Pacific Herring preliminary data summary for Central Coast 2024

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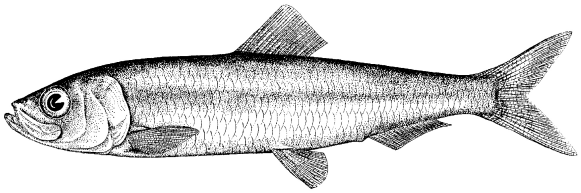

Pacific Herring (*Clupea pallasii*). Image credit: Fisheries and Oceans Canada.

Disclaimer This report contains preliminary data collected for Pacific Herring in 2024 in the Central Coast 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 Central Coast 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 Central Coast 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 2024 refers to the 2023/2024 Pacific Herring season.

2 Data collection programs

The data collection program in the Central Coast reflected a number of collaborations between DFO, the Heiltsuk Nation, and the Herring Industry. Biological samples were collected by the seine test charter vessel *Ocean Venture* for 20 days from March 17$^{\text{th}}$ to April 7$^{\text{th}}$. The primary purpose of the test charter vessel was to collect biological samples from main bodies of herring in Statistical Areas 06, 07, and 08, identified from soundings. Heiltsuk and Kitasoo Nations collected nearshore cast net herring samples again this season. Herring spawn locations were primarily identified with fixed-wing overflights. Six spawn flights were conducted this season from the end of March to mid-April. Additional spawn reconnaissance for Area 08 was conducted by the Wuikinuxv Fisheries Program.

Two dive charter vessels operated in the CC:

- The *Pachena No. 1* surveyed 21 days from April 4$^{\text{th}}$ to April 21$^{\text{st}}$, and
- The *Ocean Cloud* surveyed 12 days from April 4$^{\text{th}}$ to April 15$^{\text{th}}$.

2.1 Biological samples in Statistical Area 08

In the Central Coast major SAR, Pacific Herring in Statistical Area (SA) 08 tend to be smaller than fish in other areas. In addition, fewer biological samples are typically collected from SA 08 compared to the other areas. For example, between 1994 and 2013, on average $\sim 7\%$ of biological samples came from SA 08. In 2014 and 2015, additional resources were available to collect biological samples in SA 08, which consequently received more sampling effort than previous years, compared to the other areas. In order to avoid using non-representative biological data in the Central Coast stock assessment model, biological samples from SA 08 in 2014 and 2015 are weighted by the average historic proportion of samples in that area (i.e., $\sim 7\%$). Biological data presented in this report (e.g., proportion-at-age, weight-at-age) reflect these weights, and are considered to be representative of the Central Coast major SAR.

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 Central Coast 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, 18 Pacific Herring biological samples were collected and processed for the Central Coast 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 Central Coast 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). Some Statistical Areas tend to have larger fish at a given age (Figure 12, Table 16). 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 54 individual locations in 2024 in the Central Coast major SAR (Table 17, and Figure 13). A summary of spawn from the last

decade (2014 to 2023) is shown in Figure 14. Figure 15 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 16, Figure 17, Figure 18, Figure 19, Table 18, and Figure 20). See the spawn index technical report for calculations to convert SOK harvest to spawning biomass. In addition, spawn surveys estimate spawn depth by Statistical Area, and Section (Figure 21). 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 19b, Figure 22). For example, in 2024, Section 072 contributed the most to the spawn index (46%). As with Sections, some Statistical Areas contribute more than others to the total spawn index (Figure 19c, Figure 23). An animation shows the spawn index by spawn survey location from 1951 to 2024 (Figure 24).

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 Heiltsuk

This herring season spawning behavior was similar to last year, starting on March 28th and ending on April 11th. Observations of the younger age-3 class observed in the shallower water column, with roe build up taking longer than usual. Food fishers reported that herring roe build up was occurring in the evening, and that small herring were present throughout. The number of whales in the area decreased from previous years. The sea lion population was similar to previous years and dispersed to multiple areas, with observations of 20 or more sea lions in groups in the heavier spawning locations. Deeper spawn was observed in a few places and clear water spawn (i.e., spawn without milt) was reported as well.

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.

- Overall, the spawn duration was longer and more intense than in 2023.

- Fish began moving to shallower waters earlier in the season.
- The first spawn was reported on March 18th in Area 8.
- Generally, good weather conditions resulted in minimal interference with the assessment program

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 Central Coast major stock assessment region (SAR). Legend: '06&07' is Statistical Areas 06 and 07; and '08' is Statistical Area 08.

Region	Statistical Area	Section	Group
Central Coast	06	067	06&07
Central Coast	07	070	06&07
Central Coast	07	071	06&07
Central Coast	07	072	06&07
Central Coast	07	073	06&07
Central Coast	07	074	06&07
Central Coast	07	075	06&07
Central Coast	07	076	06&07
Central Coast	07	077	06&07
Central Coast	07	078	06&07
Central Coast	07	079	06&07
Central Coast	08	085	8
Central Coast	08	086	8

Table 3. Total landed commercial catch of Pacific Herring in metric tonnes (t) by gear type in 2024 in the Central Coast 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 Central Coast major stock assessment region (SAR). See the spawn index technical report for calculations to convert SOK harvest to spawning biomass. Harvest does not include the 2,411 lbs of spawn on egregia in 2018. Note: data may be withheld due to privacy concerns (WP).

Year	Harvest (lb)	Spawning biomass (t)
2014	239,861	355
2015	169,470	251
2016	351,953	521
2017	392,747	582
2018	289,358	429
2019	356,042	528
2020	44,857	66
2021	294,269	436
2022	0	0
2023	42,022	62
2024	30,712	46

Table 5. Number of Pacific Herring biological samples processed from 2014 to 2024 in the Central Coast 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	14	12	0	26
2015	6	14	0	20
2016	5	15	0	20
2017	4	13	27	44
2018	4	12	18	34
2019	2	10	28	40
2020	0	12	5	17
2021	2	13	14	29
2022	0	14	15	29
2023	2	11	5	18
2024	0	12	6	18

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

Type	Gear	Use	Number of samples
Test	Other	Nearshore	6
Test	Seine	Test fishery	12

Table 7. Observed number-at-age of Pacific Herring by sample type in 2024 in the Central Coast 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	4	29	146	14	17	11	17	2	NA
Seine test	22	194	608	91	91	35	50	11	6
Total	26	223	754	105	108	46	67	13	6

Table 8. Observed proportion-at-age of Pacific Herring by sample type in 2024 in the Central Coast 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	0.017	0.121	0.608	0.058	0.071	0.046	0.071	0.008	NA
Seine test	0.020	0.175	0.549	0.082	0.082	0.032	0.045	0.010	0.005
Total	0.019	0.165	0.559	0.078	0.080	0.034	0.050	0.010	0.004

Table 9. Observed mean weight-at-age in grams (g) of Pacific Herring by sample type in 2024 in the Central Coast 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	36	64	79	83	100	100	98	106	NA
Seine test	46	74	90	101	106	128	132	142	145
Total	45	73	88	99	105	122	123	136	145

Table 10. Observed mean length-at-age in millimetres (mm) of Pacific Herring by sample type in 2024 in the Central Coast 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	142	168	181	185	194	196	199	194	NA
Seine test	144	169	180	185	188	199	202	207	206
Total	144	169	180	185	189	199	201	205	206

Table 11. Observed number-at-age of Pacific Herring for nearshore samples from 2017 to 2024 in the Central Coast 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
2017	97	279	208	1111	174	454	85	74	18
2018	24	328	252	231	521	135	87	33	10
2019	15	1543	605	133	129	100	26	7	3
2020	31	10	301	66	29	23	4	4	1
2021	9	226	51	833	134	28	20	8	1
2022	51	177	308	43	527	68	19	6	3
2023	12	238	63	48	15	81	15	1	1
2024	4	29	146	14	17	11	17	2	0

Table 12. Observed proportion-at-age of Pacific Herring for nearshore samples from 2017 to 2024 in the Central Coast 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
2017	0.039	0.112	0.083	0.444	0.070	0.182	0.034	0.030	0.007
2018	0.015	0.202	0.155	0.143	0.321	0.083	0.054	0.020	0.006
2019	0.006	0.602	0.236	0.052	0.050	0.039	0.010	0.003	0.001
2020	0.066	0.021	0.642	0.141	0.062	0.049	0.009	0.009	0.002
2021	0.007	0.173	0.039	0.636	0.102	0.021	0.015	0.006	0.001
2022	0.042	0.147	0.256	0.036	0.438	0.057	0.016	0.005	0.002
2023	0.025	0.502	0.133	0.101	0.032	0.171	0.032	0.002	0.002
2024	0.017	0.121	0.608	0.058	0.071	0.046	0.071	0.008	0.000

Table 13. Observed mean weight-at-age in grams (g) of Pacific Herring for nearshore samples from 2017 to 2024 in the Central Coast 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
2017	49	69	83	93	98	115	116	120	128
2018	48	68	78	94	96	104	107	107	109
2019	52	61	67	84	97	103	102	119	114
2020	34	59	73	78	89	88	102	89	93
2021	38	58	74	82	91	94	103	120	104
2022	46	60	72	92	94	103	108	121	108
2023	43	64	74	85	99	104	109	111	107
2024	36	64	79	83	100	100	98	106	NA

Table 14. Observed mean length-at-age in millimetres (mm) of Pacific Herring for nearshore samples from 2017 to 2024 in the Central Coast 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
2017	158	175	187	193	198	207	208	209	213
2018	154	172	178	191	193	199	201	204	200
2019	153	162	167	180	190	195	196	200	206
2020	136	162	173	178	186	184	193	187	194
2021	141	161	175	180	185	192	196	200	195
2022	150	164	176	190	193	198	201	210	203
2023	145	162	170	178	186	190	191	201	194
2024	142	168	181	185	194	196	199	194	NA

Table 15. Observed proportion-at-age for Pacific Herring from 2014 to 2024 in the Central Coast 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	0.095	0.146	0.467	0.089	0.141	0.028	0.029	0.004	0.000
2015	0.008	0.454	0.156	0.249	0.055	0.064	0.009	0.004	0.001
2016	0.040	0.091	0.549	0.094	0.146	0.028	0.039	0.011	0.003
2017	0.029	0.170	0.132	0.446	0.089	0.092	0.024	0.012	0.007
2018	0.090	0.168	0.174	0.147	0.295	0.066	0.041	0.014	0.005
2019	0.012	0.616	0.178	0.053	0.053	0.059	0.024	0.002	0.002
2020	0.028	0.028	0.739	0.101	0.045	0.029	0.021	0.007	0.002
2021	0.012	0.295	0.031	0.521	0.085	0.033	0.015	0.007	0.001
2022	0.105	0.163	0.376	0.045	0.243	0.047	0.013	0.006	0.002
2023	0.030	0.614	0.118	0.104	0.027	0.089	0.014	0.003	0.000
2024	0.020	0.175	0.549	0.082	0.082	0.032	0.045	0.010	0.005

Table 16. Sample size for Pacific Herring weight-at-age analysis in 2024 in the Central Coast major stock assessment region (SAR) by Group from the most recent decade (2015 to 2024), and the previous decade (2005 to 2014), as displayed in Figure 12. 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. Legend: '06&07' is Statistical Areas 06 and 07; and '08' is Statistical Area 08.

		Sample size	
Group	Age	Previous decade	Recent decade
06&07	2	744	408
06&07	3	7,887	2,737
06&07	4	8,539	3,358
06&07	5	5,072	2,315
06&07	6	2,725	1,346
06&07	7	841	626
06&07	8	362	290
06&07	9	152	91
06&07	10	71	34
8	2	275	80
8	3	972	783
8	4	945	558
8	5	262	238
8	6	178	146
8	7	51	65
8	8	16	26
8	9	4	10
8	10	3	3

Table 17. Pacific Herring spawn survey locations, start date, and spawn index in metric tonnes (t) in 2024 in the Central Coast 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)
06	067	Abrams Is	March 23	1,328
06	067	Kwakwa Cr	March 24	748
06	067	Marvin Is	March 24	1,716
06	067	Meyers Nrws	April 03	57
06	067	Osment Inlt	March 24	1,363
06	067	Parsons Anch	March 24	1,315
06	067	Wilby Pt	March 23	870
07	072	Balagny Pass	March 23	524
07	072	Berry Inlt	March 27	321
07	072	Bird Pt	March 27	122
07	072	Blair Inlt	March 23	84
07	072	Boat Inlt	March 23	45
07	072	Branks It	March 27	22
07	072	Bullen Rk	March 24	73
07	072	Bush Pt	March 23	151
07	072	Cameron Pt	March 23	96
07	072	Cecilia Is	March 27	348
07	072	Don Lgn	March 25	247
07	072	Fisher Pt	March 27	153
07	072	Foote Islets	March 23	185
07	072	Ivory Is	March 27	1,303
07	072	King Cv	March 24	390
07	072	Lambard Inlt	March 23	130
07	072	Leighton Is	March 24	55
07	072	Mosquito Bay	March 24	1,947
07	072	Mouat Cv	March 27	209
07	072	Oliver Cv	March 23	391
07	072	Port Blackney	March 23	339
07	072	Powell Anch	March 23	550
07	072	Rankin Pt	March 23	29
07	072	Reid Pass	March 23	514
07	072	Shingle Rk	March 29	265
07	072	Spiller Chnl	March 29	2,687
07	072	Tankeeah River	March 29	347
07	072	Watch Is	March 27	791
07	074	Cree Pt	March 30	239
07	074	Dundivan Inlt	March 23	15
07	074	Idol Pt	March 23	520

