Seychelles Mariculture Master Plan

Aquaculture Fact Sheet

Snubnose Pompano

Trachinotus blochii

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by Advance Africa Management Services

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1. Background

Common names

Snubnose pompano; Silver pompano; Permit	*English*
Lune; Pampe; Panp	*French (Seychelles)*

Biology and ecology

The snubnose pompano *Trachinotus blochii* is a semi-pelagic species of the Carangidae family, occurring in tropical waters of the Indian and Pacific Oceans from the east coast of Africa and the Red Sea, to the Indo-west and Central Pacific, including volcanic islands (Figure 1) (Smith-Vaniz, 1984; Smith-Vaniz and Williams, 2016). Juveniles aggregate in small shoals near river mouths in sandy or muddy bays and in sandy inshore areas (Figure 2), while adults are generally solitary and inhabit coral or rock reef areas and sandy intertidal flats further offshore (Lieske and Myers, 1994), occurring at depths of up to 55m (Smith-Vaniz and Williams, 2016).

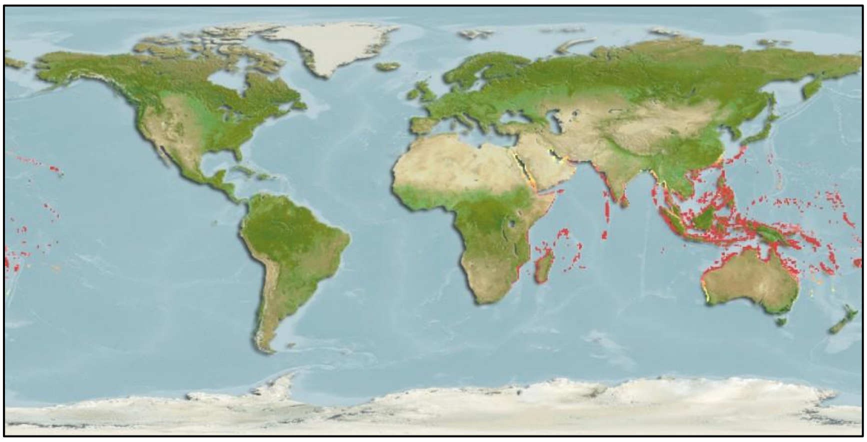

Figure 1: Natural distribution of snubnose pompano (Source: Aquamaps, 2016).

Figure 2: Shoaling juvenile snubnose pompano (Source: Globefish, 2014).

The snubnose pompano has a compressed body with a blunt, broadly rounded snout. It is silvery blue-grey in colour, often with a golden tinge on the snout and lower body. The dorsal and anal fins are a dark orange with a dark brown to black anterior margin (Figure 3). Juveniles look similar to adults, with a silvery body and dark brown dorsal, anal and pelvic fins. The species reaches a maximum length of 110cm total length (TL) and a maximum recorded weight of 8.2kg (Smith-Vaniz, 1984; Smith-Vaniz and Williams, 2016; IGFA, 2019).

Figure 3: Adult snubnose pompano.

Juvenile snubnose pompano are opportunistic planktivores and benthivores, consuming organisms such as copepods and polychaete worms, while adults are selective benthivorous grazers, with a diet comprising polychaete worms and invertebrates such as crabs and mussels. As snubnose pompano mature their pharyngeal plate (roof of the mouth) becomes well developed, allowing them to consume hard-shelled prey (Smith-Vaniz 1989; Reyes et al., 2014).

Snubnose pompano reaches sexual maturity at around one year, at a length of approximately 58cm (Juniyanto *et al*., 2008; FAO, 2019). The species is a broadcast spawner, with protracted spawning seasons that peak in different months across its distribution; in India peak spawning has been recorded from March to November (Gopakumar *et al.*, 2012).

Fisheries

Pompano is an important food species; however, it is of minor commercial importance in global fisheries and the majority of global pompano production is derived from aquaculture (Figure 4) (FAO, 2018, 2019). The species is caught using traps, gillnets and handlines, and marketed either fresh or salted and dried; India has historically produced the most pompano, with landings peaking at 16 000 tonnes in 2010, followed by Mexico, with a total annual catch of 6 000 tonnes in 2013 (FAO, 2018).

