Interim in-season juvenile salmon migration report; Discovery Islands

— Hakai Institute Juvenile Salmon Program 2022 —

Aim

To provide a rapid interim 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

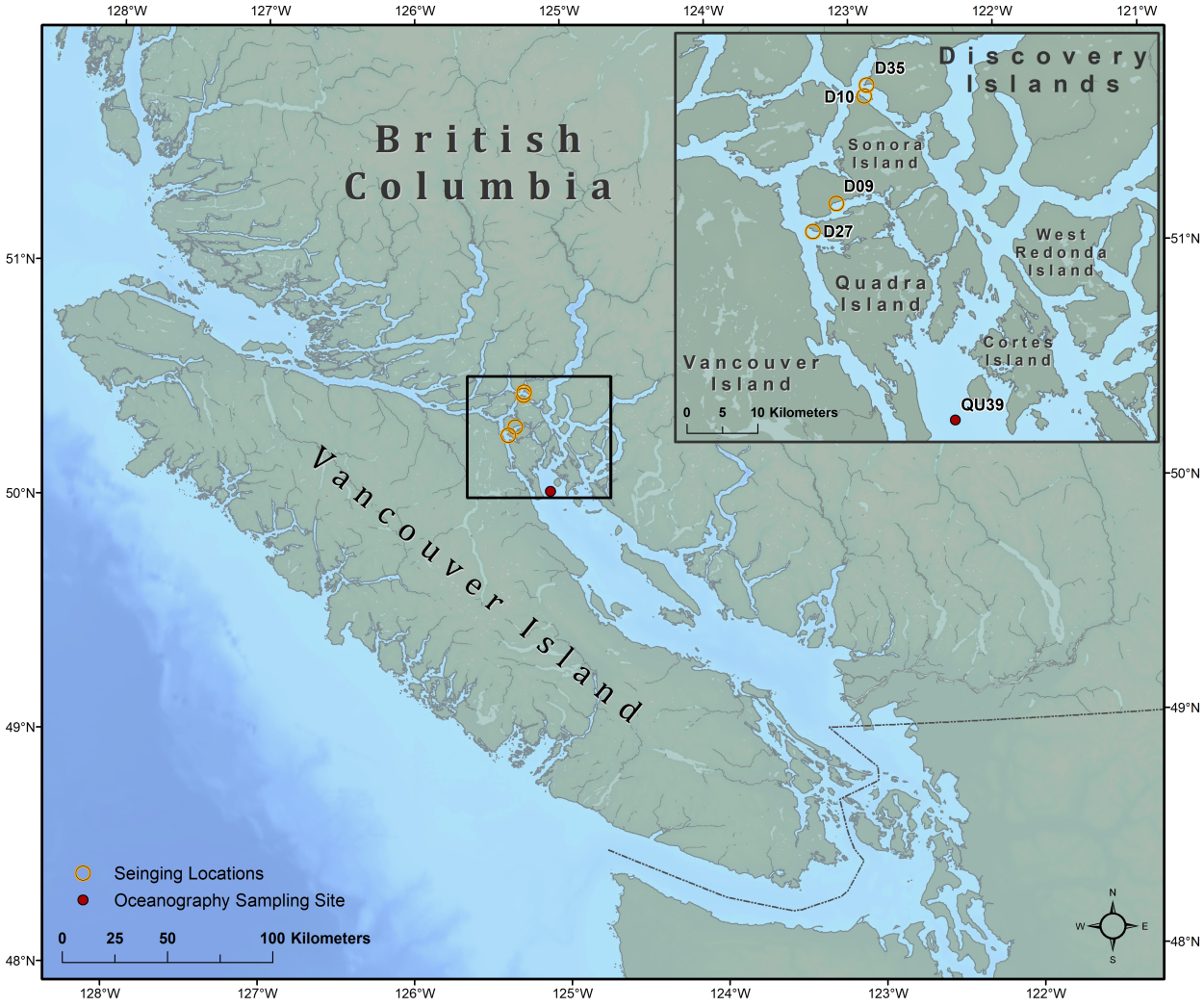
1) Determine migration timing and relative abundance;
2) Map migration habitat - oceanographic conditions along the migration route;
3) Understand the dynamics of the plankton food-webs that underpin juvenile salmon growth and health;
4) Understand parasite and pathogen infection dynamics and their impact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

Key Parameters Reported

- Catch Statistics
- Lengths
- Parasite Loads

For questions/comments please contact brett.johnson@hakai.org and b.hunt@oceans.ubc.ca

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.



