BioInvasions Records (2025) Volume 14, Issue 1: 251–259

Rapid Communication

The Korean rockfish, *Sebastes schlegelii* Hilgendorf, 1880 (Actinopterygii: Scorpaeniformes: Sebastidae) – a new component in the North-Western Black Sea coastal fish fauna

Yuriy Kvach[1,2] and Sergii Khutornoi[2,1]

[1]*Institute of Marine Biology, National Academy of Science of Ukraine, Italiyska St., 37, 65048 Odesa, Ukraine*
[2]*Institute of Fisheries, Marine Ecology and Oceanography (SSI IFMEO), Oleksandra Konyskoho St., 82a, 04053 Kyiv, Ukraine*
Corresponding author: Sergii Khutornoi (kalkan@ukr.net)

Citation: Kvach Y, Khutornoi1 S (2025) The Korean rockfish, *Sebastes schlegelii* Hilgendorf, 1880 (Actinopterygii: Scorpaeniformes: Sebastidae) – a new component in the North-Western Black Sea coastal fish fauna. *BioInvasions Records* 14(1): 251–259, https://doi.org/10.3391/bir.2025.14.1.19

Received: 26 April 2024
Accepted: 21 August 2024
Published: 10 February 2025

Handling editor: Jasmine Ferrario
Thematic editor: April Blakeslee

Abstract

In the study, the registration of the Korean rockfish, *Sebastes schlegelii* Hilgendorf, 1880 (Actinopterygii: Scorpaeniformes: Sebastidae) is described for a blackish estuary of the North-Western Black Sea, Ukraine. Two individuals are found in the Sukhyi Lyman, which is already known as a hot spot for biological invasions. The further spread of the Korean rockfish in the Black Sea is discussed.

Key words: Far-Eastern biota, Asian fish, Sukhyi Lyman, Ukraine, non-native species, new record

Introduction

The introduction of non-indigenous biota, as well as extinction of native species, have strong negative impact on biodiversity and ecosystem functions (Ricciardi and Rasmussen 1998; Mack et al. 2000; Clavero and García-Berthou 2005). This includes also the introduction of fishes, which are well documented in the Global Invasive Species Database of the IUCN (Lowe et al. 2000). On the other hand, many non-native species with documented impacts in circumscribed ecosystems of local interest were not included into the list (Kulhanek et al. 2011; Vilizzi et al. 2021).

The introduction of predatory invasive fishes needs special attention for developing risk assessment, control and eradication strategies, because it is one of the main causes of decline of local fish diversity and extirpations of species worldwide, with adverse effects cascading on food webs and scaling up to entire ecosystems (Pelicice and Agostinho 2009; Bezerra et al. 2017; Sharpe et al. 2017). Fish invaders could induce detrimental effects on local prey populations (Alexander et al. 2014; DeRoy et al. 2020). Also, to effectively compete with local predators, introduced fishes can often induce changes in the structure of the invaded systems (Latini and Petrere 2004; Weis 2011; DeRoy et al. 2020).

The list of incidentally introduced fishes in the Ukrainian waters consists of 10 species, but excluding the unsuccessfully introduced/data deficient fish species with accidental finding, only two marine species are confirmed (Kvach and Kutsokon 2017). Specifically, two gobiids, *Gammogobius steinitzi* (Bath, 1971) and *Tridentiger trigonocephalus* (Gill, 1859), recorded in the western Crimea (Boltachev and Karpova 2012; Kovtun and Manilo 2013). Both registered species are small-sized benthivorous gobiid fish, but no population of predatory alien fish species were confirmed.

The Korean rockfish, *Sebastes schlegelii* Hilgendorf, 1880 (Actinopterygii: Scorpaeniformes: Sebastidae) is a scorpion fish, inhabiting Far-Eastern Asian marine waters around the Japanese Archipelago, Korean Peninsula and Northern China (Masuda et al. 1984; Kim et al. 2005). This is a commercially important fish species which catches decreased in its natural range in Asia in the last several decades (Hutchings and Reynolds 2004; Chin et al. 2013). This is also a species commonly used in mariculture through offshore cage culture techniques, with developed breeding technologies (Lee et al. 1993; Choi et al. 2010).

