ECONOMIC CONTRIBUTION AND IMPACT OF GLOBAL OCEAN FISH POPULATIONS

Rashid Sumaila *et al.*, the *Global Ocean Economics* project, Fisheries Economics Research unit and the *Sea Around Us* project, Fisheries Centre, the University of British Columbia, Vancouver, B.C., Canada

INTRODUCTION

The goal of this study is to determine the global economic contribution and impact of activities supported by ocean fish populations, now and in the future. These activities make significant contributions to the global, regional and national economies of countries of the world, both in the form of extractive uses such as commercial and recreational fishing, and non-extractive uses such as tourism. The ocean fisheries economy also includes related activities such as the seafood processing, shipping, marketing, and retail sectors. And it also includes public sector activities such as fisheries management. In addition to direct economic values, the oceans also provide a number of non-market values such as ocean processes that influence climate and biodiversity, and bequest and existence values.

A key question for this study is, what does the current trend of declining world fisheries mean in terms of fish catches, revenues, profits, jobs, and other associated economic variables? Put another way, what will the world lose in the short and long term in direct and indirect economic benefits if ocean fisheries and related activities were to decline substantially or disappear? This study will estimate the economic contribution and impact of activities supported by ocean fish populations in three different scenarios: (1) the current status of fish populations; (2) the expected status of fish populations from now until 2050, assuming no changes in fisheries management [i.e., assuming current trends continue]; and (3) the expected status of fish populations from now until 2050, assuming improved sustainable management of marine fisheries.

Often, fisheries managers feel pressure to sacrifice the long term health of marine fish resources in favor of short term economic needs of the fishing industry and consumers of fish. Gaining a better understanding of the contribution and impact of marine fish populations on the global economy may provide a broader, longer term, economic perspective for fisheries managers.

By estimating the contribution to the global economy of ocean fish populations, the study will provide policy makers with a better understanding of the crucial contribution of ocean fisheries to the world's economies at various scales and levels, and therefore motivate them to develop sound policies aimed at protecting the oceans of the world, and supporting sustainable activities and the communities that depend on them.

SCOPE OF WORK

Even though the oceans also provide a number of non-market values such as ocean processes that influence climate and biodiversity, bequest and existence values, we limit the current analysis to goods and services derived from ocean fish populations that are marketable at a price.

This limitation is introduced for practical purposes only, and does not in any way mean that non-market values are not important. In fact, it is in our plan to incorporate these values in the next phase of the global ocean economics project.

As a result of our current focus on market values from global oceans, we interpret ocean fish populations here to mean all commercial fish and invertebrate species, and in the case of recreation and tourism, marine mammals such as whales and dolphins (watching).

The following activities are identified in the literature to be dependent on ocean fish populations: (i) capture fisheries; (ii) seafood processing, including aquaculture feed and fish oil; (iii) retail and restaurant sectors; (iv) tourism/recreational fisheries; (v) marine manufacturing and services, e.g., products aiding search and rescue of fish and fishers; (vi) marine research; and (vii) contributions from public services, e.g., fisheries management. For the purposes of this study, we will focus only on (i) to (iv). Again, this is not to say that the other activities are unimportant, rather, these other activities are carried out to support activities (i) to (iv), and hence it can be argued that the values created by them would appear as part of the values created by (i) to (iv).

METHOD

For many fisheries economists, the only economic variable that captures 'economic value' is economic rent, which is generally defined as the difference between the income in the current use of a factor of production and the absolute minimum cost required to draw the factor into a particular use. In the case of fishing, economic rent is the difference between the total revenue and total cost of fishing. In a technical sense of economic value, these economists are correct. But, clearly, economic rent is not the only figure important to policy makers. For example, central banks need to know the gross output of fish and processed fish for export in order to calculate the balance of payments. By reporting the gross value of output, we are not saying that it is equivalent to 'economic value' of fisheries, but rather we are acknowledging that it is still an important figure to produce. Similarly, Ministries of Finance, Planning, Labour, etc, need to know incomes, employment, etc., generated in the ocean fish economy, for various purposes.

