

Saving forests through the fisheries - ornamental fisheries as a means to avoid deforestation.

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Carbon has become the new global currency, and everyone from consumers to mega-corporations are talking about carbon footprints, and greenhouse gas emissions. Rightly so; global warming is a serious concern, and needs to be addressed at a multitude of levels. The ornamental fish sector is not immune to the challenge of evaluating and reducing greenhouse gases and carbon footprints. However, beyond tracking and simply reducing greenhouse gases, it can be argued that ornamental fisheries, particularly forest-based freshwater fisheries, can actually be used in larger carbon trading and clean development mechanisms.

A clean development mechanism is a mechanism by which a developed country can offset its greenhouse gas production by sponsoring an emission reduction project in a developing country. One clean development mechanism currently being discussed is Avoided Deforestation, since extant forests can sequester large amounts of carbon. However, Avoided Deforestation projects are not widely utilised, largely because an important feature of a clean development mechanism is the proof that the project would not have occurred without the incentive provided by the need for emission reduction credits. Because of the need to reduce emissions de novo for carbon credits, projects that sequester



Large parts of the Amazon region still has beautiful rainforests.

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carbon through the protection of extant swaths of forest are difficult to enact. Thus, 53% of the registered clean development mechanism projects involve energy industries, while 21% involve waste handling, with only 0.1% focused on afforestation or reforestation. This is a particularly grievous oversight, as 20 to 25% of the total global greenhouse gas emissions are linked to land use changes including deforestation. 20% of the global greenhouse gas emissions are significant, and as a perspective, this is an amount comparable to the fossil fuel emissions of the United States. The Coalition for Rainforest Nations has been working diligently to bring an initiative to the table to include avoided deforestation projects at the upcoming United Nations Framework Convention on Climate Change (see www.rainforestcoalition.org for further information).

Many ornamental fisheries (wild capture of freshwater fish for the pet trade) are located within and rely on intact functioning forest ecosystems. Thus, can an indigenous extractive use of the forest be used as the base mechanism to avoid deforestation and could they be linked as a clean development mechanism project? While ornamental fisheries have yet to be considered as a mechanism to avoid deforestation, a review of this industry demonstrates that it has the potential to be a strong agent in protecting extant forests, contributing to the maintenance of thriving

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Box 1. Background information

For more information on the fisheries, please see:

Africa

Brummet. R.E., 2005. Ornamental fishes: a sustainable livelihood option for rainforest communities. *FAO Aquaculture Newsletter*, 33:29-34.

Brazil

Chao, N.L., P. Petry, G. Prang, L. Sonneschein and M.F. Tlusty (Editors), 2001. Conservation and management of ornamental fish resources of the Rio Negro Basin, Amazonia, Brazil - Project Piaba. Editora da Universidade do Amazonas, Manaus, Brazil, 303 pgs.

India

Sekharan, M & Ramachandran, A. 2006. Market-preferred indigenous ornamental fishes of Kerala. *OFI Journal*, 52:20-21.

Peru

Moreau, A.M. and Coomes, O.T., 2007. Aquarium fish exploitation in western Amazonia: conservation issues in Peru. *Env. Cons.*, 34:12-22

economically viable local communities, and becoming a force in reducing the global carbon trading economy.

Brazil

Even though a majority of fish entering the freshwater ornamental pet trade are produced in aquaculture far from their native waters, wild fisheries are still locally important in the extant species ranges (Box 1). In the Rio Negro region of Amazonas, Brazil, the ornamental fishery is responsible for approximately 70% of the revenue for the municipality of



Temporary storage at Turkys, Manaus.

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Barcelos. Approximately 20 million fish, primarily cardinal tetras (*Paracheirodon axelrodi*) have been exported from this region annually for the past 20 years. This activity is critical to the social landscape of the region, as nearly 1,000 families are involved directly in the fishery. This industry is the backbone of the rural landscape as many small villages (extended family units) along the tributaries of the Rio Negro act as collection points for the fish, and are intermediaries between the fishermen and the main buyers in Barcelos. Being the primary economy, the ornamental fishery provides social stability for the region around Barcelos, preventing out-migration to the urban center of Manaus (population ca. 2 million) 450 km down-river. This industry relies on rivers as the main transportation mode, and exists without roads, which are a significant predictor of deforestation. In addition, the "piabeiros" acknowledge the importance of an intact flooded forest, and thus practice environmental stewardship in order to protect their fishing grounds from deforesting activities including mining, agriculture, and forestry. The total area of the fishery is roughly 122,000 km², and in addition to the fishery, also supports other extractive industries including piassava (palm fibers). Thus, this fishery can justifiably be considered an alternative to deforesting activities.