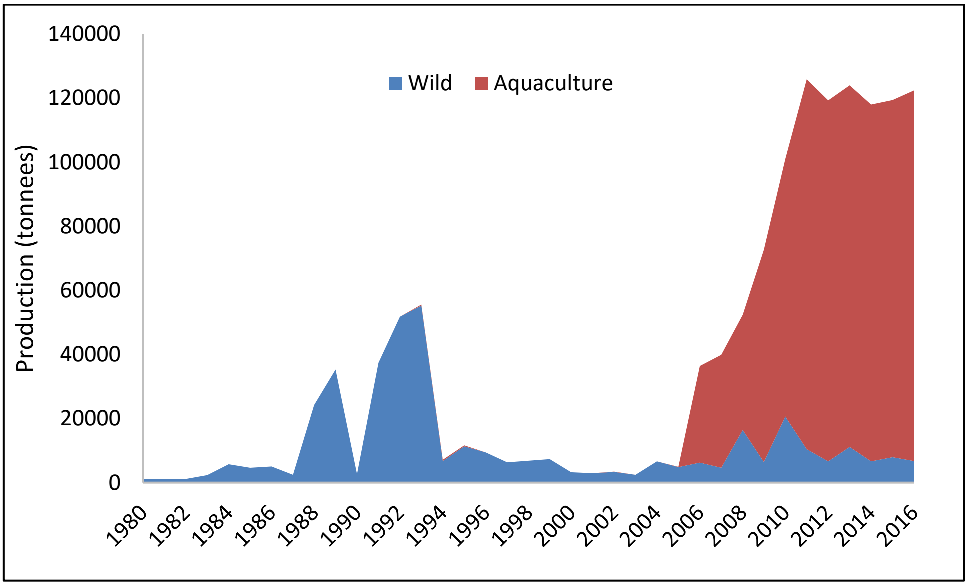

Figure 4: Global pompano production, 1980 to 2016 (Source: FAO, 2018).

Pompano is listed as ‘Least concern’ by the International Union for Conservation of Nature (IUCN), and no population declines have been observed due to fisheries exploitation or other threats (Smith-Vaniz and Williams, 2016).

Aquaculture

Snubnose pompano has a high market value and growing market demand, particularly in Asian markets such as Singapore, Taiwan, Hong Kong and China; this demand cannot be met by wild-caught fisheries, leading to an increase in aquaculture production (Figure 4) (Ransangan *et al*., 2011). Snubnose pompano accounts for almost all global pompano aquaculture production, with other species such as the Florida and the black pompano cultured to a lesser extent (FAO, 2019).

Aquaculture production of pompano species began in the 1970s with the successful spawning of Florida pompano (*T. carolinus*). The aquaculture of snubnose pompano was subsequently developed in a number of Asia-Pacific countries including Taiwan and Indonesia to meet the market demand for pompano products. The species is farmed in floating cages and land-based ponds. In many cases, aquaculture of snubnose pompano still relies on the capture and grow-out of wild fingerlings (Ransangan *et al*., 2011). Continued research into pompano aquaculture is leading to improved practices and certain countries have established successful hatcheries and fingerling production, including India, China, Taiwan, the Philippines, Vietnam and Indonesia (Yeh *et al*., 1997; Surtida, 2000; Juniyanto *et al*., 2008; Gopakumar *et al*. 2012; Nazar *et al*., 2012; Towers, 2013; Mai, 2016).

China and Indonesia are the largest aquaculture producers of pompano (Figure 5), with 112 000 and 122 000 tonnes produced in 2012, respectively. Other countries that produce pompano to a lesser extent include Singapore, Hong Kong, Dominican Republic, Philippines and Malaysia (Ransangan *et al*., 2011, Amal *et al*., 2012; FAO, 2018). In China pompano are reared in small-scale wooden floating sea cages, in combination with cobia and grouper, as well as in larger-scale commercial sea cages (Kongkeo et al., 2010). Pompano aquaculture in Indonesia occurs mainly in large sea cages (Figure 6) (MMAP, 2012).

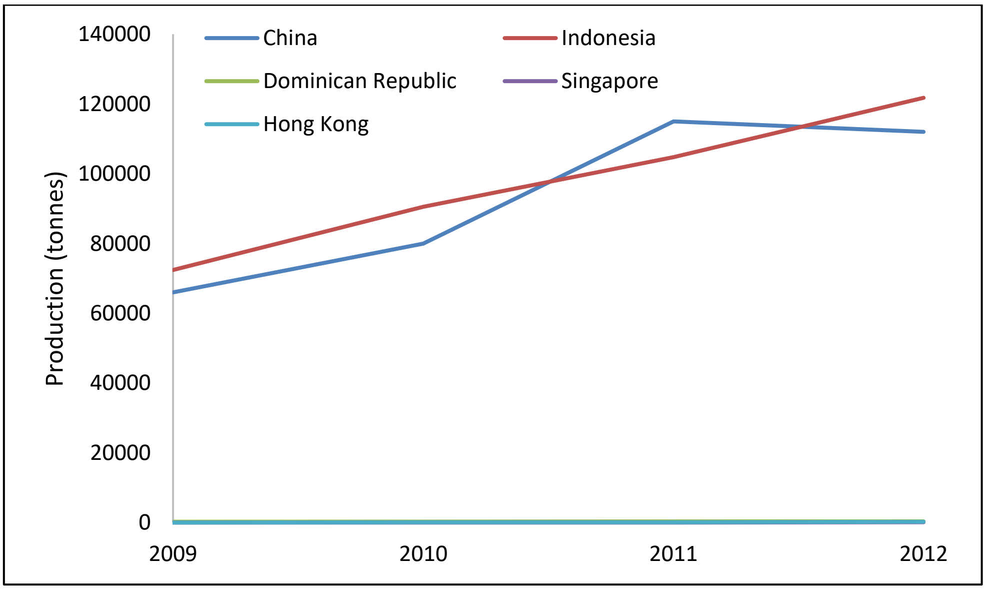

Figure 5: Global Aquaculture production of pompano, 2009 to 2012 (MMAP, 2012; FAO, 2018).

