



Appendix A

Harmonia^{+PL} – procedure for negative impact risk assessment for invasive alien species and potentially invasive alien species in Poland

QUESTIONNAIRE

A0 | Context

Questions from this module identify the assessor and the biological, geographical & social context of the assessment.

a01. Name(s) of the assessor(s):

first name and family name

1. Monika Normant-Saremba – external expert
2. Urszula Janas – external expert
3. Joanna Hegele-Drywa

acomment01.	Comments:	degree	affiliation	assessment date
	(1)	dr hab.	Department of Experimental Ecology of Marine Organisms, Institute of Oceanography, University of Gdansk	21-01-2018
	(2)	dr hab.	Department of Experimental Ecology of Marine Organisms, Institute of Oceanography, University of Gdansk	18-01-2018
	(3)	dr	Department of Experimental Ecology of Marine Organisms, Institute of Oceanography, University of Gdansk	09-02-2018

a02. Name(s) of *the species* under assessment:

Polish name: –

Latin name: ***Mnemiopsis leidyi*** L. Agassiz, 1865

English name: Warty comb jelly

acomm02.	Comments:	
	Polish name (synonym I)	Polish name (synonym II)
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	Latin name (synonym I)	Latin name (synonym II)
	<i>Mnemiopsis gardeni</i>	<i>Mnemiopsis mccradyi</i>
	English name (synonym I)	English name (synonym II)
	Sea walnut	Comb jellyfish

a03. Area under assessment:

Poland

acomm03.	Comment:
	–

a04. Status of the species in Poland. The species is:

<input type="checkbox"/>	native to Poland
<input type="checkbox"/>	alien, absent from Poland
<input type="checkbox"/>	alien, present in Poland only in cultivation or captivity
<input checked="" type="checkbox"/>	alien, present in Poland in the environment, not established
<input type="checkbox"/>	alien, present in Poland in the environment, established

aconf01.	Answer provided with a	low	medium	high	level of confidence
			X		

acomm04.	Comments:
	In Poland, this species was first found in autumn 2007, both in the Pomeranian Bay and in the Gulf of Gdansk (Janas and Zgrundo 2007 – P, Woźniczka and Pawelczyk 2009 – I). In 2008 and 2009 <i>Mnemiopsis leidyi</i> was reported only in the Pomeranian Bay, and only in autumn. In the following years it was not noted. Its presence in the Pomeranian Bay was reported again in 2014 and 2015, also only in autumn (Woźniczka 2018 – I). In addition to the coastal zone, this species was also found in open waters, i.e. in Słupsk Furrow (Schaber et al. 2011 – P). Periodic and relatively rare occurrence of <i>Mnemiopsis leidyi</i> leads to the conclusion that there is no established population of this species in Poland.

a05. The impact of the species on major domains. The species may have an impact on:

<input checked="" type="checkbox"/>	the environmental domain
<input type="checkbox"/>	the cultivated plants domain
<input checked="" type="checkbox"/>	the domesticated animals domain
<input type="checkbox"/>	the human domain
<input type="checkbox"/>	the other domains

acomm05.	Comments:
	<i>Mnemiopsis leidyi</i> has a negative influence on the natural environment, both in the native region and in the Black Sea (Purcell et al. 2001 – P). The species is a predator which can significantly reduce the abundance and diversity of zooplankton and fish populations by feeding on their eggs, larvae and juveniles (Purcell et al. 2001 – P). Studies carried out in the Baltic Sea also indicate the possible influence of <i>M. leidyi</i> on fish eggs and larvae, but it may be lower than in other regions (Haslob et al. 2007, Jaspers et al. 2011b – P). Through excessive predation, the species can also influence the trophic web, leading to disturbances in the functioning of the ecosystem in which it occurs (Kideys 2002 – P). <i>Mnemiopsis leidyi</i> also competes for food with other gelatinous zooplankton representatives and with fish feeding on zooplankton (Mutlu et al. 1994, Riisgård et al. 2012 – P). It provides food for larger <i>Ctenophora</i> and some species of fish (Purcell et al. 2001 – P). It is also a host to

pathogens and parasites and is involved in their spread (Selander et al. 2010, Daniels and Breitbart 2012, Saeedi et al. 2013 – P). At high densities, it can also monopolize the environment contributing to economic losses for fishery (Purcell et al. 2011 – P).

