

Environmental variables for the 2024 SEAK Pink Salmon Preseason Forecast

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October 2023

Objective

The overall objective is to test a variety of temperature variables, using satellite sea surface temperature (SST) data or Southeast Alaska Coastal Monitoring project (SECM) data, within the forecasting model framework to forecast the 2024 pink salmon harvest in southeast Alaska (SEAK). This write-up is a summary of available SST variables based on satellite data (i.e., average of May (May), the average over the months of May through July (MJJ), the average over the months of April through June (AMJ), or the average over the months of April through July (AMJJ) from 1997 through 2023) over four regions of SEAK; Icy Strait, Icy and Chatham Straits, northern southeast Alaska (NSEAK), and SEAK. This write-up also includes a summary of SECM survey data from various months (i.e., the average over the months of May, June, and July (MJJ)) at 20 m depths of the SECM transects (i.e., Icy Strait and Upper Chatham transects stations ISA, ISB, ISC, ISD, UCA, UCB, UCC, UCD) from 1997 through 2023.

Methods

Satellite-derived SST data

Satellite-derived sea surface temperature (SST) data from April 1997 through July 2023 were pulled from the 'SST and SST Anomaly, NOAA Global Coral Bleaching Monitoring, 5km, V.3.1, Monthly, 1985-Present' time series (https://coastwatch.pfeg.noaa.gov/erddap/griddap/NOAA_DHW_monthly.html; full citation in references). This satellite-derived SST data set was then matched to pre-determined coordinates from four spatial regions that corresponded with sixteen variables of interest (four regions; four temporal variables per region).

Satellite-derived SST variables

Icy_Strait_SST_May: The Icy Strait region encompasses waters of Icy Strait from the east end of Lemesurier Island to a line from Point Couverden south to Point Augusta. This variable is the average SST in May (Table 1; Figure 1; Figure 5a).

Icy_Strait_SST_MJJ: The Icy Strait region encompasses waters of Icy Strait from the east end of Lemesurier Island to a line from Point Couverden south to Point Augusta. This variable is the average SST in May through July (Table 1; Figure 1; Figure 5b).

Icy_Strait_SST_AMJ: The Icy Strait region encompasses waters of Icy Strait from the east end of Lemesurier Island to a line from Point Couverden south to Point Augusta. This variable is the average SST in April through June (Table 1; Figure 1; Figure 5c).

Icy_Strait_SST_AMJJ: The Icy Strait region encompasses waters of Icy Strait from the east end of Lemesurier Island to a line from Point Couverden south to Point Augusta. This variable is the average SST in April through July (Table 1; Figure 1; Figure 5d).

Chatham_SST_May: The Chatham and Icy Straits region encompasses waters of Chatham and Icy Straits east of Lemesurier Island to Point Couverden, and south to the approximate latitude of 56.025 degrees north (roughly Cape Decision off Kuiu Island) (Figure 2 and Figure 5a; Table 2). This variable is the average SST in May.

Chatham_SST_MJJ: The Chatham and Icy Straits region encompasses waters of Chatham and Icy Straits east of Lemesurier Island to Point Couverden, south to the approximate latitude of 56.025 degrees north (roughly Cape Decision off Kuiu Island) (Figure 2 and Figure 5b; Table 2). This variable is the average SST in May through July.

Chatham_SST_AMJ: The Chatham and Icy Straits region encompasses waters of Chatham and Icy Straits east of Lemesurier Island to Point Couverden, south to the approximate latitude of 56.025 degrees north (roughly Cape Decision off Kuiu Island) (Figure 2 and Figure 5c; Table 2). This variable is the average SST in April through June.

Chatham_SST_AMJJ: The Chatham and Icy Straits region encompasses waters of Chatham and Icy Straits east of Lemesurier Island to Point Couverden, south to the approximate latitude of 56.025 degrees north (roughly Cape Decision off Kuiu Island) (Figure 2 and Figure 5d; Table 2). This variable is the average SST in April through July.

NSEAK_SST_May: The NSEAK region encompasses northern Southeast Alaska from 59.475 to 56.075 degrees north latitude (approximately Districts 9 through 15, and District 13 inside area only; northern Southeast Inside subregion for Southeast Alaska (NSEI); Figure 3 and Figure 5a; Table 3). This variable is the average SST in May.

NSEAK_SST_MJJ: The NSEAK region encompasses northern Southeast Alaska from 59.475 to 56.075 degrees north latitude (approximately Districts 9 through 15, and District 13 inside area only; northern Southeast Inside subregion for Southeast Alaska (NSEI); Figure 3 and Figure 5b; Table 3). This variable is the average SST in May through July.

NSEAK_SST_AMJ: The NSEAK region encompasses northern Southeast Alaska from 59.475 to 56.075 degrees north latitude (approximately Districts 9 through 15, and District 13 inside area only; northern Southeast Inside subregion for Southeast Alaska (NSEI); Figure 3 and Figure 5c; Table 3). This variable is the average SST in April through June.

