# Vietnamese Prawn Exports to Australia
## Environmental and Social Risk

Compiled by Blueyou Consulting LTD

Australian Marine Conservation Society

blueYou®

This report was produced by BlueYou for the Australian Marine Conservation Society.

This report and its key findings reflect the opinion of the authors which made their statements and recommendations according to their best knowledge and up-to-date public information available.

# Table of Contents

## Abbreviations and acronyms

| | |
|---|---|
| AMCS | Australian Marine Conservation Society |
| ASC | Aquaculture Stewardship Council |
| BAP/GSA | Best Aquaculture Practices, a certification scheme run by Global Seafood Alliance |
| EU | European Union |
| FRDC | Fisheries Research and Development Corporation |
| LCA | Life Cycle Analysis |
| PL | post larvae |
| USD | US dollars |
| VASEP | Vietnamese Association of Seafood Exporters and Producers |
| WSSV | White Spot Syndrome Virus |
| YHV | Yellow Head Virus |

# 1. EXECUTIVE SUMMARY

Next to tuna, prawns are the most important seafood item consumed by Australians. Current annual import volumes are in the range of 40,000 tonnes at an estimated import trade value of US$320 million, which makes frozen prawns the most valuable seafood product commercialised in Australia. For Australian consumers, prawns are a popular seafood item: the annual per capita consumption of prawns amounts to more than 1.5 kilograms per person[1], which is at the same level as French consumers, but lower than Japan (1.8 kilograms), USA (2.7 kilograms) and Spain (3 kilograms), the three nations with the highest consumption.

Today, prawns are one of the most important global food commodities and, in terms of international trade value, the leading seafood item worldwide. In 2022, the estimated global production of prawns reached a record 9.4 million tonnes, with 37 percent wild-caught in fisheries and 63 percent farmed, mainly in Latin America and Asia.[2] Over the past decade, Vietnam became the leading supplier of farmed prawns into Australia and now more than two-thirds of prawns consumed in Australia are packed and shipped by Vietnamese exporters. While the majority of these prawns are farmed in Vietnam, some may originate from other countries, such as India and Ecuador, as Vietnam is a key importer and processor for seafood. In 2022, Australian importers received a total of 35,120 tonnes of frozen prawns from Vietnam. This import trade has been increasingly dominated by one single species: according to official trade statistics from Vietnam, 99% of Australian frozen prawn imports in 2022 were vannamei prawns *(Penaeus vannamei).* This species – originally inhabiting coastal waters of the Central American Pacific coast and introduced to Vietnam – has become the key species of the farmed prawn industry and is the biological basis for the ongoing intensification and increased production output in the global farmed prawn sector.

Farming and processing of prawns is associated with multiple environmental and social risks, affecting people and the environment both directly at the location of farming and product manufacturing as well as indirectly, through the ingredients and global supply chains of feedstuffs applied. The Australian import of prawns from Vietnam is based on an estimated farm gate harvesting volume of 70,000 tonnes of head-on prawns per year. To raise and harvest such a volume of prawns, more than 110,000 tonnes of feed needs to be manufactured and applied, containing 45,000 tonnes of soya (mostly imported from South America) and 22,000 tonnes of fishmeal from various sources in Asia and South America. For the manufacturing of the fishmeal component of the prawn's diet, more than 100,000 tonnes of fish raw material is required every year. The overall carbon footprint of prawns imported into Australia from Vietnam is estimated at 245,000 tonnes of $CO_2$ equivalents, significantly contributing to the footprint of Australians' food consumption.

The spectrum of impacts can vary widely from farm to farm, even for those in similar areas using similar farming systems. In general, prawns with the lowest environmental risk are those which have been raised without feed or fertilisers in smaller, nature-based aquaculture systems, such as integrated mangrove farms or polyculture systems with rice paddies, and independently verified and certified to organic or Aquaculture Stewardship

1 Based on a population of 25.7 million Australians and linearly distributed, the per capita consumption of imported prawns amounts to 1.55 kg per person. Prawns consumed from domestic sources are not included.

2 FAO (2022). Global farmed shrimp production increased in 2022 despite low demand. GLOBEFISH Trade and Market News, Q1 2023 Jan–March, 20 February 2023. UN Food and Agriculture organisation (FAO), Rome, Italy. https://www.fao.org/in-action/globefish/news-events/trade-and-market-news/q1-2023-jan-mar/en/

Council (ASC) standards. These nature-based, traditional farming systems operated by small-scale farmers are not associated with the negative impacts of intensive, feed-based prawn farms, which lead to accumulation of excess nutrients, organic pollutants and chemicals in aquatic water bodies and local coastal ecosystems through farm effluents and discharges. Also, as no feed is applied in such farming systems, risks associated with feed use and supply chains are absent, including environmental degradation, high carbon footprint, and sourcing from illegal, unreported and unregulated (IUU) fisheries. Prawns produced in intensive aquaculture systems, with high stocking densities and high use of aquaculture feeds, and no certification, carry the highest risk of environmental harm.

While certification is not a guarantee of high environmental and social standards at the farm level, independent verification and auditing by a credible and robust aquaculture certification scheme can mitigate many of the negative effects of the farmed prawn industry, particularly with regard to the contents of aquafeeds, and help provide more transparent and traceable seafood supply chains.

# 2. GLOBAL PRAWN MARKET: OVERVIEW AND INTRODUCTION

## 2.1 OVERVIEW OF GLOBAL PRODUCTION AND TERMINOLOGY

Although shrimp and prawns belong to different suborders of Decapoda, they are very similar in appearance and the terms are often used interchangeably in commercial farming and wild fisheries. Sometimes, a distinction is drawn by using the term 'prawn' only for members of the freshwater palaemonidae family and 'shrimp' for the marine penaeidae family; however, the terms continue to be used inconsistently across the globe. Specifically, Australia and some other Commonwealth nations use the word 'prawn' almost exclusively for all larger sorts of 'shrimp', hence for the purpose of this report the general term 'prawn' is applied when referring to all species of shrimp and prawns. Common names used in this report are those in the Australian Fish Names Standard (AFNS)[3] where available, or Sealifebase if the species is not listed on AFNS.[4]

Prawns are some of the most valuable types of seafood produced and traded globally[5]. In 2022, the estimated global production volume reached a record 9.4 million tonnes, with 37 percent wild-caught in fisheries and 63 percent farmed, mainly in Latin America and Asia.[6] Whereas the global production of farmed prawns has been increasing steadily, the catch of wild prawns has been relatively stable since 2003, fluctuating between about 3.1 million tonnes and 3.4 million tonnes per year.[7, 8]

## 2.2 GLOBAL FARMED PRAWN PRODUCTION AND EXPORT TRADE

During the past decade, global export and trade volume of farmed prawns has been increasing from 1.8 million tonnes in 2012 to a record high of 3.1 million tonnes in 2022. Today, the largest producers of farmed prawns are Ecuador (1.14 million tonnes), India (700,000 tonnes) and Vietnam (380,000 tonnes) (Figure 1).[9]

Virtually all farmed prawns are of the Penaeidae family, with vannamei prawns (*Penaeus vannamei*) accounting for over half of the total global prawn production in 2022.[10] The

3 FRDC (2024). Knowledge Hub: Standards – Australian Fish Names Standards. Fisheries Research and Development Corporation (FRDC), Australia. Website. https://www.frdc.com.au/knowledge-hub/standards/australian-fish-names-standard

4 Palomares, MLD, Pauly D (Eds) (2024). SeaLifeBase website. www.sealifebase.org, version. https://www.sealifebase.org

5 Rabobank, 2022. https://www.seafoodsource.com/news/supply-trade/rabobank-global-seafood-trade-value-rebounds-to-usd-164-billion

6 FAO (2022). Global farmed shrimp production increased in 2022 despite low demand. GLOBEFISH Trade and Market News, Q1 2023 Jan–March, 20 February 2023. UN Food and Agriculture organisation (FAO), Rome, Italy. https://www.fao.org/in-action/globefish/news-events/trade-and-market-news/q1-2023-jan-mar/en/

7 FAO (2022). The State of World Fisheries and Aquaculture 2022 (SOFIA). Towards Blue Transformation. UN Food and Agriculture organisation (FAO), Rome, Italy. https://www.fao.org/3/cc0461en/cc0461en.pdf

8 FAO (2022). Global farmed shrimp production increased in 2022 despite low demand. GLOBEFISH Trade and Market News, Q1 2023 Jan–March, 20 February 2023. UN Food and Agriculture organisation (FAO), Rome, Italy. https://www.fao.org/in-action/globefish/news-events/trade-and-market-news/q1-2023-jan-mar/en/

9 ITC trademap (2023). https://intracen.org/resources/tools/trade-map

10 FAO (2022). Global farmed shrimp production increased in 2022 despite low demand. GLOBEFISH Trade and Market News, Q1 2023 Jan–March, 20 February 2023. UN Food and Agriculture organisation (FAO), Rome, Italy. https://www.fao.org/in-action/globefish/news-events/trade-and-market-news/q1-2023-jan-mar/en/

black tiger prawn (*P. monodon*) is the other dominant species. Other common farmed prawn species include giant river prawn (*Macrobrachium rosenbergii*), Oriental river prawn (*M. nipponense*), blue prawn (*P. stylirostris*), fleshy prawn (*P. chinensis*), Kuruma prawn (*P. japonicus*), redleg banana prawn (*P. indicus*) and banana prawn (*P. merguiensis*).

