

## THE MYSTERY OF BLUEFIN TUNA (*THUNNUS THYNNUS*) PRESENCE AND BEHAVIOUR IN CENTRAL-SOUTH ATLANTIC IN RECENT YEARS

Antonio Di Natale<sup>1</sup>, M'Hamed Idrissi<sup>1</sup>, Ana Justel Rubio<sup>1</sup>

### SUMMARY

*This paper presents a concise historical overview of the situation of bluefin tuna in the central-southern Atlantic, showing the reported catches and analyzing the data for the last 20 years, where some mixing with southern bluefin tuna is very possible in the most southern areas. The distribution of the species is considered, taking into account all electronic or conventional tags reported so far and new anecdotic information for the most recent years. The presence of natural marks caused by cookie cutter sharks is discussed, even if this remains an unclear indication. The impact of current regulations on catch or by-catch reporting is also considered. The possible presence of potential spawning areas in various parts of the central Atlantic was also discussed, also taking into account very recent data coming from pop-up tags. The need to better focus the attention on this huge part of the ICCAT area is pointed out.*

### RÉSUMÉ

*Ce document présente un aperçu historique concis de la situation du thon rouge dans l'Atlantique centre-Sud, montrant les prises déclarées et analysant les données de ces 20 dernières années, où des échanges avec le thon rouge du Sud sont très possibles dans les zones les plus méridionales. La distribution des espèces est considérée en tenant compte de toutes les marques conventionnelles et électroniques déclarées à ce jour et les nouvelles informations anecdotiques de ces dernières années. La présence de marques naturelles causées par des squalélets féroces est discutée, même si ce phénomène demeure une indication peu claire. L'impact des réglementations actuelles sur la déclaration des prises ou des prises accessoires est également analysé. L'éventuelle présence de zones de frai potentielles dans diverses parties de l'Atlantique central a également fait l'objet de discussions, les données très récentes issues des marques pop-up ayant également été prises en compte. On a également souligné la nécessité de mieux concentrer l'attention sur cette énorme partie de la zone ICCAT.*

### RESUMEN

*Este documento presenta una concisa perspectiva histórica de la situación del atún rojo en el Atlántico central-meridional, mostrando las capturas comunicadas y analizando los datos de los 20 últimos años, en los que es muy posible que se haya producido alguna mezcla con atún rojo del Sur en las zonas más meridionales. Se considera la distribución de la especie, teniendo en cuenta todas las marcas electrónicas y convencionales declaradas hasta ahora, así como nueva información anecdótica para los años más recientes. Se discute la presencia de marcas naturales causadas por tollos cigarro, aunque sigue siendo una indicación poco clara. Se considera también el impacto de las reglamentaciones actuales sobre comunicación de captura o de captura fortuita. Se debatió también la posible presencia de zonas de desove potenciales en diversas partes del Atlántico central, teniendo en cuenta también datos muy recientes procedentes de marcas pop-up. Se indica la necesidad de centrar más la atención en esta gran parte de la zona de ICCAT.*

### KEYWORDS

*Bluefin tuna, natural marks, catches*

---

<sup>1</sup> Coordinator ICCAT/GBYP, Calle Corazón de Maria 8, 6<sup>a</sup>, 28002 Madrid, Spain.

## 1. Introduction

The presence of bluefin tuna (*Thunnus thynnus*) in central-South Atlantic Ocean is known since old times (Mather *et al.*, 1995; Doumenge, 1998; Anon., 2009), but bluefin tuna was never extensively studied in this part of its distribution range. The massive presence of bluefin tuna in southern Atlantic in the '60s resulted in high LL catches in South-western Atlantic, off the Brazilian coast (**Figure 1**) (Shiohama *et al.*, 1965; Takeuchi *et al.*, 1999).

In the following years, catches of bluefin tuna in the central-southern Atlantic showed a drastic decrease and for some authors this was the consequence of the high catches (**Figure 2**) (Mather *et al.*, 1974; Fromentin and Powers, 2005); . In the reality, the reason was never identified and there is also the suspect that it should be due to some changes in the distribution (vertical or horizontal) induced by still not well-defined oceanographic factors (Ravier and Fromentin, 2003, 2004; Fonteneau, 2009; Fromentin, 2009; Takeuchi *et al.*, 2009).

As a matter of fact, bluefin tuna continued to be reported in the area even in the following years, but always with a low apparent presence.

## 2. The lack of reported tags

All tags used so far during many trials conducted in the main distribution areas of bluefin tuna never helped for clarifying the situation in central-southern Atlantic.

As far as we know, only one electronic tag among the many used so far on both sides of the Atlantic Ocean went clearly to the Southern Atlantic: the specimen (about 150 kg) was tagged in the Spanish tuna trap of Barbate on July 27, 1998 and the tag popped-off close to Cabo Verde in January 1999 (Block *et al.*, 2001; De Metrio *et al.*, 2002, 2003, 2005).

According to the ICCAT tag data base, only a very few (4) conventional tags implanted in North Atlantic were recovered so far in South Atlantic and reported to ICCAT. 2 juveniles and an unknown-size specimen moved to the central Atlantic, 1 giant (230 cm) moved from Florida to Argentina (**Figure 4**).

No tagging, as far as we know, was never carried out for bluefin tuna in Southern Atlantic.

## 3. The natural marks

The presence of natural marks, made by the smalltooth cookiecutter shark (*Isistius brasiliensis*) on several specimens of bluefin tunas caught both in the West or in the East are known since at least one century, on both sides of the Atlantic, but particularly in the Mediterranean and in the Caribbean.

