



Fishery-independent setline survey (FISS) design and implementation in 2018, including current and future expansions

PREPARED BY: IPHC SECRETARIAT (L.ERIKSON, E. SODERLUND & T. GEERNAERT; 21 DECEMBER 2018)

PURPOSE

To provide an overview of the International Pacific Halibut Commission's (IPHC) fishery-independent setline survey (FISS) design and implementation in 2018, including current and future expansions.

BACKGROUND

The IPHC's FISS provides catch information and biological data on Pacific halibut (*Hippoglossus stenolepis*) that are collected independently from the commercial fishery. These data are collected using standardized methods, bait, and gear during the summer of each year, and provide a comparison with data collected from the commercial fishery. Biological data collected on the FISS (e.g. the size, age, and sex composition of Pacific halibut) are used to monitor changes in biomass, growth, and mortality in the Pacific halibut population. In addition, records of non-target species caught during FISS operations provide insight into bait competition, rate of bait attacks, and serve as an index of abundance over time, making them valuable to the assessment, management, and avoidance of non-target species.

The IPHC has carried out the FISS annually in the years 1963 to 1987 and from 1992 to 2018. Historical information regarding previous FISS operations has been presented in [IPHC Annual Reports](#); [IPHC Report of Assessment and Research Activities](#) documents 1993-2017; and [IPHC Technical Reports](#) 18 and 58. The majority of the current FISS station design and sampling protocols have been standardized since 1998.

Beginning in 2017 and with key updates made for 2018, interactive views of the FISS results were provided via the IPHC website:

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

MATERIALS AND METHODS

The IPHC's FISS design encompasses nearshore and offshore waters of the IPHC Convention Area ([Figure 1](#)). The current FISS station layout has been in place since 1998 (with some additions in 2006 (Bering Sea), and in 2011 (IPHC Regulatory Area 2A).

The IPHC Regulatory Areas are divided into 31 regions, each requiring between 10 and 46 charter days to survey ([Table 1](#)). FISS stations were located at the intersections of a 10 nmi by 10 nmi square grid within the depth range occupied by Pacific halibut during summer months (20-275 fm [37-503 m] in most areas). [Figure 2](#) depicts the 2018 FISS station positions (including expansion stations), charter region divisions, and IPHC Regulatory Areas surveyed.

Thirteen (13) extra stations in Southeast Alaska and eight rockfish (*Sebastes spp.*) index stations in the Washington charter region are fished on a different layout than the FISS and are not included in the IPHC stock assessment dataset.

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

The 2018 FISS chartered thirteen (13) commercial longline vessels (four (4) Canadian and nine (9) USA) during a combined 88 trips and 806 charter days ([Table 1](#)). These vessels fished 30 charter regions, covering habitat from northern California on to the island of Attu in the Aleutian Islands, and north along and including the Bering Sea continental shelf).

Vessel Operations

Of the 1,496 FISS stations planned for the 2018 FISS season, 1,458 (97%) were effectively completed. Seven expansion stations were dropped because they were either too deep or too shallow once prospected. The remaining 31 stations were rated ineffective because of whale depredation (new parameters for 2018, n=18), sand flea damage (n=7), gear issues (n=4), shark depredation (n=1) and pinniped depredation (n=1). These details are available under the FISS Performance page on the IPHC website (<https://iphc.int/data/fiss-performance>) Otoliths were removed from 13,290 fish coastwide. Approximately 818,246 pounds (371 t) of Pacific halibut, 85,716 pounds (39 t) of Pacific cod, and 51,337 pounds (23 t) of rockfish were landed from the FISS stations.

