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First record of the Antarctic jonasfish (*Notolepis coatsi*) at the Kyiv Peninsula region (Maritime Antarctic)

Trokhymets Vladlen[1]* and Dykyy Ihor[2]

[1]*Department of Ecology and Zoology, Educational and Scientific Center "Institute of Biology and Medicine", Taras Shevchenko National University of Kyiv, Ukraine*

[2]*Department of Zoology, Faculty of Biology, Ivan Franko National University of Lviv, Ukraine*

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***Corresponding author:** Trokhymets Vladlen, Department of Ecology and Zoology, Educational and Scientific Center "Institute of Biology and Medicine", Taras Shevchenko National University of Kyiv, Ukraine

Abstract

This publication addresses the issue of clarifying the distribution range of the pelagic fish species *Notolepis coatsi.* This species was first discovered for the Kyiv Peninsula area (Maritime Antarctic). The potential use of *N. coatsi* as prey for the flying seabird *Sterna vittata* in the coastal waters of Antarctica is considered.

Keywords: Ichthyofauna; Marine Birds; Food Web; Marine Ecology; Antarctica

Introduction

Fish have a major role in the food webs of the Southern Ocean and Antarctic coastal water as the basis of most top predators' diets (other fish, birds, and mammals) [1-3], second only to the Antarctic krill (*Euphausia superba* Dana, 1850) [4,5]. Flying birds, penguins, and pinnipeds transfer most of the energy from marine ecosystems to terrestrial ones in the form of feces, regurgitation and their own remains [4]. Therefore, the study of Antarctic food webs as a whole and their individual links is of priority [6]. Our study is devoted to the fish → flying bird link, namely the Antarctic jonasfish (*Notolepis coatsi* Dollo, 1908) → Antarctic Tern (*Sterna vittata* Gmelin, 1789).

In general, the Antarctic ichthyofauna is poor and numbers only about 300 marine species [7,8]. *Notolepis coatsi* is one of the most widespread marine species south of the Antarctic Polar Front [9]. This species is recorded in the Maritime Antarctic from the South Orkney Islands and Scotia Sea to Anvers Island [10,11], as well as near almost the entire coast of Continental Antarctic [11], for example in the Weddell Sea [12,13], the Lazarev Sea [14], the Cosmonaut Sea [15], the D'Urville Sea [16], and the Ross Sea [17]. Only 14 species of benthic notothenioids were found in the coastal water of the Kyiv Peninsula area [18], although researchers suggested the possibility of the existence of 34 species of fish in the coastal water of this region of the Maritime Antarctic [19]. *Notolepis coatsi* is absent from both of these lists. In addition, no pelagic fish species were caught, which can be explained by the predominance of benthic ichthyofauna at shallow depths in the coastal zone, where their diet is dominated by various benthic invertebrates, smaller benthic fishes, and algae [20,21].

Sterna vittata is a common species of the Antarctic and Sub-Antarctic seas [1], although it is found off the coast of South America [22], Africa [23] and other regions of the Southern Hemisphere. It is a common species in the Maritime Antarctica, that breeds in the Kyiv Peninsula area. There is a large number of observations of these birds in our study region, but there are no scientific publications on their ecology and nutrition. Studies by other scientists from other regions of Antarctica indicate that the specie's diet can include different groups of marine hydrobionts [24-26]: mainly small fish and crustaceans, rarely mollusks and algae.

