



Darwin Initiative Main Project Annual Report

Important note: To be completed with reference to the Reporting Guidance Notes for Project Leaders:

it is expected that this report will be no more than 10 pages in length, excluding annexes

Submission Deadline: 30th April 2017

Darwin Project Information

Project reference	22-016
Project title	Securing livelihoods, health and biodiversity through seascape-scale sustainable fisheries co-management
Host country/ies	Madagascar
Contract holder institution	Wildlife Conservation Society (WCS)
Partner institution(s)	GRET, Ministry of Marine Resources and Fisheries (MRHP), Ministry of Public Health (MSP), Ministry of Agriculture and Rural Development (MINAGRI), Committee for the Sustainable Development of Antongil Bay (PCDDBA)
Darwin grant value	£300,000
Start/end dates of project	April 2015 – March 2018
Reporting period (e.g., Apr 2016 – Mar 2017) and number (e.g., Annual Report 1, 2, 3)	April 2016 – March 2017, Annual Report 2
Project Leader name	Stéphanie D'agata
Project website/blog/Twitter	n/a
Report author(s) and date	Stéphanie D'Agata – Ravaka Ranaivoson – Tolotra Rakotonirina (WCS) Aurélie Vogel (Gret) Christopher Golden (Harvard T.H Chan School of Public Health) 29 April 2017

1. Project rationale

Antongil Bay in northeastern Madagascar embodies the challenge of balancing conservation and development priorities. The Bay supports spectacular coral reefs, 13 marine mammal species, 3 marine turtle species, and 140 fish species (including 19 shark species). A large number of species with high conservation value, including The endangered scalloped hammerhead shark (*Sphyrna lewini*), the endangered green turtle (*Chelonia mydas*) and critically endangered hawksbill turtle (*Eretmochelys imbricata*) that are harboured in the Bay are threatened by small scale fishery by-catch and direct hunting.

Concurrently, 100,000 predominantly poor, rural people living along 200 miles of the coastline rely on these waters to sustain their health and livelihoods. Fish is their primary source of iron, zinc, vitamin B12 and fatty acids. Nevertheless, these people experience rates of anaemia above 40% and stunting rates (short stature from chronic malnutrition) above 30% due to inadequate dietary intake and diversity.

Overexploitation due to increasing human population, reduction of productive agricultural land, destructive fishing practices and lack of compliance with gear restrictions are driving degradation of coastal habitat and the Bay's fisheries, loss of coral reefs and declines in fish and invertebrate abundance. In addition to biodiversity loss, eventually the Bay will fail to deliver optimal economic and health benefits to local communities if immediate action is not taken.

With this project we aim to reverse the decline in fisheries resources and consequently improve livelihoods, food security and health aspects for 11,000 coastal people dependent upon Antongil Bay's resources, and help to ensure improved sustainable fishing and farming practices that will have an overall positive impact on the marine and terrestrial environment of the Bay.

At least 250 coastal households (1,350 people) will benefit from improved rice production, reducing their need to catch and sell fish to purchase rice. In addition, around 250 women will benefit from an additional regular source of income and we aim to improve the nutritional status and reduce the rates of low birth weight for at least 100 measured households (500 people, 250 women and girls). Although we will only measure impact in 100 households, these results will be generalizable to the 11,000 inhabitants of the 24 villages managing LMMAs and over the long term to the entire landscape, affecting a population of 100,000 people.

In addition, the project aims at increasing resources and economic returns from fisheries for coastal communities, through improved management capacities, and an increased engagement of communities and government to reduce overexploitation, illegal fishing and the utilisation of destructive fishing gear.

2. Project partnerships

Groupe de Recherches et d'Echanges Technologiques (GRET):

As part of the project, provides technical training of farmers to increase rice production, improve diversification of income, especially for women through vegetable farming, poultry raising, and fish processing and marketing in 5 pilot LMMAs. In addition, GRET is helping

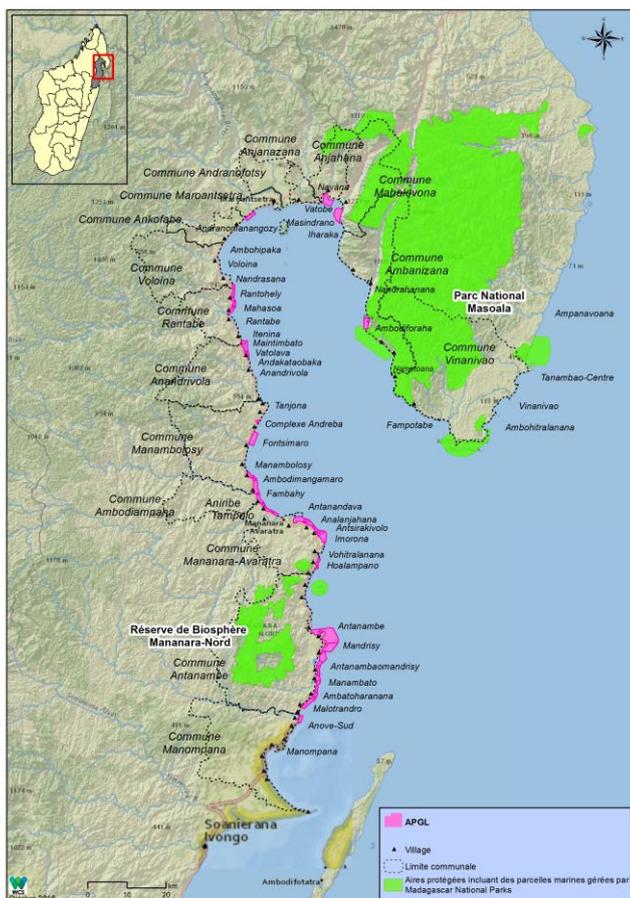
farmers to shift from erosive slash-and-burn cropping systems in watersheds to more sustainable rice farming practices, thus reducing sedimentation in coastal habitats.

Ministry of Marine Resources and Fisheries (MRHP): Through collaborative efforts with WCS and local natural resource users in 2013, MRHP developed the Antongil Bay Fisheries Co-management Plan (ABFMP), which is the first national-level plan in Madagascar to empower local communities and locally-managed marine areas in securing sustainable fisheries management. During the reported period, MRHP has been actively involved in 1) joint supervision, coordination and monitoring of the implementation process of the ABFMP; 2) joint patrols with local communities and WCS agents around the and 3) support for local small-scale fishers to obtain official fishing licenses and facilitation of the issuing of these licenses..

Ministry of Public Health (MSP): WCS has partnered with MSP to provide health status information to garner support for local health initiatives. The MSP Director has guaranteed collaborative efforts with MRHP and the Ministry of the Environment understanding the environmental underpinning of local health.

Ministry of Agriculture and Rural Development (MINAGRI): Through the Malagasy Centre for agronomic research (FOFIFA), GRET work closely with MINAGRI to give technical support to farmers mainly to launch the use of different varieties of rice. MINAGRI representatives are regularly updated about project activities and outcomes.

Committee for the Sustainable Development of Antongil Bay (PCDDBA): PCDDBA is a Malagasy association that was created in 2003 with the support of WCS. PCDDBA's mission is to ensure the integrity of the biological, ecological, socioeconomic functions of Antongil Bay and promote the sustainable development of its surrounding areas through consistent actions and consultations. PCDDBA brings together local officials, private sector representatives, fishermen and other relevant stakeholders. The collaboration with PCDDBA supports the institutionalization of the prohibition of unsustainable fishing techniques through the "Dina". PCDDBA



participated also in the ABFMP Steering Committee and co-organized the Antongil Bay annual LMMA forum.

Harvard T.H. Chan School of Public Health: the work of this partner enables the project to empirically quantify the current status of livelihood and nutritional dependencies on small-scale fisheries and to calculate the potential nutritional burden of disease averted through sustainable fisheries management. Harvard T.H. Chan School of Public Health collect continuous data in five villages along the coast of the Antongil Bay over the course of the project.

3. Project progress

3.1 Progress in carrying out project Activities

Briefly, please report on progress in implementing the project's Activities for this year. **Please report the progress of Activities under the Outputs** to which they relate. Have the activities been carried out in the manner and time planned? Please substantiate comments with evidence to support progress towards Activities.

Output 1: Nearshore fish and invertebrate abundance are increased and endangered species of sharks and marine turtles are protected through improved management capacities and engagement of communities and government in reducing overexploitation, illegal fishing and use of destructive gears in Antongil Bay.

1.1 Improve engagement and accountability of all stakeholders in ABFMP implementation by organizing annual meetings of the ABFMP Steering Committee.

The ABFMP steering committee with the support of WCS conducted its second annual meeting in Fenerive-Est on October 12-13, 2016 to assess the progress of the implementation of the Antongil Bay Fisheries Management Plan and to agree on next steps. The meeting of the ABMFP was very positive. The Ministry of Fisheries expressed its satisfaction with the implementation to date of the ABMFP and confirmed the role of WCS as the main implementing partner on this. The key resolutions from the meeting included a need for continued strengthening of fisheries enforcement through the following actions: (i) pursuing the delivery of fishermen cards with support from WCS; (ii) increasing the number of agents of the Ministry of Fisheries in Antongil Bay and support from WCS to train a representative of the Ministry to be an accredited law enforcement officer; (iii) reinforcing patrols and applying penalties during patrols; (iv) finalizing the Dinabe for Antongil Bay with support from the local authorities; and (v) pursuing awareness raising on fisheries' regulation using mass media. The meeting also agreed to the reinforcement of the Steering Committee by: (i) enlarging the ABFMP membership to include representatives from the Districts; and (ii) confirming that the Federation of the Antongil Bay Fishers is recognized as the sole community partner regarding fisheries co-management in the Bay and it is necessary to finalize the legal creation process of the Federation; and (3) seeking support from WCS to create three new LMMAs in the Bay.

