Cuban fisheries catches within FAO area 31 (Western Central Atlantic): 1950 - 1999

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ABSTRACT

Two sources of fisheries catches by Cuba were compared: National records pertaining to national waters (EEZ/shelf) obtained from local scientists, and FAO FISHSTAT for the entire FAO area 31 (Western Central Atlantic). This permitted the spatial separation of catches into 'inshore' (EEZ/shelf) and 'offshore' components (area 31 outside of Cuban EEZ/shelf). Through consideration of additional information on by-catch composition, we were able to allocate significant portions of the reported by-catch, previously recorded as 'miscellaneous marine fishes' (MMF), to individual taxa, thus reducing the MMF component in the reported landings by up to 41%. Overall, Cuban reported catches peaked at 76,000 t in 1987, and have been declining since, to just under 55,000 t by 1999. Catches are dominated by Caribbean spiny lobster (*Panulirus argus*), shrimp (*Penaeus* spp.), and in earlier periods also red grouper (*Epinephelus morio*) and grunts (Haemulidae), with Lane snapper (*Lutjanus synagris*), sharks & rays, and mangrove oysters (*Crassostrea rhizophorae*) also contribute significantly to reported catches.

INTRODUCTION

Reviews of Cuban fisheries are presented in Adams *et al.* (2000) and Claro *et al.* (2001), and will only be briefly summarized here. Cuba is increasingly becoming a significant global supplier of high-valued seafood (Adams *et al.*, 2000). Until the 1960s, most Cuban fisheries were artisanal in nature, focusing on resources of the continental shelf (Claro *et al.*, 2001). A small number of larger vessels (20-25 m length) targeted tuna and shrimp, or high priced demersal species on the continental shelves near Florida and the Bahamas, and on the offshore Campeche bank (Figure 1). Catches were relatively low at an estimated < 30,000 t annually (Claro *et al.*, 2001). During the 1960-70s, assistance from the Soviet Union permitted the development of significant long-distance fleets fishing international waters in the Atlantic and Pacific, mainly providing low-value seafood for the domestic market (Joyce, 1997; Adams *et al.*, 2000). The declaration of 200 nm EEZs by many countries starting in the late 1970s, together with increasing costs of fuel, began to curtail offshore fishing efforts considerably in the early 1980s (Joyce, 1999). The breakup of the Soviet Union in the early 1990s resulted in further price pressure coming to bear on fuel intensive offshore fisheries, essentially shutting down the long-distance fleets, leading to a major restructuring of the fishing industry in Cuba in the 1990s (Adams *et al.*, 2000). In general, emphasis shifted from high-volume, but low-value pelagic fisheries to high-value, coastal fin- and shell-fish species caught primarily in near-shore waters (Adams *et al.*, 2000).

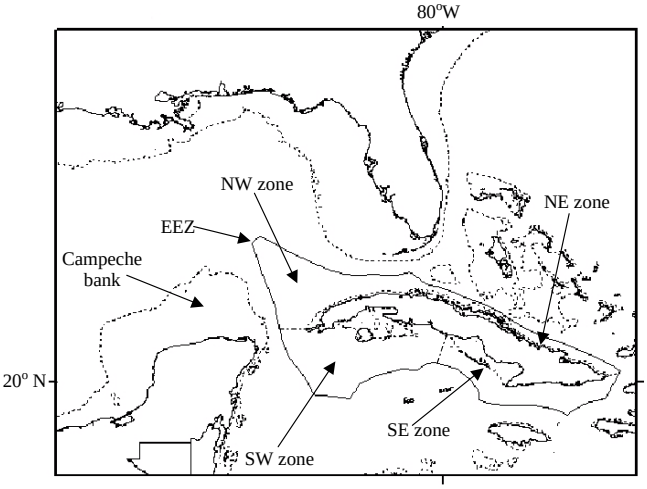

Figure 1: Map of Cuba, also showing the southern tip of Florida, the Bahamas, the 200 m shelf depth contour, Campeche Bank, and the EEZ of Cuba.