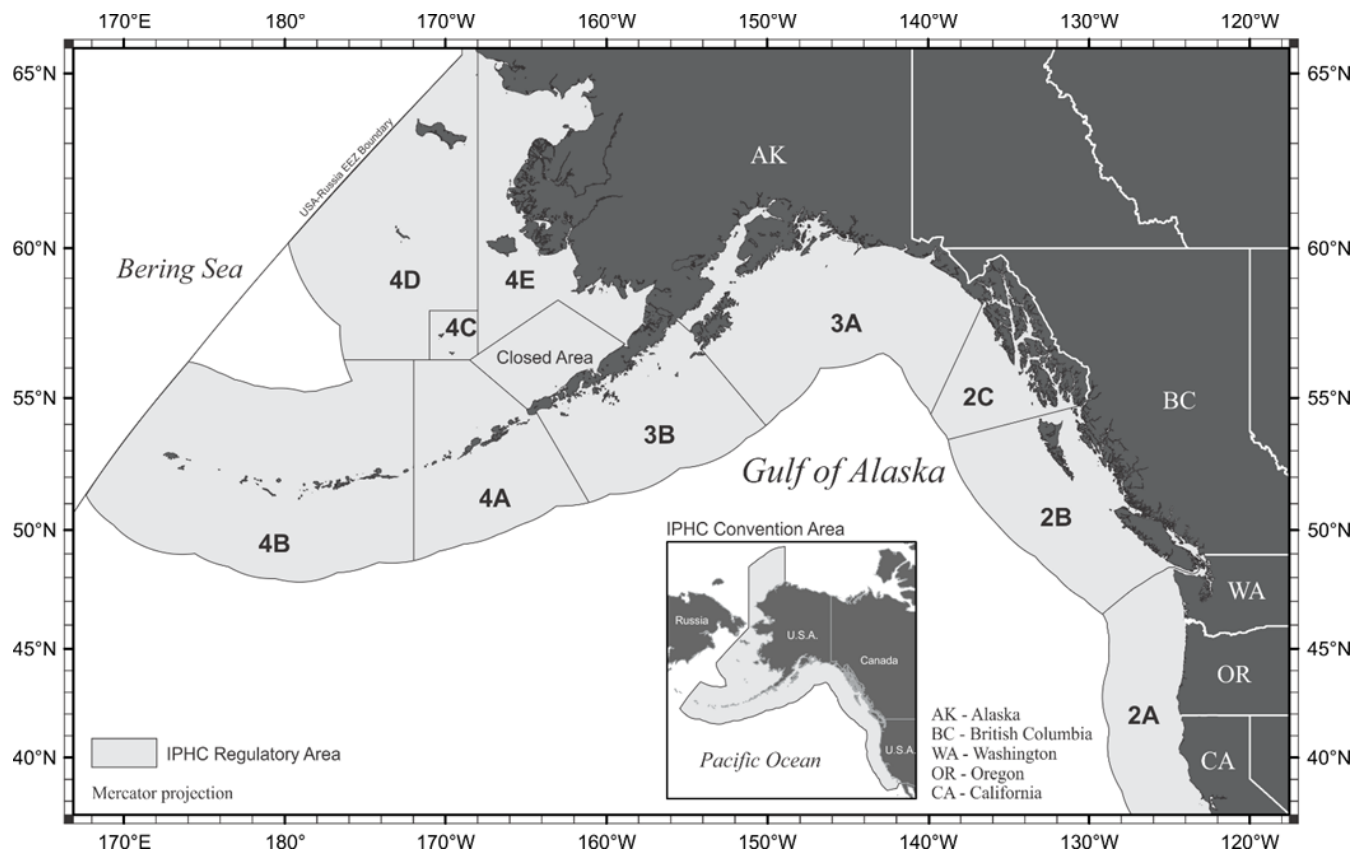


Figure 1. Map of the IPHC Convention Area (insert) and IPHC Regulatory Areas.

Table 1. Effort and catch summary by FISS charter region and vessel for all 2018 stations.

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number ¹	Charter Days ²	Planned Stations	Effective Stations ³	Pacific halibut Sold (lb) ⁴	Pacific halibut Sold (t)	Average Price USD/lb ⁵	Average Price USD/kg
2A	Oregon	<i>Pacific Surveyor</i>	-	34	47	46	7,902	4	\$8.08	\$17.82
2A	Washington	<i>Pacific Surveyor</i>	-	35	83	83 ⁶	12,975	6	\$6.07	\$13.39
2A	Puget Sound	<i>Pacific Surveyor</i>	-	12	14	13	392	<1	\$5.00	\$11.02
2B	Charlotte Inside	<i>Free to Wander</i>	29155	21	48	46	25,953	12	\$6.46	\$14.24
2B	Charlotte North	<i>Free to Wander</i>	29155	23	40	38	31,076	14	\$6.46	\$14.25
2B	Goose Is.	<i>Bold Pursuit</i>	20875	25	58	57	21,005	10	\$6.59	\$14.53
2B	St. James	<i>Pender Isle</i>	27282	27	57	57	47,841	22	\$6.02	\$13.26
2B	Vancouver Inside	<i>Vanisle</i>	21912	26	41	41	1,357	1	\$6.61	\$14.58
2B	Vancouver Outside	<i>Vanisle</i>	21912	29	58	57	17,428	8	\$6.48	\$14.29
2C	Ketchikan	<i>Vanisle</i>	21912	29	51	49	43,829	20	\$6.38	\$14.06
2C	Ommaney	<i>Predator</i>	33133	31	55	50	102,603	47	\$5.89	\$12.99
2C	Sitka	<i>Predator</i>	33133	33	59	58	52,892	24	\$6.12	\$13.49
3A	Albatross	<i>Saint Nicholas</i>	45399	25	45	44	24,502	11	\$4.75	\$10.48
3A	Fairweather	<i>Vanisle</i>	21912	24	49	47	33,955	15	\$5.31	\$11.71
3A	Gore Pt.	<i>Clyde</i>	55803	21	45	45	24,686	11	\$5.67	\$12.50
3A	Portlock	<i>Predator</i>	33133	22	46	44	28,721	13	\$5.60	\$12.34
3A	PWS	<i>Vansee</i>	19307	21	45	45	60,398	27	\$6.57	\$14.50
3A	Seward	<i>Clyde</i>	55803	23	48	47	30,433	14	\$5.60	\$12.36
3A	Shelikof	<i>Saint Nicholas</i>	45399	32	45	42	24,695	11	\$6.20	\$13.68
3A	Yakutat	<i>Seymour</i>	17530	24	51	48	69,303	31	\$6.33	\$13.95
3B	Chignik	<i>Polaris</i>	19266	19	45	45	13,799	6	\$4.53	\$9.99
3B	Sanak	<i>Kema Sue</i>	41033	29	48	47	7,888	4	\$4.31	\$9.50
3B	Semidi	<i>Clyde</i>	55803	22	47	47	16,744	8	\$5.26	\$11.61
3B	Shumagin	<i>Polaris</i>	19266	18	44	44	17,259	8	\$4.21	\$9.28
3B	Trinity	<i>Saint Nicholas</i>	45399	39	47	45	18,614	8	\$5.64	\$12.43
4A, Closed	4A Edge	<i>Norcoaster</i>	38173	36	57	57	9,160	4	\$4.15	\$9.14
4A, 4C	Unalaska	<i>Kema Sue</i>	41033	30	66	62	24,977	11	\$4.08	\$9.00
4D, 4C	4D Edge	<i>Kema Sue</i>	41033	37	68	65	20,462	9	\$4.47	\$9.86
4B	Adak	<i>Norcoaster</i>	38173	32	45	45	15,810	7	\$4.28	\$9.43
4B	Attu	<i>Norcoaster</i>	38173	27	44	44	11,587	5	\$1.54	\$3.39
Total		13 Vessels		806	1496	1458	818,246	371	\$5.75	\$12.68

¹ Alaska Department of Fish and Game vessel number in USA or Vessel Registration Number in Canada.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). Poundage may not sum to correct total because of rounding errors.⁵ Gross price.⁶ Includes eight Rockfish Index stations.

