ASC SHRIMP STANDARD REVISION

Gap Analysis of New Crustaceans Species Considered for Inclusion in ASC Shrimp Standard

March 2020

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1. Objective

The Aquaculture Stewardship Council (ASC)'s portfolio of standards contains one (the Shrimp Standard) designed to address the key environmental and social impacts related to crustacean farming. The objective of this document is to reflect upon the suitability, and feasibility, to broaden the scope of the current ASC Shrimp Standard to include addition crustacean species, i.e. *Macrobrachium rosenbergii (freshwater prawn), Procambarus clarkii (crayfish / crawfish), Cherax quadricarinatus (crayfish / crawfish), Penaeus stylirostris* (Blue Shrimp), *Penaeus merguiensis* (Banana Prawn) and *Penaeus japonicus* (Kuruma Prawn) and *Penaeus ensis* (Greasyback or Pink Shrimp).

In doing so, an analysis is made of occurring environmental[1] impacts (potentially) created by the culture of these additional species. The identified impacts are compared with those highlighted in the current Shrimp Standard v1.1, and those impacts currently not addressed are identified.

Finally, recommendations are made to address these (potential) impacts and steps going forward.

2. Scope

The scope of the present Gap Analysis is as follows:

- *Macrobrachium rosenbergii (freshwater prawn), Procambarus clarkii (crayfish), Cherax quadricarinatus (crayfish),*
- Information regarding related environmental conditions and production systems.
- Worldwide.

It should be noted that this gap analysis does not cover a detailed overview of metrics for instance as requested in the ASC shrimp standard v1.1, and which is subject to a separate analysis.

[1] The social impacts related to labour and community interactions are considered to be equal to those of the current ASC species, including shrimp.

3. Background

The ASC Shrimp Standard v.1.1 is based on the anterior work of the Shrimp Aquaculture Dialogue (ShAD) and sets requirements that define what has been deemed 'acceptable' levels as regards the major social and environmental impacts of saltwater shrimp (crustacean) farming. The purpose of the ASC Shrimp Standard was and is to provide means to measurably improve the environmental and social performance of shrimp aquaculture operations worldwide.

The scope of the Shrimp Standard (v1.1) covers:

> *"The ASC Shrimp Standard currently covers species under the genus Litopenaeus and Penaeus. The Standard is oriented towards the production for L. vannamei and P. monodon. Other species of shrimp are eligible for certification if they can meet the performance thresholds specified in the Standard. Requirements specific to other shrimp species may or may not be added in the future."*

Since the launch of the Shrimp Standard, producers of crustacean species beyond those as defined within the scope of the Standard, have requested to become certified to the ASC Shrimp Standard. Although the scope of the Standard allows this ("*Other species of shrimp are eligible for certification if they can meet the performance thresholds specified in the Standard*"), species-specific metrics and in-depth gap-analysis regarding the sufficient impact-coverage of the current Shrimp Standard was never conducted. This document seeks to address the latter gap (i.e. impact-coverage), while species-specific metrics standard-setting considerations is to be addressed via the Metrics Methodology process.

Several crustacean species have been identified as potentially of interest for inclusion in the scope of the ASC Shrimp Standard. These species are:

- *Freshwater prawn,*
- *Crawfish / Crayfish*[2] *(2 species),*
- Additional Litopenaeus species (*stylirostris, japonicus*, *merguiensis* and *ensis*).[3]

4. Methodology

The structure of this Gap Analysis describes and follows a sequence based on the 'most important' produced species.

Scientific literature, sustainability indicators/benchmarks (rating organisations' reports), and UN FAO reports were reviewed and form the basis of this Gap Analysis.

[2] '**Crawfish' and 'crayfish'** are synonymous and can & will be used interchangeably in this document.

[3] **NB**: The ASC's Technical Advisory Group (TAG) supported in November 2019 the proposal that based on recent research re. phylogenetic analyses of several shrimp within the family Penaidae, the *Penaeus* genus should be used to define all potential new saltwater shrimp species. This also means that from the Shrimp Standard Review's public consultation of March 2020, references to the 'Litopenaeus' genus will be removed and replaced by 'Penaeus', and/or used interchangeably. Notably, the Whiteleg shrimp *may* be referred to by ASC as '*Penaeus (Litopenaeus) vannamei*' – or 'P. vannamei' – and if so: this latter species refers to the same as the one listed in the scope of the Shrimp Standard v1.1 as '*Litopenaeus vannamei*' or '*L. vannamei*'.

