Juvenile salmon migration report; Discovery Islands

— Hakai Institute Juvenile Salmon Program 2022 —

Aim

To provide a rapid end of season summary of juvenile salmon migration characteristics and oceanographic conditions in the Discovery Islands and northern Strait of Georgia region in British Columbia, Canada.

Background

The Hakai Institute Juvenile Salmon Program was launched in the spring of 2015. For a complete background including methods see Hunt et al. 2018. The program operates in the Discovery Islands (Figure 1) and thus provides information on the health of juvenile salmon after passage through:

1) Strait of Georgia – stratified high plankton biomass zone; and
2) Discovery Islands – highly-mixed low-plankton-biomass zone, and area of, historically, high potential for wild-farmed fish interactions.

Program Objectives

1) Determine migration timing and relative abundance;
2) Map migration habitat - oceanographic conditions along the migration route;
3) Understand the dynamics of the plankton food-webs that underpin juvenile salmon growth and health;
4) Understand parasite and pathogen infection dynamics and their impact on juvenile salmon growth and health.

Key Parameters Reported

- Catch Statistics
- Lengths
- Parasite Loads
- Ocean Temperatures

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The following plots are subject to change as the underlying data are preliminary and subject to further quality assurance. The Hakai Institute embraces an "Open Science Policy"; to that end you can access the time series data used in this report at http://dx.doi.org/10.21966/1.566666.

Figure 1: Locations of seining and oceanographic stations surveyed in 2022.

Migration Timing

We captured very few sockeye in 2022, so it is not feasible to calculate migration timing for sockeye as done in previous years.

Table 1. Summary of sampling events conducted in 2022 in the Discovery Islands and totals of sockeye, pink, and chum salmon caught. Note NA indicates the net was not set.

Survey Date	Site ID	Site	Sockeye	Pink	Chum
2022-05-16	D09	Okisollo Channel	0	0	0
2022-05-16	D09	Okisollo Channel	0	0	0
2022-05-17	D27	Granite Point	0	0	0
2022-05-17	D27	Granite Point	0	0	0
2022-05-24	D09	Okisollo Channel	0	0	0
2022-05-24	D09	Okisollo Channel	0	55	24
2022-05-24	D09	Okisollo Channel	0	933	113
2022-05-27	D10	Hall Point	NA	NA	NA
2022-05-27	D35	Denham Bay	NA	NA	NA
2022-05-30	D09	Okisollo Channel	0	164	296
2022-05-31	D27	Granite Point	0	730	190
2022-06-06	D09	Okisollo Channel	0	0	0
2022-06-06	D09	Okisollo Channel	0	0	0
2022-06-06	D09	Okisollo Channel	1	418	112
2022-06-10	D10	Hall Point	0	0	0
2022-06-13	D09	Okisollo Channel	0	123	85
2022-06-14	D27	Granite Point	1	74	52
2022-06-17	D10	Hall Point	7	789	343
2022-06-20	D09	Okisollo Channel	40	690	306
2022-06-24	D10	Hall Point	0	60	3
2022-06-28	D09	Okisollo Channel	1	78	57
2022-06-28	D09	Okisollo Channel	0	0	0
2022-06-29	D27	Granite Point	0	302	4
2022-07-04	D09	Okisollo Channel	0	0	0
2022-07-04	D09	Okisollo Channel	1	572	14
2022-07-07	D10	Hall Point	28	2624	64