In the Black Sea the Korean rockfish was first recorded near the western Crimea in 2013, reported as the Mediterranean species dogtooth grouper *Epinephelus caninus* (Valenciennes, 1834) (Boltachev and Karpova 2013). Later, the species was correctly identified, with the new finding registrations near eastern Crimean and Caucasian coasts, since 2019 (Karpova et al. 2021). Since 2022, it was registered in the southern Black Sea near Turkish coasts, both in eastern and western parts (Bilecenoğlu et al. 2023; Yağlıoglu et al. 2023). In 2022, this species was first recorded in the western Black Sea near the Bulgaria coasts (Ivanova et al. 2024), but it was never observed in the North-Western Black Sea along the Ukrainian coasts.

Materials and methods

In 2023, visual observations of the angler catches were provided seasonally in the area of the Marine Port of Chornomorsk, Black Sea, Ukraine. The port is places in the Sukhyi Lyman, which is an estuary established by the interfluence of two rivers, the Dalnyk and Akkarzhanka, artificially transformed to a sea bay with the construction of the seaport in 1957 (Starushenko and Bushuyev 2001).

Atypical fishes for the estuary were observed in October 2023 in two localities: 46°19′10″N; 30°39′32″E and 46°19′26″N; 30°39′21″E (Figure 1). The fish specimens were caught using a hook and rode. Two fish individuals were photographed, measured (total length, TL, cm) and weighted (weight, W, g). Dorsal fin spines and rays, pectoral fin rays, anal fin spines and rays, pelvic fin spines and rays, and pored lateral line scales were counted due to Pravdin (1966).

Figure 1. The map of the sampling places of the Korean rockfish (*Sebastes schlegelii*) in the Sukhyi Lyman (upper left part, red circles) and in the Black Sea (red circles with the years of first findings; see Table 1). Question marks are finding due to unconfirmed information from the anglers.

Results

Two fish individuals were identified as the Korean rockfish, *Sebastes schlegelii* (Figure 2). The sizes of the fish (TL, cm) were 20 and 26, but the weight (W, g) was 225 and 279. By unconfirmed information from the angler, the same fish were caught in the close part of the Black Sea in near the village of Lymanka, Marina Sauvignon (46°20′36″N; 30°42′08″E) and the City of Chornomorsk (46°17′18″N; 30°39′50″E).

The sampled individuals are characterised by dark grey coloration with small darker spots (see Figure 2). Head covered with scales, three lachrymal, nasal, preocular, postocular, tympanic, parietal, and five preopercular spines present. Dorsal fin XIII–13, pectoral fin 17, anal fin III–8, pelvic fin I–5, caudal fin 15, pored lateral line scales 47.

Discussion

This study reported the first registration of the Korean rockfish (*S. schlegelii*) in the North-Western Black Sea. This finding highlights the further spread of the fish species along the Black Sea coasts. Except of the Black Sea, the case

Figure 2. Photographs of the Korean rockfish (*Sebastes schlegelii*) from the Sukhyi Lyman, Black Sea (Photos by R. Stavniychuk)

of introduction of the Korean rockfish is known from the Dutch coastal waters, North Sea, where it was first reported in 2009 (Kai and Soes 2009), but no later finding in the European waters, except of the Black Sea, were registered. The presence of the established population in the Black Sea, hypothesized by Karpova et al. (2021), was not supported in later publication (Manilo 2021). On the contrary, since the first finding near Crimea in 2013,

Table 1. Findings of the Korean rockfish (*Sebastes schlegeli*) in European and West Asian waters.

