CHAPTER 7.
FISHERIES SECTOR

Charlotte Boyd

This report seeks to highlight the economic contribution of biodiversity conservation and ecosystem services to development and equity in the Latin American and Caribbean region, hence, making an economic case for mainstreaming biodiversity and ecosystem conservation into national policies and development strategies.

7.1 INTRODUCTION AND OBJECTIVES

The fisheries sector is economically important in Latin America and the Caribbean (LAC), contributing to food security, employment, domestic income, foreign exchange earnings, and fiscal revenues. Fisheries are especially important to the livelihoods of the poor in coastal regions or near inland waters in LAC.

Fisheries depend, in turn, on the natural services provided by ecosystems, from provisioning of habitats critical to each life stage of targeted species and the food chains that sustain them, to regulation of ambient conditions and maintenance of essential metabolic, growth, and reproduction processes. Degradation or loss of such ecosystem services contributes to fisheries depletion or collapse, especially under pressure of overfishing.

The pattern of marine fisheries development in LAC parallels that in the rest of the world. Marine capture fisheries production has probably reached a plateau, despite increases in fishing capacity (FAO 2008). Further development is, thus, likely to be achieved through rebuilding depleted fisheries, restoring essential habitats, and increasing economic efficiency (Hilborn et al. 2003; Worm et al. 2009; World Bank 2009).

Recognizing this, several countries in LAC have started to reorient their fisheries toward sustainable ecosystem management (SEM). The goal of SEM in fisheries is to generate optimal sustainable yields, while safeguarding the capability of ecosystems and biodiversity to provide the ecosystem services (ES) upon which fisheries and other economic activities depend. The SEM approach involves investing in natural capital for fisheries, by maintaining or restoring the productivity, structure, and function of aquatic ecosystems. Maximizing economic rather than biological yields in fisheries will generally require larger stock biomass, meaning that economic and ecological objectives often point in the same direction (Grafton et al. 2006).

In many fisheries around the world, responsible management has succeeded in reducing excessive exploitation, in rebuilding depleted fisheries, and in sustaining those that contribute to national economies (Worm et al. 2009). There is growing consensus about the policy frameworks and management tools required, especially for high-value industrial fisheries. Several countries in LAC are at the forefront of developing and adapting these tools and approaches. A major challenge in the region is that many economically-important fisheries are characterized by large numbers of small vessels targeting multiple species. The tools that have been developed for industrial fisheries management are less well-suited to these small-scale fisheries. Several countries in LAC are pioneering new approaches and tools for managing them.

The goal of this chapter is to foster further progress towards\ SEM by providing policy makers with information on the economic value of taking an ecosystem approach to fisheries management. Case studies are used to highlight the economic costs of Business as Usual (BAU), the potential net benefits of moving toward SEM, and key policies and strategies for transition. In doing so, the focus will be on marine-capture fisheries as opposed to freshwater ones and aquaculture systems, which also offer many examples.

[21] PhD candidate, University of Washington.

The BAU approach in fisheries refers to management strategies that maximize short-run returns without considering external or long-run costs. Research shows that BAU practices deplete fish stocks and degrade essential fish habitat and other key ES, leading to loss of economic value. This situation undermines the long-term, ecosystem-wide economic potential of fisheries and related resources. In addition, BAU has direct costs, in terms of lost yields, and indirect costs associated with fishing overcapacity, subsidies, and illegal or unregulated (IUU) fishing. Furthermore, BAU does not take into account external impacts on broader ecosystem function and services, nor on other economic and non-economic activities and values (like coral reef-based tourism and social norms on biodiversity preservation).

Key Findings

The chapter examines the contribution of responsible fisheries management to key facets of development:

- **Depleted fisheries can be rebuilt under SEM** (usually); production is higher following rebuilding and the risks of collapse are lower than during the overfishing that led to depletion.
- **Returns on investment** are expected to rise as SEM maximizes economic yields and reduces fisheries overcapacity and over-investment, avoiding unbridled, self-defeating competition under BAU.
- **Employment** may rise or fall under SEM depending on the situation. Fisheries with overcapacity may see an interim reduction followed by restructuring in favor of fewer but more permanent, stable jobs.
- **Fiscal impacts** will depend on measures to recover fisheries management costs and to capture part of the increases in economic rent.
- **Equity** will be served by stakeholder engagement at all levels, more transparent decision-making, and, in some cases, by co-management of common property resources — all enhancing sustainability of ES.

