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# First record of the whip-lash squid, *Mastigoteuthis agassizii* verrill, 1881 (Mollusca: Cephalopoda: Mastigoteuthidae) in the subarctic atlantic, with notes on its morphology and biology

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## Abstract

© 2018 Informa UK Limited, trading as Taylor & Francis Group. Cephalopods are an important, abundant and taxonomically diverse component of the bathypelagic realm. However, their biology, ecology and distribution are poorly known. Specimens of *Mastigoteuthis agassizii* (Mastigoteuthidae) have been captured in the southern part of the Denmark Strait, which is at approximately 65°N. This site is approximately 550 km north of the previously most northern known border of the Mastigoteuthidae range. The main goal of this paper is to provide an extended morphological description and biological analysis of *M. agassizii*, the first species of the Mastigoteuthidae caught in the Subarctic Atlantic. Despite sample collection at 534 deep-water stations in the area, only two specimens were captured, indicating the rarity of this species in the northern part of its range. We suggest that the typical range of this species is bathyal depths throughout the North Atlantic to the Subarctic, but not through the Denmark and Davis Straits to the Arctic. These findings coincide with the geographic border of the Northern Atlantic boreal bathyal province, which is warmer and more saline compared to the Arctic province further to the north. We also provide the first descriptions of the radula and reproductive system of *M. agassizii*. The female had synchronous ovulation, fecundity of approximately 23,000 oocytes, oocyte resorption having not been found, most likely due to the early maturity stage of the female. The males, as proven by our sample and additional photo in other source, were found to have the distal part of the penis enlarged, divided into two valves and pigmented, possibly indicating they can protrude outside the mantle cavity. This enlarged valved part, as it is supposed in the literature for other deep-water squid families having it, may be used as an analogue to the lacking hectocotylus.

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## Keywords

Cephalopoda, Deep-sea, Mastigoteuthidae, *Mastigoteuthis agassizii*, Reproductive system

## References

- [1] Arkhipkin AI, Laptikhovsky VV. 2010. Observation of penis elongation in *Onykia ingens*: implications for spermatophore transfer in deep-water squid. *J Moll Stud.* 76:299–300.

