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### **ACP-EU Fisheries Research Initiative**

### **Proceedings of the INCO-DC Conference Placing Fisheries in their Ecosystem Context**

**Galápagos Islands, Ecuador, 4-8 December 2000**

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## **Preface**

The Galápagos Islands are the quintessential 'home' of the Darwinian concept of evolution, embracing, as it does, the notion of adaptation to the environment – the 'goodness of fit' of organisms in their ecosystem. Holding this conference on 'Placing Fisheries in their Ecosystem Context' in the Galápagos Islands was thus bringing the science of fisheries home to its ecosystem roots.

Here, the conference participants were exposed to near pristine ecosystems, not far removed from their state at the time of Darwin, reinforcing the notion of integrity of ecosystem as the basis of sustainability of life in all its forms.

The foundation of the conference was centred on the use of Ecopath modelling software, including the dynamic programme Ecosim and spatial module Ecospace, in ecosystem analysis. This suite of programmes has been developing, since its first conceptualisation by Jeffrey Polovina in 1984, up to the present time in parallel with the growing scientific opinion that fisheries management has to take into account the effect of fisheries on the ecosystems in which they are embedded. The Galápagos conference represents the state of the art of the software and its application.

Some thirty presentations were made during the five days of the conference, ranging from descriptions of exploited marine ecosystems in the Atlantic and Pacific Oceans to applications of ecosystem analysis to fisheries and ecosystem management.

This report consists of short summaries of all the presentations, and thus forms an encapsulation of the latest findings of and progress in placing fisheries in their ecosystem context. Many of the papers that were applied as opposed to descriptive in nature will appear in full in a special issue of the journal *Ecological Modelling*.

We take this opportunity to thank the European Commission, particularly the programme for international scientific cooperation with developing countries (INCO-DC) and the ACP-EU Fisheries Research Initiative, for the support through the INCO-DC Concerted Action ERBIC18CT97175 that led to the present report, and which made the conference possible. We also thank the staff of the organizing institutions, notably of the Charles Darwin Research Station without whose dedicated work the conference would not have come to fruition.

*The Editors*

### *ACP-EU Fisheries Research Report Series*

The ACP-EU Fisheries Research Reports is a series of publications that aim to share information about the development of the ACP-EU Fisheries Research Initiative and findings generated in order to maximise the impact of its activities. It includes proceedings of workshops and meetings, statements on policy and research activities under the Initiative. An increasing number of these goes beyond the framework of ACP-EU bi-regional S&T cooperation, in line with the global nature of the issues at hand.

## Abstract

This report presents the proceedings of a five day scientific conference on “Placing Fisheries in their Ecosystem Context”, held on 4-8 December 2000, at the Charles Darwin Research Station, Puerto Ayora, Galápagos Islands. The conference was hosted by the Charles Darwin Foundation for the Galápagos Islands and co-organized by Instituto de Ecología Aplicada, Universidad San Francisco de Quito, Ecuador; the Charles Darwin Research Station, Ecuador; and the North Sea Centre, Denmark. The conference was made possible through support from the European Commission's INCO-DC Concerted Action programme ERBIC18CT97175. The conference was based on the recognition that the sustainability of fisheries worldwide depends on the maintenance of the ecosystems in which they are embedded. The negative impact of fisheries on ecosystems, and thus on the sustainability of both the fisheries and the ecosystems, is becoming more and more obvious and must be addressed. This conference brought together practitioners with experience in a wide variety of exploited marine ecosystems, having in common their use of the Ecopath suite of ecosystem modelling software.

There were some 30 presentations at the conference, covering aspects of ecosystem-based management of fisheries; impact of fisheries on ecosystems; comparative ecosystem analysis; and ecosystem structure and dynamics, as well as a series of discussions. The presentations, which investigated marine ecosystems in many parts of the Atlantic and Pacific oceans, were based on the Ecopath approach to ecosystem analysis and offered many insights into the nature of and trends in these ecosystems. The presentations also showed the utility of this approach in providing ecosystem-based management options for fisheries in a wide variety of situations.