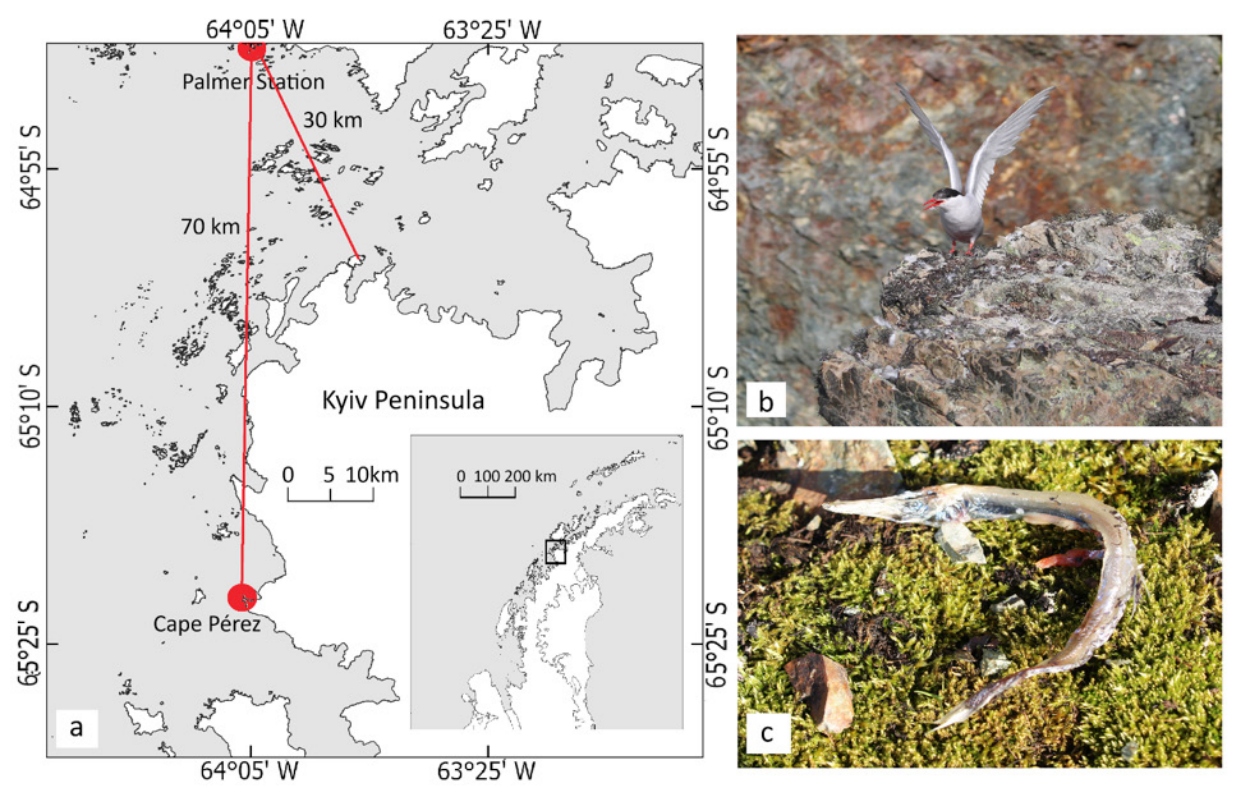

Figure 1: Location of new discovery of *Notolepis coatsi* remains. a – location of the fish remains at the Kyiv Peninsula area and its location within the Antarctic Peninsula (map was generated with QGIS 3.16 using SCAR Antarctic Digital Database v7.7 2023 [27] and UK Polar Data Centre VERSION 7.3 (Version 1.0) [28]); b – Antarctic tern, near the nest which the fish remains were found; c – fish remains (photos by Ihor Dykyy).

Results and Discussion

The remains of an unknown fish were discovered among stones with moss on a rocky hill in the coastal zone of a small bay of Cape Pérez within the southwestern part of the Kyiv Peninsula at coordinates 65°24'31"S 64°05'51"W on 25 February 2020 (Figure 1a). These fish remains were found in the middle of a small colony of three nests of *S. vittata* (Figure 1b), two meters from one of the nests. The fish had been lying on the moss under the sun for several days, as it showed visible signs of decomposition (digestion) and had already dried out (Figure 1c) [27,28]. An elongated trace of dried mucus was visible near its head, which very much resembled a bird's belch. Most likely, this was the prey of an adult *S. vittata,* which it hunted, ate, and then regurgitated for some reason (possibly due to the size of the fish, which reached 180 mm in length). We consider it unlikely that this fish was brought for the chicks, as it is too large for them and birds most often carry prey for their chicks in their beaks (our visual observations). In addition, these remains were located under a stone canopy, so they could not have accidentally fallen from above or been lost by other birds.

Further analysis of the found fish specimen in the laboratory using an identifier [7] was complicated by the fact that parts of the fins were completely destroyed, which did not allow the use of a number of morphometric features for identification. However, the belonging of this fish based on morphological similarities to representatives of the Family Paralepididae of the Order Aulopiformes was not in doubt [7,15] (Figure 2a & 2b). Further analysis of the otoliths of this fish specimen showed it belongs to the species *N. coatsi* [29]. Although it is worth noting a certain difference of the otolith from the original (Figure 2c & 2d), this can be explained by the high individual and age variability of the otoliths [7,30,31] (Figure 2d, 2f). This identification was confirmed by other researchers when checking the determination of the otoliths (see Acknowledgement).

Notolepis coatsi is a very common species in the oceanic and coastal waters of Antarctica, but findings of this species in the Maritime Antarctic coastal zone are limited to the south by the coastal waters of Anvers Island [11]. The closest place to where the new specimen was discovered was in the Palmer Station area [32]. This is 30 km from the Kiev Peninsula and about 70 km

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north of Cape Pérez (Figure 1a). This species can potentially be found further south along the Antarctic Peninsula, but it is rare in the coastal zone. This is due to the ecological features of this fish species. This is because representatives of this species can make significant vertical migrations from the surface to depths of over 2000m [7], with juveniles staying in shallower areas [30]. Recently discovered specimens of *N. coatsi* reached 180 mm, while the maximum size of representatives of this species reaches 380 mm [7]. In addition, many fish species migrate to the surface at night [33], and *S. vittata*, although characterized by predominantly diurnal behavior, has evidence of its ability to feed at night [25]. During the breeding season, these birds feed mainly near the coast in the algae zone up to 200 m from the shore, including bays [25,34]. An important point is that in the coastal areas of Cape Pérez, depths can reach more than 100 m. Therefore, the most likely sequence of events may be the following: in the evening hours, *S. vittata* hunted a small specimen of *N. coatsi* in the coastal zone near the water surface and regurgitated it near the nest. Although it is worth noting that *N. coatsi* is not a typical prey for *S. vittata* [1].

