

# A Database for the Industrial Trawl Fishery of Côte d'Ivoire

F. Menard, J. Hoëpfner, V. Nordström, T. Joanny and J. Konan

## Abstract

Fishery statistics for the industrial trawl fishery of Côte d'Ivoire have been well documented since 1968. However, data processing has changed significantly with time and some of the data files have been lost. In 1997, the Centre de Recherches Océanologiques d'Abidjan decided to retrieve and process all trawl data available from different sources. This paper gives an overview of the database covering the period 1968 to 1997 and describes its coverage, format, structure and use. The database was developed using MS ACCESS® and is a powerful tool for storing information about this fishery, and for analysis of its dynamics over a period of 30 years.

## Introduction

The industrial trawl fishery of Côte d'Ivoire based in Abidjan (where all landings take place) began in 1950. Landings from the continental shelf of Côte d'Ivoire remain low (between 4 000 and 9 000 tons annually) compared to the small pelagic fishery (several ten thousands tons per year of *Sardinella* sp.). Until 1988 fishing areas were spread out of Côte d'Ivoire (Ghana, Liberia, Sierra Leone and Guinea-Gambia). After this period, fishing took place only in Côte d'Ivoire. A lot of species are landed because of the high diversity of the demersal fish communities (Troader et al. 1969, Caverivière 1979a, 1979b, 1993). However, most species do not contribute significantly to total catches and only three families dominate the landings: Sciaenidae, Sparidae and Pomadasysidae. The Centre de Recherches Océanologiques (CRO), the fishery research institute in Côte d'Ivoire, began collecting fishery statistics from 1966; good documentation began in 1968. The first data processing was designed in 1969 (Fonteneau and Troader 1969), but it has changed significantly over

the years (Fonteneau and Bouillon 1971, Caverivière and Barbe 1977, Lhomme 1983, Bernard 1989). In the beginning, data was entered using punched cards and processed in a centralised computer. Later the data was stored in diskettes and the processing was decentralised at CRO. The data was finally dispersed on several PCs and unfortunate losses occurred. In 1997, CRO planned to retrieve and process all the trawl data available from different sources. This plan was supported by the EC (European Commission) project "Impacts of environmental forcing on marine biodiversity and sustainable management of artisanal and industrial fisheries in the Gulf of Guinea" and the "Marine Ecosystems" program of the IRD (Institut de Recherche pour le Développement). This paper gives an overview of the user-friendly database developed for data entry, queries and reports. The software chosen was MS ACCESS®, and the trawl database entitled PIC-CI for "Pêche Industrielle Chalutière de Côte d'Ivoire" covers data for the period 1968 to 1997.

## Data Coverage of PIC-CI

### Logbooks

A total of 170 vessels were active from 1968 to 1997. Vessel characteristics (size, tonnage, engine power, period of activity, etc.) have been included in the PIC-CI database. Besides the trawlers, a specialised shrimp fishery has existed since the mid-60s. The database did not include data on this fishery, except in cases where the shrimp vessels targeted demersal fish and sold their catches during the trawler fish auction. Some vessels fish using a pelagic trawl net towed between two vessels. This type of fishing is coded trip by trip in the PIC-CI database. In 1966 the CRO began a sampling system of the logbooks which provides information on the date of the trip, fishing areas, handling time and trawling depth. From 1968 to 1974 only data on one area per trip was considered. From 1975, seven different possible fishing areas and depths for a trip were considered. In the case of no sampling, an indicator "local/foreign" was created to show if the trip took place in the Côte

d'Ivoire area or abroad. The codes used have varied over the years and have been re-coded to obtain a uniform series that takes into account generic fishing areas such as Côte d'Ivoire or foreign country, and local sub-areas, according to information available in the logbooks. For the trawling depths, classes at intervals have been specified. Time at sea (duration of the trip), fishing time (total time passed in a fishing area), and trawling time (effective trawling time) are the main measures of fishing effort in the statistics and are

expressed in number of hours. However, a lot of data is missing, often because the percentage of trips covered by logbooks has decreased during the last few years.

