Blue Ventures Conservation Andavadoaka, Madagascar

conservation education research

Pioneering new techniques for marine habitat mapping in the Velondriake protected area network.

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Research Update, January to March 2008

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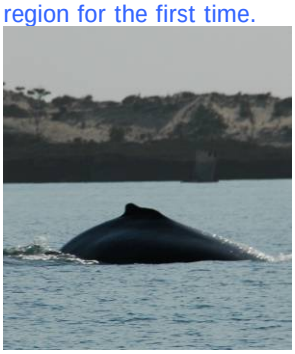
Documenting migration in the region for the first time.



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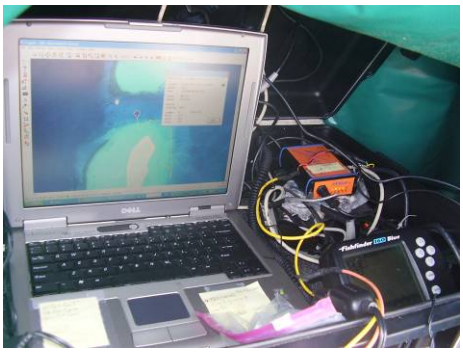
Habitat mapping in Andavadoaka

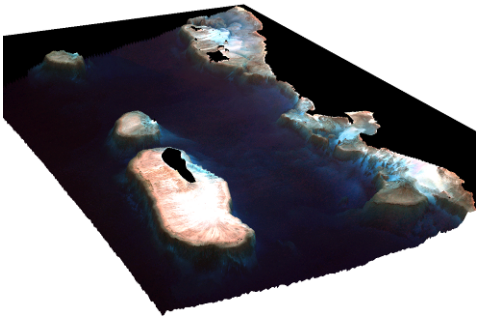
In late February Blue Ventures hosted Dr Sam Purkis from the American National Coral Reef Institute at Nova Southeastern University to lead a habitat mapping and Geographic Information Systems (GIS) ground truthing project in the Andavadoaka region. Sam was joined in the field by Blue Ventures' Operations Manager Raj Roy and Vola Ramahery, Southwest Marine Programme Coordinator for WWF, and herself a former staff member of Blue Ventures.

The team surveyed representative habitats from the entire Velondriake network over a 2 week period, covering several hundred kilometres, recording 275 video sequences of the seafloor substrate for further analysis and taking over 100,000 bathymetric (depth) readings. The research used custom-built acoustic mapping techniques to carry out the monitoring, which combines a highly accurate differential GPS (dGPS), an underwater camera, and an acoustic sounder to collect data. The data are later processed using MatLab, ArcMap and ENVI.

