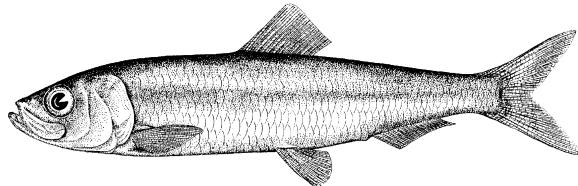


Pacific Herring preliminary data summary for Strait of Georgia 2022

Jaclyn Cleary* Matthew Grinnell†

July 21, 2022



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

Disclaimer This report contains preliminary data collected for Pacific Herring in 2022 in the Strait of Georgia major stock assessment region (SAR). These data may differ from data used and presented in the final stock assessment.

1 COVID-19 pandemic

Compared to 2020 and 2021, the COVID-19 pandemic had fewer impacts to Pacific Herring data collection and analysis in 2022. Spawn surveys proceeded as usual in most areas in 2022. The collection and analysis of biological data was not affected by the COVID-19 pandemic in 2022.

2 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

*DFO Science, Pacific Biological Station (email: Jaclyn.Cleary@dfo-mpo.gc.ca).

†DFO Science, Pacific Biological Station (email: Matthew.Grinnell@dfo-mpo.gc.ca).

this scale (Table 1, Figure 1). The Pacific Herring data collection program includes fishery-dependent and -independent data from 1951 to 2022. 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 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 2022 in the Strait of Georgia 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). For the Strait of Georgia major SAR, we use another level of spatial aggregation which we refer to as a ‘Group’. Note that we refer to ‘year’ instead of ‘herring season’ in this report; therefore 2022 refers to the 2021/2022 Pacific Herring season.

3 Data collection programs

In 2022, biological samples were collected by the seine charter vessel *Denman Isle* for 27 days from February 20th to March 18th. Two additional Industry test vessels collected biological samples between February 28th to March 15th. The primary purpose of the test charter vessel was to collect biological samples from main aggregations of herring in the SoG, as identified from soundings within the SAR boundary.

Herring spawn locations were primarily identified with fixed-wing overflights conducted by DFO Resource Management and Science staff. Twelve flights were conducted this season, between February and March.

Four dive vessels operated in the SoG:

- The *Viking Spirit* surveyed 21 days from March 11th to March 31st,
- The *Ocean Cloud* surveyed 12 days from March 9th to March 20th,
- Divers with A-Tlegay Fisheries Society surveyed 1 day on March 7th, and
- DFO divers surveyed 1 day on March 29th.

The first two dive vessels and the seine charter vessel *Denman Isle* were funded by DFO, through a contract to the Herring Conservation Research Society. DFO mentored A-Tlegay Fisheries Society divers for the spawn survey protocol in 2017 and 2019; in 2022, these divers surveyed spawn through a contract with DFO. Additional sampling and sounding efforts conducted through the Industry Test Program were contributed in-kind by the Herring Industry.

4 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 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; in some cases this may affect our ability to allocate catch to a specific SAR. 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 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 2022 in the Strait of Georgia major SAR is shown in Table 4; we also calculate the estimated spawning biomass associated with SOK harvest. See the [draft spawn index technical report](#) for calculations to convert SOK harvest to spawning biomass.

In 2022, 70 Pacific Herring biological samples were collected and processed for the Strait of Georgia major SAR (Table 5, Table 6), and a total of 2,971 Pacific Herring were aged in 2022. The locations in which the biological samples were collected are presented in Figure 4. Biological samples collected using seine gear shows that there is considerable variability in fish weight by year and sample type (Figure 5). Included herein are biological summaries of observed proportion-, number-, weight-, and length-at-age (Figure 6, Table 7, 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.

5 Spawn survey data

Pacific Herring spawn surveys were conducted at 34 individual locations in 2022 in the Strait of Georgia major SAR (Table 8, and Figure 10). A summary of spawn from the last decade (2012 to 2021) is shown in Figure 11. Figure 12 shows spawn start date by decade and Group. 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 13, Figure 14, Figure 15, Figure 16, Table 9, and Figure 17). See the [draft 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 2022).

Some Pacific Herring Sections contribute more than others to the total spawn index, and the percentage contributed by Section varies yearly (Figure 16b, Figure 18). For example, in 2022, Section 142 contributed the most to the spawn index (78%). As with Sections, some Groups contribute more than others to the total spawn index (Figure 16c, Figure 19). An animation shows the spawn index by spawn survey location from 1951 to 2022 (Figure 20).

6 General observations

General observations provide context to the data summary report. The following observations were reported by area DFO Resource Management staff, and DFO Science staff:

- Late February, as well as early and mid-March had strong winds which impacted the effectiveness of the assessment program.
- Spawn in the Strait of Georgia was observed along the East coast of Vancouver Island from Kitty Coleman south to Union Point, on the East coast of Denman Island from White Spit to Komas Bluff, around most of Hornby Island, and from Bowser to the Little Qualicum River. South of Little Qualicum River there were small spawns at Lock Bay on Gabriola and at Round Island south of Dodd Narrows.
- Additional spawn was reported in Areas 13, 15, 16, 19, and 28.
- Spawns recorded in Esquimalt Harbour and Esquimalt Lagoon (last observed in 1993 and 1950, respectively).
- Spawn recorded at Kiddie Point and Blubber Bay on Texada Island (first records at these locations).
- The majority of spawning occurred between March 2nd and 7th after multiple days of high winds and rough seas.
- The overall length of spawn observed during the flight program was below average when compared with recent years.
- Streamkeepers installed spawning panels in False Creek again this year.
- Overall fishery timing was average this year.
- The sea lion population in the Strait of Georgia during the herring season continues to impact the ability to obtain biological samples in some areas and times.

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, Sections, and Groups for Pacific Herring in the Strait of Georgia major stock assessment region (SAR). Legend: ‘14&17’ is Statistical Areas 14 and 17 (excluding Section 173); ‘ESoG’ is eastern Strait of Georgia; ‘Lazo’ is above Cape Lazo; and ‘SDodd’ is South of Dodd Narrows

Region	Statistical Area	Section	Group
Strait of Georgia	13	132	Lazo
Strait of Georgia	13	135	Lazo
Strait of Georgia	14	140	14&17
Strait of Georgia	14	141	Lazo
Strait of Georgia	14	142	14&17
Strait of Georgia	14	143	14&17
Strait of Georgia	15	150	ESoG
Strait of Georgia	15	151	ESoG
Strait of Georgia	15	152	ESoG
Strait of Georgia	16	160	ESoG
Strait of Georgia	16	161	ESoG
Strait of Georgia	16	162	ESoG
Strait of Georgia	16	163	ESoG
Strait of Georgia	16	164	ESoG
Strait of Georgia	16	165	ESoG
Strait of Georgia	17	170	14&17
Strait of Georgia	17	171	14&17
Strait of Georgia	17	172	14&17
Strait of Georgia	17	173	SDodd
Strait of Georgia	18	180	SDodd
Strait of Georgia	18	181	SDodd
Strait of Georgia	18	182	SDodd

<i>Table 2 continued</i>				
Region	Statistical Area	Section	Group	
Strait of Georgia	19	190	SDodd	
Strait of Georgia	19	191	SDodd	
Strait of Georgia	19	192	SDodd	
Strait of Georgia	19	193	SDodd	
Strait of Georgia	28	280	ESoG	
Strait of Georgia	29	291	ESoG	
Strait of Georgia	29	292	ESoG	

Table 3. Total landed commercial catch of Pacific Herring in metric tonnes (t) by gear type in 2022 in the Strait of Georgia 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	837
RoeSN	744
RoeGN	3,091

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 2012 to 2022 in the Strait of Georgia major stock assessment region (SAR). See the [draft 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)
2012	0	0
2013	0	0
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

Table 5. Number of Pacific Herring biological samples processed from 2012 to 2022 in the Strait of Georgia major stock assessment region (SAR). Each sample is approximately 100 fish. Note: Nearshore samples are not used in stock assessments.

Year	Number of samples			
	Commercial	Test	Nearshore	Total
2012	102	42	0	144
2013	97	25	0	122
2014	82	11	0	93
2015	120	38	0	158
2016	123	33	5	161
2017	121	27	0	148
2018	116	28	0	144
2019	125	35	0	160
2020	106	27	0	133
2021	89	25	0	114
2022	50	18	2	70

Table 6. Number and type of Pacific Herring biological samples processed in 2022 in the Strait of Georgia major stock assessment region (SAR). Each sample is approximately 100 fish.

Type	Gear	Use	Number of samples
Commercial	Gillnet	Roe fishery	30
Commercial	Seine	Bait fishery	10
Commercial	Seine	Food fishery	4
Commercial	Seine	Roe fishery	6
Test	Other	Nearshore	2
Test	Seine	Test fishery	18

Table 7. Observed proportion-at-age for Pacific Herring from 2012 to 2022 in the Strait of Georgia major stock assessment region (SAR). The age-10 class is a ‘plus group’ which includes fish ages 10 and older.

Year	Proportion-at-age									
	2	3	4	5	6	7	8	9	10	
2012	0.034	0.424	0.442	0.039	0.055	0.005	0.002	0.000	0.000	
2013	0.124	0.304	0.299	0.230	0.018	0.023	0.002	0.000	0.000	
2014	0.046	0.480	0.181	0.153	0.117	0.010	0.010	0.001	0.000	
2015	0.103	0.374	0.362	0.088	0.046	0.023	0.002	0.001	0.000	
2016	0.153	0.267	0.334	0.178	0.040	0.016	0.009	0.001	0.001	
2017	0.100	0.304	0.267	0.215	0.089	0.018	0.006	0.002	0.000	
2018	0.077	0.418	0.247	0.144	0.082	0.026	0.004	0.002	0.000	
2019	0.238	0.349	0.222	0.110	0.051	0.023	0.006	0.001	0.000	
2020	0.124	0.529	0.208	0.081	0.035	0.016	0.004	0.002	0.000	
2021	0.052	0.372	0.391	0.124	0.041	0.013	0.005	0.001	0.001	
2022	0.240	0.282	0.238	0.176	0.048	0.010	0.004	0.001	0.001	

Table 8. Pacific Herring spawn survey locations, start date, and spawn index in metric tonnes (t) in 2022 in the Strait of Georgia 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)
14	141	Kitty Coleman Beach	March 03	1,119
14	141	Kye Bay	March 02	9,586
14	141	Little Rvr	March 04	2,553
14	142	Baynes Snd	March 06	2,912
14	142	Cape Lazo	March 02	20,532
14	142	Collishaw Pt	March 04	12,063
14	142	Comox Bar	March 03	2,149
14	142	Ford Cv	March 05	298
14	142	Gartley Pt	March 05	2,338
14	142	Goose Spit	March 03	2,022
14	142	Komas Bluff	March 06	458
14	142	Norman Pt	March 06	114
14	142	Seal Islets	March 06	2,484
14	142	Shingle Spit	March 04	823
14	142	Tralee Pt	March 02	2,873
14	142	Whaling Station Bay	March 04	2,251
14	142	Willemar Bluff	March 03	16,036
14	143	Big Qualicum Rvr	March 05	1,137
14	143	Bowser	March 05	463
14	143	Qualicum Bay	March 06	49
15	152	Blubber Bay	March 03	213
15	152	Grief Pt	March 17	NA
15	152	Kiddie Pt (Texada Is)	March 03	446
16	161	Crescent Bay	March 03	1,076
16	163	Pender Hrbr	January 20	NA
16	165	Porpoise Bay	February 23	NA
16	165	Salmon Inlt	April 14	NA
17	173	Lock Bay	March 29	1,132
17	173	Round Is	March 29	522
19	193	Esquimalt Hrbr	March 17	71
19	193	Esquimalt Lgn	March 17	99
28	280	False Cr	February 03	NA
28	280	Indian Arm	April 01	NA
28	280	Squamish	February 21	NA