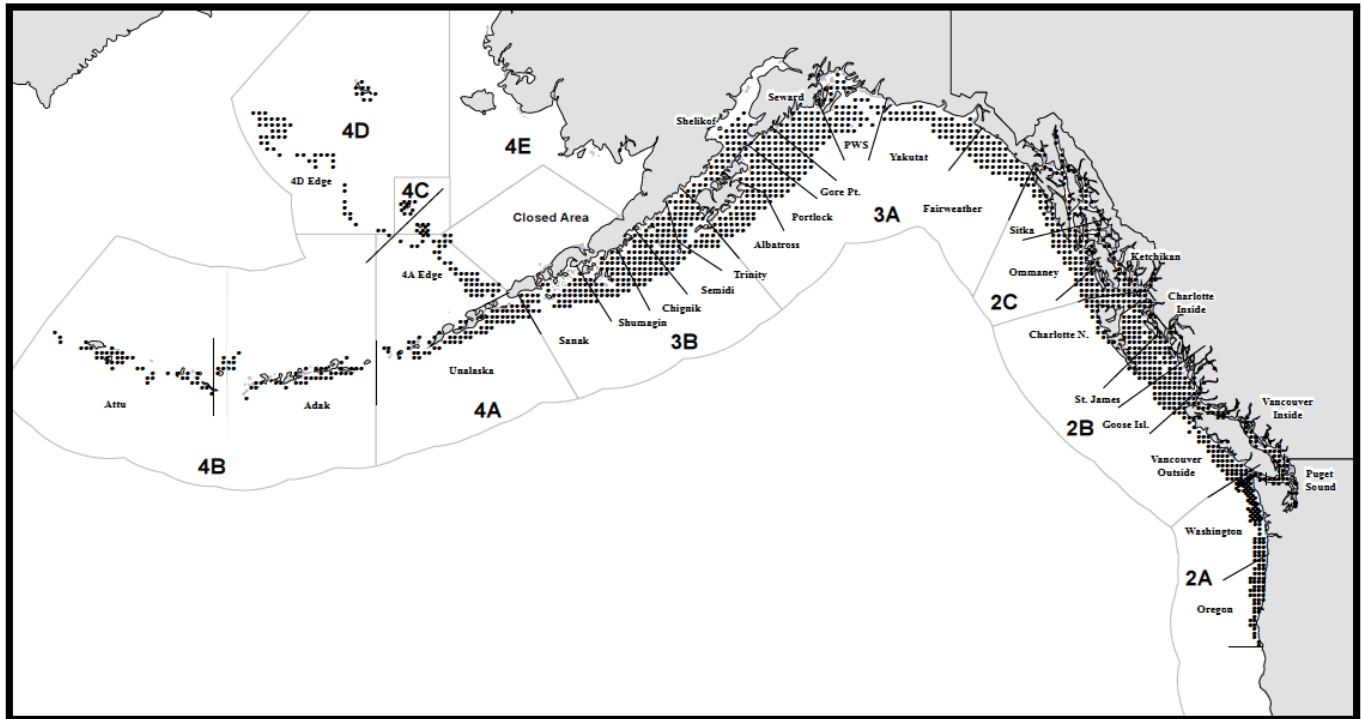


Figure 2. 2018 FISS station positions, charter region divisions, and IPHC Regulatory Areas.

Expansion stations

Since 2014, the IPHC has been sampling expansion stations in one or two IPHC Regulatory Areas each year ([Figure 3](#)). Commercial fishery data and other sources have shown the presence of Pacific halibut down to depths of 732 m (400 fm) and in waters shallower than 37 m (20 fm). Further, most IPHC Regulatory Areas have substantial gaps in station coverage within the standard 37-503 m depth range. The incomplete coverage of Pacific halibut habitat by the FISS could potentially lead to biased estimates of the weight per unit effort (WPUE) and numbers per unit effort (NPUE) used in the density indices for stock assessment modelling and for stock distribution estimation. For this reason, the IPHC has been undertaking a sequence of expansions since 2014 (following a 2011 pilot), with stations added to the standard grid to cover habitat not previously sampled.

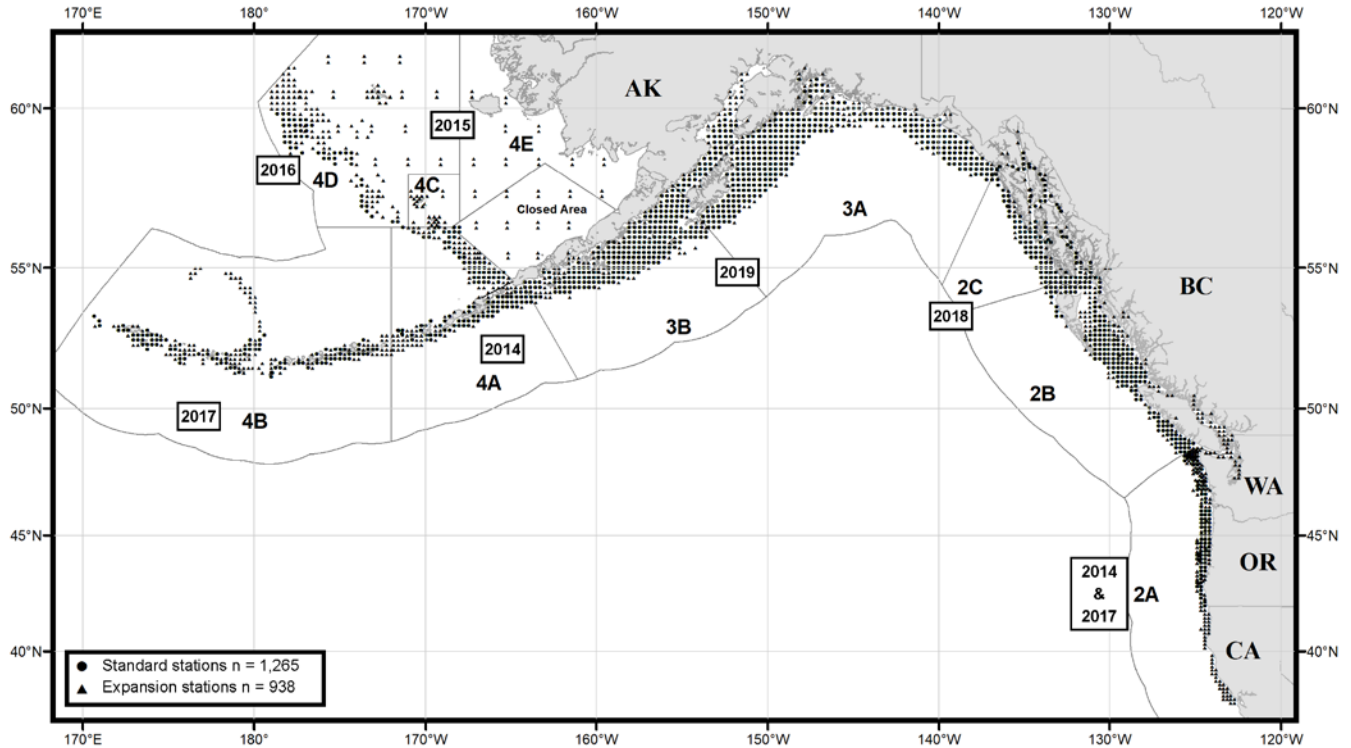


Figure 3. FISS expansion stations planned for 2014-19.