Where possible, this chapter develops comparative scenarios of the future of specific fisheries under BAU versus SEM. The text highlights a series of steps to develop the policy framework and sustainable management strategies that can support further transition toward SEM in LAC fisheries, maximizing the economic value of marine ES in the fisheries sector.

Specific observations include the following:

- The role of fisheries in LAC and their economic relevance is substantial: contributions to GDP, exports, employment, food security, fiscal revenues, and social safety nets. In 2004, four countries derived more than $2 billion annually from fisheries, and five more over $100 million, playing a part in industrial development as well as in the livelihoods of many impoverished communities.
- Maintenance of the ecological services and habitats that allow targeted stocks to thrive, along with the ecosystems that support them, is a critical consideration in fisheries governance.
- A number of countries have begun to reorient their fisheries toward SEM to improve and sustain yields while safeguarding the capability of ecosystems to provide the services upon which fisheries and other economic activities depend.
- Responsible management of single species and multi-species fisheries is integral to SEM. SEM builds on the FAO Code of Conduct for Responsible Fisheries and the Ecosystem Approach to Fisheries, widely accepted as the appropriate framework to manage marine-capture fisheries. This can include temporary or spatial refugia.
- Fisheries managers and authorities can compare current versus potential sustainable economic rent for fisheries to identify promising candidates for transition to SEM.
- Maximizing economic yields and reducing risks in fisheries generally requires larger stock biomass than maximizing biological yields. Economic and ecological goals both point in the same direction.
- A major challenge is that many fisheries are composed of large numbers of small vessels targeting multiple species. Some tools that have been developed for industrial fisheries management are less well-suited to small-scale fisheries. Several countries in LAC are pioneering alternative approaches and have developed innovative and effective tools for managing small-scale fisheries.
- When access to fisheries resources is insecure, fishers have strong incentives to maximize short-term profits, often leading to overfishing, development of overcapacity, and a 'race to fish' — both economically wasteful and destructive of ecological services. Catch shares, territorial use rights and related management systems are designed to provide actors with greater security over resource access and, hence, incentives to invest in maintaining or restoring stocks.
- The LAC region is home to a wide variety of catch share systems, with examples in Argentina, Chile, Mexico, and Peru among others. These approaches often require legislative

change but result in sustainable benefits: increased catches, improved economic performance, and steady livelihoods for fisher populations and coastal communities.

7.2 CONTRIBUTION OF FISHERIES TO NATIONAL ECONOMIES IN LAC

Fisheries are a vital part of the natural resources sector in LAC, contributing to gross domestic product (GDP), employment, food security, and the livelihoods of the poor. LAC is one of the world's most important fishery regions, with Peru the second largest fish producer in the world, and Chile also regularly in the top ten. Brazil features in the top ten inland capture fisheries (FAO 2008).

Gross Domestic Product (GDP)

In 2004, fisheries in Chile, Mexico, Colombia, and Brazil contributed more than $2 billion to GDP, and in Venezuela, Panama, Argentina, Guyana, and Peru, more than $100 million (Catarci 2004; Tietze et al. 2006; FAO 2008; World Bank 2008). The relative importance of fisheries to national economies is reflected in their contribution of 1% or more of GDP in 11 of the 25 LAC countries for which data are available (Figure 7.1, Appendix 7.3). Fisheries contribute 6.3% of GDP in Ecuador, 5.0% in Belize, 3.9% in Colombia, 3.2% in Chile, and 2.0% or more in the Bahamas, Grenada, Guyana, Panama, Peru, and St. Vincent and the Grenadines. National statistics may conceal the contribution of fisheries at a sub-national level. For example, fisheries account for 0.8% of Mexico's GDP, but 2.3% of GDP in the state of Sonora (FAO n.d.; FAO 1996). Most of these contributions to GDP have been made under BAU management practices.

