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Short communication

Ctenophores of the Baltic and adjacent Seas – the invader *Mnemiopsis* is here!

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Abstract

The invasive ctenophore *Mnemiopsis leidyi* has been detected during late summer and autumn 2006 in northern Europe. So far it has been found in the southern North Sea area, along the Swedish west coast, in the southwestern Baltic and along the south and southwestern Norwegian coasts. From the large populations observed, it is obvious that it must have been introduced before 2006, but remained unrecorded until this autumn.

Key words: Baltic Sea, Skagerrak, North Sea, *Mnemiopsis leidyi,* invasive, first record

The only comb jelly known to be widespread in the Baltic is the "Sea Gooseberry" *Pleurobrachia pileus* (O.F. Müller, 1776) belonging to the order Cydippida. This species, which may reach a length of 25 mm except its tentacles, is common in the marine waters of almost all northern Europe and can tolerate salinities down to ca 6.5 psu. In the southernmost part of the Baltic two other species of the group may regularly be found as a result of water inflow from the Kattegatt. One of these is *Bolinopsis infundibulum* (O.F. Müller, 1776) belonging to the order Lobata, i.e. species with two oral lobes. *B. infundibulum* may reach a length of 15 cm. The other is the less than 16 cm long, somewhat elongate rugby ball shaped *Beroe cucumis* O. Fabricius, 1780, belonging to the only completely atentaculate order, Beroida. While cydippids and lobates prey upon small planktonic organisms, the sack shaped beroids are predators on predominantly large gelatinous plankton organisms. A second and smaller (usually less than 3 cm long) species of the latter genus, *B. gracilis* Künne, 1939, is common in the North Sea and the Skagerrak (and likely also in the Kattegatt) and may possibly also enter the southwestern part of the Baltic occasionally. This species is feeding almost exclusively on *Pleurobrachia*, while the up to 16 cm long *B. cucumis* may consume other larger organisms as well, mainly *Bolinopsis* sp., and – if available – also salps. These species are easy to separate from each other. *B. cucumis* has a branched gastrovascular system between each of the 8 longitudinal rows of comb plates, while no trace of such a system is seen in *B. gracilis*. No other pelagic ctenophores are known to occur in western European shallow waters.

In autumn 2006 (October 31) a ctenophore species of the genus *Mnemiopsis* L. Agassiz, 1860 was for the first time reported from the Baltic, by Jamileh Javidpour who studied *Pleurobrachia* sp. in the Kiel Bay (54°40'N, 10°30'E) (Javidpour 2006, see also Javidpour et al. 2006, this issue). Javidpour reported "considerable numbers" of less than 5 cm long specimens from October onwards. Densities up to 92 individuals per cubic meter were found (Javidpour et al. 2006, this issue). I had myself observed a few specimens from a plankton haul in the vicinity of the Tjärnö Marine Biological Laboratory (TMBL) at the northern part of the

Swedish west coast (58°52'N, 11°06'E) in mid September and again on the 8th of October. A marine botanist colleague, Jan Karlsson, snorkeling in the area during late August, later told me that he observed several *P. pileus*, many specimens of a very long and thin, almost completely hyaline species of *Beroe* – likely *B. gracilis* - together with thousands of lobed ctenophores in the warm surface water. As *B. infundilum* is a cold water species, it must have been *Mnemiopsis*.

The temperatures in the uppermost water masses outside TMBL have been exceptionally warm during the late summer and autumn in 2006, approximately 19-20°C in September when *Mnemiopsis* first was observed, approximately 15°C (down to a depth of ca 50 meters) during most of October, and by the end of November approximately 9°C. This is at least 3°C more than the usual temperatures for the area.

Another exceptional circumstance during this time was the virtual lack of the usually very common pelagic scyphomedusae in the region. Not a single *Aurelia aurita* have been observed during all late summer and autumn and only rather few *Cyanea capillata* and exceptional specimens of *Rhizostoma pulmo* and *Chrysaora hysoscella* were found. It is not clear if the few scyphomedusae may have supported the occurrence of *Mnemiopsis*, but the high water temperatures may have been beneficial.

