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

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1. Introduction

This report covers the work of the WOAH *ad hoc* Group on Susceptibility of Crustacean Species to Infection with WOAH Listed Diseases (the *ad hoc* Group) who met in person in Paris, France from 8 to 10 April 2025.

An *ad hoc* Group on Susceptibility of Crustacean Species to Infection with WOAH Listed Diseases previously completed assessments for infection with *Aphanomyces astaci* (crayfish plague) in October 2015. The *ad hoc Group* convened in April to conduct another assessment as there is new scientific evidence on the susceptibility of crustaceans to infection with *A. astaci* to be reviewed.

The list of participants and the Terms of Reference are presented in Annex 1 and Annex 2, respectively.

2. Methodology

The *ad hoc* Group applied criteria, as 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 in order to determine susceptibility to infection with *A. astaci*.

A three-stage approach, as described in Article 1.5.3., was used to assess the susceptibility of a species to infection with *A. astaci* and was based on:

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

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

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.):

A. The pathogenic agent is multiplying in the host, or developing stages of the pathogenic agent are present in or on the host;
B. Viable pathogenic agent is isolated from the proposed susceptible species, or infectivity is demonstrated by way of transmission to naïve individuals;
C. Clinical or pathological changes are associated with the infection;
D. The specific location of the pathogen corresponds with the expected target tissues.

Details of the three-stage approach applied by the *ad hoc* Group for infection with *A. astaci*, including any 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:

Table 1 describes the route of transmission for infection with *A. astaci* used by the *ad hoc* Group when applying Stage 1 to assess susceptibility to infection with *A. astaci*, as well as some considerations.

Table 1: Route of transmission for infection with crayfish plague

Route of transmission	Considerations
Natural exposure included situations where infection had occurred without experimental intervention (e.g. infection in wild or farmed populations) OR Non-invasive experimental procedures such as cohabitation with infected hosts or infection by immersion or *per os.*	Experimental infection via invasive routes (i.e. injection) was not considered a natural route of transmission and therefore such studies were not evaluated.

2.2. Stage 2: Criteria to determine whether the pathogenic agent has been adequately identified:

Table 2 describes the pathogen identification methods for infection with *A. astaci* used by the *ad hoc* Group when applying Stage 2 to assess susceptibility to infection with *A. astaci*, as well as some considerations.

Table 2: Pathogen identification for infection with *A. astaci*

Pathogen Identification (*A. astaci*)	Considerations
Real-time PCR followed by sequence analysis (e.g. Vralstad *et al.,* 2009; Strand *et al.*, 2023) OR Conventional PCR followed by sequence analysis (e.g. Oidtmann *et al.*, 2006)	Due to the repeated discovery of new *Aphanomyces* strains, sequencing of amplicons from real-time PCR assay is required to confirm identity of fungal strain.

2.3. Stage 3: Criteria to determine whether the evidence indicates that presence of the pathogenic agent constitutes an infection:

Table 3 describes the evidence of infection used by the *ad hoc* Group when applying Stage 3 to assess susceptibility to infection with *A. astaci*.

Table 3: Evidence of infection with *A. astaci*

Evidence of infection			
A: Replication	**B: Viability / Infectivity**	**C: Pathology / Clinical signs**	**D: Location**
1. Presence of *A. astaci* developing hyphae with/without sporulation in the cuticle and/or underlying tissues; OR 2. Transmission from suspect individual to uninfected individual of the same species[1], AND Demonstration of increased copy number over time with qPCR for an experimental infection with confirmed *A. astaci*.	1. *A. astaci* can be cultured in artificial media from suspect cases and identified using PCR followed by sequencing; OR 2. Single passage bioassay in uninfected[2] animals of any susceptible host species and confirmation of pathogen identification[3].	1. Presence of fungal hyphae 7 to 9 µm wide in the cuticle and underlying tissues associated with haemocytic infiltration with/without melanisation. OR 2. Gross pathology such as localised whitening of the muscle under the infected cuticle. OR 3. Sudden mass mortality, and/or clinical signs such as appearance during daylight, loss of escape reflex and loss of coordination.	The tissue that becomes initially infected is the exoskeleton cuticle. Soft cuticle, as is found on the ventral abdomen and around joints, is preferentially affected; however, *A. astaci* will eventually spread throughout connective tissue and haemal sinuses.