The present work does not consider market needs nor market demand considerations.

4.1 Methodology process

- **a. Main Species:** The current production for the three species groups will be reviewed in order to assess the importance when it comes to volume available and producer's countries.
- **b. Taxonomy:** After identifying the main species currently being produced globally, a taxonomy comparison will be carried out to assess the similarities or links with the *Litopenaeus genus.*
- **c. Production:** A review of the production methods, locations and farming conditions will be also included. This will be a comparison with what the shrimp industry does.
- **d. Environment:** A brief review of the species' behaviour and species' impact on the environment will be described.
- **e. Sustainable Indicators:** Seafood Watch and Good Fish guidance will be reviewed to see 'how' they assess the species subject of this gap analysis.
- **f. Recommendations:** Based on the literature review, this document will provide recommendations about the feasibility and probability to develop metrics, and requirements for an environmentally and socially responsible standard.

5. Volumes and Producer Countries

The UN FAO State of the World Fisheries and Aquaculture ('SOFIA') report (FAO, 2018) is the main source and provides the data for this section, some species factsheets also have been added to this report to provide a graphic view.

The global aquaculture production has increased in the last decades with a total of 80.031 million tonnes in 2016 with about 7.862 million tonnes of crustaceans (FAO, 2018). China, by far the major producer of farmed food fish in 2016, has produced more than the rest of the world combined every year since 1991[1].

After *Penaeus vannamei* or whiteleg shrimp (53% of Crustacean production), Crawfish (*Procambarus clarkii*) is the second most produced crustacean (12% of Crustacean production), while Giant river prawn (*Macrobrachium rosenbergii*) is found in the sixth position as the most produced crustacean (3% of Crustacean production) worldwide[1].

The SOFIA 2018 report (FAO, 2018) however does not provide any production volume breakdown per country for these latter two (2) species, but it does highlight that these two species rank amongst the top 6 most produced crustacean species in the world. The ASC considers it important that these species also be evaluated and assessed for a scope extent, particularly given the sustained ~6% per annum global aquaculture growth of the past 15 years (2001-2016).

[1] The States of the World Fisheries and Aquaculture, FAO 2018, page 23.

5.1 Crayfish (*Procambarus spp*)

According to data from China's Ministry of Agriculture (2018), the Chinese production of (including Procambrus Spp) has increased 4-fold in the 2007 to 2017 period, reportedly reaching a total production of 1.12 million tonnes[4]; though some stakeholders are raising concerns regarding the accuracy of and access to production data from China (see also Section 8.2 & 8.3 below). The FAO (SOFIA 2018) states that global production of Procambrus Spp reached 920,000t in 2016.

According to a food consumption report by the China Cuisine Association (CCA), the increase of the domestic consumption is also responsible for the increase of domestic production and the increase of imports of Crawfish from the US.

According to data on the FAO FishStat website, the main two (2) Crayfish species are listed with global production until 2010.