Global production of farmed prawns during the first half of 2023 was impacted by increased production costs through higher feed raw material prices, falling ex-farm and import prices, and reduced demand from traditional western markets, Japan and Australia.[11] The trend continued into the third quarter of 2023, and the total production in 2023 is expected to be 1 percent lower than in 2022, with an increase in production forecast in 2024.[12]

**"Vannamei prawns accounted for over half of the total global prawn production in 2022."**

Overall, in the global farmed prawn industry, as for aquaculture more broadly, there is a clear trend towards intensification of farming systems[13] and a further trend towards introduction of vannamei prawns as the new key species – this transformation is currently happening in Indonesia, India and Bangladesh – and may lead to a global increase of production volumes accordingly.

11 FAO (2023). Shrimp market bleak. GLOBEFISH Market Reports, 18 September 2023. UN Food and Agriculture Association (FAO), Rome. https://www.fao.org/in-action/globefish/market-reports/resource-detail/en/c/1650814/

12 FAO (2023). Strong demand in China upholds global shrimp trade in 2023. GLOBEFISH Market Reports, 9 November 2023. UN Food and Agriculture Association (FAO), Rome. https://www.fao.org/in-action/globefish/market-reports/resource-detail/en/c/1661951/

13 FAO (2022). The State of World Fisheries and Aquaculture 2022 (SOFIA). Towards Blue Transformation. UN Food and Agriculture organisation (FAO), Rome, Italy. https://www.fao.org/3/cc0461en/cc0461en.pdf

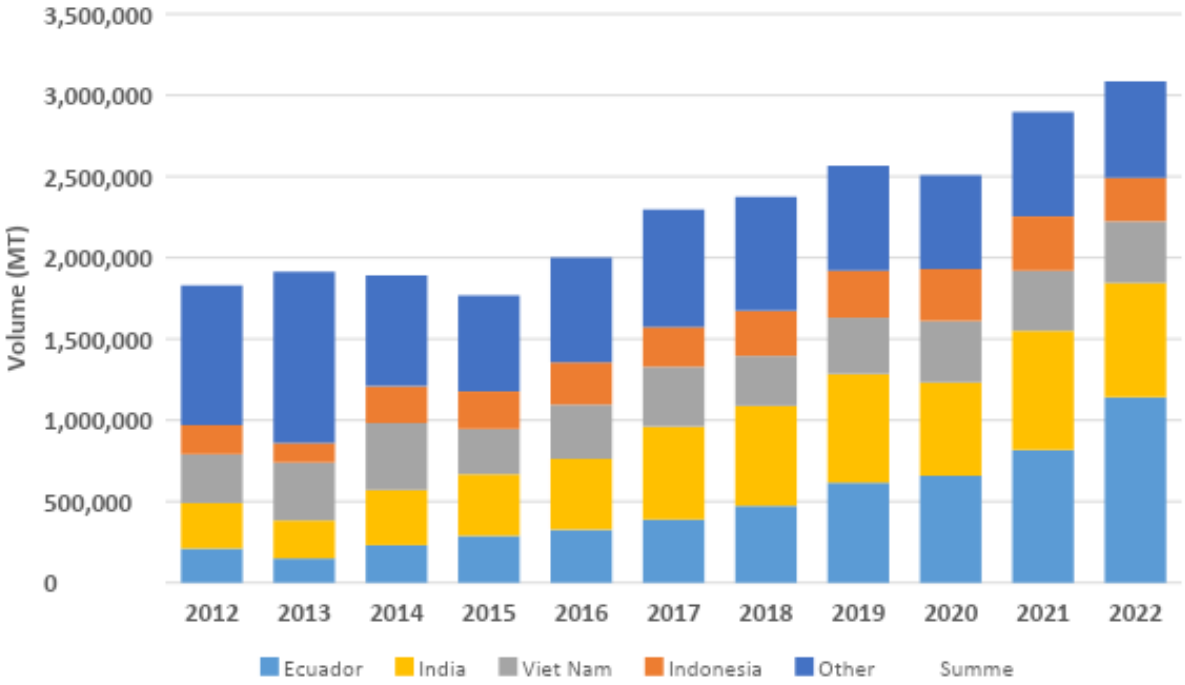


**Figure 1:** Global export trade volume (tonnes) of prawns from aquaculture 2012–2022 (Source: ITC Trademap[14])

14 ITC trademap (2023). https://intracen.org/resources/tools/trade-map

# 3. AUSTRALIAN MARKET FOR PRAWNS

## 3.1 OVERVIEW

According to Australia's limited publicly available imports data, in 2022, Australia imported 38,150 tonnes of prawns, the second biggest seafood species group after tunas.[15] The main source for imported prawns is Vietnam, which has been exporting increasing amounts to Australia over the past 5 years. In 2022, 67% of prawns imported to Australia (25,635 tonnes) were coming from Vietnam – four times more than from Thailand (5,893 tonnes), the next main country of origin for prawns. China (3,375 tonnes), Malaysia (1,768 tonnes) and New Caledonia (363 tonnes) were the other top exporters of prawns to Australia in 2022 (Figure 2).

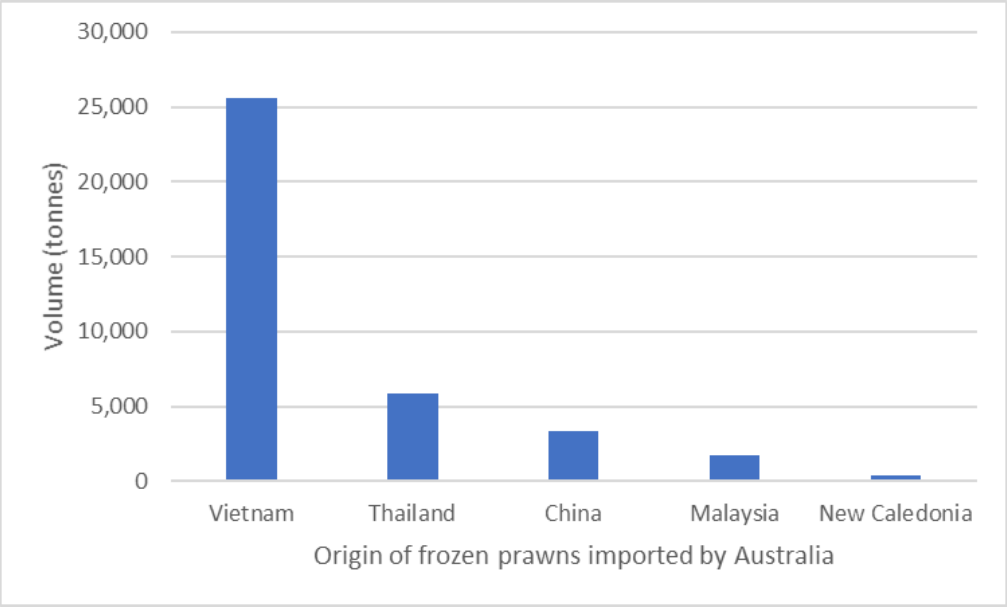


**Figure 2:** Volume (tonnes) of frozen prawns imported into Australia from the top five countries of origin in 2022 (Source: FRDC 2023[16]).

