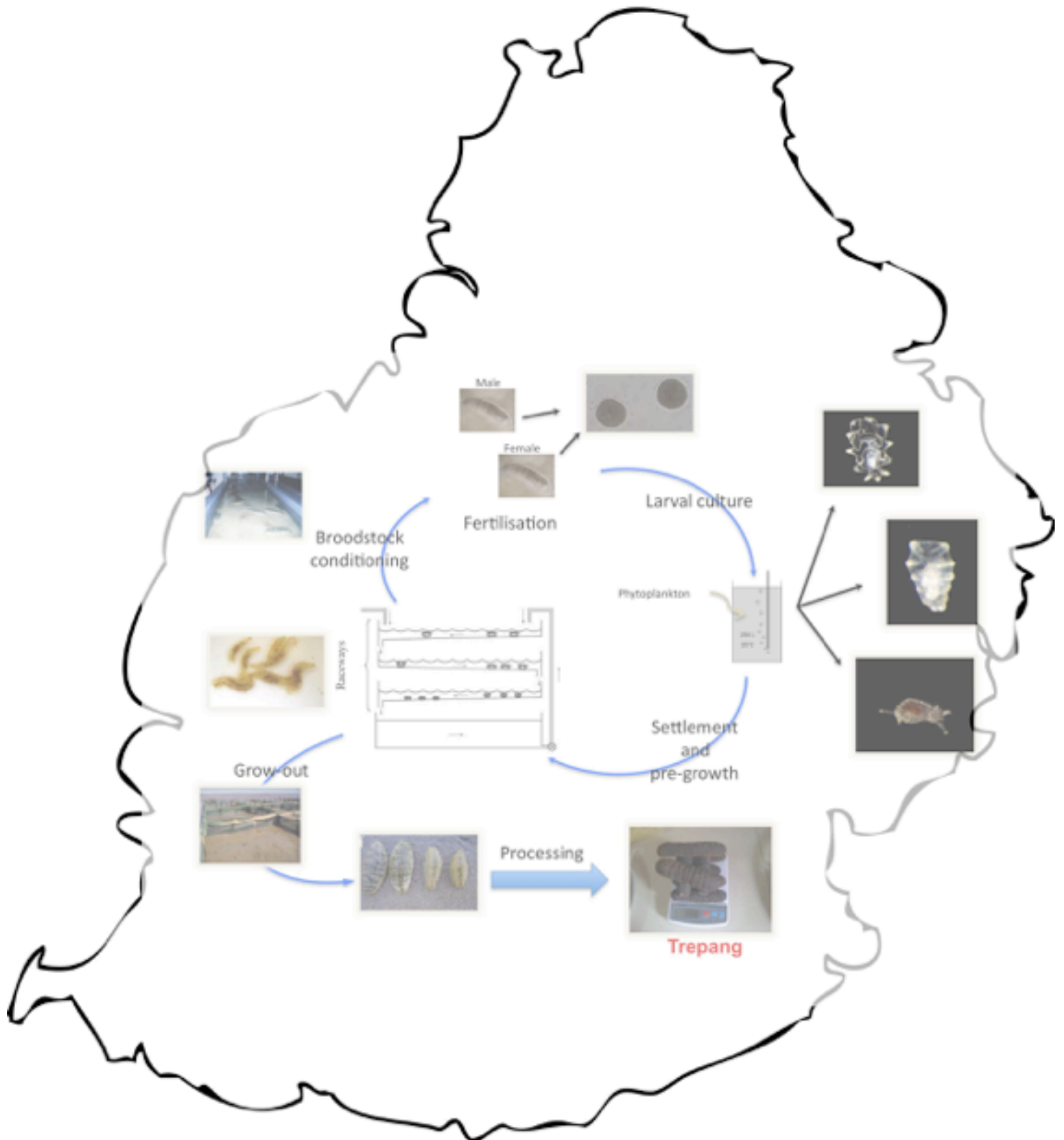


SEA CUCUMBER AQUACULTURE IN MAURITIUS



PRELIMINARY SITE ANALYSIS:

BIOSYS CONSULTING PTY LTD - AUSTRALIA

REPORT

MAURICOAST

CONSULTANCY SERVICES FOR SITE ASSESSMENT IN MAURITIUS

29th FEBRUARY 2016

PREPARED BY:


Dr DEVARAJEN VAITILINGON – BIOSYS CONSULTING PTY LTD



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OFFERORS AUTHORISATION AND CERTIFICATION

SUPPLIER DETAILS (We offer to supply the services in accordance with the terms, conditions and the offered price set out in this request for offer).		
Business Name of Supplier:	BioSys Consulting Pty Ltd	
Address:	Suite 4.1, 105 Kippax Street, NSW 2010, Australia	
ABN No.	11 139 619 542	
Contact Name and position:	Dr Devarajen Vaitilingon - Director	
Signature		Date: 29/02/16

OFFERORS INSURANCE CERTIFICATION

<p>BioSys Consulting Pty Ltd states that it holds and will maintain for the duration of the contract the following insurances:</p> <ul style="list-style-type: none">• Public Liability insurance of a minimum amount of AUD \$10,000,000*. Policy number: 15T6035459. Expires on 28/10/2016 (Renewable).• Professional indemnity insurance of AUD \$10,000,000 for one claim and AUD \$20,000,000 in the aggregate. Policy number: 02MIS1012607. Expires on 28/10/2016 (Renewable). <p>Insurance provider: CGU Professional Risks Insurance – CID</p> <p>Name insured: BioSys Consulting Pty Ltd – ABN 11 139 619 542</p>
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DOCUMENT VERSION HISTORY

