



Date:

Three-way symbiotic relationships in whale sharks

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Abstract

Symbiotic relationships between fishes and other organisms are not always easily defined, and three-way symbiotic relationships are rarely reported. Here we examine the relationship between the endangered whale shark, echeneids (remoras and sharksuckers) and a symbiotic copepod. Through their symbiosis with whale sharks, sharksuckers gain one food source from the host's parasites and energetically-free transportation to foraging areas, where they are also able to feed on the prey targeted by their hosts. The relationship between whale sharks and sharksuckers is complex, and most accurately described as mutualism. Likewise, the whale shark and copepod relationship is also complex, and could be described as a parasitic relationship with commensal or even mutualistic characteristics. Although echeneids are not considered to form host-specific relationships and can be free-ranging, the whale shark copepod occurs only on whale sharks; its survival inextricably linked to that of its host.

Keywords: commensalism, copepods, Echeneidae, mutualism, parasitism, sharksuckers.

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Summary

Symbiotic relationships, where two species live together, is common in marine ecosystems. It can be found in the form of commensalism, where teleost fish find refuge near whale sharks for increased protection. While the fish benefit from this relationship, the whale shark remains unharmed in their presence. The Echeneidae family (remoras and sharksuckers characterized by a modified, spiny dorsal fin) is suggested to have a mutualistic relationship with whale sharks. They remove and feed on the parasitic copepods found on the bodies of their hosts. In addition to the protection granted by the hosts, the sharksuckers and remoras get the unique advantage of being very close to their food source.

The whale shark copepod is believed to have a commensalism relationship with the whale shark since it feeds off of the microorganisms in the shark's skin, but a recent study suggested that they might also be parasitic, consuming the skin of the shark, as well. One of the main things that these scientists wanted to study was the relationship between the endangered whale shark, echeneids (remoras and sharksuckers) and a symbiotic copepod. However, the scientists mention the challenges of studying the feeding behaviors of large oceanic fish like whale sharks. To combat this, they looked at previous scientific studies that were done and a tourism operation in the Maldives and mimicked a method involving lights to attract plankton for feeding observations.

Findings reveal three-way symbiotic relationships involving whale sharks, echeneids, and copepods, with sharksuckers and remoras benefiting from prey abundance attracted by the host. It seems that the sharksuckers are benefitting from being passively transported to an area of high prey abundance and are likely to be feeding on the same prey as their hosts. The findings from this study suggest that while the whale shark copepod may be considered a commensal, mutualistic or parasitic species, the relationship between whale sharks and echeneids is most accurately described as mutualism. The study emphasizes the importance of considering symbiotic relationships in conservation planning, especially for endangered species like whale sharks and their associated copepods. The conclusion underscores the mutualistic nature of these symbiotic relationships and advocates for comprehensive conservation efforts for all species involved.



Check Your Understanding

Why may this team of scientists have difficulty observing the feeding behavior of large oceanic fish, like the whale shark?

If whale shark populations were to decrease, how might that effect the copepod and echeneids populations?

What implications do the paper's results have for the conservation and management of marine ecosystems?

Did you know....
At 11 cm thick,
the whale shark's
skin is the
thickest of all
known sharks!

Glossary of Key Terms

Parasitism: a relationship between two living species in which one organism benefits at the expense of the other

Mutualism: symbiosis that is beneficial to both organisms involved.

Symbiosis: interaction between two different organisms living in close physical association, typically to the advantage of both.

Commensalism: a relationship between individuals of two species in which one species obtains food or other benefits from the other without either harming or benefiting the latter