**"More than two thirds of the prawns consumed in Australia are packed and shipped by Vietnamese exporters. Of these, 99.7% are vannamei prawns."**

It is important to note here that Vietnam is both a major processing hub as well as a producer of farmed prawns. Not all prawns manufactured and exported by Vietnam have been farmed in Vietnam. This is specifically true for vannamei prawn products, where during the first six months of 2023, Vietnam imported bulk frozen, head-on products from Ecuador (1,347 tonnes) and India (8,499 tonnes) for processing and value-adding in Vietnam.[17]

15 FRDC (2023). Seafood Import and export by volume by species. Fisheries Research and Development Corporation (FRDC), Canberra, Australia. https://www.frdc.com.au/seafood-import-and-export-volume-species

16 FRDC (2023). Seafood Import and export by volume by species. Fisheries Research and Development Corporation (FRDC), Canberra, Australia. https://www.frdc.com.au/seafood-import-and-export-volume-species

17 Vietnamese custom data in the first six months of 2023.

There are no global trade statistics available on this subject, and existing food labelling and traceability regulation does not address such raw material trade adequately, except for seafood certification programs which integrate a robust chain of custody standard within their verification and auditing scheme.

## 3.2 AUSTRALIAN IMPORT AND BIOSECURITY REGULATION FOR PRAWNS

Import of prawns into Australia is subject to specific import and biosecurity regulations by the Australian government (Department of Agriculture, Fisheries and Forestry).[18] Increased biosecurity measures are in place for importing uncooked prawns and prawn products for human consumption to facilitate the safe trade of prawns while meeting Australia's appropriate level of protection.

From 7 July 2017, uncooked prawns, marinated prawns, and Australian prawns processed overseas in a non-Australian government audited supply chain have been consolidated into one product class, 'uncooked prawns'. All prawn imports were required to be frozen, and exporting countries had to confirm that this new class of uncooked prawns had been tested and found to be free of White Spot Syndrome Virus (WSSV) and Yellow Head Virus (YHV). On 18 October 2023, following a government review, a further eight viral and bacterial pathogens were added to this list.[19] Uncooked prawns are subject to 100 percent secure seals intact inspection on-arrival in Australia and must again test negative for pathogens at an Australian screening laboratory before they can be released from biosecurity control.

The Australian biosecurity regulation therefore promotes the import of cooked, ready-to-eat prawns and prawn products, as such products do not need to undergo expensive and complex screening for disease in the countries of origin. Also, the regulation favours sourcing of prawns from vertically integrated, industrial, and intensive farming operations, as these can offer higher efficiency in bio-security screening of farm origins, as opposed to extensive prawn farming systems involving many small-scale farming communities dispersed in a larger area.

## 3.3 AUSTRALIAN PRAWN IMPORTS FROM VIETNAM

According to trade data from Vietnam, the total volume and value of prawns imported from Vietnam into Australia has been strongly increasing over the past years and reached a volume of 35,120 tonnes in 2022 at an export value of US$209 million (Figure 3, Appendix Table 1).

18 DAFF (2023). Prawn imports and biosecurity. Department of Agriculture, Fisheries and Forestry (DAFF), Australian Government, Canberra. https://www.agriculture.gov.au/biosecurity-trade/policy/risk-analysis/animal/prawns/prawn-imports-and-biosecurity

19 DAFF (2023). Animal Biosecurity Advice 2023-A06: Final report for the prawn review. Department of Agriculture, Fisheries and Forestry (DAFF), Australian Government, Canberra. https://www.agriculture.gov.au/biosecurity-trade/policy/risk-analysis/memos/ba2023-a06

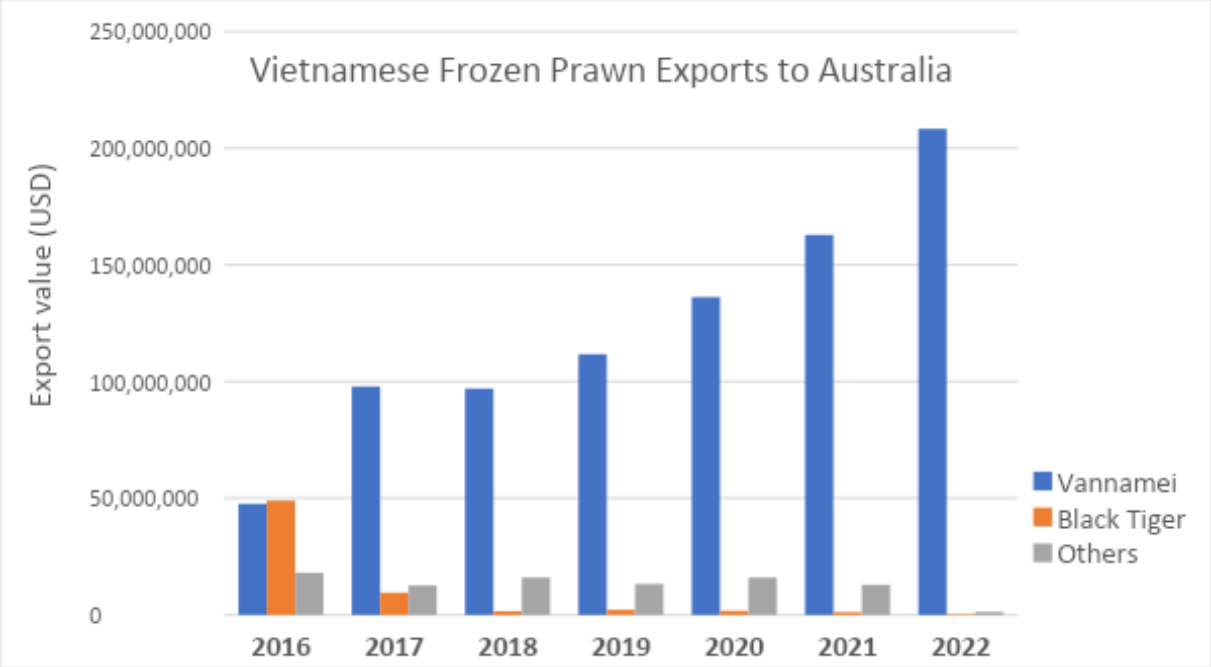


**Figure 3:** Export value (USD) of frozen prawns from Vietnam to Australia in 2016–2022 (Source: VASEP 2023[20])

Black tiger prawns still contributed to half of the total import value in 2016, however, during recent years, the export of black tiger prawns into Australia seems to have come to a complete stop, according to the trade statistics of the Vietnamese Association of Seafood Exporters and Producers (VASEP).[21] This may be due to the devaluation of the Australian dollar and reduced buying power, as the price of vannamei prawns is significantly lower than black tiger prawns, and to the change in biosecurity laws.

Today, almost all imported prawns from Vietnam are vannamei prawns. In 2022, Australian importers shipped a total of 35,120 tonnes of frozen prawns from Vietnam into the Australian market (Table 1).

> **"In 2022, Australia imported 35,120 tonnes of frozen prawns from Vietnam"**

20 VASEP (2023). Vietnamese Association of Seafood Exporters and Producers (VASEP) website. https://seafood.vasep.com.vn

21 VASEP (2023). Vietnamese Association of Seafood Exporters and Producers (VASEP) website. https://seafood.vasep.com.vn

**Table 1:** Species composition of prawns exported to Australia from Vietnam by volume (kg) in 2022 (Source: VASEP).

| Species common name* | Scientific name(s) | Export volume (kg) |
|---|---|---|
| Vannamei prawn | *Penaeus vannamei* | 34,919,050 |
| Red endeavour prawn | *Metapenaeus ensis* | 106,864 |
| Banana prawns | *Penaeus indicus, Penaeus merguiensis* | 51,000 |
| Black tiger prawn | *Penaeus monodon* | 26,191 |
| Tiger prawn; grooved tiger prawn | *Penaeus esculentus*; *Penaeus semisulcatus* | 6,440 |
| Slipper lobsters | Scyllaridae family | 4,590 |
| Blue endeavour prawn | *Metapenaeus endeavouri* | 3,880 |
| Western king prawn | *Melicertus latisulcatus* | 2,030 |
| Moreton Bay bugs | Various species of *Thenus* genus | 330 |
| Prawns (unspecified) | Various | 6 |
| **TOTAL for all** | | **35,120,381** |

*according to the Australian Fish Names Standard

## 3.4 VIETNAMESE EXPORT COMPANIES FOR AUSTRALIAN MARKET

More than 30 Vietnamese companies manufacture and export frozen prawn products to Australia. However, there has been a certain level of consolidation as the top five companies have a combined export share of 56 percent in terms of value (Table 2).

