

## Presence of anchovy eggs in the eastern Adriatic Sea during the winter, coincidence or not?

Barbara ZORICA, Vanja ČIKEŠ KEČ\*, Goran BRZULJA and Viktor KRALJEVIĆ

*Institute of Oceanography and Fisheries, Šetalište I. Meštrovića 63, P.O. Box 500,  
21000 Split, Croatia*

*\*Corresponding author: cikes@izor.hr*

*During the survey done from 11<sup>th</sup> to 14<sup>th</sup> December 2013 in area of Pomo pit (Middle Eastern Adriatic) two anchovy (*Engraulis encrasicolus*, Linnaeus 1758) eggs were caught with standard plankton net (WP2). Eggs were found at two sampling stations (43°01.188'N, 15°25.796'E and 43°06.213'N, 15°15.138'E). This is a first finding of anchovy eggs in December in the offshore areas of middle-eastern Adriatic Sea.*

**Key words:** *Engraulis encrasicolus*, small pelagic, spawning season, Adriatic Sea

### INTRODUCTION

Anchovy *Engraulis encrasicolus* (L.) is a coastal euryhaline small pelagic fish, widely distributed in the eastern Atlantic, from the North Sea to the coasts of Morocco, and Mediterranean basin with its adjacent seas (WHITEHEAD *et al.*, 1988). In the Adriatic Sea it occurs from the Gulf of Trieste to the Otranto Strait, but not deeper than 200 m. Due to its great commercial importance anchovy biology is well documented (PALOMERA & RUBIES, 1996; BETULLA MORELLO & ARNERI, 2009). As serial batch spawner it has protracted spawning season, which in the Adriatic Sea generally occurs between April and October over continental shelf in upwelling areas, with the main spawning peak between June and August (SINOVIĆ & ZORICA, 2006; BETULLA MORELLO & ARNERI, 2009; ZORICA *et*

*al.*, 2013). Anchovy eggs are pelagic and easily distinguished due to their elongated ellipsoid shape (1.15<major axis<1.25 mm, 0.50<minor axis<0.55; RAFFAELE, 1888).

### MATERIALS AND METHODS

In December 2013, precisely from 11<sup>th</sup> to 14<sup>th</sup>, scientific survey was carried out with research vessel BIOS DVA from Split to Pomo pit area (central Adriatic, Fig. 1). Throughout this survey standard vertical plankton tows were made during the daylight at 12 stations using a WP2 net (mouth opening, 0.255 m<sup>2</sup>; mesh size, 0.200 mm). WP2 net was put vertically down during the calm sea to a depth of 100 m or to 5 m above the seabed in relatively shallow marine area (less than 100 m). Plankton samples were put in marked plastic container, preserved in 4%