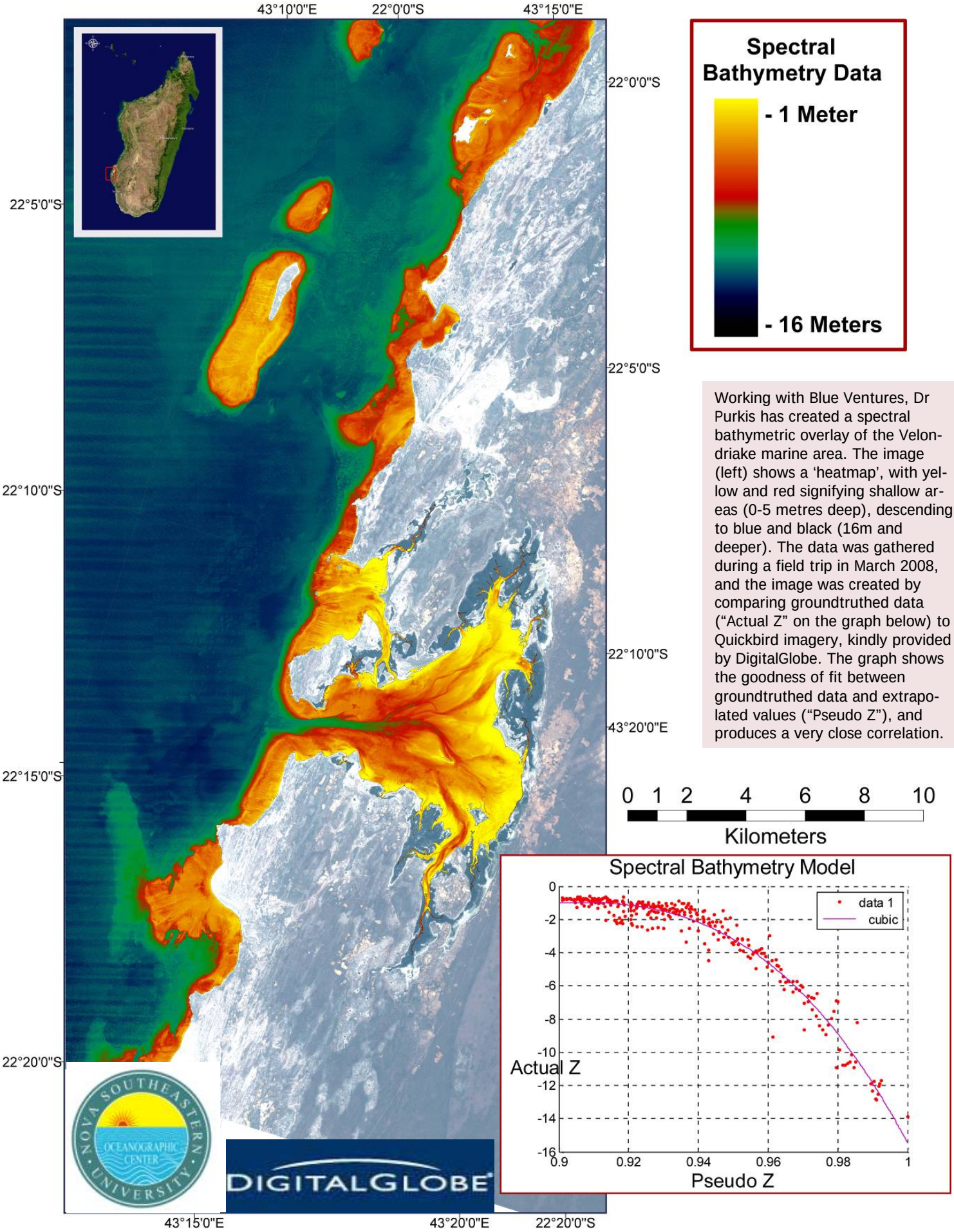


Close-up of the equipment required to record bathymetric data during the habitat mapping project (laptop, dGPS, inverter, and depth gauge)

The acoustic sounder is mounted onto a wooden arm, which is securely attached to the research boat. This collects bathymetric data at all times and is associated with a differential GPS, which attaches an accurate location to each depth recording, or 'ping'. An underwater camera is lowered over the side of the boat, and is used to record up to 1 minute of video footage of the seabed substrate at each site. This footage is later analysed to determine the dominant substrate type, and is georeferenced for inclusion in the resulting habitat map.



Screenshot of a digital elevation model (DEM) generated by comparing ground-truthed bathymetric measurements and Quickbird satellite imagery. The Quickbird imagery has been draped over the generated bathymetric model; black areas represent land.



Working with Blue Ventures, Dr Purkis has created a spectral bathymetric overlay of the Velondriake marine area. The image (left) shows a 'heatmap', with yellow and red signifying shallow areas (0-5 metres deep), descending to blue and black (16m and deeper). The data was gathered during a field trip in March 2008, and the image was created by comparing groundtruthed data ("Actual Z" on the graph below) to Quickbird imagery, kindly provided by DigitalGlobe. The graph shows the goodness of fit between groundtruthed data and extrapolated values ("Pseudo Z"), and produces a very close correlation.

Working in partnership with Reunion-based research group IRD (Institut de Recherche pour le Développement) Blue Ventures is creating a terrestrial and marine map for the entire Velondriake region, comprising 9 major habitat and substrate categories (such as sand, coral, and seagrass), and 8 major terrestrial categories (such as mangrove and savannah).

Data collected from local fishermen from 19 villages documenting the location of primary fishing sites will also be included in the analysis. The next step will be analysing the relative distribution of fishing sites and habitat areas earmarked as priority areas for conservation within the Velondriake protected area network. This information will give the Velondriake management committee important information for planning protected area and reserve zoning.

Maps produced will also form part of the educational and training materials which will be used to help local communities plan their resource use and provide a visual reference to the location of protected areas. Future projects include expanding the surveyed area further along the coast: north towards Morombe, and south to Soliary.

A team of five WWF scientists joined Vola in Andavadoaka to attend a GIS workshop run by Sam Purkis at the end of the project. They had a general tour around the Blue Ventures field site before meeting with the President of the Velondriake Committee and the Woman's Association.

