Darwin Initiative
Final Report

*To be completed with reference to the Reporting Guidance Notes for Project Leaders (http://darwin.defra.gov.uk/resources/) it is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)*

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	ReefDoctor
Partner institution(s)	Turtle Protection Association (FIMPAMIFA), Marine Science Institute (*Institut Halieutique et des Sciences Marines, IH.SM*)
Darwin grant value	£171 500
Start/end dates of project	15 April 2014 – 31 March 2017
Project leader's name	Emma Gibbons
Project website/blog/Twitter	www.reefdoctor.org https://instagram.com/_reefdoctor/ https://twitter.com/ReefDoctor
Report author(s) and date	Emma Gibbons, Cale Golding. May 2017

1 Project Rationale

This project is situated in the Atsimo Andrefena region of Southwest Madagascar. The zone of intervention is around 20k north of the main city Toliara called 'the Bay of Ranobe', a 32k coastal lagoon sub-section of the "Le Grand Recif de Toliara", the third largest coral reef system in the world. The semi-arid, drought-prone climate largely prohibits agricultural activities, and around two-thirds (20,000 people) of the approximately 30,000 thousand people that have settled in the area are entirely dependent on the marine ecosystem for their livelihoods. Acute poverty and limited alternative livelihood opportunities, combined with declining fishery yields, sparks intense competition for the remaining marine resources. The ensuing scramble competition drives further loss of biodiversity, environmental degradation, greater dependence on natural resources and finally entrenched poverty. This project sought to simultaneously offer biodiversity benefits, while alleviating poverty through the implementation of sustainable and practical aquaculture activities. Specifically, income generated through aquaculture was intended to reduce the economic imperative to hunt marine turtles and the use of destructive fishing gear – beach seine nets. By providing sustainable and reliable incomes to vulnerable communities, and promoting the link between healthy marine ecosystems and productive aquaculture activities, this project sought to transition communities from resource consumers to resource managers.