In the last 40 years, the presence of these tunas with natural marks was noted particularly in the Mediterranean (Arena, 1985, 1988a, 1988b, 1990; Di Natale, 2010) where they occurred in about 2% of the specimens, usually giant or giant-medium males (the presence of these marks was noticed only on one female specimen).

In 2012, during the ICCAT-GBYP electronic tagging activities in Atlantic Morocco, 2 out of 5 big bluefin tuna tagged on board had clear natural marks of *Isistius brasiliensis* (**Figure 6**), confirming the relevance of these natural marks (Quilez Badia *et al.*, in press).

The smalltooth cookiecutter shark (*Isistius brasiliensis*) is not distributed in the Mediterranean Sea and it is commonly present in SW Atlantic, even if its distribution range covers most of the central-south Atlantic, up to Cabo Verde on the eastern side. It is a deep species, but having nictimeral movements up to surface waters.

It is not clear at all why only giant or medium males have these marks, usually in the last inferior third of the body, in the perianal region or on the sides (**Figure 5**): maybe male bluefin tunas may have a different vertical or horizontal behaviour by sex at a certain life-stage. But, if this is the case, in which part of the central-southern Atlantic these facts may occur?

#### 4. Reported catch in Central-South Atlantic

Reported catches to ICCAT from central-southern Atlantic in recent years show a strange feature: in the decade 1990-1999 the yearly average was 138 t, with a minimum of 2.51 t (1997) and a maximum of 445.13 t (1999).

In the decade 2000-2009 the yearly average was 37.9 t, with a maximum of 275.57 t (2000) and no catches at all reported from 2007 to 2009 (**Table 2** and **Figure 7**).

There is the well-based doubt that some of the reported catches currently still included in the bluefin tuna data base, occurred both in past and recent years from at least 30°S to 45°S might be related to southern bluefin tuna (*Thunnus maccoyii*). Correctly identifying these catches may change the whole figure catch in this area.

Furthermore, anecdotic catches of Bluefin tuna have been recently reported from various areas in recent time, further complicating the understanding about the current distribution of this species (**Figure 8**).

#### 5. Effects of current regulation

There is a very curious correlation between the reported catch decrease and some management decisions: when the catch limits for the eastern stock were enforced, the catches dropped in a dramatic way (1997-1998) and when transshipments and catches were strictly regulated by the adoption of statistical documents (2007-2009), then no more catches were reported from the whole area.

Furthermore, a previous ICCAT management regime included a quota for “Others” (Rec. 02-08), while the current management measure (Rec. 10-04) strictly identify all CPCs, entities, vessels and gears who are allowed to catch the quota. No CPCs from South Atlantic are on the list and then they cannot catch any bluefin tuna, even as by-catch. According to paragraph 31 (Rec.10-04), bluefin tuna by-catch is allowed only for those CPCs having a BFT quota and it shall be landed only in authorised ports, following all procedures. Are we facing a “Catch-22 Paradox”?

If any vessel from any ICCAT CPC not listed among those having a BFT quota will incidentally catch a bluefin tuna, then this fact will face compliance issues. Is the lack of reported catches in recent years an effective absence of catches/presence or a non-reported catch issue?

#### 6. Recent information

During the GBYP activity, we collected anecdotic information, sometimes very detailed, concerning the presence of bluefin tuna in several southern Atlantic areas.

In most of the cases, few individuals are incidentally caught every year by small-scale artisanal fishermen in various areas; few fish are discarded, but most are consumed locally and never reported to local authorities. According to the information collected, most of the catches happened in the last three years, due to the higher presence of the species even in coastal areas.

In other areas, particularly in the eastern side of the ocean, a few specimens have been caught by sport fishermen. Some were reported as SBT, others, particularly big fish, were never reported to local authorities. According to the information collected, several catches happened in 1996-97 and 2006-07, while catches in recent years were almost nil in SE Atlantic.

In one case, we have been informed of a massive presence of medium and giant bluefin tunas in the NE part of the Benguela current. The major presence was between September to May, in conjunction with a high presence of small pelagic species, and it seems that some specimens were very big, even more than 500 kg. The anecdotic presence was reported from 2008 to 2011. There are no official data available, but the same information was confirmed from different sources, even from various countries.

Looking at the combined map of recent (1990-2009) catches and recent anecdotic information, there is a good correlation in most of the areas (**Figure 9**).

## 7. Potential presence of additional spawning areas

This is a very serious and undefined issue since almost one century, because some scientists put forward the hypothesis that some bft spawning areas may be present in the central-south Atlantic, in addition to the traditional areas in the Gulf of Mexico and the Mediterranean Sea.

At first this hypothesis was made by De Buen (1925, 1926), later supported by Rodríguez-Roda (1975), Sarà (1983, 1988) and Mathers III (1995). The hypothesis was that additional and maybe occasional bluefin tuna spawning may occur in the Ibero-Moroccan Bay, in the area between Canary Islands, Mauritania and Morocco, in the area around the Azores Islands and in the Gulf of Guinea.

Larval surveys carried out in all these areas (except in the Gulf of Guinea) were never able to find any bluefin tuna larvae. But this fact is not conclusive, because the trials were very limited and bft larval dispersion can be very high in open Ocean.

Very small juveniles (about 40 cm) were reported along the Atlantic coast of Morocco (Rodríguez-Roda, 1975). Mature bluefin tunas were reported in Morocco, Canary Islands, Portugal and Azores by various authors; mature tunas were noticed in Morocco in several traps in the last decades.