### Sampling at the fishing port

Landings are sold at the fish auction of the fishing port in Abidjan. The landed catches are placed in boxes according to commercial species groups before the auction takes place. These commercial species groups are a mix of different species due to marketing

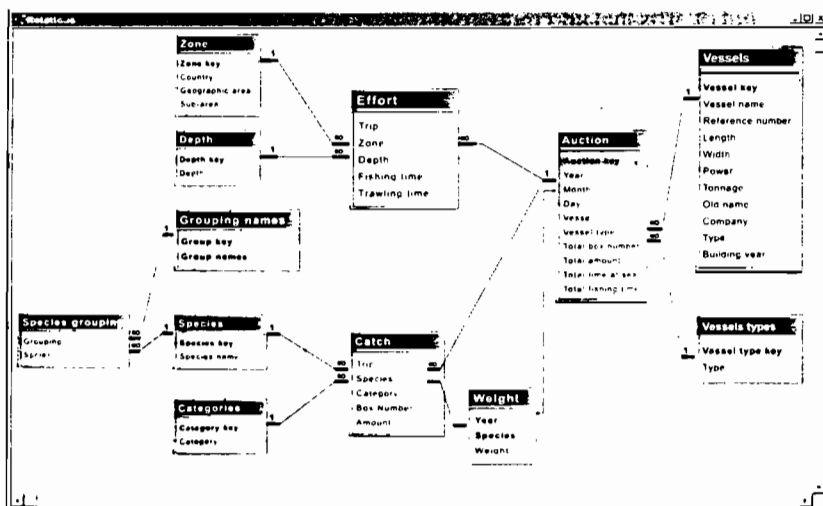
reasons and the high number of species in the catches, but most often one or two species dominate. From 1968 - 1997, 84 commercial species-groups were used, but this number has fluctuated over this period. Some of them are generic terms, others are specific and have been used very little. We chose to keep all these groups in the codes of the PIC-CI database. To standardize the series for the long time period covered, some of the 84 commercial species-groups were categorized generically (Table 1). The measures used for commercial species-groups are number of boxes, but sometimes the catches are sold in weight, in "batches" of fish or in number of fish. For purposes of standardization we used 'number of boxes' as a measure in the PIC-CI database. Conversion formulas have been applied using mean box weight per commercial species and, for some species, individual mean weights derived from different sources have been used. However, the original type of sale category used during the fish auction is coded in the database. For all landings from a trip there is always an auction slip that sums up all the sales.

**Table 1. Species comprising generic categories of commercial species-groups used in the trawler fish auction in Abidjan, Côte d'Ivoire.**

Generic category	Main species
African threadfins	<i>Galeoides decadactylus</i> , <i>Polydactylus quadrifilis</i>
Spotted grunts	<i>Pomadasys</i> spp., <i>Lutjanus</i> spp., <i>Pseudotolithus epipercus</i>
Croakers	<i>Pseudotolithus senegalensis</i> , <i>P. typus</i> , <i>P. elongatus</i> ,
Red pandora	<i>Pagellus bellottii</i> , <i>Dentex angolensis</i> , <i>D. congoensis</i>
Carangidae	<i>Caranx</i> spp., <i>Chloroscombrus chrysurus</i> , <i>Selene dorsalis</i> , <i>Trachinotus glauca</i> , <i>Trachurus trecae</i>
Rays	Rajidae, Dasyatidae, Mobulidae, Rhinobatidae
Squales	a lot of species, Squatinidae
John dory	<i>Drepane africana</i> , <i>Chaetodipterus goreensis</i> , <i>Zenopsis conchifer</i> , <i>Zeus faber mauntanicus</i>
Scombridae	small tunas, <i>Scomber japonicus</i> , <i>Rachycentron canadum</i>
Tonguesoles	<i>Cynoglossus canariensis</i> , <i>C. senegalensis</i> , <i>Dicologoglossa</i> spp., <i>Psettodes belcheri</i> , <i>Citharus linguatula</i>
Cephalopods	<i>Illex coindetii</i> , <i>Loligo</i> spp., <i>Sepia</i> spp.
Crustaceans	<i>Penaeus notialis</i> , <i>Portunus validus</i> , <i>Panulirus</i> spp., a lot of species

### Tables and relations in the PIC-CI database

Since 1968 the PIC-CI database has been organising, standardising and storing data on the industrial trawl fishery of Côte d'Ivoire. This represents several millions of records. The database comprises 12 main tables, each covering a group of related information. Tables are linked together by particular variables allowing the reconstruction of primary information. Fig. 1 is an illustration of the database structure. The organization of the database is focused on the "Auction" table. This



