Farmer to Farmer: New Caledonia
Trip Report June 2011

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New Caledonia is an overseas territory of France located in the Pacific Oceania region and is one of the largest islands in the Pacific Ocean. The land area consists of 18,575 km^2, and 300 km^2 of ocean. New Caledonia has 2,254 km of coastline and experiences hot and humid tropical weather influenced by southeast trade winds. Cyclones are frequent from November to March. The population of New Caledonia is just under 230,000 people and is growing at a rate of 1.1%. The people of New Caledonia are primarily Melanesian and European. French is the official language but over 30 Melanesian-Polynesian dialects exist. Noumea is the capital city and hosts 65% of the population. The island of New Caledonia consists of coastal plains and interior mountains that supply 25% of the world's nickel, as well as chrome, gold, cobalt and iron. Only 0.32% of land is arable with approximately 100 km^2 equipped with irrigation. Food commodities account for 20% of the imports. Vegetables, cattle, deer and swine are farmed and fish are plentiful. Approximately 20% of the employment is in agriculture.

New Caledonia has a history of shrimp aquaculture. Competition with Asian production coupled with high labor and export costs have constrained the growth of the industry. New Caledonia is looking to diversify their aquaculture production. The natural populations of sea cucumbers or "Beche-de-Mar" have been over harvested for export to Asian markets. These natural populations of sandfish (*Holothuria scabra*) have diminished and fishery regulations have been implemented. Recent research on sea cucumber spawning and larval rearing conducted by the World Fish Center in Indonesia coupled with the high value of "Beche-de-Mar" (reaching $500 per kilogram dry mass) has led to the interest in developing a sea cucumber aquaculture industry in New Caledonia. Funding has been secured by the Societe Elevage Aquacole De La Ouenghi (SEA) to develop a sea cucumber aquaculture hatchery and nursery system for the production of sea cucumbers for export to Asian markets and for restocking the natural indigenous populations. New Caledonia has a number of endemic fish and invertebrates that could potentially be good targets for aquaculture.

I departed from Phoenix on December 27 and returned Jan 29. Dr. Costa and his colleagues provided 50% of the airfare and housing during the month I was in New Caledonia. The majority of my time was spent in Boulouparis District of New Caledonia which includes most of the agricultural and aquaculture operations.

Societe Elevage Aquacole De La Ouenghi (SEA)
Participants: 9 M:6 F:3
Dr. Robert Costa, Dr. Sophie Costa, Roger Galliot

The SEA is focusing on spawning and producing sea cucumbers (*H. scabra*) for stock enhancement and export to Asia. Designs for a recirculating aquaculture system for the hatchery and for the nursery were drawn up. During cyclone season water runoff and disturbance creates poor water quality at the intake site of the pumping station. The cyclone season coincides with the spawning season of *H. scabra* and it was therefore in the interest of SEA to construct a recirculating system for the hatchery and nursery. Filtration components that were onsite at the farm were utilized into the filtration designs where applicable. The aquaculture system was designed with the ability to raise fish and other invertebrate species in the down season of sea cucumber production. Algae production protocols were discussed for the production of phytoplankton feeds for raising *H. scabra*. The SEA intends on producing over 750,000 sea cucumber juveniles to be stocked into ponds and lagoons around New Caledonia. Multiple dive trips were taken to collect broodstock and scout potential sites where sea cucumbers can be located. Because of the over fishing, finding large populations of a few hundred or more for broodstock was not a simple feat. A total of 500 adults were collected for broodstock. The broodstock pond was outfitted with a paddlewheel for mixing the water and providing aeration.

Sea Cucumber *Holothuria scabra*

The Société d'Elevage Aquacole (SEA) farm is now producing sea cucumbers (*Holothuroidea scabra*) in earthen ponds. SEA is located in Ouenghi, New Caledonia. The sea cucumber farm designs and other potential species were evaluated in the first trip to SEA. The farm is going to be an integrated farm process. The sea cucumbers are one organism that is grown in the system feeding on detritus materials and plankton. Fish species and algae are also going to be produced on the farm in the future. The fish will provide nutrients and waste for feeding the sea cucumbers and nutrients for algae. The farm will operate by utilizing the waste from one process for the benefit of another.