2018 Expansion in IPHC Regulatory Area 2A (USA)

The expansion stations in the Puget Sound charter region were fished to allow for a contiguous survey in the Salish Sea in conjunction with expansion work in IPHC Regulatory Area 2B. In addition, an ad-hoc densified grid off the north Washington coast was fished for the second time. A total of 144 stations were surveyed, of which 14 were expansion stations and 26 were the ad-hoc densified grid stations off the north Washington coast ([Figure 4](#)).

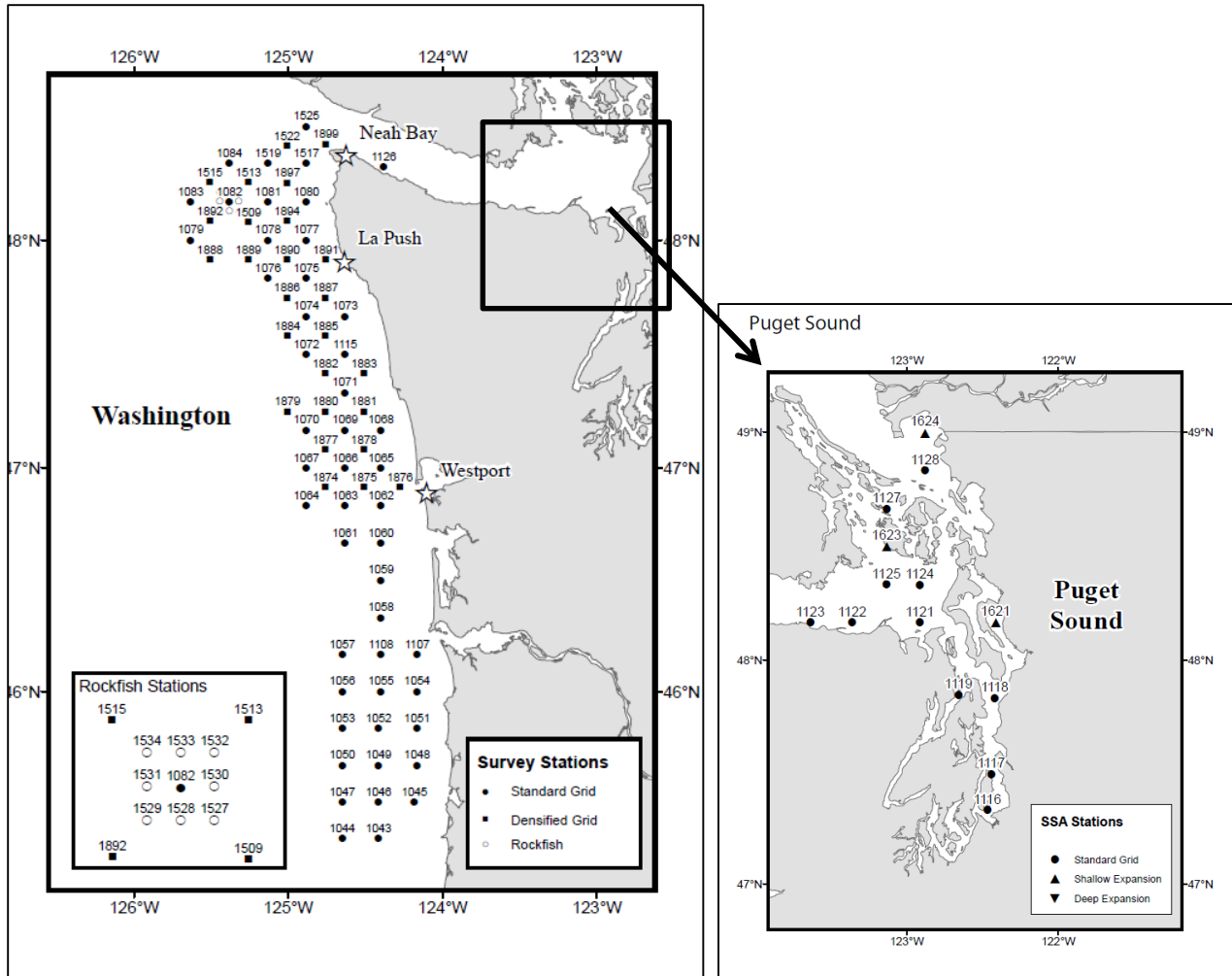


Figure 4. 2018 IPHC FISS stations in IPHC Regulatory Area 2A by charter region.

2018 Expansion in IPHC Regulatory Area 2B (Canada)

The expansion in IPHC Regulatory Area 2B included an additional 136 new stations (129 expansion and seven extra) that were added to the existing 166 FISS stations (standard) in IPHC Regulatory Area 2B. These included stations as shallow as 17 m (9 fm) and as deep as 732 m (399 fathoms (732 m) ([Figure 5](#)). To help manage this expansion, the historical Charlotte and Vancouver charter regions were divided into four new regions identified as Charlotte Inside, Charlotte North, Vancouver Inside and Vancouver Outside ([Table 2](#)).