Structure of the Fisheries Sector in LAC

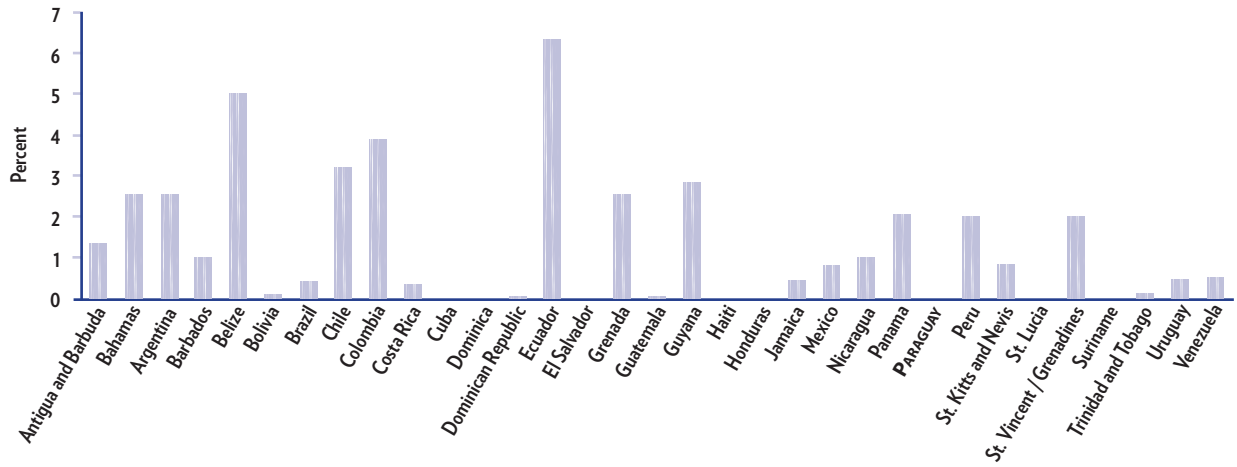
Fisheries production in LAC is dominated by marine pelagic capture fisheries: anchovy, sardines, and other schooling fish. These species provided 85% of regional production by volume in 2004 (Figure 7.2), primarily as raw material for the production of fish meal and oil (FAO 2004). However, lower volume fisheries may have higher values, as is reflected in Figure 7.3.

Demersal, pelagic, and shrimp fisheries each contribute one fifth or more of total value, followed by lobster and crab, benthopelagic, and cephalopod fisheries (Figure 1.2.3). This pattern varies by country. Pelagics are the most important contributor by value in Peru and Chile; benthopelagics in Argentina; demersals in Uruguay and Brazil' demersals and shrimps in Guyana, Venezuela, and Colombia; shrimps in Mexico, Guatemala, Honduras, and Costa Rica; lobster and crabs in Cuba, the Bahamas, and Nicaragua; and reef fish in Grenada, and St Kitts and Nevis (SAUP Database). The different fisheries present distinct challenges from both an ecological and management perspective (Table 7.1).

Foreign Exchange Earnings

Fisheries are major generators of exports in some LAC countries. In 2007, fisheries products contributed more than $3 billion to exports in Chile and more than $1 billion in Argentina, Ecuador, and Peru (FAO 2008). The share contributed by fisheries to total merchandise exports highlights their importance to a range of countries. In

Figure 7.1. Percentage Contribution of Fisheries Sector to GDP



Source: Fishery and Aquaculture Country Profiles http://www.fao.org/fishery/countryprofiles/search/en [multiple years]

Figure 7.2 Catches by LAC Fleet in Their Own EEZs *by Volume (tons)

