Sustainable "Seafood" Ecolabeling and Awareness Initiatives in the Context of Inland Fisheries: Increasing Food Security and Protecting Ecosystems

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The sustainable seafood movement has adopted a variety of certification and ecolabeling systems, as well as seafood-awareness campaigns, to influence industry and help consumers make informed decisions regarding their seafood consumption. However, a review of these programs revealed that the majority are focused on marine and coastal fisheries. Globally, freshwaters and their fish assemblages represent some of the most threatened systems and taxa because of multiple anthropogenic stressors. There is an urgent need to harness the momentum of the sustainable seafood movement for marine systems to benefit all aquatic systems, including freshwater. Moreover, given that freshwater systems are at particular risk in developing countries in which small-scale fisheries dominate, it is essential to expand awareness campaigns, through grassroots initiatives that differ significantly from current awareness campaigns that are global in focus, involve industrialized large-scale fisheries, and assume significant exports of seafood. Addressing the limitations of marine campaigns is a logical first step before launching new programs aimed at inland fisheries. In the long term, failure of the sustainable seafood movement to incorporate freshwater fisheries will lead to public perception that these fisheries are not in peril and may allow unsustainable practices to continue.

Keywords: sustainable seafood, inland fisheries, awareness campaigns, ecolabels, certification

Certification and ecolabeling are two types of market-based incentives that are increasingly being used to shift industry practices in commercial fisheries and aquaculture toward sustainability (Wessells et al. 2001, Jaffry et al. 2004, Kaiser and Edwards-Jones 2006). There has also been growth in the use of public awareness campaigns intended to inform consumers about how to make sustainable choices when buying seafood. To date, the majority of these efforts have been directed toward the marine sector and have targeted consumers in the developed world, where fish is often imported to meet market demands. The effectiveness of certification, ecolabeling, and awareness programs for improving sustainability in marine fisheries has been questioned (Kaiser and Edwards-Jones 2006, Jacquet and Pauly 2007), largely because of the lack of direct linkages between these various programs and their relevant ecological outcomes (Ward 2008). Indeed, some authors have argued that certification and ecolabeling in marine fisheries are primarily marketing opportunities rather than mechanisms for conservation (Kaiser and Edwards-Jones 2006, Jacquet and Pauly 2007, Ward 2008). Nonetheless, there are some success stories (e.g., dolphin-friendly tuna; Teisl et al. 2002), primarily spearheaded by environmental nongovernmental organizations (NGOs) that have developed or adopted certification or awareness campaigns. The informed public in the developed world is increasingly provided with options in which fisheries certification is used as a marketing tool at retail outlets and restaurants (Wessells et al. 1999).

For the purposes of this article, we do not question the usefulness of these tools and presume that they do have some conservation benefits for marine fisheries and ecosystems. Here, we focus on inland fisheries. Inland commercial and artisanal fisheries tend to be small scale (Welcomme et al. 2010) and are of critical importance to food security in the developing world (Smith et al. 2005). To date, there has been relatively little discussion of the potential ability of seafood-related certification and awareness activities to improve biodiversity of inland waters. The term *seafood*—although it contains the word *sea*, which implies marine origin—typically refers to all fish products, such as shellfish

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and roe, irrespective of the source (cultured or wild caught, marine or freshwater). Nevertheless, there are a number of fundamental differences between marine and inland fisheries that could influence the potential benefits of certification, ecolabeling, and awareness programs.

The objective of this article is to explore the sustainable seafood movement to determine the extent to which it is contributing to the conservation of inland fisheries or has the potential to do so. To address our objective, we first discuss the rise of the sustainable seafood movement and provide an analysis of certification and ecolabeling programs and awareness campaigns, with a particular focus on characterizing their exclusion of inland fisheries. Next, we briefly discuss the state of inland fisheries and contrast these with marine fisheries. We conclude by providing a framework for incorporating seafood-awareness activities into inland fisheries to increase food security and to protect freshwater ecosystems. We approach the article from the perspective that seafood certification, ecolabeling, and awareness initiatives have been successful for selected marine fisheries but have failed to be effectively used in an inland context, perhaps because of fundamental differences in how marine and inland fisheries are prosecuted, the spatial extent of the market demand, and how fish are traded.