NSEAK_SST_AMJJ: The NSEAK region encompasses northern Southeast Alaska from 59.475 to 56.075 degrees north latitude (approximately Districts 9 through 15, and District 13 inside area only; northern Southeast Inside subregion for Southeast Alaska (NSEI); Figure 3 and Figure 5d; Table 3). This variable is the average SST in April through July.

SEAK_SST_May: The SEAK region encompasses Southeast Alaska from 59.475 to 54.725 degrees north latitude (Figure 4 and Figure 5a; Table 4). This variable is the average SST in May.

SEAK_SST_MJJ: The SEAK region encompasses northern Southeast Alaska from 59.475 to 54.725 degrees north latitude (Figure 4 and Figure 5b; Table 4). This variable is the average SST in May through July.

SEAK_SST_AMJ: The SEAK region encompasses Southeast Alaska from 59.475 to 54.725 degrees north latitude (Figure 4 and Figure 5c; Table 4). This variable is the average SST in April through June.

SEAK_SST_AMJJ: The SEAK region encompasses Southeast Alaska from 59.475 to 54.725 degrees north latitude (Figure 4 and Figure 5d; Table 4). This variable is the average SST in April through July.

SECM survey temperature data

SECM survey temperature data were summarized by year (1997 to 2023), month (average over the months of May, June, and July) at 20m depths for the Icy Strait and Upper Chatham transects combined.

SECM survey temperature variables

ISTI20__MJJ: Average temperature in the upper 20m during May through July at 8 stations in Icy Strait (Icy Strait and Upper Chatham transects; Figure 1; Figure 6; Table 5).

Results

Satellite-derived SST data

Satellite sea surface temperature data were summarized by region and year (i.e., average of May (May), the average over the months of May, June, and July (MJJ), the average over the months of April through June (AMJ), or the average over the months of April through July (AMJJ)) from 1997 to 2023 (Tables 1 through 4).

Table 1: Satellite sea temperature data from the Icy Strait region from 1997 to 2023 for the month of May (May), May through July (MJJ), April through June (AMJ), and April through July (AMJJ). There are 70 satellite stations (latitude/longitude combinations) in the Icy Strait region.

year	Icy_Strait_SST_MJJ	Icy_Strait_SST_May	Icy_Strait_SST_AMJJ	Icy_Strait_SST_AMJ
1997	10.30	7.01	8.83	7.30
1998	9.97	7.34	8.85	7.56
1999	9.08	6.17	8.02	6.78
2000	9.94	7.02	8.67	7.35
2001	9.57	6.48	8.40	7.08
2002	9.34	6.26	8.02	6.60
2003	10.08	7.29	8.88	7.53
2004	10.68	7.53	9.25	7.69
2005	11.16	8.40	9.64	8.26
2006	10.19	6.84	8.86	7.49
2007	9.49	6.55	8.16	6.87
2008	8.85	6.43	7.72	6.68
2009	9.94	7.19	8.47	7.22
2010	9.87	7.71	8.68	7.81
2011	9.84	6.81	8.47	7.18
2012	9.23	6.92	8.10	7.07
2013	9.88	6.37	8.45	6.97
2014	10.23	7.90	8.81	7.62
2015	10.73	8.34	9.43	8.29
2016	11.65	8.81	10.37	9.14
2017	9.82	7.22	8.66	7.51
2018	9.99	6.92	8.74	7.43
2019	10.74	7.79	9.51	8.10
2020	10.40	7.83	9.05	7.86
2021	10.26	6.91	8.91	7.47
2022	10.34	7.13	8.88	7.40
2023	9.72	7.13	8.43	7.10

Table 2: Satellite sea temperature data from the Chatham and Icy Straits region from 1997 to 2023 for the month of May (May), May through July (MJJ), April through June (AMJ), and April through July (AMJJ). There are 313 satellite stations (latitude/longitude combinations) in the Chatham and Icy Straits region.

year	Chatham_SST_MJJ	Chatham_SST_May	Chatham_SST_AMJJ	Chatham_SST_AMJ
1997	10.08	7.48	8.83	7.59
1998	9.85	7.83	8.91	7.88
1999	8.90	6.84	8.05	7.12
2000	9.70	7.34	8.62	7.52
2001	9.15	6.74	8.18	7.12
2002	8.97	6.39	7.85	6.64
2003	9.92	7.71	8.90	7.85
2004	10.43	7.94	9.22	7.96
2005	10.67	8.51	9.48	8.44
2006	9.78	7.16	8.68	7.58
2007	9.52	7.04	8.41	7.27
2008	8.65	6.77	7.69	6.83
2009	9.75	7.30	8.46	7.35
2010	9.65	7.97	8.66	7.93
2011	9.59	7.31	8.49	7.55
2012	9.17	7.07	8.18	7.22
2013	9.66	6.74	8.44	7.21
2014	9.98	8.17	8.76	7.77
2015	10.62	8.87	9.55	8.73
2016	11.04	8.92	10.03	9.07
2017	9.65	7.65	8.70	7.76
2018	9.87	7.40	8.75	7.61
2019	10.47	8.24	9.46	8.35
2020	9.99	8.09	8.84	7.86
2021	10.06	7.25	8.90	7.63
2022	10.17	7.52	8.92	7.64
2023	9.80	7.53	8.61	7.40

