

This is the second issue of *Fishbyte* which we have collaborated in preparing, and here is another (small) change for members of the Network of Tropical Fisheries Scientists: the positions of NTFS Coordinator and *Fishbyte* Editor(s) have been uncoupled; the former role will be assumed by Dr. Modadugu Gupta, ICLARM's Director of the International Partnerships and Networks Program.

Mail addressed to the NTFS at ICLARM (or e-mail

NTFS@cgnet.com) will continue to be handled by NTFS Secretary Ms. Sandra Gayosa, who will either pass it on to Dr. Gupta, or to the *Fishbyte* Editors, depending on whether they pertain to general NTFS issues, or to *Fishbyte*. Do not let these matters take too much of your time; read rather, the mix of papers we have assembled for you from submissions by NTFS members. *D. Pauly and G. Silvestre*

# Ecological Modeling for All

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## Abstract

A brief review of the status of the ECOPATH modeling approach and software is presented, with emphasis on the recent release of a Windows version (ECOPATH 3.0), which enables consideration of uncertainties, and sets the stage for simulation modeling using ECOSIM. Modeling of coral reefs is emphasized.

## Modeling for All

Understanding how a given ecosystem functions can be achieved only by constructing a quantitative model of the interactions between its components.

The good news is that conceptual and computer tools now exist that will enable any biologist or fishery scientist, working anywhere in the world, to quickly construct and analyze a model of her or his ecosystem, based on a mix of local data and broadly accepted parameter values and relationships (see Angelini and Petrere, this issue).

One such empowering tool is the ECOPATH approach and software, whose various incarnations and applications to aquatic and farming systems have been documented — at least occasionally — in these pages. This contribution is an update, rendered necessary by a number of recent developments which we hope readers will find interesting.

## The New ECOPATH 3.0

We announced in the July 1995 issue of *Naga* that the Windows version of ECOPATH was ready for release (Christensen and Pauly 1995). It was close. We found, however, that the final stages of development were a major task (notably for the graphic routines), and hence it is only recently that we could start distributing the new package widely.

The Beta version was tested by a number of colleagues with and without prior ECOPATH experience, notably at a workshop held at the Fisheries Centre (FC), University of British Columbia, Vancouver, Canada, in November 1995. This workshop, indeed, was the first major exposure for the new ECOPATH, and this led to a number of developments which we chose to incorporate before release. Particularly important was a suggestion by Carl Walters (FC), to incorporate into ECOPATH a "sampling/importance resampling" (SIR) scheme, based on an approach of McAllister et al. (1994). This now puts the Monte Carlo routine of ECOPATH ("EcoRanger") in a semi-Bayesian context, as the SIR can be used to reduce the uncertainty in estimated parameters, given prior information on the uncertainty in the input parameters.

The new package is called ECOPATH 3.0 (rather than ECOPATH II vers. 3.0), there being no need to fear that it will be mistaken for the program initially distributed by Polovina and Ow (1983), and which incorporated the original ECOPATH approach of Polovina (1984). This new name is also to mark that major developments have taken place since the release of ECOPATH II (Christensen and Pauly 1992). The new version requires Windows (3.1+, NT or 95), and much more memory and hard disk space than before. Thus, we will continue, on request, to distribute the last DOS-version (2.2).

## Availability and Distribution of ECOPATH

Rather than being available only by mail, the new version of ECOPATH can be downloaded from either ICLARM's homepage (<http://www.cgiar.org:80/iclarm.htm>) or the UBC Fisheries Centre's homepage (<http://fisheries.com>); downloading will imply that one simultaneously registers as a user. However, we will continue to airmail the software on request (on 2 HD 3 1/2" DOS-formatted disks) to interested users, the novelty here being that we will now do this free of

charge. [This decision was facilitated by the fact that the manual for ECOPATH 3.0 is part of its built-in help facility; another consequence of this is that a printed manual for ECOPATH 3.0 is no longer planned.]

## The Next Steps

A major new development concerning ECOPATH, but too recent to be included in version 3.0, is the suggestion by Carl Walters, also at the above-mentioned FC workshop, that the system of coupled linear equations underlying ECOPATH can be straightforwardly reexpressed as a system of coupled differential equation, which can be integrated in time. In the last months, this led, thanks to a major conceptualization and programming effort by Carl Walters, to a program called ECOSIM, which can run ECOPATH files in simulation mode (Walters et al., ms, submitted).

Work is underway to make this program function as an integrated routine of ECOPATH, and it is anticipated that the next release of ECOPATH will support simulation modeling, following parametrization using the mass-balance approach. In the meantime, stand-alone versions of ECOSIM can be obtained by contacting C. Walters (walters@fisheries.com) or V. Christensen (v.christensen@cgnet.com).

Other features to be included in the next release will include routines for explicitly considering seasonal transients (i.e., seasonally os-

## Incorporating ECOPATH 3.0 into ReefBase

The first version of ReefBase, a global database on coral reefs (McManus et al. 1995), has been released (see p. 25). The ECOPATH 3.0 software and five well-documented files of coral reef ecosystems will also be incorporated in this database and accessible through its main menu. ECOPATH is eminently suited for modeling coral reefs (Pauly and Christensen 1995), and so far five trophic models of coral reef have been constructed: French Frigate Shoals, Hawaii by Polovina (1984), Bolinao, Philippines, by Aliño et al. (1993), Virgin Island by Opitz (1993) and the barrier and fringing reefs of Tiahura, Moorea, French Polynesia by Arias-Gonzales (1993). The ECOPATH files of these models have now been documented in detail using the EcoWrite routine of ECOPATH; in the case of the Tiahura model, this involved substantial translation from French to English. Entering ranges of input values, for use with the EcoRanger routine still needs to be done, but the data can be also used either as is, to represent an extant model, or as a basis for modifications, representing other coral reefs. To facilitate modeling of more reefs, ReefBase tables are under construction to readily access and format published information on various reefs. These tables will be included in the next version of ReefBase.

I thank John McManus for the opportunity to work as intern with the ReefBase team (November 1995 to June 1996), and Daniel Pauly for his guidance of my project.

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cillating inputs of biomass, mortality, diet composition, etc.) when balancing models, more graphic support, and empirical relationships embodying previous ecological knowledge. Also, ECOPATH 3.0 will be included into ReefBase CD-ROM (McManus et al. 1995), better to reach coral reef researchers (see Pauly and Christensen 1995 and Box).

Thus we hope to realize our dream of making modeling accessible to all, or at least to all colleagues interested in using ECOPATH, and thus to rely on the broadly consensual knowledge incorporated in its various routines.

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