
Developing Marine Reserves for Biodiversity Conservation and Sustainable Fisheries in Rodrigues

Development of a strategy for marine reserve management in Rodrigues using community consultation and stakeholder participation

Report on initial visit to Rodrigues, 28 February to 15 March 2005

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March 2005



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Summary and recommendations

- **Great progress has been made with the concept of marine protected areas for fisheries and conservation in Rodrigues. It is now important to ensure that everyone involved is very clear about aims, objectives and expectations for the reserves.**
- **Developing clear objectives and expectations will influence how management strategies develop.**
- **Further formal discussion and consultation is needed on the four marine reserve areas selected in the north to ensure that the management decided on is appropriate.**
- **Consultation should include collating community views on the objectives of specific marine reserves, current uses of the reserve areas, approaches to management, implications of management for resource users and the expectations of the communities.**
- **All consultation and discussion of the marine reserves should be clearly documented and available for future reference. Documentation of consultation is just as valuable as biological data in this process.**
- **It is recommended that formal statements summarising the biological and socio-economic criteria for selection, objectives and expectations need to be produced for each of the reserves.**
- **Wider community understanding of the concept of the marine reserves should support their successful management. Current fisher training programmes are excellent and education aimed at other members of the communities likely to be affected by reserves is recommended.**
- **Monitoring of the effects of marine reserves is vital in ensuring that management is appropriate and to maintain community support. Monitoring is an important component of marine protected area design and should be addressed at this stage.**
- **Development of monitoring of line and trap fisheries in collaboration with the FRTU is recommended.**
- **Close links and co-operation between the northern marine reserves project and the UNDP marine park project will benefit both projects and enhance the wider community and conservation benefits of both initiatives.**

Rodrigues Darwin Project Objectives and Duties for F. Gell

- **Assist host country partners in the development of a strategy for marine reserve management using community consultation and stakeholder participation.**
- **Take responsibility for drawing up a management plan for Rodrigues marine reserves by January 2008, using the input of host country partners and other UK experts contracted under the project.**
- **Assist, as required, with developing strategies for lagoon and reef habitat and population assessment, and providing training for host country partners in these techniques.**
- **Undertake 3 field visits for fulfilling the above commitments.**
- **Produce a report within 28 days of each field visit summarizing visit activities and giving recommendations for future actions.**

The status of the Rodrigues lagoon northern marine reserves project

Brief overview of progress since last visit (late 2002) and information gathered on March 2005 visit

Following the suggestion of a number of possible reserve sites by Shoals Rodrigues in early 2003, four amended reserve sites were accepted by the Rodrigues Regional Assembly. Shoals Rodrigues staff visited the relevant communities to talk in more detail about the concepts of marine reserves and the practicalities for marine reserves in their area. The notes on these meetings were provided by Field Centre Manager Sabrina Desiré and are given in Appendix 4.

The development of the four northern reserves is now in the hands of the Co-ordinating Committee on Fisheries and Marine Resources of the Rodrigues Regional Assembly. This committee is chaired by Mr Serge Clair, Chief Commissioner, and attended by representatives of the relevant government departments, fishers' organizations and non-governmental organizations (including Director Eric Blais representing Shoals Rodrigues). A subcommittee has been formed to draw up suitable marine reserve regulations, including Mr J.P. Genave of the National Coast Guard, Mr Jean Rex Pierre Louis of FRTU, Mr D. Peermamode of Fisheries and others.

At the same time, a larger scale UNDP project for a marine park for the south of the lagoon is underway. At the time of our visit this had reached the stage of appointing staff to manage the project. We had an appointment to meet with the UNDP project co-ordinator in Mauritius, Alexander Cote, but unfortunately he was ill so we didn't meet with him.

The acceptance of the marine reserves by the RRA is obviously a great step forward. Some of the sites have also had their boundaries marked out using marker buoys but there have been some difficulties with retaining marker buoys. Members of the committee have joined Shoals Rodrigues staff and some local fishers to set the boundaries of the reserves out on the water and to decide on locations for the marker buoys. There has not yet been any formal community consultation with those using these sites by the RRA committee. During a meeting with Mr Genave of the National Coast Guard and Mr Pierre Louis of FRTU it was suggested by Mr Genave that more formal consultation with the communities was the next step. There was discussion of the idea of putting together a memorandum of understanding between the communities and the marine resources committee so that an agreement could be reached that everyone was happy with.

A formal and carefully documented approach to community consultation is undoubtedly the next step in the process of establishing the marine reserves. The comments made by members of the communities visited in 2003 indicate the detailed concerns that fishers have about the nature of the marine reserves and in particular the issues of access and boat passage across reserves. These are issues that need to be decided with reference to marine reserves legislation already in use in Mauritius but also taking community concerns and community knowledge of the sites into consideration.

Recommendations for next stage in the development of the marine reserves

At this stage it is vital that all information that has been used in the decision making process regarding the selection of the marine reserves and the regulations that are chosen is carefully documented. This is something that will have to be done with Shoals Rodrigues staff working in close collaboration with the other members of the Fisheries and Marine Resources committee. In this section I am going to outline some data requirements that need to be considered by all those involved in the implementation of the northern reserves. When this data is collected it should be recorded in detail and outputs that explain the results clearly to the general public need to be produced to keep all stakeholders and the wider community engaged in the process.

