Pacific Herring preliminary data summary for West Coast of Vancouver Island 2024

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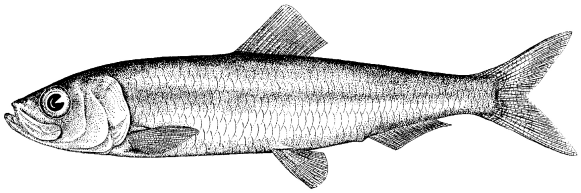

Pacific Herring (*Clupea pallasii*). Image credit: Fisheries and Oceans Canada.

Disclaimer This report contains preliminary data collected for Pacific Herring in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). These data may differ from data used and presented in the final stock assessment.

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1 Context

Pacific Herring (*Clupea pallasii*) in British Columbia are assessed as 5 major and 2 minor stock assessment regions (SARs), and data are collected and summarized on this scale (Table 1, Figure 1). Note that formal stock assessments are only done for major SARs. The Pacific Herring data collection program includes fishery-dependent and -independent data from 1951 to 2024. This includes annual time series of commercial catch data, biological samples (providing information on proportion-at-age and weight-at-age), and spawn index data conducted using a combination of surface and SCUBA surveys. In some areas, industry- and/or First Nations-operated in-season soundings programs are also conducted, and this information is used by resource managers, First Nations, and

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stakeholders to locate fish and identify areas of high and low Pacific Herring biomass to plan harvesting activities. In-season acoustic soundings are not used by stock assessment to inform the estimation of spawning biomass.

The following is a description of data collected for Pacific Herring in 2024 in the West Coast of Vancouver Island major SAR (Figure 2). Data collected outside the SAR boundary are not included in this summary, and are not used for the purposes of stock assessment. Although we summarise data at the scale of the SAR for stock assessments, we summarise data at finer spatial scales in this report: Locations are nested within Sections, Sections are nested within Statistical Areas, and Statistical Areas are nested within SARs (Table 2). Note that we refer to 'year' instead of 'herring season' in this report; therefore 2024 refers to the 2023/2024 Pacific Herring season.

2 Data collection programs

Biological samples were collected by the seine charter vessel *Proud Canadian* for 20 days from February 18th to March 8th. The primary purpose of the test charter vessel was to collect biological samples from main bodies of herring from Statistical Areas 23, 24, and 25. Nearshore herring samples were collected by the Nuu-chah-nulth staff as part of a sampling program and on-going collaboration between WCVI First Nations and DFO. These nearshore biological samples were collected from spawning aggregations using cast nets. WCVI First Nations spawn reconnaissance charters reported spawn activity in all three areas. Herring spawn locations were primarily identified with fixed-wing overflights conducted by DFO Resource Management area staff. Nine flights were conducted this season in February and March.

One dive charter vessel and a shorebased crew operated in WCVI:

- The *Pachena No. 1* surveyed 18 days from March 13th to March 30th, and
- The shorebased dive surveyed from March 12th to March 29th.

3 Catch and biological samples

In the 1950s and 1960s, the reduction fishery dominated Pacific Herring catch; starting in the 1970s, catch has been predominantly from roe seine and gillnet fisheries. The reduction fishery is different from current fisheries in several ways. First, the reduction fishery caught Pacific Herring of all ages, whereas current fisheries target spawning (i.e., mature) fish. Thus, reduction fisheries included an unknown number of age-1 fish which are not typically caught in current fisheries. Second, the reduction fishery has some uncertainty regarding the quantity and location of catch; however catches have been resolved to SAR and Statistical Area using fish slips as best as possible. For the roe gillnet fishery, all Pacific Herring catch has been validated by a dockside monitoring program since 1998; the catch validation program started in 1999 for the roe seine

fishery. Finally, the reduction fishery operated during the summer and winter months, whereas roe fisheries typically target spawning fish between February and April.

Landed commercial catch of Pacific Herring by year and fishery is shown in Table 3 and Figure 3. Total harvested spawn-on-kelp (SOK) in 2024 in the West Coast of Vancouver Island major SAR is shown in Table 4; we also calculate the estimated spawning biomass associated with SOK harvest. See the spawn index technical report for calculations to convert SOK harvest to spawning biomass. Incidental mortality from fisheries and aquaculture activities is shown in Figure 4.

In 2024, 38 Pacific Herring biological samples were collected and processed for the West Coast of Vancouver Island major SAR (Table 5, Table 6). Differences between biological data collected from two sampling protocols regarding the number-, proportion-, weight-, and length-at-age for Pacific Herring in 2024 in the West Coast of Vancouver Island major SAR are shown in Table 7, Table 8, Table 9, and Table 10, respectively. The nearshore sampling program is a multi-year pilot study (using cast nets), therefore only biological data from the seine samples were used for the purposes of stock assessment. Summaries of data collected by the nearshore sampling program are shown in Table 11, Table 12, Table 13, and Table 14. In addition, Figure 10 and Figure 11 show differences in length-at-age between the two sampling protocols, and differences by Statistical Area, respectively. The locations in which the biological samples were collected are presented in Figure 5. Included herein are biological summaries of observed proportion-, number-, weight-, and length-at-age (Figure 6, Table 15, and Figure 7, respectively). We also show the percent change in weight and length for age-3 and age-6 fish (Figure 8 & Figure 9, respectively). Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet. Only representative biological samples are included, where 'representative' indicates whether the Pacific Herring sample in the set accurately reflects the larger Pacific Herring school.

4 Spawn survey data

Pacific Herring spawn surveys were conducted at 57 individual locations in 2024 in the West Coast of Vancouver Island major SAR (Table 16, and Figure 12). A summary of spawn from the last decade (2014 to 2023) is shown in Figure 13. Figure 14 shows spawn start date by decade and Statistical Area. Spawn surveys are conducted to estimate the spawn length, width, number of egg layers, and substrate type, and these data are used to estimate the index of spawning biomass (i.e., the spawn index; Figure 15, Figure 16, Figure 17, Figure 18, Table 17, and Figure 19). See the spawn index technical report for calculations to convert SOK harvest to spawning biomass. The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Therefore, these data do not represent model estimates of spawning biomass, and are considered the minimum observed spawning biomass derived from egg counts. The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

Some Pacific Herring Sections contribute more than others to the total spawn index, and the percentage contributed by Section varies yearly (Figure 18b, Figure 20). For

example, in 2024, Section 232 contributed the most to the spawn index (36%). As with Sections, some Statistical Areas contribute more than others to the total spawn index (Figure 18c, Figure 21). An animation shows the spawn index by spawn survey location from 1951 to 2024 (Figure 22).

5 First Nations observations

The following observations were contributed by representatives of First Nations communities. These observations provide context and perspectives to this data report. In some cases we make minor edits for clarity and brevity, but we do not change the intent or substance of responses.

5.1 Nuu-chah-nulth

5.1.1 Area 23

There was mixed success with spawn on boughs (SOB) harvests in 2024 but overall, SOB harvest success was improved compared to the past few years. Spawn was distributed fairly broadly from Mayne Bay, St. Ines, Forbes Island, and Salmon Beach to Macoha and the entrance of Ucluelet Harbour around Spring Cove and Stuart Bay. For the most part, spawning duration in all areas was short except for St. Ines Island where spawning occurred over two days. As in the past several years, the short duration of most spawns necessitated harvesters be on-site at the time of spawning to get boughs in the spawn. There was very limited success for SOB in all areas except Spring Cove and Stuart Bay. Great success for spawn in Spring Cove and Stuart Bay with branches with covered with 6-8 layers.

5.1.2 Area 24

As in 2023, spawning activity in Area 24 began in early January in Hesquiaht Harbour and spread to several other areas throughout Clayoquot Sound in through February and March. The Nations were pleased to see spawn in new areas such as Epper Passage and Stubbs Island. Both Hesquiaht and Ahousaht had very successful SOB harvests from their territories at Bawden Bay, Matilda Inlet and Anton Spit, with boughs having up to 25 layers. Spawn was also observed in Tla-o-qui-aht Territories such as Stubbs Island, but they held off setting boughs as herring spawning had not been regularly observed in this area for many years and Tla-o-qui-aht did not want to disturb them.

5.1.3 Area 25

All Nations had some success with SOB harvests. Ehattesaht set trees in Port Langford with mixed success. Only 40% of the boughs had sufficient layers (3-4) to harvest. Ehattesaht also harvested about 40 pounds of kelp and eel grass from spawn events at Double Island, the back side of Harbour Island and in Mary Basin. Nuchatlaht set trees in Rosa Harbour and Port Langford and in Nuchatlitz Bay with only a few boughs

having 1-2 layers resulting in a minimal harvest. Nuchatlaht also harvested about 120 pounds of kelp and eel grass from the spawn events at Double Island, the back side of Harbour Island, and in Mary Basin. MMFN set all their trees in Yuquot (Friendly Cove) with all boughs having 8-9 layers of eggs and commenting that is was the best spawn in over five years.

6 General observations

The following observations were reported by DFO Resource Management staff and DFO Science staff. These observations provide additional context to this data report.

- Relatively high numbers of cast-net samples (23) collected by First Nation charters in Areas 23, 24, and 25 (Esperanza).
- Difficulty obtaining biological samples in Area 25 (Nootka) was due to poor weather, erratic fish movement, and fish being either off-shore, later, or too close to the beaches.
- Early spawns occurring before March 1st were not dive surveyed due to dive resource limitations. These include Kraan Head and Hesquiat Harbour in Area 24, and Nuchatlitz in Area 25.
- Spawns occurring on South Vargas Island were not surveyed due their exposed nature and inclement weather.
- In-season communication between all parties contributed to a successful spawn survey.
- Anecdotal reports suggest increased success in FSC harvest.
- Spawn distribution was widespread and included new locations when compared to previous years: North of Big Beach and Wya Point in Area 23, northwest and southwest shores of Vargas Island in Area 24, Zuciarte Channel in Area 25 (Nootka), Maquinna Point in Area 25 (Nootka), Resolution Cove and Pantoja Islands in Area 25 (Nootka), mouth of Port Eliza Inlet in Area 25 (Esperanza), and Mary Basin in Area 25 (Esperanza).
- Spawn was reported inside of net pens at an aquaculture site in Fortune Channel in Area 24

7 Tables

Table 1. Pacific Herring stock assessment regions (SARs) in British Columbia.

Name	Code	Type
Haida Gwaii	HG	Major
Prince Rupert District	PRD	Major
Central Coast	CC	Major
Strait of Georgia	SoG	Major
West Coast of Vancouver Island	WCVI	Major
Area 27	A27	Minor
Area 2 West	A2W	Minor

Table 2. Statistical Areas and Sections for Pacific Herring in the West Coast of Vancouver Island major stock assessment region (SAR).

Region	Statistical Area	Section
West Coast of Vancouver Island	23	230
West Coast of Vancouver Island	23	231
West Coast of Vancouver Island	23	232
West Coast of Vancouver Island	23	233
West Coast of Vancouver Island	23	239
West Coast of Vancouver Island	24	240
West Coast of Vancouver Island	24	241
West Coast of Vancouver Island	24	242
West Coast of Vancouver Island	24	243
West Coast of Vancouver Island	24	244
West Coast of Vancouver Island	24	245
West Coast of Vancouver Island	24	249
West Coast of Vancouver Island	25	250
West Coast of Vancouver Island	25	251
West Coast of Vancouver Island	25	252
West Coast of Vancouver Island	25	253
West Coast of Vancouver Island	25	259

Table 3. Total landed commercial catch of Pacific Herring in metric tonnes (t) by gear type in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Legend: 'Other' represents the reduction (1951 to 1970 only), the food and bait, as well as the special use fishery; 'RoeSN' represents the roe seine fishery; and 'RoeGN' represents the roe gillnet fishery. Data from the spawn-on-kelp (SOK) fishery are not included. Note: data may be withheld due to privacy concerns (WP).

Gear	Catch (t)
Other	0
RoeSN	0
RoeGN	0

Table 4. Total harvested Pacific Herring spawn-on-kelp (SOK) in pounds (lb), and the associated estimate of spawning biomass in metric tonnes (t) from 2014 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). See the spawn index technical report for calculations to convert SOK harvest to spawning biomass. Note: data may be withheld due to privacy concerns (WP).

Year	Harvest (lb)	Spawning biomass (t)
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	0	0
2019	0	0
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0

Table 5. Number of Pacific Herring biological samples processed from 2014 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Each sample is approximately 100 fish. Note: Nearshore samples are not used in stock assessments.

	Number of samples			
Year	Commercial	Test	Nearshore	Total
2014	0	4	0	4
2015	0	17	3	20
2016	0	15	10	25
2017	0	12	7	19
2018	0	20	22	42
2019	0	14	11	25
2020	0	12	7	19
2021	0	13	9	22
2022	0	10	19	29
2023	0	9	21	30
2024	0	15	23	38

Table 6. Number and type of Pacific Herring biological samples processed in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Each sample is approximately 100 fish.

