BLUEFIN TUNA (THUNNUS THYNUS L.) LINE FISHERIES IN THE ITALIAN SEAS. OLD AND RECENT DATA

A. Di Natale¹, A. Mangano¹, C. Piccinetti C.², E. Ciavaglia², A. Celona¹

SUMMARY

The tuna hand line fishery is important in several Italian areas. In the Straits of Messina, the most important narrow passage in the Mediterranean Sea, it is studied since several decades. The old and new data sets might help to add knowledge about the movements of the bluefin tuna stock. A recent longline fishery for tunas has been developed in the central-northern Adriatic Sea and it is carried out all the year round, providing the same level of information of the hand line fishery. According to these data, it appears quite clear that there is an important part of the stock remaining in the Mediterranean also in fall and winter times, possibly for more than one year, and this fact is constant. The size composition of this autumn-winter component includes only “resident” tunas, while the spring-summer fishery includes both the “resident” and the “migratory” components. The stable trend over the long time of the “resident” tunas in the Mediterranean Sea confirms the importance of this bulk component of the stock.

1 Aquastudio Research Institute, Via Trapani 6, 98121 Messina, Italy.
2 Laboratorio di Biologia Marina e Pesca, Università di Bologna in Fano, Italy.
1. Introduction

The bluefin tuna, *Thunnus thynnus* (L.), is one of the most discussed large pelagic species, because the poor knowledge of its population movements implies several management problems.

As a matter of fact, the bluefin tuna is one of the most typical Mediterranean species, known since ancestral times. Pre-historic graffiti, ancient Greek paintings on pottery, the descriptions made by Oppianus (177 B.C.) and by Plinius the Old (1 century B.C.) and the more recent scientific literature are all good proof of the importance of this species for the Mediterranean coastal inhabitants.

The Mediterranean Sea as a whole is the most important spawning ground for this species, even if another minor spawning ground is known since more recent times in the Gulf of Mexico. The Mediterranean and Atlantic bluefin tuna were split for management purposes into two separated stocks by ICCAT (1982): the West Atlantic stock, having a spawning ground in the Gulf of Mexico and distributed along the western Atlantic, particularly along the north American coast, and the East Atlantic stock, having the spawning ground in the Mediterranean Sea and distributed in the central and eastern Atlantic, in the Mediterranean Sea and, in the past, even in the Black Sea.

According to the halieutic science, a stock is a management unit, but its link with the natural history of a certain species is not always obvious. On the opposite, population is a biological concept, strictly based on the natural history of the species, sometimes with genetic evidence.

But what about the movements of this migratory species? In ancient times, most of the people thought that most of the bluefin tunas were almost resident in the Mediterranean. The tuna trap industry, on the opposite, since the XVI century, was based on the idea to have bluefin tuna seasonally travelling inside the Mediterranean and from the Atlantic Ocean. In the XX century, various signs (Norwegian hooks, bites made by an Atlantic shark, *Isistius brasilensis*, etc.) and the first spaghetti tagging programmes clearly demonstrated tuna periodical movements from the Mediterranean Sea to the east Atlantic Ocean and *viceversa*, while other observations confirmed the presence of the bluefin tuna in the Mediterranean all the year round.

In more recent times, the tagging by archival tags and satellite pop-up tags provided a more detailed information, showing sometimes large movements and travels, other times local movements and prolonged residences. The puzzle figure about the migrations and travels appears always incomplete and the discussion about the real mixing of the two stocks is still going on among scientists and managers, while a theoretical figure, having a 5% mixing between the two stocks was several times adopted in the VPA analysis, periodically carried out by ICCAT.

At this time, it is important to recover all the existing information, trying to provide the necessary background for a better understanding the natural history of this species.

Following this exercise, we decided to examine all the available data about one of the traditional fishery in Italy, the hand line fishery for tuna in the Straits of Messina, along one of the most important and narrow passage for the tuna travelling inside the Mediterranean Sea or migrating from the Atlantic Ocean. As a matter of fact, the Straits of Messina is the most narrow “tuna gate” in the Mediterranean.

