# Vannamei shrimp culture pdf

Penaeus vannamei Boone, 1931 [Penaeidae]FAO Names: En - Whiteleg shrimp, Fr - Bed pattes blanches, Es - Camarón patiblanco Images galleryFemale broodstock (Photo: Briggs, M.) Maturation tanks in Latin America (Photo: Briggs, M.) Extensive ponds (Photo: Briggs, M.) Vintage (Photo: Briggs, M.) Historical background The first spawning of this kind was achieved in Florida in 1973. After good pond results and the discovery of one-sided ablation (and proper nutrition) to promote maturation in Panama in 1976, penaeus vannamei's commercial culture began in South and Central America. The subsequent development of intensive breeding and breeding techniques led to its culture in Hawaii, the mainland United States and much of Central and South America until the early 1980s. Since this time, commercial culture of this kind in Latin America has shown a rapidly growing trend (with peaks every 3-4 years during warm, humid 'el niño' years), punctuated by a decline in su-incidents with outbreaks during cold 'la niña' years. Despite these problems, P. vannamei's production from the Americas is on the rise – having reduced its earlier peak production from 193,000 tonnes in 1998 to 193,000 tonnes in 2013. Asia has seen a phenomenal increase in P. vannamei production. Although in 1999, The New York Times However, for fear of importing exotic diseases, many Asian countries are reluctant to promote P. vannamei agriculture, so its culture remains officially limited to experimental testing only in Cambodia, India, Malaysia, Myanmar and the Philippines. Thailand and Indonesia freely allow its commercial culture, but have official restrictions, so only SPF/SPR broodstock can be imported. Similarly, most Latin American countries have strict quarantine or prohibition laws to prevent the import of exotic pathogens with new supplies. The main producer countries penaeus vannamei are shown on the map, while the full list includes: China, Thailand, Indonesia, Brazil, Ecuador, Mexico, Venezuela, Honduras, Guatemala, Nicaragua, Belize, Vietnam Nam, Malaysia, Tawian P.C., Pacific Islands, Peru, Colombia, Costa Rica, Panama, El Salvador, United States, India, Philippines, Cambodia, Suriname, Saint Kitts, Jamaica, Cuba, Dominican Republic, Bahamas.Major manufacturing countries Penaeus vannamei (FAO Fishery Statistics, 2006)Habitat and biology Whiteleg shrimp are native to the eastern Pacific coast from Sonora, Mexico in the north, through Central and South America all the way to Tumbes in Peru, in areas where water temperatures are usually >20 °C throughout the year. vannamei live in tropical marine habitats. Adults live and spawn in the open ocean, while postlarves migrate to shore to conduct their juvenile, adolescent and sub-adult phases in coastal estuaries, lagoons or mangrove areas. Males become mature from 20 g, and females from 28 g onwards at the age of 6-7 months. P. vannamei weighing 30–45 g will carry 100 000–250 000 eggs with a diameter of approximately 0.22 mm. Hatching occurs about 16 hours after spawning and fertilization. The larvae of the first stage, which therme nauplii, swim periodically and are positively phototactic. Nauplii do not feed, but live on their reserves of egg yolks. The next stages of larvae (protozoa, misa and early postlarve) remain plankton for some time, eat phytoplankton and zooplankton, and are carried towards the shore by tidal currents. Postlarve (PL) change their plankton habit about 5 days after moulting into pl, move ashore and begin to feed on benthic detritus, worms, bipeds and crustaceans. Production cycleProduction cycle Penaeus vannameiProduction systemsCaptured wild seeds were used in Latin America for extensive penaeus vannamei pond culture until the late 1990s. Domestication and genetic selection programmes then provided more consistent stocks of high-quality, disease-free and/or resistant PL, which were cultured in spawning ranges. Some were sent to Hawaii in 1989, resulting in the production of SPF and SPR lines, leading to industry in the United States and Asia.There are three sources for broodstock P. vannamei: Where they occur naturally, broodstock are sea-caught (usually aged 1 year and weigh >40 g) and spawned. Farmed shrimp harvested from a pond (after 4-5 months at 15-25 g), are grown for 2-3 months, and then transferred to maturation facilities at the age of >7 months when they weigh 30-35 g.Purchased from a tank grown SPF/SPR broodstock from the United States, (aged 7-8 months and weighing 30-40 g). Broodstock is supplied