SCRS/1995/050

Col.Vol.Sci.Pap. ICCAT, 45 (3) : 126-129 (1996)

UNUSUAL OCCURENCE OF ""GREEN TUNAS" IN ABIDJAN LANDINGS, 1993-1995

Bard, F.X., J.B. Amon Kothias, J. Panfili, A. Hervé

Centre de Recherches Océanologiques (CRO) d'Abidjan, Côte d'Ivoire
et
Institut Français de Recherche Scientifique en Coopération (ORSTOM)

SUMMARY

This document describes the strange appearance of blue/green colored tropical tunas in the Gulf of Guinea fisheries in 1993-1995. These fish, mainly skipjack and bigeye, have been observed in the landings at the port of Abidjan. These tunas were set aside from the stocks of the canning factories and studied by CRO fisheries biologists. The biostatistical system in place permits determining their date and place of capture. Biological observations of these fish are also possible since the coloration is like a type of natural tag. Information on the migration of skipjack and bigeye is also given.

RESUMÉ

Ce document décrit l'apparition étrange de thons tropicaux colorés en bleu-vert dans les pêcheries du Golfe de Guinée durant les années 1993-95. Ces poissons, surtout des listaos et des patudos, ont été observés lors des débarquements au port d'Abidjan. Ces thons ont été écartés de l'approvisionnement des usines et étudiés par les biologistes des pêches du CRO. Le système bio-statistique en place a permis de repérer leur date et lieu de capture. Ceci permet des observations biologiques grâce à ce qui apparaît comme une sorte de marquage naturel. On précise ainsi la migration des listaos et des patudos.

RESUMEN

Este documento describe la extraña aparición de túnidos tropicales de un color azul verdoso en las pesquerías del Golfo de Guinea en el período 1993-1995. Estos peces, sobre todo de las especies listado y patudo, fueron observados durante los desembarques efectuados en el puerto de Abidjan. Fueron separados de los destinados a las fábricas de conserva y estudiados por los biólogos pesqueros del CRO. Por medio del sistema bioestadístico se ha podido identificar la fecha y lugar de su captura. Se hicieron observaciones biológicas en lo que parece ser una especie de marcado natural. Se concreta de este modo acerca de la migración del listado y del patudo.

1- Introduction

Catches of tropical tunas in the Eastern Atlantic, and particularly the Gulf of Guinea, are the most important of the whole Atlantic ocean. Total catches reach about 250 000 Mt per year, of which 150 000 to 200 000 Mt are landed or transshipped at Abidjan port by an international fleet of large purse seiners. These tropical tunas are mainly yellowfin (T. albacares) and skipjack (K. pelamis), and to lesser extent bigeye (T. obesus). Albacore (T. alalunga) landings are rare. Another tuna port is Tema where a fleet of baitboats land mainly skipjack and small yellowfin and bigeye. The tunas landings in the port of Dakar, formerly important are now minor.

By August-September 1993 attention of fishery biologist of CRO in Abidjan were drawn by the stevedores on the landings of so-called "green" tunas from unloading purse seiners. These remarkable fish displayed a blue-green coloration on opercular plates, fin-rays and even scales. An organisation for systematic collect of these green tunas was set up by CRO and appropriate reward provided to stevedores. Consequently all the green tunas landed during the following months were sorted out from current flow of tunas in Abidjan and submitted to CRO scientists. Up to September 1995, 124 tunas have been recovered, of which 72 skipjack, 46 bigeye and 6 yellowfins. Detail of these rcoveries are provided by Bard et Hervé (1995).
As the sampling and collect of information system of CRO is well established (nearly 100 % of logbooks recovered) it has been possible to track the exact date and position of most of the green tunas. Figure 1 displays the spatial distribution of the recoveries in the tropical Eastern Atlantic fishery. When compared to a synthetic map of the current spatial pattern of tuna fishing by surface fleets in this area (Figure 2) , it appears clearly that recoveries of green skipjack and bigeye are well scattered amidst tunas catch of these two species. But it is not true for yellowfin.
Another feature appears when examining the catches of green tunas by 30 days steps since 1st August 1993, (Figure 3). Skipjack catches have been more abundant by early months of this phenomenon, followed by steady catches of bigeye. Yellowfin catches are always few.