Figure 6: Lucky Samudra Pompano farm in Indonesia

2. Technical approach to aquaculture production

Production cycle

Snubnose pompano can be farmed entirely on land or, as will be the case in Seychelles, through a combination of land- and sea-based phases (Figure 7). Adult fish (broodstock) are captured from the wild and held in land-based tanks, where they spawn and produce eggs. After hatching, the larvae are reared in land-based facilities. At a size of around 5 to 8cm TL the juvenile fish are transferred to cages in the sea, where they remain until they reach market size (Figure 7).

The land-based tank systems are typically a combination of pump-ashore Recirculating Aquaculture Systems (RAS) and flow through systems. The water that is pumped ashore is filtered before entering the tanks to remove pathogens and to provide optimal water quality for the fish. Similarly, effluent water leaving the tanks is cleaned in accordance with the relevant Seychelles Aquaculture Standard and global best practice.

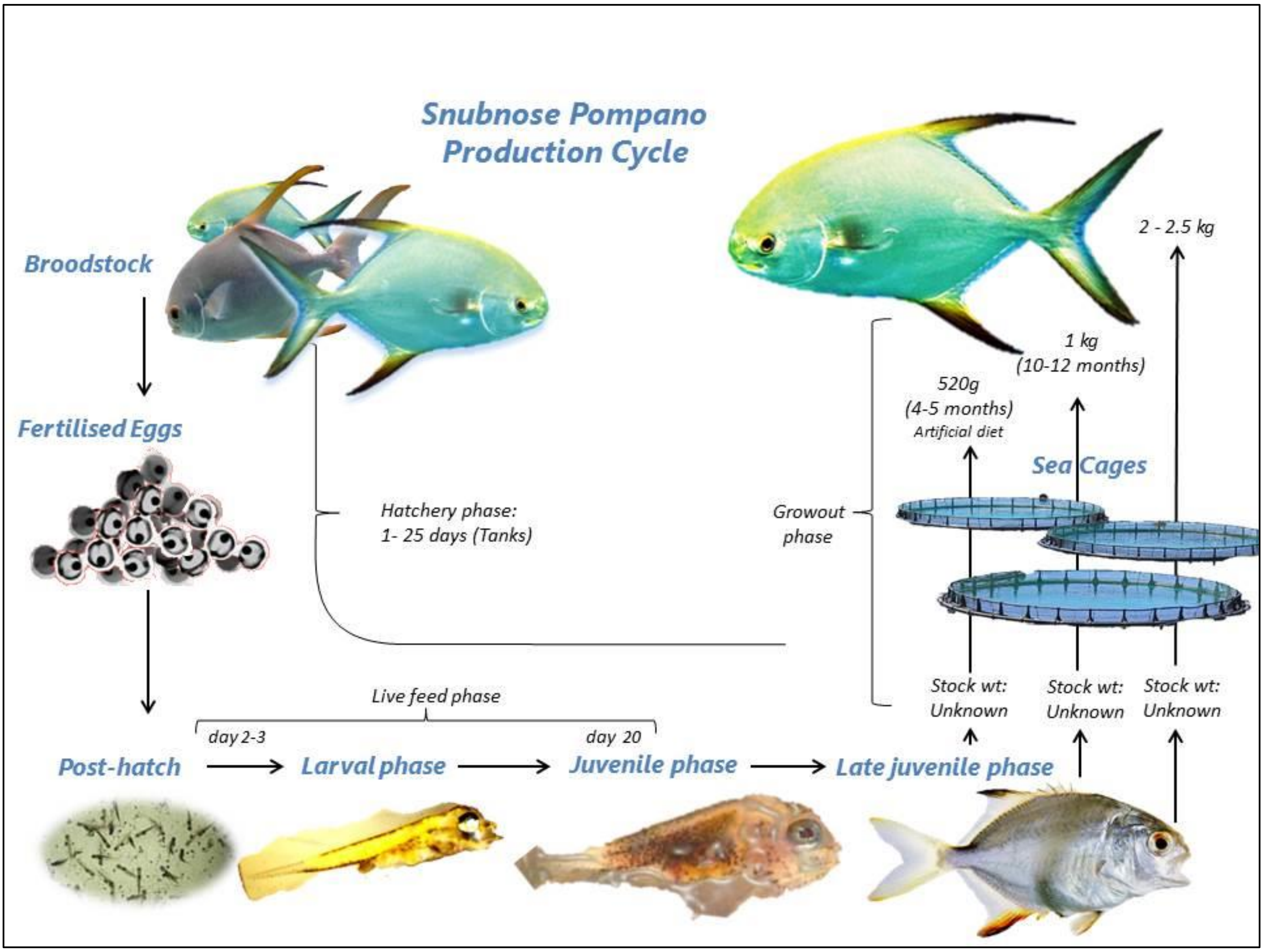

Figure 7: Production cycle of snubnose pompano

Broodstock

Snubnose pompano broodstock are captured from the wild and transported back to the broodstock acclimation and quarantine facility in specially designed broodstock transport tanks. They are placed into quarantine tanks for one to four weeks to ensure that no disease or parasites enter the system and infect other fish (Gopakumar *et al*., 2012). During this phase they are exposed to regular freshwater baths to remove any parasites they may be carrying (Koesharyani et al., 2005; Sugama et al., 2012). When the quarantine process is complete, broodstock are moved into broodstock holding tanks where they are fed daily on a natural diet of squid, fish and invertebrates, often enriched with vitamins to maintain fishes' health (Sugama *et al*., 2012).