in maturation tanks in dark rooms supplied with clean, filtered seawater. Feeds consist of a mixture of fresh and formulated litters. One stem of each female's eyes is utahn, which leads to repeated maturation and spawning. Females at the age of 8-10 months multiply effectively, while males reach a peak of >10 months. Spawning rates of 5-15 percent/night are achieved, depending on the source of broodstock. Females spawn in common or individual containers (to avoid transmission of the disease). The next afternoon healthy nauplie attracts light, collects and rinses with seawater. They are then disinfected with iodine and/or formalin, re-rinsed, counted and transferred to holding tanks or directly into larvae breeding tanks. Hatchery systems range from specialized, small, unsophisticated, often interior, backyard spawning grounds to large, sophisticated and environmentally controlled installations, along with maturation units. Nauplii are apartment, or preferably V or U U U 4-100 m³, made of concrete, fiberglass or other plastic coated material. The larvae were either bred on PL10-12 in one larval breeding tank, or harvested on PL4-5 and transferred to flat paths/ tanks and bred on PL10 -30. Survival rates up to PL10-12 should average >60 percent. Water is regularly exchanged (at 10-100 percent per day) to maintain good environmental conditions. Feeding usually consists of live food (microalgae and artemia), supplemented with micro-encapsuled, liquid or dry formulated diets. Since hatching, it takes about 21 days to get to the harvest on PL12. Care shall be taken of the reduction of bacterial/pathogenic contamination of larvae objects by a combination of periodic drying and disinfection, water settlement in bays, filtration and/or chlorination, disinfection of oils, water exchange and use of antibiotics or (preferably) probiotics. Most agricultural operations for P. vannamei do not use nurseries, but transport PL10-12 at reduced temperature either in plastic bags or oxygenated containers for transport to the pond and directly introduce them. In some cases, nurseries systems are used and consist of separate concrete tanks for nurseries or earth ponds, or even net pencils or cages located inside production ponds. Such nurseries can be used for 1–5 weeks. Nurseries are useful in colder areas with limited breeding seasons, where PL is cultivated up to a larger size (0,2-0,5 g) in heated tanks / ponds, before being supplied to ponds. The use of super-intense, temperature-controlled, greenhouse-sealed, concrete or coated racing pathways has yielded good results in the United States.Ongrowing techniques can be divided into four main categories: extensive, semi-intensive, intense and super intense, representing low, medium, high and extremely high stocking density. Extensively Communally found in Latin American countries, extensive cultivation of P. vannamei is carried out in tidal areas where minimal or no water pumping or aeration is provided. Ponds are irregular in shape, usually 5–10 ha (up to 30 ha) and 0.7–1.2 m deep. Originally, wild seeds were used that neatly entered the pond through doors or bought from collectors; Since the 1980s, spawning PL has been stocked at 4–10/m². Shrimp feed mainly with natural food enhanced by fertilization and low protein feeding. Despite the low population density, small shrimp from 11-12 g are harvested for 4-5 months. The yield in these large systems is 150–500 kg/ha/crop, with 1-2 crops per year. Semi-intensive intensive ponds (1–5 ha) are stocked with seeds produced in spawning grounds at 10–30 PL/m²; such systems are common in Latin America. Regular water exchange is pumped, the depth of the pond is 1.0–1.2 m, and the aeration is minimal at best. Shrimp feed on natural food enhanced by fertilisation supplemented with a formulated diet 2-3 times a day. Production yields in semi-intensive ponds range from 500–2 000 kg/ha/crop, kg/ha/crop, 2 crops a year. Intensive farms are usually found in areas without tides where ponds can dry out completely, dry and prepare before each sock, and are increasingly located far from the sea in cheaper areas of low salinity. This cultural system is common in Asia and in some Latin American farms that are trying to increase productivity. Ponds are often earthy, but liners are also used to reduce erosion and improve water quality. Ponds are mostly small (0.1–1.0 ha) and square or round. Water depth is usually > 1.5 m. Sock densities range from 60–300 PL/m². Heavy aeration per 1 hp/400-600 kg of harvested shrimp is