

LARVAL HABITAT OF BULLET TUNA (*AUXIS ROCHEI*) IN THE GULF OF GABES (IONIAN SEA-MEDITERRANEAN)

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SUMMARY

A multidisciplinary cruise was carried out on board of the R/V Hannibal, from 25 June to 4 July 2009 along the Gulf of Gabes (Ionian Sea-Mediterranean). In total 80 stations were investigated. Summer conditions were established, the mean sea surface temperature was 5.31°C and the water column was well stratified. The larvae of Auxis rochei were mainly concentrated between the isobaths 50 and 200 m, depicting a linear shape distribution from the South-West towards North-East. The highest concentration was 231 larvae/10m². The spawning grounds were mainly offshore.

RÉSUMÉ

Une campagne multidisciplinaire a été effectuée à bord du navire de recherche Hannibal, entre le 25 juin et le 4 juillet 2009 dans le golfe de Gabès (mer Ionienne-Méditerranée). Au total, 80 stations ont été prospectées. Les conditions estivales ont été établies, la température moyenne de surface de la mer s'élevait à 5,31°C et la colonne d'eau était bien stratifiée. Les larves d'Auxis rochei se concentraient principalement entre les isobathes de 50 et 200 m, affichant une distribution de forme linéaire à partir du Sud-Ouest vers le Nord-Est. La concentration la plus élevée était de 231 larves/10m². Les zones de frai se situaient principalement au large.

RESUMEN

Se ha efectuado una campaña multidisciplinar a bordo del buque de investigación Hannibal, a partir del 25 de junio hasta el 4 de julio de 2009, en el golfo de Gabès (mar Jónico-Mediterráneo). En total se han realizado prospecciones en 80 estaciones. Se han establecido las condiciones estivales, la temperatura media de la superficie del mar era de 5,31°C y la columna de agua estaba bien estratificada. Las larvas de melvera se concentraron sobre todo entre las isobatas 50 y 200 m, lo que supone una distribución de forma lineal a partir del sudoeste hacia el nordeste. La mayor concentración de larvas fue de 231 larvas / 10m². Las zonas de reproducción se situaban sobre todo en la costa.

KEYWORDS

Auxis rochei, Larval habitat, Gulf of Gabes, Mediterranean Sea

1. Introduction

The Gulf of Gabes is located in the southern Mediterranean Sea, forming part of the Ionian Sea (33°–35°18' N and 9°30'–13°36' E) (**Figure 1**). It occupies a wide and shallow continental shelf, reaching only 50 m depth 110 km offshore. A depth of 200 m is reached 400 km offshore (Hattab *et al.*, 2013). This region also includes several Islands (Kerkennah Archipelago and Djerba) and lagoons (Bougrara and El Bibane) and it is also characterised by a relatively high tidal amplitude with values around 1 m (Abdennadher *et al.*, 2006).

The biological and economic importance of the Gulf of Gabes is reflected in its faunal complexity and the abundance of its fishery resources, especially small and large pelagic fishes (Anon., 2011). The coastline length is of 700 km, accounting for more than a half of the Tunisian coast.

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Bullet tuna *Auxis rochei* is one of the most important species of small tuna cached in the Gulf of Gabes. 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 southern coast of Tunisia.

2. Material and methods

A multidisciplinary cruise (*ESPOIRS 11*) was carried out on board of the *R/V Hannibal*, from the 25th June to the 04th July 2009 in the Gulf of Gabes-Tunisia (Ionian Sea-southern Mediterranean). In total 80 stations were sampled (**Figure 1**). The distance between each station was 10 nautical miles apart. The maximum bottom depth was around 230 m.

Temperature and salinity profiles were recorded at each station by CTD casts, using a Sea Bird 911+. The fish larvae were sampled with a Bongo net of 60 cm mouth diameter, fitted with 335 μ 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 μ 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°C .

Bullet tuna larvae were identified, sorted and counted. These larvae and zooplankton biomass were standardised to number per 10 m² of sea surface.

3. Results and discussion

3.1 Environmental conditions

The mean sea surface temperature (SST) was $25.31 \pm 0.69^{\circ}\text{C}$. Warmer waters were found in the east of Kerkenah Islands and in the south of the inner part of the Gulf (**Figure 2a**). Relatively colder waters were found offshore, north and south of the study area. Saltier waters (> 39) were found near the coast of Gabes city (**Figure 2b**). Minimum salinity values were recorded offshore north of the study area. The most instable column water was recorded also in the north (**Figure 2c**). Higher current speeds were measured in the inner part of the Gulf (**Figure 2d**). A branch of the current coming from the north was divided into two flows; one directed to the west and the second to the south-east. The influence of AW in Gulf of Gabes seems important in summer. Indeed, the waters with salinity lower than 37.7 covered a large part of Gulf.