Migrtation Timing

We have captured very few sockeye so far this season, 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	787	343
2022-06-20	D09	Okisollo Channel	40	690	306

Catch Intensity

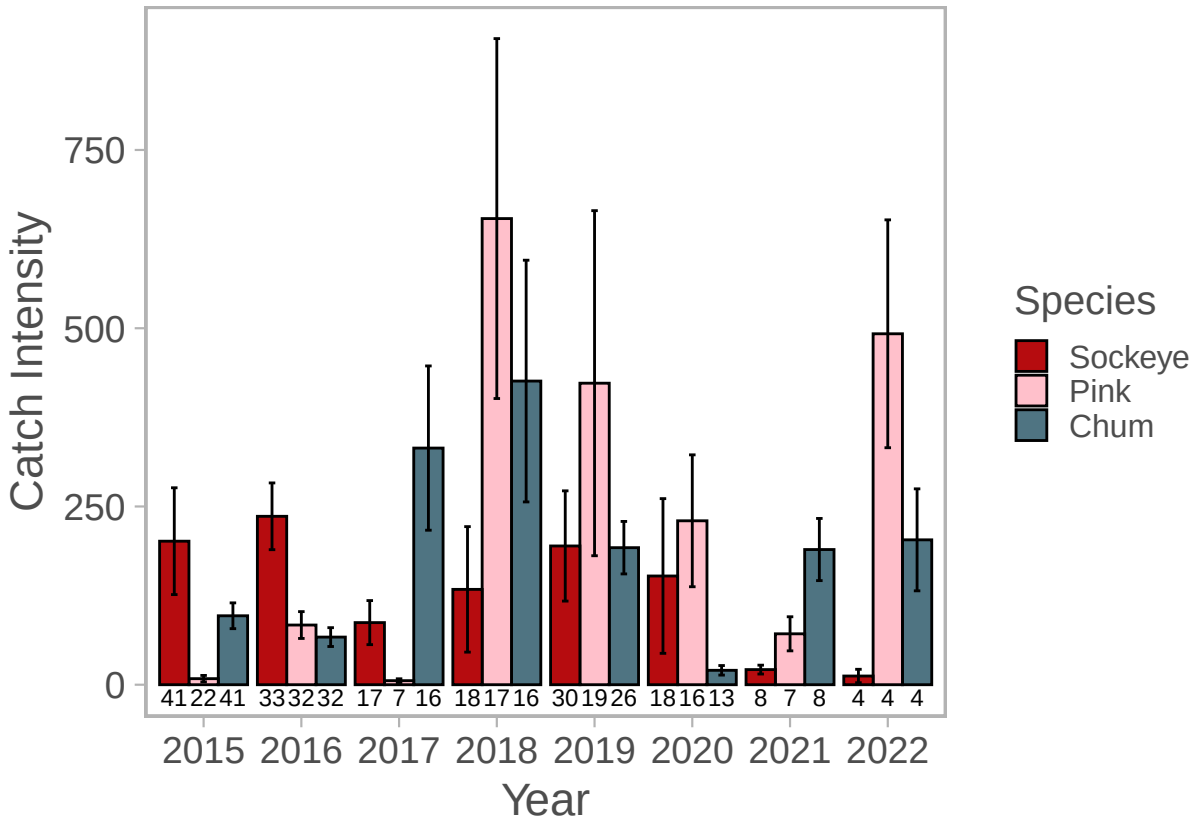


Figure 1: The catch intensity (average number of species i when i > 0 and when sockeye were also caught) of sockeye, pink, and chum salmon in the Discovery Islands. Numbers under each bar indicate the number of seines in which sockeye were caught, and error bars indicate 1 standard error.

