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FIRST FIND OF THE STARFISH, *ASTERIAS RUBENS* LINNAEUS, 1758, OFF THE ANATOLIAN COAST OF THE BLACK SEA (SINOP)

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Starfish *Asterias rubens* was found as the first record from the Anatolian coast of the Black Sea (Sinop). This alien starfish was reported in 1996 in the Bosporus Strait (the Marmara Sea). In 2009, *A. rubens* was registered off Karasu and Sakarya coasts in the Western Black Sea. *A. rubens* (8 cm in diameter; wet weight 12.970 g) was sampled by a commercial demersal trawl on the sandy-mud bottom at 85.5-m depth on 12 February, 2022, on the Anatolian coast of the Black Sea, which indicates further expansion of its areal in the sea.

Keywords: starfish, *Asterias rubens*, alien species, Black Sea, Turkey

Asterias rubens Linnaeus, 1758 is a fairly common species in the northeastern Atlantic Ocean [Budd, 2008]. Most of the species in the Black Sea are migrants of Atlantic origin that reached the Pontiac basin with the reopening of the Bosporus 7,000–10,000 years ago [Öztürk B., Öztürk A., 1996]. Some of the migrant species [such as *Rapana venosa* (Valenciennes, 1846), *Mnemiopsis leidyi* A. Agassiz, 1865, *Beroe ovata* Bruguière, 1789, and *Anadara inaequivalvis* (Bruguière, 1789)] have arrived with ship ballast waters. The Bosporus Strait of Istanbul provided the connection between the Mediterranean Sea and the Atlantic Ocean, as well as the Black Sea. Mediterranean migrants are the largest community of organisms in the Black Sea biota and account for 80% of the total number of species [Exotic Species, 2001].

Although the Black Sea has a great habitat diversity, species diversity is low due to low salinity. This provides favorable conditions for the spread of alien species [CIESM, 2010]. The phylum Echinodermata is represented by approximately 7,000 living species [Pawson, 2007]. Species of this phylum have been recorded in the Sea of Marmara since 1990 [Albayrak, 1996; Karhan et al., 2007; Yüce, Sadler, 2000].

The release of ballast waters from ships facilitates the inter-sea migration of planktotrophic larvae of non-native species. It is thought that *A. rubens* was transported to the Sea of Marmara that way [Zibrowius, 2002]. Nevertheless, it should be considered that current systems affect the dynamics of the spread of alien species [Jaspers et al., 2018].

The aim of this article is to report the Atlantic starfish *Asterias rubens* on Turkish Black Sea coast, which can be considered an indicator of the spread of this species along the coast of the Black Sea from Marmara. It is the first record of this alien species from the Anatolian coast of the Black Sea.

MATERIAL AND METHODS

A single specimen of *A. rubens* (8 cm in diameter; weight 12.970 g) (Fig. 1) was sampled by a commercial demersal trawl (codend mesh size 40 mm) off İnceburun (42°08′765″N, 34°51′895″E) and Sarıkum (42°06′886″N, 34°52′274″E), Sinop area of the Anatolian Turkey coast (Fig. 2), on the sandy-mud bottom, at average depth 85.5 m and temperature +8.4 °C, on 12 February, 2022. The sample was preserved in 96% ethanol.

The analysis of morphological characteristics and description of the starfish were carried out in the Laboratory of the Fisheries Faculty of Sinop University.