The sustainable seafood movement: A brief history and status

The sustainable seafood movement is largely based on or driven by *social marketing* (Jacquet and Pauly 2007), wherein business strategies (e.g., "sustainable" branding; Brady 2003) are applied to the resolution of social problems (Kotler and Zaltman 1971). The application of social marketing in the context of the sustainable seafood movement began in the mid-1990s as a result of a collaboration between industry and environmental NGOs that recognized that informed choices made by consumers could contribute to the conservation of marine biodiversity (Wessells et al. 1999). The timing coincided with a mounting body of evidence that marine fisheries were collapsing because of overexploitation by commercial fisheries related to both direct effects on harvested populations (Casey and Myers 1998, Pauly et al. 1998) and indirect effects through trophic cascades (Daskalov 2002). In some cases, the targeted species were not necessarily imperiled, but the techniques used to capture them had ecosystem effects as a result of habitat damage and bycatch (Chuenpagdee et al. 2003). With the world's oceans in trouble, social marketing campaigns had the potential to resonate with the public and result in positive outcomes for marine conservation and to be of economic benefit to the seafood industry.

Social marketing campaigns are diverse, ranging from ecolabeling to awareness campaigns, some of which include complete boycotts of certain species or products (Jacquet and Pauly 2007). From a business perspective, more companies choose to use environmentally preferred production, which is distinguished by an ecolabel, with the expectation of gaining a greater market share and higher profits. The Marine Stewardship Council (MSC) was one of the first certification organizations (created by World Wildlife Fund and Unilever, one of the largest seafood retailers) and continues to be involved in such activities today. Awareness campaigns are somewhat different, in that they can be independent of certification and ecolabeling processes. The goals of awareness campaigns are to educate the public and to encourage them to avoid the purchase and consumption of products that are caught or cultured unsustainably or that create ecosystem damage. The first consumer awareness campaign using wallet-sized cards was launched by the Monterey Bay Aquarium (reviewed by Jacquet et al. 2009), and today, there are many similar programs.

More than 15 years after these programs were begun, there is a growing body of scientific literature in which the basis for these programs is examined, as is their effectiveness from a variety of perspectives (e.g., ecological, business, economics; see Jacquet and Pauly 2007 and Ward 2008 for reviews). Originally, one of our goals was to conduct a quantitative literature review in which we characterized the extent to which inland fisheries were represented in the scientific literature related to the sustainable seafood movement. After amassing the literature, it was evident that such a formal analysis was simply not relevant, because there were so few studies that mentioned inland fisheries. Those studies that mentioned inland fisheries often presented examples related to mislabeling, in which fish such as freshwater tilapia were being sold as marine whitefish (e.g., Jacquet and Pauly 2007). We found no papers in which the role of social marketing programs in conserving inland fish populations or freshwater ecosystems was explicitly discussed or considered. Because of this, we had to infer the extent to which certification programs, ecolabeling, and awareness campaigns included inland fisheries.

To assemble a list of certification or ecolabeling programs and awareness campaigns, we conducted an exhaustive search using keywords (e.g., *seafood*, *ecolabel*, *certification*, *awareness campaigns*) and the leading search engine (i.e., Google). Only those programs and campaigns that were in English were included in our list. Awareness campaigns that specifically used existing seafood lists from other organizations were excluded (e.g., the Toronto Zoo and the Smithsonian National Museum of National History both use the seafood guide from the Monterey Bay Aquarium).