Dr. Sam Purkis surveying using his custom built GIS rig on the boat

In a meeting with the Velondriake Committee, Vola and her team introduced the management measures put in place by WWF in marine reserves to the south of Toliara. An exchange of information occurred with all parties discussing their experiences with the establishment of protected areas.

The following afternoon the WWF team joined Sam and Raj Roy (BV Operations Manager) on a ground truthing survey trip and then integrated this data into fishing site maps using the latest in GIS technology.

Coral spawning

Since 2006 Blue Ventures field scientists have been monitoring reefs in southwest Madagascar for signs of coral spawning. Spawning, one of the processes by which reef corals reproduce, has never been witnessed in Madagascar or the Mozambique Channel region.

Colonies of *Acropora* corals were monitored at regular intervals from September until February each year, the predicted period of peak spawning based on other studies in South Africa and the western Indian Ocean region. Pigmented eggs, a sure sign of colonies maturing for spawning, were first observed in a single colony of Acropora on the 3rd December 2007 by marine scientist Tristan Brown.

Acropora coral sample with evidence of eggs

The colony was found on a patch reef known as '007', located inside the lagoon at Andavadoaka to the south east of the island of Nosy Hao. This reef constitutes one of a group of three patch reefs that form the 'recruitment complex' of reefs. Together they show the highest levels of hard coral cover and species richness in the Andavadoaka region. The colony was re-examined on subsequent dives, and on 11th December the matured eggs had left the coral polyps, indicating that the spawning event had occurred during the period during the preceding week in December. These dates coincide with a new moon (9th December) and spring tide, commonly corals' preferred time for spawning, since at this time eggs can be carried further from the parent colony as a result of the large tidal difference. Although the spawning event itself was not witnessed, this observation provides accurate insight into the time of year that we can expect to see a spawning event in the future.

However, even though multiple samples were taken from a range of *Acropora* species located in the Andavadoaka region, and from a range of depths (6 - 20m) at all the reef types in the lagoon (fringing, barrier and patch reefs), no other eggs were found during the sampling. This shows that there is still a lot of work to do in order to get an accurate understanding of coral spawning within this region, but it is a good start.

Feasibility of Algal farming in the Velondriake Management zone

The commercial market for red algae is currently expanding on a global scale following increasing demands for carrageenan, a naturally occurring family of carbohydrates which can be extracted from red seaweed. Carrageenan is used as a gelling agent and coagulant in the food, pharmaceutical and cosmetic industries. Massive exploitation of naturally occurring algae stocks occurred in Madagascar towards the end of the 1990's and current rates of extraction may lead to local disappearance of these species.

BV Masters student, Dany Ramanantsoa, with his algal farming tank

Extensive farming of red algae occurs in numerous countries including the Philippines and Senegal, but these practises may not always be sustainably managed, especially where demand is high. A feasibility study of the potential for the introduction of algal farming into the Andavadoaka region as an alternative sustainable livelihood was conducted by a final year University of Toliara (IHSM) masters student, Dany Ramanantsoa, in December 2007.

Several favourable sites for red algae (*Euchema denticulatum*) culture were identified, and three were selected for experimental farms; Tampolove, Lamboara and Atserananangy. Manufacturing units were set up in these three villages and growth rates monitored to assess the speed of aquaculture. A growth rate of 3.5% mass increase per day from cuttings taken from the Baie des Assassins shows very good prospects for sustainably managed algal farming in these areas.

Sample of E. denticulatum ready for weighing

Local fishers were instructed in basic aquaculture techniques, and appeared to be keen on the idea of developing further algae farming trials. There was particular interest from women in the villages where trials were carried out.

The results of this study suggest that the aquaculture of *Euchema denticulatum* in Velondriake villages is certainly feasible once infrastructure and manufacturing pens are in place. It presents a key method of alternative livelihood generation for coastal communities and has potential benefits for the long-term sustainability of the Velondriake region.

Study into octopus reproduction completed

An investigation into patterns of reproduction of the reef octopus *Octopus cyanea* has recently been completed based on catch data collected in the Andavadoaka region during 12 months of fisheries sampling. Octopus fishing is the most economically important fishery for most Vezo villages within the Velondriake region, and effective management of the fishery depends on an accurate understanding of reproductive behaviour of the target species.