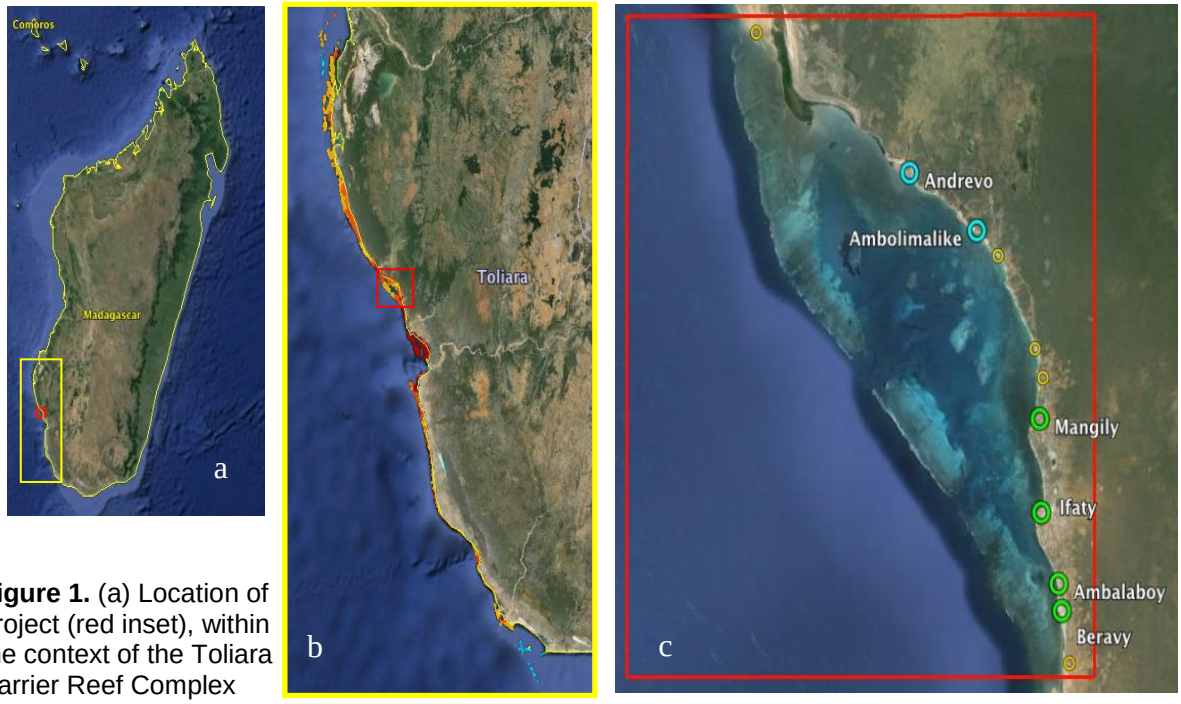


Figure 1. (a) Location of project (red inset), within the context of the Toliara Barrier Reef Complex (yellow inset); (b) "Reefs at Risk" map (World Resource Institute) indicating the geographic extent and varying threat levels to the different segments of the TBRC, and location of the Bay of Ranobe (red inset); (c) 11 of the 13 villages of the BRB (circles), where villages that are sites of sea cucumber ranching projects and seaweed farming projects are indicated by blue and green circles, respectively. (Google Earth, 10 November 2013)

2 Project Partnerships

This Darwin Initiative project was highly collaborative, with a network of partnerships established across government, commercial, and community-based associations.

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.

Collaborations with aquaculture suppliers and seafood exporters have been recognised as critical in the long-term viability of this project, and effort has been made to foster effective partnerships. The lead organisation employed seven COPEFRITO trained aquaculture technicians, to provide support to community farmers, and sponsored the successful training of an additional community member by COPEFRITO. Integration of COPEFRITO technicians into the DI project ensures no disruption to community support at the conclusion of the project. COPEFRITO and IOT conducted regular face-to-face meetings with stakeholders. Memorandums of understanding between the lead organisation, COPEFRITO and IOT helped develop strong working partnerships that extended beyond the DI project. IOT and Reef Doctor have committed to expand community-based sea cucumber farming activities in the zone of intervention, allocating funding to a minimum of 120 new beneficiaries/60 new households funding and 160 new beneficiaries/80 new households. COPEFRITO and Reef Doctor have committed to expand algae farming activities in the zone of intervention to a minimum of 340 beneficiaries/170 new households. This will provide sustainable community-based farming livelihoods for 6% of the 20,000 people that are dependant on marine resources; a total of ***1,154 beneficiaries/577 households*** **by 2019**. COPEFRITO and IOT have provided financial assistance to other conservation initiatives developed by the lead organisation, including mangrove replanting and the development of sustainable tree plantations, as further evidence

of strong and effective partnerships. This partnership recognises the technical and commercial importance of the private sector, while highlighting the community integration and facilitation delivered by the lead organisation.

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, was the primary contact for the project during the first year and a half. Dr Jamal Mahafina, as replacement director was the contact for the second half of the project. The IHSM provided technical advice on the growth of sea cucumbers and seaweeds, and served on the regional aquaculture platform, established through this program, in this capacity. Through these developments, Dr Lavitra was commissioned as lead author on a regional feasibility study exploring the potential expansion of aquaculture. Several students from the IHSM were actively involved to this project: with contributions ranging from paid staff members to the study of this project as a Masters degree thesis dissertation. A regular internship program for students from the IHSM with the lead organisation is now being developed, to foster continued collaborations and effective partnerships.

Ministre des Ressources Halieutiques et de la Pêche, Direction Régional de Tuléar (DRRHP) **(www.peche.gov.mg)**: is the Malagasy, governmental fisheries department, with the General Director, Francois Gilbert, acting as primary contact, and Regional Director as secondary contact. Through this project a full and productive partnership, extending beyond the scope of this DI-project, has been created, where none previously existed. As the project grew, so too did support from the Ministry, with regular communications, both in written reports and face-to-face meetings. The Ministry was integral in granting zoning permission for aquaculture activities, while project outcomes supported delivery of ministry targets, resulting in a truly collaborative partnership. This project became a working model for the potential of aquaculture in the region. Site visits by the National Minister Mr Gilbert, fostered collaboration, culminating in ministerial support to other lead organisation conservation projects. The Ministry further granted the lead organisation the management lease for two fisheries landing buildings, to be incorporated into community-based aquaculture projects. A long and productive partnership is expected to continue beyond this DI-project.

