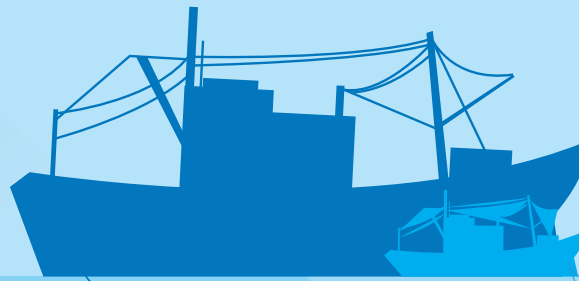


Counting the fish catch - why don't the numbers match?



Authors:
Daniel Pauly and Dirk Zeller
Associate Editor:
Lindsey Hall

Abstract

Fish and marine animals like shrimp (we'll call them all fish here), are an important food source for many people in the world. They provide vital nutrients to people with poor diets.

There are various large and small-scale fisheries involved. Some people sell their catches, while others catch fish for their families to eat. In order to know the total amount caught, we need accurate data on all fisheries catches.

We carried out a data collection project to calculate total catches from all marine fisheries in the world from 1950 to 2010.

Reading level: upper middle to high school

This made us realize that catches peaked at a much higher amount than the officially reported figures. It also showed us that they are now declining much faster than previously thought.

All fisheries need to be better monitored so that we have more accurate data. This will help us to be able to make the right decisions to protect global fish stocks

Introduction

In many *developing* countries, fish is the main animal protein available to rural people.

But the growing popularity of fish in *developed*, or *rapidly developing* countries, means that the demand is greater than their own fish stocks can supply.

To meet this demand, countries have to get more fish from other places. They either send their own fishing boats into the waters of developing countries, or buy fish from them.

This can make it hard for small-scale fisheries that supply their local communities in developing countries to compete against the larger, export-focused industrial fisheries (Fig.1).

The Food and Agriculture Organization of the United Nations (FAO) receives annual catch data from its member countries. This is the only global data set of fisheries statistics. It gets used by scientists and agencies to create fishing policies.



Figure 1:

Industrial fishing boats often drag nets through the sea to catch fish

Unfortunately, many countries don't accurately report on their small-scale fisheries. In fact, there are several data sets that they may underestimate:

- Artisanal (small-scale, commercial)
- Subsistence (small-scale, for the fishers' own consumption)
- Recreational (small-scale, for pleasure)
- Discards (unintentional catch thrown back to sea)
- Illegal catches

(Fig. 2)

This means that FAO catch data may be much less than the actual fisheries catch. Although FAO and many scientists knew that they had underestimated the figures, nobody realized just how serious the problem was.

We set out to find the real figures of global marine fish catches.



Figure 2:

Artisanal fisheries like these can catch a lot of fish!

Methods

To calculate total catch for all marine fisheries between 1950 and 2010 we used an approach called *catch reconstruction*. For each maritime area, we added up three layers of data:

Layer 1 - Domestic catch

We considered four sectors:

- ① Industrial
- ② Artisanal
- ③ Subsistence
- ④ Recreational

We assigned catches to either landings (fish that people keep and bring into land) or discards.

We used the FAO data as our baseline. We then added data from studies of scientific literature, speaking with local experts, and consulting with the country's department of fisheries. These departments often had more detailed information than what the country sent to FAO!

When data was missing, we used catch estimates for a single area, sector or year. We then expanded these data to represent an entire country, and joined the time periods between points.

To get the reconstructed catch, we added the additional "unreported" catch data to the reported catch data submitted to FAO.

Finally, we assessed the *uncertainty*. We scored each reconstruction on the quality of the data, from 1 (very low – 50% uncertainty), to 4 (very high, 10% uncertainty).

Layer 2 - Catches from foreign fleets

These are catches taken by boats of one country in another country's *Exclusive Economic Zone (EEZ)*.