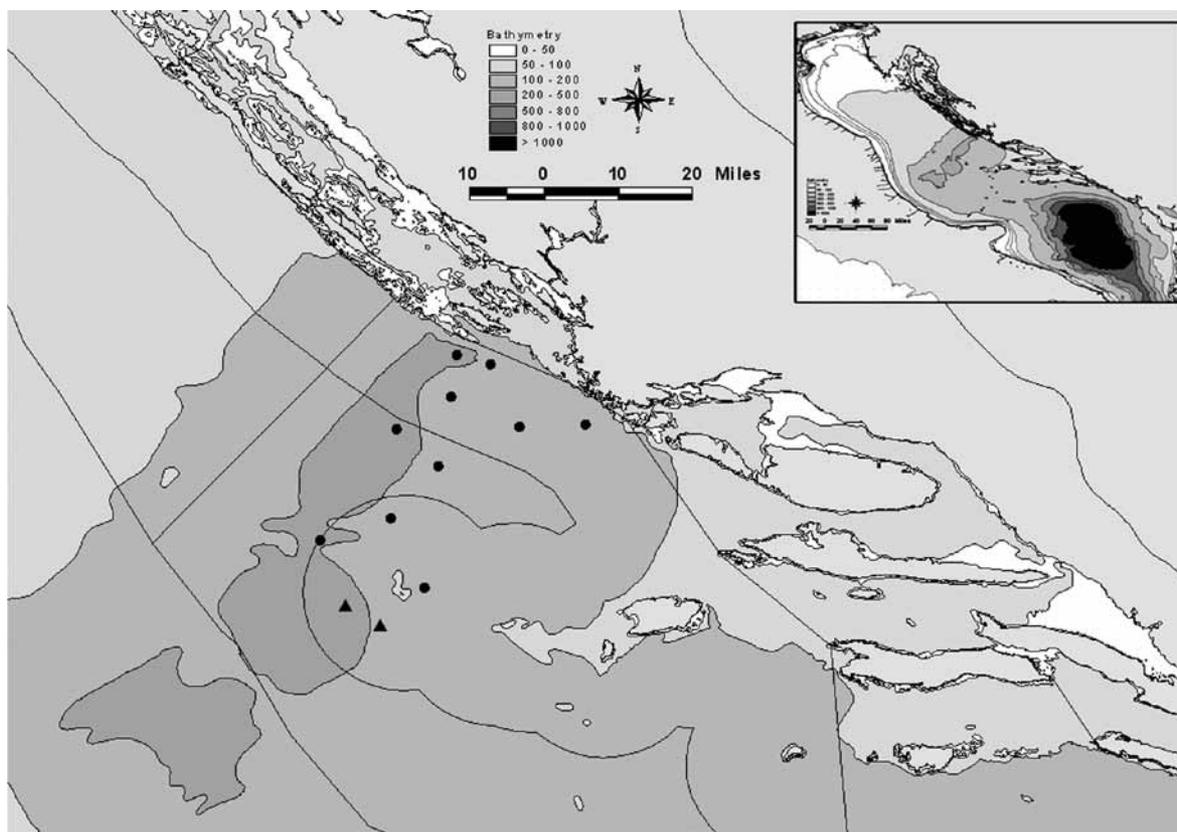


Fig. 1. Map of study area with marked negativ (●) and positiv (▲) stations during the cruise done on December 2013

buffered formalin and transported to the laboratory where they were analysed later on. Sea surface temperature was also measured at each station using a temperature probe. Anchovy eggs stages and ages were determined according to REGNER (1985).

## RESULTS

During the sampling two anchovy eggs were encountered on 11<sup>th</sup> (Station 2: 43°01.188' N, 15° 25.796'E at 14:55) and 12<sup>th</sup> (Station 3: 43° 06.213' N and 15° 15.138'E at 09:06) of December 2013. As both sampling stations (2, 3) were at the open sea the sampling depth was 100 m, although the sea bottom depth at station 2 and 3 were 181 m and 234 m, respectively. Anchovy egg found at station 2 was at the beginning of the stage IX (major axe =1.32 mm, minor axe = 0.55 mm; Fig. 2.a) while the one sampled at station 3 was in stage X (major axe =1.35 mm, minor axe = 0.50 mm; Fig. 2.b). Due to

measured sea surface temperature (17.6 °C) the expected development time of eggs, from fertilization to hatching, was 2.44 days. According to development time, the mean ages of eggs were estimated as 2.25 days (stage IX) and 2.38 days (stage X), respectively.

## DISCUSSION

Pomo pit area was previously recognised as one of the anchovy spawning areas although with low intensity (GAMULIN & HURE, 1983; REGNER, 1996; SINOVIĆIĆ, 2000b). Hence, the presence of anchovy eggs in this offshore area would not be noted as uniqueness if the eggs were observed during the warmer part of the year, but in this case the eggs were found during the winter. Bearing in mind that in general, occurrence of anchovy eggs in the Adriatic Sea was reported at very large ranges of temperature (11.6 – 28 °C) and salinity (9.1 – 38.7) (BETULLA MORELLO & ARNERI, 2009), in the Adriatic Sea, till