Type	Gear	Use	Number of samples
Test	Other	Nearshore	23
Test	Seine	Test fishery	15

Table 7. Observed number-at-age of Pacific Herring by sample type in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Number-at-age								
Sample type	2	3	4	5	6	7	8	9	10
Nearshore	24	480	885	326	218	62	8	2	3
Seine test	7	266	586	193	120	26	4	1	1
Total	31	746	1471	519	338	88	12	3	4

Table 8. Observed proportion-at-age of Pacific Herring by sample type in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Proportion-at-age								
Sample type	2	3	4	5	6	7	8	9	10
Nearshore	0.012	0.239	0.441	0.162	0.109	0.031	0.004	0.001	0.001
Seine test	0.006	0.221	0.487	0.160	0.100	0.022	0.003	0.001	0.001
Total	0.010	0.232	0.458	0.162	0.105	0.027	0.004	0.001	0.001

Table 9. Observed mean weight-at-age in grams (g) of Pacific Herring by sample type in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Mean weight-at-age (g)								
Sample type	2	3	4	5	6	7	8	9	10
Nearshore	47	69	85	98	103	114	105	110	125
Seine test	54	78	96	109	119	125	140	96	170
Total	49	72	89	102	109	117	117	105	136

Table 10. Observed mean length-at-age in millimetres (mm) of Pacific Herring by sample type in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Mean length-at-age (mm)								
Sample type	2	3	4	5	6	7	8	9	10
Nearshore	150	170	183	191	196	201	198	203	219
Seine test	152	171	183	192	198	200	209	187	211
Total	150	170	183	191	196	201	202	198	217

Table 11. Observed number-at-age of Pacific Herring for nearshore samples from 2015 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Number-at-age								
Year	2	3	4	5	6	7	8	9	10
2015	67	64	130	10	3	3	0	0	0
2016	32	537	161	122	13	3	2	0	0
2017	43	56	355	89	64	4	0	0	0
2018	171	203	142	1157	196	105	18	0	1
2019	101	616	82	37	106	15	6	0	0
2020	168	161	179	28	8	34	6	2	2
2021	47	479	146	90	11	5	8	1	1
2022	138	465	656	160	136	16	7	11	4
2023	23	798	484	384	105	52	8	1	3
2024	24	480	885	326	218	62	8	2	3

Table 12. Observed proportion-at-age of Pacific Herring for nearshore samples from 2015 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Proportion-at-age								
Year	2	3	4	5	6	7	8	9	10
2015	0.242	0.231	0.469	0.036	0.011	0.011	0.000	0.000	0.000
2016	0.037	0.617	0.185	0.140	0.015	0.003	0.002	0.000	0.000
2017	0.070	0.092	0.581	0.146	0.105	0.007	0.000	0.000	0.000
2018	0.086	0.102	0.071	0.581	0.098	0.053	0.009	0.000	0.001
2019	0.105	0.640	0.085	0.038	0.110	0.016	0.006	0.000	0.000
2020	0.286	0.274	0.304	0.048	0.014	0.058	0.010	0.003	0.003
2021	0.060	0.608	0.185	0.114	0.014	0.006	0.010	0.001	0.001
2022	0.087	0.292	0.412	0.100	0.085	0.010	0.004	0.007	0.003
2023	0.012	0.429	0.260	0.207	0.057	0.028	0.004	0.001	0.002
2024	0.012	0.239	0.441	0.162	0.109	0.031	0.004	0.001	0.001

Table 13. Observed mean weight-at-age in grams (g) of Pacific Herring for nearshore samples from 2015 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Mean weight-at-age (g)								
Year	2	3	4	5	6	7	8	9	10
2015	51	67	76	81	109	104	NA	NA	NA
2016	49	66	72	81	88	83	88	NA	NA
2017	58	70	85	91	94	98	NA	NA	NA
2018	53	77	85	95	103	107	112	NA	114
2019	54	70	81	100	111	116	118	NA	NA
2020	56	69	85	94	114	125	110	131	120
2021	57	71	82	101	111	90	124	121	121
2022	57	71	89	100	118	126	123	128	148
2023	44	72	84	97	108	119	123	142	122
2024	47	69	85	98	103	114	105	110	125

Table 14. Observed mean length-at-age in millimetres (mm) of Pacific Herring for nearshore samples from 2015 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations.

	Mean length-at-age (mm)								
Year	2	3	4	5	6	7	8	9	10
2015	154	170	178	182	199	200	NA	NA	NA
2016	154	171	178	186	188	197	192	NA	NA
2017	166	178	190	193	197	201	NA	NA	NA
2018	159	179	188	196	200	202	211	NA	220
2019	155	170	179	191	198	203	201	NA	NA
2020	156	169	180	186	200	205	197	214	204
2021	156	172	180	193	202	188	208	209	197
2022	165	176	189	196	205	209	208	217	222
2023	146	169	179	187	194	198	200	212	208
2024	150	170	183	191	196	201	198	203	219

Table 15. Observed proportion-at-age for Pacific Herring from 2014 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The age-10 class is a 'plus group' which includes fish ages 10 and older.

	Proportion-at-age								
Year	2	3	4	5	6	7	8	9	10
2014	0.029	0.752	0.147	0.029	0.032	0.007	0.000	0.004	0.000
2015	0.140	0.238	0.505	0.068	0.017	0.028	0.004	0.000	0.001
2016	0.040	0.648	0.168	0.124	0.014	0.003	0.004	0.001	0.000
2017	0.025	0.076	0.664	0.132	0.082	0.016	0.002	0.002	0.000
2018	0.053	0.133	0.109	0.566	0.096	0.035	0.005	0.002	0.000
2019	0.055	0.504	0.097	0.049	0.232	0.040	0.018	0.003	0.000
2020	0.180	0.275	0.347	0.047	0.024	0.100	0.022	0.004	0.000
2021	0.173	0.533	0.136	0.118	0.014	0.009	0.013	0.003	0.002
2022	0.073	0.292	0.436	0.089	0.097	0.005	0.001	0.005	0.001
2023	0.065	0.501	0.222	0.146	0.039	0.019	0.004	0.004	0.000
2024	0.006	0.221	0.487	0.160	0.100	0.022	0.003	0.001	0.001

Table 16. Pacific Herring spawn survey locations, start date, and spawn index in metric tonnes (t) in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Missing spawn index values indicate incomplete surveys (NAs).

Statistical Area	Section	Location name	Start date	Spawn index (t)
23	232	Amphitrite Pt	March 17	5,017
23	232	David Is	March 17	NA
23	232	Food Islets	March 17	572
23	232	Forbes Is	March 17	94
23	232	Itatsoo Cr	March 17	1,220
23	232	Macoah Pass	March 15	2,035
23	232	Maggie Rvr	March 15	2,025
23	232	Newcombe Chnl	March 17	4,870
23	232	Port Albion	March 17	191
23	232	Spring Cv	March 16	487
23	232	St Ines Is	March 17	NA
23	232	Stuart Bay	March 17	1,228
23	232	Toquart Bay	March 15	534
23	232	Two Rivers	March 17	4,551
23	232	Ucluelet	March 17	252
23	232	Ucluelet Head	March 17	2
23	232	Wya Pt	March 17	8,074
24	241	Fortune Ch	March 11	NA
24	242	Antons Spit	February 05	3,662
24	242	Hesquiat Hrbr	January 11	2,458
24	242	Hesquiat Pen	March 15	10,976
24	242	Hesquiat Pt	March 15	1,041
24	242	Leclaire Pt	March 15	16
24	242	Matlahaw Pt	March 15	10,748
24	242	Rondeault Pt	February 05	37
24	244	Bawden Bay	March 13	955
24	244	Flores Is E	March 16	5
24	244	Matilda Inlt	March 16	255
24	245	Calmus Pass	March 12	1,060
24	245	Chetarpe Reserve	March 17	506
24	245	Elbow Bank	March 12	3,866
24	245	Epper Pass	February 26	120
24	245	Felice Is	March 17	386
24	245	Kakawis	March 12	30
24	245	La Croix Group	March 12	NA
24	245	Maurus Chnl	March 12	130
24	245	McIntosh Bay	March 14	1,003
24	245	Stubbs Is	March 17	507

Table 16 continued

Statistical Area	Section	Location name	Start date	Spawn index (t)
24	245	Yarksis Reserve	March 14	1,939
25	252	Anderson Pt	March 16	1,603
25	252	Boca del Infierno Bay	March 16	363
25	252	Clerke Pen	March 16	2,016
25	252	Cook Chnl	March 16	671
25	252	Friendly Cv	March 16	1,477
25	252	Marvinas Bay & Is	March 16	143
25	252	McKay Psg	March 16	1,077
25	252	Pantoja Is	March 16	391
25	252	Saavedra Is	March 16	4,005
25	252	Santa Gertrudis Cv	March 16	407
25	253	Double Is	March 06	337
25	253	False Chnl	March 06	1,012
25	253	Harbour Is	March 06	476
25	253	Mary Basin	March 03	71
25	253	Nuchatlitz, Inner	February 08	99
25	253	Nuchatlitz, Outer	March 06	58
25	253	Port Langford	March 03	844
25	253	Queen Cv	March 06	379

Table 17. Summary of Pacific Herring spawn survey data from 2014 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Units: metres (m), and metric tonnes (t).

Year	Total length (m)	Mean width (m)	Mean number of egg layers	Spawn index (t)
2014	35,825	144	1.1	13,936
2015	20,450	275	1.1	11,323
2016	60,575	122	1.4	20,527
2017	44,200	180	1.3	16,476
2018	61,825	136	1.5	28,107
2019	49,325	130	1.2	17,029
2020	44,125	162	0.9	18,760
2021	45,851	203	1.1	29,338
2022	64,925	168	1.3	23,706
2023	74,850	195	1.9	77,005
2024	102,550	160	2.5	86,307

8 Figures

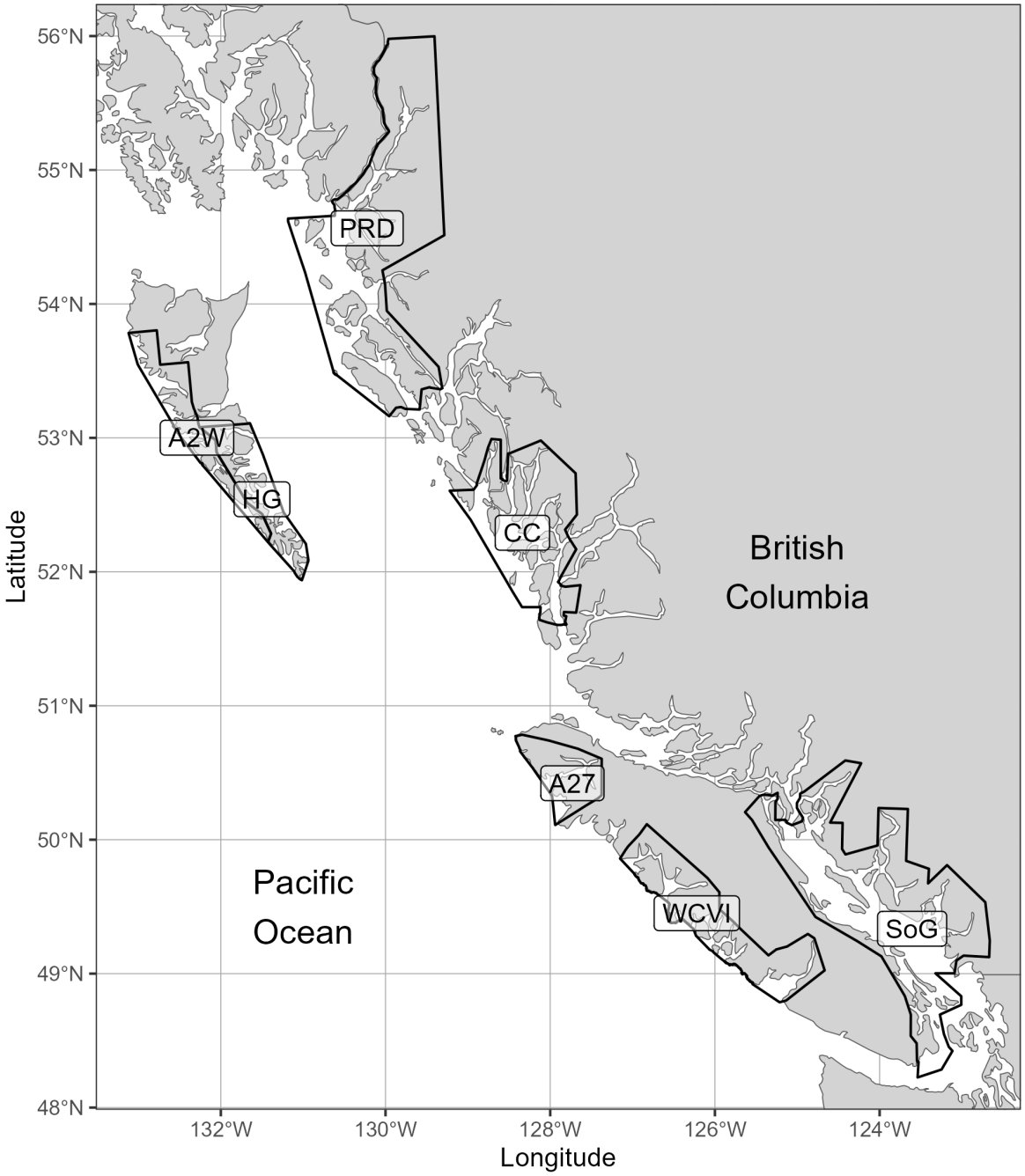

Figure 1. Boundaries for the Pacific Herring stock assessment regions (SARs) in British Columbia. There are 5 major SARs: Haida Gwaii (HG), Prince Rupert District (PRD), Central Coast (CC), Strait of Georgia (SoG), and West Coast of Vancouver Island (WCVI). There are 2 minor SARs: Area 27 (A27) and Area 2 West (A2W). Units: kilometres (km).

