

FISHERIES

Micronutrient richness of global fish catches

Analysis of the nutrient composition of fish caught around the globe reveals locations where the retention of fish for consumption by local populations could help to tackle human disease caused by nutrient deficiencies.

DANIEL PAULY

Eating fish is good for us. Fish are a source of micronutrients that help to prevent nutrient-deficiency diseases, which are a leading cause of infant deaths worldwide. Determining whether the consumption of locally caught fish could reduce the incidence of nutrient-deficiency diseases in countries particularly affected by this problem requires having access to the relevant data. Writing in *Nature*, Hicks *et al.*¹ report their assessment of the nutritional content of 367 species of fish. For 43 countries, the authors mapped the relationship between the fish-derived nutrients available from fisheries' catches and the prevalence of nutrient-deficiency diseases in communities living within 100 kilometres of the coast.

When assessing the nutritional composition of fish stocks, Hicks and colleagues focused on six crucial micronutrients: calcium, iron, zinc, selenium, omega-3 and vitamin A. They also considered protein content. Using some previously available data, the authors generated a model that could correctly predict the levels of these nutrients in different species of fish. By mining databases containing information about fisheries' catches taken between 2010 and 2014, the authors gathered information about the amount and type of fish caught in each country's exclusive economic zone (EEZ) — the area of its coastal waters over which it has sovereign fishing rights. Hicks and colleagues used their model to estimate the nutrients available from these fish catches and thus determine the spatial pattern of this nutrient availability in global fish catches. For example, they noted that tropical fish have higher concentrations of calcium, iron and zinc than have fish from other regions.

In developing countries around the tropics, fish are not usually just another healthy complement to an already rich assortment of foodstuffs. Rather, for millions of people living in these regions, fish add the missing micronutrients and proteins to what would otherwise be an unbalanced diet. In many developing countries, fish are the food source²

that provides the majority of the inhabitants with most of the micronutrients studied by the authors. The protein from fish boosts the nutritional content of typical diets in such countries, where calories are obtained mainly from foods such as maize (corn) or rice.

Hicks and colleagues' data demonstrate that fisheries' catches in some developing countries should be enough to meet the key micronutrient needs of their populations. For example, more than 75% of the population in Namibia is at risk of calcium deficiency, even though enough fish is caught there to remedy this situation. In some cases, ensuring that even a fraction of a country's total fish catch is retained for local consumption could have a substantial impact on public health. This is particularly true for children under five years old, during a crucial stage of their development when micronutrient deficiencies have a severe effect. For 22 of the countries that

Hicks and colleagues studied, 20% or less of the fish caught could provide enough key micronutrients to meet the needs of all children under five years old.

Not only do nutrient shortages harm public health, but this problem has a knock-on effect of lowering gross domestic product. It might be supposed, then, that the governments of developing countries in the tropics — along with international development organizations or institutions such as the United Nations — would be doing everything possible to encourage the domestic consumption of fish caught in the EEZs of these countries. However, most economic-development policies, including those of these countries themselves, are geared towards promoting fish exports to match the insatiable demand for fish in the markets of high-income Western countries and East Asia³.

The waters surrounding developed countries became overfished before overfishing began to occur in other countries. For example⁴, the combined fisheries' catch in the North Atlantic peaked in 1975, and the world's catch peaked in 1996. The catch limits placed on overfished regions has led such regions on a quest to obtain their fish from other sources. These days, much of the haul in many parts of the developing world is either caught by local fishermen and exported, or taken by foreign fleets — which, by paying a nominal fee to access the EEZs of developing countries, catch fish for their own markets. Such actions contribute to the scarcity of nutrients in many developing countries.



Figure 1 | Sardinella fish being processed in Mauritania to generate fishmeal. In many developing tropical countries, a substantial proportion of local fish catches are either exported for human consumption or processed locally to generate fishmeal that is then exported and used, for example, to feed farmed fish. Hicks and colleagues' analysis¹ suggests that the retention of fish for local consumption could help tackle human disease associated with nutrient deficiencies in countries where such conditions are prevalent.

SYLVAIN CHERKAOU/REUTERS

This problem is perhaps greatest for countries on the northwestern coast of Africa. There, fishing by fleets from the European Union, Russia and East Asia — and high fish exports to the EU — have led to local fish scarcity and price increases that have made fish increasingly inaccessible to local consumers⁵. In Senegal in western Africa, one of the countries studied by Hicks and colleagues, a small micronutrient-rich, herring-like fish called sardinella has been a staple for centuries. A 2016 documentary film called *An Ocean Mystery: The Missing Catch* (see go.nature.com/2kyjv51) shows sardinella being smoked, dried and hand-processed by Senegalese women and then trucked to the interior of the country, where these fish are the only affordable main source of micronutrients and animal protein. The leader of these workers emphasized in an interview in the documentary that it would be a catastrophe if the sardinella supply was interrupted, because they would have no fish to process.

Since then, this feared catastrophe has begun to happen. Despite much local consternation, more than 40 industrial fish-processing plants have been built, mainly by

Chinese enterprises, along the coast of Senegal (see go.nature.com/2kva8bu) and neighbouring countries (see go.nature.com/2jtmcjg). These plants process sardinella (Fig. 1) and similar small fish into an animal-feed product called fishmeal. Many of the local fisheries, which had traditionally supplied the regional markets with sardinella for human consumption, now instead supply the fishmeal plants. These factories export their product mainly to China, which is the world's largest fishmeal importer, and it is commonly used there to feed farmed fish.

Thoughtful consumers often insist that they eat fish certified as sustainably caught. This nebulous term often implies a hope that such fish suffered as little as possible, and that their stocks are somehow being managed to ensure the continuation of an abundant supply. If such fish come from fish farms, as is the case for most salmon on offer, this, too, is considered a good thing, because it is widely thought that fish farming relieves pressure on capture fisheries. However, using sardinella to make fishmeal for farmed fish does not reduce the pressure on wild fish. Moreover, it deprives people in the developing world on low incomes

of previously affordable, nutritious local fish — to aid the production of costly farmed fish that is mainly consumed in high-income countries².

When considering what fish we should eat, given that fish is good for us, it is time to take a broader perspective about how “us” is being defined. Hicks and colleagues’ work points a way forward. The information they have provided could be used to put a spotlight on fish availability when thinking of ways to prevent human disease caused by micronutrient deficiencies. ■

Daniel Pauly is at *Sea Around Us, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, British Columbia V6T 1Z, Canada.*
e-mail: d.pauly@oceans.ubc.ca

1. Hicks, C. C. *et al.* *Nature* <https://doi.org/10.1038/s41586-019-1592-6> (2019).
2. Golden, C. D. *et al.* *Nature* **534**, 317–320 (2016).
3. Swartz, W., Sumaila, U. R., Watson, R. A. & Pauly, D. *Mar. Policy* **34**, 1366–1373 (2010).
4. Pauly, D. & Zeller, D. *Nature Commun.* **7**, 10244 (2016).
5. Thiao, D., Lepoint, J., Ndiaye, B. & Mbaye, A. *Aquat. Living Resour.* **31**, 25 (2018).