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Notes on the occurrence of *Syngnathus rostellatus* (Teleostei, Syngnathidae) in the Mediterranean

Hablützel, Pascal I ; Wilson, Anthony B

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1 Accepted Manuscript - *Marine Biodiversity Records*

2

3 **Notes on the occurrence of *Syngnathus rostellatus* (Teleostei, Syngnathidae) in the**
4 **Mediterranean**

5

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17 Abstract

18 *Syngnathus rostellatus* Nilsson, 1855 is a nearshore pipefish species whose distributional
19 range extends along the European Atlantic coast between Bergen (NO) and the Bay of
20 Biscay (ES). Several recent articles suggest that this species has experienced a major
21 range expansion of more than 4000 km into the eastern Mediterranean, but a critical
22 review of these studies indicates that the majority of these reports are based on specimen
23 misidentifications. Considering a reliable report of *S. rostellatus* from the Mediterranean
24 coast near Gibraltar, it appears that the current distribution of this species is restricted to
25 the northeastern Atlantic Ocean and the southern Mediterranean coast of the Iberian
26 peninsula.

27

28 Keywords: range expansion, species identification, *Syngnathus rostellatus*, pipefish

29 INTRODUCTION

30 There is increasing evidence that human-mediated environmental changes, including the
31 erosion of geographical barriers, the introduction of exotic species, and habitat
32 degradation, are influencing the distribution of species (e.g. Rahel, 2007; Hiddink & ter
33 Hofstede, 2008). The accelerated rate of human modifications of the natural environment is
34 paralleled by an increasing number of reports documenting extensions and contractions of
35 the historical ranges of many species (e.g. Azzurro, 2008; Sax & Gaines, 2003; Thomas,
36 2010). The value of these studies is entirely dependent on the accurate identification of
37 specimens, and the misidentification of material can lead to erroneous conclusions of
38 major shifts in species' ranges.

39

40 Close to 40 nominal species of the globally-distributed genus *Syngnathus* are currently
41 recognized in the Eschmeyer's Catalog of Fishes (2010). Of these, eleven are known to
42 occur in Europe, making this the most species-rich group of syngnathid fishes in the region
43 (Dawson, 1986). While nine of these species names are in common use (e.g. Dawson,
44 1986), two species from the Black Sea (*S. affinis*, Eichwald, 1831 and *S. argentatus*, Pallas,
45 1814) were only recently reinstated by Kuitert (2009). Kuitert (2009) provides no
46 justification for the reinstatement of these species names, and a more systematic analysis of
47 Black Sea pipefish will be necessary in order to clarify their species status. The taxonomic
48 status of at least two additional species is also unclear. The nearshore *S. agassiz*
49 Michahelles, 1829 sensu Canestrini (1872) was synonymized with *S. abaster* by Lueken
50 (1967), but was this species was reinstated by Roig (1979) on the basis of an exhaustive
51 analysis of historical and contemporary collections from the Balearic Islands and Spanish

52 coast – this Spanish-language report appears to have been overlooked by subsequent
53 researchers. Similarly, genetic and morphometric analyses of pipefish material from the
54 Mediterranean and Black Seas suggest that *S. nigrolineatus* Eichwald, 1831 may also
55 represent a distinct species (Hablützel & Wilson, unpublished data). Clearly, the taxonomy
56 of *Syngnathus* pipefish is in a state of flux, and the genus is in need of a full systematic
57 revision.

58

59 Of the nine commonly-recognized species, two (*S. phlegon* Risso, 1827 and *S. schmidtii*
60 Popov, 1928) are pelagic, while the others (*S. abaster* Risso, 1827 sensu Canestrini (1872),
61 *S. acus* Linnaeus, 1758, *S. rostellatus* Nilsson, 1855, *S. taenionotus* Canestrini, 1871, *S.*
62 *tenuirostris* Rathke, 1837, *S. typhle* Linnaeus, 1758 and *S. variegatus* Pallas, 1811) are all
63 nearshore inhabitants (Dawson, 1986), and are dominant members of nearshore eelgrass
64 habitats along the European coastline.

65

66 *S. rostellatus* (Nilsson's pipefish) was originally described from western Sweden (Nilsson,
67 1855) and the northern French *S. dumerilii* Moreau, 1870 in Duméril (1870) is now
68 considered a junior synonym of this species (Fries *et al.*, 1895; Wheeler, 1973).

