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: 30 April

Darwin Project Information

Project Reference	21-018
Project Title	Conservation and sustainable use of marine turtles, Southwest Madagascar
Host Country/ies	Madagascar
Contract Holder Institution	Reef Doctor
Partner institutions	Turtle Protection Association (FIMPAMIFA), Marine Science Institute *(Institut Halieautique et des Sciences Marines*, IHSM)
Darwin Grant Value	£171,500.00
Funder (DFID/Defra)	Defra
Start/end dates of project	01 April 2014 – 31 March 2017
Reporting period (e.g., Apr 2015 – Mar 2016) and number (e.g., Annual Report 1, 2, 3)	April 2015 – March 2016 Annual Report 2
Project Leader name	Shane M. Abeare
Project website/blog/Twitter	www.reefdoctor.org/our-work/reefdoctor-alternative-livelihoods-programme www.facebook.com/ReefDoctorOfficial @reefdoctor
Report author(s) and date	Shane M Abeare, Emma Gibbons and Cale Golding; 06 April 2016

1. Project Rationale

Although widely known for its rich biodiversity and endemism, in economic terms, Madagascar is one of the poorest countries in the world, with 92% of the population living on less than $2 per day. In the semi-arid, drought-prone region of Toliara (fr. Tuléar), Southwest Madagascar, poverty is even more severe, as harsh living conditions drive more-and-more people towards the coast to eke out an existence from an already over-exploited coastline.

In stark contrast to the harsh conditions that characterise the terrestrial environment of the Toliara region, the coastal environment is rich and diverse as home to one of the largest barrier reef systems in the world, the Toliara Barrier Reef Complex (see Figure 1a,b). Extending for ca. 300 km along the region's coast, the TBRC provides: shelter to globally threatened coral, seagrass, and mangrove habitats, foraging areas for endangered marine turtle species (*Chelonia mydas* and *Eretmochelys imbricata*), protection against coastal erosion, and subsistence for the traditional Malagasy fishing people, known as the Vezo.

From an environmental perspective, increasing levels of poverty lead to an escalation in competition for scarce natural resources, resulting in accelerating rates of biodiversity loss as a "scramble for resources" ensues. Consequently, declining biodiversity may further destabilize the ecosystem, thereby establishing a negative feedback loop, or downward spiral, that is difficult to reverse and may result in greater food-insecurity and *extreme* poverty. In situations of such extreme poverty, alternatives must be provided, first, before biodiversity objectives may be attained, and the downward spiral toward ecosystem collapse averted.

To address the crisis being faced by the fishing communities of the Bay of Ranobe, the present project was designed to, first, provide poverty relief through the provision of a truly viable and sustainable alternative activity, mariculture. In following a highly ambitious work plan, the Project was designed to provide mariculture skills, materials, and market access to 120 households per year in six villages of the BRB (see Figure 1c). Immediate ecological benefits are being accrued as project participants are strategically selected based on the harmful/destructive nature of their normal fishing activities, thereby effectively reducing overall fishing pressure, and the use of destructive fishing gears and/or techniques. Specifically, marine turtle and beach-seine fishermen are prioritised in the selection process as a means of providing direct and indirect conservation benefits to endangered / critically endangered marine turtle species. Reduction in fishing effort of the marine turtle targeted fishery provides obvious direct and immediate conservation benefits for these endangered species. As beach seines are often considered a destructive fishing gear, given the physical contact between the seine net and benthic habitats, reduction in beach seining effort will afford a level of protection to globally threatened seagrass habitat, and at the same time, provide indirect benefits to marine turtles whose diet is primarily composed of seagrass species.

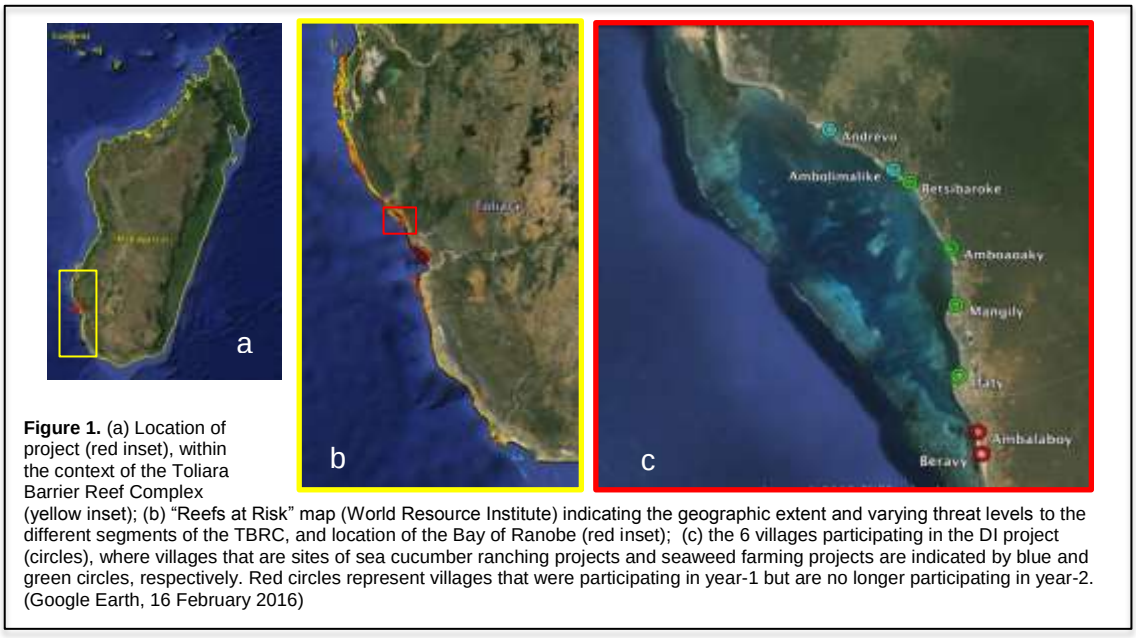

Figure 1. (a) Location of project (red inset), within the context of the Toliara Barrier Reef Complex (yellow inset); (b) "Reefs at Risk" map (World Resource Institute) indicating the geographic extent and varying threat levels to the different segments of the TBRC, and location of the Bay of Ranobe (red inset); (c) the 6 villages participating in the DI project (circles), where villages that are sites of sea cucumber ranching projects and seaweed farming projects are indicated by blue and green circles, respectively. Red circles represent villages that were participating in year-1 but are no longer participating in year-2. (Google Earth, 16 February 2016)

2. Project Partnerships

Commercial Partners

Indian Ocean Trepang (IOT, iotrepang.com): a commercial hatchery for sea cucumbers (*Holothuria scabra*, Sandfish) that supplies commercial and community-based farms in the Toliara region.

Compagnie de Pêche Frigorifique de Toliara (COPEFRITO, www.copefrito.com)**:** a seafood exporter based in Toliara and operating since 1995.

Governmental Partners

***Institut Halieutique et des Sciences Marines* (IH.SM), Université de Tuléar** (www.ihsm.mg)**:** the primary marine research institute of Madagascar and the principle partner of ReefDoctor since 2002. Dr. Thierry Lavitra, Director of the IHSM, is the primary contact for the project.

***Ministre des Ressources Halieutiques et de la Pêche, Direction Régional de Tuléar* (www.peche.gov.mg):** is the Malagasy, governmental fisheries department, with the General Director, Francois Gilbert, acting as primary contact.

Local Associations

FIMPAIMIFA: created in 2012, the Turtle Protection Association, *Fikambanana Mpaniriky Miaro ny Fano* (in Malagasy; FIMPAMIFA), is comprised of village elders and turtle hunters concerned about the over-harvesting of marine turtles, with representatives throughout the 13 villages of the Bay.

