# Pacific Herring preliminary data summary for Haida Gwaii 2020

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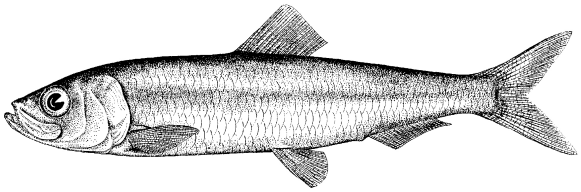
September 21, 2020



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

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**Disclaimer** This report contains preliminary data collected for Pacific Herring in 2020 in the Haida Gwaii major stock assessment regions (SAR). These data may differ from data used and presented in the final stock assessment.

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## 1 COVID-19 pandemic

The COVID-19 pandemic impacted our ability to collect and analyse Pacific Herring data throughout British Columbia in 2020. The pandemic and associated provincial response changed rapidly during the Pacific Herring field program season. Despite these challenges, surveyors assessed all major observed spawns in the 5 major stock assessment regions (SARs). However, these changes impacted our ability to assess spawn in SARs with later spawns more than SARs with earlier spawns. For example, spawns were surveyed by surface surveys instead of underwater dive surveys in Prince Rupert District and Haida Gwaii.

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Although Pacific Herring biological samples were collected as usual, the pandemic delayed the analysis of biological data for all SARs. This delay is most notable for age data which are analysed at the sclerochronology lab at the Pacific Biological Station. This lab closed on March 16$^{th}$, and resumed limited ageing analysis on July 6$^{th}$. This has resulted in delayed provision of age data for Pacific Herring and many other species. To address this backlog efficiently, senior science staff and fisheries managers at DFO are prioritizing species to analyse in the sclerochronology lab. Unfortunately, it may not be possible to analyse all the Pacific Herring age data in time for stock assessments this year. Note that although age data are not required for Pacific Herring stock assessments, they are an important component.

Due to the delay in the analysis of biological data, some tables and figures showing biological data have been omitted from this version of the report. Other tables and figures are included, but they do not have biological data for 2020. We will update data summary reports with 2020 biological data when available. We appreciate your patience and understanding as we continue to work from home in these uncertain and changing times.

# 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 this scale (Table 1, Figure 1). The Pacific Herring data collection program includes fishery-dependent and -independent data from 1951 to 2020. 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 2020 in the Haida Gwaii 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 2020 refers to the 2019/2020 Pacific Herring season.

# 3 Data collection programs

In 2020, biological samples were collected by the "Queens Reach", a seine test charter vessel funded by DFO. The primary purpose of the test charter vessel was to collect biological samples from main bodies of herring from Haida Gwaii major (priority) and

minor stock areas, identified from soundings. The "Queens Reach" operated a 25 day charter from March 9th to April 2nd, collecting samples from HG and Area 2 West. It was necessary to make changes to the dive survey program due to COVID-19. The "Haida Spirit" was unable to operate the dive charter, however the "Victoria Rose" was repurposed from a spawn reconnaissance charter to a surface survey charter and successfully completed a 20 day charter from March 30th to April 18th. The "Atlas" completed a 6 day surface survey charter in Area 2 West from April 4th to 9th. All vessels were funded by DFO, through a contract to the Herring Conservation Research Society.

# 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 2020 in the Haida Gwaii 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 2020, 12 Pacific Herring biological samples were collected and processed for the Haida Gwaii major SAR (Table 5, Table 6), and a total of 1,103 Pacific Herring were aged in 2020. The locations in which the biological samples were collected are presented in Figure 4. Included herein are biological summaries of observed proportion-, number-, weight-, and length-at-age (Figure 5, Table 7, and Figure 6, respectively). We also show the percent change in weight and length for age-3 and age-6 fish (Figure 7 & Figure 8, 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 23 individual locations in 2020 in the Haida Gwaii major SAR (Table 8, and Figure 9). A summary of spawn from the last decade (2010 to 2019) is shown in Figure 10. Figure 11 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 12, Figure 13, Figure 14, Figure 15, Table 9, and Figure 16). 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 survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020).

Some Pacific Herring Sections contribute more than others to the total spawn index, and the percentage contributed by Section varies yearly (Figure 15b, Figure 17). For example, in 2020, Section 025 contributed the most to the spawn index (52%). As with Sections, some Statistical Areas contribute more than others to the total spawn index (Figure 15c, Figure 18). An animation shows the spawn index by spawn survey location from 1951 to 2020 (Figure 19).

# 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:

- Because of COVID-19 restraints, the dive survey was replaced with a surface survey, and the seine charter was extended by four days to enhance coverage.
- Additional Haida Fisheries Program spawn reconnaisance effort helped support surface surveys.
- All major observed spawns were surveyed this year.
- Surface spawn surveys used towed video cameras along transects to determine spawn extent and intensity. These towed video camera transects were effective for spawn assessments, and may be useful to supplement future dive surveys.
- The largest concentration of fish and spawning was around Burnaby Island. No spawns were observed in the Juan Perez area.
- Spawn for Skincuttle and Burnaby Islands seemed about average.
- Spawn from Section Cove to Scudder Island did not seem as intense as the past few years, but this year the fish spawned on multiple days on the same beach.
- Herring seemed smaller this year, and seemed to have less variation in length frequency. Some samples appeared to have full stomachs. Most of the herring seemed to be fairly close to spawning. There were very few juvenile herring this year.

- Prevailing Northwest and Northeast winds kept water temperature between 6.2 and 6.4°C.
- As in previous years, the seine test encountered Humpback Whales feeding on herring. There appears to have been an increase in the number of Grey Whales feeding on herring spawn over the past four years.

# 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 Haida Gwaii major stock assessment region (SAR).

| Region | Statistical Area | Section |
|---|---|---|
| Haida Gwaii | 00 | 006 |
| Haida Gwaii | 02 | 021 |
| Haida Gwaii | 02 | 023 |
| Haida Gwaii | 02 | 024 |
| Haida Gwaii | 02 | 025 |

Table 3. Total landed commercial catch of Pacific Herring in metric tonnes (t) by gear type in 2020 in the Haida Gwaii major stock assessment region (SAR). Legend: 'Other' represents the reduction, 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 2010 to 2020 in the Haida Gwaii 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) |
|---|---|---|
| 2010 | 0 | 0 |
| 2011 | 0 | 0 |
| 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 |

Table 5. Number of Pacific Herring biological samples processed from 2010 to 2020 in the Haida Gwaii major stock assessment region (SAR). Each sample is approximately 100 fish.

| | Number of samples | | |
|---|---|---|---|
| Year | Commercial | Test | Total |
| 2010 | 0 | 12 | 12 |
| 2011 | 0 | 13 | 13 |
| 2012 | 0 | 9 | 9 |
| 2013 | 0 | 12 | 12 |
| 2014 | 0 | 12 | 12 |
| 2015 | 0 | 11 | 11 |
| 2016 | 0 | 5 | 5 |
| 2017 | 0 | 8 | 8 |
| 2018 | 0 | 11 | 11 |
| 2019 | 0 | 10 | 10 |
| 2020 | 0 | 12 | 12 |

Table 6. Number and type of Pacific Herring biological samples processed in 2020 in the Haida Gwaii major stock assessment region (SAR). Each sample is approximately 100 fish.

| Type | Gear | Use | Number of samples |
|---|---|---|---|
| Test | Seine | Test fishery | 12 |

Table 7. Observed proportion-at-age for Pacific Herring from 2010 to 2020 in the Haida Gwaii 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 |
| 2010 | 0.082 | 0.085 | 0.589 | 0.056 | 0.153 | 0.017 | 0.013 | 0.003 | 0.002 |
| 2011 | 0.018 | 0.442 | 0.076 | 0.314 | 0.055 | 0.085 | 0.008 | 0.003 | 0.000 |
| 2012 | 0.174 | 0.148 | 0.380 | 0.040 | 0.203 | 0.018 | 0.030 | 0.002 | 0.004 |
| 2013 | 0.000 | 0.677 | 0.125 | 0.128 | 0.019 | 0.041 | 0.005 | 0.004 | 0.000 |
| 2014 | 0.014 | 0.037 | 0.684 | 0.115 | 0.094 | 0.014 | 0.034 | 0.005 | 0.003 |
| 2015 | 0.034 | 0.218 | 0.055 | 0.519 | 0.059 | 0.079 | 0.018 | 0.014 | 0.004 |
| 2016 | 0.166 | 0.162 | 0.170 | 0.058 | 0.376 | 0.044 | 0.020 | 0.002 | 0.002 |
| 2017 | 0.138 | 0.322 | 0.100 | 0.112 | 0.050 | 0.200 | 0.049 | 0.015 | 0.014 |
| 2018 | 0.045 | 0.404 | 0.242 | 0.098 | 0.063 | 0.072 | 0.070 | 0.004 | 0.002 |
| 2019 | 0.018 | 0.540 | 0.312 | 0.077 | 0.022 | 0.018 | 0.012 | 0.001 | 0.000 |
| 2020 | 0.006 | 0.020 | 0.751 | 0.159 | 0.043 | 0.013 | 0.006 | 0.002 | 0.001 |

Table 8. Pacific Herring spawn survey locations, start date, and spawn index in metric tonnes (t) in 2020 in the Haida Gwaii major stock assessment region (SAR). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$. Missing spawn index values (NAs) indicate incomplete spawn surveys.

| Statistical Area | Section | Location name | Start date | Spawn index (t) |
|---|---|---|---|---|
| 02 | 021 | Alder Is Cr | March 28 | 1,362 |
| 02 | 021 | Huxley Is | April 04 | 2,773 |
| 02 | 021 | Nakons Islet | April 04 | 122 |
| 02 | 021 | Saw Rf | March 28 | 547 |
| 02 | 021 | Scudder Pt | March 28 | 3,370 |
| 02 | 021 | Sedgwick Bay | April 09 | 29 |
| 02 | 023 | McLellan Is | April 14 | 4 |
| 02 | 024 | Powrivco Bay | April 07 | 463 |
| 02 | 024 | Traynor Cr | April 09 | 1,114 |
| 02 | 025 | Bolkus Is | March 28 | 2,748 |
| 02 | 025 | Boulder Is | April 05 | 308 |
| 02 | 025 | Bush Rk | April 05 | 238 |
| 02 | 025 | Huston Pt | April 05 | 1,571 |
| 02 | 025 | Jedway Bay | April 07 | 904 |
| 02 | 025 | Kankidas Pt | April 07 | 59 |
| 02 | 025 | Poole Inlt | March 23 | 1,127 |
| 02 | 025 | Rebecca Pt | March 23 | 1,165 |
| 02 | 025 | Scudder Cr | April 04 | 11 |
| 02 | 025 | Sea Pigeon Is | April 05 | 145 |
| 02 | 025 | Slim Inlt | April 05 | 692 |
| 02 | 025 | Smithe Pt | March 28 | 355 |
| 02 | 025 | Swan Bay | March 28 | 23 |
| 02 | 025 | Swan Is | March 28 | 1,295 |