Table 17 continued

Statistical Area	Section	Location name	Start date	Spawn index (t)
07	074	Little Thompson Bay	March 28	226
07	074	Potts Is	March 30	1,067
07	074	Princess Alice Is	April 09	27
07	074	Quinoot Pt	March 26	251
07	074	Waskesiu Pass	March 28	21
07	076	Goodlad Bay	March 30	53
07	077	E Higgins Pass	March 28	653
07	078	Culpepper Lgn	April 13	2
07	078	Kynoch Inlt	April 13	58
07	078	Mathieson Chnl	April 13	4
07	078	Neekas Inlt	March 23	213
07	078	Spiller Inlt	March 30	0
08	086	Hergest Pt	March 24	587
08	086	Mustang Bay	March 27	2,457
08	086	Nalau Psg	March 27	172
08	086	Target Bay	March 27	495

Table 18. Summary of Pacific Herring spawn survey data from 2014 to 2024 in the Central Coast 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	160,450	37	0.7	13,308
2015	167,060	39	1.3	32,145
2016	164,575	40	1.6	32,507
2017	125,525	39	1.5	23,517
2018	98,149	25	1.1	12,263
2019	181,750	37	1.8	46,254
2020	160,625	39	2.0	42,713
2021	128,625	41	1.5	28,674
2022	153,675	42	1.3	22,711
2023	117,250	45	1.4	17,550
2024	137,400	40	1.4	26,802

8 Figures

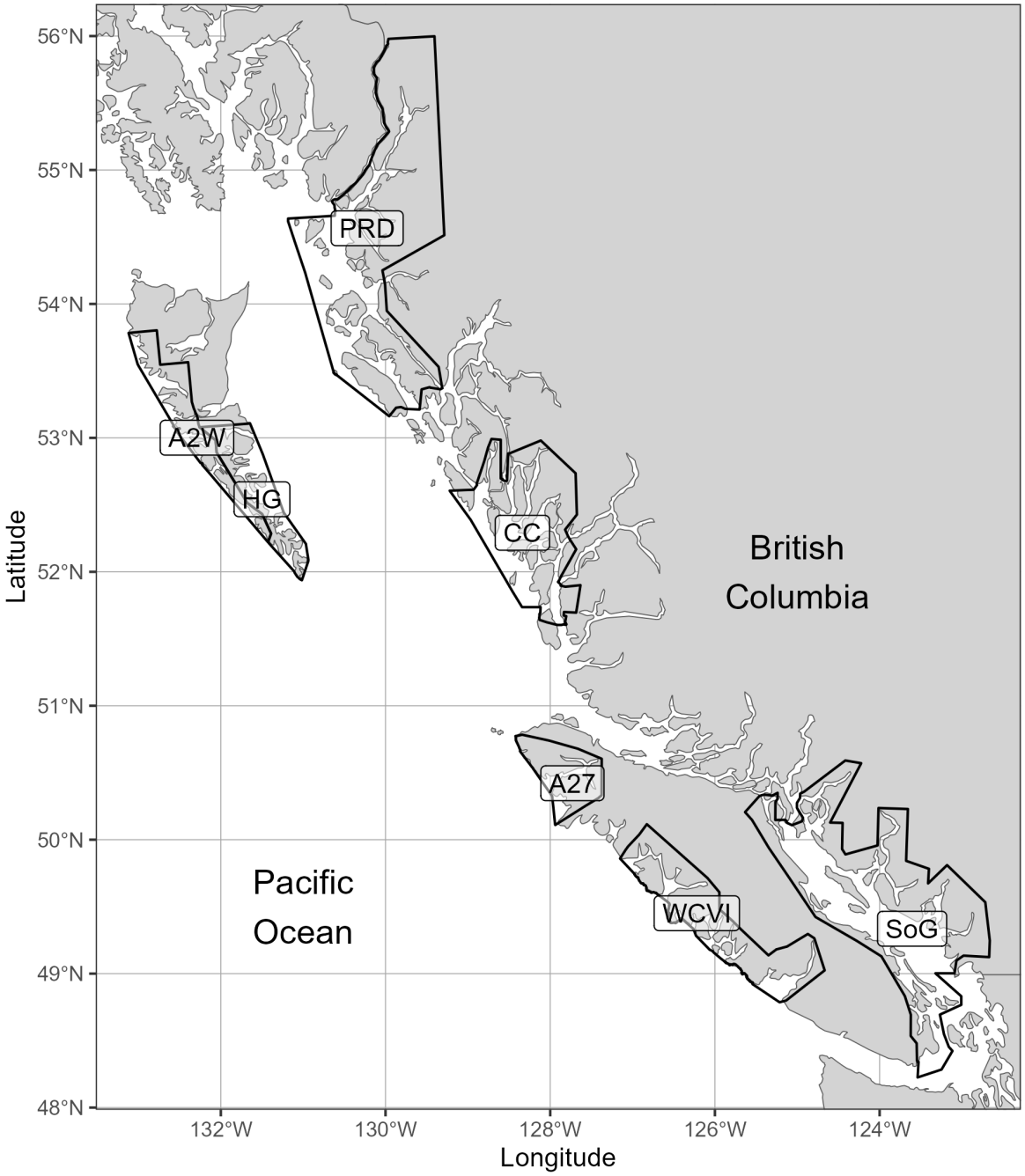

Figure 1. Boundaries for the Pacific Herring stock assessment regions (SARs) in British Columbia. There are 5 major SARs: Haida Gwaii (HG), Prince Rupert District (PRD), Central Coast (CC), Strait of Georgia (SoG), and West Coast of Vancouver Island (WCVI). There are 2 minor SARs: Area 27 (A27) and Area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

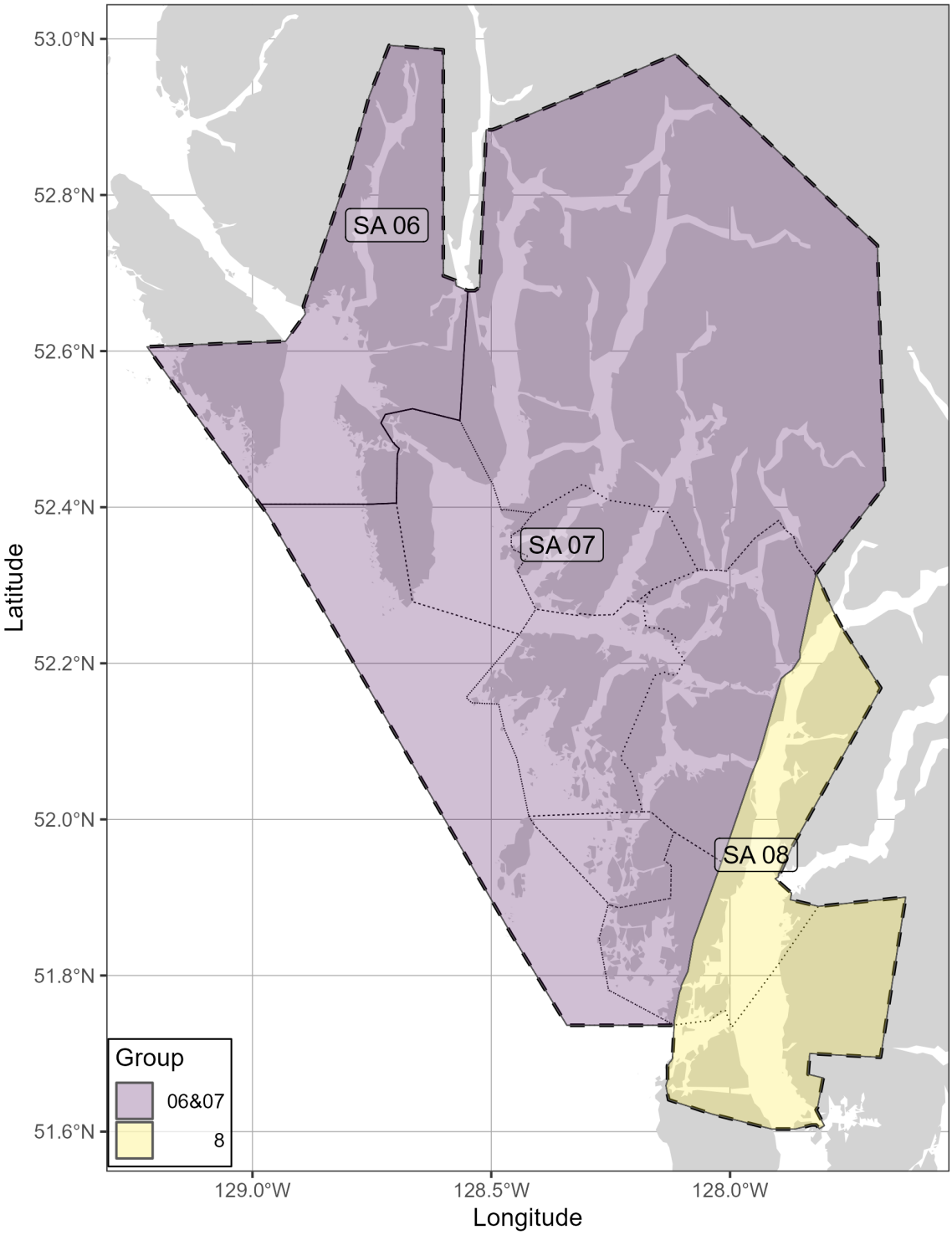

Figure 2. Boundaries for the Central Coast major stock assessment region (SAR; thick dashed lines), associated Statistical Areas (SA; thin solid lines), and associated Sections (thin dotted lines). Units: kilometres (km). Legend: '06&07' is Statistical Areas 06 and 07; and '08' is Statistical Area 08.

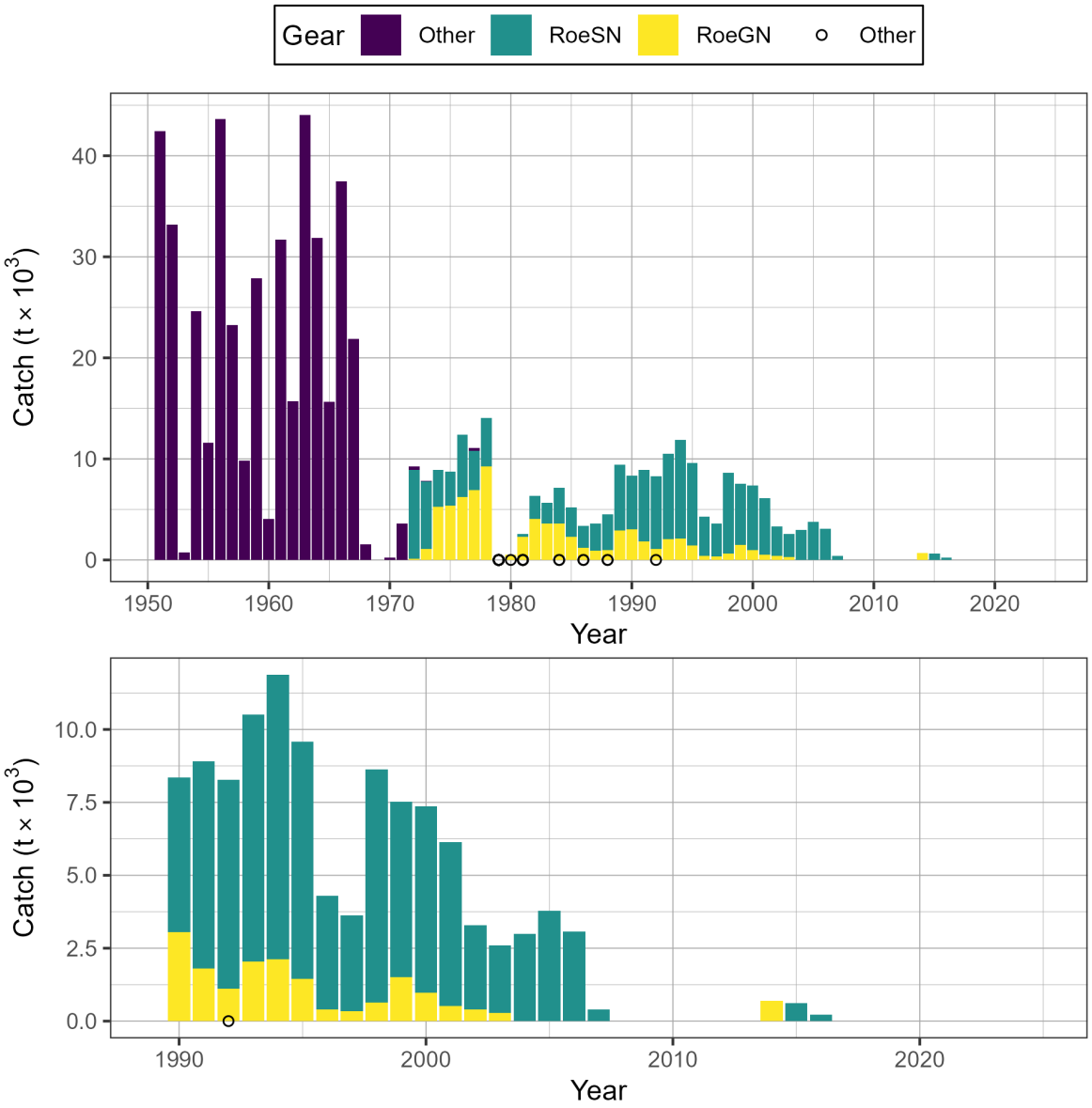

Figure 3. Time series of total landed catch in thousands of metric tonnes (t × 10^3) of Pacific Herring by gear type from 1951 to 2024 in the Central Coast major stock assessment region (SAR). Legend: 'Other' represents the reduction (1951 to 1970 only), the food and bait, as well as the special use 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.