Species Proportion

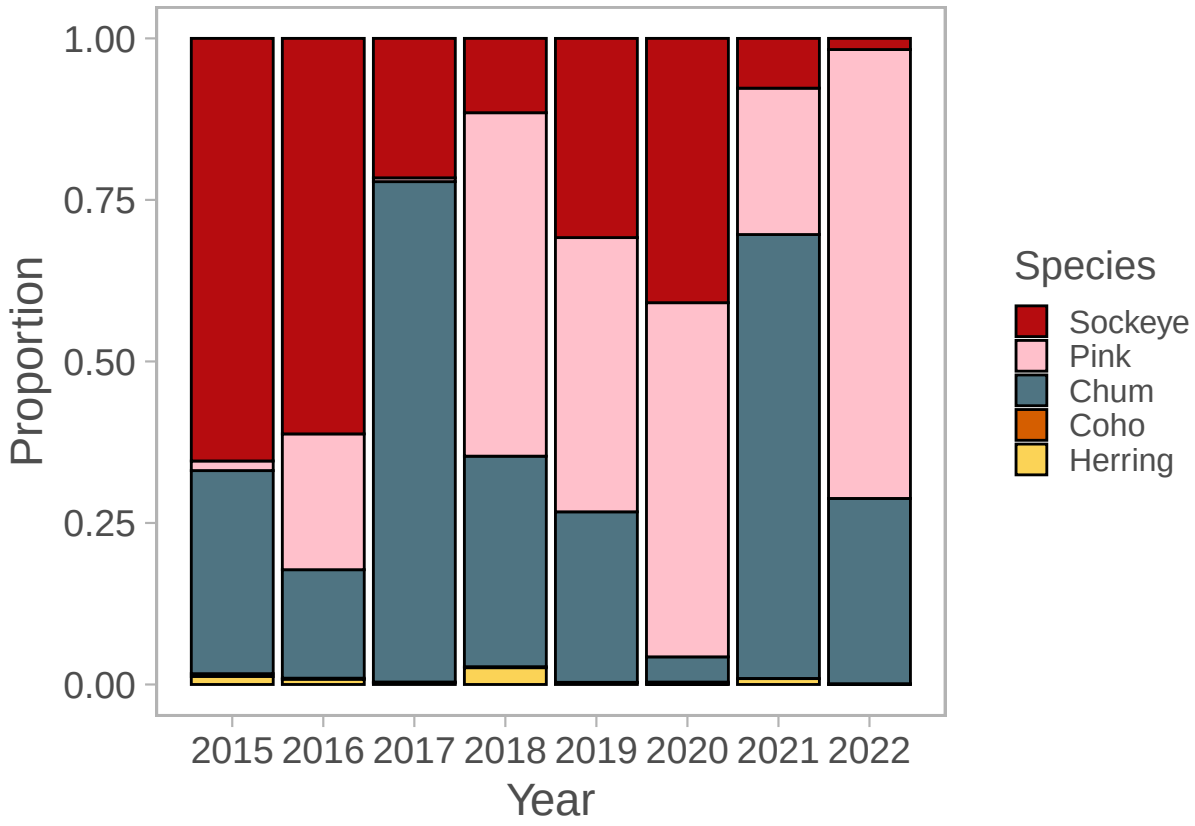


Figure 2: Proportion of juvenile salmon species caught in the Discovery Islands from 2015-2022.

