FISHBYTE SECTION

Editorial

This issue of Fishbyte-in-Naga has two papers on the inland fisheries resources of Bangladesh, and their relationship is obvious: any sound management policy rests on knowledge of the key features of the stocks that are exploited. These two papers thus document, for Bangladesh, how research and management may be articulated.

The relationship between the two papers on research on upwelling systems (to which charitable souls may add my essay in this issue of Naga on the "Peruvian anchoveta, Charles Darwin and us"), and the three papers on Lake Kariba may not be so obvious. There is a strong link, however: Lake Kariba, an artificial lake, was stocked with a clupeid Limnothrissa miodon very similar to the anchovies of upwelling systems, and the methods used or suggested to study the now important L. miodon fisheries of Lake Kariba, are those traditionally used to study upwelling fisheries. Having established this link, I hope that researchers working on both types of systems will cooperate. Fishbyte can serve as a forum for these exchanges.

Mr. T. Sudjastanji, whose obituary appears on p. 44-45, was also a friend of mine.

One more item: this issue of Fishbyte will be the last to bear Ms. Abbic Cruz-Trinidad's name as NTFS secretary. She will be replaced in January 1993 by Ms. Beth Eleccion. I thank Abbie for many years of creative and respectful interactions (but wait: she is not gone. She will still contribute to Fishbyte as an author!). D. Pauly

The Climate and Eastern Ocean Systems Project


Abstract

A brief description of the NMFS/ORSTOM/ICLARM Climate and Eastern Ocean Systems (CEOS) project is given. CEOS will study the four major eastern boundary current regions (Peru/Chile, California, Northwest and Southwest Africa) and attempt to separate local short-term changes of their resources and/or dynamics from long-term, climatic global changes. Expected products range from a large, widely accessible oceanographic/atmospheric database to various documents that will present key results as well as improved contacts and stronger analytical capabilities in cooperating national institutions.

Introduction

The injection of millions of tonnes of greenhouse gases into the earth's atmosphere may be viewed as a gigantic experiment aimed at exploring the earth's reaction to such challenge. Unfortunately, this experiment is run without proper "controls", and hence the heated debates about the actual impact of those gases may last too long, beyond the time where the "experiment" should be called off. The international scientific community is forced, however, to address this problem in spite of the lack of scientific controls.

One way to address this is through the comparative method, a major tool in those disciplines in which experiments are hard to perform, e.g., evolutionary biology (Mayr 1982), and fisheries science (Parrish et al. 1983; Bakun 1985).

Given the importance of the four major upwelling systems of Peru/Chile, California, Northwest and Southwest Africa (Fig. 1) both as sources of fish and as CO₂ "pumps", scientists from the Pacific Fisheries Environmental Group (PFEG), the National Marine Fisheries Service (NMFS), Institut Francais de Recherche Scientifique pour le Développement en Coopération (ORSTOM), and the International Center for Living Aquatic Resources Management (ICLARM), and partners from other institutions have teamed up to investigate these systems in the context of global changes, through a project called CEOS (Climate and Eastern Ocean Systems) funded by the National Oceanic and Atmospheric Administration (NOAA) and ORSTOM.

Objectives of CEOS

The CEOS project is an international collaborative study of potential effects of global climate change on the living resources of the highly productive eastern ocean upwelling ecosystems and on the ecological and economic
issues directly associated with such effects. A major focus of the study are the clupeoid fishes (anchovies, sardines, etc.) that are heavily exploited in these large marine ecosystems and which have recently been exhibiting episodes of collapse, rebound, or switches in dominance.

The major objectives of the CEOS project are thus to: 1) assemble, summarize, and analyze the data record of the past four decades regarding the four eastern ocean boundary upwelling ecosystems mentioned above along with data from other upwelling areas; 2) apply the comparative method to identify key physical processes and ecosystems responses; 3) resolve underlying global-scale trends in each individual regional system that may be obscured by local interyear and interdecadal variability; 4) investigate the relationship of these global trends to accumulating greenhouse effects; 5) construct scenarios for future consequences of global climate change on upwelling resources; and 6) analyze and project ecological and social impacts on associated human activities and values.

Eastern ocean upwelling ecosystems present certain advantages that may make the study of effects of climate change on marine ecosystems particularly tractable; thus the study may serve an even wider purpose as an illustration of the sorts of impact that could affect more complex marine ecosystems.

The most immediate response to greenhouse warming is expected to occur within the atmosphere rather than within the ocean, affecting the wind field over the ocean, and hence, patterns of upwelling. Bakun (1990) presents evidence of this already occurring over the past decades. Thus global climate change could substantially alter the factors that determine favorable reproductive habitat, long before ocean temperature changes brought on by greenhouse warming may be evident.