Table 3: Satellite sea temperature from the northern Southeast Alaska (NSEAK) region from 1997 to 2023 for the month of May (May), May through July (MJJ), April through June (AMJ), and April through July (AMJJ). There are 1,344 satellite stations (latitude/longitude combinations) in the NSEAK region.

year	NSEAK_SST_MJJ	NSEAK_SST_May	NSEAK_SST_AMJJ	NSEAK_SST_AMJ
1997	10.02	7.35	8.71	7.40
1998	9.89	7.65	8.85	7.71
1999	8.93	6.70	7.98	6.95
2000	9.70	7.23	8.57	7.39
2001	9.22	6.66	8.17	7.01
2002	9.05	6.39	7.88	6.61
2003	9.86	7.57	8.76	7.60
2004	10.38	7.89	9.09	7.79
2005	10.63	8.42	9.35	8.26
2006	9.72	6.98	8.55	7.36
2007	9.44	6.90	8.24	7.03
2008	8.65	6.64	7.63	6.74
2009	9.77	7.32	8.40	7.24
2010	9.62	7.76	8.54	7.72
2011	9.67	7.25	8.44	7.44
2012	9.14	6.95	8.09	7.10
2013	9.67	6.59	8.36	7.04
2014	10.03	8.15	8.70	7.64
2015	10.81	8.92	9.56	8.65
2016	11.18	8.92	10.05	9.00
2017	9.82	7.75	8.77	7.78
2018	10.11	7.53	8.86	7.63
2019	10.87	8.42	9.65	8.44
2020	10.23	8.26	8.98	7.94
2021	10.23	7.29	8.96	7.65
2022	10.52	7.62	9.11	7.74
2023	9.98	7.53	8.69	7.41

Table 4: Satellite sea temperature from the Southeast Alaska (SEAK) region from 1997 to 2023 for the month of May (May), May through July (MJJ), April through June (AMJ), and April through July (AMJJ). There are 2,663 satellite stations (latitude/longitude combinations) in the SEAK region.

year	SEAK_SST_MJJ	SEAK_SST_May	SEAK_SST_AMJJ	SEAK_SST_AMJ
1997	10.47	8.00	9.20	7.99
1998	10.36	8.37	9.38	8.37
1999	9.30	7.23	8.40	7.43
2000	10.02	7.71	8.95	7.86
2001	9.51	7.10	8.52	7.45
2002	9.44	6.92	8.33	7.14
2003	10.32	8.17	9.25	8.16
2004	10.98	8.58	9.74	8.51
2005	11.06	8.92	9.83	8.82
2006	10.19	7.63	9.07	7.96
2007	9.99	7.51	8.82	7.64
2008	9.18	7.22	8.17	7.28
2009	10.20	7.76	8.85	7.73
2010	10.09	8.28	9.05	8.23
2011	10.05	7.74	8.88	7.92
2012	9.68	7.47	8.63	7.61
2013	10.39	7.51	9.10	7.85
2014	10.57	8.62	9.26	8.17
2015	11.43	9.64	10.21	9.32
2016	11.67	9.61	10.59	9.59
2017	10.31	8.25	9.28	8.29
2018	10.79	8.28	9.54	8.30
2019	11.46	9.01	10.25	9.05
2020	10.70	8.90	9.52	8.53
2021	10.82	7.97	9.58	8.31
2022	11.04	8.22	9.68	8.38
2023	10.68	8.21	9.35	8.04

SECM survey temperature data

SECM survey temperature data were summarized by year (1997 to 2023), month (average over the months of May, June, and July) at 20m depths; Table 5).

Table 5: The SECM survey temperature data were summarized by year (1997 to 2023), month (the months of May, June, and July; MJJ) at 20m depths for the Icy Strait and Upper Chatham transects (stations ISA, ISB, ISC, ISD, UCA, UCB, UCC, UCD).

Year	ISTI20_MJJ
1997	9.275
1998	9.398
1999	8.560
2000	8.770
2001	9.026
2002	8.200
2003	9.308
2004	9.333
2005	10.206
2006	8.751
2007	8.936
2008	7.912
2009	9.357
2010	9.353
2011	8.653
2012	8.477
2013	8.835
2014	9.120
2015	9.607
2016	10.199
2017	8.561
2018	8.925
2019	9.911
2020	8.888
2021	8.886
2022	8.984
2023	8.923

Acknowledgements

Jordan Watson (NOAA) helped with the code to process the satellite data into a usable format. The data was accessed through NOAA’s Coral Reef Watch (https://coastwatch.pfeg.noaa.gov/erddap/griddap/NOAA_DHW_monthly.html and https://coastwatch.pfeg.noaa.gov/erddap/griddap/NOAA_DHW.html). Emily Fergusson summarized the SECM survey data by year, month, and depth. All code and associated data are located here: https://github.com/commfish/southeast_pink_salmon_preseason in the 2023_forecast folder.