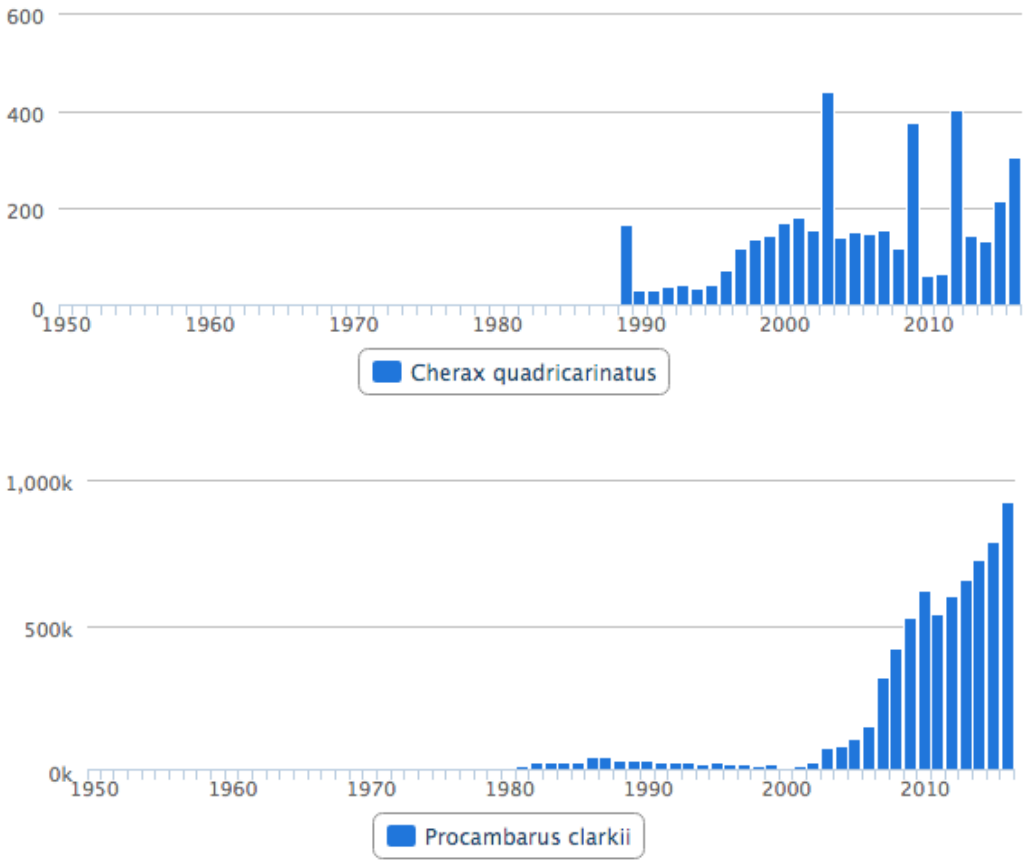


Figure 1: *Global Aquaculture Production of* Ch. Quadricarinatus and P. clarkii *based on FAO FishStat (FAO, 2016).*

[4] https://www.undercurrentnews.com/2018/06/19/china-govt-says-crayfish-industry-worth-41bn/

According to the FishStat report, the main producer countries of *P. clarkii* are: China and the USA. The main producer countries of *Ch. Quadricarinatus* are: Australia, Argentina, Uruguay, Ecuador and Mexico. Other producer countries are Belize, Israel, Morocco and Panama. The US has a long history harvesting *P. clarkii* that started in 1880.

The European native crawfish has mostly disappeared due to *P. clarkii* , which is highly invasive, and a potential vector for the crayfish plague (the fungi *Aphanomyces astaci*). Crayfish were introduced in Europe in the 1960s and spread throughout countries like Spain, Estonia, Portugal, Cyprus and France[5]. For instance, the Estonian Veterinarian and Food Board (VFB) report that there are 19 approved Crayfish farms in that country.

5.2 Freshwater Giant Prawn (*Macrobrachium spp*)

FishStat lists the USA, Mexico, Central America, Brazil, Peru, Iran, India, Thailand, Vietnam, Malaysia, Indonesia and China as the main producer countries of Freshwater giant prawn.

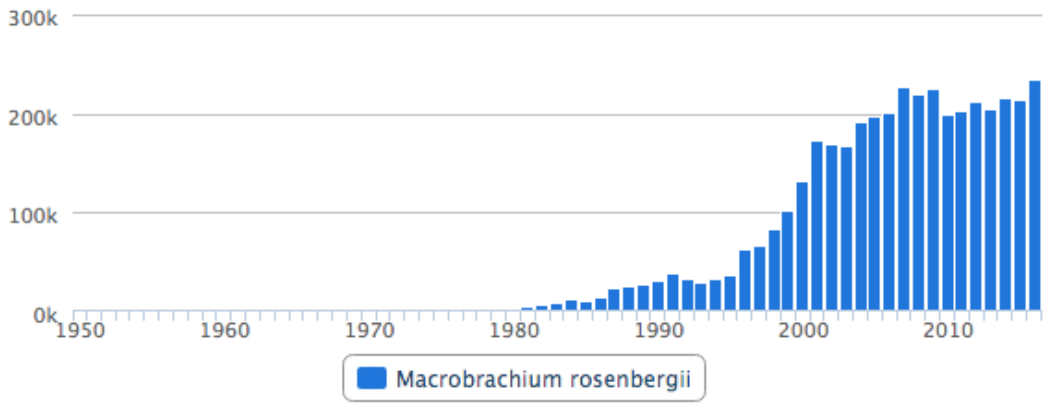


Figure 2: Global Aquaculture Production of *M. rosenbergii* based on FAO FishStat (FAO, 2016).