NON-Governmental Partners

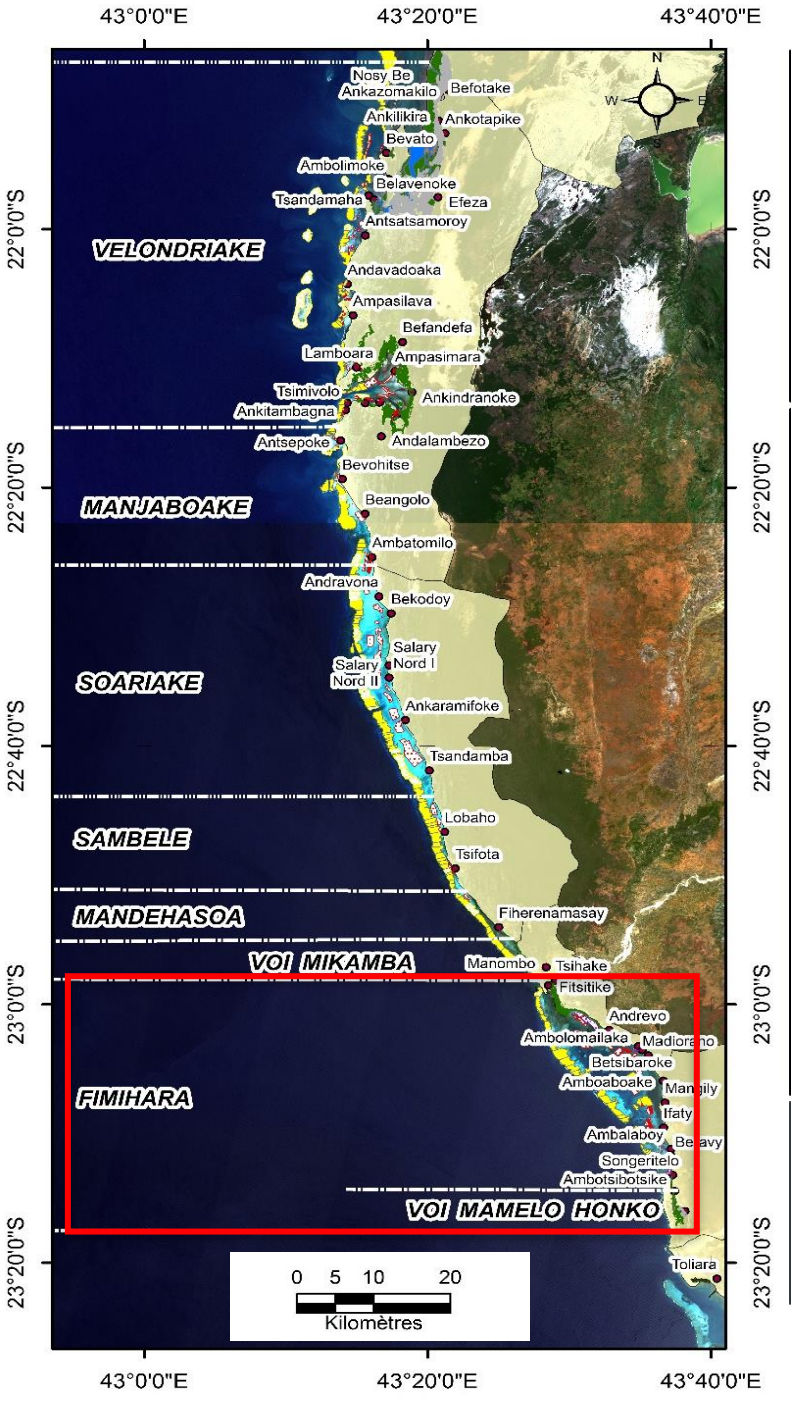
Working partnerships were achieved with NGO's involved in the regional development of community-based aquaculture projects

World Wildlife Fund for nature (WWF) – Since 2015 WWF Madagascar has implemented aquaculture projects in the villages of Beheloke and Befasy in southwestern Madagascar, to helped fishermen increase their income, and has also helped preserve the marine ecosystem.