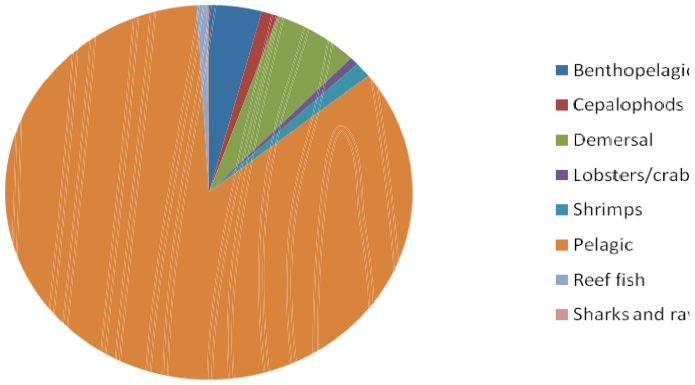
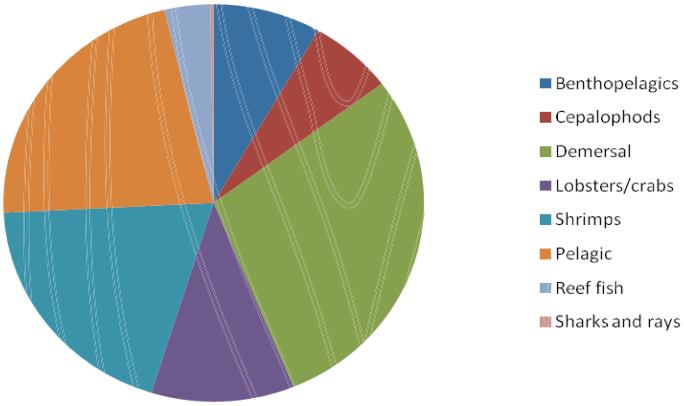


Figure 7.3 Catches by LAC Fleet in Their Own EEZs *by Value ($ of 2000)



2006, fisheries contributed 33% of merchandise exports in Panama and between 10% and 16% in the Bahamas, Belize, Ecuador, Grenada, Guyana, and Nicaragua (Figure 7.4).

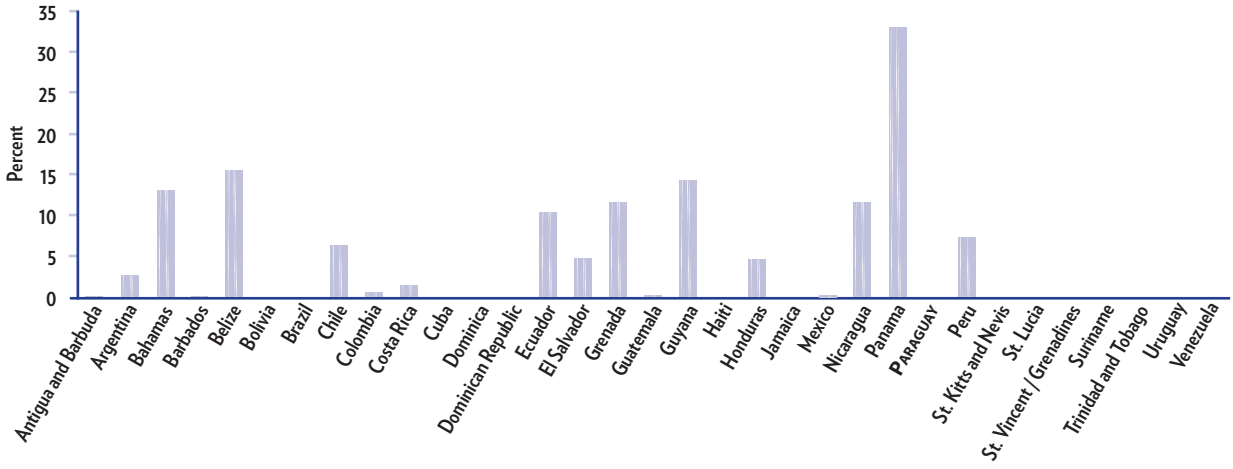
Employment

Across the region, fisheries provide about 1% of total employment; they employ more than 5% in Dominica, Suriname, St Vincent and the Grenadines, Brazil, the Bahamas, and Guyana (Figure 7.5). In 2008, this represented over 1.64 millions jobs directly in the sector and an additional 731,000 in associated secondary employment (table and sources in Appendix 7.4). More than 1 million are employed in fisheries in Brazil, and over 100,000 in each of the fisheries of Mexico, Chile, Peru, Ecuador, and Argentina. Total employment may be underestimated, given evidence that for each fisher, three persons are employed in processing, marketing, or distribution (Macfadyen and Corcoran 2002 cited in Reid et al. 2005). Nor is