Overwintering has probably occurred in estuaries along the North Sea coast (see Faasse and Bayha 2006, this issue), British Islands or the Atlantic part of Europe, from where offspring has drifted north- and eastwards. *Mnemiopsis* sp. may occur in temperatures from -0.7 to 32 (or even 35) °C (Miller 1974) and in salinities between 3.4-70 ppt (Miller 1974), but for short times slightly lower or higher values are tolerated. In low salinity areas, they die at higher temperatures (Shiganova et al. 2001). They breed only in temperatures between ca 19-23°C during darkness and when plenty of food is available (GESAMP 1997).

Whether the introduction to northern Europe happened through ships ballast water discharge from North America or the Black Sea remains unclear. Both *Mnemiopsis* sp. and *B. ovata* (see below) have - after their introduction to the Black Sea - also spread to the eastern parts of the Mediterranean, but no occurrence in the western parts of this sea has been published (Shiganova and Panov 2003).

Mnemiopsis has inner structures of the lobes originating from a position at the same level as the apical organ, not far from the top of the animal, while these structures in the similar genus *Bolinopsis* originate from a much lower level, almost halfway down between the top and the mouth side. Both of these genera have eight meridianal canals.

Diving colleagues have observed rather large amounts of the new species in the vicinity of TMBL during mid October 2006 and several have also been caught here in plankton nets in November. Because of the huge amount of specimens, it is unlikely that the introduction to north European waters happened this year and it is assumed that the species occurred before, although undetected until recently. The first to positively identify the taxon from this region was likely Keith M. Bayha, Dauphin Island Sea Laboratory, USA. Photos of the individuals caught (Figure 1) and samples from northern Europe were analysed in the first half of September 2006. After sequencing the material for rDNA and mitochondrial DNA, it was confirmed that it was definitively *Mnemiopsis* sp. (Faasse and Bayha 2006, this issue).

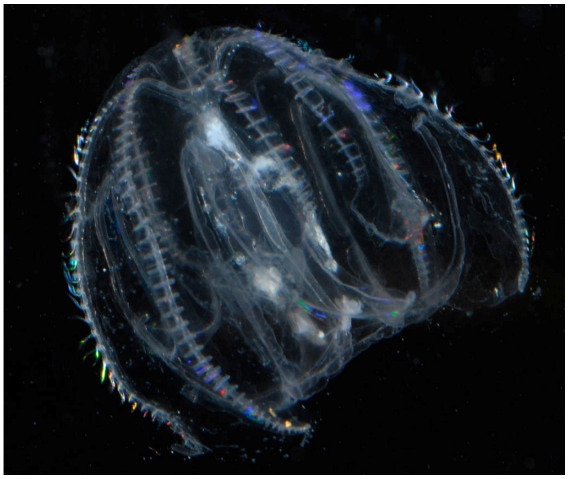

Figure 1. A specimen of *Mnemiopsis*, a little smaller than 20 mm long, from the Baltic Sea. Two long comb plate rows can be seen along the lobe to the left and two shorter rows along the central body. Iridescens is visible from the two long rows along the edge of the body. The inner structures of the lobes reaching almost to the apical organ is also fairly evident. Photo: Nicklas Wijkmark

Records of *Mnemiopsis* in coastal waters of the Northern Europe in 2006 are provided in the Annex.