The very recent ICCAT-GBYP tagging activities carried out in 2011 and 2012 in a Moroccan Atlantic trap showed that some adult individuals moved towards the Ibero-Maroccan Bay, the Canary Islands, NW Madeira and the Azores Islands during the usual spawning season, without entering into the Mediterranean Sea Quilez-Badia *et al.*, in press). The oceanographic conditions recorded when the tags popped off in the Azores area were potentially suitable for bft spawning.

## 8. Origin of the Bluefin tuna going to Atlantic Moroccan traps

Since ancient times, the Moroccan Atlantic coast hosted tuna traps, intercepting the massive passage of adult bluefin tunas (Anon., 2012).

The movement of these tunas is clearly from the South, moving to the North; historic and recent information shows that these fish are coming to Morocco passing off the West African coast.

Massive pop-up tagging made in the North-western Atlantic shows that some of these fish possibly come from the central-North Atlantic, after complex movements (Block *et al.*, 2001). It is suspected that some of these fish may come also from the southern Atlantic, but there is no evidence so far.

## 9. Conclusion

It is very clear that our understanding of the Bluefin tuna movements and presence in the central-southern Atlantic is actually very poor.

We are missing too many pieces of the Bluefin tuna puzzle and improvements are necessary, also because there are still too many question marks about the presence of Bluefin tuna in this large portion of the Ocean.

- What is the real distribution of bluefin tuna in central-southern Atlantic in recent years?
- Do the tunas going to Morocco partly come also from the southern Atlantic?
- Why so few tagged tunas (on both sides of the Atlantic) are moving towards the southern Atlantic areas?
- How the tunas distributed in the southern Atlantic may contribute to the eastern and western Atlantic stocks?
- What can tell us the genetic of the bluefin tuna in the South Atlantic?
- How this lack of data may bias our understanding of the bluefin tuna stocks?
- Is it possible that some bluefin tunas can spawn in some years in one or more of the potential additional Atlantic spawning areas?

- Can we improve the catch reporting situation from this huge geographic area, particularly considering that by-catch can occur?
- Can the ICCAT-RMA (Rec.11-06) help for improving reporting and sampling of bluefin tuna in central-southern Atlantic?

## References

- Anon. 2009a. Report of the World Symposium for the study into the stock fluctuation of northern bluefin tunas (*Thunnus thynnus* and *Thunnus orientalis*), including the historical periods (Santander, Spain, April 22 to 24, 2008). Collect. Vol. Sci. Pap. ICCAT, 63: 1-49.
- Anon., 2012, ICCAT-GBYP Symposium on Trap Fishery for Bluefin Tuna, Tangerang, 2011. Coll. Vol. Sci. Pap., LXVII: 1-398.
- Arena P., 1985, La pesca del tonno in Sicilia. Atti Conv. Pesca e Trasf. Prod. Itt. Siciliani, Trapani: 23-28.
- Arena P., 1988a, Risultati delle rilevazioni sulle affluenze del tonno nel Tirreno e sull'andamento della pesca da parte delle "tonnare volanti" nel triennio 1984-1986. MMM-CNR, Atti Seminari UU.OO. Resp.Prog. Ric., Roma: 273-297.
- Arena P., 1988b, Rilevazioni e studi sulle affluenze del tonno nel Tirreno e sull'andamento della pesca da parte delle "tonnare volanti" nel quadriennio 1984-1988. Report to: ESPI, Ente Siciliano per la Promozione Industriale, Palermo, 1-55, I-XI.
- Arena P., 1990a, Rilevazioni e studi sulle caratteristiche e lo stato delle risorse di Tonno e sugli andamenti della pesca (Relazione sulla prosecuzione 1987-89). Report to: ESPI, Ente Siciliano per la Promozione Industriale, Palermo, 1-58.
- Block B.A., Dewar H., Blackwell S.B., Williams T.D., Prince E.D., Farwell C.J., Boustany A., Teo S.L.H., Seitz A., Walli A., Fudge D., 2001, Migratory movements, depth preferences, and thermal biology of Atlantic bluefin tuna. Science, 293: 1310-1314.
- de Buen F., 1925, Biología del Atún *Orcynus thynnus* (L.) Resultado de las campañas realizadas por acuerdos internacionales. Instituto Español de Oceanografía, Madrid, 1: 1-118.
- de Buen F., 1926, Catalogo ictiológico del Mediterráneo Español y Marruecos. Res. Camp. Acuerd. Intern., 2: 150, 159, 167.
- De Metrio G., Arnold G.P., Block B.A., De la Serna J.M., Deflorio M., Yannopoulos C., Megalofonou P., Beemer S., Farwell C., Seitz A., 2002, Behaviour of post-spawning Atlantic bluefin tuna tagged with pop-up satellite tags in the Mediterranean and eastern Atlantic. Collect. Vol., Sci. Pap. ICCAT, 54(2): 415-424.
- De Metrio G., Arnold G.P., De la Serna J.M., Yannopoulos C., Labini G.S., Deflorio M., Buckley A., Ortiz De Urbina J.M., Megalofonou P., Pappalepore M., Block B., 2003, Where do Atlantic Bluefin Tuna (*Thunnus thynnus* L.) spread after the spawning in the Mediterranean Sea? Workshop on farming, Management and conservation of bluefin Tuna, 2003, Istanbul: 96-101.
- De Metrio G., Arnold G.P., de la Serna J.M., Block B.A., Megalofonou P., Lutcavage M., Oray I., Deflorio M., 2005, Movements of bluefin tuna (*Thunnus thynnus* L.) tagged in the Mediterranean Sea with pop-up satellite tags. Collect. Vol. Sci. Pap. ICCAT, 58: 1337-1340.
- Di Natale A., 2010, The eastern Atlantic bluefi tuna: Entangled in a big mess, possibly far from a conservation red alert. Some comments after the proposal to include bluefin tuna in CITES Appendix I. Collect. Vol. Sci. Pap. ICCAT, 65(3): 1004-1043.
- Doumenge F. 1998 - L'histoire des pêches thonières. ICCAT/SCRS, Col. Vol. Sci. Pap., 50: 753-802.
- Fonteneau A., 2009, Atlantic Bluefin Tuna: an overview of 100 centuries of moving fisheries. ICCAT, BFT Symposium, Coll. Vol. Sci. Pap., LXIII: 51-68.
- Fromentin J.M., 2009, Lessons from the past: investigating historical data from bluefin tuna fisheries. Fish and Fisheries, 10 (2):197-216.
- Fromentin, JM and Powers, J.E., 2005: Atlantic bluefin tuna: Polulation dynamics, ecology, fisheries and management, Fish and Fisheries 6(4), 281-306.
- Mather F.J.III, Mason J.M., Jones A.C., 1974, Distribution, fisheries and life history data relevant to identification of Atlantic Bluefin tuna stock. Collect. Vol. Sci. Pap. ICCAT, 2: 234-258.

