KURUMA PRAWN - *Marsupenaeus japonicus*

The Kuruma prawn, also known as Kuruma shrimp, Japanese tiger shrimp, flowery prawn, or kuruma ebi, is a marine prawn belonging to the Penaeidae family, and one of the most valuable shrimp species in aquaculture. It is distinguishable from other tiger shrimp species by the bright blue markings on the tip of their tails.

The species is native to the Indian and western Pacific oceans, and is currently farmed in Japan, China, Taiwan, and France. Australia and Korea had previously cultured Kuruma prawn as well, but all operations in these countries have been ceased for several years.

According to the FAO, nearly 54,000 tonnes of Kuruma prawn were produced through aquaculture in 2017, 97% of which came from China.

Land Area	Ocean Area	Environment	Species	Scientific name	2010	2011	2012	2013	2014	2015	2016	2017
China	Marine areas	Brackishwater	Kuruma prawn	Penaeus japonicus	53 174 *F*	48 604 *F*	47 347 *F*	43 978 *F*	45 367 *F*	44 376 *F*	55 368	52 466
France	Marine areas	Brackishwater	Kuruma prawn	Penaeus japonicus	50	44	44 *F*	47	58	62	60 *F*	60 *F*
Japan	Marine areas	Marine	Kuruma prawn	Penaeus japonicus	1 634	1 598	1 596	1 596	1 582	1 314	1 381	1 400
Korea, Republic of	Marine areas	Marine	Kuruma prawn	Penaeus japonicus	0 -	0 -	0 -	0 -	0 .	0 .	0 -	0 -
Taiwan Province of China	Marine areas	Brackishwater	Kuruma prawn	Penaeus japonicus	172	178	96	60	24	50	18	17
		Marine	Kuruma prawn	Penaeus japonicus	0 -	0 -	0 -	0 -	0 -	0 .	0 .	0 .
	Sub-total Marine areas				172	178	96	60	24	50	18	17
Total Taiwan Province of China					172	178	96	60	24	50	18	17
Grand total					55 030 *F*	50 424 *F*	49 083 *F*	45 681 *F*	47 031 *F*	45 802 *F*	56 827	53 943

Source: FAO Fish Stat (http://www.fao.org/fishery/statistics/global-aquaculture-production/en)
* the scientific name has been updated to *Marsupenaeus japonicus*

CHINA

In China, Kuruma prawn was first farmed in the Zhejiang, Fujian and Guangdong Provinces in 1988 (Li, Jiang and Wang, 2014). Farming of this species quickly expanded throughout coastal areas of China, particularly in the north, and achieves the highest market price of all shrimp and prawns grown in the country. Despite its high value, the Kuruma prawn represents a small portion of total Chinese shrimp aquaculture production, due to the need for low stocking densities required for survival.

Pond culture is the primary method for farming Kuruma prawn in China, though mariculture is becoming more popular and experiments with 'layered' farming are taking place (Li, Jiang and Wang, 2014). After disease devastation of the 1990s, *M. japonicus* was one of several species turned to for rebuilding the industry in the early 2000s; *Litopenaeus vannamei* took off due to biological characteristics, but Kuruma production continues thanks to its high market price (p.161, Zhang et al., 2015).

Data regarding specific production details and trade from China is notoriously difficult to locate, as much of this government information is not publicly available. Further, what is available is often misreported. For instance, "not only do both wild and farmed shrimp contribute [to trade flows], but the names of species are also inconsistent. Terms used for different species of shrimp and prawn are often confused, such as *P. monodon*, *F. chinensis* and *M. japonicus* being

categorised as *prawn* and *L. vannamei* as *shrimp* in the FAO aquaculture production and trade database (FAO 2010b)" (Zhang et al. 2015).

Risk Assessment

- Farm Siting: Medium Risk
    - Planning laws are in place, but don't completely mitigate all risks concerned with farm siting.
    - As described in China's national fisheries and aquaculture legislation, the Fisheries Law of the People's Republic of China, Chapter 2, any individual wishing to engage in aquaculture must apply for a permit.
- Nutrient Pollution: Medium Risk
    - There is some monitoring of water quality and feed use, though not to any prescribed standard. Monitoring records are incomplete. The cumulative impacts of nutrient pollution from neighbouring farms in the area are not taken into account during site planning.
    - The effluent produced by shrimp farms has been well documented, but there is no information regarding nutrient pollution specifically from Kuruma prawn farms in China.
    - It is also recognized that smaller aquaculture operations do not keep records. However, Kuruma prawn is a species requiring low stocking density and careful management of environmental conditions to ensure survival, so it is reasonable to assume adequate water quality and feeding are observed.
    - Though seafood certifications are slowly taking root in China, there are no certified Kuruma prawn farms listed with BAP or ASC.
- Feed Source: High Risk
    - The source of feed is undocumented or shown to come from an unsustainable fishery.
    - The source of feed for Kuruma prawn farm raised in China is unknown.
- Disease, medicine, chemicals: Medium Risk
    - The farm can evidence that medicines and chemicals are legal, though records incomplete.
    - The medicine and chemicals used in Kuruma prawn farming in China is unknown, but antibiotic use in shrimp farming is widespread.
- Introductions, genetics: Low Risk
    - While there is risk for escapees, the species is native to the region.
- Wild seed: High Risk
    - The operation relies on wild seed collection and is likely having an impact on wild population(s) of the species.
    - Kuruma prawn aquaculture still largely depends on wild caught stocks (Liu, Zheng and Liu, 2018).
- Fish Welfare: Low Risk
    - The operation demonstrates good animal husbandry appropriate to the cultivated species.

