

ATLANTIC BLUEFIN TUNA : BIOLOGICAL TAGS REVISITED

Hester, F.J.

East Coast Tuna Association

RESUMEN

SUMMARY

There are two additional biological tags as possible indicators of mixing of bluefin tuna between the eastern Atlantic and Mediterranean Sea and the central and western Atlantic. These markers are the incidence of so-called crater wounds, bite marks of a tropical, epileptic shark *Isistius* spp. and infection with "white cloud" a sporozoan parasite. Both markers appear to occur with different frequency in different areas and may be useful in resolving mixing rates on spawning grounds and in the central Atlantic longline fishery. Data are easily obtained during normal fish handling, and a large data base could be developed quickly. In order to evaluate the usefulness of these markers sampling needs to be carried out from all the fisheries that take large bluefin tuna in the Atlantic and Mediterranean.

RESUMÉ

Deux autres marqueurs biologiques peuvent servir d'indicateurs du mélange de thon rouge entre l'Atlantique Est et la Méditerranée et l'Atlantique Central et l'Atlantique Ouest. Ces marqueurs sont la présence de lésions en cratère correspondant à la morsure d'un requin tropical épiléptique, *Isistius* spp., et d'une infection causée par un parasite sporozoaire. Ces marqueurs semblent se présenter de façon plus ou moins fréquente dans les diverses zones, et peuvent s'avérer utiles pour déterminer le taux de mélange dans les lieux de pêche et dans la pêcherie palangrière centre-atlantique. Les données sont faciles à obtenir pendant la manipulation normale du poisson, et une importante base de données pourrait être élaborée rapidement. Pour évaluer l'utilité de ces marqueurs, il faut mener de l'échantillonnage dans toutes les pêcheries qui capturent de grands thons rouges dans l'Atlantique et la Méditerranée.

Existen dos marcas biológicas adicionales que podrían servir de indicadores del intercambio de atún rojo entre el Atlántico este y el Mediterráneo y el Atlántico oeste y central. Estos marcadores son las heridas en forma de cráter, las marcas de mordiscos de un tiburón tropical epiléptico, *Isistius* spp., y la infección "nube blanca", un parásito esporozoo. Ambos marcadores parecen presentarse con diferente frecuencia en diferentes zonas, y podrían resultar útiles para resolver las tasas de mezcla en zonas de desove y en la pesquería palangrera del Atlántico central. Los datos se obtienen con facilidad en el curso de la manipulación usual del pescado y se podría establecer con rapidez una base de datos. Con el fin de evaluar la utilidad de estos marcadores, es necesario llevar a cabo muestreo en todas las pesquerías que capturan atún rojo grande en el Atlántico y el Mediterráneo.

Introduction

Since 1981 the SCRS has provided management advice for Atlantic bluefin tuna based on an assumption of two separate stocks: eastern Atlantic and Mediterranean and western Atlantic with the division line at about 45 degrees W. Although spawning was known to occur elsewhere, the eastern stock was considered to spawn only in the Mediterranean Sea and the western stock only in the Gulf of Mexico. Even though mark recapture experiments and opportunistic tagging show movements of fish across the line, the SCRS assumed mixing rates were sufficiently low that the two sides of the ocean could be managed separately. Recently the increased bluefin catch by high seas longline vessels just east of the division line has called this assumption into question. Further, Butterworth and Punt (1993) and NRC (1994) showed that under some circumstances even low mixing rates could have major management consequences if ignored. Subsequent attempts to refine such rates based on mark-recapture data failed since too few returns have been verified to produce estimates of the necessary precision.

The question of the origin and rates of mixing of bluefin tuna in the Atlantic and Mediterranean Sea is not new. NRC (1994) summarizes prior studies. These include Walters (1979) who looked at the frequency of occurrence of two ectoparasites on Atlantic bluefin tuna to attempt to estimate exchange rates between east and west. His data are reviewed in NRC (1994), which concludes the sample size was too small and the assumptions about the distribution of the parasites too uncertain to reach any detailed conclusions. An additional difficulty with Walter's approach is the collection of data is time consuming, requiring removal and preservation of the tuna heads, which limits participation by most fishermen and buyers. The present paper reports a preliminary look at two additional biological markers that may overcome some of these difficulties, though others may exist.

Material and Methods

Two additional biological markers occur for bluefin tuna. These are crater wounds and the presence of "white cloud". Crater wounds are scars from the bites of pelagic sharks of the genus *Isistius*, of which two species occur in the tropical Atlantic, but have not been reported from the Mediterranean (Compagno 1984). This small shark (<50 cm tl) is believed to be bathypelagic by day rising to mid depths and even the surface at night. It is luminescent, which may serve to attract large predators, which it then attacks! The jaws of the sharks are modified to allow the mouth to evert and specialized teeth to scoop a section of flesh about the size of an apricot out of the much larger prey such as tunas, billfish, cetaceans and even submarine sonar domes (ibid). In the Atlantic one species *Isistius brasiliensis* has been reported to occur in tropical waters from the Bahamas to Brazil in the west, the Cape Verde Islands and Ascension Island offshore and the Gulf of Guinea to Sierra Leone and southern Angola in the east. It has not been reported from the Mediterranean. A second species *I. plutodus* is known only from the Gulf of Mexico and off Okinawa (ibid). This species has larger teeth and appears to inflict a deeper, more elongate wound than its congener.