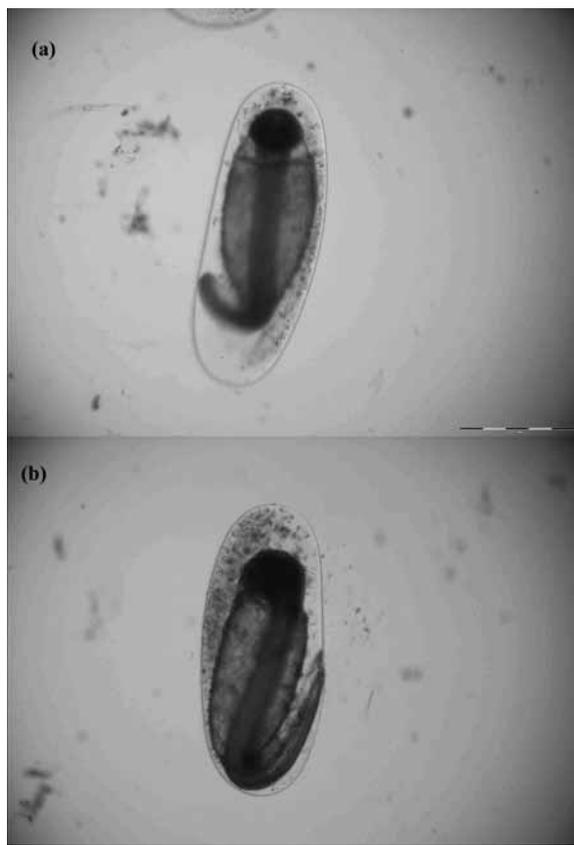


Fig. 2. Anchovy eggs found on 11<sup>th</sup> (a) and 12<sup>th</sup> (b) December 2013 in offshore area of middle Dalmatian islands - Pomo pit area

now anchovy eggs were previously found as early as in February (ZAVODNIK, 1970) and as late as in November (REGNER, 1972), with the only exception of the presence of anchovy eggs documented in December 2006 by MANDIĆ *et al.* (2012) in the coastal area of southern Adriatic Sea (Boka Kotorska Bay).

The dimensions of anchovy eggs analysed in this study were somewhat bigger (major axis > 1.25 mm) than the values previously reported for this species (RAFFAELE, 1888), but anchovy eggs from the open sea area are usually slightly larger than the ones coming from the coastal areas as they are probably released by older and larger individuals that normally overwinter in open sea area (REGNER, 1972). Back-calculation, done according to the estimated ages of eggs (2.25 and 2.38 days) analysed in this study, points out that anchovy spawned on 9<sup>th</sup> and 10<sup>th</sup> of December 2013. Bearing in mind that anchovy, as well as the other small pelagic fish spe-

cies, had extended spawning season, it is possible that anchovy inhabiting Adriatic area during 2013 prolonged its spawning till December due to favourable ecological conditions. Namely, the 2013 was observed as an extremely warm year, in which the sea temperature was almost all year round above the mean value (GRBEC *et al.*, 2010). Also, high level of precipitation during 2013 (GRBEC *et al.*, 2010) caused lower values of surface salinity that could positively contribute to anchovy spawning (ZORICA *et al.*, 2013) and that determined a protracted spawning activity.

### ACKNOWLEDGEMENTS

This study was supported by IBRD (International Bank for Reconstruction and Development, Washington D.C., USA) and MENP (Ministry of Environmental and Nature Protection), as a part of the research project “The Adriatic Sea Monitoring Program”. Referees’ comments and suggestions are greatly appreciated.

