



Short communication

First record of the warty oreo, *Allocyttus verrucosus* (Gilchrist, 1906), in Greenland waters

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Introduction

Fishes of the zeiform family Oreosomatidae, containing 10 valid species in four genera, chiefly occur in the deeper (500–1000 m) temperate slope waters of the southern hemisphere. While most oreosomatid fish are only rarely observed north of the equator (Tokranov et al., 2004; Ditty, 2006), *Allocyttus folletti* Myers, 1960 is only reported to occur in the North Pacific (Karrer, 1990; Mecklenburg et al., 2002). For the North Atlantic, occurrences of oreosomatid fish are chiefly reported for temperate to subtropical waters (Karrer et al., 1986; Ditty, 2006) but sporadic occurrences further north have also been reported for *Allocyttus verrucosus* (Gilchrist, 1906) west of Scotland (Du Buit and Quero, 1993; Quero et al., 1997) and *Pseudocyttus maculatus* Gilchrist, 1906 in Icelandic waters (Post and Jonsson, 1996). The recent issue of 'Íslenskir Fiskar' (Jónsson and Pálsson, 2006) lists *A. verrucosus*, *P. maculatus* and *Neocyttus helgae* (Holt and Byrne, 1908) for Icelandic waters, thus indicating that oreosomatid fish may occur more regularly in northern North Atlantic waters than previously anticipated. This paper describes the first record of *A. verrucosus* in Greenland waters and compares its measurements and meristics with other specimens of *A. verrucosus* and *A. folletti* allowing for absolutely certain identification. A detailed comparison of the new specimen with specimens of *A. folletti* was necessary, since *A. verrucosus* and *A. folletti* are difficult to distinguish. In the North Pacific, this was probably the reason for reports of *A. verrucosus* from that area by, e.g. Abe and Hotta (1962) and Kobayashi et al. (1968). Later, Karrer (1990), Gillespie (1993) and Mecklenburg (2002) noted that records of *A. verrucosus* from the North Pacific all belong to *A. folletti*.

Materials and methods

The specimen of *A. verrucosus* described in this paper was caught by the commercial trawler MS 'Baldwin' with a bottom trawl. The trawl started on 22.09.2008 at 62°08'N, 40°37'W and ended at 62°26'N, 40°23'W. Trawling depth was between 850 and 1085 m. In Fig. 1, the position of the new record of *A. verrucosus* is presented together with other available and valid records of the species. The specimen was deep frozen on board and taken to the Institute of Sea Fisheries in Hamburg where it was thawed and identified to the species. It was then transferred to the fish collection of the Zoological Museum Hamburg (ZMH) for validation and

inventarisation. The specimen was photographed (Fig. 2a) and fixed in 70% ethanol under catalogue number ZMH 25602 for 2 years, before its meristic parameters were counted and body dimensions were measured for accurate determination of the species. For this purpose it had to be compared with other specimens of *Allocyttus verrucosus* and *A. folletti* already preserved in the ZMH fish collection for a longer time period. The 2-year storage of the new specimen in ethanol should exclude effects of body shrinkage on measurement values. Counts were made on the left-hand side of the specimens according to Hubbs and Lagler (1958). Vertebrae, dorsal-fin spines and rays as well as anal-fin spines and rays of all ZMH specimens of *A. verrucosus* and *A. folletti* were counted via X-ray imaging using a Faxitron LX-60. Most measurements were also done following the Hubbs and Lagler (1958) method, with modifications for characters according to Abe and Hotta (1962) and Yearsley and Last (1998): body depth, head depth, postorbital head length, caudal peduncle length, spine base lengths, dorsal-fin origin to lateral line, pectoral-fin length, pelvic-fin length, thoracic-ridge length, length of abdominal edge, pectoral-fin insertion to anal-fin origin and pectoral-fin insertion to pelvic-fin origin.

Material examined

One specimen, ZMH 25602, 337.5 mm TL, Greenland waters, 62°08'N–40°37'W, 968 m mean depth, commercial halibut cruise, MS 'Baldwin', collected on 22.09.2008 with a bottom trawl (Fig. 2a).