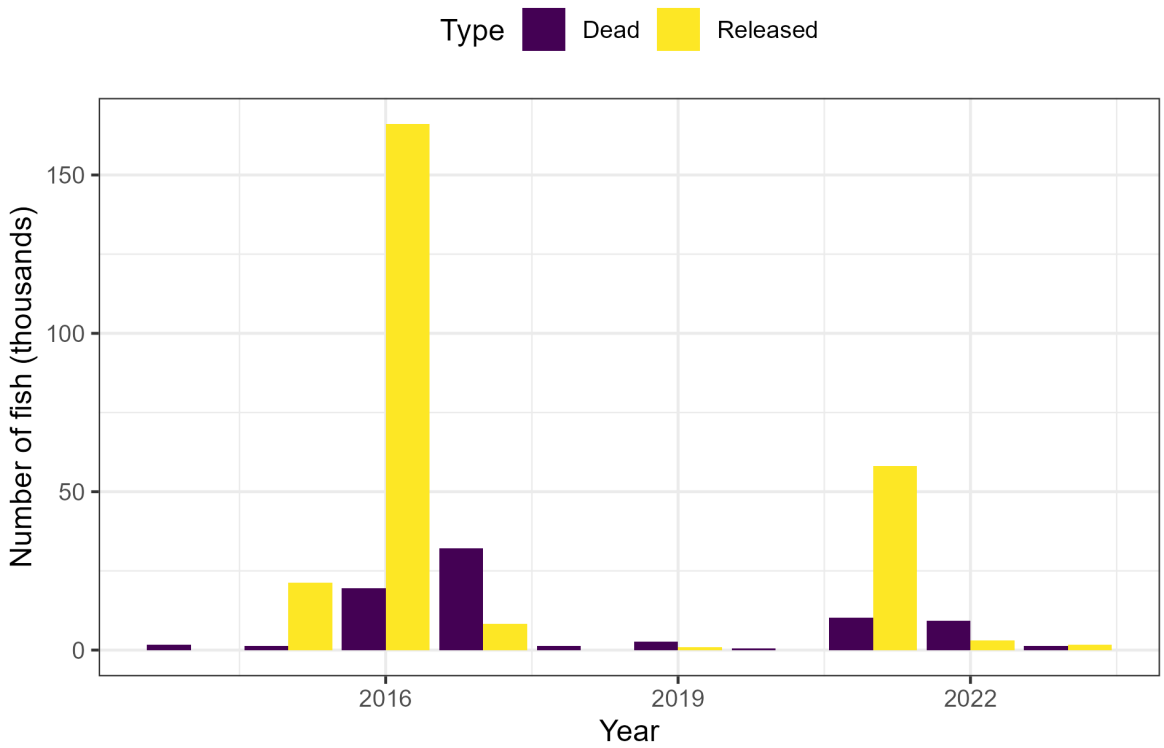

Figure 4. Incidental Pacific Herring mortality in aquaculture activities in thousands of fish from 2014 to 2024 in the Central Coast major stock assessment region (SAR). Note: figure may include data outside SAR boundaries.

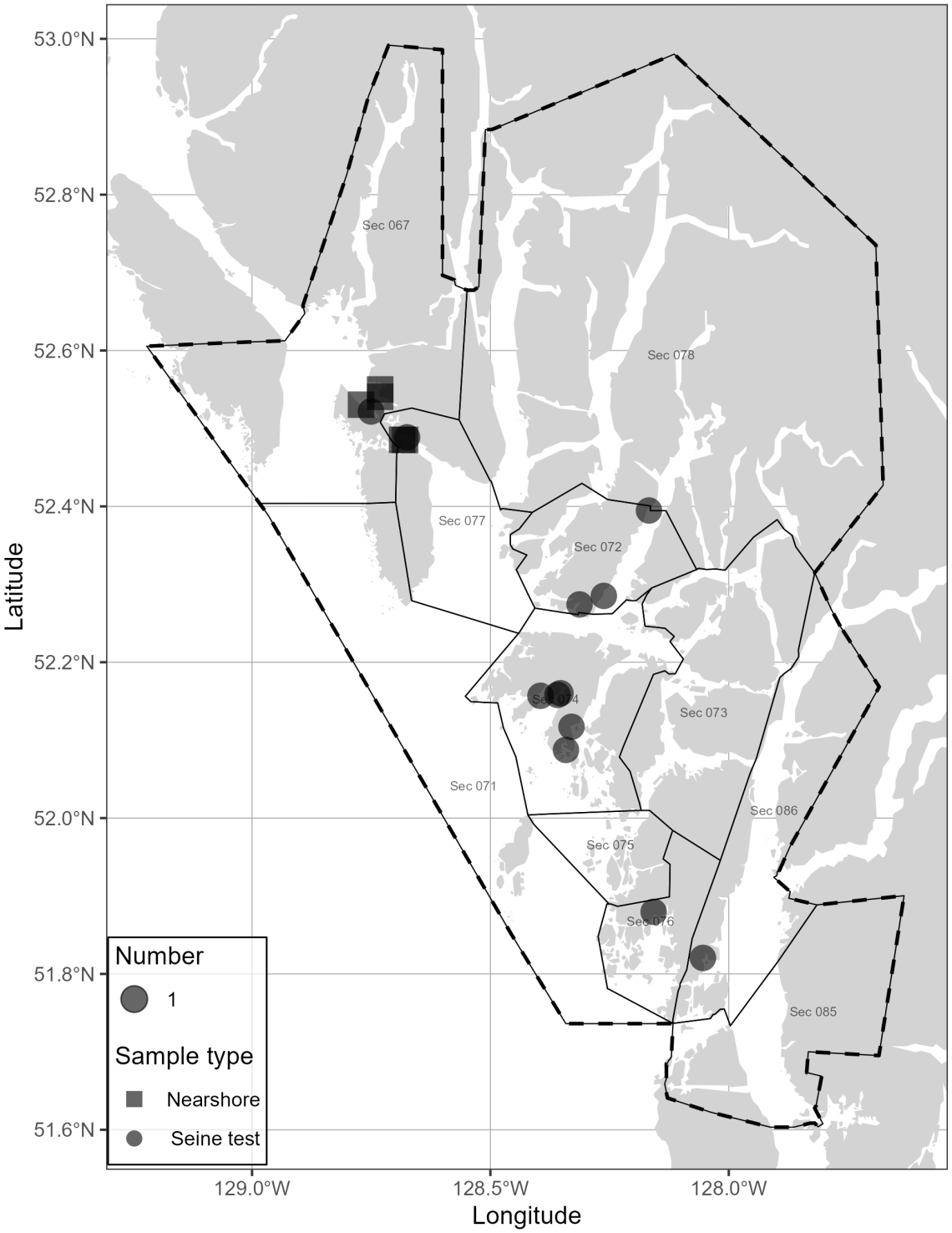

Figure 5. Location and type of Pacific Herring biological samples collected in 2024 in the Central Coast major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). Units: kilometres (km).

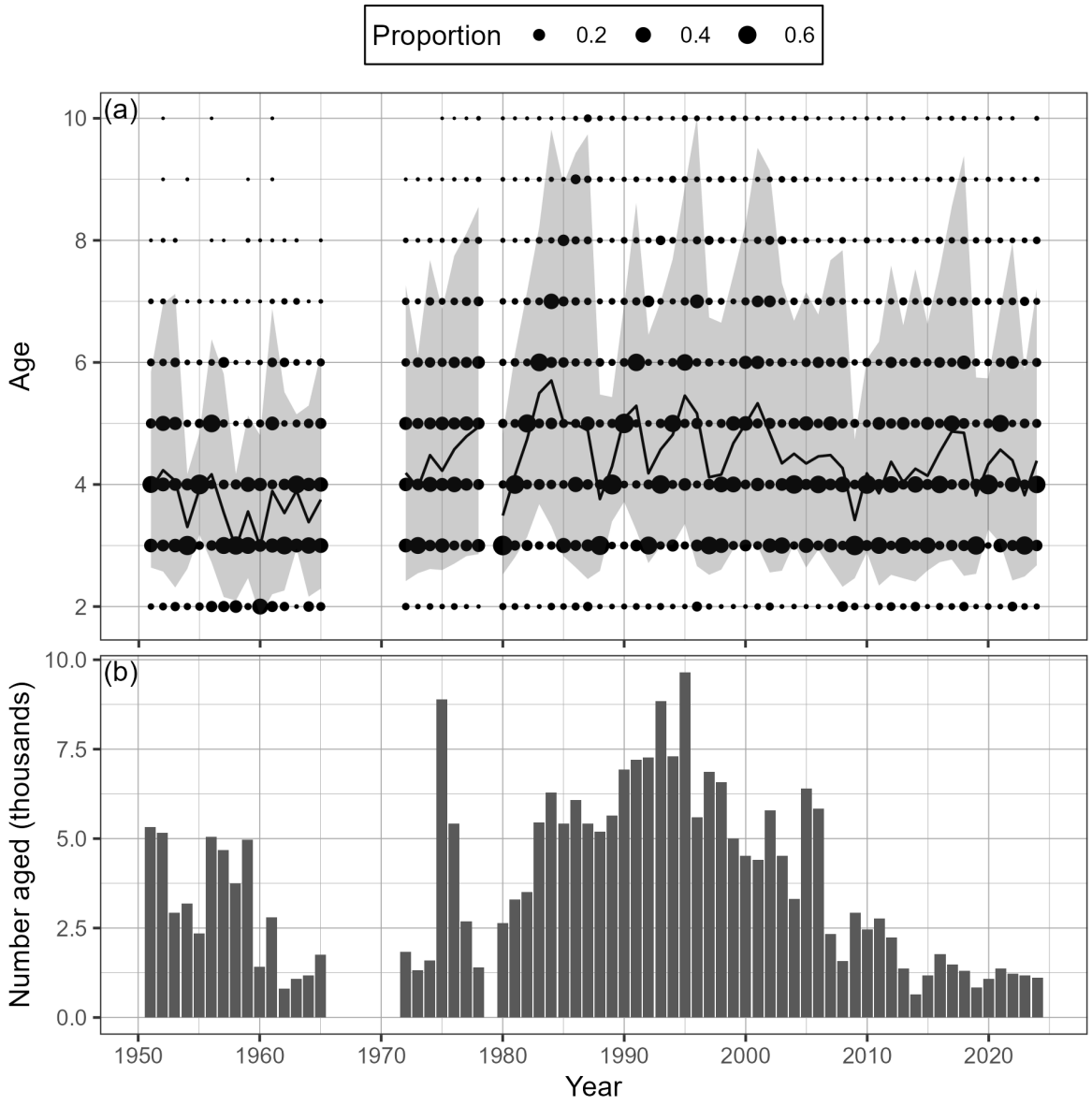

Figure 6. Time series of observed proportion-at-age (a) and number aged in thousands (b) of Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). The black line is the mean age, and the shaded area is the approximate 90% distribution. Biological summaries only include 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.

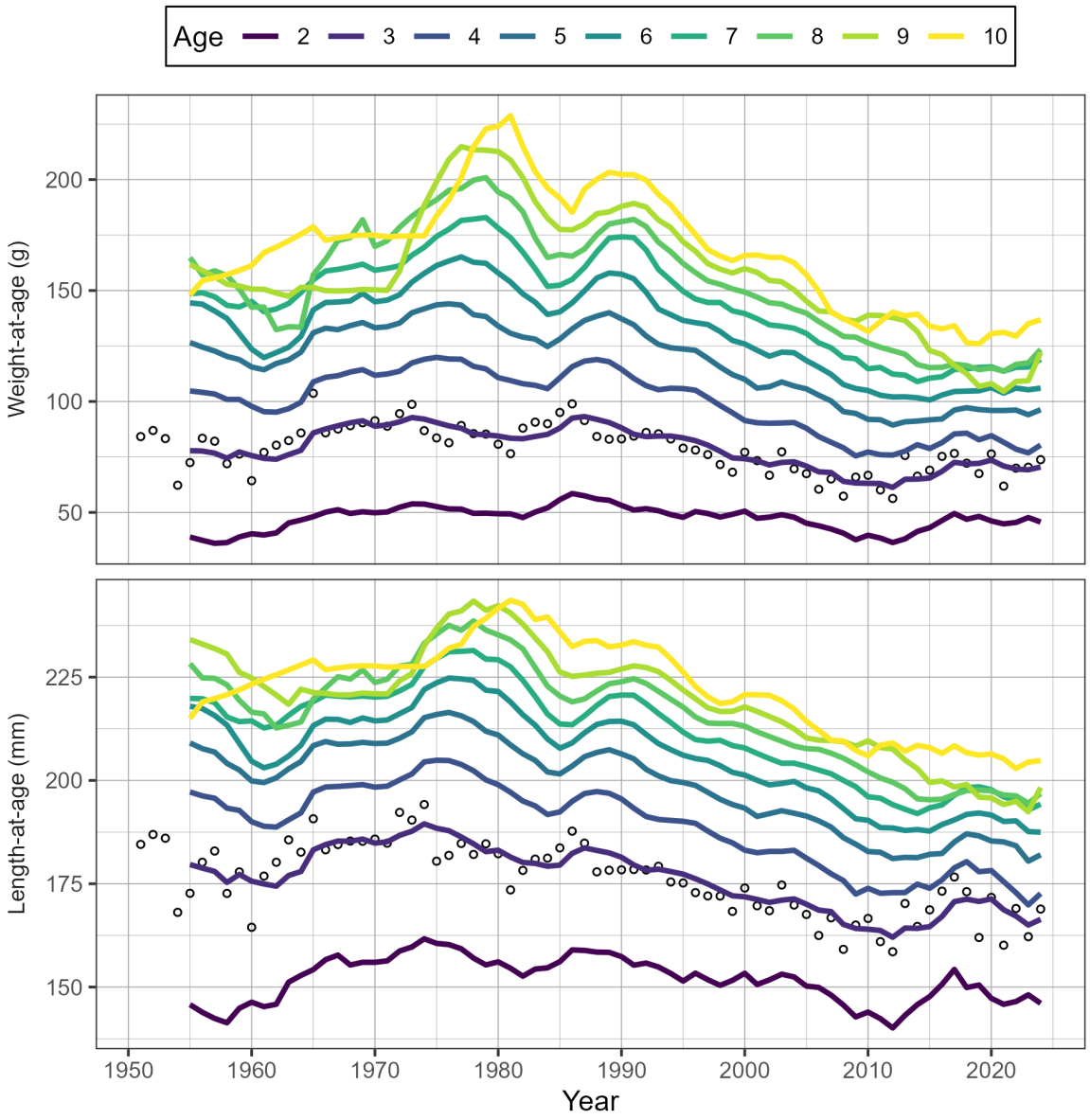

Figure 7. Time series of weight-at-age in grams (g) and length-at-age in milimetres (mm) for age-3 (circles) and 5-year running mean weight- and length-at-age (lines) for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). Missing weight- and length-at-age values (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.