Catch Intensity

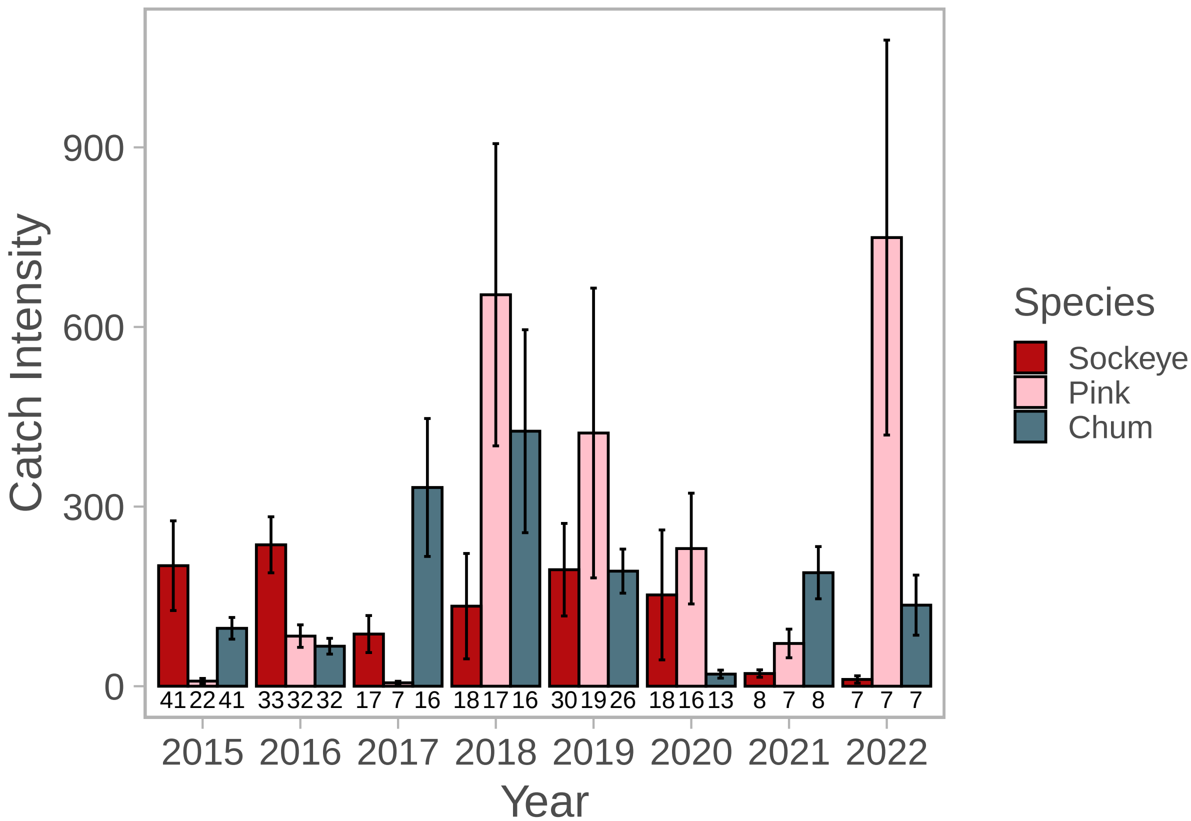

Figure 2: The catch intensity (average number of species i when i > 0 and when sockeye were also caught) of sockeye, pink, and chum salmon in the Discovery Islands. Numbers under each bar indicate the number of seines in which sockeye were caught, and error bars indicate 1 standard error.