Water column was well stratified, with the thermocline ranging between 10 and 50 m depth, with a vertical difference in temperature up to 8°C , whereas it was well mixed in winter (**Figure 3**). For both seasons the only significant correlation was found between SST and SSS in summer ($R^2 = 0.23$, $p = 0.04$).

Zooplankton biomass followed an irregular pattern of horizontal distribution (**Figure 4**). In summer higher values ($> 50 \text{ g } 10 \text{ m}^{-2}$) were registered in the south of Sfax city, in the north and north-east of Djerba and in the north east of study area. In winter higher values ($> 200 \text{ g } 10 \text{ m}^{-2}$) occurred in the east of Djerba Island.

3.2 *Auxis rochei* larval abundance and distribution

The larvae of *Auxis rochei* were mainly concentrated between the isobaths 50 and 200 m, depicting a linear shape distribution from the South-West towards North-East (**Figure 5**). The positive stations ($n=20$) represented 25% from the total ($n=80$). The highest concentration was 231 larvae/10m². It overlapped with the high concentration of zooplankton biomass. The majority of larvae were found offshore. Only one station was located near the coast of Kerkenah Islands, with the depth of 45 m.

The t-test showed that there a significant difference ($p<0.05$) in depth and stability of column water (SWC). The mean depth and SWC for positive stations were 87 and 44 m and 14.7 and 20.0 cm/s, respectively.

4. Conclusion

The present study makes evidence that the Gulf of Gabes (southern coast of Tunisia) is a spawning area of *Auxis rochei*. The spawning conditions correspond to summer: high sea surface temperature and thermocline installation. The spawning grounds were mainly offshore.

References

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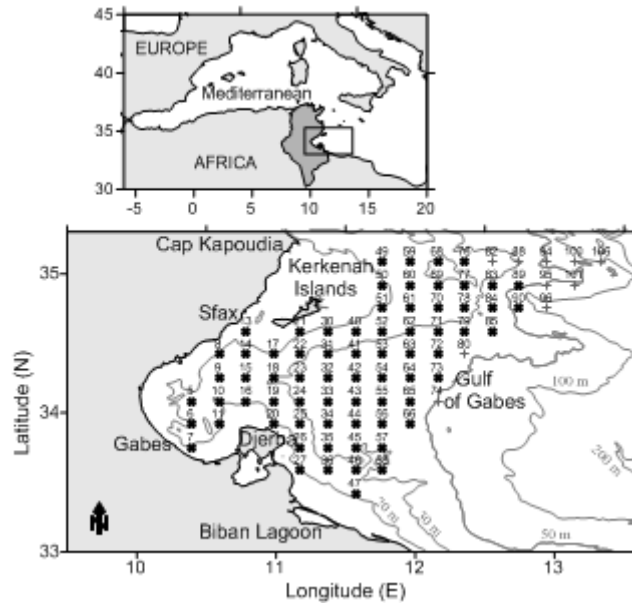


Figure 1. Location of the study area and sampling stations.

