



Short communication

First confirmed record of lozano's goby, *Pomatoschistus lozanoi* (de Buen, 1923) (Teleostei: Gobiidae), in the Elbe estuary

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Introduction

Distribution of *Pomatoschistus lozanoi* has traditionally been in the northeastern Atlantic Ocean from the North Sea to the north of Spain (Fonds, 1973), preferring the deeper coastal areas and moderate water temperatures where it is one of the most abundant fishes (Hamerlynck et al., 1990). However, the species is also found in adjoining saltwater marshes (Hamerlynck et al., 1993; Laffaille, 2000; Laffaille et al., 2000) and in lagoons in Portugal (Arruda and Azevedo, 1987; Arruda et al., 1993).

Investigations in the Scheldt estuary, Belgium, by Hamerlynck (1990), Hamerlynck and Hostens (1994) and Maes et al. (1998, 2005) demonstrated that *P. lozanoi* often prefers estuaries. The inner Severn estuary showed similar results, with *P. lozanoi* and *P. minutus* having the highest abundances of the goby family (Claridge et al., 1985).

Regarding the Elbe estuary, Thiel et al. (1995) presumed the existence of several goby species from the *P. minutus* complex, although exact species identification was not determined.

Identification of *P. lozanoi* is not easy, because the cortical appearance looks like that of other gobies in the *P. minutus* complex (Webb, 1980). Identification is therefore only possible with the help of the lateral line pattern of sensory papillae on the head (Miller, 1986), pigmentation pattern (Hamerlynck, 1990), analyses of the otoliths (Arellano et al., 1995), identification of the host specific parasite (Huysse et al., 2004), or by genetic analysis (Wallis and Beardmore, 1980; Larmuseau et al., 2008).

In 2009, new fishing campaigns were started in the Elbe estuary, including a specific search for *P. lozanoi*, the target species of the study.

Material and methods

In 2009, the Elbe estuary was sampled monthly from April to October, with each campaign lasting six days (Table 1). Altogether 307 hauls were made with a commercial stow net vessel at eleven stations (Fig. 1, Table 2). These stations were outside the shipping lanes, between Cuxhaven and Hamburg. At each station two flood and two ebb tide hauls, each of about one and a half hours duration, were carried out. Numerous environmental parameters [temperature, salinity, pH, oxygen and flow velocity] were measured at the beginning and end of each haul.

The square opening of the stow net was 135 m², and 108 m² in the shallow areas, respectively. Mesh size of the cod-end net was 8 mm. Flow velocity data [m/sec] was recorded during

the entire haul using mechanical flow meters (Hydro-Bios and General Oceanics) at depths of 1, 4 and 7 m.

Captured gobies were fixed in formaldehyde (4%) and transported to the Zoological Museum Hamburg, Germany (ZMH). Species identification of the lozano's goby was determined using the lateral line pattern of sensory papillae on the head (Fig. 2), whereby a comparison with *P. minutus* (Fig. 3) was carried out. *P. lozanoi* is characterized by the continuation of the second c-row (C2) of papillae under the horizontal d-row, just behind the corner of the mouth (Miller, 1986; Hamerlynck, 1990).

After identification, morphometric analyses were made and each fish was measured for total length (accuracy of 1 mm) and weight (total weight ± 0.001 g).

Results

During this investigation 15 *P. lozanoi* (de Buen, 1923) individuals were identified, the first-ever recorded in the Elbe estuary.

The initial record was in April 2009 at station 1 'Medem Reede' (53°53.379'N; 8°51.461'E) where altogether 14 individuals were caught in the four hauls. Water depth was between 12.0 and 14.0 m. Habitat characteristics were high flow velocity between 1.0 and 2.3 m s⁻¹ throughout the entire tide, water temperature 11.7°C, salinity of approximately 11.0 and a ground substrate of sand. The second record was in October 2009 at station 3 'Brunsbüttel Süd' (53°52.619'N; 9°12.197'E) at high tide with a water depth of 12.0–13.0 m. The habitat characteristics were similar to 'Medem Reede' but with a somewhat lower salinity of 8.0.

Morphometric measurements of total lengths (30–53 mm) and total weights (0.148–0.863 g) for all 15 individuals are listed in Table 3.

Captured specimens of *P. lozanoi* were catalogued by R. Thiel, University of Hamburg, Biocenter Grindel and Zoological Museum, Ichthyology Section, Hamburg, Germany, under catalogue numbers ZMH 25703, 25704, 25705, 25706 and 25707. The *P. minutus* specimen used for comparison is catalogue number ZMH 25796.