Species Proportion

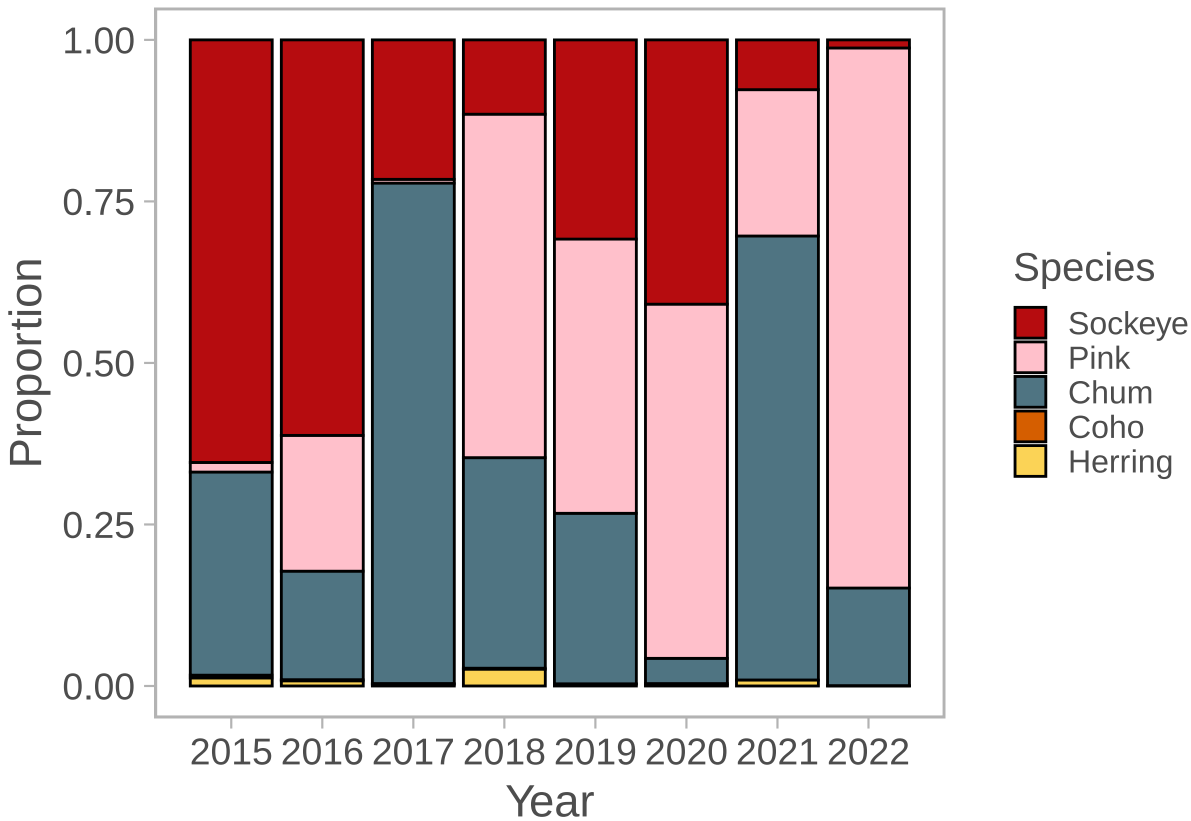

Figure 3: Proportion of juvenile salmon species and herring caught in the Discovery Islands from 2015-2022.

