Listing infectious diseases in crustaceans and selection of reference diagnostic methods

Plenum discussion

Cefas DTU

OIE Aquatic Manual 2018

2. TARGET PATHOGENS AND DISEASES

Target pathogens and aquatic animal diseases are included in the *Aquatic Code* according to the following basic considerations:

- the disease has been shown to cause **significant production losses** at a national or multinational (zonal or regional) level or the disease has been shown to or scientific evidence indicates that it is likely to **negatively affect wild aquatic animal populations** or the agent is of **public health concern**

- **infectious aetiology** of the disease is proven or an infectious agent is strongly associated with the disease, but the aetiology is not yet known

- the likelihood exists **of international spread**, including via live animals, their products or fomites

- several countries or **countries with zones may be declared free** of the disease based on the general surveillance principles outlined in *Aquatic Code* Chapter 1.4 *Aquatic animal health surveillance*

- a **repeatable and robust means of detection/diagnosis** exists

EU ASSESSMENT CRITERIA for listing diseases in AHL

Disease	
Source	
DISEASE PROFILE	
Animal species	
Morbidity and Mortality rates in animal populations	
Zoonotic character	
Resistant to treatments, AMR	
Persistence in the animal population or environment	
Routes and speed of transmission animals-animals	
Routes and speed of transmission animals-humans	
Absence, presence and distribution of the disease in the EU	
Risks of its introduction into the EU if absence in EU	
Existence of diagnostic and disease control tools	
IMPACT OF THE DISEASE ON	
Agricultural production:	
Human health:	
Animal welfare	
Biodiversity and the environment	
POTENTIAL TO GENERATE A CRISIS SITUATION AND ITS POTENTIAL USE IN BIOTERRORISM	
Bioterrorism	
FEASIBILITY, AVAILABILITY AND EFFECTIVENES OF THE DISEASE PREVENTION AND CONTROL MEASURES	
Diagnostic tools and capacities	
Vaccination	
Medical treatments	
Biosecurity measures	
Restrictions on the movement of animals and products	
Killing of animals	
Disposal of carcasses and other relevant animal by-products	
IMPACT OF DISEASE PREVENTION AND CONTROL MEASURES	
Direct and indirect cost for the affected sector and the economy as a whole	
Social acceptance	
Welfare of affected subpopulations of kept and wild animals	
Environment and biodiversity	

The OIE Aquatic Code and Aquatic Manual list 9 resp. 11 reportable diseases in crustaceans which of these should be listed by EU?

	DISEASES OF CRUSTACEANS	
Chapter 2.2.0.	General information	
Chapter 2.2.1.	Acute hepatopancreatic necrosis disease	
Chapter 2.2.2.	Infection with *Aphanomyces astaci* (Crayfish plague)	
Chapter 2.2.3.	Infection with *Hepatobacter penaei* (Necrotising hepatopancreatitis)	
Chapter 2.2.4.	Infection with infectious hypodermal and haematopoietic necrosis virus	
Chapter 2.2.5.	Infection with infectious myonecrosis virus	
Chapter 2.2.6.	Infection with *Macrobrachium rosenbergii* nodavirus (White tail disease)	
Chapter 2.2.7.	Infection with Taura syndrome virus (EU List A)	
Chapter 2.2.8.	Infection with white spot syndrome virus (EU List C)	
Chapter 2.2.9.	Infection with yellow head virus genotype 1(EU List A)	
Chapter 2.2.10.	Spherical baculovirosis (*Penaeus monodon*-type baculovirus)	**Delisted**
Chapter 2.2.11.	Tetrahedral baculovirosis (*Baculovirus penaei*)	**Delisted**

White spot disease – Infection with White Spot Syndrome Virus

EU List C

Infection with the pathogenic agent white spot syndrome virus (WSSV), Genus *Whispovirus*, Family *Nimaviridae*.