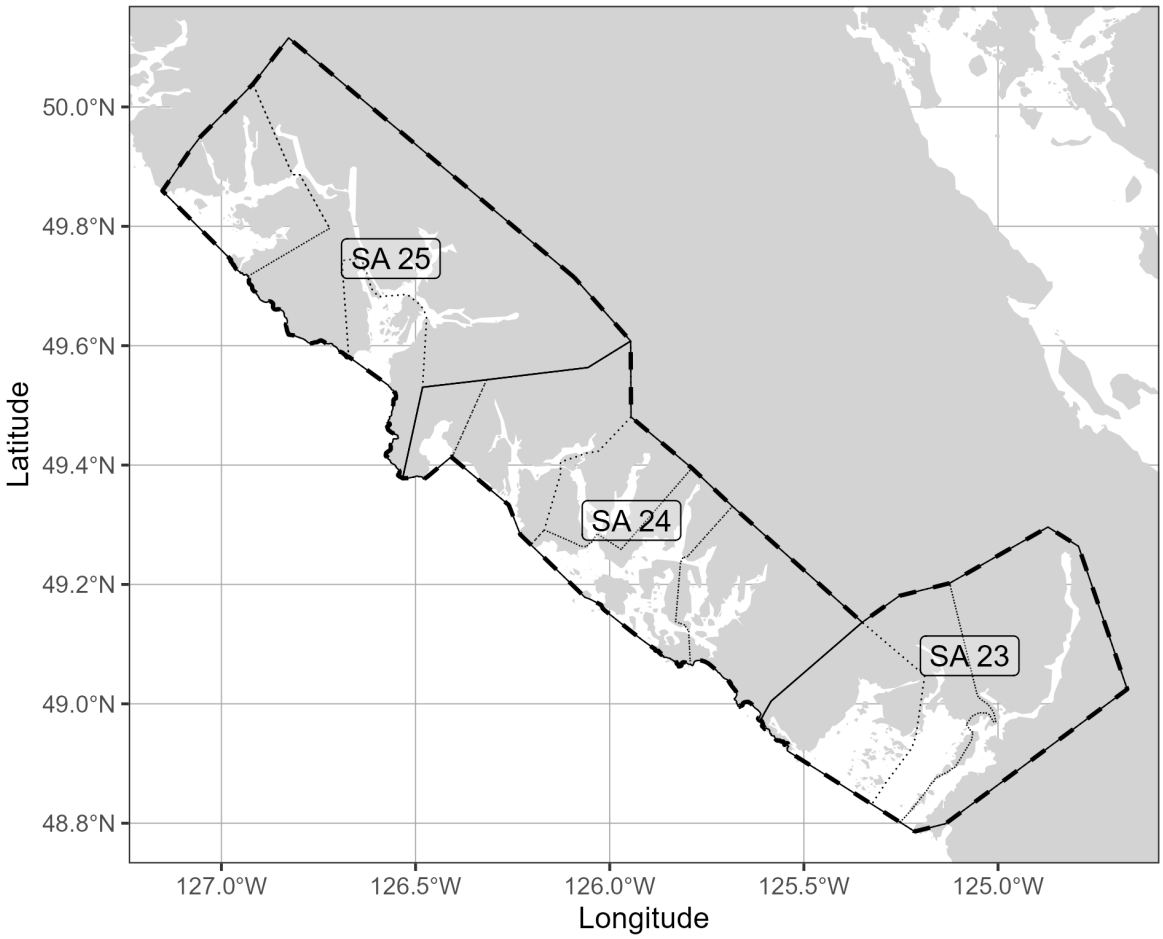

Figure 2. Boundaries for the West Coast of Vancouver Island major stock assessment region (SAR; thick dashed lines), associated Statistical Areas (SA; thin solid lines), and associated Sections (thin dotted lines). Units: kilometres (km).

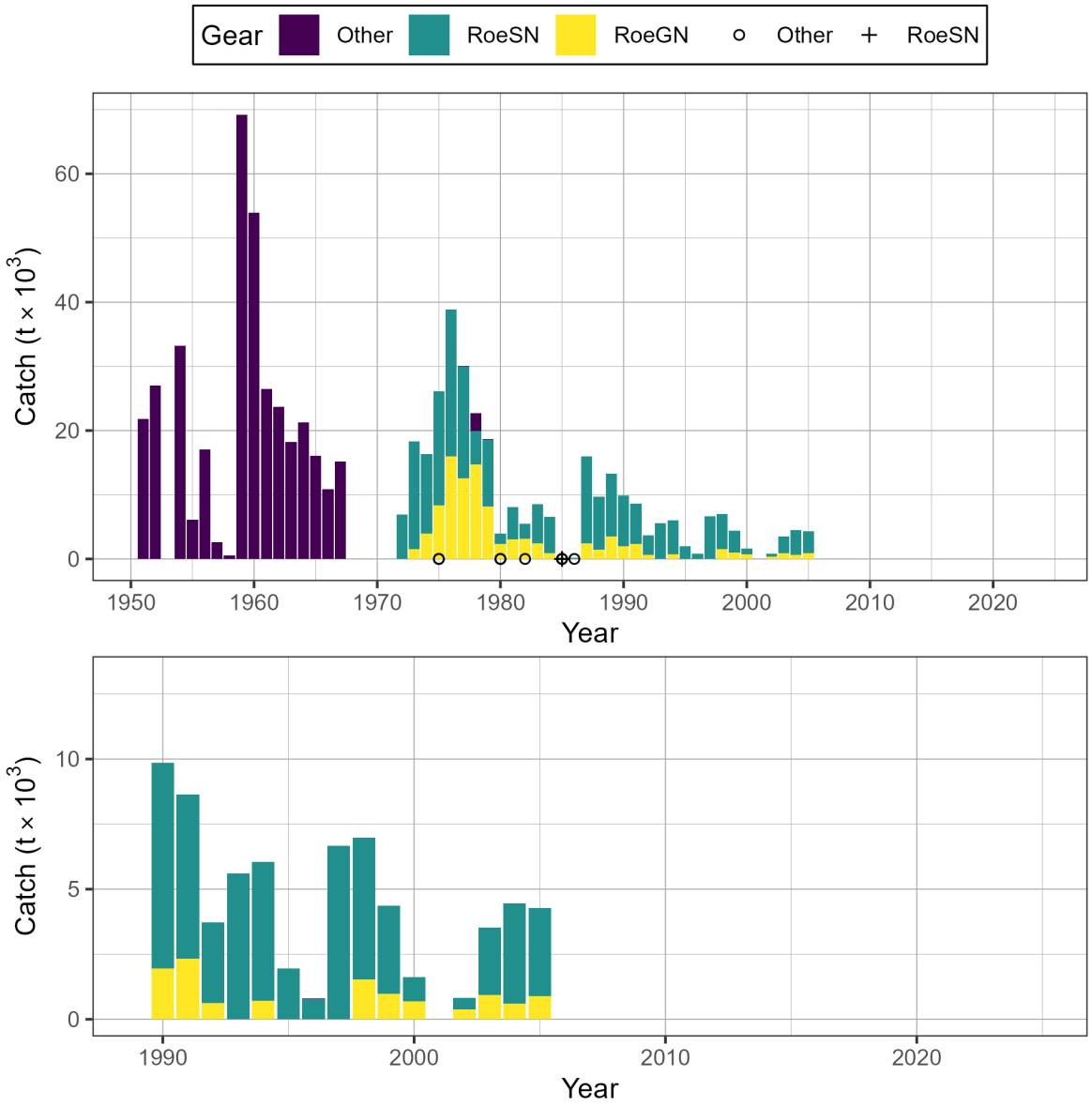

Figure 3. Time series of total landed catch in thousands of metric tonnes ($t \times 10^3$) of Pacific Herring by gear type from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Legend: 'Other' represents the reduction (1951 to 1970 only), the food and bait, as well as the special use fishery; 'RoeSN' represents the roe seine fishery; and 'RoeGN' represents the roe gillnet fishery. Data from the spawn-on-kelp (SOK) fishery are not included. Bottom panel shows catch since 1989 in more detail. Note: symbols indicate years in which catch by gear type (i.e., Other, RoeSN, RoeGN) is withheld due to privacy concerns.

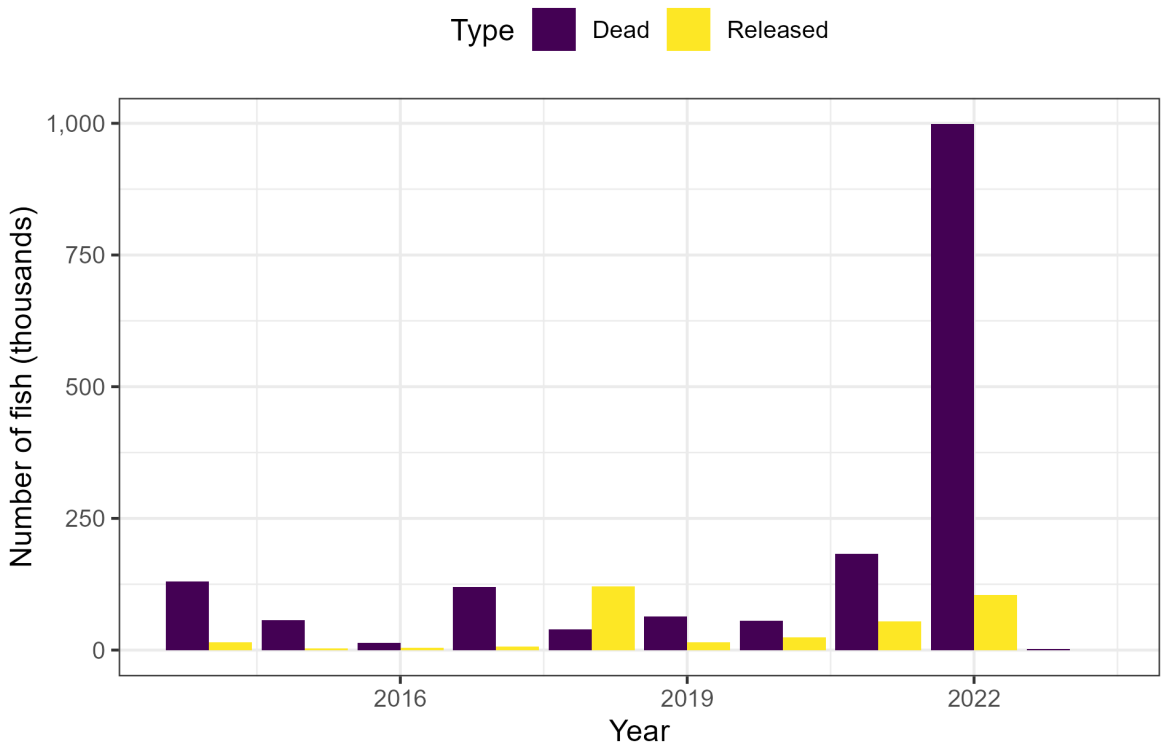

Figure 4. Incidental Pacific Herring mortality in aquaculture activities in thousands of fish from 2014 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Note: figure may include data outside SAR boundaries.

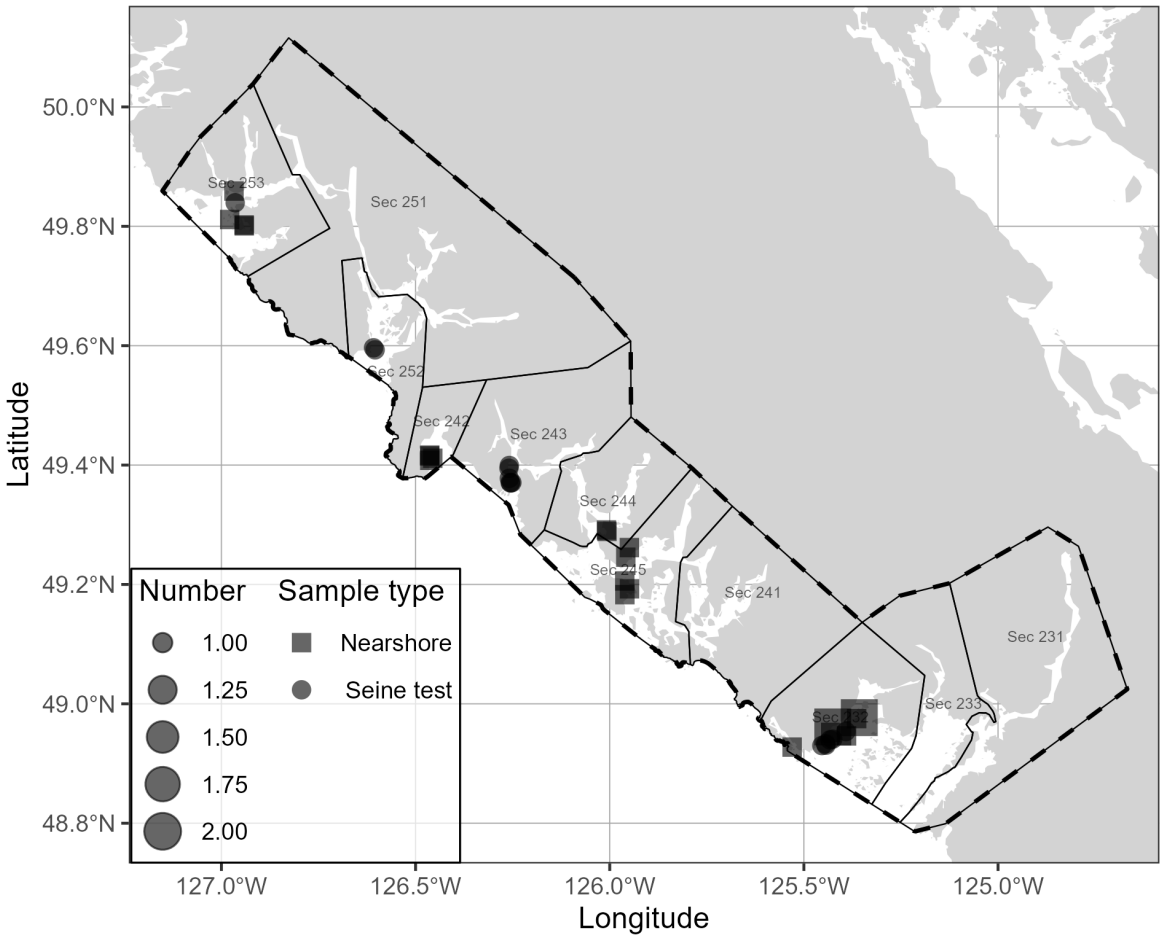

Figure 5. Location and type of Pacific Herring biological samples collected in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). Units: kilometres (km).