1. There needs to be detailed biological information collation using existing survey work and other studies. It will probably be necessary to collect new data for the sites selected too.

This work should include:

- (i) Identification of habitat features – e.g. areas of coral and other habitat in good condition, areas in poor condition with a good chance of recovering if protected,
- (ii) Identification of species associated with the site, and species which could benefit from the protection of the site.
- (iii) Identification of current threats to habitat and species.
- (iv) Consideration of the effects of different approaches to management on species and habitats.
- (v) Identification of the limitations of marine reserves to protect some habitats and species. What other management/initiatives would be needed to support these habitats and species in addition to the marine reserves?

2. Socio-economic data collection on the sites.

Detailed information needs to be built up on who uses the sites at the moment, an estimation of the economic benefits they derive from the site and an idea of the economic losses likely to be incurred when the reserves become operational.

3. Community awareness raising.

The current fisher training programme is obviously extremely successful and includes a large amount of important information relevant to marine reserves and broader marine resource management issues. It is important to widen this awareness raising to the wider communities in the areas where the marine reserves will be (so most northern coastal communities and many inland ones need to be aware of what is going on).

4. Institutional awareness raising.

It is very important to keep the marine resources committee up to date with developments in the field of marine reserve design and management. Every opportunity should be taken to increase the knowledge of those on the committee with responsibility for marine reserves. For example, if Shoals Rodrigues staff attend marine reserves course or conferences they should try to organize a session with the committee members to feed back the information gathered.

Visiting consultants and project participants should give talks to the committee members on relevant aspects of marine reserve design and management. (For example when Prof Callum Roberts and Dr Julie Hawkins come to visit it might be productive to organize a social event at which they can talk about their experiences. Callum has advised governments and NGOs all over the world on marine reserves and is a very good public speaker.) Much of what was covered in my marine reserves training session would have been particularly relevant to members of the committee drawing up marine reserve regulations etc. On my next visit I could also do a more informal talk for committee members and other interest groups that could focus on the latest developments in marine reserve design and management. It is also vital that Shoals Rodrigues staff who attend marine reserves and marine protected area meetings keep updated on new developments in other countries and the current best-practice in marine reserve design and function. The new marine reserve books and reports that have been added to the Shoals Rodrigues library are a good source of this information and they should get in touch with me if further information is required to address any particular issue.

Another way to keep people updated might be to download and copy the marine protected area newsletter, MPA News, as it is produced. This is a very good newsletter for people involved in MPAs. It might also be good to have a system for circulating email bulletins on selected marine protected area updates from around the world to the committee members.

Many of the issues involved in the establishment and management of marine protected areas are obviously very complex so an ongoing programme of talks, updates etc seems to be the best way to keep people informed and to introduce decision-makers or those directly advising decision-makers to the many different aspects of marine reserve science and management.

5. Community and institutional identification of aims and expectations

Further stakeholder meetings are needed to identify the aims of marine reserves, expected outcomes, and the management actions and regulations necessary to achieve the expected outcomes.

The participation exercises that we did in the marine reserves training session would be a good basis for similar initial sessions both with the organizations involved in the establishment of the marine reserves and with the communities involved.

Examples of questions asked and responses given by an audience including Shoals Rodrigues staff and FRTU staff:

1. What are the main threats to the marine environment in Rodrigues?

- Pollution
- Siltation
- Bad fishing practices
- Overfishing
- Illegal fishing
- Anchor damage to coral reefs
- Oil spills
- Diver damage
- Invasive species

2. What would you like to see marine reserves achieve in the long term?

Big fish
Increased biodiversity
Healthy coral reefs
Big catches for fisheries
More nursery grounds
Non-toxic fish

3. What should the main aims of the marine reserves be?

Habitat recovery
Bigger catches and sustainable fisheries
Economic benefits
Protection for endemic species
Public awareness

4. Will the selected sites achieve those aims?

They have been chosen by the fishing community so that is good
They will need better protection and patrols
Riviere Banane has endemic species
There are concerns about whether the fish larvae will come back and settle in the reserves because they are isolated
Concerns about how long the fishermen will have to wait to see benefits
Economic concerns for long term because there aren't many visitors – not much diving and no yachting to generate income to reserves.

5. How will we know if the reserves are working?

By comparing before and after data
By comparing inside and outside marine reserves
By doing an initial survey, then monitoring the habitat
By the recovery of fish and other species
Changes in fishermen's catches
Harmony between fishers and the wider community
By the amount of illegal fishing going on
By the numbers of tourists and other visitors.

6. Identifying species in need of recovery

Batardet – *Lethrinus harak* – numbers have declined because of overfishing
Barbet – numbers have declined because of habitat degradation and possible change in climatic conditions
Plate – Have declined because of overfishing and habitat degradation
Harang – Numbers have declined because of change in climatic conditions

In the examples above, general questions were asked about the Rodrigues lagoon and also about the northern marine reserve sites identified. The same questions need to be asked about each reserve site in turn. Below I have begun to put together some of the key questions that need to be considered for each site in turn. These questions will develop with responses received to the earlier questions, and with the decisions made about the regulations of the reserves and the protection that they will offer.

(a) Why was this site chosen? Go back to the records on the first meetings with the fishers and see what they said. Remember back to the discussion within Shoals and with others on the location of the reserve and what factors influenced its selection. Why was this site chosen rather than another similar site?

(b) What are the biological characteristics of this site?