In addition to China being an important producer country of giant freshwater prawn, Malaysia has increased the culture of M. rosenbergii; something which is considered to have the potential to raise income among impoverished farmers (Rubia Banu et al., 2016).

[5] The States of the World Fisheries and Aquaculture (SOFIA), UN FAO 2018.

6. Taxonomy

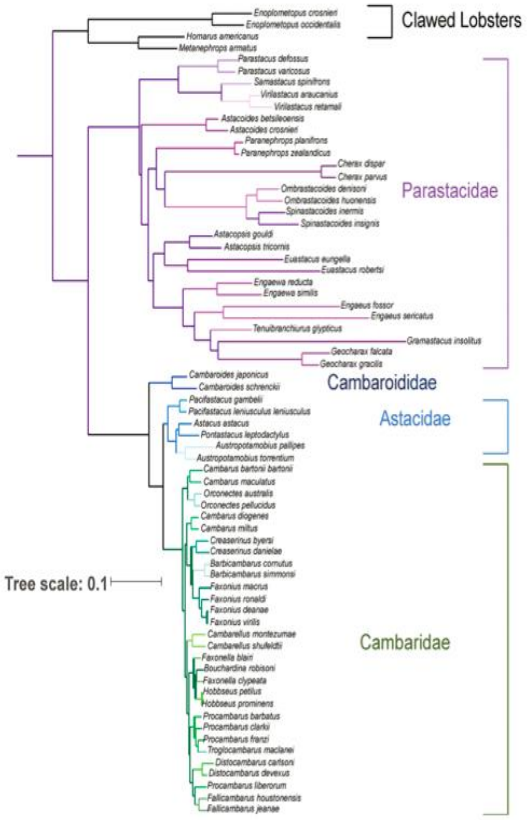
6.1 Crayfish

Crayfishes are crustaceans belonging to the Decapoda Order (decapods), they play an important role in biodiversity, ecology and conservation. Since the taxonomy classification of Linnaeus, no update has been done for crayfishes.

Keith A. Crandall, Sammy De Grave from the Oxford University have developed and updated this taxonomy classification and found 669 species including 692 distinct sub species

There are two (2) superfamilies' located on Northern and Southern hemispheres

Figure 2. Phylogenetic estimate of the freshwater crayfishes based on a subset of data from Stern et al. (2017). Family ...



Journal of Crustacean Biology, Volume 37, Issue 5, September 2017, Pages 615–653, https://doi.org/10.1093/jcbiol/rux070

OXFORD

Figure 3: *Taxonomy of Crayfishes by Oxford University.*

6.2 Freshwater giant prawn

The animal diversity web from the University of Michigan provide a detailed taxonomy of Freshwater prawn that includes three (3) infra species.