Country	Locality	Coordinates	Year	Reference
Netherlands	Oosterschelde, North Sea	51°33'18.3"N 3°54'27.5"E	2008	Kai and Soes 2009
Ukraine	Cape Aya, Crimea, northern Black Sea	44°29′16.80″N 3°36′54.39″E	2013	Boltachev and Karpova 2013
Ukraine	Kacha, Crimea, northern Black Sea	44°45′32.9″N 33°32′18.2″E	2019	Karpova et al. 2021
Ukraine	Balaklava, Crimea, northern Black Sea	44°29′24.8″N 33°34′27.9″E	2019	Karpova et al. 2021
Ukraine	Cape Meganom, Crimea, northern Black Sea	44°48′02.6″N 35°02′44.8″E	2019	Karpova et al. 2021
Russia	Cape Bolshoy Utrish, eastern Black Sea	44°45′54.5″N; 37°22′57.5″E	2019	Karpova et al. 2021
Turkey	Akçakoca, Düzce, southern Black Sea	41°05'10.3"N 31°05'25.8"E	2022	Yağlıoglu et al. 2023
Bulgaria	Varna, western Black Sea	43°11'30.0"N 27°55'19.0"E	2022-2023	Ivanova et al. 2024
Turkey	Ordu/Ünye, southern Black Sea	41°05'33.1"N 37°29'06.5"E	2023	Bilecenoğlu et al. 2023
Turkey	Giresun, southern Black Sea	40°56'38.8"N 38°27'43.0"E	2023	Bilecenoğlu et al. 2023
Turkey	Perşembe/Okçulu, southern Black Sea	41°04'12.8"N 37°48'54.5"E	2023	Bilecenoğlu et al. 2023
Turkey	Ordu/Fatsa, southern Black Sea	41°02'57.8"N 37°30'26.7"E	2023	Bilecenoğlu et al. 2023
Turkey	Gideros, southern Black Sea	41°55'51.1"N 32°54'56.5"E	2023	Bilecenoğlu et al. 2023
Bulgaria	Kiten, western Black Sea	42°14'17.0"N 27°47'04.0"E	2023	Ivanova et al. 2024
Ukraine	Sukhyi Lyman	46°19′26″N; 30°39′21″E	2023	Current study
	North-Western Black Sea	46°19′10″N; 30°39′32″E	2023	Current study

this species settled the rocky habitats along the South and Eastern Crimean coasts (2019), Caucasus (2019), Turkey and Bulgaria (2022–2023) (Karpova et al. 2021; Bilecenoğlu et al. 2023; Yağlıoglu et al. 2023; Ivanova et al. 2024; Table 1).

The Sukhyi Lyman is only estuary in the south-western Ukraine region, where the Korean rockfish was registered. This water body is recently registered as a hot spot of neobiota. Thus, the freshwater centrarchid, the pumpkinseed (*Lepomis gibbosus* (L., 1758)) is registered here since 1999 (Khutornoi et al. 2023). The Oriental river prawn (*Macrobrachium nipponense* (De Haan, 1849)) is registered here since 2020 (Bushuiev et al. 2023). Two Altanto-Mediterranean fishes, which spread their ranges from the South to the North part of the Black Sea, i.e. peacock blenny, *Salaria pavo* (Risso, 1810) and Bucchich's goby (*Gobius bucchichi* Steindachner, 1870), were registered here recently (Khutornoy 2021; Khutornoi et al. 2023). The possible source of the neobiota is the marine port of Chornomorsk, placed in the estuary, which is common trend for all sea port in the Black Sea region (Vinogradov et al. 2018; Khutornoi et al. 2023). In general, marine ports are good known "hubs" for biological invasions, because the maritime traffic plays an important role in the geographic spread of numerous aquatic

alien species (Lodge et al. 2016; Bullock et al. 2018). Another possible vector of the biological invasions in port regions is recreational fishing and commercial aquaculture (Khutornoi et al. 2023).

The Korean rockfish is known as predatory species, feeding with mainly bony fishes, echinoderms, crustaceans (Kang et al. 2023). Among the predatory alien fish species, only three were registered in the Ukrainian part of the Black Sea, e.g. blue whiting (*Micromesistius poutassou* (Risso, 1827)), red barracuda (*Sphyraena pinguis* (Günther, 1874)) and greater amberjack (*Seriola dumerili* (Risso, 1810)) (Kvach and Kutsokon 2017; Snigirov et al. 2020). But, all of them were considered as incidental finding, which have not led to established populations. Our registration is the confirmation of the further spread of the Korean rockfish along the western coasts of the Black Sea. At this moment, no established populations of this fish were confirmed in the Black Sea, but near the Turkish and Bulgaria coasts the rapid findings were provided in 2022 in 2023 (Bilecenoğlu et al. 2023; Yağlıoglu et al. 2023; Ivanova et al. 2024).