Date	Document Version	Document Revision History	Document Author/Reviser
02 / 02 / 2016	1.0	draft	D. VAITILINGON
15 / 02 / 2016	1.1	draft	D. VAITILINGON
29 / 02 / 2016	1.2	draft	D. VAITILINGON

APPROVALS FOR SUBMISSION

Date	Document Version	Approver Name and Title	Approver Signature
15/ 02 / 2016	1.1	D. Vaitilingon	DV
29 / 02 / 2016	FINAL	D. Vaitilingon	DV

1. Report Submission Form

Penang, Malaysia, 29/02/2016

To:

Mr Yash
Business Development Manager
Mauricoast
Mauritius
Phone: [+230 52594041](tel:+23052594041)
Email: mauricoast@yahoo.com

Dear Yash,

We are please to submit herein the final version of the report concerning the preliminary site analysis of the Grand Barachois at Poudre D'or. In general, our findings show that the Grand Barachois is suitable for the grow-out of sea cucumber and will constitute a major asset in the development of a profitable sea cucumber aquaculture business in Mauritius.

Yours sincerely,

Authorized Signature:



Name and Title of Signatory: Dr Devarajen Vaitilingon – Director

Name of Firm: BioSys Consulting Pty Ltd

Address: Suite 4.1, 105, Kippax Street, Surry Hills, NSW 2010, Sydney, Australia

2. Consultant's Organization and Experience

Dr Devarajen Vaitilingon – BioSys Consulting Pty Ltd

A. Consultant's Organization – BioSys Consulting Pty Ltd

BioSys Consulting Pty Ltd (herein refer to as BioSys) is a private Australian company providing engineering, management and specialist technical consulting services for the development and operation of profitable and ecologically sustainable aquaculture businesses, innovative aquatic research systems and wastewater treatment systems. The company is composed of a team of hydraulic and aquaculture engineers, project and farm managers and scientific professionals with proven expertise in innovative aquatic system designs and aquaculture industry development.

Utilising over 15 years of experience, we offer professional consulting services to the aquaculture industry, academic and research institutions, government, non-governmental and other organisations to develop aquatic systems either for commercial production of aquatic organisms, demonstration, or research. Through the application of innovative methods to aquatic system, we design and operate flexible facilities that can be customized to satisfy the client requirements and objectives. BioSys mitigates and shares project risks through project feasibility, opportunity analysis and an integrated partnering arrangement throughout the project lifecycle. This aids the understanding of any project risks in the early design stages enabling market-driven solutions and technologies.

BioSys Consulting Pty Ltd pays particular attention to species and system selection to build economically, environmentally and socially sustainable aquaculture businesses. Our team is experienced in extensive pond-based systems to intensive recirculating systems where the aquatic organisms are kept at optimal environmental conditions whilst keeping water and energy usage to a minimum. Our strength lies in the complete understanding of the biological model requirements for aquaculture, and also in the experience of our team in hydrodynamics, water chemistry, water treatment and wastewater management.

We offer a multi-disciplinary service to the aquaculture industry to set up a solid base for long-term profitability, and to academic institutions to create innovative aquatic systems for research.

SERVICES

BioSys Consulting Pty Ltd offers professional end-to-end delivery of aquaculture and aquatic research facilities to private commercial clients, research institutions and government organizations. BioSys has recently entered in a partnership with a leading management company GEPC (Global Edge Project Consulting, www.globaledgeprojects.com.au) to provide a thorough package of project management services and infrastructure design to our clients.

Our engineering and technical services include:

- 1) Site inspection and analysis
- 2) Feasibility studies
- 3) Research and development
- 4) Concept and construction designs
- 5) Mass, water and energy balances
- 6) Water intake and wastewater treatment systems
- 7) Mechanical, Chemical and Biological filtration systems
- 8) Tanks loadings and production turnover rates
- 9) Layout plans, process flow diagrams and 2D & 3D CADs
- 10) Hydraulic profiles and engineering drawings

Our project management services include:

- 1) Project briefing, analysis and planning
- 2) Preparation of strategic planning documents
- 3) Support in permit application process
- 4) Coordination of expert design consultants
- 5) Business planning and financial analysis
- 6) Operational and logistical planning
- 7) Sustainable practices

BIOSYS INVOLVEMENT IN SEA CUCUMBER AQUACULTURE

Since its inception, BioSys Consulting Pty Ltd has been involved in numerous sea cucumber aquaculture projects. The testimonial below reflects the level of work delivered during the concept design of a sea cucumber project in New Caledonia:

"From work and innovation from Biosys Consulting, this project (Sea cucumber aquaculture) was awarded the French National Grant for Innovative Enterprise (OSEO 2010). BioSys team's work has really been appreciated, especially their communication abilities and their quick response to all evolving requirements. I certainly would recommend them to anyone looking for strong advice and in need of developing modern and sustainability oriented production projects whilst optimizing running cost."

