Report of the WOAH *ad hoc* Group on susceptibility of mollusc species to infection with WOAH listed diseases

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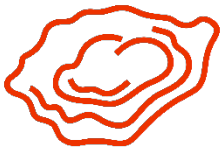

Table of Content

List of Annexes

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1. Introduction

This report covers the work of the WOAH *ad hoc* Group on Susceptibility of mollusc species to infection with WOAH listed diseases (the *ad hoc* Group) who met physically in Paris on 29 November-1 December, 2022.

The list of participants and the Terms of Reference are presented in Annex I and Annex II, respectively.

Dr Montserrat Arroyo, the WOAH Deputy Director General, International Standards and Science, welcomed members of the *ad hoc* Group and thanked them for their ongoing contributions to the work of WOAH. Dr Arroyo commended the *ad hoc* Group for its work in assessing the previous four pathogens (*Bonamia ostreae*, *Bonamia exitiosa*, abalone herpesvirus, and *Marteilia refringens*) and extended her appreciation to the members' employing institutions and national governments.

2. Methodology

The *ad hoc* Group applied the criteria outlined in Chapter 1.5. Criteria for listing species as susceptible to infection with a specific pathogen of the WOAH *Aquatic Animal Health Code* (the *Aquatic Code*), to potential host species to determine susceptibility to infection with *Perkinsus marinus*. The assessments were conducted using a three-stage approach. Details of the three-stage approach, including additional considerations are described below:

2.1. Stage 1: Criteria to determine whether the route of transmission is consistent with natural pathways for the infection (as described in Article 1.5.4.):

Table 1 describes the route of transmission for infection with *P. marinus* used by the *ad hoc* Group when applying Stage 1 to assess susceptibility to infection with *P. marinus.*

Table 1: Route of transmission for infection with *P. marinus*

Route of transmission	Considerations
1. Natural exposure included situations where infection had occurred without experimental intervention (e.g., infection in wild or farmed populations) **OR** 2. Non-invasive experimental procedures[1]: cohabitation with infected hosts or faeces of infected hosts; infection by immersion or feeding, under conditions that mimic natural conditions for the host.	*In vitro* experimental assays (contact between haemocytes and parasites) are not considered appropriate to answer the question of susceptibility or non-susceptibility. Mantle cavity inoculations carried out in Dungan *et al*., 2007 and Chan *et al*., 2021 were considered to be experimentally invasive and did not mimic natural pathways for infection because of the high infectious dose.

[1] Invasive experimental procedures including injection can only be used to demonstrate non-susceptibility.

2.2. Stage 2: Criteria to determine whether the pathogenic agent has been adequately identified (as described in Article 1.5.5.):

Table 2 describes the methods and some considerations used by the *ad hoc* Group for confirming the adequate identification of the pathogenic agent.

Table 2: Pathogen Identification for infection with *P. marinus*

Pathogen Identification (*P. marinus*)	Considerations
1. Molecular sequence of the ITS amplicons obtained through Casas *et al*., 2002. **OR** 2. PCR targeting NTS plus sequencing demonstrating high sequence similarity to *P. marinus* (Marsh *et al*., 1995). **OR** 3. Species-specific real-time (e.g., Gauthier *et al*., 2006) or conventional PCR (e.g., Audemard *et al*., 2004) targeting the ITS. **OR** 4. Microscopic evidence including *in situ* hybridization (e.g., using a DNA probe targeting the LSU of the rRNA gene, Moss *et al*., 2006).	Comprehensive data set comprised of ITS rRNA gene sequence allows supported discrimination between *P. marinus* and other *Perkinsus* species. Although the PCR targeting the NTS has not been validated, NTS PCR plus sequencing demonstrating high sequence similarity to *P. marinus* sequences would be a positive identification. While SSU and LSU regions have utility for primer and probe design, they are generally not favoured for species identification using sequencing analysis because of the high degree of similarity across *Perkinsus* species.

The *ad hoc* Group recognised that these methods do not completely align with the pathogen identification methods and case definitions outlined in the *Aquatic Manual*. The *ad hoc* Group noted that the mollusc disease-specific chapters in the *Aquatic Manual* have not been revised with the new template. The *ad hoc* Group anticipates that when the new template is applied that the case definitions would be updated to include the above methods for pathogen identification.