Fish lengths

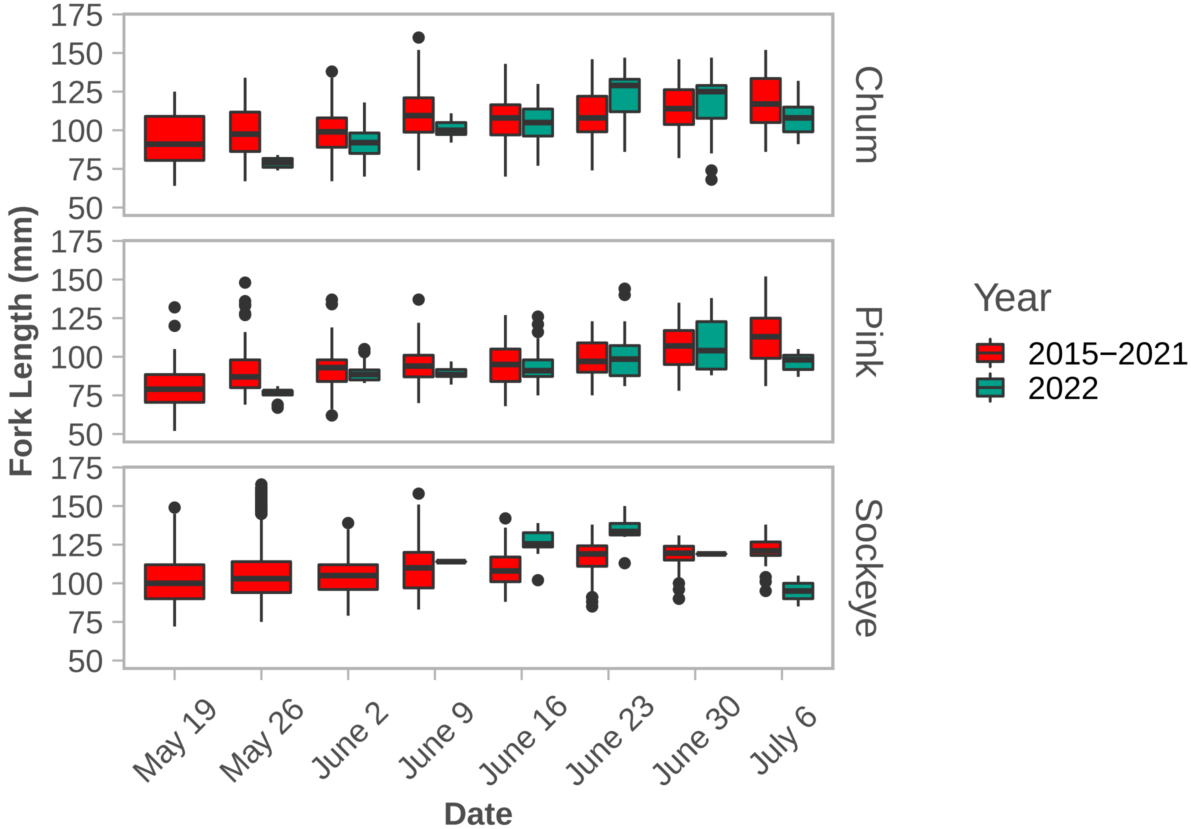

Figure 4: Fork-length boxplots of juvenile salmon in the Discovery Islands in 2022 grouped by week, and represented by the middle day of each week, compared to all lengths from 2015-2021.

Parasite Loads

In 2022 we resumed enumerating both attached and motile sea lice in the field using hand lenses (Krkosek et al. 2005) after switching in 2020 to enumerating only motile sea lice under a dissecting microscope in the lab. As a result, our time series for attached stage lice excludes some years and species of salmon. Here we present the abundance and prevalence of attached stage lice in 2015, 2017, 2018, 2019, and 2022. Our time series for parasite loads is complete for motile sealice on sockeye, pink and chum spanning 2015-2022.

Note that species identification of attached chalimus sea lice stages was not conducted in the field. Instead species proportions of chalimus staged were inferred based on the ratio of species in the copepodite and motile stages in each year.

Definitions[1]

Abundance: The total number of individuals of a particular parasite species in a sample of hosts ÷ Total number of individuals of the host species in the sample (Average number of lice per fish).

Prevalence: Number of individuals of a host species infected with a particular parasite species and louse life stage ÷ Number of hosts examined for that particular louse life stage (Proportion of fish infected with lice).

[1] Margolis, L., Esch, G.W., Holmes, J.C., Kuris, A.M. and Schad, G.A. (1982). The use of ecological terms in parasitology: report of an ad hoc committee of the American Society of Parasitologists. J. Parasitol. 68:131–133.

