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Sea lice control: Perspectives from Chile

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By Sandra Bravo

Effective, integrated pest management will require understanding of hosts, parasites and their environments

Atlantic salmon are widely affected by sea lice, while coho salmon are generally resistant to the parasites.

As in the Northern Hemisphere, sea lice are a significant threat to the Chilean salmon-farming industry. *Caligus rogercresseyi* were first recorded in Chile in 1997, infesting Atlantic salmon reared in the Puerto Montt area. Sea lice and their control have been major pathological issues for the Chilean salmon industry since 1981, when *Caligus teres* infesting coho salmon were first recorded in Region X.

In contrast to *Lepeoptheirus salmonis*, which parasitize mainly Atlantic salmon, *C. rogercresseyi* also parasitize a wide range of wild fish, including their natural hosts *Eleginops maclovinus, Odonthestes regia* and *Odonthestes nigricans. C. rogercresseyi,* which are now widely distributed in Region XI, have also been reported in southern Argentina infesting anadromous brown trout and in the north of Peru infesting tilapia reared in seawater, confirming wide distribution in South America.

The salmon industry is one of the main economic activities of the southern regions in Chile. The total salmon production in 2012 reached 804,000 mt, comprised of 61.4 percent of Atlantic salmon, *Salmo salar*, 14.0 percent coho salmon, *Oncorhynchus kisutch*; and 24.5 percent rainbow trout, *Oncorhynchus mykiss*. Atlantic salmon and rainbow trout are susceptible to *C. rogercresseyi*, while coho salmon have been shown to be resistant.

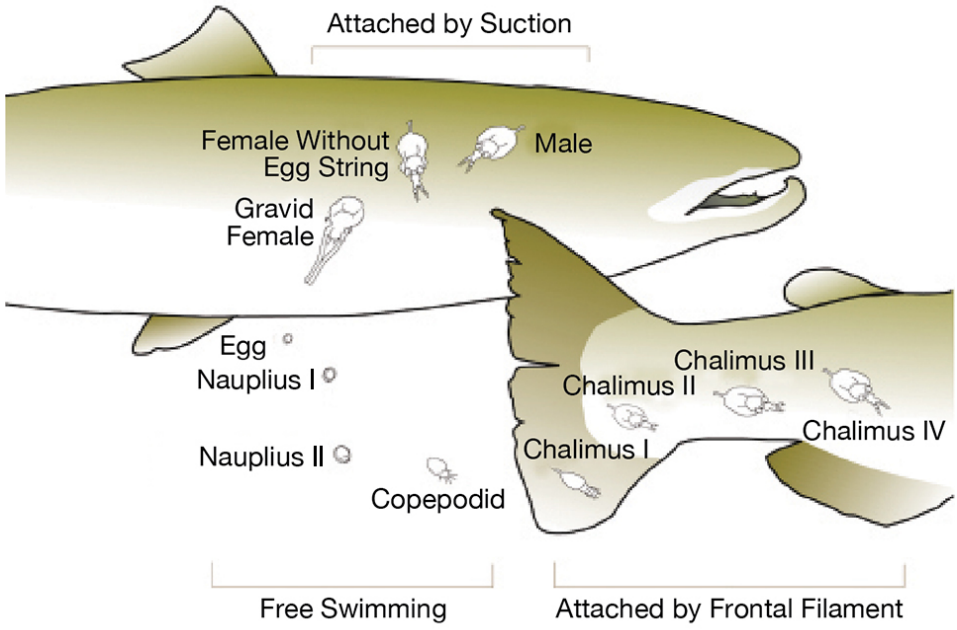
After the outbreaks of infectious salmon anemia (ISA) recorded in Region X from 2007, the salmon industry has been expanding southward to Region XI. In parallel with the relocation of salmon production, sea lice infestations also spread to Region XI, and today, *C. rogercresseyi* are the most serious threat for this region.

Development

As with *L. salmonis*, the rate of development of *C. rogercresseyi* is strongly temperature-dependent. The life cycle of *C. rogercresseyi* is completed in 26 days at 15 degrees C, in 32 days at 12 degrees and in about 45 days at 10 degrees. At 4 degrees C, there is no development of the lice.