Fish lengths

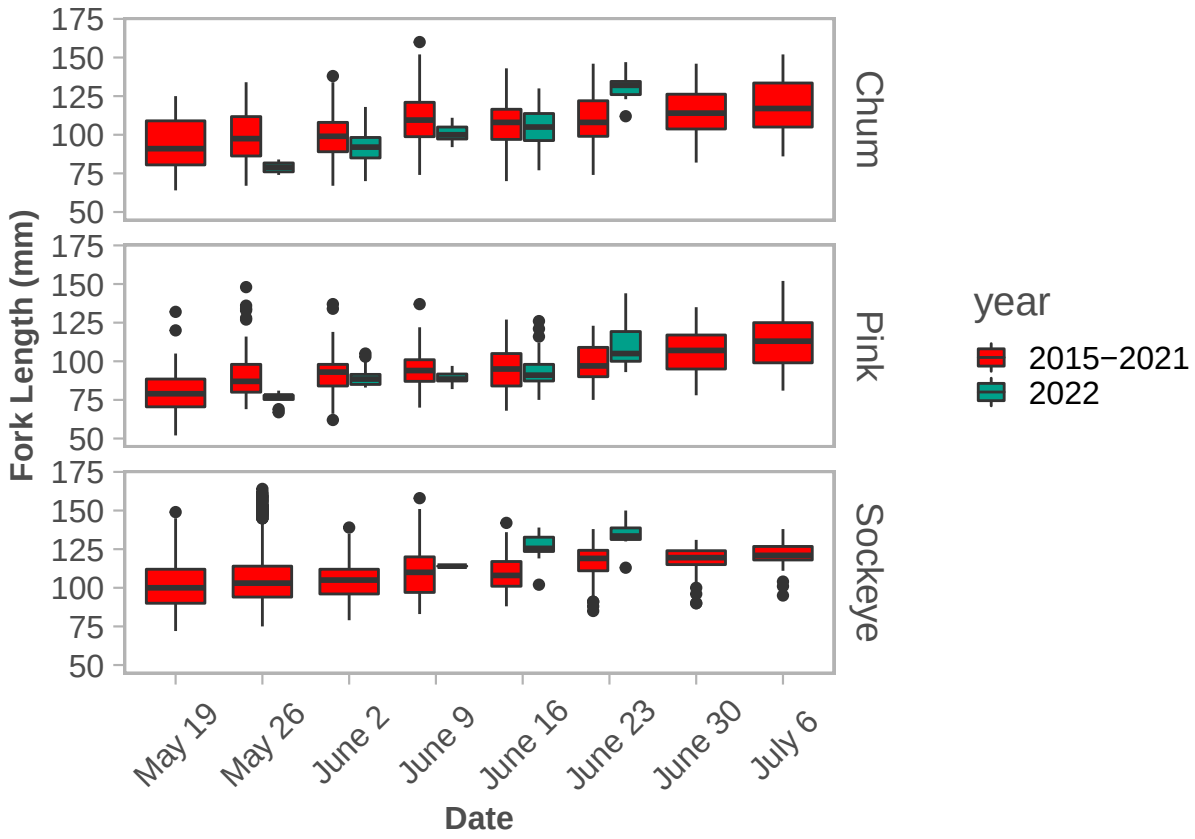


Figure 3: Fork-length boxplots of juvenile salmon in the Discovery Islands in 2022 grouped by week, and represented by the middle day of each week, compared to all lengths from 2015-2021.

Parasite Loads

In 2022 we resumed enumerating sea lice in the field using hand lenses to identify both attached (juvenile) and motile (adult) sea lice (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 2020 and 2021 for all species of salmon. We have also historically prioritized counting sea lice on sockeye, and given the low number of sockeye captured in 2022, here we report sea lice data for chum salmon only for this year thus far. We present data for abundance and prevalence of attached + motile lice for 2017, 2019 and 2022, and motile lice only for 2015-2022.

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 ÷ Number of hosts examined (Proportion of fish infeccted 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.