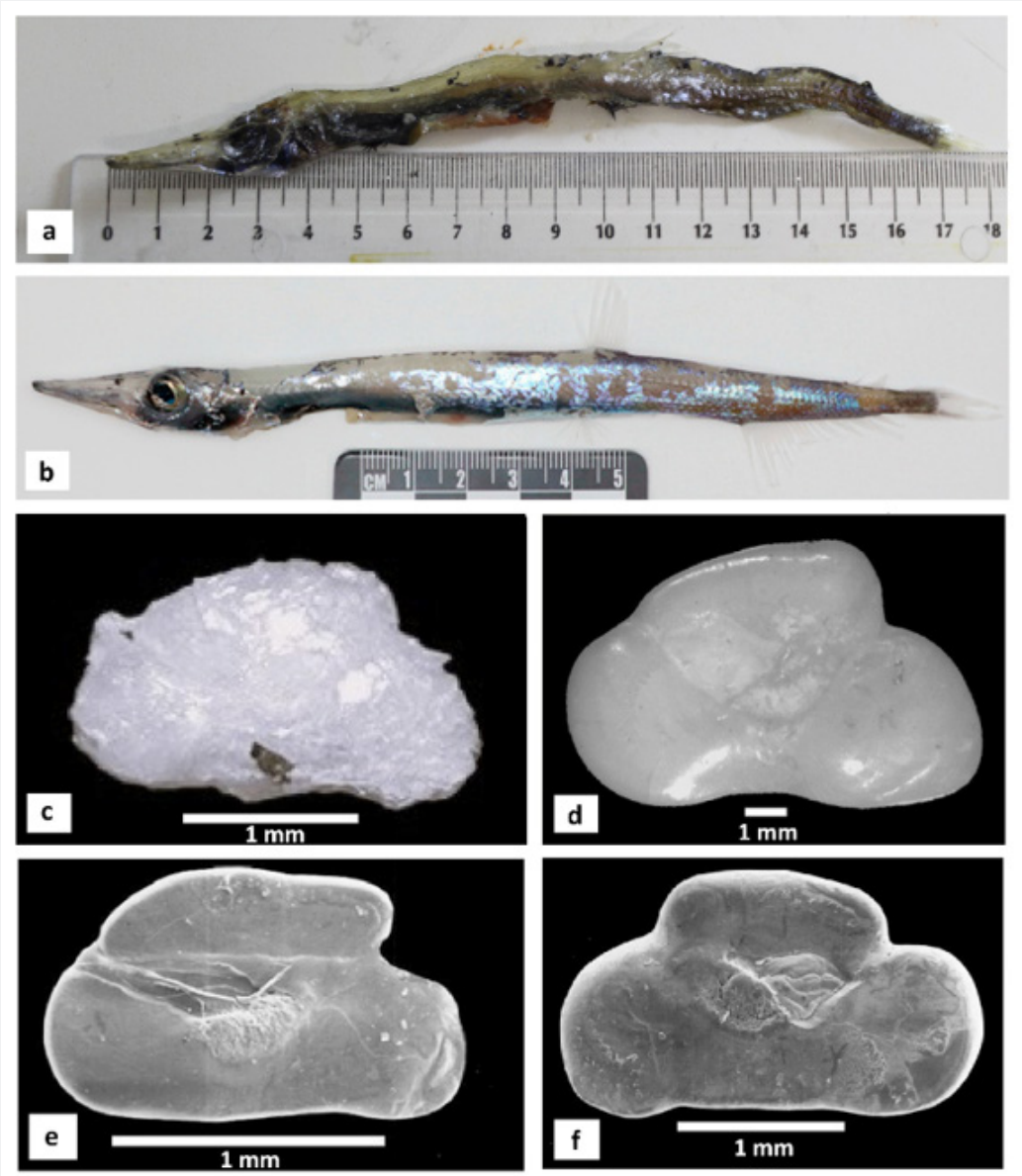

Figure 2: Comparison of the appearance and otoliths of the new find of *Notolepis coatsi* with previous finds of this fish species by other researchers. a – remains of a new specimen of fish (photo by Ihor Dykyy); b – whole specimen of other fish [15]; c – right otolith of a new specimen of fish, the body length of which reached 180 mm (photo by Ihor Dykyy); d – huge otolith of unknown size fish [29]; e – otolith of a specimen of fish, the body length of which reached 128 mm; f – otolith of a specimen of fish, the body length of which reached 284 mm [30].

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Conclusion

This publication presents data on the first discovery of the pelagic fish species *N. coatsi* in the coastal water of the Kyiv Peninsula region. In addition, the potential existence of a link in the marine food web where *S. vittata* uses *N. coatsi* as prey is noted. This review proves the need for further study of the ichthyofauna of this region Maritime Antarctic, especially regarding the poorly studied group of pelagic fish species.

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Conflict of Interest

All authors declare that they have no conflicts or competing interests and that the study was conducted according to the requirements of their national research committee.

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