The cycle comprises eight developmental stages: two planktonic nauplius stages, one infective copepod stage, four attached chalimus stages and one adult stage, without preadult stages. Under laboratory conditions, females can survive for up to 1,000 degree days at 10 degrees C, and males around 800 degree days. Copepodid and adult lice cannot survive for more than seven days free in seawater without a host.

C. rogercresseyi females can produce up to 11 batches of egg strings over a period of 74 days, with a periodicity between extrusions of egg strings of four days in summer and six days in winter. The reproductive output of *C. rogercresseyi* is lower than the fecundity rate reported for *L. salmonis*, for which up to 1,000 eggs have been reported for one pair of egg strings. *C. rogercresseyi* produce 100 eggs for one pair of egg strings.



Life cycle of *Caligus rogercresseyi*.

Treatments

Since the confirmed report of sea lice in 1981, several drugs have been used to keep lice infestations under control. As in the Northern Hemisphere, bath treatments followed by oral treatments were initially used.

Ivermectin administered in feed was introduced in Chile at the end of the 1980s and used until 2003. At the end of the 1990s, emamectin benzoate, under the trade name Slice, was introduced to the Chilean market and became the only product approved for the control of Caligus by the Chilean medicinal authority from 2000 to 2007. In 2001, three generic emamectin benzoate preparations that became available in Chile at a lower price comprised 79 percent of the market.

Since early 2005, a notable loss of efficacy of the treatments with emamectin benzoate was noticed at several fish farms. The decrease in sensitivity of *C. rogercresseyi* to the parasiticide contributed to an increase in its use, which reached 1.5 g/mt salmon produced in 2007.

After the evidence of resistance to emamectin benzoate recorded in *C. rogercresseyi*, caligidosis was included on the list of high-risk diseases for salmonids in 2007 by Servicio Nacional de Pesca (Sernapesca), the competent government authority in Chile. This allowed other chemotherapeutic products for control of *Caligus* to be introduced into the Chilean market.

In 2011, the pyrethroids deltamethrin and cypermethrin together with diflubenzuron were the main medicines used against *Caligus* in Chile. Despite widespread resistance to emamectin benzoate, the product is still used as an alternative treatment by salmon farmers (Table 1).

Bravo, Drugs used to control sea lice, Table 1

Active Ingredient (K)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Emamectin benzoate	52.0	77.0	121.0	127.0	149.0	212.0	326.0	906.0	285.0
Ivermectin	20.0	10.0	3.0	3.0	0	0	0	0	0
Diflubenzuron	0	0	0	0	0	0	0	0	162.0
Cypermethrin	0	0	0	6	0	0	0	0	0
Deltamethrin	0	0	0	0	0	0	0	5.2	105.2
Nuvan	1.6	3.4	0	0	0	0	0	0	0
Total salmonid production (mt)	342,407	504,422	482,392	488,256	569,146	614,139	647,263	600,835	630,647

Table 1. Drugs used to control sea lice in Chile.

Since the first ISA outbreaks were reported in 2007, Chilean salmon farmers have understood that prevention and good management practices based on biosecurity measures are the best tools to minimize outbreaks of disease, and that the use of veterinary medicines is not a singular solution to management problems.

Assessment, control

In 2007, a specific program for assessment and control of caligidosis was implemented by Sernapesca. Among the measures included were the following:
• standardization of weekly *Caligus* monitoring
• fallowing for three months between salmon production cycles
• synchronized delousing among neighboring salmon farms
• delousing treatment when more than six adult lice/fish were present
• harvesting of 25 percent of farm biomass when over nine lice/fish were present during three weeks within a six-week period.

Perspectives

Despite the measures implemented by the competent authority, sea lice are still a pathological problem for the salmon industry in Chile. The situation relates in part to the concentration of farms, as well as a lack of enough medicines with different modes of action and limited execution of strategies for rotation that minimize the risk of resistance. The further development of effective, integrated pest management will require greater understanding of both hosts and parasites, as well as the environments within which they interact.

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