Table 9. Summary of Pacific Herring spawn survey data from 2010 to 2020 in the Haida Gwaii major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020). 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) |
|---|---|---|---|---|
| 2010 | 33,670 | 49 | 1.2 | 6,845 |
| 2011 | 33,560 | 40 | 1.6 | 7,554 |
| 2012 | 54,610 | 28 | 1.1 | 9,720 |
| 2013 | 70,300 | 33 | 1.7 | 16,025 |
| 2014 | 52,900 | 57 | 0.9 | 10,566 |
| 2015 | 57,150 | 55 | 1.4 | 13,102 |
| 2016 | 30,345 | 54 | 1.1 | 6,888 |
| 2017 | 31,350 | 62 | 0.9 | 3,016 |
| 2018 | 35,575 | 44 | 1.1 | 4,588 |
| 2019 | 77,965 | 40 | 1.4 | 11,624 |
| 2020 | 47,950 | 75 | 2.8 | 20,423 |

# 8 Figures

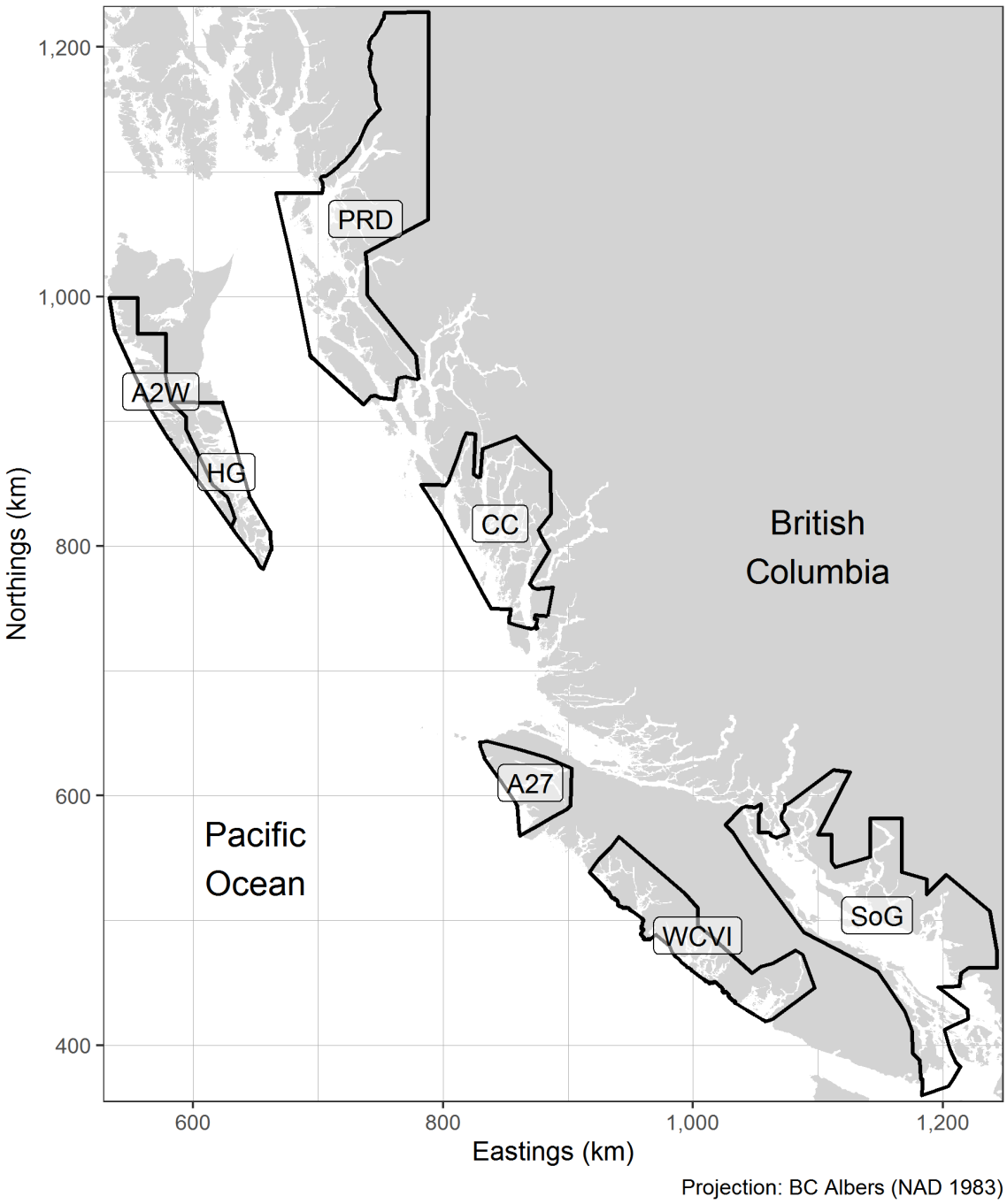


Figure 1. Boundaries for the Pacific Herring stock assessment regions (SARs) in British Columbia. There are 5 major SARs: Haida Gwaii (HG), Prince Rupert District (PRD), Central Coast (CC), Strait of Georgia (SoG), and West Coast of Vancouver Island (WCVI). There are 2 minor SARs: Area 27 (A27) and Area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

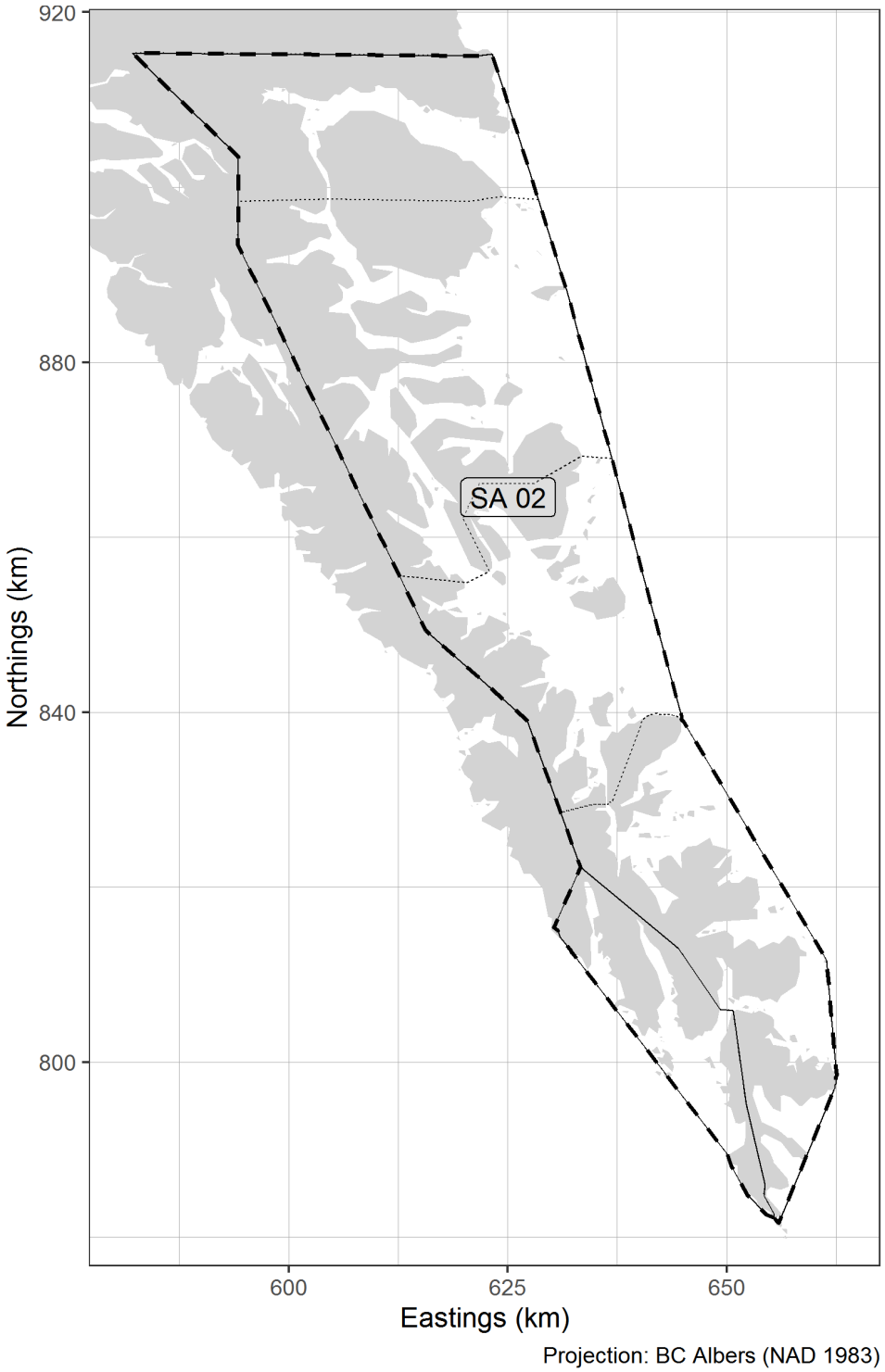


Figure 2. Boundaries for the Haida Gwaii major stock assessment region (SAR; thick dashed lines), associated Statistical Areas (SA; thin solid lines), and associated Sections (thin dotted lines). Units: kilometres (km).