Once broodstock have acclimated successfully to captivity, they can be moved to spawning tanks, where they are stocked at a sex ratio of around one female to one to three males (Juniyanto *et al*., 2008). Snubnose pompano can be induced to spawn year-round through controlled photoperiod and temperature conditions (Gopakumar *et al*., 2012). They can also be induced to spawn with human chorionic gonadotropin (hCG) (Juniyanto *et al*., 2008; Gopakumar *et al*., 2012). During spawning, eggs and sperm from mature fish are released into the water where eggs become fertilised and float to the surface. Floating fertilised eggs are collected from spawning tanks by surface skimming instruments, and transferred to larval rearing tanks (Gopakumar *et al*., 2012).

Larviculture and nursery phase

Fertilised eggs are placed in larval rearing tanks, and the larvae of approximately 2mm hatch 30 to 36 hours after fertilisation (Figure 8A) (Nazar *et al.*, 2012). Larvae begin feeding two to three days after hatching, and a variety of live feed is provided to simulate the diversity of phytoplankton species found in their natural environment. Different types of live feeds are introduced in overlapping phases to meet nutritional requirements as larvae develop and grow. The live feeds include microalgae, rotifers and Artemia (Figure 10) (Nazar *et al.*, 2012). Towards the end of the larval phase, formulated feeds are introduced to begin weaning the juveniles onto this diet, and by day 25 juveniles (approximately 15.5mm) are weaned completely on to formulated pellet feeds (Nazar *et al.*, 2012). Juveniles are transferred to nursery tanks between day 25 and 30 (Figure 8B), where they remain until they are 5 to 10cm and then transferred to grow-out facilities (Figure 9).

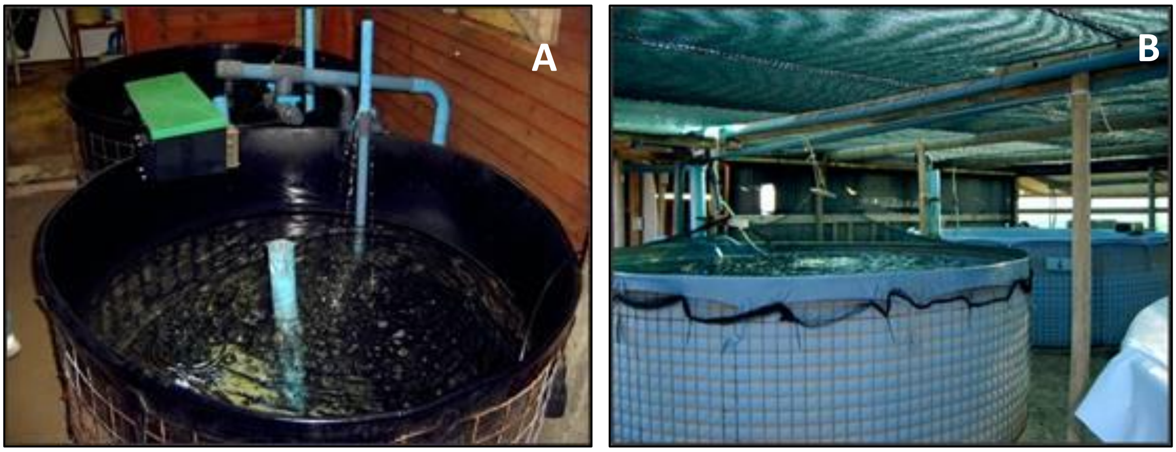

Figure 8: A) Larval rearing; and B) Nursery tanks in a land-based facility.

