

**Short note**

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## **First record of Eckström's topknot *Zeugopterus regius* (Bonnaterre, 1788) in Belgian waters**

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Here, we present the first record of *Zeugopterus regius* (Bonnaterre, 1788), a fish species new to the Belgian Part of the North Sea (BPNS) [1][2]. Its taxonomy, ecology, biology are discussed, and we speculate about its possible presence in suitable habitats in Belgian waters. We also provide information regarding the main morphological differences between *Z. regius* and two closely related species.

Eckström's topknot *Zeugopterus regius*, also known as Bloch's topknot, is a demersal flatfish species that belongs to the topknots, a group of three small and elusive species within the genus *Zeugopterus*, assigned to the Scophthalmidae: Common topknot *Z. punctatus* (Bloch, 1787), Eckström's topknot *Z. regius* and Norwegian topknot *Z. norvegicus* (Günther, 1862). All three species are associated with extremely rocky and rough substrates to which they cling. Their diet consists of worms, crustaceans and small fish [3]. They rely heavily on their camouflage while hunting for prey and hiding from predators. Crawling on the substrate is preferred over swimming [3]. This elusive lifestyle of sticking to steep slopes of hard substrate makes it harder to collect species of *Zeugopterus* on beam trawl surveys and challenges accurate estimates of their occurrence and abundance.

Several studies [4][5][6] suggested that species *Zeugopterus* might already occur in or near Belgian and Dutch waters for a long time. One specimen of *Z. norvegicus*, which is now curated in the collections of the Royal Belgian Institute of Natural Sciences, was presumably collected near the Ostend Coastline in 1911 [7]. Three specimens of *Z. punctatus* allegedly also belong to the collection of the same institute [7]. Two of them are reported to have been caught in the "North Sea" and the third one in Belgian water, on the outer Wenduine Bank in 1930. The occurrence of *Z. regius* in the BPNS remained up to now unconfirmed.

*Zeugopterus regius* appears to have the most restricted geographic distribution and is the rarest of the three species although their occurrence may have been underestimated as a consequence of their preference for extremely rough grounds which are significantly less monitored than sandy grounds. *Zeugopterus regius* is currently reported from the British Isles to Gibraltar, the western part of the Mediterranean Sea [3][8] and up to the Northern Adriatic Sea [2][9]. Surveys from the British Isles, North Sea and Baltic Sea showed that most records were located in the Irish Sea, the shallower parts of the Celtic Sea, and the English Channel where specimens were caught at depths between 10 and 100 m, with a peak around 20–25m [3]. According to surveys carried out in Portuguese waters, *Z. regius* inhabits coastal waters at depths of 10 to 180 m [10], although LOZANO Y REY found the species in Portuguese waters as deep as 233 and 300 m [11]. Historical trawl survey data collected for the Pipeta program in the Northern Adriatic Sea listed four observations in 1988 and 1991 of specimens caught between 34 and 40 m deep [2].

On 2023-04-14, between 14h21 and 15h51, during fishing trials on board of *R.V. Belgica* (71.4 m L.O.A, 2 × 1200 kW) between the Oosthinder Bank and the Noordhinder Bank (51.6475° N, 2.7208° E – 51.6572° N, 2.6103° E) at depths between 35 m and 40 m, we caught a specimen of *Z. regius* (Fig. 1),

