A Database of Landings Data on Brazilian Marine Fisheries, 1980-2000

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ABSTRACT

The objective of this study was to compile and document landings data on Brazilian marine fisheries for the period from 1980 to 2000. The Brazilian coastline ranging from above 3°N to below 30°S does not form a homogeneous unit. Thus, data by states rather than national landings data should be used as input to Brazilian marine ecosystem models. A description of the suitable data sources is given, along with information on the scientific and common names of the species in the database. Brazilian landings peaked at approximately 756,000 tonnes in 1985 and have been declining since. Sardines, croakers, drums, shrimps, tunas, and tuna-like fishes are the main groups caught. Landings originate mainly from the two southeastern states of Rio de Janeiro and São Paulo, although Santa Catarina, located in the southeast, also has considerable landings. These three states all have an industrial fleet, which contributes to these states dominating national landings.

INTRODUCTION

Fishery management aims to maintain fished stocks at sustainable levels, even if there is no consensus on what population sizes are needed to ensure sustainability of fishery resources or, indeed, on what sustainability is. The stock size and species composition found in fished areas at present have been altered by decades or even centuries of fishing pressure (Jackson *et al.*, 2001). To better understand these changes, it is necessary to have at least some indirect indicators such as catches or landings, for those cases where no direct information on stock abundance and species composition is available. Moreover, time series data for these indicators should be long enough to help overcome such problems as the 'shifting baseline syndrome' (Pauly, 1995). This can lead to increasingly depleted stocks caused by successive cohorts of scientists basing the status of a stock on short-term analysis of abundance rather than historical abundance. This can cause the persistence of low population levels for stocks subjected to high rates of fishing pressure. Thus, instead of maintaining the recent past, fishery management should aim to rebuild stocks and ecosystems to historical levels (Pitcher, 2001). Jackson *et al.* (2001) noted that short time series also fail to detect long-term environmental shifts and subsequent impacts on stocks, and consequently the depletion process of many fishing stocks worldwide are not fully explained.

Long time series of fishery data are not readily available for Brazil and thus the objective of the present study was to compile and document landings data on Brazilian marine fisheries by state for the time period 1980-2000 and to discuss some of the main features of these fisheries on a national and regional basis. The large range of the Brazilian coastline has led many researchers to accept a division of the marine environment into five different regions (north, northeast, east, southeast, and south), based on bathymetry, oceanographic structure, fauna, flora and fishery (Matsuura, 1995). Having data broken down to the state level allows for attributing data to smaller regions, which is not possible using the Food and Agriculture Organization's electronic database (FISHSTAT – www.fao.org).

FISHERIES MANAGEMENT AND LANDING DATA

Fisheries management

The first record of a large-scale fishery in Brazil goes back to 1602 when fishers from the Bay of Biscay were allowed to catch whales in Brazilian waters and build factories to process the oil (Barbosa, 1983). By the end of the 1880s, some fisheries started to decline and restrictive measures were taken: no slaves were allowed onboard fishing boats and only up to one-fifth of the employees in a fishing company could be foreigners. The first documentation related to regulation of fishing activities was prepared in 1846, following the independence of Brazil from Portugal (1822). Several colonies of fishers were established, and they were able to secure some basic rights. In 1897, after the declaration of the Brazilian Republic, the

fishing sector was nationalized and all professional fishers were required to register with their respective Port Authority.

From 1933 to 1961, the Division of Hunting and Fishery became responsible for Brazilian fisheries and the Code of Hunting and Fishery was the basis for its activities (Anon., 1973). This division was linked to the National Department of Animal Production, a unit of the Ministry of Agriculture. In 1961, the Council for Fisheries Development (CODEPE) was created and the Division of Hunting and Fishery was transferred to that council. One year later, the division was dissolved and the Superintendence for Fishery Development (SUDEPE) was created, as part of the Ministry of Agriculture (Anon., 1973). The main goal of SUDEPE was to promote a highly organized fishing sector, representing a new industrial phase of fisheries development. The specific objectives of the superintendence were to elaborate the National Plan for Fisheries Development, to give technical and financial assistance to projects related to fishing, to conduct research, and to promote the application of a Fisheries Code.

