6. Coastal fisheries of Costa Rica

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1. INTRODUCTION

Costa Rica is a small country, with a territory of 51 000 km² (Figure 1). Due to the small and open economy, export of products is a major component in many industries, including fisheries. Joaquín and Windevoxhel (1998) indicate that by the 1990s, most marine landings of the Central America region were contributed by Costa Rica (179 000 tonnes), accounting for US$616 million, close to those reported by Panama. The Central Valley, in the central region of the country, comprises 60% of Costa Rica's population. It is in this area where major cities are located and thus where most of the jobs are generated.

Table 1 shows Costa Rica's sea limits; the coastal zone holds only 7% of the population. It represents one of the less developed areas, encompassing many socio-economic problems, and includes four cities with fewer than 100 000 inhabitants. On the Pacific coast, the three main areas are: Puntarenas (95 000 inhabitants), Golfito (30 000 inhabitants) and Quepos (20 000 inhabitants). Limón (70 000 inhabitants) is located on the Caribbean coast.

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FIGURE 1
Map of Costa Rica showing the Pacific and Caribbean regions

TABLE 1
Main characteristics of the Caribbean and Pacific coasts in Costa Rica

	Caribbean	Pacific
Coastline (Villalobos, 1982)	212 km, rectilinear coastline	1 016 km, three gulfs and several bays
Percentage of areas protected (PRADEPESCA, 1995)	Slightly higher than 40% of the coastline	Less than 30% of the coastline
Exclusive economic zone (Palacios, 2007)	24 000 km^2	589 682.9 km^2
Continental platform (MINAE and PNUD, 2002)	2 400 km^2	15 600 km^2
Wind patterns	Strong influence of northeast winds, hurricane season influence	Scattered storms, wind direction changes according to the season
Climate	Humid tropical, high rain influence	Dry tropical in the north, humid tropical in the south
Small islands	Two islands	Many islands close to the coast and Coco Island about 644 km southeast
Fisheries stocks	Mainly migratory lobster, mackerel, sharks	Pelagic fishes, sharks, demersal fishes, crustaceans

Protection of wild areas comprises 12.5% of the national territory. These protected areas include: 9 national parks, 3 biological reserves, 2 no-take natural reserves, and 16 wildlife refuges and wetlands. They cover a higher percentage in the Caribbean (50%) than in the Pacific area (21%). Protection is one of the main strategies within the country, since it has been estimated that the world has between 13 and 14 million species, from which Costa Rica accounts for about 4% of them (500 000 species). However, only 17% (almost 90 000 species) of these species have been identified (i.e. it represents about 5% of the currently known species in the world, which is about 1 700 000 species) (Ministerio de Ambiente y Energía y PNUD, 2002).

2. DESCRIPTION OF FISHERIES AND FISHING ACTIVITY

2.1 Description of fisheries

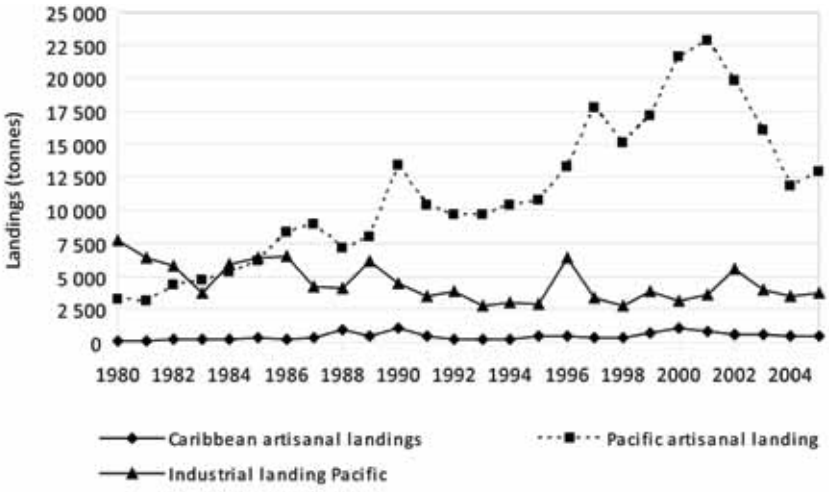
In Costa Rica, between 75% and 80% of the landings come from the artisanal fleet. From those, about 95% of the fleet operates in the Pacific Ocean, which has a larger exclusive economic zone (EEZ) (Table 1). This area can be divided into four zones: north or Guanacaste region (divided into three zones, neighbouring with Nicaragua); Gulf of Nicoya region; Central Pacific region (divided into three zones); and south Pacific region (neighbouring with Panama, divided into two zones) (Palacios, 2007).