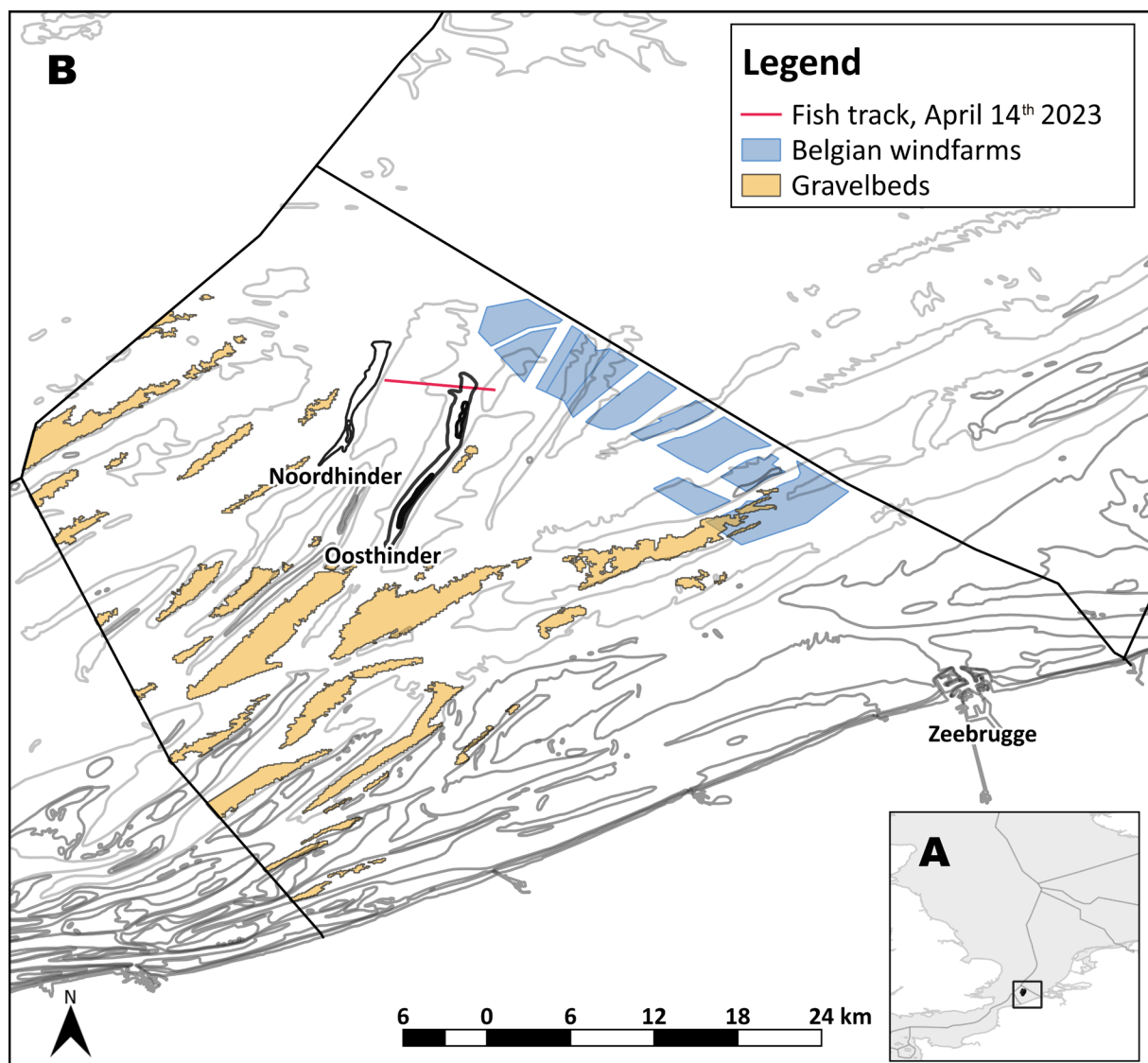


Figure 1 – A. North Sea exclusive economic zones. B. Belgian part of the North Sea (BPNS) with the fish track (red line) where *Z. regius* was caught.

with a total length of 106 mm. The specimen is presently kept at ILVO (Flanders Research Institute for Agriculture, Fisheries and Food). We used a double 4 m beam trawl net, equipped with square meshed benthic release panels (BRP's) with a mesh size of 150 mm, as described by SOETAERT *et al.* [12]. Cover codends (nets with a stretched mesh opening of 22 mm) were placed over the BRP's, to monitor escaping animals. The net was dragged with the tide for 90 minutes at an average speed of 4 knots. The specimen of *Z. regius* was discovered in the portside cover codends. The main part of the catch consisted of *Limanda limanda* (Linnaeus, 1758), *Pleuronectes platessa* (Linnaeus, 1758), boulders and trash.

