RABBITFISH: A CANDIDATE FOR AQUACULTURE IN THE PACIFIC?

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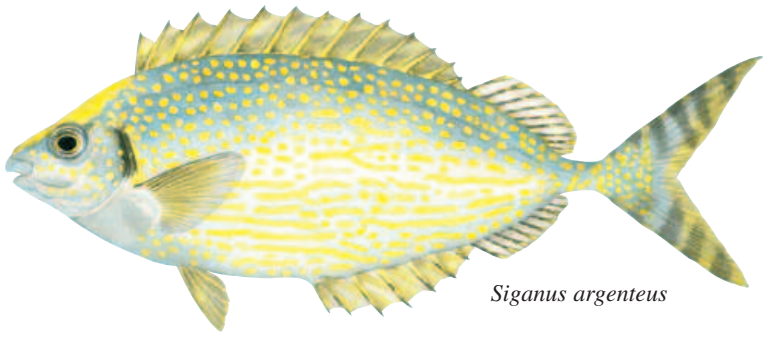
Worldwide, rabbitfish species have long been identified as appropriate candidates for aquaculture in developing areas of Asia. For example, *Siganus canaliculatus*, *S. guttatus*, *S. virgatus*, *S. spinus*, *S. punctatus*, *S. fuscescens* and *S. javus* in Malaysia and Philippines (Pacoli 1983; Von Wersternhagen and Rosenthal, 1976) and Indonesia, *S. canaliculatus* on the east coast of Africa (Bwathondi, 1982), *S. rivulatus* in the Middle East and Mediterranean region (Cagiltay 2003) and finally *S. randalli*, *S. lineatus* and *S. fuscescens* in the Pacific region (Brown et al. 1994; Rechellul pers. comm., Legarrec pers. comm.).

Rabbitfish aquaculture is fairly well understood and documented. More importantly, this group is very abundant during its recruitment periods, making it easy to catch in the shallows and thus keeping down the costs of acquiring fingerlings.

Several species of rabbitfish (mostly *S. argenteus*, *S. fuscescens*, *S. spinus* and *S. lineatus* – Fishbase, 2008) recruit into shallow seagrass beds and mangrove areas when they are about 60 days old and show strong aggregating behaviour. This phenomenon has been observed in Solomon Islands, generally in the summer months (October–February) (C. Oengpepa pers. comm). In Guam, they have been observed to recruit in high numbers in April (Tsuda and Bryan, 1973). In the Philippines, recruitment peaks were observed in February, March and April during new moon periods (Lam, 1974). A high recruitment event was observed in Fiji (Pickering pers. comm.) in December 2007. Usually, the juvenile fish recruit as a bait ball on shallow seagrass, mangrove areas or reef flats. They can be collected by push nets, cast nets, seine nets, lift nets, etc.

Excellent efforts have been made throughout the region to develop rabbitfish hatchery protocols, e.g. by the Bureau of Marine Resources in Palau for *S. fuscescens* and by Aqualagon, a New Caledonia based company for *S. lineatus* (SPC 2009). This hatchery development shows high promise for servicing niche export markets and local markets where the species has high value. However, most rural or peri-urban areas of the Pacific are best to tap into the large bait balls formed by rabbitfish when they recruit to develop a low tech, low investment type of aquaculture whether in floating cages, pens or ponds.



Siganus argenteus

REVIEW OF RABBITFISH FARMING INITIATIVES THROUGHOUT THE REGION

SOLOMON ISLANDS: Assessing local feed types for grow out of *S. argenteus*

With contributions from Cletus Oengpepa (WorldFish Center) and Patrick Mesia (MFMR)

In Solomon Islands, ACIAR recently funded a project called 'Cage culture of rabbitfish (Siganids) with emphasis on locally available diets'. The project is one of the ACIAR-funded aquaculture mini-projects that are currently being jointly implemented by James Cook University, SPC, The University of the South Pacific and the WorldFish Center together with in-country counterparts (Fisheries Services and the private sector in some cases). The three aims of this project are to (i) culture wild caught rabbitfish fingerlings in a simple cage farming system using proven commercial diets; (ii) identify locally available sources of ingredients that can be used for fish mariculture, develop simple diets and compare growth and survival of rabbitfish using these diets; and (iii) evaluate future options for

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marine finfish mariculture to address some of the emerging food security issues in the Pacific.

The WorldFish Center, Ministry of Fisheries and Marine Resources and the SPC Aquaculture Section are involved in trials which began in October 2008 at the WorldFish Center station in Nusa Tupe, Western Province. So far, a few hundred *S. argenteus* fingerlings have been collected from seagrass beds and placed in floating sea cages.

A batch of these are being fed with a commercial imported aquafeed to assess the maximum growth potential of the species under Solomon Islands conditions, while the others are being fed on locally made feed. The local feed is made of by-products that are cheap and easily found throughout Solomon Islands – fish meal from the Noro based tuna plant and copra meal. To make the feed, sago palm starch is being used a binder.

Survival has so far been excellent but growth has been better with the fish fed commercial diets. The trials will continue until all fish are brought in at commercial size. We expect to be running more feeding trials with a wider range of locally available ingredients.

