

## LARVAL DISTRIBUTION OF BULLET TUNA (*AUXIS ROCHEI*) IN THE EASTERN COAST OF TUNISIA (IONIAN SEA-MEDITERRANEAN)

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### SUMMARY

*An ichthyoplankton survey was carried out on board of the R/V Hannibal, from the 23<sup>rd</sup> June to the 9<sup>th</sup> July 2008 along the eastern coast of Tunisia (Ionian Sea-Mediterranean). Summer conditions were established, the mean sea surface temperature was 24.55°C and the water column was well stratified. Surface layers, mainly in the north part, were under the influence of Atlantic current. The present work makes evidence of the spawning of *Auxis rochei*. The larvae were concentrated offshore (far from the coast 70 to 100 miles) near the limits of the continental shelf (depth 150 to 220 m), in the east of the Sousse city. Positives stations made a continuous area. This area overlapped with the high abundance of zooplankton.*

### RESUME

*Une campagne d'échantillonnage d'ichtyoplancton a été effectuée à bord du N/R Hannibal, du 23 juin au 9 juillet 2008 le long des côtes Est tunisiennes (Mer Ionienne-Méditerranée). Les conditions estivales ont été installées. En effet, la température des eaux de surface a été de 24,55°C et la colonne d'eau a été bien stratifiée. Les couches de surface, principalement dans la partie nord, ont été sous l'influence du courant atlantique. La région Est tunisienne est une aire de ponte de la bonite (*Auxis rochei*). Les concentrations des larves ont été localisées au large aux limites du plateau continental (150 à 220 m), soit 70 à 100 miles de la côte de Sousse. Les stations de présence des larves ont représenté une aire continue. Cette aire a coïncidé avec celle de fortes concentrations du zooplancton.*

### RESUMEN

*Se realizó una prospección de ictioplancton a bordo del R/V Hannibal, desde el 23 de junio al 9 de julio de 2008, a lo largo de la costa oriental de Túnez (Mar jónico- mar Mediterráneo). Se establecieron las condiciones estivales, la temperatura media de la superficie del mar fue de 24,55° y se estratificó la columna de agua. Las capas superficiales, sobre todo en la parte septentrional, estaban bajo la influencia de la corriente del Atlántico. Este trabajo presenta evidencias de la reproducción de *Auxis rochei* en la zona oriental del Atlántico. Las larvas se concentraron en alta mar (a una distancia de 70 a 100 millas de la costa) cerca de los límites de la plataforma continental (profundidades de entre 150 y 220 m) al este de la ciudad de Sousse. Las estaciones de presencia de larvas representaron una zona continua. Esta zona se solapa con la zona de elevada abundancia de zooplancton.*

### KEYWORDS

*Auxis rochei, Fish larvae, Environmental conditions, East Tunisia, Mediterranean Sea*

### 1. Introduction

Bullet tuna *Auxis rochei* is one of the most important species of small tuna cached along the Tunisian coasts. For the management of this resource we should study all the life cycle (egg, larva, juvenile and adult). However, studies in larval stage are scarce. In the western Mediterranean we note the work of Oray and Karakulak (2005). Then, in the aim to improve the knowledge on the ecology of the species we investigated the larval distribution on the eastern coast of Tunisia.

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## 2. Material and methods

A multidisciplinary cruise (*ESPOIRS 9*) was carried out on board of the *R/V Hannibal*, from the 23<sup>rd</sup> June to the 9<sup>th</sup> July 2008 along the eastern coast of Tunisia (Ionian Sea-southern Mediterranean). **Figure 1** shows the 71 stations. The distance between each station was 10 nautical miles apart. The maximum bottom depth was around 420 m.

Temperature and salinity profiles were recorded at each station by CTD casts, using a Sea Bird 911+. Water samples for chlorophyll a were taken with Niskin bottles mounted in a rosette. Chlorophyll-a samples were filtered on board through Whatman GF/C glass fibre filters, which were frozen at  $-20^{\circ}\text{C}$ .

The fish larvae were sampled with a Bongo net of 60 cm mouth diameter, fitted with 335  $\mu\text{m}$  mesh nets, in oblique tows and at a vessel speed of 3 knots. The maximum depth sampled was 100 m, wherever possible, or to about 5 m above the bottom at shallower stations. These samples were preserved in 4% borax-buffered formalin.