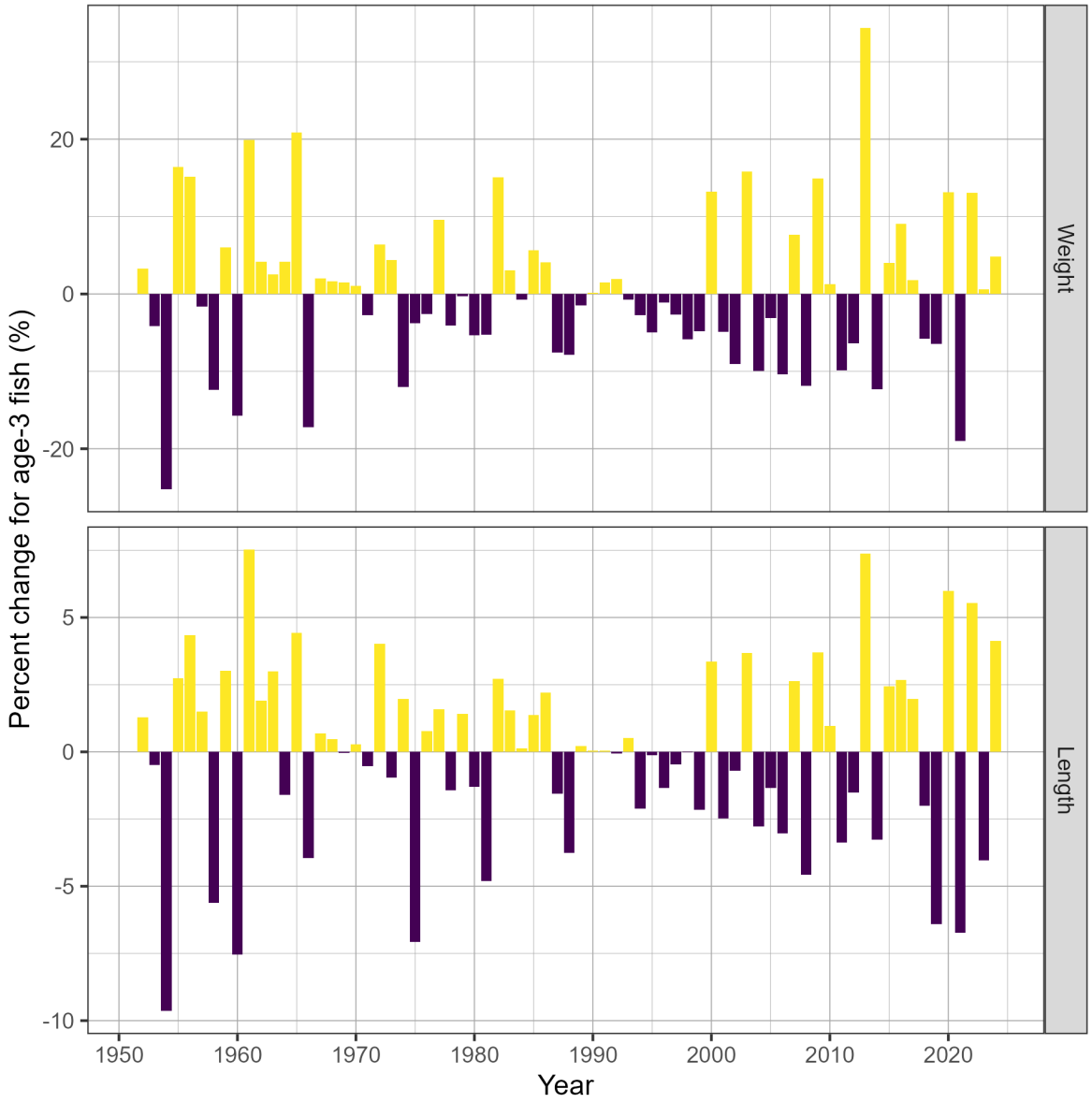

Figure 8. Time series of percent change (%) in weight and length for age-3 fish for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the weight and length of age-3 fish, 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.

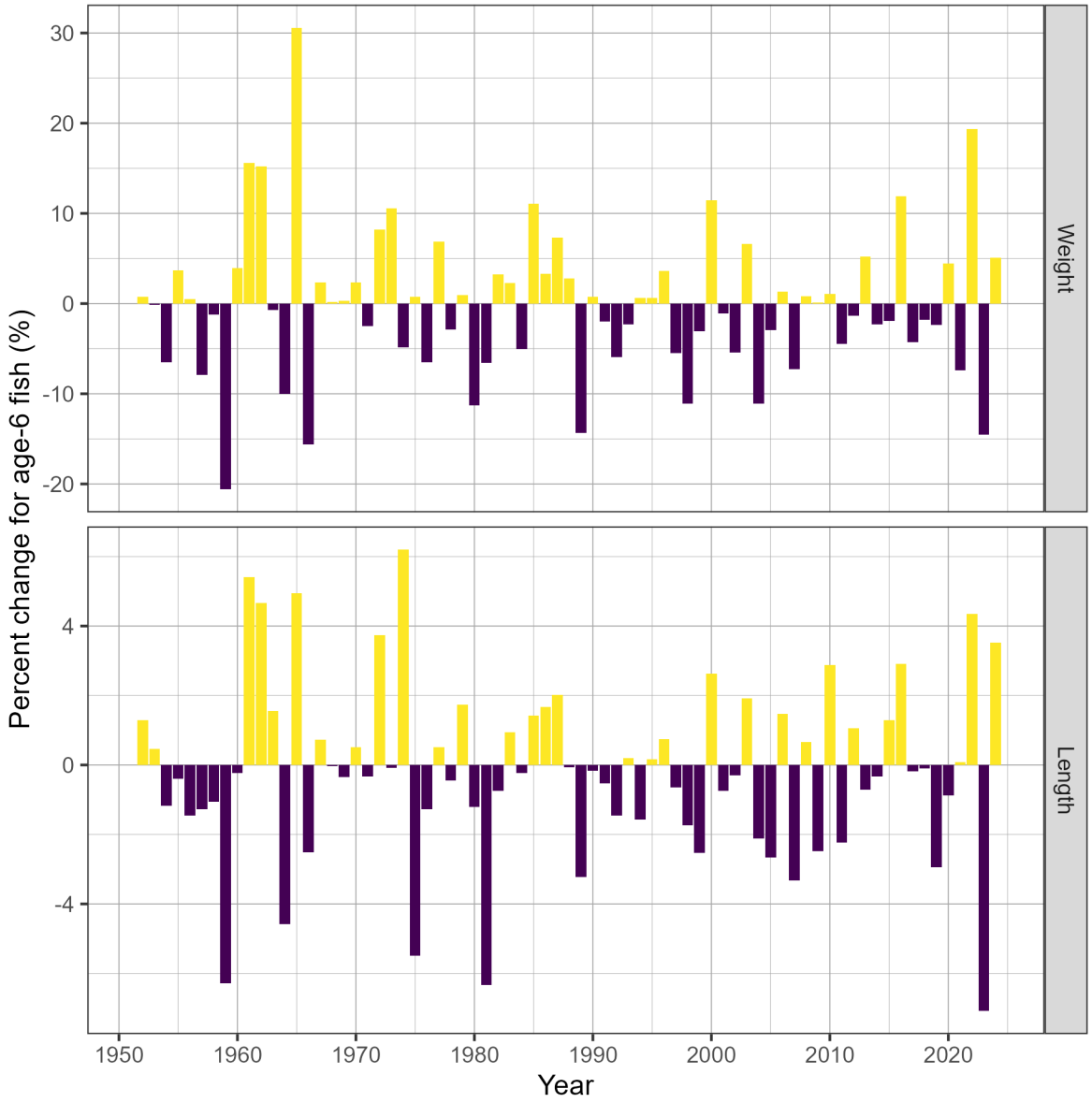

Figure 9. Time series of percent change (%) in weight and length for age-6 fish for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t is the weight and length of age-6 fish, 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.

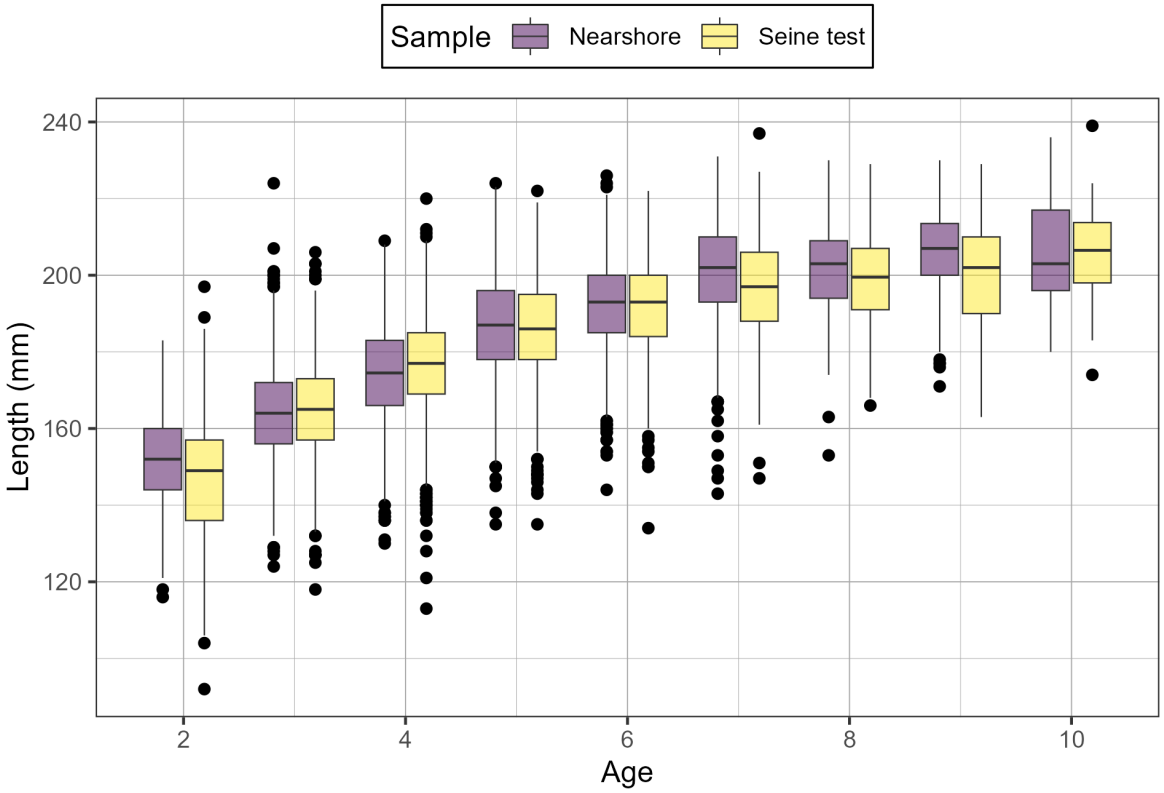

Figure 10. Length-at-age in millimetres (mm) of Pacific Herring from 2017 to 2024 in the Central Coast major stock assessment region (SAR) by sample type. The outer edges of the boxes indicate the 25th and 75th percentiles, and the middle lines indicate the 50th percentiles (i.e., medians). The whiskers extend to 1.5 × 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.