A1 | Introduction

Questions from this module assess the risk for *the species* to overcome geographical barriers and – if applicable – subsequent barriers of captivity or cultivation. This leads to *introduction*, defined as the entry of *the organism* to within the limits of *the area* and subsequently into the wild.

a06. The probability for *the species* to expand into Poland’s natural environments, as a result of self-propelled expansion after its earlier introduction outside of the Polish territory is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf02.	Answer provided with a	low	medium	high	level of confidence
				<input checked="" type="checkbox"/>	

acomm06. Comments:
Mnemiopsis leidyi occurs in the western part of the Baltic Sea, from where it spreads to the central part of this reservoir in which the population of this species has not been established so far (Schaber et al. 2011, Riisgård 2017 – P). It also appears in the Polish Maritime Areas, i.e. in the Pomeranian Bay or the Słupsk Furrow (Woźniczka and Pawelczyk 2009 – I, Schaber et al. 2011 – P). *M. leidyi* larvae are spread by sea currents, while adult animals can also swim actively by moving its cilia covering the surface of eight combs located along the body (Oliveira 2007 – P).

a07. The probability for *the species* to be introduced into Poland’s natural environments by unintentional human actions is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf03.	Answer provided with a	low	medium	high	level of confidence
				<input checked="" type="checkbox"/>	

acomm07. Comments:
Mnemiopsis leidyi may be brought to Poland in the ballast waters of ships from ports located in Europe, e.g. in the North Sea or Western Baltic Sea region, as well as those coming from on the eastern coasts of America (Reusch et al. 2010, Antajan et al. 2014 – P). However, with the International Convention for the Control and Management of Ships’ Ballast Water and Sediments entering into force on 8 September 2017, shipowners will be required to clear the water from living organisms before releasing it from the ballast tanks into the environment at the port of destination. In practice, these measures may significantly limit the potential release of this species into the natural environment of Poland.

a08. The probability for *the species* to be introduced into Poland’s natural environments by intentional human actions is:

<input checked="" type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf04.	Answer provided with a	low	medium	high X	level of confidence
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acomment08. Comments:
It is unlikely that *Mnemiopsis leidyi* would be brought to Poland intentionally, as it is not used by humans in any way, e.g. in aquaristics or as food. Therefore, the probability of introducing this species into the natural environment of Poland was estimated to be less than 1 case per decade.

A2 | Establishment

Questions from this module assess the likelihood for *the species* to overcome survival and reproduction barriers. This leads to *establishment*, defined as the growth of a population to sufficient levels such that natural extinction within *the area* becomes highly unlikely.

a09. Poland provides **climate** that is:

<input type="checkbox"/>	non-optimal
<input checked="" type="checkbox"/>	sub-optimal
<input type="checkbox"/>	optimal for establishment of <i>the species</i>

aconf05.	Answer provided with a	low	medium	high X	level of confidence
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acomment09. Comments:
The native regions of *Mnemiopsis leidyi* are shallow estuaries and bays along the eastern coasts of North and South America, situated in temperate and tropical zones (Purcell et al. 2001 – P). The species is characterised by a wide temperature tolerance range – from 0 to 32°C (Costello et al. 2012 – P), and this is the range of water temperatures in the Polish Baltic Sea zone. However, temperatures below 7-8°C result in reduced nutrition and growth of the larvae (Gambill et al. 2015 – P) and long periods of low temperatures during the year (<10°C) are unfavorable for its reproduction (Costello et al. 2012 – P). Considering the above, it is highly probable that, as in the Bornholm Basin, also in the Polish Maritime Areas, low temperatures in winter hamper the survival and reproduction of *Mnemiopsis leidyi* (Schaber et al. 2011 – P). For this reason, the climatic conditions for establishment of the species in Poland have been determined to be moderately favorable.

a10. Poland provides **habitat** that is

<input checked="" type="checkbox"/>	non-optimal
<input type="checkbox"/>	sub-optimal
<input type="checkbox"/>	optimal for establishment of <i>the species</i>

aconf06.	Answer provided with a	low	medium	high X	level of confidence
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acomment10. Comments:
The habitat of *Mnemiopsis leidyi* in Poland are large bays (Gdańsk and Pomeranian) and open sea waters (the Słupsk Furrow), where the species is a part of plankton communities. The combination of low salinity (7 psu) and low temperature in these habitats seems to be the most important limiting factor for the spread of *Mnemiopsis leidyi* in the Baltic Sea, as well as for its establishment in the Polish Maritime Areas (Schaber et al. 2011 – P). Although *Mnemiopsis leidyi* has a salinity tolerance range of 2-38 psu, reproduction of the species is possible when salinity level reaches over 6 psu and thermal conditions are optimal (Jaspers et al. 2011a – P). The low salinity also reduces the survival and fertility of the species – the latter is several dozen times lower than in the salinity of the high seas (Purcell et al. 2001, Jaspers et al. 2011a, Costello et al. 2012 – P). In higher salinity, the species is also more tolerant of lower temperatures. Taking the above information into



account, the habitat conditions for establishment of the species in Poland were determined to be unfavorable.

A3 | Spread

Questions from this module assess the risk of *the species* to overcoming dispersal barriers and (new) environmental barriers within Poland. This would lead to spread, in which vacant patches of suitable habitat become increasingly occupied from (an) already-established population(s) within Poland.

Note that spread is considered to be different from range expansions that stem from new introductions (covered by the Introduction module).

a11. The capacity of *the species* to disperse within Poland by natural means, **with no human assistance**, is:

<input type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input checked="" type="checkbox"/>	very high

aconf07.

