



GLOBAL ATLAS OF MARINE FISHERIES

A CRITICAL APPRAISAL OF CATCHES
AND ECOSYSTEM IMPACTS



EDITED BY
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FOREWORD

Josh Reichert, Pew Charitable Trusts

In the autumn of 1997, I convened a small group of some of the world's most respected marine scientists to answer two questions:

- Is it possible to assess changes taking place in the world's oceans at regular intervals, looking at a broad number of factors that can provide a portrait of changing ocean health? If so, how would one go about it?
- Is it possible to determine with some degree of accuracy what is driving these changes, and what would be the outcome both for ocean life and human society if these causative factors were left unchecked?

With one exception, the members of the group said it was not doable without very large investments in monitoring technology, for which there was no recognizable donor other than governments, which would be unlikely to provide the funds needed. The one exception was Daniel Pauly, who, in his indomitable fashion, said it was possible to undertake this kind of analysis for ocean fisheries. Even for data-poor fisheries, of which there are many, he indicated that it is possible to reconstruct the past in order to compare it with the present and to infer likely future changes. Though not perfect, this kind of reconstruction and forecasting can provide a reasonable sense of how marine fisheries have changed over time, what the populations of specific species look like today, and where we are headed if our management of these resources does not change.

Late in the afternoon, the meeting came to an end, and the participants all left, with the exception of Daniel, whom I asked to stay for a brief discussion on some of the points he had made earlier in the day. That "brief discussion"

turned into a professional relationship that has endured to this day. Daniel, and the *Sea Around Us* team, have produced some of the most groundbreaking fisheries science of the past 50 years and in the process have changed the way we think about the management of marine fish and the ocean systems on which they depend.

The goal of the *Sea Around Us* is to provide a portrait of the major changes that have taken place in populations of fish over time, primarily as a result of fishing, and to better understand the consequences of these changes to the broader ecosystems from which these fish are being taken.

The motivation behind the project was the absence of accurate and comprehensive information about the status of the world's ocean fisheries and the need for such information if we are to manage these resources prudently in the years ahead. Daniel and his colleagues at the Fisheries Centre of the University of British Columbia thought that the "official" effort to assess the state of the world's marine fisheries, which is undertaken by the Food and Agriculture Organization (FAO) of the United Nations, is flawed in very significant ways. First and foremost, the species that are the primary focus of FAO are caught overwhelmingly by large-scale, industrial fishers. However, this is only a fraction of the global marine catch. The FAO data do not include many of the recreational artisanal and subsistence fisheries, despite the fact that these "small-scale" fisheries make up about one quarter of the global marine catch and one third of the part of that catch that is destined for human consumption. Similarly, it does not include estimates of, or even placeholders for, illegally caught fish or fish that are not formally reported (estimated at one out of every five fish caught). Finally, it also fails to

include discards, that is, fish that are thrown back into the sea, dead or dying, because they are not what the fishers are looking for. In short, the landing data sent to the FAO by its member countries, which form the base of its biannual *State of the World's Fisheries and Aquaculture* (SOFIA), tend to be strongly underreported.

The significance of this is profound for several reasons. First, these global catch statistics condition the way we look at and manage marine fisheries. For example, if we are not aware of the catches made by small-scale fisheries, we will underestimate the contribution of artisanal and subsistence fisheries to food security and of recreational fisheries to the tourism industry. This underestimation then justifies the neglect of these fisheries, despite their crucial contribution to local economies. Similarly, measures against illegal fishing are hard to justify—not least because of their cost—if the size of the illegal catches is not estimated.

The goal of the *Sea Around Us*, when it was initially launched, was to produce a more comprehensive and accurate historical portrait of the world's marine fisheries than that reported by the FAO and to put in place a system that would enable that portrait to be updated regularly. We underestimated the time needed for this project. It has taken longer than anticipated to gather the data, but like a jigsaw puzzle whose image gradually reveals itself, the project slowly began to unveil a crisis taking place in the world's oceans, one that can be met only by profound changes in the way we view and manage fisheries worldwide.

Daniel Pauly and his team of researchers have been able to quantify catches from the key fishing sectors worldwide: artisanal (small-scale fisheries), subsistence (small-scale fisheries), recreational (small-scale fisheries), and

industrial (large-scale fisheries). The results of this analysis have fundamentally changed the way we define the scope of the fisheries crises and its solution.

What these data reveal is that developed countries underreport what is caught in their waters, often by as much as 50%, and developing countries underreport by 70%–200%. This profound difference is declining, however, as the landing statistics supplied to FAO by its member countries have improved over time. This is fortunate, because such discrepancies cannot be maintained for any length of time without introducing a grave disconnect between what we think we know and what really occurs in the water.

Recognizing these deficiencies enables us to overcome them. This upward reassessment of global catches also provides a sense of just how productive the oceans really are and a measure of optimism that we could enjoy high catches in the future if we rebuild depleted stocks and manage resources more prudently.

Daniel and his colleagues have produced the most comprehensive picture to date of the changing status of global fisheries. It is a sobering picture, but there is a silver lining. If we are less greedy and do not continuously overtax what they are capable of producing, the world's oceans have the potential to recover much of their former bounty.