1.2 Strengthen the ability of coastal communities to more effectively manage the network of 24 LMMAs

As part of the implementation of the ABFMP, WCS supported the creation of the Federation of Antongil Bay Fishermen, which aims to: (i) improve fishers' technical skills; (ii) improve the fishers' well-being; (iii) promote fisheries to support local development while protecting the environment, and (iv) achieve a fair price regulation to support local fishermen. The federation was officially recognized by the Government of Madagascar in July 2016, with the support of the Ministry of Fisheries and its regional representatives, mayors in the communities around the Antongil Bay, chiefs of villages, representatives from the ad hoc committee, and WCS.

The annual local meeting of the national network of locally managed marine areas – MIHARI, was held on September 14-16, 2016 in Maroantsetra with 52 representatives of the 25 LMMAs in collaboration of ABFMP Executive Committee, WCS, members of the ad hoc committee, and representatives from the Ministry of Fisheries. In November 11 to 14th 2016, 4 members of Antongil Bay LMMAs participated to the annual eastern regional LMMAs' meeting in Sainte Marie; and discussed the following key points to integrate in the regional strategy for LMMAs: (a) inconsistency between existing text and reality; (b) required negotiation with justice to activate approval of the "Dina"; (c) partnership to support formal recognition of LMMAs that are part of MIHARI, (d) advocacy among partners to promote alternative income generating activities, and (e) capacity building for members. Participants also agreed on the importance of official recognition of LMMAs as an efficient and relevant management tool to ensure sustainable management of fisheries.

In August 2016, three (03) workshops were held with local authorities to develop common strategies to eradicate the use, sale and possession of beach seines in Antongil Bay, which are illegal but still used in some areas. The workshops agreed to the following resolutions: (i) fishermen using beach seines are not entitled to obtain fishing licenses and thus cannot legally fish in Antongil Bay and if these fishermen want to be eligible for a license they will need to sign a commitment letter engaging them to stop the use of this type of fishing gear; (ii) community surveillance committees (CCS) that exist in each of the LMMAs will track fishermen that continue to use beach seines in each village. Throughout the period, 229 new fishing licenses have also been distributed to Antongil Bay fishers. To date 62% of fishers in Antongil Bay have licenses granting them exclusive access to fisheries resources.

1.3 Raise knowledge and awareness about existing fishing regulations, unsustainability of destructive fishing practices and benefits of LMMAs

Radio is the primary means of communication in the study area. WCS has established a partnership with the local radio station in Mananara in the southern part of Antongil Bay to broadcast news and updates on WCS activities and events. During 2016, eleven radio broadcasts were produced and diffused addressing issues related to fishery management, climate change and its impact on marine ecosystem, the importance of community patrols, the importance of licenses for fishermen, and new regulations on sea cucumber management.

1.4 Organize joint community and local authority patrols to enforce fishery regulations in LMMAs

Twenty one (21) community surveillance patrols were organized by CCS in 19 LMMAs during which the following five key types of offences were identified: use of beach seine, use of illegal nets, coral extraction, mangrove cutting, and fishing in the no-take zones. These missions led to the confiscation of 07 illegal nets and to the pursuit within the judicial system of two offenders by local authorities. In addition to this, twenty six (26) joint community/local authority patrols were organized leading to the confiscation of 42 illegal nets, 03 beach seines and to the pursuit of three offenders by local authorities. All of the offenders presented to local authorities were penalized by 2 days detention.

In May 2016, a global introduction to the conservation software and law enforcement monitoring tool SMART and its use in protected area management was carried out. During this session, 9 community patrol members representing 9 LMMAs received an overview of the tool, i.e. purpose of SMART in terms of enforcement monitoring, type of data collected, how to manipulate the cybertracker which allows automatic uploading of data, and how to share the data collected. In August 2016, practical on-site training was carried out with representatives from 18 LMMAs. This involved initially a three-day session on the practical use of SMART in Mananara during which 18 representatives from 18 LMMAs participated (9 previously trained and 9 new representatives).

In March 2017, members of WCS and CCS teams in Antongil Bay received a second training in use of cybertracker for data collection. Seven LMMAs in four communes were targeted for the second training and preliminary data collection. In total, the following offences were recorded during these missions: non-possession of fisherman's cards, use of illegal small-hole nets, use of mosquito net, garbage dumping, beach seine, intrusion in no-take zones were recorded during 4 days of surveillance. The total number of observations was 204 and the largest number of infractions were recorded in Mananara and Antanambe and related to non-possession of fishers' cards and use of illegal net types. Currently, 6 cybertrackers are deployed in the Antongil Bay seascape for use by the CCS to monitor various offences inside and outside LMMA.

1.5 Conduct reef surveys and fish catch monitoring to assess impacts of LMMA on coral reef health and fisheries.

Bi-weekly fish catch monitoring has been conducted in ten villages through collection of data on Catch Per Unit Effort (CPUE). Data sets in 2016 have been compared with those previously gathered from five villages in order to identify a trend in fish catch quantities and to assess the impact of LMMAs on fisheries.

Ecological reef surveys were conducted from December 3rd to 12th, 2015 in 12 LMMAs of Antongil Bay and from October 16th to the 19th 2016 in 1 LMMA, 1 open access site and 1 restricted zone of the Masoala National Park by two divers. In total, 32 dives were performed and reef fish abundance and biomass as well as coral diversity were recorded from 15 sites.

Output 2 - Livelihoods are diversified and food security is improved

2.1 Train and support a network of 50 pilot farmers on rice production. Prepare technical leaflets, organise trainings, exchange visits and cropping cycle collective assessments, and facilitate access to equipment to facilitate the adoption of tested and approved practices by 200 additional households:

During this second year, 115 people (81 men and 34 women) were trained on improved rice production practices. The project is supporting a network of 25 pilot farmers. They have achieved 2 seasons with intensified cropping techniques, and are providing help to other people who experiment these new intensified techniques.

These new practices were also applied by farmers within the farmer field schools (FFS), with 3 groups working in Amboditangena, Antsirakivolo and Hoalampano, gathering 33 persons. Each group was trained once, and discussed the techniques they were going to apply. They met regularly during the cultural season, to discuss their results and problems on the culture and compare the impact of the different techniques (on pest control, risk management, productivity, and workload).

During the counter season 2016, the Malagasy centre for agronomic research (FOFIFA) supervised on-farm-trial to compare 10 rice varieties with farmers. They are currently processing the results.

In January 2016, construction of the micro irrigation scheme (MIS) of Hoalampano was completed. The MIS will now allow a better regulation of irrigation (less shortage and overflow) on 7 ha to the benefit of 75 households. Farmers requested the project to support the extension of the irrigation canal to allow irrigation on 2 additional hectares. Studies for the construction of a new MIS (micro irrigation scheme) were finalized at the end of August 2016 and the Hoalampano MIS will be extended to cover an additional 4 ha. The construction is planned to be carried out during the 2017 dry season. 10 users of the MIS were trained about the management and infrastructure maintenance.

2.2 Train 2 village vaccinators in each site to organize vaccination campaign and perform injections. Support the creation of a village vaccinators network to organise the vaccines supply:

In each of the 5 villages, Gret trained 2 village vaccinators (VV), who were provided with iceboxes to store vaccines during transportation. Two of them received renewed training in February 2017 in Hoalampano and Antsirakivolo and these VVs passed on training to 8 other VVs.

During the year, 1132 chickens owned by 113 households were vaccinated against avian pasteurellosis (“avian cholera”) and Newcastle disease. Among them, 17 households have vaccinated more than once their chicken.

2.3 Identify vulnerable households/women and give them technical and financial support to develop an income generating activity (gardening or production of smoked fish):

A total of 147, including 82 women, developed new income activities or increased the scale of the activities they were already practising. Some of them are involved in more than one activity.

Table 1: Number of people developing income generating activities

	Gardening	Fish smoking	Poultry raising	
Women		54	15	26
Men		7		61
Total		61	15	87

- **Supply chain studies**

Call for tenders related to the study on the fish supply-chain was unsuccessful, as the sole offeror did not have the required experience. A study will be carried out in Year 3 of the project on the vanilla market, to focus on maintaining vanilla’s income at a high level, for vulnerable households.

- **Smoked fish**

Analysis of data that were gathered between March 2015 and April 2016 shows that 15 women (out of the 20 belonging to the “mareyeuse association” (wholesale fishermen) used the oven. The oven was used 119 times to smoke a total of 1230 kg of fresh fish, which means that the oven is used to smoke about 10 kg of fish each time (min: 4 kg, max: 40kg). This amount appears to be under-estimated as the seven tray rack can support 10 to 20 kg each and as the users claimed the oven was regularly full. This difference may be explained by 1) a lack of viability/motivation from the woman in charge of filling the notebook; 2) the fact that the usage fee is linked to the weight of fresh fish (50 MGA/kg).

- **Gardening**

About 60 persons were trained this year, mainly women. They were provided with seeds (tomato and leafy green leaves vegetable).

They are starting their 3rd growing season with project support. A minimum of 61 persons have been individually followed, on which 10 have harvested more than 5 species of vegetables. The amount of persons harvesting vegetables supported by project has grown from 10 for the main season 2016 to nearly 60 in the counter season 2016. Among them 55 are women.

Vegetable crops are first used to enhance food ration for households, then to provide new incomes if the volume is sufficient.