Does it have areas of good coral or other habitat?

Does it have bleached/recovering corals?

Does it have areas of coral or other habitat that are likely to recover if well-protected?

Does it have areas of coral that are so badly degraded and/or overgrown with algae that they are unlikely to recover?

Does this site have endemic species? If so where else do these species occur and how much of the population might be protected in this site?

Is this an important site for fish spawning? If so, which species use it and when? How much is known about the currents around the site and where are larvae likely to move to?

(c) What are the main threats to this site currently?

Is it overfished? Are habitats being destroyed by fishing methods? Is the site damaged by anchors? Is the site trampled by octopus fishers? Is the site polluted? Is the site sedimented?

(d) Which of these threats will be eliminated or reduced by protection as a marine reserve? Which threats will remain?

(e) How is this site used at the moment?

Which fisheries is it used for?

Is it used for recreational purposes?

How many people use the site? Are the uses seasonal or year round?

Is it possible to estimate the income generated by uses of the site?

(d) How will the marine reserve change the way the site and its surrounding area are used? What will the costs be to the current users?

(e) What will be required to manage the reserve to offer the appropriate protection?

(f) What do instigators of marine reserves hope to achieve?

These goals need to be clearly identified for each site and for the network as a whole.

(g) What do stakeholders, especially those making a living from the area, hope to achieve? What are their expectations?

Shoals could collect much of the biological data, using a combination of their own survey work, project work of visiting MSc students and possible work of a socio-economic PhD student from Plymouth.

6. Documenting consultation meetings and all other activities relating towards decision-making about the marine reserves

It is vital at this stage of the decision-making process for somebody to document every detail of the reserve designation process. If all details are recorded as the reserves develop, then there will be a good record to go back to and refer others to, especially if there is a dispute about why a particular decision was made. Keeping a good record of everything that happens is like collecting data – it is vitally important and will be a very valuable resource in the future. Every time anyone attends a meeting relevant to the marine reserves, speaks to anyone about the marine reserves or if there is any relevant development it should all be carefully documented. I would recommend buying a big hardback note book and keeping it as a record book of everything relevant to marine reserves and also to keep a special file in the filing cabinet and one on the computer, so that verbal, written or electronic information can all be stored in an organized and easily accessible manner.

Things to include in notebook (either written or stuck in with dates given for everything):

- Copies of Agendas and Minutes of the Co-ordinating Committee on Fisheries and Marine Resources.
- Copies of newspaper articles on fishing, marine conservation, marine reserves, the marine protected areas etc
- Notes on any radio programmes, events or other publication information on marine reserves, marine conservation or fisheries etc
- Copies of detailed notes taken at meetings with stakeholders
- Copies of any information received on the UNDP MPA project
- Notes on any comments or questions received from the public relevant to the marine reserves
- Notes of relevant questions or concerns from fisher training sessions.
- Whenever you visit the reserve sites keep a note of fishing and other activities happening there and note this information in the marine reserves book too.
- Copies of any legislation developed.
- Copies of any local, national, regional or international information received on marine protected areas or marine reserves.
- Copies of survey data of the sites and notes from any visits to the site, including informal observations.
- Notes on relevant developments – e.g. possible hotel at Riviere Banane, seaweed farm etc. Any Environmental Impact Assessments or other environmental information on relevant development plans would also be useful.
- Socio-economic data relevant to the marine reserve sites, e.g. from new FRTU report on fisheries economics.

Once a month some time should be put aside to write up the main developments that have happened in the last month. This could be used to brief all Shoals Rodrigues staff and interested parties like the FRTU, fisher organizations and the RRA Fisheries and Marine

Resources Committee, and a copy of this should be sent to external participants in the Darwin project too (Alasdair, Tom and Tara, Callum and Julie and myself). Keep a marine reserves file on computer too for the monthly updates and electronic copies of any relevant information received.

The big marine reserves book and the monthly updates will be really useful for Shoals Rodrigues staff to remind you of what has happened and will be vital for other stakeholders and also visiting consultants and researchers so that they can easily see what has happened in the past. It will also be a source of ideas and inspiration to deal with difficulties as they arise.

7. Lagoon use mapping

In collaboration with FRTU, FPS, National Coastguard, Dive Schools, Fishers' organizations, commercial and recreational fishers it would be really useful to establish a project to map all activities currently occurring in the lagoon.

There is already some excellent data on the location of seine net fishing but the aim of this project would be to identify how the lagoon (and particularly the northern lagoon) is used by commercial, subsistence and recreational users (and researchers!) and to produce maps that show this very clearly.

The best approach to this might be to produce a large number of maps of the lagoon with some key natural features marked on clearly and also with some well-known sites named. These could then be distributed to individuals and organizations who spend a lot of time on the lagoon and they could fill these in with the location of fishing boats and other people using the lagoon, giving the time spent at sea as an approximate measure of observer effort. This information needs to be dated and if possible entered into a GIS at regular intervals with by the person who collected it.

8. Produce a map of local fishing site names

This is another project that could be added to with information collected during other research work such as collecting data on the seine net fishery. This will help with fisher meetings so that everyone is clear about which sites they are talking about. This is suitable as a one-off volunteer or student project (particularly by a local student as it will involve lots of talking to fishers).