Table 7.1. Challenges to Different Types of Fisheries

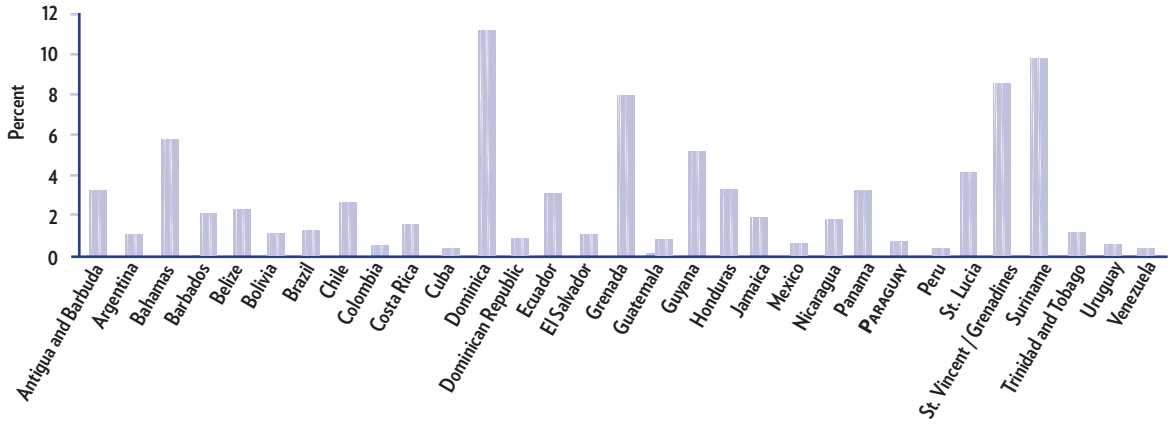
Fishery Resource	Major Concerns
Demersals (e.g., hake, grouper) [= bottom dwellers]	Threats to spawning and recruitment through overfishing Degradation of habitat and ecological services, especially in reef fisheries
Pelagics (anchoveta, sardinella, jack mackerel) [= swimmers in the water column]	Threats to recruitment through overfishing
Benthopelagics (Chilean seabass) [= deep swimmers]	Often slow-growing and long-lived so vulnerable to overfishing
Shrimp (crustaceans)	Loss of essential nursery habitat and ES; impacts of by-catch/discards on other fisheries and impacts of trawling on essential fish habitat
Lobster and crab (crustaceans)	Threats from loss of nursery habitat; overfishing
Cephalopods (squid, octopus)	Threats from destruction of spawning habitat and structures, especially for restricted range species

Figure 7.4 Fishery Exports as a Percent of Total Merchandise Exports (2006)



Source: FAO 2007?

Figure 7.5 Employment in Fisheries Sector as a Percent of Total Employment



it clear how the 2.4 millions jobs listed are split between industrial and small-scale fisheries. A separate, perhaps overlapping source estimates over a million employed in the small-scale sector (Appendix 7.4). The informal economy may also have additional fisheries jobs, especially part-time or seasonal, not reflected in those figures. Clearly, many more people are engaged in fishing in the region than there are formal fisheries jobs.