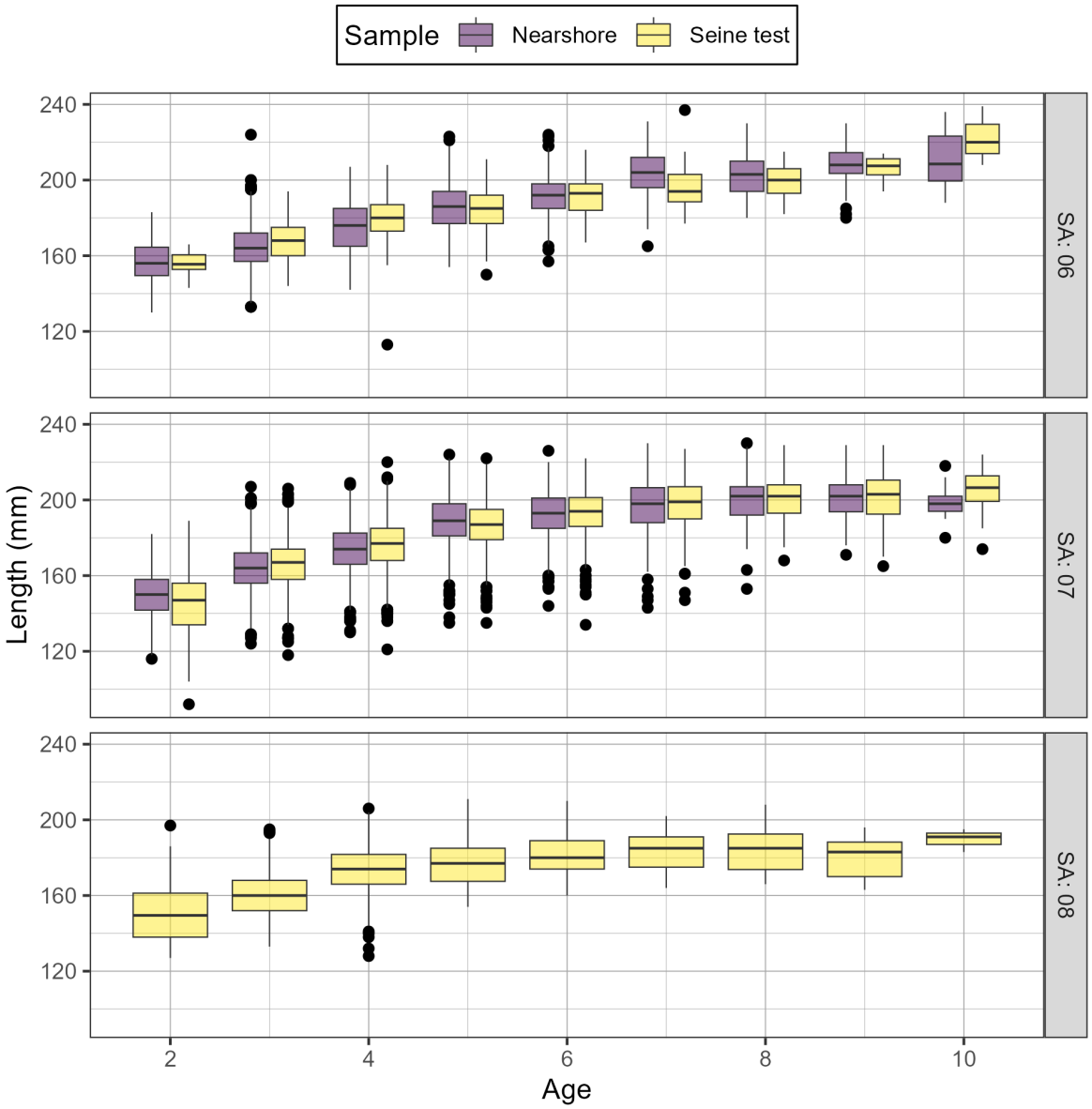

Figure 11. Length-at-age in millimetres (mm) of Pacific Herring from 2017 to 2024 in the Central Coast major stock assessment region (SAR) by sample type and statistical area (SA). The outer edges of the boxes indicate the 25th and 75th percentiles, and the middle lines indicate the 50th percentiles (i.e., medians). The whiskers extend to 1.5 × 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.

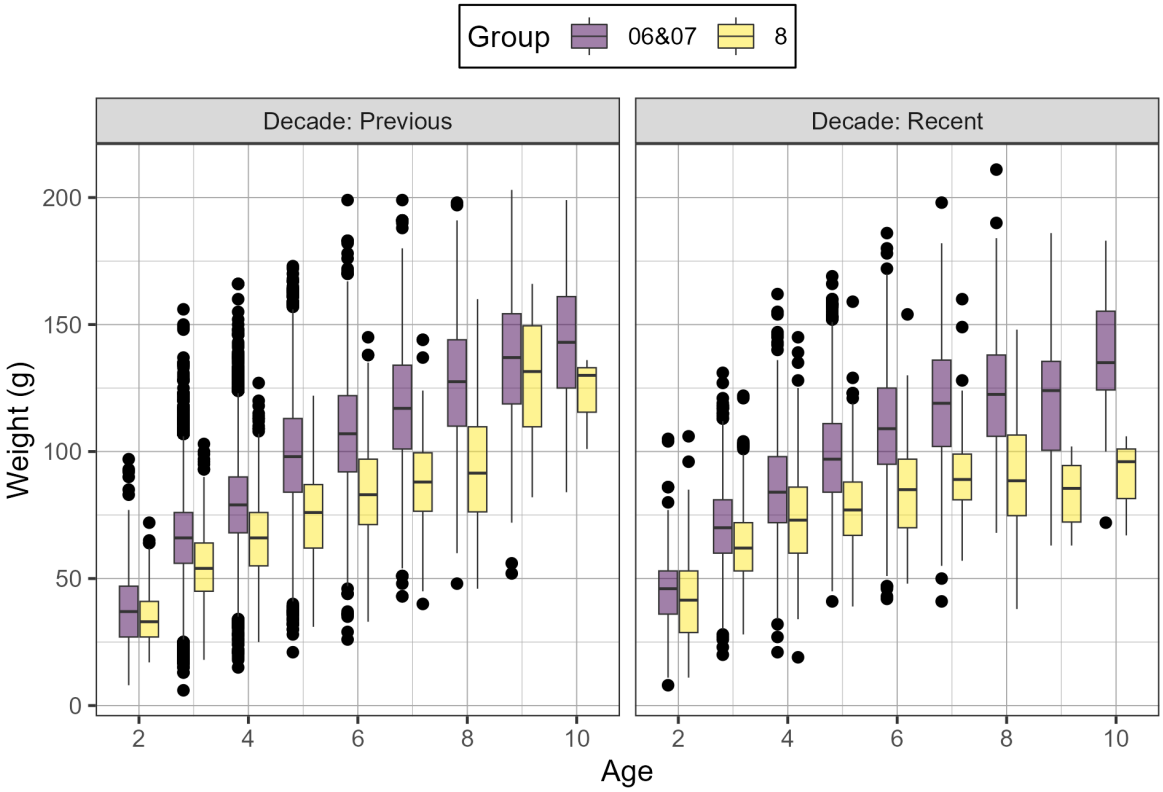

Figure 12. Weight-at-age in grams (g) of Pacific Herring in the Central Coast major stock assessment region (SAR) by Group from the most recent decade (2015 to 2024), and the previous decade (2005 to 2014). The outer edges of the boxes indicate the 25th and 75th percentiles, and the middle lines indicate the 50th percentiles (i.e., medians). The whiskers extend to 1.5 × IQR, where IQR is the distance between the 25th and 75th percentiles, and dots indicate outliers. Sample sizes are given in Table 16. 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. Legend: '06&07' is Statistical Areas 06 and 07; and '08' is Statistical Area 08.

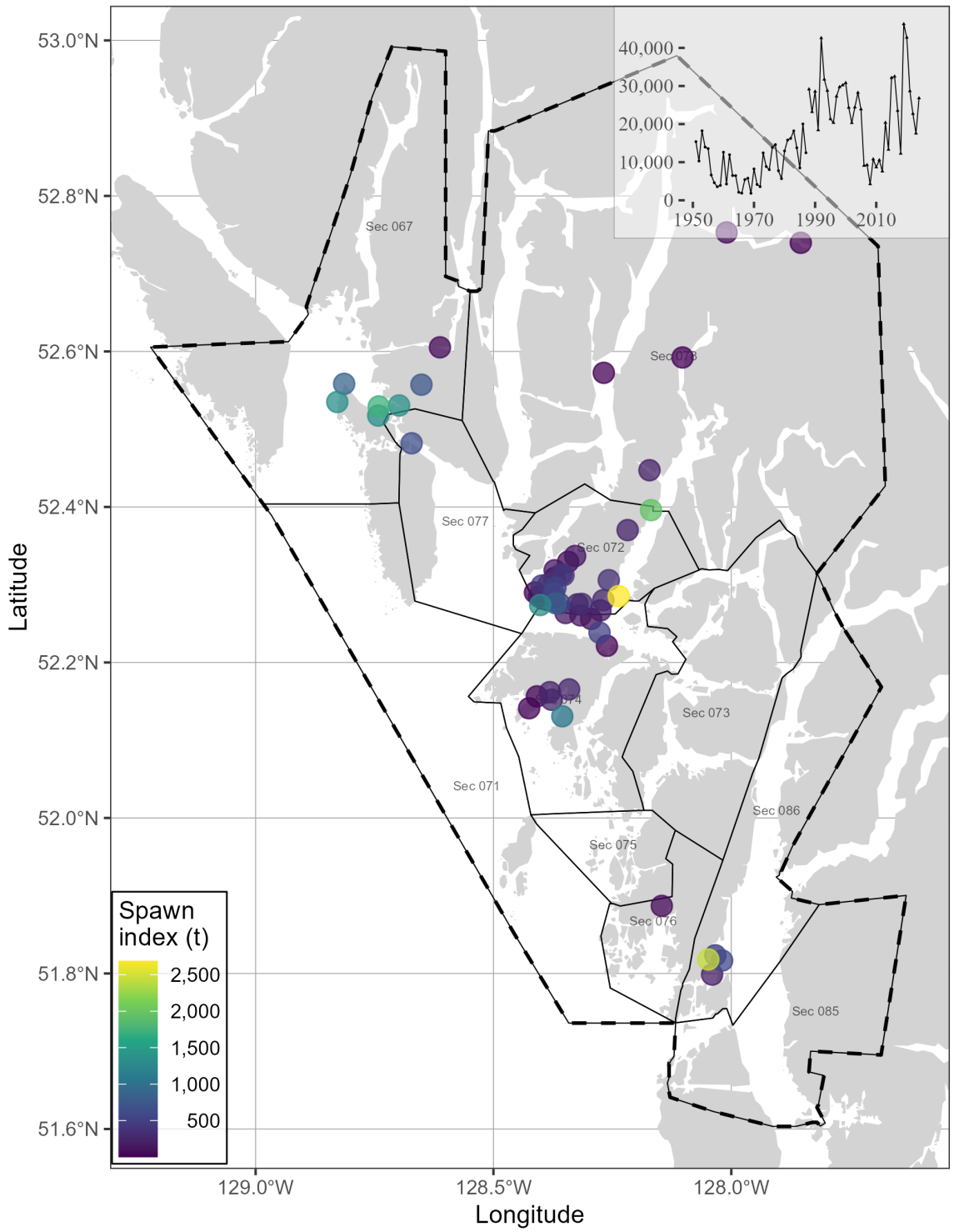

Figure 13. Pacific Herring spawn survey locations, and spawn index in metric tonnes (t) in 2024 in the Central Coast major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Missing spawn index values indicate incomplete surveys (grey circles). Inset tracks the total spawn index. Units: kilometres (km).

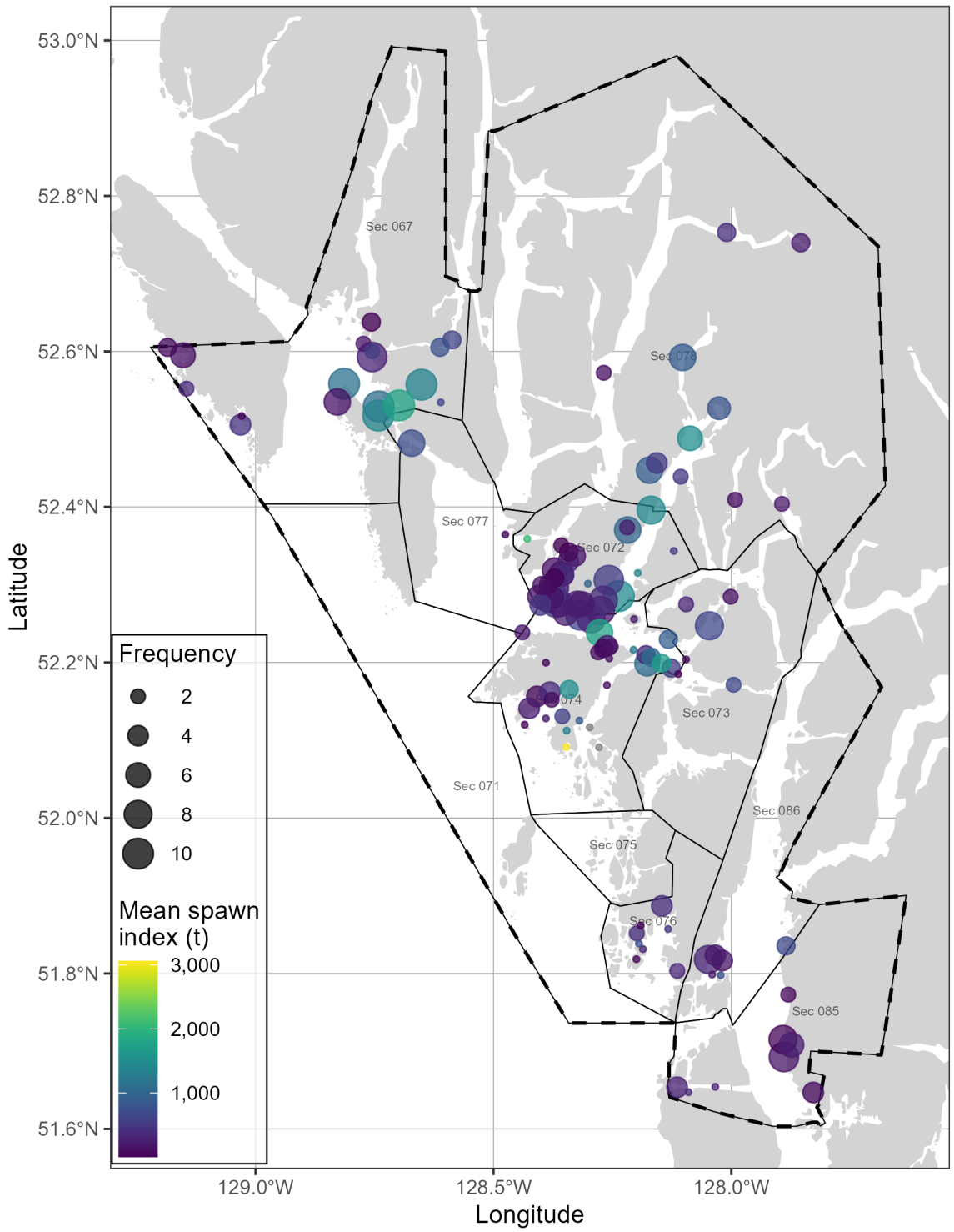

Figure 14. Pacific Herring spawn survey locations, mean spawn index in metric tonnes (t), and spawn frequency from 2014 to 2023 in the Central Coast major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Missing spawn index values indicate incomplete surveys (grey circles). Units: kilometres (km).