Since the main objective of this study is to produce numbers to support the work of all relevant agencies and policy makers, the following key economic variables will be used to measure the economic contribution and impact of ocean fish populations: economic rent from fishing; added value from wholesale, processing, retail, the restaurant, recreational and tourism sectors. We will also estimate the number of jobs created and supported in each of these sectors. Finally, we will determine the wider economic impacts of ocean fish populations on the global economy.

We will estimate the value of the key variables listed above given the current state of ocean fish populations. We will then run simulations under different management and policy scenarios to see how these key variables will change over time given changes in fish populations under different scenarios.

More concretely, we will estimate the following:

1. Fishing

1.1 Catches from world oceans;
1.2 Catch values (gross output value);
1.3 Cost of fishing;
1.4 Economic rent gross of subsidies;
1.5 Subsidies;
1.6 Economic rent net of subsidies;
1.7 Number of jobs.

The FAO and the *Sea Around Us* project (SAUP) maintain databases of global fish catch. Also, the SAUP and the Fisheries Economics Research Unit (FERU) maintain databases of ex vessel prices, catch values, subsidies, and are currently developing a cost of fishing database. The SAUP is completing development of a fishing effort database. The FAO and the International Labour Organization maintain databases of the number of jobs generated by the fishing sector. These databases will be updated, adopted and used to estimate the above variables.

The Profish project of the World Bank and the FAO is currently working to determine the economic rent loss in world fisheries. This project uses two approaches to estimate economic rent. The first approach uses a global Schaefer model while the second is based on case studies. Our project, on the other hand, is based on an EEZ-by-EEZ (Exclusive Economic Zone) approach, where catches, catch values, subsidies and economic rents are calculated for each EEZ and summed. We will, therefore, provide an alternative, complementary estimate of economic rent from the world's marine fish populations. Also, while the Profish project provides only a static estimate of economic rent loss, our project will also provide projections of future economic rent depending on the policy scenario assumed.

2. Wholesale and processing

2.1 Cost of inputs (raw materials);
2.2 Total revenue;
2.3 Added value;
2.4 Number of jobs.

Globefish maintains a database of fish product prices. Also, a number of national and industry level databases exist. We will compile, adopt and use the information in these databases to help us estimate the quantities of the variables listed above.

3. Retail and restaurant

3.1 Cost of inputs (raw materials);
3.2 Total revenue;
3.3 Added value;
3.4 Number of jobs.

As far as we know, there is currently no global database of retail and restaurant sector quantities, prices and jobs that we can rely upon in our work. We will therefore search national and industry level data sets to build such a database, which we will then use to estimate the quantities listed above.

4. Recreational and tourism

A. Recreational:

4.1a Total expenditure by anglers;
4.2a Total cost of providing service;
4.3a Added value;
4.4a Number of jobs;
4.5a Number of anglers.

B. Tourism

Key activities here include whale/dolphin watching and Dive/snorkeling

4.1b Total expenditure by tourists;
4.2b Total cost of providing services;
4.3b Added value;
4.4b Number of jobs;
4.5b Number of tourists.

We are not aware of any global database of marine recreational and tourism sectors. We will therefore rely on national and industry level data sets to build such a database, which we will use to estimate the quantities listed above.

5. Direct economic contribution: From fishing to final consumption

For the purposes of this study, we define direct economic contribution to be the sum of the economic rent from fishing net of subsidies, the added values from wholesale, processing, retail, restaurant, recreational and tourism sectors.

6. Wider economic impacts

Wider economic impacts capture, in addition to the direct economic contribution, the indirect and induced impacts of the direct economic contribution. To estimate this, we will rely on the literature on input-output tables and multipliers. The main idea here is that the change in demand for the output of a particular sector in the economy will generate knock on effects in other sectors. Such a change in demand will result in a change in demand for intermediate inputs and a change in consumption demand as employment and household income adjusts. These further sources of change in demand are known as the indirect (intermediate demand) and induced (consumption demand) effects, respectively.

Our preliminary survey of the literature convinces me that it is feasible to collect or synthesize input-output tables for many countries, which can be disaggregated to isolate the effect of ocean fishing. We will then be able to find multipliers for each country and compare/contrast them, average them by region, or create an average for the whole globe as appropriate.