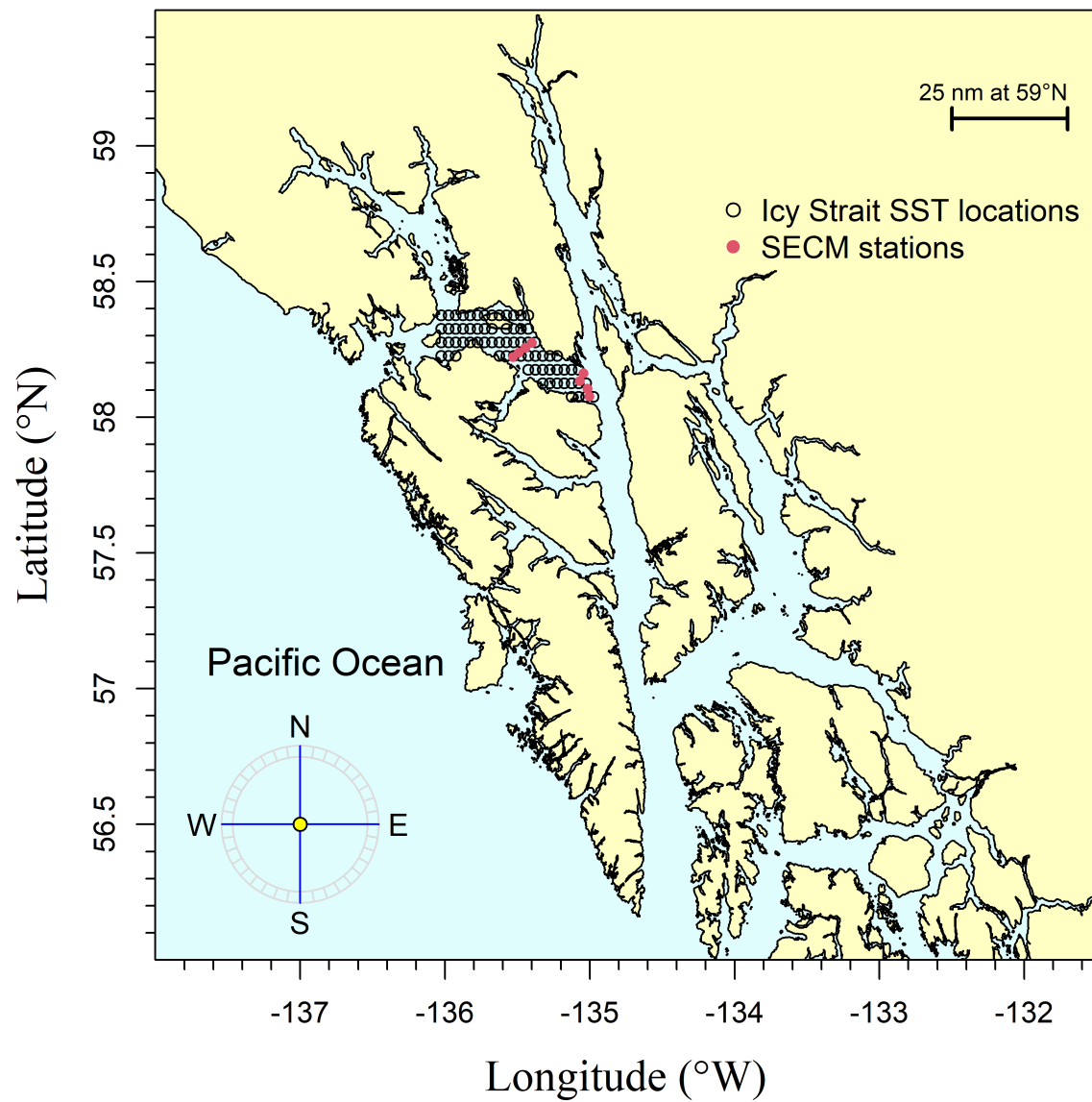


Figure 1: The Icy Strait region encompasses waters of Icy Strait from the east end of Lemesurier Island to a line from Point Couverden south to Point Augusta. The Southeast Coastal Monitoring (SECM) project transects (Upper Chatham Strait and Icy Strait) are shown as red points for comparison to the satellite stations (i.e., data points; black circles).

