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1 **A rare occurrence of reversal in the common megrim, *Lepidorhombus***
2 ***whiffiagonis* (Walbaum, 1792) (Pleuronectiformes: Scophthalmidae), in the**
3 **northern North Sea**

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13 Rare occurrence of reversal in common megrim

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25 **Abstract**

26 An adult (231 mm L_S ; 371 mm L_T), dextral (right-sided) common megrim,
27 *Lepidorhombus whiffiagonis*, is reported from the northern North Sea. This is the first
28 recorded occurrence of reversal in this species. Other than its reversed asymmetry,
29 the specimen had similar morphological and meristic characteristics to those of non-
30 reversed individuals of the same species.

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33 Keywords: flatfish, sinistral, dextral, reversed asymmetry

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50 Ontogenetic metamorphosis in flatfishes (Pleuronectiformes) results in one eye
51 migrating from one side of the head to the other (Brewster, 1987). The side to which
52 the eye migrates, resulting in a left-sided (sinistral) or right-sided (dextral) orientation,
53 is typically species dependent. However, in the most primitive flatfishes, the
54 Psettodidae (spiny turbot), the eye migrates to the left or right side with equal
55 frequency (Janvier, 2008). For many species of flatfishes, the majority of individuals
56 exhibit the same orientation, although occurrences of reversal, resulting in sinistral
57 orientation in dextral species and *vice versa* have been well documented (Norman,
58 1934; Ahlstrom *et al.*, 1984). Occurrences of reversal have been reported in a broad
59 range of species of flatfishes and in some species it is commonly encountered
60 (Norman, 1934; Gartner, 1986). Studies on the left-sided Californian flounder
61 *Paralichthys californicus* (Ayres 1859) have reported that the incidence of reversal in
62 this species is as high as 40% (Ginsburg, 1952; Kramer *et al.*, 1995). Hubbs and
63 Kuronuma (1942) noted that starry flounder *Platichthys stellatus* (Pallas 1787) exhibit
64 a geographical cline in asymmetry with sinistrality increasing from 50% in California to
65 100% in Japan. However, cases of reversal are typically rarer for the majority of
66 species of flatfishes. For example, Bruno and Fraser (1987) reported a single case of
67 reversal amongst 15,859 common dab *Limanda limanda* (L. 1758) sampled in the
68 North Sea. Similarly, occasional occurrences of reversal have been reported in
69 summer flounder *Paralichthys dentatus* (L. 1766) (Gudger, 1936), Atlantic halibut
70 *Hippoglossus hippoglossus* (L. 1758) and plaice *Pleuronectes platessa* (L. 1758)
71 (Gudger, 1935).

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74 The common megrim *Lepidorhombus whiffiagonis* (Walbaum 1792) (Scophthalmidae)
75 is a commercially important flatfish distributed from Iceland to the Mediterranean Sea
76 (Nielsen, 1989). It is one of two species of the genus *Lepidorhombus* (Günther 1862),
77 the other being the four-spotted megrim *Lepidorhombus boscii* (Risso 1810). One
78 adult (231 mm L_S ; 371 mm L_T) reversed common megrim was caught 100 km
79 northwest of the Shetland Isles in June 2009 during sampling of megrim in the northern
80 North Sea (Figure 1). The specimen is a mature male and was captured using a
81 demersal twin-rig otter trawl at a depth of 196 m. It represents the only case of reversal
82 recorded for 39,072 measured individuals of this species that were captured in the
83 North Sea between May 2008 and March 2012. In the reversed individual, interorbital
84 width is less pronounced and caudal peduncle length is greater (Table I) than
85 corresponding values of non-reversed individuals. No other significant variation in
86 meristic features or patterning and coloration were apparent in this individual,
87 suggesting that reversal did not result in significant changes in the external
88 morphology and colouration of this individual. In contrast, a similar study of reversal in
89 the shallow-water flounder *Paralichthys orbignyanus* (Valenciennes 1839) reported
90 several differences in a number of comparative measurements, including head,
91 maxilla and prepectoral lengths, between non-reversed individuals and a reversed
92 specimen of this species (Diaz de Astarloa, 1997).

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95 Reversals in megrims are not limited to *L. whiffiagonis*. Vassilopoulou (1993) reported
96 a small number of occurrences (0.026%) of reversed (dextral) individuals from
97 samples of *L. boscii* collected in the Aegean Sea, indicating that reversal exists, but is
98 rare in species of *Lepidorhombus*.

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101 This is the first reported occurrence of reversal in common megrim. Due to the rarity
102 of reversed specimens in this species, it has been preserved and deposited in the fish
103 collection of the NAFC Marine Centre, Scalloway, Shetland. The collection is not
104 formally catalogued and therefore does not assign numbers to specimens.