Size of the fish, in weight, are displayed in figure 4. It appears clearly that green skipjacks and green yellowfins are matching the commmon size of such fish in these fisheries (Fonteneau et Marcille, 1988) but large size of green bigeyes is very remarkable.

In the neighbour tuna port of Tema about 15 green skipjack and 5 green small bigeye have been recorded in the landings of the baitboats by mid- 1993. Likely, the catches took place around 2° North and 1° East, which is the center of the very stable fishing area of these baitboats. Since no green tunas have been recorded in Tema. In Dakar no green tuna have been spotted.
20 green tuna caugh during the beginning of the phenomenon were dissected . It showed that the blue-green coloration was present in any bone tissue and calcified part of the tunas, with exeception of otoliths.
Consequently for the last recovered tunas vertebrae and dorsal spiny fin-rays were removed and cutted at LASAA in Brest by care of J. Panfili. It showed that for the last fish caught, particularly during 1994 an apparent fading of the external green color was caused by internalisation of a narrow band of green pigment covered by normal bone tissue as growth of the fish proceeded. Therefore, the green pigment acted as a natural tagging by chemical such as tetracyclin used sometimes by biologists (ISYP of CCAT, 1986).

Research in the scientific litterature showed that rare occurence of green tunas have been recorded in the past in the Pacific ocean. (Yamaguchi and al, 1980). But it has been only sparse and no recoveries have been recorded

in the Atlantic ocean. This actual occurence of a considerable number of green tunas in the Eastern tropical Atlantic is clearly unusual. The remaining of this paper describes first results of studies by CRO and ORSTOM scientists on this curious phenomenon, which provide some biological features of this green coloration of tunas and confirmations of migratory pattern of skipjack and bigeye tunas.

The basic questions to be adressed were:

- What is the chemical or biochemical identity of the green factor ?.
- Is it any risk of toxicity for consuption of flesh of these tunas?
- What is the determinism of the staining action ?.
- What are the biological and ecological consequences of this phenomenon ?

2- Discussion

The identity of the green factor, accordingly to Yamaguchi and al, 1980 would be biliverdin, which is a classic intermediate degradation product of hemoglobin. In vertebrate it is transformed in bilirubin which is excreted through the bile in lower intestine. Some fish have natural biliverdin pigment in their blood (Clinocottus analis, a Labrid) or their bones (sea eel, Belone belone)
Analysis conducted by J. Panfili in Brest laboratory of ORSTOM showed that the blue-green factor extracted trom the bones of the tunas is indeed biliverdin. Affinity of biliverdin for calcium is well known, that explains the staining of the bones, probably through an excess of biliverdin in the metabolism of the fish.

Biliverdin is harmless for human consumption as it is digested in the digestive system. The senior author and his cat consumed green tuna during several weeks without noticing bad taste or any health damage. According to Yamaguchi at al, in Tokyo market the green bigeye are sold, but at lower price. However in Abidjan for avoiding any controversy, the green tuna have been systematically sorted out from canneries supply. The same was done in Tema.

The exact determinism of this excess of biliverdin is still a problem. An hypothesis was that parasitic infestation of the viscera, particularly gall bladder could machnically block the bile ducts and therefore reverse biochemical reactions. Careful dissection and histology of visceral tissues from 5 large fish, selected as fished by the beginning of the event and as green as possible, were conducted. It showed infestation by a cestods in the liver tissue: Dasynrhynchus. But such a cestod has been already classically described as a common parasit of large bigeye, and it can be argumented that if the parasit is the causal agent of excess of biliverdin, green bigeye would have been observed long time ago in the landings from Eastern Atlantic. This has never been the case.

Some experiences described by Fang (1987), Ellis and Poluhowitch (1981) on fish submitted to stress (starvation) showed an abnormal rate of biliverdin which directly excreted instead of bilirubin. So a stress y starvation of the green tuna can by hypothetised. Another possibility is a the destruction of a large amount of blood red cells which would liberate an excess of hemoglobin in the body, catabolised in biliverdin. Such fact is observed in humans in case of hematoms. The avaiility of blood drawn from a freshly fished green tuna would indeed help to select an interpretation.