Figure 9: Snubnose pompano fingerlings (Source: Jurgenfreund.photos)

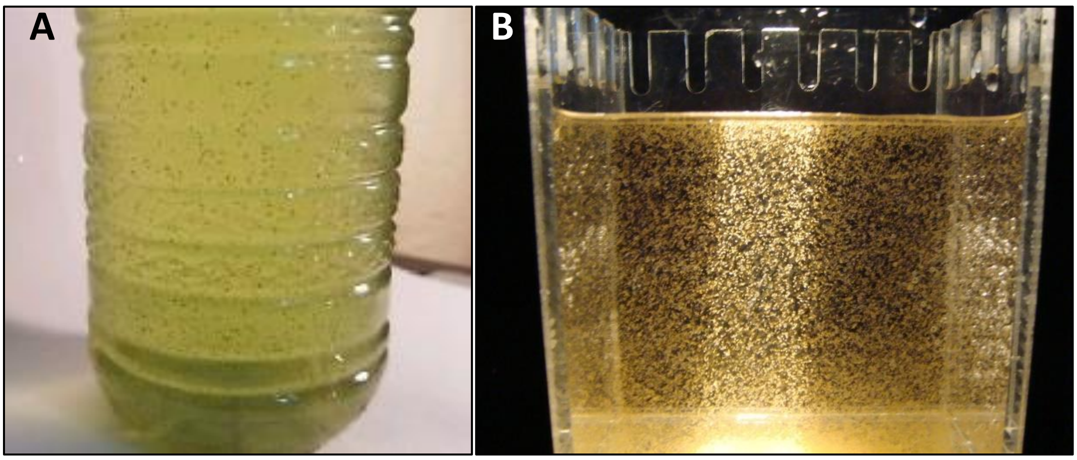

Figure 10: Live feed for larviculture rearing phase: A) Rotifers; and B) Artemia nauplii (Source: Aquaculture Nursery Farms).

Grow-out

At a size of between 5 and 10cm, fingerlings are stocked into the grow-out system where they are grown out to market size (Kongkeo *et al*. 2010). Stocking densities range from 25 to 35 fingerlings per m^3; juvenile snubnose pompano exhibit shoaling behaviour, and thus should be stocked at densities high enough to allow this behaviour, whilst not so high as to cause stress (Chavez *et al*., 2011).

The most common forms of grow-out systems are net cages or earthen ponds. The size of cages varies widely; small $8m^3$ cages are used in small scale-operations (Cremer *et al*., 2001; Chavez *et al*., 2011), while those used in large-scale commercial farms are circular, 6 to 10m diameter structures with depths of 4 to 8m (113 to $2500m^3$) (Figure 11) (Mai, 2016; NFDB, 2018). The mesh size of the cage net ranges from 5mm to 40mm depending on the size of the fish during the production cycle (Chavez *et al*., 2011). Continuous monitoring, cleaning and maintenance of the cages is performed to ensure the functionality of the cage and the welfare of the fish (Cardia and Lovatelli, 2015).

Figure 11: Sea-based cages for grow-out phase (Source: Bigstock).

During the grow-out phase, artificial pellets (Figure 12A) are the preferred feed for pompano. Fish are generally fed twice or three times daily and can be fed as often as six times per day as fingerlings (Groat *et al*., 2002; Hamed *et al*., 2016), either by hand (Figure 12B) or using automated devices. Feeding is done in such a way as to allow all individuals to reach the food. Floating pellets are preferred for pompano, allowing all fish to reach food and reduce the amount of uneaten feed (Jayakumar *et al*., 2013). Feeding is stopped when all fish are satiated and are no longer feeding.

Snubnose pompano is a highly active fish and thus has nutritional requirements that include high protein levels (Hamed *et al*., 2016). Pellets are formulated to meet the species' nutritional requirements, and can be enhanced with additions of vitamins and minerals to maintain fish health.

Figure 12: A) Artificial pellet feed for the grow-out phase; and B) Hand-feeding of fish in cages.

Fish are graded throughout the grow-out phase, and once they reach market size of 1 to 2.5kg, they are harvested from cages for processing (Figure 13).

Figure 13: Processing of farmed snubnose pompano (Source: Globefish, 2014).

Fish health

At all stages of the production cycle, care is taken to ensure fish health and welfare. Minimising stress is key to reducing susceptibility to disease and infections, and is done by maintaining optimal production and environmental parameters including stocking densities, feeding regimens, water quality and temperatures among others (Nagasawa and Cruz-Lacierda, 2004; Sugama *et al*., 2012). A very high level of biosecurity and cleanliness is also maintained to alleviate the likelihood of disease outbreaks (Sugama *et al*., 2012).

Pompano is a relatively hardy species (Jayakumar *et al*., 2013), however bacterial infections such as *Streptococcus* spp. and *Nocardia seriolae* (Amal *et al*., 2012; Vu-Khac *et al*., 2016), viral infections such as Betadinovirus (Ransangan *et al*., 2011) and parasitic infections, such as the dinoflagellate *Amyloodinium ocellatum* (Lawler, 1977) have been reported in pompano under land-based and cage culture conditions. The occurrence of such infections can be largely prevented by maintaining high standards of hygiene in land-based facilities, and screening all individuals before they enter the grow-out system so that only healthy fish are transferred to sea cages (Hawke *et al*., 2010). Parasitic infections can be treated by water treatments, such as freshwater baths, bacterial infections can be treated by the controlled use of antibiotics.

3. Market for snubnose pompano products

Pompano has a high-quality meat and therefore has a high market value of up to USD 7/kg for a whole frozen fish (Spire, 2014). There is a growing demand for pompano products in Asia and the USA, which can be met only by aquaculture due to the sporadic nature of fisheries production (FAO, 2019).