**Table 2:** Leading Vietnamese exporters of frozen prawns to the Australian market in 2020 (Source: VASEP 2023)

| Company Name | Export Value (USD) | Market Share (percent) |
|---|---|---|
| Minh Phu Hau Giang Seafood Joint Stock Company | 26,463,000 | 14.6 |
| Minh Phu Seafood Corporation (MINH PHU CORP) | 23,181,000 | 12.8 |
| Agrex Saigon Foodstuffs Joint Stock Company | 22,291,000 | 12.3 |
| CASES | 17,024,000 | 9.4 |
| Seavina Joint Stock Company (SEAVINA) | 12,670,000 | 7.0 |
| Sao Ta Foods Joint Stock Company (FIMEX) | 10,960,000 | 6.1 |
| O&H Loong Pty Ltd | 10,418,000 | 5.8 |
| Viet Uc Ocean Import Export Company | 9,800,000 | 5.4 |
| Khanhsung Co. Ltd | 5,074,000 | 2.8 |
| Trung Son Seafood Processing | 4,983,000 | 2.8 |

## 3.5 AUSTRALIAN IMPORTERS FOR VIETNAMESE PRAWNS

Frozen prawn products from Vietnam are imported into Australia through five seaports: Sydney, Melbourne, Brisbane, Fremantle, and Adelaide. The top ten largest importers of frozen prawns from Vietnam make-up more than 75 percent of the total import volume into Australia (Table 3).

**Table 3:** Top 10 Australian importers of frozen prawns from Vietnam 2022 (Source: VASEP).

| Company Name | Volume (tonnes) | Import value (USD) |
|---|---|---|
| L & FS Global Trading Pty Ltd | 5,216 | 58,944,178 |
| Loong Phoong Pty Ltd | 1,010 | 11,107,228 |
| Amanda Seafood Private Ltd | 907 | 9,062,872 |
| Bidfood Australia Ltd | 881 | 10,569,524 |
| Lay N Lucas Pty Ltd | 682 | 8,208,604 |
| Markwell Pacific Marketing Pty Ltd | 604 | 7,774,174 |
| Viet Rose International Pte Ltd | 537 | 8,055,422 |
| Oceania Sea Products Pty Ltd | 524 | 6,585,722 |
| Farmsea Food Pte Ltd | 521 | 6,271,427 |
| Chen Foods Group | 462 | 2,498,446 |

# 4. ENVIRONMENTAL AND SOCIAL RISKS OF PRAWNS FROM VIETNAM

Prawns from both farmed and wild-caught origins come with various environmental, social and governance risks (ESG), which have been characterised and addressed by many non-governmental organisations over the past two decades.[22] When assessing ESG risks associated with the import of frozen prawns for the Australian market, the farmed prawn sector of Vietnam is the most relevant source.

As noted above, however, prawns imported to Australia from Vietnam could come from other producing countries, such as India and Ecuador. While it is beyond the scope of this report to assess the risks of sources outside Vietnam, it is pertinent to note recent reports highlighting significant social and environmental problems with prawn farming and processing in India.

The Corporate Accountability Lab documented an extensive, multi-year investigation that exposed pervasive systemic abuses throughout the Indian prawn supply chain, from hatcheries and farms to processing facilities.[23] Standard practices include exploitation of vulnerable lower caste and migrant populations, dangerous working conditions, workers prevented from leaving guarded company housing, debt bondage, destruction of essential mangrove and wetland habitats, and pollution of community water supplies.

The Outlaw Ocean project, with the help of a whistleblower, exposed a variety of food safety and labour violations at an Indian prawn processing unit, including that the company knowingly and illegally exported shrimp that had tested positive for antibiotics to the USA in violation of US federal law.[24] Both these reports highlighted that auditing processes run by aquaculture certification programmes are failing to identify and prevent these issues.

## 4.1 DIRECT ENVIRONMENTAL RISKS OF THE PRAWN FARMING SECTOR IN VIETNAM

Generally speaking, when it comes to direct, local environmental risks, the Vietnamese farmed prawn sector is no different from other origins of farmed prawn in Asia or Latin America: farming prawns has multiple direct impacts on the local environment, and the ongoing intensification of the industry is increasing these risks accordingly.[25] The negative consequences of prawn farming are partly due to the lack of effective regulation, monitoring, and enforcement, and the absence of carrying capacity and functional zonal planning in major areas of prawn farming.

### Habitat Impacts

Prawn farms may be established on land that has been converted from other use. This is critical when the conversion involves original, sensitive habitats such as wetlands and mangroves. The prawn farming sector in Vietnam, as elsewhere, has been and

22 For example: WWF (2017). A business case for Improved Environmental Performance in South East Asian Shrimp Aquaculture. World Wildlife Fund (WWF). https://www.worldwildlife.org/publications/a-business-case-for-improved-environmental-performance-in-southeast-asian-shrimp-aquaculture

23 Corporate Accountability Lab (2024). Hidden Harvest: Human Rights and Environmental Abuses in India's Shrimp Industry. Corporate Accountability Lab. https://corpaccountabilitylab.org/hidden-harvest

24 The Outlaw Ocean Project (2024). India Shrimp: A Growing Goliath. The true cost of a cheap appetizer. The Outlaw Ocean Project website. https://www.theoutlawocean.com/investigations/india-shrimp-a-growing-goliath/

25 Osborne Z (2018). Pushing Vietnam's shrimp industry toward sustainability. Mongabay, 17 July 2018 https://news.mongabay.com/2018/07/pushing-vietnams-shrimp-industry-toward-sustainability/

> **"Prawn farming has multiple direct impacts on the local environment, and the ongoing intensification of the industry is increasing these risks accordingly"**

still is subject to critical conversion and destruction of sensitive habitats, despite existing legislation for the conservation of valuable wetlands and mangroves.[26] During the period of 2000–2014, prawn production pond water surface area in Vietnam increased by 274,792 ha correspondent to the loss of mangrove forest area of 2,861 ha.[27] Such conversion not only has a direct negative impact on local biodiversity, but also on the overall resilience of coastal habitats and the ability of such areas for capturing and storage of carbon, further contributing to climate change.

**Effluent and Discharges**

The continuous intensification of prawn farming is based on the application of energy-dense feedstuffs and a multitude of chemicals which are required to prepare ponds for stocking, eradicate potential disease vectors and predators, and stabilise and continuously maintain water quality parameters in line with the conditions required for intensive stocking of prawns. Ultimately, feed-based aquaculture has similar negative impacts on the local environment as other forms of animal husbandry on land: through feed and fertilisers, excess nitrogen, phosphorous and other metabolites are discharged into the aquatic environment, leading to eutrophication and accumulation of these critical compounds in the water body and sediments. Additionally, applied chemicals and therapeutic agents (e.g. disinfectants, antibiotics) find their way into the local environment and food webs, destabilising aquatic ecosystems and impacting biodiversity and resilience of habitats.

**Salinization**

The proliferation of marine prawn farming into freshwater habitats and agricultural land may be accompanied by salination of fresh surface water and aquifers, threatening the long-term fertility of soils and the ability of farmers to grow vital crops for local needs and food security. The salinization of agricultural land in southern Vietnam is currently occuring, due to a combination of changes in the flow dynamics of the Mekong River system (construction of dams in China), changing rain and weather patterns, and the introduction of marine prawn farming in various provinces in Vietnam.[28]

**Status and Impact on Wild Stocks**

Aquaculture of a particular species may negatively impact existing wild populations of the same or similar species. Possible impacts are attributed to the extraction of brood stock from the wild or the proliferation and transfer of disease and parasites from farming

26 GRAISEA (2021). Assessment of economic, social and environmental benefit and climate resilience of shrimp-rice farming practice in the Mekong Delta. Technical report by Gender Transformative and Responsible Agribusiness Investments in Southeast Asia (GRAISEA) for Oxfam. https://beamexchange.org/resources/1599/

27 Boyd CE, Davis RP, McNevin AA (2021). Perspectives on the mangrove conundrum, land use and benefit of yield intensification in farmed shrimp production: A review. Journal of the World Aquaculture Society; 53: 8–46. https://doi.org/10.1111/jwas.12841

28 Xiao H, Tang Y, Li H, Zhang L, Chen D, Tan Q (2021). Saltwater intrusion into groundwater systems in the MKD and links to global change, 2021. Advances in Climate Change Research; 12: 342–352. https://www.sciencedirect.com/science/article/pii/S1674927821000708

operations to wild populations. In the case of the vannamei prawn farming sector of Vietnam, such risks are considered minimal, as there is no local wild population of this species in the western and central Pacific Ocean. In terms of the native black tiger prawn, the impact of the aquaculture industry by catching adult breeders as brood stock for hatcheries is considered minimal, as the quantity of such breeders is rather low and does not significantly contribute to the fishing mortality on local stocks.