Paul Chabre, Aquaculture Adviser, Aquamon Pty Ltd - paul.chabre@yahoo.fr

Since then, BioSys has been involved in concept design and feasibility studies on sea cucumber projects in Tanzania, Papua New Guinea and more recently in Malaysia. See details of these projects below.

DR DEVARAJEN VAITILINGON

Dr Devarajen Vaitilingon (Dev) has an extensive knowledge in designing aquatic research facilities and aquaculture systems. During the last 15 years, he has developed a unique blend of expertise in applied research for species of aquaculture interest, and the application of innovative technologies to develop aquaculture systems that operate within the principles of ecologically sustainable development.

Dev has proven practices in developing hatchery and grow-out techniques for marine and freshwater species at both pilot and commercial scales. He was one of the scientific leaders of the **Echinoculture Project in Madagascar, which involved the culture of sea urchin, *Tripneustes gratilla* and the sandfish, *Holothuria scabra***. He was also the scientific leader of the Sea Urchin

Aquaculture Programme at Macquarie University. He was later appointed as the Principal Scientist for AusUni Pty Ltd, a private Australian company formed for the commercialisation of sea urchin roe.

Dev has published extensively on the biology and ecology of echinoderm species of aquaculture interest, which form part of his PhD thesis and other associated works. He is one of the inventors of a Patented technology in sea urchin aquaculture (PCT/AU2007/001972). Dev has directed and managed several aquaculture and aquatic system design projects. He is fully proficient in technical design, water filtration technologies, wastewater system design and modeling of mass flow within an aquatic system. He fully understands the challenges involved in designing a multi-user aquatic system for scientific research.

B. Consultant's Experience

DIRECT EXPERIENCE IN SEA CUCUMBER FARMING

Assignment name: Concept design of a sea cucumber aquaculture farm in New Caledonia	Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 100 000
Country: New Caledonia Location within country: Presque'île de Montagnes	Duration of assignment (months): 5 months
Name of Client: Halios Pty Ltd	Total No. of staff-months of the assignment: Project Director = 0.5 staff month Project Manager = 0.8 staff month
Address: Halios, BP7949, 98801 Nouméa, New Caledonia	Approx. value of the services provided by your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 30 000
Start date (month/year): September 2009	No. of professional staff-months provided by associated consultants: None
Name of associated Consultants, is any: None	Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Dr Devarajen Vaitilingon – Project Director Mr Stuart Smith – Project manager
Narrative description of Project: Halios Pty Ltd, engaged BioSys to provide services for a Pre-feasibility study and Concept design of a sea cucumber farm to be located at Presqu'île de Montagnes, New Caledonia. The work consisted in an evaluation site suitability, designed the different production units (from hatchery to grow-out), designed the processing plant, water intake and	

treatment, calculations of mass, energy and water balances within the different production units and provision of a cost estimate of the pilot and commercial facility.
<p>Description of actual services provided by your staff within the assignment:</p> <ul style="list-style-type: none"> - Technical design and engineering services - Schematic drawings, drafting services - Financial analysis including cost production model and sensitivity analysis - Project management and planning
Firm's Name: BioSys Consulting Pty Ltd

<p>Assignment name: Feasibility of a sea cucumber aquaculture farm in Papua New Guinea: Technical design and cost estimate</p>	<p>Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 1.5 million</p>
<p>Country: Papua New Guinea Location within country: Wewak</p>	<p>Duration of assignment (months): 2 months</p>
<p>Name of Client: APC International</p>	<p>Total No. of staff-months of the assignment: Project Director = 0.7 staff months Project Manager = 0.6 staff months</p>
<p>Address: PO Box 5285 Boroko NCD 111 Papua New Guinea</p>	<p>Approx. value of the services provided by your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 50 000. The service was in Kind support of estimated value \$50 K. In counter part, APC offered us a marketing support in PNG and Japan.</p>
<p>Start date (month/year): February to March 2010</p>	<p>No. of professional staff-months provided by associated consultants: None</p>
<p>Name of associated Consultants, is any: None</p>	<p>Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Dr Devarajen Vaitilingon – Project Director Mr Stuart Smith – Project manager</p>
<p>Narrative description of Project: APC International, approached BioSys Consulting Pty Ltd to undergo a prefeasibility study on the potential of setting up a sea cucumber farm in Wewak , northern coast of Papua New Guinea. The project was set in the framework of a community based one , initiated by the local land owners group. APC hired BioSys to test the viability and profitability of the project on the long-term.</p>	

Description of actual services provided by your staff within the assignment: <ul style="list-style-type: none"> - Technical input - Document preparation for local government - Financial analysis including cost production model and sensitivity analysis - Project management
Firm's Name: BioSys Consulting Pty Ltd

Assignment name: Pre-feasibility and concept design of a sea cucumber hatchery in Malaysia	Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 1 million
Country: Malaysia Location within country: Pulau Sayak, Kedah	Duration of assignment (months): Undergoing
Name of Client: Asia Aquaculture Development Co Pty Ltd, Australia	Total No. of staff-months of the assignment: Average: Full time
Address: Surry Hills, NSW 2010, Australia	Approx. value of the services provided by your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 80 000.
Start date (month/year): March 2013 - present	No. of professional staff-months provided by associated consultants: None
Name of associated Consultants, is any: None	Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Dr Devarajen Vaitilingon – Project Director Mr Stuart Smith – Project manager
Narrative description of Project: This is an undergoing project where BioSys experts were hired to assess the feasibility of setting up a sea cucumber hatchery within the research facilities of the FRI (Fisheries Research Institute, Kedah). A concept design, preliminary schematics and cost production model were developed. The construction phase is due to start in March 2014 and first spawning and fertilization planned for July 2014.	
Description of actual services provided by your staff within the assignment: <ul style="list-style-type: none"> - Site assessment - Technical design and engineering services - Schematic drawings, drafting services - Financial analysis including cost production model and sensitivity analysis - Market analysis 	