- [2] Braid HE, Bolstad K. 2015. Systematics of the Mastigoteuthidae Verrill, 1881 (Cephalopoda: Oegopsida) from New Zealand waters. *New Zealand J Zool.* 42:187-256.
- [3] Braid HE, McBride PD, Bolstad KSR. 2014. Molecular phylogenetic analysis of the squid family Mastigoteuthidae (Mollusca, Cephalopoda) based on three mitochondrial genes. *Hydrobiologia.* 725:145-164.
- [4] Chun C. 1908. Uber Cephalopoden der Deutschen Tiefsee-Expedition. *Zool Anz.* 33:86-89.
- [5] Chun C. 1910. Die Cephalopoden. Oegopsida. *Wiss Ergebn Dt Tiefsee-Exped.* 18:1-401.
- [6] Chun C. 1913. Cephalopoda. *Rep Sci Res.* 3:1-28. "Michael Sars" N Atl Deep-Sea Exped 1910.
- [7] Clarke MR. 1996. Cephalopods as prey. III. Cetaceans. *Phil Trans R Soc Lond B.* 351:1053-1065.
- [8] Clarke MR, Macleod N. 1976. Cephalopod remains from sperm whales caught off Iceland. *J Mar Biol Ass UK.* 56:733-749.
- [9] Clarke MR, Martins HR, Pascoe P. 1993. The diet of sperm whales (*Physeter macrocephalus* Linnaeus 1758) off the Azores. *Phil Trans R Soc Lond B.* 339:676-682.
- [10] Collins MA, Yau C, Allcock L, Thurston MH. 2001. Distribution of deep-water benthic and benthic-pelagic cephalopods from the north-east Atlantic. *J Marine Biol Assoc UK.* 81:105-117.
- [11] Degner E. 1925. Cephalopoda. *Rep Dan Oceanogr.* 2(9):1-94. Exped 1908-10 Medit Adj Seas.
- [12] Golikov AV, Sabirov RM, Lubin PA, Jørgensen LL. 2013. Changes in distribution and range structure of Arctic cephalopods due to climatic changes of the last decades. *Biodiversity.* 14:28-35.
- [13] Golikov AV, Sabirov RM, Lubin PA, Jørgensen LL, Beck IM. 2014. The northernmost record of *Sepietta oweniana* (Cephalopoda: Sepiolidae) and comments on boreo-subtropical cephalopod species occurrence in the Arctic. *Mar Biodivers Rec.* 7:e58. [accessed 2017 Jun 27]:[4 p.]. doi:10.1017/S1755267214000645
- [14] Hoving HJT, Perez JAA, Bolstad KSR, Braid HE, Evans AB, Fuchs D, Judkins H, Kelly JT, Marian JEAR, Nakajima R, et al. 2014. Chapter 3. The study of deep-sea cephalopods. In: Vidal EAG, editor. *Advances in marine biology: advances in cephalopod science biology, ecology, cultivation and fisheries.* London: Elsevier; p. 235-359.
- [15] Hoving HJT, Roeleveld MAC, Lipinski MR, Melo Y. 2004. Reproductive system of the giant squid *Architeuthis* in South African waters. *J Zool Lond.* 264:153-169.
- [16] Hoving HJT, Vecchione M. 2012. Mating behavior of a deep-sea squid revealed by in situ videography and the study of archived specimens. *Biol Bull.* 223:263-267.
- [17] Joubin L. 1895. Contribution a l'étude des Céphalopodes de l'Atlantique Nord. *Res Camp Scient Prince Albert I.* 9:1-63.
- [18] Joubin L. 1913. Etudes préliminaires sur les Céphalopodes recueillis au cours des croisières de S.A.S. le Prince de Monaco. 3e Note: *Mastigoteuthis magna* nov. sp. *Bull Inst Oceanogr (Monaco).* 275:1-11.
- [19] Joubin L. 1933. Notes préliminaires sur les Céphalopodes des croisières du Dana (1921-1922). 4e Partie. *Ann I Oceanogr Paris.* 13:1-49.
- [20] Klages NTW. 1996. Cephalopods as prey. II. Seals. *Phil Trans R Soc Lond B.* 351:1045-1052.
- [21] Laptikhovskiy VV, Arkhipkin AI, Hoving HJT. 2007. Reproductive biology in two species of deep-sea squids. *Mar Biol.* 152:981-990.
- [22] Lu CC, Clarke MR. 1975. Vertical distribution of cephalopods at 40N, 53N and 60N at 20W in the North Atlantic. *J Mar Biol Ass UK.* 55:369-389.
- [23] MacDonald R, Clench WJ. 1934. Descriptions of a new genus and two new species of squids from the North Atlantic. *Occas Pap Boston Soc Nat Hist.* 8:145-152.
- [24] Martin AR, Clarke MR. 1986. The diet of sperm whales (*Physeter macrocephalus*) captured between Iceland and Greenland. *J Mar Biol Ass UK.* 66:779-790.
- [25] Nesis KN. 1995. Mating, spawning, and death in oceanic cephalopods: a review. *Ruthenica.* 6:23-64.
- [26] Nigmatullin C. 2002. Ovary development, potential and actual fecundity and oocyte resorption in coleoid cephalopods: a review. In: Warnke K editor. *International Symposium «Coleoid cephalopods through time».* Berl Palaobiol Abh. 1:82-84.
- [27] Nigmatullin CM, Sabirov RM, Zalygalin VP. 2003. Ontogenetic aspects of morphology, size, structure and production of spermatophores in ommastrephid squids: an overview. *Berl Palaobiol Abh.* 3:225-240.
- [28] O'Shea S, Jackson JG, Bolstad KS. 2007. The nomenclatural status, ontogeny and morphology of *Pholidoteuthis massyae* (Pfeffer, 1912) new comb (Cephalopoda: Pholidoteuthidae). *Rev Fish Biol Fisheries.* 17:425-435.
- [29] Okutani T, Tsukada S. 1988. Squids eaten by lancetfish and tunas in the tropical Indo-Pacific oceans. *J Tokyo Univ Fish.* 75:1-44.
- [30] Ramirez-Llodra E, Brandt A, Danovaro R, De Mol B, Escobar E, German CR, Levin LA, Martinez Arbizu P, Menot L, Buhl-Mortensen P, et al. 2010. Deep, diverse and definitely different: unique attributes of the world's largest ecosystem. *Biogeosciences.* 7:2851-2899.
- [31] Rancurel P. 1972. *Mastigoteuthis inermis* espèce nouvelle de Chiroteuthidae du Golfe de Guinée (Cephalopoda - oegopsida). *B Soc Zool Fr.* 97(1):25-34.