Answer provided with a

low	medium	high X
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level of confidence

acommm11.

Comments:

Dispersion from a single source (Type A data) / Population expansion (Type B data)
Mnemiopsis leidyi is not established in Poland, probably due to unfavorable thermal conditions and salinity (Schaber et al. 2011 – P), however, during the last decade a periodical occurrence of this species has been observed (Woźniczka and Pawelczyk 2009 – I). However, if it was established, it would be very likely that it could spread rapidly in the Polish Maritime Areas due to the transfer of individuals with sea currents, and due to their ability to swim actively. Nevertheless, it is difficult to estimate the rate of such spread without using a specific model, as it depends on many factors. However, based on scientific data, it can be assumed that in favorable conditions, *Mnemiopsis leidyi* can cover a distance of even several hundred kilometers during a year (Kube et al. 2007, Schaber et al. 2011 – P). Assuming that there is no established population of this species in Poland and that individuals occurring periodically come from the Western Baltic, the degree of dispersion from a single source and the possibility of expansion of the population of *Mnemiopsis leidyi* was estimated to be very high.

a12. The frequency of the dispersal of *the species* within Poland by **human actions** is:

<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf08.

Answer provided with a

low	medium X	high
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level of confidence

acommm12.

Comments:

Once established in Poland, *Mnemiopsis leidyi* could be spread as a result of unintended human actions. While transport in ships' tanks is unlikely (domestic sea transport, associated with filling ballast tanks in one port and emptying them in another, is not developed), it cannot be excluded that this species will be transported on the hulls of the ships (it may also be fragments of individuals, as adult individuals may regenerate damaged parts of the body; Henry and Martindale 2000 – P). But there is no known data on the spread of *Mnemiopsis leidyi* as a result of intentional human activities. The above information suggests that the probability of spreading of the species in Poland as a result of human actions is medium, in the range of 1 to 10 cases per decade.

A4a | Impact on the environmental domain

Questions from this module qualify the consequences of *the species* on wild animals and plants, habitats and ecosystems.

Impacts are linked to the conservation concern of targets. Native species that are of conservation concern refer to keystone species, protected and/or threatened species. See, for example, Red Lists, protected species lists, or Annex II of the 92/43/EWG Directive. Ecosystems that are of conservation concern refer to natural systems that are the habitat of many threatened species. These include natural forests, dry grasslands, natural rock outcrops, sand dunes, heathlands, peat bogs, marshes, rivers & ponds that have natural banks, and estuaries (Annex I of the 92/43/EWG Directive).

Native species population declines are considered at a local scale: limited decline is considered as a (mere) drop in numbers; severe decline is considered as (near) extinction. Similarly, limited ecosystem change is considered as transient and easily reversible; severe change is considered as persistent and hardly reversible.

a13. The effect of *the species* on native species, through **predation, parasitism or herbivory** is:

<input type="checkbox"/>	inapplicable
<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf09.	Answer provided with a	low	medium	high X	level of confidence
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acomment13. Comments:
 In the case of the spread of *Mnemiopsis leidyi* in Poland, it is likely that as a predator it will contribute to reduction of the native zooplankton species populations (e.g. copepods of *Acartia* genus or common jellyfish *Aurelia aurita*), benthic invertebrates with pelagic larvae and fish, e.g. Baltic cod *Gadus morhua callarias* (Mutlu et al. 1999, Purcell et al. 2001, Kideys 2002 – P, Haslob et al. 2007, Javidpour et al. 2009 – P). Cod *Gadus morhua* is a vulnerable species (VU) included on the IUCN and HELCOM lists (Sobel 1996 – B, Kontula and Haldin 2013 – P). Among the larvae of the benthic invertebrates, the larvae of the foreign species are predominant, i.e. *Amphibalanus improvisus*. So far, there are no reports on the influence of *Mnemiopsis leidyi* on the reduction of native species and species of particular concern in the Baltic Sea. Moreover, as laboratory studies have shown, the impact on fish may be lower than initially expected (Jaspers et al. 2011b – P). It should also be considered that fertility of *Mnemiopsis leidyi* is several dozen times lower in low salinity than in high seas salinity (Jaspers et al. 2011a – P). It can therefore be assumed that, if *Mnemiopsis leidyi* was established and spread in Poland, it would, as a predator, contribute to at most a small decline in the population of native species of particular concern and that its influence was therefore assessed as medium.

a14. The effect of *the species* on native species, through **competition** is:

<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf10.	Answer provided with a	low	medium X	high	level of confidence
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acomment14. Comments:
 In the case of the spread of *Mnemiopsis leidyi* in Poland, it is likely that it will compete for food with native invertebrate species, such as common jellyfish *Aurelia aurita*, and fish such as Baltic cod *Gadus morhua callarias* (vulnerable species included on the IUCN and HELCOM lists; Sobel 1996 – B, Kontula and Haldin 2013 – P), as is the case in other areas where this *Ctenophora* dominates (Mutlu et al. 1994, Shiganova et al. 1998, Purcell et al. 2001, Shiganova et al. 2001 – P). Such interaction is likely to be the strongest in late summer and autumn (van Walraven et al. 2017 – P). Due to the lack of information on the influence of this

species on native species of particular concern, it appears that if it was established and spread, it would have an average influence on native species through competition, causing severe declines in their population.

a15. The effect of *the species* on native species, through **interbreeding** is:

<input checked="" type="checkbox"/>	no / very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf11.	Answer provided with a	low	medium	high	level of confidence
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acomment15. Comments:
 No known cases of hybridization of *Mnemiopsis leidyi* with other species (Didžiulis 2013 – B). In addition, there is only one native *Ctenophora* species in the Polish Maritime Areas that belongs to a different genus, i.e. *Pleurobrachia pileus*. Therefore, the likelihood of *Mnemiopsis leidyi* affecting native species by crossbreeding with them has been assessed as low.

a16. The effect of *the species* on native species by **hosting pathogens or parasites** that are harmful to them is:

<input checked="" type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf12.	Answer provided with a	low	medium	high	level of confidence
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acomment16. Comments:
 Although *Ctenophora* are hosts to various parasites and pathogens (Daniels and Breitbart 2012, Saeedi et al. 2013 – P), there are no known common parasites and pathogens for *Mnemiopsis leidyi* and the native species. Apart from that, there are no other species of the genus *Mnemiopsis* in Poland or in the world. In this regard, the influence of *Mnemiopsis leidyi* on native species by transmission of pathogens or parasites that are harmful to these species is assessed as very small.

a17. The effect of *the species* on ecosystem integrity, by **affecting its abiotic properties** is:

<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf13.	Answer provided with a	low	medium	high	level of confidence
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acomment17. Comments:
 In the case of the spread of *Mnemiopsis leidyi* in Poland, it is likely that by disturbing the abiotic factors of the ecosystem, it will cause easily reversible changes in the processes taking place in habitats, including those belonging to the habitats of particular concern. Through excessive zooplankton consumption, the species may cause disturbances of abiotic factors, such as water turbidity or concentration of biogenic compounds (CABI 2017 – B). However, such a scenario is possible only with large number of individuals, and taking low salinity of the Polish Maritime Areas into account, the fertility of the species is several dozen times lower than in the high seas salinity, so in case of establishment, the population of *Mnemiopsis leidyi* will be small (Jaspers et al. 2011a – P). Therefore, its impact on the integrity of the ecosystem by disturbing its abiotic factors has been identified as medium.

a18. The effect of *the species* on ecosystem integrity, by **affecting its biotic properties** is:

<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf14.	Answer provided with a	low	medium X	high	level of confidence
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acomment18. Comments:
 In the case of the spread of *Mnemiopsis leidyi* in Poland, the species is likely to cause easily reversible changes in habitat processes, including habitats of particular concern, as a result of disturbance of biotic factors of ecosystems. As a predator, *Mnemiopsis leidyi* preys on zooplankton, as well as on many species of fish (Purcell et al. 2001 – P). By reducing the amount of food available for them, it may have a cascade effect on the whole trophic web, i.a. by reducing the biomass of fish feeding on plankton, in consequence it can also affect the organisms that feed on them, i.e. fish, birds and mammals (GISD 2015 – B, van Walraven et al. 2017 – P). A decrease in zooplankton diversity and quantity may also result in excessive phytoplankton growth. It should also be considered that in low salinity, as of Polish Maritime Areas, the fertility of *Mnemiopsis leidyi* is several dozen times lower in low salinity than in high seas salinity (Jaspers et al. 2011a – P), the population would be small if the species was to be established and spread. Therefore, its impact on the integrity of the ecosystem by disturbing its biotic factors has been identified as medium.

A4b | Impact on the cultivated plants domain

Questions from this module qualify the consequences of *the species* for cultivated plants (e.g. crops, pastures, horticultural stock).

For the questions from this module, consequence is considered ‘low’ when presence of *the species* in (or on) a population of target plants is sporadic and/or causes little damage. Harm is considered ‘medium’ when *the organism’s* development causes local yield (or plant) losses below 20%, and ‘high’ when losses range >20%.

a19. The effect of *the species* on cultivated plant targets through **herbivory or parasitism** is:

<input checked="" type="checkbox"/>	inapplicable
<input type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf15.	Answer provided with a	low	medium	high	level of confidence
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acomment19. Comments:
Mnemiopsis leidyi is not a herbivorous species nor a parasite.

a20. The effect of *the species* on cultivated plant targets through **competition** is:

<input checked="" type="checkbox"/>	inapplicable
<input type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf16.	Answer provided with a	low	medium	high	level of confidence
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acomm20. Comments:
Mnemiopsis leidyi is an animal.