Table 9. Summary of Pacific Herring spawn survey data from 2012 to 2022 in the Strait of Georgia 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 2022). 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)
2012	130,405	112	1.2	52,636
2013	158,955	122	1.3	83,693
2014	137,090	146	1.3	120,468
2015	166,750	115	1.3	104,481
2016	118,300	157	1.2	129,502
2017	130,440	163	0.9	81,064
2018	87,745	169	1.4	91,939
2019	82,865	140	1.1	63,038
2020	154,345	133	1.4	116,151
2021	114,950	154	1.1	70,938
2022	73,925	214	1.5	85,817

8 Figures

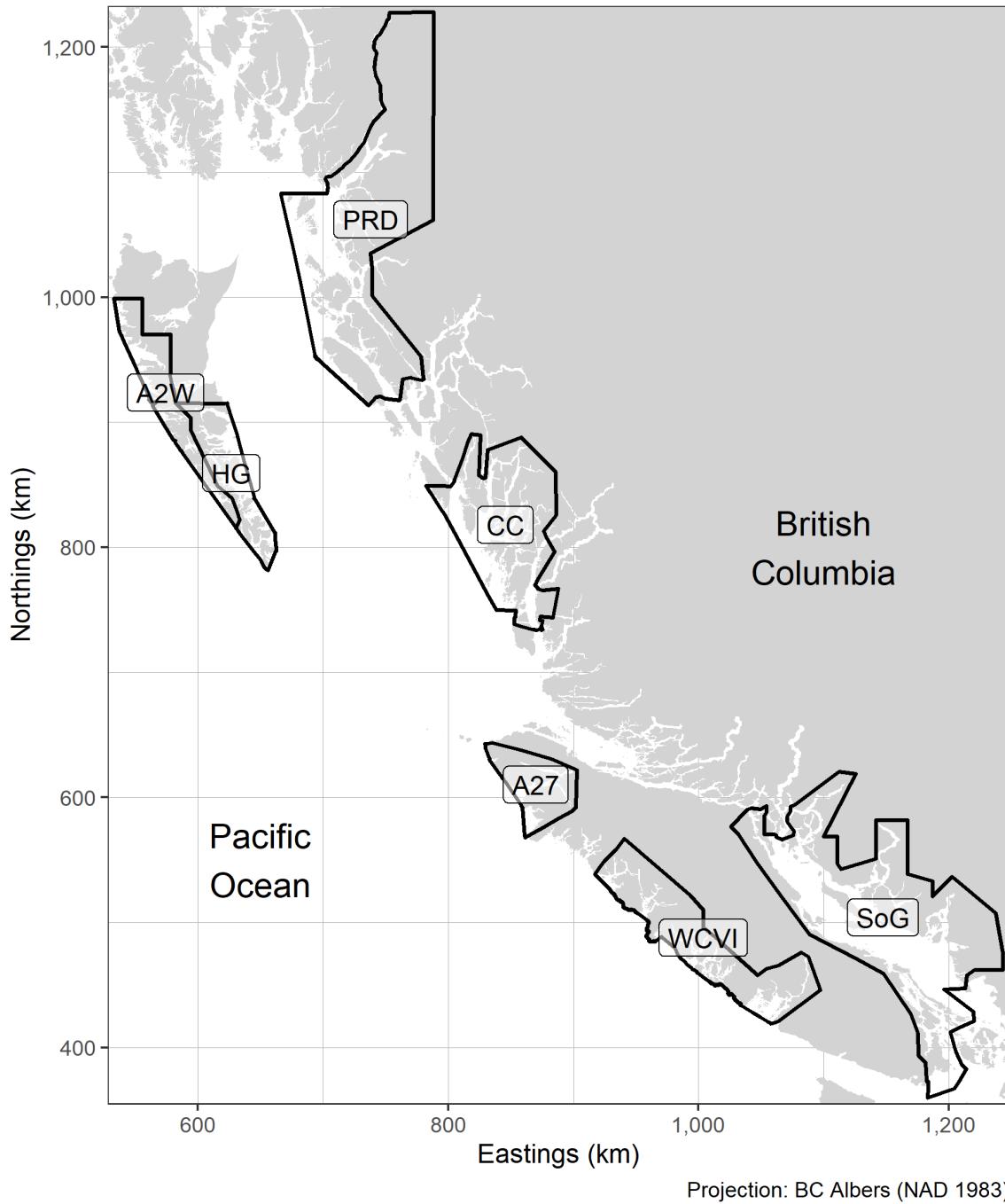


Figure 1. Boundaries for the Pacific Herring stock assessment regions (SARs) in British Columbia. There are 5 major SARs: Haida Gwaii (HG), Prince Rupert District (PRD), Central Coast (CC), Strait of Georgia (SoG), and West Coast of Vancouver Island (WCVI). There are 2 minor SARs: Area 27 (A27) and Area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

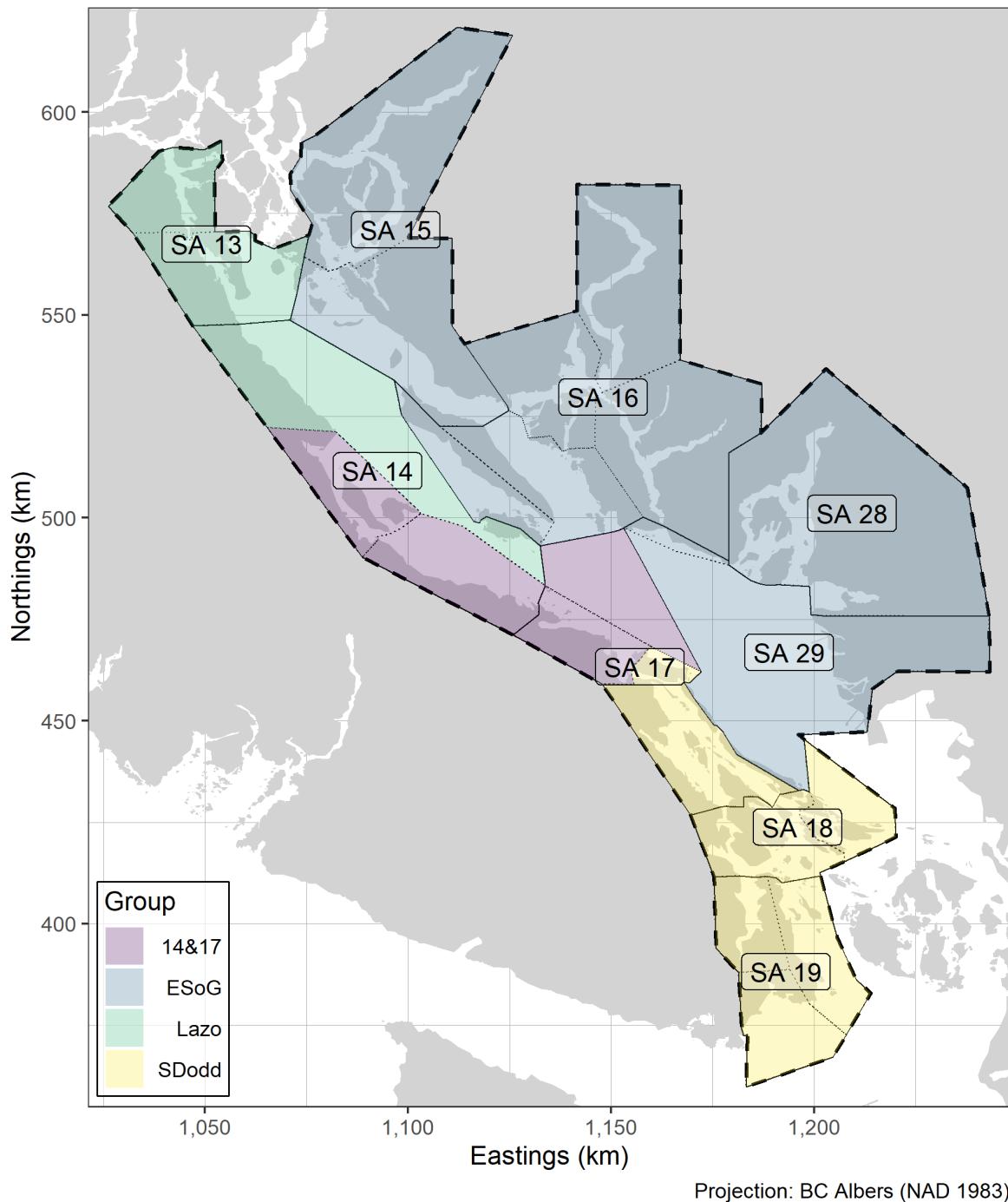


Figure 2. Boundaries for the Strait of Georgia major stock assessment region (SAR; thick dashed lines), associated Statistical Areas (SA; thin solid lines), and associated Sections (thin dotted lines). Units: kilometres (km). Legend: '14&17' is Statistical Areas 14 and 17 (excluding Section 173); 'ESoG' is eastern Strait of Georgia; 'Lazo' is above Cape Lazo; and 'SDodd' is South of Dodd Narrows