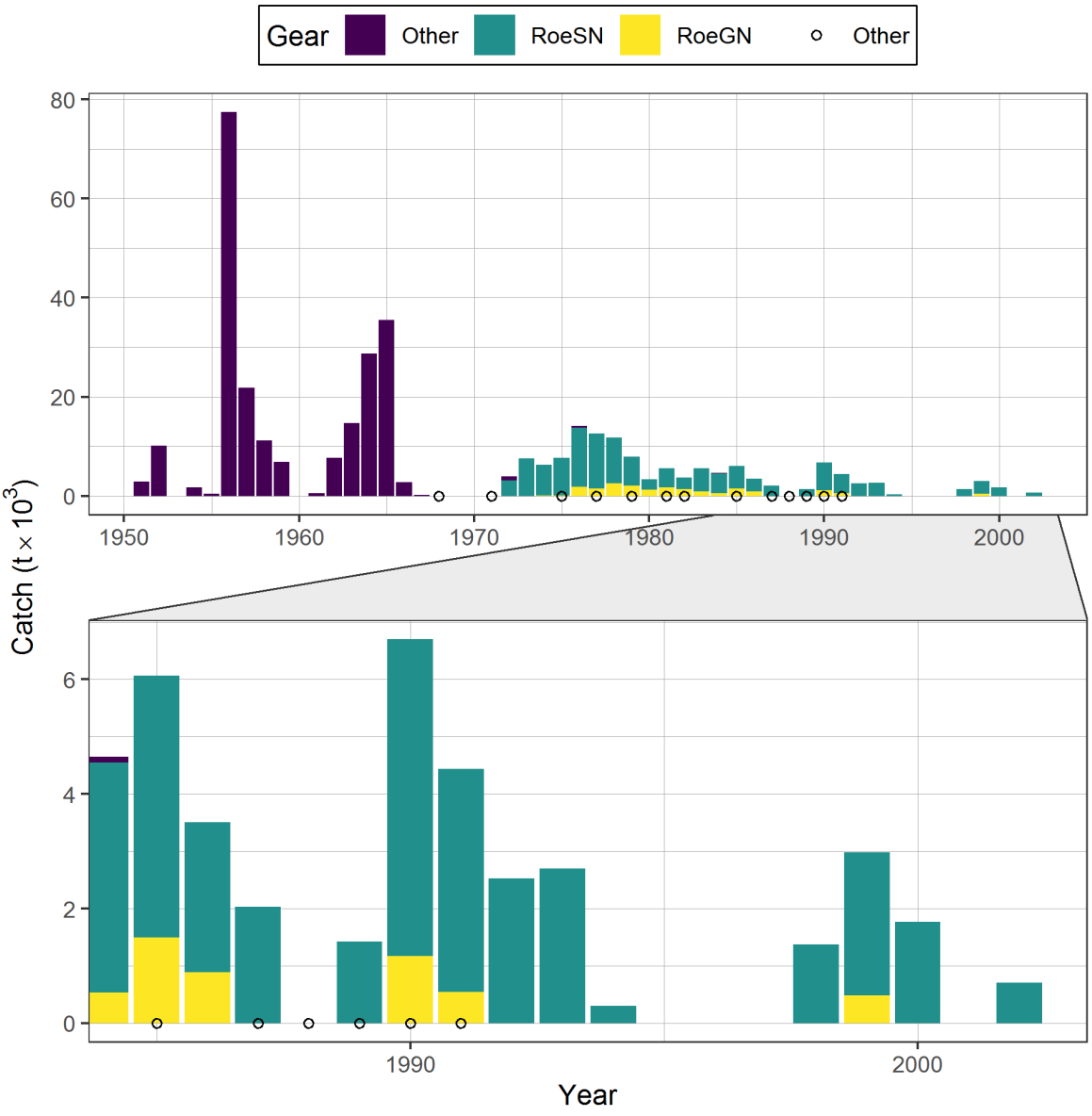


Figure 3. Time series of total landed catch in thousands of metric tonnes ($t \times 10^3$) of Pacific Herring by gear type from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). Legend: 'Other' represents the reduction, the food and bait, as well as the special use fishery; 'RoeSN' represents the roe seine fishery; and 'RoeGN' represents the roe gillnet fishery. Data from the spawn-on-kelp (SOK) fishery are not included. Note: symbols indicate years in which catch by gear type (i.e., Other, RoeSN, RoeGN) is withheld due to privacy concerns.

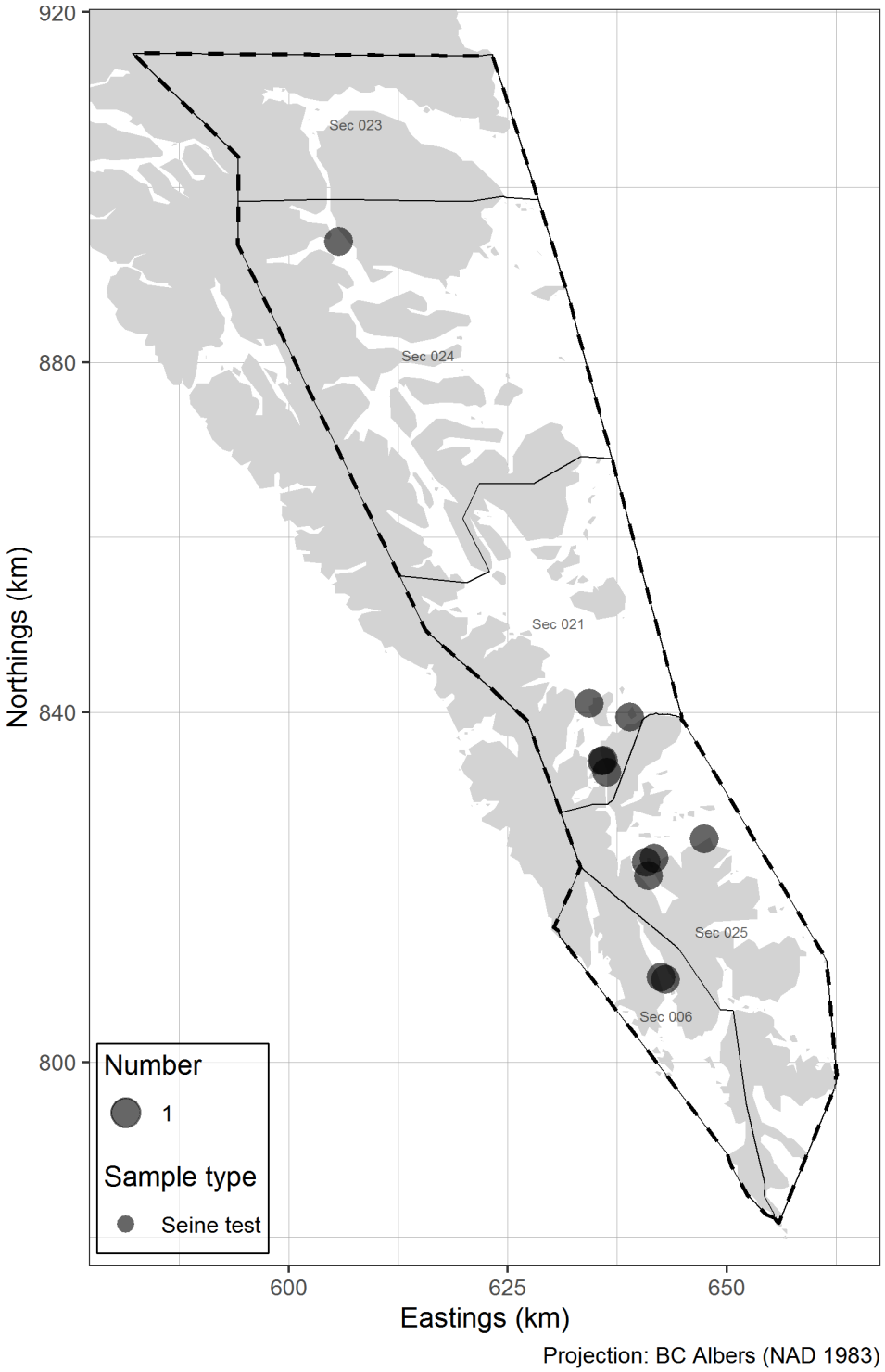


Figure 4. Location and type of Pacific Herring biological samples collected in 2020 in the Haida Gwaii major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). Units: kilometres (km).

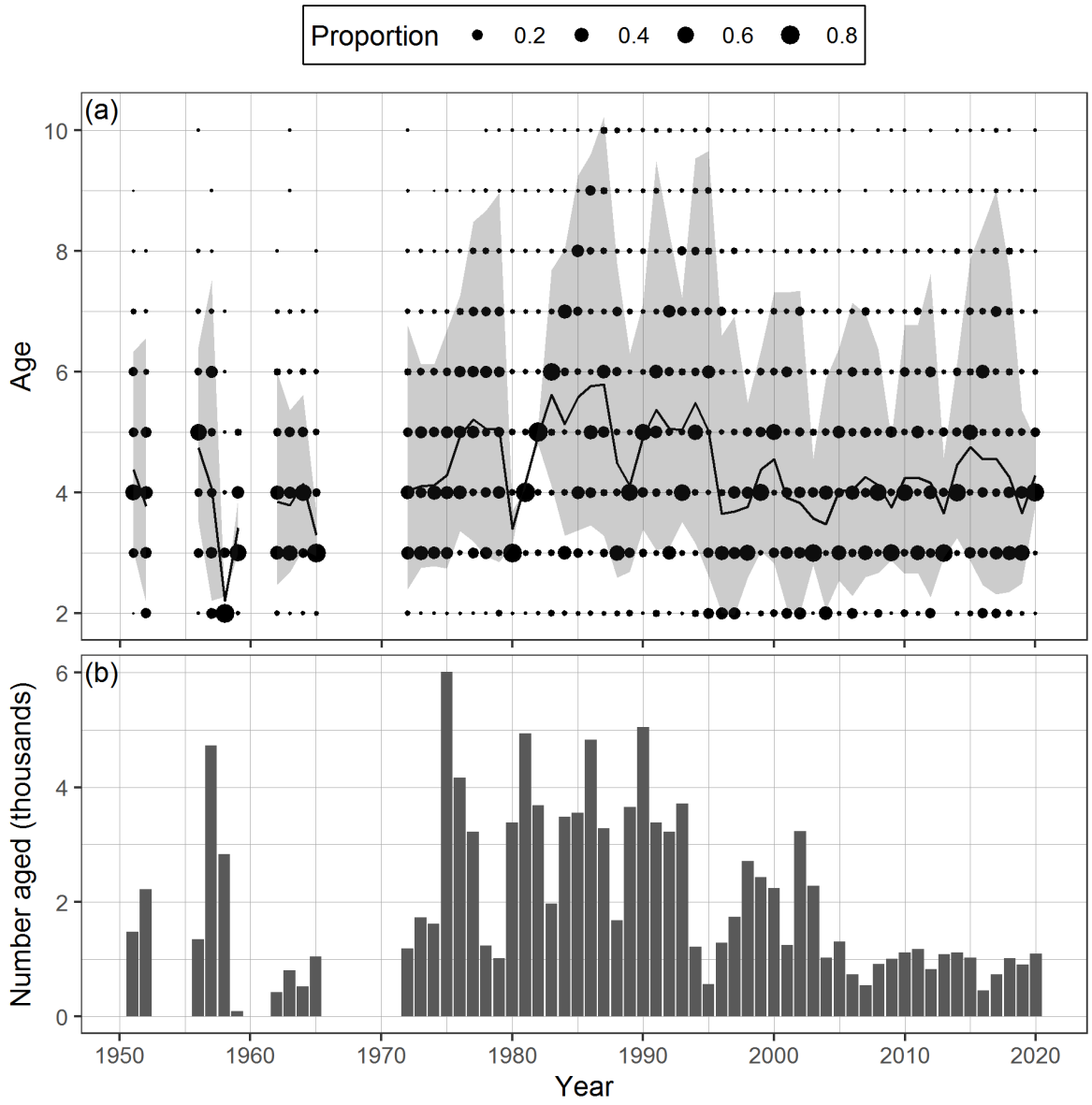


Figure 5. Time series of observed proportion-at-age (a) and number aged in thousands (c) of Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). The black line is the mean age, and the shaded area is the approximate 90% distribution. Biological summaries only include 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.