Whatever the cause of such stressing action, the simultaneous occurence of a large number of green tuna is still surprising. Using the fact that sthe green staining in bone tissue lay down a narrow ring, followed by normal bone layers, J Panfili tried to back compute the time of the deposit of biliverdin, using availble growth equations of skipjack and bigeye. It showed a scattering of the computed dates, but individual variation of the growth rate could partly account for it. If true, a period of staining around by the secund and third quarter of 1993 was possible.
However the recentest discovery of a conspicuously green skipjack "recntly stained", fished by 1st August 1995 in inner Gulf of Guinea raises new questions on the rate of appearance of this phenomenon.

As a partial conclusion, the staining green agent is undoubtly biliverdin. It is harmless for consumption, and the possible cause seems to be a stress, undertook mainly by skipjack and bigeye, less by yellowfins (unless a differential mortality affected the yellowfins).

Examination in detail of the date and place of catch of green tunas over 1993 and 1994 , by quarters shows some interesting features for skipjack and bigeye. Figures 5 (a,b) display by quarter these catches.

Skipjack

The catches of green skipjack cover mainly the 3nd and 4th quarter of 1993 with a prominent apparent move westward, north of Equator. Later, recoveries of green skipjack are scarce during 1994 and take place in the inner Gulf of Guinea.
These catches follow exactly the pattern of migration from the model of Bard et al (1988) in the Gulf of Guinea, established on taggings experiences by 1980-1981. Skipjack recruited in the inner part of the Gulf of Guinea migrate westward , north of Equator to the area centered at 2°N, 15°W, where they are joined by skipjack from Senegal by the fouth quarter. Later, during first quarter skipjack disappear relatively in the catches, and only a fraction reappear in the inner Gulf of Guinea at secund quarter. An important fraction of the skipjack is supposed to emigration the offshore area where they are not fished ("black hole").

The remarkable similarity between migration model and apparent movement of green skipjack suggest a relatively short period of coloration of the fish, during June August 1993, in Eastern of Gulf of Guinea, centered on 2°S, 8°E. Then fish behave as naturally tagged .animals. However, the new discovery of a "recently stained" green skipjack by August 1995 in the Eastern Gulf of Guinea is of course puzzling: Is the phenomenon periodic ?.

Bigeye

Green large bigeye appears during the third quarter in Gulf of Guinea and catches of such fish continue rather regularly during the following quarters of 1993-1994 in the Gulf of Guinea. The important point is that, up to now, no green bigeye has been recorded in area outside, in subtropical fisheries, such as baitboats in Azores Islands or in Central North Atlantic or Central South Atlantic , where specialized deep freezing "Sashimi" longliners target on large bigeye. The classical model of migration of bigeye (Bard et al, 1988) postulate that young bigeye migrate nothward or southward off the nursery of Gulf of Guinea and return only in equatorial area for spawning.
It has to be pointed out that in all the quoted fisheries, large and valuable bigeye are carefully processed. A green tuna would have been recorded indeed. Therefore, apparent relatively short span of movement of green bigeye in the Gulf of Guinea suggest a sedentary sub-population of bigeye tunas staying in Eastern Equatorial Atlantic. Figures 8.6, 8.9, 8.11 of Pereira (1995) work, based on catches by various gears suggest the same fact.

3-Conclusion

This clearly unusual record of a relatively large number of green tunas in the Atlantic seems unique. Th unexplained point is still the real determinism of the appearance of excess of biliverdin in fish during a limited period. No pathology has been shown, and quality of fish remains at good level. Detailed analysis of the catches of skipjack and bigeye suggest that movements of green fish act as a natural tagging. It confirms the scheme of migration of skipjack in the Eastern Atlantic, and suggest the existence of sedentary bigeye population component in the Gulf of Guinea. Any new record of green tuna, particularly in fishries ouside of Eastern Atlantic would be of great interest indeed.

4- Bibliography

Bard F X et Hervé A. 1995 A la poursuite du thon vert. XIV Fishing Week of Azores, March 1995; 10p

Bard F.X., Cayré P. et Diouf T., 1988.- Chapitre 5, Migrations de thons : 111-156. In Fonteneau et Marcille Eds.