Output 3 : The human health and livelihood effects in local populations are determined by analyzing linkages between expected improvements in dietary intake, nutritional status and commercial transactions and observing the role of fisheries co-management in facilitating these health effects in 100 households across five LMMAs

3.1 In five communities adjacent to the LMMAs, collect information on dietary intake

Data on the dietary diversity and food security status of 225 households were collected in five communities over the past twelve months to characterize these households. We also have limited individual-level dietary intake assessments to understand what individuals consume outside their household. Finally, a subset of households (5) are being observed once a week during the three meals to understand the weights of all foods consumed so we can create generalizing principles of how food is cooked, consumed, and allocated. Since April 2016, we recorded dietary recall information so that we can understand dietary diversity and food security metrics according to FANTA guidelines (<http://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score>), which rate diets with scores ranging from 0 to 12, with score 12 being for the highest dietary diversity.

LMMAs were found to have the highest percentage of households with high dietary diversity scores across all seasons. From May 2016 until December 2016, less than 2% of households were found to have low dietary diversity (0-4), with 60% of all households falling into the medium dietary diversity category (5-8), and the remaining households having high dietary diversity (9-12). We found that locally managed marine areas (LMMAs) and traditionally managed communities had nearly double the percentage of highest household dietary diversity scores (35% of households) than those households near the marine national park (20%). Diets were slightly less diverse across all sites during the September to December season than they were during the May – August season (Mean HDDS scores of 7.81 vs. 7.97). This difference was most severe in the LMMA and traditionally managed communities, where the percentage of households with high dietary diversity dropped by nearly 50% (LMMA: 28% vs. 45%, Traditionally Managed: 28% vs. 42%, National Park: 18% vs. 23%).

3.2 Train local health professionals to obtain blood samples from local participants to test for iron and zinc deficiency every six months. These blood samples will benefit local participants as our agreement with MSP allows us to determine infections with malaria and provide Point of Care treatment.

Between August 8 and September 12 2016, we had a team of medical residents from Harvard Medical School, researchers from Harvard T.H. Chan School of Public Health, physicians from the Maroantsetra regional hospital, and other local Malagasy researchers and technical specialists to conduct clinical assessments of the people in our five target health communities. We processed 848 individuals of a possible total pool of 935 individuals –more than 90% adherence to our health study. This was very successful given that some folks were unable to be assessed at the time due to being out of town, or missing for reasons other than withdrawing from the study. We trained 2 physicians, 2 EMTs, 1 laboratory technician, and 1 nurse during this survey.

In November and December 2016, we repeated this same clinical sample and were able to maintain more than 85% adherence from the initial sample pool. This was the final clinical sample to look at iron, zinc, hemoglobin, and fatty acid profiles. One more sample in April 2017 (happening now) will only include an analysis of malaria and a fingernail sample to measure the mercury levels of the coastal population.

All of the blood plasma samples are at the USDA Western Human Nutrition Research Center and are currently being analyzed. Results of the two round health sampling are in the Annex 4a.

3.3 Conduct anthropometric assessments every 3 months to determine how growth trajectories (both stunting and wasting) are affected by the availability and access to nutritious diets.

In May 2016, we established a baseline for anthropometric measurements at all five of our health tracking sites (Indicator 3.3): two traditionally managed communities, two LMMA communities, and one Marine National Park community (see Table 2). Across all sites, 30.7%, 25.9%, and 6.1%, of children aged 2-5 were stunted, underweight or wasted.

Data from August-September, and November-December 2016 are being cleaned and will be ready for presentation soon. Additional data is being collected currently (April 2017).

Village Type	2-5 yrs			6-11 yrs			12-20 yrs			0-20 yrs		
	% weight	Under% Stunted	% Wasted	% weight	Under% Stunted	% Wasted	% weight	Under% Stunted	% Wasted	% weight	Under% Stunted	% Wasted
Traditional Management	27	20	6	21	31	2	21	29	0	24	32	2
LMMA	29	36	7	28	29	5	26	39	7	29	35	6
MNP	9	5	5	15	18	6	8	12	4	11	12	5

We have on-site measurement, diagnosis and treatment for any subject with a current malarial infection, and we are also treating anyone with severe anaemia (haemoglobin <9.0 g/dL). When conducting analyses in the future, we will likely use haemoglobin as a continuous variable to observe change over time. All other nutritional results (i.e. iron, zinc, ferritin, and fatty acid profiles) will be analysed once we transport the biological samples to the US for analysis. These laboratory analyses require substantial time for processing and results dissemination. It is not possible to provide baseline results at the moment, but we have collected samples to provide these baseline results in the future (Indicator 3.2). Faecal samples were also collected and will be analysed for intestinal parasites to untangle potential mediating factors that could affect nutritional status.

3.4: Communicate results to LMMAs, regional and national networks and the CBD/World Health Organization (WHO) joint task force.

We do not currently have the laboratory results yet and thus have not disseminated the results to each of these networks. We have, however, continued to engage these partners through consultation meetings and, most recently, a large meeting of 18 participants held at SESYNC headquarters (see above). This included academics from 5 universities, the Director General of the Malagasy Ministry of Health, the Chief of Surveillance from the Malagasy Ministry of Health, and the Chief Technical Officer from the Ministry of Fisheries.

3.2 Progress towards project Outputs

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Output 1					
Nearshore fish and invertebrate abundance are increased and endangered species of sharks and marine turtles are protected through improved management capacities and engagement of communities and government in reducing overexploitation, illegal fishing and use of destructive gears in Antongil Bay.					
		baseline	Change recorded by 2017	Source of evidence	Comments (if necessary)
Indicator 1	By year 3, in each village the number of fishers that are active members of the LMMA associations increases from 50% to 75%	850 professional fishermen members of LMMAs	1130 fishermen joined LMMAs representing 60% of fishermen in the targeted sites,	LMMAs data base	
Indicator 2	By year 3, beach seines used in Antongil Bay drop from 229 to less than 100	229 beach seines recorded	157 beach seines recorded during the reported period	Report of the census of fishing gears from CCS and Ad'hoc committee patrol	
Indicator 3	By year 3, a measured increase in compliance with LMMA restrictions	01 Dinabe approved by the Court	Negotiation with Ministry of Justice is on process for the approval of the Dinabe	Data collected using SMART software	
Output 2 - Livelihoods are diversified and food security is improved through the development of environmentally sensitive small-scale agriculture, economically benefitting at least 500 households across five LMMAs					
		baseline	Change recorded by 2017	Source of evidence	Comments (if necessary)
Indicator 1	: By year 3, at least 250 households adopt environment sensitive techniques for rice production, allowing an increase of yield of at least 20 % (measured on demonstration plots).	Average yield in lowland was 2,3t/ha	To date, 33 persons adopted new rice cropping techniques and are regularly monitored by Gret, most of them attending FFS. The average yield is about 4.3 tons/ha for intensified rice cropping If we compare; the increase is about +81%.	Gret data base	In CS 2016, farmers considered as applying “traditional cropping system” eventually adopted part of the technical operations considered as intensified one which may explain why their yields were higher. Indeed, it appears that several villagers adopted either transplanting younger seedlings (8 to 15 days instead of one month and half), either transplanting less seedling per hole (1 or 2 instead 3

Indicator 2	By year 3, poultry for at least 250 households benefit from regular vaccination minimising the risk of zoonotic diseases, and reducing the mortality rate by 85%		In 2016, 113 households vaccinated their chickens.		The VV were requested to monitor the mortality rate and the number of chickens sold by the famers using vaccination services. However they did not manage to collect consistent data, mainly due to the fact that farmers are not used, if not reluctant, to keep accounts of their sell, though They all claimed to have increased their sell thanks to vaccination, without being able to provide numbers. As the number of chickens varies through the year according to different circumstances, periodic survey does not provide consistent date to assess the impact on farmers' income.
Indicator 3	At least 250 women adopt a new income generating activity (gardening, production of smoked or dried fish)		<p>Fish smoking: 15 women using “oven” to smoke fishes.</p> <p>Gardening : 62 persons including 55 women are practicing vegetables cropping with project support; 55 of them are currently selling part of their harvest, and 22 of them earned more than 22£ and 6, more than 50 £</p> <p>Vaccination and poultry raising: 26 women involved; Surveys among 10 beneficiaries highlight that farmers are doing it to earn incomes and to improve their meals. They're selling chicken mainly when celebrating and for the year crisis, during main agricultural season. Some of them also use it to pay scholar fees for children.</p> <p>6 of them earned more than 50 000 MGA in 2016, due to chicken selling. Even though the number of breeders is increasing, the price remains high, because the offer still doesn't meet the local market.</p>		The use of “oven” allows users to increase the quantity of fish that can be smoked i and the time spent and expenses for fuel is lower. Data analysis shows that women using the oven earned a total of 1 127 500 MGA (= 280 £) during the year (and this amount is probably underestimated as they do not declare the exact amount of fish they smoke) compared to 200£ if they sell directly the fresh fishes