FIMIHARA: created in 2007, FIMIHARA is comprised of village elders, chiefs and fishermen concerned about all the fisheries of the Bay of Ranobe, and management of the marine reserves, with representatives throughout the 13 villages of the Bay.

Partners Roles

Given that the lead organisation, Reef Doctor, has been working with/within the Bay of Ranobe communities since 2002, the majority of the project's activities are being implemented and/or coordinated by the organisation's employees.

In year-2 of the project, the local fishermen associations of the Bay, FIMPAMIFA and FIMIHARA have played a critical role in facilitating village meetings. As the members of these local fishermen associations are fishermen themselves, many of the associations members are beneficiaries of the project, thus they play a vital dual role as village-based facilitators and role model mariculturists.

The IH.SM and the Fisheries Department have been key, local partners since 2002. Over the years, the IH.SM has been consulted for technical advice, while students / graduates from the IH.SM have often pursued internships, or employment opportunities at Reef Doctor. In year-2, an IH.SM student has been assisting with data collection, which may also be used for their Master's degree requirements.

IOT is the commercial hatchery that provides participants pursuing sea cucumber farming projects with juvenile sea cucumbers, which are raised to commercially viable sizes / weights by project participants. At the time of harvest, both sea cucumbers and seaweed products are collected in the villages by COPEFRITO representatives, whom then transport, prepare, and export the products to overseas markets.

3. Project Progress

3.1 Progress in carrying out project activities

Output-1*. 50% decline in total annual turtle mortality associated with the targeted fishery, relative to the baseline of 655 turtles / year (average total catch of the village of Ifaty and Fitsitky in 2012 and 2013)*

Throughout the course of year-2, a monthly meeting has been held with the two local project partners, the fishermen's associations FIMPAMIFA and FIMIHARA. Given that the objectives of the two associations are complementary, with the focus of FIMPAMIFA being the turtle fishery and that of FIMIHARA being the finfish fisheries and protected area management, meetings have been, and will continue to be, held jointly. (Photo: Annex 4.1.7a)

Meetings have focused, in part, on the training of key members of FIMPAMIFA in enforcing the local law, or fishery regulation, of a minimum size-at-catch for turtles of 70cm. According to the regulation, turtles less than or equal 70cm are to be released. In order to monitor compliance, the turtle-tagging project is focused on the tag-and-release of turtles under 70cm. The turtle-tagging program allows for local partners to remain active and engaged, provides an indicator of progress, and provides an opportunity to collect important biological data.

In addition to the turtle-tagging dataset, a more general turtle fishery dataset is being collected on turtle landings and sales. These datasets allow for the evaluation of overall progress in attaining the objective for Output-1 and for monitoring the progress of activities, which have progressed as scheduled.

At the end of year-2, meetings were held with the IHSM and Fisheries Department to update regional partners on the project progress. (Photo: Annex 4.6.1b)

Output-2*. Protection of essential seagrass habitat that is critical to the long-term survival of marine turtles and the productivity of sea cucumbers, with a minimum areal target of 10% total cover*

In year-2, monthly meetings held with stakeholders of the Bay of Ranobe (i.e. FIMIHARA, FIMPAMIFA, and representatives of local businesses) culminated in the creation of the first seagrass protected areas. The newly created reserves cover a total area of 945ha, which is more than 2x the targeted areal coverage (400ha), and are designated as restricted-use zones. Despite the achievement of the DI project in surpassing its target, in year-3 efforts will be made to create a zone of strict protection of approximately 150ha within the already restricted-use area.

Seagrass surveys have continued throughout the year, as scheduled. Preliminary analyses of the data collected have been used to inform the placement of the seagrass reserves and the zoning. Moreover, an area will be proposed to the community in year-3 for consideration as the "strict protection" zone based on the results of the survey analyses. (Satellite image: Annex 4.2.2)

Output 3*. Selection of 120 households per year from 6 coastal villages to participate in the DI project, with 90% of the households benefiting from stable revenue of at least 2.00 USD/day*

<u>Sea Cucumber</u>

Given the difficulties in regularly procuring juvenile sea cucumbers due to production problems at the hatchery, in year-2 of the project, no new households were selected to participate in sea cucumber farming activities. However, continuous technical support was

provided to previously participating households by mariculture technicians, Liva Ramanjehimanana and Jivan Vijay. During the course of year-2, 5 households from Andrevo withdrew from the project, resulting in a total of 25 participating households by the end of year-2. Interestingly, the 5 remaining households in Andrevo have been very successful, with the last delivery of juveniles in February being paid for by project participants, thereby demonstrating the sustainability of the project.

Throughout the course of year-2, participating households benefited from the delivery of 42,188 juveniles, with 18,806 delivered in Andrevo and 23,382 delivered in Amobolimalike. Sales of adult sea cucumbers for the two villages reached a combined total of 15,531 USD (See Tables, below).

In order to help households in Ambolimalike better manage and survey their 20 sea cucumber enclosures, a watchtower was constructed in the early months of year-2. Given that sea cucumbers are commonly the target of theft, the watchtower was built at the request of the community, whom manage its daily/nightly use. (Photos: Annex 4.3.4)

Andrevo						
	Date	Nb. of juveniles purchased	Date	Nb. of adults harvested	Value (MGA)	Value (USD)
Year-1	25/11/14	5270				
	23/3/15	4680				
Year-2	18/6/15	5000	7/7/15	124	2,890,000	
	4/8/15	5000	27/11/15	911	3,295,000	
	1/10/15	5000	25/1/16	1639	6,626,500	
	25/11/15	3806	8/2/16	600	2,552,000	
	24/2/16		11/3/16	871	3,759,000	
	Total	**28,756**	**Total**	**4,145**	**19,122,500**	**$8,271**

USD=2312 MGA (April 2014)

Ambolimalike						
	Date	Nb. of juveniles purchased	Date	Nb. of adults harvested	Value (MGA)	Value (USD)
Year-1	26/11/14	9944				
	19/3/15	10000				
Year-2	20/5/15	6448	30/9/15	276	1,111,000	
	19/6/15	10740	25/11/15	1722	7,098,500	
	30/10/15	6194	9/2/16	971	4,389,000	
			10/3/15	720	3,147,000	
	Total	**43,326**	**Total**	**3,689**	**15,745,500**	**$6,810**

Seaweed

By the end of year-1, 94 household-based seaweed mariculture projects were started and at varying stages of expansion and development. Selected households represented 4 villages in the Bay of Ranobe: Mangily, Ifaty, Ambalaboy, and Beravy.

Due to the poor growth rates of seaweed observed in the villages of Ambalaboy and Beravy, early in year-2, the decision was made to halt all seaweed farming activities in these affected villages. It was questionable from the outset whether seaweed would thrive in the southern villages of the Bay, given the turbid waters and influence of the nearby Fiharenana River. Instead, villages further north, Amboaboaky and Bestsibaroke, were introduced and integrated into the seaweed-farming project. Due to demand, households from the village of

Ambolimalike were also accepted into the seaweed-farming activities, in addition to the sea cucumber farming activities already occurring in that village. (See Map, Figure 1, for all participating villages).