Mnemiopsis was originally described from Charleston Harbor, South Carolina, where the type species, named *M. gardeni* L. Agassiz, 1860 was found. Five years later the author's son Alexander described a new species from the Woods Hole area, *M. leidyi* A. Agassiz, 1865. Another - and last - description of a new species of this genus was named *M. mccradyi* A.G. Mayer, 1900, also found in the Charleston Harbor area. The species in this genus are originally known from around 42° N to around 46° S along the American coast. Seravin (1994) revised the genus, and concluded that all 3 species *M. mccradyi*, *M. leidyi* and *M. gardeni* are one and the same, but are polymorphic because of environmental adaptations. Most specialists seem to agree that there is only one species (e.g. Bayha et al. 2003), i.e. *Mnemiopsis leidyi* (A. Agassiz, 1865). The specimen seen from the Swedish west coast has been lacking surface papillae. Papillae may be a sign of age rather than a species difference, because very large specimens found off the US Atlantic seaboard are often very "warty" and muscular, while smaller specimens from the same waters are "smooth" (Moss pers. comm.).

In coming years we have to be very observant regarding the new invader. In the Black Sea the introduction had severe consequences in the beginning, especially for the anchovy and European and Caspian kilka fishery. The decline of the anchovy in the Black Sea was likely due to a combination of overfishing, eutrophication and the introduction of *Mnemiopsis* (Bilio and Niermann 2004). After the introduction of the predatory ctenophore *Beroe ovata* sensu Mayer, 1912, during 1997 which also originates from the Atlantic American waters, the situation has changed (Gordina et al. 2005).

Mnemiopsis has a broad food spectrum which includes fish eggs and larvae, different kinds of smaller holoplanktonic animals, and pelagic larvae of different benthic invertebrates. Even protozoan plankton (e.g. Ciliophora) may be consumed, but it cannot survive on passively ingested phytoplankton only. In areas with dense populations of this ctenophore, it may locally affect populations of species with late summer or autumn larvae (Burrell and Van Engel 1976, Bullard et al. 1999).

"*B. ovata*" does not reach the full size of the native *B. cucumis*, but is very similar. While *B. cucumis* usually is approximately two times longer than its diameter with a rounded oral side, "*B. ovata*" usually is a bit shorter, with a more flattened oral side and is also somewhat flatter seen from the sides. An adult specimen is around 1.2 - 3.3 times higher as width. It cannot be exclude that this predator may find its way also to northern Europe like it did to the Black Sea and it is a species to look out for in the future. Likely, however, "*B. ovata*" may have lower tolerance limits for salinity and temperature than *Mnemiopsis* and it remains unclear how far north along the coast of Europe it may spread. Along the US coast small specimens of *Beroe* may "bite off" small pieces from larger *Mnemiopsis* specimens (Moss pers. comm.).

The coastal waters in northern Europe – except for a few summer months – are in the lower limit of the temperature tolerance of *Mnemiopsis*, so hopefully their impact will be less severe than in the Black and Caspian Seas. However, knowing the potential impact of *Mnemiopsis* this new record from the Baltic Sea is of concern.

References

Bayha KM, McDonald JH and Gaffney PM (2003) Molecular systematics of the invasive Ctenophore *Mnemiopsis* sp. University of Delaware. Proceedings of The Third International Conference on Marine Bioinvasions, La Jolla, California, March 16-19. p. 11 (Abstract available at http://www.sgnis.org/publicat/bayhmcdo.htm)

Bilio M and Niermann U (2004) Is the comb jelly really to blame for it all? *Mnemiopsis leidyi* and the ecological concerns about the Caspian Sea. Marine Ecology Progress Series 269: 173-183

Bullard SG, Lindquist NL and Hay ME (1999) Susceptibility of invertebrate larvae to predators: how common are post-capture larval defenses? Marine Ecology Progress Series 191: 153-161

Burrell VG and Van Engel WA (1976) Predation by and distribution of a ctenophore, *Mnemiopsis leidyi* A. Agasssiz, in the York River Estuary. Estuar. Coas.t Mar. Sci. 4: 235-242

Costello J, Mianzan H and Shiganova T (2005) *Mnemiopsis leidyi* (comb jelly). (Available at: http://www.issg.org/database/species/ecology.asp?si=95&fr=1&sts=)