From the Pacific area, the Gulf of Nicoya concentrates the principal fleet and the highest landings; this is one of the largest and most exploited estuaries in Central America (Palacios, 2007; Palacios and Villalobos, 2007). This area has important mangrove coverage which, in spite of comprising only 1% of the area and accounting for 1% of the primary productivity, represents 76% of the system biomass (Wolf *et al*., 1998).

One of the characteristics of the Caribbean coast is the presence of coastal lagoons, where important recreational fisheries occur. In this region, several important protected areas have been established limiting commercial fisheries mainly to small-scale fleets. In contrast to the Pacific region, where several zones are used for landing, in the Caribbean region only one area (Limón) concentrates the fishing activity, which includes several landing sites: Barra del Colorado, Puerto Limón and small landing sites on the southern coasts, including Cahuita and Puerto Viejo. Catches in this region are much lower than on the Pacific coast, despite the reduction in catches in the latter (Figure 2).

The volume of species caught by the small-scale fishing fleet on the Pacific coast began to decrease by the beginning of the 1980s, affecting exports. The market was supported by species such as snapper and groupers and new technologies allowed an increase in shrimp landings. Since 1986, a decrease in fish catches was observed and it was attributed to overexploitation of benthic resources on the marine platform in Costa Rica, although there is not scientific support on this matter. Given this situation, boat owners, aided by government export incentives, started to built bigger boats and began to sail longer distances.

FIGURE 2
Catch landed trends in the Pacific and Caribbean coasts by artisanal fleets operating in Costa Rica



Source: Incopesca, 2006.

Fishing fleets in Costa Rica have been classified into five categories which target demersal and pelagic species (Table 2). Most boats are small-scale artisanal and they concentrate on high-value species such as lobster, shrimp and molluscs. Industrial fleets concentrate on sardine and there is a shrimp fishery that has been classified independently (Palacios, 2007). Over time, recreational fisheries have become more important for the economy of the country.

The diversity in the characteristics of the artisanal fleet is wide in Costa Rica. It includes artisanal fleets which operate small boats without motors mainly in the mangrove area where people collect molluscs; boats that use outboard engines operate about 3 miles from the coast on day trips. Other boats have navigation systems and can sail about 40 miles from the coast (Chacon *et al*., 2007). A higher proportion of an artisanal fleet operates in the Pacific and land in Puntarenas (Sancho, 2000) with about 200 boats (Table 2). However, there are significant fleets in Quepos, Playa del Coco and Golfito (Li, 2002). In these fleets, 55% of the boats are wooden, 30% are fibreglass and 15% are steel. Interviews indicated that most of the boats' lengths vary between 9 and 12 m. However, in the advanced scale artisanal fishery, boats can reach up to 30 m. They all have internal engines with an average power of 450 hp, although it is possible to find boats with only 70 hp, or more than 600 hp. Average product storage capacity is 3 000 kg; however, there are boats with up to 1 tonne storage capacity, or even 60 tonnes in the case of advanced artisanal fishery boats.

TABLE 2
Characteristics and targeted species for various Costa Rican fishing fleet categories

Category	Subcategory	Main coverage	Coast	Number of boats in 2000	Main target species
Artisanal	Small scale	Coast	Pacific and Caribbean	3 110	Croaker (*Cynocsion* sp.) Swordspine snook (*Centropomus* sp.) Snapper (*Lutjanus* sp.) Shrimp (*Lytopenaeus* sp.) Molluscs (several genera) Lobster (*Panulirus* sp.)
Artisanal	Mid-scale	Demersal	Pacific 30–50 miles	519	Snapper (*Lutjanus* sp.) Grouper (*Epinephelus* sp.) Mahi-mahi (*Coryphaena hippurus*) Sharks (several genera)
Artisanal	Advanced	Pelagic	Pacific, EEZ and international waters	143	Mahi-mahi *(Coryphaena hippurus*) Swordfish (several genera) Tuna (several genera) Sharks (several genera)
Industrial		Coast	Pacific	73	Shrimp (*Lytopenaeus* sp.)
Industrial		Semi-pelagic	Pacific	2	Sardine (*Opisthonema* sp.)