In year-2, seaweed-farming activities more than doubled with the addition of 125 new households to the existing 94 households from year-1, totalling 219 seaweed-farming households by the end of year-2. Consequently, a significant amount of effort in year-2 was focused on training all the new project participants. In order to cope with the increasing numbers of households requiring training in seaweed cultivation techniques, a special training program was developed for exceptionally motivated project participants. The training program consists of the basic training (Level-1) given to all new participants, and additional levels of training (Levels 2-3) for highly motivated mariculturists. Each advanced level of training consists of a weeklong program exposing participants to more advanced information in the cultivation of seaweed, identification of problems, and general farm management. Project participants that have undergone the advanced training (Level-2 = 64 trained; Level-3 = 31 trained), have then assisted project technicians, Pepin Emanuel and Francois Mima, in the field with the individual household projects in their respective villages. The aim of the training program is to 'train trainers' and create specialists, or leaders, in mariculture in all the 6 participating villages, whom will then help insure the sustainability of these activities once the DI project has ended.

In addition to the community-training program, Reef Doctor has developed a training program for international volunteers interested in contributing to the sustainable development of mariculture in Madagascar. The aim of this training program is to assist project Scientist, Cale Golding, with collection and management of the datasets required for the successful monitoring of project activities, and to assist with the construction and expansion of seaweed cultivation lines. (Excerpt: Annex 4.3.2)

To date, there are approximately 43 linear kilometres of rope installed throughout the 5 participating villages, from which 15,507 kg of seaweed was harvested throughout the year. Households from the 5 participating villages generated a total of 3,365 USD in gross sales over the period of April – March 2016 (See Table, below).

In conclusion, activities under Ouput-3 are progressing as scheduled, with initial socioeconomic surveys being conducted on all project participants (244 households) in order to quantify project-related benefits in terms of revenue, wealth, and well-being.

Village	Nb. households	Linear rope (m)	Harvest (kg)	Income to date (MGA)	Income to date (USD)
Ifaty	70	16500	8623	4,311,500	
Mangily	40	9800	2941	1,470,500	
Betsibaroke	48	5750	2402	1,201,000	
Ambolimailake	46	7050	1253	626,500	
Amboaboaky	15	3850	341	170,500	
Total	**219**	**42950**	**15507**	**7,780,000**	**$3,365**

Output 4*. Local optimisation of aquaculture production and creation of expansion strategy by year-3; research objectives are to increase aquaculture production, in terms of growth rate, in experimental plots by at least 15% versus control plots using repeatable, cost-effective methods*

In year-1 of the project, the experimental sea cucumber enclosures and seaweed farm were constructed. For the sea cucumber experiment, nursery enclosures were stocked at varying densities of juveniles to evaluate the effect that stocking density has on growth rates. For the seaweed experiment, a comparison has been made between two differing cultivation

techniques, namely off-bottom versus longline. Over the past 12 – 18 months, data have been collected on the growth rates of sea cucumbers and seaweed under the previously described experimental conditions. Preliminary analyses of data collected suggest that the targeted 15% improvement in growth/productivity for both sea cucumbers and seaweed has been attained.

In year-3, data collection will focus solely on seaweed growth rates in the different DI project villages in order to assess spatial variation of growth rates, which will be used to inform the GIS analyses planned for the end of the DI project.

Overall, activities related to Output 4 have progressed in year-2 as planned and are on-schedule.

Progress towards project outputs

Output 1:	50% decline in total annual turtle mortality associated with the targeted fishery, relative to the baseline of 655 turtles / year (average total catch of the village of Ifaty in 2012 and 2013			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
1.1 Continued enforcement by FI.MPA.MI.FA of the local indigenous law (dina) that prevents the exploitation of juvenile marine turtles under 70 cm year 1 - 3	0 turtles tagged-and-released	-2014-2015: 199 turtles tagged-and-released -2015-2016: 786 turtles tagged-and-released -Total = 985 turtles	Annex 4.1.1 – 4.1.3 Working Paper	Year-to-year increase in turtles tagged indicates increasing enforcement and compliance with regulations
1.2 Continuous biological monitoring of the marine turtle fishery… 50% decline in turtle mortality associated with targeted fishery by year-3, using the two largest fishing villages as indicators, where 655 turtles on average are captured per year	50% * 655 turtles/year = 328 turtles/year	-2014-2015: 199 turtles tagged-and-released -2015-2016: 785 turtles tagged-and-released	Annex 4.1.4 – 4.1.5 Working Paper	As compared with targeted 328 turtles / year, the number of turtles released in year-2 (785 turtles) exceeds target
1.3 Working paper summarising results of year-1 marine turtle fishery surveys and socio-economic research; progress evaluation	No database exists	Year-1 dataset	Annex 4.1.1 – 4.1.5 Working Paper	Indicator requires revision
1.4 Workshops and training to develop the capacity of FI.MPA.MI.FA, FI.MPA.MI.FA's marine turtle	None trained	2 FIMPAMIFA representatives per participating village trained (2p*6villages =	Annex 4.1.7a Photos	

protection teams, and turtle network year 1 - 3		12p)		
1.5 Working paper summarising results of year-2 marine turtle fishery surveys and socio-economic research; progress evaluation	No database exists	Year-1 dataset	Annex 4.1.1 – 4.1.6 Working Paper; Annex 4.5.1 – 4.5.2	
1.6 90% of juvenile marine turtles captured in the fishery are tagged and released by year 3	0% tagged	Tagging coverage varies month-to-month from 34% - 86%	Annex 4.1.3b Working Paper	
1.7 Peer-reviewed publication on the marine turtle fishery results by the end of year-3	No publications exist	In preparation	Annex 4.1 Working Paper	

Output 2:	Protection of essential seagrass habitat that is critical to the long-term survival of marine turtles and the productivity of sea cucumbers, with a minimum areal target of 10% total cover			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
2.1 A signed memorandum of understanding (MoU), between local turtle fisheries management association (FI.MPA.MI.FA) and the beach-seining communities of the targeted villages, agreeing to a gear exchange program—seine nets in exchange for participation in the Darwin Initiative by year-1	No gear exchange program	None		Indicator requires revision—places unequal burden on beach-seine fishermen and is not required to achieve Output-2; spatial restrictions and zoning are sufficient (i.e. Indicator 2.2)
2.2 Formation and implementation of a bay-wide local indigenous law (dina) providing total protection to 150ha of intertidal seagrass meadows and partial protection to an additional 250ha;	No spatial restrictions exist in coastal zone	Agreement reached to create restricted-use zones covering 945 hectares	Annex 4.2.1 – 4.2.2 Signed Agreement(s), Map	

10% of critical habitat for marine turtles, juvenile fishes, and sea cucumbers, afforded some form of protection in year-2				
2.3 Working paper summarising results of year-1 seagrass monitoring; progress evaluation	No database exists	Year-1 dataset	Annex 4.2.3 Working Paper	
2.4 Exclusion of beach-seine activity from sea cucumber farming areas 6 villages by year-2	No agreement	Agreement reached in all villages to protect mariculture infrastructure and provide a buffer zone surrounding farms (completed in year-1)	Annex 4.2.4 Signed Agreement(s); reproduced from Year-1 report	
2.5 Working paper summarising results of year-2 seagrass monitoring; progress evaluation	No database exists	Year-2 dataset	Annex 4.2.3 Working Paper	
2.6 Working paper summarising results of year-3 seagrass surveys and the discontinuation of the use of the beach-seine fishing gear	No database exists	To be completed in year-3		Indicator requires revision
2.7 Peer-reviewed publication on the seagrass monitoring results by the end of year-3	No publications	In preparation	Annex 4.2.3 Working Paper	