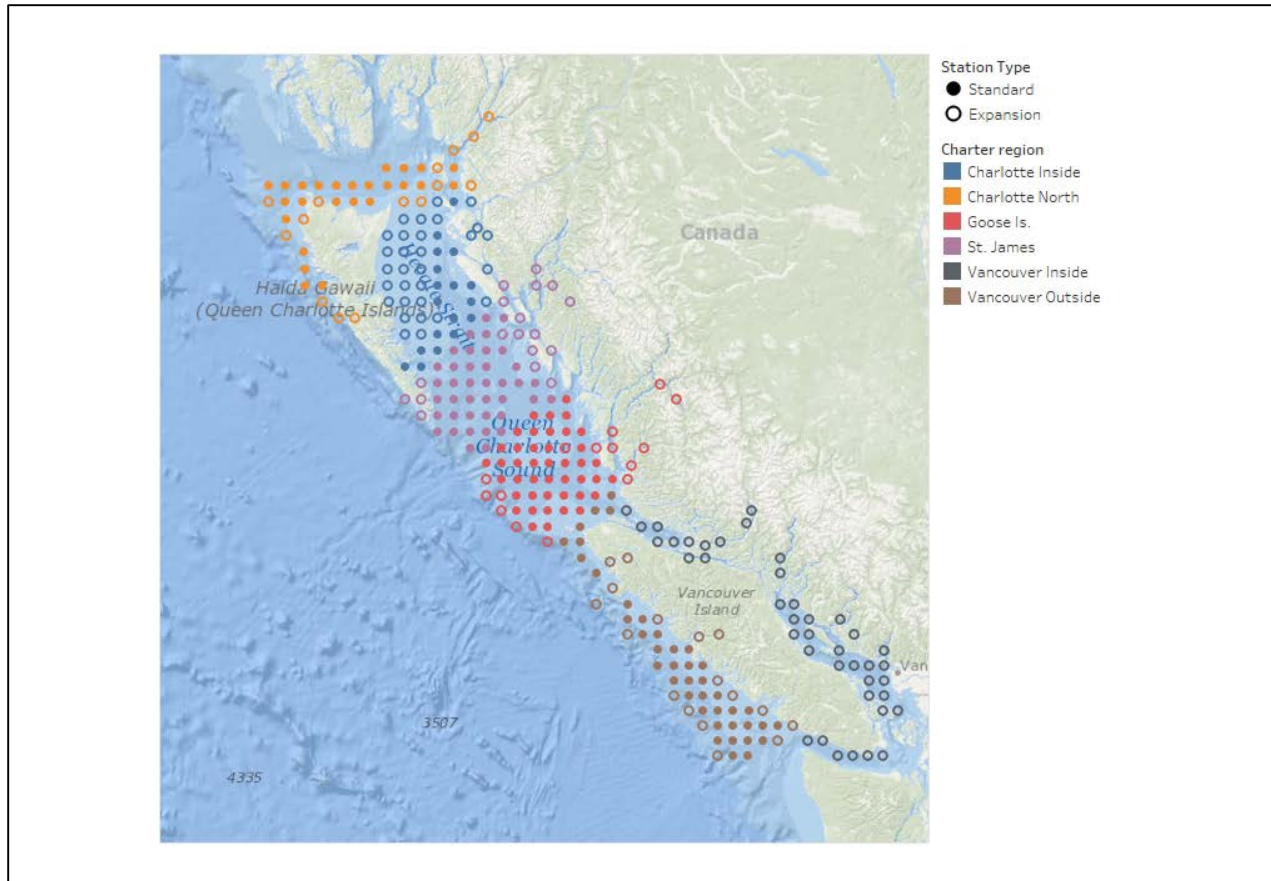


Figure 5. 2018 IPHC FISS stations in IPHC Regulatory Area 2B by charter region.

Table 2. IPHC Regulatory Area 2B FISS charter regions and count by station type.

Charter Region	Total Stations	Expansion	Extra ²	Standard
Charlotte Inside	48	29	1	18
Charlotte North	40	14	1	25
Goose Islands	58	14	1	43
St. James	57	18	0	39
Vancouver Inside	41	39	2	0
Vancouver Outside	58	15	2	41
Total	302 ¹	129	7	166

¹ six stations were not permitted because of habitat closures.

² extra stations are added between grid stations that are far apart from each other, typically up fjords and channels.

2018 Expansion in IPHC Regulatory Area 2C (USA)

The expansion in IPHC Regulatory Area 2C included 121 of the existing FISS stations (standard) with an additional 44 new stations (40 expansion and four extra), including stations as shallow as 17 m (9 fm) and as deep as 797 m (436 fm) ([Figure 6](#)). The expansion stations were divided into the existing FISS charter regions ([Table 3](#)).