Fisheries

The majority of fisheries resources in Cuban waters are considered fully- or over-exploited (Claro *et al.*, 2001), and a wide variety of species (typical for tropical multi-species fisheries) are being targeted by a wide range of gears. The most valuable target species is the Caribbean spiny lobster (*Panulirus*

argus), which accounts for approximately 15% of total near-shore catches (Claro *et al.*, 2001). By the early 1990s, this fishery consisted of about 290 simply equipped vessels of modest size operated by approximately 1,300 fishers, and generated US$100-125 million export revenues annually, accounting for over 60% of the country's annual income from fisheries (Baisre and Cruz, 1994; Joyce, 1997; Adams *et al.*, 2000). The lobster fishery is predominantly an export industry, with the major markets for Cuban lobster being Japan (28%), France (24%), Spain (19%), Italy (15%), and Canada (10%) (Adams *et al.*, 2000). Part of the annual export revenue is utilized for importing lower-valued fish products for local consumption. The lobster fishery is executed essentially in four distinct areas of the Cuban shelf waters shallower than 200 m (Figure 1): the Northeast Shelf (with ~15% of total catch) stretching from Cárdenas in the west to Nuevitas in the east (the Saban-Camagüey Archipelago); the Southeast Shelf (~ 18%) stretching from Casilda in the west to Niquero in the east (Gulfs of Anna Maria and Guacanayabo); the Northwest Shelf (~4%) stretching from the western tip of Cuba (Cape San Antonio, Gulf of Guanahacabibes) to Punta Hicacos in the east; and the Southwest Shelf (~63%), encompassing the Gulf of Batabanó and La Broa Bay (Joyce, 1997; Claro *et al.*, 2001). Strict management, including enforcement of regulations, limited entry into the fishery, regulation of gear, assignment of exclusive fishing zones and reliable data gathering systems have been proposed as reasons to consider the Cuban fishery one of the best managed lobster fisheries in the world (Baisre and Cruz, 1994).

The shrimp fishery, being the second most valuable fishery within Cuban waters, is based mainly on two species: the nocturnally active pink shrimp (*Penaeus notialis*) and the diurnal white shrimp (*P. schmitti*). Approximately 85% of commercial catches are from the former species (Joyce, 1999). Overfishing of this resource lead to declining catches from the late 1970s, exacerbated by degraded estuarine nursery habitats due to reduced river outflow caused by extensive damn construction during the 1970s and 1980s (Claro *et al.*, 2001).

The finfish fishery targets a large number of fish species (about 120 species of fishes are listed on the official government price list). The main families targeted are the Lujanidae, Serranidae, Mugillidae, Gerreidae and Pomadasidae representing demersal species, while the Clupeidae, Scombridae (mainly mackerels) and Carangidae dominate the near-shore pelagic fisheries. The Scombridae (mainly larger tuna), sharks (various families) and Istiophoridae and Xiphiidae (marlin and swordfishes) are primarily targeted in oceanic environs (Joyce, 1996). The fishery for mullets (Mugillidae) is among the most ancient in Cuba, pre-dating Spanish colonization; more recently, however, the dominant species were high value lutjanids and serranids, as well as pelagics (Joyce, 1996). The finfish fisheries are widespread on the Cuban shelf, occurring on all four shelf areas indicated above, with the highest catches coming from the eastern part of the Cuban archipelago. Historically, drastic increases in effort, combined with the widespread and rapid introduction of more efficient gears (net based rather than the traditional hook-and-line or traps) led to overfishing and a drastic decline in catches in the late 1970s. While some improvements were observed after the introduction of stronger management measures, overall, most species continue to be fully or over-exploited (Joyce, 1996; Claro *et al.*, 2001).