Zooplankton was sampled by means of a smaller plankton net, 25 cm mouth diameter fitted with a 100  $\mu$  mesh, attached to the bongo net. Hydro-Bios flowmeters were fitted to the mouth of both nets to measure the volume of water filtered. Samples from 100 microns mesh were preserved frozen at  $-20^{\circ}\text{C}$ .

Chlorophyll-a was determined using the conventional technique proposed by Lorenzen (1967). Zooplankton dry weight was determined by drying zooplankton samples in an electric oven at a temperature of  $60^{\circ}\text{C}$  during 72 hours. Bluefin tuna larvae were identified, sorted and counted. These larvae and zooplankton biomass were standardised to number per  $10\text{ m}^2$  of sea surface.

## 3. Results and discussion

### 3.1 Environmental conditions

North-south gradients in sea surface temperature (SST) and salinity (SSS) were recorded (**Figure 2**). At surface, colder waters ( $<22.5^{\circ}\text{C}$ ) were found near Cape Bon and offshore the Gulf of Hammamet and warmer waters ( $>25^{\circ}\text{C}$ ) in the south. Relatively low saline waters ( $<37.3$ ) dominated the study area, mainly in the northern part.

Summer conditions were established, since the mean SST was  $24.55^{\circ}\text{C}$  and the water column was well stratified (**Figure 3**). In the thermocline region, temperature varied between 17 and  $24^{\circ}\text{C}$ . Deeper waters (below 220 m) showed temperatures of about  $14^{\circ}\text{C}$ .

The highest chlorophyll-a concentrations were found in the north and in the east of Kuriate Island and the highest zooplankton biomasses were recorded in the east and in the southeast of this Island (**Figure 4**).

The vertical structure of water column, characterized by a strong stratification of both salinity and temperature and high SST, was typical of the season (summer) in temperate coastal regions. The positive gradients of SST and SSS from the north to the south show the influence of Atlantic Waters in upper layer of the eastern coast of Tunisia. This result is in agreement with other studies on circulation of Modified Atlantic Water MAW (Herbaut *et al.*, 1998; Fernandez *et al.*, 2005).

### 3.2 *Auxis rochei* larval abundance and distribution

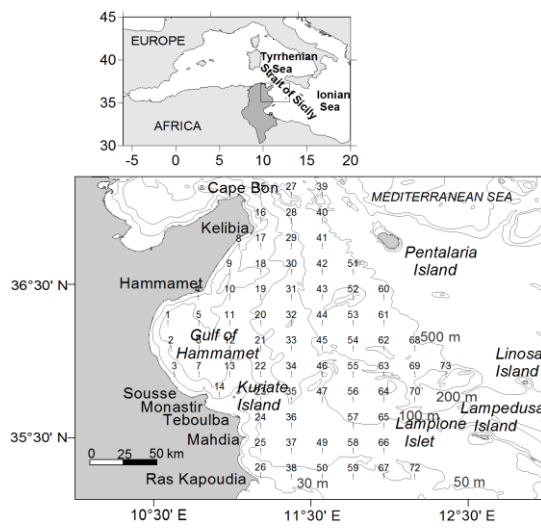
The *Auxis rochei* larvae were localised offshore in the limits of the continental shelf (depth 150-220 m), in the east of Sousse City, 70 to 100 miles from the coast (**Figure 5**). The positives stations form a continuous area. The highest concentration was 738 larvae/ $10\text{m}^2$ .

## 4. Conclusion

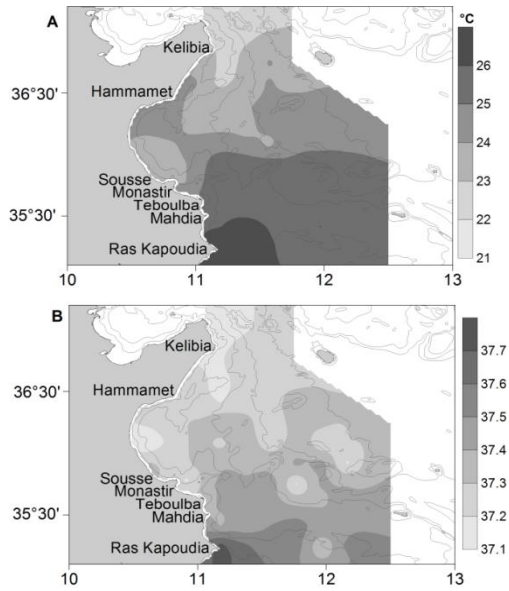
The present work makes evidence of *A. rochei* spawning in the eastern coast of Tunisia. The spawning time correspond to summer conditions: high sea surface temperature and thermocline installation. The spawning ground was offshore, in the limits of the shelf break, at 70 to 100 miles from the Tunisian coasts. It overlaps with the area of high zooplankton biomass.