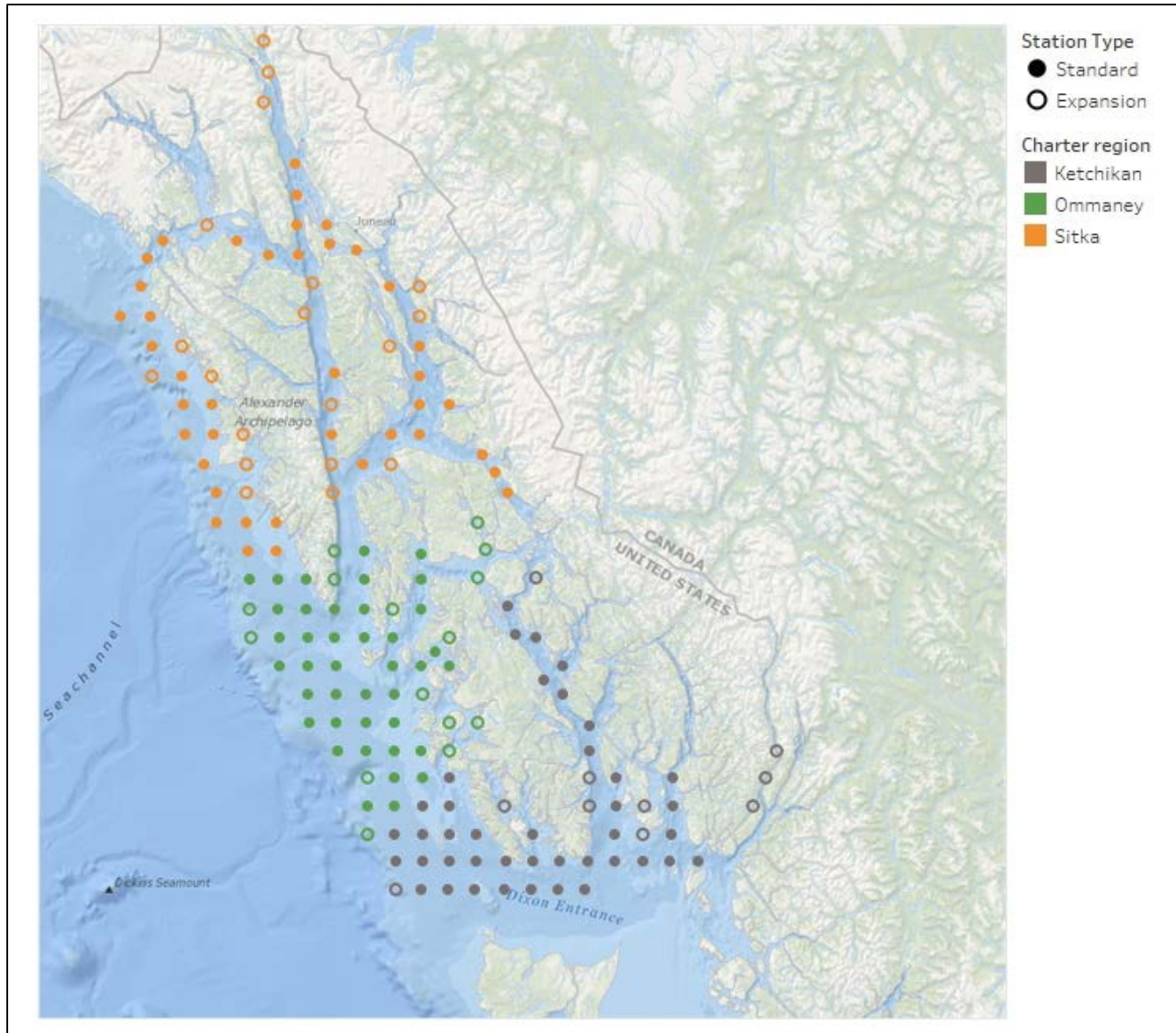


Figure 6. 2018 FISS stations in IPHC Regulatory Area 2C by charter region.

Table 3. IPHC Regulatory Area 2C FISS charter regions and count by station type.

Charter Region	Total station count	Expansion	New extra stations ²	Standard
Ketchikan	51	9	1	41
Ommaney	55	14	1	40
Sitka	59	17	2	40
Total	165 ¹	40	4	121

¹ three stations in Glacier Bay were not fished because of permitting

² extra stations are added between grid stations that are far apart from each other, typically up fjords and channels.

Sampling protocols

Sea samplers collected data according to protocols established in the 2018 FISS 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 2017, staff began arranging bait purchases for the 2018 FISS. Approximately 345,000 pounds (157 t) of chum salmon were utilized from three suppliers in the United States of America. Bait usage is based on 0.37 pounds per hook resulting in approximately 259 pounds per seven (7) skate station. Bait quality was monitored and documented throughout the season and found to meet the standard as described above.

RESULTS AND REVENUE

Beginning in 2017 and with key updates made for 2018, interactive views of FISS results were provided via the IPHC website and can be found here: <https://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. This helps to offset costs of the FISS program. 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 *R/V Pacific Surveyor* received no share of Pacific halibut or bycatch proceeds. The IPHC does not retain proceeds from the sale of incidentally captured rockfish and Pacific cod. Instead, for retained bycatch captured in USA waters, proceeds are divided equally between the vessel (for handling expenses) and the state management agency. In Canada, Fisheries and Oceans Canada (DFO) receives all proceeds from sales of retained bycatch captured in Canadian waters, subsequent to abovementioned deduction of the predetermined vessel bycatch processing fees.

Vessels chartered by the IPHC delivered fish to 26 different ports ([Table 4](#)). Fish sales were awarded based on the objectives of obtaining a fair market price and distributing sales among buyers and ports. 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. Obtaining fair market value was the main consideration in awarding fish sales. However, sales were sometimes awarded to buyers not offering the highest prices, thereby meeting the goal of distributing sales among qualified buyers. Individual sales were evaluated after each event to ensure that the buyer was meeting IPHC standards.

A summary of landings and prices from the FISS is provided by species and IPHC Regulatory Area in [Table 5](#). Average prices decreased from \$6.53/lb in 2017 to \$5.74/lb in 2018.

Table 4. FISS Pacific halibut landings by port, 2018¹.

Offload Port	Trips	Pounds	Tonnes	Total USD	Average Price (USD/lb)	Average Price (USD/kg)
Prince Rupert	7	112,551	51	\$ 726,271	\$6.45	\$14.23
Seward	6	108,140	49	\$ 689,407	\$6.38	\$14.05
Sitka	4	71,434	32	\$ 395,172	\$5.53	\$12.20
Homer	7	61,941	28	\$ 377,985	\$6.10	\$13.45
Kodiak	17	70,888	32	\$ 375,386	\$5.30	\$11.67
Yakutat	4	61,599	28	\$ 344,615	\$5.59	\$12.33
Port Hardy	7	50,593	23	\$ 316,812	\$6.26	\$13.81
Petersburg	2	42,326	19	\$ 266,162	\$6.29	\$13.86
Juneau/Auke Bay	2	34,004	15	\$ 209,416	\$6.16	\$13.58
Cordova	1	23,215	11	\$ 149,524	\$6.44	\$14.20
St Paul	5	33,584	15	\$ 143,152	\$4.26	\$9.40
Sand Point	4	31,058	14	\$ 134,910	\$4.34	\$9.58
Dutch Harbor	7	28,903	13	\$ 119,864	\$4.15	\$9.14
Adak	5	27,397	12	\$ 83,780	\$3.06	\$6.74
Alitak	3	15,727	7	\$ 76,741	\$4.88	\$10.76
Newport	4	6,624	3	\$ 53,500	\$8.08	\$17.81
Ucluelet/Barkley Sd	1	8,092	4	\$ 52,364	\$6.47	\$14.27
Tofino	2	8,014	4	\$ 51,952	\$6.48	\$14.29
Ketchikan	1	8,842	4	\$ 45,792	\$5.18	\$11.42
Westport	2	6,298	3	\$ 36,245	\$5.76	\$12.69
Astoria	1	2,600	1	\$ 21,092	\$8.11	\$17.88
Neah Bay	1	3,869	2	\$ 19,514	\$5.04	\$11.14
Charleston	1	1,487	1	\$ 12,067	\$8.11	\$17.89
Bellingham	1	392	<1	\$ 1,938	\$4.94	\$10.90
Vancouver, B.C.	1	222	<1	\$ 1,561	\$7.03	\$15.50
Nanaimo/French Creek	1	175	<1	\$ 1,181	\$6.75	\$14.87
Grand Total		819,975	372	\$ 4,706,403	\$5.74	\$12.65

¹ Net weight (head-off, dressed, washed).² Prices based on net weight.**Table 5.** FISS landings (total pounds and price) of Pacific halibut by IPHC Regulatory Area in 2018¹.

