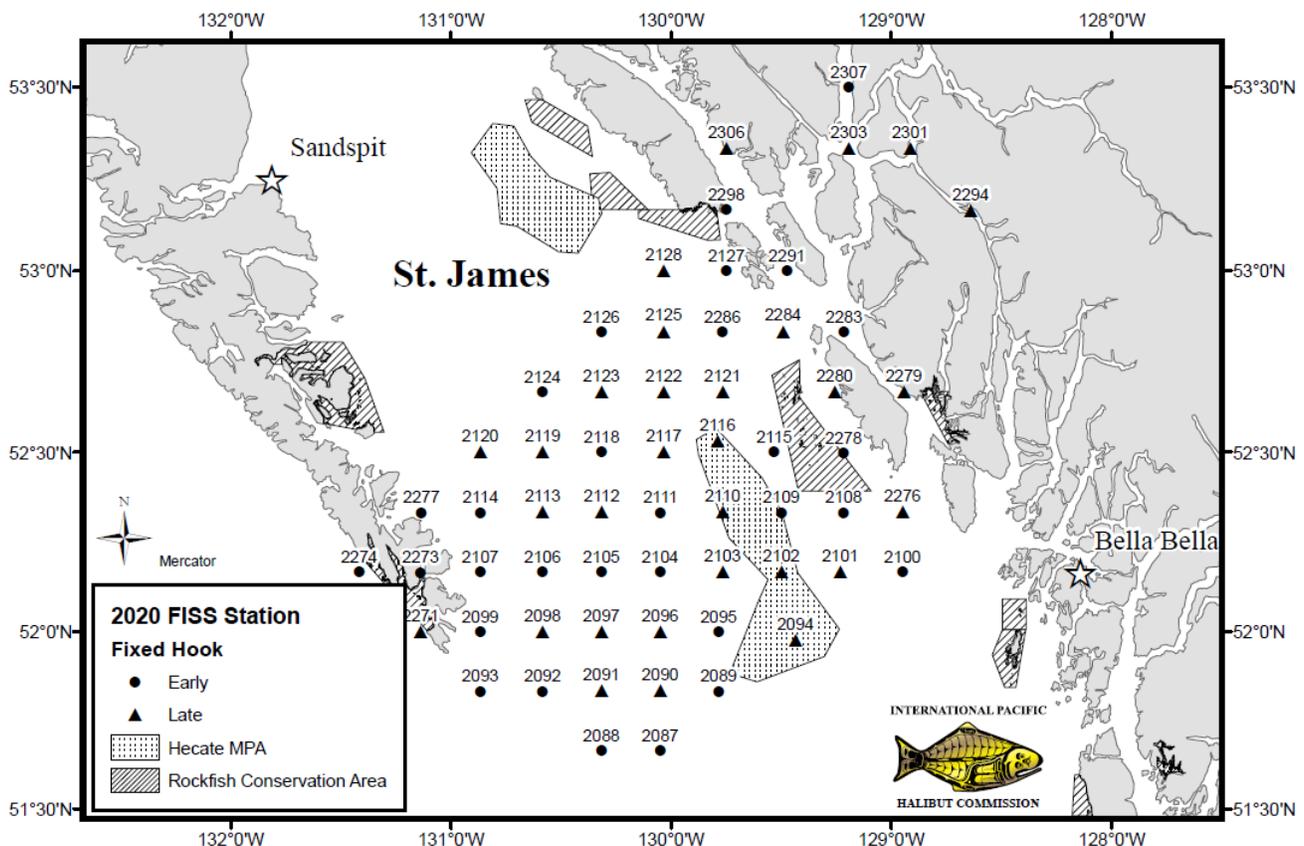


Figure 7. IPHC Regulatory Area 2B St James charter region fixed-hook gear timing.

Sampling protocols

IPHC Setline Survey Specialists collected data according to protocols established in the 2020 FISS Sampling Manual.

Bait purchase

The minimum quality requirement for FISS bait is No. 2 semi-bright (Alaska Seafood Marketing Institute grades A through E), headed and gutted, and individually quick-frozen chum salmon. The IPHC secures most of the bait needed to supply FISS operations at the end of the previous salmon season. In August 2019, staff began arranging bait purchases for the 2020 FISS. Approximately 122 tonnes of chum salmon were utilized from three suppliers in the United States of America. Bait usage is based on 0.17 kilograms per hook resulting in approximately 136 kilograms per eight skate station. Bait quality was monitored and documented throughout the season and found to meet the standard as described above.

RESULTS AND REVENUE

Interactive views of some of the FISS results are provided via the IPHC website and can be found here: <https://www.iphc.int/data/setline-survey-catch-per-unit-effort>.

As in previous years, legal-sized (O32) Pacific halibut that were caught on FISS stations and sacrificed in order to obtain biological data were retained and sold. In addition, beginning in 2020, sub-legal (U32) Pacific halibut that were caught and randomly selected for otolith sampling were also retained and sold. This helps to offset costs of the FISS. FISS vessels also retained for sale incidentally captured rockfish (*Sebastes spp.*) and Pacific cod (*Gadus macrocephalus*). These species were retained because they rarely survive the barotrauma resulting from capture. Most vessel contracts provided the vessel a lump sum payment, along with a 10% share of the Pacific halibut proceeds and a 50% share of the incidental catch proceeds.

