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CLEANING SYMBIOSIS BETWEEN WRASSES (LABRIDAE) AND LICE  
INFESTED SALMON (SALMO SALAR) IN MARICULTURE

by

Åsmund Bjordal  
Institute of Fishery Technology Research  
P.O.Box 1964, N-5024 Bergen, Norway

ABSTRACT

Epidemic infestation by the crustacean ectoparasitic salmon lice (Lepeophtheirus salmonis) is a major problem in marine salmon farming.

Cleaning symbiosis between different labrid species and lice infested salmon is described, and the possible application of this principle in full scale salmon farming is discussed.

## INTRODUCTION

Infestation by salmon lice (Lepeophtheirus salmonis Krøyer) is a severe problem in marine salmon farming. The usual treatment for this ectoparasitic copepod is to expose the infested fish to low bath concentrations of the chemical Neguvon (Brandal and Egidius, 1979) or Nuvan (Egidius and Møster, 1987). However, this is a costly and labourous procedure, and the chemicals might imply a health risk to the farm workers.

The treatment also impose stress on the fish (Bjordal, et al. 1988) and might cause mortality for marine organisms in the areas surrounding the fish farm (Egidius and Møster, 1987, Samuelsen, 1987). The present work is based on the possible use of cleaner fish for delousing as an alternative to chemical treatment.

Wrasses (Labridae), and particularly some tropical species of this fish family have a highly developed cleaning behaviour, (Gorlick, 1984, Gorlick et al. 1987, Herald, 1975). Among Labrids in temperate waters, however, there are few records of such cleaning behaviour. Cleaning behaviour observed in aquaria is described by Potts (1973) for the labrids Crenilabrus melops, Ctenolabrus rupestris and Centrolabrus exoletus, and Samuelsen (1981) observed cleaning symbiosis between C. exoletus and anglerfish (Lophius piscatorius). Hiltlen (1983) recorded cleaning symbiosis in the natural environment with C. rupestris as the cleaner and Labrus berggylta as the cleanee.

Cleaning symbiosis between wrasses and salmon has so far not been described. The aim of this investigation was to clarify if any of the wrasses in Norwegian waters would perform as cleaners for farmed salmon infested by salmon lice.

## MATERIALS AND METHODS

### Fish

The labrids, that were fished by fyke net, dip net or beach seine were mainly goldsinny (Ctenolabrus rupestris) and rock cook (Centrolabrus exoletus), but also ballan wrasse (Labrus berggylta) and cuckoo wrasse (L. ossifagus).

The salmon used in the experiment ranged from smolt (300 g) to adult fish (3 kgs), infested by salmon lice (L. salmonis). When not specified, the general infestation level was approximately 30 lice per fish.

### Experimental facilities

The experiments were carried out either in circular tanks (1,5 m<sup>3</sup>) or in floating net cages, (4 x 4 x 4 m). The experiments on the cleaning ability of different species was done in the tanks only, while the other experiments were conducted both in tanks and net cages.

## RESULTS

### Introductory trials (June 11-24, 1987).

Shortly after capture, 100 wrasses were transferred to the indoor tank, and 85 to the net cage. The majority of these were C. exoletus (90 %) while the rest were C. rupestris and female L. ossifagus. During the trial period one or two lice infested salmon were introduced to both groups of wrasses in one to two days periods. In addition one dead salmon with live lice and free swimming lice were offered to the tank group. During these trials no cleaning behaviour was observed and there was no reduction in the number of lice on the fish at removal from tank or cage.

After these introductory trials, all the Labrids were pooled in the tank. Until September 1st, they were fed on a mixed diet, mainly salmon feed (small dry pellets and wet feed), but also live feed like different kelp dwelling crustaceans (isopods and amphipods). The fish soon showed good appetite and adapted gradually to their new environment.

On September 2nd two lice infested salmon were introduced to the wrasse tank. After a few minutes, the wrasses started to feed on the lice. The next day both salmon were cleaned. This was repeated with a total of ten infested fish (in groups of 1, 2 or 3) the following twelve days. The last group of 3 salmon was cleaned within 2,5 hours.

#### Cleaning ability of different species

This experiment was conducted from October 22nd to December 3rd, 1987. The main objective was to clarify which of the four wrasse species that functioned as cleaners. One group of each species was placed in four separate tanks. The fish was fed regularly to satiation with salmon feed. Lice infested salmon were offered to the different groups, initially only one at a time, but later up to 4 salmon to the groups that showed good cleaning ability. Cleaned salmon (no lice) were removed and replaced by infested ones. The results are given in Table 3.

Table 3. Cleaning experiment, different wrasse species.  
n=original number of wrasses, M=mortality (number) of wrasses during the experiment, S=salmon introduced and SC=salmon cleaned

TIME	SPECIES	n	M	S	SC
281087 - 031287	<u>C. rupestris</u>	19	0	11	11
281087 - 091187	<u>C. exoletus</u>	21	1	3	3
281087 - 031287	<u>L. ossifagus</u> (♀)	20	2	12	12
281087 - 231187	<u>L. berggylta</u>	20	10	6	0

All species except L. berggylta showed good cleaning ability. This latter species also had a high mortality during the experiment. C. exoletus had a very aggressive cleaning behaviour. It would not only remove lice, but also a large number of scales from the back of the salmon. This group was therefore only offered three salmon.

#### Sea cage experiments

After the first successful tank trials, experiments in sea cages were continued. In one trial 24 C. exoletus, 2 C. rupestris, 1 female L. ossifagus and 1 L. berggylta in a (4x4x4m) net cage were offered 4 lice infested salmon. These were all clean when removed one week later (Oct. 20th).