Comparative material

A. verrucosus. Three specimens, ZMH 104460, 123.4, 146, 156 mm TL, station 237/66, 36°0'S–52°58'W, 800 m deep, collected on 13.06.1966; four specimens, ZMH 104919, 125.9, 172, 177, 206 mm TL, station 412/66, 35°48'S–52°48'W, 800 m deep, collected on 25.07.1966; one specimen, ZMH 107294, 148.9 mm TL, station 86/68, 25°13'S–44°33'W, 1200 m, 01.03.1968; two specimens, ZMH 107295, 246, 266 mm TL, station 120/68, 28°34'S–46°53'W, 1200 m deep, 13.03.1968; one specimen, ZMH 107299, 119.1 mm TL, station 122/68, 28°43'S–47°20'W, 500 m deep, 13.03.1968; one specimen, ZMH 108701, 74.5 mm TL, station 363-II/71, 40°18'S–39°12'W, 322 m mean depth, 08.03.1971; all collected from R/V 'Walther Herwig' with a bottom trawl; one

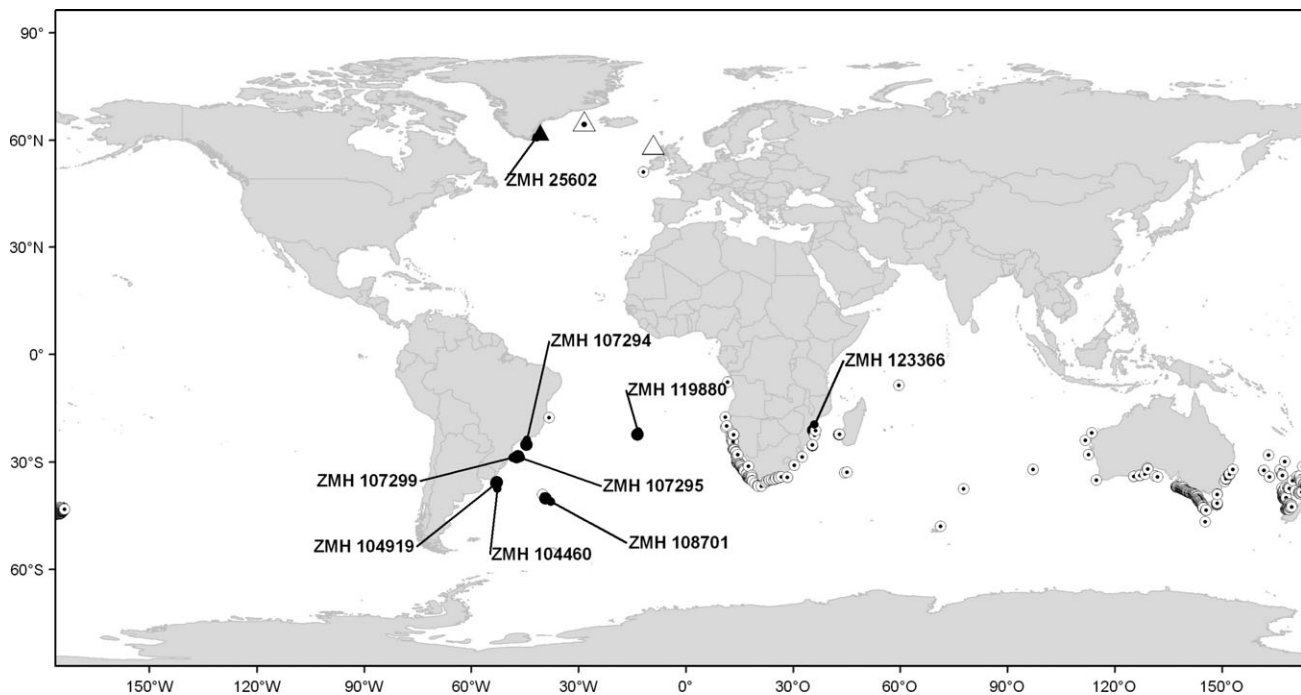


Fig. 1. Map showing worldwide records of *A. verrucosus* for which complete geographical coordinates were available (N = 1674). Black triangle: new record of ZMH 25602 (N = 1), white triangle: record by Du Buit and Quero (1993, N = 1), white triangle with black spot: record by Jónsson and Pálsson (2006, N = 1), white circles with black spot: records available from OBIS (van den Berghe, 2007, N = 1604) and GBIF (GBIF Data Portal, www.gbif.net, 29/11/2011, N = 59), white square with black spot: record by Morris et al. (2011), black circles: records of ZMH (N = 8) used for comparison in Table 1 (Number of specimens = 15)

specimen, ZMH 119880, 101.9 mm TL, station FD Garcia del Cid/8, 22°25'S–13°27'W, 200 m mean depth, Garcia del Cid, collected on 12.11.1979 with a bottom trawl; two specimens, ZMH 123666, 317, 338 mm TL, station 17/2629, 21°12'S–35°42'W, 1245 m mean depth, R/V 'Vityaz', collected on 23.11.1988 with a bottom trawl; *A. folletti*: 1 specimen, ZMH 100318, 57.2 mm TL, station 30/30, 42°41'N–179°52'W, 600 m deep, Vessel 'H. M. Smith', collected on 28.07.1955 with an IK-midwater trawl; one specimen, holotype, SU 15377, 347 mm SL, Myers (1960) for further information; 1 specimen, paratype, CAS 25988, 162 mm SL, Myers (1960) for further information; 1 