Data were collected from six fishing sites frequently targeted by octopus fishers from Andavadoaka. Sizes of Octopus landings change according to the season and the highest catches occur during austral winter season (November – February).

Analysis of the sex ratio of the catches is important for fisheries managers. There was a noticeable increase in females caught during periods of laying in May-June and September-January. There was also a high percentage of young male individuals documented in the catch. Young males live on the shallow reef before moving to the deeper waters to reproduce so if they are caught before they have had the chance to reproduce successful sustainability of the population stocks may be at risk.

Fisheries Scientist Daniel Raberinery weighing octopus during sampling

Direct observation of male octopus landed has allowed identification of the three key phases of sexual maturity within the local octopus population. The scale for sexual maturity of female octopuses was determined from microscopic studies of the oocyte. Five maturity phases, associated to the shape and colour of the female reproductive organ, have been observed. Identification of these reproductive stages allows protected area managers to intiate closure periods during key periods of oocyte development. This enhances reproductive success and ensures long term sustainability of the populations.

Results show that spawning is at its highest during two periods, the first period occurring between the end of hot season and beginning of cold season (April-May) and the second period, which is the longest, occurring between the end of dry season and beginning of rainy season (November-January). Thus highlighting the key closure periods to maximise reproductive success. Fisheries data such as this is a valuable tool for protected area managers to ensure population sustainability through strategic closure periods.

Daniel will be continuing this research as part of his doctoral research at the University of Toliara, working on a stock assessment of octopus around Andavadoaka, in particular investigating aspects of current speed and direction to assess spawning capacity.

Andavadoaka Women's Association broadens its product range

January to March 2008 has been a particularly productive period for the Women's Association of Andavadoaka. The Association was formed in 1994, and Blue Ventures helped establish its legal status in 2006. The Association now has 46 members from the village of Andavadoaka and the women range in age from 18 to 70. In January 2008, Blue Ventures marine scientist Lalao Aigrette started working with the Association to help its members diversify their income-generating activities.

January 2008 saw the Association prepare a welcome lunch for the new volunteers and staff of Blue Ventures.

The lunch began with a song and dance performance by the women, followed by a hearty meal, a few speeches of thanks and finally, a stall of craft items for sale made by the women themselves. It was deemed such a success that these lunches now take place every six weeks, serving as a regular fundraising event for the Women's Association as well as a way for Blue Ventures volunteers to formally meet the women of the village.

Volunteers browsing the Women's Association stall outside BV classroom 'Nosy Cao'

To support the development of alternative sustainable livelihoods in the region, Blue Ventures has begun offering small loans to members of the Women's Association to help them buy materials and develop their stock of souvenirs for sale to visitors to the region. Loans are paid back from the Association's profits after sale. Initially, the women were making simple handbags and embroidering a range of designs onto white cotton handkerchiefs and tablecloths. However, these items only had limited appeal to visitors. Following a productive brainstorming session with BV volunteers, who were asked what sort of items they would like to buy for themselves or as gifts, the Association has now diversified its product range to produce up a range of wrap-around skirts, men's shirts, pencil cases, handbags, toy animals for children and even full length dresses.

The Association now also embroiders designs onto volunteers' own t-shirts, and holds a stall at the Blue Ventures site every Sunday, which has been a great success at raising money for the group. Another new venture for the women has been the manufacture of hammocks. A generous donation from a recent Blue Ventures volunteer has enabled the Association to invest in the materials to start up this scheme and the hammocks have proved popular with visitors to the region.

Examples of the Women's Association embroidery

March 8th was International Women's Day, an annual event celebrated across the world. In Andavadoaka, the day started with a parade through the village by the women, culminating in a performance to the (male) dignitaries of the village and to a large audience of onlookers. In the afternoon, there was a women's football match, and in the evening, a party at one of the village bars.

Humpback whales migrate through the Andavadoaka region

Following the year's first sighting of a humpback whale in the Andavadoaka lagoon in late June, whale watching surveys were carried out three times each week from July until December 2007 by Blue Ventures staff and volunteers. Surveys were carried out from the custom built whale-watching platform on the offshore barrier island of Nosy Hao. This 5m platform provides an ideal vantage point from which migrating humpbacks can be tracked moving North and South along the coast on the seaward side of Andavadoaka's reefs.

