

Cedar Coast Field Station Report:

Hot Springs Cove Juvenile Pacific Herring die off June 20, 2018

On June 20, 2018, we received reports of mass die offs of juvenile Pacific Herring (*Clupea pallasii*), near Hot Springs Cove, British Columbia (Figure 1) from Hesquiaht fisheries, Ahousaht fisheries, Nuu-chah-nulth fisheries and local guides. Hesquiaht fisheries and local guides were reporting schools of juvenile herring in the hundreds of thousands had entered Hot Springs Cove on the 20th of June 2018 and were reporting that juvenile herring covered in sea lice were washing up on shore dead or moribund in the hundreds or thousands. We accompanied the Nuu-chah-nulth fisheries on June 21st, 2018 to collect samples and measure water parameters. We collected 27 herring by opportunistic dip netting of dead or dying fish near the surface. Collected fish were individually bagged and placed on ice until further assessment at the CCFS.

At the sampling site, the surface temperature was 17.22°C, and 14.00°C 1m below the surface. The salinity was 27.08 PSU and 29.34 PSU at the surface and 1m below the surface, respectively. The dissolved oxygen in the water was measured at 79.5 %DO at the surface, and 83.5%DO 1m below the surface.

At CCFS we measured the lengths, heights, and weights of the sampled fish. We also counted the number of sea lice (*Caligus clemensii*) and identified the different life stages of the lice using a 16x magnification hand lens. We noted any hemorrhaging or external markings on

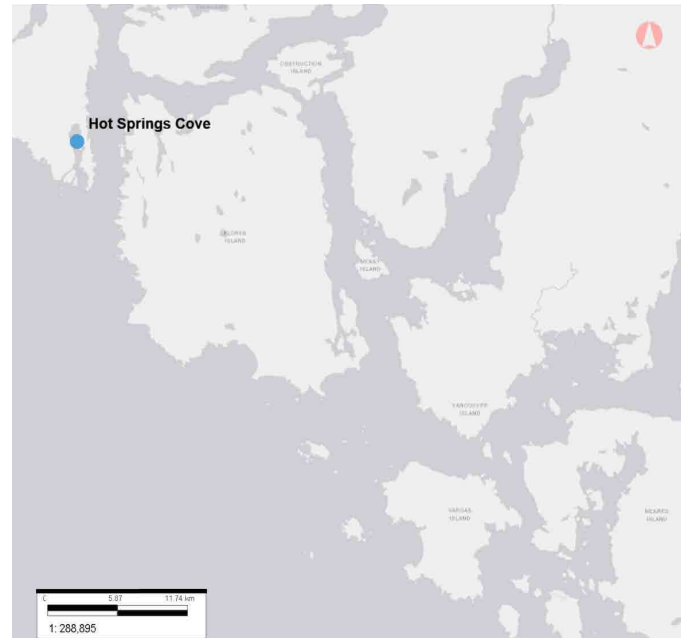


Figure 1. Hot Springs Cove and its proximity to Tofino in Clayoquot Sound. Map generated using ImapBC.

the body of the fish. The fish were measured in plastic bags as shown in Figure 2. Two fish were not assessed as they were too degraded for our analysis.



Figure 2. A juvenile Pacific Herring shortly after collection, note the *Caligus* lice (orange) on flank (left). A juvenile Pacific herring after being measured, weighed, and counted for sea lice, note hemorrhaging on the flank (right).

The 25 fish ranged in lengths from 60-80mm, and ranged in weights from 1.47-3.63g. Each fish was host to a mean of 5.6 lice at all life stages, ranging from 2-19 lice per fish. The majority of lice were motile (adult) *C. clemensi* and gravid (females with eggs) *C. clemensi*. Two juvenile *C. clemensi* copepodites were observed. 84% of the fish were host to at least one sea louse. 80% of the fish exhibited some form of hemorrhaging. Juvenile herring have been reported to host *C. clemensi* in British Columbia (Morton *et al.*, 2008, Beamish *et al.* 2009). Morton reported an abundance of ~1 lice per fish in proximity to salmon farms in the Discovery Islands, BC and Beamish reported a prevalence of 60% during a natural outbreak of sea lice in the gulf islands of BC. *C. clemensi* are a native ectoparasite in BC water and herring are believed to be one of the larger natural reservoirs. Farmed Atlantic Salmon in Clayoquot Sound are reported to have relatively low abundance of *C. clemensi*. *C. clemensi* adults and pre-adults are highly motile and have a propensity to detach when

their hosts are handled (Godwin *et al.* 2015). *C. clemensi* are less pathogenic than *L. salmonis*, yet they can still negatively impact their host by reducing their hosts ability to forage when at a high abundance (Godwin *et al.*, 2017).