2.3. Stage 3: Criteria to determine whether the evidence indicates that presence of the pathogenic agent constitutes an infection (as described in Article 1.5.6.):

Evidence to support criterion A alone was sufficient to determine infection. In the absence of evidence to meet criterion A, satisfying at least two of criteria B, C or D were required to determine infection.

Table 3 describes the evidence of infection with *P. marinus,* used by the *ad hoc* Group when applying Stage 3 to susceptibility to infection with *P. marinus,* as well as some considerations.

Table 3: Evidence of infection with *P. marinus*

Evidence of infection			
A: Replication	**B: Viability / Infectivity**	**C*: Pathology / Clinical signs**	**D**: Location**
1. Presence of multinucleated cells or, within individual hemocytes, multiple uninucleated cells demonstrated by: a) Histopathology OR b) *In situ* hybridization (ISH) OR c) TEM **OR** 2. Demonstration of high-intensity natural infections by qPCR, histology, RFTM, or ISH. **OR** 3. Demonstration of increasing copy number over time with qPCR (targeting DNA) or reverse transcription qPCR (targeting RNA) in tissues.	1. Transmission via co-habitation to uninfected individuals of a known-susceptible species. **OR** 2. Successful infection of uninfected susceptible animals by inoculation with infective material from the host in question. **OR** 3. Demonstration of viability through development of cells isolated or cultivated from tissues (e.g. RFTM). **OR** 4. Flow cytometry with markers. **OR** 5. Vital stains.	1. Mortality[2] **OR** 2. Chronic wasting **OR** 3. Microscopic lesions such as generalized haemocyte infiltration to destruction or disruption of digestive epithelium or connective tissues of organs which may include gills and/or mantle.	1. With microscopic techniques, the parasite can be observed within hemocytes or extracellularly: Either: a) within haemalspace of connective tissues associated with any organ AND/OR b) digestive epithelia **OR** 2. Without microscopic techniques, if in external tissue(s) (i.e. gills, mantle, rectum), this needs to be accompanied by a high intensity infection or positive molecular result from internal tissue(s).

[2] It is sometimes difficult to correlate the presence of the pathogen with mortality. In this case, mortality alone was not sufficient when other pathogens or environmental factors were documented.

* Pathology/Clinical signs may be non-specific, variable and include some or all of the characteristics listed.

** As demonstrated by histology or *in-situ* hybridisation (ISH) or sufficiently high infection intensity by qPCR or RFTM.

3. Results

The *ad hoc* Group agreed that only two of the six species currently included in Article 11.5.2. as susceptible to infection with *P. marinus*, American cupped oyster (*Crassostrea virginica*) and Ariake cupped oyster (*Magallana* [Syn. *Crassostrea*] *ariakensis*), met the criteria for listing as susceptible to infection with *Perkinsus marinus* in accordance with Chapter 1.5. of the *Aquatic Code* and were proposed to remain in Article 11.5.2. Four species, Baltic clam (*Macoma balthica*), northern quahog (*Mercenaria mercenaria*), Pacific cupped oyster (*Magallana* [Syn. *Crassostrea*] *gigas*), and soft shell clam (*Mya arenaria*), did not meet the criteria for listing as a susceptible species and were proposed to be deleted from Article 11.5.2.

Two additional species were found to meet the criteria for listing as susceptible species to infection with *P. marinus*, Cortez oyster (*Crassostrea corteziensis*), and palmate oyster (*Saccostrea palmula*) were proposed to be included in Article 11.5.2.

Three species, Gasar cupped oyster (*Crassostrea tulipa*), mangrove cupped oyster (*Crassostrea rhizophorae*), and Pacific cupped oyster (*Magallana* [Syn. *Crassostrea*] *gigas*) were assessed as having incomplete evidence of susceptibility and were proposed to be included in Section 2.2.2. of Chapter 2.4.5., Infection with *Perkinsus marinus* of the *Aquatic Manual*.

Pathogen-specific positive PCR results had been reported in the following three species, Columbia black oyster (*Crassostrea columbiensis*), soft shell clam (*Mya arenaria*), and stone oyster (*Striostrea prismatica*), but an active infection had not been demonstrated. These species were proposed to be included in the second paragraph of Section 2.2.2. of Chapter 2.4.5., Infection with *Perkinsus marinus*, of the *Aquatic Manual*.

