

CONTRIBUTIONS OF HUMAN ECOLOGY TO CONCILIATE PEOPLE AND BIODIVERSITY WITH A FOCUS ON FISHING COMMUNITIES

R.A.M. Silvano

Dep. Ecologia, Universidade Federal do Rio Grande do Sul (UFRGS) and Fisheries and Food Institute (FIFO) Brazil

A. Begossi

Fisheries and Food Institute (FIFO) and Fisheries Management and Training Program (CAPESCA/PREAC), Universidade Estadual de Campinas (Unicamp) Brazil

Keywords: Management, fisheries, conservation, Atlantic Rain Forest, Amazon, Brazil, fish, food taboos, use of natural resources, co-management, diversity, ethnobiology.

Contents

1. Introduction
 2. Local people and biodiversity
 - 2.1. The Main Issue
 - 2.2. Local People and Biological Diversity: Friends or Foes?
 - 2.3. Contributions of Human Ecology to understand the Use of Biodiversity by Local People
 - 2.3.1. Investigating the Use of Nature
 - 2.3.2. Major Research Topics in Human Ecology
 - 2.3.3. How to Do It? General Methods Adopted in Studies of Human Ecology
 3. Fishing communities and biodiversity
 - 3.1. Why Fish? General Features of Local Fisheries
 - 3.2. Brief Case Study: Use of Fish, Plants and Fish Diversity among Brazilian Fishing Communities
 - 3.2.1. Overview of the Brazilian Fishing Communities
 - 3.2.2. Objectives and Hypotheses
 - 3.2.3. Data Gathering and Analysis
 - 3.2.4. Patterns on Fish Use among Brazilian Fishing Communities?
 4. Co-management of natural resources
 5. Conclusions
- Acknowledgments
Glossary
Bibliography
Biographical Sketches

Summary

The world's highest priority areas for biodiversity conservation (hotspots) are usually located in tropical developing countries, which typically show an ever-increasing human population, including many poor people, who usually rely directly on extracting natural resources, such as plants, fish, game animals or small-scale agriculture. The discipline of human ecology investigates the several interactions that humans maintain with

ecosystems and other organisms, and may thus provide an important, although not fully acknowledged, contribution to address and to conciliate the conflicting demands of social well being with the need to protect biodiversity. Some of the major research areas of Human Ecology that have been particularly useful to understand the behavior of local people are the subsistence models, niche theory, territoriality, co-management, common based management, cultural ecology and ethnobiology. Studies of Human Ecology have been gathering data on the diversity of natural resources used by local people, as well as about the strategies of resource utilization, through quantitative research methods, such as interviews, systematic sampling of resource use, and surveys of the people's diet (feeding habits). Such an approach has contributed to the study and management of local fisheries in tropical developing countries, where the co-management, which involves the local communities, government and scientists, has shown to be a promising approach to achieve sustainable use of fishing resources. Although there is not a definite answer to the question regarding conservation and local people, the more coherent solution would be to recognize that there would be usually some degree of change or impact on natural ecosystems due to the presence of local people, but to completely exclude or to disregard such people is no longer feasible or desirable, as this would probably result in social and ecological damage on the long run.

1. Introduction

Most of the world's biodiversity is currently threatened and many species have been disappearing before they could be studied and even described. Moreover, the world's highest priority areas for biodiversity conservation (hotspots) are usually located in tropical developing countries, such as the Brazilian's Atlantic rainforest and cerrado, the Indian tropical forests, among others. Such developing countries typically show an ever-increasing human population, including many poor people, who usually rely directly on extracting natural resources, such as plants, fish, game animals or small-scale agriculture. Therefore, biodiversity conservation plans in those countries should deal with local people, especially for those more endangered regions that have been suffering increasing human pressure, such as the Brazilian Atlantic forest.