- [32] Robison BH, Sherlock RE, Reisenbichler KR. 2010. The bathypelagic community of Monterrey Canyon. *Deep-Sea Res II*. 57:1551-1556.
- [33] Roper CFE, Jereb P. 2010. Family Mastigoteuthidae. In: Roper CFE, Jereb P, editors. *FAO Species Catalogue for Fishery Purposes, №4: Cephalopods of the world. An annotated and illustrated catalogue of species known to date. Vol. 2. Myopsid and oegopsid squids*. Rome: FAO; p. 250-256.
- [34] Roper CFE, Voss GL. 1983. Guidelines for taxonomic descriptions of cephalopod species. *Memoirs National Museum Victoria*. 44:48-63.
- [35] Sabirov RM, Golikov AV, Lubin PA. 2009. Finding of the lesser flying squid *Todaropsis eblanae* (Oegopsida, Ommastrephidae) from the Barents Sea. *Zool Zh*. 88:1010-1012. Russian with English abstract.
- [36] Sabirov RM, Golikov AV, Nigmatullin C, Lubin PA. 2012. Structure of the reproductive system and hectocotylus in males of lesser flying squid *Todaropsis eblanae* (Cephalopoda: Ommastrephidae). *J Nat Hist*. 46:1761-1778.
- [37] Salcedo-Vargas MA 1993. Revision of the squid family Mastigoteuthidae (Mollusca: Cephalopoda) from the Northwest Pacific [PhD thesis]. Tokyo (Japan): Tokyo University of Fisheries; p. 253.
- [38] Santos MB, Pierce GJ, Herman J, Lopez A, Guerra A, Mente E, Clarke MR. 2001a. Feeding ecology of Cuvier's beaked whale (*Ziphius cavirotris*): a review with new information on the diet of this species. *J Mar Biol Ass UK*. 81:687-694.
- [39] Santos MB, Pierce GJ, Smeenk C, Addink MJ, Kinze CC, Tougaard S, Herman J. 2001b. Stomach contents of northern bottlenose whales *Hyperoodon ampullatus* stranded in the North Sea. *J Mar Biol Ass UK*. 81:143-150.
- [40] Smale MJ. 1996. Cephalopods as prey. IV. Fishes. *Phil Trans R Soc Lond B*. 351:1067-1081.
- [41] Steenstrup J. 1857. Oplysninger om Atlanterhavets colossale Blacksprutter. *Forhandlinger ved de Skandinaviske Naturforskeres Syvende Mode*. 7(1856):182-185.
- [42] Vecchione M, Pohle G. 2002. Midwater cephalopods in the western north Atlantic Ocean off Nova Scotia. *Bull Mar Sci*. 71:883-892.
- [43] Vecchione M, Young RE 2014a. *Echinoteuthis atlantica* (Joubin, 1933). Version. The Tree of Life Web Project. [updated 2014 Dec 6; accessed 2017 Jun 27]. [http://tolweb.org/Echinoteuthis\\_atlantica/19509/2014.12.06](http://tolweb.org/Echinoteuthis_atlantica/19509/2014.12.06).
- [44] Vecchione M, Young RE 2014b. *Mastigopsis hjorti* (Chun, 1913). Version. The Tree of Life Web Project. [updated 2014 Dec 6; accessed 2017 Jun 27]. [http://tolweb.org/Mastigopsis\\_hjorti/19517/2014.12.06](http://tolweb.org/Mastigopsis_hjorti/19517/2014.12.06).