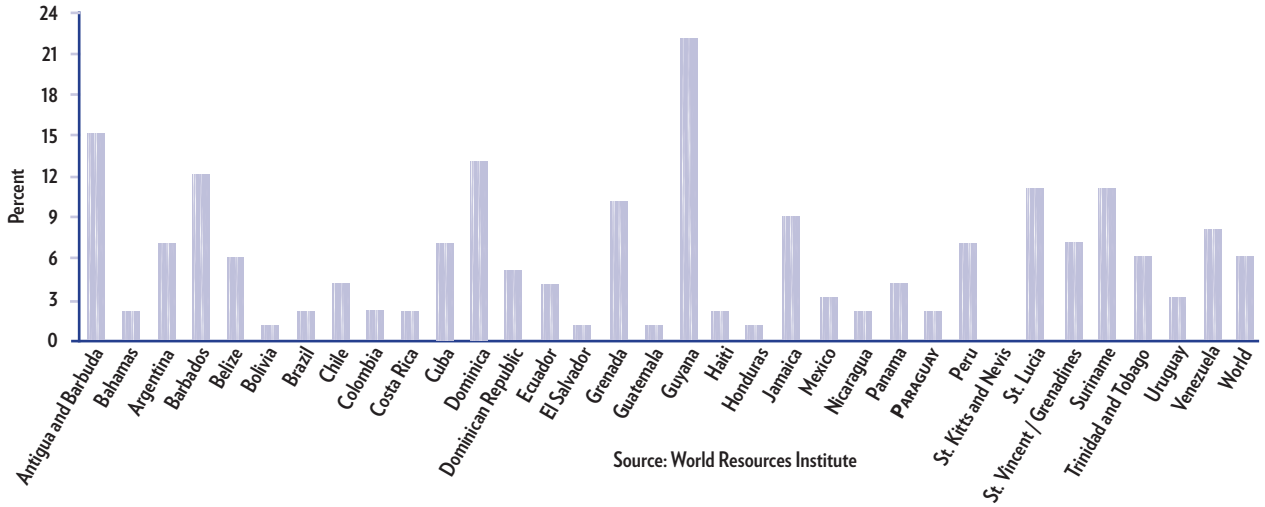
Employment. Small-scale fisheries tend to be labor intensive (FAO 2005). In a study of Pacific marine capture fisheries, FAO (2007) found that small-scale fisheries involved 2.5 times more participants per unit of product than large-scale fisheries. In the 22 LAC countries with data available, there are approximately 1.035 M small-scale fishers (Chuenpagdee et al. 2006). Many of these fishers work in fisheries on a part-time or temporary basis to supplement other food and income sources. Fishing as a secondary or complementary activity, including seasonal fishing, is essential to many rural and coastal households (FAO 2005). These opportunities are particularly important if they are a main source of food or cash to households, or if they come in periods of low labor demand for other activities such as agriculture.

Food Supply

Fisheries provide an important contribution to food supply at the national level. In 13 of 33 LAC countries for which data is available, the percentage of protein supply from fish products equals or exceeds the world average of 6% (Figure 7.6). Global population growth and corresponding increases in demand for food suggests that the need to build food security may be expected to continue (FAO 2005).

Food Security. Worldwide, fish can exceed 25% of the total animal protein used in the poorest countries, reaching as much as 90% in isolated inland and coastal areas. Fish is particularly valu-

Figure 7.6 Fish Protein as a Percentage of Total Protein Supply (2000)



able where other sources of animal protein are scarce or expensive (FAO 2005). Small-scale fisheries often supply local markets as well as support subsistence consumption (Thorpe et al. 2000). Poor households may sell much of their catch and use the cash to purchase cheaper foods. Increases in fish prices, attributable to rising demand, will benefit households that are net producers of fish, but will harm those that are net consumers.

Global increases in aquaculture production, though significant, have not offset the stagnation in total fish production (Liu and Sumaila 2008). Excluding China, population growth has outpaced the growth of total food fish supply, resulting in a decrease in per capita fish supply (FAO 2002). Stable or declining catches in the face of growing demand have led fish prices to rise dramatically in some local markets, placing an essential source of protein out of reach for many low income consumers (Ovetz 2006).

Fisheries as Factors in Poverty Allieviation

There have been growing efforts to understand poverty and vulnerability in fishing communities and the potential of fisheries to contribute to poverty alleviation. Research has focused on small-scale fisheries, with little data on poverty among industrial fishery workers. Small-scale fishers are vulnerable because of the unpredictable nature of fishing and because most of these fishers lack tenure over the resources they exploit. Many small-scale fishing communities are remote and isolated, with limited access to basic infrastructure, capital, and technology, and few economic alternatives (FAO 2005). Many small-scale fisheries in LAC are being degraded rapidly; concern about overfishing is widespread (Chapman et al. 2008). Small-scale fishing communities, traditionally reliant on near-shore marine resources, are affected by reduced access to seafood for subsistence, underemployment, and income reduction (Defeo and Castilla 1999).