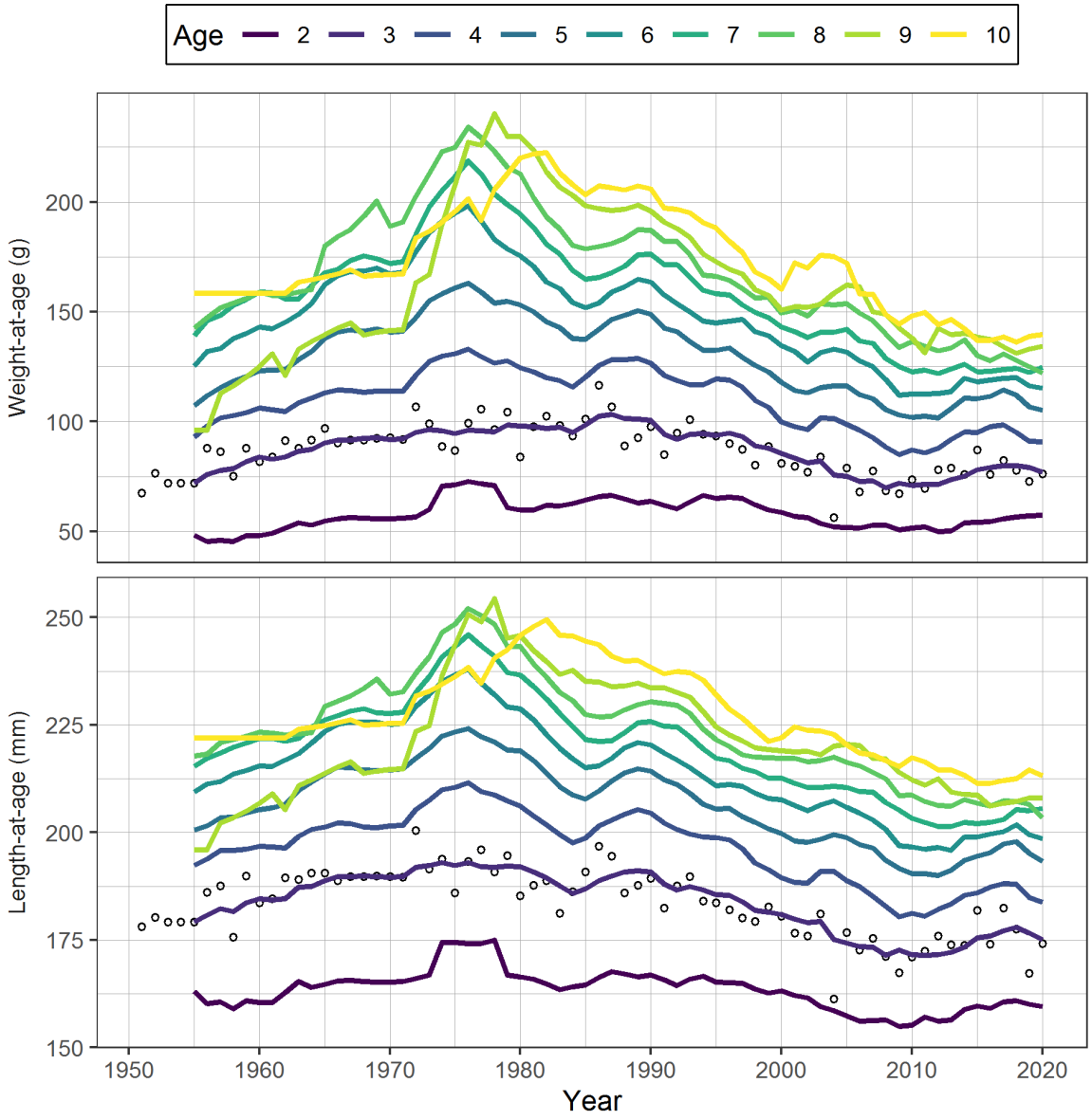


Figure 6. Time series of weight-at-age in grams (g) and length-at-age in milimetres (mm) for age-3 (circles) and 5-year running mean weight- and length-at-age (lines) for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). Missing weight- and length-at-age values (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.

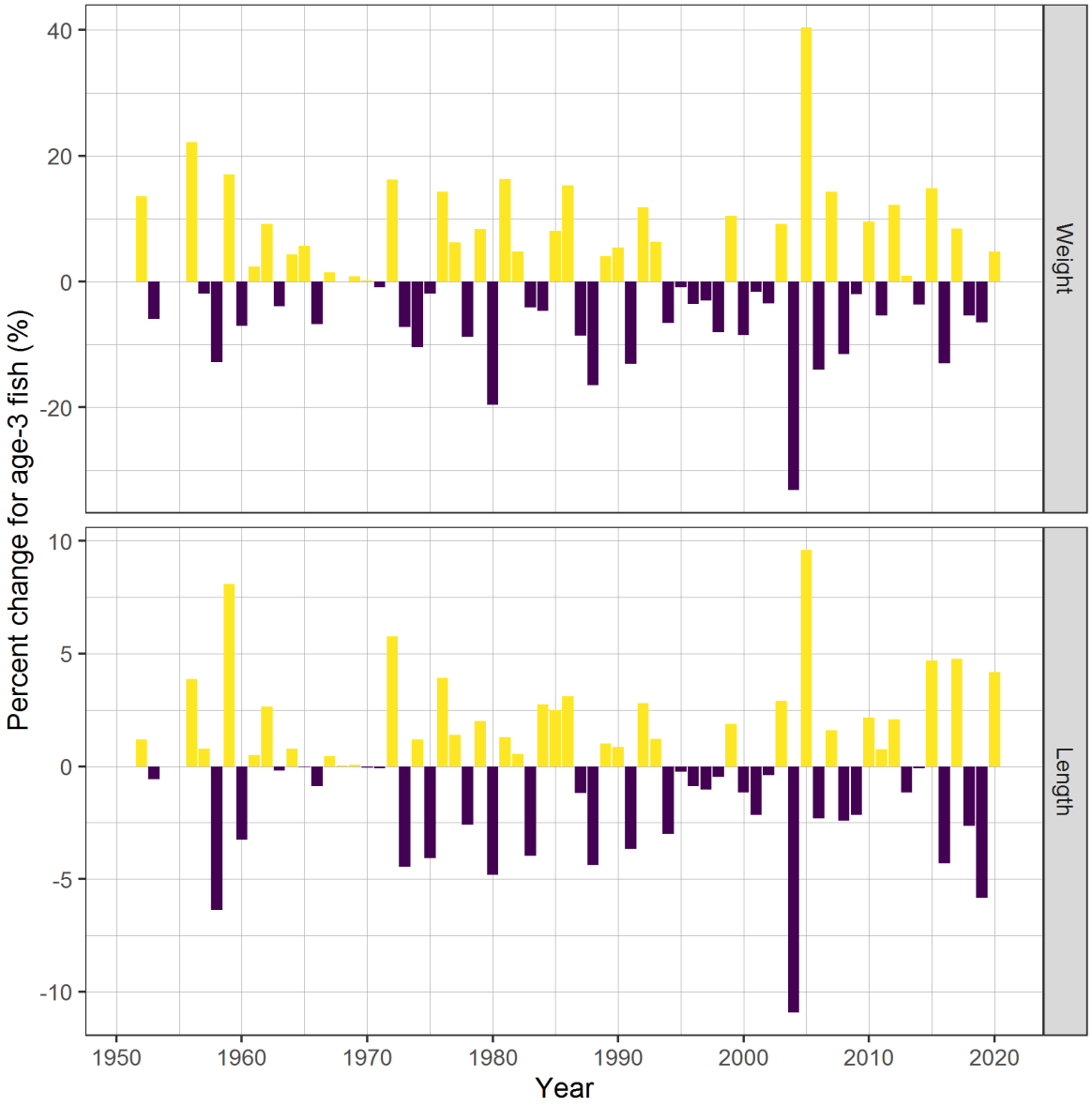


Figure 7. Time series of percent change (%) in weight and length for age-3 fish for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where $\alpha_t$ is the weight and length of age-3 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.

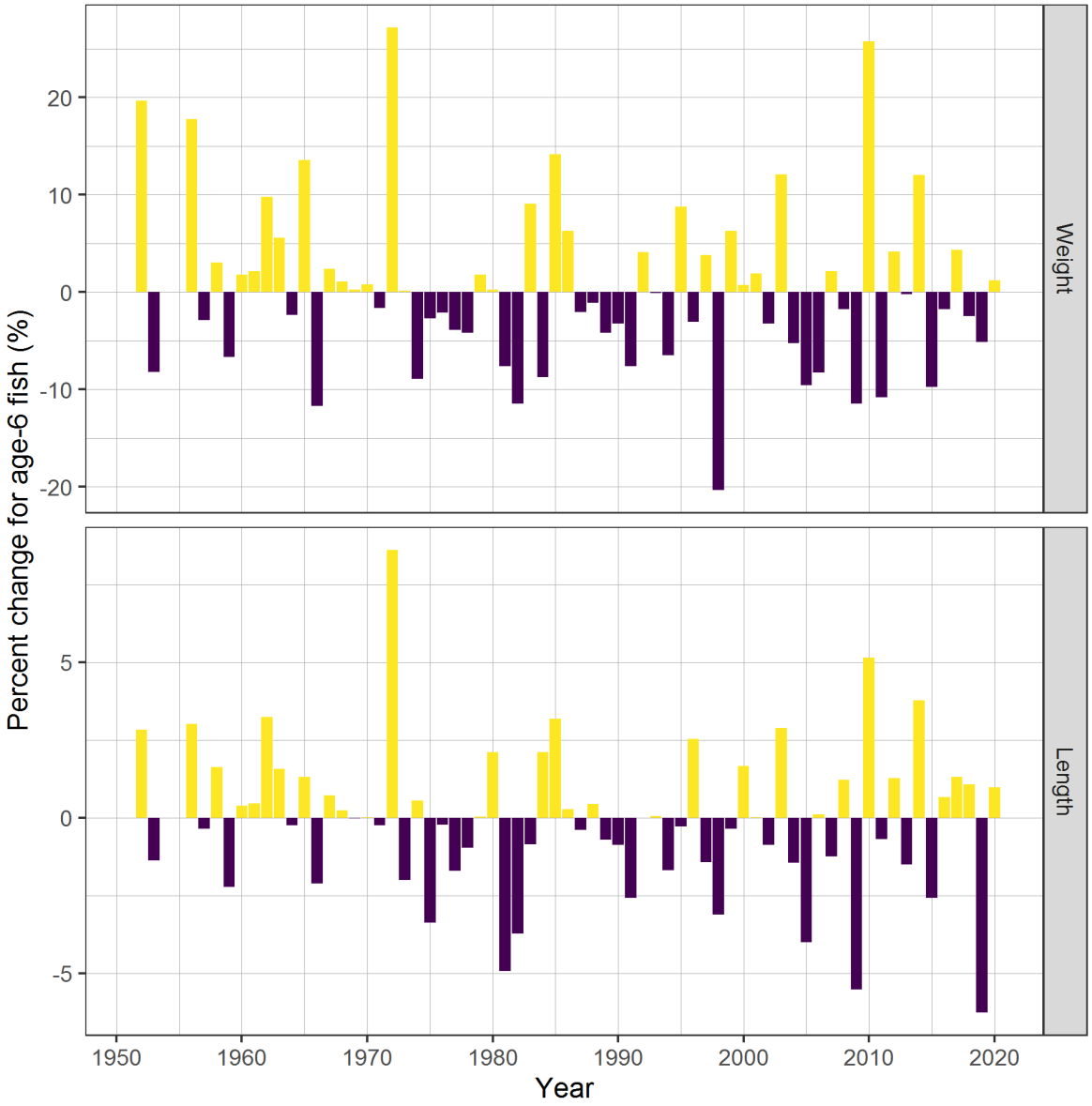


Figure 8. Time series of percent change (%) in weight and length for age-6 fish for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where $\alpha_t$ is the weight and length of age-6 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.