The advanced artisanal fleet has a wide range of operation. According to fishers, fishing days per boat are between 10 and 20 days, depending on the fishing productivity of the zone. Boats fishing independently, such as the advanced liners, have fishing trips that last approximately one and a half months. The normal area of fishing extends from Central America to Colombia. In the case of the advanced artisanal fishery, the area of fishing extends from southern Peru (10°S) to Mexico (30°N).

The product cooling methods have evolved along with the fishery, boats and techniques. Ice blocks were used years ago, changing in the mid-1980s to ice flakes. In the last couple of years, new boats with cooling systems on board were incorporated for the pelagic fishery, allowing greater independence. In the beginning, the cooling system presented problems for both national and international markets. Exports were rejected, or accepted at low price, since the quality was not the same as the product preserved in ice, due to flesh characteristics. The producers were changing and adapting techniques in order to achieve the standards demanded by the market. Currently, the product is stored and packed in better conditions, improving the dock price.

There is an international artisanal fleet, which is mainly operated by Taiwan Province of China, with flags of convenience from countries such as Panama and Belize. This is not a regular year-round fleet and is estimated at 50 boats. The main reason for allowing these boats into Costa Rica is economics. There is no regulation on the landings of these boats. There are some enterprises that unite the business people from Taiwan Province of China who live in the country and the Costa Rican people.

In the case of trawlers, there are licences for 69 boats; however, only between 40 and 50 are in operation, due to the economic fisheries crisis caused by overexploitation. The industrial fleet is mainly composed of small sardine boats, with limited contribution, since it has traditionally been developed in the external areas of the Gulf of Nicoya. Nevertheless, for about 10 years, some companies have tried to obtain more licences. However this has not been possible given the status of the sardine populations in the Gulf of Nicoya, which feeds humpback whales. This factor, in addition to fishing pressure, has not allowed the recovery of the stock. Nonetheless, there is still pressure to open the fishery, especially in the south (Golfo Dulce).

One problem reported in Costa Rica is associated with the shark fin fishery, which is mainly carried out by the pelagic fishery. A few years ago, due to lobbying, a control process was developed to prevent the disposal of shark carcasses offshore. However, statistics are not accurate and it is hard to follow trends and regulate this activity because this measure does not prevent the fishing pressure and the risk of overfishing as the boat owners find multiple ways to avoid restrictions.

2.2 Fishing activity

Multiple species are targeted by fishers in the area. The small-scale fishery is based on coastal species, where white shrimp (*Litopenaeus stylirostris* or *L. occidentalis*) are the most sought. This activity is generally carried out with drift nets or gillnets in shallow waters, and in boats with outboard engines of 25 hp. The most valued species by fishers are presented in Table 3. Local and scientific names of commercial species are provided.

In this document, we will refer primarily to the fishing activity in the small-scale artisanal fishing coastal area located in the Gulf of Nicoya.

2.3 Target species and fishing gears

As outlined above, different fleets operate in Costa Rican waters. Table 4 compares the production in percentage of the fleets, showing an increase of landings for the medium-scale fleet and a reduction for the small-scale fleet in the analysed period. From 2000 on, international advanced fleets started moving out of Costa Rica, mainly because of legal restrictions against shark finning, giving more potential to the medium-scale fleet.

Depending on the time of the year, the moon phase, currents or area, the same fishers may seek different fish species. Sciaenidae are the most valued; however, Lutjanidae, Serranidae and Scombridae are also fished. Generally, fishing is carried out in boats with 25 hp outboard engines. Wooden boats, generally with on-board engines and four crew members, fish mahi-mahi in waters less than 80 km from the coast. Along the coast, fishing occurs in shallow waters for species like snappers which reside in rocky areas.