The numerous findings of the Korean rockfish of different size, registered near the Crimean and Bulgarian coasts, support the numerous introductions (Karpova et al. 2021; Ivanova et al. 2024). The possible ways of this are the ship ballast waters, as well as mariculture of the giant oyster (*Magallana gigas* (Thunberg, 1793)) (Mitov et al. 2020; Bilecenoğlu et al. 2023; Yağlıoglu et al. 2023). This bivalve was first introduced to the Crimean coasts of the Black Sea in 1980 for maricultural purposes, and in 2001–2003 started to be cultivated on the Romanian coasts (Zolotarev 1996; Zaharia and Crivăț 2017). In recent decade the commercial demand on oysters, as well as oyster farms, increase in Ukraine (Chetveryk and Kravchuk 2020). The current development of the oyster mariculture in Ukraine could be one of the possible vectors of the Korean rockfish introduction in the northern Black Sea region.

The Korean rockfish can survive wide range of water temperatures 5–28 °C and the potential climate changes could induce impacts on the species spread (Chen et al. 2021). This fish is ovoviviparous, and its larvae and juveniles can be found in association with drifting seaweed (Breder and Rosen 1966; Zhang et al. 2014; Xi et al. 2017). Recently, macrophytes show anomaly development in the North-Western Black Sea, especially near Ukrainian coasts (Minicheva et al. 2018). The drift of macrophytes along the coasts could facilitate the spread of larvae and juveniles of the Korean rockfish. This might be another factor contributing to the spread of the species in the Black Sea.

The North-Western Black Sea is characterised by low salinity and strong influence of large European rivers, such as Danube, Dnipro and Dniester. Nevertheless, the findings of non-indigenous marine fish are known here (e.g., the greater amberjack *S. dumerili*; Snigirov et al. 2020; Luzhniak et al.

2020). Taking into account the more numerous registrations of the Korean rockfish in the Black Sea, and the longer age of the invasion (since 2013), this species has more perspective to establish a stable population, which confirmation needs further surveys.

Authors' contribution

Sergii Khutornoi identified the fish to the species level and prepared the first draft of the manuscript. The main ideas of the manuscript and its general structure were formulated by Yuriy Kvach. The final approval of the manuscript was conducted by both authors.

Acknowledgments

Authors thank to Ruslan Stavniychuk, an angler who caught the Korean rockfish in the Sukhyi Lyman. We also thank two anonymous reviewers for their valuable comments.

Funding declaration

Publication of this study was supported by the European Union's Horizon Europe HORIZON-CL6-2024-BIODIV-01 project "GuardIAS - Guarding European Waters from IAS", under grant agreement no. 101181413 (Katsanevakis et al. 2024).

References

Alexander ME, Dick JTA, Weyl OLF, Robinson TB, Richardson DM (2014) Existing and emerging high impact invasive species are characterized by higher functional responses than natives. *Biology Letters* 10: 20130946, http://doi.org/10.1098/rsbl.2013.0946

Bilecenoğlu M, Yokeş MB, Aydin M (2023) First record of *Sebastes schlegelii* Hilgendorf, 1880 along the Turkish Black Sea coast – new addition to the alien species inventory. *Turkish Journal of Maritime and Marine Sciences* 9: 119–128, https://doi.org/10.52998/trjmms.1358814

Bezerra LAV, Angelini R, Vitule JRS, Coll M, Sánchez-Botero JI (2017) Food web changes associated with drought and invasive species in a tropical semiarid reservoir. *Hydrobiologia* 817: 475–489, http://doi.org/10.1007/s10750-017-3432-8

Boltachev AR, Karpova E (2012) Morskiye ryby Krymskogo poluostrova [Marine fishes of Crimean Peninsula]. Biznes-Inform, Simferopol, 228 pp [in Russian]

Boltachev A, Karpova E (2013) First record of dogtooth grouper *Epinephelus caninus* (Valenciennes, 1834), Perciformes, Serranidae, in the Black Sea. *BioInvasions Records* 2: 257–261, https://doi.org/10.3391/bir.2013.2.3.14

Breder CM, Rosen DE (1966) Modes of reproduction in fishes. T.F.H. Publications, Neptune City, New Jersey, 941 pp

Bullock JM, Bonte D, Pufal G, Carvalho CS, Chapman DS, Garcia C, Garcia D, Matthysen E, Delgado MM (2018) Human-mediated dispersal and the rewriting of spatial networks. *Trends in Ecology and Evolution* 33: 958–970, https://doi.org/10.1016/j.tree.2018.09.008