Fisheries management

Management of Cuban fisheries differs from that of most other countries in that a fairly high amount of centralized control has historically been exerted through the Ministry of Fishing Industries (Ministerio de la Industria Pesquera, MIP), which traditionally held responsibility for all aspects of management of marine resource use (Joyce, 1999; Claro *et al.*, 2001). An improved fishery administration policy was implemented in 1981, and licensing of commercial and recreational fisheries, as well as quota, size, seasonal closure and inspection regulations have been introduced in the 1990s, and are thought to improve control and monitoring of management activities. The major development related to increased de-centralization of the day-to-day operations. Thus, MIP is directly responsible for legal and administrative functions, while production activities, control and services was delegated to newly created Provincial Fishing Associations (Adams *et al.*, 2000). One major concern related to management is the fact that both production by the industry as well as conservation of the resource is being controlled by the same entity, raising the

spectre of overemphasis of production at the expense of sustainability (Claro *et al.*, 2001). Furthermore, while historically, fishing was the primary economic activity in Cuban marine waters, tourism is increasingly placing different demands on the marine ecosystems. This development is calling for integrated management approaches, with some trial projects being in place, and coordinated by the Ministry of Science, Technology and the Environment (Claro *et al.*, 2001).

The aims of this study were to:

1. Compare the official FAO FISHSTAT statistics for Cuba (FAO area 31) from 1950 to 1999 with the national data as obtained directly from Cuban Ministry of Fishing Industries (MIP);
2. Use the above comparison to separate Cuban catches into those taken within national waters (EEZ/shelf) and from waters outside EEZ but still within FAO area 31 (historically mainly on Campeche Bank and shelf- or near-shelf-waters of Florida and the Bahamas); and
3. Account for the substantial component of 'miscellaneous marine fishes' in the FAO data through species allocation of the reported by-catch component.

RESULTS

Total reported landings from Cuban fisheries in FAO area 31, as reflected in the official FAO FISHSTAT database (Figure 2a), show the typical development for many fisheries, with an increase in reported landings from < 10,000 t year^{-1} in the 1950s to its peak of 76,000 t year^{-1} in the late 1980s, and have been declining ever since. Catches are reported by 34 taxonomic groups, and are dominated by lobster (*Panulirus argus*), shrimp (*Penaeus* spp.), and in earlier periods, also red grouper (*Epinephelus morio*, Serranidae) and grunts (Haemulidae), but by far the largest single component is 'miscellaneous marine fishes' (MMF, Figure 2a). This large MMF component masks a peak in reported landings for taxonomically accounted entities in the late 1960s – early 1970s (Figure 2a). The peaks of catches for red grouper, grunts and (slightly later) shrimp in the late 1960s – early 1970s, followed by declines in reported landings for these taxa indicate overfishing of these resources (especially in light of habitat destruction for the inshore shrimp resources), as well as the reported decline of the offshore fisheries discussed earlier. Comparison of the FAO dataset (for entire FAO area 31) with the national data for Cuban catches in Cuban waters (Cuban EEZ/shelf) obtained from the Cuban Ministry of Fisheries (MIP), indicated similar patterns, although lower catches are reported for national waters before 1976 (Figure 2b). Good correspondence since the mid 1970s reflects good transfer mechanisms of landings statistics from the national source institutions to FAO FISHSTAT. The provision of national catches covering Cuban waters (EEZ/shelf) only, permitted differentiation of reported landings into 'inshore' (EEZ/shelf, based on national data) and 'offshore' (non-national FAO area 31) waters (see below). Furthermore, the availability of national data on by-catch, combined with Cuban studies on shrimp fisheries by-catch (Claro *et al.*, 2001), permitted re-allocation of by-catch from the indiscriminate MMF category to taxonomic entities in the adjusted catch (see below). Thus, accounting for by-catch components of catches, and inshore versus offshore catches, enabled us to generate a 'new' adjusted catch database for Cuban fisheries in FAO area 31 containing data for 57 taxonomic groups from 1950-1999 (Figure 2c).