TABLE 3
Main species targeted by fishing gear, boats and number of boats and crew that fish in the Costa Rica EEZ

Species	Type and size of fishing gear	Type and size of boat	Number of boats in the fishery	Average number of crew members
Shrimps (*Litopenaeus stylirostris* or *L. occidentalis*)	Gillnet, larger than 0.7 m, from 300 to 400 m	Small scale, less than 6 m	Approx. 850	2
Croacker (*Cynocsion* sp.) **Snook (*Centropomus* sp.)** **Snapper (*Lutjanus* sp.)**	Midwater longline/200 hooks Gillnet of 0.7 to 0.9 m	Small scale, 7 to 9 m	Approx. 100	2
Black tuna (*Euthynnus lineatus*), mackerel (Scombridae)	Drift gillnet of 0.1 m of 600 m	Mid-scale, 7.5 m to 9 m	Approx. 200	3
Mahi-mahi (*Coryphaena hippurus*), sharks (Carcharhinidae, Sphyrnidae, Lamnidae) and swordfish (*Istiophorus platypterus*, *Makaira mazara*, *Makaira indica* and *Tetrapturus audax*)	30 km maximum Surface longline/ 36-40 hooks/mile American type	Mid-scale Maximum 14 m	Approx. 530	5
Snapper (*Lutjanus* sp.) and grouper (Serranidae)	6.5 km maximum Bottom longline	Mid-scale Maximum 10 m	Approx. 600	4
Tunas (*Thunnus albacares* and *Thunnus obesus*), swordfish (*Xiphias gladius*), sharks (Carcharhinidae, Sphyrnidae)	97 km maximum longline, 36 to 40 hooks/mile	Mid-scale, pelagic. Maximum 17 to 18 m (fleet from Costa Rica) Between 800 to 1 000 miles	Approx. 100	7–8
Tunas (*Thunnus albacares* and *Thunnus obesus*), swordfish (*Xiphias gladius*), sharks (Carcharhinidae, Sphyrnidae)	235 km maximum longline, 36 to 40 hooks/mile	Mid-scale, pelagic. Maximum 30 to 37 m. International fleet, mainly Taiwanese	Approx. 50, mainly Chinese	13–15

TABLE 4
Percentage comparison of artisanal fish fleet landings from 1996 to 2002

Fishing fleet	1996	1997	1998	1999	2000	2001	2002
Handline	0	1	0	0	0	0	0
Small scale	19	17	22	19	1	10	12
Medium scale	35	33	25	29	43	51	49
Advanced scale	43	46	47	49	43	38	39
Not available	3	4	5	3	1	1	1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: INCOPESCA, 2006.

The pelagic mid-scale fleet focuses on export species such as mahi-mahi, swordfish and sharks. The foreign fleet, as well as the local fleet, fish on the same species; however, the foreign fleet has a larger autonomous capacity, and in the case of sharks this fleet has shown clear interest in the fins rather than the flesh.

In terms of pelagic species, most of the information is provided by the International Commission for the Conservation of Atlantic Tunas (ICCAT), and studies focus primarily on tuna (Hinton and Bayliff, 2002).

The shrimp fishery is carried out by 55 trawlers (INCOPESCA, 2006); these boats operate along the Pacific coast where several species are targeted. Wild shrimp populations are the most studied species, specifically Gulf of Nicoya shrimp which is monitored to assess the implementation of annual closures.

Shrimp fishery

The artisanal shrimp fishery in the Gulf of Nicoya started around 1924 (Campos, 1984). Between 1950 and 1960, the number of boats fluctuated between three and six, but by 1970 there were 60 artisanal boats catching shrimp in the area. According to González *et al*. (1993), the use of trawlnets in the shrimp fishery by the semi-industrial fleet from 1945 to 1975 caused severe damage to the internal area of the gulf. Even in the 1960s, the artisanal fishery was very small and small boats were launched from the beach. The main development of this fishery occurred around 1986, when the use of monofilament net increased (Araya, 1995).

The target species of this fishery are white shrimp (*Litopenaeus occidentalis, Litopenaeus stylirostris, Litopenaeus vannamei),* and Titi shrimp (*Xiphopenaeus riverti* and *Trachipenaeus byrdi*), both caught between 5 and 50 m depth. Ping shrimp (*Farfantepenaeus brevirostris*) and Kolibri shrimp (*Solenocera agassizii, S. foca*) are caught between 40 and 100 m, and Camello shrimp (*Heterocarpus vicarius, H. affinis*) are caught between 180 and 500 m. Table 5 shows the periods with the highest landings for a variety of shrimp species. The 1960s were the most important decade for white shrimp and the 1970s saw the highest Titi shrimp landings. Kolibri shrimp maximum landings occurred in the 1980s, whereas the early 1990s saw highest landings for Pink and Camello shrimp.

The shrimp fishery is a good example of the typical evolution process of fisheries from the development to the declining phase. The shrimp fisheries started in the 1950s, and the four different stages are shown in Figure 3. A steady phase was observed between 1952 and 1957, an increase of catches marks the development stage from 1958 to 1978, a peak phase from 1979 to 1986, and declines began in 1985.