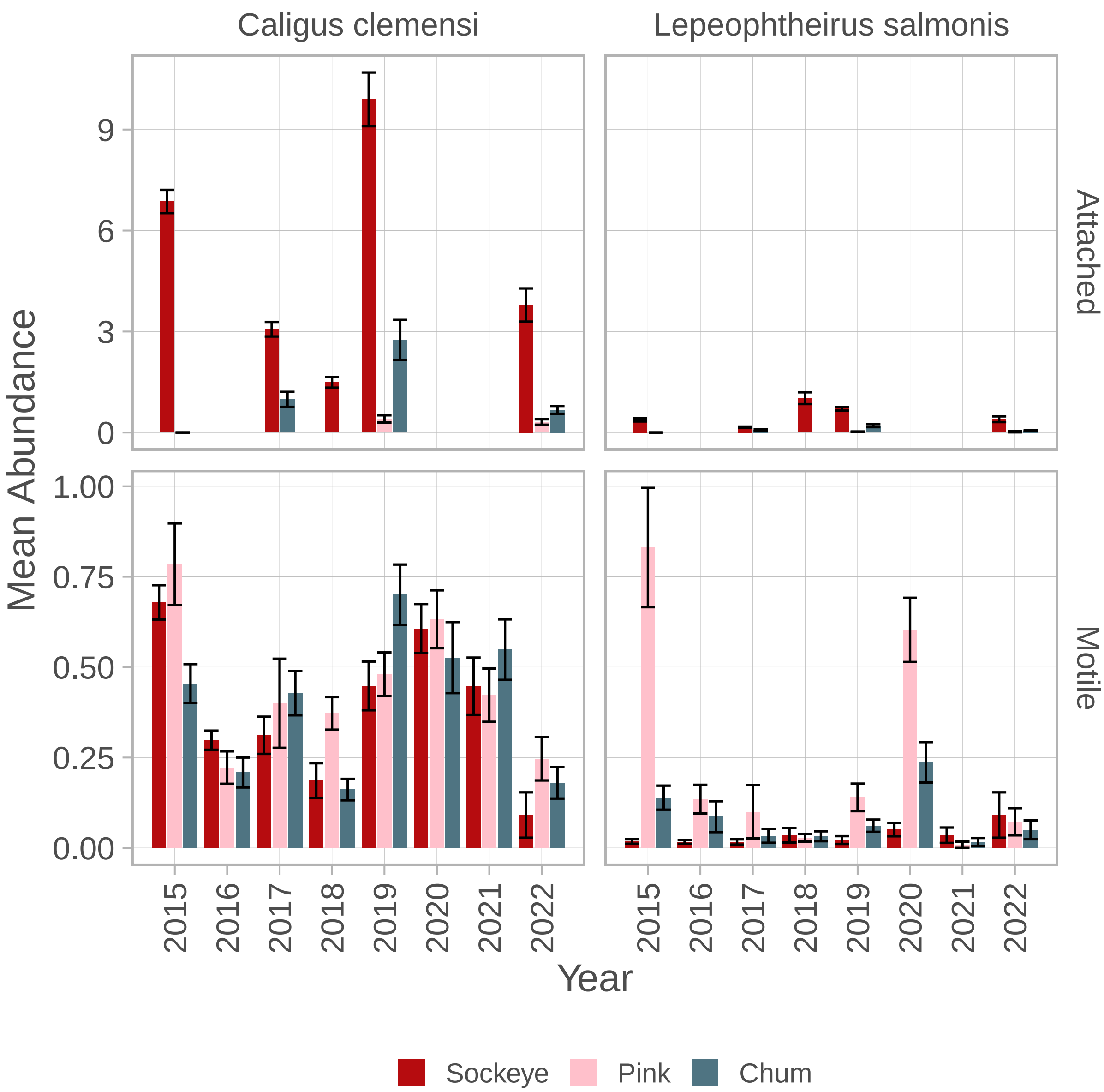

Figure 5: The mean abundance (+/- 1 SE) of sea lice in the Discovery Islands, BC.