Output 3:	Selection of 120 households per year from 6 coastal villages to participate in the DI project, with 90% of the households benefiting from stable revenue of at least 2.00 USD/day			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
3.1 Workshop on aquaculture techniques	No mariculture skills	Level-1 training: 240 households trained, Level-2 training: 64 individuals trained Level-3 training: 31 individuals trained	Annex 4.3.1 Excerpt of training materials and certifications	
3.2 120 aquaculture projects (sea cucumber / seaweed) in-place and stocked in the 6 targeted villages, with priority given to	No mariculture activities	124 participants selected in year-1	Annex 4.3.3 – 4.3.5 Photos	

turtle fishermen and beach-seine fishermen, by year-1				
3.3 Working paper summarising results of year-1 data collection: environmental data associated with the sea cucumber enclosures and growth rates/ seaweed productivity; progress evaluation	No database exists	Year-1 dataset		
3.4 Additional 120 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority given to all other interested community members, by year-2	No mariculture activities	244 participants selected by the end of year-2	Annex 4.3.3 – 4.3.5 Photos	
3.5 Working paper summarising results of year-2 data collection: environmental data associated with the sea cucumber enclosures and growth rates/ seaweed productivity; progress evaluation	No database exists	Year-2 dataset	Annex 4.4	
3.6 Additional 60 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority given to the most successful, or productive, participants by year-3		To be completed in year-3		
3.7 Peer-reviewed publication on the marine turtle fishery by the end of year-3	No publications	In preparation	Annex 4.4	Indicator requires revision
3.8 National symposium presenting Darwin Initiative project results in the		To be completed in year-3		

regional capital, Tulear, during the last quarter of year-3				

Output 4:	Local optimisation of aquaculture production and creation of expansion strategy by year-3; research objectives are to increase aquaculture production, in terms of growth rate, in experimental plots by at least 15% versus control plots using repeatable, cost-effective methods			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
Installation of experimental sea cucumber enclosures and seaweed cultivation lines to test different approaches aimed at optimising production in year 1	None	- 3 enclosures constructed to test effects of sea cucumber stocking density; longline and off-bottom experimental farms constructed in year-1	Annex 4.3.4 – 4.3.5 Photos	
Working paper summarising results of year-1	None	Data analyses: descriptive statistics	Annex 4.4.1 – 4.4.4	
Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 2	None	Data analyses of year-2 data	Annex 4.4.2 – 4.4.3	
Working paper summarising results of year-2	None	Data analyses: descriptive statistics	Annex 4.4.1 – 4.4.4	
Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 3		To be completed in year-3		
Creation of a community expansion program for aquaculture projects in-line with the exit strategy for the project by end of year-3		To be completed in year-3		
Peer-reviewed publication on the optimisation of		In preparation	Annex 4.4.1 – 4.4.4	

aquaculture production by the end of year-3				
Development of a GIS-based spatial model to predict site suitability and productivity by end of year-3		To be completed in year-3		

3.2 Progress towards the project Outcome

Outcome:	Promote the long-term survival of marine turtle populations through the incremental and adaptive implementation of a bay-wide aquaculture project that directly assists the marginalized fishing communities transition to sustainable livelihoods.			Comments (if necessary)
	Baseline	Change by 2016	Source of evidence	
Indicator 0.1 50% decline in turtle mortality associated with the targeted fishery by year-3, using the two largest turtle fishing villages as indicators (Ifaty and Fitsitky), where, in recent years, 655 turtles on average are captured per year	50% * 655 turtles/year = 328 turtles/year	786 turtles were directly saved in year-2 through the tag-and-release program, thereby surpassing the project target of 328 turtles/year. Furthermore, mariculture activities result in a reduction in turtle fishing effort, indirectly saving even more turtles from being victims of the fishery, albeit difficult to quantify.	Annex 4.1.1	
Indicator 0.2 Improved livelihoods: 90% of the 360 targeted households, comprised of 360 men and 360 women, from 6 coastal villages will directly benefit from a stable revenue of, at least, 2.00 USD/day (WHO poverty line), where current baseline revenues fluctuate dramatically and	Average revenue: 1.00 USD / Day	Average revenues from sales of mariculture products from participating villages range from 0.08 – 2.11 USD / Day	Annex 4.5.2	In year-3, project staff will focus on achieving target of baseline revenue ($1.00/day) + mariculture revenue ($1.00/day) = $2.00/day

range from 0.70 – 1.40 USD/day				
Indicator 0.3 Local laws (dinas) created for the protection of 10% (ca. 400ha) of critical seagrass habitat / marine turtle feeding grounds throughout the Bay by year-3, where a minimum of 150 ha is provided total protection and 250 ha allows for limited, low-impact resource extraction. No seagrass protected areas currently exist in the Bay of Ranobe.	No coastal protected areas exist in the Bay of Ranobe	945 ha of seagrass habitat designated as "restricted-use", surpassing the 10% (400 ha) target.	Annex 4.2.1 – 4.2.2	In order to complete 100% the objective, in year-3, a 150ha "strictly protected" zone will be designated from within the newly created protected area
Indicator 0.4 Local optimisation of aquaculture production and creation of expansion strategy by year-3; research objectives are to increase aquaculture production, in terms of growth rate, in experimental plots by at least 15% versus control plots using repeatable, cost-effective methods	Traditionally, seaweed mariculture projects in Madagascar all employed the off-bottom technique, despite poor productivity and repeated failures. Off-bottom plots in the Bay of Ranobe exhibit an average daily-growth rate of 1.7 %/day.	Preliminary testing in year-1, then more extensive testing throughout year-2 confirm that the longline technique introduced by the present project is far superior to the traditionally employed technique. Longline cultivation produces an average daily growth rate of 4.8 %/day surpassing the targeted 15% increase in productivity with a 282% increase	Annex 4.4.2 – 4.4.3	Expansion strategy to be elaborated in year-3

3.3 Monitoring of assumptions

Outcome and Output-level assumptions remain unchanged:

<u>Outcome-level assumptions</u>

1. Madagascar remains politically stable throughout the project period;
2. The project area remains unaffected by natural disasters, such as cyclones;
3. Effective protection and stewardship of aquaculture units will be put into place to prevent significant losses due to theft, disease, or predation;
4. Potential conflict related to territorial user-rights will be resolved through the economic incentives associated with aquaculture activities;

5. Sea cucumber farming projects require a reliable and sufficient supply of juveniles from the IOT hatchery; problems in hatchery production could significantly impact project outcomes.

Output-level assumptions

1. Agreement reached on land-use rights: MoUs signed and Dina's created;
2. Natural mortality rates remain within a range that allows for economic sustainability;
3. Given that sea cucumbers are a commercially valuable species, effective measures are put into place to avoid major losses due to theft;
4. Growth period for sea cucumbers required to attain a marketable weight of 400 grams is 8 - 9 months, and seaweed turn-over rate of 4 months;
5. Community groups remain committed to the project.

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

Direct and indirect conservation benefits have been accruing since the beginning of the project, with the primary strategy in the selection of participating households being the reduction in destructive fishing techniques (i.e. turtle fishing and beach-seining). Moreover, through direct conservation interventions, the project has tagged-and-released 985 endangered / critically endangered marine turtles, and has provided a level of protection to 945 hectares of seagrass habitat.

To date, 244 households have directly benefited in receiving training, materials, and the continual technical support necessary for each household to pursue its own family-based, mariculture project. At the same time, Darwin project staff are collecting data on: 1) growth rates of sea cucumbers and seaweed, 2) water temperature, 3) water chemistry, and 4) weather in order to understand the factors affecting mariculture productivity. After a sufficient amount of data have been collected, analyses should provide information regarding the optimal conditions, locations, and growth techniques, for mariculture in the Bay of Ranobe and directly benefit the productivity of the family-based projects. Specific poverty alleviation benefits of the Darwin project are discussed further in Section 5.