India

A second example is the south Indian state of Kerala. This area is currently an important supplier of wild-caught native ornamental fish to the global trade. Much of this comes from the streams and rivers of Western Ghats (WG) - a global biodiversity hotspot known for its exceptionally rich and endemic fish fauna. The fluvial systems part of WG in Kerala harbours many species of ornamentals which are in great demand in the international markets. The wild collection and trade of native ornamentals from this region has increased rapidly in the last few years showing a ten-fold increase in



Permanent ornamental fish exposition of Projeto Piaba in Barcelos, Brazil.

Photo: Y. Bernet (© www.yorambernet.com).

the number of species exported from 10 to 114. Although no official quantification of the exports has been carried out, the trade of ornamentals from this region could easily run into multiple millions of dollars.

The WG is home to a large population of tribes and forest-dwelling communities who for centuries have depended on extraction activities including firewood and illegal timber collection as well as the cultivation of bananas, rubber and spices (through deforestation and clearance) for their sustenance. This has resulted in extensive fragmentation, with current estimates that only 20% of the original forest cover of the WG remains in virgin state.

A small yet vital transformation is being witnessed with the arrival of the ornamental fish exporters. The lure of better income through the collection of native ornamentals has made this sector attractive to many, and currently members of forest-dwelling communities have started to show interest in this sector. Fishers targeting large food fish species in the region are also slowly turning into ornamental fishery to make ends meet in view of declining food fish catches. However, there is still a lot to be done to develop the native ornamental fisheries of the region into sustainable community-based enterprises providing alternate livelihood options for the locals and as a result, weaning them away from forest destruction activities.

This situation of ornamental fisheries being critical to the economy and culture of local economies repeats itself in

many countries worldwide. Another South American example is Peru, where nine million fishes worth US\$ 2.5 million were exported to 24 countries in 2001. Most fish were collected close to the city of Iquitos, although some were harvested as far away as 1100 km from this export centre. As in the Rio Negro, approximately 10,000 people earn income from this activity. In Africa, collection and export of freshwater ornamental fishes from the rainforest streams of Africa is an emerging activity especially in Guinea and Cameroon. Of the 8 million people who live in the Lower Guinea forest, 20 percent are more or less fulltime fishers and another 70 percent (mostly women and children) fish seasonally.

These fisheries provide a financial base for many rural or impoverished peoples. Thus, their inclusion in the ornamental fishery trade should immediately interest the global carbon trading and avoided deforestation proponents. One criticism of the avoided deforestation programs is that they can only be implemented at the expense of the local population. A secondary concern is that the forest will then be controlled by someone outside of the country. In the case of fisheries, there is typically sufficient government infrastructure / overview to manage fisheries. However, even though fisheries management is prevalent in each of these countries, they characteristically give little credence to ornamental species, even with their strong local economic valuation. Thus in each of the ornamental fisheries presented above, additional effort is needed to create or substantiate the basis of sound fishery management, mainly through the assessment of stock sizes of key species, and particulars germane to each of the



Estate stream, Kerala, India, a hot spot for biodiversity.

Photo: Rajeev Raghavan

fisheries, including total allowable catches, closed fishing seasons and areas, and from the larger industry, marketing of the environmental benefits associated with wild harvest of freshwater ornamental species. The monies invested into an avoided deforestation program can be dedicated to shoring up the fisheries management milieu where needed, or in investing in the community to provide access to fishery grounds through land acquisition, as well as programs to provide insurance and unemployment / retirement benefits to the fisher folk. Investment in securing the future long-term permanence of the freshwater ornamental fisheries would meet the social, environmental and fiscal goals and objectives of a long-term avoided deforestation program.



Fish collecting in the Estate stream, Kerala, India.