69 Ehrenbaum (1905-1909) defined the distribution range of *S. rostellatus* as the Atlantic
70 coast between Bergen to the Sea of Biscay (Figure 1). *S. rostellatus* is found at moderate
71 densities in the Kattegat of western Sweden, and while there are scattered reports of
72 individual specimens in the southern Baltic (e.g. Ehrenbaum, 1905-1909; Otterstøm,
73 1917), a recent exhaustive survey of this region failed to detect this species (HELCOM
74 2007). These earlier descriptions have been complemented by subsequent reports of *S.*

75 *rostellatus* from the northern Irish coast (Douglas and Egan 1983) and sites as far south as
76 Málaga, Spain (Helling (1943); Reina-Hervás *et al.* (1981-1982)) (Figure 1). *S. rostellatus*
77 has recently been reported from sites within the Mediterranean as far east as southern
78 Turkey (Louisy, 2002; Gökoglu *et al.*, 2004; Ben Amor *et al.*, 2008) (Figure 1), suggesting
79 that this species may be experiencing a major range extension.

80

81 Here, we provide a morphological diagnosis of *S. rostellatus*, and use this tool to evaluate
82 recent report of *S. rostellatus* outside its historical distributional range (Dawson, 1986).
83 Our analyses indicate that the majority of these recent reports stem from the
84 misidentification of specimens and that the distribution of this species remains restricted to
85 the northeastern Atlantic Ocean and the Mediterranean coast of the Iberian peninsula.

86

87 MATERIALS AND METHODS

88 Pipefish individuals were identified on the basis of the meristic and morphometric data
89 provided in the original articles and, if available, from pictures. The original description of
90 *S. rostellatus* by Nilsson (1855), together with subsequent descriptions by Moreau in
91 Duméril (1870) and Dawson (1986) were used as references, and these descriptions were
92 supplemented with the analysis of ethanol-preserved specimens from Northern Spain
93 (Sada) and Western Sweden (Fiskebäckskil) (Table 1). Methods for the measurements and
94 meristic counts used in this article follow Dawson (1986).

95

96 RESULTS

97 **Identification**

98 *Syngnathus rostellatus* differs from all other European species of the genus by the
99 following combination of characters: distal margins of body rings without spine-like
100 points; 13-17 trunk rings; 35-42 tail rings; 32-45 dorsal fin rays; 10-13 pectoral fin rays;
101 lack of brown dots in the dorsal fin; and small size (< 17 cm TL) (Table 1). While the
102 meristic counts of the Black Sea population of *S. abaster* (*S. abaster nigrolineatus* sensu
103 Berg (1949)) overlap with those of *S. rostellatus*, this species can be clearly distinguished
104 from *S. rostellatus* both morphologically and genetically (Hablützel & Wilson, unpublished
105 data)).

106

107 **Distribution**

108 Almeida (1986) reported 12 *S. rostellatus* specimens (including eight pregnant males) from
109 Vila Nova de Milfontes (PT) (Figure 1). The reproductive status of the individual
110 specimens was not indicated in the original paper, but the data provided indicate that the
111 smallest pregnant male in this collection had a TL of ≤ 12.1 cm. *Syngnathus rostellatus*, *S.*
112 *abaster*, *S. agassiz* and *S. typhle* are the only four coast-associated species of *Syngnathus* in
113 Western Europe which are reported to reach sexual maturity at this size. *Syngnathus*
114 *abaster* has fewer dorsal fin rays (≤ 31), *S. agassiz* has less tail rings (≤ 35) and *S. typhle*
115 has more pectoral fin rays (≥ 14) than does *S. rostellatus* (Table 1). The meristic counts of
116 the specimens collected by Almeida (1986) are thus consistent with the identification of
117 these specimens as *S. rostellatus* (Table 1). Almeida (1986) also re-examined specimens
118 from Praia de Mira (PT) (Figure 1) collected by Helling (1943) and identified these
119 individuals as *S. rostellatus*. On the basis of the details provided in Almeida (1986), we
120 conclude that all of these individuals are indeed *S. rostellatus*.

121

122 Reports of *S. rostellatus* from Málaga (Figure 1) by Lozano y Rey (1919) and Reina-
123 Hervás *et al.* (1981-1982) also appear to be reliable. While details on the specimens
124 analyzed by Lozano y Rey (1919) were not provided in the original publication, Hervás *et*
125 *al.* (1981-1982) provided detailed information on five specimens collected from the same
126 region. The low number of trunk rings detected in these specimens (16-17; Table 1) clearly
127 separates them from juvenile *S. acus* (trunk rings: 18-19) which are otherwise similar in
128 their general appearance. The *S. rostellatus* from Málaga also differ from *S. abaster*, *S.*
129 *agassiz* and *S. typhle* in meristic counts (see above).