Shrimp fisheries by-catch

Studies summarized in Claro *et al.* (2001) provide information on species composition and percentage contribution of by-catch (Table 1). The shrimp fisheries accounts for approximately 80% of total reported by-catch (Table 2). The component not accounted for by the shrimp fisheries consists of unspecified finfish fisheries (Claro *et al.*, 2001). As all by-catch is landed and utilized for animal feed (Claro *et al.*, 2001), Cuba also reports these by-catches to FAO, which incorporates these catches as MMF (L. Garibaldi, FAO, pers. comm.). Utilizing the data on composition of by-catch we were able to reassign a significant proportion of FAO MMF (Figure 2a) to individual taxa within the adjusted database, thus reducing MMF by up to 41% (Figure 2c).

Inshore-offshore distribution

The availability of EEZ/shelf based catches by a national source enabled us, by way of comparison with FAO area 31 data, to separate Cuba's reported landings by area, resulting in catches from inshore areas (EEZ/shelf waters) and offshore areas (waters outside Cuban EEZ, but within area 31). The results indicate that offshore catches peaked in the late 1960s- early 1970s, and were minimal by the early 1990s (Figure 3a).

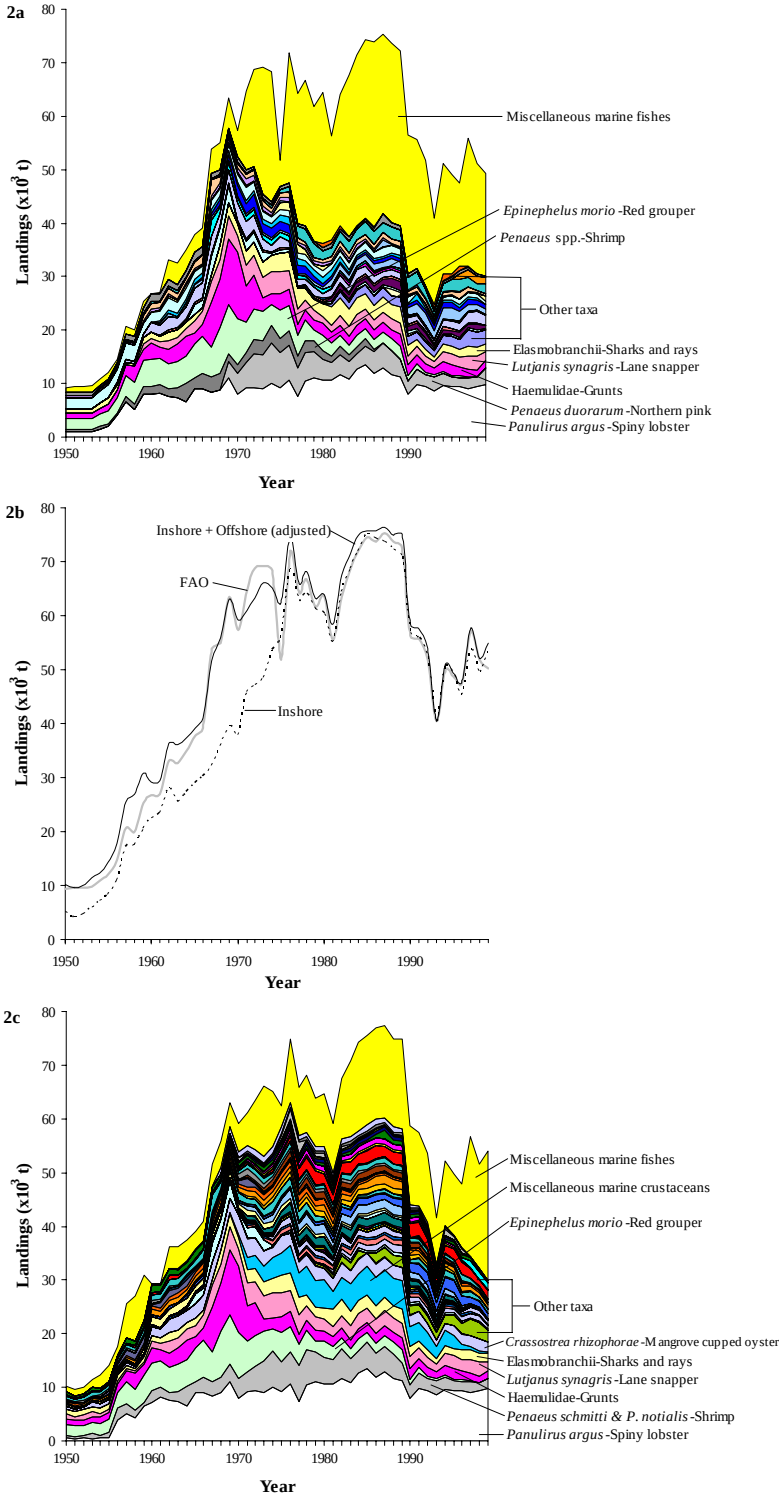

Figure 2: Time series of fisheries catches for Cuba, (a) FAO FISHSTAT data for FAO area 31 (Western Central Atlantic), (b) total catches from FAO (area 31), inshore (Cuban EEZ/shelf), and 'new' adjusted catch time series, and (c) 'new' adjusted catch time series by taxonomic entity, accounting for Cuban catches taken in national waters and offshore.

Table 1: Taxonomic composition and percentage contribution of by-catch, based on studies in the shrimp fisheries (Claro *et al*., 2001). The 'other marine fishes' category also contains by-catch reported by the general finfish fisheries.

Taxon	Percentage	Taxon	Percentage
Chondricthyes	1.90	*Lepophidium brevibarbe*	4.59