- Considering the biological needs of Kuruma prawn, it can be assumed that the animal's welfare is high priority: this species requires low stocking densities and proper aeration in order to survive.
- This species if often transported live, or frozen.

JAPAN

Kuruma prawn, or kuruma-ebi as it is known locally, is an important species to Japan both as a wild caught fishery and in aquaculture. It is the most valuable of commercially caught shrimps, though wild capture production peaked in the 1980s and has steadily declined since 1989 (FAO FishStat). Since the 1960s, Japan has maintained a Kuruma prawn stocking program in order to keeps its capture fishery ongoing, applying aquaculture hatchery technology for the release of juveniles.

Aquaculture production of Kuruma prawn in Japan began in 1889 with hatching and rearing in ponds (FAO 2006-2020), a technique which has since been transferred to China, Southeast Asia, India, and Latin America for shrimps. Natural seawater ponds enclosed with embankments or nets are still the primary method of production for Kuruma prawn, although some land-based tanks exist.

The primary export markets for Japan's aquaculture products include Hong Kong, the United States, Thailand, and Singapore. However, a niche market for kuruma-ebi has developed in Japan where it is a popular delicacy and fetches a high price – much production is consumed domestically, sent to Tokyo and other large cities. In Japan, seafood products are brought to wholesale markets across the country through fisheries cooperative associations or procured by brokers, then sold by auction. This strategy makes it difficult to specify just how much Kuruma prawn is being exported, and to where.

Risk Assessment

- Farm Siting: Low Risk
  - Effective planning laws in place that ensure farms have been situated in a way that minimizes impact on the local environment, also considering siting in relation to other farms.
  - Japan's Law to Ensure Sustainable Aquaculture Production "seeks to prevent the self-induced environmental deterioration around fish farms," (FAO 2004-2020) with Basic Guidelines issued by the national government.
  - Further, Fisheries Cooperative Associations, whose members are made up of fishermen responsible for properly managing their resource, are also responsible for developing Aquaculture Ground Improvement Programmes, to be approved by prefectural authorities.
  - While natural ponds are still common, land based intensive tanks are also used.
- Nutrient Pollution: Medium Risk
  - There is some monitoring of water quality and feed use; monitoring records are incomplete.
  - As with any aquaculture operation, nutrients are released into the environment through the rearing and feeding of aquatic animals. Kuruma prawn are very

susceptible to changes in environment, and die offs have occurred with increases in temperature and pH levels.

- Feed source: Medium Risk
    - The farm can evidence that >50% of the feed comes from a responsible source, either certified or in a FIP.
    - A formulated diet for Kuruma prawn was developed in the 1980s. Artemia and rotifers are used.
    - Kuruma prawn require high amounts of protein, increasing costs for feed as well as potential for unsustainable ingredients.
- Disease, medicine, chemicals: Medium Risk
    - The farm can evidence that medicines and chemicals are legal, though records are incomplete.
    - With the commercialization of Kuruma prawn farming in Japan in the 1980s came the spread of disease; vibriosis is still an issue in Japan and treated with vaccination.
- Introductions, genetics: Low Risk
    - The farm operation does not pose a risk to native populations as the species is already native to the country and farmed species genetics unlikely to establish in the wild.
    - While there is risk for escapes, the species is native to the region and Japan intentionally releases hatchery raised juvenile prawns as part of a stocking program. Farming poses no further risk.
- Wild Seed: Medium Risk
    - The operation relies on wild seed collection though the wild population is healthy/some management is in place.
    - Kuruma prawn farming in Japan makes use of wild caught seed as well as hatchery raised seed from wild caught broodstock.
    - While the wild population has been historically overexploited, and the wild fishery is much smaller than in the past, stock enhancement programs are in place to aid the recovery of wild populations.
- Fish Welfare: Low Risk
    - The operation demonstrates good animal husbandry appropriate to the cultivated species.
    - Considering the high prices that can be achieved for Kuruma prawn in Japan, it is in the farmers' best interest to properly manage the species. Care is taken to provide a healthy diet and to transport without damage to the prized stripes and coloring of the Kuruma prawn.