Humpback whales, *Megaptera novaeangliae*, are part of the Mysticete or 'baleen' whale family. The term baleen refers to a series of up to 400 fringed overlapping keratin plates hanging from each side of the upper jaw. Baleen whales feed on krill, small shrimp-like crustaceans, and small fish and consume up to 1 1/2 tonnes (1,361 kg) of food a day.

Humpbacks have a wide global distribution, and most populations generally follow a regular migration route, summering in temperate and polar waters for feeding, and wintering in tropical waters for mating and calving. This migration has been documented around the coast of Madagascar with seasonal rises in whale numbers around the East coast during September and October in known breeding grounds around Antongil Bay and Isle St Marie. The Wildlife Conservation Society (WCS) has conducted a long-term study of the behaviour and genetic diversity of this East coast population, and similar work has also been conducted in the Comoros Islands to the north west of Madagascar.

Humpback whale with pectoral fin raised

The whales' annual migration along the west coast of Madagascar has not previously been documented. Blue Ventures volunteers were trained in cetacean identification techniques, and took part in tri-weekly trips to the platform throughout the migratory period from June to December. The preliminary results of this study suggest two peaks in the migratory flow in July and August, and a significant decrease in the number of individuals travelling north in September and October. Sightings recorded also indicate mating behaviour occurs primarily on the northward migration. Lower sighting numbers for whales travelling south correlates to reduced aerial displays.

Future plans for this monitoring include genetic tagging or photo identification studies to investigate the origin and destination of these whales. The Comoros Islands are a known breeding area and it is possible that the whales travelling along the west

coast of Madagascar are heading there. Further identification studies will prove this theory, and funding proposals are currently being submitted based on the positive results of this preliminary study.

Rapid changes in fish utilisation of mangrove habitat in Western Madagascar

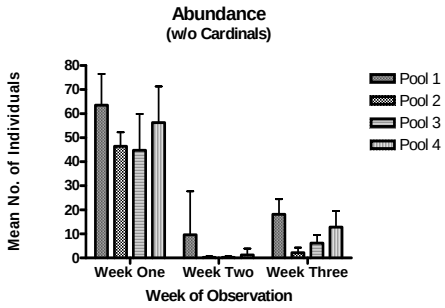
Mangrove habitats are used by many fish species as feeding and/or nursery areas. Many of these fish species are found as adults on coral reefs. Studies have been performed in many areas of the world documenting which species are utilising mangroves, what aspects of the habitat are attracting them, and whether the fish found in mangroves are only juveniles or adults as well. In general, the habitat is considered to be useful to juveniles for feeding and protection from predators.

Antsaranasoa mangroves near Andavadoaka

Husband and wife team Peddrick and Judith Weis from the USA visited Andavadoaka in January 2008. They investigated fish use of mangroves through fish surveys in a small mangrove area (1200m x 300 m) south of Andavadoaka. The *Antsaranasoa* mangroves are atypical in that there are fossil coral outcroppings in many places, including on the seaward side of much of the mangrove forest. The forest contains five species of mangroves: *Avicennia marina*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, *Rhizophora mucronata*, and *Sonneratia alba*. There are a number of inlets for sea water to enter the mangrove during flood tides. There is little or no freshwater input and the salinity inside and outside the mangrove was 36 ppt in all areas sampled, both before and after rain storms.

The Weises focussed on the northernmost inlet. There is a sand bar near the inlet that delays the inflow of water at flood tide and allows standing water to remain in parts of the channel at low tide. At low tide, there are a number of areas that are deeper, called pools. Fish found in these pools were examined at all phases of the tidal cycle, over a three-week period, using underwater visual census (UVC) by snorkelling, supplemented by some trapping.

Over a three week sampling period, large variation was evident between the abundance of fish in the studied pools. In Zanzibar, the mangrove fish community was reduced in the rainy season. However, in this area of Madagascar, there is very little evidence of a rainy season. The reasons for the dramatic changes seen in the fish community remain unknown, due to the short duration of this study, although the data suggest that the surveys were conducted at a time when older larger juveniles left for the reef and new smaller fish were recruiting into the mangrove.



Total numbers of fish of all species (except cardinalfish) in each pool and for each week – means and standard deviations.

Utilisation of mangrove habitat will likely vary throughout the year depending on the reproductive cycles of the different fish species whose juveniles utilise the mangroves. Longer term studies are needed throughout the year to learn about cycles in fish use of the mangroves.