Susceptible host species: A wide range of aquatic crustaceans especially decapods, including marine, brackish and freshwater prawns, crabs, crayfish and lobsters

Geographical distribution: China (People's Rep. of), Japan, Korea (Rep. of), South-East Asia, South Asia, the Indian Continent, the Mediterranean, the Middle East, and the Americas. Zones and compartments free from infection with WSSV are known within these regions.

Diagnostic methods: PCR, nested PCR, real-time PCR, ISH, bioassay method, histology

Test recommended for targeted surveillance to declare freedom:

Real-time PCR

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Taura Syndrome – Infection with Taura Syndrome Virus

EU List A

Infection with the pathogenic agent Taura syndrome virus (TSV), Genus Aparavirus, Family *Dicistroviridae*, Order Picronavirales.

Susceptible host species: Greasyback shrimp (*Metapenaeus ensis*), northern brown shrimp (*Penaeus aztecus*), giant tiger prawn (*P. monodon*), northern white shrimp (*P. setiferus*), blue shrimp (*P. stylirostris*), whiteleg shrimp (*P. vannamei*), fleshy prawn (*Penaeus chinensis*)?, giant river prawn (*Macrobrachium rosenbergii*)?, the copepod (*Ergasilus manicatus*)?, the barnacles (*Chelonibia patula* and *Octolasmis muelleri*)?, northern pink shrimp (*Penaeus duorarum*)??, kuruma prawn (*Penaeus japonicus*)??, southern white shrimp (*Penaeus schmitti*)??, gulf killifish (*Fundulus grandis*)??, blue crab (*Callinectes sapidus*)??, the crabs (*Uca vocans* and *Sesarma mederi*)??, Indo-Pacific swamp crab (*Scylla serrata*)??

Geographical distribution: Widely distributed in shrimp-farming regions of the Americas, Sounth-East Asia and the Middle East.

Diagnostic methods: Histology (H&E), ISH, bioassay method, dot-blot immunoassay method, IFAT, IHC, RT-PCR, real-time RT-PCR.

Test recommended for targeted surveillance to declare freedom:

RT-PCR, real-time RT-PCR

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Yellow head disease – Infection with yellow head virus genotype 1

EU List A

Infection with yellow head virus genotype 1 (YHV1) of the genus *Okavirus*, Family *Roniviridae* and Order *Nidovirales*.

Susceptible host species: Giant tiger prawn (*Penaeus monodon*), white leg shrimp (*P. vannamei*), blue shrimp (*P. stylirostris*), daggerblade grass shrimp (*Palaemonetes pugio*), Jinga shrimp (*Metapenaeus affinis*), Sunda river prawn (*Macrobrachium sintangense*)?, yellow shrimp (*Metapenaeus brevicornis*)?, Carpenter prawn (*Palaemon serrifer*)?, Pacific blue prawn (*Palaemon styliferus*)?, northern brown shrimp (*Penaeus aztecus*)?, northern pink shrimp (*Penaeus duorarum*)?, kuruma prawn (*Penaeus japonicus*)?, banana prawn (*Penaeus merguiensis*)?, northern white shrimp (*Penaeus setiferus*)?, red claw crayfish (*Cherax quadricarinatus*)?

Geographical distribution: YHV1 has been reported in Chinese Taipei, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand and Vietnam. GAV and other genotypes in the yellow head complex have been detected in healthy *P. monodon* from Australia, Chinese Taipei, India, Indonesia, Malaysia, Mozambique, the Philippines, Thailand and Vietnam. YHV1 has also been detected in *P. vannamei* in Mexico.

Diagnostic methods: RT-PCR, nested RT-PCR, multiplex RT-PCR, ISH, bioassay.

Test recommended for targeted surveillance to declare freedom:

Nested RT-PCR followed by confirmatory sequencing of the amplified PCR product.

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AHPND - Acute hepatopancreatic necrosis disease

Infection with strains of *Vibrio parahaemolyticus* (VpAHPND) that contain a ~70-kbp plasmid with genes that encode homologues of the *Photorhabdus* insect-related (Pir) toxins, PirA and PirB. Although there are reports of the isolation of other *Vibrio* species from clinical cases of AHPND, only VpAHPND has been demonstrated to cause AHPND.