Ellis MJ; Poluhowitch JJ., 1981- Biliverdin concentrations in the plasmas of fresh and brackish water eels. Anguilla rostrata. Comp. Biochem Physiolo. (A) 70(4) : 587

Fang L.S. 1987 Study on the heme catabolism of fish. Comp. Biochem. Physiol., B. 88B(2) : 667-673

Fang L.S. and Bada J.L 1988 A special pattern of haem catabolism in a marine fish , Clinicottus analis, with green blood plasma. J. Fish Biol. 33(5) : 775-780

Fonteneau A.et MarcilleJ. Ed. 1988 Ressources, pêches et biologie des thonidés tropicaux de l'Atlantique Centre Est. FAO, Doc. Tech. Pêches.292, 280p.

Pereira J. G. 1995 A pesca do atum nos Accores e o atum patudo (T. obesus) do Atlantico Thesis Univesidade dos Acores , 330 p

Yamaguchi K , Yufu T and Kanoh S. 1980 A pigment in the blue green vertebrae of a big-eyed tuna (Parathunnus sibi). Bull. Japan. Soc. Sci. Fish., 4(5) :513

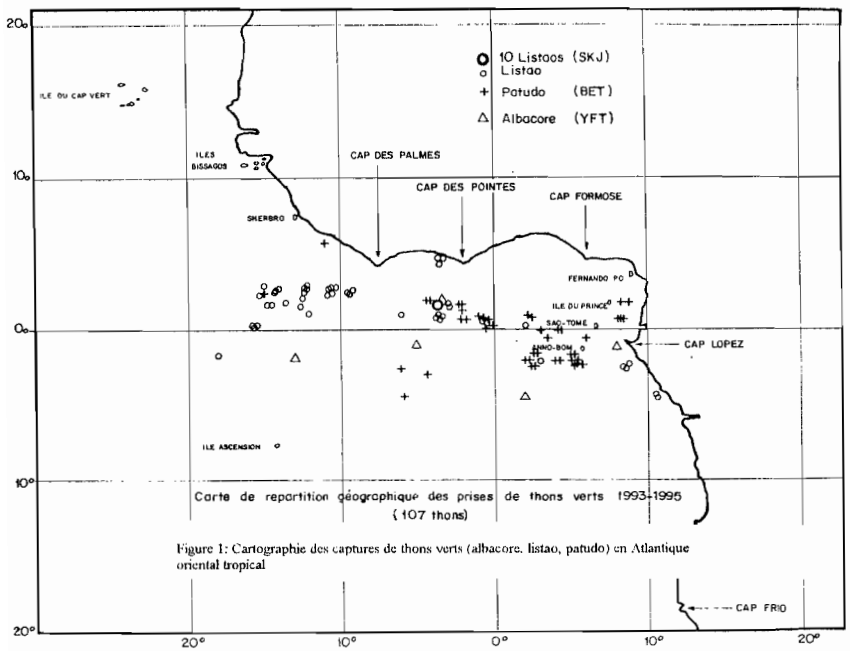
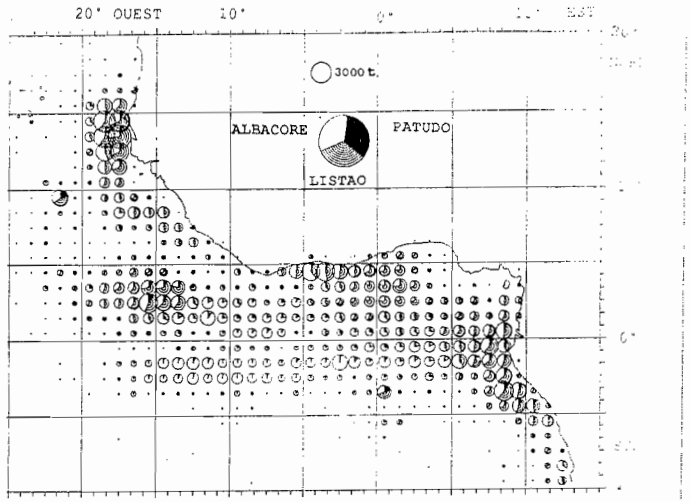
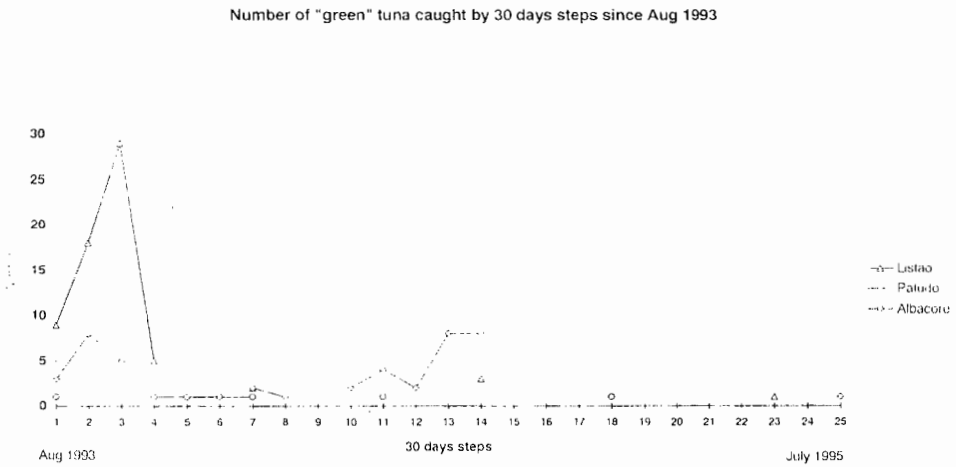


