

The following passage is from the book *Symbiosis* by Nicolette Perry (Blandford Press, Dorset, Poole, England, 1983). It describes the cleaning habits of fish.

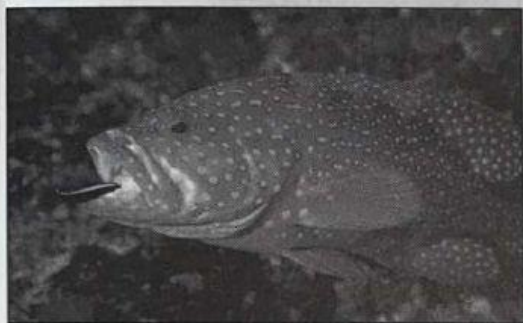


Figure 1. There are at least 45 species of fish that are known cleaners (engage in cleaning symbiosis with other fish). One example is the goby, which cleans the Nassau Grouper. The Black Surgeon fish goes from black to blue while being cleaned by the *Labroides dimidiatus*.

Cleaning symbioses¹ are found in the sea, in freshwater, on land and in the air, but the greatest number of examples concern marine species. It is essential for all creatures to have some method of keeping themselves clean and free from parasites. If they do not, they will probably fall ill from infected wounds or the effects of disease and blood loss from parasites. For those species that are unable to clean themselves it is obviously vital to find some other animal to perform this cleaning function. This chapter is concerned with describing some typical examples of cleaning symbioses as well as the more extraordinary ones.

The vast majority of cleaners are fish; at least 45 species are known cleaners and there may well be more. Fish that are habitually cleaned often have to modify their usual behavior to allow the cleaners to do their work. It is not normal for aggressive species like shark, barracuda and moray eels to allow small fish to swim safely near them. With known cleaner species, however, these and other fish change their attitude completely and allow the cleaners all over their bodies without displaying any ferocity² towards them. The clients will slow down or stop completely (unusual behavior for most fish, as they usually move all the time), open and close their mouths and gill³ covers and assume awkward-looking postures to help the cleaners. It is

¹symbiosis = the living or working together of two different organisms in a mutually beneficial relationship.

²ferocity = fierceness, violence.

³gill = the organ through which a fish breathes.

quite possible that some species have become extinct because of an inability to establish a cleaning symbiosis. So many individuals could have fallen foul of ectoparasites,⁴ fungi and bacteria that the population was made inviable.

Some fishes change color while being cleaned. Black Surgeon Fish go from black to blue when they are being cleaned by *Labroides dimidiatus*. The Goatfish changes from pale brown to pink while the same cleaner picks it over for parasites.

Fishes being groomed guard their cleaners against danger by warning them of the approach of predators. The Nassau Grouper when cleaned by gobies⁵ warns its cleaner by suddenly closing its mouth, leaving only a small gap to allow the goby to escape. Even if the grouper is in imminent danger itself it takes time to warn the goby. This shows the regard that the client feels for its cleaner and the service that it performs.

Several species of cleaner set up cleaning stations in one particular place. The local fish soon realize where the cleaner is located and will visit it whenever they require cleaning. Quite astonishing numbers of fish are cleaned in this way: not only territorial species that would normally be found in the area but also migratory ones which have gone out of their way to visit these stations. Client fish will patiently wait their turn to be cleaned, and even form orderly queues.

Quite a considerable amount of observational and experimental work has been done on these cleaning stations. Limbaugh, for example, discovered that over three hundred fish can be cleaned by a single Senorita Fish in a six-hour period. These fish go back to the same cleaner every few days for another session and this enables them to remain in peak condition.

Limbaugh also did some experiments in waters off the Bahamas. He removed all the cleaner fish from one locality and observed the effects on the species normally found there. Within two days the numbers of fish were severely reduced and within two weeks almost all the territorial fish had disappeared. Those that remained had developed the fuzzy marks that are an indication of fungal infection. It had been shown in previous experiments that the introduction of

⁴ectoparasites = parasites that live on the exterior of the host.

⁵gobies = a kind of cleaner fish.

cleaners into an aquarium infected by fungi can restore its inhabitants to health.