4. Assessments

Species were determined to be susceptible based on the combination of assessment outcomes as outlined in Article 1.5.7.

Table 4 describes the different scores and outcomes of the assessments undertaken by the *ad hoc* Group.

Table 4: Scores and Outcome of assessments

Score	Outcome
1	Species assessed as susceptible (as described in Article 1.5.7.). These species were proposed for inclusion in Article 11.5.2. of Chapter 11.5., Infection with *Perkinsus marinus*, of the *Aquatic Code* and Section 2.2.1. of Chapter 2.4.5., Infection with *Perkinsus marinus*, of the *Aquatic Manual.*
2	Species assessed as having incomplete evidence for susceptibility (as described in Article 1.5.8.) were proposed for inclusion in Section 2.2.2., Species with incomplete evidence for susceptibility of Chapter 2.4.5., Infection with *Perkinsus marinus*, of the *Aquatic Manual*.
3	Species assessed as not meeting the criteria or for which there was unresolved or conflicting information. These species were not proposed for inclusion in either the *Aquatic Code* or the *Aquatic Manual*. The exceptions were species where pathogen-specific positive PCR results had been reported but an active infection had not been demonstrated. These species were proposed for inclusion in the second paragraph in Section 2.2.2. Species with incomplete evidence for susceptibility of Chapter 2.4.5. Infection with *Perkinsus marinus*, of the *Aquatic Manual*.
4	Species assessed as non-susceptible.
NS	Species not scored due to insufficient or irrelevant information.

Table 5 summarises the assessments for host susceptibility to infection with *Perkinsus marinus* together with the outcomes and relevant references.

Table 5: Assessments for infection with *P. marinus*

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen identification	Stage 3: Evidence for infection				Outcome	References
					A	B	C	D		
Score 1										
Ostreidae	*Crassostrea corteziensis*	Cortez oyster	N and E	ITS PCR and sequence analysis	YES	YES	ND	YES	1	Escobedo-Fregoso *et al.*, 2017
			N	NTS PCR and sequence analysis	YES	YES	YES	YES	1	Cáceres-Martínez *et al.*, 2010
			N	NTS PCR and sequence analysis	YES	YES	YES	YES	1	Cáceres-Martínez *et al.*, 2008
	Crassostrea virginica	American cupped oyster	N	ISH[3]	YES	ND	YES	YES	1	Carnegie *et al.*, 2021
			N	ITS PCR	YES	YES	ND	YES	1	Audemard *et al.*, 2008
			N	ITS PCR and sequence analysis	YES	YES	YES	YES	1	Reece *et al.*, 2008
			N	ITS PCR and sequence analysis	NO	YES	ND	YES	1	Abollo *et al.*, 2006
	Magallana [Syn. *Crassostrea*] *ariakensis*	Ariake cupped oyster	N	ITS PCR and ISH	YES	YES	YES	YES	1	Moss *et al.*, 2006
			N	NO (RFTM and histology)	ND	YES	NO	NO	NS	Calvo *et al.*, 2001
	Saccostrea palmula	palmate oyster	N	NTS PCR and sequence analysis, FISH, and RFTM	YES	YES	YES	YES	1	Cáceres-Martínez *et al.*, 2012
Score 2										
Ostreidae	*Crassostrea rhizophorae*	mangrove cupped oyster	N	ITS PCR and sequence analysis	YES	YES	ND	YES	1	da Silva *et al.*, 2013
			N	ITS PCR and sequence analysis	ND	ND	ND	NO	3	Lohan *et al.*, 2018
			N	NO (ITS PCR at genus level, RFTM, and histology)	YES	YES	YES	YES	NS	Brandão *et al.*, 2013
	Crassostrea tulipa	Gasar cupped oyster	N	ITS PCR and phylogenetic analysis and FISH	YES	I[4]	I[4]	YES	1	da Silva *et al.*, 2014
			N	ITS PCR and sequence analysis	I[5]	I[5]	I[5]	I[5]	3	Luz Cunha *et al.*, 2019
			N	NO (ITS PCR at genus level)	ND	ND	ND	NO	NS	da Silva *et al.*, 2016
	Magallana [Syn. *Crassostrea*] *gigas*	Pacific cupped oyster	N	ITS PCR and sequence analysis	ND	YES	NO	NO	2	Enríquez-Espinoza *et al.*, 2015
			N	ITS PCR and sequence analysis	ND	ND	NO	NO	3	Leibowitz *et al.*, 2018