Clupeidae	1.18	*Acanthurus* spp.	0.53
Synodontidae	2.30	*Scomberomorus* spp.	0.03
Congridae	1.11	*Prionotus* spp.	4.41
Hippocampus spp.	0.27	Pleuronectiformes[a]	2.26
Centropomidae	0.23	Balistidae	0.45
Serranidae	2.87	Sphoeroides	0.32
Carangidae	4.02	Diodontidae	0.05
Lutjanus synagris	3.45	Ostraciidae	0.12
Diapterus rhombus	6.93	*Ogcocephalus* spp.	0.83
Eucinostomus spp.	7.92	Crustaceans	24.04
Haemulon spp.	0.91	Molluscs	5.29
Sparidae	1.30	Other marine fishes	22.29
Micropogonias furnieri	0.45	------	---

[a] Originally reported as Bothidae and Cynoglossidae.

Table 2: Total by-catch reported by Cuba, based on shrimp and general finfish fisheries, for the time period 1969-1999.

Year	Tonnes	Year	Tonnes
1969	1,061	1985	21,540
1970	2,407	1986	22,182
1971	9,577	1987	21,253
1972	10,149	1988	21,665
1973	11,974	1989	22,298
1974	15,753	1990	15,464
1975	17,269	1991	13,844
1976	21,167	1992	14,183
1977	18,521	1993	9,830
1978	22,064	1994	12,082
1979	20,430	1995	9,783
1980	22,228	1996	4,547
1981	13,752	1997	2,190
1982	16,695	1998	1,532
1983	21,243	1999	1,058
1984	19,986	---	---

Catches were dominated by red grouper (*Epinephelus morio*, Serranidae) and grunts (Haemulidae). Inshore catches, on the other hand increased significantly until the mid 1980s, after which they started declining (Figure 3b). The inshore catches consisted of a higher diversity of taxa, dominated by lobster (*Panulirus argus*), shrimp (*Penaeus* spp.) and MMF, with lane snapper (*Lutjanus synagris*), oyster (*Crassostrea rhizophorae*), sharks and rays, and marine crustaceans also contributing significant amounts.

Adjusted catches by Cuba in area 31

The 'new', adjusted catch statistics (Figure 2c) indicate only minor overall changes from the original FAO dataset (Figure 2a). However, the availability of by-catch information permitted a distinct improvement of species allocations with concomitant reduction in the MMF component.