By analyzing time series data from similarly functioning regional ecosystems distributed over the globe, we hope to tease out the significant global trends from within the “noise level” of naturally occurring regional climatic variability. By these, trends can be mechanistically linked to accumulating greenhouse effects, and would constitute one basis for projection into the future.

A somewhat independent basis for projecting effects of climate change will be sought in the analysis of the large amplitude natural regional variability (i.e., the “noise”) overlying the trends. That is, ecosystem responses to shorter period interyear variations in large-scale atmospheric forcing that may be confined to a single region will also be analyzed. In this approach, greatly increased degrees of freedom for empirical model formulation and verification are obtained from the more numerous realizations of shorter period events in the data record and from the fact that the different regional sets of realizations may be independent from one another.

Some initial scenarios are already available. For example, Bakun (1990) has argued that one consequence of increased greenhouse effects that can be confidently expected is that temperature gradient between the ocean and the continents will increase during the spring-summer upwelling seasons in these systems. This would be reflected in increased alongshore wind and enhanced sea breeze circulation, which would impact recruitment (Mendelssohn and Mendel 1987). Evidence exists for an “optimal environmental window” with respect to wind effects (Fig. 2), such that changes in characteristic wind speed may disrupt finely tuned reproductive strategies of the small pelagic fishes which are essential trophic components of these ecosystems.

Another approach to identifying trends in ecosystem processes will be through the construction of sequences of trophic models of the ecosystems and by computing...
Identification of trends attributable to (global) climate change and of the mechanisms for change (or conversely, for homeostasis) will be attempted via detailed analysis of temporal changes in ascendency and related indices. The analysis will include comparisons among upwelling systems and also comparisons with models of other systems (coral reefs, estuaries, freshwater bodies, etc.) presently being accumulated at ICLARM within the framework of a project on "Global Comparisons of Aquatic Ecosystems" (Christensen and Pauly, in press).

Human activities facing local and global changes are also studied. The exploitation of marine renewable resources in the different upwelling areas appears to be a real challenge due to the fact that these resources are unstable. Comparative analyses of market response to local and global changes will be studied—building upon contributions in Curry and Roy (1991), and Durand et al. (1991) in Peru, Morocco, and Senegal. Also, detailed analyses of time series of fish catch and prices, i.e., of one of the main products from upwelling systems, will be performed.

This will give some new insights on how human activities are coping with economic and social changes at different levels of organization, from which different new approaches on how to use unstable renewable resources may be derived.

**Brainstorming Workshop on Simulation Modelling of the Peruvian Upwelling Ecosystem**

**ASTRID JARRE-TEICHMANN**

**WOLF HERTLEIN**

**S.E. JØRGENSEN**

Faithful readers of Naga will note that Fig. 1 is a reproduction of the cover photo of the April 1990 issue, which also included a brief remark on ICLARM's collaboration with the Instituto del Mar del Peru (IMARPE) at Callao, Peru, on the Peruvian upwelling ecosystem. This cooperation, aimed ultimately at a model for managing the large pelagic fisheries of Peru, resulted to date in the construction, (partial) analysis and publication of a considerable database, including 30 years’ worth of oceanographic and biological time series (see contributions in Pauly et al. 1999). Recent progress included the construction of a set of 17 trophic (ECOPATH II) models (Jarre-Teichmann 1992), including models of three periods characterized by different species dominance and fishing patterns systems, “monthly” models capturing seasonal changes and models typifying warm and cold temperature anomalies (El Niño/La Niña).

An informal workshop on "Simulation modelling of the Peruvian upwelling ecosystem" has recently been conducted with ICLARM support, in the context of the CEOS Project (see p. 26). Five scientists of the informal Danish “Copenhagen Modelling Group” (CMG), i.e., the last author, as well as Henning Mejer, Henrik Maler, Søren Nielsen and Jørgen Salomonsen, met with AJT and WH at Kollkolle Seminar Center near Copenhagen during 19-20 August.
Linkages of the CEOS Project

The CEOS project addresses most of the strategic and integrating priorities listed in the U.S. "Global Research Program Priority Framework", especially the "Ecological Systems and Dynamics" category, and addresses in some way most of the issues listed under that category: e.g., (assembly and analysis of) Long-Term Measurements of Structure/Function", "Response to Climate and Other Stresses", "Interactions Between Physical and Biological Processes", "Models of Interactions, Feedbacks, and Responses", "Productivity/Resource Models", etc.

The project is designed within the general framework of the International Program of Ocean Science in Relation to Living Resources (OSLR), which is cosponsored by the Intergovernmental Oceanographic Commission and the Food and Agriculture Organization of the United Nations (Bakun et al. 1982). It can be considered an initial effort in the newly proposed subprogram of OSLR and Ecosystem Dynamics and Living Resources (EDLR). Elements of CEOS directly related with "recruitment" constitute Contributions to the Sardine-Anchovy Recruitment Project (SARP), a major component of the International Recruitment Program (IREP) of OSLR.