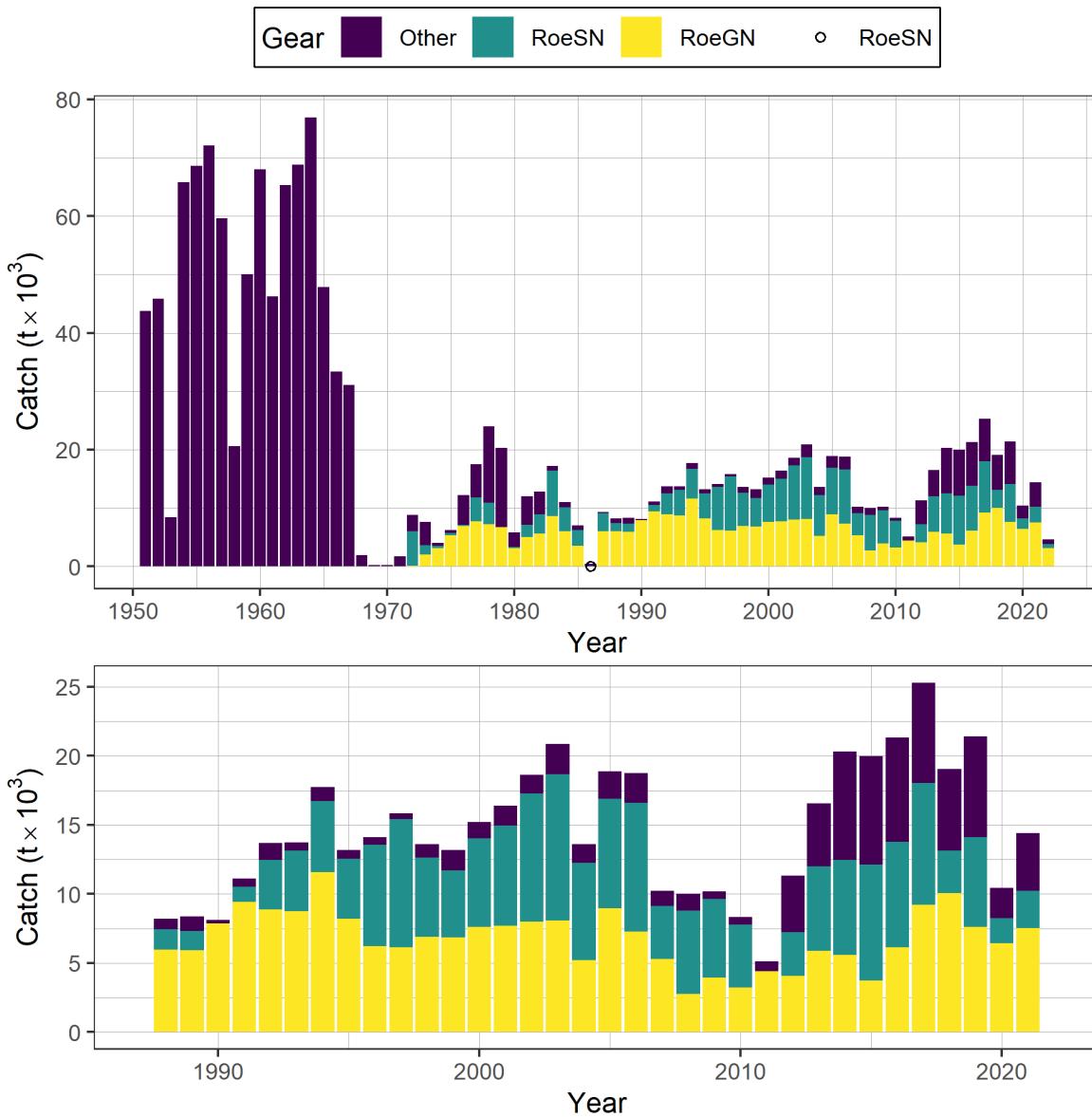


Figure 3. Time series of total landed catch in thousands of metric tonnes ($t \times 10^3$) of Pacific Herring by gear type from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). Legend: ‘Other’ represents the reduction (1951 to 1970 only), the food and bait, as well as the special 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 1987 in more detail. Note: symbols indicate years in which catch by gear type (i.e., Other, RoeSN, RoeGN) is withheld due to privacy concerns.

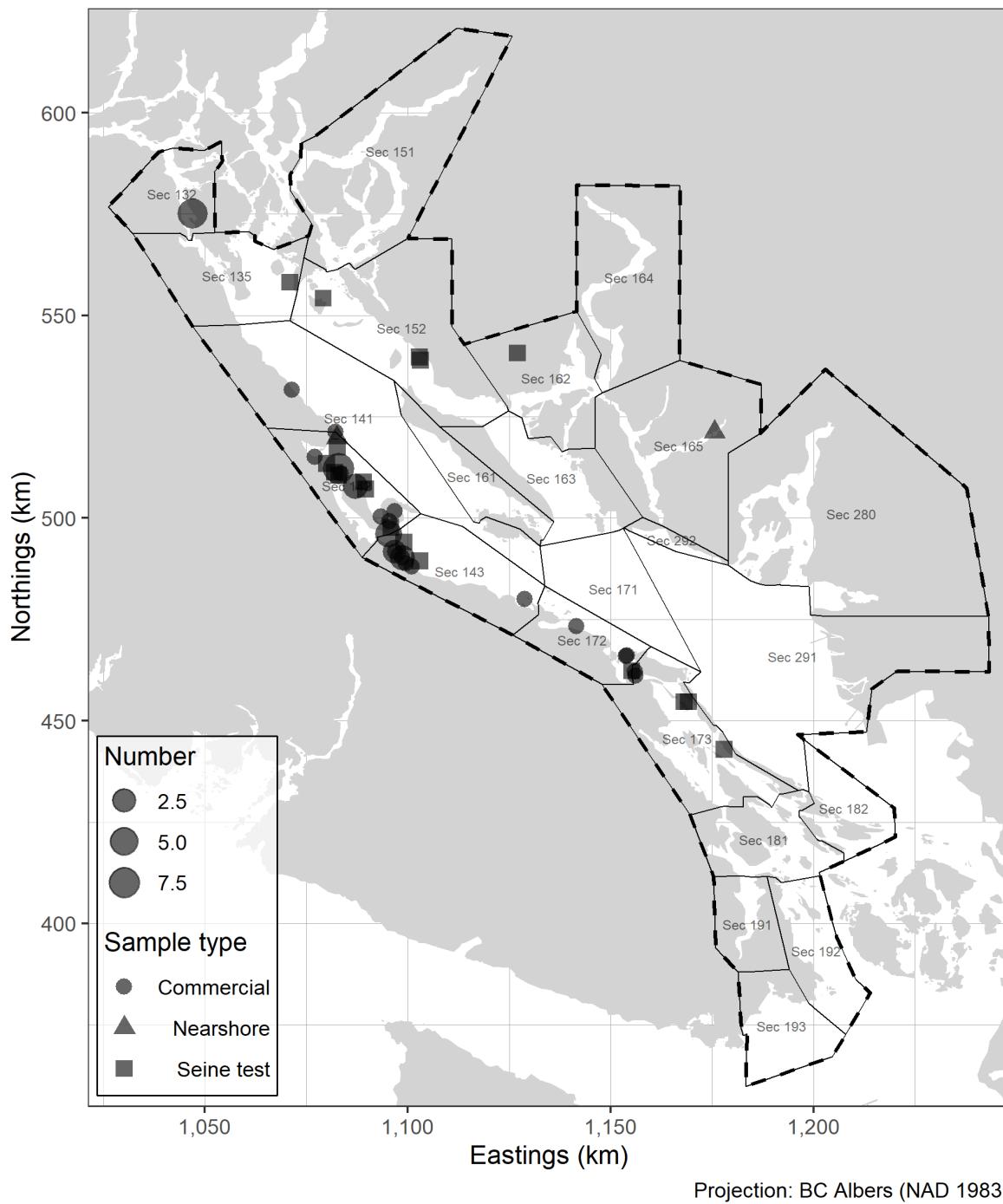


Figure 4. Location and type of Pacific Herring biological samples collected in 2022 in the Strait of Georgia major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). Units: kilometres (km).

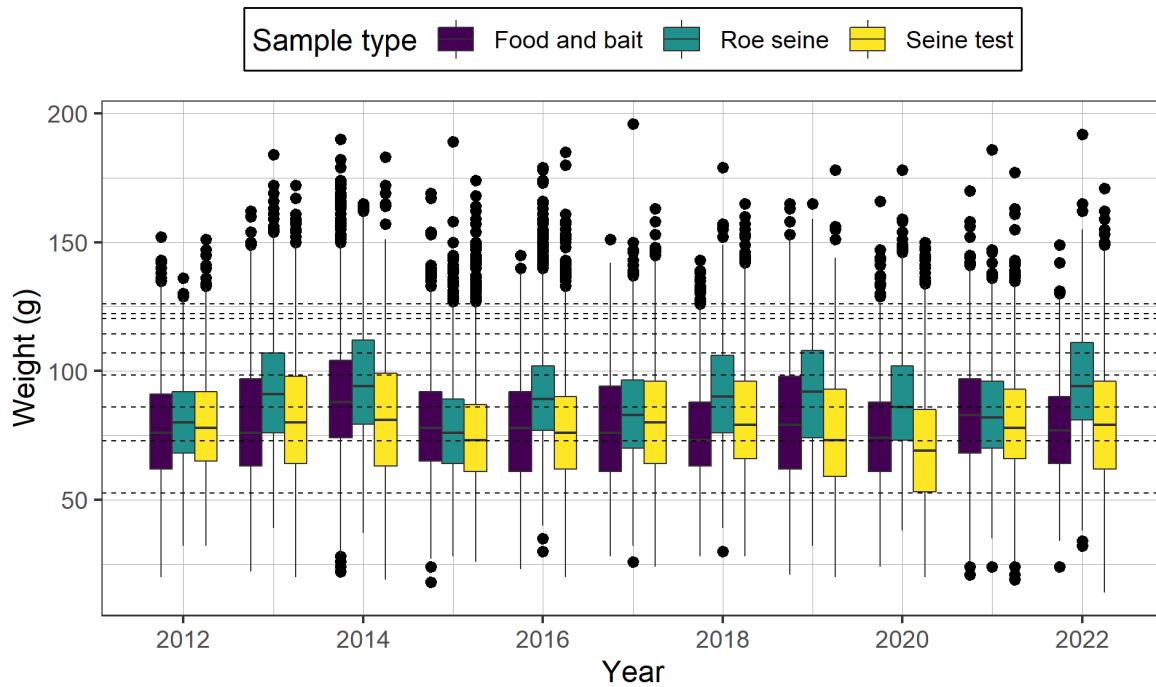


Figure 5. Time series of weight in grams (g) of Pacific Herring by sample type from 2012 to 2022 in the Strait of Georgia major stock assessment region (SAR) in Statistical Areas 14 and 17. The outer edges of the boxes indicate the 25th and 75th percentiles, and the middle lines indicate the 50th percentiles (i.e., medians). The whiskers extend to $1.5 \times \text{IQR}$, where IQR is the distance between the 25th and 75th percentiles, and dots indicate outliers. Horizontal dashed lines indicate the mean weight-at-age for age-2 (lowest line) to age-10 (incrementing higher from age-2) fish. 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.