specimen, paratype, UCLA W 57-13, Myers (1960) for further information. An X-ray of the holotype of *A. folletti* (SU 15377), available from the California Academy of Sciences (CAS) under <http://research.calacademy.org/redirect?url=http://researcharchive.calacademy.org/research/Ichthyology/Types/index.asp>, was used to count the vertebrates of SU 15377. However, no vertebrate counts were available for CAS 25988 and UCLA W 57-13.

Results

Description

Counts and measurements are given in Table 1. ZMH 25602: DE 36, DS VI, DR 30; AE 30, AS III, AR 27; VS I, VR 6; PR 20; CppR 13, CpcR 2; TGR 24; LL 86; Ve 37, Tve 13, TaVe 24 (Fig. 2b). Body deep, laterally compressed and moderately rhomboidal (Fig. 2a). Predorsal profile relatively straight. Body depth 59.3% SL. Head large in size, length 40% SL. Eye large, orbit diameter 15.7% SL. Mouth upturned, protractile. Upper jaw protrusile, length 15.9% SL. Caudal peduncle depth 6.6% SL. Pectoral fins high on body. Dorsal and anal fin bases long. First dorsal spine

much shorter than second spine. First dorsal-fin spine length 2.1% SL. Second dorsal-fin spine length 5.4% SL. Dorsal-fin ray length 13.8% SL. Pelvic-fin spine length 12.8% SL. Scales small, ctenoid and adherent. Remnants of two rows of enlarged, subrectangular plate-like scales on each side. Lateral line distinct, arched anteriorly. Operculum naked, covered with radiating bony ridges.

Identification and distribution

The specimen agrees well with the counts and measurements obtained from the analyzed ZMH fish collection material of *A. verrucosus*. No count and measurement ranges outside the minimum and maximum values of the characters of 15 specimens of *A. verrucosus* presented in Table 1. In contrast, ZMH 25602 differs from *A. folletti* in having lower numbers of DE, AR, AE, LL, TaVe and Ve, larger UJL, CPD and DRL and smaller OD, 1 DSL, 2 DSL and VSL (Table 1).

This specimen is the first *A. verrucosus* record for the ZMH fish collection from the northern hemisphere, while all reference material comes from south of the equator (Fig. 1).