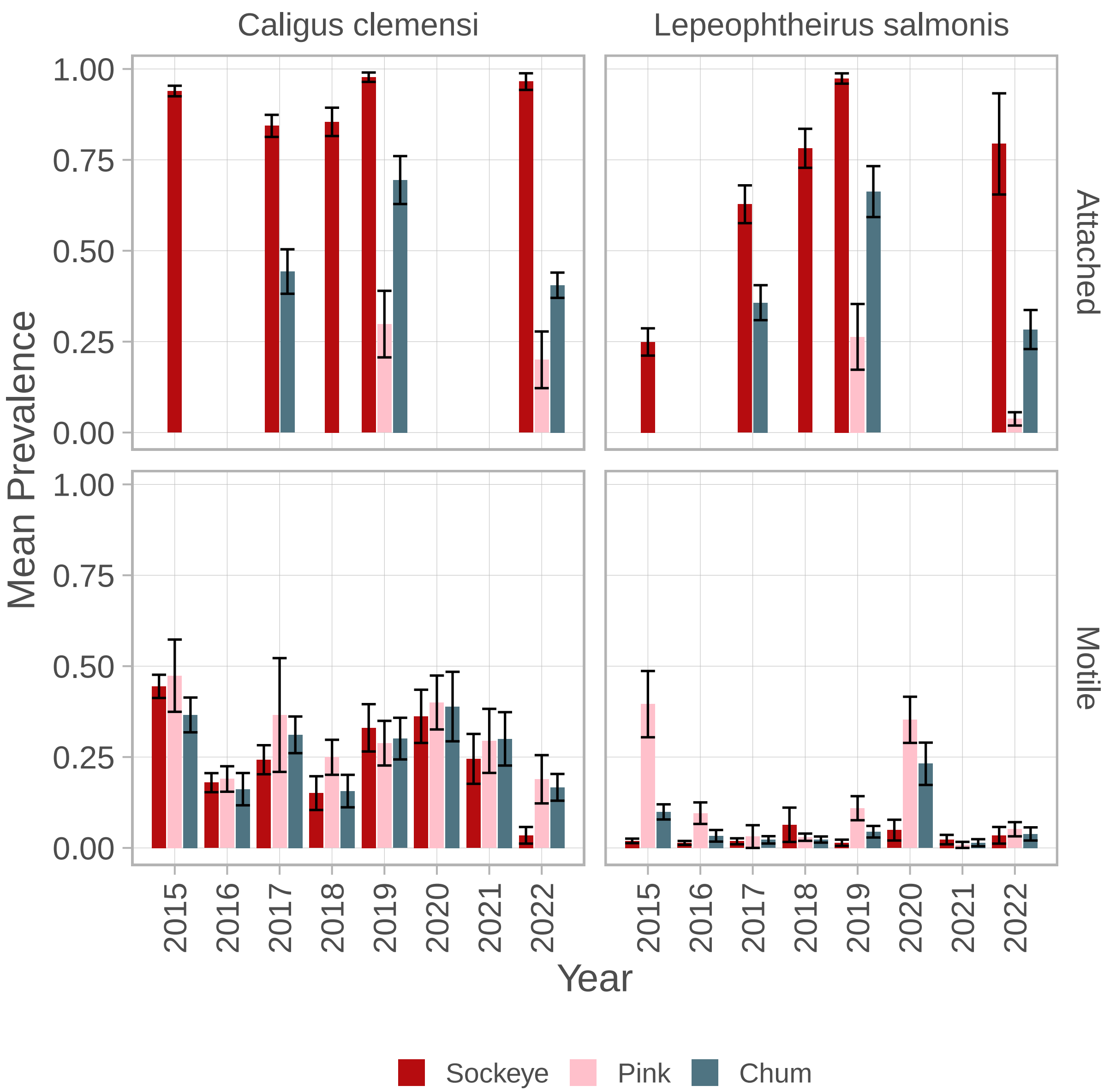

Figure 6: The mean prevalence (+/- 1 SE) of sea lice in the Discovery Islands, BC.

