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Short communication

First record of *Mnemiopsis leidyi* A. Agassiz, 1865 in the Gulf of Gdańsk (southern Baltic Sea)

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Abstract

We report the discovery of *Mnemiopsis leidyi* A. Agassiz, 1865 in the Gulf of Gdańsk (southern Baltic Sea, Poland) in October 2007. During the first month of observations the species was found in many areas of the Gulf of Gdańsk, from the surface to a depth of 42 m. The length of individual *M. leidyi* varied from 1.8 to 8.0 cm.

Key words: invasive ctenophore, *Mnemiopsis leidyi*, alien species, Baltic Sea, Gulf of Gdańsk

Only one ctenophore species *Pleurobrachia pileus* (O. F. Müller, 1776) had previously been recorded in the Gulf of Gdańsk (southern Baltic Sea) (Wiktor 1990). Here we present the first report on the occurrence of a new ctenophore, *Mnemiopsis leidyi* A.Agassiz, 1865 (Ctenophora, Lobata), in this area.

The ctenophores were caught by divers using hand nets (3 mm mesh) in October-November 2007. The animals were taken to the laboratory and immediately examined while still alive. They were identified as *M. leidyi* by virtue of the oral lobes extending to the apical sense organ (statocyst) over nearly the entire body length (Faasse and Bayha 2006) (Figure 1). The total length of individuals was measured under a magnifying glass (x 5). Additionally, observations reported by the divers and their estimates of abundance and size of individuals are presented in the Annex.

Mnemiopsis leidyi originates from the eastern coast of North and South America (Purcell et al. 2001) and has been introduced into the Azov, Black, Caspian, Marmara Seas and the eastern Mediterranean Sea (e.g. Shiganova et al. 2001). It was not identified from along western and northern European coasts until October 2006 (Javidpour et al. 2006). *Mnemiopsis leidyi* was first observed in Danish waters in August 2005 (Tendal et al. 2007 this issue). The species was successively detected in the Danish Straits in November 2005 (Oliveira 2007), Kiel Bay in

October 2006 (Javidpour et al. 2006), south-western and central Baltic – Pomeranian Bay in December 2006 and the Kiel Bight, Kadet Furrow, Bornholm Deep, Gotland Basin in winter and spring 2007 (Kube et al. 2007), as well as in the Åland Sea and the Bothnian Sea in August-September 2007 (Lehtiniemi et al. 2007 this issue).

On 3rd October 2007, the first individuals of *M. leidyi* (about 10) were observed and collected by a diver in the coastal zone of the Gulf of Gdańsk at a depth of 1.5 m (water temperature 14 °C, salinity 7 psu, see Annex). Subsequently, *M. leidyi* individuals were observed by divers in Gulf waters from the surface to a depth of 42 m (Figure 2). The total lengths of specimens varied from 1.8 to 8.0 cm, similar to the sizes given by Oliveira (2007) for individuals collected in the Oslofjorden in Norway (from 4.0 to 8.0 cm). The greatest length recorded thus far in the newly invaded areas was 12-15 cm, noted in the Sound in July 2007 (Tendal et al. 2007 this issue).

The abundance of *M. leidyi* based on underwater observations ranged from 3 to 20 ind.·m^{-3} (Annex). Rather than being homogeneously dispersed, the specimens formed clusters, sometimes accompanied by *Aurelia aurita* (Arciszewski pers. comm.). A more massive occurrence of *M. leidyi*, ranging from 30 to 92 ind.·m^{-3}, was reported in Kiel Bight (Javidpour et al. 2006). In the Åland Sea their presence was restricted to deeper waters in or below the halocline (approx. 80-110 m). Lehtiniemi et al. (2007) estimated their maximum numbers as 694 ind.·m^{-2} (density = 23 ind.·m^{-3} in a layer 30 m thick). The highest mean abundance observed was 304 ind.·m^{-3} in the Black Sea by Vinogradov et al. (1989).