- [45] Vecchione M, Young RE 2014c. *Mastigoteuthis agassizii* Verrill, 1881. Version. The Tree of Life Web Project. [updated 2014 Dec 6; accessed 2017 Jun 27]. [http://tolweb.org/Mastigoteuthis\\_agassizii/19508/2014.12.06](http://tolweb.org/Mastigoteuthis_agassizii/19508/2014.12.06).
- [46] Vecchione M, Young RE 2016. *Magnoteuthis magna* (Joubin, 1913). Version. The Tree of Life Web Project. [updated 2016 Nov 16; accessed 2017 Jun 27]. [http://tolweb.org/Magnoteuthis\\_magna/19520/2016.11.16](http://tolweb.org/Magnoteuthis_magna/19520/2016.11.16).
- [47] Vecchione M, Young RE, Lindgren A 2016. *Mastigoteuthidae* Verrill, 1881. Version. The Tree of Life Web Project. [updated 2016 Feb 27 (under construction); accessed 2017 Jun 27]. <http://tolweb.org/Mastigoteuthidae/19453/2016.02.27>.
- [48] Vecchione M, Young RE, Piatkowski U. 2010. Cephalopods of the northern Mid-Atlantic Ridge. *Mar Biol Res*. 6:25-52.
- [49] Verrill AE. 1881a. Report on the Cephalopods, and on Some Additional Species Dredged by the U.S. Fish Commission Steamer "Fish Hawk", During the Season of 1880. *Bull Museum Comp Zool*. 8:99-116.
- [50] Verrill AE. 1881b. The Cephalopods of the North-eastern Coast of America. Part II. The Smaller Cephalopods, Including the "Squids" and the Octopi, with Other Allied Forms. *Trans Conn Acad Sci*. 5:259-446.
- [51] Watling L, Guinotte J, Clarke MR, Smith CR. 2013. A proposed biogeography of the deep ocean floor. *Prog Oceanogr*. 11:91-112.
- [52] Xavier JC, Cherel Y, Allcock L, Rosa R, Sabirov RM, Blicher ME, Golikov AV. A review on the biodiversity, distribution and trophic role of cephalopods in the Arctic and Antarctic marine ecosystems under a changing ocean. 2018. *Mar Biol*. 165(93):26. [accessed 2018 Jul 16]. doi:10.1007/s00227-018-3352-9
- [53] Young RE, Lindgren A, Vecchione M. 2008. *Mastigoteuthis microlucens*, a new species of the squid family Mastigoteuthidae (Mollusca: Cephalopoda). *Proc Biol Soc Wash*. 121:276-282.
- [54] Young RE, Vecchione M 2014. *Echinoteuthis glaukopsis* (Chun, 1908). Version. The Tree of Life Web Project. [updated 2014 Dec 6 (under construction); accessed 2017 Jun 27]. [http://tolweb.org/Echinoteuthis\\_glaukopsis/52637/2014.12.06](http://tolweb.org/Echinoteuthis_glaukopsis/52637/2014.12.06).
- [55] Young RE, Vecchione M, Lindgren A 2014. *Magnoteuthis microlucens* (Young, Lindgren & Vecchione 2008). Version. The Tree of Life Web Project. [updated 2014 Dec 6 (under construction); accessed 2017 Jun 27]. [http://tolweb.org/Magnoteuthis\\_microlucens/65304/2014.12.06](http://tolweb.org/Magnoteuthis_microlucens/65304/2014.12.06).