Bushuiev S, Snigirov S, Son M, Sokolov I, Kharlov G, Kvach Y (2023) Expansion of the alien East Asian river prawn *Macrobrachium nipponense* (De Haan, 1849) in southwestern Ukraine and assessment of its commercial usage prospects. *Aquatic Invasions* 18: 231–246, https://doi.org/10.3391/ai.2023.18.2.104092

Chen Y, Shan X, Ovando D, Yang T, Dai F, Jin X (2021) Predicting current and future global distribution of black rockfish (*Sebastes schlegelii*) under changing climate. *Ecological Indicators* 128: 107799, https://doi.org/10.1016/j.ecolind.2021.107799

Chetveryk O, Kravchuk N (2020) Doslidzhennia kon'yuktury rynku ustryts: stan ta perspektyvy rozvytku na zasadakh marketynhu [The research or the oyster's market condition: current state and future perspective development on the basis of marketing]. *Bioeconomics & Agrarian Business* 11(1): 1–18 [In Ukrainian with English summary]

Chin BS, Nakagawa M, Noda T, Wada T, Yamashita Y (2013) Determining optimal release habitat for black rockfish, *Sebastes schlegelii*: examining growth rate, feeding condition, and return rate. *Reviews in Fisheries Science* 21: 286–298, https://doi.org/10.1080/10641262.2013.837364

Choi H-S, Jee, B-Y, Cho, M-Y, Park M-A (2010) Monitoring of pathogens on the cultured Korean rockfish *Sebastes schlegeli* in the marine cages farms of south sea area from 2006 to 2008. *Journal of Fish Pathology* 23: 27–35 [in Korean with English summary]

DeRoy EM, Scott R, Hussey NE, MacIsaac HJ (2020) High predatory efficiency and abundance drive expected ecological impacts of a marine invasive fish. *Marine Ecology Progress Series* 637: 195–208, https://doi.org/10.3354/meps13251

Hutchings JA, Reynolds JD (2004) Marine fish population collapses: consequences for recovery and extinction risk. *Bioscience* 54: 297–309, https://doi.org/10.1641/0006-3568(2004)054[0297:MFPCCF]2.0.CO;2

Ivanova PP, Dzhembekova NS, Raykov VS, Raev Y (2024) A first record of non-native Korean (black) rockfish *Sebastes schlegelii* Hilgendorf, 1880 from the Bulgarian Black Sea coast. *BioInvasions Records* 13: 141–148, https://doi.org/10.3391/bir.2024.13.1.12

Kai Y, Soes DM (2009) A record of *Sebastes schlegelii* Hilgendorf, 1880 from Dutch coastal waters. *Aquatic Invasions* 4: 417–419, https://doi.org/10.3391/ai.2009.4.2.23

Kang M-G, Lee S-H, Kim M-J, Kwak S-N, Han I-S, Park J-M (2023) Resource use among six commercial fish species from the south-eastern gill net fisheries, Korea. *Water* 15: 1146, https://doi.org/10.3390/w15061146

Karpova EP, Tamoykin IY, Kuleshov VS (2021) Findings of the Korean rockfish *Sebastes schlegelii* Hilgendorf, 1880 in the Black Sea. *Russian Journal of Marine Biology* 47: 29–34, https://doi.org/10.1134/S106307402101003X

Katsanevakis S, Zaiko A, Olenin S, Costello MJ, Gallardo B, Tricarico E, Adriaens T, Jeschke JM, Sini M, Burke N, Ellinas K, Rutten S, Poursanidis D, Marchini A, Brys R, Raeymaekers JAM, Noé N, Hermoso V, Blaalid R, Lucy FE, Verbrugge LNH, Staehr PAU, Vandepitte L, de Groot D, Elliott M, Reuver M, Maclaren J, Li M, Oldoni D, Mazaris A, Trygonis V, Hablützel PI, Everts T, Pistevos JCA, Dekeyzer S, Kimmig SE, Rickowski FS, Panov VE (2024) GuardIAS – Guarding European Waters from Invasive Alien Species. *Management of Biological Invasions* 15: 701–730, https://doi.org/10.3391/mbi.2024.15.4.14

Khutornoy SO (2021) Struktura prybereznykh ikhtiotsenoziv pivnichno-zakhidnoi chastyny Chornoho moria [The structure of the off-shore ichthyocenoses of the northwestern Black Sea], PhD Thesis. Institute of Marine Biology of the NAS of Ukraine, Odesa, 176 pp [In Ukrainian with English summary]