In 1967, a decree was approved to stimulate the development of fishing industries. Unfortunately, this legal measure also removed rights that fishers had enjoyed earlier (Barbosa, 1983). Simultaneously, SUDEPE and the United Nations established the Fishery Research and Development Program (PDP), and fishery research finally began to develop in a structured context.

The Institute of Research and Development of the Fishing Sector was created in 1980; it was linked to SUDEPE, and was responsible for the continuation of the activities developed by the PDP. In 1989, SUDEPE was dissolved and replaced by the Institute of Environment and Natural Renewable Resources (IBAMA). This institute deals with issues formerly handled by the Secretary of Environment (SEMA), the Superintendence of Rubber (SUDHEVEA), the Brazilian Institute for Forest Issues (IBDF), and SUDEPE. This concentration of responsibilities had a negative impact on the fishing sector, since IBAMA lacks financial and human resources, and therefore cannot meet its responsibilities.

In 1998, a National Plan for Fishery and Aquaculture was proposed (GESPE, 1998), but it never became operational. In the same year, a decree split fishery responsibility between the Ministry of the Environment (MMA/IBAMA) and the Ministry of Agriculture and Supply (Cardoso *et al.*, 1998). This decree established that MMA/IBAMA would be responsible for setting catch limits, gear restrictions, and minimum 'fish' size for all Brazilian fisheries, except those involving migratory species and unexploited or under-exploited stocks. This was hardly practical, and a new bill was proposed where all responsibility related to the fishing sector would be transferred to the Ministry of Agriculture and Supply. However, in 2003, a newly elected Brazilian President created a Secretary of Fisheries directly associated with the Presidential Office. Such a pattern of sequential changes in institutions managing the fishing sector does not allow for the establishment of a good system of data collection, or a sound national fishery policy.

Landing data

Aragão (1997) presents an overview of the evolution of the system of data collection related to the fishing sector. Before 1967, the Production Statistical Service (SEP) of the Ministry of Agriculture was responsible for assembling landing data collected by IBGE (Brazilian Institute of Statistics and Geography), state institutions and the Ministry of the Treasury. In 1967, SUDEPE created the Statistical Advisory Board, which proposed a new plan for data collection. However, it was never put in place. In 1968, the PDP Program (SUDEPE/FAO) began collecting landings data in the southern region and later extended its activities to other regions. In the early 1970s, PDP and SUDENE (Superintendent for the Development of the Northeastern Region) collaborated to collect data from the northeast region. When PDP took sole responsibility of SUDEPE in 1980, the data collection system started to deteriorate. During this period, IBGE continued to collect data, but their quality is considered low.

One year after the demise of SUDEPE and the establishment of IBAMA, the latter developed a system of data collection that began in Ceará (ESTATPESCA), northeastern Brazil. This system was gradually extended to other states of the northeast region, but was not able to encompass all states in this region. Some states did not collect any data during this transitional period due to lack of human and financial resources. At present, data

Table 1: Sources used to compile marine landings data from industrial and artisanal fleets.

PERIOD	PERIODICITY	FORMAT	SOURCES
1980	Annual	Paper	(IBGE, 1980)
1981-89	Semi-annual	Paper	(IBGE, 1981; 1982; 1983; 1984; 1985; 1986; 1987; 1988; 1989)
1990-97	Annual	Paper	(CEPENE, 1995a; b; c; d; e; 1997a; b;1998)
1998	Annual	Electronic	IBAMA, (G.C. dos Santos, pers. comm.)
1999	Annual	Paper	(CEPENE, 2000b)
2000	Annual	Electronic	IBAMA, (S. Bezerra, pers. comm.)

collection is highly heterogeneous, as it is conducted by IBAMA, state institutions, and/or universities. IBAMA is still responsible for gathering data from all these institutions and presenting them in the form of printed bulletins ('Estatística da Pesca'). With recent political changes, the future of data collection from the fishing sector is unclear.