Discussion

Pomatoschistus lozanoi had not been discovered previously in the Elbe estuary probably because of considerable problems of identification and differentiation with *P. minutus* under field conditions. To resolve these difficulties in species

Table 1
Pomatoschistus lozanoi capture campaign and total haul numbers

Campaign	Month	Year	Opening date	Expiration date	Haul numbers
1	April	2009	04 / 20	04 / 25	1–44
2	Mai	2009	05 / 11	05 / 16	45–88
3	June	2009	06 / 02	06 / 07	89–132
4	July	2009	07 / 02	07 / 07	133–176
5	August ^a	2009	08 / 03	08 / 08	177–220
6	September	2009	08 / 31	09 / 05	221–263
7	October	2009	10 / 05	10 / 10	264–307

^aOne haul not performed due to strong winds.

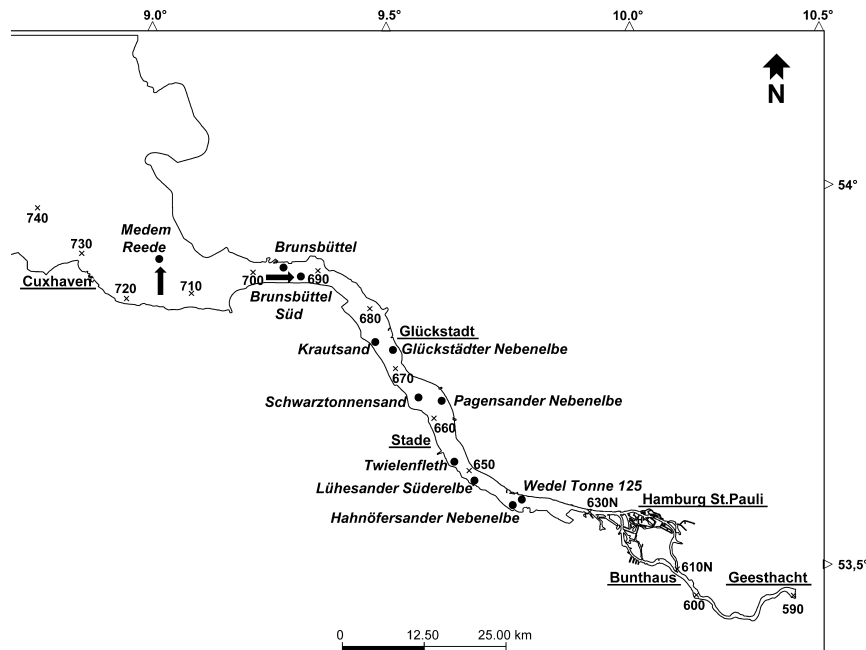


Fig. 1. Study area, sampling sites and stream kilometers. Black circles = sampling stations; X = stream kilometer; Arrows = recorded locations of *Pomatoschistus lozanoi* (© by BAW)

Table 2
Pomatoschistus lozanoi sampling sites, 2009 fishing campaign, stream kilometers and coordinates

Sample site	St. km.	Lat. position North	Long. position East
Medem Reede	714	53°53.379	8°51.461
Brunsbüttel	692.5	53°53.247	9°11.587
Brunsbüttel Süd	692	53°52.575	9°10.856
Krautsand	674.4	53°46.514	9°22.999
Glückstädter Nebelbe	673	53°46.844	9°24.398
Schwarztonnensand	665	53°42.901	9°28.120
Pagensander Nebelbe	662	53°42.326	9°31.146
Twielenfleth	651.5	53°36.522	9°33.994
Lühesander Süderelbe	648	53°35.099	9°36.013
Hahnöfersander Nebelbe	641.3	53°33.036	9°41.682
Wedel-Tonne 125	638.4	53°33.643	9°44.288

St., stream; km., kilometers; Lat., latitude; Long., longitude.

identification a laboratory-based meristical and morphometrical analysis was chosen as an adequate method. Analyses of the lateral line pattern of sensory papillae on the head (Miller, 1986), the pigmentation pattern (Hamerlynck, 1990) and the otoliths (Arellano et al., 1995) can be especially helpful.