- Mather F.J.III, Mason J.M., Jones A.C., 1995, Life History and Fisheries of Atlantic Bluefin Tuna. NMFS-SEFSC 370: 1-165
- Quílez-Badía G., Cermeño P., Susana Sainz Trápaga S., Tudela S., Di Natale A., Idrissi M., Abid N., in press, 2012 ICCAT-GBYP pop-up tagging activity, in Larache (Morocco), SCRS/2012/143.
- Ravier C., Fromentin J.M., 2003, Long-term fluctuations in Atlantic bluefin tuna (*Thunnus thynnus*): are they environmentally driven? Col. Vol. Sci. Pap. ICCAT, 55 (3): 1208-1216.
- Ravier C., Fromentin J.M., 2004, Are the long-term fluctuations in Atlantic bluefin tuna (*Thunnus thynnus*) population related to environmental changes? Fish. Oceanogr. 13: 145–160.
- Rodríguez Roda J., 1975, Expedición científica para la identificación de zonas de puesta del atún, *Thunnus thynnus* (L.) (Campaña “Maroc-Iberia, I” del “Cornide de Saavedra”). Res. Exp. Cient. Buque Ocean. “Cornide de Saavedra”, Barcelona, 4: 113-130.
- Sarà R., 1983, Tonni e Tonnare. Una Civiltà, una Cultura. Libera Università di Trapani Ed., Trapani : 1-128.
- Sarà R., 1998, Dal mito all’aliscofo. Storie di Tonni e Tonnare. Banca Aegusea Ed., Favignana Palermo.
- Shiohama, T., Nyojin, M. , Sakamoto H., 1965. The catch statistic data for the Japanese tuna long-line fishery in the Atlantic Ocean and some simple consideration on it, Rept. Nankai Reg. Fish. Res. Lab., 21, 131pp.
- Takeuchi, Y., Suda, A. and Z. Suzuki Z., 1999: Review of information on large bluefin tuna caught by Japanese lonline fishery off Brazil, from the late 1950s to the early 1960s, ICCAT CVSP, 49(2), 416-427.
- Takeuchi Y., Kazuhiro Oshima K., Suzuki Z., 2009, Inference on nature of Atlantic bluefin tuna off Brazil caught by Japanese longline fishery around the early 1960s SCRS/2008/073, ICCAT, BFT Symposium, Coll. Vol. Sci. Pap., LXIII: 186-194

**Table 1.** Details on the conventional tags recovered and reported in central-south Atlantic (from ICCAT tag data base).

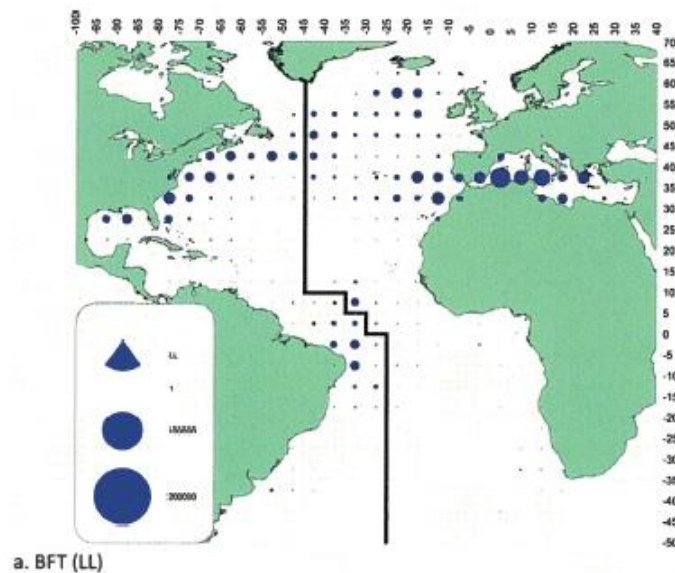
BLUEFIN TUNA - CONVENTIONAL TAGS REPORTED FROM CENTRAL-SOUTH ATLANTIC																													
Specimen Rel-Rec-Event Identifier (unique)		Release INFO																Recovery INFO											
TagCapID	SpecimenID	srTags	SpeciesCode	ReFleetCode	ReGearCode	ReYear	ReDate	ReLatY	ReLonX	ReLenCM	ReLenRel	ReLenUnit	ReType	ReWgtKGR	ReWgtUnit	RcFleetCode	RcGearCode	RcYear	RcDate	RcLatY	RcLonX	RcLenCM	RcLenRel	RcLenUnit	RcType	RcWgtKGR	RcWgtUnit		
23563	23562	HTG004904	BFT	EC.ESP	BB	1988	04/08/1988	44,3333333332	38,33333333	59	59	cm	FL		kg	EC.ESP	BB	1989	09/07/1989	2,8	-43	68	68	cm	UNK	9,5	9,5	kg	
96613	96489	HC-009603	BFT	USA	RR	1963	23/05/1963	25,45	-79,55			un	UNK		un	UNCL.FLEETS	LL	1965	03/03/1965	8,51667	-33,35			un	UNK	170	170	kg	
248883	242330	HR-288352	BFT	USA	LL	1993	11/06/1993	40,17	-67,7			un	UNK	68,03886	150	lb	USA	LL	2002	05/02/2002	6	-36	69	69	cm	UNK	240	240	kg
272666	263357	HWH000391	BFT	USA	RR	1969	05/06/1969	25,5	-79,3			un	UNK	170	170	kg	JPN	LL	1973	27/02/1973	-40	-53,5	230	230	cm	LJF	250	250	kg