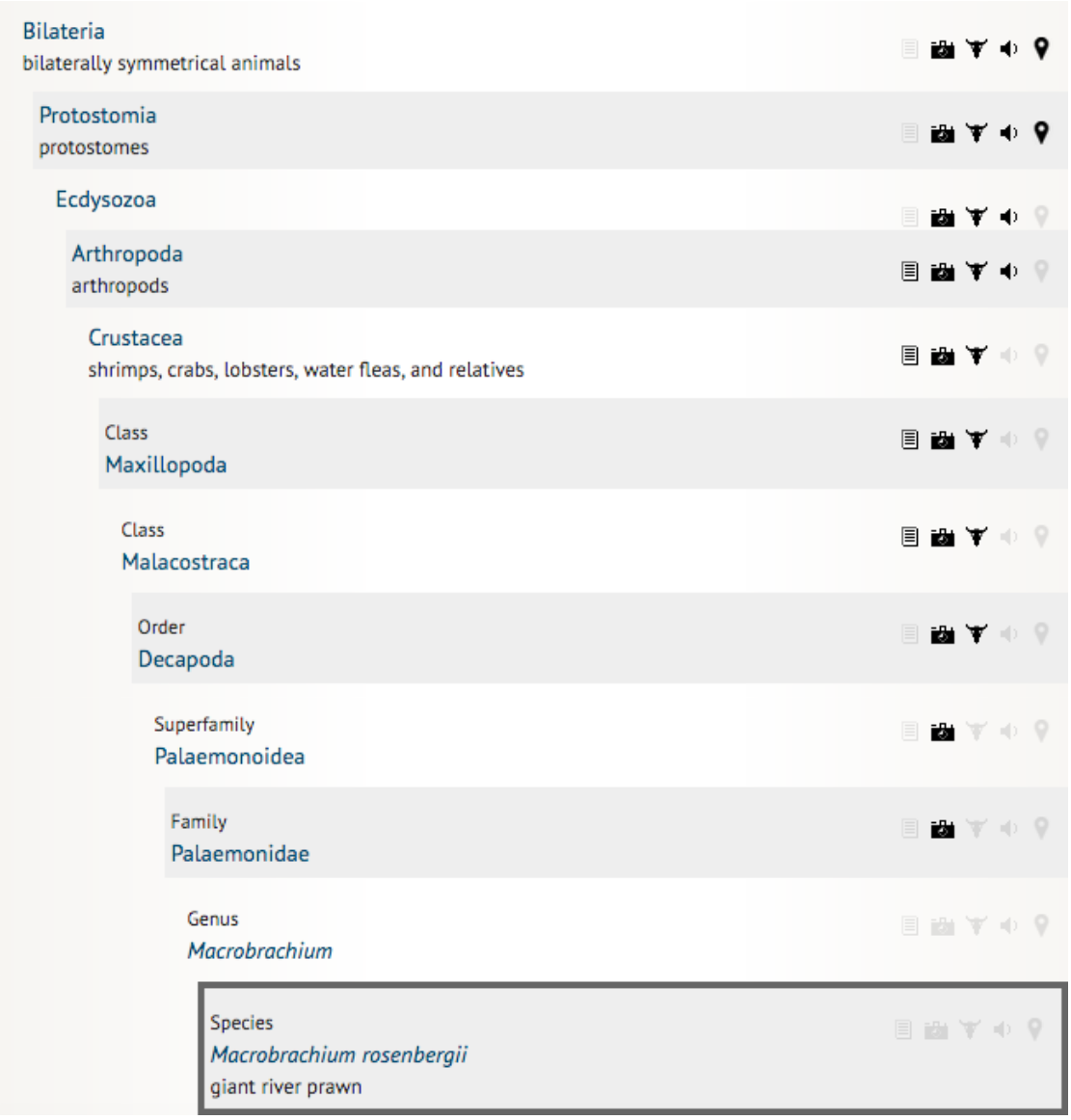


Figure 4: *Taxonomy of Crayfishes by Michigan University,*

The taxonomy review shows that there is a common linkage of these three (3) species until the Subphylum = Crustacea and Order = Decapoda. Each of them goes apart with a different suborder and family.

Other crustaceans possibly considered for extension of the ASC Shrimp Standard scope are (Blue Shrimp), *Penaeus merguiensis* (Banana Prawn), *Penaeus japonicus* (Kuruma Prawn) and *Penaeus ensis* (Greasyback or Pink Shrimp) are not included in this gap analysis, but have also a common linkage at the Subphylum = Crustacea and Order = Decapoda.

The *Cherax sp*. has been included from this part of the Gap Analysis because of the availability of data, and because of their importance to Australian Crawfish producers.

7. Production systems

This tentative comparison intends to summarise differences and similarities when considering various farming dimensions.

Table 1: Species-specific topics assessed for comparison production method and environment conditions

Topic/ Species	White shrimp	Redclaw *(Cherax spp)*	Crayfish *(Procambarus spp)*	Freshwater prawn	
Habitats / Salinity	Marine,	Freshwater	Freshwater,	Freshwater,	FAO, 2017, IUCN
Closed cycle	YES	Redclaw are reared directly in the juvenile pond	Self-sustaining, stocking is needed only in new ponds	Broodstock – hatchery and Broodstock wild harvested	FAO, 2017
Temperature	>20 Celsius degree	> 23 to < 31 Celsius degree	eurythermal species (10-22 ºC to >30 ºC)	28 to 31 Celsius degree (Optimum)	FAO, 2017
Production system	Ponds[6], raceways and RAS	Ponds	Ponds	Ponds	FAO, 2017
Intensity of production	Super intensive, intensive, semi-intensive and extensive	Semi-intensive and extensive	Intensive and Extensive production	Intensive, semi-intensive and extensive	FAO, 2017
Production length[7]	30 to > 180 days	6 – 15 months	2 to 6 months	The length depends on the market demand	FAO, 2017
Stocking densities	10 to 300 PLs/m^2	High stock densities, 5-15 m^2 recommended	Data no available	5 to 20 PLs/m^2	FAO, 2017
Feed	Feed is highly used by the global shrimp industry	Feed , 25% protein content is recommended	Supplemental feeds are not routinely used. Omnivorous, feeding on insects.	Fed commercial or "farmmade" Feeds	FAO, 2017
FCR	1.25: 1 or 1.30:1	Data no available	Data no available	2:1 or 3:1	FAO, 2017
Low O_2 Toleration	NO	YES	YES	YES	IUCN, 2012
Cannibalism	YES	NO	YES	No reported	FAO, 2017, IUCN