7. Potential future direct economic contribution

We will develop a computational model that couples ecosystem models (Ecopath with Ecosim) with complete fish chain economic models to help us make projections into the future based on different scenarios. The schematic diagram of our modeling framework is given in Figure 1.

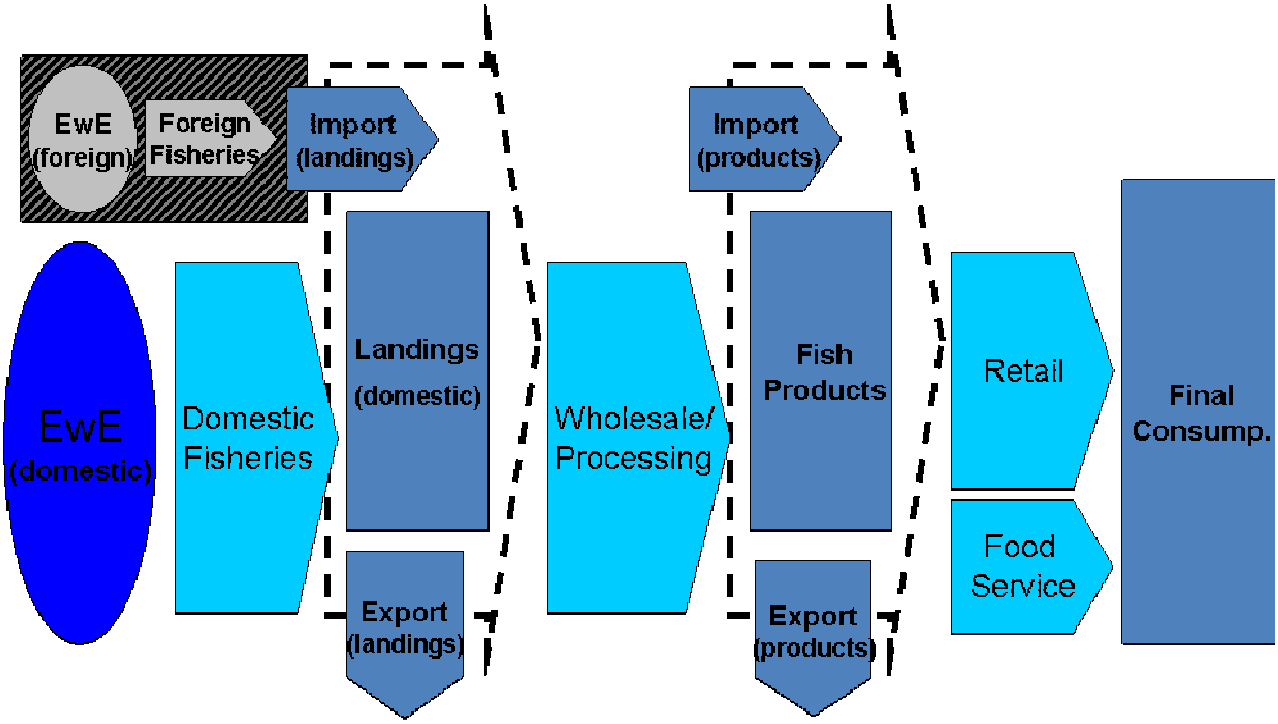

Figure 1: Schematic representation of the Global Ocean Economics Project Model, which couples ecosystem models to economic models of the complete fish chain. NB: The tourism and recreational analysis is carried out outside of this framework.

We organize the fish chain into three main sectors: (i) the primary sector; (ii) the wholesale and processing sector; and (iii) the retail and restaurant sector (Figure 1). For each sector, we compute the input of raw materials/intermediary goods (in both volume and value); the output of raw materials/intermediary goods/final products (in both volume and value) and the value-added and/or economic rent.

8. Potential future wider economic impacts

Combine results from Section 7 above and the literature on input-output tables to provide estimates of the potential future wider economic impacts of ocean fish populations, depending on the management scenario assumed.