In this area there are traditionally several types of fishing activities targeting bluefin tuna. The most documented is the historical harpoon fishery, targeting this species, but also swordfish (*Xiphias gladius*), Mediterranean spearfish (*Tetrapturus belone*) and sometimes even the sunfish (*Mola mola*). Due to the fact that this fishery can catch only specimens coming to the surface and that is not carried out in autumn-winter, all the data coming from this activity have not been used in this exercise, because they are not comparable with the others. At the same time, the data related to the surface hand-line troll fishery targeting juvenile tunas in fall, illegal since several years, have not been used for the same reason. As a consequence, the only data used in this trial are those related to the hand line fishery, either troll or drifting, targeting bluefin tuna other than juveniles.
Additional data have been collected also in another area, in the Adriatic Sea. This basin shallow and colder than other Italian seas, also has a traditional tuna fishery. In more recent times (from 1999), a longline fishery has been developed, as a consequence of the proper conditions and the bluefin tuna presence all the year round. The use of this new information can help to better describe the situation.

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2. Methods


It was impossible to find the originals files collected by Scordia and Genovese, even checking the archives at the University of Messina; as a matter of fact, the individual measures taken by them in 1932-35 and in 1948-54 seem to be lost.

The data have been recovered by the published papers, in the form used by the two authors. Scordia (1932, 1934a, 1934b, 1935, 1936, 1937, 1938) used 10 weight classes, Genovese (1953, 1955, 1958, 1959) used 15 weight classes, both with different intervals. Due to the lack of the individual data, the classes have been kept as they were published.

The most recent data (Di Natale 2003, 2004), concerning the tuna taken by this fishery in the years 2000 to 2003, were fully available and have been presented according to the ICCAT format.

To better represent the situation in the various periods taken into consideration, it was necessary to define the period of the fishery targeting mostly tuna considered as residents (fall-winter) from the fishery targeting also migrant tunas (spring-summer). The two periods have been defined according to the detailed description provided by Scordia (1932, 1934a, 1934b, 1935, 1936, 1937, 1938) and Genovese (1953, 1955, 1958, 1959), integrated by the more recent information provided by Arena (1963, 1981, 1982, 1988) and Arena \textit{et al}. (1979), for the same geographical zone.

According to this information, the data from September to March have been used to describe the weight frequency of the bluefin tuna resident in the area, while the data from April to August have been used to describe the spring-summer fishery, including both the “migratory” component and the “resident” tunas.

All the data have been collected in the fishermen village of Ganzirri, located north of Messina (Sicily), on the western side of the Strait.

Data from the north-central Adriatic Sea, obtained from the new log-line fishing activity, were collected at landing all the year round in the harbour of Fano, where the longline fleet is based.

3. The fishery

The commercial hand line fishery for bluefin tuna is a traditional activity in the Straits of Messina. It is now carried out by a fleet of very small wooden vessels (between 5 to 8 m in length), variable in number from year to year, usually with two fishermen on board.

The autumn-winter fishery is carried out either during the day or the night, with hand lines having single hooks. These hooks were originally hand-made in iron by local artisans, while now they are industrial and made in steel. The day fishing is carried out trolling the line behind the vessels, at slow speed, particularly in autumn. Hooks are generally medium-size, having white chicken plumes or, in the past, a wooden fish. The night fishing is carried out keeping the line vertical, passively using the current of the Straits; the fishing depth is between 40 to over 200 m and the hooks are big, having live \textit{Trachurus trachurus} or \textit{Anguilla anguilla} as bait.
The spring-summer fishing is carried out mostly at night, using a bigger hook and the same type of bait used in winter. The fishing depth is usually shallower if compared to the winter one. The day fishing is carried out in the same manner than in winter, substituting the plumes with fish bait.

All the various types of tuna lines had metallic wires as a terminal component, to reinforce the strength. In old times, it was in copper wire, nowadays is often in harmonic steels, sometimes made even by piano cords. The main line was made in natural fibres and nowadays is made in thick monofilament nylon or in multifilament polyammyde.

Fishing with the vertical line may be done, also, keeping the line at the bottom, by a stone or a lead at a certain distance from the hook. The last part of the line, with hook and bait, is free to float drifting by the current. The success of this fishing method implies that the tuna can pass over the bottom for feeding on nektonic species in some periods.

Due to the low size of the vessels, the large size tuna are usually kept along the side and the vessels go back to the village after each relevant catch; only small and medium size tunas are kept on board. For the same reason, the fishery is carried out only with good weather conditions and according to the direction of the strong currents of the Straits. The home harbours are located in Messina and in the near villages of Pace, St. Agata, Ganzirri and Torre Faro along the Sicilian side of the Straits and in Punta Pezzo, Catona, Villa San Giovanni and Scilla along the Calabrian side. The fishing ground include the southern part of the Straits in front of the Calabrian coast and the true Straits between Calabria and Sicily, but not the area north of Capo Peloro (Sicily).