**Fig. 1. Structure of the PIC-CI database showing tables and links.**

table has 10 fields and makes an inventory of all the recorded trips with related general information. Each trip is registered with an auction key that is used as a reference for the other tables. The "Catch" table organises the landing data of each trip in number of boxes and price for each commercial species. The "Effort" table stores the information on fishing areas, effort measures and depths of trawling. These three tables constitute the core information in the database. Around these tables, we find :

- seven tables which code the information in the database into: fishing type, commercial species groups and groupings, sale categories in the fish auction, codes for the fishing areas and depths
- two auxiliary tables : box weights per year and per commercial species group, vessel information.

A 13<sup>th</sup> table "Scientific species" provides the scientific names of the main species in the commercial species groups. Two other tables, "Temp selected species" and "Temp trip by zone" contain temporary data when query requests are executed. These dynamic tables are updated whenever a query is made..

fortnight); fishing area: and species for a catch query (detailed species or generic categories). The choice of fishing zones is organized into a hierarchy per country, per geographic area and per sub-area (local names) in the effort queries. although only countries are available for the catch queries. As all the catches from a particular trip are mixed, it is difficult to express the catches as a function of fishing areas. However, vessels do not often fish in different countries during the same trip. Results are extracted from the database as tables that are easy to transfer to a spreadsheet. With respect to the effort outputs expressed in fishing time and time at sea, the user is given the possibility to check the percentage of data present in the database for the present query compared to the total number of trips. In this way one can get an idea of the quality of the data and the possible adjustments that should be made to obtain extrapolated results.

### Some examples of use

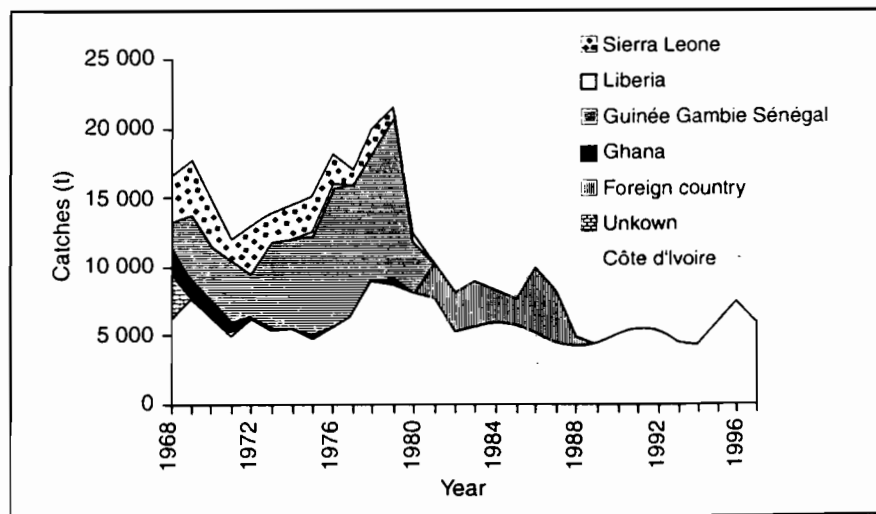
Fig. 2 displays the yearly catch data per country between 1968 and 1997. The quantities fished out of Côte d'Ivoire were high until 1979.

**Table 2. Landings (t) and fishing efforts (sum of the time at sea in hours) of the industrial trawl fishery on the continental shelf of Côte d'Ivoire (1968-1997).**

Year	Landings (t)	Effort (hrs)
1968	6 240	78 626
1969	7 761	116 803
1970	6 282	80 635
1971	5 275	78 497
1972	6 167	106 747
1973	5 255	97 415
1974	5 365	79 588
1975	4 829	71 614
1976	5 440	68 301
1977	6 384	72 337
1978	8 939	91 842
1979	8 914	86 099
1980	8 048	69 808
1981	7 610	56 594
1982	5 146	53 667
1983	5 577	78 903
1984	5 946	94 323
1985	5 604	97 169
1986	5 082	78 903
1987	4 487	66 559
1988	4 082	66 493
1989	4 263	59 284
1990	5 022	60 091
1991	5 394	71 001
1992	5 319	83 862
1993	4 409	77 458
1994	4 322	69 659
1995	5 779	81 345
1996	7 332	90 885
1997	5 820	63 358