Khutornoi S, Son MO, Kvach Y (2023) First record of two fish species (Actinopterygii) in the Sukhyi Lyman, northwestern Black Sea, Ukraine. *Acta Ichthyologica et Piscatoria* 53: 157–162, https://doi.org/10.3897/aiep.53.111525

Kim IS, Choi Y, Lee CL, Lee YJ, Kim BJ, Kim JH (2005) Illustrated book of Korean fishes. Kyo-Hak Pub Co, Seoul, 615 pp [in Korean]

Kovtun OA, Manilo LG (2013) Mediterranean fish – *Gammogobius steinilzi* Bath, 1971 (Actinopterygii: Percifonnes: Gobiidae) – a new representative of the Black Sea ichthyofauna. *Acta Ichthyologica et Piscatoria* 43: 307–314, https://doi.org/10.3750/AIP2013.43.4.08

Kulhanek SA, Ricciardi A, Leung B (2011) Is invasion history a useful tool for predicting the impacts of the World's worst aquatic invasive species? *Ecological Applications* 21: 189–202, https://doi.org/10.1890/09-1452.1

Kvach Y, Kutsokon Y (2017) The non-indigenous fishes in the fauna of Ukraine: A potentia ad actum. *BioInvasions Records* 6: 269–279. https://doi.org/10.3391/bir.2017.6.3.13

Latini AO, Petrere M (2004) Reduction of a native fish fauna by alien species: an example from Brazilian freshwater tropical lakes. *Fisheries Management and Ecology* 11: 71–79, https://doi.org/10.1046/j.1365-2400.2003.00372.x

Lee JY, Kang YJ, Lee S-M, Kim I-B (1993) Protein requirements of the Korean rockfish *Sebastes schlegeli*. *Journal of Aquaculture* 6: 13–27 [in Korean with English summary]

Lodge DM, Simonin PW, Burgiel SW, Keller RP, Bossenbroek JM, Jerde CL, Kramer AM, Rutherford ES, Barnes MA, Wittmann ME, Chadderton WL, Apriesnig JL, Beletsky D, Cooke RM, Drake JM, Egan SP, Finnoff DC, Gantz CA, Grey EK, Hoff MH, Howeth JG, Jensen RA, Larson ER, Mandrak NE, Mason DM, Martinez FA, Newcomb TJ, Rothlisberger JD, Tucke AJ, Warziniack TW, Zhang H (2016) Risk analysis and bioeconomics of invasive species to inform policy and management. *Annual Review of Environment and Resources* 41: 453–488, https://doi.org/10.1146/annurev-environ-110615-085532

Lowe S, Browne M, Boudjelas S, De Poorter M (2000) 100 of the World's worst invasive alien species a selection from the global invasive species database. The Invasive Species Specialist Group IUCN, Auckland, 12 pp

Luzhniak VA, Chepurnaia TA, Zhivoglyadov AA (2020) First discovery of greater amberjack *Seriola dumerili* (Carangidae) in Russian waters of the Black Sea coast of the Caucasus. *Journal of Ichthyology* 60: 335–338, https://doi.org/10.1134/S0032945220020095

Mack RN, Simberloff D, Lonsdale WM, Evans H, Clout M, Bazzaz FA (2000) Biotic invasions: causes, epidemiology, global consequences, and control. *Ecological Applications* 10: 689–710, https://doi.org/10.1890/1051-0761(2000)010[0689:BICEGC]2.0.CO;2

Manilo L (2021) Alien fishes in the Black Sea waters of Crimea (Ukraine). *Geo & Bio* 20: 79–101, https://doi.org/10.15407/gb2010

Masuda H, Amaoka K, Araga C, Uyeno T, Yoshino T (1984) The fishes of the Japanese Archipelago, Vol. 1. Tokyo: Tokai University Press, 437 pp

Minicheva GG, Bolshakov VN, Kalashnik ES, Zotov AB, Marinets AV (2018) Ecology, cenology, conservation of algae and their role in nature assessment of the reactions of the black sea ecosystem's algaecommunities to influence of climatic factors. *Algologia* 28: 121–135, https://doi.org/10.15407/alg28.02.121