A growing body of knowledge has accumulated about patterns of use of natural resources by local communities in several tropical and subtropical ecosystems, in Brazil and elsewhere, including small-scale peasant farmers, artisanal fishers, indigenous communities, and even poor people living in the suburbs of large cities. Nevertheless, there remain some gaps on the knowledge about the biological features of exploited species, the dynamics of natural and disturbed ecosystems, the consequences of exploitation to the species exploited and to the biological communities and the intensity and overall trends in resource utilization by local people. In Brazil, as in many similar tropical countries, such lack of data is due mainly to the corresponding lack of financial and personnel resources to conduct the appropriate studies, plus the huge dimensions of Brazil, which sometimes means to cover large distances and to reach remote regions. The problem in getting natural resources' use data is also accentuated by the high diversity of potential useful resources found in many Brazilian tropical regions. Research conducted so far, in Brazil as well as in other tropical countries, focused mostly on the biological aspects of natural resources exploited. However, albeit important, such biological research would be not sufficient to adequately address the

complex issue of sustainable management of natural resources. The discipline of human ecology investigates the several interactions that humans maintain with ecosystems and other organisms, including knowledge about and use of the natural resources. Human ecology may thus provide an important, although not fully acknowledged, contribution to address and to conciliate the conflicting demands of social well being of local communities with the need to protect biodiversity and ecosystem's integrity.

2. Local People and Biodiversity

2.1. The Main Issue

There has been a growing scientific and political debate about how to address the complicated issue of human presence around or inside top priority conservation areas, such as parks, biological reserves, among others. How to deal with those local indigenous or small-scale peasant communities, who have been living in a region and using natural resources, such as fish, game animals or plants, which biologists are desperately trying to protect? Considering a definition of sustainability as using a natural resource in a way that the same resource would be available to be used by future generations, the question could be rephrased: Would it be possible for local communities to use high biodiversity ecosystems in a sustainable fashion? Albeit not simple, this is an increasingly important and demanding question, which biologists, politics, technicians and other people in charge of natural resources' management may no longer be able to avoid.

2.2. Local People and Biological Diversity: Friends or Foes?

Some biologists argue that sustainable use of high biodiversity and complex tropical ecosystems would not be possible, and therefore the conservation of such important ecosystems, such as rainforests or coral reefs, requires banning of all forms of natural resources' collection and even peoples' removal. Albeit such position may seem too radical at first glance, it has been supported by scientific data, which indicate several kinds and levels of impacts that even local people using simple techniques to exploit natural resources have been exerting on the animals, plants, and ecosystems exploited. For example, indigenous communities have been eliminating entire populations and species of large and medium mammals from some tropical forest sites (especially islands or fragmented habitats), local artisanal fishermen have been depleting and over-fishing fishes and other aquatic animals (turtles and manatees), especially in tropical reefs and estuaries. Furthermore, increasingly historical evidence provided mainly from archeological and paleoecological studies indicate that ancient and traditional human societies depleted important biological resources long time ago. Indeed, such same evidence indicate that unsustainable use of natural resources and ecosystems could have been at least partially responsible for the collapse of some of these former human societies, such as the Mayas of Central America or the people from Easter Island, in the Pacific.

By other hand, several biologists, ethnobiologists and anthropologists affirm that those local people who have been living and managing their natural resources and habitats for a long time acquired a detailed biological knowledge and developed wise management

strategies, allowing those local communities not only to maintain, but sometimes even to enhance the local biodiversity of terrestrial and aquatic ecosystems. As well as observed for biologists contrary to the presence of local people in conservation areas, those ‘people friendly’ researchers have also sound arguments and scientific data to support their positions. For example, several places held today as ‘pristine’ tropical forest, in Amazon, Brazilian *cerrado* and other inaccessible regions, may be in fact a result of indigenous management techniques, including planting of fruit trees, clearance and posterior regeneration of pristine forest, systematic burning of vegetation, and so on. Indeed, local people, such as small-scale farmers, have been generating biodiversity through the selective breeding of several species and varieties of cultivated plants over hundreds or thousands of years. Also, the presence of traditional people in an important conservation site may also prevent other forms of economic development and resource use, which would be much more damaging to natural ecosystems, such as large scale mining, fishing, timber extraction, urban development, industrial facilities, large barrages and forest conversion to pasture or large scale agriculture, which its accompanying pollution by pesticides and other chemicals. And finally, there has been increasingly recognized that several local or traditional communities have developed elaborated systems of natural resources management (see discussion bellow), which may, intentionally or unintentionally, promote sustainable use of natural resources.