Rabbitfish is highly regarded in Solomon Islands and some areas such as North Malaita have high populations, great farming spots and good rabbitfish recruitment patterns. We hope to be able to demonstrate the cheapest way to farm these

Top: Small scale experimental floating farm in Solomon Islands

Middle: Kurukuru (WorldFish staff) feeding the rabbitfish

Bottom: Monthly sampling of rabbitfish growth in Solomon Islands

fish and the MFMR wishes to transfer these farming /feeding techniques to places such as Lao lagoon in the near future.

New Caledonia: Hatchery development for a lucrative 'Picot Rayé' (*S. lineatus*) market

By Franck Legarrec (Aqualagon)

The 'picot' is the favourite fish of New Caledonians. It reaches USD 14–18 per kg and its current production (fishing only) is around 50 t per year. Research on picot started in 2003 in collaboration with the *Laboratoire d'Etudes des Ressources Vivantes et de l'Environnement Marin* (LERVEM) at the University of New Caledonia. In 2004, the project was awarded a prize in a French technological innovation contest run by ANVAR. A pilot-scale hatchery was installed to demonstrate technical feasibility.

During the initial phases of the research, broodstock was routinely secured and a good understanding of their maturation was developed. A complete picot life cycle was achieved repeatedly during the initial trials and specific requirements for live phytoplankton and zooplankton during larval rearing were developed. Cage trials proved that picot reached commercial size (300 g) in less than a year.

In 2009, a commercial hatchery and commercial farm will be established in southern New Caledonia with a total production capacity of 100 t per year. Aqualagon is expecting to produce 30 t per year from 2010 onwards. Focusing on the local market, Aqualagon is hoping to diversify its production by (i) selling fingerlings to other farmers, (ii) developing the restaurant/wholesaler market for picot, and (iii) possibly exporting.

Cook Islands: Making the best of large recruitments of *S. argenteus* in Rarotonga: Pond farming of rabbitfish

By Tap Pryor (Titikaveka Growers Association)*

Each January in Rarotonga, rabbitfish (*Siganus argenteus* or *morava*) run in thick schools close to the beaches. Surrounded by a net, they form what looks like a huge, black medicine ball, indeed called a 'bait ball'. Predator fish lurk in slightly deeper water, looking for the carelessly wandering mini-school and racing in like wolves after caribou. The fingerlings are so abundant they seem uncountable, perhaps best quantified by the local term 'heaps'.

Top: *S. lineatus* broodstock in New Caledonia

Bottom: Releasing freshly caught *S. argenteus* fry at TGA's land based pond facilities

* Titikaveka Growers Association (TGA) is an NGO promoting organic agriculture and inland aquafarming in Cook Islands in close association with the Ministries of Agriculture and Marine Resource Management.

Titikaveka Growers Association (TGA) developed and operates a demonstration aquafarm on Rarotonga. Amongst its facilities are two lined ponds holding 600,000 litres of seawater each with a salinity of 22–25 ppt or roughly 61–69% of the salinity of ocean water.

The seawater is pumped in from the nearby lagoon just once to fill the ponds after which it is recirculated internally through large (22 x 2 x 1 m), oyster-loaded biofilters at 600 lpm. TGA maintains a dense, marine phytoplankton culture in the ponds. At present, we have over 150,000 oysters in inventory and add about 50,000 per month from a hatchery in Tasmania, Shellfish Culture Ltd. Grow-out requires 8 months from seed to market, so the peak load will be about 400,000 oysters from 2 cm to 10 cm.

Phytoplankton culturing on the demonstration aquafarm is normally assisted by a polyculture of milkfish, but as one pond had been recently filled, it contained no fish in January. To compensate, TGA's Chairman, Teava Iro, decided to recruit some rabbitfish and easily transferred about 5,000 fingerlings by simply bucketing them from the bait ball into containers and rushing them by truck three km to the pond. They lived.

Alerted to the apparent success of the small trial, Secretary of Marine Resources, Ian Bertram, organized a second operation two weeks later from the opposite side of the island near Avatiu Harbour. Equipped with a battery-powered aerator and several tanks, MMR staff were able to transfer an additional 30,000 or so to the same pond with only a handful of losses. These too continue to thrive.

For the month that we have had them in stock, we have been feeding a chicken mash (16.5% protein) twice daily, which they scoop up eagerly. Presumably, they supplement this by grazing surface algae and zooplankton. We note in Antoine's paper that other Siganid species – all omnivores – have successfully been fed a wide range of diets, including everything from tapioca leaves and seaweed to chopped fish and fish meal pellets. We intend to try many of these. The recommended ration in the tropics is 5–7% of bodyweight, a huge amount of food whenever most of ours reach a marketable 250 grams.

We also note that Siganids are pervasive throughout the region. Who can say how well TGA's trial will turn out by January 2010! However, if these fish continue to survive and grow and if we can learn how best to feed them, we will try to acquire more fingerlings. At 50 fish/cu^3, we will carry bio-loads of 12.5 kg/cu^3 when marketable, an achievable target even when doubled by the oyster load. With the benefit of biofilters and/or packages of bacteria and enzymes (probiotics) to maintain water quality, we may end up with a second demonstration of some possible use to the region.

Transporting *S. argenteus* on the back of a truck in Cook Islands

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