4. Contribution to SDGs

Contribution to SDGs in year-2 of the project include:

1. End poverty: Poverty alleviation through sustainable mariculture activities;
2. End hunger: Economic benefits provide purchasing power;
5. Gender equality: Men and women are equally represented in the project;
8. Sustainable economic growth: Sustainable mariculture as an alternative to destructive fishing practices
14. Conserve and sustainably use the oceans: Reduction of unsustainable fishing pressure through the promotion of mariculture.

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

The present Darwin Initiative project provides significant local support in meeting 9 out of the 20 Aichi Targets defined by the Convention on Biological Diversity (CBD):

Strategic Goal A

Target 4 – Government, business and stakeholders implement plans for sustainable production and consumption – *Progress*: the Darwin project is the catalyst in bringing together governmental actors (Fisheries Department), business (seafood exporter,

COPEFRITO), and the community mariculture projects into a sustainable production model.

Strategic Goal B

Target 5 – Reduction in the loss / degradation of habitats – *Progress*: 945 hectares of critical seagrass habitat have been accorded protection.

Target 6 – Sustainable fisheries – *Progress*: 244 households are already participating in the project, which translates into a significant reduction in fishing effort.

Target 7 – Agriculture / aquaculture managed sustainably – *Progress*: the principle activity of the present project is sustainable mariculture.

Target 10 – Pressures on coral reefs are minimized – *Progress*: participation of fishermen in the project activities translates into reduced fishing pressure on the coral reefs of the Bay.

Strategic Goal C

Target 11 – Conservation of 10% of coastal / marine areas – *Progress*: 945 hectares of critical seagrass habitat have been accorded protection, representing 30% - 40% of the seagrass cover in the Bay of Ranobe.

Target 12 – Conservation of known threatened species – *Progress*: to date, training and support of the local turtle association, FIMPAMIFA, has resulted in the release of 985 marine turtles, including 928 endangered green turtles (*Chelonia mydas*) and 54 critically endangered hawksbill turtles (*Eretmochelys imbricate*).

Strategic Goal D

Target 14 – Safeguard of essential ecosystem services taking into account the needs of women, indigenous and local communities, and the poor and vulnerable. *Activities*: of the 488 current project participants 239 are women (49%) and 100% are from the local community.

In addition to furthering objectives set under the CBD, through the marine turtle conservation agenda of the present project, support is provided to Madagascar in meeting its obligations under the Convention on the Conservation of Migratory Species and Wild Animals (CMS), which establishes legal protection to marine turtles.

6. Project support to poverty alleviation

Recognizing the importance of poverty alleviation in order to achieve conservation outcomes, the present DI project was conceived to place equal importance on both of these objectives. Beneficiaries of the project, fisherfolk and their families, are receiving direct benefits in the immediate and medium-term.

Empowerment – Within each of the participating households, one man and one woman are selected, usually the heads of the household, to directly participate and receive training. Of the 488 current project participants 239 are women (49%).

Income – To date, 488 project participants have benefited from training, materials and construction of the necessary infrastructure for 244 household-level mariculture projects, which have been fully supported by the Darwin project funding. Mariculture products purchased from DI project participants by the local exporter, COPEFRITO, reached a total of 18,446 USD.

Food Security – Although the local communities traditionally consume neither sea cucumbers nor seaweed, project participants will benefit from stable revenue, allowing them to purchase food items on a regular basis. At the same time, the continual reduction in fishing effort, as participants transition into full-time mariculture activities, should increase

food security for the greater community of fisherfolk, as the Bay of Ranobe fisheries moves toward more sustainable levels of fishing pressure.

7. Project support to Gender equity issues

In a village setting, there exists a strong cohesion within family units, and is the reason for which the present Darwin project adopted a “households” approach for the implementation of the project. Given the high level of interest of community members to participate in the project, the demand from the community surpasses the financial capacity of the project, making it necessary to conduct a formal selection process. During the selection process, project staff are able to explicitly implement a policy of gender equality in ensuring, to the extent possible, that selected households are comprised of one man / one woman.

To date, 244 household-mariculture projects have been created, with 219 of the households pursuing seaweed cultivation and 25 households pursuing sea cucumber farming. As a result, 249 men / 239 women have received the necessary training and materials to pursue, at will, mariculture activities.

8. Monitoring and evaluation

Given the scientific objectives of the present DI project, data collection was intentionally made an integral part of the project, which serves well for project monitoring purposes. However, the Project Leader intends to submit some revisions of the logical framework in order to improve concision and clarity.

9. Lessons learnt

Overall, in year-2, the project has progressed well, and has achieved some key accomplishments in meeting the ambitious objectives defined in the project Outcome / Outputs. However, given the opportunity to re-design the project, I would probably streamline and focus efforts more on the core objectives of marine turtle conservation and poverty alleviation through mariculture development. Although valuable and worthwhile, too many products produce an overly-ambitious project that risks to detract from its core objectives. That said, in reality, there really is no project that is too ambitious provided an adequate budget. In the end, it is a balance between “ambition” and “budget” that is difficult to strike, while still remaining appealing to funders.

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

In response to the end-of-year report, the Reviewer requested supplemental information to be included in the present report, including:

- *Evidence of regular communications with partners*—See photos, Annex 4.6.1
- *Draft of the MoU*—See document excerpts, Annex 4.6.2
- *Increased use of Darwin identity*—See photos, Annex 4.6.3

11. Other comments on progress not covered elsewhere

In year-2, a three-tiered training program was developed to build local capacity in terms of technical and practical management of mariculture farms. Individuals from all participating households took part in level-1 training, with particularly motivated participants undergoing more advanced levels of training. In addition to assisting with the year-3 expansion of the

project, trained participants will be valuable community resources once the DI project has ended.

Despite much progress, some setbacks were experienced in year-2, with mariculture activities in the villages of Beravy and Ambalaboy being halted and two new villages integrated into the project, Amboaboaky and Betsibaroke. Additionally, a relatively common disease of seaweed, a disease known as EFA (epiphytic filamentous algae), spread throughout the household projects of Mangily and affected to some extent neighbouring projects of Ifaty. Although the spread of the disease was quickly contained, most of the cultivation lines in Mangily had to be removed, destroyed, and replaced. Given that the exact causes linked to EFA outbreaks are unknown, and there are no treatments, efficiently managing disease outbreaks will be key to the success of seaweed cultivation projects.

12. Sustainability and legacy

- One of the numerous accomplishments in year-2 includes the sea cucumber projects being pursued by households of the village of Andrevo. At the end of year-2, households began purchasing their own supplies, thereby demonstrating economic sustainability.
- An intensive training program has been developed for project participants that will help ensure the technical sustainability of the project.
- An internship program has been created through the host organisation, Reef Doctor, in order to enlist internationally skilled and motivated assistance.
- Amongst project participants, mariculture associations have been forming in the villages, which provides a social network and a level of social sustainability.
- Agreements are being made between the exporter, COPEFRITO, and village-based groups, thereby extending their social networks and reinforcing the social sustainability of the project. (See excerpt, Annex 4.6.2)

There are no changes to the overall strategy planned in year-3. Project staff will continue working until the end to ensure that all, or most, of the project participants attain the levels of sustainability that we are witnessing throughout the 6 project villages.

Lastly, it is worth noting that the extraordinary accomplishments and scale of the present DI project has been the topic of conversation at local, regional, and national levels. As a result, and proof, of the project's success, renown, and legacy, just two months ago, a European Union delegation visited the DI project village of Ifaty. (See photos, Annex 4.6.1)

13. Darwin Identity

In year-2, the DI project has become the centrepiece, and *raison d'etre*, of the integrated Reef Doctor "Alternative Livelihoods Programme". Now, as an integrated programme, the organisation has developed an international internship programme in support of the DI project in the hopes of securing perennial supplemental funding and skilled labour to ensure the success and lasting impact of the DI project. The DI logo appears prominently on the organisation's website in numerous locations, and project updates are posted to a blog page, Twitter and Instagram account, and Facebook.