The 2020 FISS chartered 11 commercial longline vessels (five Canadian and six USA) during a combined 62 trips and 558 charter days ([Tables 1](#)). Of the 898 FISS stations planned for the 2020 FISS season, excluding the 60 stations fished with snap gear, 872 (97%) were effectively completed. Five stations could not be fished. Twenty-one stations were deemed ineffective due to whale depredation (n=16), pinniped predation (n=1), gear soak time (n=1), shark depredation (n=1), and setting and gear issues (n=2). Otoliths were removed from 11,053 fish coastwide. Approximately 402 tonnes (887,000 pounds) of Pacific halibut, 11 tonnes (23,500 pounds) of Pacific cod, and 39 tonnes (85,600 pounds) of rockfish were landed from the FISS stations.

Table 1a. Effort and landing summary by FISS charter region and vessel for all 2020 stations and all Pacific halibut (sampled U32 and all O32).

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number ¹	Charter Days ²	Planned Stations	Effective Stations ³	Pacific halibut Sold (t) ⁴	Pacific halibut Sold (lb) ⁴	Average Price USD/kg ⁵	Average Price USD/lb ⁵
2B	Charlotte	Bold Pursuit	20875	51	84	83	26	58,255	\$12.60	\$5.72
2B	Goose Is.	Bold Pursuit	20875	25	56	56	14	30,294	\$13.44	\$6.10
2B	St. James	Hanna Lio (Snap)	23162	39	60	58	26	56,979	\$12.93	\$5.87
2B	St. James	Vanisle	21912	38	60	58	23	51,114	\$13.34	\$6.05
2C	Ketchikan	Star Wars II	20492	31	48	45	17	37,781	\$9.23	\$4.19
2C	Ommaney	Star Wars II	20492	37	52	52	35	76,079	\$9.88	\$4.48
2C	Sitka	Pender Isle	27282	34	52	48	31	68,369	\$12.29	\$5.57
3A	Albatross	Kema Sue	41033	26	49	49	25	55,114	\$9.13	\$4.14
3A	Fairweather	Pender Isle	27282	26	51	50	21	45,534	\$7.61	\$3.45
3A	Gore Pt.	Allstar	55922	27	48	46	21	46,324	\$9.36	\$4.25
3A	Portlock	Devotion	42892	27	51	47	18	39,268	\$8.79	\$3.99
3A	PWS	Polaris	19266	33	67	67	33	72,700	\$9.28	\$4.21
3A	Seward	Saint Nicholas	45399	15	17	17	9	20,491	\$9.68	\$4.39
3A	Seward	Polaris	19266	16	35	33	21	46,386	\$9.93	\$4.51
3A	Shelikof	Kema Sue	41033	29	64	63	32	71,505	\$10.20	\$4.63
3A	Yakutat	Seymour	17530	32	64	59	33	73,482	\$10.17	\$4.61
3B	Chignik	Devotion	42892	19	26	25	3	6,230	\$8.73	\$3.96
3B	Semidi	Saint Nicholas	45399	28	39	39	7	15,169	\$7.93	\$3.60
3B	Trinity	Saint Nicholas	45399	25	35	35	7	15,529	\$11.88	\$5.39
Total		11 Vessels		558	958	930	402	886,603	\$10.49	\$4.76

¹ Canada: Vessel Registration Number and USA: ADF&G vessel number.

² Days are estimated - some vessels fished two charter regions in one day.

³ Stations that did not meet setting parameters or deemed ineffective are excluded.

⁴ Net weight (head-off, dressed, washed). May not sum to correct total due to rounding.

⁵ Ex-vessel price.

Table 1b. Effort and landing summary by FISS charter region and vessel for all 2020 stations and O32 Pacific halibut.

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number ¹	Charter Days ²	Planned Stations	Effective Stations ³	Pacific halibut Sold (t) ⁴	Pacific halibut Sold (lb) ⁴	Average Price USD/kg ⁵	Average Price USD/lb ⁵
2B	Charlotte	Bold Pursuit	20875	51	84	83	26	57,064	\$12.62	\$5.72
2B	Goose Is.	Bold Pursuit	20875	25	56	56	13	29,341	\$13.43	\$6.09
2B	St. James	Hanna Lio (Snap)	23162	39	60	58	26	56,809	\$12.94	\$5.87
2B	St. James	Vanisle	21912	38	60	58	23	50,630	\$13.35	\$6.05
2C	Ketchikan	Star Wars II	20492	31	48	45	17	37,193	\$9.23	\$4.19
2C	Ommaney	Star Wars II	20492	37	52	52	34	74,794	\$9.90	\$4.49
2C	Sitka	Pender Isle	27282	34	52	48	36	78,495	\$10.67	\$4.84
3A	Albatross	Kema Sue	41033	26	49	49	25	54,183	\$9.14	\$4.15
3A	Fairweather	Pender Isle	27282	26	51	50	16	35,117	\$9.86	\$4.47
3A	Gore Pt.	Allstar	55922	27	48	46	21	45,406	\$9.39	\$4.26
3A	Portlock	Devotion	42892	27	51	47	17	36,967	\$8.92	\$4.04
3A	PWS	Polaris	19266	33	67	67	33	72,128	\$9.30	\$4.22
3A	Seward	Saint Nicholas	45399	15	17	17	9	20,409	\$9.68	\$4.39
3A	Seward	Polaris	19266	16	35	33	21	46,060	\$9.94	\$4.51
3A	Shelikof	Kema Sue	41033	29	64	63	32	69,728	\$10.25	\$4.65
3A	Yakutat	Seymour	17530	32	64	59	33	73,482	\$10.17	\$4.61
3B	Chignik	Devotion	42892	19	26	25	2	4,419	\$8.40	\$3.81
3B	Semidi	Saint Nicholas	45399	28	39	39	5	10,216	\$9.87	\$4.48
3B	Trinity	Saint Nicholas	45399	25	35	35	8	18,335	\$10.04	\$4.56
Total		11 Vessels		558	958	930	395	870,776	\$10.51	\$4.77