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	4CDE	Total Weight and Average Price
Pounds	21,269	144,660	199,324	298,421	74,303	34,137	27,397	20,462	819,974
Tonnes	10	66	90	135	34	15	12	9	372
Price USD/lb	\$6.79	\$6.34	\$6.06	\$5.92	\$4.84	\$4.05	\$3.06	\$4.47	\$5.74
Price USD/kg	\$14.93	\$13.94	\$13.33	\$13.01	\$10.64	\$8.91	\$6.73	\$9.84	\$12.65

¹ Net weight (head-off, dressed, washed).***Pacific halibut catch-per unit effort in weight (WPUE) and numbers (NPUE)***

The FISS covers commercial as well as non-commercial fishing grounds, so the average WPUE and NPUE for all IPHC Regulatory Areas surveyed was below that of the commercial

fleet. Detailed information such as catch by station within the IPHC Regulatory Area(s) as well as over a time series is available here:

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

A record of hook status, either as a 20% subsample or a full census, is collected for each set. Hook status, which is either the organism captured, a bait returned, an empty hook, or a missing hook, is used to calculate the hook competition adjustment factor. The impact of the hook competition adjustment can also be observed through the above link.

Pacific halibut biological data

FISS Sea Samplers record fork lengths of all Pacific halibut caught, with the corresponding location details. All O32 Pacific halibut, as well as sublegal-sized (U32) Pacific halibut randomly selected for otolith collection are assessed for sex, maturity, prior-hooking injury severity, and evidence of depredation. Otoliths, used to determine age, are collected from a randomized subsample. Male Pacific halibut are assessed as either mature or immature, and females as immature, mature, spawning or resting. All U32 Pacific halibut not selected for otolith collection were measured and released alive, a subsample of which were tagged prior to release. Details of the biological data collected on the FISS are available here: <https://iphc.int/data/fiss-biologicals-maps-and-plots>

Prior hooking injury results

A prior hooking injury (PHI) is defined an injury that appears to have occurred when the fish was being released during a previous capture by hook-and-line gear. A PHI code was assigned using predefined criteria for every Pacific halibut captured (e.g. no injury, minor injury, moderate injury, severe injury, or unknown). The PHI results are also available at the above link.

Biological data for other species

Over 100 other species of fish or other organisms are consistently observed on the IPHC FISS. To explore the bycatch species observed by IPHC Regulatory Area since 1998 check out the interactive web pages here: <https://iphc.int/static/56/fiss-bycatch>

FUTURE WORK

2019 expansions

As shown in [Figure 7](#), one more year remains to complete the FISS expansions for each IPHC Regulatory Area. The IPHC will be continuing with the FISS expansion into IPHC Regulatory Areas 3A and 3B, as approved by the Commission in 2014. The IPHC has begun vetting the proposed FISS stations with the respective State and Federal agencies. In some cases, this also involves special permitting requirements. There are 89 expansion stations planned for IPHC Regulatory Area 3A and 67 for IPHC Regulatory Area 3B.

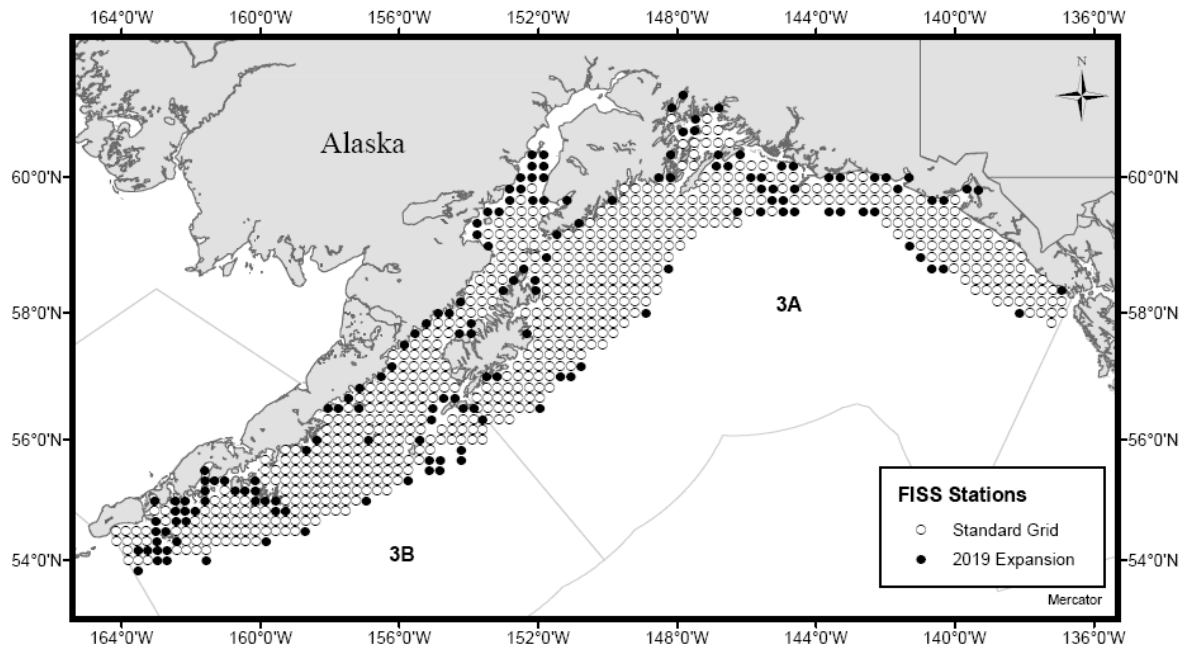


Figure 7. Proposed 2019 IPHC Regulatory Areas 3A and 3B FISS stations.