a21. The effect of *the species* on cultivated plant targets through **interbreeding** with related species, including the plants themselves is:

- inapplicable
- no / very low
- low
- medium
- high
- very high

aconf17. Answer provided with a

low	medium	high
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 level of confidence

acomm20. Comments:
Mnemiopsis leidyi is an animal.

a22. The effect of *the species* on cultivated plant targets by **affecting the cultivation system's integrity** is:

- very low
- low
- medium
- high
- very high

aconf18. Answer provided with a

low	medium	high X
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 level of confidence

acomm22. Comments:
Due to the fact that *Mnemiopsis leidyi* is not a herbivorous species, it is very unlikely that it will affect the condition or yielding of cultivated plants in any way.

a23. The effect of *the species* on cultivated plant targets by hosting **pathogens or parasites** that are harmful to them is:

- very low
- low
- medium
- high
- very high

aconf19. Answer provided with a

low	medium	high X
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 level of confidence

acomm23. Comments:
Due to taxonomic and environmental differences (*Mnemiopsis leidyi* is an invertebrate which inhabits the waters of the Baltic Sea), it is very unlikely that *Mnemiopsis leidyi* is a host or vector of pathogens and parasites that are harmful to plants.

A4c | Impact on the domesticated animals domain

Questions from this module qualify the consequences of *the organism* on domesticated animals (e.g. production animals, companion animals). It deals with both the well-being of individual animals and the productivity of animal populations.

a24. The effect of *the species* on individual animal health or animal production, through **predation or parasitism** is:

- inapplicable
- very low
- low
- medium
- high
- very high

aconf20. Answer provided with a

low	medium X	high
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 level of confidence

acomment24. Comments:
In case of the spread of this species in Poland, it is highly probable that as a predator it will reduce the production (stock) of commercially caught fish species, such as Baltic cod *Gadus morhua callarias* or herring *Clupea harrengus* (Jaspers et al. 2011b, Kellnreitner et al. 2013 – P). Due to the consumption of juvenile fish, the effect on the health of an individual animal or on animal production through predation has been identified as high.

a25. The effect of *the species* on individual animal health or animal production, by having properties that are hazardous upon **contact**, is:

- very low
- low
- medium
- high
- very high

aconf21. Answer provided with a

low	medium	high X
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 level of confidence

acomment25. Comments:
Unlike *Cnidaria*, *Ctenophora* do not have cnidocytes and therefore do not pose a risk to animals during direct contact. So far, an influence of *Mnemiopsis leidyi* on the health of an individual animal or on animal production through posing a risk during direct contact has not been reported.

a26. The effect of *the species* on individual animal health or animal production, by hosting **pathogens or parasites** that are harmful to them, is:

- inapplicable
- very low
- low
- medium
- high
- very high

aconf22. Answer provided with a

low	medium X	high
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 level of confidence

acomment26. Comments:
Although *Ctenophora* and jellyfish can carry pathogens harmful to fish (Purcel and Arai, 2001 – P), no pathogens or parasites are known to be common to *Mnemiopsis leidyi* and to fish species commercially caught in the Baltic Sea. The bacillus of glanders *Burkholderia mallei* were found in the body of *Mnemiopsis leidyi* living in the Caspian Sea (Saeedi et al. 2013 – P). This bacterium causes a chronic infectious disease primarily in odd-toed ungulates. Although the disease is included in the list of the World Organisation for Animal Health (OIE), it is very rare in Europe. The source of the infection are sick animals, more specifically, nasal leak, sputum from the lungs, pus from ulcer. Feed and water contaminated with secretions of sick animals may also be an important source of infection (Gliński and Kostro

2012 – P). Taking this information into account, it therefore appears that the infection of a single animal (i.e. a horse) through contact with *Mnemiopsis leidyi*, a zooplankton species found in marine waters, is close to zero. For this reason, although according to the instructions, the presence of a parasite included in the OIE list, shared between species and livestock, gives an indication for the choice of the medium response, using a methodology acceptable to the expert judgement, the influence of *Mnemiopsis leidyi* on the health of an individual animal or animal production through the transmission of harmful pathogens and parasites to these animals has been identified as very low.