necessary for water circulation and oxygenation. Feeding with artificial nutrition is carried out 4-5 times a day. FCRs are 1.4–1.8:1. Since the outbreak of viral syndromes, the use of stocks without domesticated diseases (SPF) and resistant (SPR), implementation of biosecurity measures and reduced water exchange systems is common. However, food, water exchange/quality, phytoplankton aeration and flowering require careful monitoring and management. Production yields of 7-20 000 kg/ha/crop can be achieved, with 2-3 crops per year, up to a maximum of 30-35 000 kg/ha/crop. In the system of bacterial jib ponds (0.07 – 1.6 ha) highly aerated, recirculating, heterotrophic bacterial systems are managed. Low protein foods are fed 2-5 times a day, in an effort to increase the ratio of C:N to >10:1 and redirect the added nutrients through bacterial rather than algae pathways. Sock at 80-160 PL / m², ponds become heterotrophic and flok bacteria are formed, consumed by shrimps, reducing dependence on high protein feeders and FCR and increasing cost efficiencies. Such systems have generated production of 8-50,000 kg/ha/crop in Belize and Indonesia.Superintensive Research conducted in the United States focused on growing P. vannamei in super-intensive raceway systems closed in greenhouses, using no water exchange (only replacing evaporation losses) or discharging, supplied with SPF PL. They are thus biosect, environmentally friendly, have a small ecological footprint and can produce profitable, high-quality shrimps. The supply of 282 m² of racing routes with 300–450 0.5-2 g of minors/m² and ongrowing in 3-5 months achieved production of 28 000-68 000 kg/ha/crop at growth rates of 1.5 g/week, survival of 55-91 percent, mean weight of 16-26 g and FCR of 1.5-2.6:1,P. vannamei are very effective in using the natural productivity of shrimp ponds, even in intense cultural conditions. In addition, food costs are generally lower for P. vannamei than monodone more carnivores P. due to their lower protein need (18-35 percent compared to 36-42 percent), especially where bacterial jib systems are used. Food prices for P. vannamei range from USD 0.6/kg in Latin America and Thailand to USD 0.7 - 1.1/kg elsewhere in Asia; FCR of 1.2-1.8:1 is generally Extensive Extensive semi-intensive ponds are harvested by draining the pond at low tide through a network of bags installed in sockets. If the tide does not allow harvesting, water can be pumped out. In some larger farms, harvesting machines pump shrimp and water to the shore of the pond where they are watered. Intensive ponds can be culled in a similar way and small 2-6 man seine nets are dragged around the pond to make coral shrimp on the side of the pond from where they are removed with cast or dipped mesh or perforated buckets. Partial harvesting is common in Asian intensive culture after the first 3 months. In Thailand, artificial gate cases are temporarily installed inside one corner of the pond to harvest a closed pond system. The shrimp are then trapped in nets attached to this temporary gate when the pond is pumped out. In super-intensive systems, shrimp are simply harvested with large nets when needed for processing. If shrimp are sold directly to processing plants, specialized harvesting and handling teams are usually used to maintain the quality of shrimp. After sorting, the shrimp is washed, sprawled and immediately stifled in ice water at 0-4 °C. Often sodium metabisulphate is added to the cooled water to prevent melanosis and a red head. Shrimps are then kept in ice in insulated tanks and transported by truck to processing plants or to local shrimp markets. In processing plants, shrimps are placed in ice buckets and cleaned and sorted according to standard export sizes. Shrimps are processed, quickly frozen at -10 °C and stored at -20 °C for export by boat or air cargo. Due to rising demand, tax-free and higher profit margins, many processing plants operate value-added product lines. Production costs vary depending on many factors. Operating costs for seed production average USD 0.5-1.0/1 000 PL, while sales prices vary from USD 0.4/1 000 PL8-10 in China and USD 1.0-1.2/1 000 PL12 in Ecuador to USD 1.5 3.0/1 000 PL12 around Asia. Lower food costs and higher levels of intensity result in an mean production price for ongrowing of approximately $2.5–3.0/kg for P. vannamei, compared to $3.0-4.0/kg for a more extensive P. monodon culture. Diseases and control measures Major disease problems suffered by P. vannamei are shown in the table below. The