Output 3 The human health and livelihood effects in local populations are determined by analyzing linkages between expected improvements in dietary intake, nutritional status and commercial transactions and observing the role of fisheries co-management in facilitating these health effects in 100 households across five LMMAs					
		baseline	Change recorded by 2017	Source of evidence	Comments (if necessary)
3.1	In five communities adjacent to the LMMAs, train female heads of households to record their diets using kitchen scales into standardized dietary journals.	No households trained.	We installed two research assistants per community to work with the 225 households to record their diets. All households are having dietary information recorded monthly.	Data on dietary intake, household dietary diversity scores, and the weights of foods are collected for each household.	
3.2	Train local health professionals to obtain blood samples from local participants to test for iron and zinc deficiency every six months. These blood samples will benefit local participants as our agreement with MSP allows us to determine infections with malaria and provide Point of Care treatment.	No health professionals trained.	We trained 2 physicians, 2 EMTs, 1 laboratory technician, and 1 nurse to conduct these clinical blood samples. These health professionals carried out two full clinical health surveys (July/Aug 2016 and Nov/Dec 2016) and are in the process of carrying out a limited, and final, clinical health survey this month (April).	All of our above-mentioned data on research participant adherence and preliminary results of anemia, malaria, etc. are evidence of this.	
3.3	Conduct anthropometric assessments every 3 months to determine how growth trajectories (both stunting and wasting) are affected by the availability and access to nutritious diets.	We collected anthropometric measurements (including calculations of stunting and wasting) from 879 individuals within 225 households across all five sites in May of 2016. We found that, across all sites, 30.7%, 25.9%, and 6.1% of children	We repeated the collection of anthropometric measurements (including calculations of stunting and wasting) from approximately 879 individuals within the same 225 households measured in May across all five sites in both August-September and November-December of 2016. These data are currently being entered and analysed to assess possible changes.	TBD (see notes)	A more complicated analysis will be required to look at growth velocities to determine whether seasonal changes in dietary intake are driving changes in growth velocities. This is a very complicated analysis and will take time.

		aged 2-5 were stunted, underweight or wasted.			
3.4	Communicate results to LMMAs, regional and national networks and the CBD/World Health Organization (WHO) joint task force.	No substantial relationships developed with LMMAs and limited relationships developed with regional and national networks.	In December 2016, I presented this work at the CBD COP in Cancun, Mexico (https://www.cbd.int/cop/)		

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3.3 Progress towards the project Outcome

Outcome:	Sustainable fisheries management and livelihoods diversification in Northeastern Madagascar protects coral reefs (7,000 hectares), improves food security, livelihoods and health for 11,000 people, and becomes a model for the region.			Comments (if necessary)
	Baseline	Change by 2017	Source of evidence	
Indicator 1 By 2017, improved coral reef health, measured by a 20% increase in coral cover and fish biomass in at least one third of Antongil Bay LMMAs.	The baseline will be obtained during the first month of the project through underwater reef surveys that will be conducted in Antongil Bay LMMAs.	<p><u>Next survey in October/November 2017 will give us the change by 2017</u></p> <p>Base line results in 2015/2016: Coral reef habitat was present in 13 over the 24 LMMAs.</p> <p>Overall, the level of reef fish biomass was significantly different in all three type of management: no take zone, open access, restricted zone. The highest levels of biomass were observed in no-take areas, with a median at 643kg/ha compare to restricted areas (411 kg/ha) and open access areas (138kg/ha) (Figure 1). We observed 365% more fish biomass in no-take areas compared to open-access areas, with a significant difference (ES = 1.38). The smallest difference was observed between no-take and restricted areas (57% more in no-take areas), albeit the difference being significant (ES = 1.02) (Table 3 Annex 4b).</p> <p>Overall, the median live coral cover was 25% significantly higher in no-take areas (41.8%) than in restricted areas (28% cover; ES=0.73) and open access areas (14.5%; ES=0.99)</p>	Ecological report by the end of 2017 to compare reef fish biomass and reef coral cover between 2015 and 2017.	When considering the sustainable biomass reference of 1100kg/ha (Graham et al., 2016; Darling and D'agata 2017), all three type of management felt under this reference. The median biomass in no-take areas was only 58.5% of the sustainable reference, while being 37.4% for restricted areas and only 12.5% for open access areas
Indicator 2 By 2017, improved fisheries yield, measured by a 20% increase in fish and macro-invertebrate catch (especially species from the following families and groups: carangidae, lethrinidae, siganidae, nemipteridae, sphyraenidae, scaridae, mulidae, lutjanidae,	In the early 2000's, mean hourly catch rates measured by WCS in Antongil Bay were just under 1 kg/hour/fisher and mean daily catch rates were 4.4 kg/day/fisher (During the project first quarter we will obtain a 2015 baseline for the project)	<p>Overall, we observed an increase in fish CPUE in all 5 villages since 2015 and 2016 when considering the median of the distribution. The highest increase was observed at Imorona (+67% between 2015 and 2016) followed by Antanambe (+58% between 2015 and 2016) and Tampolo (+ 40% between 2015 and 2016) (Table 4 and Figure 4 , Annex 4c).</p> <p>The highest fish CPUE in 2016 were observed in Antanambe (Median 12.5 kg.fishermen/year) and Tampolo (Median 9.7 kg/fishermen/year), while the</p>	LMMAs fish landing surveys and fishers interviews.	In Antongil bay, fish CPUE community-based monitoring is currently running in 6 villages, 3 of which are running since 2014, and 2 since 2015

serranidae and octopus) per unit of effort in 24 Antongil Bay LMMAs		<p>smallest fish CPUE was observed in Anove Nord (Median 1.1 kg/fishermen/year)</p> <p>Octopus fishing is not occurring systematically in each village surveyed, which explains the lack of data in Anove Nord or Tampolo for example. Due to the lack of data in 2014, only results from 2015 and 2016 will be discussed.</p> <p>Overall, the median octopus CPUE ranged from 8.7 to 37.6 kg/fishermen/day in 2015 and 2.2 to 15.8 kg/fishermen/day in 2016. The median octopus CPUE decreased in Antanambe of 58% between 2015 and 2016, yet the sampling effort increased between 2015 and 2016, refining the CPUE estimates and most probably explaining the large decrease observed. In Imorona, the median octopus CPUE between 2015 and 2016 was relatively stable (less than 1% increase) (Table 4).</p>		
Indicator 3 By 2017, a 50% decrease in poaching and by-catch of endangered marine species (sharks and marine turtles) in 24 Antongil Bay LMMAs.	A recent study showed that the scalloped hammerhead was the most commonly encountered species identified in the Antongil Bay shark fishery	n.a	LMMAs fish landing surveys and fishers interviews.	Survey regarding shark is postponed for next period and will include collection of historical data on catch to ascertain trends over time of by-catch
Indicator 4: By 2017, a 15% increase in dietary diversity, a 30% increase in food security and a 15% increase in income diversity in 100 households across the five targeted LMMAs	As these baselines do not exist we will collect baseline data in Year 1	n.a	Household survey data and dietary record analysis.	Pending results from the laboratory analyses and velocities calculation. These analyses will help tracking changes in dietary intake, food security scores, nutrient biomarkers, and changes in growth velocity.
Indicator 5 : By 2017, a 20% decrease in iron and zinc deficiency and a 20% decrease in low birth weight in 100 households across the five targeted LMMAs	Estimates based on Makira (a forested area in the Antongil Bay watershed): 10% prevalence in iron deficiency; 33% prevalence in zinc	n.a	Anthropometry and clinical nutrition results.	

	deficiency; and birth weight average estimated at 2300 grams.			
Indicator 6: By 2017, a 20% increase of rice productivity in plots in 250 households applying improved practices; an 85% decrease in poultry mortality and a 20% increase in income from poultry raising and gardening in 250 households in the villages of the five targeted LMMAs	<p>Surveys undertaken by Gret in the project area after the main cropping on the first season in 2013 showed an average yield of 1500 kg/ha in irrigated fields and 770 kg/ha in the uplands rice fields.</p> <p>Measurement undertaken by Gret within 22 irrigated plots testing new practices found an average yield of 1933 kg/ha on the off-season 2013, and within 42 irrigated plot, an average of 3100 kg/ha in the first season of 2014.</p> <p>Baselines do not exist on income from poultry-raising and gardening. They will be collected during year 1</p>	<p>Technically, it seems that improved rice cropping techniques have proved their effectiveness. We have no guarantee at that time that 250 households will adopt part of the proposed techniques without direct support.</p> <p>Regarding income generating activities, the objective of 250 households has been achieved at 59%. The project has good chance to reach its objective. However, it will be difficult to prove the impact on income, as farmers are very reluctant to monitor and share data on their sales and income and a qualitative approach to this data collection will be adopted.</p>	Rice yields surveys, poultry mortality monitoring, and poultry and gardening income surveys	Project technicians invest a lot of time and in visiting and monitoring farmers requesting their help and did not manage to spend additional time to carry out larger survey. In February 2017, Gret hired a new staff who will be in charge of implementing additional surveys.

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3.4 Monitoring of assumptions

	Assumption	Comments
Assumption 1	Government authorities have sufficient authority and motivation to control illegal activities and enforce the rules in Antongil Bay LMMAs.	WCS's strategy is to provide logistical support to the local government by contributing to the costs for governmental. Interventions (CSP, licenses). We feel that the local government has sufficiently taking ownership over supporting all law enforcement activities within this project and has demonstrated good motivation on enforcing rules and empowering the structures of the LMMAs.
Assumption 2	Strengthening small-scale fisheries co-management will be supported by all stakeholders from local to national levels as tangible benefits are perceived.	The benefits of small-scale fisheries co-management are recognized by most relevant stakeholders at all levels, such as MRHP at local and at national level, local communities, and local administration). So far, the co-management approach has improved fishermen's ownership over fishery resources resulting in more sustainable fishing practices. Further on, the involvement of communities on fisheries resources management (mainly through Community patrolling and local administration) has reduced the cost of governmental interventions at the national level.
Assumption 3	The fishery will recover fast enough to deliver nutritional and health benefits. Outcomes like iron and zinc deficiency can recover quickly, but we may not see changes in stunting and low birth weight which have a longer etiology and trajectory.	There is inadequate data to test this assumption as yet. The results will be available in Year 3.
Assumption 4	Local institutions and economies allow for the development of new income generating activities for poor people and the lack of infrastructure does not hinder the development of changes within supply chains.	In 2016, vanilla's prices were even higher than in 2015, in respect to the phenomena described above for 2015. The price of first necessity goods has consequently been increasing. Cloves harvesting was under 2015's one, which let people having more free time to crop vegetables. The situation of the expensive prices in vanilla and cloves market is hiding the potential difficulties for vulnerable people. They don't show much interest into other products chain value. But every economical operator in Madagascar is waiting for a crisis to happen in the following year (as the 2004 one).