A total of 10 certification or ecolabeling programs were found (table 1). The MSC and Friend of the Sea NGOs had certified the highest number of species (more than 55, including marine, freshwater, and diadromous species), whereas the average number of species certified by the other organization was 5.7 (with a range of 1–16 species). In general, marine organisms accounted for 71% of the certified species, followed by freshwater (23.4%) and diadromous (5.6%) species. Various species of catfish (e.g., channel catfish [*Ictalurus punctatus*], blue catfish [*Ictalurus furcatus*],

Table 1. Summary of the number of marine, freshwater, and diadromous species that have achieved certification or ecolabeling under various organizations.

Organization	Country of origin	Extent of coverage	Number of species included			Specific freshwater species	Specific diadromous species
			Marine	Freshwater	Diadromous		
Marine Stewardship Council[a]	Global	Global	45	2	8	Pike-perch, golden perch	Sea bass, salmon (sockeye, chum, coho, chinook, pink), mulloway, yellow-eye mullet
Friend of the Sea[a]	Global	Global	47	3	7	Basa, European perch, pike-perch	Striped bass, mulloway, salmon (chinook, coho, sockeye, Atlantic, Australian)
Global Aquaculture Alliance[a]	United States	Global	1	3	0	Channel catfish, blue catfish, tilapia	n/a
Agreement on the International Dolphin Conservation Program[a]	United States	Global	1	0	0	n/a	n/a
Naturland	Germany	Global	7	7	2	Rainbow trout, brown trout, char, carp, freshwater prawn, tilapia, basa	Salmon, sea bass
Marine Eco Label Japan[b]	Japan	National	1	1	0	Freshwater clam	n/a
Southern Rocklobster[b]	Australia	National	1	0	0	n/a	n/a
Aquaculture Stewardship Council[a]	Netherlands	Global	5	3	1	Rainbow trout, basa, tilapia	Salmon
Seafood Trust Eco Certification[b]	Ireland	Global	n/a	n/a	n/a	n/a	n/a
KRAV	Sweden	National	7	0	0	n/a	n/a

[a]Nongovernmental organization.
[b]Industry program.
n/a, not applicable

basa [*Pangasius bocourti*]), rainbow trout (*Oncorhynchus mykiss*), tilapia (*Oreochromis* spp.), and pike-perch (*Sander lucioperca*) were the most common freshwater species to receive ecolabels or certification, with the majority of these species being farmed fish. The five species of Pacific salmon (i.e., chinook salmon [*Oncorhynchus tshawytscha*], chum salmon [*Oncorhynchus keta*], coho salmon [*Oncorhynchus kisutch*], pink salmon [*Oncorhynchus gorbuscha*], and sockeye salmon [*Oncorhynchus nerka*]) and mulloway (*Argyrosomus japonicus*) were the most commonly certified diadromous species.

The seafood-awareness campaigns were most often initiated by aquariums and other NGOs (n = 18), followed by industry (n = 4) and government (n = 1) (table 2). The number of species or species groups covered by awareness campaigns ranged from 8 to 201 (mean = 56.7, standard deviation = 38.5) species. On average, marine species made up the majority (86.7%) of organisms covered in the awareness campaigns, followed by diadromous species (7.6%) and freshwater species (5.7%). Similar to the ecolabeling or certification programs, the most commonly listed freshwater species in awareness campaigns included catfish (various species), rainbow trout, and tilapia. However, lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and crayfish (*Procambarus clarkii*) were often included. Both the Vancouver Aquarium's Ocean Wise campaign and the Shedd Aquarium's Right Bite campaign include many of the species targeted by commercial fishers in the Laurentian Great Lakes. Other campaigns, such as Mother Earth News' Sustainable Seafood Shopping Guide and Green America's Safe Seafood List, include a number of freshwater species that should be eaten with caution or avoided because of high toxin levels but make no mention of population status or sustainable fishery methods. In terms of diadromous fishes, the five species of Pacific salmon are commonly mentioned in awareness campaigns, as are Atlantic salmon (*Salmo salar*), a variety of sturgeon species (for both flesh and caviar; e.g., *Huso huso, Acipenser* spp.), and a number of eel species (*Anguilla* spp.).