On the other hand, well managed small-scale fisheries can contribute to poverty reduction by generating prosperity at the household level or by acting as an engine for local economic growth (Thorpe 2005; FAO 2005). Small-scale fisheries can be economically efficient and generate jobs and profits. For example, the spiny lobster (*Panulirus argus*) fishery along the Yucatan Peninsula represents one of the world's most important artisanal fisheries (Defeo and Castilla 2005). Modernization, technological innovation, and export orientation have become features of many small-scale fisheries in recent years. In Chile, Argentina, Mexico, and Costa Rica, small-scale fishers directly export their products (FAO 2005).

Fisheries can be an important source of food security, employment, cash income, and improved equity for impoverished populations in coastal areas and near inland water bodies (FAO 2005).

Gender Equity. Fisheries jobs can employ women as well as men in both the harvesting and processing sectors (FAO 2005). In the state of Bahia, Brazil, approximately 20,000 women harvest shellfish for sale. Women represent 39% of labor employed in Chile's industrial fishing sector (Gallardo Fernández 2008).

Fisheries as a Safety Net. Small-scale fisheries, like other open access or common property resources, can provide an important safety net that may be critical to a large proportion of the poor in coastal and rural areas. In these cases, open access is the key factor that enables fisheries to fulfill this safety-net function (FAO 2005). This has implications for the design of systems to provide more secure tenure in small-scale fisheries. For many fishing communities, diversification of target species is an important risk management strategy for maintaining income and employment in the face of variable resource availability.

7.3 DEVELOPMENT AND CURRENT STATUS OF FISHERIES IN LAC

Development of fisheries in LAC Under BAU

World production from capture fisheries leveled off in the late 1980s, despite technological advances and increases in fishing effort (Hilborn et al. 2003; Gelchu and Pauly 2007). The data suggest that marine capture fisheries production has reached a maximum (FAO 2008). For marine capture fisheries, further development is most likely to be achieved through rebuilding depleted fisheries, investing in the natural capital on which productivity depends, and increasing the economic efficiency of fishery exploitation (Hilborn et al. 2003; Worm et al. 2009; World Bank 2009).

Available data on fisheries production in LAC are consistent with this global pattern. In LAC, fisheries development was limited until the post-war period, when increasing world demand for fish products stimulated investment in export-oriented fisheries in some places (Gelchu and Pauly 2007). Fisheries development was further advanced by the establishment of Exclusive Economic Zones (EEZs) in the 1970s, with substantial government investment and subsidies in many countries (Khan et al. 2006; Gelchu and Pauly 2007; Abdallah and Sumaila 2008). But this expansion led to the collapse or near-collapse of several fisheries, including the Peruvian anchoveta, Brazilian sardinella, and Argentinean hake, among other fisheries (Christy 1997). The volume of fisheries production in LAC expanded steadily through the 1980s, peaked in the 1990s, and has been stabilizing or declining thereafter (Figure 7.7) (Thorpe et al. 2000). The sector has been built largely under BAU conditions and practices. Since this led to collapse of a growing number of fisheries, a shift toward SEM approaches has occurred in some cases, usually focused narrowly on particular stocks. In other cases, adjustments were made within the BAU scenario, such as serially depleting species down the trophic chain.

Box 7.1. Fisheries sub-sectors in LAC

The fisheries sub-sectors of LAC economies are characterized by a diversity of scales of operation and modes of organization. Jopia and Yazigi (2009) describe the main sectors in Chile in terms that are broadly applicable to the entire region (to which recreational and sport fisheries have been added):

Industrial Fisheries. Purse-seine, trawl, long-line, or other harvesting operations that use boats and equipment that exceed a threshold size (e.g., for Chile, the industrial sector is characterized by the use of vessels with a hold capacity above 50 t and a length over 18 m). Large corporate fishing enterprises often co-exist with single vessel owners.

