



# Nutritional implications of international fishing and trade

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Over the past three decades, global production of marine capture fish has remained steady with respect to volume following a period of rapid growth after World War II. This stagnation on a global scale, however, obscures underlying shifts in production. The proportion of marine capture harvest from tropical fishing areas has grown rapidly (1). Additionally, technological advances in transportation, preservation, and storage of harvests have increased the magnitude and value of fish and fish products traded worldwide (2). Because fish is widely recognized as an important source of food and nutrition (3), gains in production and trade have the potential to help address international food security concerns. In recent years, the Food and Agriculture Organization has noted a rise in the rates of moderate to severe food insecurity, a trend that predates and has been exacerbated by the COVID-19 pandemic (4). The work by Nash et al. (5) adds valuable insight to understanding the implications of global marine fish trade and foreign fishing on supplies of key micronutrients.

The most commonly used definitions of food security originate from the 1996 World Food Summit and account for food availability, economic and physical access, utilization, and stability (4). Nationally aggregated data, such as country-specific food balances, that include information of production, imports, and exports are often used to understand global trends in all types of food production and utilization. Food balances are then used to estimate other commonly cited food insecurity statistics, permitting cross-country comparisons of changes in food supply (6). Despite the intrinsic weakness of nationally aggregated statistics to smooth over heterogeneity within a country (7), the scope and complexity of global trade networks mean that aggregate measures are an important first step to understanding the availability of food.

Researchers studying the global fish trade often use trade balances calculated from value or volumetric measurements of exports and imports of fish and fish products. Patterns in the value and volume of trade flows suggest that developed countries are importing high-value fish and that developing countries are exporting high-value and importing low-value fish (Fig. 1). Further, both imports and exports are rising substantially for all but low-income countries. This global redistribution of high-value commodities to wealthier countries is consistent with economic theory, but the welfare implications of these observed patterns are disputed (8, 9). Moreover, it is not immediately clear whether value- or volume-based estimates are most relevant to understand the implications of the seafood trade on food security for many reasons. First, standard definitions of food security today extend beyond quantity to include quality considerations. Nutritional value varies across fish species, limiting the information contained in aggregate quantity measures. Additionally, prices reflect dietary preferences beyond nutritional value. Second, definitions of food security today include the stability of food

supplies, a dimension for which national-level trade balances on their own offer limited insight. The methods used by Nash et al. (5) provide a fresh perspective on understanding welfare implications of the global fish trade.

Because industrial marine fishing fleets operate over vast distances (10), relying on export and import data can limit our understanding of the connection between global fishing activities, the availability of food, and the management of marine fish stocks. Trade data have been connected to harvest records as to map consumer markets to likely origins of seafood (9, 11). In their paper, Nash et al. (5) not only utilize catch and trade data but also, use nutrient composition data to estimate the distribution of nutrients derived from the capture and trade of marine fish. This allows the authors to present a nuanced analysis of the relationship between marine capture fisheries and inadequate nutrient intake on a global scale.

Nash et al. (5) estimated the impact of the marine fish trade and foreign fishing, both separately and jointly, expressed in terms of the number of reproductive age females whose recommended nutrient intake could be met by the mass of nutrients available in traded and fished food. They find that foreign fishing is responsible for moving 1.5 times more nutrients than trade, underscoring the importance of considering landings in addition to trade data. In their analysis, they calculated trade and foreign fish balance, the latter expressed as harvests caught outside of a country's economic exclusive zone (EEZ) less fish removed from its EEZ by other countries. These balances were then compared with the prevalence of inadequate nutrition intake and dependence on fish as a source of protein. When fishing in international waters (the high seas) is included in the calculation of the foreign fish balance, Nash et al. (5) find that foreign fishing increases countries' access to several essential micronutrients. Importantly, this finding is true for countries with medium to very high prevalence of inadequate nutrient intake (5). While other research has found evidence that fishing in the high seas may not be profitable without substantial government subsidies (12) and that increasing the regulation of the high seas to fishing may be important for sustainable management of marine fisheries (13), these results suggest that high seas fishing may be playing an important role in food security. When the