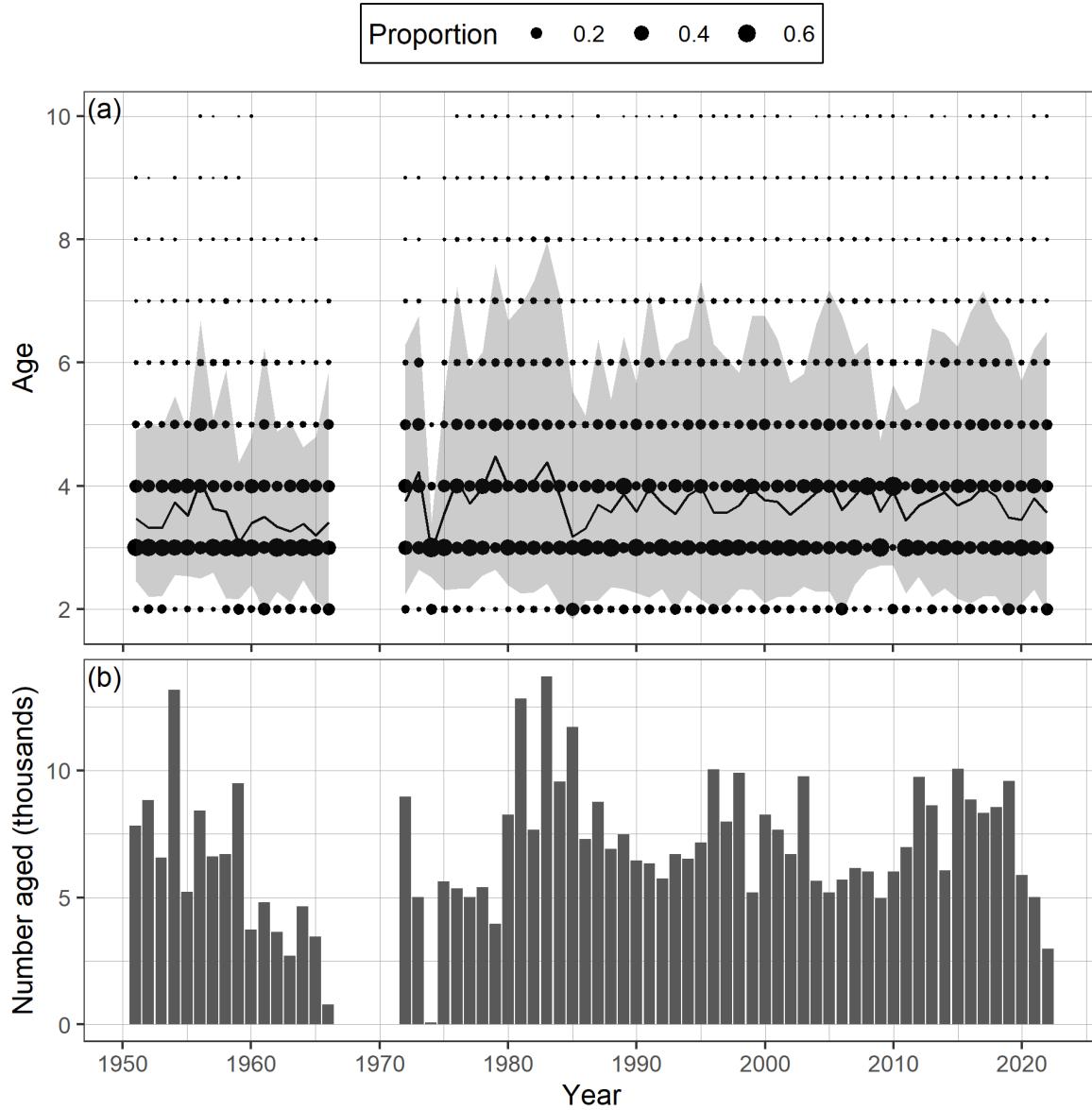


Figure 6. Time series of observed proportion-at-age (a) and number aged in thousands (b) of Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). The black line is the mean age, and the shaded area is the approximate 90% distribution. Biological summaries only 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.

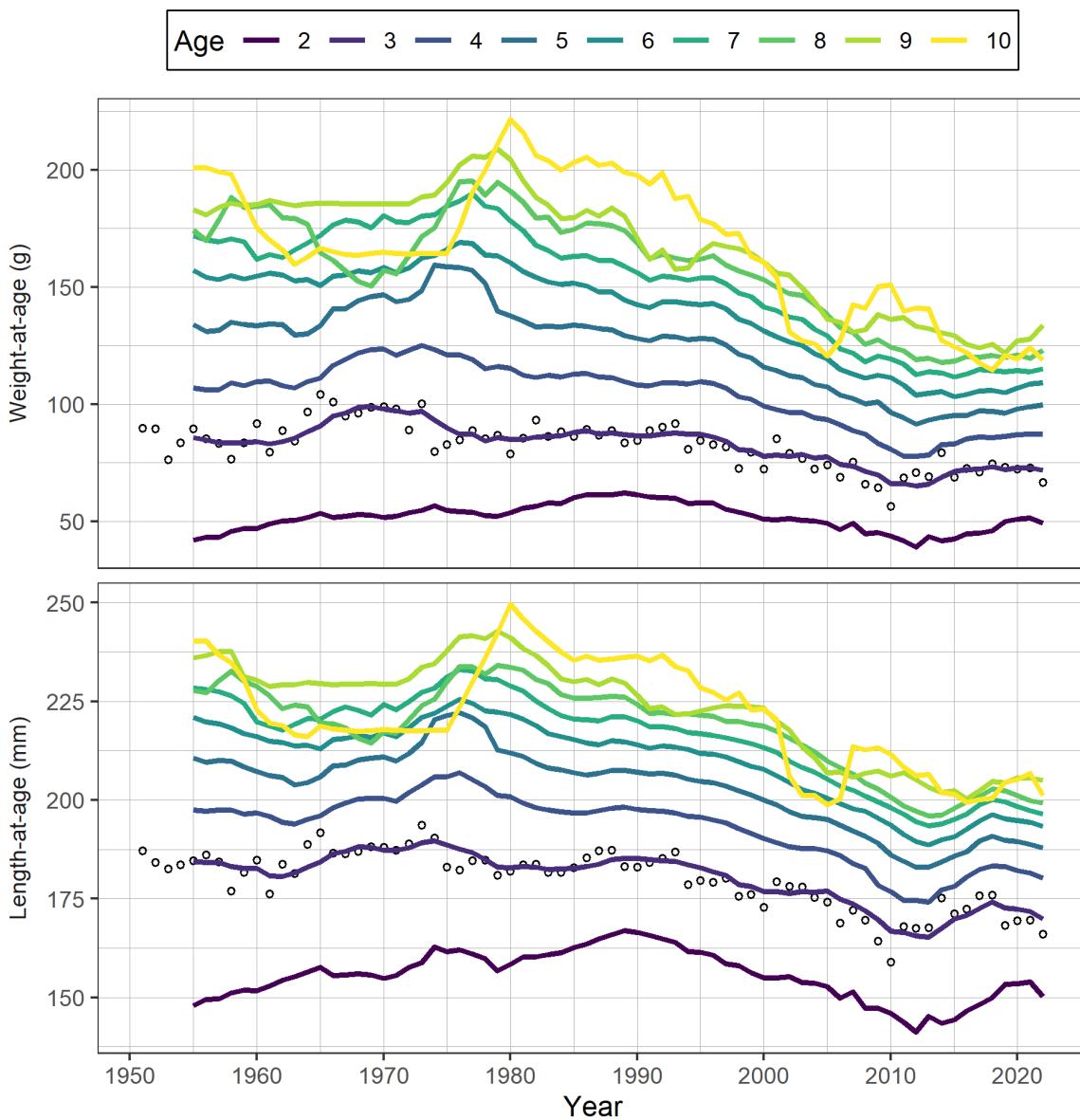


Figure 7. Time series of weight-at-age in grams (g) and length-at-age in milimetres (mm) for age-3 (circles) and 5-year running mean weight- and length-at-age (lines) for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). Missing weight- and length-at-age 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.

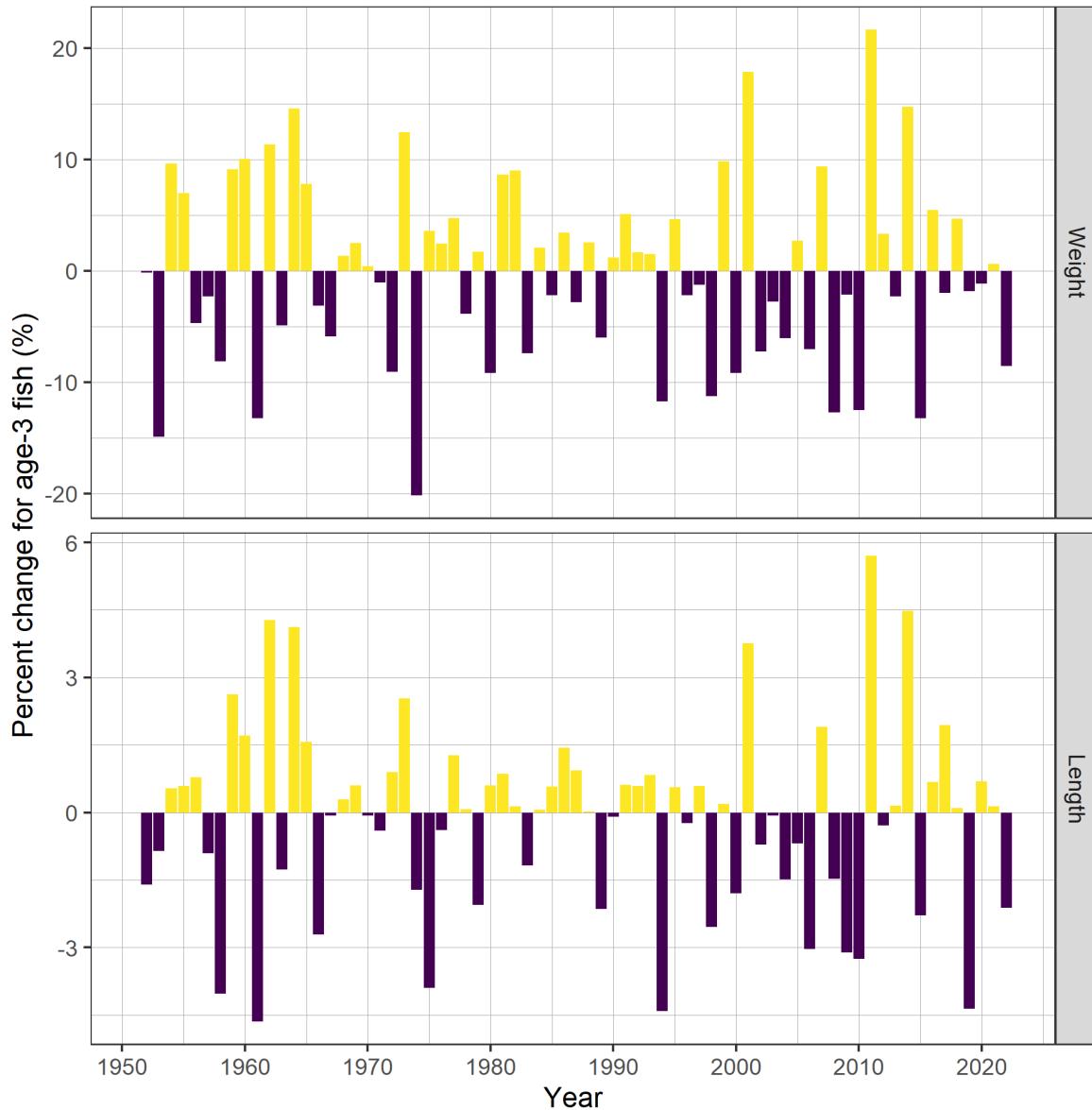


Figure 8. Time series of percent change (%) in weight and length for age-3 fish for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the weight and length of age-3 fish, 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.