## 4.2 IMPACTS ASSOCIATED WITH FEED INGREDIENTS FOR FARMED PRAWNS

In 2022, almost all prawns imported into Australia from Vietnam were vannamei prawns. This species is exclusively raised with feed, as there are no extensive farming systems for vannamei prawns in Vietnam. Hence, the import and consumption of these prawns are associated with a rather large and significant indirect environmental footprint on global scale, through the farming, harvesting, and manufacturing of feed ingredients being used for the prawn feed. A typical prawn feed has a protein content of 45–55 percent and a fat content of 1–1.5 percent.[29] The protein is mostly provided through fishmeal and soya and the fat through fish oil.

The feed-associated environmental footprint relates to impacts on both terrestrial and aquatic ecosystems:

1. **Terrestrial habitat loss and conversion of critical habitat**: Similar to the local impact of land conversion for the prawn farms in Vietnam (wetlands and mangroves), the farming of feed ingredients such as soya leads to the destruction of important habitat such as the rainforest in the Amazon.

2. **Soil degradation, erosion, and loss of biodiversity:** Conventional agriculture of feedstuffs leads to soil degradation, erosion, and loss of biodiversity in the countries of origin.

3. **Use of fertilisers and pesticides:** Conventionally farmed soya and other agriculture feedstuffs require an increasing amount of nitrogen, phosphorus, and pesticides to keep yields high, contributing to the accumulation of these critical compounds in the planet's ecosystems.

4. **Overfishing and critical stock status of marine species:** Fishmeal is still the preferred source of protein in prawn feeds, and this may be sourced from illegal, unreported and unregulated (IUU) fisheries, and fisheries that exploit overfished stocks,have significant bycatch of vulnerable or threatened species, and/or target juveniles from economically important species (see Box 1).

The indirect environmental impacts of Vietnamese prawns imported to Australia, through the feedstuffs applied on supplying prawn farms, are estimated in Table 4.

29 Data from Blueyou Consulting based on field data in Vietnam prawn aquaculture work.

**Table 4:** Estimated prawn feed-related metrics for assessing the environmental footprint of Vietnamese prawns imported into Australia annually. (Figures and metrics are estimated based on Life Cycle Analysis conducted by Blueyou Consulting in 2020 and experience in the Vietnamese prawn industry. Carbon footprint analysis refers to intensive farming of vannamei prawns in Vietnam.)

| Parameter | Feed Impact Metrics | Estimation details |
|---|---|---|
| **Farm gate volume of prawns for Australian market** | 70,000 T | 40,000 tonnes of import, 25% is head-on, 75% headless, average yield for headless is 50% |
| **Volume of prawn feed applied** | 110,000 T | Average FCR 1.6 |
| **Volume of soya as feed ingredient** | 45,000 T | 40% inclusion rate |
| **Volume of fishmeal** | 22,000 T | 20% inclusion rate |
| **Volume of fish oil** | 1,000 T | 1% inclusion rate |
| **Volume of wet fish (for fishmeal and fish oil)** | 100,000 T | 4.5 kg wet weight for 1 kg fishmeal<br>10–12 kg wet weight for 1 kg fish oil |
| **Carbon footprint of head-on farm gate prawn production** | 245,000 tonnes $CO_2$ eq. | 3.5 kg $CO_2$ eq. / kg head-on prawns |

## 4.3 SOCIAL RISKS IN VIETNAMESE PRAWN SECTOR

The global farmed prawn industry has been subject to various criticism in terms of social risk associated with the sector, and this includes farms in Vietnam.[30, 31] Social risks are multifaceted and complex to characterise and quantify, as they involve all production steps along (global) supply chains, including the ingredients in aquafeeds applied on farms.

For the farmed prawn sector in Vietnam specifically, the following social risk areas can be identified:

### Direct Risks of Prawn Farming and Final Product Manufacturing

- Local community-related risk in terms of siting of prawn farms (land use conflicts, displacement of local communities, reduced access to coastal waterways by local community members etc.)
- Labour laws, worker safety and human rights risks at farming level (worker safety, human rights, labour conditions on prawn farms)
- Labour laws and human right risks at harvesting and raw material consolidation level (worker safety, human rights, labour conditions for contract workers)

30 Sammut J, Van Sang N, Van Hao N et al (2020). Improving the sustainability of rice shrimp farming system in the MKD, Vietnam. Australian Centre for International Agricultural Research (ACIAR), Canberra, Australia. https://www.aciar.gov.au/sites/default/files/2021-11/final-report-SMCN-2010-083_0.pdf

31 Impactt (2021). Human Rights Impact Assessment of Tesco's shrimp supply chain in Vietnam, Feb 2021. Tesco, Welwyn Garden City, England, UK. https://www.tescoplc.com/media/758000/hria-of-tesco-s-shrimp-supply-chain-in-vietnam.pdf

- Labour laws and human rights risks at prawn manufacturing level (worker safety, human rights, labour conditions in factories)

- Labour laws and human rights risks at packaging manufacturing level (worker safety, human rights, labour conditions in factories).

**Indirect Risks associated with Feed**

- Human right conflicts, especially impacting local communities and indigenous people in South America (illegal deforestation of rainforest for planting soya, a key feed ingredient)

- Human rights, labour abuses and working conditions on fishing fleets to catch raw material for the aquafeeds industry (forage fisheries and "trash-fish" operations, see Box 1)

- Human rights, labour laws and working conditions in farmed or wild-caught seafood supply chains which produce raw material for aquafeeds (processing by-products such as fish oil from farmed salmon in Chile, farmed pangasius in Vietnam, or fishmeal from processing white fish in Vietnam from North Pacific fisheries, such as Alaskan pollock)

- Labour law and human right risks at feed manufacturing level (workers safety, human rights, labour conditions in factories).

Such indirect, feed-related social risk may be highly critical for a specific supply chain, and only of moderate risk for another supply chain. Obviously, to mitigate such risks, seafood supply chains supporting the feed industry must include transparency, integrity, and traceability (see Section 4.4 below).

Existing aquaculture certification programs are addressing social risk topics in seafood supply chains, but to a varying degree and not in all aspects of the supply chains. In this regard, it is interesting to note the existence of a Fair Trade seafood certification program by Fair Trade USA.[32] So far, this is the only seafood certification program which is addressing social and community-related risks along entire seafood supply chains, for both wild capture fisheries as well as farmed seafood operations.

**Low value or 'trash' fish used as feeds for aquaculture**

Fishes and other marine species used as feeds in global aquaculture come from three main sources:

- Reduction fisheries targeting small pelagic forage species, like anchoveta, sprat, herring, and blue whiting, specifically to be made into fish meal and

32 https://www.fairtradecertified.org/

fish oil. Management and stock heath of these fisheries varies widely.[33, 34]
- Waste by-products from processing farmed or wild-caught seafood supply chains which produce raw material for fishmeal and fish oil.
- Low value or 'trash fish' fisheries whose catches are processed into fishmeal and fish oil, used on site in farm-made aquafeeds, or used unprocessed directly as feed.