Note: The detection of *A. astaci* encoded mRNA by reverse transcriptase-PCR with increased copy number over time in an infected host is a method that could be considered for stage 3A when validated methods are available.

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[1] To demonstrate replication by this approach requires evidence for transmission in confirmed pathogen-free hosts of the same species as being assessed.

[2] An uninfected animal must have tested negative prior to the commencement of experimental conditions.

[3] To demonstrate viability or infectivity of the target pathogen within the host being assessed, single passage in any known susceptible SPF host is required.

3. Scoring and assessments

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

Table 4: Scores

Score	Outcome
1	Species assessed as susceptible (as described in Article 1.5.7.). These species were proposed for inclusion in Article 9.2.2. of Chapter 9.2. 'Infection with *Aphanomyces astaci* (crayfish plague)' of the *Aquatic Code* and Section 2.2.1. of Chapter 2.2.8. 'Infection with *Aphanomyces astaci* (crayfish plague)' 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 2.2.2. 'Infection with *Aphanomyces astaci* (crayfish plague)' 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 have been reported but an active infection has 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 2.2.2. 'Infection with *Aphanomyces astaci* (crayfish plague)' of the *Aquatic Manual*.
4	Species assessed as non-susceptible.
NS	Species not scored due to insufficient or irrelevant information.

Table 5 summarises all of the assessments for host susceptibility to infection with crayfish plague undertaken by the *ad hoc* Group together with the outcomes and relevant references. For Stage 3, as described in Chapter 1.5. of the *Aquatic Code*, 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 evidence of infection.

Assessment Table Key:

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

Table 5: Assessments for infection with *A. astaci*

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
Score 1										
Astacidae	*Astacus astacus*	noble crayfish	N	PCR and sequence analysis [4]	ND	YES	ND	YES	1	Hochwimmer *et al.*, 2009
			N	qPCR and sequence analysis	ND	YES	ND	YES	1	Jussila *et al.*, 2021
			N	PCR and sequence analysis	ND	YES	YES	YES	1	Kozubíková-Balcarová *et al.*, 2013
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Mojžišová *et al.*, 2020
	Austropotamobius pallipes	white claw crayfish	N	PCR and sequence analysis	YES	ND	YES	YES	1	Cammá *et al.*, 2010
			N	PCR and sequence analysis	YES	YES	YES	YES	1	Casabella-Herrero *et al.*, 2023
			N	PCR and sequence analysis	ND	YES	YES	YES	1	Kozubíková-Balcarová *et al.*, 2013
			N	qPCR, PCR and sequence analysis	ND	ND	YES	YES	1	Mirimin *et al.*, 2022
			N	PCR and sequence analysis	YES	YES	YES	YES	1	Rezinciuc *et al.*, 2013
	Pacifastacus leniusculus	signal crayfish	N	PCR and sequence analysis [4]	ND	YES	ND	YES	1	Hochwimmer *et al.*, 2009
			N	PCR and sequence analysis	YES	ND	YES	YES	1	Martín-Torrijos *et al.*, 2019
			N	PCR and sequence analysis	ND	ND	YES	YES	1	Martín-Torrijos *et al.*, 2018

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[4] Primer used for this paper was not listed as a validated method as described in the *Aquatic Manual*, as this was followed by sequencing to confirm pathogen identification Stage 2 was considered met.

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
	Pontastacus leptodactylus	Danube crayfish	N	PCR and sequence analysis	ND	ND	YES	YES	1	Alvanou *et al*., 2024
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Kokko *et al.,* 2018
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Kokko *et al.,* 2012
	Austropotamobius torrentium	stone crayfish	N	qPCR and sequence analysis	ND	ND	NO	YES	2	Kušar *et al*., 2013
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Mojžišová *et al*., 2020
			N	PCR and sequence analysis	YES	YES	YES	YES	1	Jussila *et al*., 2017
Cambaridae	*Faxonius limosus*	spinycheek crayfish	N	PCR and sequence analysis	ND	ND	ND	YES	2	Kozubíková *et al*., 2009
			N	PCR and sequence analysis	ND	YES	YES	YES	1	Kozubíková-Balcarová *et al*., 2013
			N, E	PCR and sequence analysis	YES	YES	YES	YES	1	Kozubíková *et al*., 2011a
	Faxonius obscurus	no common name	N	PCR and sequence analysis	ND	YES	ND	YES	1	Butler *et al*., 2020
	Faxonius rusticus	no common name	N	PCR and sequence analysis	ND	ND	ND	YES	2	Butler *et al*., 2020
			N	qPCR and sequence analysis	YES	YES	YES	YES	1	Panteleit *et al*., 2019
	Procambarus alleni	no common name	N	qPCR and sequence analysis	ND	ND	ND	YES	2	Mojžišová *et al.,* 2024
			N	qPCR and sequence analysis	YES	YES	NO	YES	1	Mrugała *et al*., 2015
	Procambarus clarkii	red swamp crayfish	N	PCR and sequence analysis	YES	ND	YES	YES	1	Aquiloni *et al.,* 2011