The SEA algae lab, nursery and hatchery received seawater from the IFREMER field station via gravity flow. There was an 11 meter head differential between the water source at the IFREMER field station and SEA. A 110 millimeter PVC pipe was used to deliver water across 1,000 meters to a water collection and filtration system at SEA at a rate of approximately 10 - 15 m^3 per hour. The filtration system consists of a sand filter, and 800 um, 500 um, and 250 um bag filters, a protein skimmer with ozone, a 5 um and 1

um bag filter, and an ultraviolet sterilizer. The system capacity is approximately 10 – 15 m^3 per hour. Three air blowers provided aeration to the algae lab, hatchery and nursery. A heat distribution pipe and a drain for condensation were installed in the air manifold. The algae lab and cultivation area had a series of cartridge filters consisting of a desiccant filter, a 50 um and a 1 micron filter.

Robert Costa, Benjo, Jason Licamele and Marcel

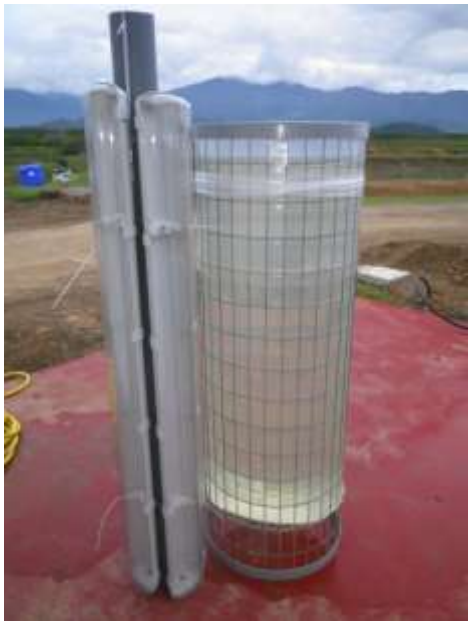
Layout of the filtration system at SEA

The nursery has the ability to recirculate water and purge the system as needed. Water leaving the hatchery and the nursery systems can be discarded into the ponds or off the farm. The nursery system utilizes mechanical, biological, foam fractionation and ozone, and ultraviolet sterilization filtration. This allows you the flexibility to run a recirculating system but also purge the system. Purging the systems periodically or having a 10-30% water exchange periodically was recommended. During times when the sea water can't be used because of low salinity from runoff after the cyclones, the water from the hatchery can be run of full recirculation for an extended period until the water quality is optimal. New species for expansion include growing Siganus fish species, tridacnid clams, corals and other marine ornamental fish species. Macro-algae can also be utilized as a filtration mechanism; however the biological load from the sea cucumber hatchery will not be enough to support a mass culture. Fish effluent will have enough nitrates for

algae culture and this can be utilized in the future. There are a number of possible algae species that can be grown that have a high value and are listed in a report from the SPC.

Matias and Carole working in the algae cultivation lab at SEA

Matias in the algae inoculation room at IFREMER



Algae photo-bioreactor designed for SEA

IFREMER (French Research Institute for Exploration of the SEA) was visited and a tour of their shrimp production was provided by the technical staff. Studies involving the use of biological flocculants for cultivating shrimp broodstock were being conducted.

The shrimp broodstock and pond production were in operation during the visit. It is the intention of IFREMER to switch the current shrimp pond production to biofloc production. IFREMER housed the algae inoculation lab for SEA, as well as provided access to their water holding station. Wild strains of algae were being evaluated for potential use in health, food and biofuel production. There was collaboration between IFREMER and SEA.

Researchers at the IFREMER Field Station, New Caledonia

The shrimp broodstock facility at IFREMER, New Caledonia

Shrimp (Penaeus stylirostris) at IFREMER

Shrimp pond at IFREMER

The first task on the trip was to finalize the designs and construction of filtration system, nursery and hatchery. The second task was to induce and observe spawning of the sea cucumbers. Techniques were developed and applied to induce spawning in the sea cucumbers. This will allow the farm to produce sea cucumber larvae throughout the year. Upon completion of the trip the filtration system was designed and in place, the aeration system was set up, the algae lab was constructed, the algae cultivation room, hatchery and nursery were designed and construction began. Currently the construction of the farm is complete and production of sea cucumbers has begun. The farm is currently producing over 1,000,000 sea cucumbers raised to the juvenile/nursery stage. Collaboration between SEA and myself will continue in the future. The next project is to develop protocols for rearing local valued fish species for anticipated production in 2012.

Table 1.

Location / Organization	**Male**	**Female**	**% M/F**	**Number of families represented**	**Number of consumers benefiting**	**Number of recommendations**
SEA	6	3	66	8	50	4
IFREMER	10	10	50	16	20	0
Total	**16**	**13**	**55**	**22**	**60**	**4**