3.5 Impact: achievement of positive impact on biodiversity and poverty alleviation

We trust that improved fishery management supported by the project will contribute to the conservation of biodiversity of the Bay that we can measure from the next ecological survey.

Regarding poverty alleviation, the increase in fish catch per unit effort mentioned above and the increased from the diversification of local communities' livelihood are among the project's contribution. Quantitative data on household income will be available in Year 3. The analysis on dietary intake, food security scores, and nutrient biomarkers will also help understanding the link between fishery and wellbeing and this will be completed in Year 3.

4. Contribution to the Global Goals for Sustainable Development (SDGs)

The project contributes to the SDG 2 by supporting more sustainable fishing and agricultural practices and to the SDG 14 by contributing to the protection and sustainable use of marine resources through co-management approaches. Improved local fisheries management plans and co-management approaches to improve the

management of small-scale fisheries have been developed and are under implementation leading to more sustainable fishing practices. Training sessions have been conducted to improved agricultural practices.

5. Project support to the Conventions, Treaties or Agreements.

The project directly contributed to the CBD's Strategic Plan for Biodiversity's (2011-2020) strategic goals:

- Improved local fisheries management plans and co-management approaches to improve the management of small-scale fisheries have been developed and are under implementation leading to more sustainable fishing practices;
- Patrolling committees are in place ensuring a better law enforcement for marine protected areas resulting in improved biodiversity protection;
- Alternative livelihood opportunities are under development and implementation, such as poultry and improved rice cultivation.

During CBD COP in Cancun, December 2016, our partner from Harvard T.H. Chan School of Public Health, who is member of a CBD/WHO joint task force on biodiversity and human health, has presented the project activities regarding connection between marine conservation and nutrition/health.

6. Project support to poverty alleviation

This project aims to reverse the decline in fisheries resources and aim to achieve an improved catch per unit effort (CPUE) for fishermen through fisheries' co-management approaches. An improved CPUE, in addition to the development and implementation of alternative livelihoods for fishing communities, will result in more secure livelihoods and increased economic return for the local population in the long term. So far, an improved income situation is not measurable but the increase in CPUE reveals a promising trend.

7. Project support to gender equality issues

The project targets 250 women to benefit from other income generating activities so as to reinforce women social statue among community and in their respective household too. During this past year, the project has involved 82 women in smoked fish activities, gardening and poultry farming. Significant efforts will be made by Gret to increase the participation of women in project activities in Year 3.

Few women – members of community control and surveillance committee - participate to community patrols and WCS will lead community discussions to encourage women to participate in these activities.

8. Monitoring and evaluation

Please refer to the comments in the tables.

9. Lessons learnt

Whereas data collection from CPUE, CCS and joint committee patrols, reef surveys are running well there is a need to communicate the results to local communities and local stakeholders both to raise awareness of the benefits generated by the project and to allow local communities to use data to adapt their decisions on natural resource use and LMMA management.

It is possible that some of the health indicators may not track seasonally and annually. This was very much experimental and envelope pushing when we began this work. I think we will have rich data to work with once the laboratory analyses are finished. However, it is difficult to determine that without seeing the analyses yet.

Antongil Bay has been severely affected by cyclone Enawo in mid-March 2017. This massive cyclone led to the displacement of more than 300,000 people. This event disrupted the original study design regarding health component. Harvard T.H. Chan School of Public Health, is now determining ways forward of investigating socio-ecological resilience and measuring the vulnerability and recovery of local coastal human populations.

The project partner Gret has experienced difficulties in allocating suitable human resources to the project activities. This has caused delays in activity implementation and data analyses and means that quantitative data on the impacts of the project on livelihoods and revenues is lacking. The activities led by Gret are in the process of transitioning to a new project manager and WCS will work closely with this new project manager to ensure that delays are made up and that Gret is able to complete activity implementation and data analyses in the remaining year of the project.

10. Actions taken in response to previous reviews (if applicable)

Not applicable.

11. Other comments on progress not covered elsewhere

n/a

12. Sustainability and legacy

To ensure on ground sustainability of fishery management plan, a tangible commitment from local communities is essential. Therefore, a key focus of WCS is to support local communities in three pillars: (1) organizational sustainability; (2) technical capacity in conservation activities : implementation of LMMAs, patrols, CPUE, (3) financial sustainability by promoting income generating activities. It is a long term process, and the project has helped us launching it.

Antongil Bay Fishery Management Plan is currently recognized at national level, and serves as reference for other bays.

13. Darwin identity

Not applicable

14. Project expenditure

Please note that the project partner Gret was unable to provide detailed financial data for inclusion in this report. Data in the table below thus refers to project spending excluding the budget allocated to Gret. Gret has advised that it has fully spent the Year 2 allocated budget and will provide details in the financial report to be submitted on 30 May 2017.

Table 1: Project expenditure excluding expenditure by project partner Gret during the reporting period (1 April 2016 – 31 March 2017)

Project spend since last annual report	2016/17 Grant (£)	2016/17 Total Darwin Costs (£)	Variance %
Staff costs			9%
Travel and subsistence			6%
Operating Costs			-13%
Capital Equipment			
Overhead Costs			10%
TOTAL			100%

The 13% variation on the operating costs line is due to under-spending on costs associated with the health sample analyses. The reasons for this under-spending are explained in the preceding sections. This spending will be carried out in the next year of the project.

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2016-2017

Project summary	Measurable Indicators	Progress and Achievements April 2016 - March 2017	Actions required/planned for next period
<p>Impact</p> <p>Madagascar's artisanal fisheries are effectively managed to simultaneously optimize coral reef biodiversity protection and sustainable harvests that deliver benefits for human health and livelihoods.</p>		<p>(Report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity e.g. steps towards sustainable use or equitable sharing of costs or benefits)</p>	
<p>Outcome :</p> <p>Sustainable fisheries management and livelihoods diversification in Northeastern Madagascar protects coral reefs (7,000 hectares), improves food security, livelihoods and health for 11,000 people, and becomes a model for the region.</p>	<p>By 2017, improved coral reef health, measured by a 20% increase in coral cover and fish biomass in at least one third of Antongil Bay LMMAs.</p> <p>By 2017, improved fisheries yield, measured by a 20% increase in fish and macro-invertebrate catch (especially species from the following families and groups: carangidae, lethrinidae, siganidae, nemipteridae, sphyraenidae, scaridae, mulidae, lutjanidae, serranidae and octopus) per unit of effort in 24 Antongil Bay LMMAs</p> <p>By 2017, a 50% decrease in poaching and by-catch of endangered marine species (sharks and marine turtles) in 24 Antongil Bay LMMAs.</p> <p>By 2017, a 15% increase in dietary diversity, a 30% increase in food security and a 15% increase in income diversity in 100 households across the five targeted LMMAs</p> <p>By 2017, a 20% decrease in iron and zinc deficiency and a 20% decrease in low birth weight in 100 households across the five targeted LMMAs.</p>	<p>Coral reef habitat was present in 13 over the 24 LMMAs. The highest levels of biomasses were observed in no-take areas, with a median at 643kg/ha compare to restricted areas (411 kg/ha) and open access areas (138kg/ha) (Figure 1). Overall, the median live coral cover was 25% significantly higher in no-take areas (41.8%) than in restricted areas (28% cover; ES=0.73) and open access areas (14.5%; ES=0.99)</p> <p>We observed an increase in fish CPUE in all 5 villages since 2015 and 2016 when considering the median of the distribution</p> <p>Technically, it seems that improved rice cropping technics have proved their effectiveness</p>	<p>Next reef survey in October 2017 to assess evolution of coral reef habitat</p> <p>Pursuing fish catch monitoring and activities related to fishery management: patrol and law enforcement monitoring, awareness raising on regulation, local community</p> <p>Training on improved rice cropping technics, value chain analysis, and support to local farmers</p> <p>Laboratory and velocity analysis - anthropometric assessments – communication of the results</p>