World Conservation Society (WCS) – Since 2016, WCS southwest Madagascar has implemented community based seaweed aquaculture, and joined the regional aquaculture platform group.

Blue Ventures (BV) - BV participates in community based aquaculture of both sea cucumbers and seaweed, and has partnered with Reef Doctor to share expertise and experiences. Exchange visits, regular meetings and platform participation have fostered a healthy collaborative partnership.

Region aquaculture platform *– Commercial business partners: COPEFRITO and IOT;* ***NGO's:*** *Reef Doctor, WWF, WCS, BV;* ***Government bodies:*** *Regional Director of Fisheries (DRRHP);* ***Institutions****: Institut Halieutique et des Sciences Marines (IH.SM); instigating the establishment of the first regional aquaculture platform group to provide transparency and sustained growth of community-based aquaculture farming in the region, through quarterly meetings.*



Local Associations

Fikambanana Miaro sy Hanasoa ny Ranomasina (FIMIHARA): created in 2007, FIMIHARA is comprised of village elders, chiefs and fishermen concerned about all fisheries, marine conservation in the Bay of Ranobe, and co-management of the marine reserves. As the primary marine association representing the Bay of Ranobe, FIMIHARA became the natural responsible body for aquaculture zoning licenses issued by the Ministry of Fisheries and Marine Resources. As project beneficiaries are also FIMIHARA members, the association has been well placed to facilitate conservation objectives, such as the discontinuation of destructive fishing practices, throughout the zone of intervention, and serve as role models for effective and sustainable aquaculture production. After receiving association building training in the final year of the project, FIMIHARA are well placed to sustain aquaculture activities beyond the DI timeframe.

Fikambanana Mpaniriky Miaro ny Fano (FIMPAMIFA): created in 2012, the Turtle Protection Association, is a sub-association of **FIMIHARA** comprised of village elders and turtle hunters concerned about the over-harvesting of marine turtles, with representatives throughout the 13 villages of the Bay. FIMPAMIFA continues to play an active role in monitoring of the marine turtle fishery, in partnership with the lead organisation, and was integral in the expansion of this monitoring program from two communities at the projects' beginning, to six communities at its conclusion. FIMPAMIFA manages 13 teams of community-based fishers who support the local indigenous law (dina) for the protection of juvenile turtles, and act as community contact points for turtles submitted to the tag-and-release program. As a community association, the support of FIMPAMIFA was critical in facilitating seagrass protected areas established through this project, and in disseminating updates and progress back to the community.

3 Project Achievements

3.1 Outputs

Output 1: 50% reduction in the baseline marine turtle exploitation rate and a potential exit from the fishery: This output was achieved through the direct protection of 1,589 juvenile turtles through the tag-and-release program (indicator 1.1, annex 7.1). This program engaged project partners FI.MPA.MI.FA as community catalysts to engage fishermen in conservation