Pompano is also sold into the Live Marine Reef Fish Food Trade (LRFFT) to a small extent, however it is less valuable in this trade than other species such as grouper and snapper, and the majority of pompano production is marketed as processed fresh or frozen, whole gilled and gutted, or filleted (Figure 14; Figure 15) (Li, 2000; Spire, 2014). In the USA there is a demand for whole and filleted products for restaurants and high-end grocery stores, which is supplied domestically by the small USA aquaculture production of Florida pompano, as well by imports from Asian aquaculture production. There is opportunity for increased production to supply USA markets.

There is a high demand for Pompano products in Asia, particularly China. Most of the farmed pompano in China is consumed on the domestic market. In Indonesia, a large portion of aquaculture production is consumed domestically, with about one third exported. The largest export market for pompano products is China, followed by other Asian countries including Thailand, Malaysia and Japan. A small portion of products from Asia is exported to Australia, USA and Mauritius (Spire, 2014).

Figure 14: A) Chilled snubnose pompano fillet (Source: Pelicanseafoodcompany.com).

Figure 15: A) Whole fresh, gilled and gutted snubnose pompano; and B) Prepared whole snubnose pompano (Source: hkmarinelife.hk.h).

4. Suitability for aquaculture in Seychelles

The species

The snubnose pompano is indigenous to Seychelles waters and is permitted by regulations for aquaculture production. Broodstock can be obtained from local waters for use in aquaculture facilities. The species is well suited for aquaculture in land-based rearing and sea cage-based grow out facilities, and has been successfully produced in other countries (Gopakumar *et al*., 2012). It has fast and uniform growth rates, with recorded growth to around 380g in 120 days in cage culture conditions (Chavez *et al*., 2011; Jayakumar *et al.*, 2014). It accepts formulated feed, has a high tolerance for a wide range of salinities, and is robust and tolerant of cage culture conditions (Groat *et al*., 2002; Chavez *et al*., 2011; Kalidas *et al*., 2012; Hamed *et al*., 2016).

It is a highly regarded product with a large growing international demand, and is suitable for supplying local and domestic markets (Groat, 2002; Chavez *et al*., 2011).

Environmental and oceanographic conditions

Being within the species' natural range, the environmental conditions of Seychelles waters, such as temperature and salinity, are optimal for the survival and growth of snubnose pompano.

A number of factors have to be considered when selecting an area and sites for cage culture (Cardia and Lovatelli, 2015). The Seychelles inner islands, in particular, provide a suitable marine environment for cage culture of naturally occurring species. This region falls outside of the cyclone belt, and is less affected by the strong seasonal south east monsoon than the outer islands (Chang-Seng, 2007; ASCLME, 2012; UNEP, 2004). The oceanographic conditions are well within the optimum range for successful cage culture. Wave height, including during the SE and NE monsoons, is below the maximum swell height of 6m that such cages can withstand. Average current speeds are high enough to ensure water circulation within cages and dissolving of particles, without being too strong for the cage structure. Dissolved oxygen levels are above the threshold required for cage culture (Hecht, 2016).

Within this region a number of specific sites have been identified which will provide the conditions for optimal fish growth and minimal environmental and social impact. These zones are located such that they do not interfering with other activities such as tourism, artisanal fisheries and transport routes, and are far enough offshore to allow optimum water quality for fish health and to further ensure they do no conflict with land-based activities. These sites are characterised by ideal depth and sea-floor structure (relatively flat and soft or sandy) for cage culture, and a lack of coral reef or seagrass below cages to minimise the impact on marine ecosystems (Hecht, 2016).

Access to markets

Seychelles' level of transport infrastructure and its location in the middle of the western Indian Ocean makes it well-suited to aquaculture production for global markets. Seychelles has access to markets in Europe, the USA and Asia, via air and sea transport, and is able to receive imports of supplies, such technical equipment, from high-quality suppliers around the world. It also has access to local markets as products can be transported within and between islands.

References

Amal, M. N. A., Zamri-Saad, M., Iftikhar, A. R., Siti-Zahrah, A., Aziel, S. and Fahmi, S. (2012). An outbreak of *Streptococcus agalactiae* infection in cage-cultured golden pompano, *Trachinotus blochii* (Lacépède), in Malaysia. *Journal of Fish Diseases*, 35(11), 849-852.

Aquamaps (2016). *Reviewed distribution maps for* Trachinotus blochii *(Snubnose pompano), with modelled year 2100 native range map based on IPCC A2 emissions scenario* [Online]. Available at: www.aquamaps.org [Accessed 14 February 2019].

ASCLME (2012). National Marine Ecosystem Diagnostic Analysis, Seychelles. Contribution to the Agulhas and Somali Current Large Marine Ecosystems Project (supported by UNDP with GEF grant financing). 60p.

Caberoy, N.B. and Quinitio, G.F. (1998). Sensitivity of grouper *Epinephelus coioides* eggs to handling stress at different stages of embryonic development. The Israeli Journal of Aquaculture—Bamidgeh, 50, 167-173.