All three species of topknot are relatively broad-bodied, left-eyed flatfish with a small head. *Zeugopterus regius* is a small and inconspicuous fish and is most likely confused with *Z. punctatus*. Compared to *Z. punctatus*, *Z. regius* has a more pointed head with a distinct notch at the upper eye (Fig. 2, arrow 1) as well as an elongated first fin ray in the dorsal fin (Fig. 2, arrow 2). The dorsal scales are small and have three to five spines, forming hair-like skin flaps which are missing on the ventral side [1][13]. The pelvic fins are separated from the anal fin (Fig. 2, arrow 3), whereas in *Z. punctatus* the pelvic fins and anal fin are fused. The colouration of *Z. regius* is pale brown, pale red or even pale pink with irregular dusky patches and a dark blotch with a brown-yellow centre towards the tail end [3][13][14] (Fig. 2, arrow 4). *Zeugopterus regius* reaches a maximum size of 20 cm [3][14].

*Zeugopterus punctatus* is the largest and most rounded of the topknots. It grows to a maximum reported size of 25 cm and is pale brown with a dark brown, mottled camouflage pattern and possesses a characteristic, irregular dark band across the eye (Fig. 3, arrow 1). The large mouth of *Z. punctatus* is almost vertical at a right angle to the body axis (Fig. 3, arrow 2), and the pelvic fins are connected by a

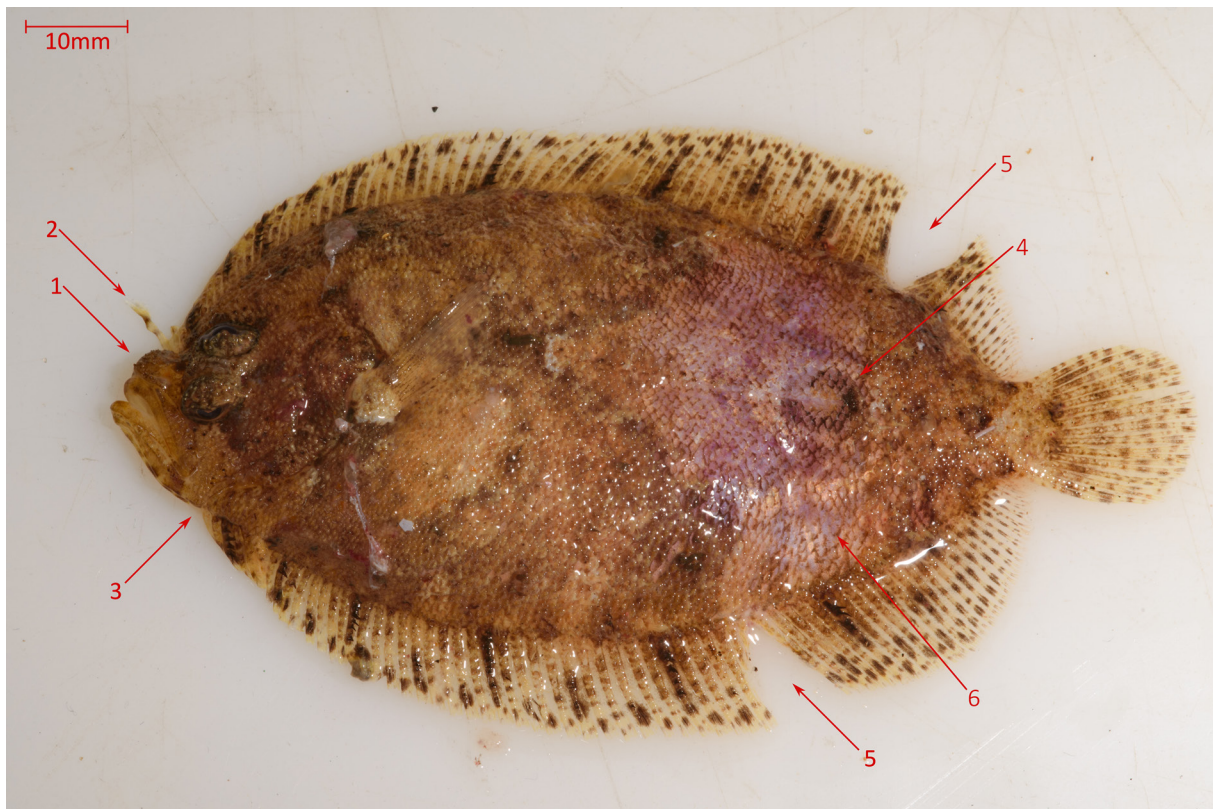


Figure 2 – Specimen of *Zeugopterus regius* (106 mm) caught in the BPNS, 2023-04-14 (© Jan Ranson). The distinct notch at the upper eye (1), the elongated first fin ray of the dorsal fin (2), the separated pelvic and anal fins (3), a dark blotch with a brown-yellow center (4), torn fins (5) and a bruise (6) are shown in the photograph with arrows.

membrane to the anal fin (Fig. 3, arrow 3) [3][13][14], which are all features that are clearly lacking in our specimen of *Z. regius*.