8. Developing appropriate monitoring.

It is important to ensuring that current Shoals Rodrigues monitoring will tell us something about the effectiveness of the marine reserves and other planned management strategies and ensuring that monitoring (biological, fisheries and socio-economic) is on the agenda for the Co-ordinating Committee's work too.

Experience from marine reserves around the world has shown the importance of good quality monitoring of the effects of marine protected areas and other management techniques to ensure the continued support of communities. Monitoring results also need to be presented to

communities in an accessible form. One approach that has been used elsewhere is community monitoring and this is something that could be considered for Rodrigues.

Shoals Rodrigues already have a comprehensive lagoon and fisheries monitoring programme in place. There are some areas of monitoring that may be beneficial to develop to help understand how management is working, in particular monitoring of fisheries other than the seine net fishery.

9. Trap and line fishing monitoring

(a) Why trap and line fishery data would be useful

It is very important to be able to monitor the effects that marine reserves and other marine resource management approaches are having on fish catches. To do this, good baseline data is required before management is implemented.

The seine net fishery is currently being well studied by Shoals Rodrigues and by FRTU. However, some uncertainty surrounds the future of seine net fishing so it is particularly important that other fishing methods are well studied before and after the implementation of marine reserves. Information is needed on:

1. Number of fishers involved in basket trap, line and mixed fishing in the seine net fishing season and in the closed season for seine net fishing.
2. Fishing effort in terms of number of person days fished per week, number of traps or lines fished, time spent fishing.
3. Catch per unit effort for trap, line and mixed fishing.

(b) Approaches to collecting this data

To monitor the effects of management in the northern lagoon, the following fish landing sites are suggested for regular catch sampling (the final selection of sites will depend on the sample sizes possible in the first year of study, and other practical considerations):

1. Pointe Mathourin
2. Baie du Nord
3. Anse Goeland
4. Baie Malgache
5. Pointe l'Aigle
6. Baie aux Huitres
7. Port Mathurin
8. Anse aux Anglais
9. Grand Baie
10. Riviere Banane
11. Pointe Coton
12. St Francois

Possible approaches:

1. Through fisher training or other meetings talk to the trap and line fishers about the possibility of regularly sampling their catches
2. It may be necessary for some incentive for people to wait to have their catches sampled – e.g. each catch sampled earns the fisherman a ticket for a monthly raffle with a good prize that can be afforded through relevant research budgets.
3. For each site selected for monitoring get a good idea of the number of fishers regularly landing catch at that site, get official government records of boats and fishers registered and try to see how that matches up with the fishers that use the site regularly.
4. Of the 12 suggested sites above it may be necessary to narrow this down to 8 sites that can be sampled easily and that allow a good number of catch samples to be collected annually for each site.
5. If these sites are being sampled by FPS/FRTU staff, they should be encouraged to continue to collect data and ensure that they indicate the method of fishing, number of traps, time spent fishing etc.
6. Data sheets for collecting this information need to be adapted from the sheets developed on my last visit, in collaboration with Shoals Rodrigues staff
7. A database similar to that used for the seine net fishing data would be useful and could be used for data collected by Shoals Rodrigues staff and by FRTU staff.

10. Fish gonad development work

We did attempt to start a guide to fish gonad development stages for the main seine net species during this first visit but only a small number of fish were obtained for examination so this will be an ongoing project. The species studied during our visit was *Lethrinus nebulosus*. Morphometric and other information was collected on a number of fish and digital photographs taken of the gonads.

I am trying to find some appropriate published guides to staging of gonads for the important seine net fisheries species (*Siganus sutor*, *Lethrinus nebulosus*, etc). In the meantime I recommend that Shoals Rodrigues staff continue to take down the same measurements for fish bought for dissection that they have been doing and also to take pictures of gonads that can be linked back to the fish measurements and the catch that the fish came from. Jovani and Sydney did most of the dissections so can take this forward. I will continue to look for suitable guides to support this work, and literature on the species from elsewhere in the Indian Ocean. I can correspond with staff over putting together the gonad stage guides for future use.

11. Recommendations for additional projects/funding applications

It might be useful to have a Marine Protected Area/Marine Reserves officer in Shoals Rodrigues who can develop expertise in the science and management of marine reserves and can assist the Director and the science staff in their work towards the management and monitoring of marine protected areas and have responsibility for producing briefing materials for other organizations and the general public. This officer could maintain the meticulous marine reserves research and consultation records, keep up to date on international developments and be the chief liaison person with the local communities. Obviously all this

work can be done very capably by existing staff but there may be time constraints on their work in this area because of other diverse commitments.

12. Marine protected areas references

There are a number of useful marine protected area reports and CDs in the Shoals Rodrigues library already and these should be used to build up knowledge of design, science and management issues. New additions include:

“How is your MPA doing?” A new IUCN guide to monitoring existing MPAs that gives a great insight into the management issues faced by those establishing marine protected areas, and has some good case study information from existing MPAs.

“Marine Reserves” by Sobel and Dahlgren. An excellent up to date book looking at the science and management of marine protected areas with lots of good case study material.

Ecological Applications special issue on the Science of Marine Reserves. This contains many interesting papers on the science behind marine protected areas.

Resources recommended for Shoals Rodrigues

The latest FishBase CD and book would be really useful and would save time (and money!) trying to access information online. It is available to for purchase from the World Fish Center, Penang.

13. Developing links with the UNDP Marine Park Project

It seems to be very important that the northern marine reserves and the UNDP marine park project evolve together.