¹ Canada: Vessel Registration Number and USA: ADF&G vessel number.

² Days are estimated - some vessels fished two charter regions in one day.

³ Stations that did not meet setting parameters or deemed ineffective are excluded.

⁴ Net weight (head-off, dressed, washed). May not sum to correct total due to rounding.

⁵ Ex-vessel price.

Table 1c. Effort and landing summary by FISS charter region and vessel for all 2020 stations and sampled U32 Pacific halibut.

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number ¹	Charter Days ²	Planned Stations	Effective Stations ³	Pacific halibut Sold (t) ⁴	Pacific halibut Sold (lb) ⁴	Average Price USD/kg ⁵	Average Price USD/lb ⁵
2B	Charlotte	Bold Pursuit	20875	51	84	83	1	1,191	\$11.73	\$5.32
2B	Goose Is.	Bold Pursuit	20875	25	56	56	0	953	\$13.71	\$6.22
2B	St. James	Hanna Lio (Snap)	23162	39	60	58	0	170	\$11.80	\$5.35
2B	St. James	Vanisle	21912	38	60	58	0	484	\$12.65	\$5.74
2C	Ketchikan	Star Wars II	20492	31	48	45	0	588	\$9.27	\$4.20
2C	Ommaney	Star Wars II	20492	37	52	52	1	1,285	\$8.87	\$4.02
2C	Sitka	Pender Isle	27282	34	52	48	0	268	\$10.48	\$4.75
3A	Albatross	Kema Sue	41033	26	49	49	0	931	\$8.53	\$3.87
3A	Fairweather	Pender Isle	27282	26	51	50	0	23	\$9.48	\$4.30
3A	Gore Pt.	Allstar	55922	27	48	46	0	918	\$8.02	\$3.64
3A	Portlock	Devotion	42892	27	51	47	1	1,865	\$8.25	\$3.74
3A	PWS	Polaris	19266	33	67	67	0	572	\$7.03	\$3.19
3A	Seward	Saint Nicholas	45399	15	17	17	0	82	\$8.84	\$4.01
3A	Seward	Polaris	19266	16	35	33	0	326	\$8.82	\$4.00
3A	Shelikof	Kema Sue	41033	29	64	63	1	1,777	\$8.26	\$3.75
3A	Yakutat	Seymour	17530	32	64	59	0	0	\$ -	\$ -
3B	Chignik	Devotion	42892	19	26	25	1	2,247	\$7.68	\$3.48
3B	Semidi	Saint Nicholas	45399	28	39	39	1	2,114	\$9.19	\$4.17
3B	Trinity	Saint Nicholas	45399	25	35	35	0	33	\$9.70	\$4.40
Total		11 Vessels		558	958	930	7	15,827	\$9.16	\$4.16

¹ Canada: Vessel Registration Number and USA: ADF&G vessel number.

² Days are estimated - some vessels fished two charter regions in one day.

³ Stations that did not meet setting parameters or deemed ineffective are excluded.

⁴ Net weight (head-off, dressed, washed). May not sum to correct total due to rounding.

⁵ Ex-vessel price.

Vessels chartered by the IPHC delivered fish to 12 different ports ([Tables 2](#)). Fish sales were awarded based on obtaining a fair market price. When awarding sales, the Commission considered the price offered. The number of years that a buyer had been buying and marketing Pacific halibut, how fish were graded at the dock (including the determination of No. 2 and chalky Pacific halibut), and the promptness of settlements following deliveries were also selection criteria. Individual sales were evaluated after each event to ensure that the buyer was meeting IPHC standards. Average prices decreased from \$12.31/kg in 2019 to \$10.49/kg in 2020 ([Tables 3](#)). This represents a 14.8% drop in price, which is lower than the 25% drop predicted due to COVID-19 constraints.

Table 2a. FISS Pacific halibut landings by port for all Pacific halibut (sampled U32 and all O32), 2020^{1,2}.