130

131 In contrast to these reliable reports of *S. rostellatus* from outside its historical range,
132 several recent descriptions of *S. rostellatus* from sites in Tunisia and Turkey (Figure 1)
133 appear to be in error. Photographs of the individuals included in both of these studies are
134 provided in the original articles (Gökoglu *et al.*, 2004; Ben Amor *et al.*, 2008). Both
135 pictures show large (18.7 cm and 21.1 cm TL), long-snouted species with high numbers of
136 trunk rings (18 for the Tunisian and > 17 for the Anatolian individual (note that Gökoglu *et*
137 *al.* used a non-standard trunk counting method which differs from other publications of
138 syngnathid pipefish (e.g. Dawson, 1986))), indicating that neither of these specimens are *S.*
139 *rostellatus* (Table 1; Figure 2). The specimens illustrated by Gökoglu *et al.* (2004) and Ben
140 Amor *et al.* (2008) most closely resemble either *S. tenuirostris* or *S. acus* (Figure 2),
141 species which are known to occur in the Mediterranean region (Kaup, 1856; Dawson,
142 1986).

143

144 Louisy (2002) reported a single *S. rostellatus* female from Banyuls-sur-Mer, France
145 (Figure 1). The author did not provide meristic data, but included two color pictures of the
146 living specimen. The low number of dorsal fin rays (29 or 30; Table 1) and the flattened
147 form of the snout (versus the slightly convex snout of *S. rostellatus* (Figure 2)) suggest that
148 the specimen is actually *S. abaster*. The report of *S. taenionotus* from Southern France in
149 Louisy (2002) also appears to be in error, and is based on an apparent misidentification of a
150 *S. typhle* individual (data not shown). Unfortunately, the photographs and identifications
151 used by Louisy (2002) have been incorporated into a recent global survey of syngnathid
152 species (Kuitert 2009), further propagating these errors.

153

154 Confusion about the distributional range of *S. rostellatus* also exists at its northeastern
155 periphery in the Southern Baltic Sea. Kuitert (2009) recently reported two specimens from
156 Wismar, Germany. We argue that both pictured specimens are misidentified and in fact are
157 *S. typhle*, recognizable by the elevation of the snout evident in these individuals, diagnostic
158 for this species (see Figure 2). One of the two specimens also shows a color pattern of
159 white spots which is known only from juvenile *S. typhle* and is not found in *S. rostellatus*.

160

161 **The lasting impact of historical errors on the European biogeography of *Syngnathus***

162 Dawson's (1986) key to European syngnathid species has been an important reference for
163 researchers working on European *Syngnathus* species. Unfortunately, an error in the
164 illustration included in this text has perpetuated confusion relating to species-level
165 identification. While the meristic counts provided in Dawson (1986) are accurate, the
166 illustration of *S. rostellatus* included in this report was derived from a sketch originally

167 published in Fries *et al.* (1895) and subsequently reprinted by Poll (1947) in his review of
168 Belgian marine fishes. Unfortunately, while the original illustration (Fries *et al.* 1895)
169 referred to *S. typhle* (plate XXIX, figure 1), Poll (1947) mislabeled this specimen as *S.*
170 *rostellatus* in both the text and the figure legend of his book (p. 186, Figure 126), and
171 Dawson kept this description in his text.

172

173 Poll (1947) made a second labeling error in his *Fauna de Belgique*, including an
174 illustration of *S. rostellatus* originally published in Fries *et al.* (1895) in his description of
175 *S. typhle* (plate XXVIII, figure 8b; note that this specimen is also inconsistently labeled as
176 both *S. rostellatus* and *S. acus* in the original publication). Such labeling errors have
177 undoubtedly contributed to the confusion surrounding the identification of European
178 *Syngnathus* species, and we have attempted to remedy this situation here, including
179 photographs of all of commonly recognized nearshore *Syngnathus* species known to occur
180 in this region (Figure 2).

181

182 CONCLUSIONS

183 Considering the reliable reports of *S. rostellatus* from the Portuguese and the Spanish
184 Mediterranean coasts, we suggest that the current range of *S. rostellatus* is broader than
185 that indicated by Dawson (1986). The contemporary range of this species extends from the
186 Norwegian coast as far south as the western Mediterranean at Málaga, Spain. This
187 distributional pattern coincides with the present frontal system between Almeria and Oran,
188 with separates Atlantic waters to the west from Mediterranean waters to the east (Tintore *et*
189 *al.*, 1988). Reports of *S. rostellatus* from Mediterranean sites east of Málaga appear to be

190 erroneous, and stem from specimen misidentifications.

191

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194 identification. Filip Volckaert and two anonymous reviewers provided helpful comments
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196 access to their pipefish collection. The study was supported by the University of Zurich,
197 Switzerland.

198

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303 279.

304 **Fig. 1.** The traditional distribution of *S. rostellatus* according to Dawson (1986) (black),
305 extended by reports from the Irish (Douglas & Egan 1983), Portuguese (Almeida, 1986)
306 and Spanish (Reina-Hervás *et al.*, 1981-1982) coasts and the southern Baltic Sea
307 (Ehrenbaum, 1905-1909; Otterstøm, 1917) (grey); collection localities of *S. rostellatus*
308 discussed in the text are indicated (circles), as are reports of *S. rostellatus* based on
309 apparent misidentifications of specimens (stars).