Cardia, F. and Lovatelli, A. (2015). Aquaculture operations in floating HDPE cages: a field handbook. FAO Fisheries and Aquaculture Technical Paper No. 593. FAO, Rome. 152p.

Chang-Seng, S. D. (2007). Climate Variability and Climate Change Assessment for the Seychelles. Seychelles Second National Communication (SNC), Under the United Nation's Framework of the Convention of Climate Change (UNFCCC). Ministry of Environment and Natural Resources, Republic of Seychelles. 56p.

Chavez, H. M., Fang, A. L. and Carandang, A. A. (2011). Effect of stocking density on growth performance, survival and production of silver pompano, *Trachinotus blochii*, (Lacepede, 1801) in marine floating cages. *Asian Fisheries Science*, 24, 321-330.

Chavez, H.M., Fang, A.L. and Carandang, A.A. (2011). Effect of Stocking Density on Growth Performance, Survival and Production of Silver Pompano, *Trachinotus blochii*, (Lacépède, 1801) in Marine Floating Cages. *Asian Fisheries Science* 24, 321-330

Cremer, M.C., Jian, Z. and Lan, P. (2001). *Growth performance of pompano on extruded feed in coastal cages at Hainan, China*. Results of ASA/China Feeding Trials 35-01-138. American Soybean Association. http://www.soyaqua.org/pdf2/02PompanoTRHainan.pdf.

FAO (2018). Fishery and Aquaculture Statistics. Global aquaculture production 1950-2016 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2018. Available at: www.fao.org/fishery/statistics/software/fishstatj/en [Accessed 8 February 2019].

FAO (2019). *Cultured Aquatic Species Information Programme:* Trachinotus *spp (*T. carolinus, T. blochii*)* [Online]. Available at: http://www.fao.org/fishery/culturedspecies/Trachinotus_spp/en [Accessed 14 February 2019].

Gopakumar, G., Nazar, A. A., Jayakumar, R., Tamilmani, G., Kalidas, C., Sakthivel, M. and Rao, G. S. (2012). Broodstock development through regulation of photoperiod and controlled breeding of silver pompano, *Trachinotus blochii* (Lacepede, 1801) in India. *Indian Journal of Fisheries*, 59(1), 53-57.

Groat, D. R. (2002). *Effects of feeding strategies on growth of Florida pompano (Trachinotus carolinus) in closed recirculating systems.* Doctoral dissertation, Southampton College.

Hamed, S.S., Jiddawi, N.S., Bwathondi, P.O.J. and Mmochi, A.J. (2016). Effect of feeding frequency and feeding rate on growth performance of juvenile silver pompano, *Trachinotus blochii*. *Western Indian Ocean Journal of Marine Science*, 15, 39-47.

Hawke, J.P. Baumgartner, W., Patro, B., Gothreaux, C. and Lan, H.P. (2010). Diseases of cultured pompano *Trachinotus* spp [Abstract]. In: World Aquaculture Society Meetings [Online]. Available at: https://www.was.org/meetings/ShowAbstract.aspx?Id=19056 [Accessed 26 February 2019].

Hecht, T. (2016). Selection of aquaculture development zones around the inner islands of Seychelles and their ecological carrying capacity. Advanced Africa Management Service Report. 105p.

The International Game Fish Association (IGFA) (2019). *Pompano, snubnose (Trachinotus blochi). All-Tackle World Records* [Online]. Available at: https://igfa.org/igfa-world-records-search/?search_type=ScientificName&search_term_1=Trachinotus&search_term_2=blochi [Accessed 26 February 2019].

Jayakumar, R., Nazar, A.K.A. and Gopakumar, G. (2013). *Culture of Silver Pompano* Trachinotus blochii *in coastal aquaculture ponds*. Mandapam Regional Centre of CMFRI Mandapam Camp, India. pp. 189-194.

Jayakumar, R., Nazar, A.K.A., Tamilmani, G., Sakthivel, M., Kalidas, C., Rameshkumar, P., G Rao, G.H. and Gopakumar, G. (2014). Evaluation of growth and production performance of hatchery produced silver pompano *Trachinotus blochii* (Lacépède, 1801) fingerlings under brackish water pond farming in India*. Indian Journal of Fisheries*, 61(3), 58-62.

Juniyanto, N. M., Akbar, S. and Zakimin (2008). Breeding and seed production of silver pompano (*Trachinotus blochii*, Lacepede) at the Mariculture Development Center of Batam. *Aquacultue Asia Magazine*, 13(2), 46-48.

Kalidas, C., Sakthivel, M., Tamilmani, G., Kumar, P.R., Nazar, A.K.A., Jayakumar, R., Balamurugan, Ramkumar, Jothi, P. and Gopakumar, G. (2012). Survival and growth of juvenile silver pompano *Trachinotus blochii* (Lacepède, 1801) at different salinities in tropical conditions. *Indian Journal of Fisheries*, 59(3), 95-98.