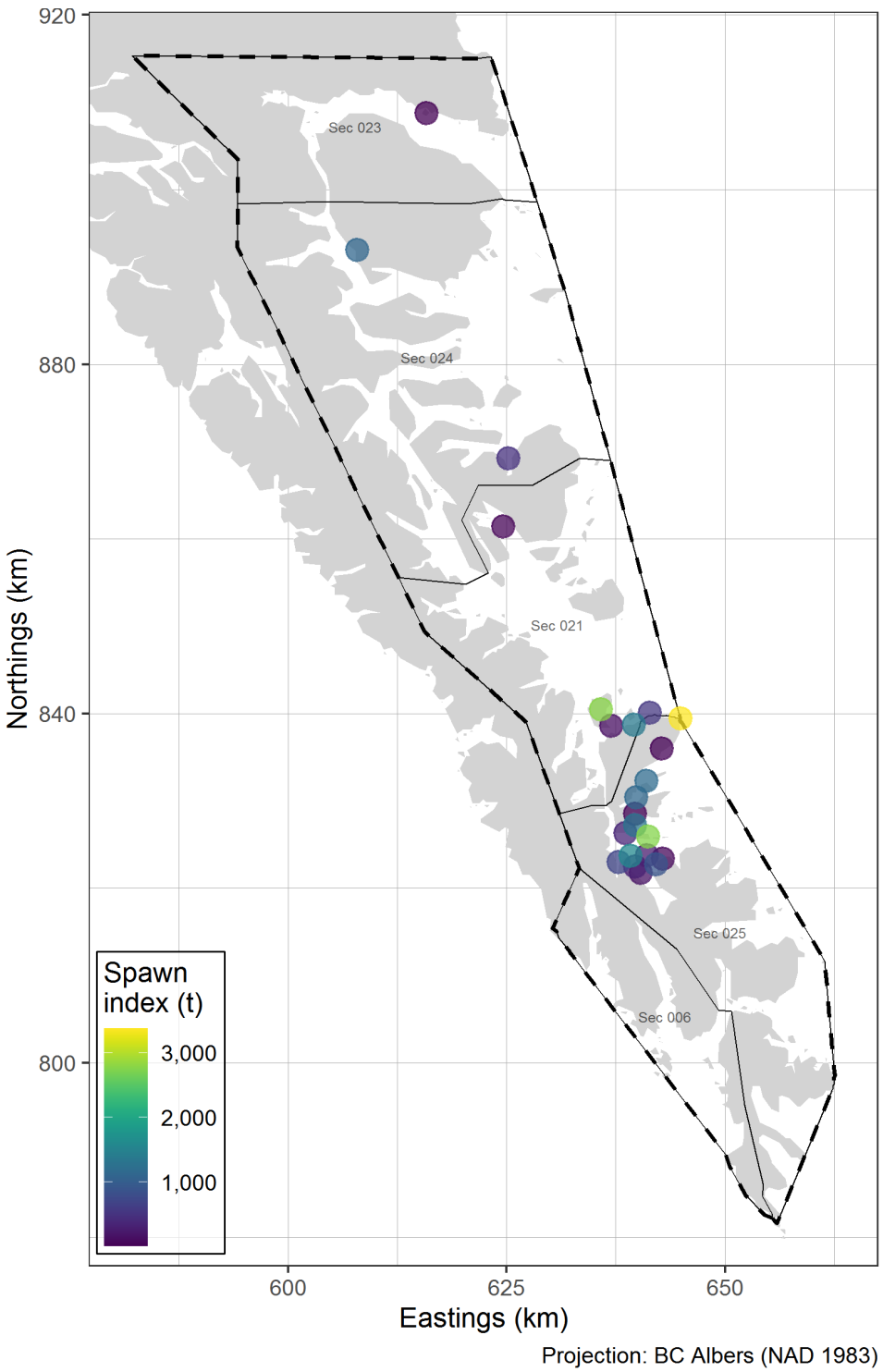


Figure 9. Pacific Herring spawn survey locations, and spawn index in metric tonnes (t) in 2020 in the Haida Gwaii major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$. Missing spawn index values (grey circles) indicate incomplete spawn surveys. Units: kilometres (km).

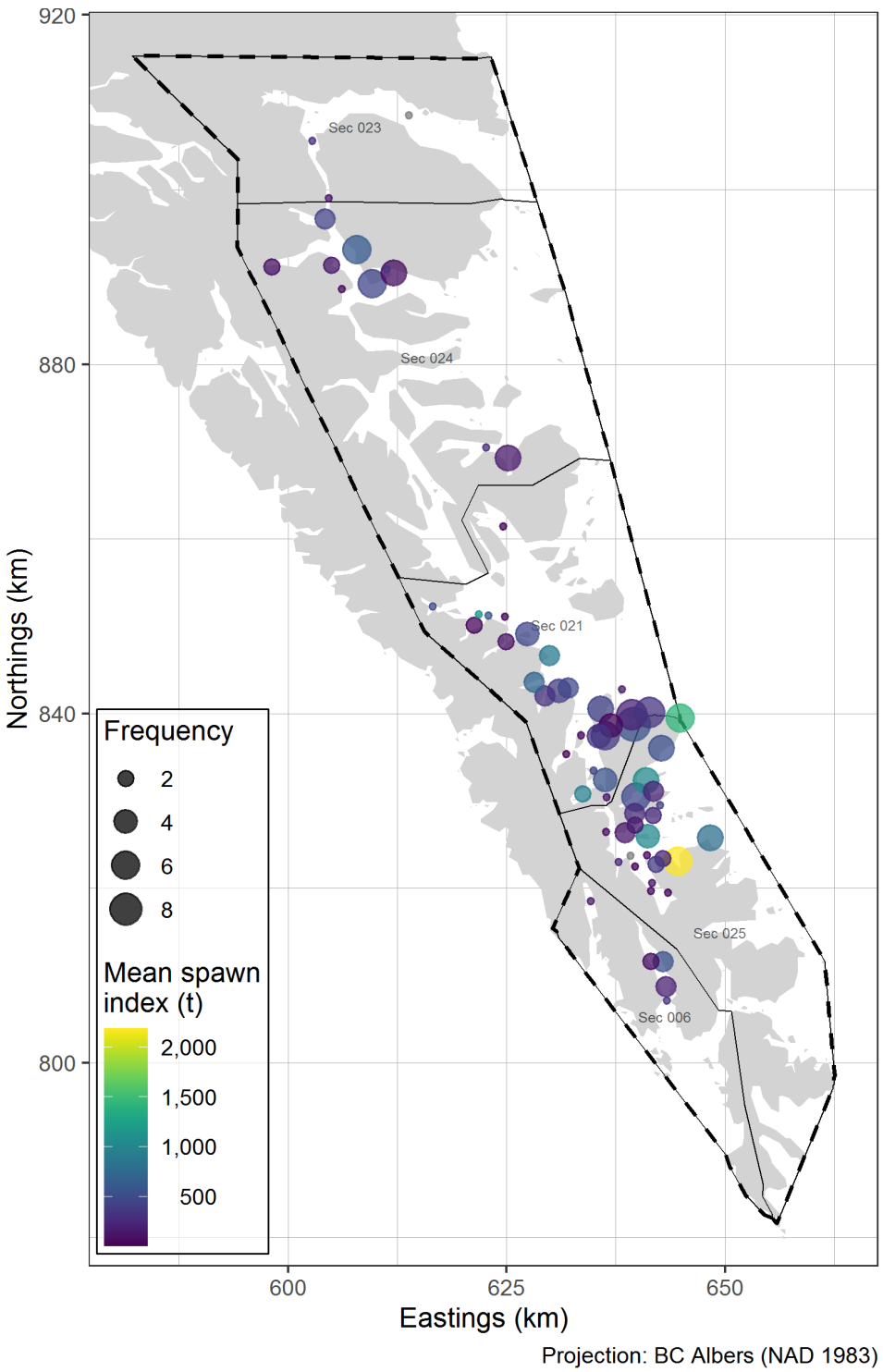


Figure 10. Pacific Herring spawn survey locations, mean spawn index in metric tonnes (t), and spawn frequency from 2010 to 2019 in the Haida Gwaii major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$. Missing spawn index values (grey circles) indicate incomplete spawn surveys. Units: kilometres (km).