A fleet of modern vessels in Fiberglas carries out the commercial longline fishery in the north-central Adriatic, targeting both bluefin tuna and swordfish with the same gear. The average length of these vessels is around 18 metres and they use an American type longline with about 1000 hooks, fishing at about 30-40 m depth (taking into account the very shallow waters in the Adriatic Sea). This fishery is carried out all the year round, with good weather conditions, for three days a week (Friday, Saturday and Sunday), to avoid any interference with the trawl fishery.

4. The data

In the years 1932-35, Scordia collected a total of 3157 weight samples, from 15 to over 400 kg. Among these, 2302 fishes were caught during the autumn-winter fishery, while only 855 have been caught in the spring-summer fishery. The fall-winter data show two major components: between 15 to 49 kg and the mode situated in the following class between 50 to 99 kg (Figure 1).

In the years 1948-54, a total of 6667 weight samples have been collected by Genovesi, from <4.4 to over 344 kg. Among these, 6573 fishes were caught during the autumn-winter fishery, while only 94 have been caught in the spring-summer fishery. Even here, due to the very low sample obtained from the spring-summer fishery, only the autumn-winter data set is represented in Figure 2. The mode was between 25 to 39 kg for the resident tunas.

In the years 2000-03, Aquastudio collected a total of 824 weight samples, from 15 to 269 kg. Among these, 398 fishes were caught during the autumn-winter fishery, while 426 have been caught in the spring-summer fishery. For the first time, these data sets got a comparable level, even if the total catch was at a lower level than in the past. Figures 3 and 4 show the frequencies. The mode was between 40 to 44.9 kg for the “resident” tunas and between 45 to 49.9 kg for the tunas caught in spring-summer.

To better clarify the situation of the various data sets used for this exercise, it is useful to show the entire data bank available, which clearly shows the discrepancy in number of samples between the fall-winter fishery and the spring-summer one, discrepancy almost null only the most recent data set. Table 1 shows the entire data bank and Figure 5 shows it in a clear graph.

The last data set concerns the data collect in the Adriatic Sea between 2002 to 2004 by the Laboratory in Fano from a new longline fishing activity carried out all the year round. Due to the natural characteristic of the Adriatic Sea, the season separation is slightly different from the previous one, because it is supposed that, if any migrant fishes may arrive in the area, this can happens only after April, because of the water temperature and the geographical location. The same two-month delay has been adopted at the end of the summer period. As a matter of fact, the three available data sets concern the autumn-winter 2002-2003, the spring-summer fishery from May
to October 2003 and the fall-winter fishery from November 2003 to April 2004. In the case of the samples taken in the Adriatic Sea, the samples are related to the length frequencies in cm, adopting the ICCAT format.

Figure 6 shows the data from the fall-winter fishery in 2002-2003, having the mode in the class between 150 to 154 cm; Figure 7 shows the data from the spring-summer fishery in 2003, having the mode in the class between 125 to 129 cm; Figure 8 shows the data from the fall-winter fishery in 2003-2004, having the mode in the class between 130 to 135 cm.

5. Discussion

The first observation raise from the different compositions in number between the two periods taken into account (spring-summer and autumn-winter) in the two historical data sets from the hand-line fishery in Straits of Messina. The different distribution of the samples, with a very high proportion of “resident” tuna obtained by the autumn-winter fishery, is not well explained in the original papers concerned, but it is clearly stated that the hand line fishery was carried out in all the months, in all the days having good weather conditions. In theory, the sampling should be lower in autumn-winter, but it is clearly not the case, because only 1375 tunas were sampled in spring-summer, 12.91% over a total of 10648 fishes. Anyway, from the above-mentioned data sets it is possible to get interesting information even taken into account that these data sets are coming from three different historical periods. In the most recent years when the sampling has been carried out, the summer hand-line fishery and the autumn one almost disappear in the last four years, clearly affecting the total data (put possibly in a neutral manner). As a result, it was possible to better balance the sampling, even if it was based on a lower level of catches compared to the old times.