The state of inland fisheries and why seafood-awareness campaigns are needed

The Food and Agriculture Organization of the United Nations (FAO) defines *inland fisheries* as those in freshwater or estuaries whose target species are those that spend all or part of their life cycle therein (FAO 1992). In 2008, inland capture fisheries produced an estimated 10 million metric tons of fish and crustaceans (*www.fao.org/fishery/statistics/software/fishstat/en*). However, this number fails

Table 2. Summary of awareness campaign coverage of marine, freshwater, and diadromous species.

Organization	Campaign name	Country of origin	Extent of coverage	Number of species included			Specific freshwater species	Specific diadromous species
				Marine	Freshwater	Diadromous		
Sustainable Seafood Canada[a]	Sea Choice	Canada	Global	49	5	3	Catfish, tilapia, basa, swai, rainbow trout	Arctic char, Pacific salmon, Atlantic salmon
Vancouver Aquarium[a]	Ocean Wise	Canada	Global	167	15	19	Channel catfish, basa, swai, paddlefish, crayfish, lake herring, lake trout, lake whitefish, chain pickerel, round whitefish, lake sturgeon, tilapia, walleye, white bass, yellow perch	Beluga sturgeon (caviar), Russian sturgeon (caviar), starry sturgeon (caviar), white sturgeon (caviar), Arctic char, American eel, European eel, Japanese eel, salmon (chum, coho, chinook, pink, sockeye, Atlantic), American shad, rainbow smelt
Blue Ocean Institute[a]		United States	Global	31	2	7	Channel catfish, tilapia	Salmon (chum, pink, coho, sockeye, chinook), striped bass, eel
Environmental Defense Fund[a]		United States	Global	43	6	6	Channel catfish, basa, swai, crayfish, tilapia, rainbow trout	Arctic char, sturgeon (fish, caviar), salmon (sockeye, pink, Atlantic), striped bass
Monterey Bay Aquarium[a]	Seafood Watch	United States	Global	40	5	5	Channel catfish, basa, swai, tilapia, rainbow trout	Arctic char, salmon (Atlantic, Pacific), sturgeon (caviar, fish), striped bass
New England Aquarium[a]	Celebrate Seafood	United States	National	17	3	4	Channel catfish, tilapia, rainbow trout	Alaska salmon, striped bass, Arctic char, sturgeon (caviar, fish)
Shedd Aquarium[a]	Right Bite	United States	Global	46	8	6	Catfish, yellow perch, tilapia, lake whitefish, basa, lake trout, walleye, rainbow trout	Salmon (Atlantic, Pacific), Arctic char, striped bass, sturgeon (caviar), rainbow smelt
Aquarium of the Pacific[a]	Seafood for the Future	United States	Global	15	2	4	Channel catfish, rainbow trout	White sturgeon, striped bass, Arctic char, Pacific salmon
National Oceanic and Atmospheric Administration[b]	FishWatch	United States	National	68	0	7	n/a	Striped bass, salmon (Atlantic, chinook, coho, sockeye, chum, pink)
Earth Easy[c]	Sustainable Seafood Guide	United States	Global	57	4	5	Catfish, tilapia, crayfish, rainbow trout	Arctic char, salmon (chinook, sockeye), sturgeon (fish, caviar), striped bass
Hawaii Seafood[a]	Keeping Hawaii Seafood Sustainable	United States	Regional	8	0	0	n/a	n/a
Monterey Fish Market[c]	Sustainable Seafood	United States	Global	27	2	2	Catfish, trout	Chinook salmon, striped bass
Mother Earth News[c]	Sustainable Seafood Shopping Guide	United States	Global	54	8	5	Paddlefish (caviar), catfish, tilapia, largemouth bass, pike, walleye, crayfish, rainbow trout	Sturgeon (fish, caviar), striped bass, Arctic char, salmon (Pacific, Atlantic)
Star Chefs[c]	Loving our Seafood to Death	United States	Global	43	3	2	Catfish, tilapia, crayfish	Sturgeon (caviar), salmon
Green America[a]	Safe Seafood	United States	Global	45	9	2	Perch, tilapia, channel catfish, lake trout, lake whitefish, largemouth bass, pike, walleye, crayfish	Sturgeon (fish, caviar), salmon
WWF[a]		Indonesia	National	51	0	1	n/a	Milkfish