Photo: Rajeev Raghavan

One of the initial criteria for a clean development mechanism program is proof that the project would not have occurred without the incentive provided by the need for emission reduction credits. It can be justifiably argued that without better management and additional investment, freshwater ornamental fisheries will slowly fade in a changing global climate and marketplace. Direct threats to freshwater ornamental fisheries are the destruction of habitat, ecological degradation, and unsound fishing practices. In terms of maintaining industry sustainability however, out-of-country trends such as consumer perceptions and

preferences, retail trade practices, domestic and international regulations, and competition from foreign aquaculture operations. It is this last threat that is most significant because the production of any species outside of the native country removes value from its native forest. If the forest is not necessary for the production of the fish, then the forest is viewed in terms of other goods and services. However, we argue that the ecosystem benefits of the intact forest, along with its fishery production is a substantial reason to provide protection of the flooded forest ecosystem, and the fisher folk

Box 2. Energy requirements of ornamental fishes

Life-cycle assessment is a way to determine the resources needed for any product from its "cradle" to its "grave". For ornamental fishes, major energy requirements will be to produce or catch the fish, as well as to distribute them to the wholesaler and consumers. The energy required to produce fish has been determined for a number of fishery and aquaculture species. In general, it costs multiple giga-joules per tonne of fish produced (GJ / T). In aquaculture, costs vary by production system, and intensive systems that rely on pumped water have greater energy requirements. Feed type can also greatly impact overall production costs because for diets that have fishmeal as a major dietary component, there is a great deal of energy required to catch those fish, render the meal and oil, transport it to a feed mill, then to create the artificial diet. Estimates for the energy necessary for aquaculture production range from 24 GJ/T for semi intensive tilapia, through 87 GJ/T for carp in an aerated pond fed high-protein feed, to 337 GJ/T for high density carp in a recirculation system fed a high-protein feed.

Once the fish are produced or harvested, they need to be distributed to the consumer. The cost associated with distribution depends on the vehicle used to move the fish. In general, large truck transport requires three to five times less energy (3 mega-joules per tonne per kilometer, MJ / Tkm) compared to air freight (14 MJ / Tkm). Therefore, the 3845 km flight from Manaus, Amazonas, Brazil to Miami, USA, will cost 53 GJ/T. Since there are few production energy costs, this puts the energy for wild fish on a par with the energy required to produce the fish in aquaculture operations in the US. A more detailed analysis of the energy required for aquaculture production is needed before a more definite answer can be determined.

For more information see:

Troell, M, P. Tyedmers, N. Kautsky, and P. Rönnbäck (2004) "Aquaculture and Energy Use", Cleveland, C. (editor-in-chief) Encyclopedia of Energy. Elsevier, Amsterdam. vol. 1, p. 97-108.

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that make their living from this environmentally benign industry. The ornamental aquaculture industry has to instill a global ethic with respect to the species it decides to produce.

One argument employed in a freshwater ornamental fishery / aquaculture debate is that it is counterintuitive to fish for species distant from their markets. Local production of fish means less energy is needed to get the fish to market. Thus, the argument is that the carbon dioxide production necessary for the transport of live fish is likely to negate any ecosystem benefits of the intact forest. However, such an argument ignores the energy cost of producing the fish, and to address such a debate, a full life-cycle assessment of both the ornamental fishery and the aquaculture operation is necessary. While neither exists, a few lessons derived from the study of food fish aquaculture can illuminate this situation (see box 2). Based on both the costs of producing and distributing the fish, it is likely that wild-caught fish from the Amazon will be on a par with, if not less costly (from an environmental perspective) than fish produced in aquaculture.

The motto for Project Piaba is "Buy a fish save a tree". However, rather than a single tree, ornamental fisheries can be used as a driver to save entire forests and intact ecosystems. These environmentally benign industries are focused around extant native communities that derive a great deal of economic benefit from a functioning fishery. If the

fisher folk cannot fish, they will either outmigrate to urban centres, or likely become involved in environmentally destructive activities including forestry, agriculture, and mining. Thus the functional fishery is directly and positively correlated to overall forest health. These fisheries can provide a useful tool in implementing avoided deforestation programmes, as they already involve the community at the local level. They also have government infrastructure either currently in place, or readily available that can be implemented for in-situ management of the funding stream. However, these fisheries are immediately threatened by a host of issues, including ex-situ production of fish in aquaculture. Without capacity building, these fisheries are likely to dwindle without reaching their full economic and ecological potential. The financial payout associated with the avoided deforestation program can go to working on species stock and harvest management plans, providing infrastructure to the fishermen, and providing insurance and retirement benefits. It is our hope that multinational funding agencies will look at the benefits that ornamental fisheries can bring to the avoided deforestation debate, and will recognise that investing in the development of programs to help these fisheries adapt to growing pressures and take advantage of market opportunities to maximise benefits to rural communities and in doing so, avoid pending deforestation.