Attached and Motile Stage Sea Lice Abundance

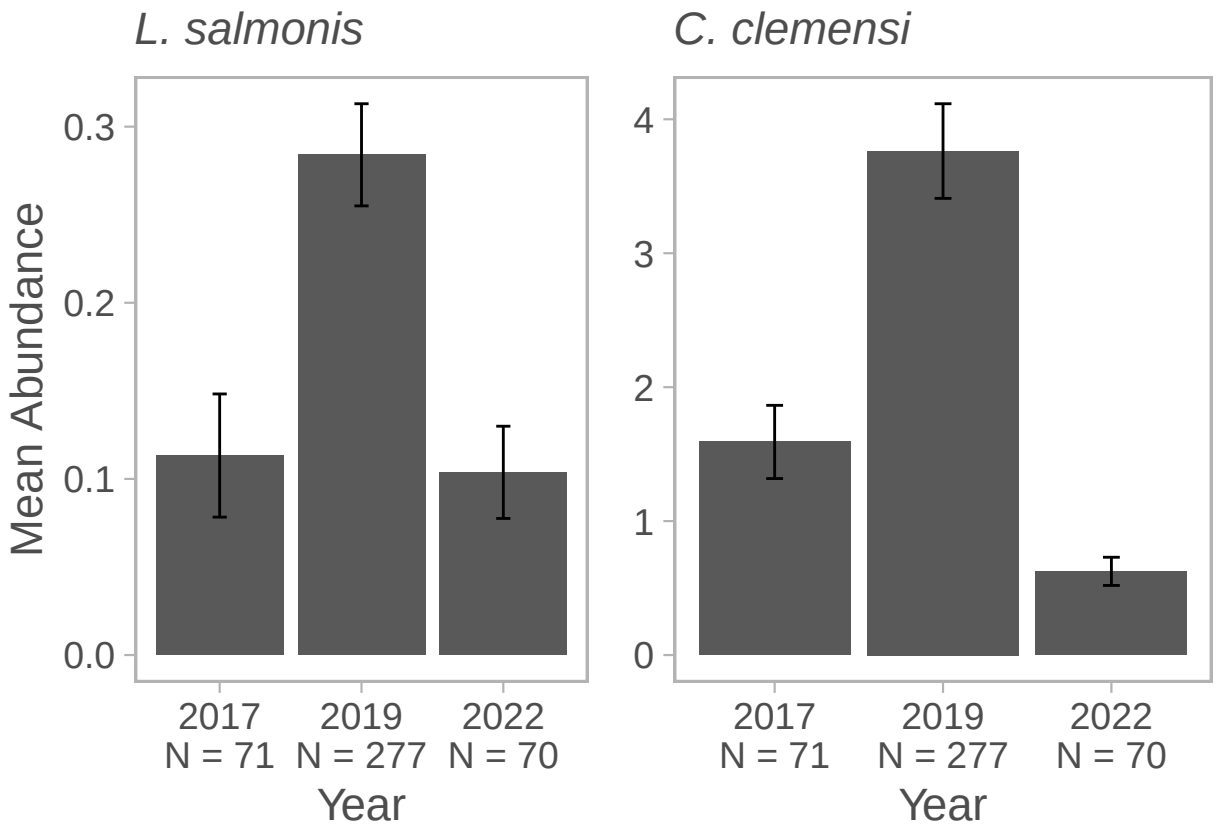


Figure 4: The abundance ± SE of attached and motile *Lepeophtheirus salmonis* and *Caligus clemensi* sea lice infecting juvenile chum salmon in the Discovery Islands in 2022. Note the different Y-axis scales.

Attached and Motile Stage Sea Lice Prevalence

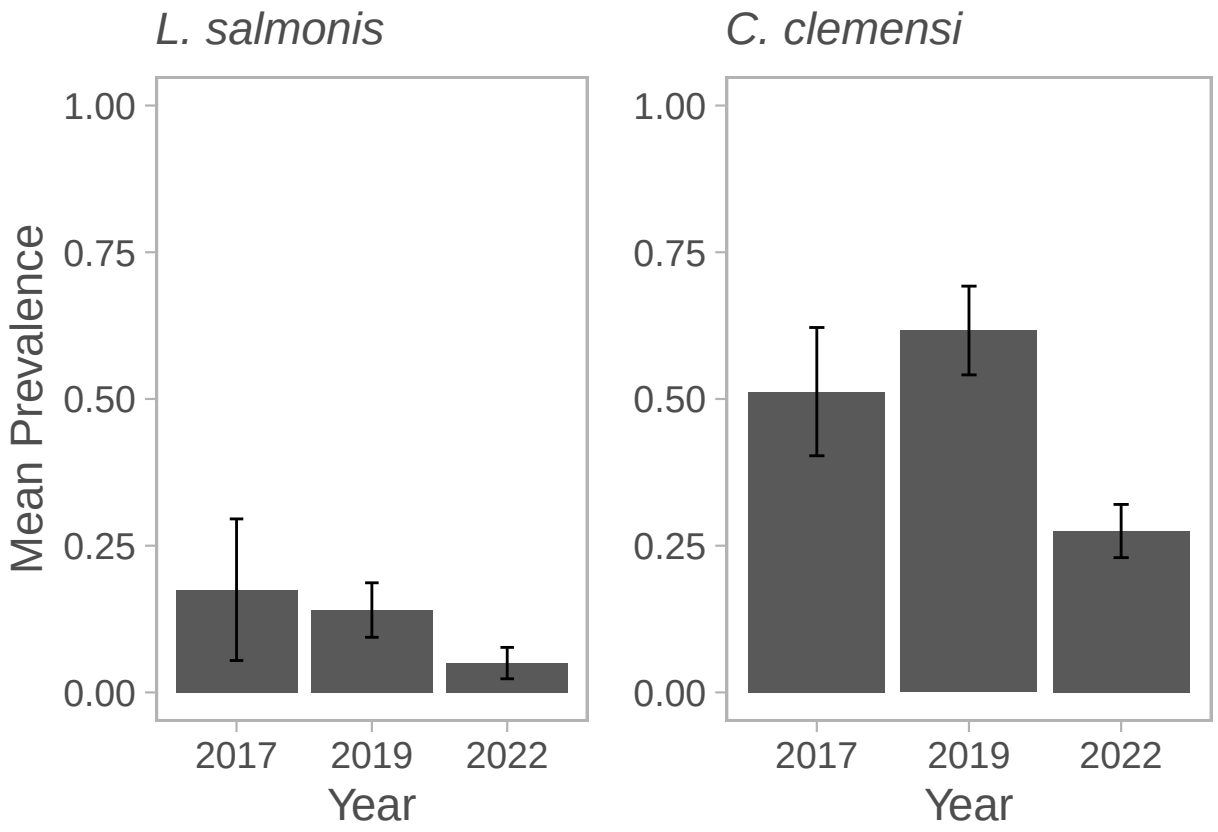


Figure 5: The proportion (± SE) of juvenile chum salmon that had at least one attached or motile *Lepeophtheirus salmonis* or *Caligus clemensi* sea louse in the Discovery Islands in 2022.