-
-
-

TO ACCESS ALL THE 30 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

Aswani S., and Hamilton, R. (2004). Integrating indigenous ecological knowledge and customary sea tenure with marine and social science for conservation of bumphead parrotfish (*Bolpometodon muricatum*) in the Roviana Lagoon, Solomon Islands. *Environmental Conservation* **31**, 1-15. [This study makes an innovative research combining studies of ethnobiology and fish ecology, in order to get data to aid in fisheries management].

Bayley PB, and Petrere Jr. M. (1989). Amazon fisheries: assessment methods, current status and management options. *Canadian Special Publication on Fisheries and Aquatic Sciences* **106**, 385-398. [This is a comprehensive review of local fisheries in the Amazon Basin].

Begon, M.E., Harper, J.L. and Townsend, C.R. (2006). *Ecology: from individuals to ecosystems*, 4nd. Ed., 759 pp. Oxford, UK: Blackwell Publishing. [This is a comprehensive textbook explaining and illustrating many ecological concepts that have been also applied in Human Ecology].

Begossi, A. (1995). Fishing spots and sea tenure: incipient forms of local management in Atlantic Forest coastal communities. *Human Ecology* **23**, 387-406. [This study discusses the various forms of territorial behavior among Brazilian coastal fishers and the implications for management].

Begossi, A. (1998). Cultural and ecological resilience among caicaras of the Atlantic Forest coast and caboclos of the Amazon.. *Linking Social and Ecological Systems for Resilience and Sustainability*, (eds.

F. Berkes and C. Folke), 129-157. Cambridge, UK: Cambridge University Press. [This is a broad discussion of the strategies of resource exploitation by two cultural groups, linking it to the management of natural resources].

Begossi, A. (2004). *Ecologia de Pescadores da Mata Atlântica e da Amazônia.*, 332 pp. São Paulo, Brazil: HUCITEC. [Although in Portuguese, this book brings several examples of the possible applications of Human Ecology to better understand the use of natural resources].

Begossi A, Hanazaki, N. and Ramos R (2004). Food chain and the reasons for food taboos in the Amazon and on the Atlantic Forest coast. *Ecological Applications* **14**, 1334-1343. [This paper makes a comparative and large scale analyses of food taboos among Brazilian local fishers].

Berlin, B. (1992). *Ethnobiological Classification. Principles of Categorization of Plants and Animals in Traditional Societies.* Princeton, U.S.A: Princeton University Press. [This is one of the classic books in the field of ethnobiology, providing several examples of ethnobiological studies on animals and plants].

Diegues, A.C. (1999). Human populations and coastal wetlands: conservation and management in Brazil. *Ocean & Coastal Management* **42**, 187-210. [This is a comprehensive review of local and small scale coastal Brazilian fishers, discussing also their environments and management scenarios].

Gadgil M, Berkes F. and Folke C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio* **22**, 151-156. [This paper presents and discuss the positive influences that local people may have to biodiversity conservation].

Galetti M. (2001). Indians within conservation units: lessons from the Atlantic Forest. *Conservation Biology* **15**, 798-799. [This is an illustrative paper that, as other recent ones, highlights some prejudicial effects that local people may have to biodiversity conservation].

Hardesty, D.L. (1975.) The niche concept: suggestions for its use in human ecology. *Human Ecology* **3**, 71-85. [This is a classical study, which explores and discusses the application of the niche concept in Human Ecology, launching some hypotheses].

