

Qualitative texture characteristic of herring (*Clupea pallasii pallasii*) pre-larvae developed from the natural and artificial spawning-grounds in Severnaya Bay (Peter the Great Bay)

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Some authors consider the frequency of morphologically deformed herring larvae to be indicative of the quality of spawning substrate. The relative frequency of normal and deformed larvae in recently hatched herring eggs from natural and artificial spawning grounds has been determined in Severnaya Bay. The maximal quantity (94%) of well-developed larvae hatched from roe was from artificial spawning substrate but was only 25% or less from the natural

seagrass substrate (*Zostera marina*). The deformed larvae from natural substrates included the absence of a yolk sac (4.2%) or high water content (16.6%). The principal deformities of larvae from artificial substrates were curvature of the spine (8%) and irregular head and tail parts (5% and 10%). Approximately 50% of larvae with spinal curvature recovered about one day after hatching.

Pacific Herring: Common Factors Have Opposite Impacts in Adjacent Ecosystems

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Pacific hake are the dominant resident species in the Strait of Georgia (Beamish and McFarlane, 1999) and off the west coast of Vancouver Island in summer (Ware and McFarlane, 1995) – Figure 1. In the La Perouse Bank area, Pacific hake are a large migratory population. During the 1960s, 1970s and 1980s, they spawned off Baja, California during the winter and migrated north to summer feeding grounds (Francis, 1983). Prior to 1990, approximately 25 to 30% of the mature biomass moved into Canadian waters. Since the early 1990s a much larger percentage of the stock (approximately 40%) was present in the Canadian zone.

The fishery for Pacific herring dominated catches in the Strait of Georgia and off the west coast of Vancouver Island from the early 1950s until the mid-1960s (Schweigert and Fort, 1999). The fishery collapsed in the mid-1960s and was closed

from 1967 to 1971. It re-opened in 1972 and has been largely regulated by market demands.

Herring are now abundant in the Strait of Georgia and at low levels off the west coast of Vancouver Island (Fig. 2). Predation on herring by hake off the west coast of Vancouver Island increased in direct relation to the increased northward migration of Pacific hake (Ware and McFarlane, 1995). However, hake in the Strait of Georgia reduced their predation on herring despite having a high biomass (Table 1). After 1989, there was a shift to higher mean sea surface temperatures in both areas (Fig. 3) that was part of a large scale shift in climate/ocean conditions as seen in the change in the pattern of the Aleutian Low. Off the west coast of Vancouver Island the high percentage of herring in the diet of hake (approximately 37% annually) is clear evidence of the preference of hake for herring as a prey (Table 2). This preference for herring and the large