Ocean Temperatures

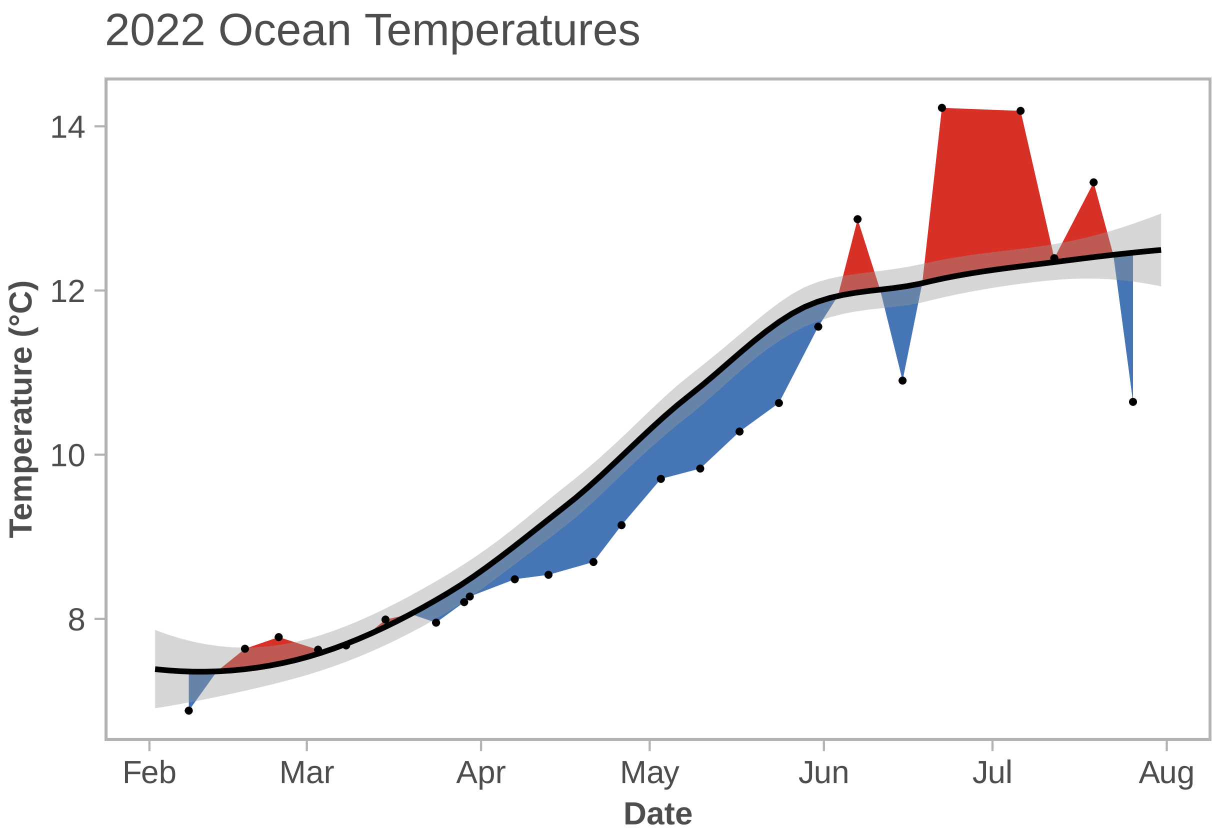

Figure 7: Ocean temperatures (top 30 m) at station QU39 in the northern Strait of Georgia between Quadra and Cortes Island. The solid black line is a LOESS regression based on temperatures from 2015-2021, representing the study period average. The shaded grey area is 1 SE of the LOESS regression. Blue areas represent temperatures from 2022 that are below average and red areas represent above-average temperatures.

Highlights

- In 2022 we observed the lowest catch intensity of sockeye salmon in our time series and the date of first sockeye capture was the latest in the time series. However, low abundance of sockeye affected catchability and our ability to accurately estimate migration timing.
- Sea lice abundance and prevalence were mostly within the time series ranges. Confidence in counts of sea lice on sockeye is low due to small sample sizes.
- Juvenile salmon experienced colder than average ocean temperatures during the early phase of their migration.

References

Hunt, B.P.V., B.T. Johnson, S.C. Godwin, M. Krkosek, E.A. Pakhomov, and L. Rogers. 2018. The Hakai Institute Juvenile Salmon Program: early life history of sockeye, pink and chum salmon in British Columbia, Canada. NPAFC Doc. 1788. 14 pp. Institute for the Oceans and Fisheries and Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Hakai Institute, Earth to Ocean Research Group, Simon Fraser University, Department of Ecology and Evolutionary Biology, University of Toronto, and Salmon Coast Field Station (Available at http://www.npafc.org).

Johnson, B., Gan, J., Godwin, S., Bachen, K., van der Stap, T., Krkosek, M., Rogers, L. A., Portner, L., Janusson, C., & Hunt, B. P. V. (2017). Hakai Institute Juvenile Salmon Program Time Series. [Dataset] https://doi.org/10.21966/1.566666

Krkošek, M., Morton, A., and Volpe, J.P. 2005b. Nonlethal assessment of juvenile pink and chum salmon for parasitic sea lice infections and fish health. Trans. Am. Fish. Soc. 134(3): 711–716. doi:10.1577/T04-133.1.