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169 Table 1 A comparison of morphological features of a reversed and non-reversed
 170 *Lepidorhombus whiffiagonis*.

	Reversed	Non-reversed <i>L. whiffiagonis</i> (n=22)		
	<i>L. whiffiagonis</i>	Range	Mean	S.D.
Total length (L_T)	331	314 - 357	329	10.8
Standard length (L_S)	272	262 - 302	276	11.6
Head length	28.3	27.2 - 30.3	28.5	3.59
Prepectoral distance	27.2	26.8 - 29.6	27.9	3.34
Maxilla length	16.5	15.2 - 17.5	16.3	1.78
Caudal peduncle length	20.6	14.3 - 20.1	18.4	3.45
Pectoral fin length	16.1	11.6 - 18.4	15.1	3.05
Interorbital width	0.3	0.5 - 1.0	0.7	0.29
Dorsal-fin rays	90	84 - 93	87	2.28
Anal-fin rays	67	65 - 72	68	2.27
Pectoral-fin rays	11	10 - 12	11	0.45

171 Total and standard lengths are reported in mm: all other measurements are % standard length

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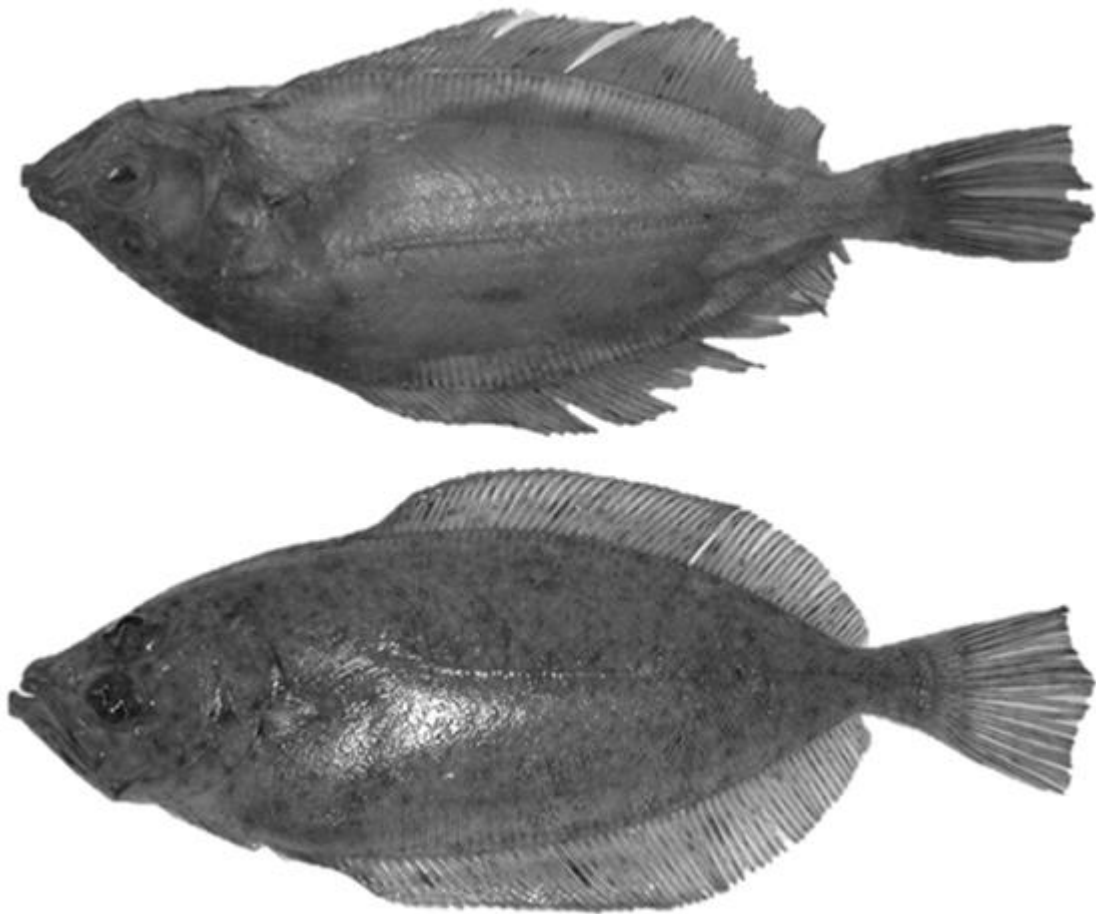
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180 Figure 1 Reversed specimen of *Lepidorhombus whiffiagonis*, 272 mm Ls (top), and
181 non-reversed specimen, 284 mm Ls (bottom), caught in the northern North Sea.

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