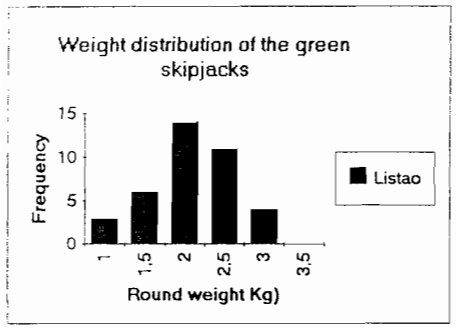
Figure 1: Cartographie des captures de thons verts (albacore, listao, patudo) en Atlantique oriental tropical



Prises toutes flottilles de surface, par espèce et carré de 1°, moyenne de la période 1980 à 1986.
Catches of all surface fleets by species and 1° square, average of the period 1980 to 1986.

Figure 2: Prises toutes flottilles de surface, par carré de 1°, des trois espèces de thons tropicaux. Source: Fonteneau, 1991.





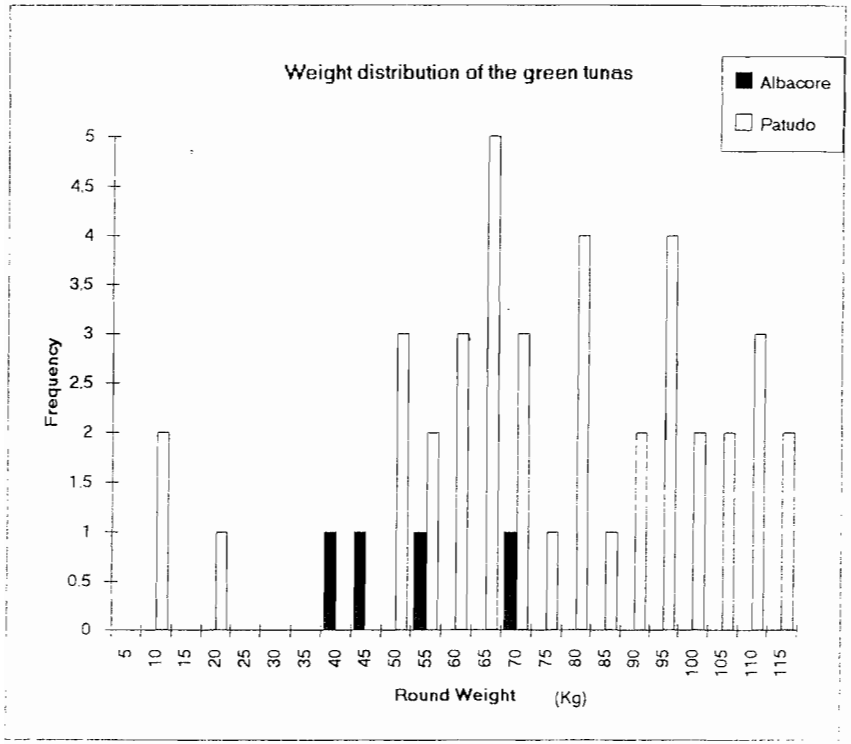


Figure 4: Distribution des poids individuels trois espèces de thons verts pêchés. On note la forte taille des patudos verts.