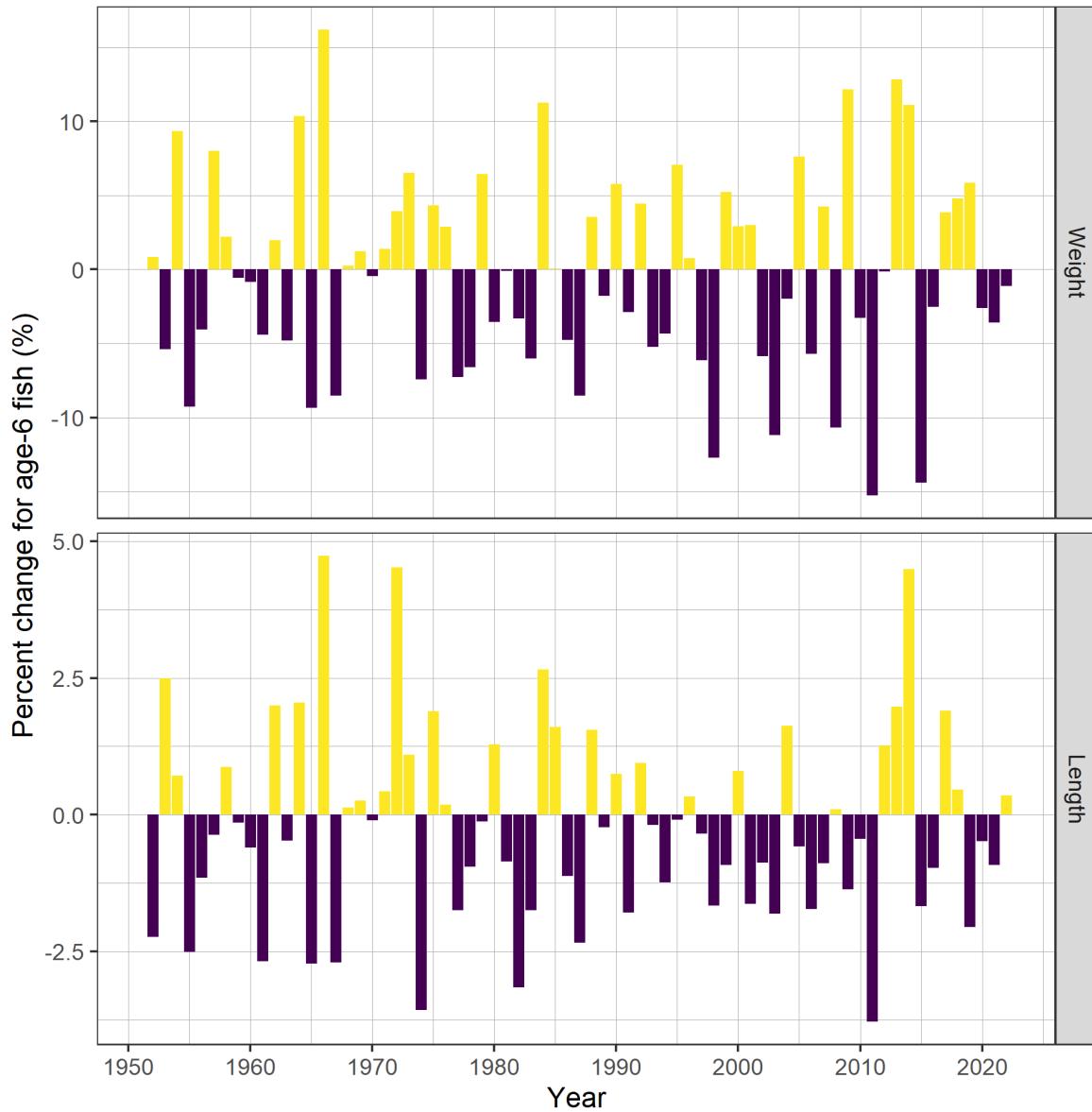


Figure 9. Time series of percent change (%) in weight and length for age-6 fish for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the weight and length of age-6 fish, 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.

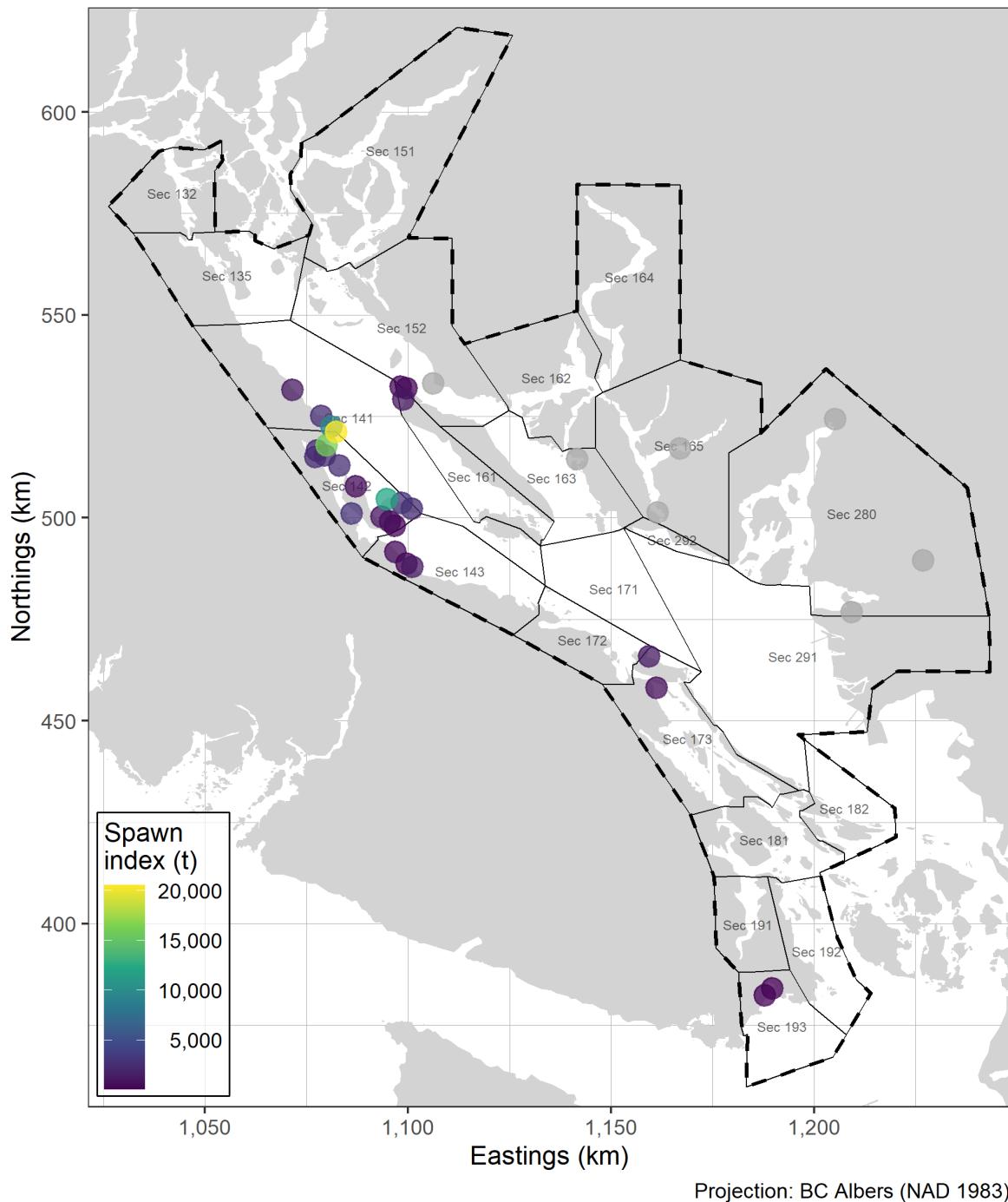


Figure 10. Pacific Herring spawn survey locations, and spawn index in metric tonnes (t) in 2022 in the Strait of Georgia major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The ‘spawn index’ is not scaled by the spawn survey scaling parameter, q . Missing spawn index values indicate incomplete surveys (grey circles). Units: kilometres (km).

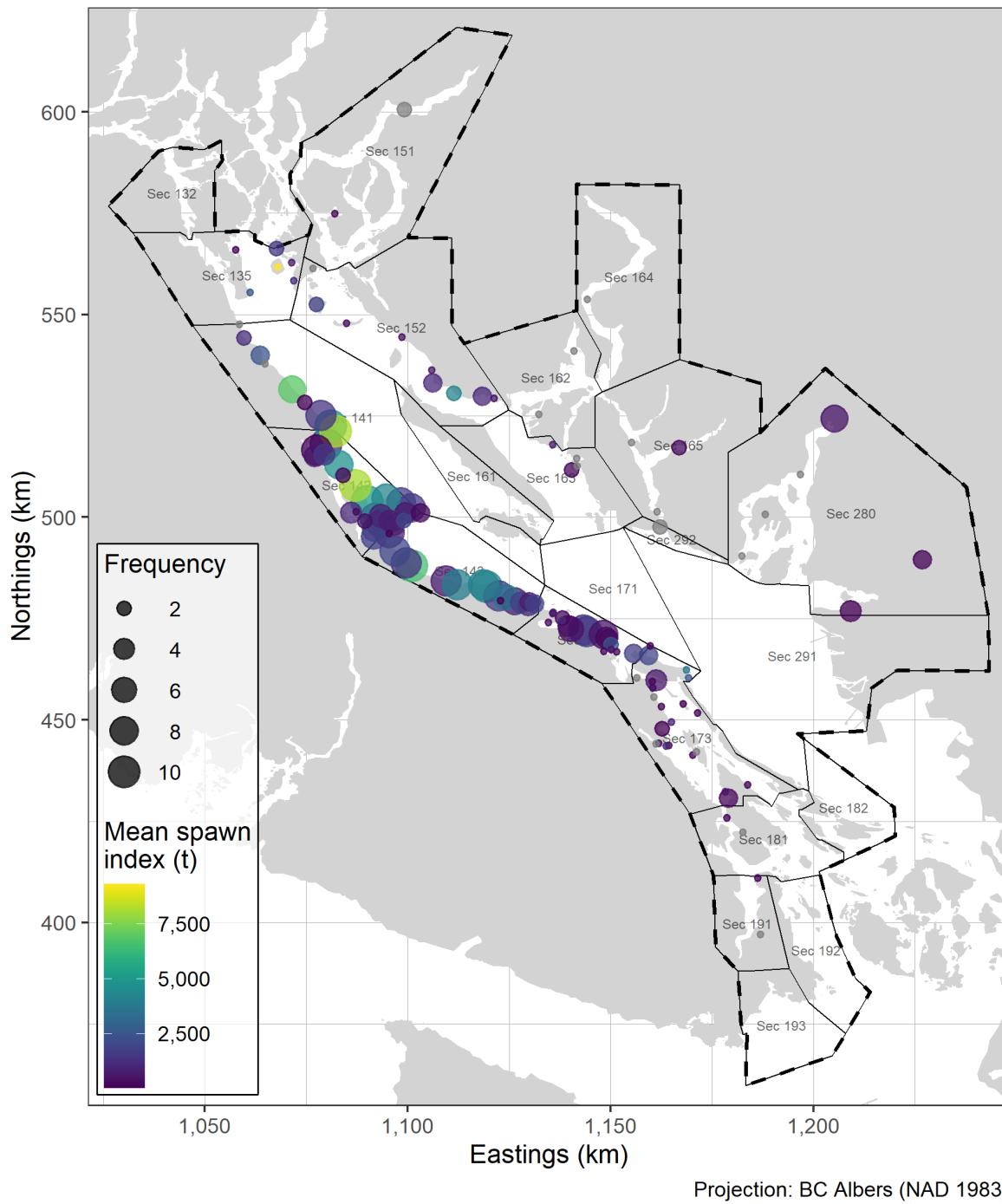


Figure 11. Pacific Herring spawn survey locations, mean spawn index in metric tonnes (t), and spawn frequency from 2012 to 2021 in the Strait of Georgia major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The ‘spawn index’ is not scaled by the spawn survey scaling parameter, q . Missing spawn index values indicate incomplete surveys (grey circles). Units: kilometres (km).