Some argue that the importance of the artisanal fishery in Brazil is one of the factors leading to poor data collection (Paiva, 1997). Another factor is the difficulty in establishing a clear boundary between the artisanal and industrial sectors. Others attribute the difficulty of data collection to problems in communication and in organizational structure (see e.g., Marcílio and Lisanti, 1973), lack of institutional interest in an activity with low contribution (0.25%) to the gross domestic product (FAO Fishery Country Profile: The Federal Republic of Brazil, March 2002, www.fao.org/fi/fcp), the shortage of financial and specialized human resources, and quite rightly, to unstable institutional arrangements.

Compiled Data

Annual landing data for Brazilian commercial marine fisheries were compiled for the period 1980-2000 by state, by fishery type (artisanal and industrial), and by species or group of species (Table 1). Some terms have to be defined in the context of this study:

- Landings data: refers to weight in tonnes of the taxa caught (molluscs, crustaceans, fish, turtles, mammals), but excluding discards or other unreported catches;
- Commercial: includes both artisanal and industrial fisheries, but excludes subsistence and recreational fisheries;
- Artisanal: including manual collection, or using paddled or sailing boats, and small motor boats (usually < 12-15 m and < 20 Registered Gross Tonnage); however, the limits differ among states; and
- Industrial: originated from boats > 12-15 m and > 20 Registered Gross Tonnage; limits differ among states.

Results and Discussion

The landings data for Brazilian commercial marine fisheries compiled in this study from national documents are available in electronic format from www.seaaroundus.org. The sum of the data for the seventeen states that record marine landings reproduces the majority of the data available for Brazil from the FAO database for the period 1980-1988, with a peak of 756,000 tonnes in 1985 (Fig.1). After 1988 there is increased discrepancy between the two sources. However, both databases show a strong decline (about 32%) in catch from 1985 onwards, with the total landings in 2000 of 468,000 tonnes. This national pattern follows the declining trend of global catches discussed in Pauly *et al.* (2002), and will likely lead to a shortage of seafood supply.

The overall decline in Brazilian landings is mainly accounted for by the massive decline in landings of sardine (mainly *Sardinella brasiliensis*), which collapsed by 1990 when landings dropped from 300,000 to 50,000 tonnes (Figs. 2 and 3). The marine mammal fishery (exclusively whales) was completely banned in 1985, although a ban on successive species had taken place since 1981, the last exploited species being the minke whale, *Balaenoptera acutorostrata* (Singarajah, 1997). The turtle fishery is a minor component of the total landings and in 1980 landings were 60 tonnes. A gradual process to ban turtle fisheries also occurred in Brazil from 1967 onwards, until the complete ban in 1986 (Marcovaldi and Marcovaldi, 1999).

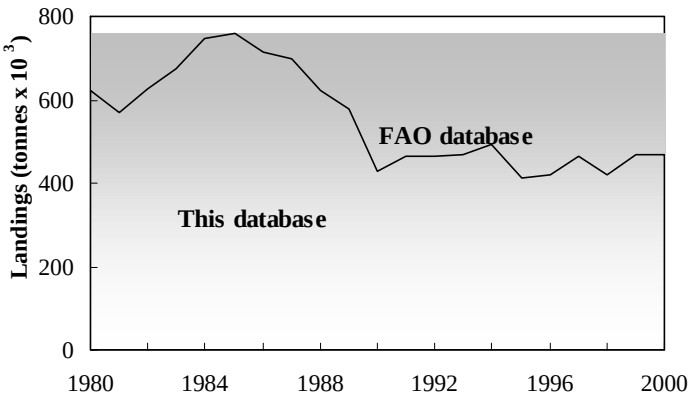

Figure 1: Landings data for Brazilian marine commercial fisheries from FAO FISHSTAT (www.fao.org), covering Brazil as a whole (i.e., without divisions into states) and from the reconstructed, state-specific data based on this study.

However, contrary to the whale fishery, some turtles were still caught in 1987-88 and are recorded in this database (< 5 tonnes). After that year, there are no landings data for turtles, although they are still caught as by-catch in swordfish and other pelagic longline fisheries (Weidner and Arocha, 1999), and for home consumption.