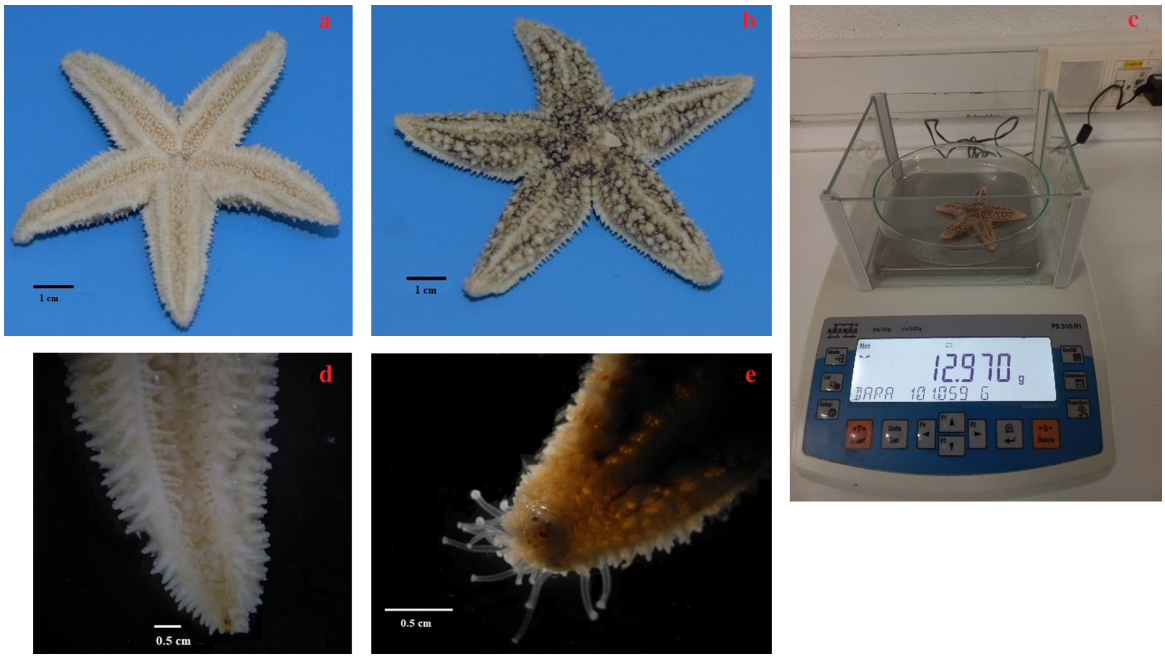

Fig. 1. *Asterias rubens* (8 cm in diameter) captured at Sinop, the Black Sea (original photos)

Body of the starfish is generally small and disc-shaped. The five arms begin to narrow at the base; the average diameter is 35 mm. On the aboral side, there are small cream spots at the base of the spines, while the arms are cream-colored, with a brown spot at the tips. The body wall is soft and flexible. There are numerous papules on the surface [Müller, Troschel, 1842].

The bottom of the starfish is covered with hundreds of tube feet that are used to walk, cling to rocks, and catch prey. With these tiny legs, *A. rubens* moves at speeds of 30 cm *per* minute, or 60 feet *per* hour [Dale, 1997].