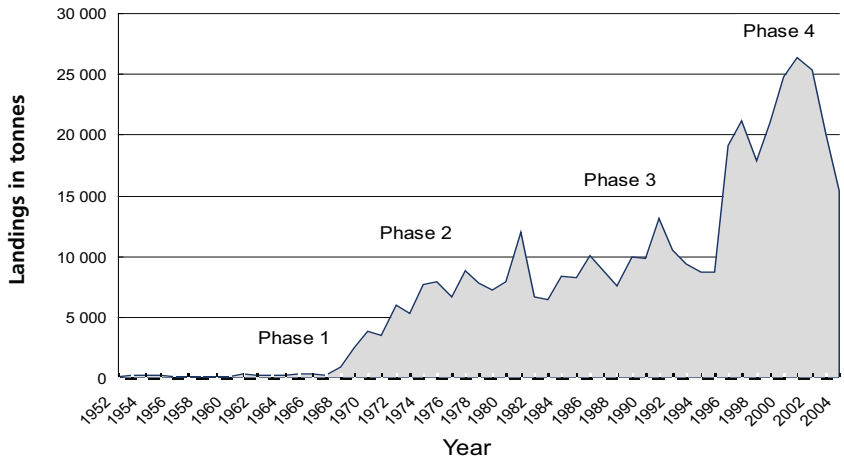
Finfish fisheries

Several studies have been undertaken to evaluate the conditions of fisheries in the area (Palacios, 2007; Palacios and Villalobos, 2007), but an integrated analysis is still lacking. A summary of catch trend analysis is presented here.

TABLE 5
Shrimp fishery by group of species between 1952 and 2004

Shrimp group	Scientific name	Landing 2004 (tonnes)	Maximum average landing in last five years (tonnes)	Maximum landing (year)
White shrimp	*Litopenaeus occidentalis, L. stylirostris, L. vannamei*	196	368	1963–1967
Titi shrimp	*Xiphopenaeus riverti, Trachypenaeus bydi*	54	934	1971–1975
Pink shrimp	*Farfantepenaeus brevirostris*	29	545	1988–1992
Kolibri shrimp	*Selenocera agassizii, S. foca*	399	1 366	1984–1988
Camello shrimp	*Heterocarpus vicarius, H. affinis*	70	619	1987–1991
Total		**748**	**3 832**	

FIGURE 3
Shrimp fishery evolution in Costa Rica from 1952 to 2002



Catch trend analysis of finfish (including all species) was undertaken to identify trends and maximum catches (using a five-year average to smooth the data). When the average value of the catch series is compared with catches in 2004, a 41% decrease in landings is evident (Table 6). Given the limitation of information by species, comparisons were based on groups of species (Palacios, 2007). Except in the case of sardine, most fisheries resources reached the highest catches between the 1980s and 1990s. Sharks and swordfish reached the highest values by 2004, and sardine and the mix of low-quality species showed the lower values regarding long-term average catches.

TABLE 6
Evaluation of catch trends of finfish species landed in Costa Rican fisheries in the Pacific area