Mitov P, Uzunova S, Kenderov L, Dimov S, Yanachkov P (2020) Pacific oyster invasion along Bulgarian Black Sea coast. In: Scientific Conference "Kliment's Days", 5th November 2020, Abstracts. Sofia University St. Kliment Ohridski, Faculty of Biology, p 55, https://doi.org/10.13140/RG.2.2.26745.08806

Pelicice FM, Agostinho AA (2009) Fish fauna destruction after the introduction of a non-native predator *Cichla kelberi* in a Neotropical reservoir. *Biological Invasions* 11: 1789–1801, https://doi.org/10.1007/s10530-008-9358-3

Pravdin IF (1966) Rukovodstvo po izucheniyu ryb [A guide to the study of fish]. Pishhevaja promyshlennost, Moscow, 376 pp [in Russian]

Ricciardi A, Rasmussen JB (1998) Predicting the identity and impact of future biological invaders: a priority for aquatic resource management. *Canadian Journal of Fisheries and Aquatic Sciences* 55: 1759–1765, https://doi.org/10.1139/f98-066

Sharpe DMT, De León LF, González R, Torchin ME (2017) Tropical fish community does not recover 45 years after predator introduction. *Ecology* 98: 412–424, https://doi.org/10.1002/ecy.1648

Snigirov SM, Zamorov VV, Karavanskyi YV, Pitsyk VZ, Kurakin OP, Abakumov OM, Liumkis PV, Snigirov PM, Morozov YV, Kvach YV, Kutsokon YK (2020) Taxonomic and eco-faunistic features of the nowadays fish fauna of the Gulf of Odesa, the Dniester mouth forefront near-shores and coastal waters of the Snake (Zmiinyi) Island. *Odesa National University Herald. Biology* 25: 113–139, https://doi.org/10.18524/2077-1746.2020.2(47).218060 [in Ukrainian with English summary]

Starushenko LI, Bushuyev SG (2001) Prichernomorskie limany Odeshchiny i ikh rybokhoziajstvennoe znachenie [Black Sea estuaries and lagoons of the Odessa region and their fisheries importance]. Astroprint, Odessa, 151 pp [in Russian]

Vilizzi L, Copp GH, Hill JE, Adamovich B, Aislabie L, Akin D, Semenchenko V (2021) A global-scale screening of non-native aquatic organisms to identify potentially invasive species under current and future climate conditions. *Science of the Total Environment* 788: 147868, https://doi.org/10.1016/j.scitotenv.2021.147868

Vinogradov AK, Bogatova YI, Synegub IA (2018) Ecology of marine ports of the Black and Azov Sea Basin. Springer International Publishing, Cham, 412 pp, https://doi.org/10.1007/978-3-319-63062-5

Weis JS (2011) Invasion and predation in aquatic ecosystems. *Current Zoology* 57: 613–624, https://doi.org/10.1093/czoolo/57.5.613

Xi D, Zhang X, Lü H, Zhang Z (2017) Prediction of cannibalism in juvenile black rockfish, *Sebastes schlegelii* (Hilgendorf, 1880), based on morphometric characteristics and paired trials. *Aquaculture Research* 48: 3198–3206, https://doi.org/10.1111/are.13150

Yağlıoglu D, Doğdu SA, Turan C (2023) First morphological and genetic record and confirmation of Korean rockfish *Sebastes schlegelii* Hilgendorf, 1880 in the Black Sea coast of Türkiye. *NESciences* 8: 140–150, https://doi.org/10.28978/nesciences.1363941

Zaharia T, Crivăţ M (2017) Creşterea dirijată a stridiei japoneze (*Crassostrea gigas*) la litoralul românesc. In: Zaharia T, Niţă VN, Nenciu MI (eds), Bazele acvaculturii marine in România. CD PRESS, Bucureşti, pp 28–49

Zhang H, Yanagimoto T, Zhang XM, Song N, Gao TX (2014) Lack of population genetic differentiation of a marine ovoviviparous fish *Sebastes schlegelii* in Northwestern Pacific. *Mitochondrial DNA* 27: 1748–1754, https://doi.org/10.3109/19401736.2014.963797

Zolotarev V (1996) The Black Sea ecosystem changes related to the introduction of new mollusc species. *Marine Ecology* 17: 227–236, https://doi.org/10.1111/j.1439-0485.1996.tb00504.x