Discussion

As most other oreosomatid fish, also *A. verrucosus* is predominantly found in temperate to subtropical waters of the southern hemisphere where it occurs circum-globally (Fig. 1). However, its congener, *A. folletti*, appears to be more common north of the equator in the Pacific Ocean, where it is often referred to *A. verrucosus* (e.g. Karrer, 1990; Mecklenburg et al., 2002; Tokranov et al., 2004). In the Atlantic, occurrences of *A. verrucosus* north of the equator are

Table 1

Proportional measurements and meristic counts for new record of one specimen of *A. verrucosus* (ZMH 25602) in comparison with minimum (Min.), maximum (Max.) and means with standard deviations (SD) of 15 other ZMH fish collection *A. verrucosus* specimens from 8 records (see Fig. 1)

Characters	<i>Allocyttus verrucosus</i>					<i>Allocyttus folletti</i>					
	ZMH 25602	Min.	Max.	Mean	SD	N	Min.	Max.	Mean	SD	N
Total length (TL)	337.5	74.5	338.0			15	57.2				1
Standard length (SL)	283	66.7	284.0			15	50.6	347			4
% SL											
Body depth (BD)	59.3	54.6	89.0	64.4	10.1	15	55.2	70.2	59.3	7.6	4
Head length (HL)	40.0	37.2	56.0	43.8	5.3	15	36.3	42.0	39.1	2.4	4
Head depth (HD)	31.4	26.6	43.0	32.0	4.6	15			30.2		1
Head width (HW)	19.8	18.5	32.8	23.3	3.9	15			19.2		1
Snout length (SnL)	11.7	9.1	18.1	13.7	2.4	15	10.0	12.3	11.1	1.0	4
Upper jaw length (UJL)	18.9	12.1	22.1	17.1	2.3	15	15.0	17.9	16.0	1.3	4
Lower jaw length (LJL)	23.3	8.9	23.3	19.3	4.3	15			19.6		1
Postorbital head length (PHL)	13.0	7.4	17.8	12.8	2.5	15			15.4		1
Lachrymal width (LW)	3.4	2.8	6.4	4.5	0.8	15			3.8		1
Orbit diameter (OD)	15.7	14.1	26.5	18.3	3.4	15	16.2	21.6	17.9	2.5	4
Interorbital width (IW)	12.0	10.8	17.3	13.5	2.2	15	11.2	12.9	12.1	0.8	4
Caudal peduncle depth (CPD)	6.6	5.5	9.5	6.7	1.0	15	5.5	6.1	5.8	0.2	4
Caudal peduncle length (CPL)	10.2	5.1	16.6	8.9	2.5	15			9.1		1
Prepectoral length (PPL)	42.2	36.9	58.3	44.7	5.7	15			42.1		1
Prepelvic length (PVL)	46.2	43.8	99.1	55.5	13.7	15			50.4		1
Predorsal length (PDL)	60.6	53.8	82.8	63.5	7.0	15	51.0	61.3	56.6	4.3	4
Preanal length (PAL)	67.3	63.1	99.3	75.9	10.9	15	62.9	87.0	69.2	11.9	4
Dorsal-fin base length (DBL)	44.8	39.4	64.9	47.1	7.1	15	40.7	49.3	46.0	3.8	4
Anal-fin base length (ABL)	37.9	33.6	56.0	40.4	6.3	15	36.4	41.0	38.8	2.1	4
First dorsal-fin spine length (1DSL)	2.1	1.4	4.8	3.0	1.0	15	2.3	4.9	3.6	1.1	4
Second dorsal-fin spine length (2DSL)	5.4	5.2	14.2	8.8	2.1	15	7.1	11.7	9.0	1.9	4
Second dorsal-fin spine base length (2 DSBL)	1.2	0.9	2.9	2.0	0.6	15			1.8		1
Dorsal-fin ray length (DRL)	13.8	10.3	19.9	14.5	2.7	15	10.8	13.5	12.0	1.1	4
Dorsal-fin origin to lateral line (DO-LL)	13.2	10.4	19.7	13.9	2.4	15			13.8		1
