

# Science for Environment Policy

## Interactions between species affect their response to climate change

**Shifts in species' ranges** are expected under climate change, as organisms move to find suitable conditions. New research in the Mediterranean Sea has found that the way species interact could also have a significant effect on their resilience in a changing climate.

**Climate change can affect species in multiple ways** and changing temperatures can interact with other pressures, such as invasive species or changing habitat. Research into anticipating species' responses should therefore take into account all factors that might affect species, not limited to the immediate effects of physical conditions.

In this study, researchers investigated the effects of warming in the Mediterranean Sea on interactions and habitat use of two species of fish, the rainbow and ornate wrasse. The ornate wrasse is more common in warmer waters, whereas the rainbow wrasse is more tolerant of colder temperatures. However, these species do co-exist in the same habitats; both prefer seaweed forests, which provide easy access to food, but they can also be found in seagrass beds.

The researchers assessed the abundance of both species in four areas of the Western Mediterranean, including both seaweed and seagrass habitats. Seaweed forests in the colder northern latitudes contained more rainbow than ornate wrasse but the opposite was true in the southern waters. In these warmer waters, ornate wrasse were more common in seaweed forests and rainbow wrasse were found mainly in the substandard seagrass habitat.

To test whether these patterns would differ under climate change, and to study the behaviour of the fish in more detail, they also carried out a series of experiments on captive fish. Two large outdoor tanks (8m diameter and 1.5m depth) were set up with controlled temperatures. To avoid confusion with tank effects, temperature and habitat treatments were randomly assigned to the two tanks. Therefore replicated trials were not always repeated in the same tank. Artificial seaweed forests and seagrass beds were available to the fish in both tanks. In the first set of experiments, only a single species was used, and the choice of habitats was assessed. In the second set there were either equal numbers of the two species, twice as many, or three times as many ornate as rainbow wrasse.

As expected, in the single species experiments, both ornate and rainbow wrasse clearly preferred seaweed forests. However, when higher temperatures were combined with higher numbers of ornate wrasse, rainbow wrasse spent more time resting rather than searching for food, and were forced into the less-preferred seagrass beds.

The researchers suggest that seagrass may serve as an important refuge for rainbow wrasse, as projected higher temperatures will enable the ornate wrasse to increase its abundance and to displace the rainbow from the preferred seaweed forests. However, they caution that the movement of rainbow wrasse into seagrass habitat could be detrimental to other species which are only able to thrive in seagrass.

This study demonstrates that interactions between species can alter climate change response and the authors urge that this aspect of ecosystem resilience should be taken into account in future research.



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