## References

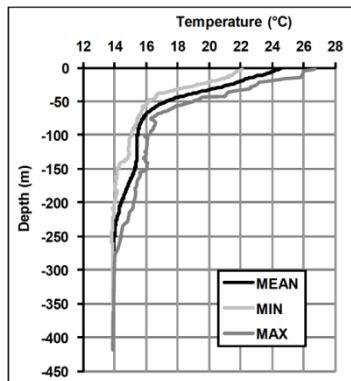
- Herbaut, C., Cordon, F. and Crépon, M. 1998. Separation of a coastal current at a strait Level: Case of the Strait Sicily. *J. Phys. Oceanogr.* 28: 1346-1362.
- Lorenzen, C.J. 1967. Determination of chlorophyll and phaeo-pigments: spectrophotometric equations. *Limnol. Oceanogr.* 12 : 343-346.
- Oray I. and Karakulak S. 2005. Further evidence of spawning of bluefin tuna (*Thunnus thynnus* L., 1758) and the tuna species (*Auxis rochei* Ris., 1810, *Euthynnus alletteratus* Raf., 1810) in the eastern Mediterranean Sea: preliminary results of TUNALEV larval survey in 2004. *J. Appl. Ichtyol.* 21: 236-240.



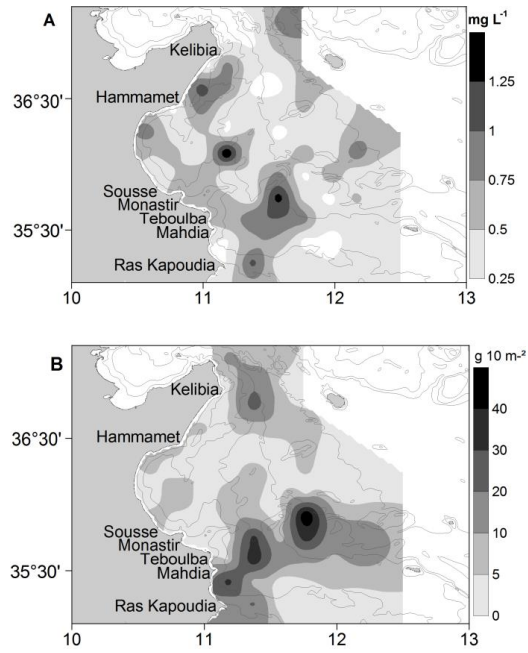
**Figure 1.** Location of the study area and sampling stations.



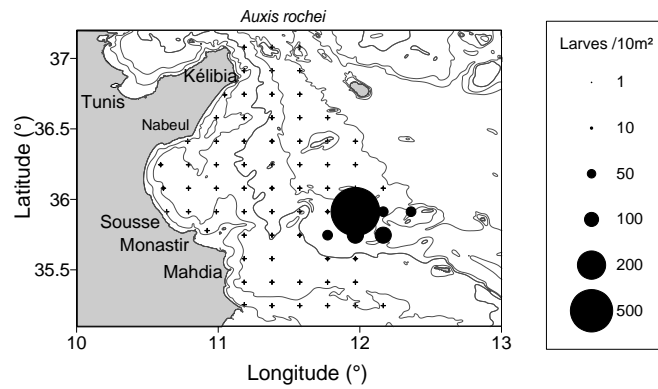
**Figure 2.** Horizontal distribution of (A) temperature and (B) salinity at surface (5 m).



**Figure 3.** Vertical profiles of temperature (min, mean and max).



**Figure 4.** Horizontal distribution of (A) chlorophyll-a at surface dry weight of (B) zooplankton biomass.



**Figure 5.** Horizontal distribution of bullet tuna *Auxis rochei* larvae in the East of Tunisia.