Low-value fisheries operate predominantly in East, South and Southeast Asia, and are mainly trawl fisheries, often with small mesh nets, which indiscriminately target multiple species. Low-value fisheries catch a wide range of species of fishes, crustaceans, cephalopods and other invertebrates that are of low commercial value by virtue of their low quality, small size, or lack of market demand. Commercially usable individuals are picked out and the remainder become feeds for the aquaculture and agriculture industries. Low-value fisheries are largely unregulated and there is little if any data collected on the catches,[35] but these could account for over 20% of landings in many Southeast Asian countries, and more than 50% in Thailand and China.[36] These fisheries have significant environmental and economic impacts, in particular through seabed habitat destruction by bottom trawlers, bycatch of threatened species like sharks and sea turtles, and removal of large numbers of juvenile commercial species from already degraded marine ecosystems. For example in the Gulf of Thailand, there have been catch declines over the past five years of economically important pelagic fish, squid, and crab species, with increases in trash fish and forage fish catches, reflecting a worrying decline in ecosystem health and economic productivity.[37] There are also some Southeast Asian fisheries targeting small pelagic forage fishes with less bycatch, but these are also generally unmanaged with little data. Southeast Asian fisheries, especially in Thailand, have also been associated with significant human rights abuses and slavery.[38, 39]

33 SFP (2023). Reduction Fisheries: 2023 Management and stock status sustainability overview (PART 1). Sustainable Fisheries Partnership (SFP). October 2023. https://sustainablefish.org/impact-initiatives/target-75/reduction-fisheries-reports/

34 Veiga P, Martin D, Lee-Harwood B (2017). Reduction Fisheries: SFP Fisheries Sustainability Overview 2017. Sustainable Fisheries Partnership Foundation. https://s3.amazonaws.com/sfpcms.sustainablefish.org/historical-assets/publication_27/2017_SFP_reduction_fisheries_report.pdf

35 Tacon AG, Metian M (2015). Feed Matters: Satisfying the Feed Demand of Aquaculture. Reviews in Fisheries Science & Aquaculture; 23:1–10. DOI: 10.1080/23308249.2014.987209

36 Veiga P, Martin D, Lee-Harwood B (2017). Reduction Fisheries: SFP Fisheries Sustainability Overview 2017. Sustainable Fisheries Partnership Foundation. https://s3.amazonaws.com/sfpcms.sustainablefish.org/historical-assets/publication_27/2017_SFP_reduction_fisheries_report.pdf

37 EJF (2024). Scourge of the Seas. The impact of bottom trawling on Thailand's marine ecosystems and recommendations for sector reform. Environmental Justice Foundation (EJF), London. https://ejfoundation.org/resources/downloads/Scourge-of-the-Seas_EN.pdf

38 EJF (2015). Thailand's seafood slaves. Human Trafficking, Slavery and Murder in Kantang's Fishing Industry. Environmental Justice Foundation (EJF), London. https://ejfoundation.org/resources/downloads/EJF-Thailand-Seafood-Slaves-low-res.pdf

39 EJF (2024). Scourge of the Seas. The impact of bottom trawling on Thailand's marine ecosystems

The aquaculture industry in Southeast Asia, including Vietnam for farmed prawns, relies heavily on feeds from these local forage fisheries and low-value fisheries.[40, 41]

## 4.4 SUPPLY CHAIN INTEGRITY AND TRANSPARENCY RISKS

Global supply chains of seafood often lack transparency despite ongoing efforts by regulators, non-governmental initiatives, and industry organisations for implementing measures of traceability and improved transparency, to combat illegal or destructive practices in the sector. For the farmed prawn industry in Vietnam specifically, there are several transparency risks associated with the supply chains, as follows.

### Feed Ingredients

Transparency and traceability of aquaculture feed ingredients is a particular concern. Information about the specific ingredients and their origins are rarely available – ingredients vary from batch to batch depending on price and availability, and feed producers treat this information as confidential.[42] This is especially critical for feed ingredients which carry potential environmental or social risk, such as soya (deforestation of rainforest) and fishmeal (critical status of marine fish stocks and social conditions on fishing vessels), as noted in Section 4.3 above. Third party verification and certification schemes create more transparency in this area to a certain degree,[43] and prevent critical unsustainable raw materials, such as soya from destructive farming and fishmeal from illegal fisheries, from entering the supply chain as feed ingredients for certified farmed prawns. Addressing traceability of feed ingredients and excluding harmful and critical ingredients from entering a specific farmed seafood supply chain is most important, as the environmental footprint of farmed seafood is strongly related to feed and its ingredients.

---

and recommendations for sector reform. Environmental Justice Foundation (EJF), London. https://ejfoundation.org/resources/downloads/Scourge-of-the-Seas_EN.pdf

40 Veiga P, Martin D, Lee-Harwood B (2017). Reduction Fisheries: SFP Fisheries Sustainability Overview 2017. Sustainable Fisheries Partnership Foundation. https://s3.amazonaws.com/sfpcms.sustainablefish.org/historical-assets/publication_27/2017_SFP_reduction_fisheries_report.pdf

41 MBA Seafood Watch (2023). Whiteleg Shrimp, Giant Tiger Prawn – *Litopenaeus vannamei*, *Penaeus monodon.* Vietnam Ponds. Report ID 27793, 9 January 2023. Monterey Bay Aquarium (MBA), California, USA. https://www.seafoodwatch.org/globalassets/sfw-data-blocks/reports/s/seafood-watch-whiteleg-shrimp-giant-tiger-prawn-vietnam-27793.pdf

42 MBA Seafood Watch (2023). Whiteleg Shrimp, Giant Tiger Prawn – *Litopenaeus vannamei*, *Penaeus monodon.* Vietnam Ponds. Report ID 27793, 9 January 2023. Monterey Bay Aquarium (MBA), California, USA. https://www.seafoodwatch.org/globalassets/sfw-data-blocks/reports/s/seafood-watch-whiteleg-shrimp-giant-tiger-prawn-vietnam-27793.pdf

43 Not all seafood certification schemes address environmental and social risks on the level of feed mills and their sourcing policies, supply chain traceability, integrity of raw material inventories in the feed mill and during the manufacturing process.

**Origin of Farmed Prawns**

Under conventional modes of operation, the information about the origin of the farmed prawn raw material is not shared within the supply chain. Prawn processors may source their raw material for manufacturing either directly from farming operations, or indirectly through intermediaries, collectors, and traders. Excluding prawns from illegal or critical operators is not possible without effective and efficient traceability schemes established. In the case of Vietnam as a global processing hub for seafood, some exported final products of frozen prawns may have been farmed outside Vietnam, e.g. in Ecuador, India or Indonesia, and such information is not shared along the supply chain.

Third party verification and certification schemes that operate effective audits and chain of custody schemes as basis for the integrity and traceability within the supply chain are an effective tool for importers, food service distributors and retailers to create more transparency in their supply chains and mitigate environmental impacts, but don't entirely exclude the risk of sourcing seafood from harmful or illegal practices.[44]

44 WWF (2017). A business case for Improved Environmental Performance in South East Asian Shrimp Aquaculture. World Wildlife Fund (WWF). https://www.worldwildlife.org/publications/a-business-case-for-improved-environmental-performance-in-southeast-asian-shrimp-aquaculture

## 5. CASE STUDY – KEY FARMING SYSTEMS FOR VIETNAMESE PRAWNS

This case study takes a closer look at the different farming systems used to produce the two prawn species that dominate production in Vietnam, black tiger prawns and vannamei prawns. Together these two species dominated Australian prawn imports until 2017, when vannamei took the lead and is now the main species imported (see sections 3.2 and 3.3).

Vannamei prawns are native to the Eastern Pacific Ocean and were introduced into Vietnam during the late 1990s and early 2000s. This species has played a pivotal role in driving the growth of the Vietnamese prawn industry and contributes about 60–70 percent of Vietnam's total prawn production.[45] Black tiger prawns are native to Asia including Vietnam and make up about 30–40 percent of the country's prawn market. Although Vietnam is the leading global producer of black tiger prawns, this market has experienced minimal growth, averaging less than 1 percent per year.[46]

Like all Penaeid species, adult prawns of both species live and reproduce in the open ocean. Postlarvae (PL) migrate inshore to spend their juvenile, adolescent, and subadult stages in coastal estuaries, lagoons, or mangrove areas. This life-cycle is reflected in how and where prawns are farmed. Aquaculture development caused a notable transformation in coastal land use in the 1990s, when shrimp farming experienced rapid expansion in coastal regions, resulting in rapid conversion of both mangrove forests and agricultural land into prawn farms, with a significant focus on the Mekong Delta in southern Vietnam.[47] The expansion was actively encouraged by the Vietnamese Government and received support from organisations such as the World Bank and the Asia Development Bank.

Vannamei prawns dominate the farmed prawn market because they are suitable for intensive farming with shorter farming cycles, high yields, and faster cash flows. They have a reputation for being more disease-resistant, and are therefore predominantly produced intensively by larger corporations. In contrast, black tiger prawns are primarily cultivated by small family businesses in extensive or semi-intensive farms that use no or minimal feed, but demand significant amounts of land.[48] The key farming systems are summarised below and in Table 5.