Koesharyani, I., Roza, D., Mahardika, K., Johnny, F., Zafran and Yuasa, K. (2005). *Manual for fish disease diagnosis—II: marine fish and crustacean diseases in Indonesia, 2nd edition*. Gondol Research Institute for Mariculture and Japan International Cooperation Agency. Bali, Indonesia. 57p.

Kongkeo, H., Wayne, C., Murdjani, M., Bunliptanon, P. and Chien, T. (2010). Current practices of marine finfish cage culture in China, Indonesia, Thailand and Vietnam. *Aquaculture Asia*, 15(2), 32-40.

Lawler, A. R. (1977). *Dinoflagellate (*Amyloodinium*) infestation of pompano*. In: Sindermann, C.J. (Ed.) Disease diagnosis and control in North American marine aquaculture. Elsevier Scientific Publishing Company, Netherlands. pp. 257-264.

Li, L.W.H. (2000). Live Marine Fish Trade and Mariculture in Hong Kong, Agriculture and Fisheries Department, Hong Kong Special Administrative Region [Online]. Available at: http://library.enaca.org/Grouper/Research/Livefish/2000/0808.htm [Accessed 2015].

Lieske, E. and Myers, R. (1994). *Collins Pocket Guide. Coral reef fishes. Indo-Pacific and Caribbean including the Red Sea.* Harper Collins Publishers.

Mai, M.D. (2016). Development of technology for culture of silver pompano (*Trachinotus blochii* lacepede, 1801) toward good aquaculture practice in Vietnam. Ministry of Agriculture and Rural Development Research Institute for Aquaculture No. 3, 54p.

Munday, B.L., Kwang, J. and Moody, N. (2002). Betanodavirus infections of teleost fish: a review. *Journal of Fish Disease*, 25, 127-142.

Nagasawa, K. and Cruz-Lacierda, E. R. (Eds.) (2004). *Diseases of cultured groupers*. Philippines: Aquaculture Department, Southeast Asian Fisheries Development Center. 81p.

National Fisheries Development Board (NFDB) (2018). Guidelines for Sea Cage Farming in India. Ministry of Agriculture & Farmers Welfare Government of India. Hyderabad, 32p.

Nazar, A. A., Jayakumar, R., Tamilmani, G., Sakthivel, M., Kalidas, C., Ramesh Kumar, P. and Gopakumar, G. (2012). Larviculture and seed production of the silver pompano, *Trachinotus blochii* (Lacepede, 1801) for the first time in India. *Indian Journal of Fisheries*, 59(3), 83-87.

Ransangan, J., Manin, B. O., Abdullah, A., Roli, Z. and Sharudin, E. F. (2011). Betanodavirus infection in golden pompano, *Trachinotus blochii*, fingerlings cultured in deep-sea cage culture facility in Langkawi, Malaysia. *Aquaculture*, 315(3), 327-334.

Reyes, O. S., de Jesus-Ayson, E. G. T., Pedroso, F. L. and Cabanilla, M. I. C. (2014). Hatchery production of snubnose pompano *Trachinotus blochii* Lacepede. *Aquaculture Department, Southeast Asian Fisheries Development Center*. http://hdl.handle.net/10862/3046.

Smith-Vaniz, W.F. (1984). *Carangidae*. In: Fischer,W. and Bianchi, G. (Eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol. 1. FAO, Rome.

Smith-Vaniz, W.F. and Williams, I. (2016). Trachinotus blochii *(errata version published in 2017)*. The IUCN Red List of Threatened Species 2016: e.T20436497A115384558. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T20436497A46664144.en. Downloaded on 14 February 2019.

Spire Research and Consulting (2014). *Value Chain Analysis of Marine Fish Aquaculture in Indonesia Business Opportunities for Norwegian Companies*. Innovation Norway.

Sugama, K., Rimmer, M.A., Ismi, S., Koesharyani, I., Suwirya, K., Giri, N.A. and Alava, V.R. (2012). *Hatchery management of tiger grouper (*Epinephelus fuscoguttatus*): a best-practice manual*. ACIAR Monograph No. 149. Australian Centre for International Agricultural Research: Canberra. 66p.

Surtida, M. B. (2000). The pompano. *SEAFDEC Asian Aquaculture*, 22(3), 27.

Towers, L. (2013). *BFAR Succeeds in Natural Spawning of Pompano in Hatchery* [Online]. Available at: https://thefishsite.com/articles/bfar-succeeds-in-natural-spawning-of-pompano-in-hatchery [Accessed 27 February 2018].

UNEP (2004). Payet, R.A., Soogun, N., Ranaivoson, E., Payet, R.J. and Ali Abdallah, F. *Indian Ocean Islands, GIWA Regional assessment 45b*. University of Kalmar, Kalmar, Sweden. 100p.

Yeh, S.-P., Yang, T. and Chu, T.-W. (1997). *Marine Fish Seed Industry In Taiwan* [Online]. Available at: http://aquafind.com/articles/seed.php [Accessed 27 February 2019].