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Cordova	1	10	21911	\$92,217	\$9.28	\$4.21
Craig	1	9	20,810	\$97,053	\$10.28	\$4.66
Homer	7	36	79,270	\$374,549	\$10.42	\$4.72
Juneau	2	17	37,606	\$176,910	\$10.37	\$4.70
Ketchikan	5	24	52,557	\$226,552	\$9.50	\$4.31
Kodiak	11	75	164,756	\$681,845	\$9.12	\$4.14
Petersburg	2	18	40,493	\$175,615	\$9.56	\$4.34
Port Hardy	12	63	139,377	\$834,260	\$13.20	\$5.99
Prince Rupert	5	39	85,894	\$480,254	\$12.33	\$5.59
Sand Point	1	2	4,590	\$15,989	\$7.68	\$3.48
Seward	8	60	132,938	\$579,382	\$9.61	\$4.36
Sitka	2	16	36,045	\$157,815	\$9.65	\$4.38
Yakutat	5	32	70,356	\$325,337	\$10.19	\$4.62
Grand Total	62	402	886,603	\$4,217,777	\$10.49	\$4.76

¹ Net weight (head-off, dressed, washed).² Prices based on net weight.**Table 2b.** FISS Pacific halibut landings by port for O32 Pacific halibut, 2020^{1,2}.

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Cordova	1	10	21595	\$91,406.68	\$9.33	\$4.23
Craig	1	9	20430	\$95,381.10	\$10.29	\$4.67
Homer	7	35	77519	\$367,810.84	\$10.46	\$4.74
Juneau	2	17	37606	\$176,909.61	\$10.37	\$4.70
Ketchikan	5	23	51587	\$222,399.03	\$9.50	\$4.31
Kodiak	11	72	159742	\$663,100.68	\$9.15	\$4.15
Petersburg	2	18	39970	\$173,798.60	\$9.59	\$4.35
Port Hardy	12	62	137770	\$824,644.49	\$13.20	\$5.99
Prince Rupert	5	38	84435	\$472,645.24	\$12.34	\$5.60
Sand Point	1	1	2954	\$10,426.25	\$7.78	\$3.53
Seward	8	59	130790	\$570,417.13	\$9.62	\$4.36
Sitka	2	16	36045	\$157,814.51	\$9.65	\$4.38
Yakutat	5	32	70333	\$325,238.05	\$10.19	\$4.62
Grand Total	62	395	870,776	\$4,151,992	\$10.51	\$4.77

¹ Net weight (head-off, dressed, washed).² Prices based on net weight.

Table 2c. FISS Pacific halibut landings by port for sampled U32 Pacific halibut, 2020^{1,2}.

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Cordova	1	<1	316	\$810.00	\$5.65	\$2.56
Craig	1	<1	380	\$1,672.00	\$9.70	\$4.40
Homer	7	1	1751	\$6,738.54	\$8.48	\$3.85
Juneau	2	0	0	\$ -	\$ -	\$ -
Ketchikan	5	<1	970	\$4,153.20	\$9.44	\$4.28
Kodiak	11	2	5014	\$18,744.77	\$8.24	\$3.74
Petersburg	2	<1	523	\$1,816.50	\$7.66	\$3.47
Port Hardy	12	1	1607	\$9,615.09	\$13.19	\$5.98
Prince Rupert	5	1	1459	\$7,609.08	\$11.50	\$5.22
Sand Point	1	1	1636	\$5,562.40	\$7.50	\$3.40
Seward	8	1	2148	\$8,964.80	\$9.20	\$4.17
Sitka	2	0	0	\$ -	\$ -	\$ -
Yakutat	5	<1	23	\$98.90	\$9.48	\$4.30
Grand Total	62	7	15,827	\$65,785.28	\$9.16	\$4.16

¹ Net weight (head-off, dressed, washed).² Prices based on net weight.**Table 3a.** FISS landings (total pounds and price) of all Pacific halibut (sampled U32 and all O32) by IPHC Regulatory Area in 2020¹.

IPHC Regulatory Area	2B	2C	3A	3B	Combined
Tonnes	89	83	214	17	402
Pounds	196,642	182,229	470,804	36,928	886,603
Price USD/kg	\$13.02	\$10.07	\$9.66	\$9.62	\$10.49
Price USD/lb	\$5.90	\$4.57	\$4.38	\$4.36	\$4.76

¹ Net weight (head-off, dressed, washed)**Table 3b.** FISS landings (total pounds and price) of O32 Pacific halibut by IPHC Regulatory Area in 2020¹.

IPHC Regulatory Area	2B	2C	3A	3B	Combined
Tonnes	88	82	211	15	395
Pounds	193,844	180,088	464,182	32,662	870,776
Price USD/kg	\$13.02	\$10.08	\$9.68	\$9.77	\$10.51
Price USD/lb	\$5.91	\$4.57	\$4.39	\$4.43	\$4.77

¹ Net weight (head-off, dressed, washed)**Table 3c.** FISS landings (total pounds and price) of sampled U32 Pacific halibut by IPHC Regulatory Area in 2020¹.

IPHC Regulatory Area	2B	2C	3A	3B	Combined
Tonnes	1	1	3	2	7
Pounds	2,798	2,141	6,622	4,266	15,827
Price USD/kg	\$12.57	\$9.18	\$8.19	\$8.43	\$9.16
Price USD/lb	\$5.70	\$4.16	\$3.72	\$3.82	\$4.16

¹ Net weight (head-off, dressed, washed)**FISS timing**

Each year, the months of June, July, and August are targeted for FISS fishing. In 2020, this activity took place from 27 June through 9 September. On a coastwide basis, FISS vessel activity

was highest in intensity at the beginning of the FISS season and declined early in August as boats finished their charter regions (Figure 8). All FISS activity was completed by early-September.