	By 2017, a 20% increase of rice productivity in plots in 250 households applying improved practices; an 85% decrease in poultry mortality and a 20% increase in income from poultry raising and gardening in 250 households in the villages of the five targeted LMMAs		
Output 1. Nearshore fish and invertebrate abundance are increased and endangered species of sharks and marine turtles are protected through improved management capacities and engagement of communities and government in reducing overexploitation, illegal fishing and use of destructive gears in Antongil Bay.	<p>By year 3, in each village the number of fishers that are active members of the LMMA associations increases from 50% to 75%</p> <p>By year 3, beach seines used in Antongil Bay drop from 229 to less than 100</p> <p>By year 3, a measured increased in compliance with LMMA restrictions</p>	<p>1130 fishermen joined LMMAs representing 60% of fishermen in the targeted sites</p> <p>157 beach seines recorded during the reported period</p> <p>Negotiation with Ministry of Justice is on process for the approval of the Dinabe</p>	
Activity 1.1 : Improve engagement and accountability of all stakeholders in ABFMP implementation by organizing annual meetings of the ABFMP Steering Committee.		Second annual meeting in Fenerive-Est on October 12-13, 2016 to assess the progress of the implementation of the Antongil Bay Fishery Management Plan and to agree on next steps	
Activity 1.2 : Strengthen the ability of coastal communities to more effectively manage the network of 24 LMMAs through capacity building activities (formal training in administration, financial management, leadership, fisheries management and enforcement; organization of debates and networking between LMMA representatives and local authorities at an annual Antongil Bay LMMA network forum and national LMMA network forum).		<p>In August 2016, Three (03) workshops for developing common strategies conducted by ad-hoc committee formalized by regional decree N° 2012-008 are organized to eradicate the use, sale and possession of beach seines in Antongil Bay</p> <p>Creation of the Federation of Antongil Bay Fishermen</p> <p>Participation of representatives from LMMAs in ABS to national and regional forum of LMMAs in Mananara and in Sainte Marie</p>	
Activity 1.3 : Raise knowledge and awareness about existing fishing regulations, unsustainability of destructive fishing practices and benefits of LMMAs through learning visits for fishers at the newly inaugurated WCS-managed environmental campus in		WCS has established a partnership with the local radio station in Mananara in the southern part of Antongil Bay to broadcast news and updates on WCS activities and events. During 2016, three radio reports were produced and addressed issues related	

<p>Maroantsetra, exchange visits to LMMA sites, production of regular issues of the Malagasy language 'Dalaly' magazine and radio broadcasts.</p>	<p>fishery management, on climate change and its impact on marine ecosystem, and on the importance of community patrols. We also produced four awareness raising radio programs on the importance of licenses for fishermen, and four others related to fishery and new regulations on sea cucumber management</p>
<p>Activity 1.4: Organize joint community and local authority patrols to enforce fishery regulations in LMMAs, and trial the use of SMART (Spatial Monitoring and Reporting Tool - http://www.smartconservationsoftware.org) to support collection and analysis of threat data in real-time and optimize planning of enforcement patrols.</p>	<p>Twenty one (21) patrols were organized by CCS in 19 LMMAs during which five key offences were identified; twenty six (26) patrols were organized by Ad'hoc Committee – Training for CCS members and WCS staffs on the use of SMART: cybertracker tools; CCS is currently using cybertracker during patrols</p>
<p>Activity 1.5: Conduct reef surveys and fish catch monitoring to assess impacts of LMMA on coral reef health and fisheries.</p>	<p>Ecological report in progress</p>
<p>Output 2. Livelihoods are diversified and food security is improved through the development of environmentally sensitive small-scale agriculture, economically benefitting at least 500 households across five LMMAs.</p>	<p>By year 3, at least 250 households adopt environment sensitive techniques for rice production, allowing an increase of yield of at least 20 % (measured on demonstration plots)</p> <p>By year 3, poultry for at least 250 households benefit from regular vaccination minimising the risk of zoonotic diseases, and reducing the mortality rate by 85%</p> <p>At least 250 women adopt a new income generating activity (gardening, production of smoked or dried fish)</p> <p>To date, 33 persons adopted new rice cropping technics and are regularly monitored by Gret, most of them attending FFS. The average yield is about 4.3 tons/ha for intensified rice cropping If we compare; the increase is about +81%.</p> <p>In 2016, 113 households vaccinated their chickens.</p> <p>82 women involved in income generating activities : 15 in Fish smoking, 55 in gardening, 26 regarding poultry raising</p>
<p>Activity 2.1: Train and support a network of 50 pilot farmers on rice production. Prepare technical leaflets, organise trainings, exchange visits and cropping cycle collective assessments, and facilitate access to equipment to facilitate the adoption of tested and approved practices by 200 additional households.</p>	<p>During this second year, 115 people (81 men and 34 women) were trained on improved rice production practices.</p>
<p>Activity 2.2: Train 2 village vaccinators in each site to organise vaccination campaign and perform injections. Support the creation of a village vaccinators' network to organise the vaccines supply.</p>	<p>10 village vaccinators (VV) – 2 per village, trained on vaccination and were provided with iceboxes to store vaccines during transportation.</p>
<p>Activity 2.3: Identify vulnerable households/women and give them technical and financial support (to develop a new income generating activity (gardening or production of smoked-fish).</p>	<p>A total of 147, including 82 women, developed new income activities or increased the scale of the one they were already practising</p> <p>Supply chain studies: to be relaunched for the study on the fish supply-chain. A study will be done about vanilla market, to focus on maintaining vanilla's income at a high level, for vulnerable households.</p> <p>Smoked fish: Data analysis during March 2015 and April 2016 shows that 15 people (out</p>

	<p>of the 20 belonging to the “mareyeuse association” (wholesale fishermen) effectively used the oven, all being women.</p> <p>Gardening: about 60 persons were trained this year, mainly women. They were provided with seeds (tomato and leafy green leaves vegetable).</p>
<p>Activity 2.4: Provide training and technical support (with regular visits from animators) on production, processing and/or marketing of products to at least 250 women. Organize exchange visits among women and support them to get organized to facilitate marketing.</p>	
<p>Output 3. The human health and livelihood effects in local populations are determined by analyzing linkages between expected improvements in dietary intake, nutritional status and commercial transactions and observing the role of fisheries co-management in facilitating these health effects in 100 households across five LMMAs. Madagascar is the 6th most stunted country in the world and this output will be hugely influential for demonstrating potential impacts of fisheries management on human health. The findings are disseminated and inform management and policy decisions of LMMAs, relevant local and regional networks and decision-making bodies, and the CBD/WHO task force.</p>	<p>By year 3, there will be a 15% increase in dietary diversity at the household level and a 30% increase in food security through measurement of the number of food categories utilized and through adoption of regular consumption of dried and smoked fish during periods of hardship.</p> <p>By year 3, there will be a 20% decrease in iron and zinc deficiency as measured by nutritional status from venous blood draws. This is the most comprehensive method for understanding real health effects of changes in fishery access.</p> <p>By year 3, there will be a 20% decrease in low birth weight as measured by anthropometry.</p> <p>We installed two research assistants per community to work with the 225 households to record their diets. All households are having dietary information recorded monthly.</p> <p>We trained 2 physicians, 2 EMTs, 1 laboratory technician, and 1 nurse to conduct these clinical blood samples. These health professionals carried out two full clinical health surveys (July/Aug 2016 and Nov/Dec 2016) and are in the process of carrying out a limited, and final, clinical health survey this month (April).</p> <p>We repeated the collection of anthropometric measurements (including calculations of stunting and wasting) from approximately 879 individuals within the same 225 households measured in May across all five sites in both August-September and November-December of 2016. These data are currently being entered and analysed to assess possible changes.</p>
<p>Activity 3.1: In five communities adjacent to the LMMAs, train female heads of households to record their diets using kitchen scales into standardized dietary journals.</p>	<p>Data on the dietary diversity and food security status of 225 households were collected in five communities over the past twelve months to characterize these households</p> <p>We also have limited individual-level dietary intake assessments to understand what individuals consume outside their household. Finally, a subset of households (5) are being observed once a week during the three meals to understand the weights of all foods consumed so we can create generalizing principles of how food is cooked, consumed, and allocated</p>
<p>Activity 3.2: Train local health professionals to obtain blood samples from local participants to test for iron and zinc deficiency every six months. These blood samples will benefit local participants as our agreement with MSP allows us to determine infections with malaria and provide Point of Care treatment.</p>	<p>Between August 8 and September 12 2016, we had a team of medical residents from Harvard Medical School, researchers from Harvard T.H. Chan School of Public Health, physicians from the Maroantsetra regional hospital, and other local Malagasy researchers and technical specialists to conduct clinical assessments of the people in our five target health communities</p>

<p>Activity 3.3: Conduct anthropometric assessments every 3 months to determine how growth trajectories (both stunting and wasting) are affected by the availability and access to nutritious diets.</p>	<p>In May 2016, we established a baseline for anthropometric measurements at all five of our health tracking sites. The laboratory analyses require substantial time for processing and results dissemination. It is not possible to provide baseline results at the moment, but we have collected samples to provide these baseline results in the future</p>
<p>Activity 3.4: Communicate results to LMMAs, regional and national networks and the CBD/World Health Organization (WHO) joint task force.</p>	<p>We do not currently have the laboratory results yet and thus have not disseminated the results to each of these networks</p>

