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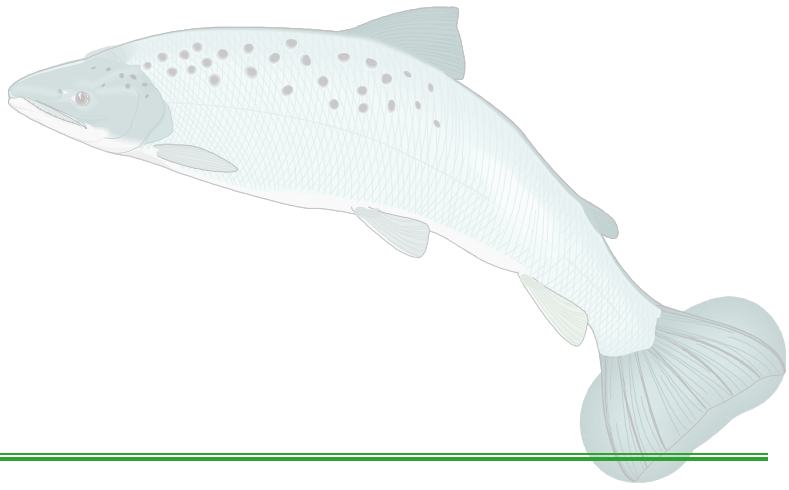
Fact Sheet
on

Integrated Pest Management of Sea Lice in Salmon Aquaculture



March 2003

ISBN: 0-662-34002-7
Catalogue Number: H113-2/14-2003E-IN

Sea lice, parasitic copepods belonging to the family Caligidae, can cause serious disease in farm-reared salmonids, leading to losses from direct mortality, poor growth, treatment costs and labour to deal with the problem. The use of long-term integrated strategies for managing sea lice is important to the sustainability of the industry and the environment in which it operates. Integrated pest management (IPM) uses all necessary techniques to suppress pests effectively, economically and in an environmentally sound manner. By using a combination of prevention and treatment tactics, a grower should achieve more consistent long-term control. Chemical treatments are used as one part of integrated management, rather than the sole method of control.

A detailed management plan will need to be developed to suit local situations, and some elements of the strategy may be easier to implement in new operations. Using the greatest number of management tools possible will provide better control with the least chance of relying solely on chemical treatments to deal with outbreaks.

Integrated Pest Management Program for Sea Lice

Management for prevention

A number of preventative measures can be taken that should reduce the likelihood of sea lice becoming a problem.

Location of sites is important with respect to sources of infection and water quality. In addition to enhancing production, use of good quality sites leads to healthier fish that may be less susceptible to infection with sea lice. In particular, adequate water flow can help prevent build-up of sea lice larvae in a site and contribute to dispersal of therapeutants following a treatment.

Farms should be sited at a distance from potential sources of infection, including locations where salmon are known to concentrate, e.g., salmon-bearing rivers, estuarine holding areas and adjacent farms, which may be infested with the parasite. Local decisions on spacing farms will depend on an understanding of currents, tidal flow, and other factors that may enhance or restrict larval dispersal.

Year-class separation is probably the most effective husbandry technique, whereby smolts are not introduced to a site with older fish. Consequently, smolts will not be immediately infected from older fish at the site, thereby slowing down the acquisition of sea lice. Where year-class separation is not feasible, it may be useful to treat salmon already on a site in order to reduce lice numbers as much as possible before introducing smolts.

Year-class separation should be combined with fallowing of sites for at least four to six weeks in order to remove the source of reinfection and break the life cycle of the sea louse.

Proper management of fish densities and the use of clean nets can also help reduce the infection.

Monitoring pest populations and pest damage

Decisions about when to conduct a treatment should be based on a program of monitoring lice species, stages and numbers. The farm veterinarian should play an integral role in establishing any monitoring system. Every farm needs to have staff trained in identifying stages and signs of damage due to sea lice. Regular consultations with the farm veterinarian are important in collecting information useful for making decisions regarding lice control options. Key personnel should have a specific duty to regularly examine fish, count lice and keep records. If the counting on a farm is performed by a single trained person, the consistency of the monitoring program will be improved and the person will gain more experience.

The monitoring program should address:

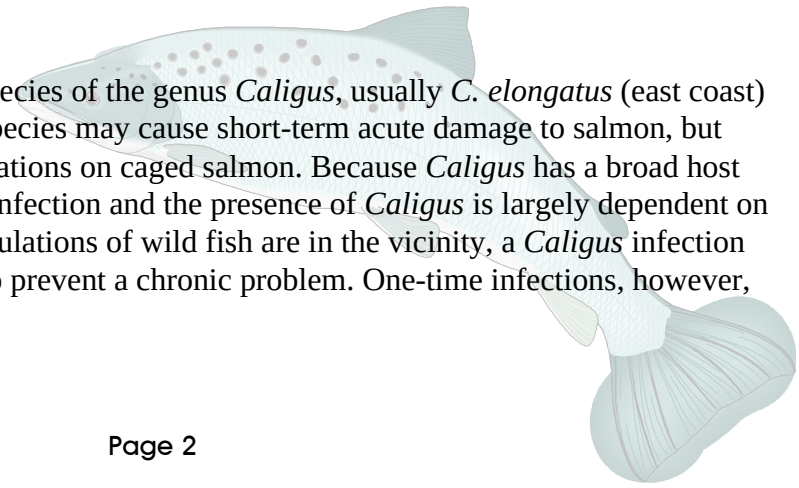
- how many fish and how many cages to sample;
- how to catch fish for a representative sub-sample, and how to handle fish to minimize stress;
- how often to sample;
- which stages to count; and
- damage assessment.