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
			N	PCR and sequence analysis	ND	ND	YES	YES	1	Martín-Torrijos *et al.*, 2018
			N	PCR and sequence analysis	YES	YES	YES	YES	1	Martín-Torrijos *et al.*, 2021a
			N	PCR and sequence analysis	YES	ND	YES	YES	1	Martín-Torrijos *et al.*, 2021b
Cambaroididae	*Cambaroides japonicus*	no common name	N	PCR and sequence analysis	YES[5]	ND	YES	YES	1	Martín-Torrijos *et al.*, 2018
Parastacidae	*Cherax quadricarinatus*	red claw crayfish	N	PCR and sequence analysis	YES	ND	YES	YES	1	Hsieh *et al.,* 2016
			N	NO (qPCR only)	ND	ND	NO	YES	NS	Mrugała *et al.*, 2015
Potamidae	*Potamon potamios*	no common name	N	qPCR and sequence analysis	YES	ND	YES	YES	1	Svoboda *et al.,* 2014b
Varunidae	*Eriocheir sinensis*	Chinese mitten crab	N	qPCR and sequence analysis	ND	ND	ND	YES	2	Schrimpf *et al.,* 2014
			N	qPCR and sequence analysis	YES[6]	ND	YES	YES	1	Svoboda *et al.,* 2014b
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Tilmans *et al.,* 2014
Score 2										
Cambaridae	*Cambarus bartonii*	Appalachian brook crayfish	N	qPCR and sequence analysis	ND	ND	ND	YES	2	Petrusek *et al.*, 2025
	Cambarellus (Cambarellus) montezumae	no common name	N	PCR and sequence analysis	ND	ND	NO	YES	2	Martín-Torrijos *et al.*, 2023

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[5] Hyphae identified in photographs included in report.

[6] Hyphae identified in one of six animals examined.

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
	Cambarellus patzcuarensis	no common name	N	qPCR and sequence analysis	ND	ND	NO	YES	2	Mrugała *et al.*, 2015
	Cambarellus shufeldtii	Cajun dwarf crayfish	N	PCR and sequence analysis	ND	YES	ND	ND	2	Martín-Torrijos *et al.*, 2021c[7]
	Faxonius immunis	calico crayfish	N	NO (qPCR only)	ND	ND	ND	YES	NS	Filipová *et al.*, 2013
			N	PCR and sequence analysis	ND	ND	ND	YES	2	Petrusek *et al.*, 2025
	Faxonius propinquus	no common name	N	qPCR and sequence analysis	ND	ND	ND	YES	2	Petrusek *et al.*, 2025
	Faxonius virilis	no common name	N	PCR and sequence analysis	ND	ND	ND	YES	2	Butler *et al.*, 2020
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Petrusek *et al.*, 2025
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Tilmans *et al.*, 2014
	Procambarus enoplosternum	no common name	N	qPCR and sequence analysis	ND	ND	NO	YES	2	Mrugała *et al.*, 2015
	Procambarus fallax	no common name	N	qPCR and sequence analysis	ND	ND	ND	YES	2	Keller *et al.*, 2014
			N	NO (qPCR only)	YES	YES	NO	YES	NS	Mrugała *et al.*, 2015[8]
	Procambarus llamasi	no common name	N	qPCR and sequence analysis	ND	ND	NO	YES	2	Mrugała *et al.*, 2015
			N	qPCR and sequence analysis	ND	ND	ND	YES	2	Panteleit *et al.*, 2017
	Procambarus raneyi	no common name	N	qPCR and sequence analysis	ND	YES	ND	ND	2	Martín-Torrijos *et al.*, 2021c[7]

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[7] In Martín-Torrijos *et al.*, 2021 animals were held individually to moult, moults were then incubated for three days prior to examination. As the tissue was not analysed via PCR immediately following the moult, the AHG considered there to be an opportunity for cross-contamination and criterion 3D was not met.