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Impact: Madagascar's artisanal fisheries are effectively managed to simultaneously optimize coral reef biodiversity protection and sustainable harvests that deliver benefits for human health and livelihoods.</p>			
<p>Outcome: Sustainable fisheries management and livelihoods diversification in Northeastern Madagascar protects coral reefs (7,000 hectares), improves food security, livelihoods and health for 11,000 people, and becomes a model for the region.</p>	<p>By 2017, improved coral reef health, measured by a 20% increase in coral cover and fish biomass in at least one third of Antongil Bay LMMAs.</p> <p>By 2017, improved fisheries yield, measured by a 20% increase in fish and macro-invertebrate catch (especially species from the following families and groups (carangidae, lethrinidae, siganidae, nemipteridae, sphyraenidae, scaridae, mulidae, lutjanidae, serranidae and octopus) per unit of effort in 24 Antongil Bay LMMAs</p> <p>By 2017, a 50% decrease in poaching and by-catch of endangered marine species (sharks and marine turtles) in 24 Antongil Bay LMMAs.</p> <p>By 2017, a 15% increase in dietary diversity, a 30% increase in food security and a 15% increase in income diversity in 100 households across the five targeted LMMAs</p> <p>By 2017, a 20% decrease in iron and zinc deficiency and a 20% decrease in low birth weight in 100 households across the five targeted LMMAs.</p> <p>By 2017, a 20% increase of rice productivity</p>	<p>Coral reef health reports.</p> <p>LMMAs fish landing surveys and fishers interviews.</p> <p>Household survey data and dietary record analysis</p> <p>Anthropometry and clinical nutrition results.</p>	<p>Government authorities have sufficient authority and motivation to control illegal activities and enforce the rules in Antongil Bay LMMAs.</p> <p>Strengthening small-scale fisheries co-management will be supported by all stakeholders from local to national levels as tangible benefits are perceived.</p> <p>The fishery will recover fast enough to deliver nutritional and health benefits. Outcomes like iron and zinc deficiency can recover quickly, but we may not see changes in stunting and low birth weight which have a longer etiology and trajectory.</p> <p>Local institutions and economies allow for the development of new income generating activities for poor people and the lack of infrastructure does not hinder the development of changes within supply chains.</p>

	in plots in 250 households applying improved practices; an 85% decrease in poultry mortality and a 20% increase in income from poultry raising and gardening in 250 households in the villages of the five targeted LMMAs	Rice yields surveys, poultry mortality monitoring, and poultry and gardening income surveys	
Output 1 Nearshore fish and invertebrate abundance are increased and endangered species of sharks and marine turtles are protected through improved management capacities and engagement of communities and government in reducing overexploitation, illegal fishing and use of destructive gears in Antongil Bay.	1.1 By year 3, in each village the number of fishers that are active members of the LMMA associations increases from 50% to 75% 1.2 By year 3, beach seines used in Antongil Bay drop from 229 to less than 100 1.3 By year 3, a measured increased in compliance with LMMA restrictions	1.1 LMMA association registration books 1.2 Report of the census of fishing gears in year 3 1.3 Data collected using SMART software	
Output 2 Livelihoods are diversified and food security is improved through the development of environmentally sensitive small-scale agriculture, economically benefitting at least 500 households across five LMMAs	2.1 By year 3, at least 250 households adopt environment sensitive techniques for rice production, allowing an increase of yield of at least 20 % (measured on demonstration plots) 2.2 By year 3, poultry for at least 250 households benefit from regular vaccination minimising the risk of zoonotic diseases, and reducing the mortality rate by 85% 2.3 At least 250 women adopt a new income generating activity (gardening, production of smoked or dried fish)	2.1 Household agricultural surveys (on yields and practices), pilot plot yield measurements carried out every cropping season 2.2 Vaccination records (by project first, then progressively by village-vaccinators) carried out at every vaccination campaign 2.3 Project monthly survey on a sample of women (on number and amount of sales)	
Output 3 The human health and livelihood effects in local populations are determined by analyzing linkages between expected improvements in dietary intake, nutritional status and commercial transactions and observing the role of fisheries co-management in facilitating these health effects in 100 households across five LMMAs. Madagascar is the 6 th most stunted country in the world and this output will be	3.1 By year 3, there will be a 15% increase in dietary diversity at the household level and a 30% increase in food security through measurement of the number of food categories utilized and through adoption of regular consumption of dried and smoked fish during periods of hardship.	3.1 Household surveys that will include coping strategies indices, food security ratings, dietary and income diversity scoring, and social and economic wellbeing measures. Each of the 100 households enrolled in the health study will maintain a dietary calendar so that we can observe the ways in which food consumption changes based on our intervention. We will use a BACI (Before After Control Intervention) study design where we work both inside and outside of areas where the intervention is	

<p>hugely influential for demonstrating potential impacts of fisheries management on human health. The findings are disseminated and inform management and policy decisions of LMMAs, relevant local and regional networks and decision-making bodies, and the CBD/WHO task force.</p>	<p>3.2 By year 3, there will be a 20% decrease in iron and zinc deficiency as measured by nutritional status from venous blood draws. This is the most comprehensive method for understanding real health effects of changes in fishery access.</p> <p>3.3 By year 3, there will be a 20% decrease in low birth weight as measured by anthropometry</p>	<p>taking place to determine impact.</p> <p>3.2 Clinical visits with healthcare professionals will include blood draws. The blood will be analysed for a suite of nutritional markers to understand changes in the levels of iron and zinc deficiency within individuals over time.</p> <p>3.3 Clinical visits with healthcare professionals will also include anthropometric assessments to understand changes in birth weight, stunting and wasting.</p>	
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Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

Activity 1.1 : Improve engagement and accountability of all stakeholders in ABFMP implementation by organizing annual meetings of the ABFMP Steering Committee.

Activity 1.2 : Strengthen the ability of coastal communities to more effectively manage the network of 24 LMMAs through capacity building activities (formal training in administration, financial management, leadership, fisheries management and enforcement; organization of debates and networking between LMMA representatives and local authorities at an annual Antongil Bay LMMA network forum and national LMMA network forum).

Activity 1.3 : Raise knowledge and awareness about existing fishing regulations, unsustainability of destructive fishing practices and benefits of LMMAs through learning visits for fishers at the newly inaugurated WCS-managed environmental campus in Maroantsetra, exchange visits to LMMA sites, production of regular issues of the Malagasy language 'Dalaly' magazine and radio broadcasts.

Activity 1.4: Organize joint community and local authority patrols to enforce fishery regulations in LMMAs, and trial the use of SMART (Spatial Monitoring and Reporting Tool - <http://www.smartconservationsoftware.org>) to support collection and analysis of threat data in real-time and optimize planning of enforcement patrols.

Activity 2.1 Train and support a network of 50 pilot farmers on rice production. Prepare technical leaflets, organise trainings, exchange visits and cropping cycle collective assessments, and facilitate access to equipment to facilitate the adoption of tested and approved practices by 200 additional households.

Activity 2.2. Train 2 village vaccinators in each site to organise vaccination campaign and perform injections. Support the creation of a village vaccinators' network to organise the vaccines supply.

Activity 2.3: Identify vulnerable households/women and give them technical and financial support (but with a financial share form beneficiary) to develop a new income generating activity (gardening or production of smoked-fish). Implement two supply-chain studies to define a strategy to improve the commercialisation of these products, targeting the local market. Provide training and technical support (with regular visits from animators) on production, processing and/or marketing of products to at least 250 women. Organize exchange visits among women and support them to get organized to facilitate marketing.

Activity 2.4: Provide training and technical support (with regular visits from animators) on production, processing and/or marketing of products to at least 250 women. Organize exchange visits among women and support them to get organized to facilitate marketing.

Activity 3.1: In five communities adjacent to the LMMAs, train female heads of households to record their diets using kitchen scales into standardized dietary journals.

Activity 3.2: Train local health professionals to obtain blood samples from local participants to test for iron and zinc deficiency every six months. These blood samples will benefit local

participants as our agreement with MSP allows us to determine infections with malaria and provide Point of Care treatment.

Activity 3.3: Conduct anthropometric assessments every 3 months to determine how growth trajectories (both stunting and wasting) are affected by the availability and access to nutritious diets.

Activity 3.4: Communicate results to LMMAs, regional and national networks and the CBD/World Health Organization (WHO) joint task force.

Annex 3: Standard Measures

Please expand and complete Table 1: new projects should complete the Y1 column and also indicate the number planned during the project lifetime. Continuing project should cut and past the information from previous years and add in data for the most recent reporting period. Quantify project standard measures over the last year using the coding and format from the Darwin Initiative Standard Measures (see website for details: <http://darwin.defra.gov.uk/resources/>) and give a brief description. Please list and report on relevant Code No's only. The level of detail required is specified in the Standard Measures Guidance notes under 'definitions and reporting requirements' column. Please devise and add any measures that are not captured in the current list. Please note that these measures may not be a substitute for output level objectively verifiable indicators in the project logframe.

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
9	Fishery management plans progress reports			1	1		2	3
12	Data base coral reef (1)				1		1	3
14B	Number of conferences/seminars/workshops attended at which findings from Darwin project work will be presented/ disseminated.			2	1		3	3

In Table 2, provide full details of all publications and material produced over the last year that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Mark with (*) all publications and other material that you have included with this report.

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)

Annex 4 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

Annex 4 a – Health sample results

Inventory of Data and Sample Collection for the MAHERY Atongil (Madagascar Health and Environmental Research - Antongil) Cohort Study

SURVEY/INTERVIEW INFORMATION	2015		2016		2017		
	Sept - Dec (Hot/Dry)	Jan - April (Hot/Wet)	May - Aug (Cold/Wet)	Sept - Dec (Hot/Dry)	Jan - April (Hot/Wet)	May - Aug (Cold/Wet)	Sept - Dec (Hot/Dry)
Dietary intake	◆	◆	◆	◆	◆	◆	◆
Direct household food observation		▲	▲	▲	▲	▲	▲
Socio-economic status	◆	◆	◆	◆	◆	◆	◆
Household fisheries activities	◆	◆	◆	◆	◆	◆	◆
Catch-per-unit effort for fishing	▲	▲	▲	▲	▲	▲	▲
Natural resource use	◆	◆	◆	◆	◆	◆	◆
Self-reported illness and treatment			●	●	●		
DIRECT ASSESSMENT/BIOLOGICAL SAMPLES							
Anthropometrics			●	●	●	●	●
Hemoglobin			●	●			
Fasting venipuncture blood samples			●	●			
Blood plasma			●	●			
Dried blood spots			●	●	●		
Malaria RDTs			●	●	●		
Thin blood smears			●	●			
Fecal samples			●	●			
Fingernail samples			●	●	●		
Micronutrient nutrition analysis			●	●			
Intestinal parasite evaluation			●	●			
Mercury analysis					●		

