Contribution of Fisheries and Aquaculture to Food Security and Poverty Reduction: Assessing the Current Evidence

CHRISTOPHE BÉNÉ [a], ROBERT ARTHUR [b], HANNAH NORBURY [b], EDWARD H. ALLISON [c], MALCOLM BEVERIDGE [d], SIMON BUSH [e], LIAM CAMPLING [f], WILL LESCHEN [d], DAVID LITTLE [d], DALE SQUIRES [g], SHAKUNTALA H. THILSTED [h], MAX TROELL [i] and MERYL WILLIAMS [j,*]

[a] *International Center for Tropical Agriculture (CIAT), Cali, Colombia*
[b] *MRAG, London, UK*
[c] *University of Washington, Seattle, USA*
[d] *University of Stirling, UK*
[e] *Wageningen University, Netherlands*
[f] *Queen Mary University of London, UK*
[g] *University of California, San Diego, USA*
[h] *WorldFish, Phnom Penh, Cambodia*
[i] *Beijer Institute of Ecological Economics and Stockholm Resilience Centre, Sweden*
[j] *Aspely, Australia*

Summary. — Following a precise evaluation protocol that was applied to a pool of 202 articles published between 2003 and 2014, this paper evaluates the existing evidence of how and to what extent capture fisheries and aquaculture contribute to improving nutrition, food security, and economic growth in developing and emergent countries. In doing so we evaluate the quality and scientific rigor of that evidence, identify the key conclusions that emerge from the literature, and assess whether these conclusions are consistent across the sources. The results of the assessment show that while some specific topics are consistently and rigorously documented, thus substantiating some of the claims found in the literature, other areas of research still lack the level of disaggregated data or an appropriate methodology to reach consistency and robust conclusions. More specifically, the analysis reveals that while fish contributes undeniably to nutrition and food security, the links between fisheries/aquaculture and poverty alleviation are complex and still unclear. In particular national and household level studies on fisheries' contributions to poverty alleviation lack good conceptual models and produce inconsistent results. For aquaculture, national and household studies tend to focus on export value chains and use diverse approaches. They suggest some degree of poverty alleviation and possibly other positive outcomes for adopters, but these outcomes also depend on the small-scale farming contexts and on whether adoption was emergent or due to development assistance interventions. Impacts of fish trade on food security and poverty alleviation are ambiguous and confounded by a focus on international trade and a lack of consistent methods. The influences of major drivers (decentralization, climate change, demographic transition) are still insufficiently documented and therefore poorly understood. Finally the evaluation reveals that evidence-based research and policy narratives are often disconnected, with some of the strongest and long-lasting policy narratives lacking any strong and rigorous evidence-based validation. Building on these different results, this paper identifies six key gaps facing policy-makers, development practitioners, and researchers.
© 2015 Elsevier Ltd. All rights reserved.

Key words — poverty reduction, food security and nutrition, development, fisheries, aquaculture

1. INTRODUCTION

Food security and poverty reduction have been central to the world development agenda but the principal themes have evolved with the growing population, and changes in the world economy, technology, and state of the environment. Recent food security discourse stresses the need for multiple policy, economic and social actions addressing consumer demand, access, supply and nutrition (Grafton *et al.*, 2015). Within the global food production and distribution system, poverty reduction strategies have renewed the focus on the role of smallholders in agriculture, and identified the importance of upstream and downstream linkages, as well as non-farm activities (Hazell *et al.*, 2007).

Fish [1] matters to all these food security and poverty reduction themes—nutrition, supply (and its sustainability), demand, access, and the role of small-scale workers—but, in the capture fisheries and aquaculture sectors, not all these themes have been adequately addressed and assessed. A large part of the past and recent fish research has focused on managerial issues driven by ecological/conservation and efficiency/economic considerations. Despite new narratives that highlight the potential contributions of capture fisheries and aquaculture to food security and poverty reduction, little has been done to evaluate rigorously the evidence base for the actual contribution of the two sectors to food security and poverty reduction (see however HLPE, 2014; Béné *et al.*, 2015).

With more focus on the nutritional value of food commodities, fish is acknowledged as a major nutrient-dense animal-source food for a significant proportion of the nutritionally vulnerable people, overshadowing that of most of terrestrial animal foods. In 2010, the quantity of fish produced was twice that of poultry and three times that of cattle (FAOSTAT and FISHSTAT). In 2010, of the 30 countries where fish contribute more than one-third of the total animal protein supply, 22 are Low Income and Food Deficient countries (LIFDCs) (Kawarazuka & Béné, 2011). Furthermore, in addition to animal protein, fish contain unique long-chain poly-unsaturated fatty acids (LC-PUFAs) and highly bioavailable essential micronutrients—vitamins D and B, minerals (calcium, phosphorus, iodine, zinc, iron, and selenium). These compounds, often not readily available elsewhere in diets, have beneficial effects for adult health and child cognitive development (HLPE, 2014).