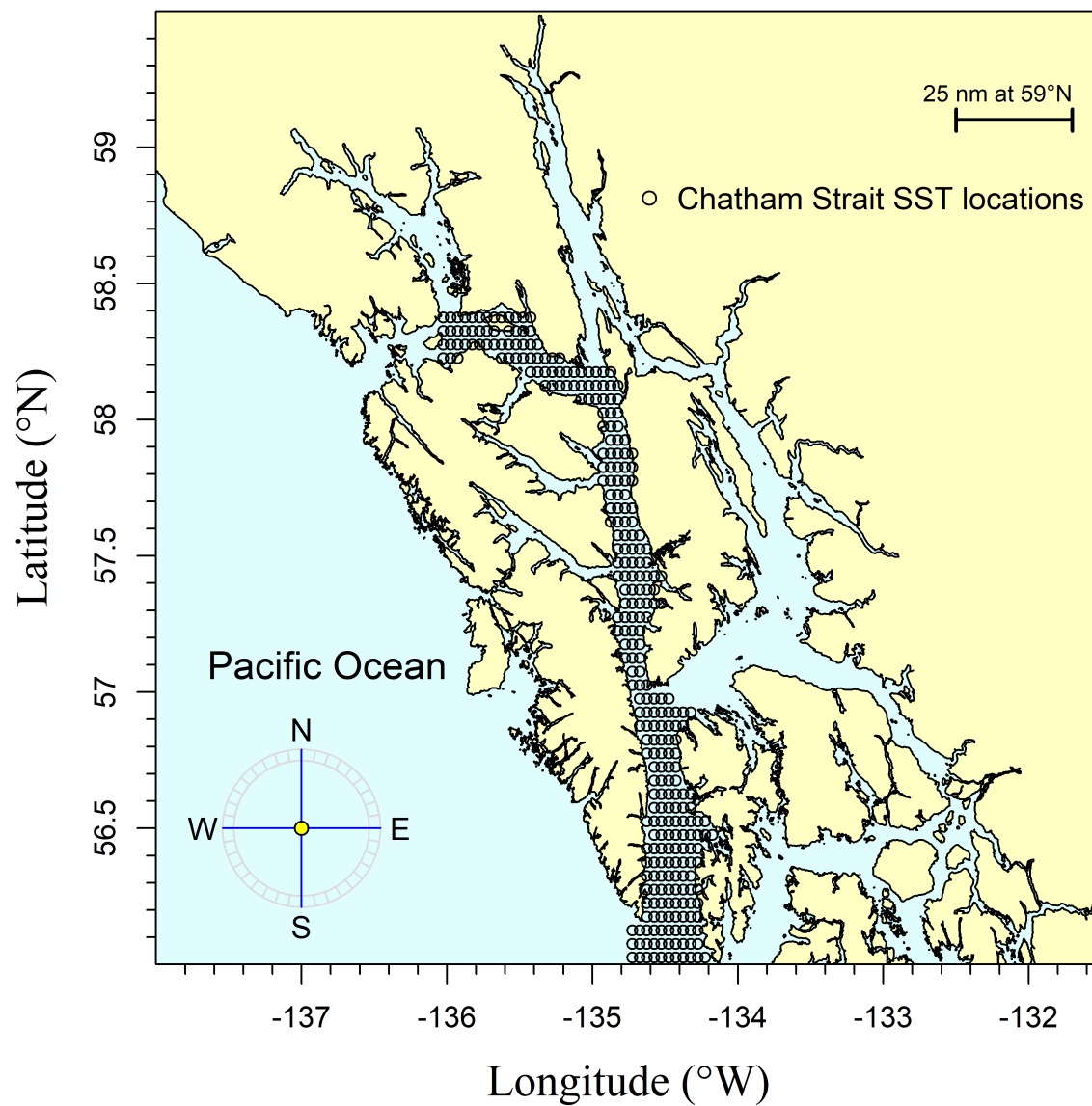


Figure 2: The Chatham and Icy Straits region encompasses waters of Chatham and Icy Straits east of Lemesurier Island to Point Couverden, south to the approximate latitude of 56.025 degrees north (roughly Cape Decision off Kuiu Island). The black circles are the satellite stations (i.e., data points).