(a) Ideally there should be strong links between the UNDP project and the RRA northern reserves project as the success of each project will benefit the other. If both projects are successful they would together create a network of protected areas throughout the lagoon that could make a very positive difference to fisheries and marine conservation for Rodrigues.

(b) No-take marine reserves will inevitably lead to some initial decrease in fishing sites and therefore catches for fishers. One way to avoid this would be to encourage the uptake of alternative livelihoods by fishers. Developing alternatives to fishing on Rodrigues requires professional input and this is perhaps something that will be incorporated in the UNDP project which could be broadened to include northern communities. If training programmes are set in place to retrain fishers either to work in the marine park or to do something completely different, then it would be beneficial if these programmes could target fishers from the whole Island.

(c) Training schemes to train up wardens, rangers and other marine park staff for the southern marine park would be beneficial to staff selected/identified for the northern reserves. At meetings, fishers from many communities in the north of the Island have indicated that they would like to protect the reserves themselves, but only if they could be properly trained, paid a wage and given the appropriate resources. Employing at least some marine rangers or

wardens from among the local fishers makes a lot of sense and has worked well in other countries. Hopefully this approach will be considered by the managers of the UNDP project and can be worked on in collaboration with the northern reserves.

Follow-up work, ongoing between field visits

1. Developing trap and line fishery monitoring.

Over the next few months, I would like to work in correspondence with Shoals staff, Alasdair and other advisers to formulate data collection forms and a monitoring plan for the trap and line fishery. This requires some trial data collection and exchange of information on what is practical and what information is needed for monitoring. Ideally a database similar to that developed for the seine net fishery should be designed. Correspondence with FRTU on this would also be useful.

2. Develop gonad development guides for the main fishery species

I need to find more information on the key species to assist with the staging of fish gonads. Shoals staff need to continue taking all the biological measurements for a sample of the key species caught in seine net fishing and also photograph and describe the gonads. Over time it should be possible to build up a visual guide to the gonad stages of these key species. This could be produced in clear, laminated format that could be used in the field. Once Shoals researchers are clear about the stages of the gonads then information on the sex and stage of the gonads can be recorded with confidence without the need for photographs. It is essential that a digital camera is available to take pictures of all fish available for dissection and that the full biological details on the fish, the place and date they were caught and any other relevant information is kept in a clear and easily accessible format.

3. Information on marine protected areas.

I hope that Shoals Rodrigues staff will get in touch if they need to find information to help with decision-making or to deal with queries from other stakeholder groups or the wider community.

Plans for next trip

My next trip is scheduled for April 2006

On my next trip I would like to be in the field for three to four weeks if possible and hope to organize with Shoals Rodrigues staff to:

1. Visit each of the four northern reserve sites for a reasonable amount of time and snorkel/dive to see features of interest (identified in site selection criteria reports for each site). Hopefully this can be organized to fit in with monitoring and other routine work in advance of my visit.
2. Contribute training and public lecture(s) as appropriate to a broad range of stakeholders – I hope to organize this well in advance with Shoals staff so that presentations and handouts can be prepared before field visit. It would be particularly useful if Shoals staff could identify the key issues of concern and interest well in advance.
3. Review biological and socio-economic site selection information and identify any areas where more information may be required.
4. Review trap and line fishery data collection and next stage in trap and line monitoring. Advise on analysis and writing up of line fishery data.
5. Join Shoals Rodrigues staff on seine net fishing and trap and line fishery monitoring.
6. Work with Shoals Rodrigues staff to complete the fish gonad staging guide.
7. Bring any new relevant literature to add to Shoals Rodrigues library.

Appendix 1: Diary of field visit 2005

1. Sunday 27 February:

Travel from Isle of Man to Newcastle. Initial discussion of project with Alasdair Edwards.

2. Monday 28 February:

Travel from Newcastle to Mauritius.

3. Tuesday 01 March:

Travel from Mauritius to Rodrigues.

Organized documents and other materials.

In the afternoon had an initial meeting with Alasdair Edwards, Sabrina Desiré (Field Station Manager), Eric Blais (Shoals Rodrigues Director) and Emily Hardman (Science Co-ordinator), and established programme of work, meetings and training. In particular discussed the training sessions organized for the second week of the trip.

4. Wednesday 02 March:

In the morning read new Shoals Rodrigues science reports produced since my last visit. Prepared individual work plan.

In the afternoon has a meeting to get up to date with work progress on marine reserves and monitoring with Eric Blais and Sabrina Desiré. Organised to join Shoals staff on a fisheries sampling trip with the seine net fishers.

5. Thursday 03 March:

Seine net fishing trip was cancelled by fishers because of calm weather.

In the morning I continued to read more recent reports and did more work planning. At 10.15 I joined the education officers for fisher training at Riviere Banane and Port Sud Est. The theme of the session was fish biology and ecology. Discussed the fisheries and marine reserve side of the current fisher training programme with Natacha Felicite, Liliana Meunier and Runolph Raffaut and found out more about the wider programme and how it is progressing. They reported that they were getting lots of good feedback from fishers on their sessions on marine reserves but that the big concern of the fishers was the enforcement of the reserves. Read fisher training notes relevant to fisheries and marine reserves.

Later on continued to speak to Shoals staff to get background on progress of reserves and possible sources of other relevant information.