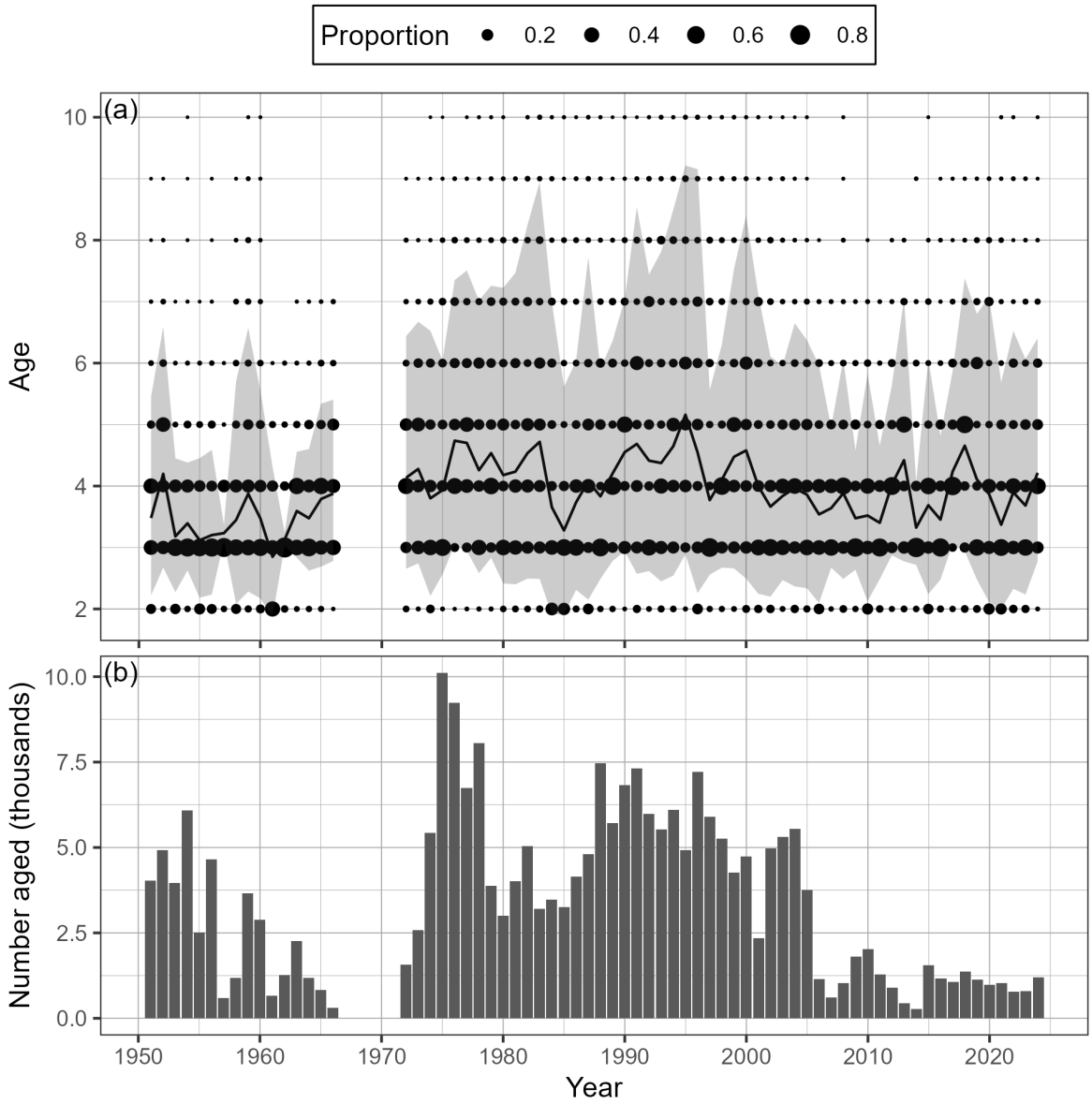

Figure 6. Time series of observed proportion-at-age (a) and number aged in thousands (b) of Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The black line is the mean age, and the shaded area is the approximate 90% distribution. Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet. The age-10 class is a 'plus group' which includes fish ages 10 and older.

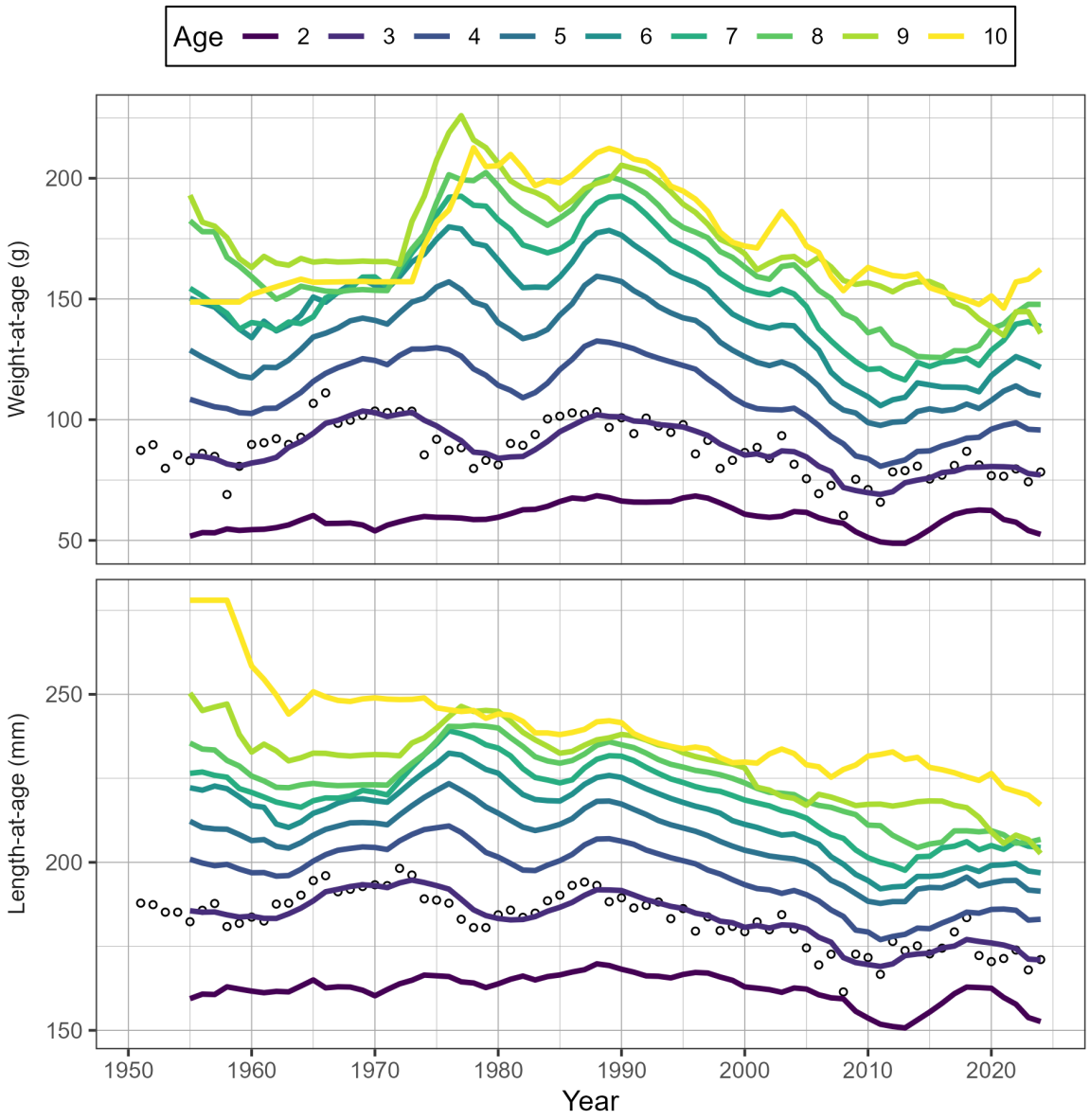

Figure 7. Time series of weight-at-age in grams (g) and length-at-age in milimetres (mm) for age-3 (circles) and 5-year running mean weight- and length-at-age (lines) for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Missing weight- and length-at-age values (i.e., years with no biological samples) are imputed using one of two methods: missing values at the beginning of the time series are imputed by extending the first non-missing value backwards; other missing values are imputed as the mean of the previous 5 years. Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet. The age-10 class is a 'plus group' which includes fish ages 10 and older.

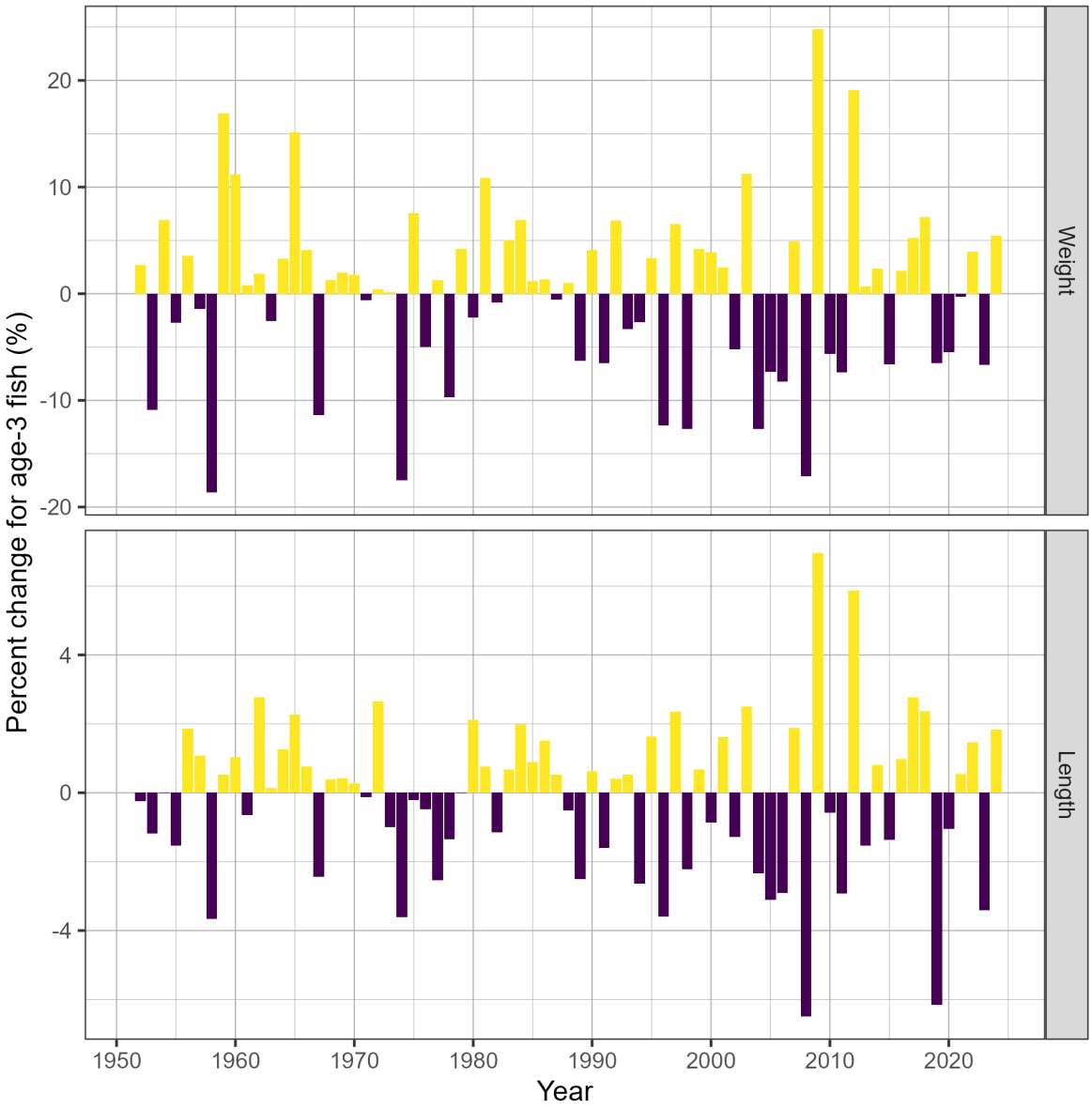

Figure 8. Time series of percent change (%) in weight and length for age-3 fish for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the weight and length of age-3 fish, respectively, in year t. Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet.