First anal-fin spine length (1ASL)	3.6	1.6	6.0	4.3	1.2	15			2.8		1
First anal-fin spine base length (1ASBL)	0.8	0.8	2.3	1.5	0.4	15			1.8		1
Anal-fin ray length (ARL)	12.8	12.0	20.9	15.4	2.5	15	12.7	16.0	14.1	1.5	4
Pectoral-fin length (PL)	17.6	13.7	24.2	18.1	2.7	15			20.8		1
Pelvic-fin spine length (VSL)	12.8	10.9	23.0	15.5	2.9	15	15.8	22.9	18.5	4.9	4
Caudal-fin ray length (CRL)	16.8	12.7	28.9	19.0	3.6	15			12.3		1
Pelvic-fin length (VL)	17.7	16.1	29.1	21.2	3.9	15			31.0		1
Pelvic-fin insertion to anal-fin origin (VI-AO)	20.4	14.8	53.8	27.0	8.5	15			56.5		1
Thoracic-ridge length (TRL)	20.4	18.0	37.2	24.6	5.5	15	17.1	30.4	21.1	6.2	4
Length of abdominal edge	22.7	17.5	59.2	27.2	9.8	15	18.4	59.5	29.0	20.3	4
Pectoral-fin insertion to pelvic-fin origin (PI-VO)	15.5	14.0	40.5	20.6	6.1	15			28.7		1
Pectoral-fin insertion to anal-fin origin (PI-AO)	26.3	23.5	46.9	31.4	6.4	15			43.5		1
PI-VO/PI-AO	58.8	53.3	86.3	64.5	7.7	15			65.9		1
Orbit diameter/head length (OD/HL)	39.1	36.1	48.5	42.2	4.0	15			40.6		1
Dorsal-fin spines (DS)	6	5	7	6.2	0.8	15	5	7	6.3	1.0	4
Dorsal-fin rays (DR)	30	28	32	30.5	1.0	15	30	33	31.8	1.3	4
Dorsal-fin spines and rays (DE)	36	35	38	36.7	0.9	15	37	38	38.0	0.8	4
Anal-fin spines (AS)	3	2	3	2.8	0.4	15	3	3	3.0	0.0	4
Anal-fin rays (AR)	27	26	30	29.0	1.0	15	29	32	30.8	1.3	4
Anal-fin spines and rays (AE)	30	29	33	31.8	1.1	15	32	35	33.8	1.3	4
Pelvic-fin spines (VS)	1	1	1	1.0	0.0	15	1	1	1.0	0.0	4
Pelvic-fin rays (VR)	6	6	6	6.0	0.0	15	6	6	6.0	0.0	4
Pectoral-fin rays (PR)	20	17	20	19.1	0.6	15	19	21	20.5	1.0	4
Caudal-fin principal rays (CpPR)	13	13	13	13.0	0.0	15	13	13	13.0	0.0	4
Caudal-fin procurvent rays (CpcR)	2	2	2	2.0	0.0	15			2.0		1
Total gill rakers (TGR)	24	24	27	25.4	0.8	15	24	32	26.8	3.6	4
Lateral line scales (LL)	86	80	91	86.8	3.4	15	92	100	95.3	5.0	4
Trunk vertebrae (TVe)	13	13	14	13.1	0.2	15	12	13	12.5	0.7	2
Tail vertebrae (TaVe)	24	23	25	24.1	0.7	15	27	28	27.5	0.7	2
Total vertebrae (Ve)	37	36	38	37.1	0.6	15	40	40	40.0	0.0	2

Also meristic counts and morphometric measurements given for 1 specimen of *A. folletti* from the ZMH fish collection plus 3 specimens of *A. folletti* analysed by Myers (1960), combined where possible. Total and standard lengths in millimetres, other measurements expressed as a percentage of standard length.

reported from off West Africa (Golovan, 1976, 1978), Suriname and French Guiana (Shimizu, 1983; Heemstra, 2003), from Canadian waters (Morris et al., 2011), and from the European shelf edge west of Ireland and Scotland (Fig. 1; Du

Buit and Quero, 1993; Quero et al., 1997). While the northernmost record is from west of Iceland (Jónsson and Pálsson, 2006), our specimen is the first record of an oreosomatid fish from Greenland waters.

