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How can we make sure to catch only the fish we want to eat?

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Abstract

How much do you think seafood is worth? Would it surprise you to know that the world's seafood market was worth over $250 *billion* in 2021?! And it's not just money. 3 billion people (over 1/3 of the world's population) rely on seafood as their main source of protein.

But the way that we fish is harming marine life. Bycatch, where animals like sharks and turtles are accidentally caught, is a big problem. We urgently need to find solutions!

We wanted to find out whether we could use lights to make gillnet fishing better. Could using illuminated nets reduce the amount of bycatch?

We found that illuminated gillnets reduced the amount of bycatch. Even better, fishers using the nets still caught lots of the fish that they were targeting and spent less time retrieving the nets. It's a win-win!

Introduction

What do you imagine when you think of a fishing boat? Perhaps you picture a small rowboat with a few fishing rods. But this isn't what most fishing looks like across the world. There are loads of different boats and ways to catch fish!

The biggest fishing boat in the world is 144 meters (472 feet) long and uses nets that can be bigger than football fields! Fishing like this is called **commercial fishing**. It's big business, employing 60 million people globally.

The most popular type of fishing gear in the world is called a **gillnet** (Fig. 1). It's important for coastal communities

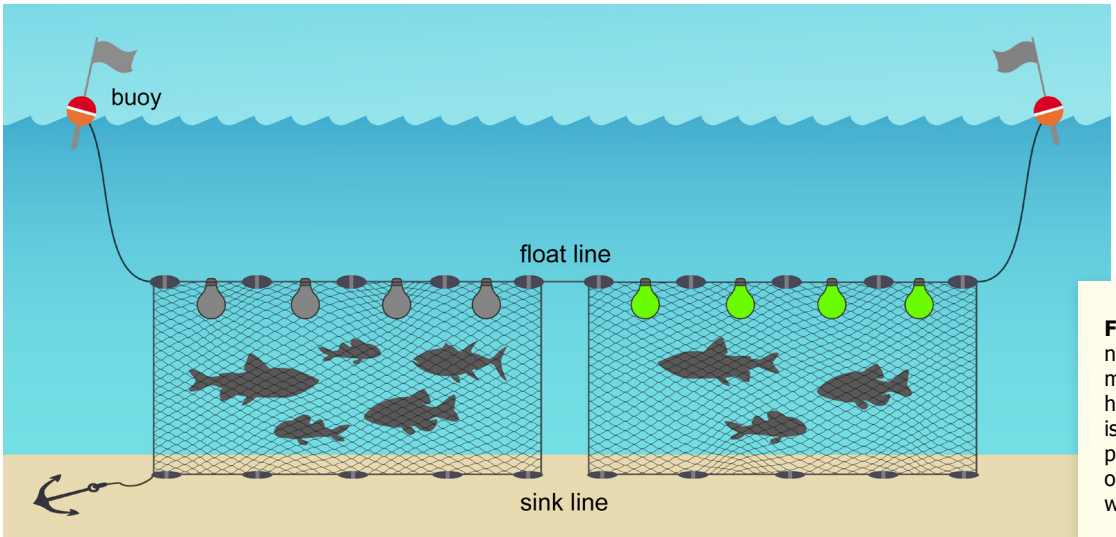

Figure 1: A gillnet is a wall of netting that traps fish and other marine animals. A bottom-set gillnet hangs from a float line of buoys and is anchored to the seafloor. We used paired sets of these nets with lights on them, one illuminated and one with the lights off.

all around the world. Gillnets are easy to use and not too expensive, so millions of people rely on this type of fishing for food, and to earn a living.

The problem is that gillnet fishing isn't very **selective**. It's not just the **target** species (the ones we're trying to catch) that get caught. Everything from sharks to turtles are caught too. We call this **bycatch** – and most of the time these animals are thrown back into the sea, dead or injured.

But telling people not to use gillnets isn't always a practical solution. We wanted to work with **fishers** to find a way to make gillnet fishing more **sustainable**. We know that many bycatch animals are sensitive to light and may behave differently than target species. Could we use this to prevent them from being caught? We designed an experiment using illuminated gillnets to find out!

Methods

We wanted to make sure that our experimental nets would work for fishers in the real world. So, we teamed up with local gillnet fishers off the coast of Baja California Sur, Mexico.

We worked with the fishers to build illuminated nets. We attached battery-powered waterproof lights to the top of the net. These pointed down to light up the whole net. We also added inactive lights to the conventional nets, to keep everything as similar as possible!

We then carried out a controlled experiment to compare the nets. We chose a busy fishing area during the peak gillnet season. Here, fishers mainly target California halibut and large grouper. We deployed 28 sets of paired gillnets (illuminated and conventional) for between 8 and 14 hours each, at depths ranging from 11 meters to 44 meters (36-144 feet). The nets were deployed, retrieved, and sorted by the same fishing crew.

We collected data on the:

- amount of bycatch,
- amount of target catch, and
- time taken to retrieve and sort (remove bycatch and target species from) the net.

Results

In total, our nets were in the water for almost 700 hours. During this time they caught 39 species, weighing over 2.5 metric tons in total (as much as a small elephant!). We found that:

- Illuminated nets reduced the total bycatch by 63% (Fig. 2).
  - Shark and ray bycatch was reduced by 95%!
  - 27 bycatch species were caught, including loggerhead turtles and Humboldt squid.
- There was no difference between the nets when it came to the target catch.
  - That means the lights did not prevent the target fish from being caught!
  - 14 target fish species were caught and kept by the fishers to sell.
- It took the fishers 57% less time to bring in and sort the illuminated nets!
  - Having less bycatch meant the nets were lighter, with less drag.
  - Also, less time was spent handling difficult animals like turtles and rays.
  - We expect this to save fishers an average of between 56 and 70 minutes per fishing trip!