Locally, the DI logo has been publicised on roadside signage, t-shirts, and in all presentations given locally or regionally. (For examples, see photos in Annex 4.6.1 and 4.6.3)

14. Project Expenditure

Table 1 Project expenditure <u>during the reporting period</u> (1 April 2015 – 31 March 2016)

Project spend (indicative) since last annual report	2015/16 Grant (£)	2015/16 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			0	
Consultancy costs			0	
Overhead Costs			0	
Travel and subsistence			0	
Operating Costs			-4	
Capital items (see below)	0	0	0	
Others (see below)			+2	
TOTAL				

Staff Member	Role in Project	Darwin
Shane Abeare	Project supervisor	
Emma Gibbons	Project coordinator	
Cale Golding	Aquaculture scientist	
Liva Ramanjehimanana	Socioeconomic officer	
Jivan Vijay	Socioeconomic officer	
Pepin Emanuel	Field technician	
Francois Mima	Field technician	

Other Costs	
Aquaculture materials	£
-Infrastructure construction materials (fence, posts, rope, cement, etc)	
-Juvenile sea cucumbers	

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2015-2016

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
Impact Eradicate *extreme* poverty in the Bay of Ranobe communities, safeguard regional biodiversity through sustainable-use of marine resources, in terms of sustainable tourism, fisheries, and aquaculture, following an ecosystem-based approach.		To date, 244 households have received the necessary training and materials to pursue small-scale mariculture projects. Introducing mariculture activities at such a large scale has significantly reduced fishing pressure on the coral reef environment of the Bay of Ranobe, thereby pushing the system closer to sustainability. Sustainable fisheries will provide benefits to the greater community of fishermen and marine tourism stakeholders.	
Outcome Promote the long-term survival of marine turtle populations through the incremental and adaptive implementation of a bay-wide aquaculture project that directly assists the marginalized fishing communities transition to sustainable livelihoods.	0.1 50% decline in turtle mortality associated with the targeted fishery by year-3, using the two largest turtle fishing villages as indicators (Ifaty and Fitsitky), where, in recent years, 655 turtles on average are captured per year	0.1. By the end of year-2, 786 marine turtles were rescued from the fishery, tagged and released.	0.1. In year-3, the project will continue on the same trajectory and attempt to increase the number of turtles rescued.
	0.2 Local laws (dinas) created for the protection of 10% (ca. 400ha) of critical seagrass habitat / marine turtle feeding grounds throughout the Bay by year-3, where a minimum of 150 ha is provided total protection and 250 ha allows for limited, low-impact resource extraction. No seagrass protected areas currently exist in the Bay of Ranobe.	0.2. In year-2, 945 hectares of seagrass habitat were zoned for "restricted-use", thereby providing a level of protection to an area much greater than had been originally targeted.	0.2. In year-3, within the newly zoned area, 150 hectares will be designated for "strict protection".
	0.3 Improved livelihoods: 90% of the 360 targeted households, comprised of 360 men and 360	0.3. By the end of year-2, 244 households were trained mariculturists, with most having benefited from at	0.3. In year-3, 120 new households will be selected, and project staff will focus on expanding / improving existing

	women, from 6 coastal villages will directly benefit from a stable revenue of, at least, 2.00 USD/day (WHO poverty line), where current baseline revenues fluctuate dramatically and range from 0.70 – 1.40 USD/day	least on harvest. At present, the overall average for household income from mariculture sales equals 0.50 USD/household/day.	household projects, attempting to increase revenues to the targeted additional 1.00 USD/day.
	0.4 Local optimisation of aquaculture production and creation of expansion strategy by year-3; research objectives are to increase aquaculture production, in terms of growth rate, in experimental plots by at least 15% versus control plots using repeatable, cost-effective methods	0.4. Data analyses indicate that the introduced and modified longline seaweed cultivation technique is superior to the traditionally used technique, providing 282% greater growth rates.	0.4. In year-3, project staff will focus on the development of the GIS database that can used for spatial planning and expansion of the project in the future.
Output 1. 50% decline in total annual turtle mortality associated with the targeted fishery, relative to the baseline of 655 turtles / year (average total catch of the village of Ifaty in 2012 and 2013	1.1 Continued enforcement by FI.MPA.MI.FA of the local indigenous law (dina) that prevents the exploitation of juvenile marine turtles under 70 cm year 1 – 3	1.1. Progress on-track; good indicator	
	1.2 Continuous biological monitoring of the marine turtle fishery to evaluate success of recently created management strategies, and the 50% targeted decrease in exploitation of marine turtles in the 6 targeted villages of the BRB year 1 – 3	1.2. Progress on-track; good indicator	
	1.3 Working paper summarising results of year-1 marine turtle fishery surveys and socio-economic research; progress evaluation	1.3. Progress on-track; redundant indicator	
	1.4 Workshops and training to develop the capacity of FI.MPA.MI.FA, FI.MPA.MI.FA's marine turtle protection teams, and	1.4. Progress on-track; good indicator	

	turtle network year 1 – 3 1.5 Working paper summarising results of year-2 marine turtle fishery surveys and socio-economic research; progress evaluation 1.6 90% of juvenile marine turtles captured in the fishery are tagged and released by year 3 1.7 Peer-reviewed publication on the marine turtle fishery results by the end of year-3	1.5. Progress on-track; redundant indicator 1.6. Progress on-track; good inidicator 1.7. Progress—to be completed in year-3; good indicator
Activity 1.1 Meetings and focus groups held with those involved in the marine turtle fishery in the 6-targeted villages to introduce Darwin Initiative		Completed
Activity 1.2 Marine turtle protection team training on dina management and enforcement		Completed
Annual marine turtle meeting hosted by ReefDoctor and FI.MPA.MI.FA; bringing together national, local institutions, government bodies, NGO's from southwest Madagascar, and stakeholders from the BRB		Completed
Biological monitoring of the marine turtle fishery in the 6-targeted villages of the BRB: 1) fisheries exit surveys, 2) landing surveys, 3) market surveys, and 4) record number of turtles tagged/released		On-going—data collection will continue throughout year-3 for scientific and project monitoring purposes
Meetings and focus groups held with those involved in the marine turtle fishery in the 6-targeted villages to introduce Darwin Initiative		Completed
Working paper and submission for publication		On-going—manuscript will be submitted in year-3
Output 2. Protection of essential seagrass habitat that is critical to the long-term survival of marine turtles and the productivity of sea cucumbers, with a minimum areal target of 10% total cover	2.1 A signed memorandum of understanding (MoU), between local turtle fisheries management association (FI.MPA.MI.FA) and the beach-seining communities of the targeted villages, agreeing to a gear exchange program—seine nets in exchange for participation in the Darwin Initiative by year-1 2.2 Formation and implementation	2.1. In year-3, gear-exchange will be offered to all participants, and not just beach-seiners, as optional in-exchange for additional mariculture materials; non-essential as an indicator.