### The user interface of the PIC-CI database

An interface has been developed in order to provide a simple and very intuitive tool for the user with a minimum learning period. Two major topics are covered: calculations of catches and the corresponding fishing effort. The following parameters are used to define the queries: time period in years (the user has to select beginning and end years for data to be included in the query); time interval by which the results will be outputted (year, quarter, month or



**Fig. 2. Total yearly landings (t) by fishing areas of the industrial trawl fishery based in Côte d'Ivoire from 1968 to 1997.**

Powerful vessels were allowed to prospect large areas and to make long trips. From 1980 free access into the waters of foreign countries became difficult and the powerful vessels left the fishery. Table 2 presents yearly catch data for the continental shelf of Côte d'Ivoire for the period 1968-1997. Fishing effort expressed as time at sea of all of the active fishing vessels in the area was extracted. Among the species, croakers (*Pseudotolithus* spp., Sciaenidae), red pandora and dentex (*Pagellus bellottii* and *Dentex* spp., Sparidae) and bigeye grunt (*Brachydeuterus auritus*, Pomadasysidae) constituted about

half of the catches (Fig. 3). Following Pauly et al. (1998), Fig. 4 presents the estimated yearly mean trophic level of landings of the industrial demersal fishery, using the 16 main commercial species caught from 1975 to 1997. Mean trophic level for each year is computed as the mean of the trophic level of each commercial species (found in the FishBase 98 CD-ROM, see Froese and Pauly 1998) weighted by the catches. No particular trend of the mean trophic level has appeared, suggesting a weak influence of the fishery activity on the biodiversity of the demersal resources of the Ivoirian continental shelf.

## Conclusion

The PIC-CI database is a powerful tool for the analysis of the dynamics of the industrial trawling fishery over 30 years. The user interface has been developed in order to meet the basic requirements in fishery studies, but a trained MS ACCESS® user should program his/her own queries. A data entry interface has also been developed in order to directly input the landing and logbook data collected at port. This database could also be incorporated into a regional database, but the confidentiality of some of the data will make it necessary to first aggregate the data into an adequate format.

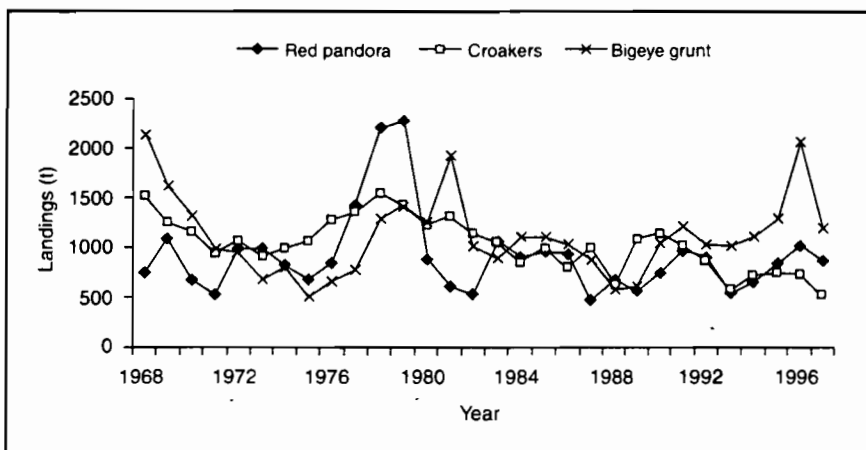


Fig. 3. Yearly landings (t) of croakers, red pandoras and bigeye grunts caught on the continental shelf of Côte d'Ivoire from 1968 to 1997.