[6] Includes: cover with liners, concrete or ground
[7] The production length depends on the commercial size

The main differences amongst the shrimp, red claw crawfish, giant river prawn, and red swamp crawfish regard the habitat & salinity and feed dimensions. Although, salinity is an issue, no reference could be found that would provide details.

Regarding habitats, shrimp is a crustacean that grows and reproduces in high salinity habitats such as marine and estuarine waters, and around mangrove areas. Meanwhile, the freshwater prawn and crawfish grow in freshwater rivers and wetlands habitats with lower salinity levels (sluggish streams and lentic habitats, ditches, ponds with vegetation, creek, wetlands, habitats with high turbidity and rivers).

The second difference identified regards the feed used in the production cycle. Out of the three new species reviewed in this study, only redclaw crawfish is fed fully during production. The other two (2) use feed partially (FAO 2017). For instance, crawfish diet includes feed heavily on snails, fish, amphibians, and plants.

Another example of farming or capture of these crustaceans can be found in Nigeria: freshwater prawns are caught using mainly fishing traps, which are baited with fish, coconut, cassava, onions and palm-kernel nuts. To a lesser extent, they are caught in cast and gill nets as incidentals while targeting some other fin fishes (USAID, 2002). Some considerations should therefore be given to allow farm operations using no feed.

An implication of the above would be that ASC metrics related to feed *should* be adjusted and reviewed in the metric - standard development i.e. FFDR and FCR, taking into account best industry practices and science available.

On the other hand, there are many common characteristics like production system, intensity of production, and production length that depend on the market demand (size of the final product and traded volumes).

The production system used for these three species are already known and included in the current ASC shrimp standard v1.1 (see Table 1). Knowing the production system and production cycle of the species will also help provide ASC with audit cycle timelines during the production cycle, including stocking (when it is practiced) and harvest process of these three new species.

A general review of the water usage is also part of this gap analysis: it was found that water sourcing processes for the production cycle is very similar to those practised in the saltwater shrimp aquaculture, but coming from freshwater bodies.

Crayfish are grown in shallow earthen ponds 20 to 60 centimetres deep. Relatively flat, drainable land with clay soils is required. Water requirements are similar to those for other types of freshwater aquaculture, with the possible exception of quantity/volumes of water required, which can be greater. Ponds are flooded and drained each year, and -- because of the biological oxygen demand (BOD) resulting from decaying vegetation -- additional water exchanges are sometimes necessary (FAO, 2016).

Cherax or Redclaw is native to the upper reaches of rivers in north-eastern Australia, and in Papua New Guinea. Its preferred habitat is in high turbidity, slow moving streams or static water holes (billabongs) that characterize the rivers in that region.

Redclaw aquaculture, both in juvenile and grow-out ponds, is performed in earthen ponds, typically 0.05 to 0.5 hectares (ha), with a depth of 1.0-2.5 metres and a V-shape that allows rapid and complete drainage. Water is sourced from surface supplies or underground and should have a pH of 6.5-8.0, hardness of >40 ppm, and low levels of salinity (<5 ‰) and metals such as iron and manganese (<0.1 mg/litre) [FAO 2016c].

Artificial shelters are essential; they should be abundant, and their shape, specification and positioning should permit water to drain-out freely and completely as the pond is drained (FAO, 2016)

Although in Australia Redclaw aquaculture is practised in ponds, there are some initiatives for using tanks.

Freshwater prawns are reared in a variety of freshwater enclosures, including tanks, irrigation ditches, cages, pens, reservoirs, and natural waters; the commonest form being earthen ponds. Integration of freshwater prawn culture with crop production also occurs (typically in Viet Nam) (FAO, 2016).