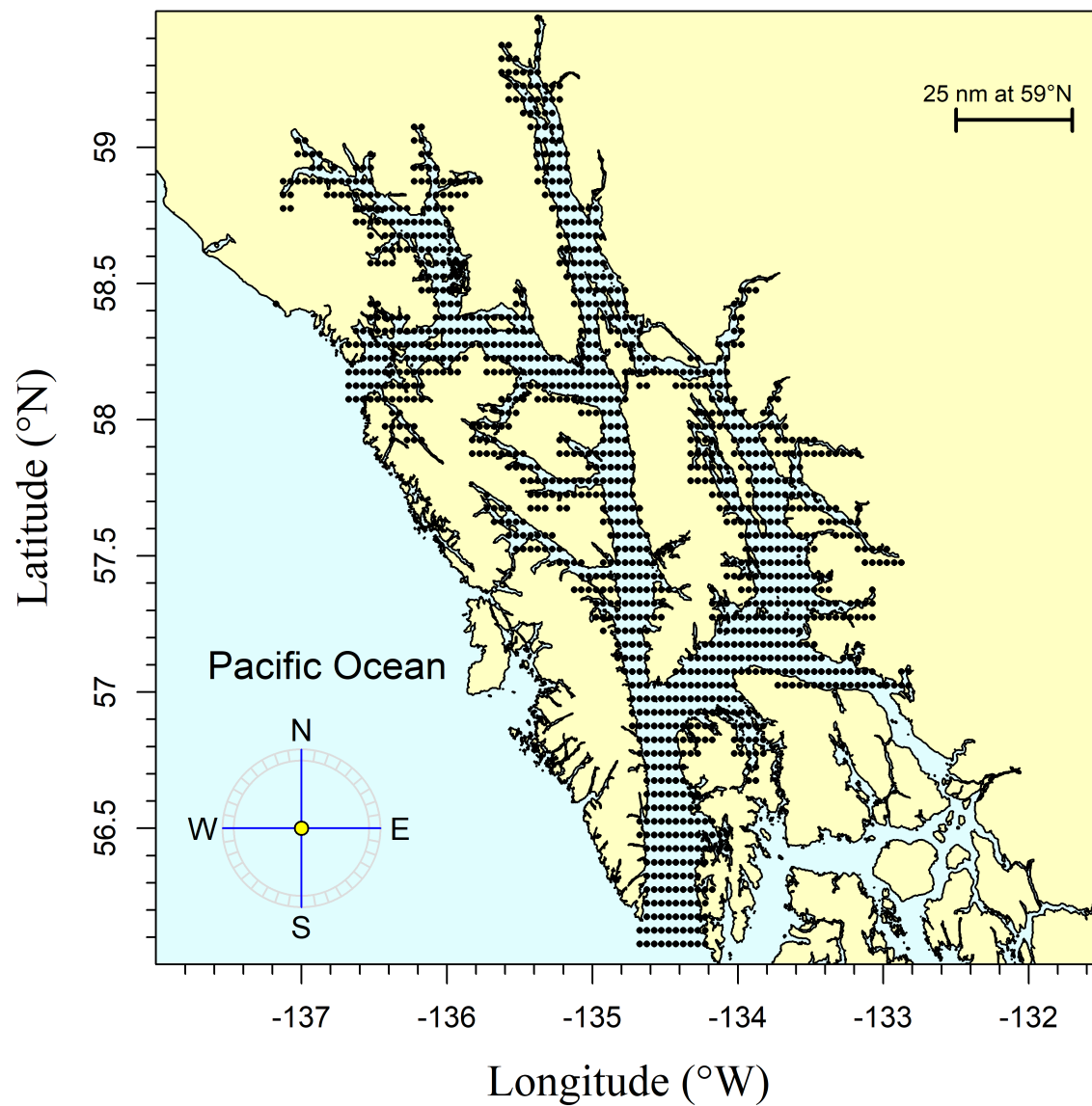


Figure 3: The northern Southeast Alaska (NSEAK) region encompasses northern Southeast Alaska from 59.475 to 56.075 degrees north latitude and from -137.175 to -132.825 degrees west longitude. The black circles are the satellite stations (i.e., data points).