Table 2. (Continued)

Organization	Campaign name	Country of origin	Extent of coverage	Number of species included			Specific freshwater species	Specific diadromous species
				Marine	Freshwater	Diadromous		
WWF[a]		Hong Kong	Global	59	0	3	n/a	Salmon (Pacific, Atlantic), sturgeon (caviar)
WWF[a]		Malaysia	National	49	0	1	n/a	Longtail shad
WWF[a]		Singapore	Global	43	0	3	n/a	Salmon (Pacific, Atlantic), milkfish

[a]Nongovernmental organization.
[b]Governmental organization.
[c]Industry campaign.
n/a, not applicable; WWF, World Wildlife Fund

to include the recreational sector and small-scale artisanal fisheries that are difficult to monitor, and it is therefore an underestimation of the actual harvest. In developed regions (e.g., North America, Europe, Australia), the dominant user of inland fisheries is the recreational angling community, whereas small-scale commercial and subsistence fisheries are the dominant users in developing countries (Arlinghaus et al. 2002). Inland fisheries in developing countries serve as an important source of food protein and employment (it is estimated that for hundreds of millions of rural households, their income is based on inland fisheries; Welcomme et al. 2010). Unlike in marine fisheries, relatively few inland fisheries products are exported and traded on international markets; they are instead consumed locally. Beyond the capture sectors, there are also significant aquaculture activities in inland waters, and that activity is growing annually (Hempel 1993, Tacon et al. 2010). Inland fish culture can have negative environmental effects, ranging from nutrient enrichment to the introduction of alien species (Tacon et al. 2010).

Freshwater ecosystems face many threats, most of which are external to fisheries activities (Welcomme et al. 2010). For example, habitat degradation, loss of riverine connectivity (caused by dams), water extraction for irrigation, climate change, pollution, eutrophication, and invasive species all contribute to making freshwaters some of the most threatened ecosystems in the world (Warren and Burr 1994, Cowx 2002). As a result of these factors, the loss of biodiversity in freshwater is believed to exceed that observed in both terrestrial and marine environments (Ricciardi and Rasmussen 1999). Moreover, freshwater fishes may be the most threatened group of vertebrates on Earth after amphibians, and the global extinction rate of fishes is believed to be in excess of that of higher vertebrates (Bruton 1995). This decline in freshwater fisheries is now visible in some recreational fisheries in Canada (Post et al. 2002) and in small-scale fisheries in developing countries (Allan et al. 2005). There is also evidence of historic commercial overfishing in inland waters of North America (Humphries and Winemiller 2009). In addition, with the growth of the world's human population expected to continue, both the global consumption of freshwater and the human impacts on freshwater aquatic ecosystems will undoubtedly exceed current levels (Gleick 1998, Malmqvist and Rundle 2002). Inland fisheries will become even more important for food security in developing countries with population growth (Smith et al. 2005, Welcomme et al. 2010), and in the developed world, there is a growing interest in eating local foods, so demand for inland fisheries may increase (e.g., the 100-mile diet movement in North America and Europe; Feenstra 1997, Hinrichs 2003).

Would ecolabeling and awareness campaigns work for inland fisheries?