Mnemiopsis leidyi is characterized by its broad food spectrum, as it feeds on zooplankton, fish eggs and larvae (Kremer 1979). The species may negatively affect fish stocks; both directly - by preying on fish eggs and larvae, and indirectly - by competing and reducing the food base for planktivorous fish. The animals most endangered by their presence in the southern Baltic are mainly sprat *Sprattus sprattus* (Linnaeus, 1758) and herring *Clupea harengus* (Linnaeus, 1758). Other fish which have a planktonic larval stage, such as flounder *Platichthys flesus* (Linnaeus, 1758) and cod *Gadus morhua* (Linnaeus, 1758), are also potentially threatened. Haslob et al. (2007) showed that cod eggs and *M. leidyi* occur in the same water layers in the southern Baltic and that the latter prey on the eggs.

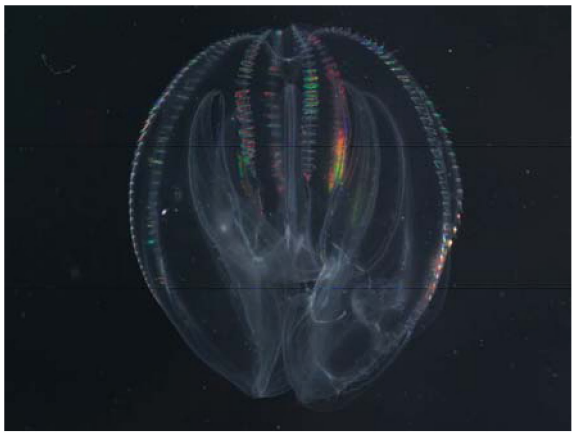

Figure 1. Mnemiopsis leidyi from the Gulf of Gdańsk, October 2007 (length 2.5 cm). Photograph by P. Wysocki

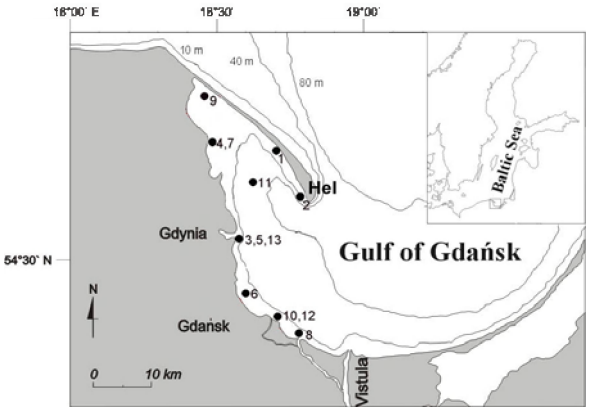

Figure 2. Distribution of *Mnemiopsis leidyi* in the Gulf of Gdańsk in 2007. Numbers refer to column 1 in Annex

It has not yet been ascertained whether the population of *M. leidyi* is able to persist in the southern Baltic Sea. Water temperature, food stocks and the occurrence of predators are crucial factors influencing its distribution and abundance (Kremer 1994, Purcell et al. 2001).

The ctenophore is tolerant of a wide range of salinity and temperature conditions. In the United States it occurs in water temperatures between 2°C and 32°C and salinities between 2 and 38 psu (Kremer 1994). Lehtiniemi et al. (2007) found that *M. leidyi* is able to reproduce in the north-eastern Baltic Sea, where both temperature and salinity reach the physiological tolerance limit of this species. We infer that reproduction in all other areas of the Baltic Sea

is therefore very probable. It is relevant in this context that a strong increasing trend of sea surface temperature has been observed in the southern Baltic Sea during the summer, for the last twenty years (Siegel et al. 2006, Bradtke et al. submitted). This climatic change favours the reproduction of the population of *M. leidyi* and other alien species.

Mnemiopsis leidyi is able to survive low temperatures < 4°C in conditions of high salinity in its place of origin, however they do not survive a fall in salinity, as in the winter in the Black and Azov Seas (see review Purcell et al. 2001). According to Kube et al. (2007), *M. leidyi* over-wintered in 2006-2007 in the south-western Baltic Sea (> 3°C, > 10 psu). It is important to determine whether the species is able to survive more severe winters in waters of lower salinity as is the case in the southern and eastern areas of the Baltic Sea. Even if *M. leidyi* were unable to survive winter in the coastal zone, individuals may be able to overwinter below the halocline. Specimens thriving in this layer were observed during the cold season in the Bornholm Deep and the Bornholm Basin (Kube at al. 2007). In addition, the population of *M. leidyi* in the southern Baltic could be enhanced by animals reproducing in the western part of the Baltic or in the Danish Straits (Hansson 2006, Javidpour et al. 2006, Kube at al. 2007, Oliveira 2007, Tendal et al. 2007 this issue).