Firm's Name: BioSys Consulting Pty Ltd

OTHER RELEVANT EXPERIENCES

Assignment name: Echinoculture program in Madagascar	Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 200 K
Country: Madagascar Location within country: Toliara	Duration of assignment (months): 60 months
Name of Client: Cooperation Universitaire au Developpment (CUD) - Belgium	Total No. of staff-months of the assignment: Average 2 staff month
Address: Brussels, Belgium	Approx. value of the services provided by your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 72 000.
Start date (month/year): Sep 1999 – Sep 2004	No. of professional staff-months provided by associated consultants: RR – 1 staff month IE – 0.4 staff month MJ – 0.6 staff month
Name of associated Consultants, is any: Richard Rasolofonirina (RR) Igor Eeckhaut (IE) Michel Jangoux (MJ)	Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Devarajen Vaitilingon (DV) – Research Fellow
Narrative description of Project: The project was initiated in 1998 by the CUD and involved a transfer of technologies and know-how between two academic institutions (Universite Libre de Bruxelles and Universite de Tulear). DV lead the Belgium scientific team and brought all the know-how in echinoderm aquaculture. The project was centered around the R&D and later pilot production of sea urchin (<i>Tripnuestes gratilla</i>) and sea cucumber (<i>Holothuria scabra</i>). This initiative went on to be very successful in achieving their objectives and lead to a starting point in the commercialization of the sea cucumber <i>H. scabra</i> in Madagascar.	
Description of actual services provided by your staff within the assignment: - Research and Development - Aquatic system design	
Firm's Name: Devarajen Vaitilingon	

Assignment name: Sea urchin aquaculture program at Macquarie University, Australia	Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 1 million
Country: Australia Location within country: Sydney	Duration of assignment (months): 46 months

Name of Client: AusUni Pty Ltd / Macquarie University	Total No. of staff-months of the assignment: Average 3.3 staff month
Address: North Ryde, NSW 2109, Australia	Approx. value of the services provided by your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 300 000.
Start date (month/year): Sep 2005 – July 2009	No. of professional staff-months provided by associated consultants: JE – 0.3 staff month SS – 1 staff month LR – 1 staff month HB – 1 staff month
Name of associated Consultants, is any: Jane Williamson (JW) Stuart Smith (SS) Luke Regtop (LR) Hayden Beck (HB)	Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Devarajen Vaitilingon (DV) – Principal Scientist (Program leader)
Narrative description of Project: The project was initiated in 2005 by a partnership between a private company (Trellini Institute of Marine Science) and Macquarie University. It benefited from both private funding and Australian Federal Government grant (of more than \$500 K). DV was engaged on a full time basis to run the sea urchin aquaculture program. He was the Principal Scientist and responsible in coordinating all R&D works. The project lead to the setting up of a start up company AusUni Pty Ltd responsible for the commercialization of sea urchin roe. The project was a success in all aspects of production (from hatchery to grow-out and roe conditioning) and marketing. It generated two patentable technologies, with one filed patent (PCT/AU2007/001972).	
Description of actual services provided by your staff within the assignment: <ul style="list-style-type: none"> - Research and Development - Commercialization strategies - Business development - Aquatic system design - Marketing strategies - Cost production modeling 	
Firm's Name: Dr Devarajen Vaitilingon	

Assignment name: Sydney Institute of Marine Science: Design and Installation	Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 18 million
Country: Australia Location within country: Sydney	Duration of assignment (months): 24 months
Name of Client: Sydney Institute of Marine Science	Total No. of staff-months of the assignment: 2 staff-months
Address:	Approx. value of the services provided by

Chowder Bay, NSW 2088, Australia	your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 500 000.
Start date (month/year): Januray 2009 – February 2010	No. of professional staff-months provided by associated consultants: none
Name of associated Consultants, is any: none	Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Devarajen Vaitilingon (DV) – Project Director Stuart Smith (SS) – Project Manager
Narrative description of Project: From 2009, we were engaged as project managers and technical consultants to deliver the \$15.0M capital component of the EIF grant, which included: administration refurbishment, PC2 and standard dry laboratory refurbishments, lecture theatre upgrade, seawater system upgrade, including new pumping, reticulation and controlled temperature facilities, PC2 wet laboratory and miscellaneous site infrastructure upgrades and procurement of research equipment. As part of a \$1.0M upgrade to an existing seawater research facility, we managed the design and certification of a new PC2 wet-lab facility controlling environmental, CO ₂ and containment conditions to create the first 'wet' PC2 facility in Australia.	
Description of actual services provided by your staff within the assignment: <ul style="list-style-type: none"> - Technical design and engineering services - Schematic diagrams - Mass, energy and water balance calculations - Project management during installation - Research and Development on innovative technologies 	
Firm's Name: BioSys Consulting Pty Ltd	