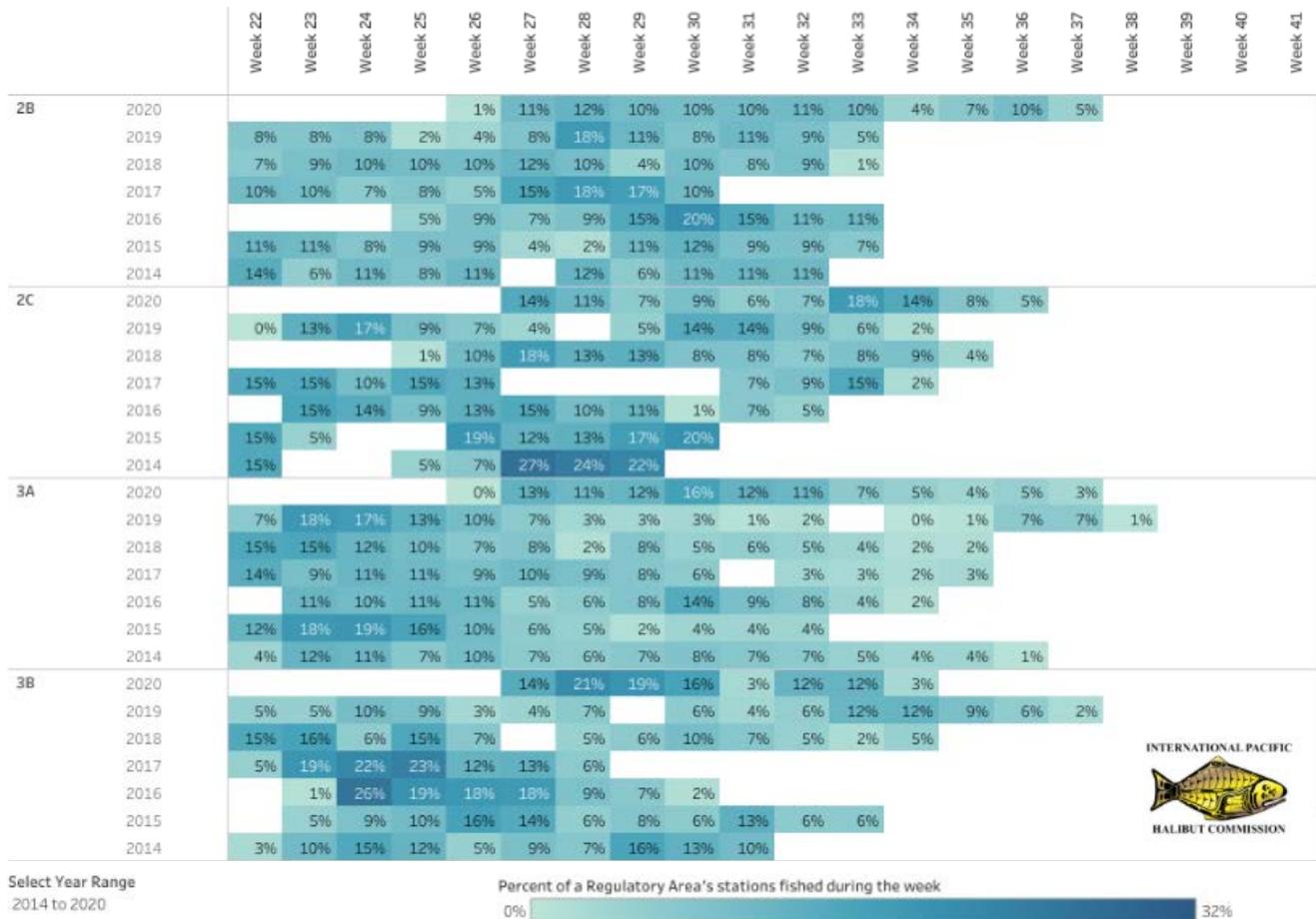


Figure 8. Percent of the total FISS stations completed by IPHC Regulatory Area during each week of the year (2014-2020). Week 22 begins in late May or early June depending on the year.

Results of space-time modelling in 2020

Revisions to the data inputs for space-time modelling of survey data included the use of a smoother curve for calibrating NMFS trawl survey data with IPHC FISS data in the Bering Sea, and the inclusion of snap-gear data in IPHC Regulatory Area 2B modelling. The former was a result of recommendations from reviewers of Webster et al. (2020), in which we presented methods for space-time modelling of Bering Sea survey data.

Figures 9 and 10 show time series estimates of O32 WPUE (most comparable to fishery catch-rates) and all sizes NPUE over the 1993-2020 period included in the 2020 space-time modelling. Overall there was an estimated increase of 6% in the coastwide O32 WPUE index, due largely to a 16% increase in Region 3, offset by a 7% decrease in Region 2 (Figure 9). Coastwide all sizes NPUE was stable, with just a 1% estimated decrease (Figure 10). Estimated 1993-20 time series by IPHC Regulatory Area are in Appendix A.

