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STANDARDIZED INDICES OF ABUNDANCE 1988-1994 FOR BILLFISH (SAILFISH, BLUE MARLIN) AND SWORDFISH *(X. gladius)* OFF CÔTE D'IVOIRE

Joanny, T., J.B. Amon Kothias, F.X. Bard

Centre de Recherches Océanologiques, B.P. V-18, Abidjan, Côte d'Ivoire

1-Introduction

A peculiar fishery of canoes using gillnet targetting at large pelagic fish, settled in 1984 offshore the port of Abidjan (Côte d'Ivoire). This fishery was in fact brought by migrating Ghanaian fishermen of a fishery developed in Ghana by 1974, using the lage mesh net "nifa-nifa" (Mensah and Doyi, 1992). Since 1984 to now, the fishery prospered offshore Abidjan for two main reasons:

The continental shelf south of Abidjan is narrow (5 to 10 nautical milles) and fishermen can set their nets just over the continental slope, which is the good fishing grounds, at expense of short trips. Moreover the Vridi channel at the entrance of the port of Abidjan allows an easy access in any time and weather.

The fish market of Abidjan is in high demand of fish, and prices are therefore good.

CRO decided to monitor this fishery as a contribution to the Billfish Program of ICCAT and continuous records of the daily landings along with efforts in canoes trip were registered since 1988.

This fishery operates at night with drifting gill-nets perpendicular to the coast, at the limit between blue oceanic waters and coastal waters which is generally up to continental slope. It targets on any large pelagic fish drifting at night, mainly sharks, billfishes, tunas. The detail of operations and specific composition of catches has been described by Bard and Konan (1992).

2- Material and Methods

All sailfish (Istiophorus), blue marlin (Makaira) and swordfish (Xiphias) were measured (along with large sharks and tunas) and length converted in weight using L/W relationships from ICCAT litterature. The effort, in number of trips by night were also registered. Two file of all this informations are maintened, one in number of every species of fish on a daily basie. The other dealing only with silfish, marlin, swordfish is in weight, on a monthly basis.

It is the secund file, in weight of the three species, by month for 1988-1994 which is analysed. The goal is to compute an annual index of abundance standardized by the now classical, method of GLM.

The explained variable are the monthly CPUE in kg/trip for each species. The explaining variable are the year (ANN) and the sea surface temperature (TPE) which is measured daily at Abidjan. The choice of sea surface temperature as an explaining variable is due to the fact that coastal area of Côte d'Ivoire (and Ghana) is seasonnaly under influence of uwellings, twice a year. And it has an impact on this fishery. It has been showed by Hervé (ms) for example that during the major upwelling (July-September) the catches of sailfish are very low. No geographical area was taken in consideration as the fishing grounds are quite limited in extension: It is an area at close range of Abidjan, less than 6 hours of navigation for a canoe with 40 HP outboard motor.

The model is multiplicative, thus computed through logarithm, expressed as :

$$\text{ANN TPE} = \text{Ln (RDE+1) Ln (RDM+1) Ln (RDV+1)}$$

with ANN= year, TPE= monthly index of cold water, RDE= CPUE of swordfish, RDM= CPUE of marlin, RDV= CPUE of sailfish.

Computations were run by SAS software of ORSTOM and details of the output are set as annex.

3- Results and discussion

The annual standardized indices of abundance, as well as the quantities caught for each of the three species appears in following table. Figure displays the Indices of Abundance compared to the CPUE. It can be observed that the correction by standardization is more important for sailfish (Voiliers). It can be explained by the closer link between sea surface temperature (TPE) and the abundance of this species. It is reflected in the high value of Fisher F = 56.61 as compared to the much lower values for the two others species.

The overall picture of the annual indices of abundance show a moderate decline for billfish and nearly no decline for swordfish. However given the narrowness of the exploited area, it has to be carefully decided between two explanations:

If it is a rather "local model of production"; as the effort clearly increased over the range of years (table), it could be ascertained that decrease of abundance is caused by higher effort.

Or is that relecting a general decrease of abundance of the species in Eastern tropical Atlantic ?.

