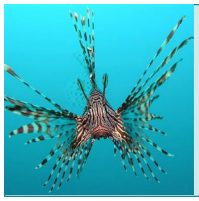

Lionfish Invasion: Density-Dependent Population Dynamics

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Introduction

VIDEO CLIP: Intro to Lionfish

Lionfish are beautiful, tropical coral reef fish that are found in a wide area of the Indian and Pacific Oceans. The reason that people are concerned about them is that lionfish are now what we call an invasive species. They are now found in a part of the world's oceans where they don't belong.

And so what has happened is, over the last years, probably through the release of aquarium lionfish that were brought into the United States, they have formed a population in the Atlantic Ocean and begin to spread rapidly. We know they have very few predators of their own in the Atlantic region. Sharks and other predatory fish just don't seem to be consuming lionfish and controlling their populations.

Some of the research we've done in the Bahamas where we've observed populations of native species that lionfish consume have shown that lionfish can reduce the biomass of their prey by 95% in just a two-year period. What we're seeing is that reefs actually look very different after lionfish numbers have increased rapidly on them to the point where we're seeing some species simply are not being found on these sites anymore.

Monitoring lionfish populations is incredibly important, so that we understand where the invasion has taken hold, how many lionfish there are, and what kinds of habitats they're affecting. And so by understanding the numbers of lionfish we have in the invaded Atlantic region, we can understand and estimate what their impact on native species is likely to be and also understand how much we might need to reduce the population of lionfish in order to start preventing those impacts from happening and protect our native coral reefs in the Atlantic region.

Models

Lionfish Estimates

VIDEO CLIP: Estimating Lionfish Populations

Some of the challenges that come specifically with monitoring lionfish are that they now have a range in the Atlantic and Caribbean that is over 4 million square kilometers. We're finding lionfish from very shallow waters in estuaries and mangroves, all the way to over 1,000 feet deep, where commercial submarine are seeing lionfish on the bottom. It's a huge range, so instead of censusing every single lionfish in the population, what we are able to do is instead sample the population using a variety of underwater ways of doing measurement.

Some of the methods we use to estimate populations of lionfish are what we call underwater visual surveys. This involves a scientist or a volunteer or a citizen scientist using scuba diving to go underwater and count fish along a certain area of the reef tract. We call this kind of survey a transect, and what we do in the survey is we would count all the lionfish that we see within a certain area along essentially a giant measuring tape that's stretched under water. And by understanding the area that

we've searched and the number of lionfish we've seen in that area, we can calculate the density of lionfish.

By doing that same survey over a large number of different sites, we can begin to build a picture of what the average density is of lionfish in a certain amount of habitat and then scale up that estimate to a broader regional level to understand what the population size might be.

Sometimes we don't always have the ability to do these underwater transect surveys, and if we want to cover a really broad area of the lionfish population, we might have to use a different method. And that's where an underwater roving survey can come in handy. What happens with this technique is that scuba divers will go underwater and instead of using a large measuring tape to look at the area they've surveyed, they will time how long they're searching for lionfish, and they will then count the number of lionfish they've seen in a certain number of minutes on their swim.

The volunteer fish survey project uses citizen science volunteers who are scuba-dive-trained and travel all over the world to do recreational dives, often while they're on holiday. Even if you don't plan to become a marine biologist, you can still contribute to marine research through gathering data, even while you're on holiday or doing something on the side.