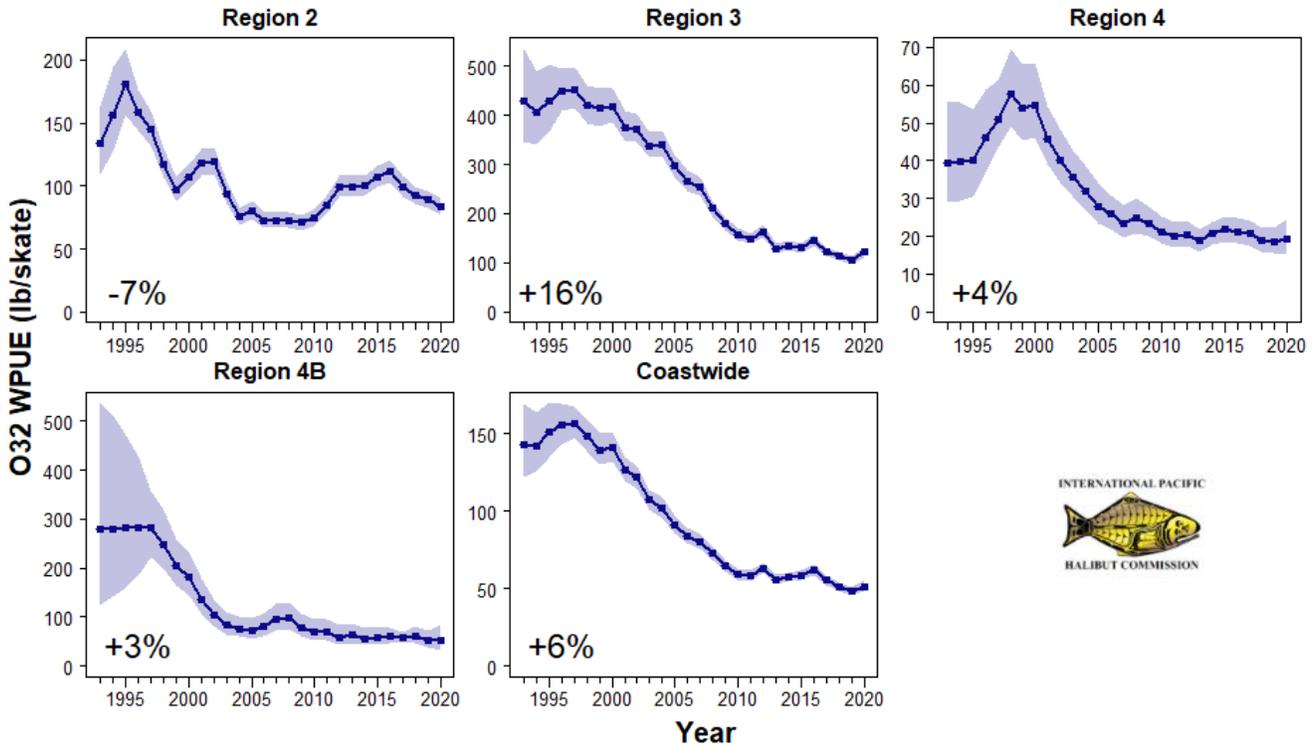


Figure 9. Space-time model output for O32 WPUE for 1993-2020 for Biological Regions. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2019 to 2020.