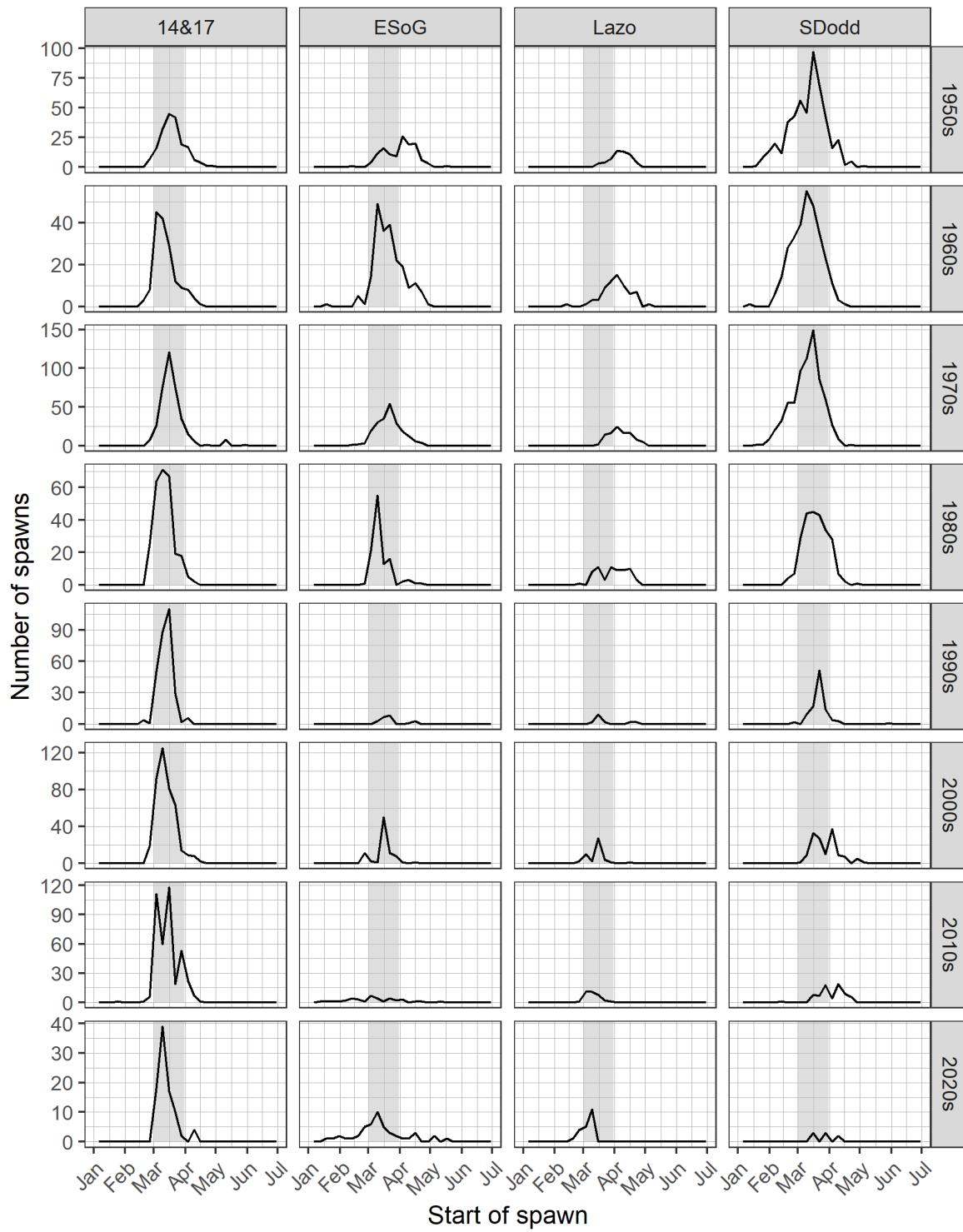


Figure 12. Pacific Herring spawn start date by decade and Group. Grey shaded regions indicate March 1st to 31st. Note that spawn size and intensity varies; therefore the number of spawns is not directly proportional to spawn extent or biomass. Legend: '14&17' is Statistical Areas 14 and 17 (excluding Section 173); 'ESoG' is eastern Strait of Georgia; 'Lazo' is above Cape Lazo; and 'SDodd' is South of Dodd Narrows

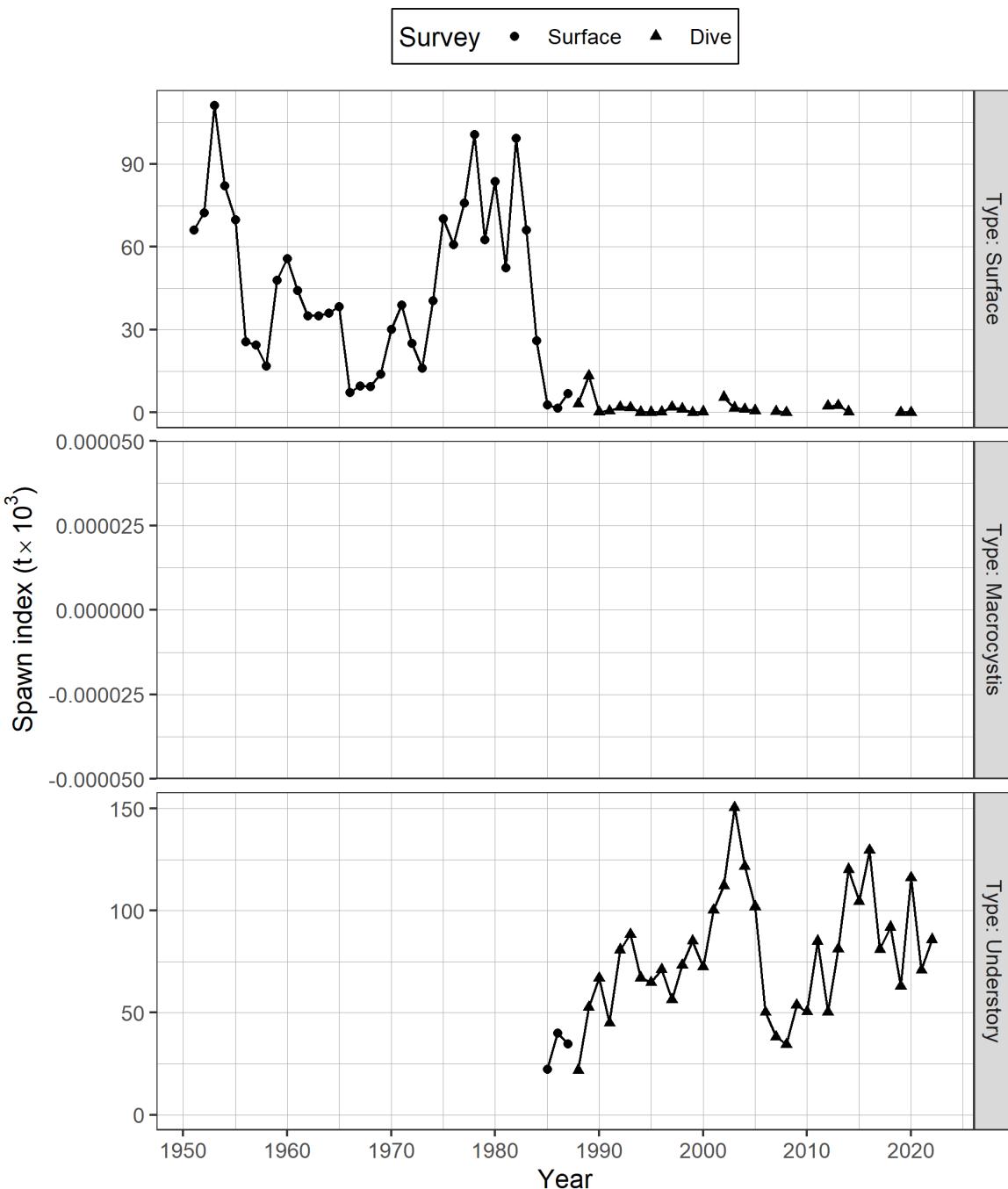


Figure 13. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) by type for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). There are three types of spawn survey observations: observations of spawn taken from the surface usually at 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 2022).

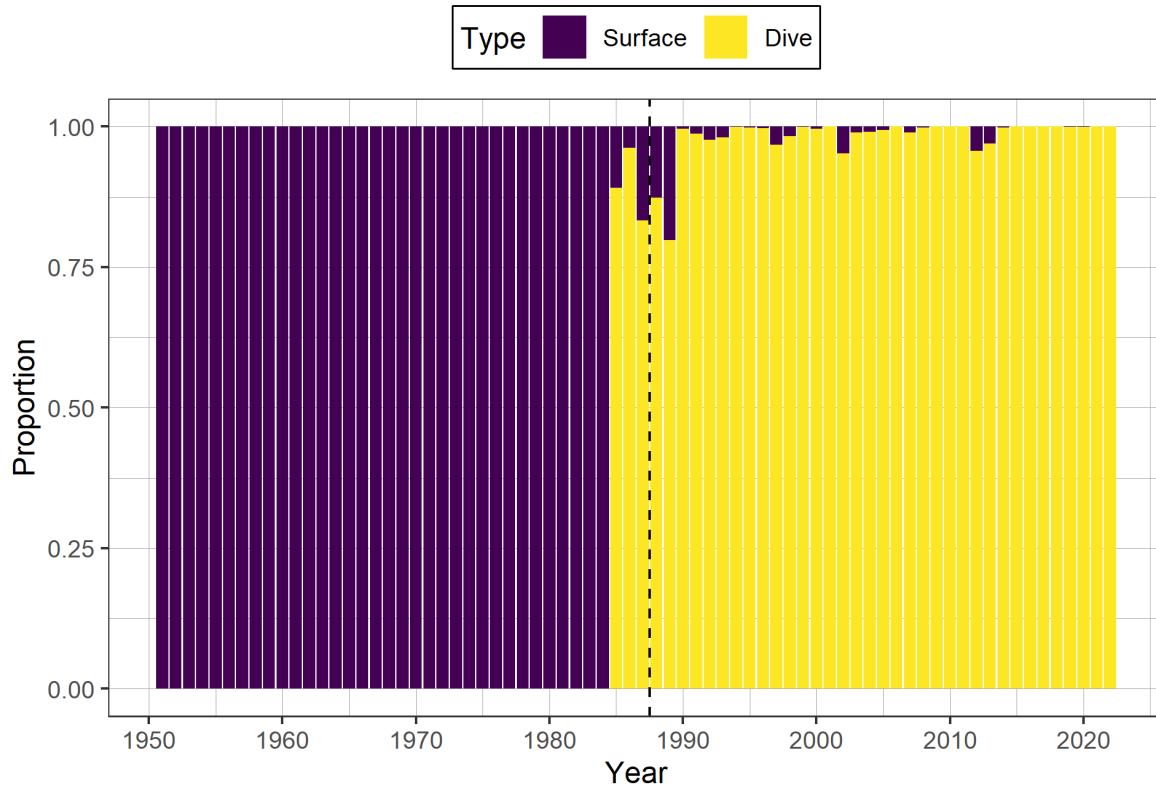


Figure 14. Time series of proportion of spawn index by surface and dive surveys for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2022).