Presence of *P. lozanoi* in the Elbe estuary is of particular biogeographical interest because the previously known distri-

bution of this species has been the North Sea coastal areas of Belgium and the Netherlands (Fonds, 1973; Hamerlynck and Hostens, 1994). *Pomatoschistus lozanoi* was therefore assumed by Miller (1986) to be a typically north-eastern Atlantic coastal species and considered by Hamerlynck et al. (1990) and Kellnreitner et al. (2011) as a species commonly found on sandy grounds in the Wadden Sea, e.g. in the Sylt-Rømø bight and around the British Isles.



Fig. 2. Photo of sensory papillae of lateral line system on head of *P. minutus*. Material from Zoological Museum, University of Hamburg (ZMH), catalogue no. ZMH 2574



Fig. 3. Photo of sensory papillae of lateral line system on head of *P. lozanoi*. Material from Zoological Museum, University of Hamburg (ZMH), catalogue no. ZMH 25707

Table 3
Morphometric measurements of all recorded *Pomatoschistus lozanoi*

Haul No.	Sample site	Total length [mm]	Weight [g]	A.T. [haul]	T.T. [haul]	Tide	ZMH-No.
1	M. R.	37	0.306	13:05	14:35	ebb	25 703
1	M. R.	43	0.668	13:05	14:35	ebb	25 703
2	M. R.	30	0.148	15:00	16:30	ebb	25 704
2	M. R.	34	0.339	15:00	16:30	ebb	25 704
2	M. R.	37	0.366	15:00	16:30	ebb	25 704
2	M. R.	39	0.400	15:00	16:30	ebb	25 704
2	M. R.	40	0.377	15:00	16:30	ebb	25 704
2	M. R.	42	0.530	15:00	16:30	ebb	25 704
2	M. R.	45	0.543	15:00	16:30	ebb	25 704
2	M. R.	47	0.759	15:00	16:30	ebb	25 704
2	M. R.	50	0.838	15:00	16:30	ebb	25 704
3	M. R.	42	0.605	19:15	20:45	high	25 705
3	M. R.	47	0.797	19:15	20:45	high	25 705
4	M. R.	48	0.403	20:30	22:00	high	25 706
274	B. S.	53	0.863	15:15	16:45	high	25 707

No., number; M. R., Medem Reede; B. S., Brunsbüttel Süd; A.T., acceleration time; T.T., terminal time; ZMH-No., catalogue number, Zoological Museum, University of Hamburg, Germany.

Discovery of *P. lozanoi* in the Elbe estuary indicates a habitat with marine or brackish water, sandy ground, moderate water temperatures and higher oxygen levels as being suitable for this species. In the Elbe estuary *P. lozanoi* was captured only in the outer areas near the North Sea. A possible reason might be that *P. lozanoi* prefers areas with higher salinity (3.0–14.0), good oxygen availability and water temperatures of at least 5.0°C. Investigations by Maes et al. (1998) in the Scheldt estuary showed higher abundance of *P. lozanoi* in the outer station of 'Doel', where salinity was between 3.4 and 13.4, oxygen 3.1–6.5 mg L⁻¹, and temperature 5.1–23.8°C.

The Elbe estuary obviously represents a proper habitat for *P. lozanoi*, which is indicated by these first records. To support this assumption, more specific information is desirable. Therefore, future investigations should analyse the influence of food availability, whereby Hamerlynck and Cattrijsse (1994) and Laffaille et al. (1999) already identified mysis as the preferred food.

In future investigations another method might also be used; although the method of Miller (1986) and Hamerlynck (1990) was helpful to identify *P. lozanoi*, the determination was difficult in juveniles and the lateral line pattern of sensory papillae on the head was often damaged during the fishing

procedure and freezing of the fish (Wallis and Beardmore, 1980). Genetic analyses should thus be considered in the future because the investigation by Wallis and Beardmore (1980) noted the existence of *P. lozanoi* and *P. minutus* hybrids. The existence of *P. norvegicus* also makes the application of genetic analysis desirable, because Webb and Miller (1974) indicated that *P. norvegicus* might also be a hybrid. Another investigation by Larmuseau et al. (2008) also showed that genetic analysis was very helpful in identifying the post-larvae individuals from both species. Post-larvae identification is very important: information on densities, spatial and temporal alterations, as well as total lengths can be major contributions to knowledge of their distribution, migration, and recognition of possible bottlenecks in their recruitment (Beyst et al., 1999). Hence, future efforts to perform accurate genetic analyses would be needed to distinguish among the species of the *P. minutus* complex, in which *P. lozanoi* was probably overlooked in several areas in recent years.

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