Some interesting aspects become more evident looking at the bluefin tuna average weight per year concerning the fall-winter fishery in the various data sets. The data are showed in Table 2, and plotted in a graph in Figure 9. It appears quite clear that the “resident” tunas, taken by the fall-winter fishery are almost stable in terms of trend of the average weight in the long period. It is very important to underline that, besides of the average weight in the various years, all the samples include also big fishes, always over 150 kg and up to over 235 kg.

At the same time, it is important to notice that the most recent data sets (Figure 3-4 and 7-8) are showing a clear overlapping between the so-called “resident” tuna and the catches obtained from the spring-summer fishery that is thought to include also a migratory component.

This is confirmed either by the data sets obtained from the hand-line fishery in the Straits of Messina or the data from the recent longline fishery in the north-central Adriatic Sea. In both cases the size frequencies are similar in the distribution.

6. Conclusion

It is sufficiently obvious that the catches obtained by the hand line fishery in the Straits of Messina in autumn-winter (September to March) mainly consist of adult “resident” tunas, because they happen in a period when usually adult tunas are still to enter into the Mediterranean or had left this basin after spawning.

These “resident” tunas, generally older than the year of first maturity, are not necessarily fishes living in the Mediterranean for their entire life. It is likely that a large part of these “resident” tunas had spawn in the previous season. They can stay in the Mediterranean waters for various periods of their life, at least for more than one year up to a non-defined and unknown number of years, spending their time here travelling and possibly reaching the eastern part of the Mediterranean or moving westward.

The fraction of tuna stock fished in spring-summer appears even more complex, if possible. It includes tunas entering from the Atlantic Ocean into the Mediterranean Sea in spring to spawn, and the “resident” tunas, often coming at the surface for spawning.

According to the recent data obtained from the hand line and the longline fisheries, it seems that the most important component of these spring-summer catches is made of resident tunas. This affect the general figure of the “migratory” component, because it overlaps resident and migratory specimens taken in the same period and that cannot be easily distinguished. The size composition is similar to the catches obtained in the opposite period.
The old catch data, confirmed by the most recent ones in the Straits of Messina and in the north-central Adriatic Sea, demonstrate that medium and large tunas, other than the young classes, live all the year round in the Mediterranean. These fishes are not preys of the currently most used fishing gear because they mainly don’t live in surface waters.

We cannot say how relevant should be the number of specimens coming from the Atlantic Ocean to enter into the Mediterranean for spawning. But we can also affirm that the “resident” component is very important. The stable trend in mean weight during the last 70 years of the “resident” tunas demonstrate that the relevant level of Mediterranean catch over the last 6 years had never evidently affected this component of the stock. 3

7. Bibliography


3 This paper has been preliminary presented and discussed at the 2nd Meeting of the Working Group to Develop Integrated and Co-ordinated Atlantic Bluefin Tuna Management Strategies, held in Marseille, France, 17-20 May 2004.


OPPIANUS, 177 B.C. De alieutica. Della caccia e della pesca. 1a ed. italiana, Roma, 1756: 1-183.


Table 1. Proportion of samples between spring-summer and autumn-winter hand line fisheries in the Strait of Messina.

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<td>898</td>
<td>80</td>
<td>656</td>
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<td>315</td>
<td>3618</td>
<td>1479</td>
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<td>600</td>
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<td>45</td>
<td>23</td>
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<td>220</td>
<td>283</td>
<td>105</td>
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Table 2. Mean weight (kg) of BFT taken from the fall-winter hand line fishery in the Strait of Messina.

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<td>mean weight</td>
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<td>79.8</td>
<td>65.9</td>
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<td>57.6</td>
<td>43.5</td>
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<td>50.3</td>
<td>56.4</td>
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Figure 5 - Graphic proportion of fall-winter and spring-summer BFT in the samples taken from the hand line fishery in the Straits of Messina
Figure 6 - Length frequencies of BFT taken by the long-line fishery in the north-central Adriatic Sea between November 2002 to April 2003. no = 153

Figure 7 - Length frequency of BFT taken by the long-line fishery in the north-central Adriatic Sea between May to October 2003. no = 232

Figure 8 - Length frequency of BFT taken by the long-line fishery in the north-central Adriatic Sea between November 2003 to April 2004. no = 181
Figure 9 - Mean weight of "residents" BFT taken by the hand line fishery in the Strait of Messina in autumn-winter.