Susceptible host species: Giant tiger prawn (*Penaeus monodon*), whiteleg shrimp (*Penaeus vannamei*), fleshy prawn (*Penaeus chinensis*)?, kuruma prawn (*Penaeus japonicus*)?

Geographical distribution:
The disease has been reported from China (People's Rep. of) (2010), Vietnam (2010), Malaysia (2011), Thailand (2012), Mexico (2013) and the Philippines (2014).

Diagnostic methods: *Vp* AHPND can be isolated on standard media used for isolation of bacteria from diseased shrimp. Bacterial species identification may be carried out using 16S rRNA PCR or toxR-targeted PCR and sequencing. AHPND-specific PCR methods that target the Vp AHPND toxin genes.

Test recommended for targeted surveillance to declare freedom from AHPND:
Real-time PCR

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Crayfish plaque - Infection with *Aphanomyces astaci*

Infection with the pathogenic agent *Aphanomyces astaci* of the Family Leptolegniaceae, Phylum Oomycota (water moulds).

Susceptible host species: All species of freshwater crayfish, e.g. the Noble crayfish (*Astacus astacus*), signal crayfish (*Pacifastacus leniusculus*), have to be considered as susceptible to infection with *A. astaci*, but the outcome of an infection varies depending on species.

Geographical distribution:

Diagnostic methods: Main available diagnostic methods are polymerase chain reaction (PCR) and isolation of the pathogen in culture media followed by confirmation of its identity.

Test recommended for targeted surveillance to declare freedom:

Highly susceptible species: regular inspections – PCR analysis of any dead/moribund animals

North American crayfish species: PCR (real-time PCR preferred method due to higher sensitivity

Necrotising hepatopancreatitis - Infection with *Hepatobacter penaei*

Infection with the pathogenic agent Candidatus *Hepatobacter penaei*, an obligate intracellular bacterium of the Order α-Proteobacteria.

Susceptible host species: Whiteleg shrimp (*Penaeus vannamei*), northern white shrimp (*Penaeus setiferus*)?, northern pink shrimp (*Penaeus duorarum*)?, blue shrimp (*Penaeus stylirostris*)?, banana prawn (*Penaeus merguiensis*)?, aloha prawn (*Penaeus marginatus*)?, northern brown shrimp (Penaeus aztecus)?, giant tiger prawn (*Penaeus monodon*)?, American lobster (*Homarus americanus*)?

Geographical distribution:

Diagnostic methods: Histology (H&E stain), IHC, ISH, PCR (RT-PCR, real-time PCR).

Test recommended for targeted surveillance to declare freedom:

real-time PCR (also histology when acute mortality episodes during targeted surveillance programmes)

IHHNV – Infection with Infectious hypodermal and haematopoietic necrosis virus

Infection with the pathogenic agent infectious hypodermal and haematopoietic necrosis virus (IHHNV) Family *Parvoviridae*, Genus *Penstyldensovirus*.

Susceptible host species: Yellowleg shrimp (*Penaeus californiensis*), giant tiger prawn (*Penaeus monodon*), northern white shrimp (*Penaeus setiferus*), blue shrimp (*Penaeus stylirostris*), white leg shrimp (*Penaeus vannamei),* northern brown shrimp (*Penaeus aztecus*)? + several other species (PCR positive but no active infection).

Geographical distribution:

Diagnostic methods: Histology (H&E stain) for acute infections; PCR (PCR, real-time PCR), dot-blot hybridisation test, ISH for chronic infections.

Test recommended for targeted surveillance to declare freedom:

PCR, real-time PCR (also histology when acute mortality episodes during targeted surveillance programmes)

IMNV – Infection with Infectious myonecrosis virus

Infection with the pathogenic agent infectious myonecrosis virus (IMNV), similar to members of the Family Totiviridae.