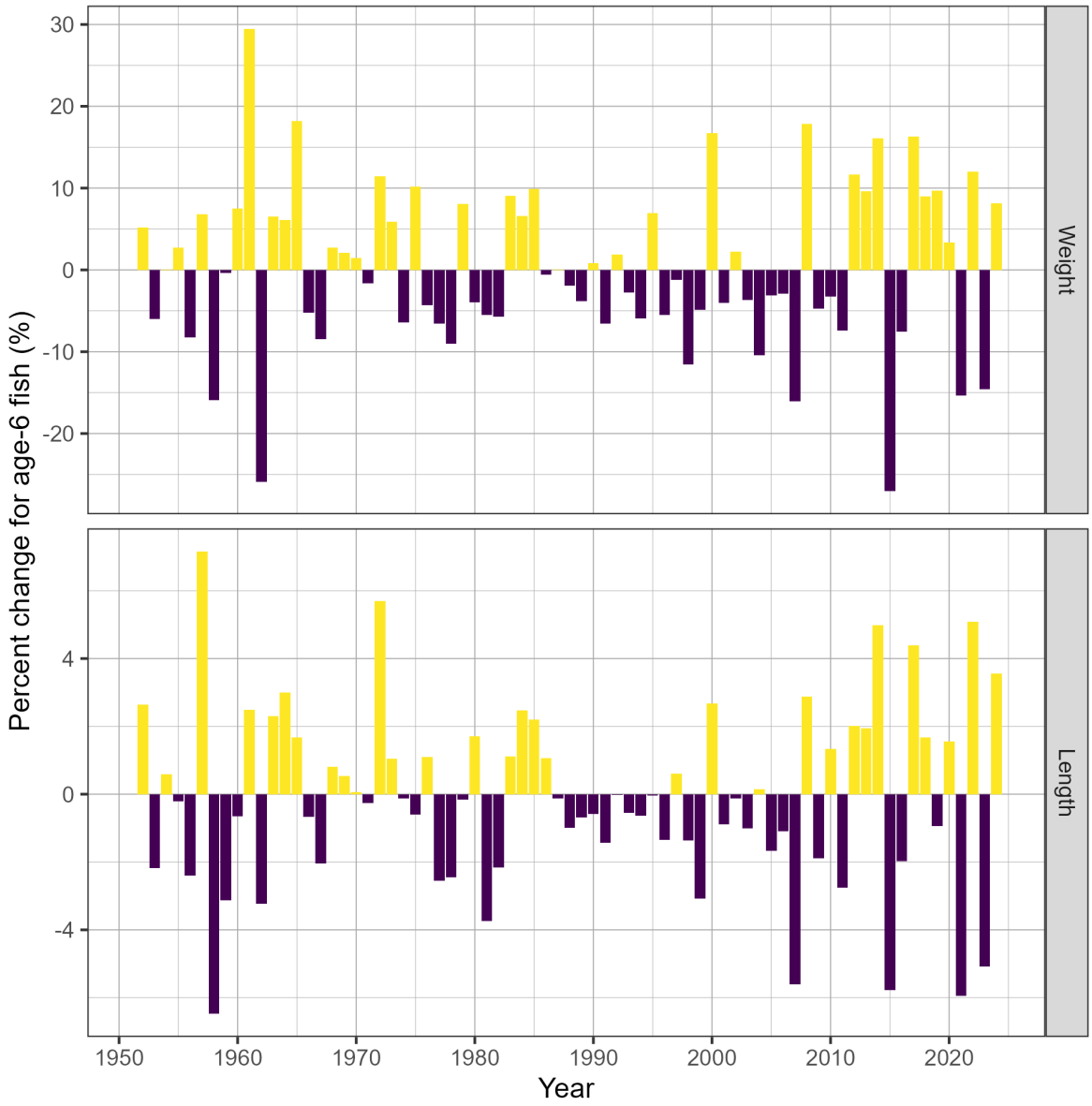

Figure 9. Time series of percent change (%) in weight and length for age-6 fish for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the weight and length of age-6 fish, respectively, in year t. Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet.

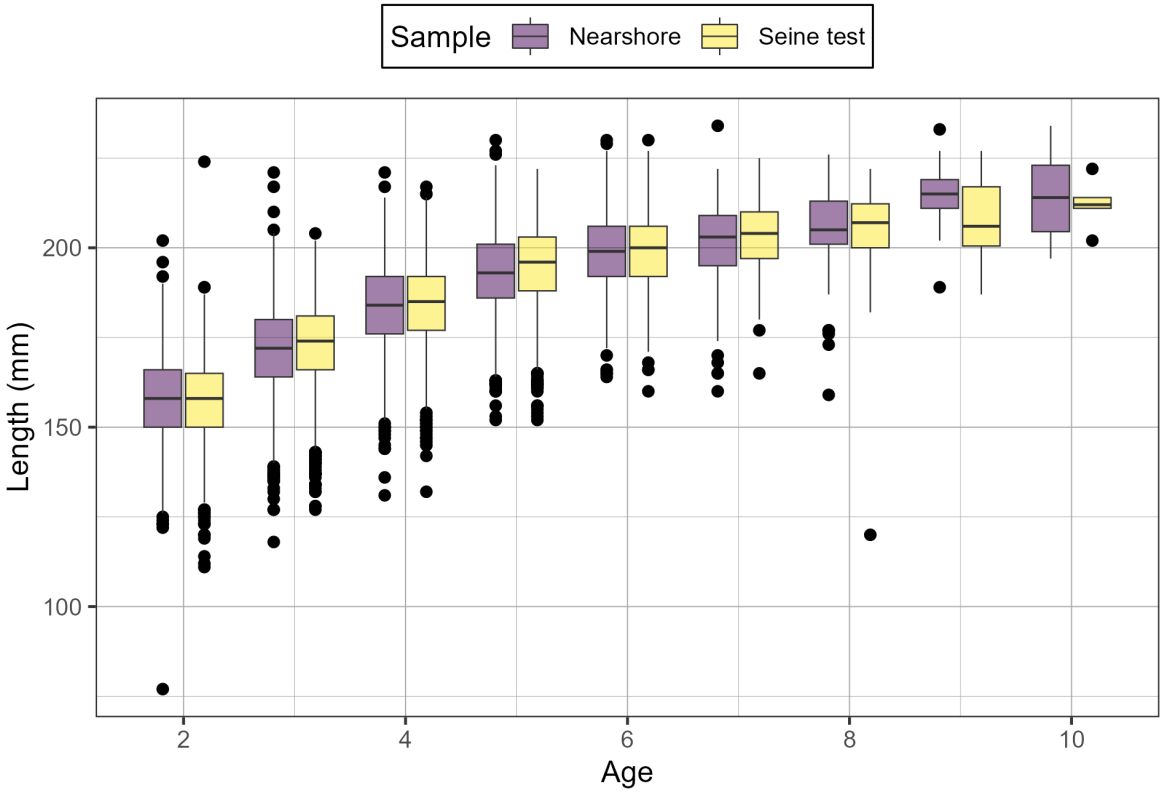

Figure 10. Length-at-age in millimetres (mm) of Pacific Herring from 2015 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR) by sample type. The outer edges of the boxes indicate the 25th and 75th percentiles, and the middle lines indicate the 50th percentiles (i.e., medians). The whiskers extend to 1.5 $\times$ IQR, where IQR is the distance between the 25th and 75th percentiles, and dots indicate outliers. Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations. The age-10 class is a 'plus group' which includes fish ages 10 and older.

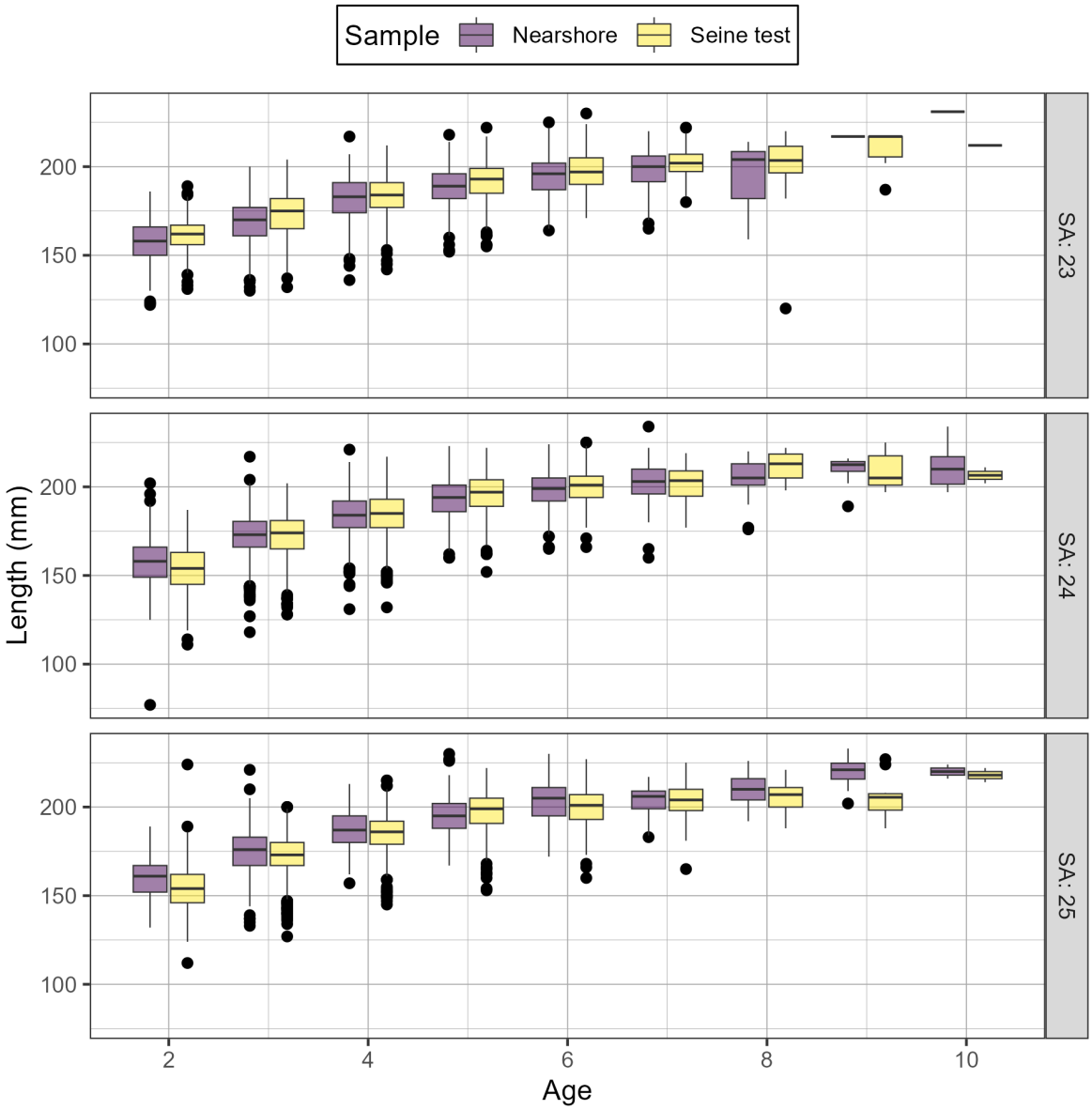

Figure 11. Length-at-age in millimetres (mm) of Pacific Herring from 2015 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR) by sample type and statistical area (SA). The outer edges of the boxes indicate the 25th and 75th percentiles, and the middle lines indicate the 50th percentiles (i.e., medians). The whiskers extend to 1.5 $\times$ IQR, where IQR is the distance between the 25th and 75th percentiles, and dots indicate outliers. Biological summaries only include samples collected using seine nets (commercial and test) due to size-selectivity of other gear types such as gillnet. Legend: 'Nearshore' refers to samples collected using cast nets as part of a pilot study with First Nations. The age-10 class is a 'plus group' which includes fish ages 10 and older.

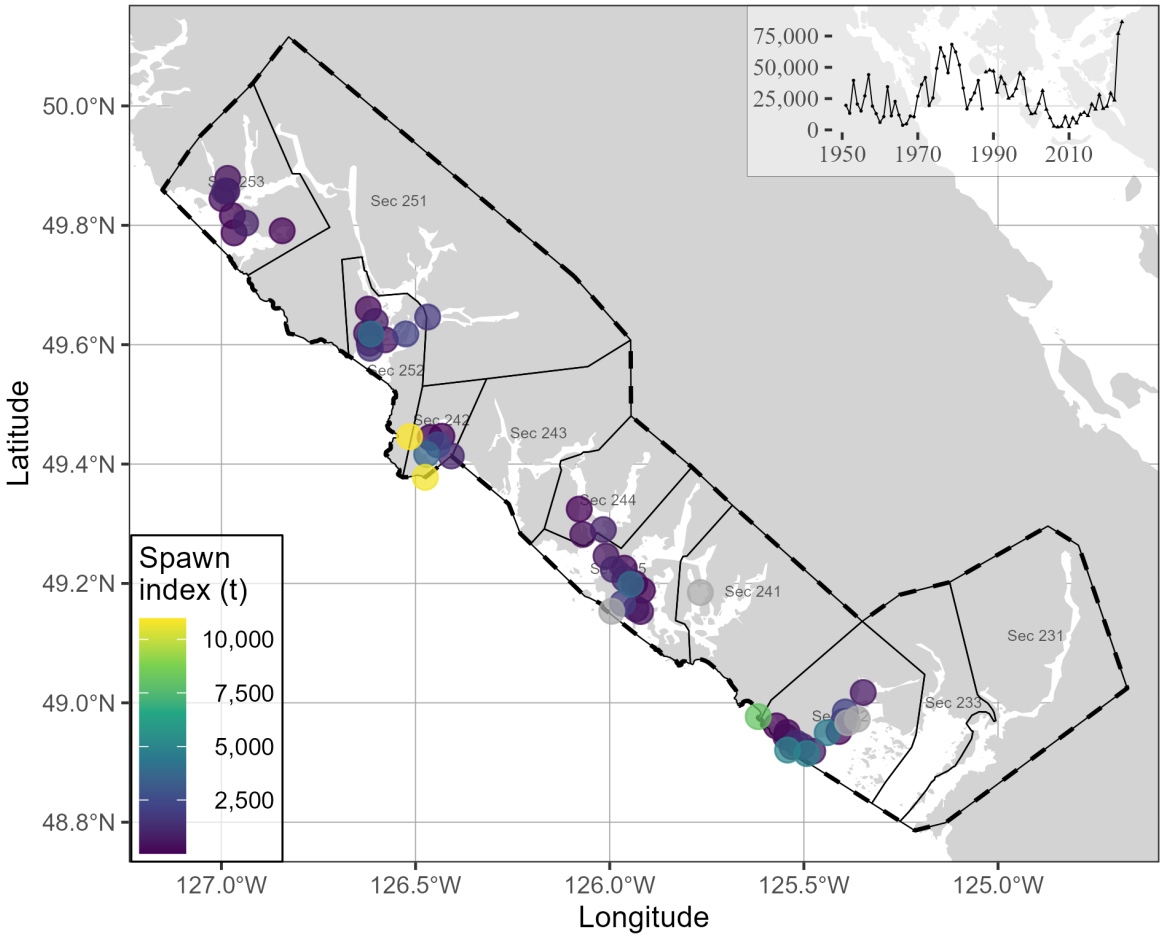

Figure 12. Pacific Herring spawn survey locations, and spawn index in metric tonnes (t) in 2024 in the West Coast of Vancouver Island major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Missing spawn index values indicate incomplete surveys (grey circles). Inset tracks the total spawn index. Units: kilometres (km).