[8] Unable to score paper due to lack of sequencing, hyphae were identified and culture performed.

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
	Procambarus vazquezae	no common name	N	qPCR and sequence analysis	ND	ND	NO	YES	2	Mrugała *et al.*, 2015
	Procambarus virginalis	no common name	N	qPCR and sequence analysis	ND	ND	NO	YES	2	Mojžišová *et al.*, 2024
			N	qPCR and sequence analysis	ND	ND	NO	YES	2	Mojžišová *et al.*, 2022
Score 3										
Cambaridae	*Cambarus latimanus*	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Cambarus striatus	Hay crayfish	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Creaserinus fodiens	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Creaserinus oryktes	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Faxonius etnieri	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Faxonius tricuspis	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Faxonius wrighti	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus ablusus	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus acutus	white river crayfish	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus hayi	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus hybus	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus pubescens	no common name	N	qPCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
	Procambarus troglodytes	no common name	N	qPCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus viaeviridis	vernal crayfish	N	qPCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
	Procambarus vioscai	no common name	N	qPCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
Palaemonidae	*Palaemon kadiakensis*	no common name	N	PCR and sequence analysis	ND	ND	ND	ND	3	Martín-Torrijos *et al.*, 2021c[7]
Not scored (NS)										
Atyidae	*Neocaridina davidi*	no common name	E	NO (qPCR only)	ND	ND	ND	ND	NS	Svoboda *et al.* , 2014a
Cambaridae	*Cambarellus (Pandicambarus) texanus*	no common name	N	Negative (qPCR)[9]	ND	ND	ND	ND	NS	Mrugała *et al.*, 2015
	Cambarus fasciatus	Etowah crayfish	N	NO (qPCR only)	ND	ND	ND	ND	NS	Panteleit *et al.*, 2017
	Cambarus manningi	no common name	N	NO (qPCR only)	ND	ND	ND	ND	NS	Panteleit *et al.*, 2017
	Cambarus robustus	Big water crayfish	N	Negative (qPCR)	ND	ND	ND	ND	NS	Petrusek *et al.*, 2025
	Faxonius leptogonopodus	no common name	N	Negative (qPCR)[10]	ND	ND	ND	ND	NS	Mrugała *et al.*, 2015
	Orconectes harrisonii	belted crayfish	N	Negative (qPCR only)	ND	ND	ND	ND	NS	Mrugała *et al.*, 2015
	Orconectes luteus	golden crayfish	N	NO (qPCR only)	ND	ND	ND	ND	NS	Panteleit *et al.*, 2017
	Orconectes neglectus	ringed crayfish	N	NO (qPCR only)	ND	ND	ND	ND	NS	Panteleit *et al.*, 2017

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[9] 20 animals tested with qPCR and negative results recorded.

[10] Two individuals tested and negative results recorded on qPCR.