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen identification	Stage 3: Evidence for infection				Outcome	References
					A	B	C	D		
			N	ITS PCR and sequence analysis	NO	ND	ND	NO	3	Luz Cunha *et al.*, 2019
			EI	NO (RFTM)	ND	ND	NO	NO	NS	Chan *et al.*, 2021
			N	NO (RFTM and histology)	YES	YES	ND	YES	NS	Calvo *et al.*, 1999
			N	NO (presumed based on infective material)	NO	ND	ND	ND	NS	Meyers *et al.*, 1991
Score 3										
Myidae	*Mya arenaria*	Soft shell clam	N	ITS PCR and sequence analysis	ND	I[6]	NO	YES	3	Reece *et al.*, 2008
			EI	*P. marinus* isolates from bank	YES	YES	YES	YES	NS	Dungan *et al.*, 2007
Ostreidae	*Crassostrea columbiensis*	Columbia black oyster	N	ITS PCR and sequence analysis	ND	ND	ND	NO	3	Lohan *et al.*, 2018
	Striostrea prismatica	stone oyster	N	ITS PCR and sequence analysis	ND	ND	ND	NO	3	Lohan *et al.*, 2018
Not scored (NS) because pathogen ID was inconclusive										
Anomiidae	*Pododesmus rudis*	Atlantic falsejingle	N	NO (RFTM and FISH)	ND	ND	ND	ND	NS	Vázquez *et al.*, 2018
Isognomonidae	*Isognomon alatus*	flat tree-oyster	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
	Isognomon bicolor	bicolor purse-oyster	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
Mytilidae	*Brachidontes exustus*	scorched mussel	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
	Geukensia demissa	Atlantic ribbed mussel	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
	Ischadium recurvum	hooked mussel	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
Ostreidae	*Ostrea puelchana*	Argentinian flat oyster	N	NO (RFTM and FISH)	ND	ND	ND	ND	NS	Vázquez *et al.*, 2018
	Ostrea stentina	dwarf oyster	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
Pinnidae	*Atrina maura*	Maura pen shell	N	NO (RFTM, PCR at genus level)	ND	YES	ND	NO	NS	Góngora-Gómez *et al.*, 2016
	Atrina rigida	stiff pen shell	N	NO (NTS PCR)	ND	ND	ND	NO	NS	Laramore *et al.*, 2017
Tellinidae	*Macoma balthica*	Baltic clam	N	NO[7]	N/A	N/A	N/A	N/A	NS	Reece *et al.*, 2008
			EI	*P. marinus* isolates from bank	YES	YES	YES	YES	NS	Dungan *et al.*, 2007

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen identification	Stage 3: Evidence for infection				Outcome	References
					A	B	C	D		
Veneridae	*Chionista fluctifraga*	smooth venus	N	NO (RFTM)	ND	ND	NO	ND	NS	Enríquez-Espinoza *et al*., 2015
	Mercenaria mercenaria	northern quahog	N	NO (RFTM)	ND	I[8]	ND	ND	NS	Reece *et al*., 2008
			N	NO (NTS PCR)	NO	YES	NO	NO	NS	McCoy *et al*., 2007
	Meretrix meretrix	Asiatic hard clam	N	NO (TEM)	YES	ND	YES	YES	NS	Abdel-Baki *et al*., 2014
	Ruditapes philippinarum	Japanese carpet clam	N	NO (ISH at genus level)	YES	ND	YES	YES	NS	Elston *et al*., 2004

[3] PCR and sequence analysis was completed, but not included in the study (per Carnegie personal communication during the *ad hoc* Group meeting).

[4] The animals in this study were co-infected with *P. olseni,* therefore, assessments for stage 3B and 3C were inconclusive as one cannot differentiate between *P. marinus* and *P. olseni*.

[5] The animals in this study were co-infected with *P. beihaiensis,* therefore, assessments for stage 3 were inconclusive as one cannot differentiate between *P. marinus* and *P. beihaiensis*.