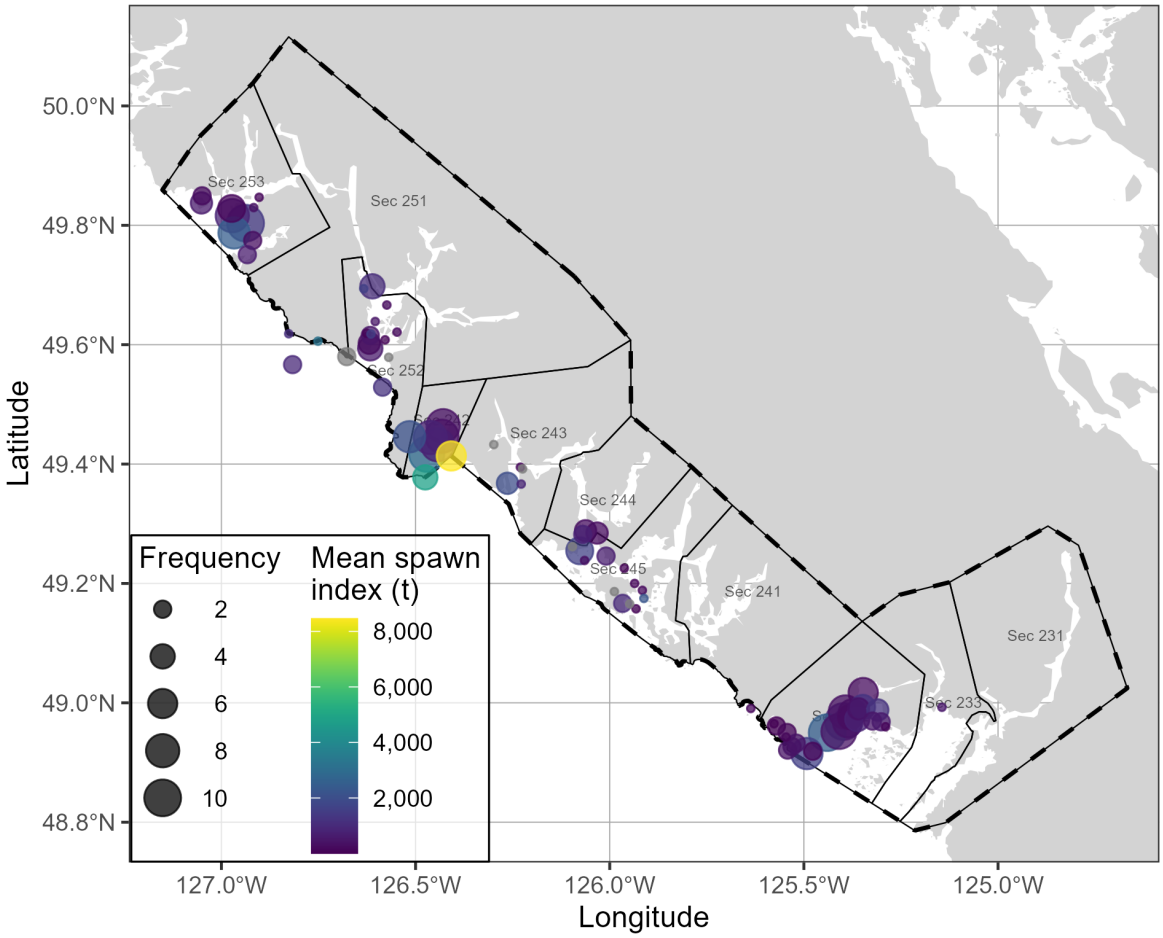

Figure 13. Pacific Herring spawn survey locations, mean spawn index in metric tonnes (t), and spawn frequency from 2014 to 2023 in the West Coast of Vancouver Island major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Missing spawn index values indicate incomplete surveys (grey circles). Units: kilometres (km).

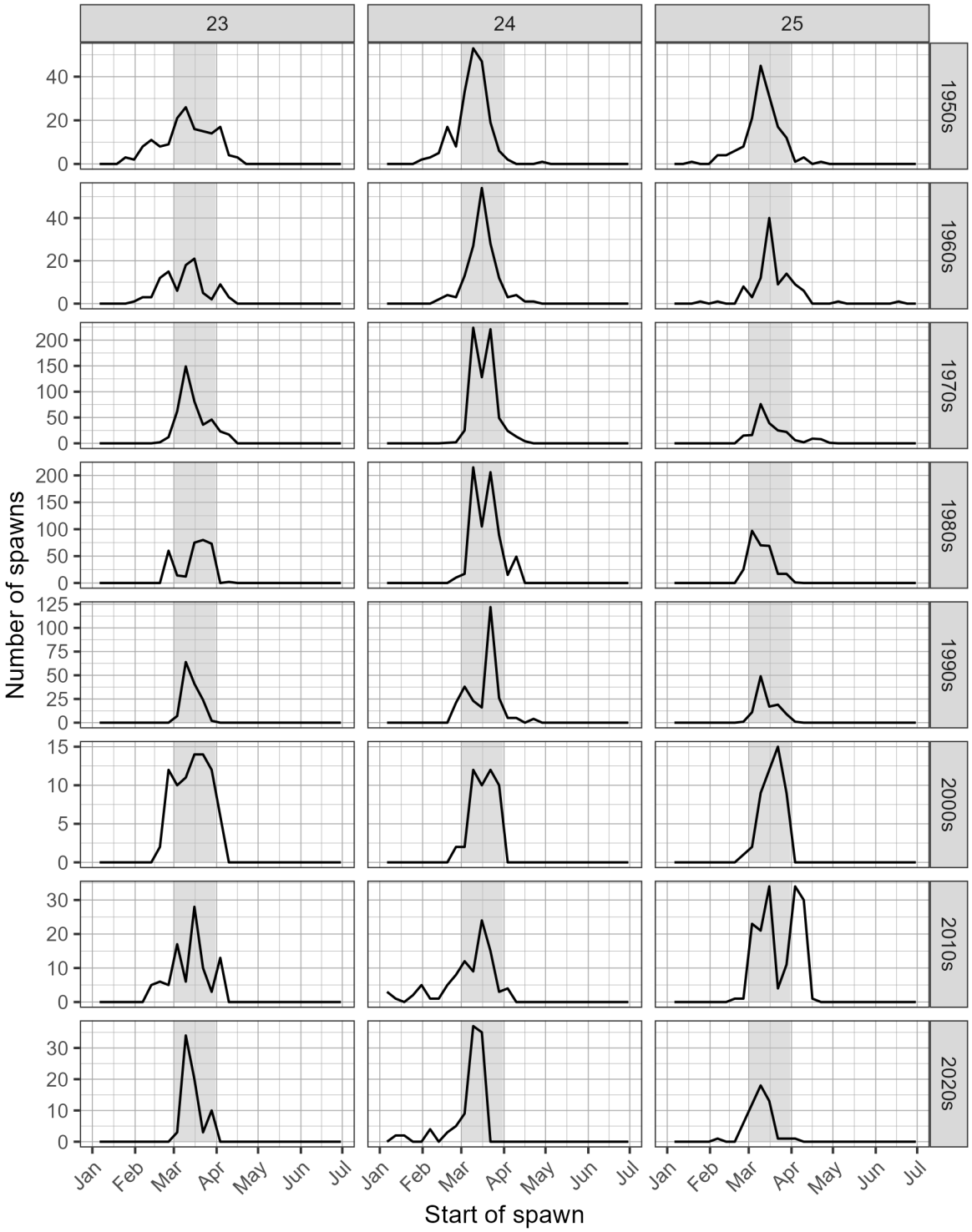

Figure 14. Pacific Herring spawn start date by decade and Statistical Area. Grey shaded regions indicate March 1st to 31st. Note that spawn size and intensity varies; therefore the number of spawns is not directly proportional to spawn extent or biomass.

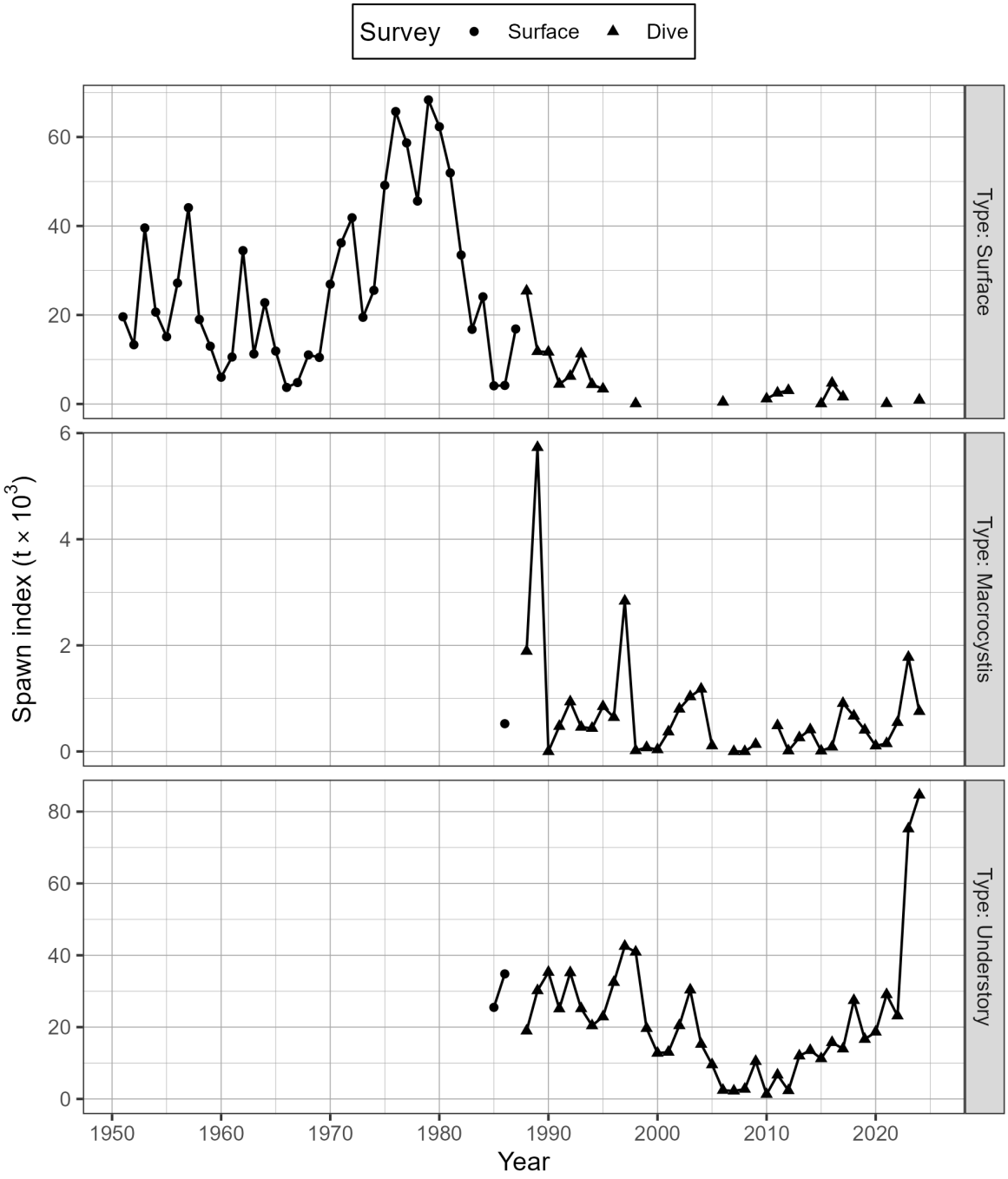

Figure 15. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) by type for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). There are three types of spawn survey observations: observations of spawn taken from the surface usually at low tide, underwater observations of spawn on giant kelp, Macrocystis (*Macrocystis* spp.), and underwater observations of spawn on other types of algae and the substrate, which we refer to as 'understory.' The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

