

Phytoplankton Blooms in Esquimalt Lagoon in 2008 and the Effects of Freshwater Inputs

*Report for the Esquimalt Lagoon Stewardship Initiative, Capital Regional District
December 2008*

Summary

Esquimalt Lagoon has been reported to have recurring thick phytoplankton blooms (discoloured, usually reddish water) in the past few years. Fish kills have also been reported. Although the phytoplankton blooms of Esquimalt Lagoon were studied in the 1970s and 1980s, little research has been done on them in the last twenty years. A three-month study was instituted to attempt to discover what species of phytoplankton were causing the blooms, and to investigate the influence of nutrient levels and other factors in the fresh water inputs. Phytoplankton blooms and environmental parameters, including nitrate and phosphorus levels, were monitored in Esquimalt Lagoon and its freshwater sources from early August to early October in 2008.

High concentrations of phytoplankton were seen in samples from this entire period, and in some cases plankton blooms were extremely thick. Dominant species were dinoflagellates: a small *Gymnodinium*



species in August and early September, and *Prorocentrum micans* and *Prorocentrum minimum* in September and October. These are common dinoflagellate species, and were seen blooming in other places on the west coast of Vancouver Island at the same time. The small *Gymnodinium* species is probably the same species that bloomed in Esquimalt Lagoon in the 1970s and 1980s, but *Gymnodinium sanguineum*, which was the dominant bloom species during that time, was only seen in a few samples this year, at very low levels.

Nitrate levels measured in the freshwater inputs in 2008 were very high, and in the lagoon they were higher than usual in marine systems. Nitrate is considered to limit phytoplankton growth in estuarine and marine systems; phosphorus is usually the limiting nutrient in fresh water environments. Nitrate levels in the lagoon and the creeks were much lower in the 1970s and 1980s. The major sources of nitrogen into estuaries are fertilizer (from lawns, farms, and golf courses), wastewater, and atmospheric deposition.

A fish kill event occurred on September 19 and 20; this was almost certainly caused by a combination of a thick phytoplankton bloom and low tides in the middle of the night. Phytoplankton, in the process of photosynthesis, produce oxygen during the day, but use it up overnight in cell respiration. When there is a thick bloom and decreased water volume (i.e. low tide) in the middle of the night, oxygen levels in the water

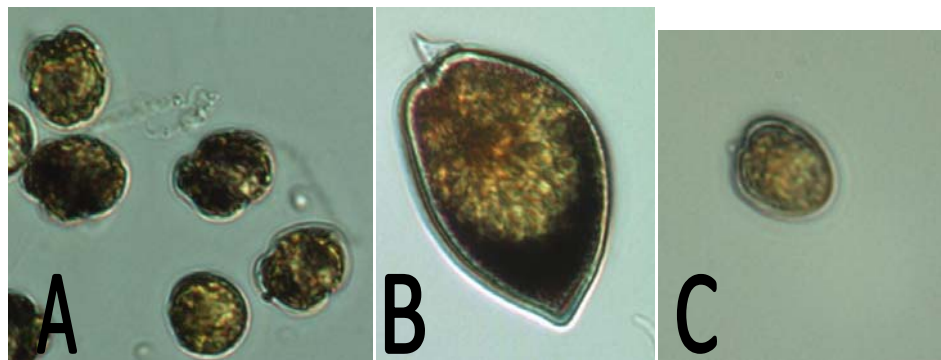


may fall to zero, and all life in that area (fish, other aquatic species) suffocates. There are certain species of phytoplankton that are toxic or otherwise harmful to fish and/or invertebrates, but these species were not seen in any significant concentration in Esquimalt Lagoon during the monitoring season.

Although phytoplankton productivity drives our rich marine environment in BC, continued thick phytoplankton blooms are an issue because of the threat they pose to other marine life, either by oxygen depletion or by outright toxicity. The thick accumulations of blooms have also been reported to cause problems by shading eelgrass beds, which negatively impacts the health of these important environments.

Because of the limited circulation and exchange with outside waters in Esquimalt Lagoon, high nitrate levels in the freshwater inputs and the lagoon are of extreme concern. Recommendations include:

- an investigation into nitrate sources, and better management of nitrate inputs into creeks in the Esquimalt Lagoon catchment area
- continued monitoring of phytoplankton blooms and environmental parameters in the Esquimalt Lagoon system.



Dominant dinoflagellate species in Esquimalt Lagoon August – October 2008. A. *Gyrodinium estuariale* (tentative identification). B. *Prorocentrum micans*. C. *Prorocentrum minimum*. Photographs taken from Lugol's iodine preserved Esquimalt Lagoon samples, all species to the same scale.

Bloom and fish kill photographs courtesy of Arnold Rossander

Report by: Nicky Haigh

nixy consulting, 3174 Rock City Rd, Nanaimo, BC, V9T 1T4

Email: nixy@telus.net

Ph: 250-537-7176