A4d | Impact on the human domain

Questions from this module qualify the consequences of *the organism* on humans. It deals with human health, being defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (definition adopted from the World Health Organization).

a27. The effect of *the species* on human health through **parasitism** is:

<input checked="" type="checkbox"/>	inapplicable
<input type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	vert high

aconf23.	Answer provided with a	low	medium	high	level of confidence
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acomm27. Comments:
Mnemiopsis leidyi is not a parasite.

a28. The effect of *the species* on human health, by having properties that are hazardous upon **contact**, is:

<input checked="" type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf24.	Answer provided with a	low	medium	high	level of confidence
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acomm28. Comments:
Unlike *Cnidaria*, *Ctenophora* do not have cnidocytes and therefore do not pose a risk to humans during direct contact. Only contact with *Mnemiopsis leidyi* infected with parasitic larvae of sea anemone *Edwardsiella lineata*, which has been reported in this species on the Swedish coast, can be dangerous (Selander et al. 2010 – P). Touching cnidocytes of this anemone may cause irritation, rash and itching of the skin in humans. Although it is likely that the salinity of the Polish zone of the Baltic Sea would be too low for the development of *Edwardsiella lineata* (Selander et al. 2010 – P), it cannot be excluded that they may occur periodically with individuals of *Mnemiopsis leidyi* transported with sea currents moving from the area of Danish Straits. However, even with the wide spread of this species, the likelihood of direct human contact with *Mnemiopsis leidyi* infected with parasitic larvae appears to be low – less than one case per 100 000 people and the influence on human health is small and does not lead to any permanent damage.

a29. The effect of *the species* on human health, by hosting **pathogens or parasites** that are harmful to humans, is:

<input type="checkbox"/>	inapplicable
<input type="checkbox"/>	very low
<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf25.	Answer provided with a	low	medium X	high	level of confidence
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a29. Comments:
 There is no information on the influence of *Mnemiopsis leidyi* on human health as a result of the transmission of parasites or pathogens. However, it is known that this species may be affected by different bacteria and therefore the potential effects cannot be entirely excluded (Daniels and Breitbart 2012, Saeedi et al. 2013 – P). The following bacteria have been found on the body of individuals living in the Caspian Sea: *Micrococcus* sp., *Staphylococcus* sp., *Vibrio metschinokovii*, *Burkholderia mallei* i *Aeromonas* sp.; and *Micrococcus* sp., *Streptobacillus* sp., *Vibrio metschinokovii*, *Bacillus circulans*, *Bacillus sphericoccus*, *Bacillus coagulans*, *Micrococcus kristinae*, Enterobacteriaceae, *Vibrio* sp., *Cytophaga* sp. on its surface (Saeedi et al. 2013 – P). The same author, referring to Austin (1989), states that all bacteria isolated from *Ctenophora* are considered to be a part of natural marine flora. None of these bacteria is included in the list of the European and Mediterranean Plant Protection Organisation (EPPO), while the list of the most serious diseases published by the World Organisation for Animal Health (OIE) includes only the bacillus of glanders *Burkholderia mallei*, which is a bacterium that causes a chronic infectious disease primarily in odd-toed ungulates. This disease is transmissible to humans. However, the disease is very rare in Europe. The source of the infection are sick animals or feed and water contaminated with nasal leak, sputum from the lungs, pus from ulcer (Gliński and Kostro 2012 – P). Two very rare cases of diseases caused by *Vibrio metschinokovii* in elderly people were described in the scientific literature (Hansen 1993 – P). An exceptionally high number of human wound infections with *Vibrio* bacteria during recreational activities at the Baltic Sea were detected during very hot summers of 1994, 2003 and 2006 (Baker-Austin et al., 2013 – P), i.e. before the introduction of *Mnemiopsis leidyi*. Based on the above, and considering that in the event of the spread of *Mnemiopsis leidyi* in Poland, due to low salinity, the abundance of this species will be several dozen times lower than in the high seas salinity, it appears that the impact on human health as a result of the transmission of pathogens and parasites harmful to humans will be medium.

A4e | Impact on other domains

Questions from this module qualify the consequences of *the species* on targets not considered in modules A4a-d.

a30. The effect of *the species* on causing damage to **infrastructure** is:

<input checked="" type="checkbox"/>	very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf26.	Answer provided with a	low	medium	high X	level of confidence
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a30. Comments:
 There are no reports of any negative influence of *Mnemiopsis leidyi* on the infrastructure.

A5a | Impact on ecosystem services

Questions from this module qualify the consequences of *the organism* on ecosystem services. Ecosystem services are classified according to the Common International Classification of Ecosystem Services, which also includes many examples (CICES Version 4.3). Note that the answers to these questions are not used in the calculation of the overall risk score (which deals with ecosystems in a different way), but can be considered when decisions are made about management of *the species*.

a31. The effect of *the species* on **provisioning services** is:

<input type="checkbox"/>	significantly negative
<input checked="" type="checkbox"/>	moderately negative
<input type="checkbox"/>	neutral
<input type="checkbox"/>	moderately positive
<input type="checkbox"/>	significantly positive

aconf27.	Answer provided with a	low	medium	high X	level of confidence
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acomm31.	Comments:
	In the case of spread of <i>Mnemiopsis leidyi</i> in Poland there is a possibility that it will have moderately negative influence on catering services. The species can have negative impact on stock of commercially caught fish species, primarily Baltic cod <i>Gadus morhua callarias</i> or herring <i>Clupea harrengus</i> (Purcell et al. 2001, Jaspers et al. 2011b, Kellnreitner et al. 2013 – P). Although the studies have shown that the species can feed on eggs and larvae of those fish, the studies are not conclusive (Haslob et al. 2007, Jaspers et al. 2011b – P). However, such negative effects occur only in regions where <i>Mnemiopsis leidyi</i> is present in large numbers. However, taking low salinity of the Polish Maritime Areas into account, the fertility of <i>Mnemiopsis leidyi</i> is several dozen times lower than in the high seas salinity (Jaspers et al. 2011a – P), so in case of establishment and spread of the species, its population would be small as a consequence, its effect on supply services would be minor.