Family	Scientific name	Common name	Stage 1: Route of infection	Stage 2: Pathogen Identification	Stage 3: Evidence of Infection				Outcome	References
					A	B	C	D		
	Orconectes ozarkae	Ozark crayfish	N	NO (qPCR only)	ND	ND	ND	ND	NS	Panteleit *et al.*, 2017
	Orconectes palmeri	gray-speckled crayfish	N	Negative (qPCR)	ND	ND	ND	ND	NS	Mrugała *et al.*, 2015
	Procambarus pilosimanus	no common name	N	NO (qPCR only)	ND	ND	ND	YES	NS	Peiró *et al.*, 2016
	Procambarus simulans	no common name	N	NO (qPCR only)	ND	ND	ND	ND	NS	Panteleit *et al.*, 2017
Gecarcinucidae	*Parathelphusa convexa*	No common name	N	NO (qPCR only)	ND	ND	ND	YES	NS	Putra *et al.*, 2018
Palaemonidae	*Macrobrachium dayanum*	Kaira river prawn	E	NO (qPCR only)	NO	ND	ND	NO	NS	Svoboda *et al.*, 2014a
	Macrobrachium lancasteri	Riceland prawn	N	NO (qPCR only)	ND	ND	ND	YES	NS	Putra *et al.*, 2018
Pallaseidae	*Pallaseopsis quadrispinosa*	no common name	N	NO (qPCR only)	ND	ND	ND	ND	NS	Svoboda *et al.*, 2014b
Parastacidae	*Cherax destructor*	no common name	E	No (qPCR only)	ND	ND	YES	ND	NS	Mrugała *et al.*, 2016
	Cherax holthuisi	no common name	N	Negative (qPCR)[11]	ND	ND	ND	ND	NS	Mrugała *et al.*, 2015
	Cherax lorentzi	no common name	N	Negative (qPCR)[12]	ND	ND	ND	ND	NS	Mrugała *et al.*, 2015
	Parastacus brasiliensis	no common name	N	NO (qPCR only)	ND	ND	ND	ND	NS	Peiró *et al.*, 2016
	Parastacus defossus	no common name	N	NO (qPCR only)	ND	ND	ND	YES	NS	Peiró *et al.*, 2016
	Parastacus pilimanus	no common name	N	NO (qPCR only)	ND	ND	ND	ND	NS	Peiró *et al.*, 2016

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[11] 5 animals tested with qPCR and negative results recorded.

[12] 5 animals tested with qPCR and negative results recorded.

4. Results

The *ad hoc* Group agreed that 13 species meet the criteria for listing as susceptible to infection with *A. astaci* in accordance with Chapter 1.5 of the *Aquatic Code*. These are proposed to be listed in Article 9.2.2 of Chapter 9.2. 'Infection with *A. astaci* (crayfish plague)'. These species are shown in Table 6 below:

Table 6: Species that met the criteria for listing as susceptible to infection with *A. astaci*

Family	Scientific name	Common name
Astacidae	*Astacus astacus*	noble crayfish
	Austropotamobius pallipes	white claw crayfish
	Pacifastacus leniusculus	signal crayfish
	Pontastacus leptodactylus	Danube crayfish
	Austropotamobius torrentium	stone crayfish
Cambaridae	*Faxonius limosus*	spinycheek crayfish
	Faxonius obscurus	no common name
	Faxonius rusticus	no common name
	Procambarus alleni	no common name
	Procambarus clarkii	red swamp crayfish
Cambaroididae	*Cambaroides japonicus*	no common name
Parastacidae	*Cherax quadricarinatus*	red claw crayfish
Potamidae	*Potamon potamios*	no common name
Varunidae	*Eriocheir sinensis*	Chinese mitten crab

14 species were assessed as having incomplete evidence of susceptibility and were proposed to be included in Section 2.2.2 of Chapter 2.2.2. of the *Aquatic Manual*. These species are shown in Table 7 below:

Table 7: Species that have incomplete evidence of susceptibility to infection with *A. astaci*

Family	Scientific name	Common name
Cambaridae	*Cambarus bartonii*	Appalachian brook crayfish
	Cambarellus (Cambarellus) montezumae	no common name
	Cambarellus patzcuarensis	no common name
	Cambarellus shufeldtii	Cajun dwarf crayfish
	Faxonius immunis	calico crayfish
	Faxonius propinquus	no common name
	Faxonius virilis	no common name
	Procambarus enoplosternum	no common name

Family	Scientific name	Common name
	Procambarus fallax	no common name
	Procambarus llamasi	no common name
	Procambarus raneyi	no common name
	Procambarus vazquezae	no common name
	Procambarus virginalis	no common name

Pathogen-specific positive PCR results have been reported in the 16 species listed below in Table 8. These species were proposed to be included in the second paragraph of Section 2.2.2. of Chapter 2.2.2., Infection with *A. astaci* (crayfish plague) of the *Aquatic Manual.*

Table 8: Species with pathogen-specific PCR results for infection with *A. astaci*

Family	Scientific name	Common name
Cambaridae	*Cambarus latimanus*	no common name
	Cambarus striatus	Hay crayfish
	Creaserinus fodiens	no common name
	Creaserinus oryktes	no common name
	Faxonius etnieri	no common name
	Faxonius tricuspis	no common name
	Faxonius wrighti	no common name
	Procambarus ablusus	no common name
	Procambarus acutus	white river crayfish
	Procambarus hayi	no common name
	Procambarus hybus	no common name
	Procambarus pubescens	no common name
	Procambarus troglodytes	no common name
	Procambarus viaeviridis	vernal crayfish
	Procambarus vioscai	no common name
Palaemonidae	*Palaemon kadiakensis*	no common name