Please see Figure 2 on page 3

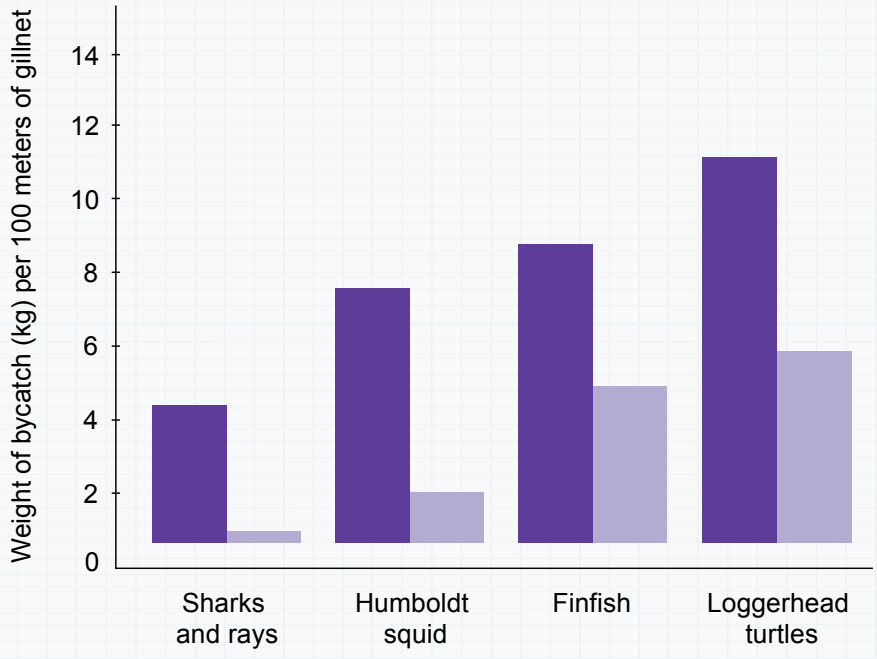

Figure 2:
The amount of bycatch in conventional nets versus illuminated nets for different groups of marine animals.

Roughly how many kilograms of Humboldt squid were caught per 100 meters of conventional net as compared to 100 meters of illuminated net?

Discussion

Illuminated nets are better for the fishers and better for marine life. We can use these nets to reduce bycatch of sharks and rays – which we're losing rapidly because of overfishing and bycatch.

So why do the illuminated nets reduce bycatch, but not target catch? Do the lights make it easier for animals to see and avoid the net? Animals like sharks and rays can have sensitive eyes. Maybe the light is annoying enough to avoid? We need to do more work to find out!

Using illuminated nets makes gillnet fishing safer and more profitable. Bycatch animals are often big and heavy – they can injure fishers and damage the nets. And with illuminated nets, fishers can catch the same amount of target catch in less time!

So, illuminated nets could make gillnet fishing more sustainable. But we need to get fishers on board. The lights aren't that cheap (~$7-9 each), and the batteries need to be replaced periodically. We're looking into solar-powered lights that could help.

Conclusion

You may have heard that there are plenty of fish in the sea… but really, there aren't. 90% of target fish populations are fished to their maximum or even worse, overfished. But you can use the power of your plate to help!

There are loads of great websites to help you choose sustainable fish. Check out the MBA Seafood Watch or WWF seafood guides (multiple countries), the MCS Good Fish Guide (UK), or NOAA's FishWatch (USA). Also look for labels that indicate more sustainable types of fishing, like pole-and-line.

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Glossary of Key Terms

Bycatch – marine animals that are caught accidentally in fishing nets. This includes dolphins, sea turtles, sharks, rays, and seabirds. Often these species are already threatened or endangered, with fishing usually being the biggest threat they face.

Commercial fishing – catching fish for profit. This can be small scale (like gillnet fishing) or large scale.

Fishers – traditionally people that work in fishing have been called fishermen. But it's not always men that fish! So, "fishers" is now the best way to talk about people who work in fishing.

Gillnet – a wall of netting that hangs in the water. The net is usually made of nylon. It's designed so that the fish get their gills stuck in the net and cannot escape. Gillnets usually target fish like salmon, halibut, grouper, cod, haddock, herring, and seabass.

Selective – limiting how much is taken or chosen. In fishing, it describes how much bycatch a type of fishing tends to have. Gillnets are not selective because they have high bycatch. Pole-and-line fishing is more selective because they usually catch only target fish.

Sustainable – able to be maintained long-term. Generally, the more selective a type of fishing is, the more sustainable it is. At the moment, most fishing is not sustainable – we are catching too many target fish, as well as bycatch.

Target species, target catch – the type of fish that the fishers are trying to catch so they can sell it (for example, at a fish market).

Check your understanding

1. Why is telling people to stop eating fish not a solution? What about telling fishers to stop using gillnets?
2. How did we design our experiment to make sure that it was controlled?
3. How many target fish and bycatch species were caught in total during our experiment?
4. Why is reducing bycatch a win not just for marine life but also for fishers?
5. What are the most sustainable species of fish to eat in your country?

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