Common name	Scientific name	Catch in 2004 (tonnes)	Maximum average catch in 5-year period (tonnes)	Period of maximum catches	2004 proportion of maximum catch
First quality (corvina and snook) > 2.5 kg	*Cynoscion albus* *Centropomus viridis* *Centropomus nigrescens*	135.6	382	1980–1984	0.35
First quality (corvina and croaker) < 2.5 kg	*Cynoscion squamipinnis* *Cynoscion stolzmanni* *Cynoscion phoxocephalus* *Cynoscion reticulatus* *Nebris occidentalis*	992.9	1 634	1995–1999	0.61
Spotted rose snapper	*Lutjanus guttatus*	158.3	330	1993–1997	0.48
Pacific red snapper	*Lutjanus peru*	219	605	1984–1988	0.36
Lower quality (44 species of 17 families)	*Caranx hippos* *Oligoplites mundos* *Paralunchurus dumerilli* *Mugil curema* *Anisotremus dovii* *Other species*	943	2 085	1986–1990	0.14
Sardine (jack, grunt and mullet)	*Opisthonema libertate* (65%) *Opisthonema bulleri* (35%) *Opisthonema medirastre* (5%)	975	6 554	1970–1974	0.15
Barracuda	*Sphyraena ensis*	7.14	14.3	1991–1995	0.50
Corvina	*Micropogonias altipinnis*	271	695	1979–1983	0.39
Conger	*Ophisoma prorigerum* *Ophisoma macrurum* *Rhynchoconger nitens* *Ariosoma gilberto* *Chiloconger labiatus* *Paraconger similis*	78.5	165	1993–1997	0.47
Grouper and bass	*Epinephelus* spp. *Paralabrax humeralis* *Paralabrax loro* *Paralabrax nebulifer* *Alphestes multigutats*	144.3	871	1984–1988	0.16
Dolphinfish	*Coryphaena hippurus*	2321	7 059	1997–2001	0.33
Sharks	*Mustelus lunatus* *Carcharhinus leucas* *Sphyrna lewini*	2025	3 979	1996–2000	0.51
White marlin	*Tetrapterus angustirostris*	416.5	690	1997–2001	0.60
Striped marlin	*Tetrapterus audax*	234	316	1994–1998	0.74
Sailfish	*Isitophorus platypterus*	1 244	1 235	1996–2000	1
Swordfish	*Xiphias gladius*	178	1 798	1995–1999	0.09
Total		11 534	28 412.3		0.41

3. FISHERS AND SOCIO-ECONOMIC ASPECTS

Tourism is the main economic activity in the country. Since the late 1980s, the export trend has caused a change in the Costa Rican production structure, from mainly agriculture to electronic and tourism-based by the end of the 1990s. Since 1995, tourism activity reached an annual growth of 11%, accounting for 28.2% in the total dollar export (Joaquín and Windevoxhel, 1998; Instituto Costarricense de Turismo, 2002).

In 1999, the coastal zone comprised 58% of the country's hotel accommodations with 26 500 hotel rooms; these facilities are projected to reach 31 200 rooms by 2010 (Agencia de Cooperación del Japón e Instituto Costarricense de Turismo, 2001). On the other hand, according to Li (2002), the percentage of international tourists interested in aquatic activities that visited Costa Rica is above 25%, which represented by that time 33% of the total income coming from tourism.

Agriculture is the second most important economic activity in the country. It provided about 14.9% of the gross domestic product (GDP) in 2004 (MAG, 2005). About 20% of the land is suitable for agriculture (Joaquín and Windevoxhel, 1998). In both coastal areas, even though the land is not well suited for agriculture, it is still the main source of jobs, especially in plantations of banana, coconut, cocoa, rice and sugar. Another relevant component is extensive livestock farming.

The fishing industry had no significant relevance before the 1970s. The catalyst for economic development in fisheries is the industry sector, such as the development of a fleet directed to catch shrimp, sardine and tuna (Blondin, 1992). According to Breton *et al*. (1991), by the 1990s export from fishing represented 0.4% of the GDP, giving the artisanal fisheries little relevance in the occupational structure of Costa Rica. This condition has not changed much into the twenty-first century.

Demographic statistics on the population employed in fisheries are limited. Surveys carried out by Programa para el Desarrollo Pesquero en Centroamérica (PRADEPESCA, 1995) showed that the Pacific coast had 8 395 fishers, and the Caribbean coast had 800 fishers (9 195 fishers in total).

Although the above data, both in economic and demographic terms, seem to indicate that fisheries have little relevance, the truth is that the Costa Rican fisheries play particularly important roles in the generation of labour in coastal areas, not only as alternative primary work for marginal sectors, but also because small-scale artisanal fisheries are the main source of marine products for domestic consumption. Other fleets, particularly artisanal medium scale, advanced scale and industrial, focus their production on the export market, with species such as mahi-mahi, marlin and sharks, while the coastal fishery provides species such as croaker, catfish, small sharks and low-value fish. The latter offer a relatively low price and are the only option for the consumer population in Costa Rica. The strategic importance of fisheries resources should be viewed in terms of social value, since under economic criteria it holds little relevance.

Most people who are employed in fisheries have an elementary education with a low level of illiterate persons, and only a small proportion of people have a high level of education (Table 7).