To decide whether ecolabeling and awareness activities would be successful for inland fisheries, it is useful to assess the common shortcomings of marine programs and to determine whether they are likely to also be shortcomings if these programs were applied to freshwater species. Jacquet and Pauly (2007) identified key limitations of seafood-awareness campaigns that were further elaborated by Ward (2008). Here, we briefly discuss these in the context of inland fisheries. Where challenges appear for successfully applying ecolabeling and awareness campaigns for inland fisheries, we provide suggestions on how existing programs could be modified or how new programs could be developed to overcome or mitigate these problems.

Jacquet and Pauly (2007) suggested that the main problems faced by seafood social marketing are the characteristics of the market itself, in terms of both consumers and producers. Given the sparse inclusion of inland fisheries in current ecolabeling, certification, and awareness campaigns, we suggest that the public is generally unaware of the dire state of many inland fish populations and their ecosystems. Although scientists and environmental media have been effective at bringing marine fisheries issues into the spotlight, the same cannot be said for freshwater fisheries (both cultured and wild capture). We suggest that consumers need to know that there is a problem before they will be motivated to act through their purchasing power. Such awareness campaigns are a critical first step that must take place even before a market approach is implemented. Even with

educational campaigns, the data suggest that, in developing areas such as Asia, Latin America, and Africa, consumers may not be receptive to ecolabeling programs (Gardiner and Viswanathan 2004). In addition, the markets for inland fish tend to be more local, with relatively little export or international trade, and small-scale fisheries are fundamentally different from large-scale industrial fisheries. These factors would need to be considered and could be addressed by campaigns at local, national, and global scales. One last consideration for inland fisheries markets is that in developed countries, the recreational fishing sector is the primary user (Arlinghaus et al. 2002). Although many fish are caught and released, a significant proportion (estimated at about 36%; Cooke and Cowx 2004) is harvested. Efforts to target this unconventional market in which fish are not sold or traded but still constitute a component of protein intake could occur at the time of licensing.

Not unlike those directed toward marine commercial fisheries, campaigns directed toward inland fisheries would suffer immensely from a lack of traceability (Golan et al. 2003). Far fewer inland fisheries products are exported and traded, so the mechanisms for tracking supply chains are less developed. Consumer awareness campaigns for inland fisheries could be easily manipulated. Another problem is the inability to track the boats and fishers catching the fish, particularly when they do so illegally. In inland waters, the fisheries tend to be small scale (Welcomme et al. 2010), and there may be no mechanisms to limit entry into the fishery. Moreover, there may be no federal legislation regulating capture within a country; therefore, only when fish are exported does international legislation (e.g., CITES [Convention on International Trade in Endangered Species of Wild Fauna and Flora]) play a potential role. Freshwater resources tend to be managed at a state or federal level, with relatively little legislation and few multinational management frameworks. Efforts to target the shortcomings in policies and management would first increase the likelihood of success of inland fisheries campaigns.

Given that many inland fisheries are conducted in isolation of the international community because of a lack of exports, there is a tendency for the misuse of common names. It is unclear the extent to which mislabeling or renaming occurs within inland fisheries. It is likely that consumers of fish in developing countries who purchase fish from local markets or trade other goods or services to obtain fish have more knowledge of the local species and are therefore more effective than consumers in the developed world at discerning mislabeled products. In general, if there is a relationship between the fisher and the consumer, as there tends to be in small-scale artisanal fisheries, it is less likely that intentional mislabeling would occur. Nevertheless, this does not exclude the potential for accidental mislabeling due to an inability to identify different species. Inland fisheries may suffer from more opportunities to mislead consumers on the basis of cultured versus wild captured products because of the well-developed aquaculture industry in inland waters relative to that in marine waters. One possible solution to the problem of intentional mislabeling is to encourage that the species be sold whole (when this is possible) rather than filleted. This would be effective only when consumers are educated about the product. Incentive programs that certify the reliability of small-scale fishers and aquaculturists in the honest marketing of their products may also increase the success of inland fisheries certification and ecolabeling campaigns.