DISCUSSION

Overall, the data comparison between national source data and FAO FISHSTAT indicated a good data transfer mechanism between Cuba and the global database maintained by FAO, something rare in this region (see other contributions in this volume). The general decline in catches illustrated by these data are in line with many other countries, and reflect a global fisheries crisis (Watson and Pauly, 2001; Pauly *et al.*, 2002). The history of Cuban fisheries (Claro *et al.*, 2001), at least for FAO area 31, is reflected in the spatio-temporal distribution of reported landings. The overall decline of catches since the early 1990s should be considered of great concern for Cuba, both with regards to internal supply of food, as well as revenue generation. Worrisome in this regards is the concentration of production management and resource conservation under the auspices of one industry-associated organization (Claro *et al.*, 2001), a situation not conducive to sustainability.

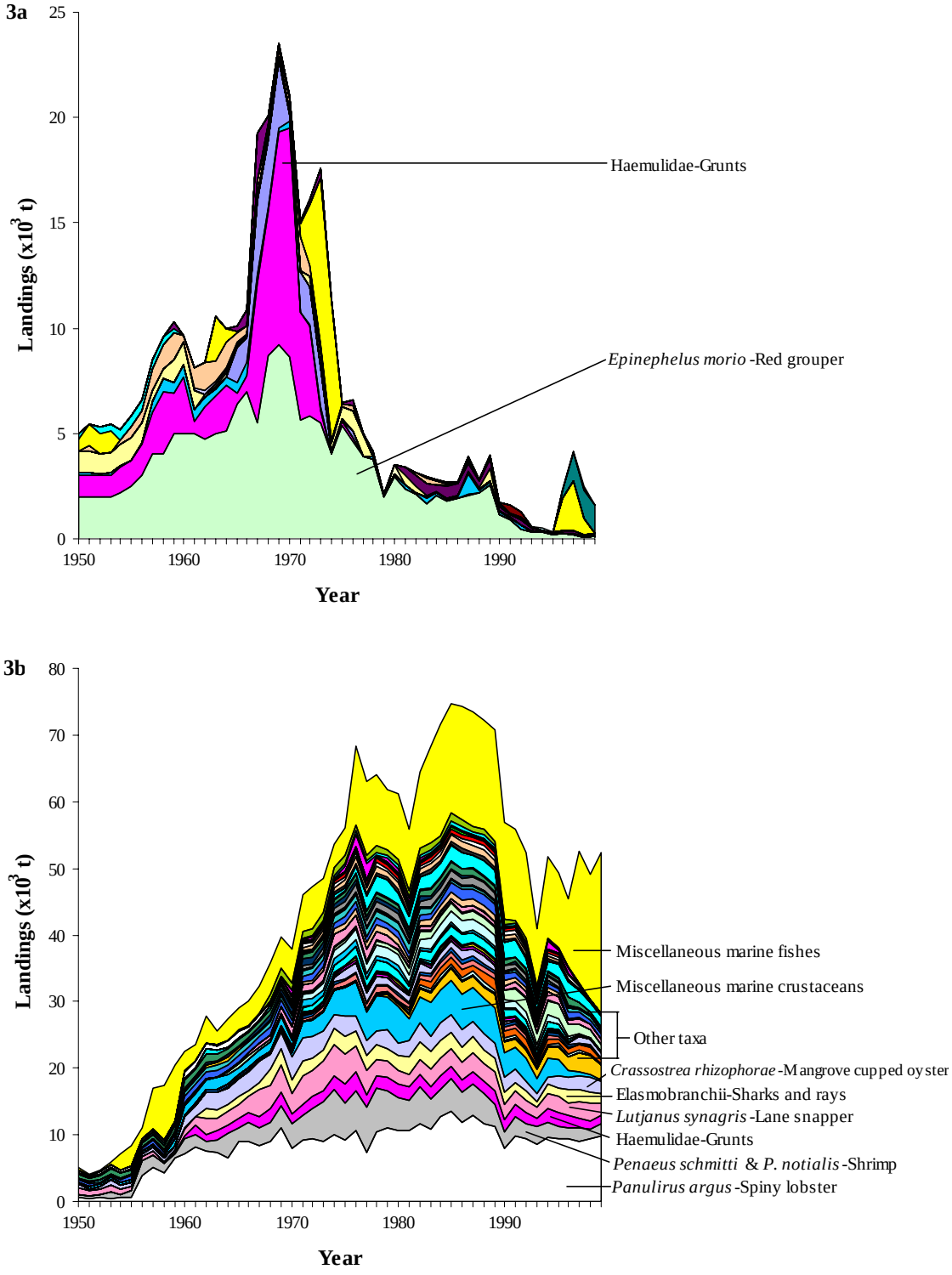

Figure 3: Cuban fisheries catches, separated into (a) 'offshore' and spatially non-assignable component, and (b) 'inshore' catches from EEZ/shelf waters, for the period 1950-1999.

Thus we were able to incorporate information of by-catch composition into species allocation of reported catches, and thereby reduce the indiscriminate MMF component, is of considerable importance for ecosystem-based management considerations in Cuba. This will allow better accounting of extractions in an ecological context, and enables fisheries catches to be mapped onto ecosystems.

The improved spatial assignment and taxonomic composition of catches of Cuban fisheries will be incorporated into the *Sea Around Us Project* database (see www.seaaroundus.org), which forms the foundation for large-scale, spatial catch maps (Watson *et al.*, 2001; Watson and Pauly, 2001; Pauly *et al.*, 2002). Such data are also useful for assessment of spatial trends in fish biomass over time (Christensen *et al.*, 2003).

ACKNOWLEDGMENTS