After encoding the database, the common names presented in the original source were assigned to their proper scientific name, using the decision process illustrated in Figure 4. The database of common and scientific names (I) was created only for this study and includes molluscs, crustaceans, fish, turtles and whales. The database of names (II) includes 4,172 common names associated with 725 species of marine and estuarine fish, representing an extension of the database presented in Freire and Pauly (2003), and has now been included in FishBase (www.fishbase.org). After applying the process illustrated in Figure 4, seven species remained unknown: 'bonito barriga lisa', 'ubaroba' and 'miracú' (Rio de Janeiro state), 'papa fina' and 'papuda' (Bahia), 'sagra' (Paraná), and 'tapa pomba' (Santa Catarina)[1].

The majority of Brazilian marine landings come from Rio de Janeiro, São Paulo, and Santa Catarina (Fig.5). The drastic decline in landings from Rio de Janeiro is mainly associated with the collapse of the sardine fishery. These states are located in the southeastern and southeast regions, where most of the landings occur (Fig.6). The decline in landings from the industrial sector is evident in both regions, although it is also noted in the artisanal sector. This reflects the typical development of the fishing sector, where the introduction of a new fishery (in this case, the industrial), leads to initial increases in landings and then to oscillations and collapse (Pauly, 1997). The northeastern and northern regions account for about 200,000 tonnes, with most landings coming from artisanal fisheries. In this case, the introduction of a limited industrial fishery appears to have caused little damage to the artisanal sector, as they have both remained stable for the past 20 years. When this study can be extended to include the period 1950-1979, a more detailed analysis may be done as most of the industrial fleet began to operate in the 1960s, although a new burst had been observed in the mid 1990s.

Future Work

This study will be extended to include, in the first phase, data related to the period 1970-1979. For those cases where landings data are available from sources other than the national database, they will be incorporated in the present database, together with the original information. Furthermore, this database will be gradually corrected for discards and other unreported catches, and incorporated into a global database following the methodology described in Watson *et al.* (2000) and developed by the *Sea Around Us* Project (SAUP; see www.seaaroundus.org).

In the second phase, the database will be expanded to the period 1950-1969. This phase will probably be more problematic as no comprehensive data was found for this period, except for publications by IBGE that present landings data combined in broad groupings such as 'fish', 'crustaceans', 'mammals', and do not distinguish between catches originating from marine and freshwaters.

[1] If any local expert identifies any problems in the match between common and scientific names or knows the scientific names of the species listed, please contact the author.

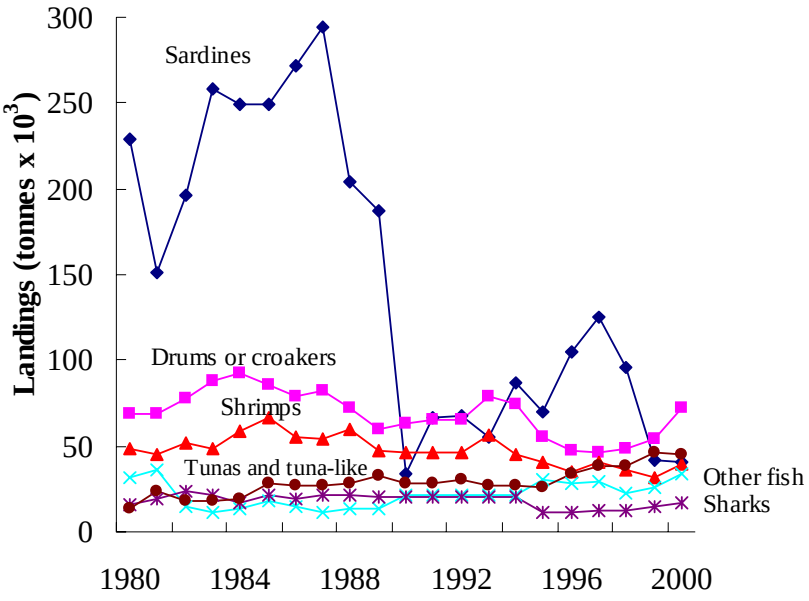

Figure 2: Landings of the main groups represented in Brazilian marine commercial fisheries (1980-2000).