TABLE 7
Fishers´ educational levels to 1995

Educational level	Percentage (%)
No studies	4
Primary educational level incomplete	30
Primary educational level complete	40
Secondary educational level incomplete	21
Secondary educational level complete	3
University educational level incomplete	1
University educational level complete	1

Fishing tradition is stronger in the small fishing communities located along both coastlines; however, it is more significant on the Pacific coast than on the Caribbean coast. Most fishers are men; however, there are also women, especially in activities related to mollusc extraction. The canning industry hires many women (about 1 200), mainly for cleaning tuna. There are urban fishers, located principally in Puntarenas city (Pacific coast) and Limón (Caribbean coast); the rest can be considered rural fishers. Puntarenas city is where most of the medium- and advanced-scale fleets land.

Moreover, although there are no up-to-date precise figures or studies on the matter, it is important to mention the contribution fishing has on the household economy through child labour. This is mostly from the extraction of species and by-products of mangroves, as well as children's participation in the cleaning of the products landed by small-scale fishers. In most cases, children do not receive salaries, but they occasionally receive some lower-value fish which they can sell or use for direct consumption.

The Gulf of Nicoya is the area where most of the small-scale fishers are located. This is also where most scientific and social studies have taken place. Since 1829, Puntarenas has been the first port and commercial centre in the country on the Pacific coast (Blondin, 1992). Most fishers live in the area of the Gran Chacarita, with very limited local power at the political and economic levels, which diminishes the possibilities of local development. There is also a high rate of unemployment; it is difficult to estimate, though it is presumed to be about 35%.

Studies on the Pacific coast include those of Charles and Herrera (1992) who gathered information from the Cooperativa de Pescadores de Puerto Thiel/Port Thiel Fishers Cooperative (COOPETHIEL) to evaluate the monthly income of fishers. They found a range between US$88 and US$176 for the period from 1988 to 1991, showing that although this income is not high, it does not fall within the category of extreme poverty. More recent studies conducted by the Instituto Mixto de Ayuda Social (Social Aid Institute), a governmental institution responsible for working with poverty groups, obtained similar results, leading to the conclusion that most fishers fall at the poverty level and not into the extreme poverty level.

Herrera and Charles (1994) compared the situation of COOPETHIEL (as an example of an artisanal fishery) on the Costa Rica Pacific coast with artisanal fisheries on the Caribbean coast. They found similar levels of income earned by fishers but with different cultural patterns. For instance, the population along the Caribbean coast experiences a strong influence from international tourism, speaks Caribbean English and is predominantly black.

Villalobos and Hernández (1998) undertook a study on the social conditions of the Gulf of Nicoya using an ecosystem-based approach. They established a process of differentiation of the artisanal fishing fleet by specific socio-economic, technological, environmental and production factors. They argue that these differences should be considered in the implementation of fisheries management protocols in the area, based on technical criteria and results derived from social studies.

The tourism industry is changing the process of artisanal fisheries in many regions of the country. The increase of tourism development on a large scale has sometimes led to an increase in demand for fish products to supply local tourism demand. In this sense, Gónzalez and Villalobos (1999) and Villalobos and Gónzalez (2000) analysed the processes of interaction between traditional fishing and tourism in the northern Caribbean. They also looked at the effects of technological development on the fishing environment in the Caribbean. Their results showed that tourist activity was becoming increasingly relevant as a strategy for coastal development. In addition, tourism is changing the coastal marine environment, as well as the social and cultural patterns of the artisanal fishing communities.

In other cases artisanal fishing communities have substantially transformed their traditional ways of operation and have opted for new forms of employment related to recreational fishing, tourism and ecotourism. Examples are found along the Pacific coast in Tambor, Puerto Níspero, Puerto Moreno and Moreno, and along the Caribbean coast, such as Manzanillo. All of these towns were dedicated to traditional commercial fishing by the mid-1990s, but currently remnants of fisher activities are virtually imperceptible. There is a tendency that seems to be increasing in some parts of the country, such as Quepos, Osa Peninsula and the Golfo Dulce, where more and more fishers are incorporated into activities directly linked to tourism.

4. COMMUNITY ORGANIZATION AND INTERACTIONS WITH OTHER SECTORS

The history of the Costa Rican fishing industry shows various organizational experiences different in nature from the late 1970s and early 1980s. The fishing cooperative organizational model was the most practiced until the end of the 1980s. The model incorporated nearly 18% of the fishing population (about 20 fishing cooperatives). However, by 2000, almost 50% of cooperatives had disappeared. Although no comprehensive studies have been conducted to analyse fully this decrease in organizations, one clear factor has been a perceived inconsistency between the cooperative model used and the nature of traditional fishing activity.

