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How Corals Avoid Mating Between Different Species

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Spawning time frames greatly impact the rate of hybridization between coral species.

SOURCE: Coral Reefs
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While crossing two different species and intertwining genetic material is the foundation of some science fiction, the results of cross breeding, or hybridization, are not as glamorous in the natural world. Hybridization can result in physical deformities, non-neurotypical brain function, or even sterility. Hybridization is not ideal for the survivorship of offspring and is typically avoided in nature. For some organisms, such as corals, that reproduce by releasing gametes into the open ocean, it is not exactly clear how they avoid cross breeding between species.

Morita et al. sought to answer this question by conducting a study on two species of coral that occupy the same habitat, *Acropora donei* and *Acropora tenuis*. The researchers wanted to determine how corals avoid hybridization in nature. They observed the two species interacting in three different locations in Okinawa, Japan (Aka Island, Sesoko Island, and Oku) and compared the results to corals reared in the laboratory.

Corals undergo gamete release, or spawning, once every year during late spring or early summer. Released eggs and sperm enter the water column in bundles in the days following a full moon. The scientists collected gametes from both species of *Acropora* at each of the three locations (except *Acropora donei* at Sesoko Island because they did not spawn). The eggs and sperm were separated and then the eggs were introduced to both species' sperm individually to test fertility rates. Each species' eggs were then exposed to a mixture of the two species' sperm to test for sperm preference and the resulting coral offspring were analyzed for paternal identification. Finally, the two species of *Acropora* were observed in the field to determine the effect of population density on the risk of hybridization.

The results from the laboratory showed that both species of coral preferred to fertilize with their own species' sperm (conspecific) instead of the other species' sperm (heterospecific) in isolated experiments. The fertilization rates for both species were higher with conspecific sperm. However, when both species' sperm were mixed as they might be in nature, the results differed. At optimal sperm concentrations, both species preferred to fertilize with the conspecific sperm resulting in little to no hybridization. The lower than optimal sperm concentrations produced higher rates of hybridization for one species of corals (*A. donei*), but not the other (*A. tenuis*). This data showed that when given the opportunity, these two species will hybridize, but it was not beneficial in answering their original question of how they avoid hybridization in nature.

The authors went back into the field and observed each species very carefully. They concluded that the timing of spawning is key. *Acropora* release their gametes gradually, but a thirty-minute interval can be enough time to prevent hybridization in the ocean. *A. tenuis* spawns first to fertilize their eggs before *A. donei* spawning begins. Additionally, at Sesoko Island, the colonies of *A. donei* are surrounded by *A. tenuis* colonies, which could be the reason for a decrease in the amount of gametes *A. donei* release in an attempt to limit any further hybridization. *A. donei* is at a higher risk of hybridization at this location due to a high population density. Aka Island and Oku Island had lower risks of hybridization despite having drastically different population densities because the two colonies did not overlap. For both species of *Acropora*, their sperm were able to stay close enough to fertilize their own eggs without hybridization.

The coral species *Acropora donei* and *Acropora tenuis* are capable of hybridizing, but tend not to in order to promote genetic diversity and population survivorship. Timing of spawning events, sperm preference, and population density are the major factors that contribute to the small percentage of hybridization these corals experience in nature.

Citation: Morita, M., S. Kitanobo, R. Nozu, K. Iwao, H. Fukami, and N. Isomura. 2019. Reproductive strategies in the intercrossing corals *Acropora donei* and *A. tenuis* to prevent hybridization. Coral Reefs **38**: 1211–1223. doi:10.1007/s00338-019-01839-z. Published on 03 July 2019.