

# DYNAMICS OF ABUNDANCE AND BIOMASS OF *OITHONA DAVISAE* (FERRARI F.D. & ORSI, 1984) IN THE DANUBE REGION OF THE BLACK SEA IN 2016–2019

Yu. V. Kharytonova, V. G. Dyadichko

<sup>a</sup> Institute of Marine Biology of the National Academy of Sciences of Ukraine, 6 Udilnyy Ln., 65012, Odessa, Ukraine

Corresponding author: Yu. V. Kharytonova (*kharytonova\_julia@ukr.net*)

**Introduction.** Introduction of new species into a water is one of the most pressing environmental problems of marine biology. Accidental introduction of alien species is recognized as the most powerful form of anthropogenic impact on the Black Sea ecosystem. From time to time, Mediterranean species of copepods have been recorded in the Black Sea plankton near the Bosphorus area.

Some specimens of a cyclopoid copepod new to the Black Sea were found in Sevastopol Bay in December 2001. The zooplankton species *Oithona davisae* (Ferrari F.D. & Orsi, 1984) is indigenous to coastal areas of Japan and the China Seas. However it has successfully invaded in many other coastal marine regions such as San Francisco Bay, the Mediterranean Sea, the North Sea and the Black Sea. It had transported in ballast water tanks. The species was identified as *Oithona brevicornis*. Recently, the species was reidentified as *O. davisae* (Altukhov, Gubanov & Mukhanov, 2014).

*O. davisae* is a pelagic cyclopoid copepod. The naupliar and copepodite phases are separated into six stages each. *O. davisae* has a wider potential salinity tolerance due to the estuarine lifestyle, due to which it has a higher body density, exhibits greater motor activity and the rate of oxygen consumption, the value of which is comparable to the theoretically expected respiration rate of calanoid copepods (Gubanov et al., 2019; Polischuk & Nastenکو, 2006).

For the period 2005–2013 in the Odessa sea region and in the Danube region, the zooplankton structure was replenished with new Black Sea alien species – *O. davisae*. An outbreak of development of *O. davisae* was noted in September 2012, when it completely replaced the native form of *Oithona minuta* (T. Scott, 1894). Its number was 35459 ind/m<sup>3</sup> and biomass was 85.53 mg/m<sup>3</sup> (Aleksandrov et al., 2017).

In the Odessa Sea Region in 2013 and 2014 were also identified 159 specimens of *O. davisae* (biomass – 4 mg/m<sup>3</sup>). With increasing of the abundance of the *O. davisae* a further decrease in the abundance of *Oithona similis* (Claus C., 1866), that was not recorded in samples from 2013, was observed (Aleksandrov et al., 2017).

The aim of the work was to reveal the change in the abundance and biomass of *O. davisae* in the Danube region in 2016–2019.

**Materials and methods.** In Danube region 23 samples of zooplankton were taken in 2016, 22 samples in 2017, 12 samples in 2018 and 17 in 2019.

Zooplankton samples were taken using a standard Juday plankton net with the mouth area 0.1 m<sup>2</sup> and mesh size 150 μ. Samples were fixed with buffered formaldehyde solution (4 % final concentration). The samples were processed under binocular microscope. Abundance and biomass of *O. davisae* were determined according the standard method (Alexandrov & Kharytonova, 2019).

**Results.** In the Danube region of the North-Western part of the Black Sea, *O. davisae* had been observed since 2011. Its was completely naturalized in North-Western part of the Black Sea and belongs to the dominant taxa not only among Copepoda, but also of all zooplankton. For example, in 2016, its biomass reached 328 mg/m<sup>3</sup> (35 % of the biomass of all zooplankton in this period). It should be noted that this omnivore species belongs to the forage zooplankton for fish, therefore, its mass development may have a positive effect on planktophagous fishes (Polischuk & Nastenکو, 2006).

The highest abundance and biomass of *O. davisae* in the Danube region were observed in 2016: 4479.9 ind/m<sup>3</sup>, and 26.879 mg/m<sup>3</sup> respectively. In 2017 and 2018 these indicators practically

did not differ. In 2019 we observed a significant decrease in the abundance (607.4 ind/m<sup>3</sup>) and biomass (3.645 mg/m<sup>3</sup>) of *O. davisae*.

In 2016–2019 *O. davisae* was one of the main components of forage zooplankton. Its biomass formed a significant proportion of the total biomass of Copepoda. In 2016, the % *O. davisae* of all Copepoda biomass was 29.21 %. During subsequent years, we observed a slight decreasing of % of *O. davisae* from the biomass of Copepoda. This metric was reached 20.5 % in 2017, but increased to 21.4 % in 2018, and up to 23.46 % in 2019.

**Conclusion.** *O. davisae* completely naturalized in the North-Western part of the Black Sea and is one of the main components of forage zooplankton. The abundance and biomass of *O. davisae* decreased from 2016 to 2019 in the Danube region together with decreasing of all Copepoda number and biomass.

#### References

**Aleksandrov B.G., Vorobeva L.V., Kulakova I.I. & Sinegub I.A.** 2017. *Odesskiy region Chernogo morya: gidrobiologiya pelagialy i bentaly* [Odessa region of the Black Sea: hydrobiology of pelagial and benthal]. Odessa: Astroprint. 324 p. (In Russian).

**Alexandrov B.G. & Kharytonova Yu.V.** 2019. *Kerivnytstvo z monitorynhu zooplanktonu morskyykh vod Ukrainy ta vyznachennia yikh ekolohichnoho stanu za standartamy Dyrektyvy YeS pro Morsku stratehiu* [Leadership on the zooplankton monitoring of Ukraine sea waters and the definition of their environmental standard EU Directive on Marine Strategy]. Odessa: Astroprint. 33 p. (In Ukrainian).

**Altukhov D.A., Gubanova A.D. & Mukhanov V.S.** 2014. New invasive copepod *Oithona davisae* Ferrari and Orsi, 1984: seasonal dynamics in Sevastopol Bay and expansion along the Black Sea coasts. *Marine ecology*, **35** (1): 28–34. <https://doi.org/10.1111/maec.12168>.

**Gubanova A.D., Garbazey O.A., Popova E.V., Altukhov D.A. & Mukhanov V.S.** 2019. *Oithona davisae*: Naturalization in the Black Sea, Interannual and Seasonal Dynamics, and Effect on the Structure of the Planktonic Copepod Community. *Oceanology*, **59**: 912–919. <https://doi.org/10.1134/S0001437019060079>.

**Polischuk L.N. & Nastenko E.V.** 2006. *Mezo- i makrozooplankton. Severo-zapadnaya chast Chernogo morya: biologiya i ekologiya* [North-western part of the Black Sea: biology and ecology]. Kiev: Naukova dumka. 229–237. (In Russian).