6. Friday 04 March:

Morning spent in office discussing various aspects of habitat survey and training.

10.15am met with Jean-Rex Pierre Louis for an update on the marine reserves and developments on the UNDP Marine Park project. Found out more about the role of the Coordinating Committee on Fisheries and Marine Resources and FRTU's involvement in drawing up new regulations for the marine reserves. Also found out more about FRTU's study of fisheries economics which should be coming out soon. This will be a very useful resource in the development of the marine reserve management strategy.

After the meeting continued with discussion and planning of possible alternative habitat surveys.

In the afternoon went to Passe Armand with Alasdair, Sydney and Emily to trial the new reef flat habitat survey.

7. Saturday 05 March:

Spent the day planning marine reserves training for Shoals and FRTU and FPS staff and producing Powerpoint presentations.

8. Sunday 06 March:

Continued to prepare marine reserves training and handouts.

9. Monday 07 March:

Plan was for AE to do his training on fisheries data, but last minute bank holiday was called so no FRTU or FPS staff were available. Shoals staff were at work. Brief meeting in Shoals at which Alasdair went through his presentations. I checked up on work plans and on the content of the training, ensuring that everything that Shoals expected to be covered would be included in the marine reserves training. I spent the rest of the day continuing to work on training materials, incorporating updated information on the progress of the marine reserves.

10. Tuesday 08 March:

Bank holiday for Shoals staff. Continued preparing for training, and looking at new information and reading reports to build on background. Also began preparation for presentation to Co-ordinating Committee on Fisheries and Marine Resources.

11. Wednesday 09 March:

In the morning I attended Alasdair's training on fisheries data analysis methods and results. This session was attended by all Shoals Rodrigues staff, 3 FRTU staff and one FPS staff.

Following the training session I talked further with Jean-Rex Pierre Louis about UNDP Marine Park and other reserve plans and how the Darwin project could provide support.

In the afternoon we continued to work on the habitat survey method with Sydney and Emily. Tried the quadrat method at Grand Bassin (huge waves – lots of problems) and Passe Armand. I also hoped to see the Grand Bassin marine reserve site in more detail but the tides meant that this wasn't possible.

12. Thursday 10 March.

In the morning I did my marine reserves training session. It was attend by Shoals staff minus Eric, and the Education Department who were out on fisher training. Sydney (training), Jovani (science), Sabrina, Emily, Anna (volunteer), Tolbiz? (FRTU), Silvio (FRTU) were all present. The full content of the talk and handout are attached. There was some good discussion of some of the questions raised and good audience participation.

In the afternoon I met with Jean Rex Pierre Louis (FRTU) and Mr Genave from the Coastguards. We discussed some of the possibilities for marine reserves in the north and the next steps in their establishment. Jean-Rex gave me a copy of the Mauritian legislation for marine reserves and marine parks. This is the starting point for the rules that will be written for the Rodrigues reserves. Eric joined the discussion about the next steps to take in the establishment of the reserves. Key points raised include the need for clear socio-economic information on the areas that will be affected, more detailed biological and social information on all the sites and a very clear, formal consultation process and the drawing up of Memorandums of Understanding between the Government and the communities involved.

13. Friday 11 March

Final meetings with Shoals Rodrigues staff about marine reserve and fish survey work.

Dissection of *Lethrinus nebulosus* to look at gonad development and to take photos, with Jovani and Sydney. The fish appeared to be all male. Full biological information (length, weight, girth and other morphometric measurements) were taken and digital photographs of the gonads and a description of the stage. This information will be built on with each set of fish sampled to build up a resource showing the full range of fish sex and gonad stages.

1.30pm Alasdair, Eric and I attended the beginning of the Co-ordinating Committee on Fisheries and Marine Resources. Following Alasdair's presentation on the Darwin project I did a short presentation on marine reserves, incorporating some of the discussion from Thursday's training session. We then left to allow the members to continue with their meeting.

Back at the office I continued to gather relevant information for report writing and copy reports and other information relevant to my work on the project.

14. Saturday 12 March

Went into office to photocopy information needed to take back, sort out final arrangements with Sabrina, Eric and Emily. Picked up things to take back to the UK for repair etc.

15. Sunday 13 March– Travel to Mauritius

16. Monday 14 March– Meeting with Pamela Bapoo-Dundoo at UNDP about UNDP small projects. Meeting with Alexander Cote cancelled because he was ill. Attended other administration meetings with Eric and Alasdair.

17. Tuesday 15 March – Left Mauritius and arrived Newcastle at 10pm.

18. Wednesday 16 March – Flew back to Isle of Man.

19. Thursday 17 March – Information gathering for report.

20. Friday 18 March –Report writing

21. Saturday 19 March – Report writing

22. Sunday 20 March – Report writing

Key material not yet obtained – Minutes of RRA committee on fisheries and marine resources to follow the development of the marine reserves.

Appendix 2: Handout for marine reserves training

Marine Reserves for Fisheries and Conservation Training Day 10 March 2005

Main Points

1. **The future of marine life and fisheries is at risk.** In the last 20 years or so people all over the world have begun to realise how much humans are damaging the oceans. Overfishing, habitat destruction, pollution, climate change and invasions of alien species have all had serious impacts on the oceans.
2. **Many scientists think that fishing is having the biggest impact on marine life.** Fishing changes the populations of animals, some methods destroy habitats and very heavy fishing can completely change an ecosystem so it become unrecognisable.