### REFERENCES

- BETULLA MORELLO, E. & E. ARNERI. 2009. Anchovy and Sardine in the Adriatic Sea — Oceanography and Marine Biology: An Annual Review, 47: 209-256.
- GAMULIN, T. & J. HURE. 1983. The spawning and spawning areas of pelagic fishes. *Acta Adriat.*, 24: 97–131.
- GRBEC, B., A. BAJIĆ & VILAB TEAM. 2010. Virtual laboratory. Institute of Oceanography and Fisheries, Split. Meteorological and Hydrological Service, Zagreb.
- MANDIĆ, M., S. REGNER, J. KRPO-ČETKOVIĆ & A. JOKSIMOVIĆ. 2012. Unusual occurrence of anchovy (*Engraulis encrasicolus*, Linnaeus 1758) eggs in December 2006 in Boka Kotorska Bay (Adriatic Sea). *Acta Adriat.*, 53(1): 133–137.
- PALOMERA, I. & P. RUBIES. 1996. The European anchovy and its environment. *Sci. Mar.*, 60 (suppl.) 2: 299 p.
- RAFFAELE, F. 1888. Le uova galleggianti e le larve dei Teleostei nel golfo di Napoli. *Mitt. Zool. Stat. Neapel*, 8: 1-84.

- REGNER, S. 1972. Contribution to the study of the ecology of the planktonic phase in the life history of the anchovy in the central Adriatic. *Acta Adriat.*, 14(9): 3–43.
- REGNER, S. 1985. Ecology of planktonic stages of the anchovy, *Engraulis encrasicolus* (Linnaeus, 1758), in the central Adriatic. *Acta Adriat.*, 26(1): 5–113.
- REGNER, S. 1996. Effects of environmental changes on early stages and reproduction of anchovy in the Adriatic Sea. *Sci. Mar.*, 60 (Suppl.) 2: 167–177.
- SINOVIĆ, G. 2000b. Anchovy, *Engraulis encrasicolus* (Linnaeus, 1758): biology, population dynamics and fisheries case study. *Acta Adriat.*, 41(1): 3–53.
- SINOVIĆ, G. & B. ZORICA. 2006. Reproductive cycle and minimal length at sexual maturity of *Engraulis encrasicolus* (L.) in the Zrmanja River estuary (Adriatic Sea, Croatia). *Estuar. Coastal Shelf Sci.*, 69 (3-4): 439-448.
- WHITEHEAD, P.J.P., G.J. NELSON & T. WONGRATANANA. 1988. Clupeoid fishes of the world. Engraulidae. *Fao Fish. Synop.* 125, 7 (2): 305–579.
- ZAVODNIK, D. 1970. Comparative data of the spawning of sardine (*Sardina pilchardus* Walb.), sprat (*Sprattus sprattus* L.) and anchovy (*Engraulis encrasicolus* L.) in the north Adriatic. *Ichthyologia* 2: 171–178.
- ZORICA, B., I. VILIBIĆ, V. ČIKEŠ KEČ & J. ŠEPIĆ. 2013. Environmental conditions conducive to anchovy spawning in the Adriatic Sea. *Fish. Oceanogr.*, 22(1): 32-40.

Received: 25 March 2014

Accepted: 25 April 2014

## Nalaz brgljuna u istočnom dijelu Jadranskog mora tijekom zime, slučajnost ili ne?

Barbara ZORICA, Vanja ČIKEŠ KEČ\*, Goran BRZULJA i Viktor KRALJEVIĆ

*Institut za oceanografiju i ribarstvo, Šetalište I. Meštrovića 63, P.P. 500, 21 000 Split, Hrvatska*

*\*Kontakt adresa, e-mail: cikes@izor.hr*

### SAŽETAK

Tijekom znanstvenog istraživanja obavljenog u razdoblju od 11. do 14. prosinca 2013. godine na području Jabučke kotline (srednji dio istočnog Jadrana) u ihtioplanktonskim uzorcima prikupljenim sa standardnom planktonskom mrežom (WP2) su pronađena dva jaja brgljuna (*Engraulis encrasicolus*, Linnaeus 1758) na dvije postaje (43° 01.188' N, 15° 25.796' E and 43° 06.213' N, 15° 15.138' E). Ovo je po prvi put zabilježen nalaz jaja brgljuna tijekom prosinca u stupcu morske vode na području otvorenih voda srednjeg istočnog Jadrana.

**Ključne riječi:** *Engraulis encrasicolus*, mala pelagična riba, vrijeme mriješćenja, Jadransko more