**Table 2.** Reported catches of Bluefin tuna in central-south Atlantic (from ICCAT data base).

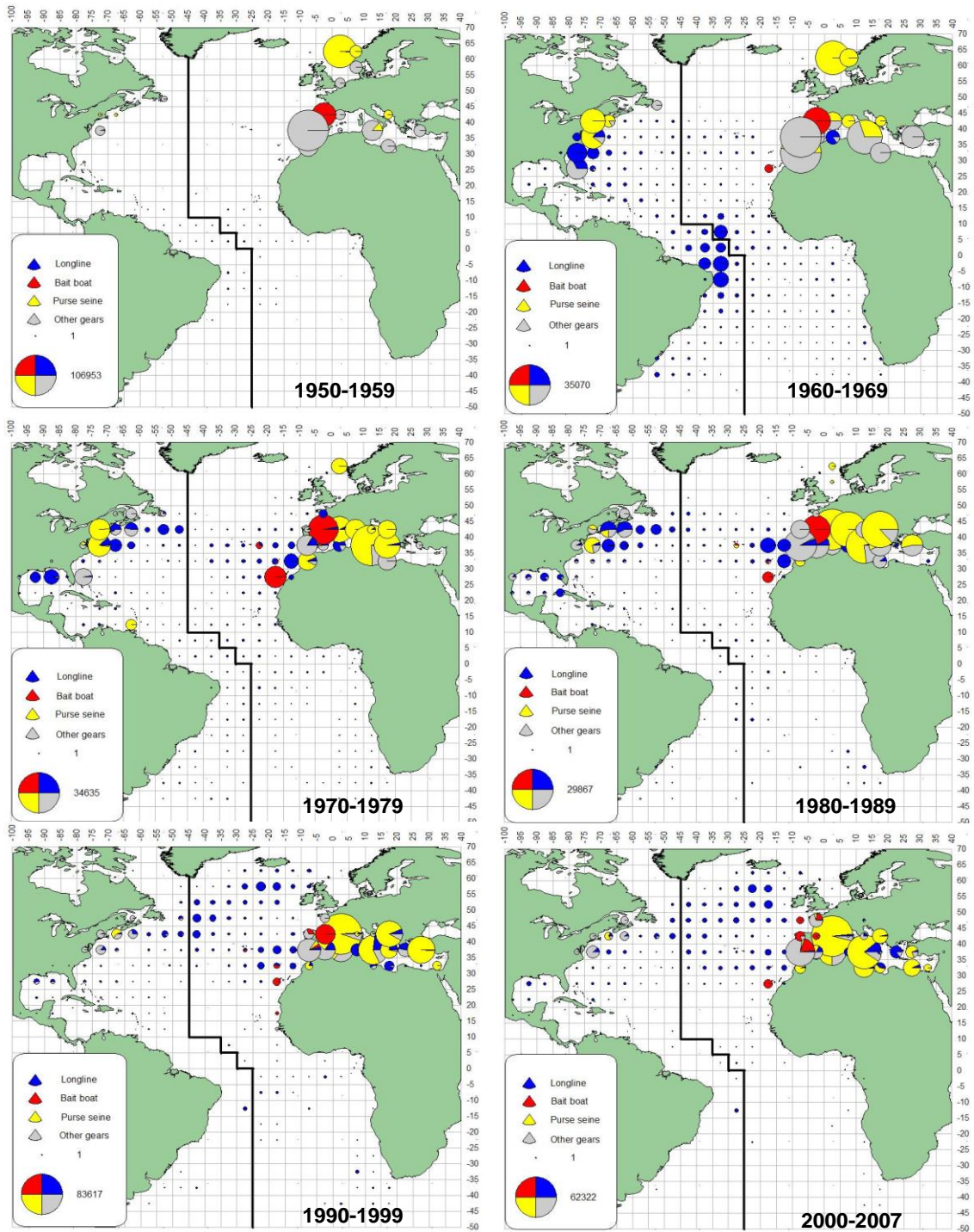
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Catch (t)	17,63	97,03	150,12	276,44	86,41	192,22	108,29	2,51	7,04	445,13