Layer 3 - Tuna and other pelagic fish

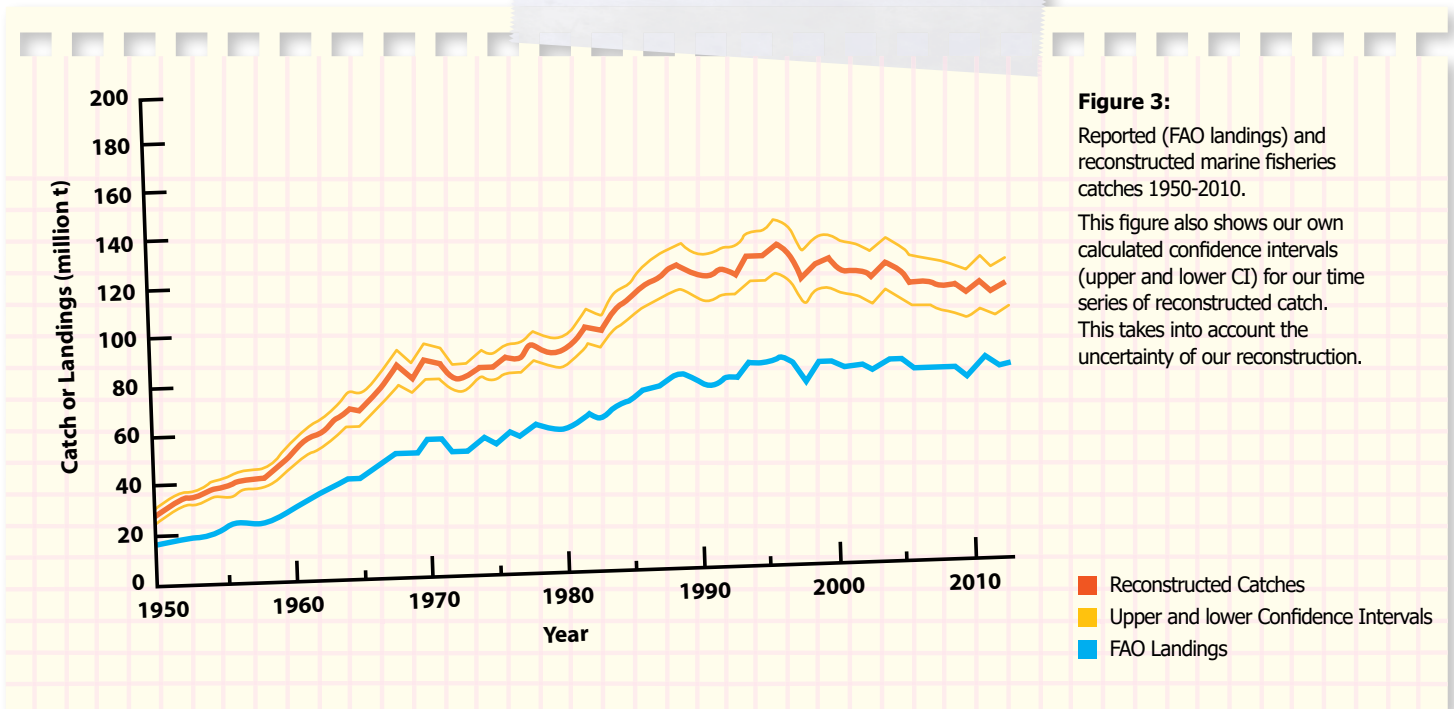
We assigned catches to each area according to the data available.

Results

1) Global pattern

FAO data suggest that global marine fisheries catches peaked in 1996 at 86 mt (million tonnes), and then slightly declined, although FAO labels this as 'stability in global catches.'

We found that global catches between 1950 and 2010 were 50% higher than FAO data, and catch actually peaked at 130 mt. Catches are now declining over three times more rapidly than reported (Fig. 3).



2) Spatial pattern

We saw declining catches in some maritime areas, like the Northwest Atlantic. Other maritime areas like the Indian Ocean still show increasing reported catches, but these data are far more uncertain.