In the world food regime, in addition to production, trade is a major factor. Fish products, from capture fisheries and aquaculture, presently account for about 10% of total agricultural exports, and the value of the global fish trade exceeds the value of international trade in all other animal source foods combined (World Bank, 2011). Low- and medium-income countries (LMICs) play a major role as they supply 50% of all fish exports by value and more than 60% by quantity (World Bank, 2011). In general, fish production contributes 0.5–2.5% of GDP globally but for countries such as Mauritania and Vietnam, the contribution is 10% or more (Allison, 2011), and, in some Pacific small island states dependent on fisheries, 25% of their GDP (Gillett, 2009b).

Despite the importance of fish to economic development and food provision, public debate in relation to fish is dominated by concerns over resources and environmental sustainability (e.g., Worm et al., 2006; Pauly 2009). Capture fisheries are commonly presented as in "crisis" and with the future potential of fisheries as a food source jeopardized. Similarly, a strong historical dependence of aquaculture on marine ingredients derived from capture fisheries as key feeds is presented as a challenge for the sector. Discussions on steering fisheries beyond crisis sometimes invoke food security concerns (e.g., Srinivasan, Cheung, Watson, & Sumaila, 2010) but are more typically focused on finding ways to ensure that fisheries are governed to maximize their monetary value (e.g., Cunningham, Neiland, Arbuckle, & Bostock, 2009) while conserving charismatic species and habitats, such as sharks and coral reefs (Newton, Côté, Pilling, Jennings, & Dulvy 2007).

Some recent works in developing countries have challenged these views, however, highlighting the locally complex, diverse, and dynamic nature of capture fisheries and aquaculture, stressing their central role in providing food, income and employment, as well as a range of social and cultural values and benefits to the local populations (e.g., Neiland & Béné, 2004; Friend, Arthur, & Keskinen, 2009; Chuenpagdee 2011; Weeratunge et al., 2014).

In addition, strong narratives and discourses highlighting the potential contribution of the fishery and aquaculture sectors to poverty reduction and food security are widely promoted—at least within the sector literature (see, e.g., Béné, Macfadyen, & Allison, 2007; Heck, Béné, & Reyes-Gaskin, 2007). Establishing whether these narratives can be supported by evidence is important to both international policy and science. For instance, it is widely stated that 90% of the households dependent on fish-related activities for their income live in LMICs, and the vast majority of the people who depend directly on fish as a major source of animal protein and micro-nutrient live in LIFDCs. But, while generally accepted, what is the strength of evidence to support such claims, and to what level of specificity can we claim that fish-related activities effectively play a role in economic development, food provision, and ultimately poverty alleviation and reducing malnutrition?

This paper evaluates the existing evidence of how and to what extent capture fisheries and aquaculture contribute to food security and poverty reduction. In doing so we evaluate the quality and scientific rigor of that evidence, identify the key conclusions that emerge from the literature, and assess whether these conclusions are consistent across the sources. This paper therefore differs fundamentally from a conventional literature review in the sense that its aim is not simply to conduct a review and synthesis of the existing literature, but to actually assess the scientific quality and consistency of that literature, and, where it exists, the reasons for inconsistencies.

For this, a scoping review was completed, following a precise evaluation protocol that was applied to more than 200 articles grouped into eight development themes (called "clusters") that relate to fish and its contribution to food security, nutrition, human health, economic growth, and poverty alleviation at both local and national levels. In addition the assessment considered four cross-cutting development issues: international trade, governance, scale, and gender, which are also often considered to be critical factors in relation to issues of food security and poverty alleviation. The scoping review will reveal a heterogeneous "landscape" in which certain clusters are characterized by high scientific quality and/or relatively consistent conclusions, while others show lower methodological rigor, or display more inconsistent or more inconclusive findings.

The paper is organized as follows. Section 2 presents the details of the methodology of the scoping review. Section 3 summarizes the main findings of the review, organized around the eight clusters and four cross-cutting issues. Section 4 draws on these results to identify areas where more research is required to "refine" our understanding of the ways fisheries and aquaculture effectively contribute to development and food security and offers some concluding remarks.

2. METHODS

The assessment is based on an in-depth evaluation of the existing evidence related to capture fisheries and aquaculture activities in LMICs and the ways the two sectors contribute to economic growth, food security, and nutrition. The aim was to compile and review existing literature; provide a rigorous assessment of the scientific quality of the evidence provided in this literature; and ensure that the assessment was completed in a rigorous, transparent, and consistent way. For this a protocol drawing on methodologies found in the domain of scoping review (e.g., Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2011) [2] was developed, building upon a three-step approach.

Step 1—Scanning and selection: Academic research documents, including journal articles, books and book chapters, government and international institution studies, reports, working papers, and other gray literature sources were scanned, using two research engines: ScienceDirect and Google Scholar. Five inclusion/exclusion criteria were applied: language (only English documents were retained), year of publication (only documents published in the last 12 years (2003–2014) were considered; academic quality (documents of non-scientific or non-academic nature—news-media