Motile Stage Sea Lice Only

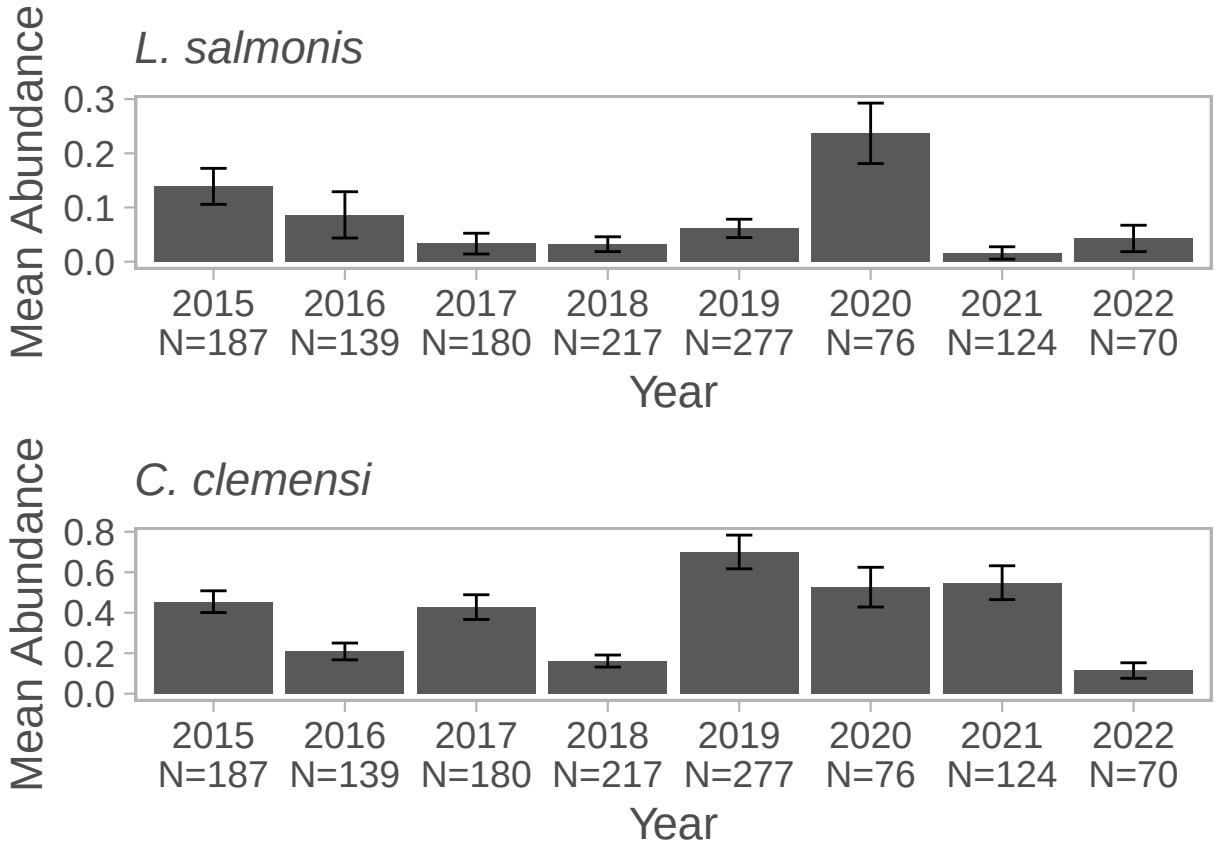


Figure 6: The mean abundance (± SE) of motile *Lepeophtheirus salmonis* (left panel) and *Caligus clemensi* (right panel) sea lice infecting juvenile chum salmon in 2022 compared to our time series. Note the different Y-axis scales

Highlights

- Very few sockeye have been caught
- Sea lice loads in 2022 do not look considerably different from previous years though we have low confidence in that assessment due to small sample sizes for comparison.

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 ssessment 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.