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 host species are in accordance with FAOTERM (http://www.fao.org/faoterm/collection/faoterm/en/). Where a common 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

The *ad hoc* Group agreed that to have an overall species score of '1' the ideal situation was two papers with a score of '1'. However, a single robust study scoring '1' was also considered enough to conclude susceptibility of a species in the absence of conflicting evidence. In addition, when there was a single study scoring '1', the ad hoc Group considered other additional studies which received scored of '2' and '3' as further evidence to support the determination of the susceptibility of a species in the absence of conflicting evidence. 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 consider that they were necessary to assess comprehensively because the species had already been determined as susceptible by other studies, these references were only noted in the list of references (Section 8).

The *ad hoc* Group noted difficulties in finding evidence to assess the susceptibility of crustacean species to infection with *A. astaci*. As described in the *Aquatic Manual*, the repeated discovery of new *Aphanomyces* strains means that sequencing is required to determine the species of *Aphanomyces* in the case of an amplification product in the real-time assay result. Many papers had species that were not scored due to the lack of sequence analysis performed such that pathogen identification in Criteria 2 could not be met. In addition, the lack of histological and epidemiological information in the studies prohibited species from receiving scores of '1' as the criteria in Stage 3 could not be assessed. The *ad hoc* Group highlighted that research which includes sequence analysis and techniques in addition to molecular analysis would allow more fulsome assessments of susceptibility of crustacean species to infection with *A. astaci*.

The *ad hoc* Group noted that papers which were published prior to usage of molecular techniques could not be scored as they did not meet criteria 2 which reflects modern techniques and technologies. However, the *ad hoc* Group emphasised that these papers provided quality information on the pathogenic agent and the infection caused by this agent even though the papers were not scored.

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, and determined that it is applicable for the susceptible species for crayfish plague identified.

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…/Annexes

Annex 1. List of Participants

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

Paris, 8 to 10 April 2025

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List of participants

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Annex 2. Terms of Reference

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

Paris, 8 to 10 April 2025

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Terms of reference

Background

Chapter 1.5. 'Criteria for listing species as susceptible to infection with a specific pathogenic agent' of the *Aquatic Code*, provides criteria for determining which host species are listed as susceptible in Article X.X.2. of each disease-specific chapter in the *Aquatic Code*.

Assessments for all of the WOAH listed diseases are being undertaken progressively by *ad hoc* Groups. Once completed, the revised list of susceptible species in the relevant Article X.X.2. of the *Aquatic Code* is circulated for Member comment and then presented for adoption.

Species, where there is some evidence of susceptibility but insufficient evidence to demonstrate susceptibility are included in the relevant disease-specific chapter in the *Aquatic Manual*.

The *ad hoc* Group on Susceptibility of Crustacean Species to Infection with WOAH Listed Diseases completed assessments for infection with *Aphanomyces astaci* (crayfish plague) in October 2015; however, there is new scientific evidence that needs to be assessed.

Purpose

The *ad hoc* Group on Susceptibility of crustacean species to infection with WOAH listed diseases will undertake reassessments for infection with crayfish plague in crustaceans using new scientific evidence since the October 2015 assessments.

Terms of Reference

1) Review relevant literature documenting susceptibility of species for infection with crayfish plague and apply the criteria, as outlined in Chapter 1.5. 'Criteria for listing species as susceptible to infection with a specific pathogen', to potential host species.

2) Determine susceptible species for infection with crayfish plague based on Article 1.5.7.

3) Determine species with incomplete evidence for susceptibility for infection with crayfish plague based on Article 1.5.8.

Expected outputs of the *ad hoc* Group

1) Propose a list of susceptible species for inclusion in the Article 9.2.2. of Chapter 9.2. 'Infection with crayfish plague' in the *Aquatic Code.*

2) Propose a list of species with incomplete evidence for susceptibility for inclusion in Section 2.2.1. and Section 2.2.2. of Chapter 2.2.2. Infection with crayfish plague of the *Aquatic Manual*.

3) A report for consideration by the Aquatic Animals Commission at its September 2025 meeting.

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