A synthesis of the distribution of *Mnemiopsis leidyi* in European waters

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Summary

We synthesize the distribution *of M. leidyi* throughout European waters and show that it has established populations through northern and southern Europe reaching as far north as 63.5ºN.

Introduction

The comb jelly *Mnemiopsis leidyi*, native to the east coast of America, has a long invasion history in European waters. Its first sighting dates back to the early 1980s from the Black Sea (Purcell *et al.*, 2001). *M. leidyi* has been introduced to northern Europe around 25 years later, with animals originating from

a different, North American sub-population (Reusch *et al.*, 2010). Due to difficulties of morphological identification of its larval stages, there has been some ambiguity about *M. leidyi*'s distribution range in northern Europe. Here we present a comprehensive review of the distribution range throughout Europe spanning the past 35 years.

Materials and Methods

Based on published literature and unpublished expert data, we synthesize the distribution range of the invasive comb jelly *M. leidyi*. Data was collected by dedicated gelatinous zooplankton or ichthyoplankton surveys, zooplankton investigations, diving observations or confirmed sightings evaluated by experts including identification based on morphology and DNA analyses.

Results and Discussion

Since its first sighting in the Black Sea, *M. leidyi* is now present in adjacent waters such as the Sea of Azov, the Caspian Sea, the Sea of Marmara and the Mediterranean Sea (Purcell *et al.*, 2001). In 2009, *M. leidyi* was confirmed from the western most coastline of the Mediterranean Sea (Fuentes *et al.*, 2010), with further sightings around the Mediterranean Sea indicating established permanent populations throughout southern Europe. The first confirmed sighting of *M. leidyi* in northern Europe, in Oslofjord, dates back to 2005 (Oliveira, 2007). However, it has recently been shown that *M. leidyi* simultaneously occurred at the south western coasts of the North Sea (Antajan *et al.*, 2014), raising questions about the original area of introduction in northern Europe. Up to now, the northern most sighting of *M. leidyi* is Trondheimsfjord, which is >63N along the Norwegian coast. However, even though *M. leidyi* was present in the Baltic Sea from 2006 to the winter of 2010/2011, reports thereafter are sporadic and indicate that it could not establish a permanent population in the low saline Baltic Sea region. On the other hand, areas with higher salinity and higher winter temperatures, like the Dutch Wadden Sea (Van Walraven *et al.*, 2013) and German Bight, support year-round populations. Further, reports of *M. leidyi* larvae in the northern Baltic Sea seem to be misidentifications of another arctic relict comb jelly species *Mertensia ovum*, as confirmed by DNA analyses from recent surveys (Jaspers et al. 2013). Our synthesis shows that *M. leidyi* is widespread with established permanent populations in northern and southern Europe. It reaches exceptionally high abundances, especially in northern Europe, with documented negative effects on local fish populations.

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