---

45 Rubel H, Woods W, Perez D, et. al., (2019). A strategic approach to sustainable shrimp production in Vietnam, the case for improved economics and sustainability. Boston Consulting Group (BCG) for the Gordon and Betty Moore Foundation. https://media-publications.bcg.com/BCG-A-Strategic-Approach-to-Sustainable-Shrimp-Production-in-Vietnam-Aug-2019.pdf

46 Rubel H, Woods W, Perez D, et. al., (2019). A strategic approach to sustainable shrimp production in Vietnam, the case for improved economics and sustainability. Boston Consulting Group (BCG) for the Gordon and Betty Moore Foundation. https://media-publications.bcg.com/BCG-A-Strategic-Approach-to-Sustainable-Shrimp-Production-in-Vietnam-Aug-2019.pdf

47 Nguyen TTN, Tran HC, Ho TMH, Burny P, Lebailly P (2019). Dynamics of Farming Systems under the Context of Coastal Zone Development: The Case of Xuan Thuy National Park, Vietnam. Agriculture; 9(7):138. https://doi.org/10.3390/agriculture9070138

48 Quyen NTK, Hien HV, Doan KLN, Yagi N (2020). Quality Management Practices of Intensive Whiteleg Shrimp (*Litopenaeus vannamei*) Farming: A Study of the Mekong Delta, Vietnam. Sustainability; 12(11): 4520. https://www.mdpi.com/2071-1050/12/11/4520

### 1.1 Intensive production system

Vannamei prawns are primarily produced through intensive aquaculture. Black tiger prawns are less common in intensive systems but are now on the rise, driven by the increasing availability of disease-free postlarvae.[49] Intensive systems span a spectrum from semi-intensive to super-intensive, each characterised by escalating stocking density, feed inputs and yields, with more complex pond management involving water treatment, recirculation, mechanical aeration, and the use of various chemicals and other inputs.

In semi-intensive systems, natural substrates are common, whereas intensive systems often feature plastic-lined ponds, and super-intensive systems frequently employ both plastic lining and covering. Intensive systems predominantly depend on formulated feed.[50, 51]

### 1.2 Extensive production system

Extensive systems are characterised by low stocking density. Traditionally, these ponds relied on the natural influx of juvenile prawns for stocking, but nowadays, hatchery-raised PL are commonly used. Black tiger prawn is the primary species raised in extensive systems.

Rice–prawn production is increasing rapidly in Vietnam because of increasing saltwater intrusion in the Mekong Delta, especially during 2016 and 2020.[52] Two types of rice–prawn systems exist in Vietnam:

rotational rice–prawn systems, where the two crops are produced consecutively in the paddy fields/ponds

combined co-culture systems, where both crops are produced at the same time with ditches and platforms in the ponds for the prawn and rice, respectively.

For combined co-culture systems, the giant river prawn (*Macrobrachium rosenbergii)* is often stocked simultaneously with rice, because of its preferences for the low salinities present during the rainy season.[53] The rotational system is stocked with brackishwater prawns, mostly black tiger prawns, during the dry season, when salinity is higher.

Pond or field sizes vary, but they tend to be larger than intensive systems and often

49 Schuur AM, McNevin AA, Davis RP, Boyd CE, Brian S, Tinh HQ, Duy NP (2022). Technical and financial feasibility for intensification of the extensive shrimp farming area in Mekong Delta, Vietnam. Aquaculture, Fish and Fisheries; 2: 12–27. https://doi.org/10.1002/aff2.26

50 Tu VH, Trang NT, Hong NB, Son LT, Duyen CTL, Yabe M (2021). Environmental efficiency of Intensive shrimp farming in transforming areas of The Coastal Mekong Delta. Journal of the Faculty of Agriculture, Kyushu University; 66(2): 277–89. https://doi.org/10.15017/4486560

51 Le NTT, Hestvik EB, Armstrong CW, Eide A (2022). Determinants of inefficiency in shrimp aquaculture under environmental impacts: Comparing shrimp production systems in the Mekong, Vietnam. Journal of the World Aquaculture Society; 53: 963–83. https://doi.org/10.1111/jwas.12874

52 Hai TN, Phuong NT, Van HN, Viet LQ (2020). Promoting Coastal Aquaculture for Adaptation to Climate Change and Saltwater Intrusion in the Mekong Delta, Vietnam. World Aquaculture; 51(2): 19–26. https://www.was.org/Magazine/2020/02/19/#zoom=z

53 Dang HD (2020). Sustainability of the rice-shrimp farming system in Mekong Delta, Vietnam: a climate adaptive model. Journal of Economics and Development; 22 (1): 21–45. https://doi.org/10.1108/JED-08-2019-0027

include natural substrates. The most common practice is to apply low stocking densities, with consequent low yields compared to intensive systems, although some farms opt for higher stocking densities akin to those found in semi-intensive systems (see Table 5 for details).

Prawn aquaculture within mangrove forest is also known as silviculture, which by definition have a low ratio of surface water to mangrove area (typically 1 or below, but there is no strict definition). These systems tend to have the largest pond sizes, typically in the range of 3 to 10 ha, and lowest stocking densities, ranging from about 1 to 6 PL/$m^2$.[54, 55]

Extensive systems do not rely on external feed or fertiliser. Instead, prawns primarily feed on natural organisms within the pond, provided by the mangrove forest, and water exchange is facilitated through tidal cycles.[56, 57, 58] Additionally, the mangrove trees in these areas are typically harvested at intervals of 10 to 20 years for timber and charcoal.

### 1.3 Risk of serious environmental impacts and human rights abuse

While there can be significant differences in farms in terms of comparative risk, in general extensive farming systems described here tend to have the lowest environmental impact, with super intensive systems at the other end of the spectrum having the highest. This is mainly related to the use of feed and stocking density, as noted in section 4. The stocking density in prawn farming is directly related to the amount of waste generated during the farming process, and therefore plays a key role in environmental impacts. High stocking densities can have adverse effects on water quality and the surrounding environment, increase the susceptibility of prawns to diseases and have a range of concerns related to feed use.

Certification can reduce risk to some extent and provide traceability (see Section above). There is an array of global aquaculture certification standards, including Organic EU, Bio Suisse, Friends of the Sea, Aquaculture Stewardship Council (ASC), Global Seafood Alliance's (GSA) Best Aquaculture Practices (BAP), GlobalG.A.P, and Naturland. In Australia, all three major retailers have commitment to source farmed seafood certified by ASC, GSA/BAP or GlobalG.A.P. ASC is the only certification that is ISEAL-code compliant[59] and is the only one of these certifications using a consumer-facing logo. It is considered the

54 Nguyen TTN, Tran HC, Ho TMH, Burny P, Lebailly P (2019). Dynamics of Farming Systems under the Context of Coastal Zone Development: The Case of Xuan Thuy National Park, Vietnam. *Agriculture*. 2019; 9(7):138. https://doi.org/10.3390/agriculture9070138

55 Anh MN, Sano M, Kuga M (2020). Characteristics of Integrated Shrimp Farming Systems in the Mekong Delta of Vietnam. Journal of Regional Fisheries; 60(2): 109–19. https://doi.org/10.34510/jrfs.60.2_109

56 Anh MN, Sano M, Kuga M (2020). Characteristics of Integrated Shrimp Farming Systems in the Mekong Delta of Vietnam. Journal of Regional Fisheries; 60(2): 109–19. https://doi.org/10.34510/jrfs.60.2_109

57 Ha TTT, Bush SR, Mol APJ, van Dijk H (2012). Organic coasts? Regulatory challenges of certifying integrated shrimp–mangrove production systems in Vietnam. Journal of Rural Studies; 28 (4): 631–9. https://doi.org/10.1016/j.jrurstud.2012.07.001

58 Ha TTT, van Dijk H, Bush SR. (2012). Mangrove conservation or shrimp farmer's livelihood? The devolution of forest management and benefit sharing in the Mekong Delta, Vietnam. Ocean & Coastal Management 69: 185–193. https://doi.org/10.1016/j.ocecoaman.2012.07.034

59 https://www.isealalliance.org/iseal-community-members

highest standard certification of those listed, but criticism remains[60], especially regarding the lack of consideration of cumulative farm impacts[61] and weak labour standards.