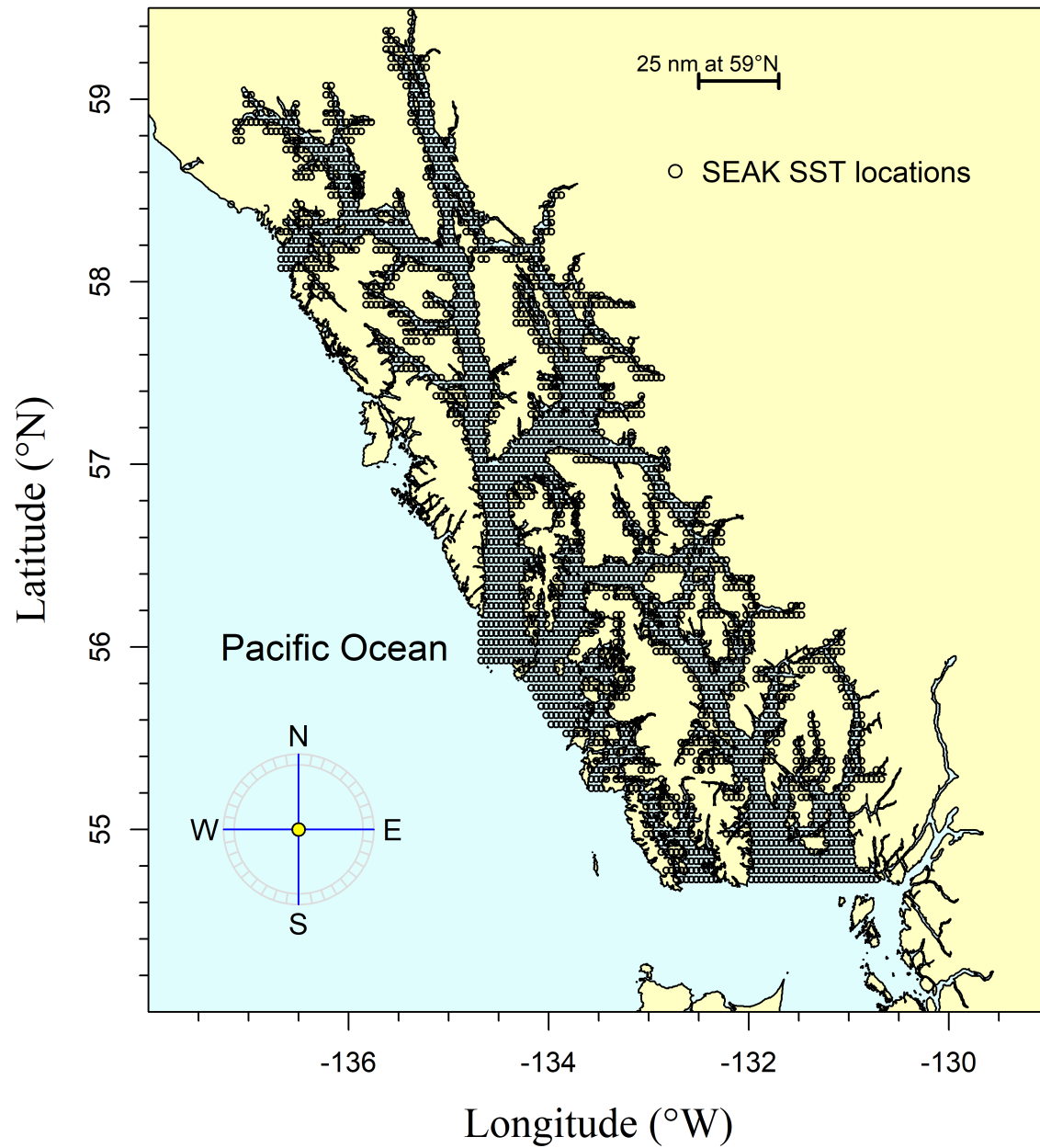


Figure 4: The Southeast Alaska (SEAK) region encompasses Southeast Alaska from 59.475 to 54.725 degrees north latitude and from -137.175 to -130.675 degrees west longitude. The black circles are the satellite stations (i.e., data points).