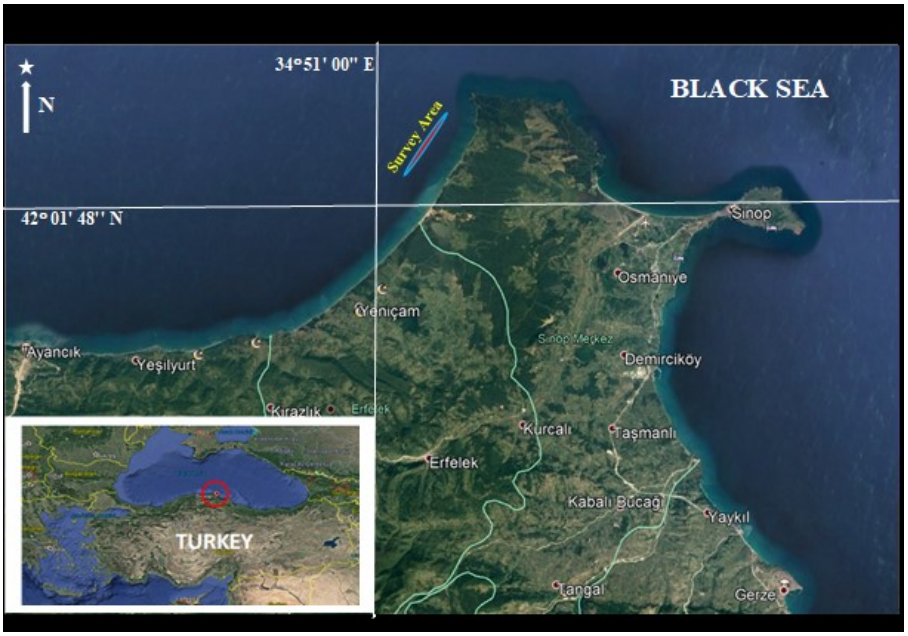

Fig. 2. Location of the survey area

RESULTS AND DISCUSSION

Habitat. *Asterias* species are found on hard, rocky, sandy, or soft substrates, with most species preferring rocky sea bottoms. In winter, *A. rubens* activity is confined to the bottom. Sea stars are able to attach to hard surfaces and move well [Hennebert et al., 2010], but the movement and attachment systems are dysfunctional on non-adhesive, *i. e.* soft, substrates [Anger et al., 1977]. Physical parameters significantly constrain species abundance, physical activity, and predation rates [Hancock, 1955].

It is known that environmental conditions, such as temperature, salinity, and hydrodynamic regime, affect distribution, life cycle, nutrition, abundance, and performance of *A. rubens* [Menge et al., 1994].

In a study conducted by Y. Ceylan and S. Gül [2021], based on current *A. rubens* distribution, it was reported that temperature is the most restrictive environmental variable.

Feeding. *A. rubens* feeds on a wide range of living organisms and carcasses, most of which are composed of macroinvertebrates, including molluscs, polychaetes, and other echinoderms. Sometimes, small crustaceans are caught by suction discs of tube feet. *A. rubens* feeds mainly on molluscs, especially bivalves and snails. Digestive enzymes enter the hunt along with the everted stomach lining to further aid digestion. The starfish can also use its tube feet to open a bivalve [Pearse et al., 1987]. However, their food seems to consist largely of bivalve molluscs [Budd, 2008; Chadwick, 1923]. Therefore, there is no problem for this species to find food in the Black Sea, because *Mytilus galloprovincialis* Lamarck, 1819, a mytilid bivalve, forms very large populations on the coast of this sea [Hancock, 1958]. *M. galloprovincialis* is a species of high economic significance which is cultivated in countries bordering the Black Sea, and it is important in terms of creating habitats for many hydrobionts [Zaitsev, Mamaev, 1997].

While the spread of *A. rubens* has been reported around Marmara and in the Bosporus system for more than 20 years, it is detected for the first time in the current research area.

As a result, new studies are needed to understand the current state of *A. rubens* in the Black Sea and its effects on the ecosystem. For the Black Sea, which responses quickly to changes in the ecosystem, the existence and spread of the species is important. The spread of *A. rubens* to the shores of Karasu

and Sakarya in the Sea of Marmara, the Bosporus system, and the Western Black Sea has been reported for more than two decades [Albayrak, 1996; Ceylan, Gül, 2021; Dalgıç et al., 2009; Karhan et al., 2007; Öztoprak et al., 2014; Yüce, Sadler, 2000], and it was detected for the first time on the shores of Sinop in this study. As a result of this research, it has been proved that this species has spread to the Anatolian coast of the Black Sea region.

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ПЕРВАЯ НАХОДКА МОРСКОЙ ЗВЕЗДЫ *ASTERIAS RUBENS* LINNAEUS, 1758 У АНАТОЛИЙСКОГО ПОБЕРЕЖЬЯ ЧЁРНОГО МОРЯ (ГОРОД СИНОП)

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Атлантическая морская звезда *Asterias rubens* впервые обнаружена у Анатолийского побережья Чёрного моря (город Синоп). В 1996 г. этот вид-вселенец был найден в проливе Босфор (Мраморное море). В 2009 г. морская звезда зарегистрирована у берегов Карасу и Сакарья в западной части Чёрного моря. Особь *A. rubens* (диаметр — 8 см; сырой вес — 12,97 г) поймана 12 февраля 2022 г. донным тралом на песчано-илистом дне на глубине 85,5 м у Анатолийского побережья Чёрного моря. Это свидетельствует о дальнейшем расширении ареала морской звезды в море.

Ключевые слова: морская звезда, *Asterias rubens*, виды-вселенцы, Чёрное море, Турция