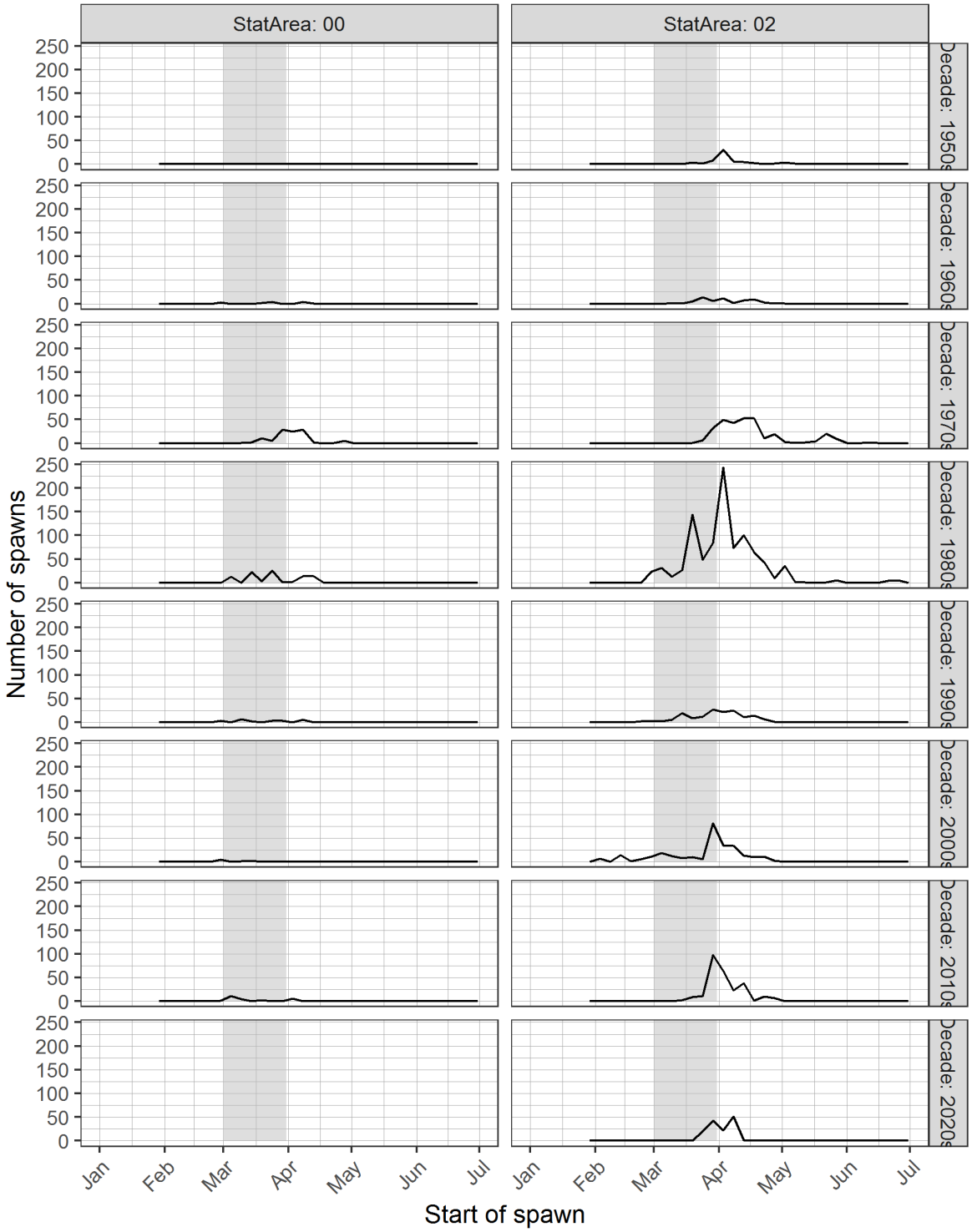


Figure 11. Pacific Herring spawn start date by decade and Statistical Area. Grey shaded regions indicate March 1st to 31st. Note that spawn size and intensity varies; therefore the number of spawns is not directly proportional to spawn extent or biomass.

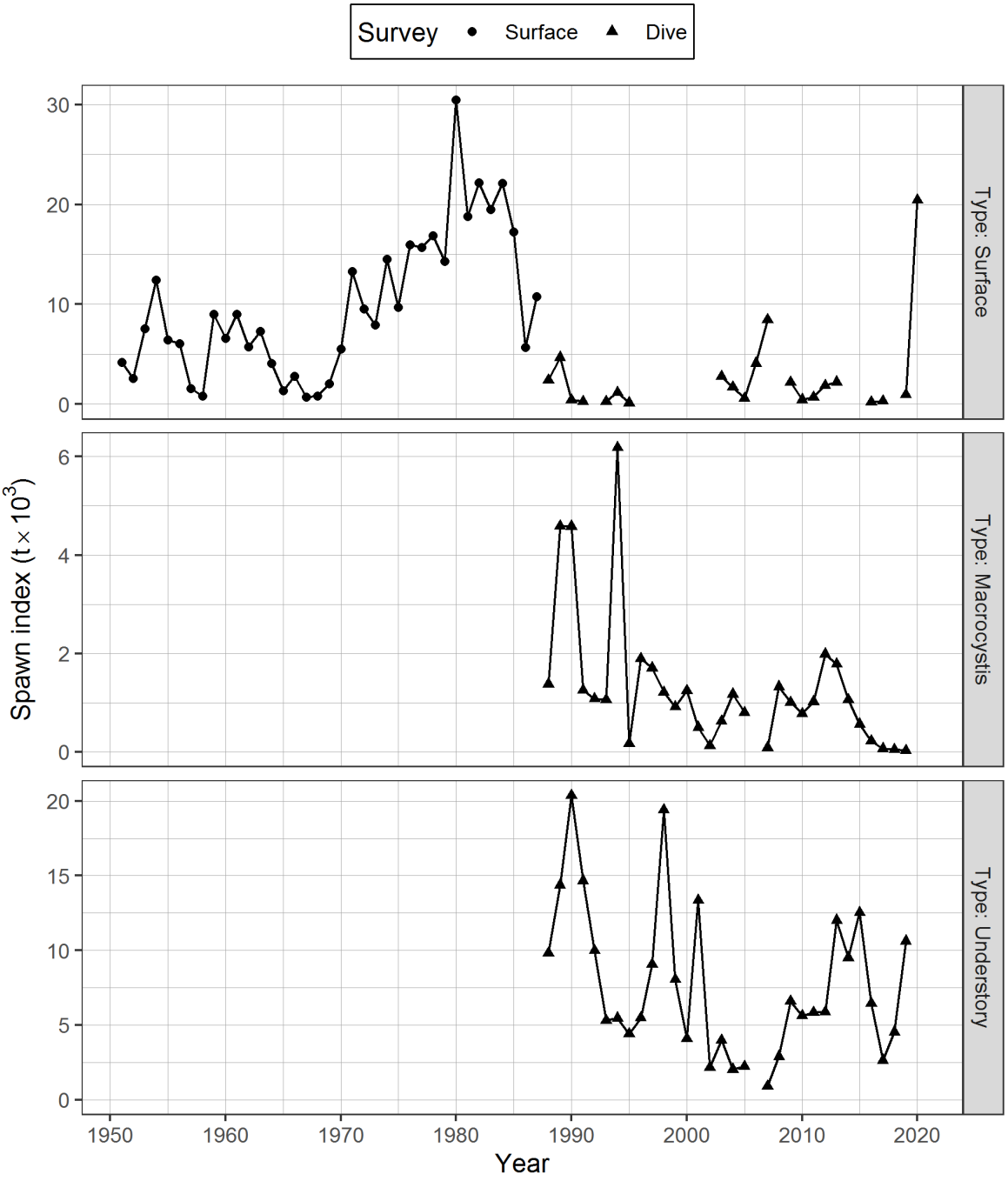


Figure 12. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) by type for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). There are three types of spawn survey observations: observations of spawn taken from the surface usually at low tide, 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 survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020).

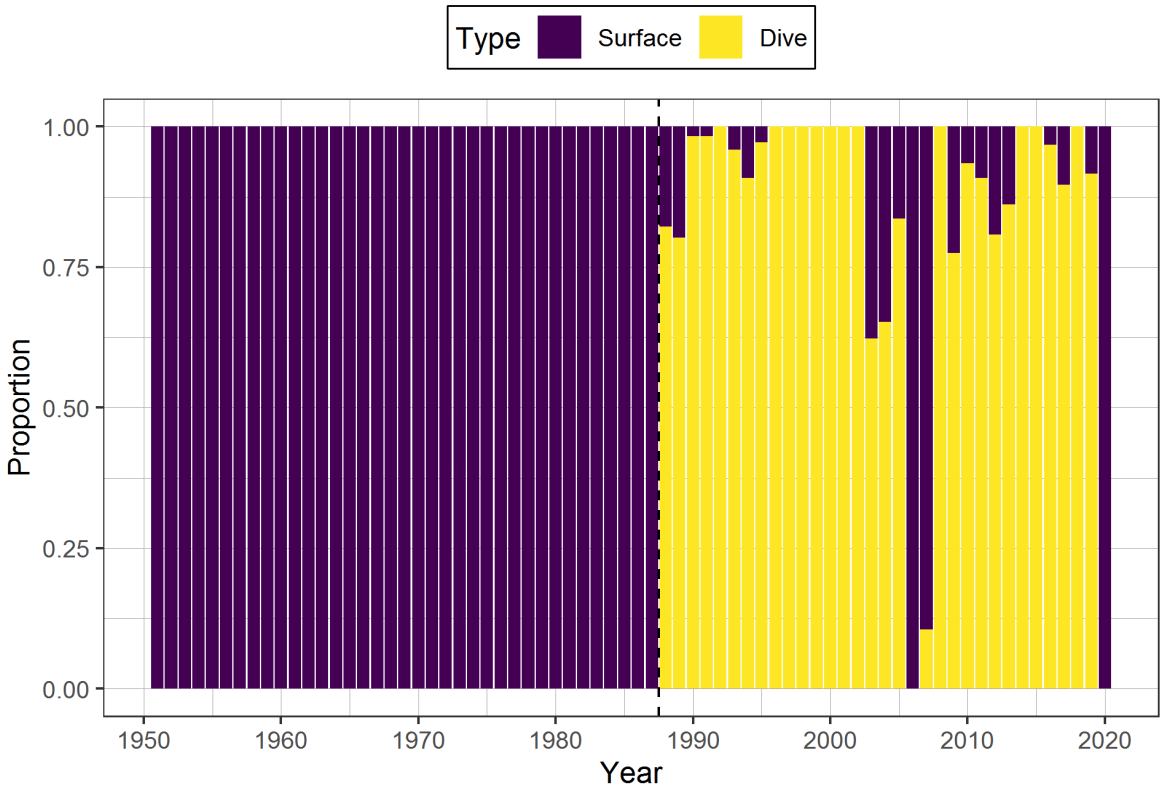


Figure 13. Time series of proportion of spawn index by surface and dive surveys for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020).