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Catch (t)	275,57	49,70	0,50	33,07	3,15	2,03	15,24	-	-	-

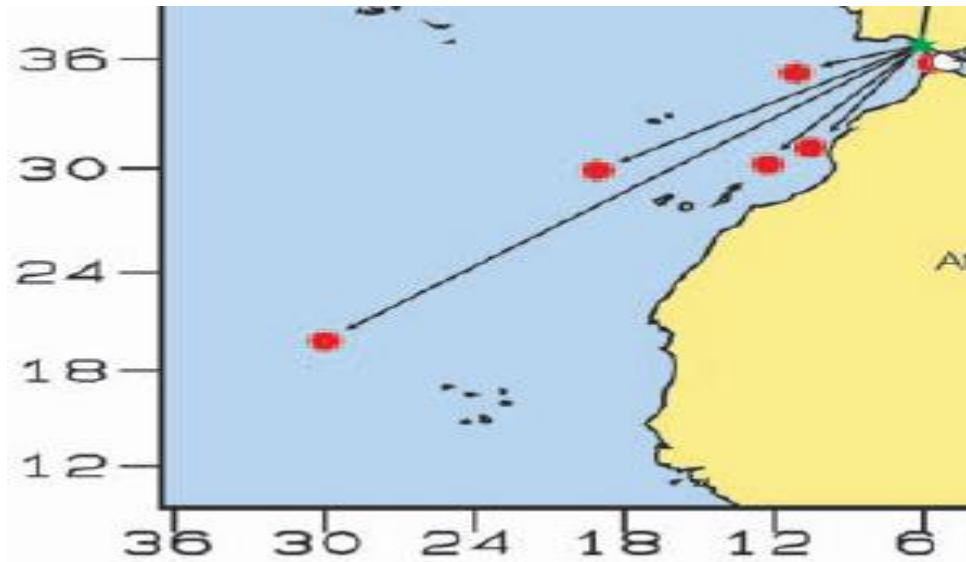


**Figure 1.** Overview of longline bluefin tuna total reported catches in the ICCAT Convention area.

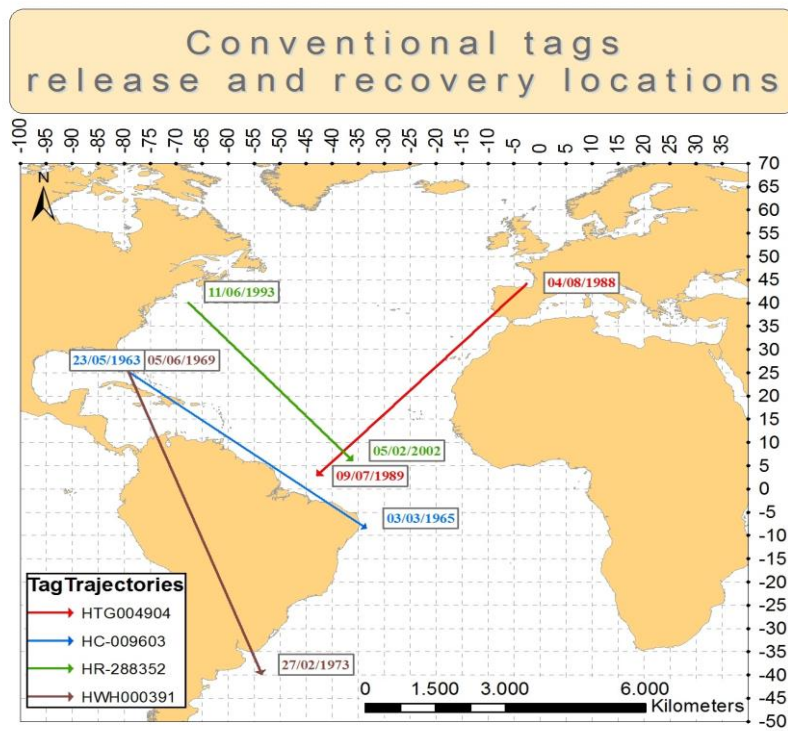


**Figure 2.** Maps of catch distribution in the ICCAT Convention area, by decade. It is very clear the disappearance of reported catches in the South Atlantic in general and in the Brazilian waters in particular.

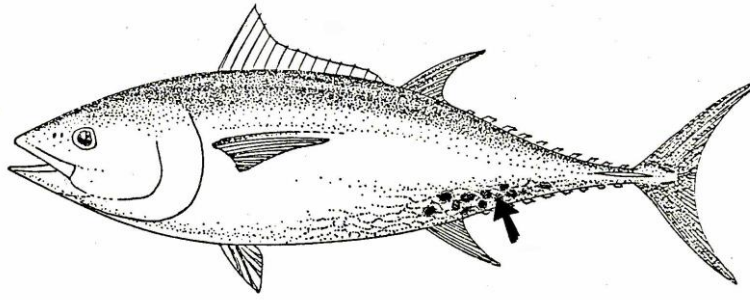




**Figure 3.** Evidence of one pop-up electronic tag, deployed in Barbate and popped off NW of Cabo Verde in 1999 (De Metrio *et al.*, 2003).