Other organizational forms have been used at different times and from different institutional perspectives for the local fishers' committees (COLOPES) from 1987 to 1995. These had considerable success and acceptance among fishers, although they disappeared due to political decisions.

It is estimated that there are 50 organizations actually linked directly or indirectly to the fishing industry in Costa Rica for the Central Pacific area, although only 37 of these were formally incorporated and duly registered. Included in this category are two cooperatives, fishing associations, chambers, trade unions and some COLOPES (Araya, 2006). Table 8 shows main activities or duties undertaken by fishing organizations along the Central Pacific coast.

TABLE 8
Fishing organization activities in the Central Pacific region in 2006

	Fishing associations	Fishers' committees (COLOPES)	Fish cooperatives	Labour unions	Fishers' chambers	Total
Fuel subsidy	3	–	1	–	1	4
Marketing	2	–	1	1	–	3
Legal services	12	7	–	1	–	20
Productive projects	1	–	–	–	–	1
Other activities	5	2	–	1	–	8
Total	23	9	1	3	1	37

Source: Departamento de Extensión y Capacitación, INCOPESCA.

Other organizational efforts have developed in some fishing communities, especially in the Gulf of Nicoya region. These efforts have been promoted by the Universidad Nacional (National University) and other support institutions, which seek to incorporate productive alternatives in these communities, articulating the main activity with ecotourism and mariculture to benefit marginal sectors, mainly small-scale fishers, women and youth.

5. FISHERY MANAGEMENT AND PLANNING

By law, fishery planning and management is the responsibility of the Instituto Costarricense de Pesca y Acuicultura (INCOPESCA, Costa Rica Fishery and Aquaculture Institute). The Universidad Nacional (National University), the Universidad de Costa Rica (Costa Rica University), the Ministerio de Ambiente y Energía (Ministry of Environment and Energy), as well as various other foundations and non-governmental organizations, participate in marine activities, such as the World Wildlife Fund, Instituto Nacional de Biodiversidad (Biodiversity National Institute) and Fundación Costa Rica – USA (CRUSA).

In Costa Rica there is abundant legislation on environmental matters in the form of specific laws, regulations and decrees, but legislation is fragmented and non-cohesive. INCOPESCA coordinates the fishery and aquaculture sectors, promotes and organizes fishery development, marine hunting, aquaculture and research, and encourages conservation and sustainable use of aquaculture and marine biological resources based on technical and scientific criteria. INCOPESCA is responsible for issuing hunting, marine fishery and boat-building permits, as well as the licences and concessions for aquaculture production (Cajiao-Jiménez, 2003).

The Ministerio de Ambiente y Energía (MINAE – Ministry of Environment and Energy) is the institution responsible for marine protected areas, which include mangroves. Sea turtle capture is prohibited (Red Regional para la Conservación de las Tortugas Marinas en Centroamérica, 2001) and INCOPESCA is responsible for protecting and conserving sea turtles in the jurisdictional waters of Costa Rica.

Fishery laws date back to 1948, but were challenged in the mid-1990s through unconstitutional measures. Because of this, the laws remained for more than five years in the National Congress, causing serious problems for resource management. The most recent revisions were done before 2005, but there are still shortcomings that limit the application of laws by INCOPESCA, which leads to high rates of non-compliance in the fishery sector.

6. ISSUES AND CHALLENGES

Current fishery policies are not applied with an integral vision of resource management or integrated resource management. There are no clear policies regarding the use of international tendencies, such as the FAO Code of Conduct for Responsible Fisheries or the Precautionary Approach. Moreover, there are no clear policies in terms of resource allocation; basically, licences provide the right to fish any resource fishers want to exploit. Efforts to avoid overfishing are limited to closed areas, but are difficult to enforce due to the lack of resources.

Despite being the most developed country in Central America, Costa Rica still needs to improve its conditions to compete with other countries in Latin America. Given the reduction in catches of important resources, attention is needed to control the fishing effort and, in some cases, to reduce the size of the fleet as well as upgrade it. However, subsidies on fuel increase the existing pressure on marine resources and, in the case of closures, the government provides little monetary support. INCOPESCA has been inefficient during its 14 years of existence due

to the problems noted above in regard to the application of law, low budget, and the shortage of qualified professional personnel. On the other hand, an increase in added value has been considered, but this will require improvement in fisheries infrastructure and sanitary control.

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