[6] For assessment of stage 3B (viability), the study used RFTM and therefore cannot eliminate the possible presence of *P. chesapeaki.*

[7] Of the 39 animals tested for *P. marinus*, none were found to be positive for the parasite.

[8] The one out of 60 animals in this study that tested positive by RFTM had only two *Perkinsus* hypnospore cells, indicating viable cells present at extremely low intensity. In addition, the RFTM positive result could not be confirmed by either *Perkinsus* genus-specific PCR or species-specific PCR assay.

Assessment Table Key

N: Natural infection
E: Experimental (non-invasive)
EI: Experimental invasive
YES: Demonstrates criterion is met
NO: Criterion is not met
I: Inconclusive
ND: Not determined
NS: Not scored
N/A: Not applicable

5. Naming convention for susceptible species

The scientific names of the host species are in accordance with the World Register of Marine Species (WoRMS) https://www.marinespecies.org/index.php.

The common names of mollusc species are in accordance with FAOTERM (http://www.fao.org/faoterm/collection/faoterm/en/). Where the common mollusc name was not found in FAOTERM, the naming was done in accordance with https://www.sealifebase.ca.

6. Comments on the *ad hoc* Group's rationale and decision-making

'Inconclusive' was used to distinguish situations where more information was provided than would have been assessed as 'Non-determined' but the *ad hoc* Group could not conclude that the criterion was met. Each time inconclusive was used within the assessment table, the *ad hoc* Group provided additional information in a footnote. The *ad hoc* Group treated 'Inconclusive' as 'Non-Determined' when making their final assessment.

6.1. General comments

The *ad hoc* Group agreed to focus on studies published from 2000 onwards, when molecular testing was available. Papers published in earlier years were referred to when necessary to increase confidence of an assessment or when no recent paper was available for the assessment of a specific host species. When necessary to corroborate pathogen identification, the *ad hoc* Group contacted authors of the studies to further describe pathogen identification methods.

The *ad hoc* Group agreed that while the ideal situation was two papers with a score of '1', a single robust study scoring '1' was also enough to conclude susceptibility of a species in the absence of conflicting evidence. Where sampling strategy was distributed across seasons or locations, and/or where a single paper provided all evidence (molecular with corresponding evidence from histology within the same animals) the *ad hoc* Group considered that one strong paper was sufficient to conclude susceptibility of a species. Additional studies were still reviewed to check for any supporting or conflicting evidence. When additional papers were identified but the *ad hoc* Group did not feel that they were necessary to assess comprehensively because the species had already been determined as susceptible by other studies, these studies were retained in the list of references only.

The *ad hoc* Group indicated that for some of the studies there was a lack of unambiguous host species identification, particularly in tropical locations where several closely related species may be present. The *ad hoc* Group accepted that the host species were as identified in the study regardless of whether the author stated that host species identification was undertaken. The *ad hoc* Group recommended that in the future authors should include host identification methods in their studies to ensure that susceptibility assessment retains high confidence.

6.2. Species-specific comments

Magallana* [Syn. *Crassostrea*] *ariakensis: There was one strong paper (Moss *et al*., 2006) assessed as a '1' which met all criteria for susceptibility to *P. marinus*. Although pathogen identification was not done using molecular approach, the information provided in Calvo *et al.*, 2001 provides a second temporal sampling event from the same location, therefore, provides ancillary evidence for the Moss *et al*., 2006 study.

Crassostrea rhizophorae: One paper scored '1' and one scored as a '3'. For the other studies scored 'NS', it cannot be determined that the pathogens identified are actually *P. marinus*. Neither the da Silva *et al*., 2013 (score '1') or Lohan *et al*., 2018 (score '3') studies included histology; therefore, the *ad hoc* Group assessed *Crassostrea rhizophorae* as an overall score of '2'. If any additional evidence becomes available in the future, this assessment should be reviewed.

Crassostrea tulipa: One paper scored '1' and one scored as a '3'. For the other studies scored 'NS', it cannot be determined whether the pathogens identified were actually *P. marinus*. Additionally, in the da Silva *et al*., 2014 study scored as a '1', FISH was only performed on one individual, sequences were only completed for four oysters and as there was a co-infection with *Perkinsus olseni* in this study, the criteria for stage 3 were difficult to assess. The *ad hoc* Group assessed *Crassostrea tulipa* as an overall score of '2' given that the single study scored as a '1' had a co-infection with *P. olseni*, few studied animals and uncertainty of host species identification.