Assignment name: Bribie Island Research Centre: Recirculating aquaculture system design and installation for Cobia broodstocking	Approx. value of the contract (in current US\$ or Euro or MUR equivalent): US\$ 200 K
Country: Australia Location within country: Bribie Island, QLD	Duration of assignment (months): 6 months
Name of Client: Department of Employment, Economic Development and Innovation, QLD Government	Total No. of staff-months of the assignment: 1.6 staff-months
Address: BIRC, Woorim, QLD	Approx. value of the services provided by your firm under the contract (in current US\$ or Euro or MUR equivalent): US\$ 78 K.
Start date (month/year):	No. of professional staff-months provided

Sep 2010 – March 2011	by associated consultants: none
Name of associated Consultants, is any: none	Name of senior professional staff of your firm involved and functions performed (indicate most significant profiles such as Project Director/Coordinator, Team Leader): Devarajen Vaitilingon (DV) – Project Director Stuart Smith (SS) – Project Manager
<p>Narrative description of Project:</p> <p>We were engaged for the provision of four independent recirculation aquaculture systems (RAS) to four existing culture tanks (40 m³ each). The systems were capable of supplying premium quality water for finfish broodstock, including temperature control, solids removal, nutrient conversion, water clarity and sanitation. The systems allowed specific conditions for finfish broodstock maintenance all year round. The systems were designed to house any tropical, sub-tropical and temperate finfish species such as barramundi (<i>Lates calcarifer</i>) and cobia (<i>Rachycentron canadum</i>). Spawning of Cobia has been successfully achieved so far. Our system has not only helped the research team to better manage their water usage (from 150% water exchange rate per day to less than 5%) and water quality, but also provided a state-of-the-art system to the institution.</p>	
<p>Description of actual services provided by your staff within the assignment:</p> <ul style="list-style-type: none"> - Technical design and engineering services - Schematic diagrams - Mass, energy and water balance calculations - Project management during installation - Research and Development on innovative technologies 	
Firm's Name: BioSys Consulting Pty Ltd	

3. Background

BioSys Consulting Pty Ltd, was commissioned by Mauricoast Ltd to undergo a site assessment for the feasibility of sea cucumber aquaculture in Mauritius. Mauricoast Ltd, has been granted access by the Government of Mauritius to a barachois, off Poudre D'or for the development of mud crab, oyster and sea cucumber farming. The site is about 54 ha of lagoon with access to coastal land for further land-based development.

The sea cucumber fishery has been in tremendous pressure since the mid-2000s and a surveys conducted in 2007-2008 and 2013 has shown a decrease in abundance of sea cucumber resource (Lampe-Ramdoo et al., 2014). Consequently, the Government of Mauritius has put a moratorium on sea cucumber fishery until 2016 in view of reversing the decline in the population.

Recent surveys in the east coast of Mauritius has shown the presence of some species of high commercial value, but most of the species identified were medium to low commercial value. The choice of sea cucumber species for any aquaculture development in Mauritius will be dependent on the availability of wild caught broodstock.

Although Mauritius has a history of sea cucumber fisheries to a point where the resource is nearly over-exploited, the island does not has any history of sea cucumber aquaculture. As such, developing such a business will require a prefeasibility study to assess if sea cucumber mariculture is feasible and can lead to a viable and profitable business. Such as study will involve: 1) assessing the existing infrastructure for a hatchery and nursery development and grow-out; 2) assessing the broodstock population in the wild; 3) developing a concept design, which will then lead to a construction design and; 4) developing an economic analysis of the project.

A prefeasibility study was undertaken in Mauritius on the 22nd December 2015. The study was mainly focused on the site analysis (of the Grand Barachois), face to face meeting with the clients and representatives of the local government, and a visit to the Albion Fisheries Centre.

This report details the findings of the prefeasibility study.

4. Aim

The aim of this project is to undergo an assessment and analysis of the sites for grow-out of sea cucumber and also visiting and assessing the suitability of the existing infrastructure at the Albion Fisheries Centre for hatchery/nursery development. It is understood that this first trip in Mauritius will also aim at meeting the client for the first time, have a face-to-face meeting and understand his short and long-term requirements.

5. Approach and methodology

The techniques use for site analysis are: 1) visual assessment; 2) bathymetric survey, and; 3) in-depth analysis by specialized laboratory.

Visual assessment

Visual assessment will be done by snorkeling at predetermined sites, see site plan below.



During snorkeling, attention will be paid to substrate type, sand granulometry, presence or absence of potential predators for sea cucumbers and presence or absence of any sea cucumbers.

The mechanisms of water exchange in the basin will also be assessed by visual checks of the different walls around the basin (indicated by the arrows). The accessibility of the sites and ability to set up sea pens will also be assessed.

Bathymetric survey

A survey of the water depth will be undertaken along the line transects indicated on the site plan. The depth will then be plotted against the GPS points, this information will be important during sea pens construction. A depth survey will also give an idea of sea pen location.