FRANCE

A small amount of Kuruma prawn farming takes place in France, where oyster farmers have been able to utilize their marshy flats for both species. Culture of *M. japonicus* began in French Polynesia and subsequently in France in the 1980s. The industry exists on France's west coast, extending as far north as Brittany. The Kuruma prawn is farmed semi-extensively in brackish water lagoons and several hatcheries exist along that stretch of coast providing larvae that are reared from May to October (Quigley et al., 2013).

Risk Assessment

- Farm Siting: Low Risk
    - France manages inland and marine aquaculture with separate regulations; all shellfish producers must join the National Committee for Shellfish Culture.
    - Conducting marine aquaculture requires authorization, may involve a public inquiry, and "The advice of the following authorities is required: tax authority, local health service, consumers' service, French Research Institute for Exploitation of the Sea (IFREMER), concerned Municipal Authorities and relevant professional organizations. The final opinion is given by the local Commission for Marine Aquaculture," (FAO 2005-2020, France).
    - Shellfish farming does not require an Environmental Impact Assessment with study, but rather an Environmental Impact Notice, which "must identify possible impacts on the environment and determine the conditions under which the project can avoid them." (FAO 2005-2020, France).
- Nutrient Pollution: Unknown
    - Kuruma prawn are raised in a natural system, and it is unclear if nutrient runoff is a problem.
- Feed Source: Low Risk
    - Kuruma prawn grown in the marshes of France feed on naturally occurring organisms in the environment.
- Disease, medicine, chemicals: Unknown
    - France regulates which medicines and chemicals can be used for veterinary and aquaculture purposes.
- Introductions, genetics: Medium Risk
    - There is a high risk of escapes from the farm and these are likely to establish themselves and compete with native species/populations.
    - Kuruma prawn is considered an invasive species in the Mediterranean, and there is evidence that is has outcompeted the native penaid species *Melicertus kerathurus.*
    - It has been confirmed that Kuruma prawn has been identified in waters of the North Atlantic around the UK, though there is no indication of natural reproduction (Quigley et al. 2013).
- Wild Seed: Medium Risk
    - While several hatcheries exist in the Kuruma farming region of France, it is unclear whether the broodstock used to produce seed are wild caught in the region or shipped from Japan.
- Fish Welfare: Medium Risk
    - Kuruma prawn is shipped live.

Taiwan

Taiwan is noted as one of the four main producers of *Marsupenaeus japonicus*, according to FAO aquaculture production data. Research and development of shrimp aquaculture was significantly advanced in Taiwan in the late 1960s, and in fact led to the widespread production of Kuruma that now occurs in Japan. A number of shrimp species are produced in Taiwan, including

Kuruma prawn, primarily cultured in land-based ponds in the islets and lagoons along the coastline. Shrimp are often raised in a polyculture system with fish species.

References

FAO CATALOGUE Vol.1 - Shrimps and Prawns of the World. An Annotated Catalogue of Species of Interest to Fisheries.L.B. Holthuis 1980. FAO Fisheries Synopsis No.125, Volume 1.

FAO 2005-2020. National Aquaculture Legislation Overview. France. National Aquaculture Legislation Overview (NALO) Fact Sheets. Text by D'Andrea, A. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 1 February 2005.

FAO 2006-2020. National Aquaculture Sector Overview. Japan. National Aquaculture Sector Overview Fact Sheets. Text by Makino, M. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 11 July 2017.

FAO 2004-2020. National Aquaculture Legislation Overview. Japan. National Aquaculture Legislation Overview (NALO) Fact Sheets. Text by Spreij, M. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 15 November 2004.

Li, Y., Jiang, L. & Wang, R. Layered farming for Marsupenaeus japonicus Bate. Chin. J. Ocean. Limnol. 32, 549–553 (2014). https://doi.org/10.1007/s00343-014-3112-8

Liu, Jiahui, et al. Genetic Parameters for Growth-Related Traits and Survival with Age in the Kuruma Shrimp Marsupenaeus Japonicus. Aquaculture Research, vol. 50, no. 1, pp. 42–48. (2018). doi:10.1111/are.13862.

Momoyama, K., & Muroga, K. (2005). Diseases of Cultured Kuruma Shrimp in Japan: a Review. Fish Pathology, 40(1), 1–14. doi: 10.3147/jsfp.40.1

Quigley, Declan & Herdson, Douglas & Flannery, Kevin. (2013). Occurrence of the kuruma prawn Marsupenaeus japonicus (Spence Bate, 1888) in the Celtic Sea, English Channel, and North-West France. BioInvasions Records. 2. 57-61. 10.3391/bir.2013.2.1.10.

Zhang, Wenbo, et al. A Comparative Analysis of Four Internationally Traded Farmed Seafood Commodities in China: Domestic and International Markets as Key Drivers. *Reviews in Aquaculture*, vol. 9, no. 2, 2015, pp. 157–178. (2015) doi:10.1111/raq.12110.