Whether we take advantage of this opportunity is a political decision, far more than it is a technical one. For many years, we have failed to adequately measure what we are taking out of the world's oceans. We no longer have an excuse to do so. This global fisheries atlas tells a story of the decline of abundance and provides a series of concepts and tools that will help governments better measure the size of their catches and their impact on marine ecosystems. Thus, this atlas represents good

science in the service of good conservation. It is a tool that can help us to better understand and document what is happening in the oceans so that we can manage marine fisheries in ways that will restore their productivity as opposed to accentuating their decline.

We would be wise to heed the insights contained in this atlas. Failure to do so will lead

us further down a path we are now traveling, at an even faster pace. We know well where that path goes. The other road has a far better destination. It will take patience, discipline, political will, and short-term sacrifice. But it has a future that will provide for both people and nature, as opposed to the other path, which has none.

PREFACE

The atlas you are holding in your hands presents key results of the *Sea Around Us*, a research activity initiated at the University of British Columbia by the Pew Charitable Trust, currently funded mainly by the Paul G. Allen Family Foundation, and devoted to studying and documenting human impacts on marine ecosystems, especially those caused by fisheries, and to propose policies to mitigate those impacts.

In the first 2 years of its existence, from mid-1999 to mid-2001, the *Sea Around Us* concentrated on the North Atlantic and attempted to answer the following six questions:

- 1 What are the total fisheries catches from the ecosystems, including reported landings, unreported landings, and discards at sea?
- 2 What are the biological impacts of these withdrawals of biomass for the remaining life in the ecosystems?
- 3 What would be the likely biological and economic impacts of continuing current fishing trends?
- 4 What were the former states of these ecosystems before the expansion of large-scale commercial fisheries?
- 5 How do the present ecosystems rate on a scale from “healthy” to “unhealthy”?
- 6 What specific policy changes and management measures should be implemented to avoid worsening of the present situation and improve ecosystems’ health?

First, answers to these questions were published, for the North Atlantic, as a book in 2003,¹ and having passed this test, we began to apply the methods the *Sea Around Us* developed to answer these six questions for the global ocean.

In the process, we gradually realized that a key dataset we and most other researchers working on international fisheries were using, the global fisheries catch statistics assembled and disseminated annually since 1950 by the Food and Agriculture Organization of the United Nations (FAO)—was biased in a profound way. We hasten to add that FAO is not at fault: The bias, which works against small-scale fisheries (i.e., artisanal, subsistence, and recreational), is caused largely by most of its member countries not comprehensively including the catch of such fisheries in their annual data submission to FAO.

Thus, answering question 1 for the global ocean involved developing a global dataset that, in addition to including statistics that FAO provides, would also explicitly cover small-scale fisheries. Also, as appropriate for ecosystem-based management, we had to include in our database time series of fisheries discards, which FAO has documented globally in successive reports but kept outside its main database (which thus remains largely a database of “landings” rather than catches).

Our approach for answering question 1 was to perform (or encourage our colleagues throughout the world to perform) catch reconstructions whose scientific rationale and technical features are discussed in chapters 1 and 2 of this atlas, respectively. More than two hundred peer-reviewed journal articles, book chapters, reports, and working papers (all available at www.seaaroundus.org) that this work generated are summarized on pp. 185 to 457 of this atlas. These summaries describe, in the form of one-page accounts, the marine fisheries of the Exclusive Economic Zones (EEZs) of 273 countries (or parts thereof) and island territories, covering about 40% of the surface of the ocean, where about 95% (by weight) of the world marine catch is being

taken. Complementing these summaries, chapter 3 describes the assembly of catch data documenting the industrial fisheries for large pelagics (mainly tuna), much of it on the high seas, outside the EEZs.

Jointly, these contributions demonstrate convincingly that the global marine fisheries catches are much higher than reported in official statistics; some of the implications for research and policy are briefly explored in chapter 14, which thus deals with question 6. Chapters 4 and 5 then cover various topics that the *Sea Around Us* worked on to address questions 2 to 5, some explicitly, others implicitly.

Because of its broad scope, we hope this atlas and its underlying data will be useful to researchers and students interested in comparative analyses of fisheries and marine biodiversity, and to the staff of international

organizations, whether governmental or nongovernmental, with a stake in fisheries governance and marine conservation.

As for the *Sea Around Us*, our close association with the Pew Charitable Trusts ended in 2014, and we are now funded mainly by the Paul G. Allen Family Foundation. Also, the focus of the *Sea Around Us* has shifted from documenting fisheries' impacts on the oceans to mitigating these impacts, in collaboration with various governments and civil society. Information on our progress therein, along with the data underlying the graphs and analyses presented here, can be also found on our website (www.seaaroundus.org). Note, finally, that our home at the University of British Columbia changed from the Fisheries Centre, which regrettably ceased to exist in June 2015, to a new Institute for the Oceans and Fisheries.

Daniel Pauly
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NOTE

1. Pauly, D., and J. Maclean. 2003. *In a Perfect Ocean: Fisheries and Ecosystem in the North Atlantic Ocean*. Island Press, Washington, DC.