Then a larger experiment was started in the same net cage with 750 lice infested salmon and 48 C. exoletus. On Dec. 3rd, 15 C. rupestris and 5 L. ossifagus were supplied to the cage. When the experiment was terminated (Jan. 5th, 1988), the salmon was almost clean.

The salmon normally swam in a ring formed school in the cage center, while the Labrids would stay along the cage walls. During the experiment there was made numerous observations of Labrids that would enter the salmon school, swim alongside one salmon, actively inspecting it and pick lice from different parts of the salmon body.

At the end of the experiment the stomach contents of 10 C. exoletus and 5 C. rupestris were analyzed. Of the C. exoletus stomachs, 5 contained salmon lice (1, 1, 2, 8 and 14), 2 contained various small crustacean and polychaets, and 3 were empty. Of the C. rupestris stomachs, one contained lice (9), one had a polychaete, while three had an unidentified content.

During the experiment, the mortality was 19 C. exoletus and 5 C. rupestris.

#### Cleaning capacity (261087 - 271087)

To get an indication of the relative cleaning capacity 40 lice infected salmon were offered to a mixed group of 29 labrids in a (4x4x4m) net cage (24 C. exoletus, 2 C. rupestris, 2 L. berggylta and 1 female L. ossifagus). When offered, the salmon were infested with a total of 1329 lice (15-53 lice per fish). The next day, the salmon was removed and the number of lice was now reduced to 565 (3-28 lice per fish).

#### Interspecific behaviour

Aggressive behaviour between salmon and the different wrasse species was never observed. When a salmon was introduced to a tank with wrasses, it would normally swim vigorously around for a short time (1-2 min.), and then come to a rest position at the bottom of the tank. A few (1-3) wrasses would then start to pick lice - in the beginning carefully from the posterior part of the salmon body, but then more actively, and finally also from the head region (Fig. 1).

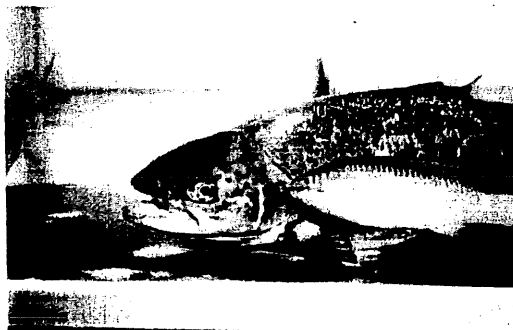


Figure 1. Goldsinny (C. rupestris) picking lice from the head region of a salmon.

C. exoletus showed the most aggressive cleaning behaviour. When the salmon was cleaned, this species was observed to continue picking on the salmon body removing a considerable number of scales. C. exoletus was also observed to attack the black spot on the caudal peduncle of C. rupestris.

## DISCUSSION

Three different wrasse species are identified as functional cleaners of lice infected salmon in culture: The goldsinny (Ctenolabrus rupestris), the rock cook (Centrolabrus exoletus), and the female cuckoo wrasse (Labrus ossifagus). The results so far indicate that the goldsinny and the rock cook are the most potent cleaners.

There is a big gap from demonstrating the principle of this cleaning symbiosis in small scale experiments to make this into a functional method in full scale fish farming. However, the different findings described above indicate that wrasses might be used as cleaner fish for lice infested salmon in intensive culture, as an alternative method to treatment with chemicals.

## REFERENCES

- Bjordal, Å., A. Fernø, D. Furevik & I. Huse, 1988. Effects on salmon (Salmo salar) from different operational procedures in fish farming. Coun.Meet.int.Coun.Explor.Sea, 1988, F:16.
- Brandal, P.O. & E. Egidius, 1979. Treatment of Salmon Lice (Lepeophtheirus salmonis Krøyer, 1838) with Neguvon<sup>R</sup> - Description of Method and Equipment. Aquaculture 18 (1979), 183 - 188.

- Egidius, E. & B. Møster, 1987. Effect of Neguvon<sup>R</sup> and Nuvan<sup>R</sup> Treatment on Crabs (Cancer pagurus, C. maenas), Lobster (Homarus gammarus) and Blue Mussel (Mytilus edulis). Aquaculture, 60 (1987), 165-168.
- Gorlick, D.L. 1984. Preference for Ectoparasite-infested Host Fishes by the Hawaiian Cleaning Wrasse, Labroides phthirophagus (Labridae). Copeia, 1984 (3), pp. 758-762.
- Gorlick, D.J., P.D. Atkins & G.S. Losey, 1987. Effect of Cleaning by Labroides dimidiatus (Labridae) on an Ectoparasite Population infecting Pomacentrus vaiuli (Pomacentridae) at Enewetak Atoll. Copeia, 1987 (1), pp. 41-45.
- Herald, E.S. 1975. Living fishes of the world. Doubleday & Co. Inc., N.Y., 304 pp.
- Hilldén, N.O. 1983. Cleaning Behaviour of the Goldsinny (Pisces, Labridae) in Swedish Waters. Behavioural Processes 8 (1983), 87-90.
- Potts, G.W. 1973. Cleaning symbiosis among British Fish with special reference to Crenilabrus melops (Labridae). J. mar. biol. Ass. U.K. (1973) 53, 1-10.
- Samuelsen, O.B. 1987. Aeration rate, pH and Temperature Effects on the Degradation of Trichlorfon to DDVP and the Half-lives of Trichlorfon and DDVP in Seawater. Aquaculture, 66 (1987), 373 - 380.
- Samuelsen, T.J. 1981. Der Seeteufel (Lophius piscatorius, L.) in Gefangenschaft. Zeitschrift des Kölner Zoo, 24 (1), 17-19, 1981.