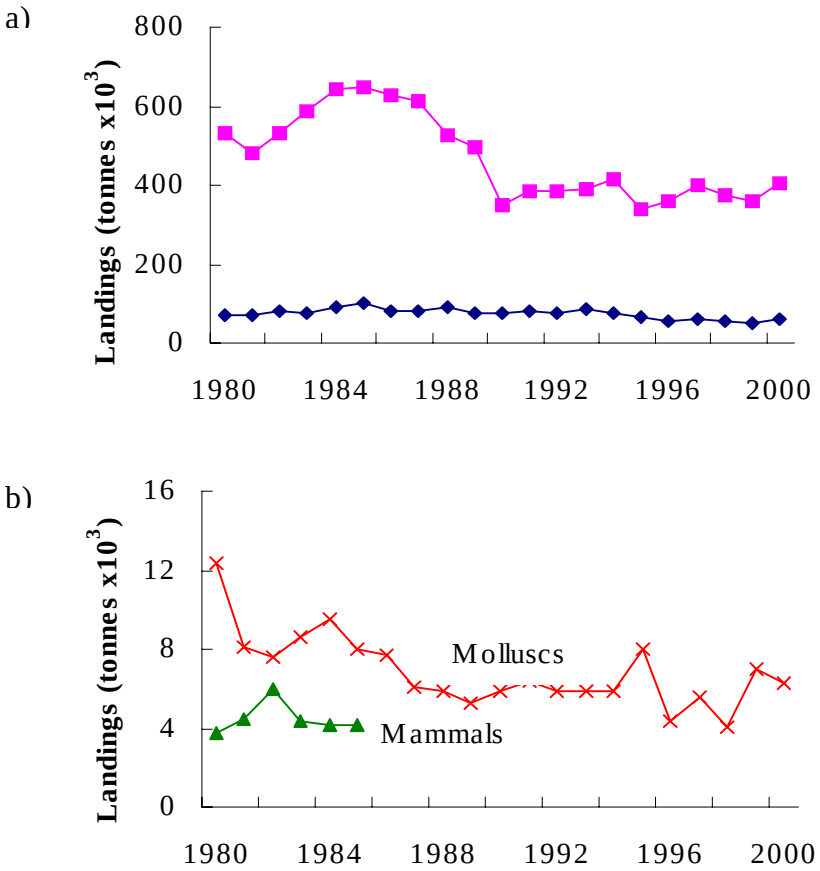

Figure 3: Groups represented in the landings from Brazilian marine commercial fisheries (1980-2000): a) Fish and crustaceans; b) Molluscs and marine mammals.