*Zeugopterus norvegicus* is the smallest of topknots, only reaching 12 cm and has a more slender, less rounded body compared to the other topknot species. Like *Z. regius* the pelvic fins are separated from the anal fin (Fig. 4, arrow 2). The colour is brown to reddish with irregular dusky and white blotches [3][13][14]. Yet, confusing *Z. regius* with *Z. norvegicus* is unlikely given the smaller and more pointed head of *Z. norvegicus* and the absence of the distinct deep notch that is typical of *Z. regius* (Fig. 4, arrow 1).

Our specimen of *Z. regius* sustained some minor damage: torn fins and a bruise (Fig. 2, arrows 5 and 6). Despite these injuries, we can conclude that this is the first unequivocally documented record of *Z. regius* in the BPNS.

Currently, there are no earlier observations of *Z. regius* from the BPNS. But during previous campaigns, we encountered a few specimens of *Z. regius* close to Belgian territorial waters. On 2022-04-05, a specimen was recorded off Le Havre, France (49.6328° N, 0.2910° W), and on 2022-09-01, two other specimens were caught near the BPNS, in UK territorial waters (51.2487° N, 1.7109° E).

There are multiple hypotheses why there have not been any observations of topknots in the BPNS before. All three species are associated with rough substrates that are difficult to trawl. Consequently, this makes them harder to detect during trawling surveys. These types of hard substrates are naturally absent in the BPNS, with the exception of some areas with gravel beds and artificial structures. Yet, the location where the Belgian specimen of *Z. regius* was caught, is not known to have natural rocky



Figure 3 – *Zeugopterus punctatus*, size not registered, caught in the English Channel, United Kingdom, 2023-03-06 (© Jan Ranson). Numbers indicate the dark band (1), the large mouth (2), and fused pelvic and anal fins (3).

or rough substrates [15]. It is possible that the specimen of *Z. regius* encountered was a vagrant being off course. The species is reported to spawn in the western Channel from April up to June [3]. During this period, the usually passive fish becomes restless and starts searching for mates. It is possible that this surge in activity increases the chances of a specimen drifting out of its territory. Alternatively, another possible factor that could explain the current record and potential future discoveries of other hard substrate species might be the increasing presence of artificial hard structures and substrates in the surrounding areas of the location. There are multiple windfarms in the vicinity (mostly monopiles), and more are being constructed [16]. Northwester 2 is the closest windfarm at an approximate distance of 6 km to the area where the specimen was caught. The construction of these windfarms adds a lot of (artificial) hard structures which might offer a suitable habitat for rock dwelling species like *Z. regius*. Whereas the submerged parts and scour protection of windfarms become increasingly colonised by organisms typical of rocky and hardened habitats, these structures might also serve as stepping stones for these species from where they can disperse to suitable areas nearby [17]. On the other hand, these structures that serve as a refuge for hard substrate species might not be suitable to act as spawning grounds, limiting or inhibiting spillover effects from these areas to neighbouring hard substrate areas.

Furthermore, the area between the Noordhinder Bank and Oosthinder Bank is not a part of any standardised fishery survey. Monitoring programs normally cover soft sandy sediments, missing the preferred rocky habitat of *Zeugopterus* on a regular basis. As the species of *Zeugopterus* have only limited commercial value [18] and are a somewhat non-descript group of small species, they probably go unnoticed by fishermen most of the time, which could provide an additional explanation for the lack of observations of species of *Zeugopterus*.

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Figure 4 – *Zeugopterus norvegicus* caught off the UK coast, preserved by freezing (total length 91 mm), August 2022 (© Jan Ranson). Pointed head lacking a distinct notch (1), and separated pelvic and anal fins (2) are shown.

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