availability of SPF and SPR broodstock provides a means to avoid these diseases, although biosecurity procedures are also important, including: Thorough drying/scraping of the bottom of the pond between cycles. Reducing water exchange and fine screening of any inn water. Use of bird net or scarring. Installing barriers around the pond. Sanitation. Once viruses have entered the ponds, there are no chemicals or drugs available to treat infections, but good management of the pond, water, food and stock health status can reduce their virontin. In some cases antibiotics and other medicines have been used in treatment, but their inclusion in this table does not imply a recommendation White dot point also known as WSBV or WSSVPart of the white spot baculovirus complex (recently renamed as a new family as nimavirus)VirusAcutely infected shrimp show reduced food consumption; lethargy; high mortality rate of 100% within 3-10 days of the appearance of clinical signs; loose cutie with white spots with a diameter of 0.5 -2.0 mm, most accurately inside the carapace; moribund shrimp often have a pink to reddish-brown color due to the spread of cuticular chromatophores & little if any white spotsUse SPF broodstock; wash and disinfect eggs/nauplii with iodine, formalin; display broodstock, nauplii, PL & pond stages; avoid rapid changes in water quality; maintain water temperature >30 °C; avoid stress; avoid the use of fresh foods such as fish for garbage; minimise water exchange to prevent virus carriers from entering; treat infected ponds and spawning grounds with 30 ppm chlorine to kill infected shrimps and carriers; disinfect associated equipmentTaura syndrome (TS); also known as Taura Syndrome Virus (TSV) or red repaSingle-stranded RNA virus (Picornaviridae)VirusOccurs during a single moult in juvenyl shrimp starting 5-20 days after socks, or having a chronic course over several months; weakness, soft shell, empty intestines and diffuse spread of red chromatophores in pendantes; mortality varies 5-95%; survivors may have black lesions and remain carriers for lifeUse SPF & SPR broodstock; wash and disinfect eggs & nauplii; clean and disinfect contaminated vehicles and equipment; scare away birds (vectors); destroy all stocks and thoroughly disinfect infected objectsInfectious Hypodermal & Haematopoietic necrosis (IHHNV), causing Runte Deformation Syndrome (RDS)System parvovirusVirusLi mortality for resistant P. vannamei; however, reduced feeding, growth and feed efficiency; cuticular deformation (bent rostrum – RDS) occurs in <30% of infected populations, increasing variances of the final harvest weight and reducing the market value of the SPF broodstock; wash and disinfect eggs & nauplii; if infected, the cultural object must be completely and very carefully disinfected to avoid the reintroduction ofBaculoviral Midgut Gland Necrosis (BMN); also known as midgut gland cloudy disease, white cloudy liver disease, and white turbidity diseaseNon-okluded enteric baculovirusVirusInfects larval & early PL stages, causes high mortality; white turbidity hepatopancreas caused by necrosis of the tubule epithelium; larvae float inactively on the surface; later stages show resistance; positive broodstock are a source of infectionSeparate eggs from faeces, wash eggs & nauplii with running clean seawater & disinfect with iodine &/or formalin; disinfect the infected culture facility to avoid the reintroduction ofVibriosis Vibrio spp., especially V. harveyi & V. parahaemolyticusBacteriaMay cause various important syndromes, such as luminiscence & so-called zoea-2 & syndromes In the spawning area; see as luminiscence in water &/or shrimp body; bowel disorder; fouling of the body; reduced feeding and high mortality In ponds, high levels of vibes are with a red discoloration of shrimp (especially tails) and internal and external necrosis; low feeding levels and chronic mortality; often a secondary infection resulting from poor environmental management; weak shrimp that become susceptible to viral infectionsOnly managing the systemin spawning grounds, disinfect facilities, equipment, water and workers; use live feeds without bacteria; cover the culture of containers with plastic metal to prevent transmission in ponds, prevent proper preparation; flowering control; good water and food management; density control and aeration of socks for maintaining optimal environmental conditions during the culture cycleSuppliers pathological expertiseAssistance can be provided from the following sources:Prof. Lightner, D. Aquaculture Patology SectionDepartment of Veterinary Science University of ArizonaBuilding 90, Room 202Tucson, AZ 85721, United StatesTelephone: (+1) 520 6218414Fax: (+1) 520 6214899 Prof. Chen, Department of ZoologyDirector, Institute of Fisheries BiologyNational Taiwan UniversityNo. 