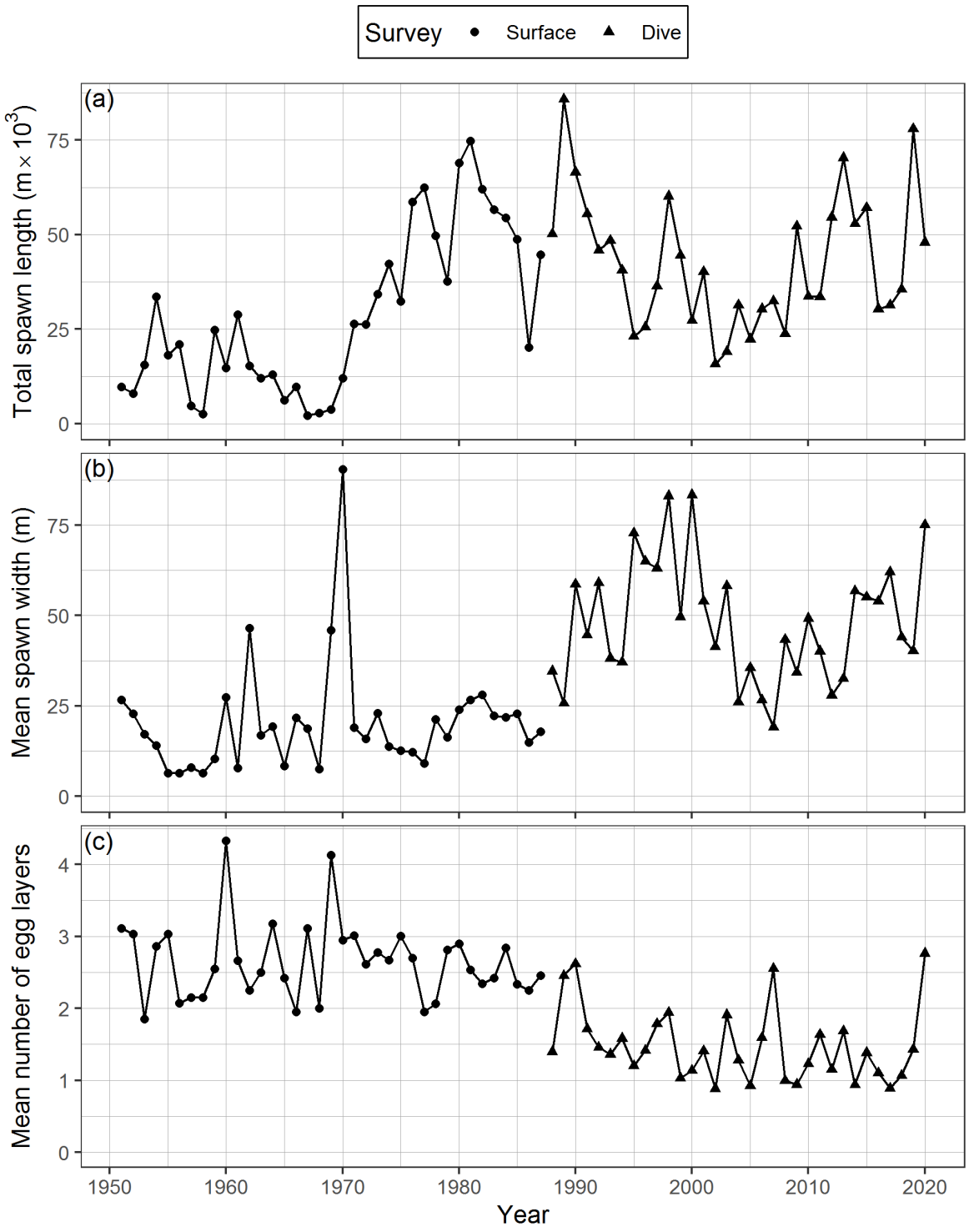


Figure 14. Time series of total spawn length in thousands of metres ($m \times 10^3$; panel a), mean spawn width in metres (b), and mean number of egg layers (c) for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020).

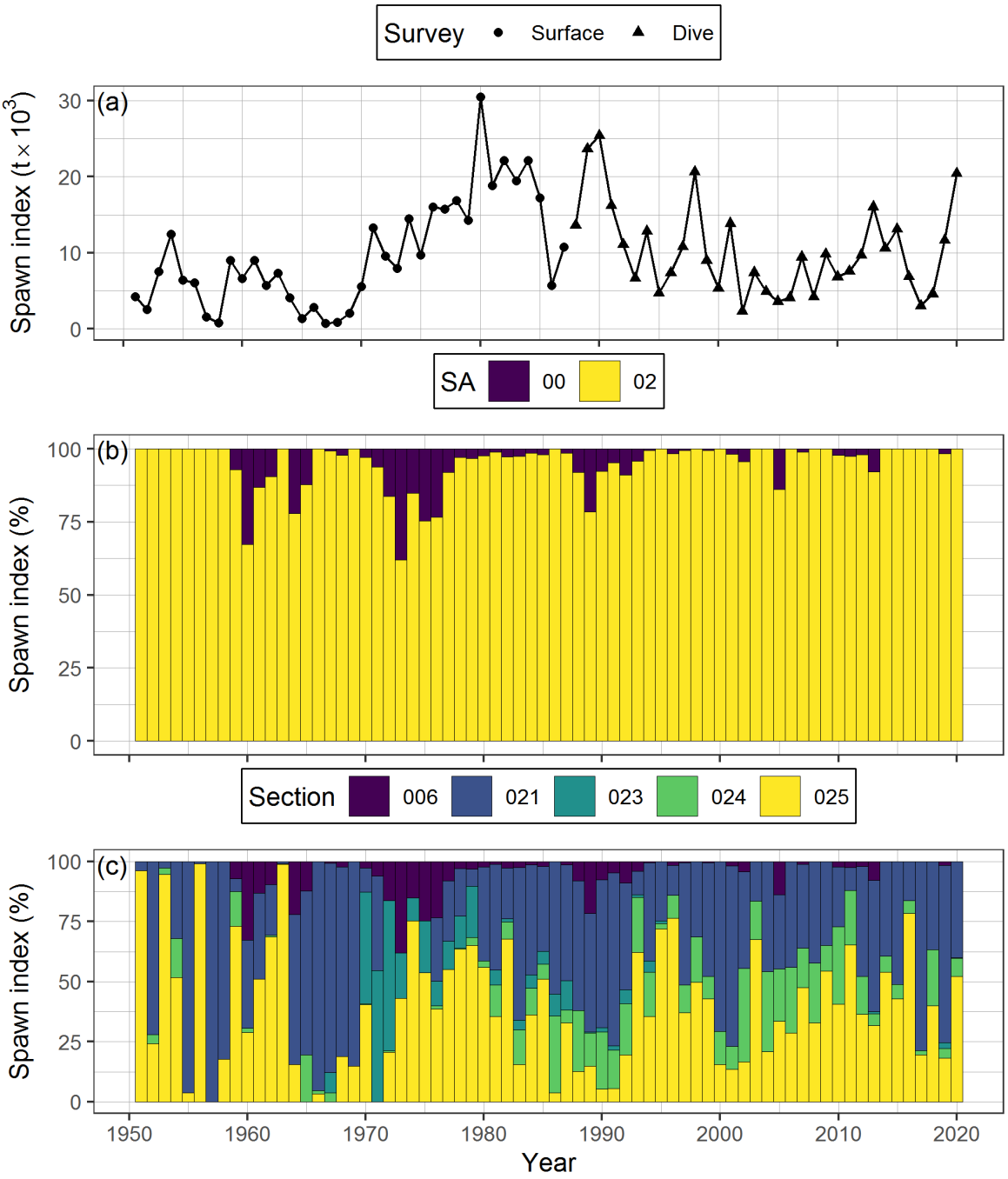


Figure 15. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR; panel a), as well as percent contributed by Statistical Area (SA), and Section (b, & c, respectively). The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$.

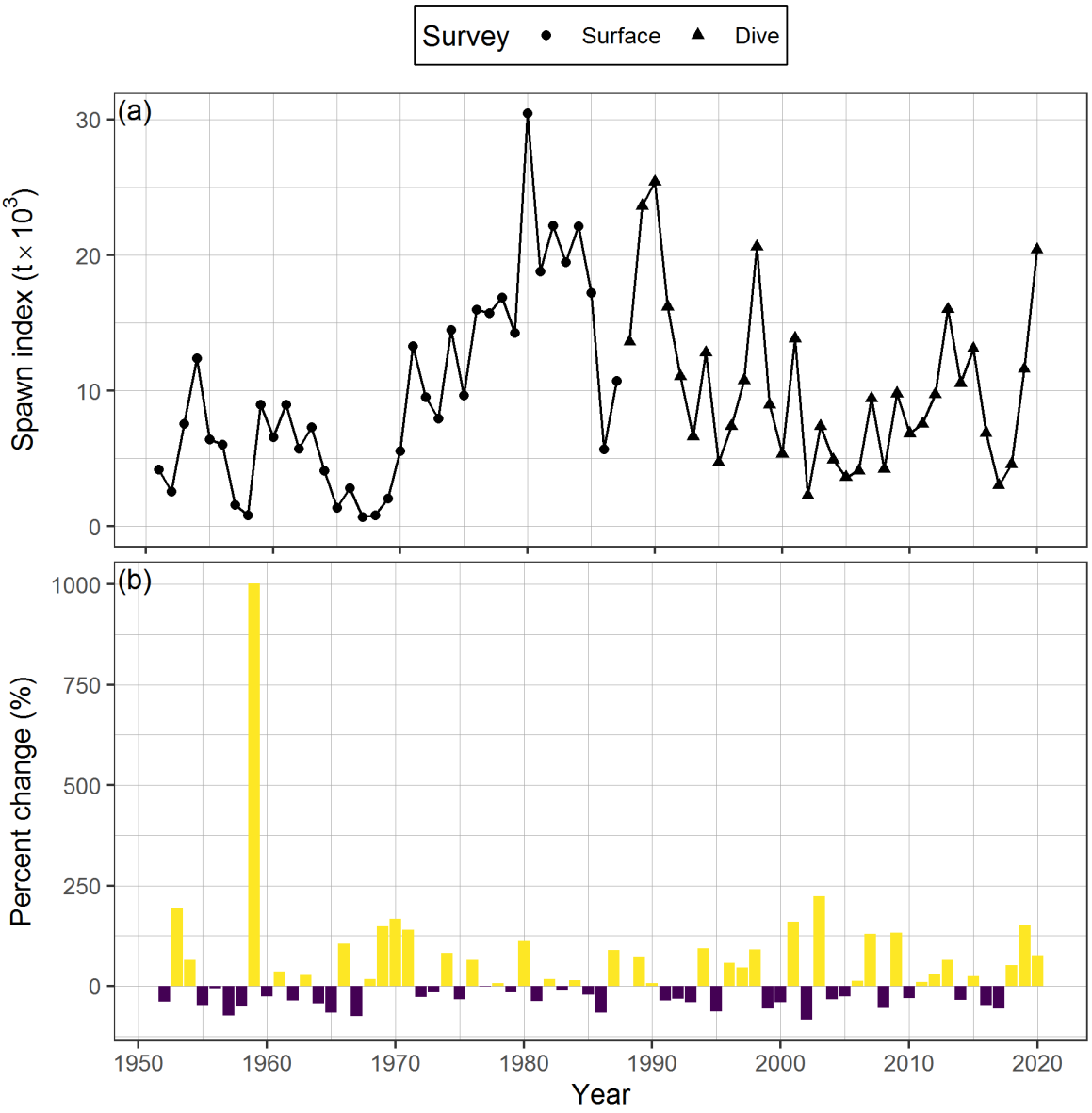


Figure 16. Time series of spawn index in thousands of metric tonnes ($t \times 10^3$) for Pacific Herring from1951 to 2020 in the Haida Gwaii major stock assessment region (SAR; panel a), and percent change (b). Percent change is $\delta_t = \frac{\alpha_t - \alpha_{t-1}}{\alpha_{t-1}}$ where $\alpha_t$ is the spawn index in year $t$. The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$.

