

## AQUACULTURE

# Transparency in aquaculture subsidy reporting urgently needed

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**Aquaculture-producing countries should prioritize transparent reporting of the subsidies they provide to the sector.**

In this special issue of *Science Advances*, Quaade *et al.* (1) report that aquaculture (i.e., fish farming) production data are “sparse, self-reported, and aggregated” and that this limits the effective understanding and monitoring of the industry’s trends and potential risks. The authors then build a manual survey of aquaculture production from remote sensing imagery. If aquaculture production data are sparse, then data on the amounts and types of subsidies provided to the sector are almost nonexistent.

However, what are subsidies? They are financial benefits provided, directly or indirectly, by governments to support specific economic sectors, e.g., aquaculture, for all sorts of reasons (social, economic, political, or environmental). While sometimes well intentioned, subsidies can have negative consequences if they support activities that harm third parties and/or generate biodiversity loss such as the depletion of fish stocks and the overuse of water and other natural resources, i.e., if they generate negative externalities (2). Such “perverse” subsidies have been estimated, debated, and discussed extensively for sectors such as wild fisheries (3), agriculture (2), and oil and gas (4). Aquaculture has, to date, almost escaped such scrutiny, to the extent that there is currently not a single published global aquaculture subsidy database that we could find. This oversight is probably because aquaculture is predominantly a private economic activity with defined ownership rights and therefore assumed not to generate harm to third parties as in the case of wild fisheries.

Yet, aquaculture can and does cause third party harm, and it is therefore the responsibility of governments of aquaculture-producing

countries to report the amounts and types of subsidies they provide to the sector. The expansion of aquaculture can compete for space and resources with traditional fisheries, leading to tensions over water quality, feed sources, and habitat (5). Aquaculture has welfare impacts on both farmed and wild animals (6). Through escapees and the use of antibiotics, farmed animals transfer disease to wild salmon (7). Furthermore, aquaculture consumes forage fish, such as anchovies and sardines, which are nutritious and can be consumed directly by people, as fishmeal and oil (8, 9).

Aquaculture production is geographically highly concentrated, with China alone accounting for over 50% of global output (10). Thirteen countries produce at least 1% of total global aquaculture production each, which collectively accounts for ~92% by weight and 89% by value in 2021 of global numbers, respectively (11).

When my research group began gathering data, we found that only limited publicly available data exist and that these data are often patchy, scanty, and scattered and mostly at the country level. We found only one regional study that attempted to estimate aquaculture subsidies for 20 European countries (12). The absence of comprehensive global datasets on subsidies within the aquaculture industry hinders in-depth research into their global impact.

Given the increasing production volume of aquaculture and therefore the potential to cause massive irreversible third-party harm, it is crucial that countries begin to systematically collect and report aquaculture subsidy data. The good news is that, in addition to our group, the Organization for Economic

Co-operation and Development (OECD) has just started an aquaculture subsidies data collection effort.

The top 13 aquaculture countries have a special duty and responsibility in this respect because of their sheer size. The first step in this effort is to categorize and identify the different potential aquaculture subsidies that ideally all aquaculture-producing countries need to report data on.

## CATEGORIES AND TYPES OF AQUACULTURE SUBSIDIES

Aquaculture subsidies can take various forms, including direct payments, infrastructure investment, and post-disaster relief. I group them into six broad categories, including an “Others” category to capture subsidy types that cannot be easily placed in one of the other five groups. Each of these categories can be further split into subcategories or subsidy types.

1) Research and development: Government grants for technology development, research infrastructure support, collaborative initiatives, technology transfer programs, innovation funds, and environmental monitoring.

2) Infrastructure development: Government grants for farm infrastructure, hatchery and nursery support, processing and handling facilities funding, water management infrastructure, and community aquaculture infrastructure support.

3) Management programs and services: These subsidies ensure regulatory compliance, provide extension services, support disease management, quality assurance, best management practices, environmental impact assessments, ecosystem restoration, and public awareness campaigns.

4) Marketing support: Government grants for market development, export promotion programs, product certification support, market

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access facilitation, brand promotion, retail support, and market information services.

5) Production incentives: Government subsidies to offset production costs, such as feed, labor, energy, and veterinary expenses, including production subsidies, input cost reduction programs, technology adoption grants, insurance and risk management programs, price stabilization measures, and investment incentives for expansion.

6) Others: This category captures any subsidy that cannot easily be placed under the five main categories above.

Aquaculture subsidies can play a critical role in enhancing the sustainability, efficiency, and growth of the sector. However, they can also push the sector into generating harmful impacts on the environment and people. Categorizing these subsidies into distinct groups helps policymakers and researchers understand their impacts and facilitates easier data collection and analysis for comparative studies both between and within countries and across different categories of subsidies.

Reporting subsidies to the aquaculture sector is important because fish farming can produce harms to third parties and the environment. It is therefore necessary that

taxpayers are informed about the magnitudes and types of subsidies that are given to the sector to ensure that they do not cause harm. Reporting aquaculture subsidies would allow researchers to have the data they need to conduct studies and generate insights that would allow countries to develop their aquaculture sectors sustainably. Comprehensive subsidy data are crucial for ensuring accountability, assessing impacts, and identifying areas for improvement. By enhancing transparency in the reporting of aquaculture subsidies, governments can foster a more sustainable and resilient aquaculture sector that would contribute positively to global food security, economic development, and environmental conservation.

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