Susceptible host species: Brown tiger prawn (*Penaeus esculentus*), banana prawn (*P. merguiensis*), whiteleg shrimp (*P. vannamei*), giant tiger prawn (*Penaeus monodon*)?, blue shrimp (*Penaeus stylirostris*)?, southern brown shrimp (*Penaeus subtilis*)??

Geographical distribution:

Diagnostic methods: Histology (H&E stain) needs to be confirmed by other methods, ISH, nested RT-PCR, quantitative real-time PCR.

Test recommended for targeted surveillance to declare freedom:

Nested RT-PCR

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White tail disease – Infection with *Macrobrachium rosenbergii* nodavirus

Infection with the pathogenic agent *Macrobrachium rosenbergii* nodavirus (MrNV), Family Nodaviridae and extra small virus (XSV).

Susceptible host species: Giant river prawn (*Macrobrachium rosenbergii*), whiteleg shrimp (*P. vannamei*)?, kuruma prawn (*Penaeus japonicus*)??, Indian white prawn (*Penaeus indicus*)??, giant tiger prawn (*Penaeus monodon*)??, dragonfly (*Aeshna* sp.)??, giant water bug (*Belostoma* sp.)??, beetle (*Cybister* sp.)??, backswimmer (*Notonecta* sp.)??, hairy river prawn (*Macrobrachium rude*)??, monsoon river prawn (*Macrobrachium malcolmsonii*)??, brine shrimps (*Artemia* sp.)?? red claw crayfish (*Cherax quadricarinatus*)??

Geographical distribution:

Diagnostic methods: Cell culture and ELISA, RT-PCR, RT-nPCR, multiplex RT-PCR, quantitative RT-PCR, ISH.

Test recommended for targeted surveillance to declare freedom:

n RT-PCR

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Spherical baculovirosis (*Penaeus monodon*-type baculovirus)

OIE delisted

Infection with *Penaeus monodon*-type baculovirus. Synonyms: MBV from *P. monodon* was designated PmSNPV (singly enveloped nuclear polyhedrosis virus from *P. monodon*).

Susceptible host species: MBV infections reported in one or more species of the following penaeid genera or subgenera (the latter between brackets): *Penaeus* (*Penaeus*), *Penaeus* (*Metapenaeus*), *Penaeus* (*Fenneropenaeus*) and *Penaeus* (*Melicertus*).

Geographical distribution: MBV enzootic in wild penaeids in the following regions bordering on the Indo-Pacific: East and South-East Asia, Indian subcontinent, Middle East, Australia, Indonesia, New Caledonia, East Africa, and Madagascar. Outside the normal geographical range of *P. monodon*, no reports of MBV in wild penaeid shrimp. However, MBV reported from sites where introduced *P. monodon* has been cultured in the Mediterranean, West Africa, Tahiti and Hawaii as well as several sites in North and South America and the Caribbean, but only in the introduced *P. monodon* stocks

Diagnostic methods: Wet mounts of fresh tissue/faecal strands, histology, ISH, PCR.

Test recommended for targeted surveillance to declare freedom:

PCR, wet mounts, histology

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Tetrahedral baculovirosis (*Baculovirus penaei*)

OIE delisted

Infection with *Baculovirus penaei monodon*-type baculovirus. Synonyms: PvSNPV (singly enveloped nucleopolyhedrovirus from *Penaeus vannamei*)

Susceptible host species: Species of the following penaeid genera or subgenera (the latter between brackets): *Penaeus* (*Litopenaeus*), (*Farfantepenaeus*), (*Fenneropenaeus*), (*Melicertus*), (*Penaeus*), *Trachypenaeus* and *Protrachypene*. All penaeid species may be potential hosts.

Geographical distribution: Enzootic in wild penaeids in the Americas and Hawaii. Not reported in wild or cultured penaeid shrimp in the eastern hemisphere despite numerous introductions of American penaeids to Asia and the Indo-Pacific.

Diagnostic methods: Wet mounts of fresh tissue/faecal strands, histology, ISH, PCR.

Test recommended for targeted surveillance to declare freedom:

PCR, wet mounts, histology

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