

# Ecosystem Responses in a Marine Reserve

**In marine reserves, animals and plants usually increase in their biomass, abundance, number of species, and body size. These changes can increase ecosystem resilience and productivity.**

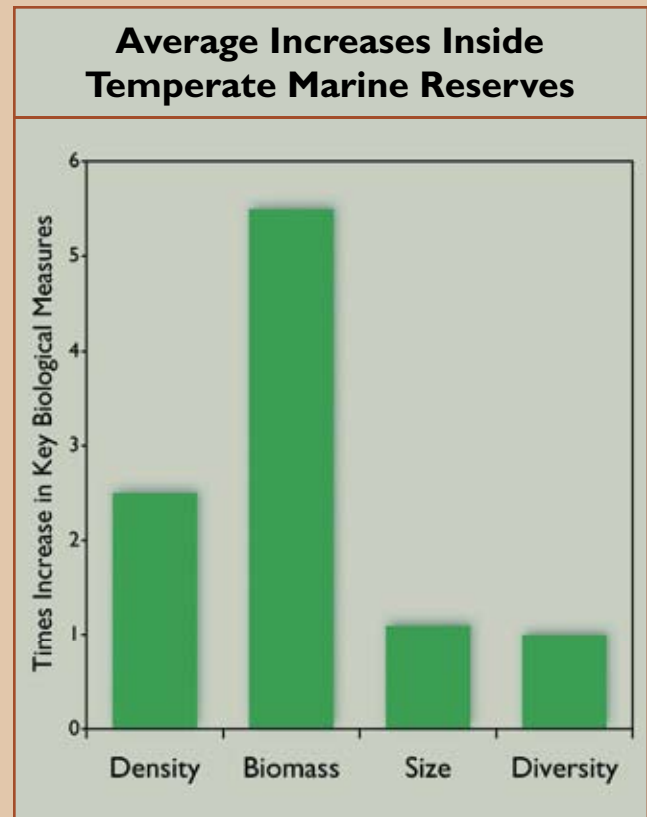
Scientists have studied the performance of more than 80 marine reserves of different sizes in a variety of temperate and tropical habitats.

The review found that, on average, in temperate marine reserves:

- density, or number of individuals per unit area, is 2.4 times higher;
- biomass, or weight of all animals, is 5.5 times higher;
- body size of animals is 1.3 times larger; and
- diversity, or number of species, is 1.2 times greater.

Biological changes in marine reserves occur because fish and invertebrates are not removed by fishing, and because their habitat is protected.

Inside reserves, habitats can recover and better sustain the plants and animals that rely on them. Animals survive longer and grow larger inside reserves. In turn, these animals can provide a food source for larger predators.



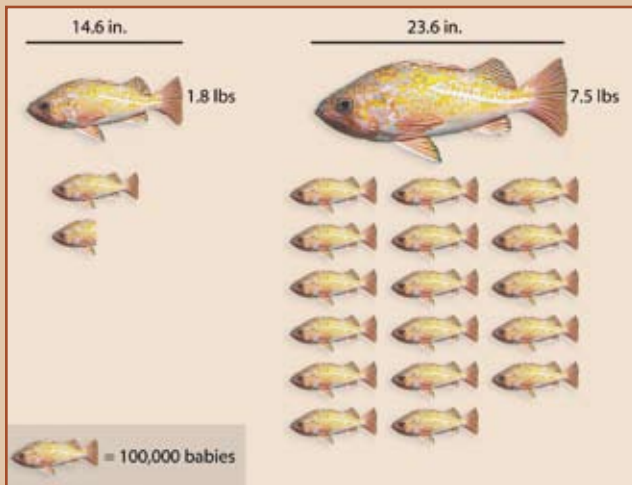
The graph (above) shows the average increase in density, biomass, individual size, and diversity of animals protected in temperate marine reserves. Modified from Halpern 2003.

**Although it is difficult to predict the exact changes for any particular species or location, the data from existing reserves show that, on average, increases in abundance, body size, biomass, and the number of species are common outcomes after marine reserves are established.**

# Ecosystem Responses in a Marine Reserve

## Larger and older animals can produce far more young than their smaller counterparts.

Because animals in reserves grow larger and increase in abundance, marine reserves can support higher rates of growth and reproduction.



Average numbers of babies produced by two different sizes of vermilion rockfish.

## Many species, not just those that are fished, respond to protection of entire ecosystems in marine reserves.

For example, California lobster and California sheephead prey on purple urchins, which consume kelp. Fishing for lobsters and sheephead reduces populations of these predators, resulting in an increase in urchins and a decrease in kelp. Protecting the marine ecosystem in reserves restores the marine food web and contributes to greater productivity of the marine ecosystem.

Marine reserves allow for the recovery of entire ecosystems.



California sheephead. Photo: Laura Francis

Bigger body size is one of the most important biological consequences of marine reserves, because large fishes and invertebrates can produce enormous numbers of young. The relationship between body size and the number of young is well known. For many marine fishes and invertebrates, small increases in body size can lead to large increases in the number of eggs produced. For example, a 23-inch vermilion rockfish can produce 17 times more young than a 14-inch fish.