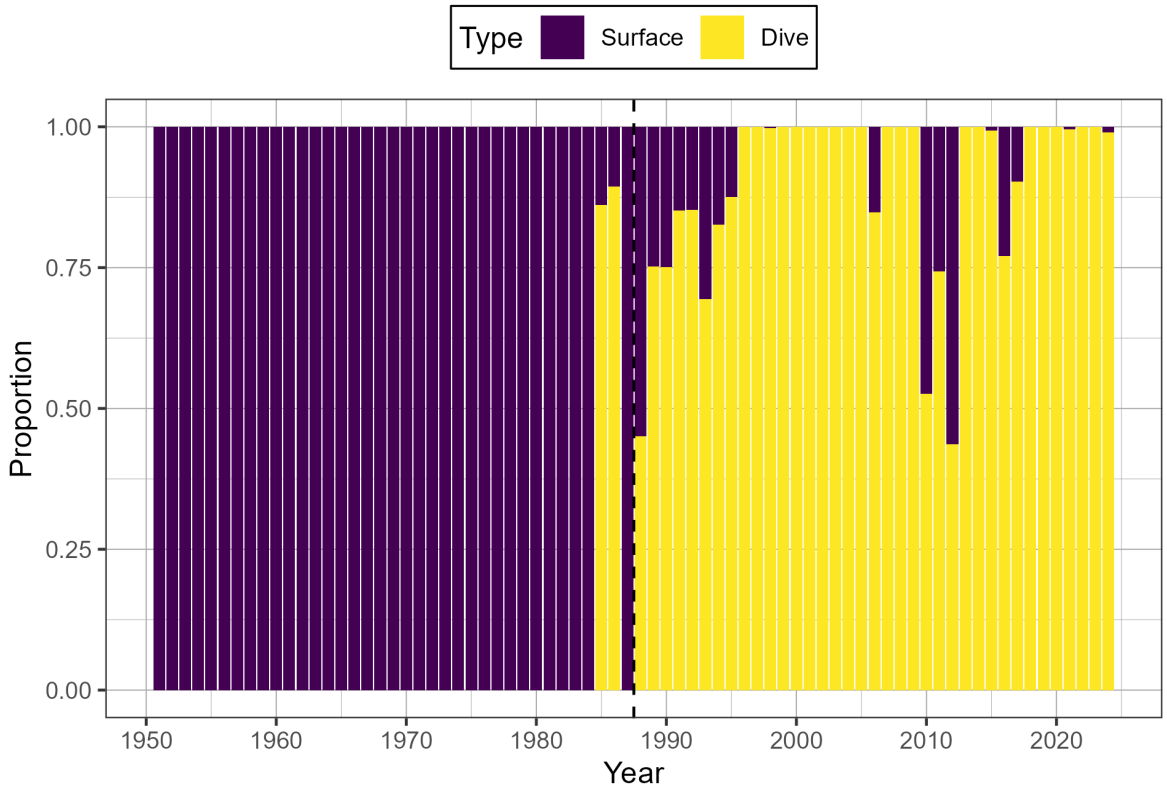

Figure 16. Time series of proportion of spawn index by surface and dive surveys for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

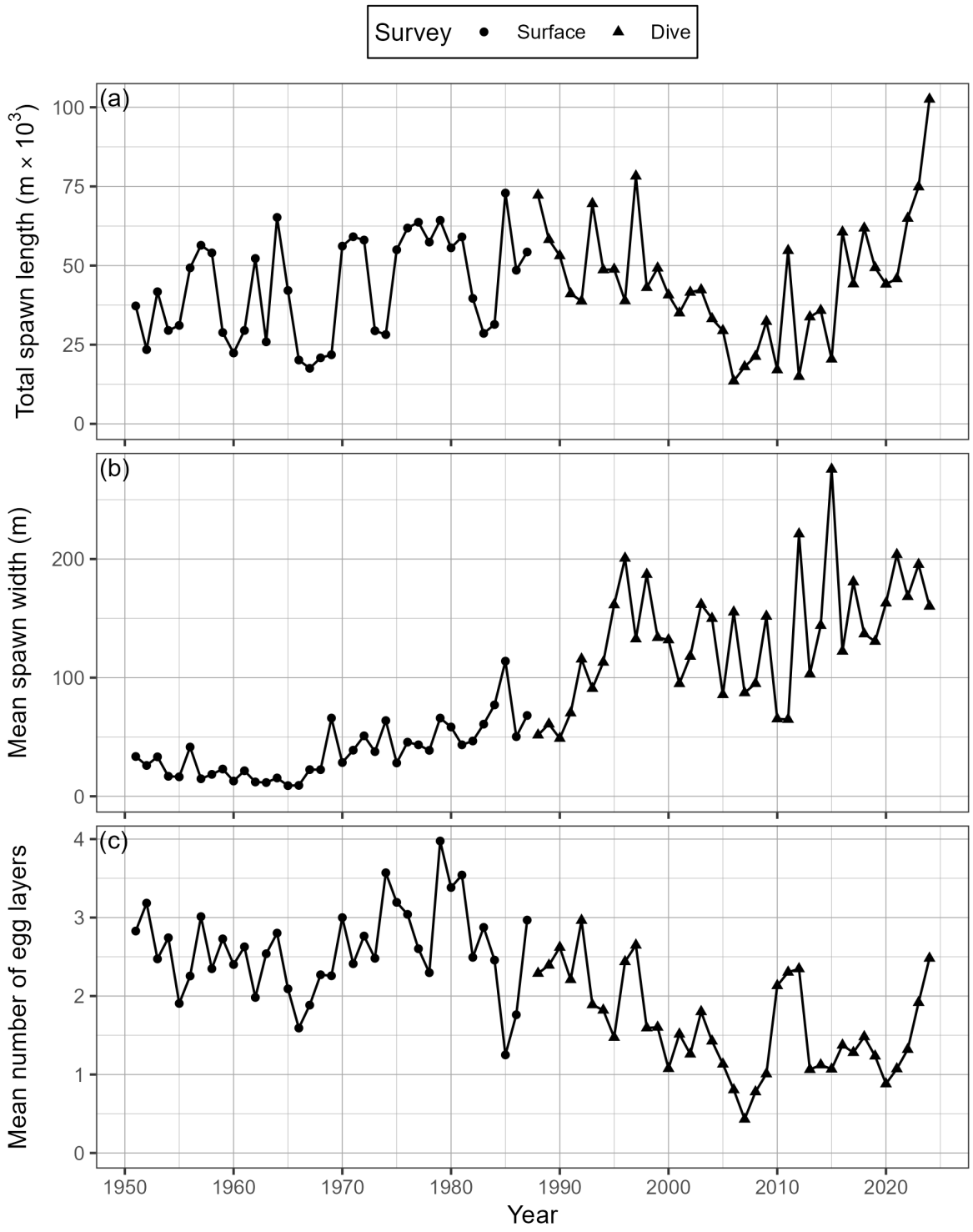

Figure 17. Time series of total spawn length in thousands of metres ($m \times 10^3$; panel a), mean spawn width in metres (b), and mean number of egg layers (c) for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

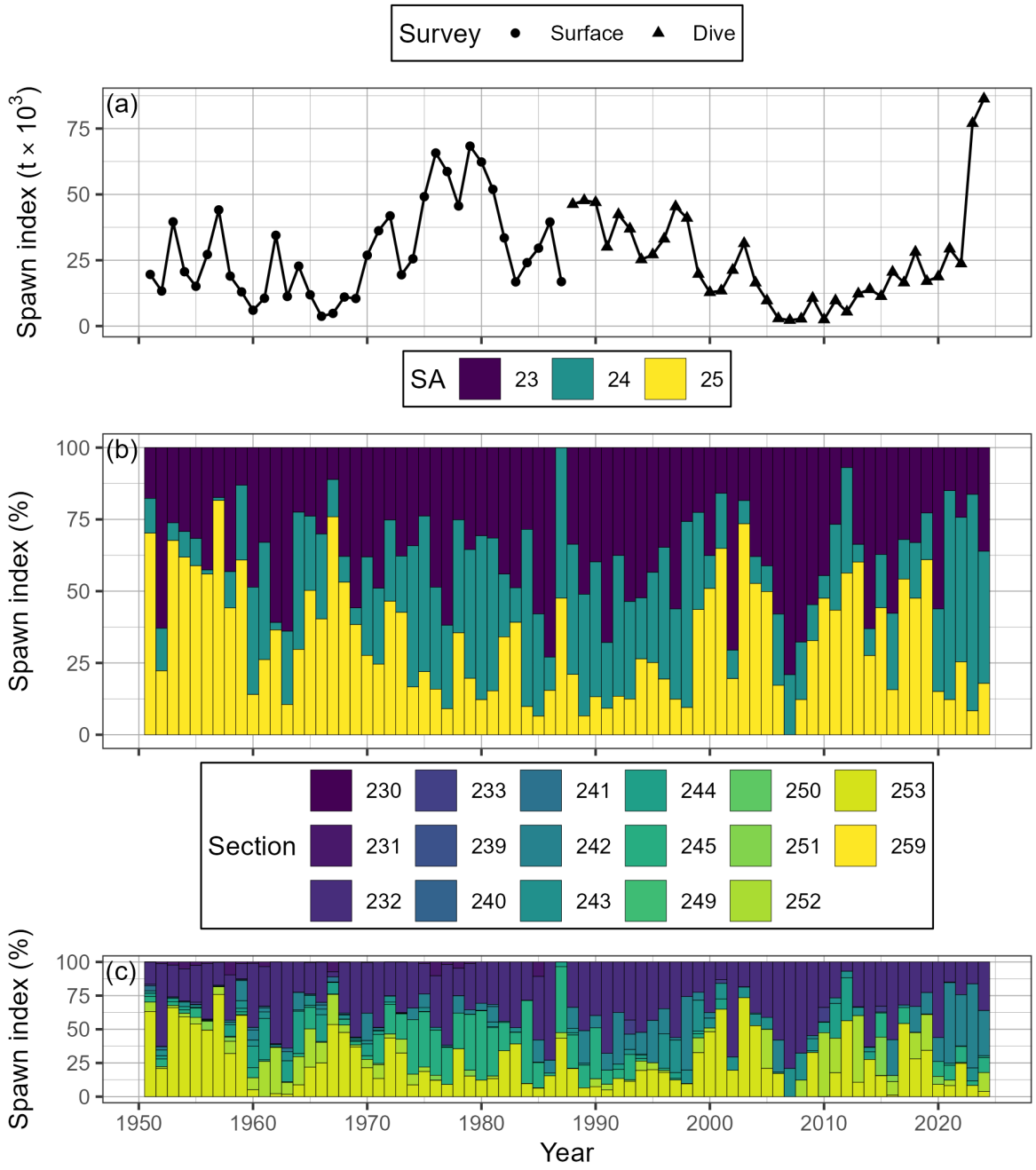

Figure 18. Time series of spawn index in thousands of metric tonnes (t $\times$ 10^3) for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR; panel a), as well as percent contributed by Statistical Area (SA), and Section (b, & c, respectively). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). Note that spawn surveys in the dive survey period (1988 to 2024) are a combination of surface and dive surveys (Figures 15 and 16). The 'spawn index' is not scaled by the spawn survey scaling parameter, q.

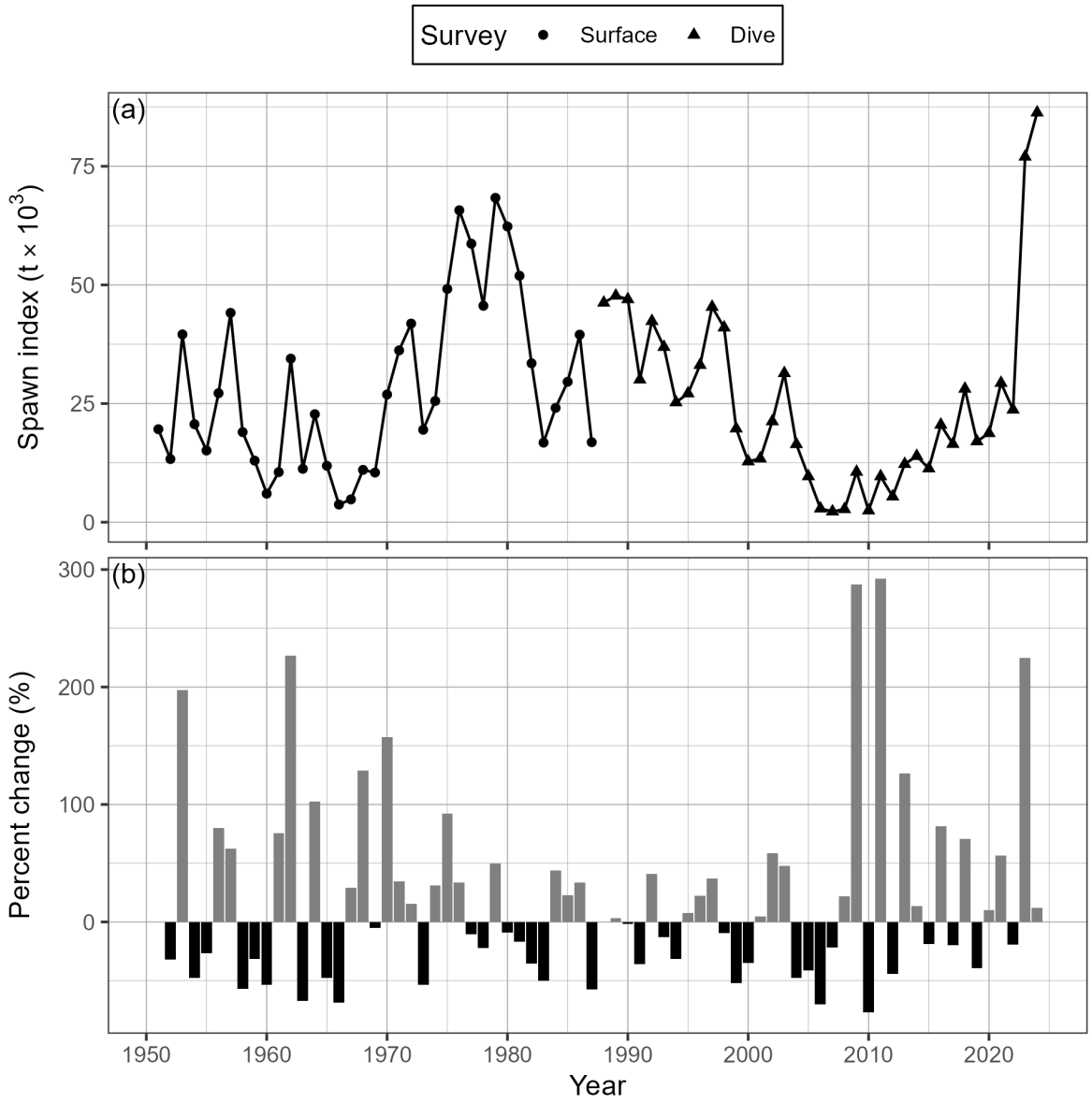

Figure 19. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR; panel a), and percent change (b). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the spawn index in year t. The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Note that spawn surveys in the dive survey period (1988 to 2024) are a combination of surface and dive surveys (Figures 15 and 16).