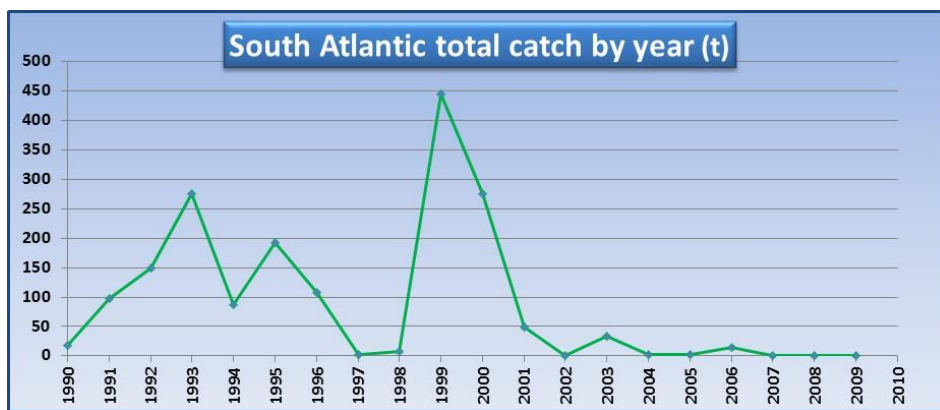
**Figure 4.** Tracks of the four conventional tags reported in central-southern Atlantic.



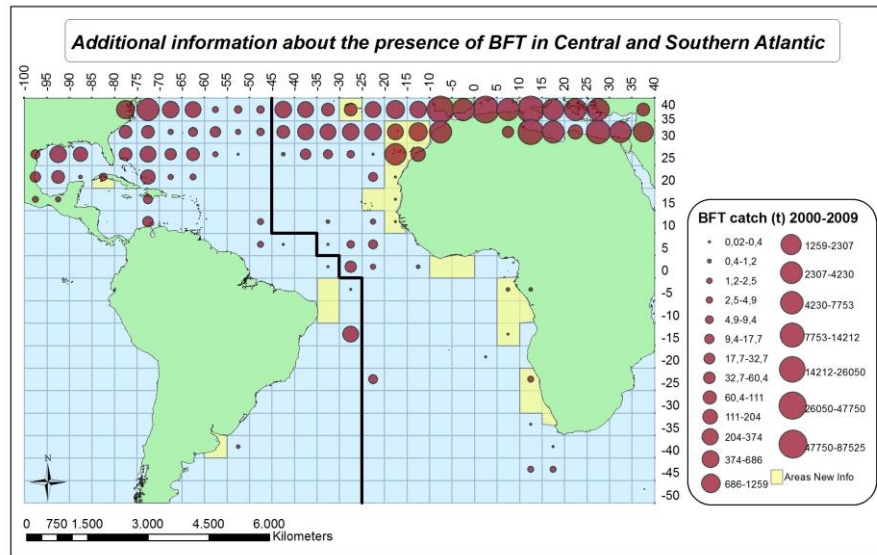
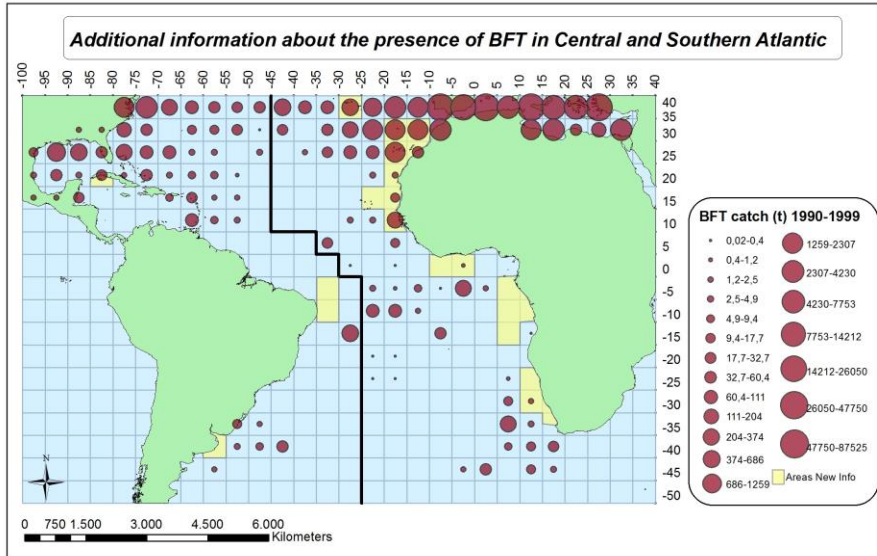
**Figure 5:** Schematic image of the preferred area where natural marks of *Isistius brasiliensis* usually occur on bluefin tuna.