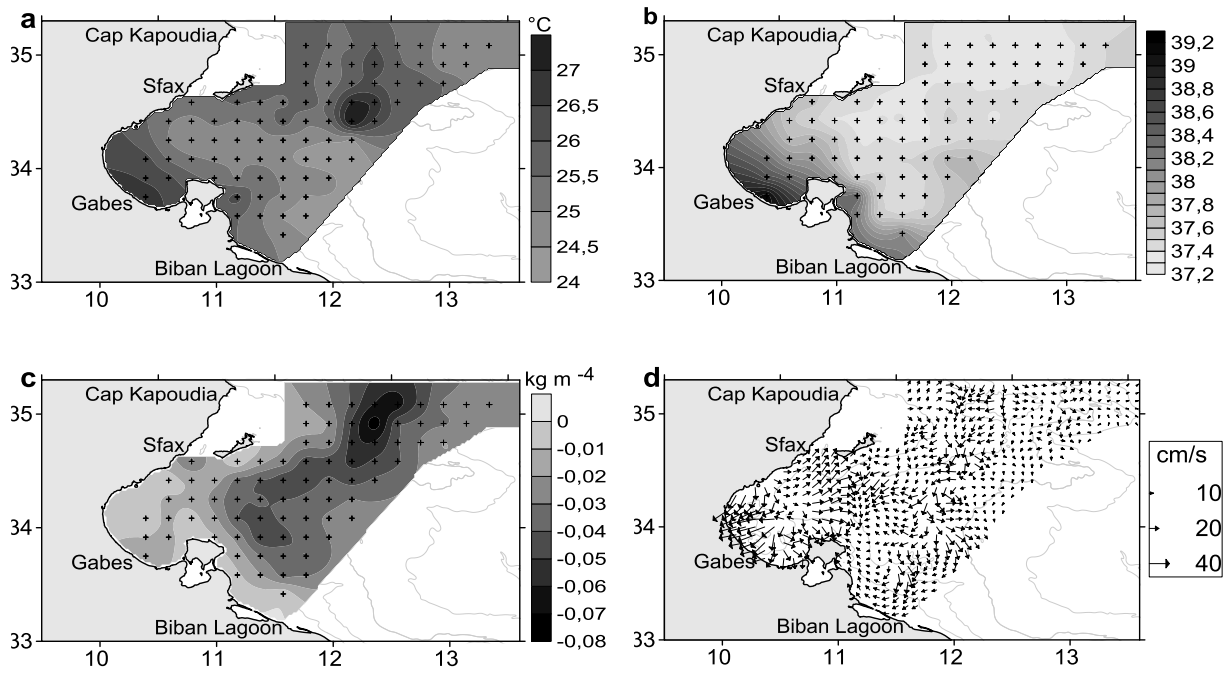


Figure 2. Horizontal distribution of temperature (a), salinity (b), water stability (c) and current (d) at surface (5 m) (Gulf of Gabes, summer).

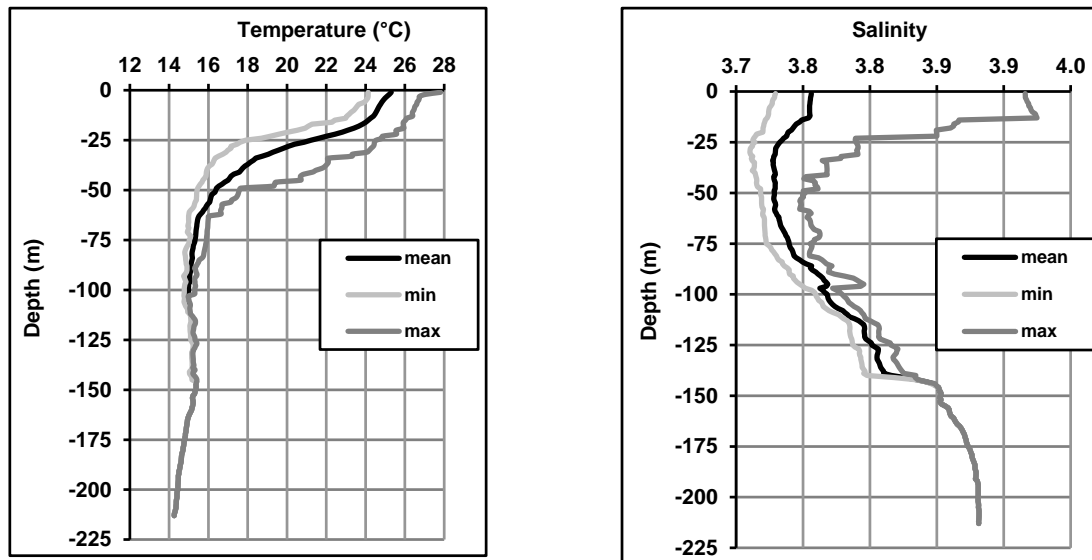


Figure 3. Vertical profiles of temperature (a) and salinity (b) (min, mean and max) (Gulf of Gabes, summer).

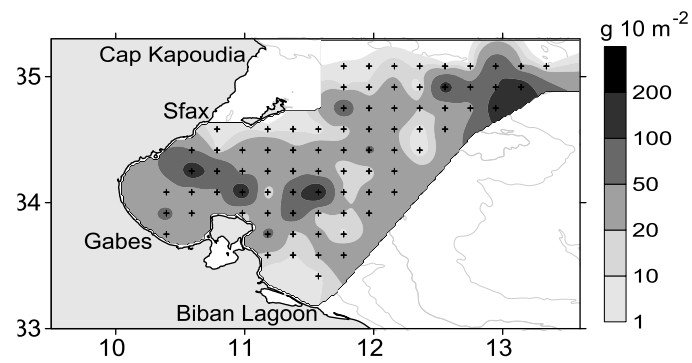


Figure 4. Horizontal distribution of dry weight of zooplankton biomass (Gulf of Gabes, summer).

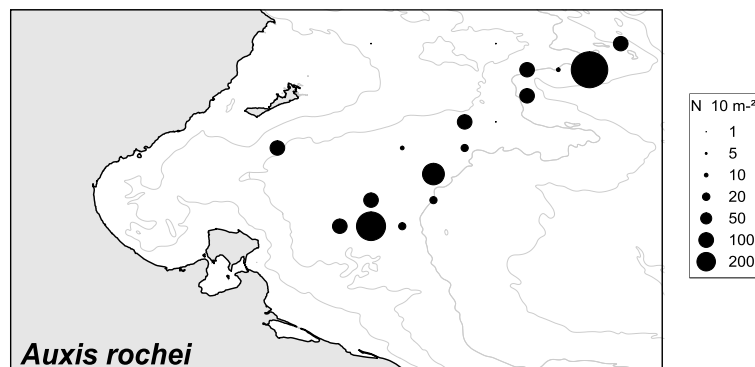


Figure 5. Horizontal distribution of bullet tuna *Auxis rochei* larvae in the Gulf of Gabes.