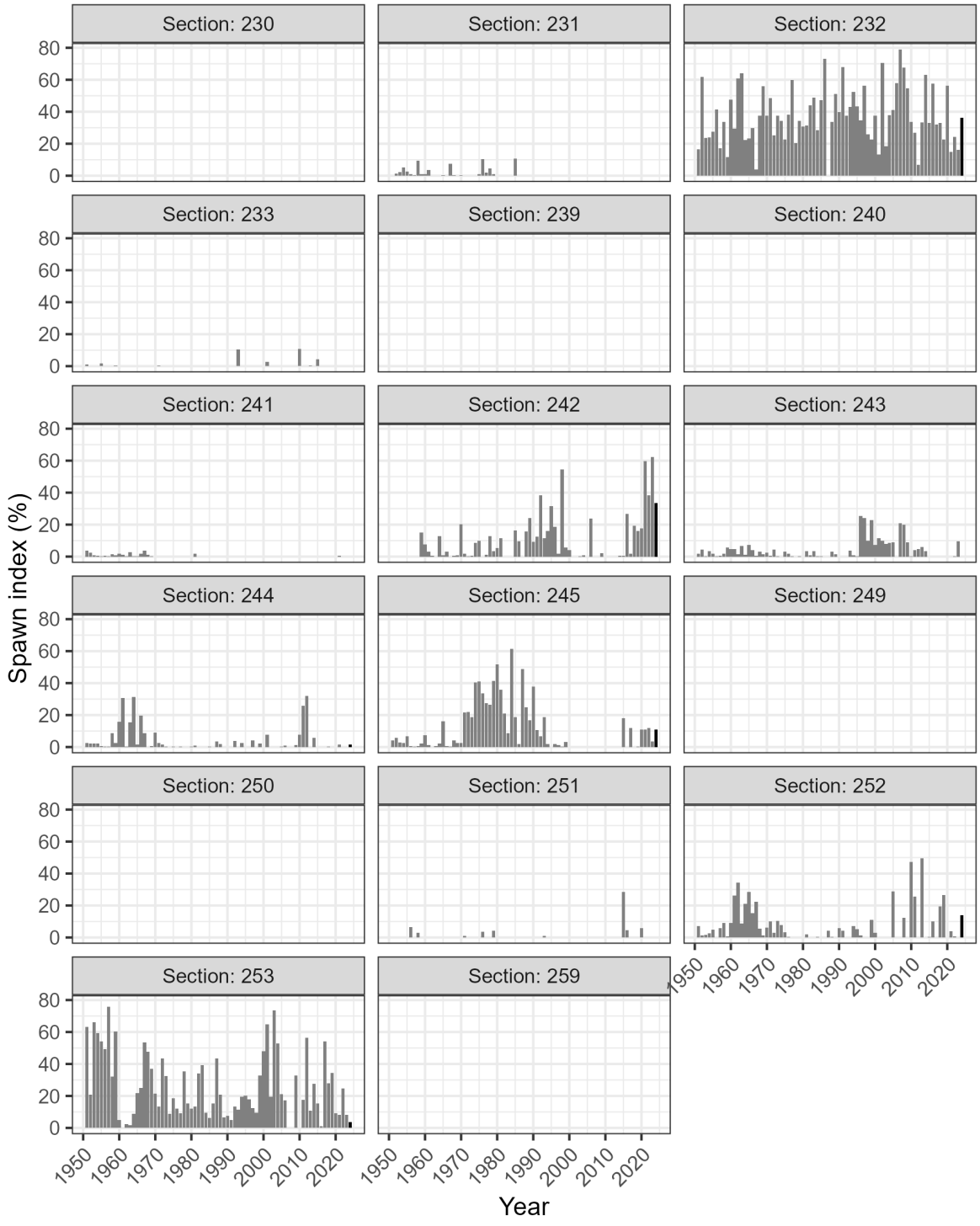

Figure 20. Time series of percent of spawn index by Section for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The year 2024 has a darker bar to facilitate interpretation. The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q.

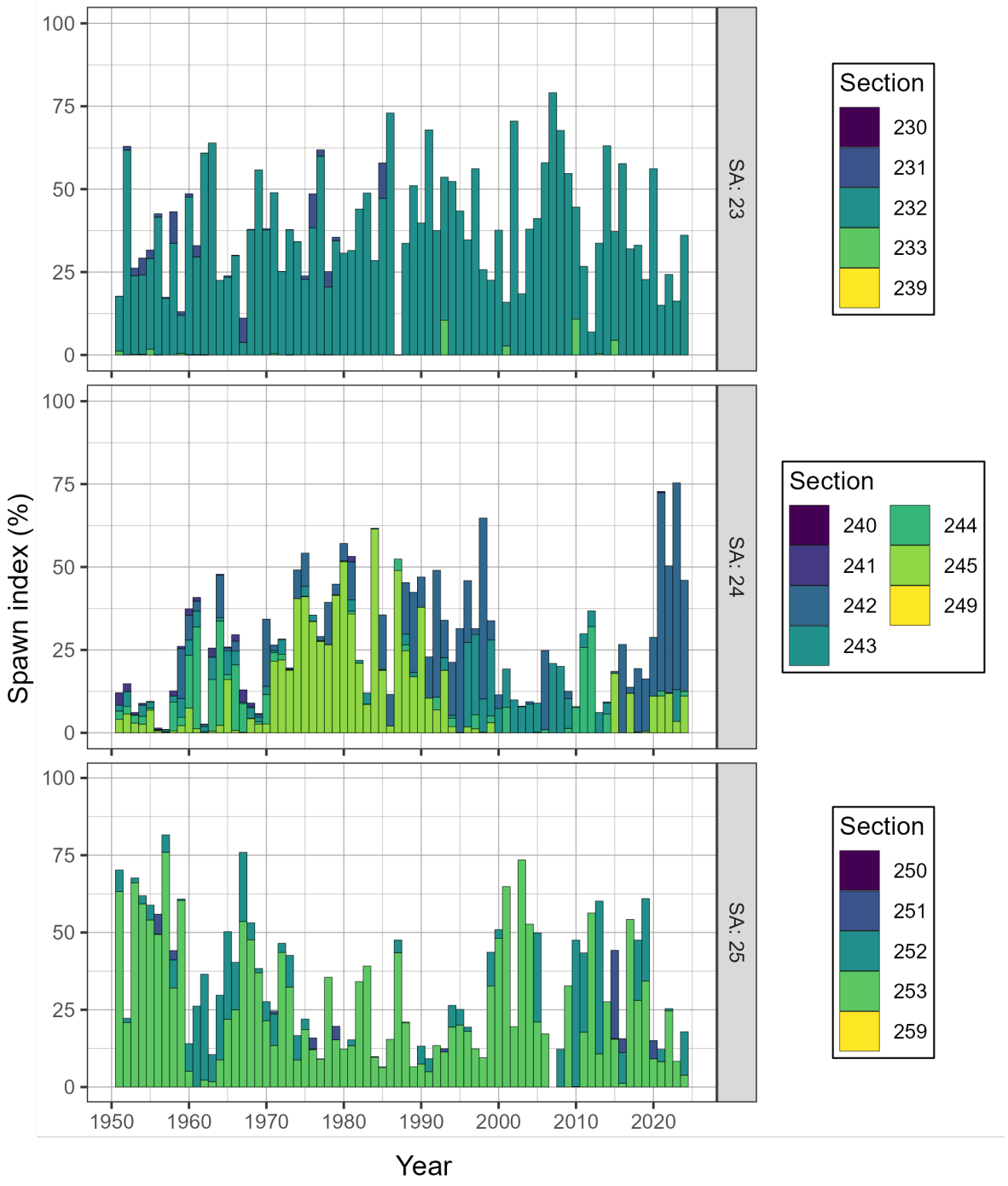

Figure 21. Time series of percent of spawn index by Statistical Area (SA) and Section for Pacific Herring from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q.

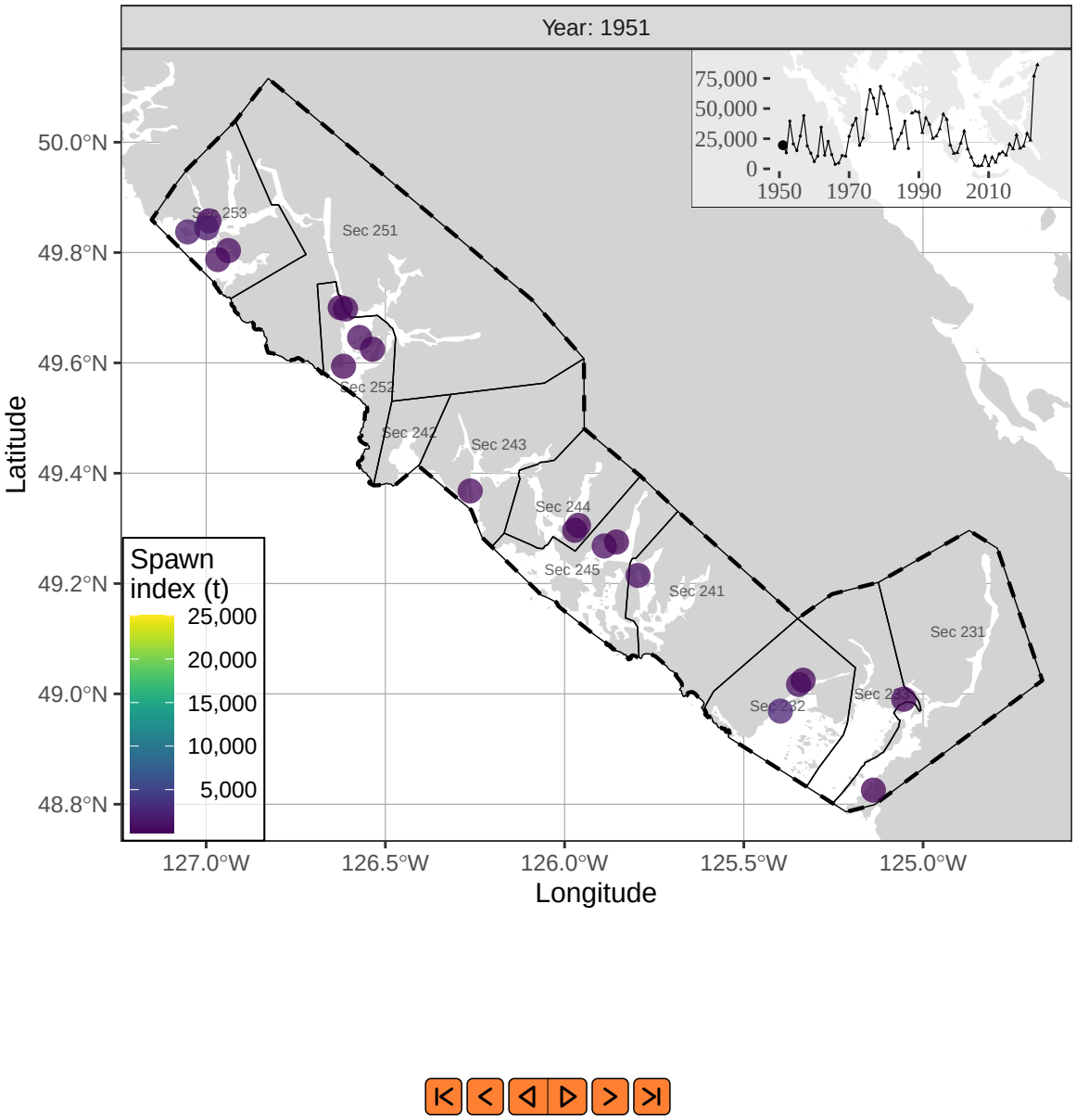

Figure 22. Animation of Pacific Herring spawn index in metric tonnes (t) by Location from 1951 to 2024 in the West Coast of Vancouver Island major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Missing spawn index values indicate incomplete surveys (grey circles). Inset tracks the total spawn index. Units: kilometres (km). View the animation: download the report, open with Adobe, enable Java, and click "play".