Faasse MA and Bayha KM (2006) The ctenophore *Mnemiopsis leidyi* A. Agassiz 1865 in coastal waters of the Netherlands: an unrecognized invasion? Aquatic Invasions 1(4): 270-277

Gordina AD, Zagorodnyaya JuA, Kideys AE and Satilmis AE (2005) Summer ichthyoplankton, food supply of fish larvae in the Black Sea during 2000 and 2001. J. mar. Biol. Ass. U.K. 85: 537-548

Javidpour J (2006) Ctenophores in the Baltic (message written 31 October to the Cnidaria Newsgroup – original message available in an answer from O. Müller P. Oliveira at: http://maillists.uci.edu/mailman/public/cnidaria/2006-November/001238.html and pictures at:

http://maillists.uci.edu/mailman/public/cnidaria/2006-October/001235.html
Javidpour J, Sommer U and Shiganova T (2006) First record of *Mnemiopsis leidyi* A. Agassiz 1865 in the Baltic Sea. Aquatic Invasions 1(4): 299-302
Miller RJ (1974) Distribution and biomass of an estuarine ctenophore population, *Mnemiopsis leidyi* (A. Agassiz). Chesapeake Sci. 15: 1-8
Mills CE, Pugh PR, Harbison GR and Haddock SHD (1996) Medusae, siphonophores and ctenophores of the Alborán Sea, south western Mediterranean. Scientia Marina 60 (1): 145-163
Mills CE (2001) Jellyfish blooms: are populations increasing globally in response to changing ocean conditions? Hydrobiologia 451: 55-68
Seravin LN (1994) The systematic revision of the genus *Mnemiopsis* (Ctenophora, Lobata). II: Species attribution of *Mnemiopsis* from the Black Sea and the species composition of the genus *Mnemiopsis.* Zoologičeskij žurnal 73 (11): 19-34
Shiganova TA, Mirsoyan ZA, Studenikina EA, Volovik SP, Siokoi-Frangou I, Zervoudaki S, Christou ED, Skirta AY and Dumont H (2001) A review of the invader ctenophore *Mnemiopsis leidyi* (A. Agassiz) population development in the Black Sea and in other seas of the Mediterranean basin. Marine Biology 139: 431-445
Shiganova TA and Panov VE (2003) *Mnemiopsis leidyi* A. Agassiz, 1865. (Compiled for the Regional Biological Invasions Center. Available at: http://www.zin.ru/projects/invasions/gaas/mnelei.htm)

Annex

Records of *Mnemiopsis* in the Northern Europe in 2006

Location	Record coordinates		Record date	Species abundance (ind./plankton haul)	Collector (data source)
	Latitude, °N	Longitude, °E			
Skagerrak	58°52.10'	11°06.20'	late August 2006	"thousands"	Jan Karlsson "lobed ctenophore in surface waters" (pers. comm.)
Skagerrak	58°52.10'	11°06.20'	mid September 2006	≥4 (in plankton haul)	Own observation
Skagerrak	58°52.10'	11°06.20'	08.10.2006 and 14.10.2006	8-10 (in plankton haul) and "thousands"	Own observation and Video by L.-O. Loo
Skagerrak	58°52.10'	11°06.20'	23.11.2006	>20 (in plankton haul)	Own observation
Kiel Bay, SW Baltic	54°40'	10°30'	October and November 2006	29-92 individuals per cubic meter	Javidpour et al. 2006 (this issue)
coasts of the Netherlands	(see Faasse and Bayha 2006 in this issue)	(see Faasse and Bayha 2006 in this issue)	beginning of September	"large numbers"	Faasse and Bayha 2006 (this issue)
Oslofjord	no data	no data	late autumn 2006	unknown	T. Falkenhaug and A. Jelmert, pers. comm.
near Bergen	no data	no data	late autumn 2006	unknown	T. Falkenhaug and A. Jelmert, pers. comm.