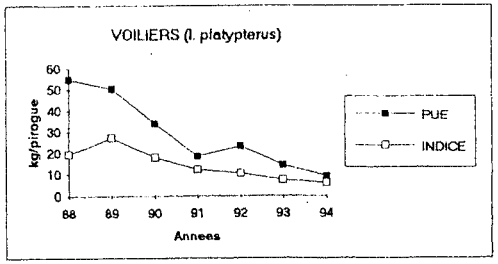
4 Bibliography

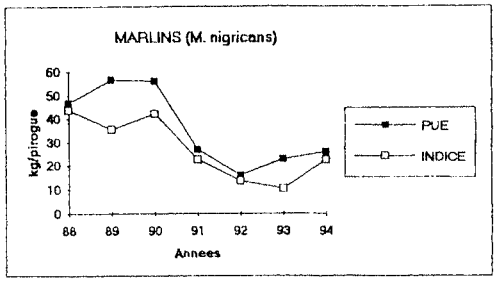
Mensah M. et Doyi B. A., 1992 The billfish fishery in Ghana SCRS/92/75

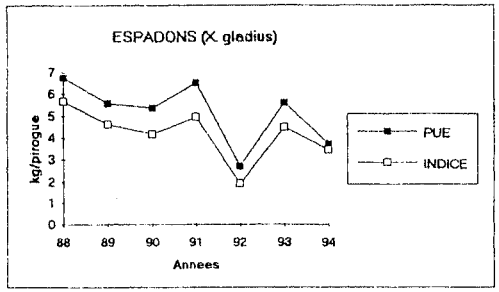
Bard F.X. and J. Konan , 1992 Information sur les requins débarqués au port d'Abidjan SCRS/92/143

Années des Captures Years	Production de Voiliers (Kg)	Production de marlin (Kg)	Production d'espadons (Kg)	Nombre de pirogues (trips)	Indice de Voiliers
1988	67179	87698	12688	1826	19,57
1989	54528	64760	6747	1372	27,32
1990	61952	72418	9583	1970	17,83
1991	39881	77714	21394	3235	12,31
1992	70929	57672	15434	3925	10,38
1993	44397	110554	18868	4658	7,28
1994	43788	140001	22600	6268	5,91

Nominal data and standardised indices of abundance for sailfish (voiler), blue and swordfish (espadon) 1988 - 1994







General Linear Models Procedure
Class Level Informations

Class	Levels	Values
ANN	7	88 89 90 91 92 93 94

Number of observations in data set = 80

Dependent Variable: Log(RDE+1)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	218.5360351	27.3170044	75.23	0.0001
Error	72	26.1440029	0.3631112		
Uncorrected Total	80	244.6800380			

R-Square	C.V.	Root MSE	LOESP Mean
0.243936	37.18354	0.602587	1.620575

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ANN	7	215.4991396	30.7855914	84.78	0.0001
TPE	1	3.0368955	3.0368955	8.36	0.0051

Dependent Variable: Log(RDM+1)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	856.3304271	107.0413034	186.80	0.0001
Error	72	41.2571149	0.5730155		
Uncorrected Total	80	897.5875421			

R-Square	C.V.	Root MSE	LOMAR Mean
0.353046	23.44731	0.756978	3.228421

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ANN	7	854.1676335	122.0239476	212.95	0.0001
TPE	1	2.1627936	2.1627936	3.77	0.0560

Dependent Variable: Log(RDV)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	629.7179913	78.7147489	88.18	0.0001
Error	72	64.2726256	0.8926754		
Uncorrected Total	80	693.9906169			

R-Square	C.V.	Root MSE	LOVOI Mean
0.502854	35.56149	0.944815	2.656848

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ANN	7	579.1870338	82.7410048	92.69	0.0001
TPE	1	50.5309575	50.5309575	56.61	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
TPE	0.214598834	7.52	0.0001	0.02852301

Le modèle utilisé est log-linéaire, il a la forme
log(RDE+1) log(RDM+1) log(RDV+1) = ANN TPE

RDE, RDM, RDV représentent respectivement les rendements exprimés en Kg/pirogue d'espadon, de marlin et de voilier. ANN est le logarithme de l'effet de l'année prise pour variable de classification et TPE est la variable continue des temprératures.
Les rendements sont variables en fonction des années de pêche pour les trois espèces de poissons, tant dis que les températures n'ont d'influences très significatives que sur les captures de voiliers.
La troisième table d'analyse de variance montre que les meilleurs rendements ne sont pas obseveés pour les faibles températures.