310

311 **Fig. 2.** Photographs of the head morphology of the nearshore *Syngnathus* species discussed
312 in this article, along with an indication of the collection locality of the individual
313 specimens. **A:** *S. abaster*, Scardovari (IT); **B:** *S. acus*, Tasende (ES); **C:** *S. agassiz*, Naples
314 (IT); **D:** *S. rostellatus*, Sada (ES); **E:** *S. taenionotus*, Scardovari (IT); **F:** *S. tenuirostris*,
315 Crimea (UA); **G:** *S. typhle*, Venice (IT); **H:** *S. variegatus*, Crimea (UA). Scale bar equals 1
316 cm. Pictures (A-E, G) taken from specimens collected by the authors and collaborators
317 (A,B,D,E,G) or from the collection of the Senckenberg Museum Frankfurt (C; SMF8334).
318 Drawings (F, H) after Rathke (1837), see Kuitert (2009) for photographs of these species.

Figure 1



Figure 2

319

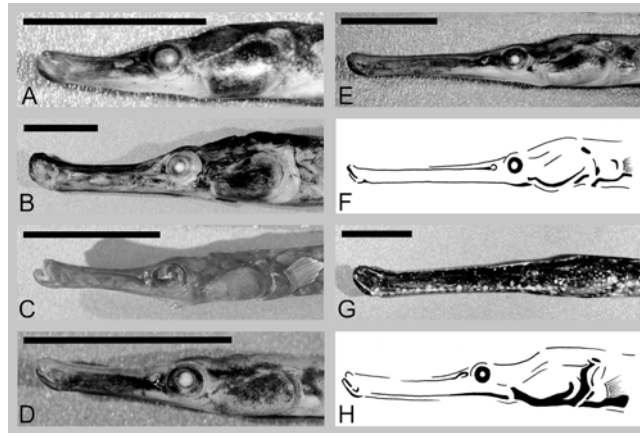


Table 1. Meristic characters of *S. rostellatus* from the original species description (Nilsson, 1855) and from more recent studies of the species. Morphological data for specimens outside the expected range for *S. rostellatus* are indicated in bold.

| Location | N | Trunk rings | Tail rings | Dorsal fin rays | Pectoral fin rays | Length of largest specimen [cm TL] | Conclusion | Reference |
|-----------------------------|------|----------------|------------|-----------------|-------------------|------------------------------------|-----------------------|--|
| Sweden | n.a. | 16 | 40 | 32-34 | 10 | 12.4-14.8 (5-6 tum) | <i>S. rostellatus</i> | Nilsson, 1855 |
| Côte du Hâvre (FR) | n.a. | 14 | 36-39 | 34-36 | 11-12 | 10.3 | <i>S. rostellatus</i> | Moreau in Duménil, 1870 |
| Europe | n.a. | 13-17 | 37-42 | 33-45 | 10-13 | 17.0 | <i>S. rostellatus</i> | Dawson, 1986 |
| Sada (ES) | 30 | 14-16 | 39-42 | 37-42 | 10-12 | 13.0 | <i>S. rostellatus</i> | this study |
| Fiskebäckskil (SE) | 9 | 14-15 | 39-41 | 38-43 | 11-12 | 13.7 | <i>S. rostellatus</i> | this study |
| Vila Nova de Milfontes (PT) | 12 | 14-16 | 35-42 | 34-40 | 10-11 | 14.0 | <i>S. rostellatus</i> | Almeida, 1986 |
| Praia de Mira (PT) | 6 | 15 | 39-42 | 37-42 | 11 | 16.9 | <i>S. rostellatus</i> | Almeida, 1986 |
| Málaga (ES) | 5 | 16-17 | 34-41 | 36-38 | 11-12 | n.a. | <i>S. rostellatus</i> | Reina-Hervás <i>et al.</i> , 1981-1982 |
| Gulf of Tunis (TN) | 1 | 18 | 39 | 35 | 12 | 21.1 | <i>Syngnathus</i> sp. | Ben Amor <i>et al.</i> , 2008 |
| Anatolian Coast (TR) | 1 | > 17 | 41 | 33 | 13 | 18.7 | <i>Syngnathus</i> sp. | Gökoglu <i>et al.</i> , 2004 |
| Banyuls-sur-Mer (FR) | 1 | n.a. | n.a. | 29 or 30 | n.a. | n.a. | <i>S. abaster</i> | Louisy, 2002 |
| Wismar (DE) | 2 | n.a. | n.a. | n.a. | n.a. | n.a. | <i>S. typhle</i> | Kuiter, 2009 |

N, number; 1 tum = 2.47 cm