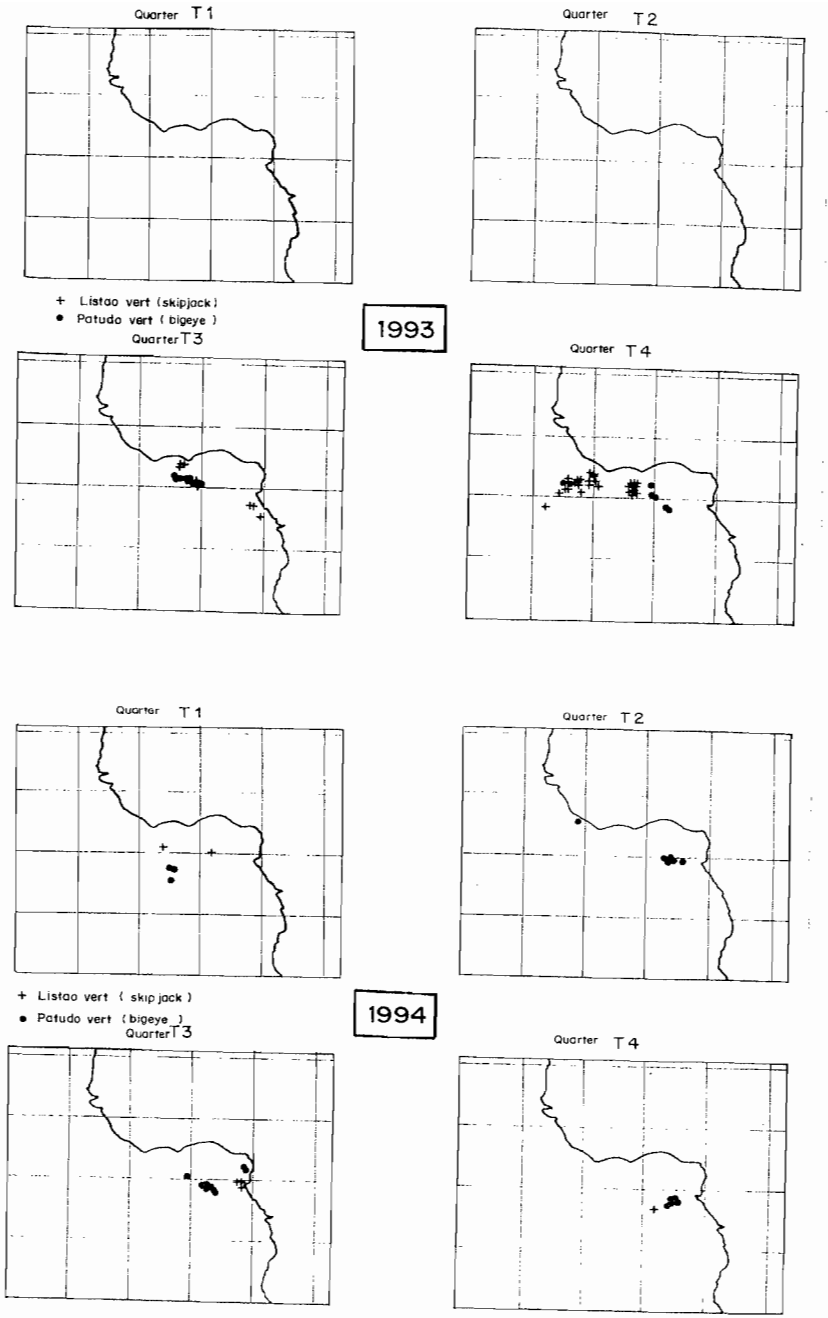


Figure **5** Cartographie trimestrielle des captures de listaos et patudos verts.
A- 1993. Noter que les pêches de thons verts commencent au troisième trimestre.
B- 1994