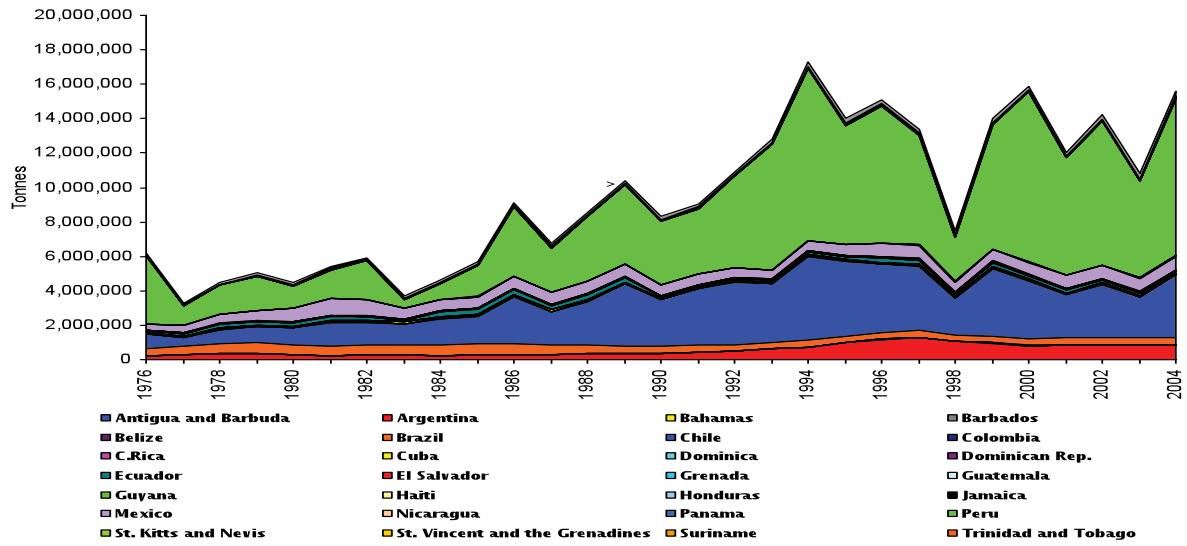
Small-scale Fisheries. Small-scale or artisanal fisheries are generic terms for fishing operations not classified as industrial. They cover a range of activities from subsistence to commercial fishing, from individuals gathering shellfish to multi-vessel fleets using a variety of technologies. Small-scale fisheries may include owners with multiple vessels, but they typically have local ownership. Some are traditional indigenous fisheries; many operate in the informal sector. They are often constrained by limited access to technology and capital. While industrial fisheries contribute the mass of fishery production in the region, some 90% of the region's fishers are small-scale (Reid et al. 2005; Chuenpagdee et al. 2006). Small-scale fisheries often present challenges for fisheries managers due to the large number of small vessels operating out of numerous harbors, often targeting multiple species.

Recreational and Sport Fisheries. These make significant contributions to local income and employment in some places, as well as contributing to foreign exchange earnings through international tourism.

Processing. The processing sector is defined as all 'facilities where raw materials (coming from fleet catches and aquaculture) are changed into final or intermediate products.' The largest and most capital intensive processing operations in Chile are the fishmeal factories. Processing for human consumption is generally more labor intensive. In many cases, processing is vertically integrated with harvesting.

Support Services. Fisheries rely on suppliers of a wide range of products, transport, and marketing services, and other inputs that are not identified as part of the fishery sector. The need for sustainable fisheries and ecosystem management involves government agencies, technical advisory groups, and NGOs as well.

Figure 7.7. Volume of Catches by LAC Fleet in Their Own EEZs (tons)



Source: Sea Around Us Database.

The inherent volatility of the anchoveta fishery can make fisheries time series difficult to interpret, but the long-term smoothed pattern is similar with or without Peru. The value of fisheries production shows a similar pattern from 1976 to 2004, albeit with slower growth and less apparent variability (Figure 7.8).

Figure 7.8. Dollar Value of Catches of LAC Fleet in Their Own EEZs