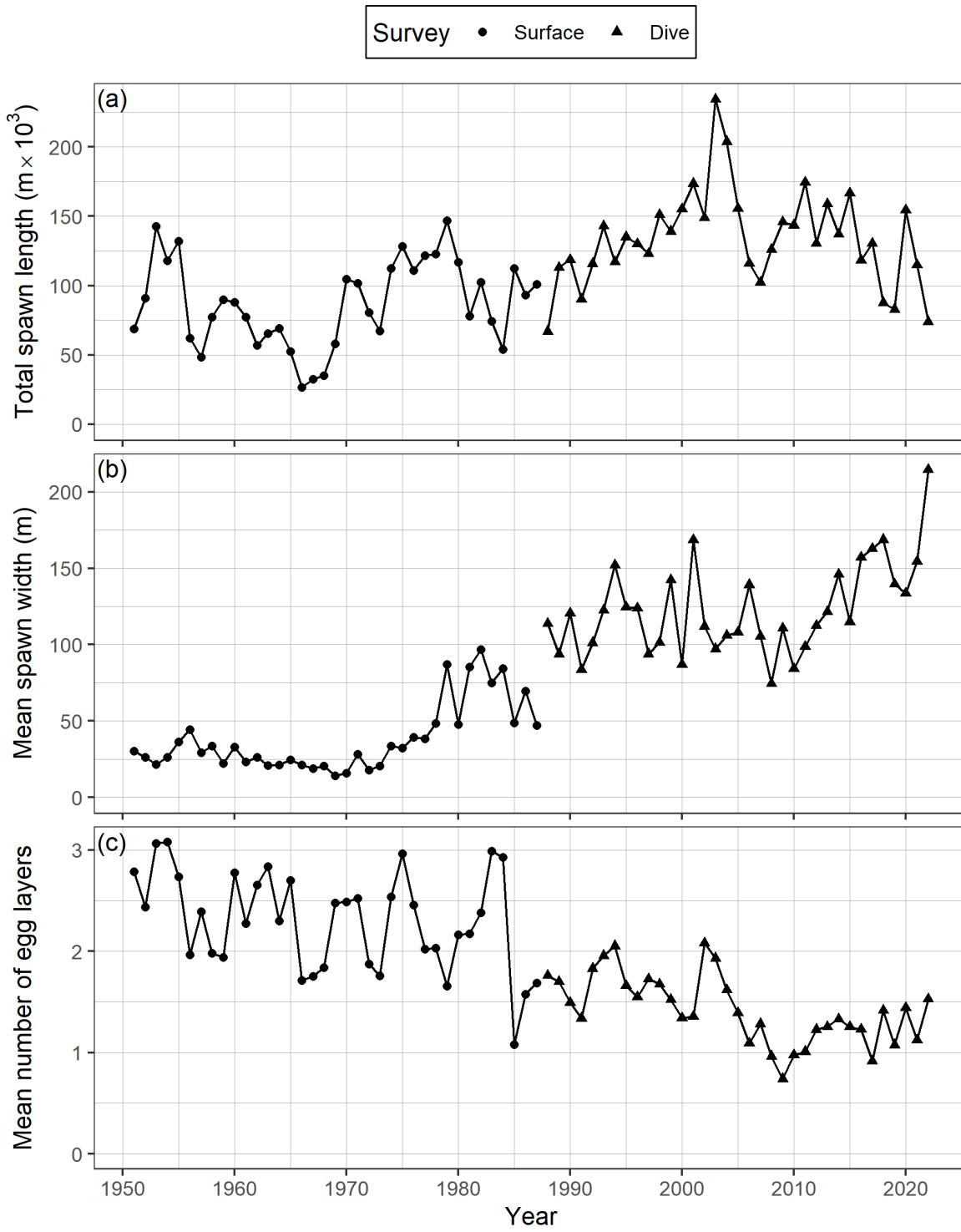


Figure 15. Time series of total spawn length in thousands of metres ($m \times 10^3$; panel a), mean spawn width in metres (b), and mean number of egg layers (c) for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2022).

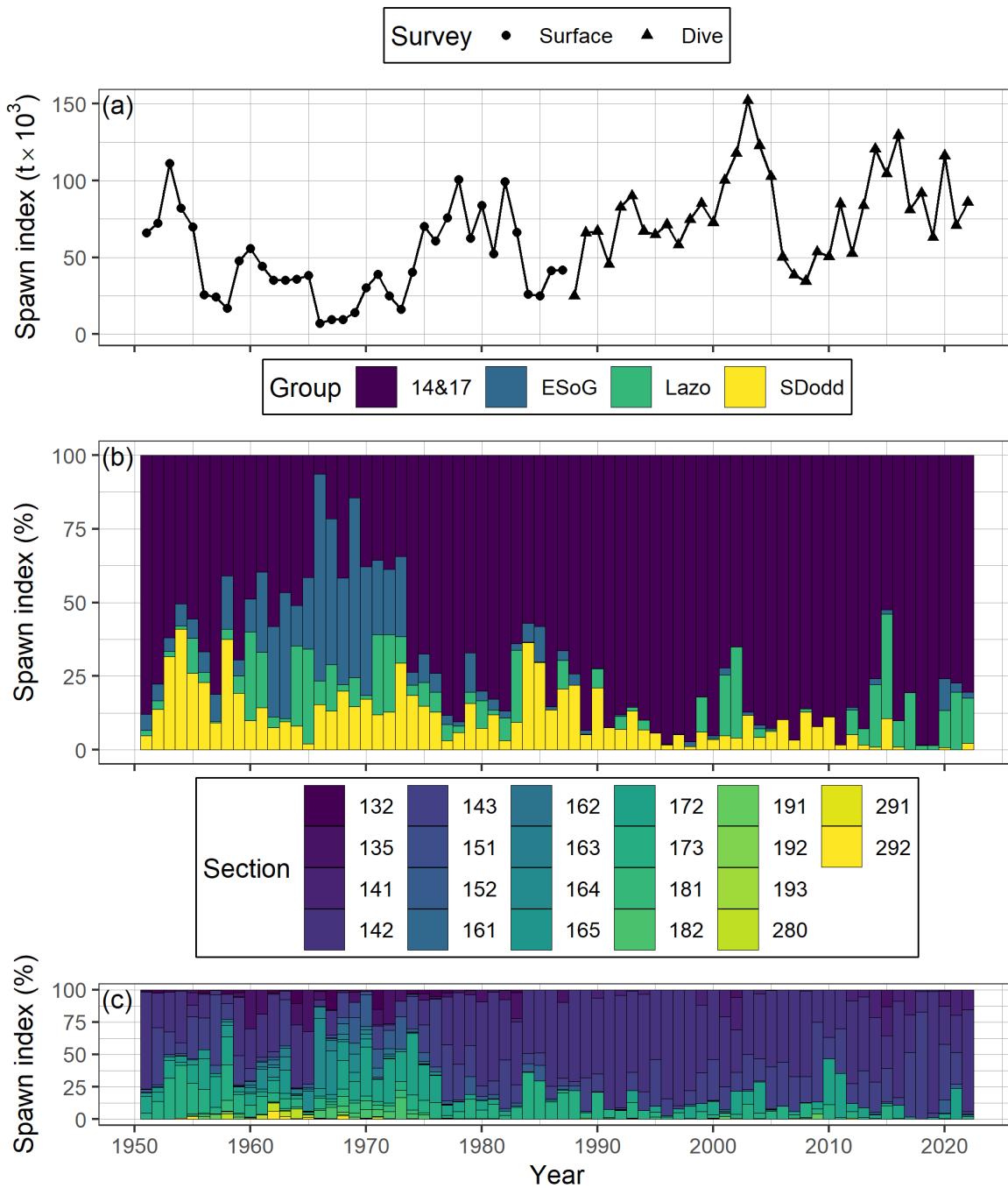


Figure 16. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR; panel a), as well as percent contributed by Group, and Section (b, & c, respectively). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2022). Note that spawn surveys in the dive survey period (1988 to 2022) are a combination of surface and dive surveys (Figures 13 and 14). The ‘spawn index’ is not scaled by the spawn survey scaling parameter, q . Legend: ‘14&17’ is Statistical Areas 14 and 17 (excluding Section 173); ‘ESoG’ is eastern Strait of Georgia; ‘Lazo’ is above Cape Lazo; and ‘SDodd’ is South of Dodd Narrows