Johannes RE. (1998). The case for data-less marine resource management: examples from tropical nearshore finfisheries. *Trends in Ecology and Evolution* **13**, 243-246. [This author is one of the most important in the field of ethnoichthyology, and in this paper he proposes the idea of using fishers' knowledge to aid in fisheries management].

McGrath DG, Castro F, Fudemma C, Amaral BD, and Calabria J. (1993). Fisheries and the evolution of resource management on the lower Amazon Floodplain. *Human Ecology* **21**, 167-196. [This paper investigates the common based management system of lakes that started among Brazilian Amazon fishers].

Pauly, D., Christensen, V., Guénette, S., Pitcher, T.J., Sumaila, U.R., Walters, C.J., Watson, R., and Zeller, D. (2002). Towards sustainability in World Fisheries. *Nature* **418**, 689-695. [This is a review of the current status and trends in fisheries, including the local fisheries in tropical developing countries].

Queiroz HL, and Crampton WGR (1999). *Estratégias Para Manejo de Recursos Pesqueiros em Mamirauá.* Sociedade Civil Mamirauá, MCT-CNPq, Brasília. [This book describes the implementation and some of the results of the co-management fishery of the Mamiraua Reserve, Brazilian Amazon].

Silvano RAM, and Begossi A. (2005). Local knowledge on a cosmopolitan fish, ethnoecology of *Pomatomus saltatrix* (Pomatomidae) in Brazil and Australia. *Fisheries Research* **71**, 43-59. [This is a comparative ethnobiological survey involving coastal fishers from Brazil and Australia who exploit the same fish species].

Smith, E. A. (1983). Anthropological applications of optimal foraging theory: a critical review. *Current Anthropology* **24**, 625-651. [This is a review of most of the optimal foraging models that have been used to study the foraging behavior of humans].

Valbo-Jorgensen J, and Poulsen AF. (2000). Using local knowledge as a research tool in the study of river fish biology: experiences from the Mekong. *Environment, Development and Sustainability* **2**, 253-276. [This is a broad ethnobiological survey comparing fish knowledge among several fishing communities, in order to better understand fish migration along the extensive Mekong River, in southeast Asia].

Wilson, D.C., Nielsen, J.R. and Degenbol, P. (2003). *The Fisheries co-management experience: accomplishments, challenges and prospects*. Dordrecht, Germany: Fish and Fisheries series 26, Kluwer Academic Publishers. [This book brings several examples and analyses of co-management systems worldwide, discussing their potentials and applications].

Biographical Sketches

Renato Silvano is bachelor in biology and has a Doctor degree in Ecology by the University of Campinas (Unicamp), Campinas, Brazil. He has been doing research dealing with artisanal fisheries, fish ecology and ethnobiology since 1994, participating in about 11 research projects conducted in both marine, estuarine and freshwater environments, in places such as the southeast and northeast Brazilian coasts, as well as the Brazilian Amazon. Currently, Renato is professor in the ecology department of the Federal University of Rio Grande do Sul (UFRGS), in Porto Alegre, Brazil. His actual research interests are research projects linking fish ecology, fishermen's behaviour and fishermen's local ecological knowledge, in order to better understand the dynamics of small-scale artisanal fisheries in tropical countries. He has published in journals such as *Environmental Biology of Fishes*, *Fisheries Research* and *Ecological Economics*, among others.

Alpina Begossi is a researcher in Fisheries and in Human Ecology at the Universidade Estadual de Campinas, Brazil. She teaches Human Ecology at the Graduate Group in Ecology, Unicamp. Her background includes a Bs. in Biology (Ecology) (UFRJ, 1981), a Ms. in Biological Sciences (Ecology) (Unicamp, 1984), and a PhD in Ecology (UCDavis, 1989). She has been publishing articles in journals such as *Ecology and Society*, *Economic Botany*, *Ecological Applications*, *Fisheries Research*, *Journal of Ethnobiology*, and *Human Ecology*, among others.