	of a bay-wide local indigenous law (dina) providing total protection to 150ha of intertidal seagrass meadows and partial protection to an additional 250ha; 10% of critical habitat for marine turtles, juvenile fishes, and sea cucumbers, afforded some form of protection in year-2	2.2. Progress in achieving 945 hectares of protected seagrass habitat versus the targeted 400ha. However, in year-3, will seek an additional 150ha designated for strict protection.
	2.3 Working paper summarising results of year-1 seagrass monitoring; progress evaluation	2.3. Progress on-track; redundant indicator
	2.4 Exclusion of beach-seine activity from sea cucumber farming areas 6 villages by year-2	2.4 Completed
	2.5 Working paper summarising results of year-2 seagrass monitoring; progress evaluation	2.5. Progress on-track; redundant indicator
	2.6 Working paper summarising results of year-3 seagrass surveys and the discontinuation of the use of the beach-seine fishing gear	2.6. Progress on-track; redundant indicator
	2.7 Peer-reviewed publication on the seagrass monitoring results by the end of year-3	2.7. To be integrated into GIS rather than published independently
Activity 2.1. Development of the MoU agreement on intertidal land-use rights related to the conflict between beach-seine fishing activities and aquaculture activities		2.1. Partially completed—MoU developed with beach-seine fishermen, however, gear-exchange not addressed. Will be provided as an option, in year-3, in exchange for additional mariculture materials
Activity 2.2. Formation and implementation of a bay-wide local indigenous law (dina) protecting 10% (400ha) of seagrass meadows		2.2. Partially completed—945 hectares zoned in year-2, with an additional 150 ha planned for year-3
Activity 2.3. Community training on dina management and enforcement		2.3. Completed
Activity 2.4. Periodic stakeholder meetings to facilitate a smooth social transition from capture fisheries to aquaculture and resolve any minor conflicts		2.4. On-going

Activity 2.5. Seagrass surveys: data collection on species composition/diversity and density to monitor effects of sea cucumber/seaweed farming infrastructure/activities, and protection status		2.5. Completed—data require additional analyses in year-3
Working paper and submission for publication		2.6 Results will be integrated into GIS database in Activity 4.4
Output 3. Selection of 120 households per year from 6 coastal villages to participate in the DI project, with 90% of the households benefiting from stable revenue of at least 2.00 USD/day	3.1 Workshop on aquaculture techniques	3.1. On-going training; good indicator
	3.2 120 aquaculture projects (sea cucumber / seaweed) in-place and stocked in the 6 targeted villages, with priority given to turtle fishermen and beach-seine fishermen, by year-1	3.2. Completed; redundant indicator
	3.3 Working paper summarising results of year-1 data collection: environmental data associated with the sea cucumber enclosures and growth rates/ seaweed productivity; progress evaluation	3.3. Progress on-track; redundant indicator
	3.4 Additional 120 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority given to all other interested community members, by year-2	3.4. Progress on-track; redundant indicator
	3.5 Working paper summarising results of year-2 data collection: environmental data associated with the sea cucumber enclosures and growth rates/ seaweed productivity; progress evaluation	3.5. Progress on-track; redundant indicator
	3.6 Additional 120 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority given to the most successful, or productive,	3.6. Progress on-track

	participants by year-3 3.7 Peer-reviewed publication on the marine turtle fishery by the end of year-3 3.8 National symposium presenting Darwin Initiative project results hosted by Reef Doctor in the regional capital, Tulear, during the last quarter of year-3	 3.7. Mistype—publication on “seaweed growth” not “marine turtle”; publication on seaweed growth will be combined with publication described in Activity 4.3 3.8. On-track
Activity 3.1. Meetings and focus groups held in the 6-targeted villages to implement Darwin Initiative		Completed
Activity 3.2. Selection of 120 households per year per target village as project beneficiaries		On-going; in year-3 additional 120 households will be selected
Activity 3.3. Sea cucumber/seaweed farming workshops held; construction and stocking of sea cucumber enclosures in each village		On-going; 120 new seaweed farms constructed in year-3
Activity 3.4. Continual technical and logistical support for maintenance of enclosures/cultivation lines and sale of sea cucumbers/seaweed		On-going
Activity 3.5. Socio-economic surveys: changes in poverty level resulting from Darwin Initiative		On-going
Activity 3.6. Working paper and submission for publication		Publication will be combined with Activity 4.3
Output 4. Local optimisation of aquaculture production and creation of expansion strategy by year-3; research objectives are to increase aquaculture production, in terms of growth rate, in experimental plots by at least 15% versus control plots using repeatable, cost-effective methods	4.1 Installation of experimental sea cucumber enclosures and seaweed cultivation lines to test different approaches aimed at optimising production in year 1 4.2 Working paper summarising results of year-1 4.3 Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 3 4.4 Creation of a community expansion program for aquaculture	4.1. Completed 4.2. Progress on-track; redundant indicator 4.3. Completed 4.4. Progress on-track; good indicator

	projects in-line with the exit strategy for the project by end of year-3 4.5 Peer-reviewed publication on the optimisation of aquaculture production by the end of year-3 4.6 Development of a GIS-based spatial model to predict site suitability and productivity by end of year-3	4.5. Progress on-track; good indicator 4.6. Progress on-track; good indicator
Activity 4.1. Construction and stocking of experimental sea cucumber enclosures/seaweed cultivation lines		4.1. Completed
Activity 4.2. Continuous biological and environmental assessment of productivity		4.2. On-going; data collection will stop in year-3 for analyses
Activity 4.3. Working paper(s) and submission of manuscript(s) for publication of sea cucumber/seaweed optimisation studies		4.3. On-going; submission of manuscript in year-3
Activity 4.4. Development of a GIS-based spatial model to predict site suitability and productivity		4.4. On-going; to be completed in year-3
Activity 4.5. End-of-project national symposium to present the results of the Darwin Initiative project		4.5. To be completed in year-3

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
Impact: Eradicate *extreme* poverty in the Bay of Ranobe communities, safeguard regional biodiversity through sustainable-use of marine resources, in terms of sustainable tourism, fisheries, and aquaculture, following an ecosystem-based approach.			
Outcome: Promote the long-term survival of marine turtle populations through the incremental and adaptive implementation of a bay-wide aquaculture project that directly assists the marginalized fishing communities transition to sustainable livelihoods.			1. Madagascar remains politically stable throughout the project period 2. The project area remain unaffected by natural disasters, such as cyclones 3. Effective protection and stewardship of mariculture units will be put into place to prevent significant losses due to theft, disease, and/or predation 4. Potential conflict related to coastal territorial user-rights will be resolved through the economic incentives associated with the mariculture activities
Outputs: **1**. 50% decline in total annual turtle mortality associated with the targeted fishery, relative to the baseline of 655 turtles / year (average total catch of the village of Ifaty in 2012 and 2013	1a. Continued enforcement by FI.MPA.MI.FA of the local indigenous law (dina) that prevents the exploitation of juvenile marine turtles under 70 cm year 1 – 3 1b. Continuous biological monitoring of the marine turtle fishery to evaluate success of recently created management strategies, and the 50% targeted decrease in exploitation of marine turtles in the 6 targeted villages of the BRB year 1 – 3 1c. Working paper summarising results of year-1 marine turtle fishery surveys and socio-economic research; progress evaluation 1d. Workshops and training to develop the capacity of FI.MPA.MI.FA, FI.MPA.MI.FA's marine turtle protection	1a. Stable, or increasing, numbers of juvenile marine turtles tagged-and-released 1b. Data summaries as means of verification of biological monitoring; number of turtles tagged-and-released (rescued from fishery) compared to baseline (50%*655 = 328 turtles) 1c. Data summaries 1d. Photos, or training materials	1a. Number of turtles tagged are indicative of the number of turtles caught 1b. Turtle fishermen participating in the project earn an income comparable to what they had earned previously, i.e. mariculture is financially beneficial 1c. Sufficient data can be collected to create publishable article