The bite wounds from these sharks heal to leave an indented scar, hence crater wound, that fills over time but likely always remains visible and identifiable by a fisherman, buyer or observer aboard a vessel. In the case of bluefin tuna, crater wounds seem limited to giant fish. Perhaps fish are only subject to attack when they enter tropical waters to spawn. Attacks could occur in the Gulf of Mexico and the Florida Strait south to off Brazil, as well as central and eastern tropical Atlantic. Since spawning has been reported in the Gulf of Guinea (Richards and Simmons, 1971), and since giant bluefin are reported by some fishermen to be seen "rushing" in the near shore waters off Sierra Leone, crater wounds could be expected to occur with some frequency on large Atlantic bluefin that venture into tropical waters, e.g. spawn in the Gulf of Mexico or the Gulf of Guinea, but not likely on school or medium fish, which appear confined to the temperate waters of the Atlantic, or on giants that spawn only in the Mediterranean.

The second marker is "white cloud", symptomatic of infestation by *Kudoa sporozoa*, a sporozoan parasite of tunas (and perhaps other species). Symptoms vary with tuna species. In bluefin the parasite manifests itself in the flesh as a clouding of tiny white cysts (Suda, pers. comm.). Occlusion of the flesh may be extensively invasive throughout the fish. Quite frequently it can be detected when the tail of the fish is cut by a buyer to determine fat content and quality. Infested fish usually have low market value, and buyers are skilled at detecting its presence. Incidence of white cloud appears highest in the western Atlantic in fish from the northeastern US. It seems less size specific than crater wounds, occurring in medium as well as giant bluefin. This suggests a possible extra-tropical distribution of the parasite or the vector. At this point little is known about the means or source of the infection, or what other species, if any, serves as a vector.

This season limited data was collected from fish caught in the western Mediterranean and in the west Atlantic. Ideal sampling is to measure every fish examined and count crater wounds if present, and note the presence or absence of white cloud when the fish is examined for market. This protocol was not followed closely this year so the observations are qualitative. To date approximately 1500 fish from the western Mediterranean were examined ranging in size from about 75 kg to over 300 kg. In the western Atlantic approximately the same number, mostly over 150 kg, were examined in catches from Canada and the US.

Results

The incidence of occurrence of white cloud and crater wounds between the north american fisheries and the Mediterranean fishery appear to be quite different. White cloud appears to be common (up to 10% of the medium and giant fish were affected at times), whereas infestations of Mediterranean fish is seldom reported and may be rare. Crater wounds were common on giant fish in the west, about 10% of the fish examined in the U.S. General Category and over 90% of the very large (250-400kg) Canadian fish had scars. In the western Mediterranean about than 1% of the fish examined had scars. The relation between number of crater wounds and fish length was not established, but appears to be positively correlated with increasing size.

Discussion

No conclusions should be drawn based on the preliminary data from these additional biological markers on movements and mixing rates by bluefin tuna. It does appear that the incidence of crater wounds is higher in the west than the east, perhaps related to spawning in the Gulf of Mexico. The origin of the crater wounds seen in Mediterranean fish is unclear. Does *Isistius brasiliensis* occur in the Mediterranean or were these fish attacked in the tropical Atlantic, and if so where. What is the relation of the fish reported from Sierra Leone to fish elsewhere. Are crater wounds found on fish from the central north Atlantic fishery. The size composition from this fishery is mixed, but sufficient large fish (FL >200 cm) are caught at the beginning of the season (Miyabe and Hiramatsu, 1993; Suda, 1993) to make examination for crater wounds worthwhile. The smaller fish are unlikely to have been subject to attack by *Isistius*; however, they may be subject to infestation by white cloud.

What is the area where infection by white cloud occurs and what is the etiology? Does *Isistius* spp. occur in the Mediterranean? What is the relation of Gulf of Guinea fish to the rest of the Atlantic? Some of these questions can be answered through systematic sampling. Others through cooperative exchange of information. To begin to answer them, priority for 1995-6 might include:

1. Systematic sampling for crater wounds and white cloud in catches from the central Atlantic, Spanish and Moroccan traps and eastern Mediterranean Sea.
2. A literature search for information on white cloud and other sporozoan parasites of large pelagic fishes, and distributional information on *Isistius* in the Mediterranean.
3. Verification of the occurrence of large bluefin tuna off Sierra Leone.
4. Investigate the possibility of distinguishing between crater wounds inflicted by *I. brasiliensis* and *I. plutodus*.

References

- Butterworth, D.S., and A.E. Punt. 1993. The robustness of estimates of stock status for the western North Atlantic bluefin tuna population to violations of the assumptions underlying the associated models. ICCAT Working Document SCRS/93/68.
- Compagno, L.J.V., 1984. FAO Species Catalogue, Vol. 4. Sharks of the world, Part 1 - Hexanchiformes to Lamniformes. p90 ff.
- Miyabe, N. and K. Hiramatsu. 1993. Description of the Japanese longline fishery operating in the central North Atlantic. ICCAT Working Document SCRS/93/49.
- National Research Council, 1994. An Assessment of Atlantic Bluefin Tuna. Nat'l Acad. Press, Wash. D.C. 148 pp.
- Suda, A. 1993. Some preliminary observations on the biological characteristics of the concentrations of bluefin tuna in the northwestern and central North Atlantic Ocean. ICCAT Working Document SCRS/93/138.
- Walters, V., 1979. Ectoparasites of eastern and western Atlantic bluefin tuna. ICCAT Working Document SCRS/79/79.