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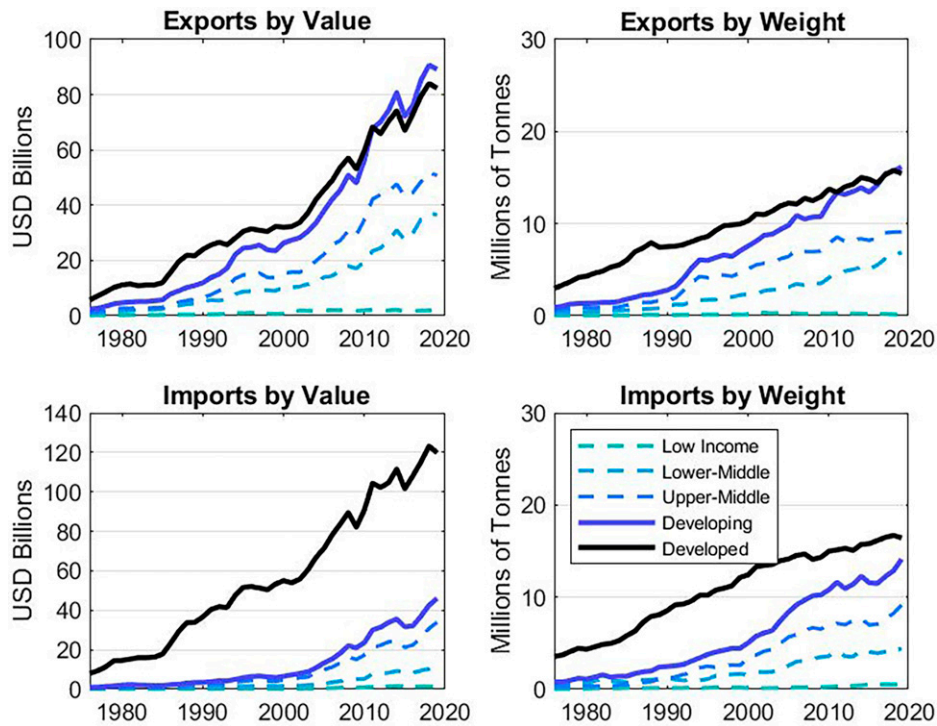
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**Fig. 1.** Trends in international trade flows of fish and fishery products suggest that developed countries (solid black lines) are importing high-value fish. Developing countries (solid blue lines) are importing low-value fish and exporting high-value fish. Middle-income countries are driving changes in developing country import and export patterns. Values are converted into US dollars (USD) from national currencies by applying average annual exchange rates from the International Monetary Fund. Weights are converted into tons from national units and exclude the weight of the container and liquid added for preservation or flavor. Data from ref. 17.

authors exclude fishing in the high seas in the balance calculation, only countries with relatively adequate nutritional intake benefit from foreign fishing. This result is consistent with evidence that industrial fishing in foreign waters is dominated by higher-income countries (14), countries that tend to have lower rates of inadequate nutrition.

The authors further demonstrate the value of their methodology by building a vulnerability framework that allows them to identify the countries that are the most vulnerable to changes in nutrient supplies. This exercise is particularly valuable as it addresses issues of food stability, a key component of standard definitions of food security. In their framework, exposure depends on changes in fish-derived nutrients due to changes in trade and foreign fishing, accounting for a country's domestic catch. Sensitivity is a function of a country's reliance on fish for food, and adaptive capacity is a function of the capacity to cope with fluctuations in fishery-derived nutrients. They find that the most vulnerable countries are in fact countries that are currently benefiting from trade and foreign fishing, with respect to nutrient flows, and countries with low adaptive capacity. These patterns are expected to be exacerbated by climate change.

The result of this analysis has clear implications for marine policy; countries that face high degrees of nutrient vulnerability might consider improving management of domestic marine stocks, including reassessing permissions made to foreign fishing fleets. Changes in policy could improve current and future access to valuable micronutrients. Caution should, however, be taken when interpreting these results as part of the broader conversation of food insecurity. While marine capture fisheries are a very

important resource for food and nutrition, this research does not directly account for production and trade of aquaculture. Since 2016, aquacultural production has contributed more fish for human consumption than capture fisheries globally, a pattern even more prominent in developing countries (1). Because the majority of wild fish stocks are at or above sustainable harvest levels and growth in fish consumption has outpaced population growth (1), aquaculture will play an increasingly important role in meeting dietary demand for fish.

It is tempting to think of these micronutrient balances as new and improved welfare measures of global fishing and the fish trade. Like the other types of national-level balances, there are limitations to this metric. These micronutrient balances are unable to estimate heterogeneity with respect to the distribution of and access to nutrients within each country. Observing current macro trends, we can reasonably conclude that this heterogeneity is a problem driving increasing food insecurity. The proportion of the global population that is undernourished has increased over the past three decades, despite an increase in food production per capita (7) and an increase in fish production per capita (1). Household-level studies are essential for documenting this presumed variation in access to fish and fish products. For example, Dey et al. (15) find that patterns in household consumption of fish vary widely based on economic status and the urban/rural divide in selected Asian countries, several of which were identified as having relatively low vulnerability by Nash et al. (5). Heterogeneity with respect to access and utilization is of fundamental importance because nutritional status is known to be an immutable trait that can lead to poverty traps or self-reinforcing

mechanisms that prevent households from escaping poverty (16).

Rather than an alternative, nutrient balances should be considered in addition to other macrolevel balance measures

of availability and microlevel measures of access and utilization of fish and fish products. The sum of these measures will undoubtedly bring us closer to understanding how global fishing and trade impact food security around the world.

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