a32. The effect of *the species* on **regulation and maintenance services** is:

<input type="checkbox"/>	significantly negative
<input type="checkbox"/>	moderately negative
<input checked="" type="checkbox"/>	neutral
<input type="checkbox"/>	moderately positive
<input type="checkbox"/>	significantly positive

aconf28.	Answer provided with a	low	medium	high X	level of confidence
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acomm32.	Comments:
	In the case of spread of <i>Mnemiopsis leidyi</i> in Poland it is very likely that it will have no influence on catering services. Through excessive zooplankton consumption, the species may cause disturbances of biotic factors, such as water turbidity or concentration of biogenic compounds overused by growing phytoplankton (CABI 2017 – B). However, such changes occur only in regions where <i>Mnemiopsis leidyi</i> is present in large numbers. It should also be considered that in low salinity, as of Polish Maritime Areas, the fertility of <i>Mnemiopsis leidyi</i> is several dozen times lower in low salinity than in high seas salinity (Jaspers et al. 2011a – P), if the species were to be established and spread, its population would be small and therefore unlikely to change the environmental parameters.
	In this regard, the influence of this species on regulatory services is defined as neutral.

a33. The effect of *the species* on **cultural services** is:

<input type="checkbox"/>	significantly negative
<input type="checkbox"/>	moderately negative

- neutral
- moderately positive
- significantly positive

aconf29. Answer provided with a

low	medium	high X
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 level of confidence

acomm33. Comments:
In the case of spread of *Mnemiopsis leidyi* in Poland it is likely that it will have no influence on cultural services. Although such impact has not been identified so far, it seems that when this species occurs in large numbers in coastal waters, it may reduce their recreational value. On the other hand, taking low salinity of the Polish Maritime Areas into account, the fertility of *Mnemiopsis leidyi* is several dozen times lower than in the high seas salinity, which can have a negative influence on the population size of this species in case of establishment (Jaspers et al. 2011a – P).

A5b | Effect of climate change on the risk assessment of the negative impact of the species

Below, each of the Harmonia^{+PL} modules is revisited under the premise of the future climate. The proposed time horizon is the mid-21st century. We suggest taking into account the reports of the Intergovernmental Panel on Climate Change. Specifically, the expected changes in atmospheric variables listed in its 2013 report on the physical science basis may be used for this purpose. The global temperature is expected to rise by 1 to 2°C by 2046-2065.

Note that the answers to these questions are not used in the calculation of the overall risk score, but can be but can be considered when decisions are made about management of *the species*.

a34. INTRODUCTION – Due to climate change, the probability for *the species* to overcome geographical barriers and – if applicable – subsequent barriers of captivity or cultivation in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf30. Answer provided with a

low	medium	high X
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 level of confidence

acomm34. Comments:
There is no reason to believe that as a result of climate change, the likelihood of introducing the species into Poland will change. The predicted temperature change (1 to 2°C) will not improve the habitat conditions for *Mnemiopsis leidyi* in Poland. They will remain unfavorable for the development of the population.

a35. ESTABLISHMENT – Due to climate change, the probability for *the species* to overcome barriers that have prevented its survival and reproduction in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf31. Answer provided with a

low	medium	high X
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 level of confidence

acomm35.

Comments:

Mnemiopsis leidyi has been appearing periodically in Poland for 10 years, although so far it has not established a population due to moderately favorable climatic conditions (too low temperatures in winter) as well as unfavorable habitat conditions related mainly to too low salinity of water (about 7 psu). Although tolerance to low salinity may increase with temperature, from the point of view of species physiology it is unlikely that this will happen within the assumed limits of change. Therefore, it seems that the expected climate changes will not contribute to the establishment of *Mnemiopsis leidyi* in Poland.

a36. SPREAD – Due to climate change, the probability for *the species* to overcome barriers that have prevented its spread in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf32.

Answer provided with a

low	medium	high
		X

level of confidence

acomm36.

Comments:

It is unlikely that a temperature increase in the forecasted period would contribute to the spread of *Mnemiopsis leidyi* in Poland if it is not established. On the other hand, it should be kept in mind that climate change is expected to reduce the salinity of the Baltic Sea waters, which is currently too low for the species to establish in the Polish Maritime Areas. Climate change will also affect hydrological parameters, such as sea currents, waves and water density, which in turn may also disrupt the spontaneous spread of planktonic larvae and adult *Mnemiopsis leidyi*.

a37. IMPACT ON THE ENVIRONMENTAL DOMAIN – Due to climate change, the consequences of *the species* on wild animals and plants, habitats and ecosystems in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf33.