60 See for example: WWF (2017). A business case for Improved Environmental Performance in South East Asian Shrimp Aquaculture. World Wildlife Fund (WWF). https://www.worldwildlife.org/publications/a-business-case-for-improved-environmental-performance-in-southeast-asian-shrimp-aquaculture

61 Monterey Bay Aquarium Seafood Watch (2023). Whiteleg Shrimp, Giant Tiger Prawn. Vietnam Ponds. Available at: https://www.seafoodwatch.org/globalassets/sfw-data-blocks/reports/s/seafood-watch-whiteleg-shrimp-giant-tiger-prawn-vietnam-27793.pdf

**Table 5:** Comparison of prawn farming systems for the two main prawn species in Vietnam.

| | **Vannamei prawns,** *Penaeus vannamei* | | **Black tiger prawns,** *Penaeus monodon* | | | |
|---|---|---|---|---|---|---|
| System type | Conventional intensive and super intensive | 3rd party certified conventional intensive and super intensive | Conventional semi-intensive | 3rd party certified conventional semi-intensive | Conventional extensive | 3rd party certified conventional extensive |
| System description | Intensive and super intensive pond farming system with feed and continuous aeration.<br><br>Intensive systems often feature plastic-lined ponds.<br><br>Super-intensive systems frequently employ both plastic lining and covering. | Intensive and super intensive pond farming system with feed and continuous aeration.<br><br>Intensive systems often feature plastic-lined ponds.<br><br>Super-intensive systems frequently employ both plastic lining and covering. | Semi-intensive pond farming system with feed and partial aeration.<br><br>Natural substrates common. | Semi-intensive pond farming system with feed and partial aeration.<br><br>Natural substrates common. | Extensive farming systems with no feedstuffs applied, no pond aeration. These encompass integrated mangrove aquaculture, polyculture systems with rice and prawn, and extensive prawn farming in ponds. All systems are usually polyculture. | Extensive farming systems with no feedstuffs applied, no pond aeration. These encompass integrated mangrove aquaculture, polyculture systems with rice and prawn, and extensive prawn farming in ponds. All systems are usually polyculture. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Pond size[62,63,64,65,66,67,68,69] | 0.2–1.5 ha | 0.2–1.5 ha | 0.8–2 ha | 0.8–2 ha | 2–6 ha | 2–6 ha |

62 Hai TN, Duc PM, Son VN, Minh TH, Phuong NT (2015). Innovation of marine shrimp seed production and farming in Vietnam. World Aquaculture; 46(1): 32–7. https://www.was.org/Magazine/Vol/46/1

63 Le NTT, Hestvik EB, Armstrong CW, Eide A (2022). Determinants of inefficiency in shrimp aquaculture under environmental impacts: Comparing shrimp production systems in the Mekong, Vietnam. Journal of the World Aquaculture Society; 53: 963–83. https://doi.org/10.1111/jwas.12874

64 Nguyen TV, Tien T (2021). Current status, potential and challenges of shrimp farming in Can Gio District, Ho Chi Minh City. Science and Technology, Nông nghiệp và phát triển nông thôn - KỲ 1 - TH NG 9/2021. (Vietnamese)

65 Thakur K, Patanasatienkul T, Laurin E, Vanderstichel R, Corsin F, Hammell L (2018). Production characteristics of intensive whiteleg shrimp (Litopenaeus vannamei) farming in four Vietnam Provinces. Aquaculture Research; 49(8): 2625–32. https://doi.org/10.1111/are.13720

66 Dien LD, Sang NV, Faggotter SJ, Chen C, Huang J, Teasdale PR, Sammut J, Burford MA (2019). Seasonal nutrient cycling in integrated rice-shrimp ponds. Marine Pollution Bulletin: 149: 110647. https://doi.org/10.1016/j.marpolbul.2019.110647

67 Trang NTD, Ashton EC, Tung NCT, Thanh NH, Van Cong N, Nam TS, Thuan NC, Khanh HC, Duy NP, Truong NN (2022). Shrimp farmers perceptions on factors affecting shrimp productivity in integrated mangrove-shrimp systems in Cà Mau, Vietnam. Ocean & Coastal Management: 219: 106048. https://doi.org/10.1016/j.ocecoaman.2022.106048

68 Anh MN, Sano M, Kuga M (2020). Characteristics of Integrated Shrimp Farming Systems in the Mekong Delta of Vietnam. Journal of Regional Fisheries; 60(2): 109–19. https://doi.org/10.34510/jrfs.60.2_109

69 Dang HD (2020). Sustainability of the rice-shrimp farming system in Mekong Delta, Vietnam: a climate adaptive model. Journal of Economics and Development; 22 (1): 21–45. https://doi.org/10.1108/JED-08-2019-0027

| | | | | | | |
|---|---|---|---|---|---|---|
| Stocking density[70,71,72,73,74] [75,76,77] | Intensive: 50–100 PL/$m^2$<br><br>Super intensive: 150–350 PL/$m^2$ | Intensive: 50–100 PL/$m^2$<br><br>Super intensive: 150–350 PL/$m^2$ | 30–40 PL/$m^2$ | 30–40 PL/$m^2$ | 5–25 PL/$m^2$ | 10–30 PL/$m^2$ |
| Rearing cycle | 3–5 months<br><br>(partial harvesting may apply) | 3–5 months<br><br>(partial harvesting may apply) | 4–5 months<br><br>(partial harvesting may apply) | 4–5 months<br><br>(partial harvesting may apply) | 4–5 months<br><br>(partial harvesting may apply) | 4–5 months<br><br>(partial harvesting may apply) |
| Feed Conversion Rate | 1.4–1.7 | 1.4–1.7 | 1.8–2.2 | 1.8–2.2 | None applied | None applied |

70 Nguyen TV, Tien T (2021). Current status, potential and challenges of shrimp farming in Can Gio District, Ho Chi Minh City. Science and Technology, Nông nghiệp và phát triển nông thôn - KỲ 1 - TH □NG 9/2021. (Vietnamese)

71 Thakur K, Patanasatienkul T, Laurin E, Vanderstichel R, Corsin F, Hammell L (2018). Production characteristics of intensive whiteleg shrimp (Litopenaeus vannamei) farming in four Vietnam Provinces. Aquaculture Research; 49(8): 2625–32. https://doi.org/10.1111/are.13720

72 Trang NTD, Ashton EC, Tung NCT, Thanh NH, Van Cong N, Nam TS, Thuan NC, Khanh HC, Duy NP, Truong NN (2022). Shrimp farmers perceptions on factors affecting shrimp productivity in integrated mangrove-shrimp systems in Cà Mau, Vietnam. Ocean & Coastal Management: 219: 106048. https://doi.org/10.1016/j.ocecoaman.2022.106048

73 Van Nguyen C, Schwabe J, Hassler m (2021). White shrimp production systems in central Vietnam: Status and sustainability issues. Egyptian Journal of Aquatic Biology and Fisheries; 25(1): 111–22. https://dx.doi.org/10.21608/ejabf.2021.145791

74 Anh MN, Sano M, Kuga M (2020). Characteristics of Integrated Shrimp Farming Systems in the Mekong Delta of Vietnam. Journal of Regional Fisheries; 60(2): 109–19. https://doi.org/10.34510/jrfs.60.2_109

75 Dien LD, Sang NV, Faggotter SJ, Chen C, Huang J, Teasdale PR, Sammut J, Burford MA (2019). Seasonal nutrient cycling in integrated rice-shrimp ponds. Marine Pollution Bulletin: 149: 110647. https://doi.org/10.1016/j.marpolbul.2019.110647

76 Dang HD (2020). Sustainability of the rice-shrimp farming system in Mekong Delta, Vietnam: a climate adaptive model. Journal of Economics and Development; 22 (1): 21–45. https://doi.org/10.1108/JED-08-2019-0027

77 Burford MA, Hiep LH, Van Sang N, Khoi CM, Thu N K, Faggotter S J, Stewart-Koster B, Condon J, Sammut J (2020). Does natural feed supply the nutritional needs of shrimp in extensive rice-shrimp ponds? – A stable isotope tracer approach. Aquaculture; 529: 735717. https://doi.org/10.1016/j.aquaculture.2020.735717

## Appendix

**Table A1:** Export value (USD) of frozen prawns from Vietnam to Australia in 2016–2022 (Source: VASEP 2023)

| Year | Vannamei | Black tiger | Other Species | Total Export Value USD |
|---|---|---|---|---|
| **2016** | 47,614,156 | 48,960,597 | 18,057,895 | **114,632,648** |
| **2017** | 97,791,589 | 9,515,657 | 12,618,658 | **119,925,904** |
| **2018** | 97,095,489 | 1,575,957 | 16,019,587 | **114,691,033** |
| **2019** | 111,617,697 | 2,178,568 | 13,275,657 | **127,071,922** |
| **2020** | 136,238,835 | 1,764,985 | 16,023,174 | **154,026,994** |
| **2021** | 162,896,789 | 1,156,957 | 12,895,766 | **176,949,512** |
| **2022** | 208,239,117 | 333,410 | 1,259,033 | **209,831,560** |
| | | | | |