From the above the value of cleaning symbiosis in the marine habitat can easily be seen. Without the work of all the cleaners of the ocean, the effects of parasites, fungi and injury would kill many more species than they do already. The Senorita Fish is an example of a typical cleaner. It is of the wrasse family and lives off the coast of California. It is an active, small, cigar-shaped fish that the local people call the Senorita because of its cleaning habits. Its client fishes include the Topsmelt, Black Sea Bass, Opaleye, Blacksmith Fish and many more. These fish are almost all much larger than the cleaner and would normally prey on wrasses of the Senorita's size. They do not attack the Senorita, however, but wait patiently until it is their turn to be cleaned, hold themselves still and often in the most peculiar postures while being attended to. The fish in the area of the coast that the Senorita Fish inhabits are especially troubled by fungal infection, and removal of the white growths caused by the fungi is the cleaner's most important function. The cleaning phenomenon has been observed for many years to the extent that one species is popularly called the Cleaner Fish or Wrasse. It is a small, slim fish with cyan-colored⁶ body, striped with darker blue or black. The cleaner fish goes onstage further than the Senorita in that it actively attracts clients by "dancing." It swims in a vertical position, head downwards, and undulates its body from side to side. This is a most unusual posture for fish, as they usually swim horizontally to the sea bed. This "dancing" makes the cleaner noticeable to even the most myopic fish, and it has become the cleaner's trade mark.

Clients line up, as for the Senorita, until it is their turn to be cleaned, and also allow the little fish to enter their mouths and gill cavities unharmed. The contents of various species' stomachs have been examined to assess the quantity of cleaner fish that are eaten, both by fish that are known clients and others. It has been found that very few cleaners are consumed by any species, although fish of similar size make up the bulk of the diet. So few cleaner fish are eaten that it seems probable that the small number that are taken accidentally by absent-minded clients rather than actively predated upon.

⁶cyan-colored = greenish-blue.

Vocabulary

Look at the reading to answer the questions.

1. Which of the following phrases could be substituted for *fallen foul of* in paragraph 2?
 - a. been the cause of
 - b. been eliminated by
 - c. eaten enough of
 - d. been harmed by
2. Which of the following is closest in meaning to the word *inviolate* as used in paragraph 2?
 - a. unable to communicate
 - b. unable to survive
 - c. unable to move
 - d. unable to be eaten
3. Which word in paragraph 4 means "attended to or cared for"?
4. In paragraph 4, what does *imminent* mean?
 - a. immediate
 - b. constant
 - c. great
 - d. frequent
5. Which of these words is closest in meaning to *peak* as it is used in paragraph 6?
 - a. top
 - b. average
 - c. inferior
 - d. artificial
6. Something fuzzy
 - a. is hard and clear.
 - b. is covered with fluffy particles.
 - c. changes shape.
 - d. changes color.
7. In paragraph 8, what does *undulates* mean?
 - a. looks right to left as it passes
 - b. advances in stops and starts
 - c. moves back and forth in a wavy form
 - d. swims quickly in a straight line

8. What is the meaning of *myopic* in paragraph 8?
 - a. unable to see faraway objects clearly
 - b. having sharp eyes and good hearing
 - c. able to see in the dark
 - d. unable to distinguish large objects
9. Which of these words is closest in meaning to *assess* as used in paragraph 9?
 - a. judge
 - b. compare
 - c. confirm
 - d. view
10. Which phrase in paragraph 9 means "the greater part of"?

Vocabulary Extension

Part A

Match the verbs with the nouns as they were used in the context of the reading. Look back at the reading to check your answers. Add two more nouns that may be used with each verb.

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|-----------------|-------------|--------------|
| a. a station | c. ferocity | e. effects |
| b. smaller fish | d. behavior | f. a service |

- | | | | |
|--------------------|-----------------|-------|-------|
| 1. <u>d</u> modify | <u>behavior</u> | _____ | _____ |
| 2. _____ display | _____ | _____ | _____ |
| 3. _____ perform | _____ | _____ | _____ |
| 4. _____ set up | _____ | _____ | _____ |
| 5. _____ observe | _____ | _____ | _____ |
| 6. _____ prey on | _____ | _____ | _____ |

Part B

Make questions about cleaner fish, using each of the word combinations in Part A.