Several national research laboratories working on similar systems are associated with this project through a cooperative agreement with ORSTOM. This project presently includes: the Institut Scientifique des Pêches Maritimes, Morocco; the Centre de Recherches Oceanographiques d'Abidjan, Côte d'Ivoire; the Fisheries Research Utilization Branch, Ghana; and the Centre de Recherches Oceanographiques de Dakar-Thiaroye, Sénégal, which will focus on regional case studies of climatic variability, coastal ecosystem dynamics and associated human responses. The collaboration of scientists from these institutes with the CEOS project is funded by the Scientific Committee on Dynamics and Use of Renewable Resources (DURR) of ORSTOM. Other national institutions are linked directly with the project, and/or through their own linkages with ICLARM.

Expected Products and Results of the CEOS Project

The project is expected to produce new insights - but these we cannot plan. We have planned some of the products, however, in which these insights will be presented. These will be:

- a multiauthored book, tentatively titled "Global versus Local Changes in Marine Pelagic Systems", which will contain most of the research results;
- one synopsis for each of the four anchovy species making up the bulk of the biomass in each of the abovementioned ecosystems (Engraulis ringens, E. mordax, E. encrasicolus and E. capensis);
- a report presenting ECOPATH II models of the four systems, and the data upon which they are based;
- various scientific papers in the primary literature.

References


A. Jarre-Teichmann and W. Hertleii are from Alfred Wegener Institute of Polar and Marine Research, Bremerhaven, Germany. S.E. Jørgensen is with the Royal Danish School of Pharmacy, Copenhagen, Denmark.
The CEOS project, as one of its contributions, will make the Comprehensive Ocean-Atmosphere Data Set (COADS) available for use on MS DOS and Mac II Personal Computers at two different levels of resolution. Worldwide data on air temperature, sea-surface temperature, surface winds, sea-level pressure, and number of observations were extracted for 1946-90 from the Word Weather Disk (CD ROM) and from original COADS files, then implemented into microcomputer files.

A program called CODE2 was then written which can be used at the first level of resolution to retrieve monthly means by 2° squares, pertaining to a single box or a complex staircase of 2° boxes along a coastline. Output from the CODE2 program consists of annual and monthly output files, and a binary file of the selected data. The annual output file shows on a single line the 12 monthly means of a single parameter for a year, by parameter. The monthly output file shows all five parameters for a year, by month. The data are comma delimited in each output file, allowing for easy import into spreadsheet and/or graphics software. The second level of resolution will create programs for retrieving the raw data (rather than 2° monthly means) from the COADS data set. This involves more than 2.5 gigabytes of data, starting from 1870. Before this reorganization, access to the COADS data set was available only on a mainframe computer and was a slow and tedious process. Contact the CEOS Project, c/o PFEG for details.

Thus, the project will last until mid-1994 at least, and this offers numerous possibilities for interested colleagues in developing or developed countries to team up with us. If you are interested, please write to the CEOS project at PFEG, P.O. Box 831, Monterey, California, 93942, USA, or fax us at (408) 646-3319.

Timing and Additional Linkages

The PFEG and ORSTOM component of the CEOS project began mid-1991 when Claude Roy and Philippe Cury, both from ORSTOM, began what will be a two-year stay at PFEG, in Monterey, California, USA, while the two-year ICLARM component (D. Pauly and V. Christensen) began in September 1992.

Also, the project will support the entry into FISHBASE, a computerized encyclopedia of fish (Pauly and Froese 1991), of the biological data on the major fish species in each of the abovedicted four upwelling systems. Further, the CEOS project will make available, most probably on CD-ROM (laser) disk, the time series of oceanographic and other data upon which trend analyses will be based. This applies particularly to the COADS data set, which will be made available for use on MS DOS (and Macintosh) personal computers (box).

A. BAKUN, presently with the Department of Fisheries, FAO, Rome, was until May 1992 Director of the Pacific Fisheries Environmental Group (PFEG), Monterey, California, a laboratory of the NMFS Southwest Fisheries Center, NOAA; C. CURTIS, H. HUSBY, R. MENDELSOHN, and R. PARRISH are with the PFEG; M. DURAND is with ORSTOM, Paris; P. CURY and C. ROY are with ORSTOM, but presently based at PFEG; V. CHRISTENSEN and D. PAULY are with ICLARM, J. MENDEO is with the Universidad Nacional Agraria, Lima, Peru.

References


ICLARM Contribution No. 990.
CEOS Contribution No. 7.