The 2016 report from the FAO Fisheries and Aquaculture department states that specific negative effects of *M. rosenbergii* culture on the environment, including water use, have yet to be documented. It is also reported that the productivity is generally lower, and the potential for the abuse or waste of resources is minimal, and (unlike the inland culture of marine shrimp) that the grow out of *Macrobrachium* does not make agricultural land saline.

Table 1 only summarises topics to evaluate similarities and differences among the three freshwater species. It will still be necessary for ASC to set metrics for each of these three novel species in order to measure the impact on the environment. For collecting metrics base on the current ASC farm standard related requirements e.g. FCR, it would needed to contact, visit and engage with farms, NGOs, academia, research centre and other stakeholders in the producer countries.

8. Environmental concerns and sustainable indicators

8.1 International Union for the Conservation of Nature (IUCN)

According to the IUCN website, *Macrobrachium rosenbergii* is considered as a species of Least Concern (LC) in the Red list (March 2012); *Procambarus clarkii* is considered as a LC species (June 2010) and, finally, *Cherax quinquecarinatus* (June 2009) is also included in the list of LC species.

Crawfish is considered in several areas as invasive. While in some states of the USA it is considered as “established populations” (California, Delaware, Maryland, Ohio, Oregon, South Carolina, Utah, Virginia, Washington, and Wisconsin), in other states it is considered as an “introduced species” -- but not established -- in Alaska, Hawaii, Idaho, Illinois, Indiana, Nevada, and New York. In the northern part of Mexico and southern and south-eastern USA it is a native species.

Indeed, alien species introduction is one of the major threats to biodiversity and ecosystem functioning (Carlton 1996; Lodge et al., 2000). One of the best-known invasive freshwater alien species is the red swamp crayfish, *Procambarus clarkii* all of which have greatly affected rivers and lakes worldwide (D'Itri, 1997). The only regions where crawfish has not yet been introduced are Antarctica and Oceania. In Europe, the species was introduced in the 1960s; where it has been established (in the wild) and farming has been developed (DG MARE, 2016).

The main concern with Red swamp crayfish is that it competes aggressively with native crayfish species for food and habitat. Feeding behaviour reduces the amount of available habitat for amphibians, invertebrates, and juvenile fish. Burrowing and foraging behaviour can also lead to summer cyanobacteria blooms and eutrophic conditions (Tainã et al., 2005).

Understanding of the invasive process in different countries and habitats as well as comprehending the characteristics of the species that might favour its successful invasion can help managers to recognise the potential threats that this species poses to newly invaded ecosystems and to support management and impact mitigation efforts (Tainã et al., 2005).

Currently, crayfish and freshwater prawn are traded species in their country of origin and also exported globally (Globefish, 2018). Having sufficient data available for assessing the sustainable status of these species means this gap analysis also considered and reviewed the assessments carried out by rating organisations.

8.2 Seafood Watch (*a programme from the Monterey Bay Aquarium*)

Given the influence of rating organisations and their regular assessment at country level, species level or production level, ASC considered them a reliable source to look at when it comes to data available and species' impact. Seafood Watch Reports are available for both species; Crawfish (*Procambarus clarkii*) and Giant freshwater prawn (*Macrobracuium rosenbergii*).

The Monterey Bay Aquarium was founded 1984. Based in San Francisco, California; the Monterey Bay Aquarium's Seafood Watch programme helps consumers and businesses make choices for a healthy ocean. Seafood Watch carries out regular assessments per species and per producer country. For scoring the species status, a total of ten (10) indicators are assessed, including:

> Data available, effluent, Habitat, Chemicals, Feed, Escapes, Disease, Source, Wildlife Mortalities, and Escapes.

The final rating has 3 levels: Green = best choice, Yellow = Good alternative and Red = avoid.

Crawfish:

The Red swamp crawfish farmed in the US in pond is recommended as a "best choice" because it has low impact on the environment and because it is highly regulated given access to data for all 10 indicators.

The same species farmed in the US with another aquaculture production method – Traps -- is a good alternative; mainly because the stock has not been assessed and the limited management of the fishery is the main concern.

Finally, crawfish farmed in China is rated red / “Avoid”. Data information access and government enforcement are deemed weak, thus leading to serious concerns about the impact of effluents and escapes including the spread out of pathogens to native crawfish and farmed shrimp populations into the environment according to the Seafood Watch’s 2013 assessment.

Giant freshwater prawn

Giant freshwater prawn farmed in North America, Central America and South America in ponds and worldwide in indoor recirculating tanks are a “best choice”. Most of the farms are small therefore their impact is very low.