Magallana* [Syn. *Crassostrea*] *gigas: The *ad hoc* Group decided to include the six papers available for this species in order to show the complexity associated with the assessment of this species. Based on these studies, the *ad hoc* Group assessed *Magallana* (Syn. *Crassostrea*) *gigas* as a '2'. If any additional evidence becomes available in the future this assessment should be reviewed.

***Mya arenaria*:** One paper (Dungan *et al*., 2007) was not scored due to the experimental conditions used in the study which do not mimic natural infection (the mantle cavity inoculate contained very high concentration of pathogen). The other paper available was scored as a '3' as only one clam in the study was positive for *P. marinus* out of 475 and there was inconclusive evidence of infection (Reece *et al*., 2008). As a result, the *ad hoc* Group assessed *Mya arenaria* as a '3'.

***Macoma balthica*:** One of the papers (Dungan *et al*., 2007) assessed was not scored because the experimental invasive conditions used in the study do not mimic natural infection (the mantle cavity inoculate contained very high concentration of pathogen). The second paper (Reece *et al*., 2008) did not show any infection (0/39) in the animals collected from the endemic zone. As a result, the *ad hoc* Group assessed *Macoma balthica* as a 'NS".

7. Article 1.5.9 Listing of Susceptible species at a taxonomic ranking of Genus or Higher

The *ad hoc* Group considered Article 1.5.9, Listing of susceptible species at a taxonomic ranking of Genus or higher in the *Aquatic Code,* and determined that it was not applicable for the susceptible host species for *P. marinus* identified at this time.

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…/Annexes

Annex I. List of Participants

MEETING OF THE WOAH *AD HOC* GROUP ON SUSCEPTIBILITY OF MOLLUSC SPECIES TO WOAH LISTED DISEASES

29 November to 1 December 2022

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MEMBERS OF THE *AD HOC* GROUP

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WOAH *AD HOC* GROUP ON SUSCEPTIBILITY OF MOLLUSC SPECIES TO INFECTION WITH WOAH LISTED DISEASES

29 November to 1 December 2022

Terms of reference

Background

Chapter 1.5. Criteria for listing species as susceptible to infection with a specific pathogenic agent, was introduced in the 2014 edition of the *Aquatic Code*. The purpose of this chapter is to provide criteria for determining which host species are listed as susceptible in Article X.X.2. of each disease-specific chapter in the *Aquatic Code.* The criteria are to be applied progressively to each disease-specific chapter in the *Aquatic Code*.

These assessments will be undertaken by *ad hoc* groups and the assessments will be provided to Members for comment prior to any change in the list of susceptible species in Article X.X.2. of the disease-specific chapters in the *Aquatic Code.*

For species where there is some evidence of susceptibility but insufficient evidence to demonstrate susceptibility through the approach described in Article 1.5.3., information will be included in the relevant disease-specific chapter in the *Aquatic Manual*.

Purpose

The *ad hoc* Group on Susceptibility of mollusc species to infection with WOAH listed diseases will undertake assessments for infection with *Perkinsus marinus* in molluscs.

Terms of Reference

1) Review relevant literature documenting susceptibility of species for infection with *Perkinsus marinus* and apply criteria, as outlined in Chapter 1.5. Criteria for listing species as susceptible to infection with a specific pathogen, to potential host species in order to determine susceptibility to infection with *Perkinsus marinus*.

2) Determine susceptible species for infection with *Perkinsus marinus* based on Article 1.5.7.

3) Determine species with incomplete evidence for susceptibility for infection with *Perkinsus marinus* based on Article 1.5.8.

Expected outputs of the *ad hoc* Group

1) Propose a list of susceptible species for inclusion in Article 11.5.2. of Chapter 11.4, Infection with *Perkinsus marinus*, in the *Aquatic Code.*

2) Propose a list of species with incomplete evidence for susceptibility for inclusion in Section 2.2.2. of Chapter 2.4.5. Infection with *Perkinsus marinus* of the *Aquatic Manual.*

3) A report for consideration by the Aquatic Animals Commission at its February 2023 meeting.