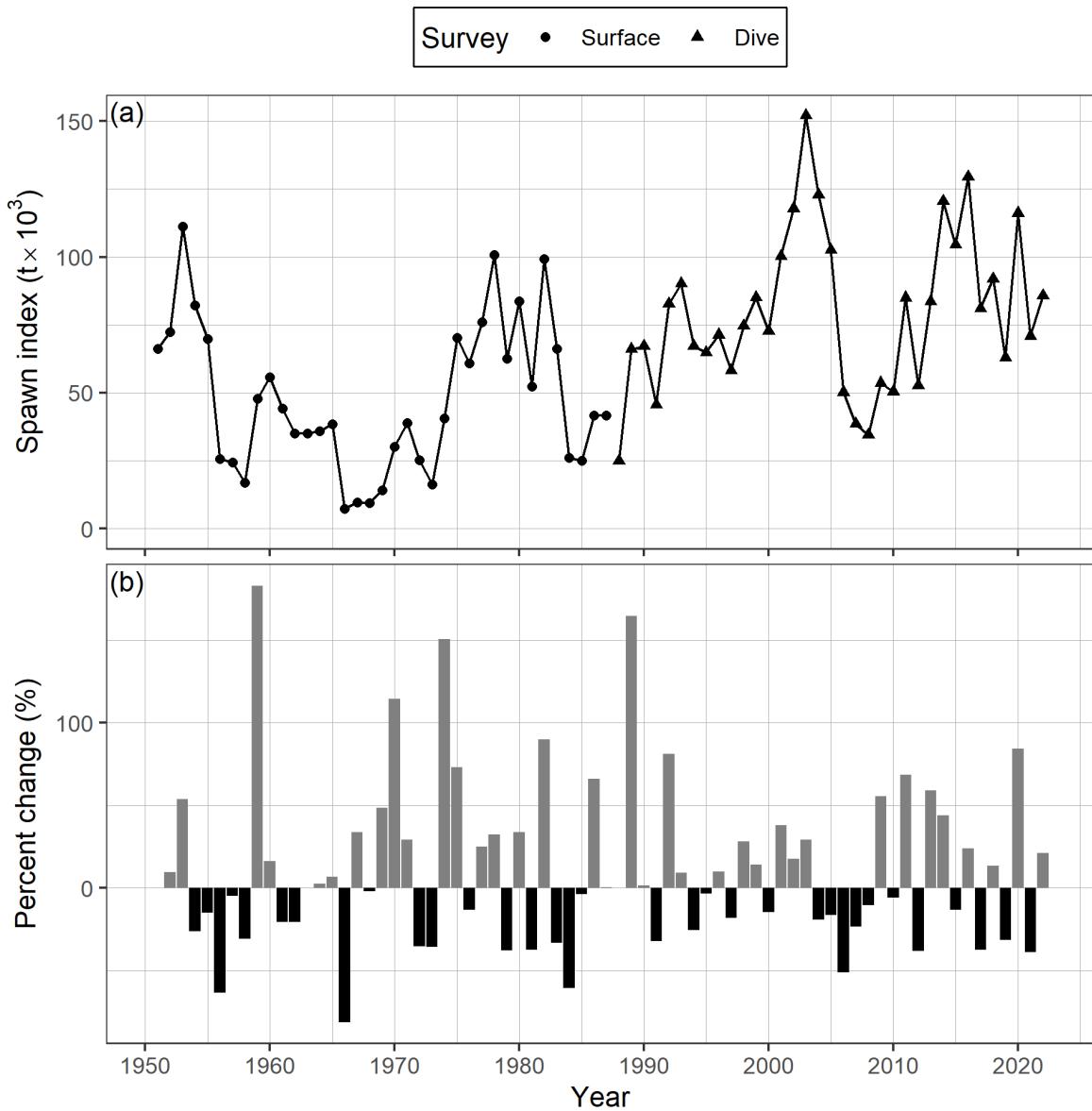


Figure 17. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR; panel a), and percent change (b). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where 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 2022). The ‘spawn index’ is not scaled by the spawn survey scaling parameter, q . Note that spawn surveys in the dive survey period (1988 to 2022) are a combination of surface and dive surveys (Figures 13 and 14).

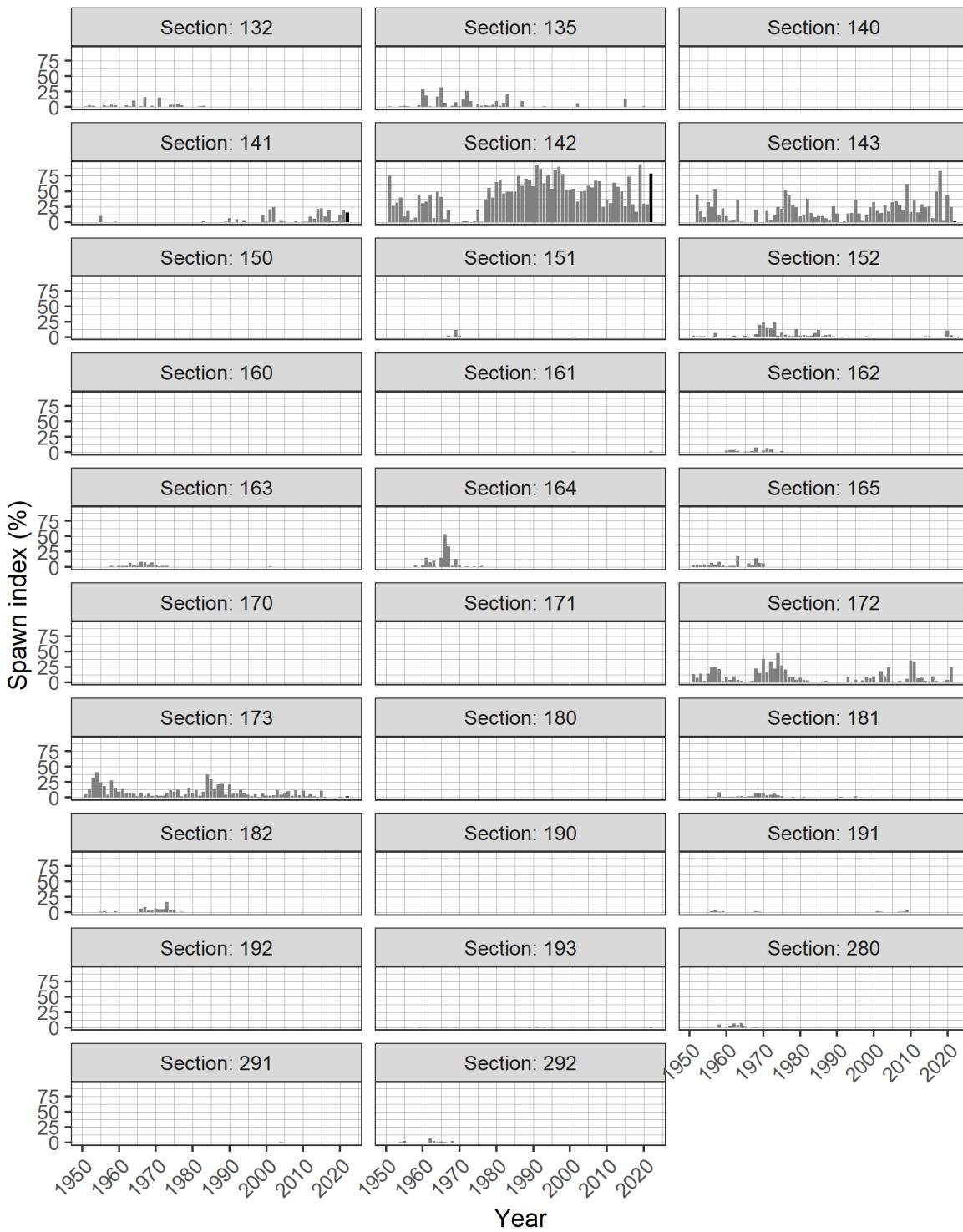


Figure 18. Time series of percent of spawn index by Section for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). The year 2022 has a darker bar to facilitate interpretation. The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2022). The ‘spawn index’ is not scaled by the spawn survey scaling parameter, q .

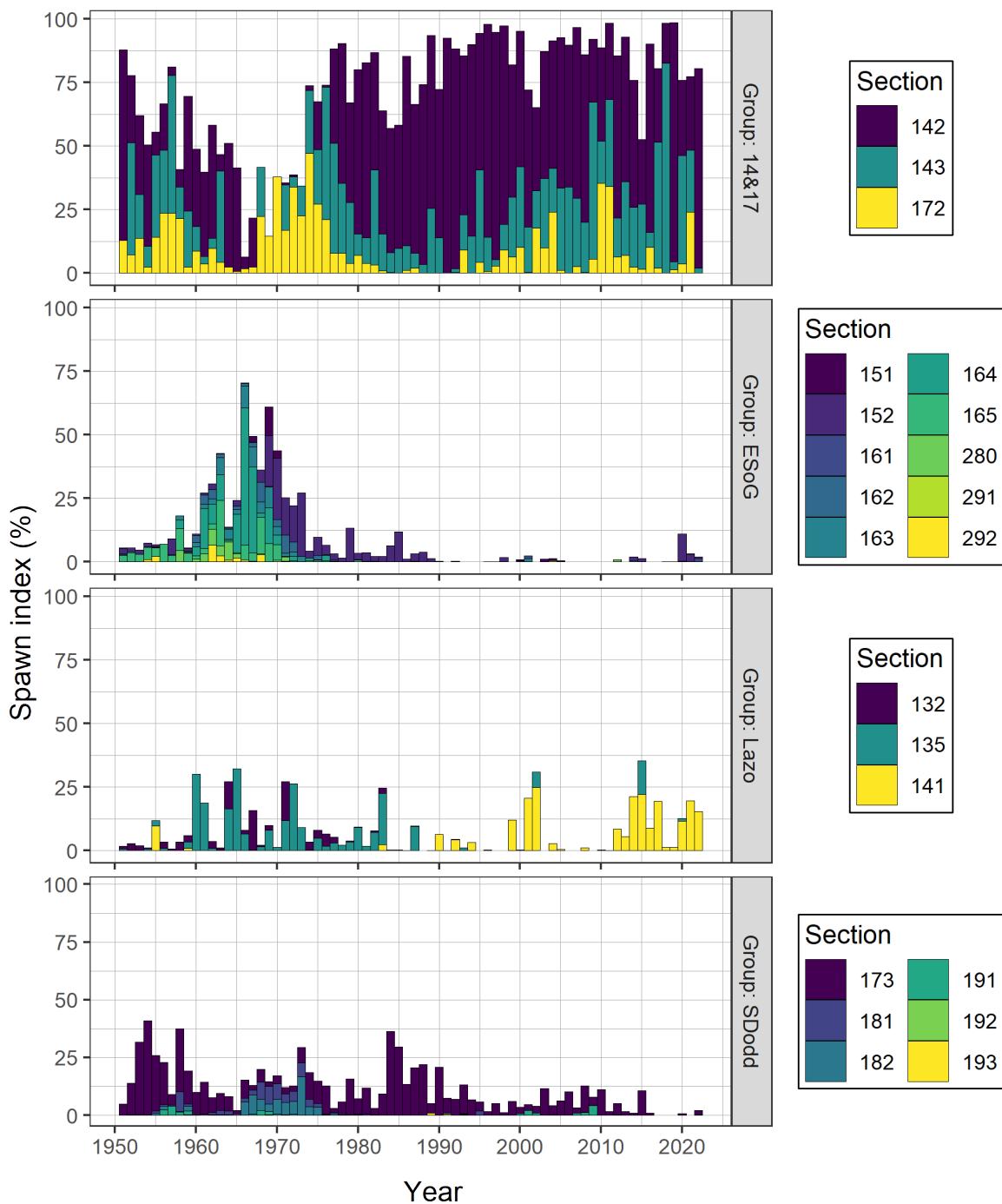


Figure 19. Time series of percent of spawn index by Group and Section for Pacific Herring from 1951 to 2022 in the Strait of Georgia major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2022). The ‘spawn index’ is not scaled by the spawn survey scaling parameter, q . Legend: ‘14&17’ is Statistical Areas 14 and 17 (excluding Section 173); ‘ESoG’ is eastern Strait of Georgia; ‘Lazo’ is above Cape Lazo; and ‘SDodd’ is South of Dodd Narrows

Figure 20. Animation of Pacific Herring spawn index in metric tonnes (t) by Location from 1951 to 2022 in the Strait of Georgia 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 2022). 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”.