The authors wish to acknowledge the Pew Charitable Trust for funding the *Sea Around Us Project* at the Fisheries Centre, University of British Columbia.

REFERENCES

Adams, C., Sanchez-Viga, P. and Garcia-Alvarez, A. 2000. An overview of the Cuban commercial fishing industry and recent changes in management structure and objectives. Institute of Food and Agricultural Sciences, University of Florida, Gainsville, EDIS document FE 218, 8 pp. Available at edis.ifas.ufl.edu.

Baisre, J.A. and Cruz, R. 1994. The Cuban spiny lobster fishery, pp. 119-132. *In*: B.F. Phillips, J.S. Cobb and J. Kittaka (eds.) Spiny Lobster Management. Fishing News Books, Oxford.

Christensen, V., Guénette, S., Heymans, J.J., Walters, C.J., Watson, R., Zeller, D. and Pauly, D. 2003. Hundred-year decline of North Atlantic predatory fishes. Fish and Fisheries 4: 1-24.

Claro, R., Baisre, J.A., Lindeman, K.C., and García-Arteaga, J.P. 2001. Cuban Fisheries: Historical Trends and Current Status, pp. 194-219. *In*: R. Claro, K.C. Lindeman and L.R. Parenti (eds.) Ecology of the Marine Fishes of Cuba. Smithsonian Institution Press, Washington.

Joyce, I.T. 1996. The fisheries of the Cuban insular shelf: culture, history and revolutionary performance. PhD thesis, Simon Fraser University, Burnaby, 624 pp.

Joyce, I.T. 1997. The spiny-lobster fishery in Cuba. The Geographical Review 87(4): 484-503.

Joyce, I.T. 1999. Socialism and the fishery: a case study of the Cuban shrimp fishery. The Canadian Geographer 43(1): 53-69.

Pauly, D., Christensen, V., Guénette, S., Pitcher, T.J., Sumaila, U.R., Walters, C.J., Watson, R., and Zeller, D. 2002. Towards sustainability in world fisheries. Nature 418: 689-695.

Watson, R., Gelchu, A. and Pauly, D. 2001. Mapping fisheries landings with emphasis on the North Atlantic, pp. 1-11. *In*: D. Zeller, R. Watson and D. Pauly (eds.) Fisheries Impacts on the North Atlantic Ecosystems: Catch, Effort and National/Regional Data Sets. Fisheries Centre Research Reports, Vancouver, Vol. 9(3).

Watson, R. and Pauly, D. 2001. Systematic distortions in world fisheries catch trends. Nature 414: 534-536.