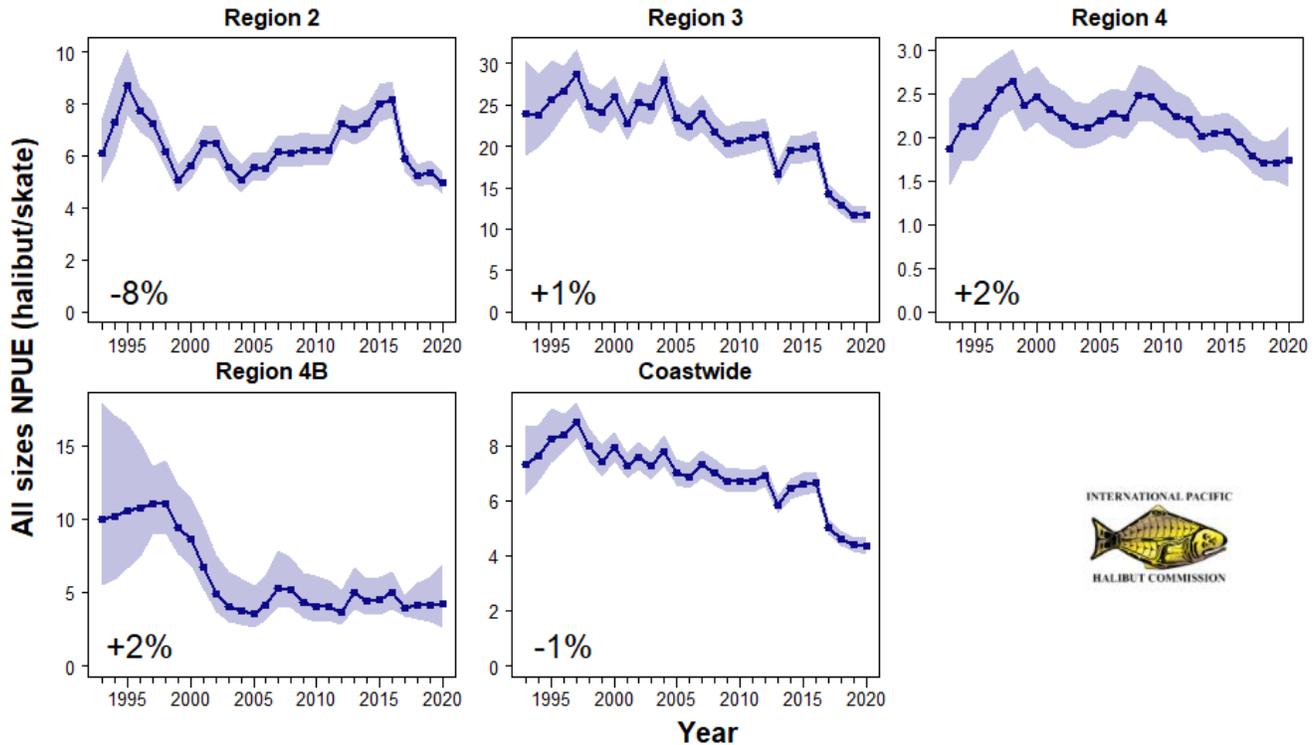


Figure 10. Space-time model output for all sizes NPUE for 1993-2020 for Biological Regions. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes NPUE from 2019 to 2020.

In Regulatory Area 2B, data from both fixed and snap gears were used in the modelling. Parameters allowing for different catch rates of the two gears were included in the models, and estimates of WPUE and NPUE series were based on model predictions assuming fixed gear to ensure consistency with other Regulatory Areas. Parameter estimates of gear type differences all implied that snap gear catch rates were lower on average ([Table 4](#)), with estimated catch rate ratios of 0.72 to 0.83 for the three indices modelled in 2020 (i.e., we estimate snap gear had 72% to 83% of the catch of fixed gear, depending on the index). Posterior 95% credible intervals were all wide, and included the value 1, i.e., no difference in catch rate, meaning that no clear conclusions regarding the relative effectiveness of the two gear types can be drawn from this project on its own. However, the results are generally consistent with those of the much larger gear comparison study in 2019, which estimated a ratio of 0.86 for all three indices. Additional modelling will be used to combine the data from both studies and from future studies to be conducted elsewhere, which will lead to more precise overall estimates of the ratio of catch rates across all IPHC Regulatory Areas.

Table 4. Posterior estimates of the ratio of snap to fixed gear catch rates for O32 and all sizes WPUE, and all sizes NPUE, from space-time modelling of data from the St James charter region in Regulatory Area 2B in 2020.

Variable	Ratio of snap to fixed catch rate	
	Posterior mean	95% credible interval
O32 WPUE	0.83	0.63 – 1.10
All sizes WPUE	0.79	0.60 – 1.03
All sizes NPUE	0.72	0.60 – 1.17

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2020-IM096-06 Rev_1 which provided an overview of the IPHC's FISS design and implementation in 2020 and results of the space-time modelling of Pacific halibut survey data for 1993-2020.