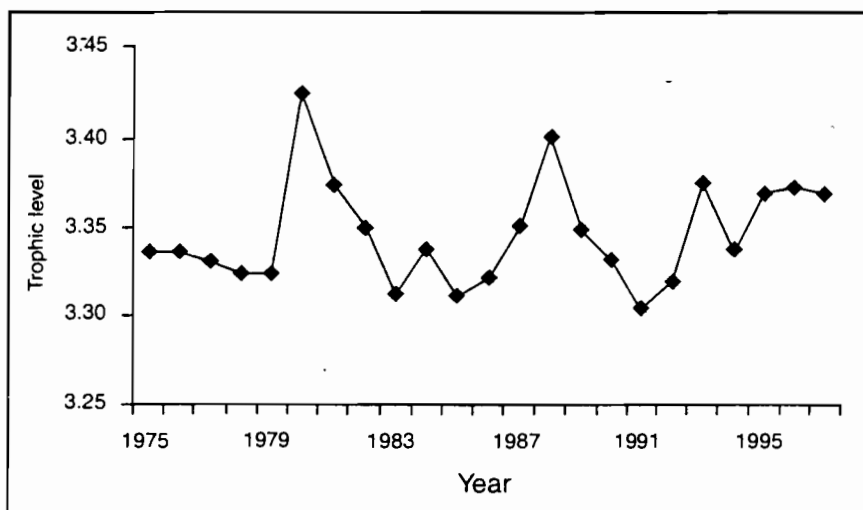


Fig. 4. Fluctuation of the mean trophic level of trawl fishery landings from 1975 to 1997. (from Fishbase 98, Froese and Pauly, 1998).

## References

- Bernard, Y. 1989. STATCHAL Chaîne de statistiques chalutières - Notice d'utilisation. Report of the Centre Rech. Océanogr. Abidjan, 29 p.
- Caverivière, A. 1979a. La pêche industrielle des poissons démersaux en Côte d'Ivoire. Généralités-localisation-homogénéité relatives des zones de pêche ivoiriennes. Doc. Scient. Centre Rech. Océanogr. Abidjan 10(2) 43-93.
- Caverivière, A. 1979b. Estimations des potentiels de pêche des stocks démersaux ivoiriens par les modèles globaux. Effet de la prolifération du baliste (*Balistes capriscus*). Doc. Scient. Centre Rech. Océanogr. Abidjan 10(2) 95-164.
- Caverivière, A. 1993. Les ressources en poissons démersaux et leur exploitation, p. 427-488. In P. Le Loeuff, E. Marchal and J.B. Amon-Kothias (eds.) Environnement et ressources aquatiques de Côte d'Ivoire. I: Le milieu marin. Paris, ORSTOM..
- Caverivière, A. and F. Barbe. 1977. Traitements statistiques des données de la pêche au chalut des poissons démersaux en Côte d'Ivoire. Prises-efforts-distributions de fréquence. Arch.

- Scient. Centre Rech. Océanogr. Abidjan 2(1), 16 p.
- Fonteneau, A. and J.P. Troadec. 1969. Récolte, stockage et traitement des données statistiques relatives à la pêche au chalut en Côte d'Ivoire. Doc. Scient. Prov. Centre Rech. Océanogr. Abidjan 38.
- Fonteneau, A. and P. Bouillon. 1971. Analyse des rendements des chalutiers ivoiriens. Définition d'un effort de pêche. Doc. Scient. Centre de Rech. Océanogr. Abidjan II(1-2), 1-10.
- Froese, R. and D. Pauly, Editor. 1998. Fishbase 98 :Concepts, designing and data sources. ICLARM, Philippines.
- Lhomme, F. 1983. Méthodes de codage et traitement informatique utilisés par le programme "Exploitation rationnelle des stocks du plateau continental ivoirien". Report Centre Rech. Océanogr. Abidjan NDR 02/83, 63 p.
- Pauly, D., V. Christensen, J. Dalsgaard, R. Froese and F. Torres, 1998. Fishing down marine food webs. *Science*, 279, 860-863
- Troadec, J.P., M. Barro and P. Bouillon. 1969. Pêche au chalut sur la radiale de Grand-Bassam (Côte d'Ivoire) (mars 1966-février 1967). Doc. Scient. Centre de Rech. Océanogr. Abidjan, 33, 14 p.
- 
- F. Menard, J. Hoepffner, T. Joanny and J. Konan** are from *Département des Ressources Aquatiques Vivantes, Centre de Recherches Océanologiques, BP V 18 Abidjan, République de Côte d'Ivoire* and **V. Nordstrom** is from *HEA, IRD<sup>1</sup>, BP 5045, 34032 Montpellier, France.*
- <sup>1</sup> Institut de Recherche pour le Développement (ex-ORSTOM)