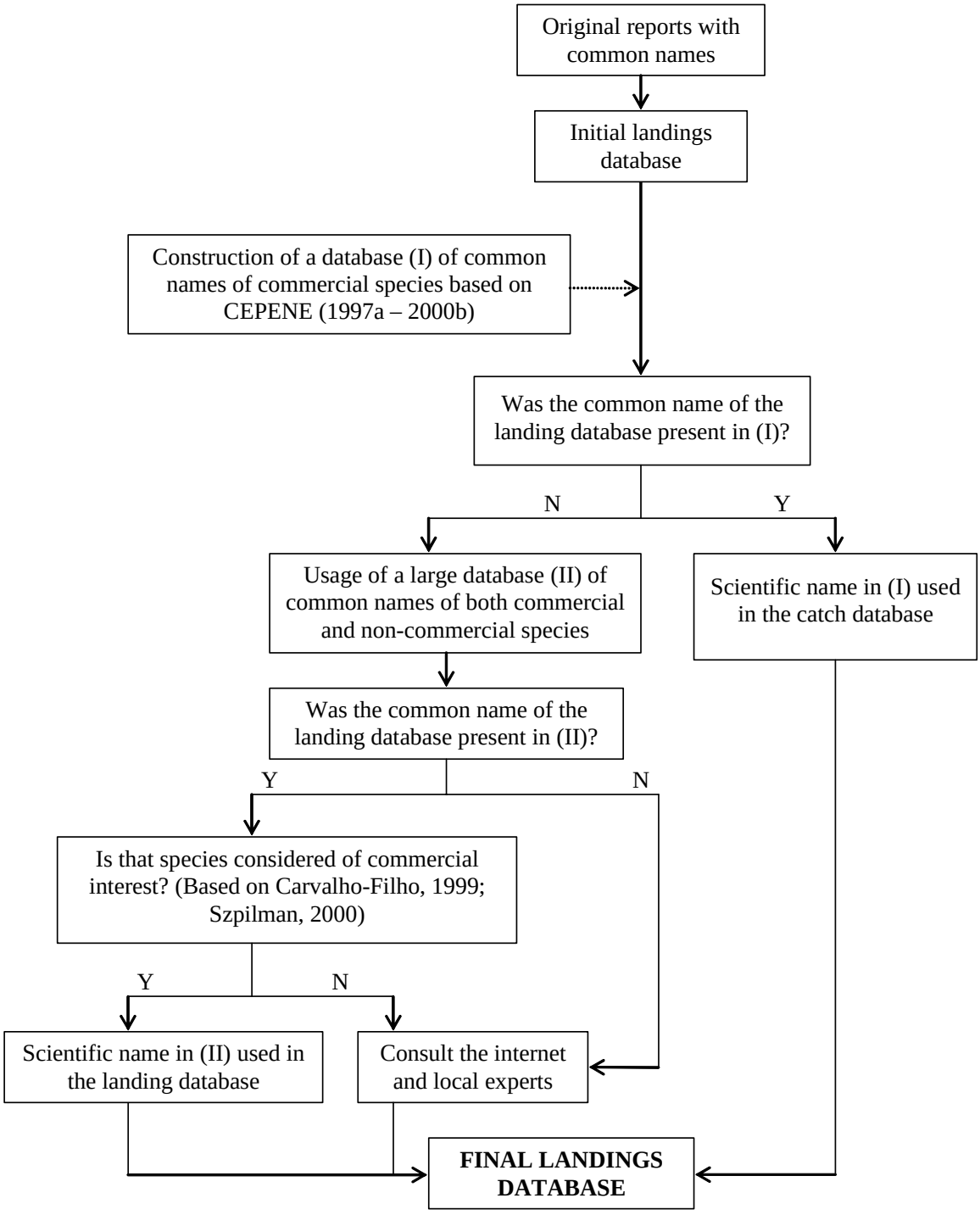

Figure 4: Decision process on the correspondence of common names and scientific names for commercial species to obtain the final landing database. The database of common names (II) is largely available in FishBase (www.fishbase.org).

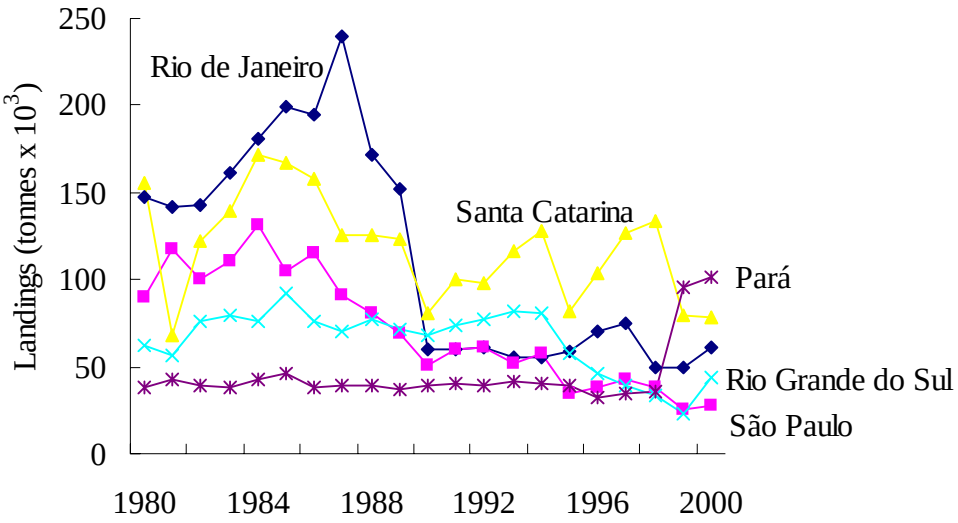

Figure 5: States that record the highest landings in Brazil (industrial and artisanal fisheries combined).