The sampled fish were subsequently sent to the Pacific Biological Station (PBS) for bacterial and viral analysis. Of the 27 sent, 26 were analyzed. Regarding the bacteriology, one fish was host to the bacteria *Pasteurella* spp., and three were host to *Vibrio vulnificus*. Kidney tissue from the fish were used to identify the presence of any infectious virus in the fish. It was found that 22 of the herring were host to an infectious virus. The virus was identified to be viral hemorrhagic septicemia virus (VHSV), genotype Iva, a strain endemic to wild Pacific herring and known to cause disease. The hemorrhaging observed on the sampled fish is known to be associated with VHSV.

VHSV has been well documented in Pacific Herring, but it's effects on the Pacific Herring stock are not

clear. Young, immunologically naïve Pacific Herring are known to be susceptible to the virus. It is likely that epizootic events caused by VHSV are due to environmental stress, and/or transmission to susceptible age classes of Pacific Herring (Elston and Meyers, 2009; Kocan *et al.*, 2001). Atlantic salmon (*Salmo salar*) and Pacific Salmon (*Oncorhynchus* spp.) are known natural hosts to VHSV. Pacific herring in and around salmon farms are believed to transfer the virus to farmed Atlantic Salmon, creating a concern of viral spillback from farmed salmon to other marine fishes (Garver, 2017).

We will continue our monitoring programs in the Clayoquot Sound region and will respond to reports regarding Pacific Herring and other fish species as they arise. Please contact the Cedar Coast Field Station with any comments, questions or concerns.

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References

- Beamish, R., Wade, J., Pennell, W., Gordon, E., Jones, S., Neville, C., Lange, K. and Sweeting, R., 2009. A large, natural infection of sea lice on juvenile Pacific salmon in the Gulf Islands area of British Columbia, Canada. *Aquaculture*, 297(1-4), pp.31-37.
- Elston, R., and Meyers, T. 2009. Effect of viral hemorrhagic septicemia virus on Pacific herring in Prince William Sound, Alaska, from 1989 to 2005. *Diseases of Aquatic Organisms* 83: 223-246
- Garver, K. 2017. Susceptibility of Sockeye salmon to viral hemorrhagic septicemia virus. Program for Aquaculture Regulatory Research (PARR). Accessed 7/11/2018. Available at: (<http://www.dfo-mpo.gc.ca/aquaculture/rp-pr/parr-prra/projects-projects/2015-P-01-eng.html>)
- Godwin, S.C., Dill, L.M., Reynolds, J.D. and Krkošek, M., 2015. Sea lice, sockeye salmon, and foraging competition: lousy fish are lousy competitors. *Canadian journal of fisheries and aquatic sciences*, 72(7), pp.1113-1120.
- Godwin, S.C., Krkošek, M., Reynolds, J.D., Rogers, L.A. and Dill, L.M., 2017. Heavy sea louse infection is associated with decreased stomach fullness in wild juvenile sockeye salmon. *Canadian Journal of Fisheries and Aquatic Sciences*, (999), pp.1-9.
- Kocan, R.M., Hershberger P.K., Elder, N.E., and Winton, J.R. 2001. Epidemiology of viral hemorrhagic septicemia (VHS) among juvenile Pacific herring and Pacific sandlances in Puget Sound, Washington. *Journal of Aquatic Animal Health* 13(2): 77-85
- Morton, A., Routledge, R. and Krkosek, M., 2008. Sea louse infestation in wild juvenile salmon and Pacific herring associated with fish farms off the east-central coast of Vancouver Island, British Columbia. *North American Journal of Fisheries Management*, 28(2), pp.523-532.