Family Planning Update

In mid February Blue Ventures Medical Officer, Rebecca Hill, held a meeting attended by 60 women from Andavadoaka, attracting a number of new attendees to the family planning service. The information poster trialled at the mid-March BV Open Day was well received, attracting more men than women, and has since been duplicated for display in other villages within Velondriake to raise awareness of the weekly clinic in Andavadoaka. Three demonstrations showing condom use were given; two by Malagasy staff members and one by the president of Velondriake, Monsieur Roger. In addition, to promote the use of contraception in the Velondriake region, Andavadoaka's Women's Association have been embroidering logos such as "mampiasa kapoty" (use condoms) on t-shirts of the volunteers and staff which were worn on the Open Day and attracted a great deal of attention from the village.

BV staff and Mr. Roger with condoms at the Open Day

The family planning clinic currently operates with very limited funds, relying on BV Malagasy staff to take turns to act as interpreters. This often does not provide sufficient continuity to follow cases through, and consequently the project is currently seeking support to hire a full time Malagasy nurse to assist with the programme.

Additional full time personnel will also assist plans for the clinic's expansion to create new satellite centres in other villages within Velondriake.

Family planning poster prepared by BV volunteers and Medical Officer for the March open Day

Other News...

Climate change workshop, Antananarivo

In late January WWF Madagascar hosted a national workshop assessing climate change impacts to Madagascar's biodiversity and livelihoods. A number of representatives of the Velondriake protected area network were present at the workshop, participating in a week of discussions in Antananarivo. Alasdair Harris and Francisco Ramananjatovo, from Blue Ventures and WCS respectively, provided an update on the Velondriake initiative at the meeting.

The workshop brought together a diverse group of climatologists, biologists, conservation practitioners (including protected areas' managers), community management practitioners, and community groups to discuss the potential implications of climate change directly on biodiversity and indirectly through its potentially detrimental impacts on livelihood and food security for people.

The meeting was the first of its kind in Madagascar, and aimed to improve understanding of climate scenarios for Madagascar, as well as of predictions of changes in species distribution. The workshop also shared information on threats from climate change to human communities in specific areas (particularly food security impacts), and guidelines on what, if any, are the implications of shifts in livelihood strategies for conservation of refuge and climate resilient priority forest and marine areas.

The workshop developed a set of recommendations based upon this information to adapt to or mitigate some of the impacts of climate change for both conservation and protected areas' planning and where relevant human livelihood strategies will be a major outcome of the workshop, with suggestions made for filling gaps in knowledge and follow-on activities to enhance resilience.

BV Open Day March 15th

In mid March Blue Ventures held an open day for the village. BV volunteers created posters about the interrelationship between the mangroves, seagrass and reefs, the effects of marine protected areas on fishing stocks, the activities of the Women's Association, and information materials about the family planning service that Blue Ventures has been operating in the region over recent months. Additional posters described some of the alternative livelihood projects being developed in the region, and the benefits of using the solar stoves being distributed by Blue Ventures Carbon Offset programme. For children, activities included a toy turtle racing game and a fishing game, casting fishing rods into a marine reserve bucket and a non-reserve bucket.

Children from the village were given the opportunity to experience breathing using scuba (and received a sweet for their bravery), and our Malagasy staff were on hand to elaborate on the themes, and ensure that the conservation message was spread.

Family planning and contraception was a particular theme of this open day with demonstrations of condom use by one of the BV Malagasy staff and even the ex-village president. The condom message wasn't restricted to the demonstration or posters. Nearly all of the volunteers, and most of the staff had employed the Women's Association to embroider messages on the back of t-shirts promoting condom use.

'And they're off...' The start of the pirogue race

In the afternoon, we held a pirogue race. There were 25 entrants, and each pirogue had three Vezo and one vazaha (tourist). This was a serious event for the village teams given a long stretch of bad weather which limited fishing, so not only was their pride at stake, but the prize money was extremely important to them.

There was a slight mishap with an alleged false start, and the race being rerun, but fortunately for all concerned the same boat won the second time round - so the best rowers evidently did win.

The village listening to the volunteer and staff song

The day finished with some light entertainment; BV staff and volunteers sang a conservation song in Malagasy written by James, our boat driver. The village was suitably amused and impressed. An English speaking competition followed, and finally Bic's finfish presentation and a film about overfishing in Indonesia before heading back to Coco Beach for supper. Everyone agreed that it had been a fantastic and educational day for all concerned.

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