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Speed of infected cage removal impacts spread of ISA

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Infectious Salmon Anemia virus can remain infective in cold, nonsterile seawater for at least a week

Infectious salmon anemia (ISA) is an infectious disease of salmonids caused by a virus in the Orthomyxidae family. It causes anemia and often extensive morbidity and mortality on infected farms. The disease has been difficult to control in Maine, USA, and New Brunswick, Canada, since its introduction to the region in 1996.

Efforts to control ISA are based on biosecurity and biocontainment. Biosecurity, preventing pathogen introduction to clean sites, and biocontainment, preventing pathogen dispersal from infected sites, go hand in hand. Without containment, the job of prevention is extremely difficult, if not impossible.

This association between biosecurity and biocontainment is perhaps no-where as pressing as in the aquatic environment, where water, wind and tidal currents enable the movement of particulates, wastes and microorganisms from farm to farm and region to region.

Farm workers use a seine to corral fish for harvest. The scale of most cage culture makes early harvests due to disease an expensive affair.

Proximity risks

In an opinion-based survey the authors conducted in 2002, fish-farming experts felt that a farm's proximity to a clinical outbreak was a primary risk factor in the spread of ISA. Experts also felt that the time it took to remove an infected cage was a predictor of the severity of the spread of infection throughout a site.

Since farms typically isolate themselves as much as possible from one another with site-specific equipment, gear and crews; restrictions on traffic between farms; and cleaning and disinfection; locational risk is most likely due to waterborne transfer. Although biosecurity is very important, if a site sheds virus into a shared water column, neighboring sites can expect to be awash in virus on the next tide, regardless of their biosecurity precautions. Effective biocontainment, however, can be difficult and costly to practice.

ISA transmission

The U.S. Department of Agriculture and Micro Technologies, Inc., of Richmond, Maine, USA, repeatedly sampled water from and around an ISA-positive site last winter. ISA genomic material was frequently detected in these water samples, at times over a kilometer from the infected site.

ISA can move quickly among fish in commercial cage operations.

Micro Technologies has also demonstrated that ISA virus can remain infective in cold, nonsterile seawater for at least a week. Given the extreme currents and tides in this part of the world, a week is plenty of time to travel from an infected site in Canada to a noninfected site in Maine or vice versa.

Furthermore, the prevalence of ISA-infected and presumably shedding fish in a cage increases rapidly over time in direct correlation with increases in mortality in the cage. Even preclinical fish can shed the virus.

In a study conducted on ISA-positive cages, the authors found a tight relationship between the proportion of polymerase chain reaction positives from fish sampled during the harvest of a cage and mortality rates in the same cage the week prior to harvest. At 0.05 percent mortality/day, once considered a threshold rate for confirming laboratory findings, the apparent prevalence of ISA is probably around 14 percent.

Early removal difficult

It is presumed that a key to effective control of ISA is removal of infected cages prior to large-scale shedding into a shared water column. However, early removal is a difficult control measure for the salmon industry to follow. A typical farm has eight to 20 cages at a site, each holding 10,000 to 30,000 fish of the same year class. At 4.08 kg average dressed weight and a price of U.S. $4.41/kg, each cage could net approximately $500,000. Loss of even a single cage represents a substantial loss in revenue.

In addition, diagnostic tests are imperfect, so early diagnoses are sometimes debated. Furthermore, even recommendations for removals of market-age fish can conflict with market demand, harvest scheduling and vessel availability, drug withdrawal times, or the weather. So compliance is a serious issue.

Field removal study

Maritime Veterinary Services (MVS) works with a number of salmon farms in both Maine and New Brunswick. With permission from the industry, MVS identified nine sites diagnosed with ISA during a targeted year class and production cycle. For each site, it calculated the length of time between diagnosis and harvest (speed of removal) of the first positive cage at each site. MVS also calculated the time between diagnosis of the index and secondary cages at each site, as well as the percentage of positive cages at two, three, and four months after onset of the index cage.

Study data suggested that speed of removal affected all of the measurements. Slow removals ultimately led to more infected cages and a possibly faster onset of infection in secondary cages.

Economic tradeoffs

Early removals of ISA-positive cages led to improved survival of neighboring cages and possible delays in onset of the secondary waves of ISA infection. Whether early removal translates to an economic gain for the farmer needs still to be shown. Do farms that hold on to their fish to match market pressures achieve enough short-term economic gain to make up for the eventual heightened spread of disease throughout their sites? Attempting to address this question empirically is the authors' next step.

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