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## Table of Abbreviations

ACP	African, Caribbean and Pacific Countries entertaining development cooperation with the European Union in the framework of the Lome and Cotonou Conventions
CDRS	Charles Darwin Research Station, Galápagos Islands
CRODT	Centre de Recherches Océanographiques de Dakar-Thiaroye
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DIFRES	Danish Institute for Fisheries Research
EC	European Commission
ENEA	Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, Italy
ENSO	El Niño southern oscillation
ETP	Eastern tropical Pacific
EU	European Union
EwE	Ecopath with Ecosim
GAM	generalised additive model
GDP	Gross Domestic Product
IATTC	Inter-American Tropical Tuna Commission
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, Brazil
ICES	International Council for the Exploration of the Sea
ICRAM	Central Institute for Scientific and Technological Research Applied to the Sea, Italy
IEO	Instituto Español de Oceanografía, Spain
IOUSP	Instituto Oceanográfico, Universidade de São Paulo, Brazil
INCO-DC	International Cooperation in Science and Technology with Developing Countries
INVMAR	Instituto de Investigaciones Marinas y Costeras, José Benito Vives de Andrés
IPN	Instituto Politécnico Nacional, Mexico
MSVPA	Multispecies virtual population analysis
MSY	Maximum sustainable yield
NMFS	National Marine Fisheries Service, USA
NWHI	North West Hawaiian Islands
P/B	Production/biomass
PPR	Primary production required
SBB	South Brazil Bight
S&T	Science and Technology
TL	Trophic level
UBC	University of British Columbia
UNAM	Universidad Nacional Autónoma de México, Mexico



Participants in the ACP-EU Conference: “Placing Fisheries in their Ecosystem Context”, Charles Darwin Research Station, Galápagos Islands, Ecuador, 4-8 December 2000.

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## Using FishBase to initiate construction of Ecopath models

*Daniel Pauly*

There are numerous ways to define and represent an ecosystem, and the choice of approach to be used will usually depend on a number of reasons. Foremost among these is the availability of input data required by a given representation or modeling approach. One of the simplest way to describe an ecosystem, and one simple enough to be programmed as a FishBase routine, is to use the data in its DIET COMPOSITION, PREDATORS, FOOD ITEMS and FOOD CONSUMPTION tables to generate directly, without analysis by Ecopath, a simple representation of the trophic structure of an ecosystem, i.e., a 'Lindeman pyramid,' commonly used to summarize food web information, (see Lindeman, 1942). Thus, once the ecosystem or country/FAO area combination to be modeled has been chosen, the routine in question groups, and thus can output, by trophic level (in steps of ½ trophic level), the species of fish occurring in the area under consideration.

Then, the diet composition and food items studies (if any) for these species are used to identify prey items (e.g. invertebrates and plants, otherwise not covered in FishBase) also likely to occur in the area under study; these prey items are grouped by trophic levels, as well. The routine then proceeds with the reported predators (e.g. marine mammals) of the fish species listed, and groups these, as well, in ½ trophic level steps.

The result is an interactive Lindeman pyramid, included in both the CD-ROM and Internet versions of FishBase, whose different levels can be 'clicked' to count and list the fish of a given ecosystem, and other organisms therein, by ½ trophic level steps (see [www.fishbase.org](http://www.fishbase.org)).

As it turns out, this simple representation of an ecosystem model led to new insights on the 'trophic signature' of ecosystems (Froese et al. 2001). Moreover, once it was developed, this routine turned out to be extremely useful for accelerating the construction of Ecopath models, as it quickly assembles, and lists in order of their maximum size, the species that comprise the various functional (fish) groups in the ecosystem in question, these groups being largely defined by a particular trophic level/size combination. This usefulness is particularly true in that the list is connected with a routine, based on work by Dr. M.L. 'Deng' Palomares and others, which attaches to the fish in this list the Ecopath-relevant information contained in FishBase, i.e., diet compositions, growth and mortality parameters, and food consumption estimates

Also, the list of non-fish groups, although less detailed, provides some guidance on how to represent these groups in one's Ecopath model. We intend to improve the routine underlying this pyramid along two lines:

- 1) By identifying new ecological inferences that can be drawn from ecosystem-specific lists of taxa arranged by trophic levels and additional data extracted from FishBase, e.g., by comparing between ecosystems the number of species at different trophic levels (Froese et al. 2001); and
- 2) By establishing further links between Lindeman pyramids and generic Ecopath models.

Watch FishBase for more on these.

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