For example, in some places coral reefs like those seen in Rodrigues have been so badly affected by fishing that they no longer have any coral at all. The predators were fished out, then the herbivores were fished out and there was no fish left to eat the algae so it could out-compete the coral and completely changed the habitat.

3. **We need to look after the marine ecosystem.** The ecosystem approach to fisheries management and marine conservation means that instead of just looking at species on their own, we should also try to look at the wider system. For a rabbitfish that might mean looking at the algae or seagrass it eats, the big fish that eat it, the seagrass and reef habitats that it needs during its life and the influence of fishing.
4. **Marine protected areas are areas of the sea where there are some rules to protect the animals and plants inside.** If a marine protected area has rules but nobody enforces them, it is called a “paper park” because it exists on paper, but in reality it doesn’t protect anything and is the worst type of marine protected area. The best type of marine protected area for the animals and plants inside it (and for the surrounding area) is a **fully-protected marine reserve or no-take marine reserve where no fishing or other damaging activities are allowed.**
5. **Marine reserves let exploited ecosystems recover.** They allow animals, plants and habitats to recover from being damaged by fishing. Coral can recover from being crushed and broken by nets or by trampling. Fish that were always usually caught when they were small can live until they are very big and old if they stay within the reserve.
6. **Big fish are important!** A big fish is an important thing because it can produce so many more eggs than a small one. For example in one study one 10kg snapper produced the same number of eggs as 212 1kg snappers.

Quite a small number of large fish can really add to the number of baby fish produced.

7. Well-protected marine reserves have been shown to have great benefits for the conservation of the species and habitats inside their boundaries.

8. Well-protected marine reserves have also benefited fisheries outside the boundaries.

9. Marine reserves need active management. They need:

- A full consultation process involving all stakeholders
- Clear objectives
- Strong rules
- Good enforcement, preferably by well-trained rangers or wardens
- Good monitoring of biological and social and economic effects of management
- Good local education and awareness raising
- Support from the youngest fisher through to top politicians
- Collaboration between non-governmental organisation and government departments to share expertise and knowledge

10. Marine reserves cost money!

They need funds to set them up and to run them. Possible sources of funding include:

- Government funding for fisheries and conservation
- International conservation organisations – e.g. WWF
- Tourism
- Subscriptions
- Merchandise and events
- Environmental taxes
- Environmental trust funds
- A combination of these sources
- Need to aim for financial sustainability within a few years of establishment.

11. Marine reserves have to be monitored. People need to know how the marine reserves are working so good quality MONITORING of fisheries, habitats and fish and invertebrates is vital. The results of this monitoring need to be fed back to the stakeholders and community so that they know what is going on.

Regular fisheries monitoring provides an excellent way to look at how the fisheries are responding to marine reserves and other management.

12. Marine reserves won't work in isolation and need to be surrounded by good management. They are just one tool that will help fisheries and marine conservation but they need the support of well-regulated fisheries with control of illegal fishing.

13. **Marine reserves need to be protected from other threats as well as fishing.** Pollution, intensive diving or other recreational uses, development etc can threaten marine reserves.
14. **Marine reserves will be most likely to succeed with excellent co-operation and collaboration between stakeholders, government departments and non-governmental organisations.**

There is now a wealth of information on how marine reserves have been successfully established all over the world. Many of these are described in the books recommended below.

Useful books and reports (Shoals Rodrigues has these books)

Roberts, C.M. & J.P. Hawkins. 2000. Fully-protected Marine Reserves: A Guide. WWF Endangered Seas Campaign, 1250 24th Street, NW, Washington, DC 20037, USA and Environment Department, University of York, York YO10 5DD, UK. (Available online – see www.panda.org/EndangeredSeas/). Lots of background information on marine reserves and how they can be designed and managed. Lots of case studies of successful marine reserves from around the world.

Sobel, J. and C. Dahlgren. 2004. Marine Reserves: A Guide to Science, Design and Use. Island Press, Washington DC. Information on designing and studying marine reserves and some different case studies.

Pomeroy, R.S., J.E. Parks and L.M. Watson. 2004. How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness. IUCN, Gland, Switzerland and Cambridge, UK. (Available online – see www.iucn.org). This guide is designed for assessing marine reserves that have been in place for two years or more but has lots of ideas and information that would be useful in the early stages of design and designation too.

Gell, F.R. and C.M. Roberts. 2003. The fishery effects of marine reserves and fishery closures. WWF-US, Washington DC. (Available online www.worldwildlife.org/oceans/). This is a review of the evidence the effects of marine reserves on fisheries and has case studies on marine reserves which have shown benefits to fisheries.

Websites

MPA News is a newsletter about marine reserves aimed at managers and others involved in marine protected areas. It covers many of the practical issues of marine reserve management as well as discussing developments in MPA research. It can be downloaded from:

<http://depts.washington.edu/mpanews/>

Prof. Callum Roberts and Dr. Julie Hawkins' book on marine protected areas which covers many of the main issues and has some good case studies of marine reserves around the world is also available on-line:

http://www.panda.org/resources/publications/water/mpreserves/mar_index.htm

The Soufriere Marine Management Area have an informative website with information on incomes from user fees etc. They also have a good newsletter which covers many aspects of the day to day running of a marine park:

<http://www.smma.org.lc>

If you have any questions or comments about marine reserves once I have left Rodrigues please do get in touch and I will try to help!