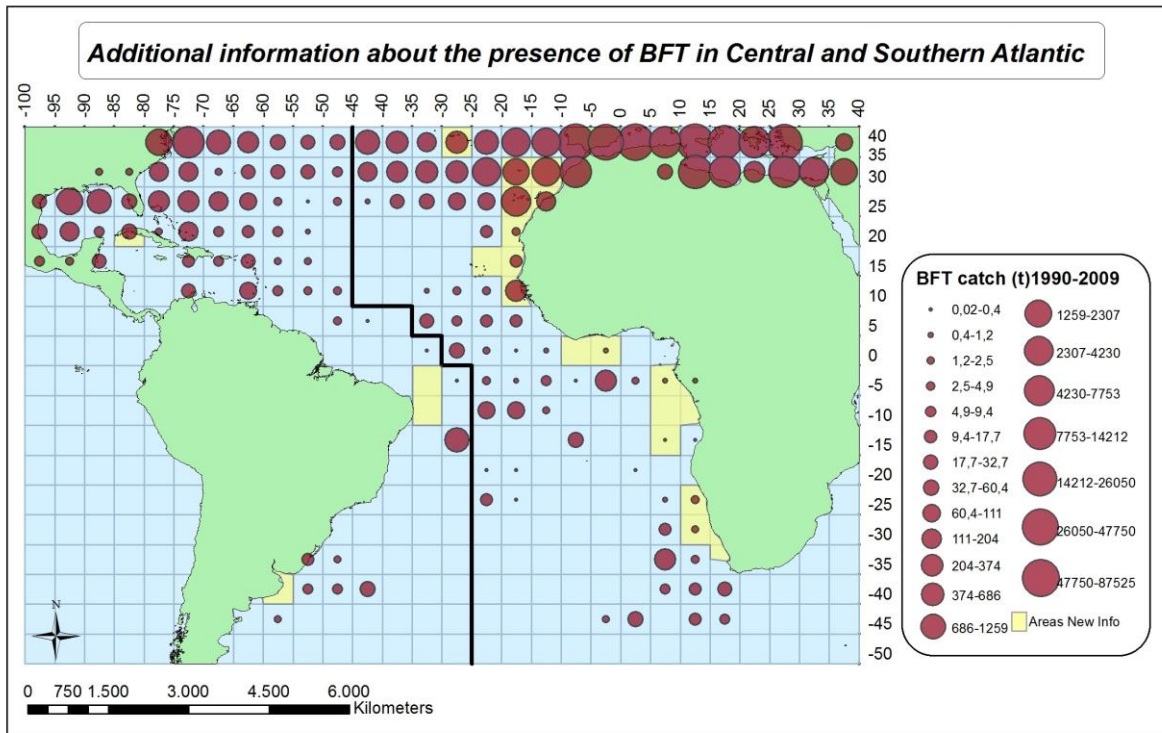
**Figure 6.** Natural marks on Bluefin tuna in the tuna trapin Larache (Morocco) in May 2012.



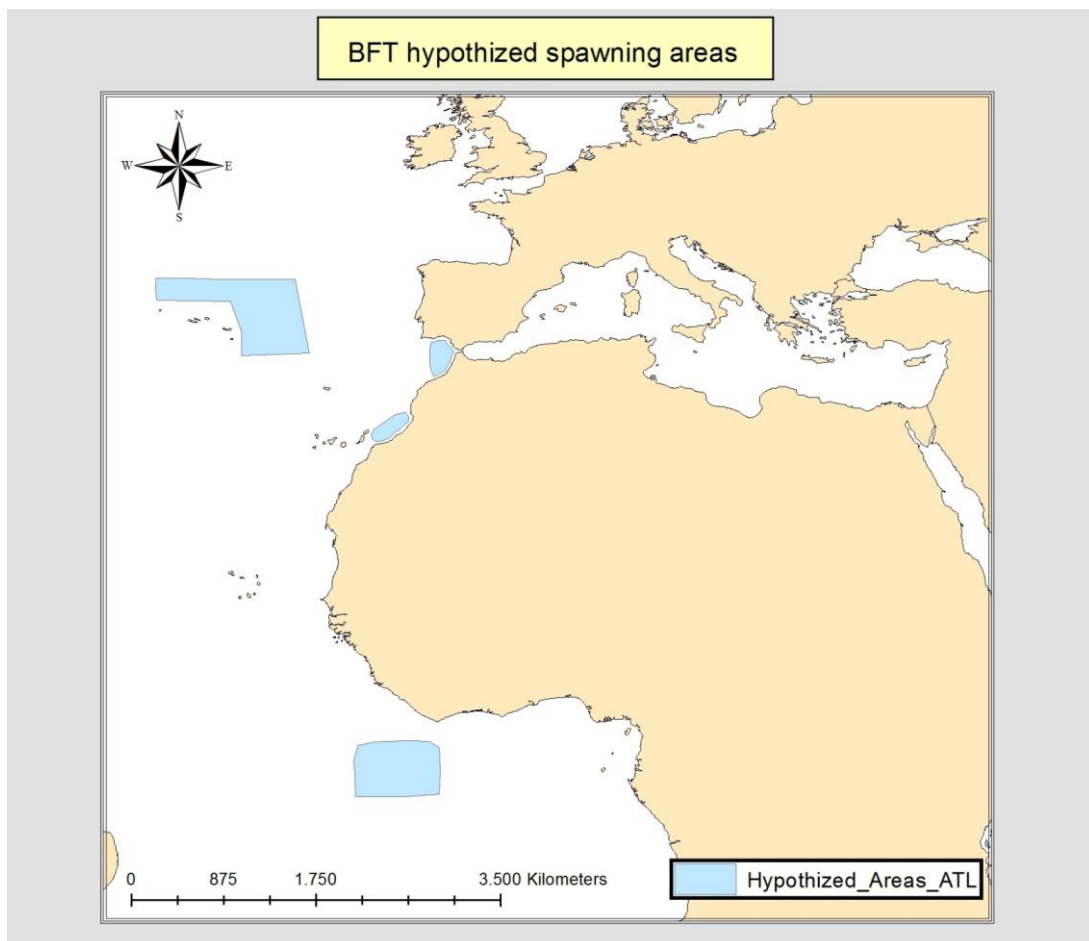
**Figure 7.** Graph of the total bluefin tuna catches reported central-South Atlantic in the last 20 years (from ICCAT data base)



**Figure 8.** Distribution of reported catches in central-South Atlantic (circles) and information about the recent presence of bluefin tuna in the various areas.



**Figure 9.** Reported bluefin tuna catches in the last two decades (circles) and recent information (squares).



**Figure 10.** Hypothesised bluefin tuna spawning areas in the Atlantic Ocean.