APPENDIX A

Space-time modelling results by IPHC Regulatory Area

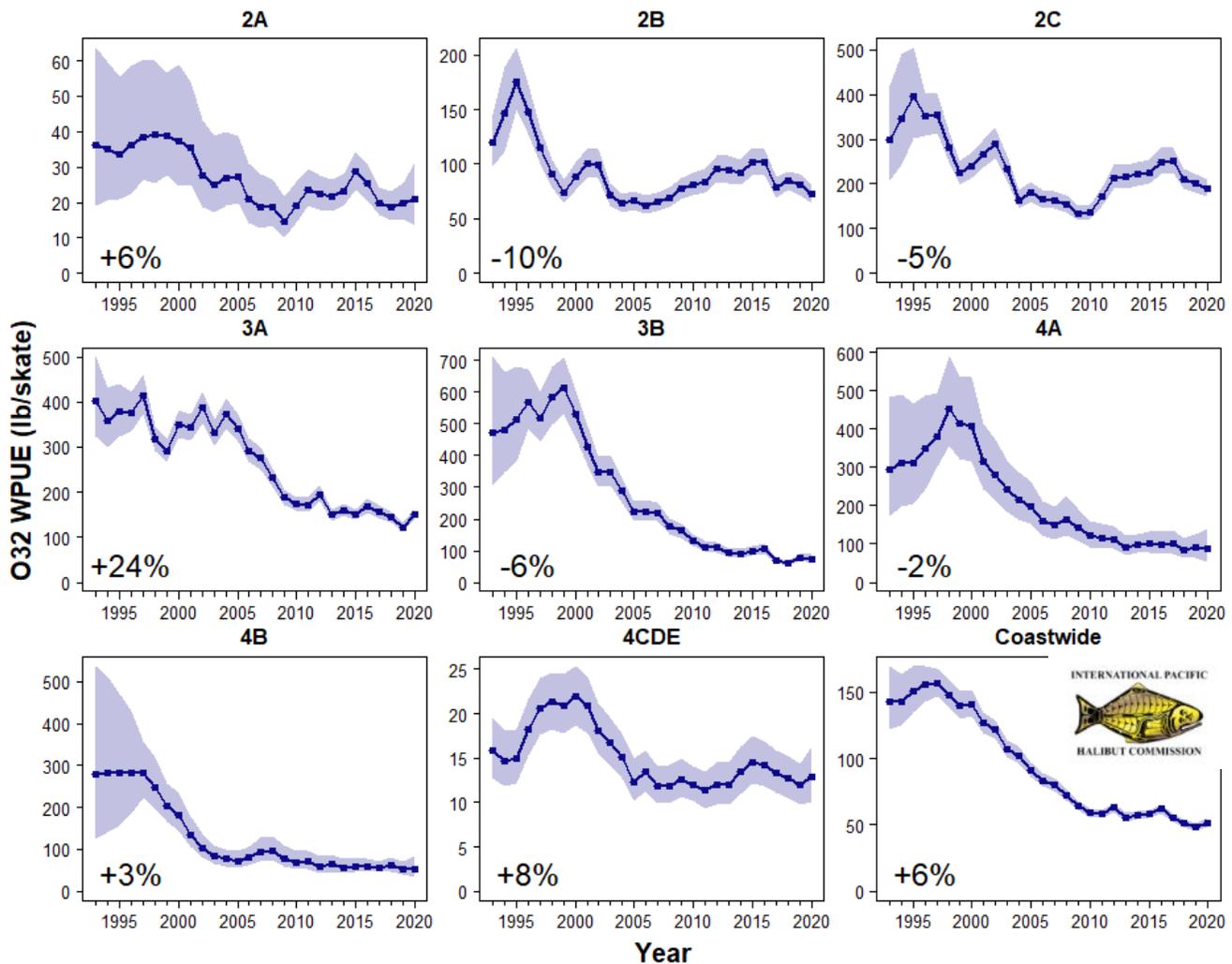


Figure A.1. Space-time model output for O32 WPUE for 1993-2020. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2019 to 2020.

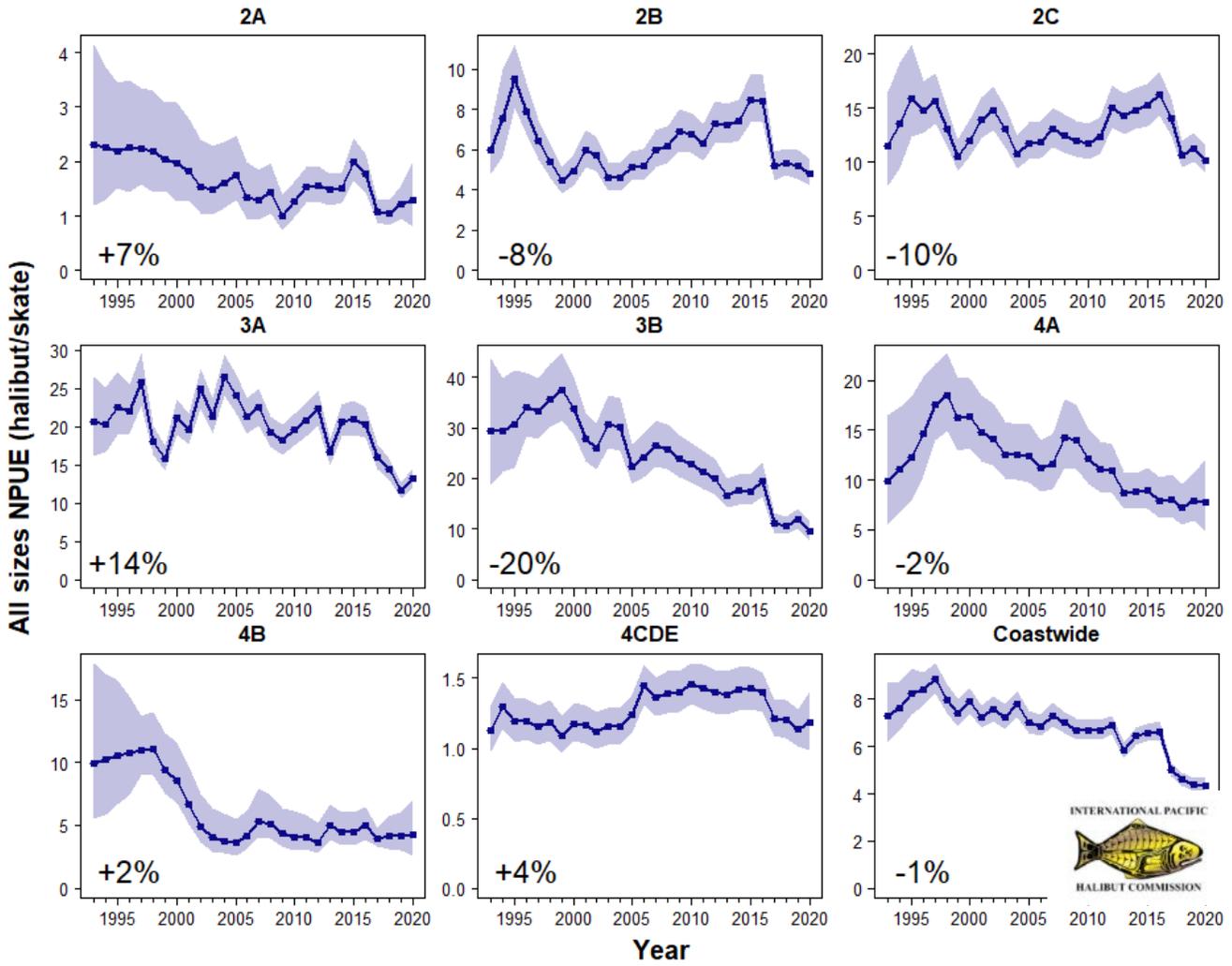


Figure A.2. Space-time model output for all sizes NPUE for 1993-2020. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean total NPUE from 2019 to 2020.