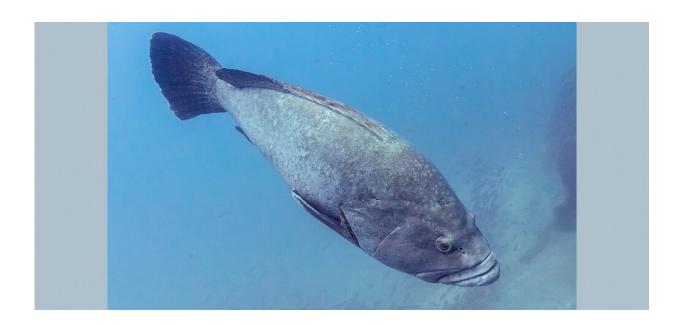# Study reveals decline in predatory fish catch on the southeastern Brazilian Coast

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Study shows the replacement of large species by others that are less valuable commercially, and 37 species were considered overfished (Dusky grouper Epinephelus marginatus). Credit: Diego Delso/Wikimedia Commons

In an article published in the journal *PLOS ONE*, Brazilian scientists show that one of the effects of overfishing in Arraial do Cabo, Rio de Janeiro state, Brazil, is the replacement of large, valuable species by smaller species for which there used to be little demand.

According to the authors, the decline in stocks of Pomatomus saltatrix

(bluefish), Epinephelus marginatus (dusky grouper), Caranx hippos (crevalle jack) and Seriola fasciata (lesser amberjack) has been followed by an increase in the capture of less commercially valuable but more abundant species, such as Trichiurus lepturus (beltfish), Balistes capriscus (gray triggerfish), Aluterus monoceros (unicorn leatherjacket), and Priacanthus arenatus (Atlantic bigeye).

In the article, which focuses on artisanal fishing, the authors note that fishers have to spend longer at sea to obtain the same yields as in the past, and that the youngest are switching to other sources of income such as tourism and are often encouraged by their families to quit fishing.

Concentrating on large-bodied fish can cause the decline of top predators such as groupers, sharks and tunas, and even lead to local extinction of some species, the article stresses. The first author is Carine O. Fogliarini, a researcher at the Federal University of Santa Maria's Marine Macroecology and Conservation Laboratory.

Also signed by Vinicius J. Giglio Fernandes, a researcher at the Federal University of São Paulo (UNIFESP) with a postdoctoral scholarship from FAPESP, the article confirms the existence of a well-known trend scholars refer to as fishing down the food web.

"The decline in stocks of higher trophic-level species [larger species and apex predators] leads to more fishing of smaller-bodied species at a lower trophic level. Overfishing eventually leads to concentration on the smallest species at the bottom of the food chain. In an article published in 2014, we had already highlighted the decline in several mesopredator species [mid-level carnivores], including grouper and bluefish, and now, by combining local fishers' knowledge and landing data, we've shown how upper-level species are being overfished in Arraial do Cabo and the average size of landed species is decreasing," said Mariana G. Bender, who heads UFSM's Marine Macroecology and Conservation Laboratory

and is last author of the article.

To confirm this latter finding, the researchers used mean trophic level (MTL) as a metric and set out to estimate its decline in a 16-year time series. "Roughly speaking, when this number falls significantly, it's a sign that we're fishing many more low-level species," Fogliarini said. "We had some difficulty with MTL because it's a general metric that takes into account the mean trophic level of landed biomass and its variation over time. So we divided MTL into four categories: all landed species; species from a trophic level [TL] above 4; TL equal to 3.5 or higher; and TL below 3.5."

The researchers observed a downtrend in MTL and landings of species with a TL above 4 and with a TL equal to 3.5 or higher. "Catches with a TL above 4 tended to rise and then fall sharply," Bender said. "This means landings of species with a TL above 4 were indeed declining, and they tended to be replaced by species with a lower TL."

The study also suggests that assessing changes on the basis of a single indicator, such as MTL, may mask results and that the use of several approaches, including local knowledge, can make the changes more explicit.

New targets

The researchers interviewed 155 artisanal fishers in Figueira, Monte Alto, Praia Grande, Praia dos Anjos, Prainha and Pontal, corresponding to 10.3% of the artisanal fisher communities concerned. They classified the interviewees into four groups: less experienced (under 20 years of experience), intermediate (21-35 years), experienced (36–40 years), and very experienced (over 40 years).

"Fishers with more years of experience recognized a significantly larger

number of overfished species than those with fewer years of experience," Fogliarini said. "We observed the same pattern for the number of species recognized as target species. The more experienced the fisher, the more species mentioned as new targets of local fishing."

The researchers identified 37 species as being overfished, led by bluefish in all experience categories (45%), but grouper and crevalle jack were most cited by the most experienced group. "They've fished grouper in the region for many decades and it's important to the local economy. Grouper and crevalle jack have always been highly valued there, but both species are increasingly scarce," Bender said.

Beltfish ranked second among overfished species and first among new target species. "According to the most experienced fishers, the species initially had no value and was buried in the sand when landed as bycatch, but a market gradually emerged for the species, which became a new target and was eventually overfished," Fogliarini noted.

The second most cited species among new targets was gray triggerfish, followed by Argentine conger (Conger orbignianus), unicorn leatherjacket and Atlantic bigeye. "The same downtrend reported for bluefish, beltfish, grouper, crevalle jack and lesser amberjack was confirmed by the landing data we were able to access," Fogliarini said. "We also found that the younger fishers reported new target species more than the older ones, and this also matched the most recent landing data we had."

Reasons for overfishing

According to the interviewees, the reasons for overfishing were rising numbers of fishers and fishing boats, the presence of industrial fishing vessels in the area, and unsustainable fishing techniques such as trawling and purse seining.

Marine fishery data from the Rio de Janeiro Fishery Monitoring Project for the period January-June 2020 shows that 59.9% of the artisanal catch in Arraial do Cabo was obtained by purse seining, with a skiff hauling out the net from the fishing boat to surround the fish. Hook and line came second, and beach seining came third.

"In beach seining, they use several skiffs and pull the net to the beach, where they land the catch. We also know about shark fishing, where they surround the fish and haul them to the beach. This is highly predatory because it catches a lot of pregnant females," Fogliarini said.

Data and public policy

According to Bender, the monitoring project data analyzed by the researchers was for too short a period (16 years, between 1992 and 2008), and more recent data exists but they did not have access to it. More assertive public policy is needed to assure continuous monitoring as well as data production and availability.

"Monitoring is irregular in Brazil, in the sense that it isn't done everywhere and it isn't continuous. It should ideally be periodic [once a month, for example] and include inspection of landings at various points of the coast, because catches vary in terms of composition from one place to another," Bender said. "Most important of all, it should be based on species and be as detailed as possible, avoiding the use of common or popular names, which is the current methodology and makes it hard to construct stock scenarios for the entire coast. There may be several species in a generic category such as 'grouper', which anyway refers to different species in Bahia and Santa Catarina states. Common names can change from one region to another."

For Fogliarini, consumers are also very important. "Few initiatives try to reach the consumer, and yet it's demand that determines what's caught,"

she said. "We need consumer awareness campaigns. A lot remains to be done to reach a reasonable level of awareness about fish consumption."

More information: Carine O. Fogliarini et al, Telling the same story: Fishers and landing data reveal changes in fisheries on the Southeastern Brazilian Coast, *PLOS ONE* (2021). DOI: 10.1371/journal.pone.0252391

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