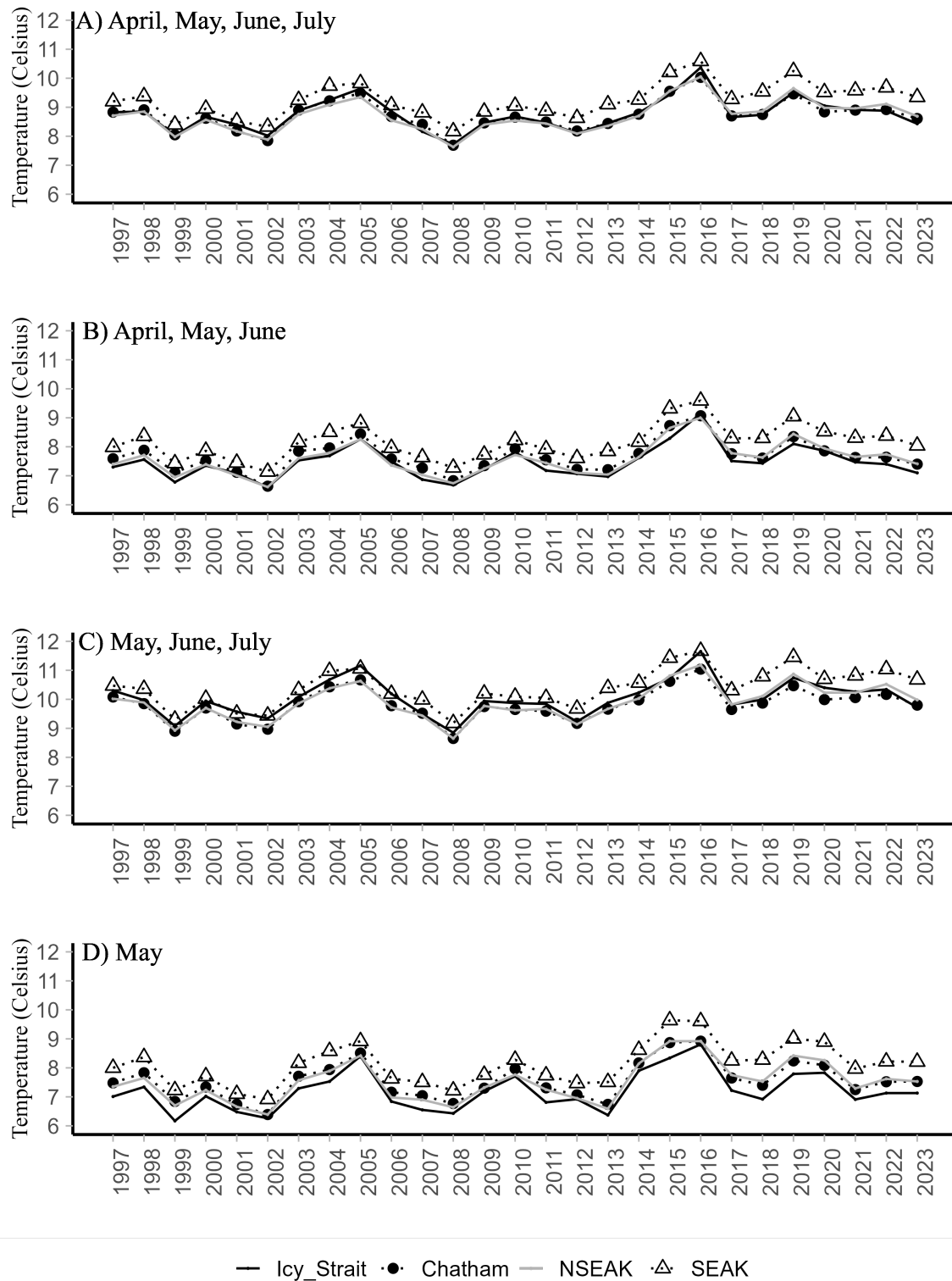


Figure 5: A. The May temperature averaged over each region (Chatham and Icy Straits, Icy Strait, NSEAK, SEAK) from 1997 through 2023. B. The May, June, and July temperature averaged over each region (Chatham and Icy Straits, Icy Strait, NSEAK, SEAK) from 1997 through 2023. C. The April through June temperature averaged over each region (Chatham and Icy Straits, Icy Strait, NSEAK, SEAK) from 1997 through 2023. D. The April through July temperature averaged over each region (Chatham and Icy Straits, Icy Strait, NSEAK, SEAK) from 1997 through 2023.

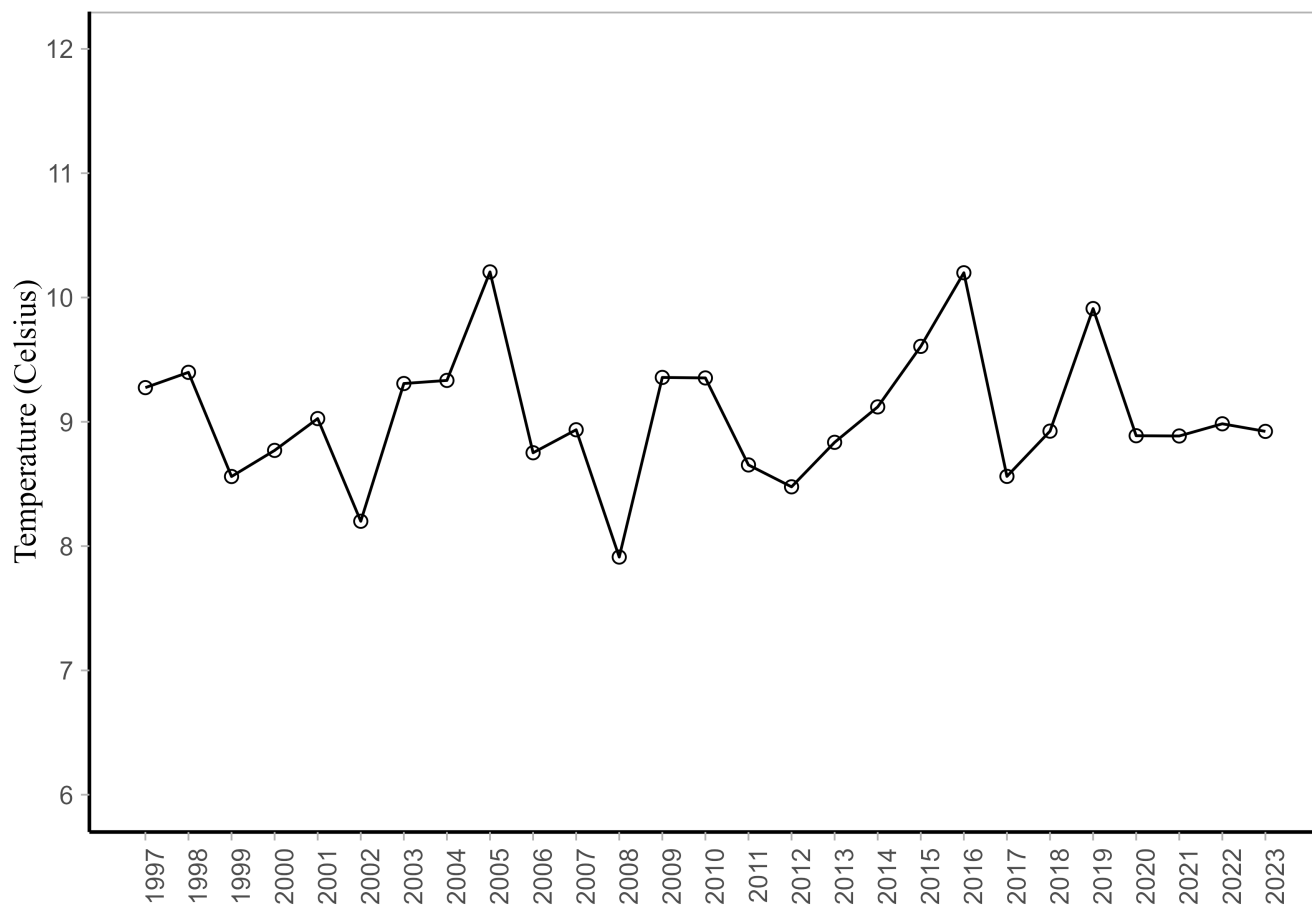


Figure 6: Average temperature (degrees Celsius) at 20m during May, June, and July at 8 stations in Icy Strait (Icy Strait and Upper Chatham transects; ISTI) from 1997 through 2023.

References

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