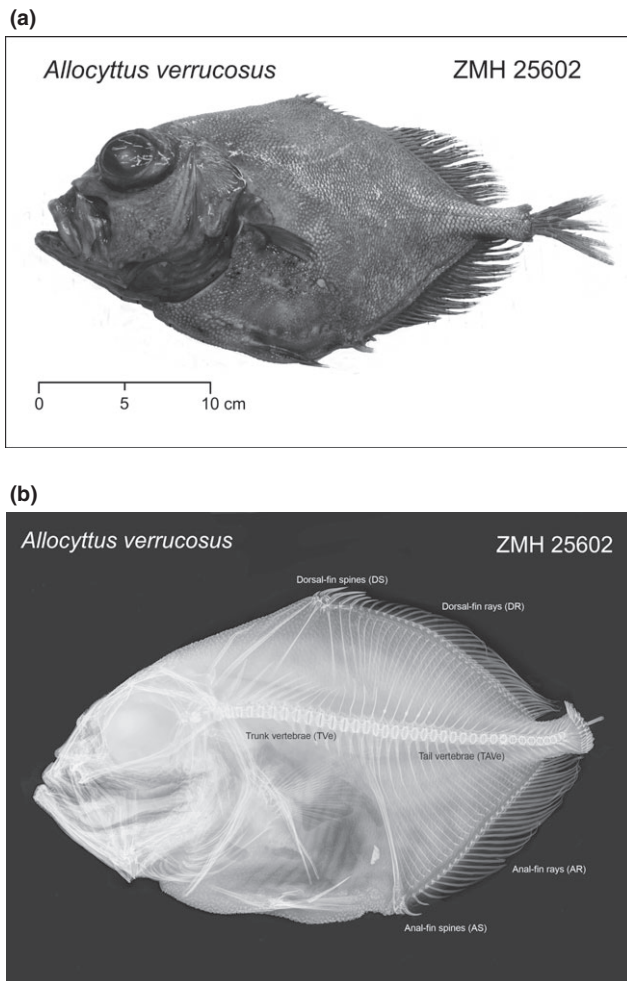


Fig. 2. *Allocyttus verrucosus*, ZMH 25602, 337.5 mm TL, (a) collected by bottom trawling in Greenland waters, picture taken before preservation in ethanol. (b) X-ray taken after 2-year preservation in ethanol, meristic characters taken from X-rays are indicated

The records of *A. verrucosus* in the Atlantic Ocean north of its native distribution correspond well to the northward spread of Antarctic Intermediate Water (AAIW, Tsuchiya, 1989). After its formation in the Antarctic polar front, AAIW is subducted to depths between 500 and 1500 m, which represent the preferred depth range of *A. verrucosus*. While AAIW can be traced up to 20°S across the entire southern Atlantic Ocean (Dietrich et al., 1975), in the Western Atlantic the AAIW becomes entrained in the western boundary current and is advected northwards along the South American Slope across the equator. Later entrainment in the Gulf Stream and the North Atlantic Current distributes AAIW to off West Africa (Aken, 2000) and as far north as Iceland and Greenland (Tsuchiya, 1989; Bower et al., 2002). As all oreosomatid fish, *A. verrucosus* is a long-lived, slow growing and late maturing species (Stewart et al., 1995; Smith et al., 2002). Our specimen (TL = 33 cm) was probably more than 100 years old at capture (Stewart et al., 1995). Juvenile *A. verrucosus* have a long pelagic phase of 4–5 years where they may become entrained at depth into the AAIW with which they may be transported into the North Atlantic. But even during their early demersal life at lengths of <15 cm (Stewart et al., 1995) they still might be susceptible to stronger currents, becoming, thus, advected to areas of higher latitude.

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