Water and sediment sampling

A sample of water in each barachois will be taken for analysis of different chemical and physical parameters. A list of these parameters was already submitted to the client, however, a copy can also be found in Annex of this document. Likewise, sediment samplings will be taken for in-depth granulometry and chemical analysis. Sand particle

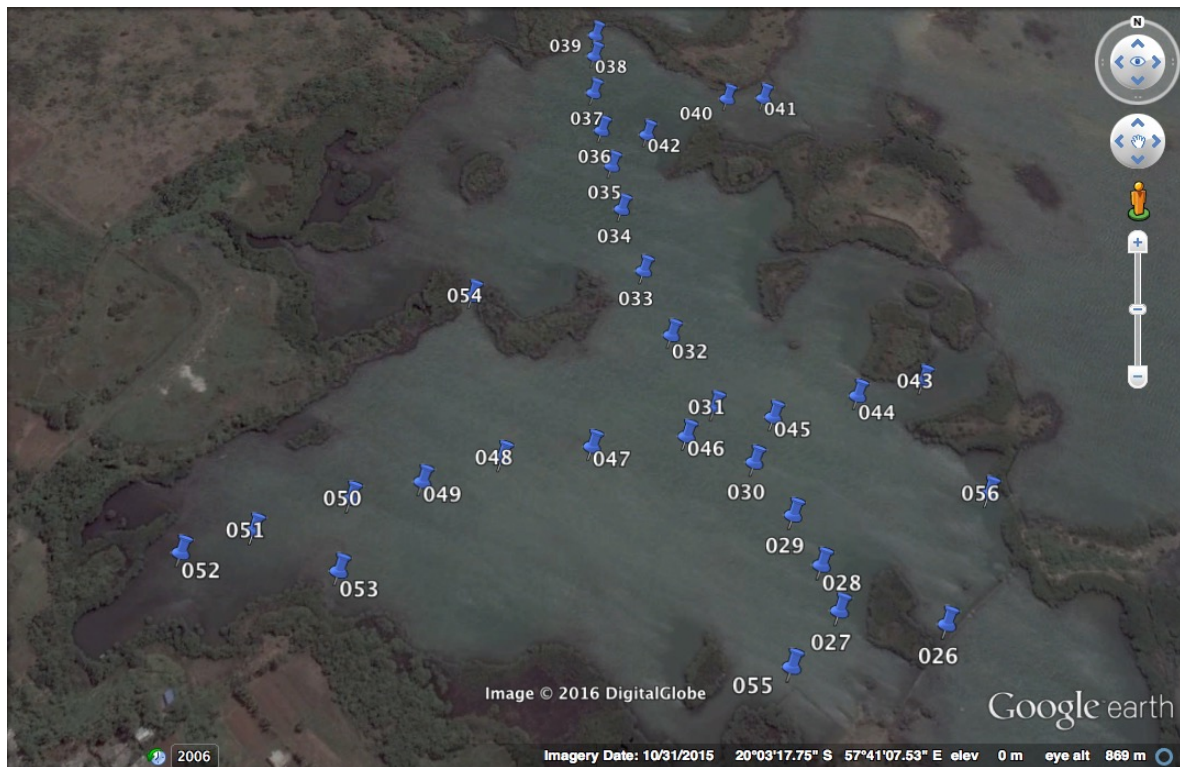
size is particularly important for juvenile growth. In addition, some of elements such as iron can be found in the sediment but not necessarily in the water column.

The aim of the visit at Albion Fisheries Centre will be to have a first appreciation of the infrastructure available for setting up a hatchery and nursery for sea cucumber. Some measurements of building size will be taken in order to evaluate the production capacity of the hatchery. Particular attention will be paid to the inlet water treatment, biosecurity of the building and space availability for broodstock management.

6. Results

Site survey

The site survey was done along two major axes of the barachois, as shown on the map below. At each point (represented by the placemark # on the map), GPS location, water depth, and salinity were recorded.



The average water depth recorded was 2.1m. The deepest point recorded was 3.6m at locations # 35 and 36, while the shallowest point was observed at locations # 51 and 52 for a depth of 0.7m. From locations # 31 to 37, the average water depth recorded was 3.4m.

The average salinity of seawater in the barachois was 35.5 ppt. While most of the stations recorded a salinity of 33.5 ppt, at the locations #51 and #52, salinity was lower recording 32.7 and 31.9 ppt respectively. The average temperature recorded was 30 °C.

The benthos of the barachois was assessed visually by free diving at the following locations: #36, #41-43, #47, and #51 – 56. In general, the benthos was sandy with sparse

coral / shell grits. The sand granulometry at all sites, except #47 and #55, was within the medium to fine sand. At locations #47 and #55, the benthos was sandy and muddy.

Visual assessment also revealed the presence of *Gracillaria sp* (red macroalgae, Rhodophyta) at locations #42 where it is attached to the rocky substrate and locations #51 – 53 where it occurs as dense and intricate mats covering the sandy substrate.

The seagrass species *Halophila sp* was observed at location # 43, where it occurs as dense mat. The same species was also observed at location #54 but in much less density.

The only potential predators of sea cucumber observed while free diving were crabs (commonly, juvenile mud crabs). A specimen of *Holothuria atra* was observed at location #56.

The table below summarizes the characteristics of each location surveyed. Note: Water and sediment analyses are still being processed by specialised laboratory.