Weekly ▲ Monthly ◆ At clinical visits ●

Annex 4b – Result of Ecological monitoring

Figure 1. Distribution of reef fish biomass (kg/ha) of fishable individual (> 10cm) in all three management areas (NT: No-take, R: Restricted, OA: Open access). The reference of 1100 kg/ha for sustainable fishable biomass is given as the red dotted line (Darling & D'agata 2017)

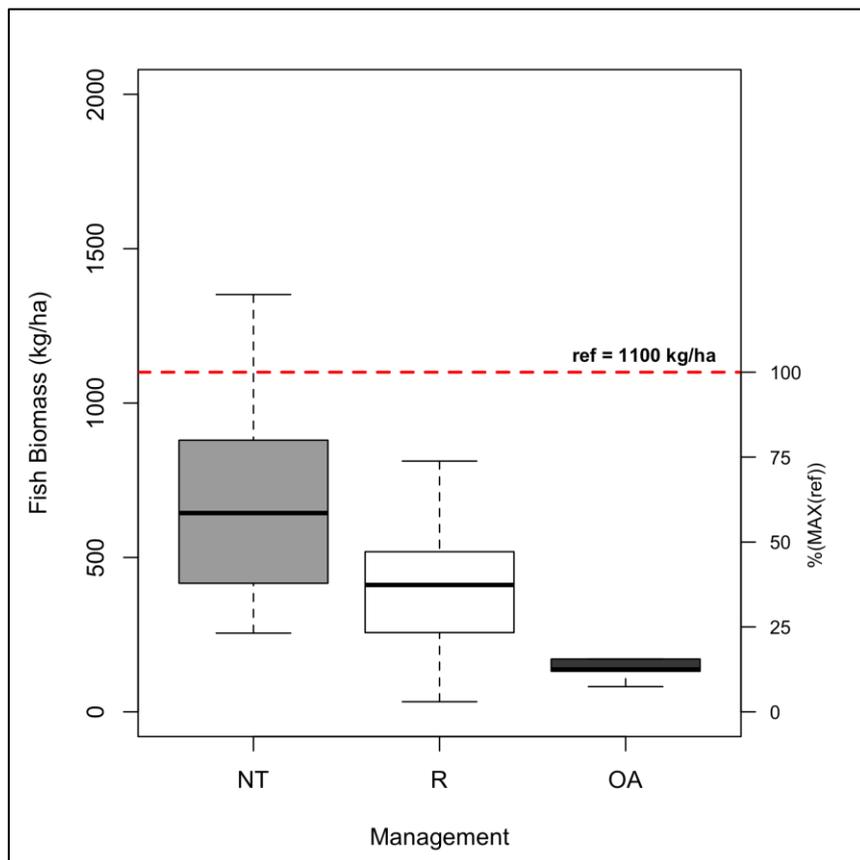


Table 1. Effect size (ES) between fish biomasses distribution for the 3 management types to test for significant difference between distributions. The magnitude of the effect size is as follow: ES < 0.2 "negligible", ES < 0.5 "small", ES < 0.8 "medium", ES > 0.8 "large".

<i>CohenD effect size</i>	No-Take	Restricted	Open Access
No-Take			
Restricted	1.02 (<i>Large</i>)		
Open Access	1.82 (<i>Large</i>)	1.38 (<i>Large</i>)	

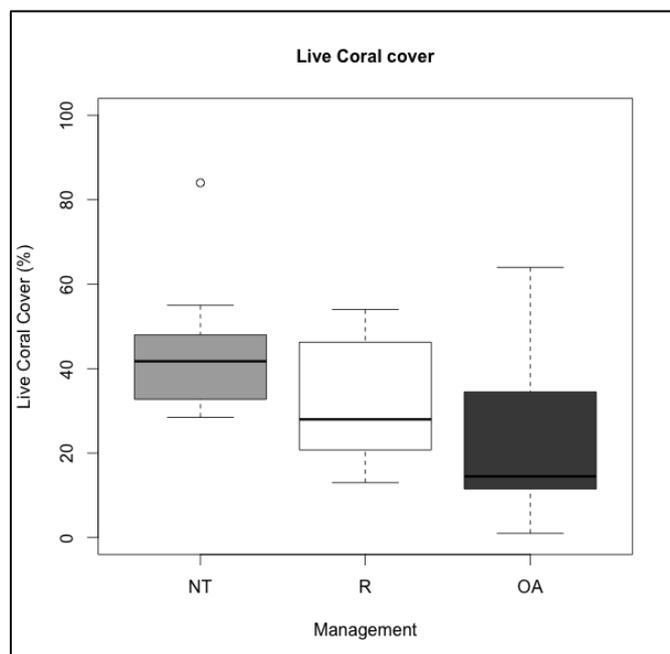


Figure 2. Live coral reef cover (%) in all three management areas (NT: No-take, R: Restricted, OA: Open access).

Table 2: Effect size (ES) for live coral cover and macro algae distributions for the 3 management types to test for significant difference between distributions. The magnitude of the effect size is as follow: ES < 0.2 "negligible", ES < 0.5 "small", ES < 0.8 "medium", ES > 0.8 "large".

		<i>CohenD effect size</i>	No-Take	Restricted	Open Access
<i>Live coral</i>	No-Take				
	Restricted		0.73 (<i>Large</i>)		
	Open Access		0.99 (<i>Large</i>)	0.42 (<i>Large</i>)	

Annex 4b – Result of CPUE analysis

Table 3. Results of fish catch monitoring (Catch per Unit Effort – CPUE – in kg/fishermen/day) in 6 villages of the Antongil Bay between 2014 and 2016. The mean, standard deviation and median of the fish CPUE distribution are provided, as well as the number of surveys fin each village each year.

<i>Villages</i>	2014				2015				2016			
	<i>Mean</i>	<i>Sd</i>	<i>Median</i>	<i>n</i>	<i>Mean</i>	<i>Sd</i>	<i>Median</i>	<i>n</i>	<i>Mean</i>	<i>Sd</i>	<i>Median</i>	<i>n</i>
Analanjahana	3.59	3.36	3.06	167	-	-	-	-	4.33	4.1	2.88	100
Anove Nord	-	-	-	-	-	-	-	-	2.37	3.45	1.1	34
Antanambe	-	-	-	-	50.11	124.69	7.84	97	24.21	38.47	12.53	189
Imorona	0.9	0.93	0.8	6	4.31	6.23	2.55	155	5.07	5.1	4.28	133
Mandrisy	-	-	-	-	4.82	7.13	1.88	14	5.28	6.94	3.03	198
Tampolo	11.73	13.18	7.34	196	7.65	4.78	6.94	106	12.37	8.21	9.7	148

Figure 3: Fish CPUE (median) trends in 5 villages of Antongil Bay between 2014 and 2016.

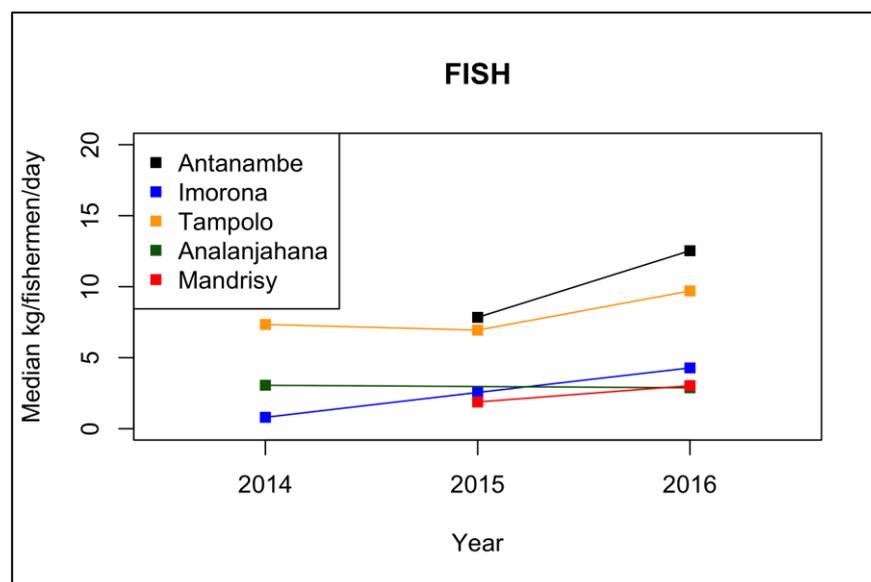


Table 4. Results of *octopus* catch monitoring (Catch per Unit Effort – CPUE – in kg/fishermen/day) in 6 villages of the Antongil Bay between 2014 and 2016. The mean, standard deviation and median of the fish CPUE distribution are provided, as well as the number of surveys in each village each year.

Villages	2014				2015				2016			
	Mean	Sd	Median	n	Mean	Sd	Median	n	Mean	Sd	Median	n
Analanjahana	-	-	-	-	-	-	-	-	2.21	-	2.21	1
Anovel Nord	-	-	-	-	-	-	-	-	-	-	-	-
Antanambe	-	-	-	-	39.26	17.43	37.6	12	17.59	10.11	15.78	32
Imorona	2.82	-	2.82	1	8.61	5.84	8.72	36	8.03	5.9	9.5	35
Mandrisy	7.5	-	7.5	1	-	-	-	-	13.71	8.5	12.5	71
Tampolo	-	-	-	-	-	-	-	-	-	-	-	-

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	Yes
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	No
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	No
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	
Have you involved your partners in preparation of the report and named the main contributors	Yes
Have you completed the Project Expenditure table fully?	Yes
Do not include claim forms or other communications with this report.	