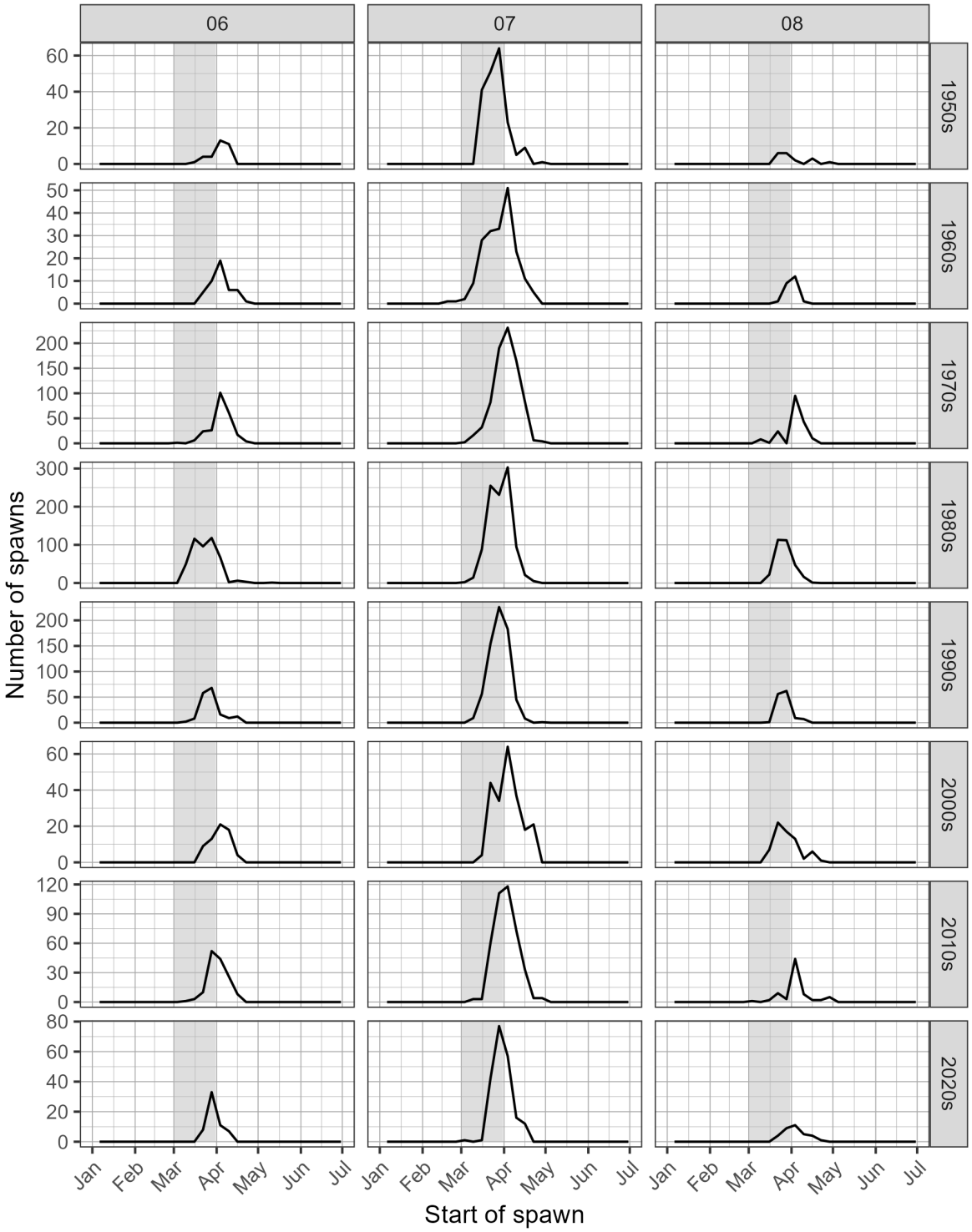

Figure 15. Pacific Herring spawn start date by decade and Statistical Area. Grey shaded regions indicate March 1st to 31st. Note that spawn size and intensity varies; therefore the number of spawns is not directly proportional to spawn extent or biomass.

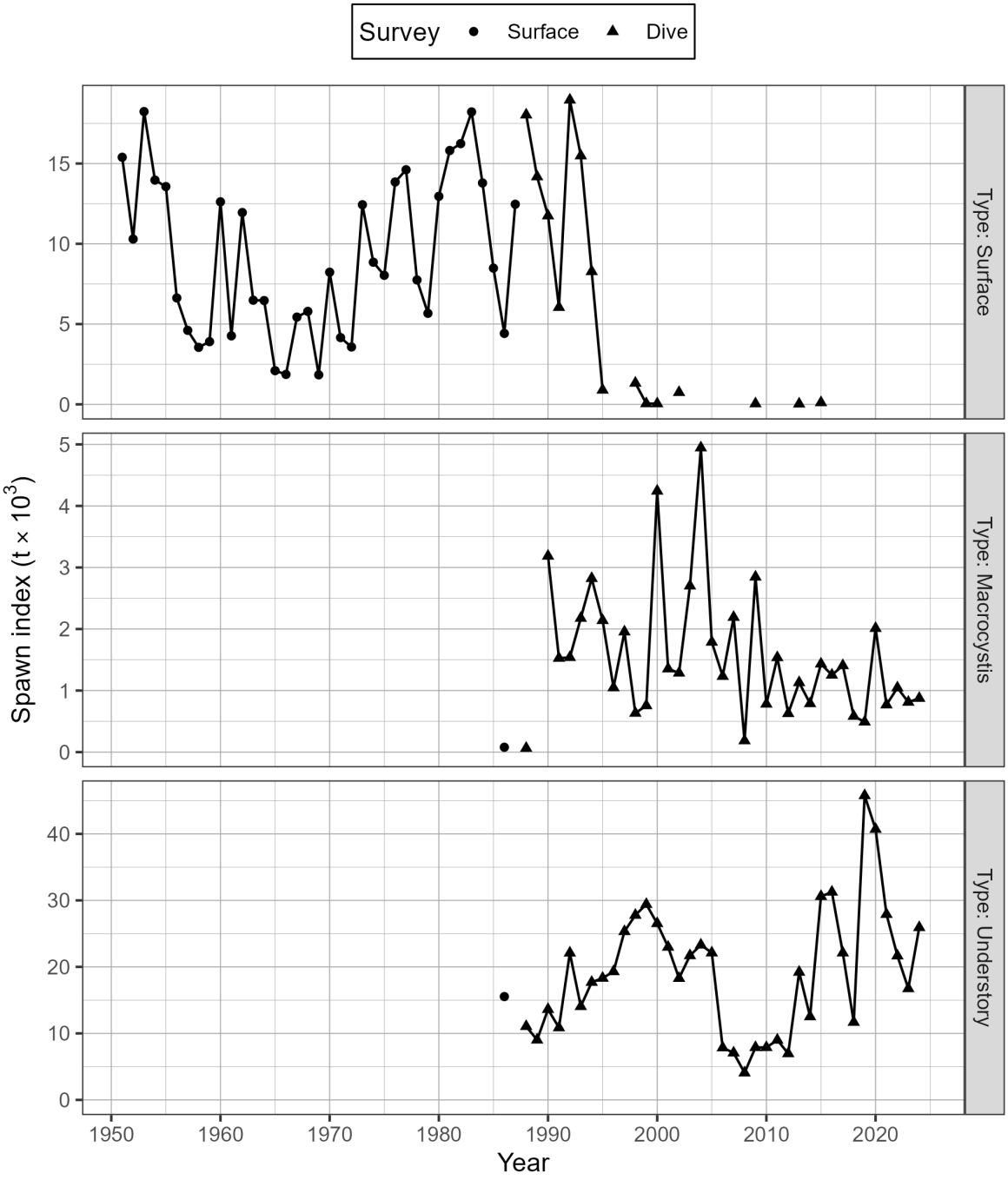

Figure 16. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) by type for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). There are three types of spawn survey observations: observations of spawn taken from the surface usually at low 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).

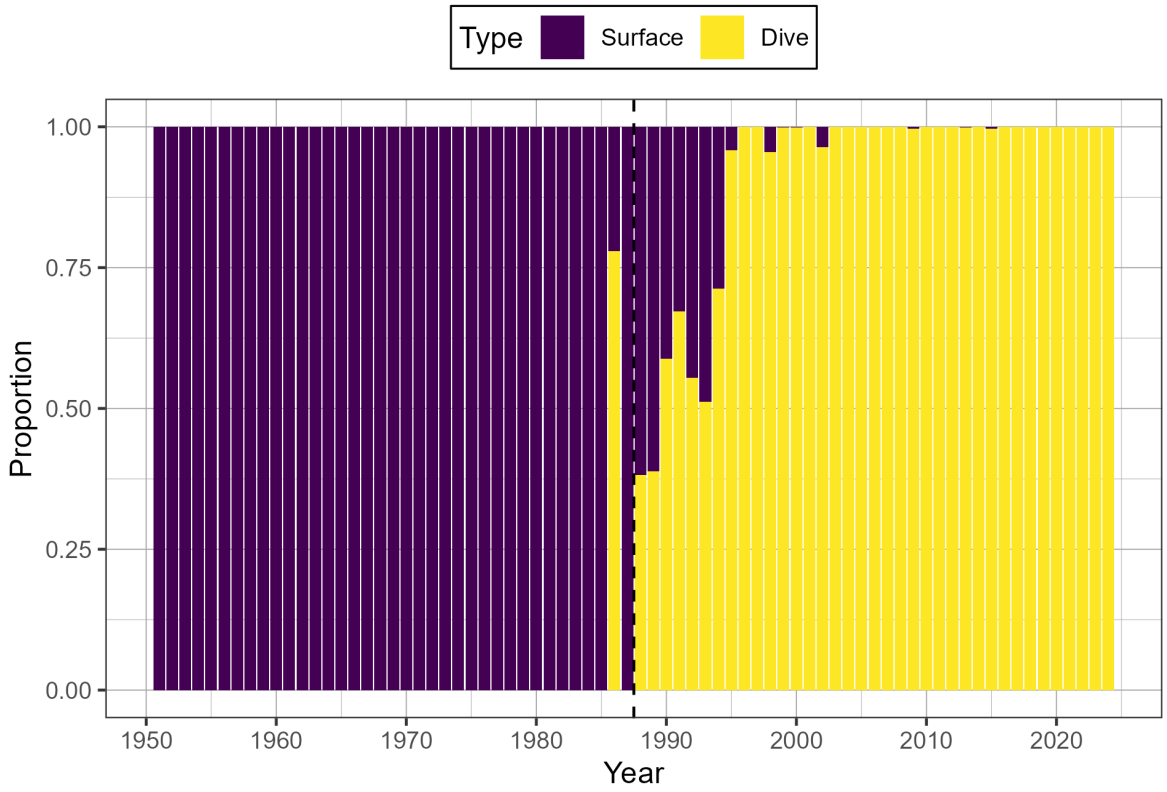

Figure 17. Time series of proportion of spawn index by surface and dive surveys for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