My email is fiona.gell@gov.im

I hope you have found this useful!

Dr Fiona Gell

Appendix 3: Notes on meetings with fishers about marine reserves in 2003

These notes are taken from Sabrina Desiré's notes on the meetings that Shoals Rodrigues staff held with fishers in the communities close to the proposed marine reserves. These meetings preceded the final selection of reserve sites. This information was used to refine the 5 sites, then this was presented to the RRA.

Location: Terre Rouge

Date: 19/08/03

Attendance: 31 fishers (probably more women than men)

Local contacts: Virginie Moothien, Maryanne Speville Hortense (8310533) and Jean Noel Speville Hortense

The fishers agreed that marine reserves are good thing and are what they need. One issue of concern raised was about ensuring that access was available to fishing sites, for example incorporating lanes or walkways for them to access sites.

Enforcement was an area of concern. They discussed the possible role of FPS in looking after the reserve and they said that they need to make sure that all fisheries regulations were well enforced.

The fishers were not keen on the coral reef being included but then discussed the location of the reef – Jeantac, la Passe Cabri.

Location: Roseaux

Date: 20/08/03

Attendance: 7 fisherwomen there (there are a total of 38 in the village)

Local contacts: Linkley Perrine, Florise Jolicoeur 8310193

These fishers said that they need to be given compensation if part of their fishing area is closed. They think that there is a need to encourage people to rely less on fishing, for example giving young people the chance to be tourist guides. They accept the idea of looking after the reserve themselves.

Illegal fishing in the reserve is their big concern and they do have concerns about the most effective way to protect the reserve.

They believe that there is the need to close all fishing activities in some areas and give fishers compensation as has happened with the seine net fishery.

Location: Anse Nicolas

Date: 22/08/03

Attendance: 22 fishers

Local contact people: Roméo Felicite and Jimmy Meunier.

Everyone agreed that there are too many fishers in the lagoon. They think that a reserve would be good and it would be good for the fishers themselves to be park rangers and be paid for this work.

Their main problem they foresee is passing boats. They don't want boats going through the reserve and they are concerned about the effects of boat engines and other damaging types of propulsion.

They believe that there is a need to develop more jobs for young people. If fishing areas were closed they wouldn't have an alternative place to fish so government should pay them compensation. Off-lagoon fishing would be good if the government could provide them with a big boat.

Thus community also raised concerns about the problem of sand mining. They believe that sand-mining activities could cause a problem with the marine reserve as it is very close to the proposed area.

They would prefer it if the Coastguard were responsible for looking after the marine reserve, rather than the FPS. They emphasized how important it was to have good management.

They believe that good areas for reserve are Passe Demi and la Passe Cocos. They think that if these areas were closed for one year there would be a big increase in octopus.

Location: Baladirou Date: 18/08/03

Attendance: 23 fishers

Local contacts: Marie Ancy Louis and Marie Jeanne Azie (who work with Shoals Rodrigues on the octopus project)

The Baladirou fishers think marine reserves are a good idea but they were concerned about access and pointed out that they need an area to go through in their boats. They think that the Baladirou area is too small for a marine reserve because there are too many fishermen in one area. They also think that Riviere Banane might have problems because the water is too low in the lagoon and that Anse aux Anglais would be better. Considering the alternatives to present fishing activities that are available, these fishers said that they would prefer to have marine reserves to growing algae.

Most of the Baladirou fishers said that fishermen themselves would be the best people to look after the reserves. They said that they would need boats, equipment and possibly weapons.

Location: Pointe l'Herbe Date: 05/09/03

Attendance: 5 fishermen.

This group thinks that it is a very good thing to implement a reserve locally but it would need to have good management. They believe that for good enforcement, people from outside the Island together with fishermen should look after the reserve. They also believe that the old seine net reserve at Baie Topaz should be fully managed again. They are very concerned about the use of the poisonous *batatran* plant and believe its use should be stopped completely because fishing with *batatran* is a big problem for the marine environment. Young fish, such as emperors and goatfish which are the future of the local fishery, are killed by *batatran* so this fishery is highly unsustainable.

Location: Grand baie Date: 04/09/03

Attendance: 8 fishermen

These fishers highlighted the problem of sand filling the lagoon because of erosion. They were also concerned about the damage caused to the lagoon by seine net fishermen. They believe that careful underwater studies should be used in the setting up of the reserve. They think it is very important that there are marker buoys to mark the boundaries of the reserve. They also think it is vital that there is no illegal fishing in the reserve.

Location: Baie Malgache Date: 12/09/03
Attendance: 16 fishermen (only men)

These fishers believe that the government should encourage fishermen to plant trees rather than go fishing. They think that fishermen should be responsible for enforcing the reserve. They need to be paid for that. They think that Carcasse is a good area for a reserve. They said that government need to offer them R7000 per month to stop fishing.
[For reference, the bad weather allowance is around R2700 per month]

Location: Riviere Banane Date: 02/10/03

The Riviere Banane fishers were concerned that there are too many people using one area at Riviere Banane. For example, people from Baladirou come and fish there too. There should be a lane for boats and there should be good management for the reserve as well. These fishers chose the Bassin Nole and la Queue Trou as possible areas for protection. [Need for detailed map of local names]

Appendix 4: Handouts for Marine Reserves Powerpoint presentation