On the other hand, indoor recirculating facilities tanks have less effluents, disease, escapes and habitat impact than other aquaculture systems.

While the same species farmed in Asia and Bangladesh in ponds is a “good alternative” because data availability is good and most environmental impact is low to moderate.

Major concerns are based on the larvae and juvenile collection methods as this usually takes place in nursery grounds. Furthermore, the entire Bangladesh giant freshwater prawn industry relies on wild caught Broodstock and juveniles (Seafood Watch 2013)

8.3 Good Fish (Foundation)

Good Fish is an independent non-profit environmental organisation; one of their objectives is to support consumers and entrepreneurs in making responsible choices. Good Fish Foundation took over the VISwijzer in November 2014 from Stichting De Noordzee.

Good Fish evaluates the following topics in a species assessment:

> 1. comes from a well-managed file, 2. has been caught or farmed with minimal environmental damage, 3. it is traceable to the origin, 4. it had a good life, 5. it is pure and healthy, 6. it was not caught illegally, and 7. it has been caught or produced under good and fair working conditions.

Good fish has only scored Crayfish (*Procambarus clarkii*) in their rating.

Crayfish:

The Red crawfish is recommended as “green” for pond cultivation in North America mainly because it depends on the natural environment in terms of feed, therefore the pressure to feed sources, usually coming from wild caught is low.

In Europe the crayfish caught with traps and basket is recommended as “green”. But there are some concerns regarding fisheries management being poorly coordinated for crayfish coming from Spain.

On the other hand, Crayfish coming from China cultivated in ponds is recommended as “avoid” mainly because there is little or no data on the effect of cultivation on the environment. Crawfish caught with traps and basket is recommended as “second choice”.

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China is nevertheless the biggest producer of crawfish (See Section 5.1), and these two rating organisations are concerned about the crawfish farmed in China because of:

- Data information access, and government enforcement, are deemed weak,
- Serious concerns about the impact of effluents and escapes including the spread out of pathogens to native crawfish and farmed shrimp populations into the environment.

Recommendations

Based on the data collected and analysis, it is highly recommended -- and feasible -- to include these three (3) species, considering the following two (2) conditions:

- the revised Shrimp Standard should contains requirements addressing freshwater impacts and,
- the scope of the Standard be extended to include freshwater species or crustaceans.

Recognising that the main habitat of freshwater prawn and crawfish is freshwater, and that the current Shrimp Standard v1.1 only addresses requirements aimed at farming in marine and estuarine habitats, it is therefore recommended to add several criteria and/or indicators / requirements to cover the following issues:

1. Freshwater abstraction
2. Freshwater discharge
3. Escape management
4. Non-native species
5. Wetland conservation
6. Metrics & data collection/analysis.

Although the current ASC Shrimp Standard v1.1 does not yet cover the above-mentioned items (except points 3 and 6), other ASC standards do contain relevant criteria / indicators / requirements (e.g. Tilapia and Freshwater Trout standards).

Based on the significant differences between the analysed species in terms of habitat and salinity, it is considered that a common ASC crustacean scope is suitable for them and would also provide the opportunity to ‘easily’ add other crustaceans when it comes to habitat’s differences and to possibly extend the scope of the standard at a later stage to other novel species (e.g. lobsters).

An immediate next step and recommendation is also to further develop the results presented in this Gap Analysis per species against the ASC Shrimp Standard's environmental and production principles (metrics). This will require additional data collection and a more in-depth understanding of parameters and metrics per species. Such an analysis can play a very critical role in opening discussions on how to address requirements for the ASC crustaceans' scope, and/or include it into the future ('aligned'/all-species) ASC Farm Standard.

For the next and second stage, the following considerations shall be taken at the moment to develop the requirement looking at the high-quality information, the production system and impact of these crustaceans.

a. Mapping and identifying of the Top 4 producer's countries for the three (3) species,
b. Mapping and identifying of the regional and national producer associations for these three (3) species,
c. Mapping of the main stakeholders for environmental, labour, and trading issues for these three (3) species,
d. Collect data from academia, research centres, also collect data on industry practices (metrics), observe the farm management and interview stakeholder in each country.
e. To organise a Technical Working Group to assess the development of requirements, metrics and performance indicators for these three (3) species.
f. A scope adjustment that proposes a broader range of species belonging to the Crustaceans.

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