1 Roosevelt Road, Section 4.Taipei, Taiwan 10764, Taiwan, ChinaTelephone Province: (+886) 2 3687101 Fax: (+886) 2 3687122Prof. Flegel, T. Centex Shrimp, Chalern Prakiat BuildingFaculty of ScienceMahidol UniversityRama 6 RoadBangkok, 10400, ThailandTelephone: Personal (+66) 2 2015876 Mobile phone (+66) 1 4035833Office (+66) 2 20158-70 or -71 or -72Fax: (+66) 2 2015873 Dr. Walker, P. Associate Professor and Chief Research ScientistCSIRO Livestock IndustriesPMB 3 IndooroopillyQueensland 4068 , AustraliaTelephone: (+61) 7 32143758 Fax :+61) 7 32142718 Production statisticsFAO show that total agricultural production of Mr vannamei has steadily increased from 8 000 tonnes in 1980 to 8 000 tonnes in 2013. After a small decline in 1999 and a significant drop in 2000 due to the arrival of WSSV in Latin America, FAO data shows a rapid increase in production to over 1 386,000 tonnes in 2004, due to the recent rapid expansion of this species into Asia. In 2004, the main producer countries Market and tradeProductsFrozen head-on, head-off, and beaned shrimp were once the main products for export to the main global markets of the United States, the European Union and Japan. The trend now is for processing value-added products. This is due to a lack of anti-dumping tariffs for processed products on the United States market, fewer people eating out and a desire for ready-made or ready-made home food products. Prices and market statistics The main market for shrimp is the United States, which was expected to import about 477,000 tons worth $3.1 billion in 2005, 1.8 times the 264,000 tons imported in 2000. The United States has traditionally stocked small frozen or processed headless shrimp from Latin America. More recently, the United States In 2004, he looked to Asia to offer his growing demand (1.9 kg/capita in 2004). The main suppliers to the United States in 2005 were Thailand, Ecuador, India, China and Viet Nam. However, P. vannamei's rapidly growing production has led to severe price depression on international markets. Similarly, the value of farm gates by 15-20 g the size of whiteleg shrimp is steadily decreasing from USD 5/kg in 2000 to about USD 3.0 -3.5/kg in 2005. The next most important market is the European Union (imports of 183 000 tonnes in the first half of 2005), which favors small (31/40 count), whole, frozen shrimp. Japan, whose market mainly requires large headless (16/20 counting) shrimp, typically delivers P. monodon from large extensive Asian farms. Market regulationsStandardi for sanitary conditions and the use of medicines and chemicals and the usual rules on food safety for seafood (especially shrimp) are already high in all major importing countries. However, the European Union market has stricter regulations (zero tolerance) on residues of chemicals and antibiotics, as well as a Generalised Preference System (DSP) on tax imports. The United States market is more strictly enforcing sanitary standards such as HACCP or Sensory Assessment, but it has also encouraged strict controls on banned antibiotics in shrimp. Since June 2005, finalized and set (for the general rate) final antidumping duties on shrimp from culture imported into the United States from 6 major shrimp producing countries and set (for the general rate) at approximately 113 percent for China, 26 percent for Vietnam Nam, 10 percent for India, 7 percent for Brazil, 6 percent for Thailand and 4 percent for Ecuador. Mexico and Indonesia avoided these tariffs. Research Follows some of the areas with the highest priority for P. vannamei culture research: Continuous development of SPR lines P. vannamei for viruses, including TSV, WSSV, IHHNV, BMNV and IMNV. Development of faster growing stock lines SPF/SPR. Continuous development of biosection, high density and low salinity culture system. Vaccination and other effective treatments for shrimp viruses. Replacement of non-environmentally friendly and expensive seafood meals in shrimp feed. Efficient water purification and management systems for closed culture systems. Techniques to reduce bacterial loads in shrimp culture systems. Effective procedures for disinfection of eggs, naulli and PL in spawning points. Effective substitutes (i.e. probiotics and immunostimulances) for