Sampling frequency should be in the range of once a month to once a week. In general, lice should be counted more frequently when water is warm (>12°C) and in the spring when temperatures and lice populations are increasing. The sampling strategy should include a differentiation of stages, including adult and ovigerous females.

Information that should be recorded for each fish includes net cage sampled, genus, number and stage of lice and index of lesion. Other information to be recorded includes date of sampling, date of last treatment, water temperature, and name of the person(s) conducting the sampling.

Operators will encounter sea lice species of the genera *Lepeophtheirus* or *Caligus*. *Lepeophtheirus salmonis* (commonly referred to as the *salmon louse*) is responsible for the majority of serious disease outbreaks and is capable of causing severe damage and becoming a long-term chronic problem. This species occurs almost exclusively on salmonids, and can become established on populations of net-cage salmon. If present, it must be controlled. Because of the greater potential for damage, the trigger levels that indicate treatment is needed would need to be lower than for *Caligus*.

Salmon may also be infected with species of the genus *Caligus*, usually *C. elongatus* (east coast) and *C. clemensi* (west coast). This species may cause short-term acute damage to salmon, but tends not to establish endemic populations on caged salmon. Because *Caligus* has a broad host range, there are multiple sources of infection and the presence of *Caligus* is largely dependent on movements of wild fish. If large populations of wild fish are in the vicinity, a *Caligus* infection may need to be controlled in order to prevent a chronic problem. One-time infections, however, may not need to be controlled.



Sea lice commonly have ten developmental stages. These include two free-living nauplius stages, one free-swimming infectious copepodid stage, four chalimus stages that are attached securely to the fish, two pre-adult stages, and one adult stage. The pre-adult and adult stages freely roam over the surface of the host. The attached copepodids, chalimus, pre-adult and adult stages of sea lice feed on mucus, skin and blood. Development is rapid at warm temperatures: a generation can be completed in about a month at 15 C with large numbers of eggs produced, leading to rapidly increasing populations.

Disease is caused by the feeding activities of the sea lice, which tend to congregate on the head and back, near the dorsal and adipose fin and the vent. Visible damage advances from fin erosion to fin loss, and open lesions on the dorsal surface. These follow a progressive pattern of grey, white and red patches. Red patches represent areas of extensive damage, tissue loss and hemorrhaging. If infections are allowed to progress to this state, the damage reduces the market value of the fish, will often lead to secondary infection, e.g., vibriosis or furunculosis, and can ultimately result in death.

The monitoring program will provide the basis for making decisions on when to treat. In establishing the monitoring program, therefore, it is also necessary to establish the treatment triggers, i.e., the populations of lice that will indicate a treatment is necessary. In addition to total counts, the relative proportion of chalimus and mobile stages (pre-adults and adults) and whether the proportion is changing are also useful in determining the need for treatment. High numbers of larval stages may indicate that a site is becoming self-infecting and urgently in need of treatment.

Reducing pest populations to acceptable levels

The treatment strategy should be chosen to provide effective treatment while minimizing the potential for negative impact on the environment and human health. Currently, treating infestations of sea lice involves the almost exclusive use of therapeutants.

A veterinarian with expertise in fish health management should be consulted to develop monitoring and control programs and to assist in decisions on therapeutant options and frequency.

Product labels and use instructions need to be understood and carefully followed. Specific treatment procedures, such as application method, withdrawal times, and worker and environmental safety, are reviewed as part of registration and licensing of products and are reflected on product labels and use instructions. Pertinent provincial departments responsible for the environment and for aquaculture should be contacted prior to treatments to determine any regulatory requirements that must be met prior to treatments.

Considerations for the farm management and attending veterinarian when choosing a treatment include the method of application (bath or in-feed treatment), the cost per treatment, cost of total treatments over the treatment season, efficacy against different stages, and withdrawal times

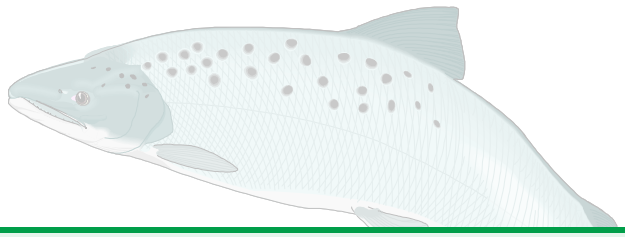
(short or long) in relation to the anticipated time to harvest. Planning is needed because both trained staff and appropriate material must be on hand to conduct treatments.

Pumping of fish is a supplemental control method that can have some utility in removing a proportion of mobile (adult) lice as part of routine management practices, e.g., at the time of grading or splitting fish, or as a short-term control near harvest time. When pumps are used, they should be fitted with screens to retain dislodged sea lice.

Additional Sources of Information

Further information on the integrated management of sea lice is available in an overview document entitled *Integrated Pest Management of Sea Lice in Salmon Aquaculture*, produced by the National Working Group on Integrated Management of Sea Lice.

There are numerous scientific papers on various aspects of sea lice biology and management that provided the basis for information in this document. A complete bibliography of sea lice information is being collected as part of the European Union Concerted Action Programme on sea lice, and is available on the World Wide Web at http://www.ecoserve.ie/projects/sealice/index.html.



This publication is the result of a collaborative effort between the Salmon Health Consortium and the Pest Management Regulatory Agency. The content is not regulatory in nature. It reflects the opinions of a diverse group of stakeholders and is intended to support the excellence and the sustainable development of the Canadian salmon industry.