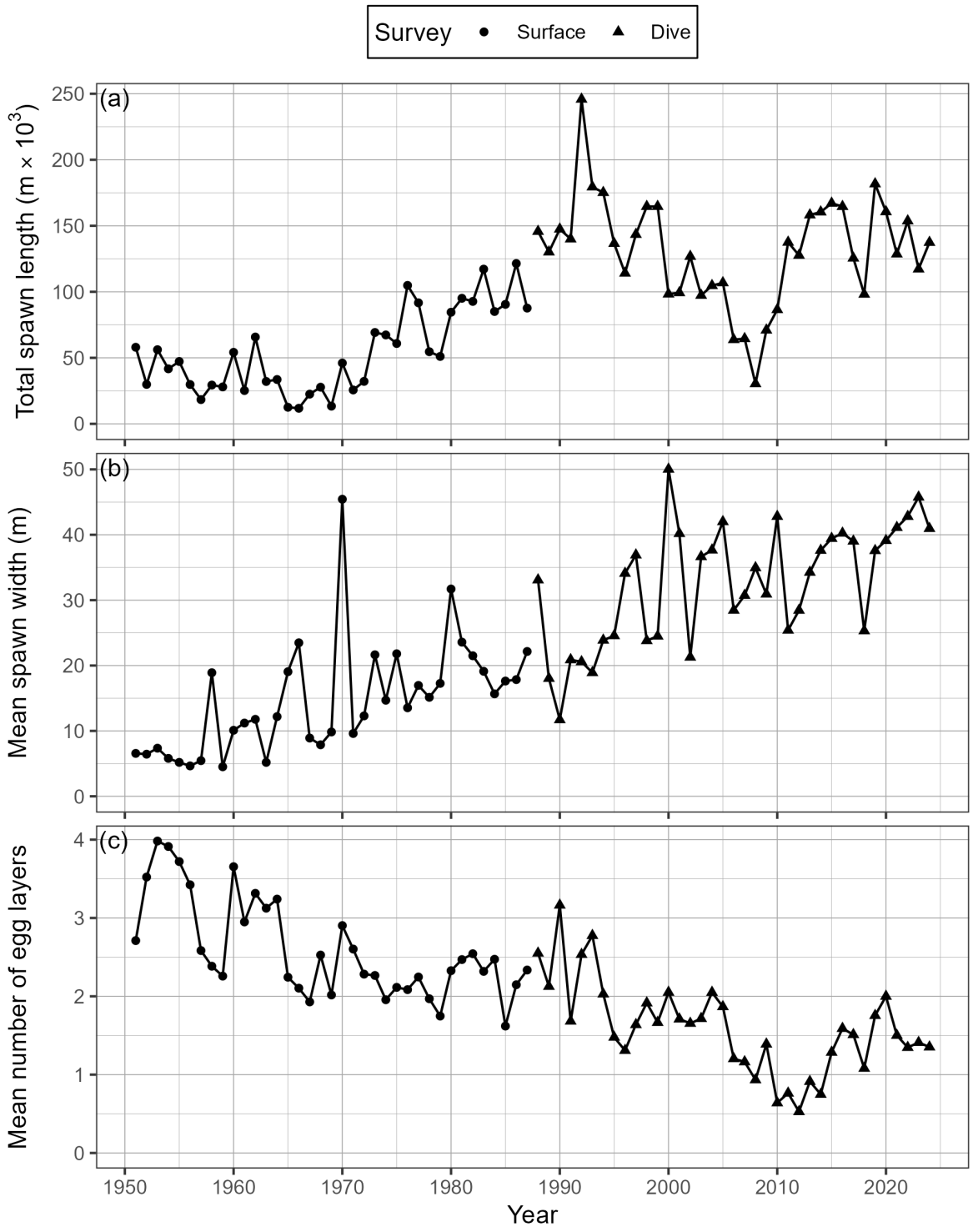

Figure 18. Time series of total spawn length in thousands of metres ($m \times 10^3$; panel a), mean spawn width in metres (b), and mean number of egg layers (c) for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

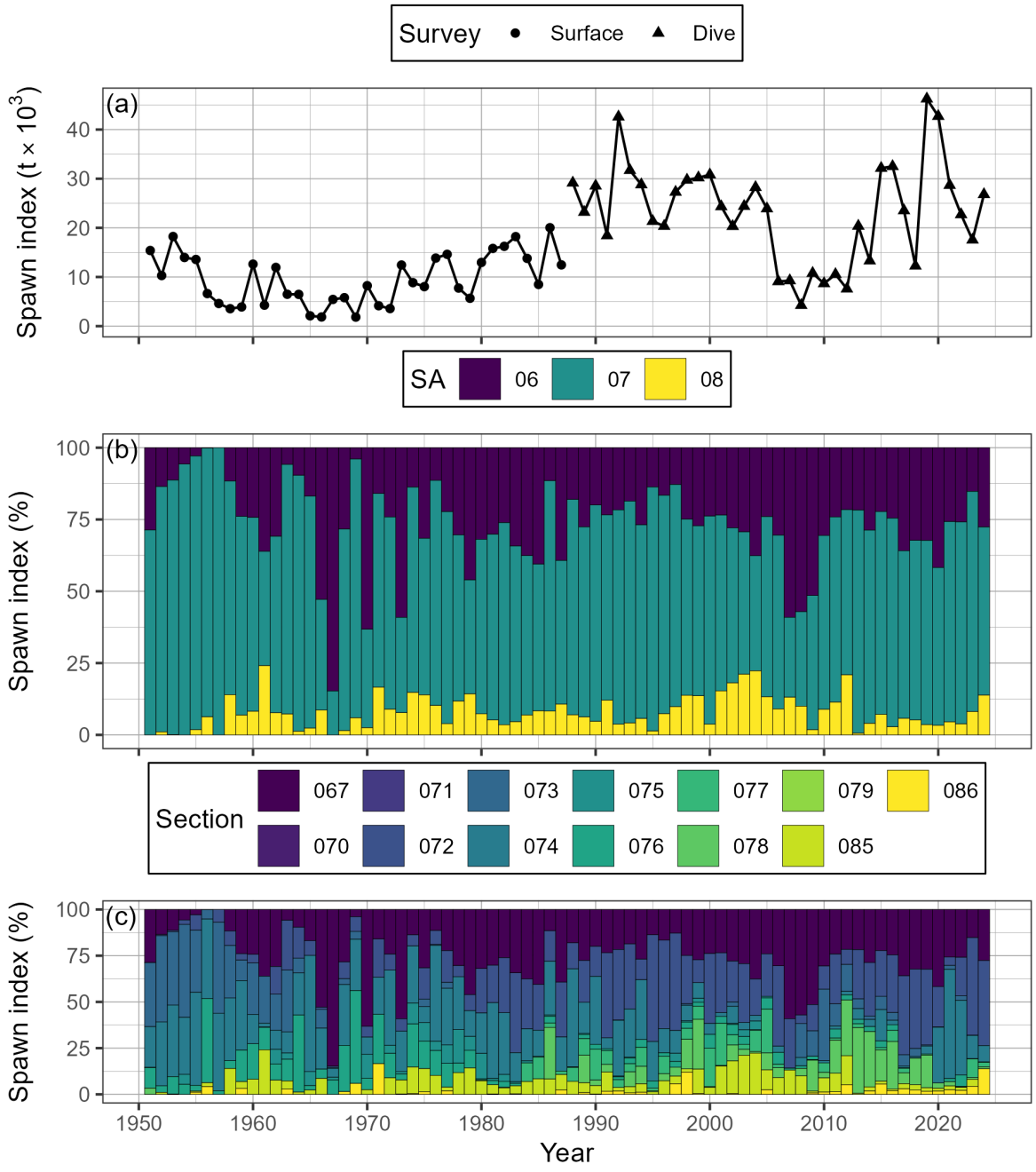

Figure 19. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR; panel a), as well as percent contributed by Statistical Area (SA), and Section (b, & c, respectively). The spawn index has 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 16 and 17). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Legend: '06&07' is Statistical Areas 06 and 07; and '08' is Statistical Area 08.

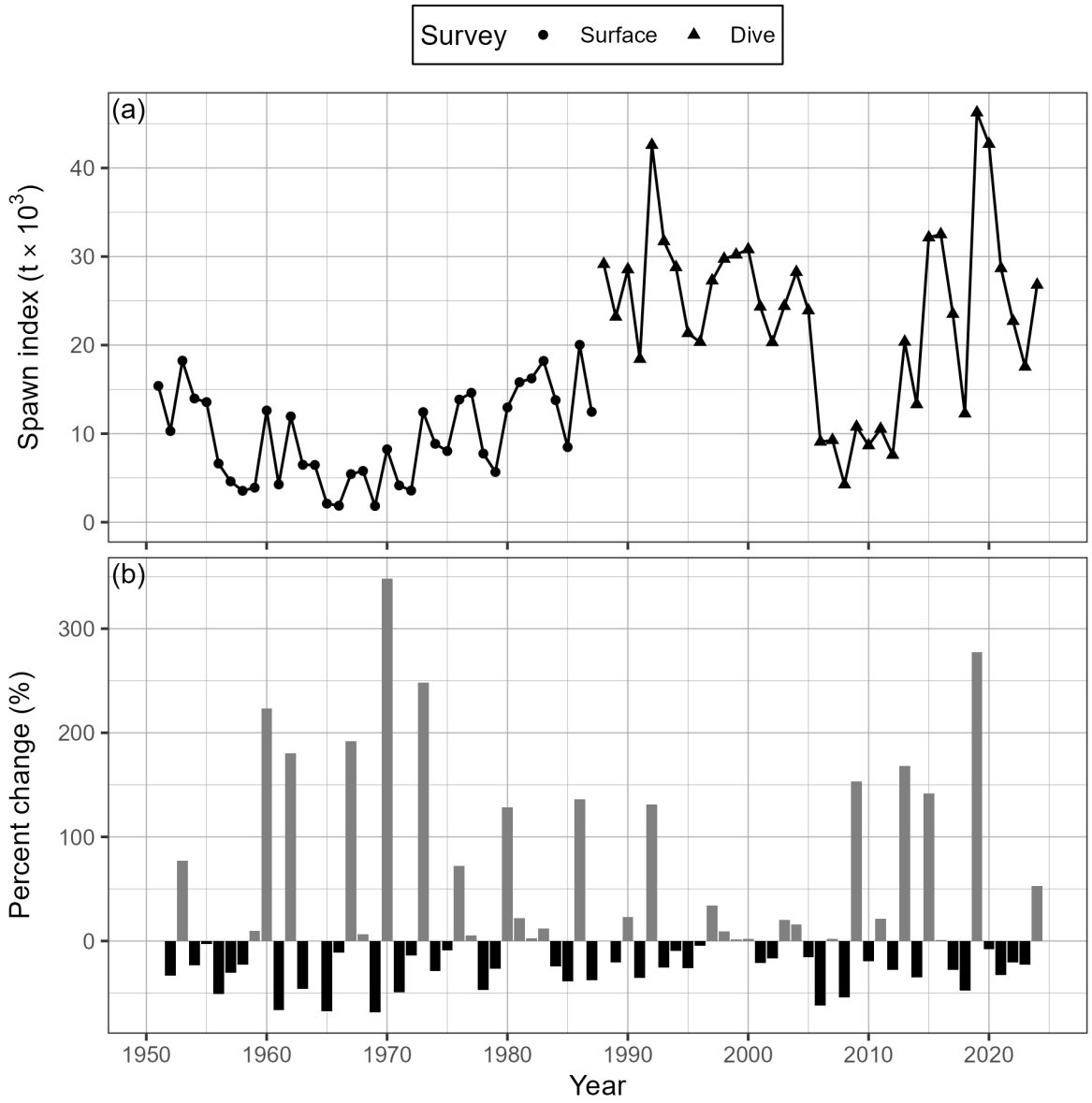

Figure 20. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR; panel a), and percent change (b). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where α_t 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 16 and 17).

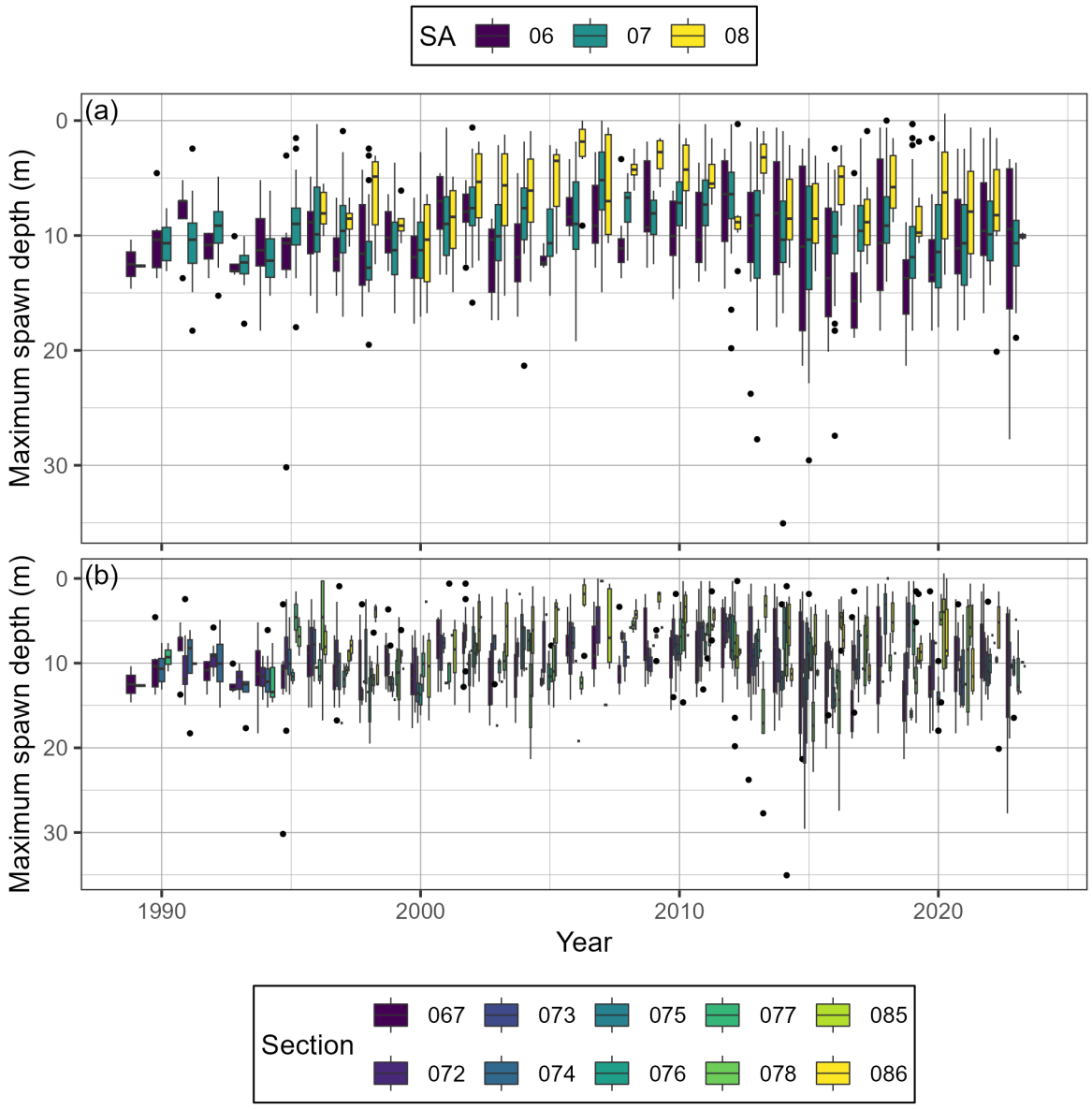

Figure 21. Time series of maximum spawn depth in metres (m) for Pacific Herring from 1989 to 2024 in the Central Coast major stock assessment region (SAR) by Statistical Area (SA; panel a), and Section (b). Note that depth is not corrected to chart datum. The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024).