Answer provided with a

low	medium	high
		X

level of confidence

acomm37.

Comments:

If, as a result of climate change, the population status of *Mnemiopsis leidyi* in Poland does not change, i.e. reproduction will not be possible, the number and spread of this species will remain relatively stable and therefore it is unlikely that the impact on the natural environment will remain unchanged.

a38. IMPACT ON THE CULTIVATED PLANTS DOMAIN – Due to climate change, the consequences of *the species* on cultivated plants and plant domain in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf34.

Answer provided with a

low	medium	high
		X

level of confidence

acomm38.

Comments:

Mnemiopsis leidyi has no influence on the condition or yielding of cultivated plants and global warming will not change that.

a39. IMPACT ON THE DOMESTICATED ANIMALS DOMAIN – Due to climate change, the consequences of *the species* on domesticated animals and animal production in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf35.

Answer provided with a

low	medium	high X	level of confidence
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acomm39.

Comments:

If, as a result of climate change, the population status of *Mnemiopsis leidyi* in Poland does not change, i.e. reproduction will not be possible, the number and spread of this species will remain relatively stable and therefore it is unlikely that the impact on the stock (production) of commercially caught fish species is unlikely to increase or decrease. The impact of *M. leidyi* on this sector through the transmission of pathogens and parasites is also likely to remain unchanged. There are no known pathogens or parasites common to *Mnemiopsis leidyi* and fish species commercially caught in the Baltic Sea.

a40. IMPACT ON THE HUMAN DOMAIN – Due to climate change, the consequences of *the species* on human in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf36.

Answer provided with a

low	medium	high X	level of confidence
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acomm40.

Comments:

If, as a result of climate change, the population status of *Mnemiopsis leidyi* in Poland does not change, i.e. reproduction will not be possible, the number and spread of this species will remain relatively stable and therefore it is unlikely that the influence on the human species would be altered.

a41. IMPACT ON OTHER DOMAINS – Due to climate change, the consequences of *the species* on other domains in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf37.

Answer provided with a

low	medium	high X	level of confidence
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acomm41.

Comments:

There are no reports of any negative influence of this species on the infrastructure and global warming and is not expected to contribute to this change.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.67	1.00
Establishment (questions: a09-a10)	0.25	1.00
Spread (questions: a11-a12)	0.75	0.75
Environmental impact (questions: a13-a18)	0.33	0.58
Cultivated plants impact (questions: a19-a23)	0.00	1.00
Domesticated animals impact (questions: a24-a26)	0.33	0.67
Human impact (questions: a27-a29)	0.25	0.50
Other impact (questions: a30)	0.00	1.00
Invasion (questions: a06-a12)	0.56	0.92
Impact (questions: a13-a30)	0.33	0.75
Overall risk score	0.19	
Category of invasiveness	potentially invasive alien species	

A6 | Comments

This assessment is based on information available at the time of its completion. It has to be taken into account, however, that biological invasions are, by definition, very dynamic and unpredictable. This unpredictability includes assessing the consequences of introductions of new alien species and detecting their negative impact. As a result, the assessment of the species may change in time. For this reason it is recommended that it is regularly repeated.

acom42.

Comments:

Mnemiopsis leidyi has been identified by the International Union for Conservation of Nature as one of the 100 most invasive species in the world because of the threat it poses to biodiversity and associated ecosystem services. Through predation and competition for food it affects the populations of many species that form zooplankton and fish fauna. As a consequence, it leads to a disturbance in the trophic web functioning, i.e. an increase in primary production and a reduction in the populations of many fish species that feed consumers of higher trophic levels, including humans. The reduction in commercial fish stocks leads to economic losses in fishery. However, the negative influence of *Mnemiopsis leidyi* is observed only in ecosystems where favorable habitat conditions for the development of the population of this species exist. In Poland, such conditions are not present, as the species has not formed a population since it first appeared in 2007. In the following years, only its periodic appearance was observed in the Pomeranian Bay and in the Słupsk Furrow, where it probably spread spontaneously from the western Baltic Sea. The development of *Mnemiopsis leidyi* in Poland is probably hampered by long periods of cold in winter combined with low salinity of water. It should be noted, however, that even if a population was established, it would be of low quantity, as the survival and fertility of this species is significantly reduced in low salinity compared with that of the high seas. Therefore, the threat that *Mnemiopsis leidyi* could pose to biodiversity and related ecosystem services in Poland seems to be small. The example of this species shows that a foreign species can be invasive in one ecosystem and not in the other. Invasiveness is determined by many factors occurring at the local level. Therefore, information on the negative influence of a species from other ecosystems should not be transferred without a thorough analysis of its biology and ecology in relation to the biotic and abiotic factors of the new environment.

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