Placemark	Time (am)	Coordinates		Depth (m)	Salinity (ppt)	Temperature (°C)	Was benthos surveyed? (Yes / No)	Comments
		Longitude	Latitude					
26	10:30	S 20° 03'24.9"	E 057 ° 41'17.6	1.0	33.6	29.8	N	Boat pick up and drop off point
27		S 20° 03'24.5"	E 057 ° 41'14.6	1.6	33.6	29.7	N	Starting point
28		S 20° 03'23.2"	E 057 ° 41'14.1	1.9	33.5	29.6	N	
29		S 20° 03'21.8"	E 057 ° 41'13.5	2.0	33.6	29.6	N	
30		S 20° 03'20.2"	E 057 ° 41'12.4	2.0	33.6	29.6	N	
31	10:45	S 20° 03'18.5"	E 057 ° 41'11.3	3.0	33.7	29.9	N	
32		S 20° 03'16.2"	E 057 ° 41'10.0	3.4	33.6	29.8	N	
33		S 20° 03'14.0"	E 057 ° 41'09.2	3.4	33.5	29.8	N	
34		S 20° 03'11.8"	E 057 ° 41'08.5	3.4	33.6	29.8	N	
35	10:50	S 20° 03'08.5"	E 057 ° 41'07.3	3.6	33.6	29.9	Y	Sandy bottom with coral grits. Sand granulometry: Medium to fine sand. Presence of sand worms, sponges and other common sand dwelling invertebrates.
36		S 20° 03'07.0"	E 057 ° 41'07.2	3.6	33.5	29.8	N	
37		S 20° 03'05.6"	E 057 ° 41'07.3	3.4	33.6	29.8	N	
38	10:55	S 20° 03'04.8"	E 057 ° 41'07.4	2.5	33.6	29.8	N	
39		S 20° 03'07.7"	E 057 ° 41'12.2	1.4	33.6	29.7	N	
40		S 20° 03'07.6"	E 057 ° 41'13.6	1.2	34	29.8	N	
41	11:00	S 20° 03'08.5"	E 057 ° 41'10.2	2.0	33.6	29.8	Y	Close to the entrance, benthos was dominated with rocks and coral boulders
42	11:20	S 20° 03'17.8"	E 057 ° 41'17.7	2.2	33.6	30.1	Y	Sandy bottom with coral grits. Sand granulometry: Medium to fine sand. <i>Gracillaria sp</i> was found closer to the rocks towards the mangrove.
43		S 20° 03'17.7"	E 057 ° 41'17.9	0.9	33.6	29.9	Y	Presence of <i>Halophila sp</i> (seagrass) on sandy bottom. Site is suitable for juvenile grow-out
44	11:25	S 20° 03'18.2"	E 057 ° 41'15.7	1.8	33.7	29.8	N	
45		S 20° 03'18.8"	E 057 ° 41'13.2	2.8	33.6	29.8	N	
46		S 20° 03'19.4"	E 057 ° 41'10.5	2.8	33.7	29.8	N	
47		S 20° 03'19.7"	E 057 ° 41'07.4	2.0	33.8	29.9	Y	Sandy and muddy benthos. This site was close to an rocky outcrop. The rocks were covered with oysters and few sponges.
48		S 20° 03'20.0"	E 057 ° 41'04.6	2.1	33.7	30	N	
49		S 20° 03'20.8"	E 057 ° 41'02.2	2.3	33.7	30.1	N	
50		S 20° 03'21.3"	E 057 ° 41'00.0	1.8	33.2	30.3	N	
51		S 20° 03'22.1"	E 057 ° 40'57.4	1.7	32.7	30.5	Y	Sandy bottom with sparse <i>Gracillaria sp</i>
52	11:45	S 20° 03'22.8"	E 057 ° 40'55.3	0.7	31.9	31	Y	Benthos covered with mat of <i>Gracillaria sp</i>
53		S 20° 03'23.7"	E 057 ° 40'54.2	0.7	33.8	30.9	Y	Benthos covered with mat of <i>Gracillaria sp</i>
54		S 20° 03'23.1"	E 057 ° 40'59.9	1.0	33.7	30.8	Y	Site suitable for juvenile grow-out. Sandy bottom with coral grits.
55		S 20° 03'14.9"	E 057 ° 41'03.4	1.0	33.6	30.6	Y	Sandy and muddy bottom. High level of silt and clay particles
56		S 20° 03'21.1"	E 057 ° 41'19.1	1.9	33.7	30.6	Y	Sandy and rocky at the entrance. A specimen of <i>Holothuria atra</i> was observed there.

Water and sediment sampling

The sampling of water and sediment for analysis is still under progress. Mauricoast, has now identified a local laboratory to perform the necessary tests. During the preliminary assessment, we have identified hot spots where samplings of both water and sediment will be required. These were grouped into three sites (Site 1, 2 and 3) shown on the map below:



A list of compounds to be tested have been identified and confirmed by all parties with the help of lead chemists from both MOI. Those tests are still under progress. See annex for list of compounds to be tested.

Tentative hatchery location

The site survey was also extended to the lands immediately annexed to the barachois, with particular attention paid to available space for land-based production systems. A potential site for setting up a hatchery and nursery facilities was identified. The site is around 850 m² (see map below), located next to the grand barachois, with easy access to seawater feed, potable water source, electricity and road facilities. The site will be able to accommodate a building of around 600 m² for setting up a Hatchery, Nursery and office space for about 5 permanent trained staffs.