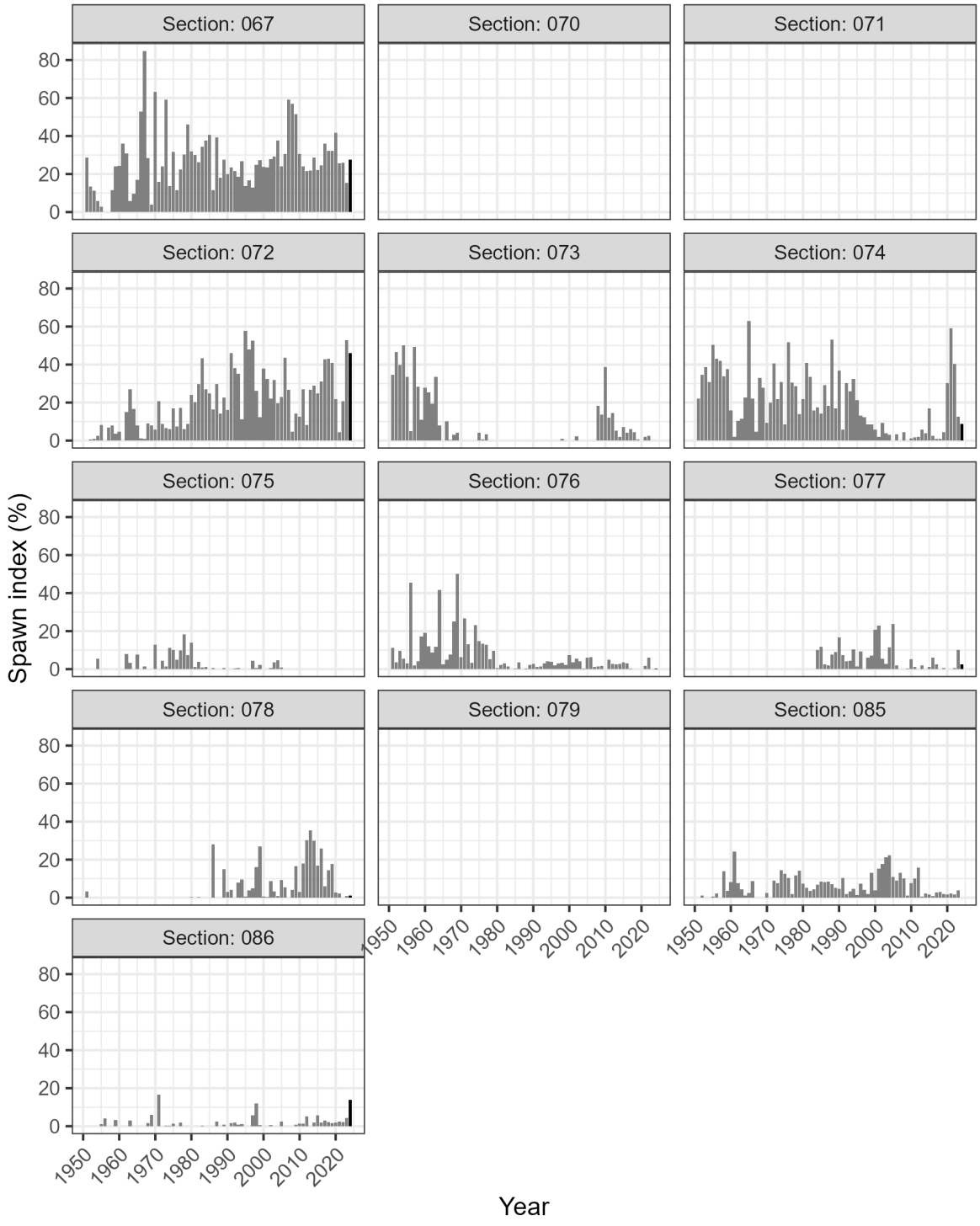

Figure 22. Time series of percent of spawn index by Section for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). The year 2024 has a darker bar to facilitate interpretation. The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q.

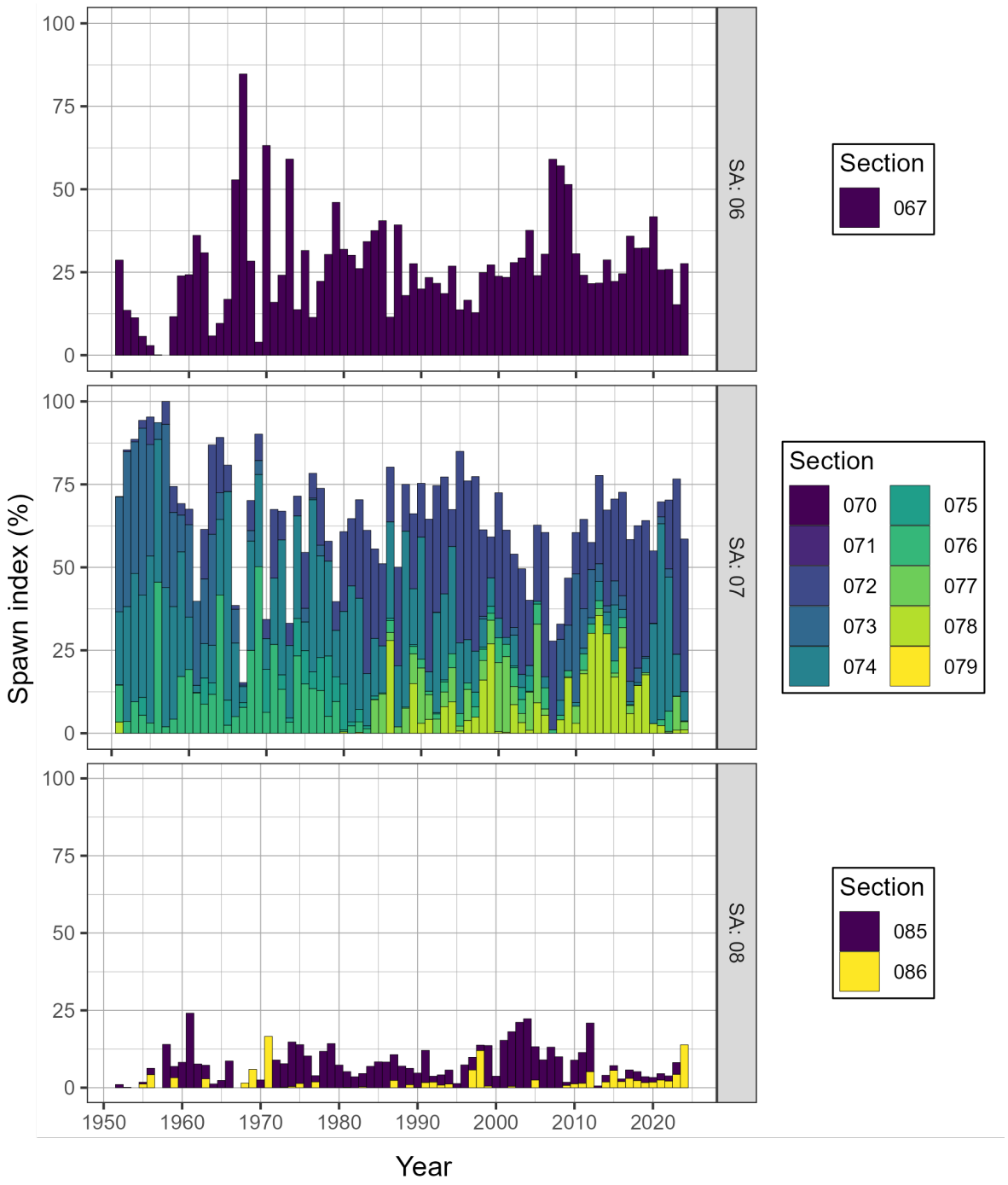

Figure 23. Time series of percent of spawn index by Statistical Area (SA) and Section for Pacific Herring from 1951 to 2024 in the Central Coast major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant coastwide survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2024). The 'spawn index' is not scaled by the spawn survey scaling parameter, q. Legend: '06&07' is Statistical Areas 06 and 07; and '08' is Statistical Area 08.

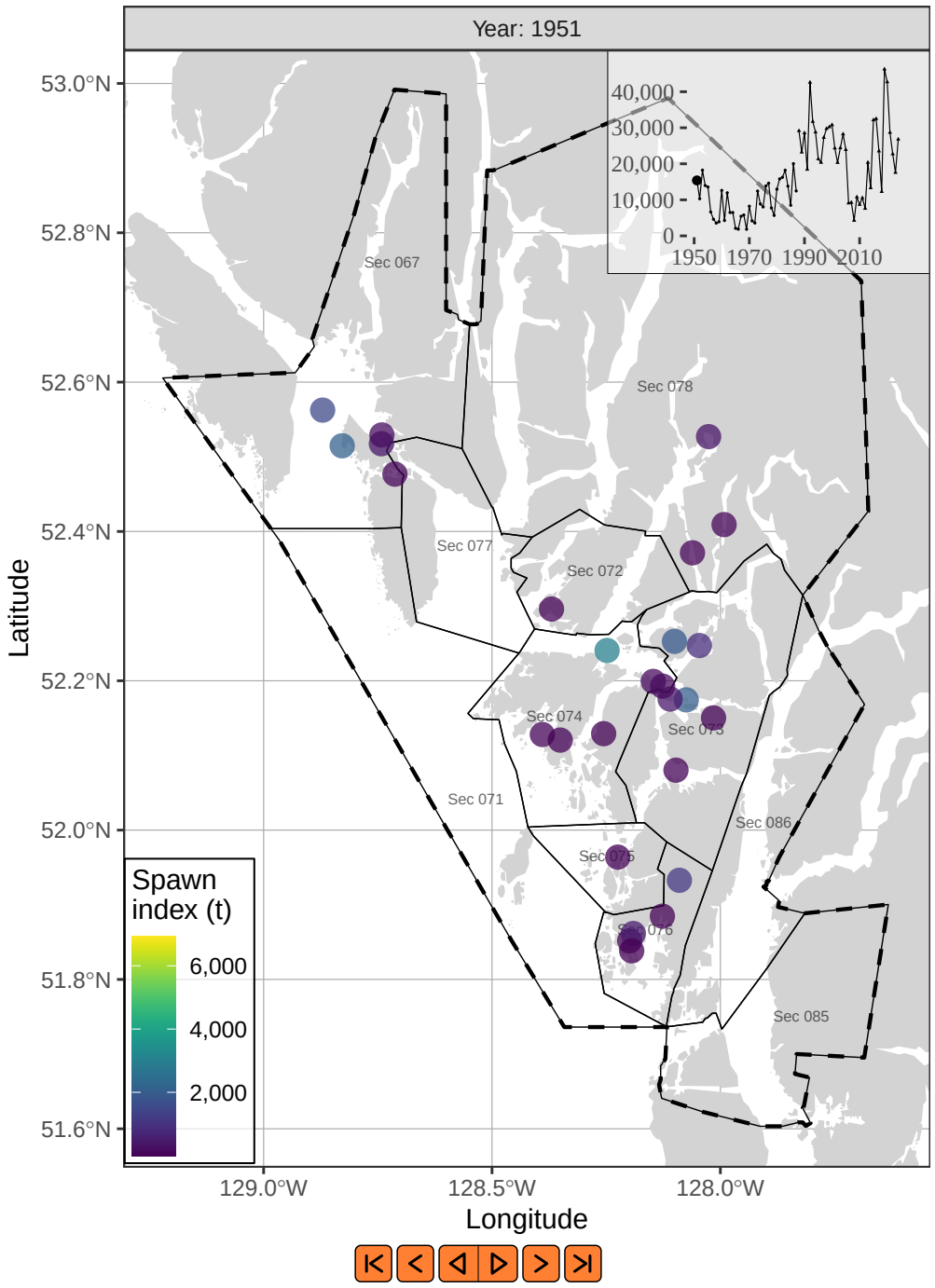

Figure 24. Animation of Pacific Herring spawn index in metric tonnes (t) by Location from 1951 to 2024 in the Central Coast major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The spawn index has two distinct periods defined by the dominant coastwide 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".