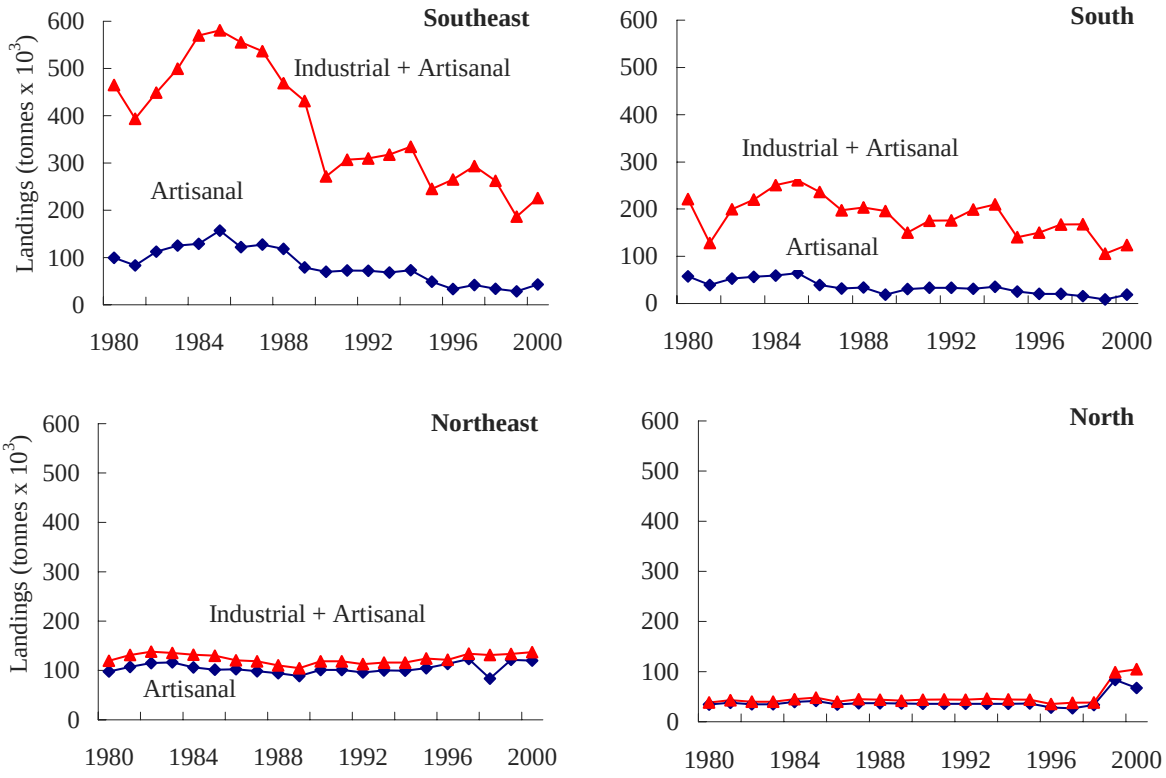

Figure 6: Landings for industrial and artisanal fisheries broken down by region for Brazilian marine ecosystems (1980-2000).

CONCLUSION

This database represents the landings data for marine commercial fisheries of Brazil recorded in national reports, but several flaws inherited from the original sources could not be overcome. For example, for the period between 1990 and 1994, the entries were calculated based on the mean/average landings for the period 1986-1989, and corrected only for those species that were dealt with in the context of a previous study (CEPENE, 1997a); Maranhão and Bahia states were not included in the ESTATPESCA program developed for the northeast region (CEPENE, 2000a), and data were repeated for some years. Finally, catch data for shrimps and sardines from São Paulo are probably underestimates (Gasalla and Tomas, 1997).

The objective was to assemble basic data needed for assessments, which have been scattered in documents that are not readily available. It also presented an opportunity to collaborate with fellow researchers to create a better national database from specific study groups.

All users should be aware that the state associated with each record does not imply that all the landings came exclusively from the marine environment corresponding to the political division of that state. There is high mobility for some boats with higher power engines and the user should be able to define the extension of these movements to attribute landings to the correct marine area. Finally, some uncertainty exists between the common and scientific names for some reported species and the database is biased towards nomenclature used in the northeastern region as most of the documents were available for analysis from this region.

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