	teams, and turtle network year 1 – 3 1e. Working paper summarising results of year-2 marine turtle fishery surveys and socio-economic research; progress evaluation 1f. 90% of juvenile marine turtles captured in the fishery are tagged and released by year 3 1g. Peer-reviewed publication on the marine turtle fishery results by the end of year-3	 1e. Updated data summaries 1f. Comparison of "landings" dataset to "tagging" dataset to calculate percentage tagged (rescued) 1g. Document / correspondence indicating submission of manuscript	
2. Protection of essential seagrass habitat that is critical to the long-term survival of marine turtles and the productivity of sea cucumbers, with a minimum areal target of 10% total cover	2a. A signed memorandum of understanding (MoU), between local turtle fisheries management association (FI.MPA.MI.FA) and the beach-seining communities of the targeted villages, agreeing to a gear exchange program—seine nets in exchange for participation in the Darwin Initiative by year-1 2b. Formation and implementation of a bay-wide local indigenous law (dina) providing total protection to 150ha of intertidal seagrass meadows and partial protection to an additional 250ha; 10% of critical habitat for marine turtles, juvenile fishes, and sea cucumbers, afforded some form of protection in year-2 2c. Working paper summarising results of year-1 seagrass monitoring; progress evaluation 2d. Exclusion of beach-seine activity from sea cucumber farming areas 6 villages by year-2 2e. Working paper summarising results of year-2 seagrass monitoring; progress evaluation 2f. Working paper summarising results	2a. Signed MoU 2b. Signed agreements 2c. Example data / data analyses 2d. Signed agreements 2e. Updated data / data analyses	2. Community acceptance 2g. Sufficient data can be collected to create publishable article

	of year-3 seagrass surveys and the discontinuation of the use of the beach-seine fishing gear	2f. Updated data / data analyses	
	2g. Peer-reviewed publication on the seagrass monitoring results by the end of year-3	2g. Proof of submission	
3. Selection of 120 households per year from 6 coastal villages to participate in the DI project, with 90% of the households benefiting from stable revenue of at least 2.00 USD/day	3a. Workshop on aquaculture techniques	3a. Photos or training materials	3. Any spatial conflicts are resolved, and materials required to implement 120 household projects are available and affordable
	3b. 120 aquaculture projects (sea cucumber / seaweed) in-place and stocked in the 6 targeted villages, with priority given to turtle fishermen and beach-seine fishermen, by year-1	3b. Photos or documents	3g. Sufficient data can be collected to create publishable article
	3c. Working paper summarising results of year-1 data collection: environmental data associated with the sea cucumber enclosures and growth rates/ seaweed productivity; progress evaluation	3c. Example data / data analyses	
	3d. Additional 120 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority given to all other interested community members, by year-2	3d. Photos or documents	
	3e. Working paper summarising results of year-2 data collection: environmental data associated with the sea cucumber enclosures and growth rates/ seaweed productivity; progress evaluation	3e. Updated data / data analyses	
	3f. Additional 120 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority given to the most successful, or productive, participants by year-3	3f. Photos or documents	
	3g. Peer-reviewed publication on the marine turtle fishery by the end of year-3	3g. Proof of submission—email or other document	
	3h. National symposium presenting Darwin Initiative project results hosted by Reef Doctor in the regional capital,	3h. Photos and/or excerpt of presentation	

	Tulear, during the last quarter of year-3		
4. Local optimisation of aquaculture production and creation of expansion strategy by year-3; research objectives are to increase aquaculture production, in terms of growth rate, in experimental plots by at least 15% versus control plots using repeatable, cost-effective methods	4a. Installation of experimental sea cucumber enclosures and seaweed cultivation lines to test different approaches aimed at optimising production in year 1 4b. Working paper summarising results of year-1 4c. Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 3 4d. Creation of a community expansion program for aquaculture projects in-line with the exit strategy for the project by end of year-3 4e. Peer-reviewed publication on the optimisation of aquaculture production by the end of year-3 4f. Development of a GIS-based spatial model to predict site suitability and productivity by end of year-3	4a. Photos and/or the existence of data indicating necessary infrastructure is in-place 4b. Example data / data summaries 4c. Updated data / data summaries 4d. Document created 4e. Proof of submission—email 4f. Results to be included in 4d	4. Same as assumptions above 4e. Sufficient data can be collected to create publishable article

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)

1.1. Meetings and focus groups held with those involved in the marine turtle fishery in the 6-targeted villages to introduce Darwin Initiative

1.2. Marine turtle protection team training on dina management and enforcement

1.3. Annual marine turtle meeting hosted by ReefDoctor and FI.MPA.MI.FA; bringing together national, local institutions, government bodies, NGO's from southwest Madagascar, and stakeholders from the BRB

1.4. Biological monitoring of the marine turtle fishery in the 6-targeted villages of the BRB: 1) fisheries exit surveys, 2) landing surveys, 3) market surveys, and 4) record number of turtles tagged/released

1.5. Working paper and submission for publication

2.1. Development of the MoU agreement on intertidal land-use rights related to the conflict between beach-seine fishing activities and sea cucumber/seaweed farming

2.2. Formation and implementation of a bay-wide local indigenous law (dina) protecting 400ha of seagrass meadows

2.3. Community training on dina management and enforcement

2.4. Periodic stakeholder meetings to facilitate a smooth social transition from capture fisheries to sea cucumber/seaweed farming and resolve any minor conflicts

2.5. Seagrass surveys: data collection on species composition/diversity and density to monitor effects of sea cucumber/seaweed farming infrastructure/activities, and protection status
2.6. Working paper and submission for publication
3.1. Meetings and focus groups held in the 6-targeted villages to implement Darwin Initiative
3.2. Selection of 120 households per year
3.3. Sea cucumber/seaweed farming workshops held; construction and stocking of sea cucumber enclosures in each village
3.4. Continual technical and logistical support for maintenance of enclosures/cultivation lines and sale of sea cucumbers/seaweed
3.5. Socio-economic surveys: changes in poverty level resulting from Darwin Initiative
3.6. Working paper and submission for publication
4.1. Construction and stocking of experimental sea cucumber enclosures/seaweed cultivation lines
4.2. Continuous biological and environmental assessment of productivity
4.3. Working paper(s) and submission of manuscript(s) for publication of sea cucumber/seaweed optimisation studies
4.4. Development of a GIS-based spatial model to predict site suitability and productivity
4.5. End-of-project national symposium to present the results of the Darwin Initiative project

Annex 3 Standard Measures

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
4C	Mariculture Internship program; project staff		International	0	3	3	3	6
4D	Mariculture Internship 10-weeks; project staff		International	0	2	3	2	5
5	Project staff		Madagascar	3	0	3	3	6
6A	Local mariculture project participants	249 men 239 women	Madagascar	240	244	240	488	720
6B	Approx. 1 week of mariculture and technical training per village for 6 villages			6	6	6	12	18
11B	Turtle fisheries /conservation; mariculture optimisation			0	0	2	0	2
14A	EOP Symposium			0	1	1	1	2
14B	Annual regional meetings; WIOMSA international conference			1	0	1	1	2
20	Capital items + mariculture infrastructure			£35,000	£15,850	£15,000	£50,850	£65,850
23	Rufford Small Grants+ FRDA+ Staff salaries (in kind; £30,000)			£46,000	£30,000	£30,000	£76,000	£106,000

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)
Conservation and sustainable use of marine turtle, Southwest Madagascar	Newsletter	Shane Abeare, June 2015	Male	American	Darwin Initiative	http://www.darwininitiative.org.uk/assets/uploads/2014/05/Darwin-Gender-Newsletter-FINAL-26th-June.pdf
Conservation and sustainable use of marine turtle, Southwest Madagascar	Newsletter	Cale Golding, February 2016	Male	Australian	Darwin Initiative	http://www.darwininitiative.org.uk/assets/uploads/2016/02/February-2016-SDG-Newsletter-FINAL.pdf