3) Fishing sector

Industrial fisheries catch has fallen from 87 mt in 2000, to 73 mt in 2010. This is the main cause of the global total decline in catches since 1996.

Artisanal fishing catches are gradually growing, from 8 mt per year in the 1950s to 22 mt in 2010.

Subsistence fisheries accounted for 3.8 mt per year and recreational fisheries account for under 1 mt per year. These catches are rarely reported to FAO.

Discards peaked in the late 1980s and have fallen to an average of 10.3 mt per year from 2000 - 2010. This fall is partly responsible for the reducing levels of global catch, and reflects the declining industrial catch.

Discussion

We included estimates of uncertainty for each country's data. While some of our estimates have high levels of uncertainty, officially reported data may be similarly uncertain. This is because most countries use sampling and estimations to work out their official national catch.

Industrial fisheries catches are falling, but as countries start to include artisanal and other small-scale catches in their official catch data, this is partially covering up the fall. This can make the trend look more stable than it is.

Our study showed that stock rebuilding is an important policy that should be more widely practiced. It also suggests that

it could be even more beneficial than previously estimated from reported catches. However, we are concerned that the recent catch decline is a threat to *food security*, shown by the decline in seafood caught per person.

Our reconstructed catch data study for all countries is the first of its kind. We hope it will help to create better policies to govern the world's fisheries. The first step should be for national policies to recognize the likely scale of the fisheries that they are not including in their official data collection systems. This could then help to improve their systems.

Conclusion

The UN created the FAO database to help people make decisions to protect marine *ecosystems*. It is therefore really important that its data are accurate. However, we found that the trend of global marine fisheries catches is actually one of decline, whereas FAO suggests that it is stable. Our study shows that there is a need to improve the accuracy of this database.

At the end of any science experiment, you have to make your conclusions and recommendations. These will only ever be as good as the data you collect at the beginning of the experiment, so make sure that you're confident in your data!

Glossary of Key Terms

Exclusive Economic Zone – The areas of the seas that countries have claimed for resource use and management under the United Nations Convention on the Law of the Sea (UNCLOS), or which they could claim under UNCLOS rules, but have not done so (like many countries around the Mediterranean).

Developed country – A country that is economically and industrially more developed compared to other countries. This includes the US and Canada, and countries in Europe.

Developing country – A country that is less developed economically and industrially than others. It normally also has a lower standard of living. This includes many countries in Africa.

Rapidly developing country – We define Brazil, Russia, India and China as rapidly developing countries. Their economies are growing very fast and their populations are becoming wealthier. This generally results in the countries consuming more meat and fish, as people's diets change.

Ecosystem – A community of animals that interact with each other, and their physical environment.

Food security – The ability for people to have reliable access to enough affordable and nutritious food to keep them healthy.

Pelagic fish – Fish that live in a part of the sea known as the *Pelagic* zone. This means that the fish live most of their lives neither close to the bottom of the sea, nor close to the shore or reefs. You can also think of these as 'open ocean' animals.

Uncertainty – This recognizes the statistical precision of the data, or how likely it would be to be able to replicate the results. A low level of uncertainty means that it will be more likely to be able to get the same results again if someone repeated the study.

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Check your understanding

1 Why do you think that countries under-report catches from artisanal and other small-scale fisheries? Why is this a problem?

2 The data request form sent by FAO to each country every year contains the country's previous year's data. Why do you think that this could result in poor data being provided by the countries?

3 When we analyzed official records of catches for some countries, we sometimes found no record of a fall in catch in the years following a natural disturbance (like a tsunami), or socio-political disturbance (like a civil war). Why does this indicate that the official catch data may not have been very accurate?

4 We applied a rule to never enter 'NA' (not applicable) when no data was available for a known fishery. Instead, we used a best estimate of catch, for example by analyzing the number of boats involved in fishing and the average catch rate of those boats. Why would it be bad for NAs to be used?