antibiotics. Development Although the spread of P. vannamei culture has been rapid in recent years, especially in Asia, it has led to a decrease in the value of harvested shrimp. This trend is expected to continue. In such circumstances, less efficient manufacturers may not be able to compete with those capable of producing more environmentally friendly or cheaper products. Recent global trends have been towards the integration of industry, in response to the growing demand for traceability and within the cultural system. MarketThere is slowly a growing demand for shrimp on world markets, as fisheries capture stagnates and people become wealthier and more aware of healthy food choices. Despite the increased demand, the price for P. vannamei is steadily declining. In the future, the P. vannamei market is expected to become more competitive, mainly due to the saturation of export markets and the decrease in world economic growth, as well as the emergence of non-tariff barriers in the shrimp trade. In addition, the industry will have to meet the requirements of importing countries on: chemical residues. Food safety. Certification.Traceability.Eco-labelling.Environmental sustainability. RecommendationsEvery shrimp farmers become acutely aware of the growing need to grow shrimp on a responsible, traceable and low impact that can improve biosecurity and help protect the environment, while also producing shrimp in a cost-effective way. Newly developed intensive bacterial jib and super-intensive systems may have the potential to solve all these problems and should be investigated more thoroughly. In order to continue the smooth growth of shrimp farming in the long term, domestic consumption (as in China) should be promoted to complement problematic export markets. The recent spread of shrimp culture has sparked much public debate about its environmental and sustainability effects, as perceived: The use of mangrove protective ecosystems to build ponds. Slash and burn the style of using ponds for several years, before moving to new areas. Salinization of groundwater and agricultural land. Pollution of coastal waters by the wastewater of ponds. Overuse of marine meals leads to inefficient use of vital sources of protein and disruption of marine ecosystems. Biodiversity issues arising from the collection of wild seeds and litters and the introduction of non-native species and their accompanying pathogens. Social conflicts with other resource users. The farm discharges, causing self-pollution in the areas of shrimp farming. Governments and the shrimp industry are trying to mitigate the above impacts. The new intensive systems do not require the use of tidal mangrove areas, and mangroves are transplanted. Culture technology in inland areas has been improved by using minimal seawater and closed, coated systems to prevent salinisation. Closed systems that do not use new water and are not discharged, together with better management practices, are applied to prevent coastal water contamination. Overfishing of wild seeds and litters was solved using domesticated stocks P. vannamei. The use of fish meat is reduced by transfer to the culture of P. vannamei, which is more capable of using low protein foods than P. monodone. Social conflicts remain, but the shrimp culture industry employs thousands of rural people, who would be far worse off without it. Adopting more environmentally friendly shrimp culture practices further reduce such conflicts. Responsible aquaculture practicesDue to rapidly spread and increase awareness of the negative environmental and own production effects of shrimp farming practices, many shrimp producing countries make sincere efforts to comply with the concept of responsible aquaculture as detailed in Article 9 of directives. The formulation and adoption of BMPs (or good aquaculture practices ( GAP) is given prevalence to improve biosecurity, increase cost efficiency, reduce chemical residues and increase traceability. Organic certification for shrimp farming is seriously considered. 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Srodni linkoviAquatic Animal Pathogen and Quarantine Information System – AAPQISDatabase on Introductions of Aquatic Species – DIASFAO FishStatJ – Universal software for fishery statistical time seriesGlobal Aquaculture Alliance – GAANational Marine Fisheries Service – NMFSNetwork of Aquaculture Centres in Asia-Pacific – NACAOffice International des Epizooties – OIEShrimp News International. Marine Shrimp Farming ProgramWorld Aquaculture Society – WAS WAS