As with the marine realm, there are efforts to adopt an ecosystem approach to fisheries management in inland waters (Beard et al. 2011). In some ways, such a need is greater in freshwater systems, in that the relevant threats extend beyond overexploitation. Stressors, such as habitat alteration, barriers and the associated loss of connectivity, pollution, eutrophication, invasive species, and climate change, can often act simultaneously (e.g., synergistically or cumulatively) on freshwater ecosystems and can have irreversible effects (Richter et al. 1997). Although single-species awareness campaigns could still be beneficial for inland fisheries (e.g., a variety of sturgeon species could benefit from reduced harvest pressure), the consideration of whole ecosystems would be ideal. For example, there have been few studies in which bycatch in inland waters has been examined. There may therefore be significant problems for other taxa, including imperiled turtles or nonharvested fish species (Raby et al. 2011).

Prognosis and conclusions

Our qualitative and quantitative examination of existing certification, ecolabeling, and awareness campaigns revealed that many such activities related to sustainable seafood fail to consider inland fisheries. Although a lack of education of the general public on the severity of issues surrounding inland waters is partly to blame, the question remains as to whether future social marketing activities could be used to generate meaningful ecological benefits to these aquatic ecosystems and their inhabitants. We would submit that the answer is yes but that for most regions of the world, the way in which social marketing campaigns are utilized would require a major shift—particularly in developing countries. Just as marketing campaigns surrounding marine artisanal fisheries in developing countries do not have the same impact and cultural traction that they do in developed countries, the same lack of success can be expected for inland artisanal fisheries. Instead, grassroots initiatives that combine knowledge of the state of fish stocks (on a regional basis) with logical advice to consumers—and, in particular, fishers—with regards to which species (or size classes) would benefit from reduced harvest and consumption. Communication with fishers and consumers needs to be targeted through fisheries cooperatives, regional fisheries management agencies (ideally through a comanagement framework), and local media and outreach activities (e.g., targeting youth and elders or women) that have been effective in dealing with other conservation crises (e.g., the bushmeat crisis; Bennett et al. 2007). The challenge, of course,

is that food security needs—although they are intimately linked to sustainable fisheries harvest—are a growing reality in the developing world.

As wild inland fish stocks decline and international demand for fish protein increases, there is also a greater impetus for the development of commercial aquaculture in developing countries in which environmental policies are less stringent and the costs of production are lower than those in the developed world (Tacon et al. 2010). Given that freshwater aquaculture products are consumed locally as well as exported to international markets, both grassroots awareness and traditional social marketing campaigns are likely to be necessary in order to better inform consumers about how to make responsible decisions that can help protect freshwater ecosystems. Offering a clear definition of what sustainable aquaculture is or should be (Wurts 2000) as it relates to the health of inland aquatic ecosystems is likely to be an important component of awareness campaigns, regardless of their target audience.

Although the implementation of social marketing activities in inland fisheries would probably suffer from the same problems and limitations that have been noted in marine fisheries (Jacquet and Pauly 2007), with perhaps even more difficult problems to surmount (e.g., measuring campaign effectiveness), this does not mean that combining these strategies would not be worthwhile. Assessment and research activities would need to accompany any program in inland waters in order to understand how the program could be implemented to best serve conservation objectives. In addition, there is also need for bioeconomic studies that consider how markets in developed countries would respond to different social-marketing initiatives. A modeling exercise by Gudmundsson and Wessells (2000) revealed that overharvest problems in open-access fisheries might not be solved by awarding a label to a fishery. Instead, the authors argue that the labeling system needs to be changed so that the related economic incentives generate a sustainable level of harvesting. There are currently no studies of fisheries-labeling studies in freshwater, so there is a need for similar studies on inland fisheries in which access tends to be completely open, especially in developing countries. Finally, and perhaps most importantly, it is necessary to communicate that inland fisheries social marketing campaigns will not have positive conservation outcomes in the absence of efforts to abate the number of other stressors acting on these imperiled ecosystems.

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