Meetings with local government

During the visit in Mauritius, Mauricoast has organised a visit at the Albion Fisheries Centre (AFC) and a meeting with the Minister of Ocean Economy, Marine Resources, Fisheries, Shipping and Outer Islands, Honourable Premdutt Koonjoo and his senior staff.

The site at Albion could potentially offer a start up facility for the production of sea cucumber (until the hatchery and nursery at Poudre D'or is built and operational). The marine station is equipped with all necessary infrastructure to allow small businesses such as Mauricoast to start up production, while in the meantime setting up a bigger and more commercial facility.

Recently, Mauricoast has been informed by the Ministry that soon they will send letter of confirmation to use space at Albion to start up sea cucumber hatchery production.

7. Conclusion

The site at Grand Barachois, Poudre D'or offers the necessary features for the development of sea cucumber aquaculture. From a first analysis of the site, it seems suitable for the pre-growth and grow-out stages of sea cucumber. The hatchery and nursery facilities will need to be built from scratch. The location has been identified and some Pas geometric works have already been undertaken to survey the site in view of setting up the hatchery and nursery. In the meantime, Mauricoast may use the space at the Albion Fisheries Centre to start up production.

The analysis of water and sediment is important to complete this study. However, at this stage we can only rely on using visual assessment and the presence of other key marine organisms (such as sponges, algae, fish and other invertebrates), as an indication that the actual water quality is cleaned enough to support such marine life.

During the survey, we have identified some hot spots, namely # 51 and 52, where a salinity drop was observed. Analysis performed by chemists at the MOI confirmed that the salinity drop was due to underground freshwater source in the lagoon. Tests done using ²²²Radon sampling were performed at two sites; firstly at location # 41 near the inlet

water channel, and secondly at location # 52 where a lower salinity was recorded. Analysis showed that the radon content at location # 52 was significant at $588 \pm 210 \text{ Bq/m}^3$ and nil at location # 41. These measurements suggest the input of freshwater is from a submarine groundwater discharge into the barachois near location # 52. Note that the level of ^{222}Rn observed was well below the World Health Organisation standard level in drinking water: $< 100 \text{ Bq/litre}$ ($< 100\,000 \text{ Bq/m}^3$). The fact that the freshwater input in the barachois is from an underground water source, it is unlikely that this water will be carrying any contaminants, which are normally carried away from surface water runoff.

The location of the barachois (as an embayment of the lagoon) offers very good conditions for aquaculture. The site is connected to channels (#41, 43 and 56) that allow fresh seawater from the nearby lagoon to enter the barachois. The flushing of water in the barachois occurs at every tidal change, so at least twice per day. This being a major advantage to the project since no pumping system is required for water exchange in the barachois. This easy access to seawater will also be an asset to the project when it comes to setting up a seawater feed for the hatchery and nursery facilities. The proximity of seawater source will constitute a major advantage to the project.

Besides, certain specific sites within the barachois (#43 and 54), are particularly suitable for juvenile grow-out. The sand granulometry was observed to be fine, occurrence of seagrasses and seaweed and a topography that allows for physical delimitation to be set up to cage the juvenile before being released into the grow-out section of the barachois. These characteristics are particularly important when it comes to sea cucumber aquaculture.

If the barachois is a very good asset to the project, the success of the project will rely on few important parameters: 1) access to enough broodstock all year round; 2) access to a hatchery and nursery facilities, and 3) capital investment. Mauricoast has already been granted permission for collection of broodstock from the wild by the relevant authority.

We are suggesting Mauricoast to start producing juvenile sea cucumber using the Albion Fisheries Centre facilities as soon as it is available. Once their own hatchery and nursery building is completed, they can shift over there with more experience gained in the field.

From our experience in the field of sea cucumber aquaculture, this study shows that Mauricoast has all the necessary assets and access to knowhow to start up a profitable business. The lagoon around Mauritius has few sea cucumber species of high marketable value. Using these species to start up aquaculture production in Mauritius, we expect Mauricoast to be able to recuperate its investment within 5 years and be profitable after that.

8. Annex

List of compounds to be analysed from water and sediment samples.

#	Analyte	Test Method
1	Organochlorine pesticides	
	a-BHC	Liquid-liquid extraction/GC-MS
	g-BHC (Lindane)	
	b-BHC	
	d-BHC	
	Heptachlor	
	Aldrin	
	Heptachlor epoxide	
	trans-chlordane	
	Endosulfan I	
	Dieldrin	
	4,4-DDE	
	Endrin	
	Endosulfan II	
	4,4-DDD	
	Endosulfan sulphate	
	4,4-DDT	
	Methoxychlor	
	Acetochlor	
	Metolachlor	
2	Organophosphorus Pesticides	
	Demeton (total)	Liquid-liquid extraction/GC-MS
	Diazinon	
	Disulfoton	
	Fenitrothion	
	Malathion	
	Chlorpyrifos	
	Parathion ethyl	
	Parathion methyl	
	Azinophos methyl	
	Ethion	
3	Phenylureas	
	Diuron	Liquid-liquid extraction or SPE/LC-MS
	Tebuthiuron	
4	Pyrethroids	
	Cypermethrin	Liquid-liquid extraction or SPE/LC-MS
	Deltamethrin	
	Permethrin	