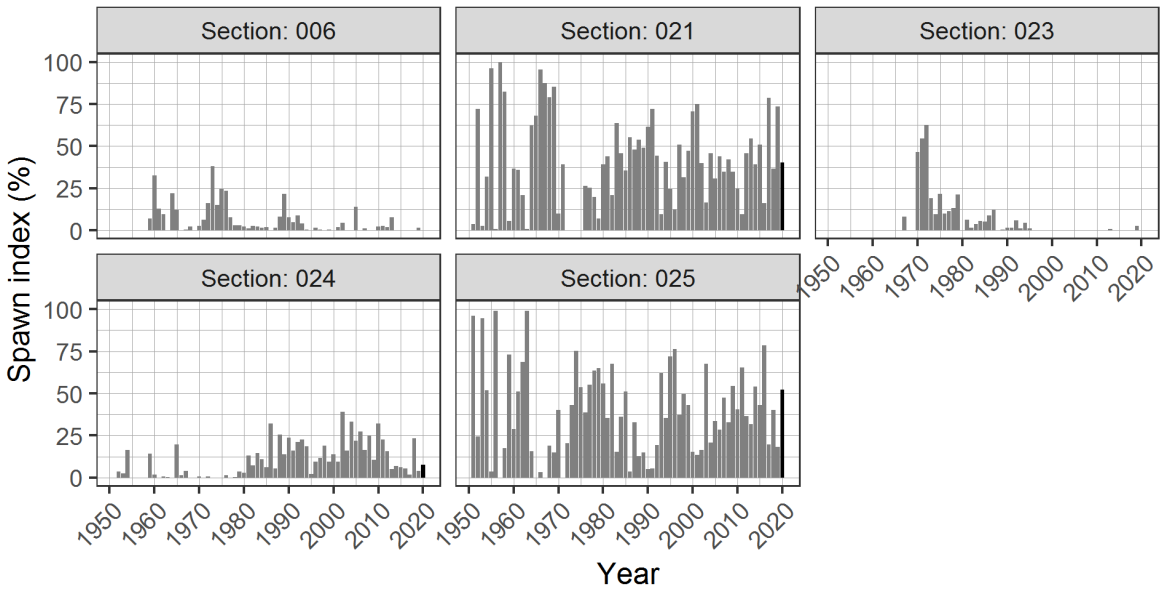


Figure 17. Time series of percent of spawn index by Section for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). The year 2020 has a darker bar to facilitate interpretation. The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$.

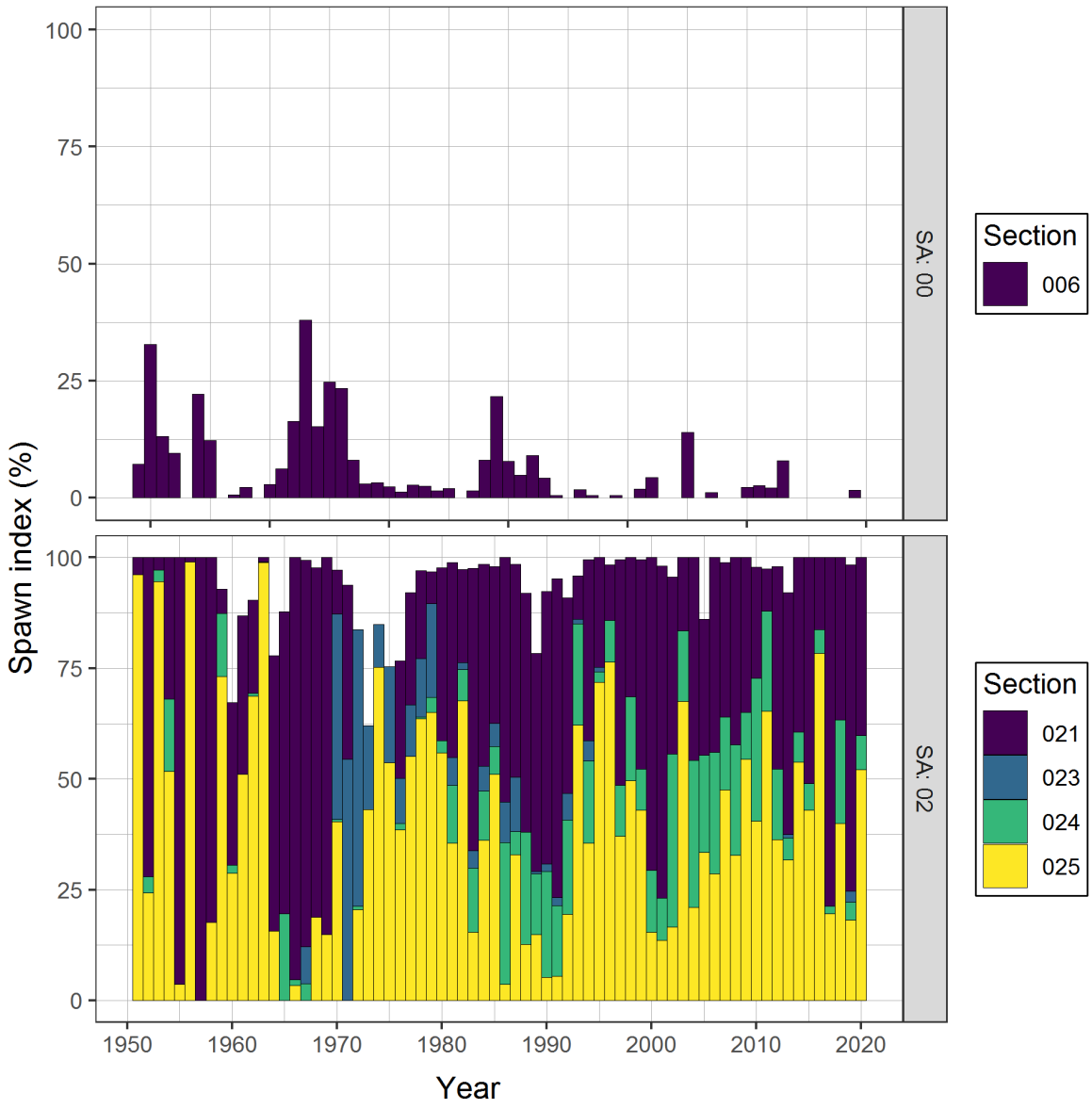


Figure 18. Time series of percent of spawn index by Statistical Area (SA) and Section for Pacific Herring from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR). The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$.

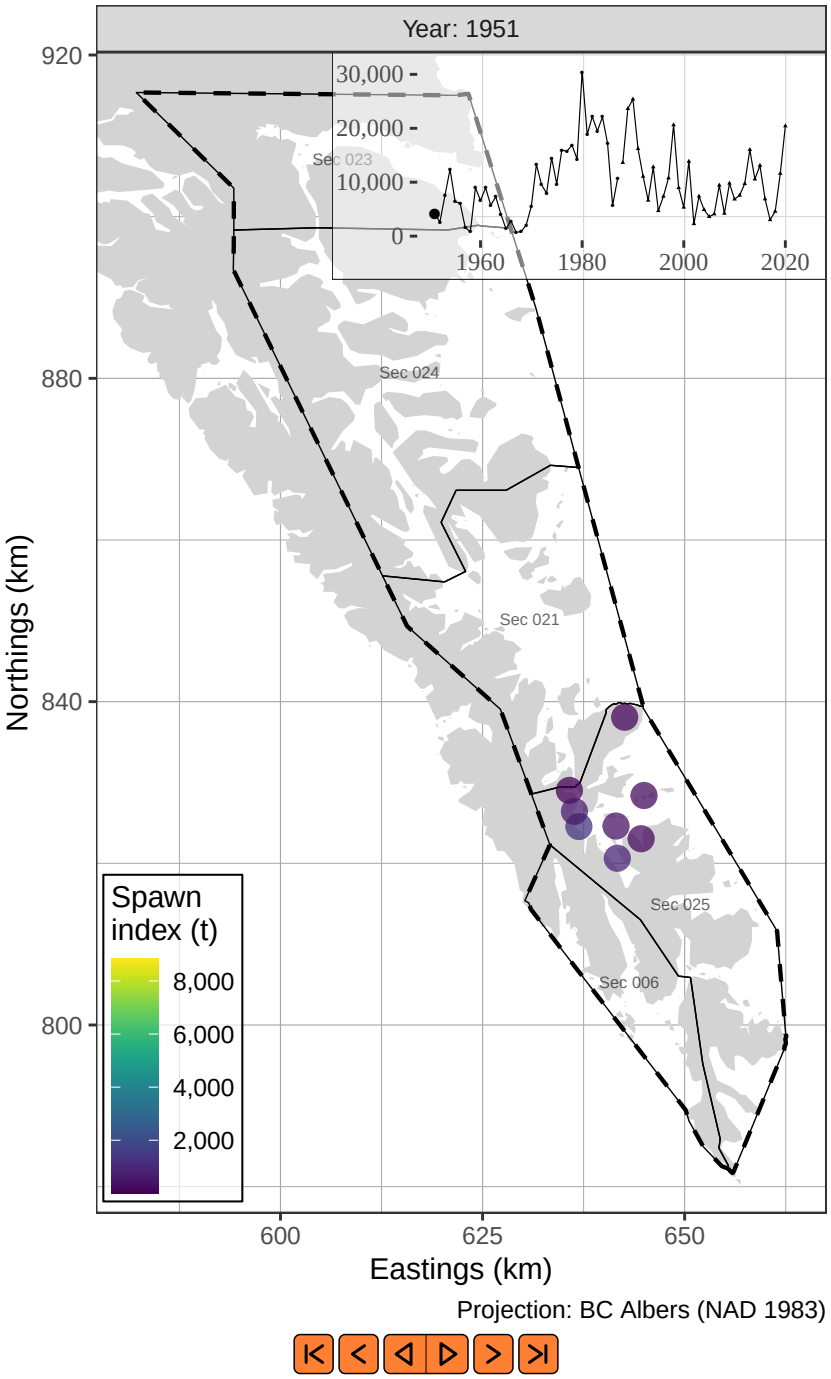


Figure 19. Animation of Pacific Herring spawn index in metric tonnes (t) by Location from 1951 to 2020 in the Haida Gwaii major stock assessment region (SAR; thick dashed lines), and associated Sections (Sec; thin solid lines). The spawn index has two distinct periods defined by the dominant survey method: surface surveys (1951 to 1987), and dive surveys (1988 to 2020). The 'spawn index' is not scaled by the spawn survey scaling parameter, $q$. Missing spawn index values (grey circles) indicate incomplete spawn surveys. Inset tracks time series of total spawn index. Units: kilometres (km).