

Occurrence of the invasive crustacean species along the Montenegrin coast (South Adriatic)

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Abstract

The aim of this paper is to review and describe the current status of the two invasive crustacean species along the Montenegrin coast including the Boka Kotorska Bay. Those species are the American blue crab, *Callinectes sapidus* Rathbun, 1896 and the Northern brown shrimp, *Penaeus aztecus* (Ives, 1891). These non-indigenous species are presented in the Montenegro waters from 2013 but concerning the blue crab according to communication with the local fishermen it is observed many years earlier. Recent research reveals that these species are extending its distribution area. The last new records are reported from the Tivat Salina lagoon for the first species and open Montenegrin waters for the second. The invasive potential of these species was estimated using the AS-ISK (Aquatic Species Invasiveness Scoring Kit).

Keywords: invasive species, crustaceans, Montenegrin coast, South Adriatic.

Introduction

The blue crab, *Callinectes sapidus*, native of the Western Atlantic, is an euryhaline species that lives in estuarine and marine habitats, conducting long distance migrations in different phases of its life cycle (Carr *et al.* 2004). According to communication with the local fishermen this species was observed in Montenegro 2006, but the first documented report was 2013. Information on the presence of this species was existed only as a personal observation of Mačić & Kljajić (2012) referring to Port Milena, inlet Jaz and Oblatno (Marković & Đurović 2014). The last record was from the Tivat Salina Lagoon (Marković *et al.* 2017). During the last year, this species was very abundant along the south Montenegrin coast, especially in River Bojana mouth, where it is begin to commercially exploited.

The second species which is also native to the Western Atlantic coast is the Northern brown shrimp, *Penaeus aztecus* (Ives, 1891) which was recorded in Montenegrin waters in 2013 (Marković *et al.* 2014). Referring to communications with the local fishermen, this species is present also in trawl nets in the open sea of Montenegro (Marković *et al.* 2016).

The aim of this work is to review the occurrence of these species in Montenegro waters and their possible invasive potential using the Decision support tools for the identification and management of invasive non-native aquatic species AS-ISK (Aquatic Species Invasiveness Screening Kit).

Material and methods

Available information on the presence of non-indigenous crustacean species in Montenegro waters were gathered from the scientific literature and private communication with fisherman. AS-ISK tool was used to assess the invasiveness risk of these species (Tomanić, 2016). This decision support tool is freely available in <https://www.cefas.co.uk/nns/tools/> and applicable to all aquatic plants and animals regardless of ecosystem (i.e. marine, brackish and freshwater) (Copp *et al.* 2016). AS-ISK includes a preamble of background information on the species as well as questions on its potential socio-economic impacts and those on ecosystem services, and an additional section (six questions) for the assessor to predict how forecasted changes in climate are likely to influence the risks of introduction, establishment, dispersal and impact of a species (Copp *et al.* 2016). Based on the responses, the possible values for the BRA (Basic Risk Assessment) and CCA (Climate Change Assessment) score range from -12 to 64 and from -24 to 76, respectively.

Results

Information on the presence of the blue crab was existed only as a personal observation of Mačić & Kljajić (2012) referring to Port Milena, inlet Jaz and Oblatno. The first documented record of the occurrence of *C. sapidus* in Montenegro waters was in December 2013 when two adult male specimens were caught by gillnet called polandara with a 45 mm mesh size at a depth of 15 m on sandy-mud bottom in Boka Kotorska Bay (Marković & Đurović 2014). The past documented records were mainly referred on male specimens while the first mature female with no eggs was recorded in Tivat Salina lagoon where there are favorable environment conditions for the establishment of its population (Marković *et al.*, 2017). Concerning the Mediterranean Sea, the species has been recorded and positively established populations in 12 countries (Perdikaris *et al.* 2015). Referring to communications with the fishermen, the highest abundance of this species was observed during last year in Bojana River mouth as well as in Ulcinj Salina lagoon where they were found small individuals as well as females with eggs. These records and future sampling could give some reasons for the conclusion that this species might spawn in those lagoons and will be able to establish a population.

On 19 September 2013, an adult female specimen of *F. aztecus* was caught by a "bukvara" gillnet, which has a 22 mm mesh size, at a depth of 20-25 m on sandy-mud bottom in the Boka Kotorska Bay (Marković *et al.*, 2014). Taking into account environmental factors in research area and presence of the adult individuals mainly ovigerous females, population of the Northern brown shrimp could be successful established but more attention could be also paid on vegetation, substrate type, food, predators and interaction on these parameters (Marković *et al.* 2016). This species was also captured by commercial bottom trawls which operate in the open waters of Montenegro.

The AS-ISK scores for the blue crab were 43.5 and 55.5 for the BRA and CCA, respectively, while for the brown shrimp were 39.5 and 51.5 (Tomanić, 2016). The application of the AS-ISK risk identification tool suggested that the both species have high risk of invasiveness (Tomanić, 2016).

Discussion

The increase of marine non-indigenous species in the eastern Mediterranean is certainly attributable to an increase of human activities (shipping transport), but it is also a consequence of climate change (Minos *et al.*, 2015). The shipping is the most likely vector of introduction of these species in the Adriatic Sea including Montenegro waters. Coutts *et al.* (2003) claimed that in the large ships the area of the sea-chests can harbor biologically significant accumulations of macrofouling biota, including portunid crabs which may have reached the port waters in a juvenile stage passing through the meshes of the grid that protects the sea-chest.

According to Bax *et al.* (2003) if a marine invasive species is not detected shortly after arrival and become widely distributed, there are no proven techniques to eradicate it.

In Tivat Salina lagoon, it is noticed that the autochthonous species *Carcinus maenas* (Linnaeus, 1758) was disappeared during the months when the blue crab was appeared. This invasive species compete with the other crab species, increasing for example the natural mortality, distribution and dynamics of indigenous crabs. According to Kevrekidis (2014), in terms of ecosystem effects, the establishment of *P. aztecus* might result in competition with the native carapace prawn *Penaeus kerathurus* (Forskål, 1775), taking into account the similarities in their life cycles.

Both species are commercially important and the best way to reduce its population is their exploitation. Fishermen from Ulcinj area started to catch blue crab, but for now its exploitation is limited and localized only on Bojana River mouth. Concerning the brown shrimp, after trawling operations, it is sold together with native commercial shrimp *Parapenaeus longirostris* and *Penaeus kerathurus*.

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