It is unlikely that zooplankton stocks would limit the development of the *M. leidyi* population in the southern Baltic Sea, because zooplankton is available throughout the year (Mudrak and Żmijewska 2007). The mean biomass of meso-zooplankton was estimated as ranging from 15 to 30 mg $C \cdot m^{-3}$ between August and November (see Janas and Witek 1993). In its area of origin, *M. leidyi* is recorded only in waters with high zooplankton stocks. When zooplankton biomass decreases to < 3 mg $C \cdot m^{-3}$, the ctenophores disappear (Kremer 1994). Another major factor is that there are, at present, no potential predators in the Baltic Sea that could impact the population of *M. leidyi*.

M. leidyi has joined the ever-increasing group of non-indigenous species in the southern Baltic Sea (e.g. Skóra and Stolarski 1993, Szaniawska et al. 2003, Janas et al. 2004). However, none of the other alien species has such a notorious reputation as *M. leidyi* (e.g. Shiganova et al. 2001, Knowler 2005). Therefore, it is essential that studies continue on its expansion, abundance and impact on the Baltic Sea biocenosis.

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Annex

Records of *Mnemiopsis leidyi* in the Gulf of Gdańsk in October and November 2007

Map ref.	Location	Record coordinates		Date	Depth, m	Water temp. °C	Abundance and size	Collector
		Latitude, N	Longitude,E					
1	Jurata	54°40'47"	18°42'24"	03.10.2007	1.5	14	10 ind. during dive, 1.8-2.5 cm	M. Dubiński
2	Wreck "Munin"	54°36'07"	18°47'25"	03.10.2007	12.0 and 42.0	9	~3 - 4 ind.·m^{-3}	W. Jechna
3	Yacht port Gdynia	54°31'03"	18°33'07"	07-20.10.2007	0-1.0		10-20 ind. every observation, ~2-5.5 cm	P. Wysocki
4	Rzucewo	54°41'10"	18°28'07"	13.10.2007	1.5-2.0		few dozens of ind. during dive, max. ~6 cm	J.Abramowicz
5	Yacht port Gdynia	54°31'03"	18°33'08"	15.10.2007	0-1.0	12	4 ind. during observation, 2-8 cm	Own data
6	Gdańsk Jelitkowo	54°25'59"	18°36'01"	16.10.2007	6.0		~2-3 ind.·m^{-3}, ~3 cm	M.Sapota
7	Rzucewo	54°41'10"	18°28'07"	16.10.2007	0-2.5		few dozens of ind. during dive, ~6 ind.·m^{-3}, ~1.5-7 cm	B.Arciszewski
8	Gdańsk Górki Zachodnie	54°22'14"	18°46'34"	20-27.10.2007	0-0.5	12	10-15 ind. every observation, ~3-5 cm	P. Wysocki
9	Władysławowo	54°46'18"	18°26'15"	28.10.2007	0-2.0		30 ind. during dive, ~4-6 cm	K. Dominiak
10	Gdańsk Westerplatte	54°24'14"	18°41'06"	28.10.2007	0-4.0	12	few hundreds during dive, up to ~ 20 ind.·m^{-3}, ~1.5-8 cm	P. Wysocki
11	Wreck "Delfin"	54°38'	18°36'	01.11.2007	21.0	9	~1 ind.·m^{-3}, max. ~5 cm	W. Jechna
12	Gdańsk Westerplatte	54°24'14"	18°41'06"	11.11.2007	0-4.0	8	30 ind. during dive, 2.5-6 cm	P. Wysocki
13	Yacht port Gdynia	54°31'03"	18°33'07"	12.11.2007	0-1.0	6	16 ind. during observation, 2.5-6 cm	Own data