Gear comparison

The IPHC will be undertaking a gear comparison during the 2019 FISS to compare fixed-hook and snap gear. The comparison will evaluate whether data from both gear types can be used in the IPHC stock assessment process and how FISS work compares to the gear and results of the commercial fishery. All stations in IPHC Regulatory Area 2C will be fished twice, once by the FISS standard of fixed-hook gear and once by snap gear.

To accomplish this work, IPHC Regulatory Area 2C has been divided into early and late charter regions instead of by the traditional three charter regions of Ketchikan, Sitka and Ommaney. Vessels using snap or fixed-hook gear interested in bidding on IPHC Regulatory Area 2C should refer to the 2019 FISS Bid Specifications for the bidding options (<https://iphc.int/the-commission/opportunities>). Vessels using any single gear type will not be able to fish more than half the stations in IPHC Regulatory Area 2C in 2019 i.e. 65 stations. The stations for each charter region by gear type are shown in Figures [8](#) and [9](#).

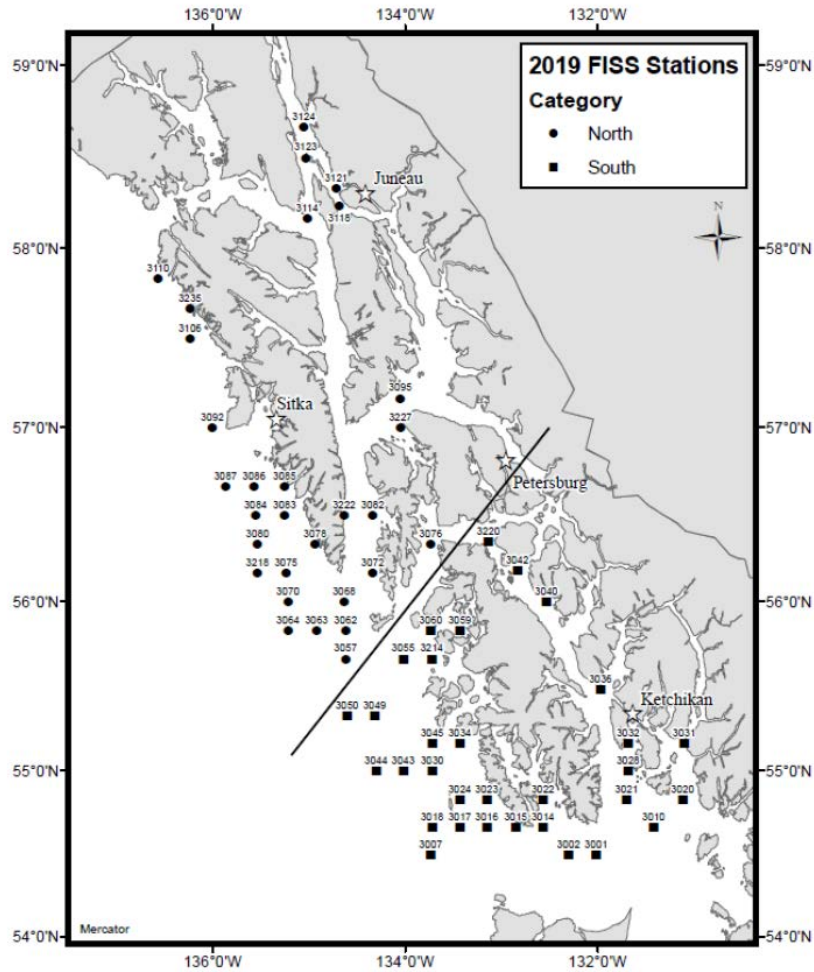


Figure 8. IPHC Regulatory Area 2C fixed-hook gear early (26 May to 15 July) charter region or snap gear late (16 July to 31 August) charter region.

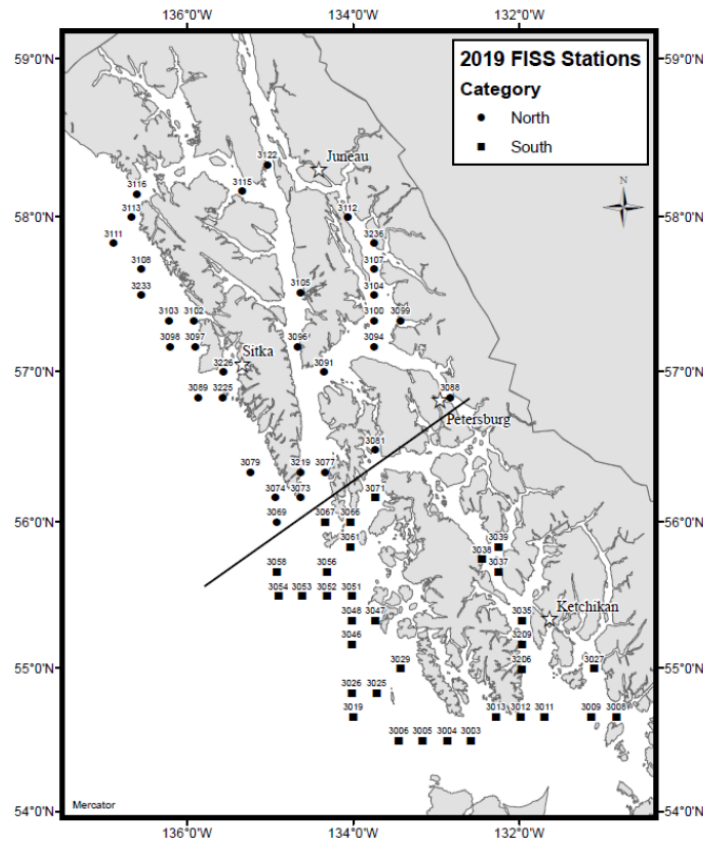


Figure 9. IPHC Regulatory Area 2C fixed-hook gear late (16 July to 31 August) charter region or snap gear early (26 May to 15 July) charter region.

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2019-AM095-06 which provided an overview of the International Pacific Halibut Commission's (IPHC) fishery-independent setline survey (FISS) design and implementation in 2018, including current and future expansions.

REFERENCES

Nil

APPENDICES

Nil