behaviours. If a juvenile turtle were caught in fishing gear, fishermen would deliver the turtle to a FI.MPA.MI.FA (Miaro Fano – turtle protection team) representatives, assist with the collection of biological data and the tagging and subsequent ocean-release of the turtles. Success of this tag and release program was achieved through the active participation of the whole fishing community, empowering and engaging the community in conservation behaviour to attain long-term conservation objectives. Continued training and support of FI.MPA.MI.FA's turtle protection teams (indicator 1.3, annex 7.1.1) was influential in achieving a success rate of 74.2% of juveniles caught in the fishery surrendered to the tag-and-release program (indicator 1.4, annex 7.3). While this was lower than the targeted 90%, it was not critical to achieve the output, and still reflects positive achievements, where previously no turtles caught in the fishery were released. As a result, the proportion of juvenile turtles killed in the fishery declined, from 37% (average 2012/2013) to 25%. As discussed in greater depth in section 3.2, increasing burden on marine resources driven by drought-exacerbated famine resulted in unanticipated difficulty in achieving marine turtle conservation outputs. Critically, 2015/16 was describes by WCS as the year *'illegal hunting of Madagascar's sea turtles is reaching a crisis level - with the increase in poaching of marine turtles and the 'rampant exploitation' causing great concern when a single sea turtle can be sold at the same price as a fisherman's monthly income'* this was suggested to be driven by the local and Southeast Asia markets (Annex 7.5.). Although absolute turtle mortality increased 6% from the baseline in the Darwin Initiative (DI) project community, continued monitoring of the turtle fishery in a non DI-project community indicated turtle mortality increased 23% over the same period (indicator 1.2, annex 7.2), indicating positive benefits of the project on turtle mortality. Monitoring of the fishery, including active fishermen, indicated that there was no displaced fishing pressure from the project community to the non-project community, and thus observed benefits to the turtle mortality rate are genuine.

Output 2: Protection and mapping (annex 8) 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: This output was achieved successfully, through the formation of local laws (dina) providing protection for over 400 ha of seagrass habitat, with complete protection provided for over 150 hectares (indicator 2.1, annex 8.3) and the exclusion of beach seine activity from sea cucumber farming zones (indicator 2.2, annex 8.2). However, due to the prohibitive cost of materials and long time to maturation of sea cucumbers, sea cucumber farming was restricted to only 2 communities. Communities also decided unanimously, to exclude beach seine activities from villages engaged in seaweed activities, to protect farmers.

Output 3: Selection of 10 community groups per year per target village (n=6) to participate in the Darwin Initiative; with a projected number of people directly participating in the training totalling 720 people and associated family units (ca. 3,600 people) indirectly benefiting by year-3: This output was met with 360 HH provided aquaculture projects of which 267 HH are active and operational projects by the end of year 3 (indicators 3.2, 3.3, 3.4, annex 9.2 and 10.3), and training in aquaculture activities delivered to 720 people from 360 households (indicator 3.1, annex 9.1 and 10.3). Given high demand, the project was extended to an additional community, with a total of 7 villages having access to aquaculture activities. Project activities were presented at a national symposium during the last quarter of year 3 (indicator 3.6, annex 9).

Output 4: Local optimisation of aquaculture productivity through a multi-year investigation into the poorly understood factors affecting sea cucumber / seaweed growth rates designed to provide direct benefits to local sea cucumber / seaweed farmers: Growth rate of seaweed improved through investigation of multiple growth techniques (indicator 4.1, 4.2, 4.3, annex 10.2). Introduction of "long-line" system of seaweed cultivation increased average daily growth rate from 1% to 4.5%, while trials of a new loping method of attaching seaweed of the growth lines further increased average daily growth to 6.9% (annex 10.2). As noted in first year and second year annual reports, sea cucumber experimental trials were hindered by limited availability of juvenile sea cucumbers from suppliers, and the long time to maturation of sea cucumbers required to return meaningful results of studies. Assumption 4 on the project proposal predicts a growth time of 8-9 months to achieve market size. This assumption was based on expert opinion from project partners, but proved to be an underestimation of the time required to achieve market size. Actual time was 11-12 months for the majority of sea cucumbers. Despite these limitations, studies of sea cucumber growth suggested an optimal

biomass in enclosures of 400 g/m^2, to maximise average daily growth, while total biomass should not exceed 500 g/m^2, as after this stage, biomass gains plateau (annex 10.2).

Development of a community aquaculture expansion strategy for the southwest of Madagascar (indicator 4.4, annex 10.1), backed by a spatial model and report predicting site suitability developed by project partners with support of the lead organisation (indicator 4.6, annex 10.1), substantiated by a Memorandum of Understanding between the lead organisation and IOT, provides sustainability of project activities and a strong legacy after the end of the DI funding.

Achievements in outputs

Output 1:	50% reduction in the baseline marine turtle exploitation rate and a potential exit from the fisheries.		
	Baseline	Change recorded by end of project	Source of evidence
Indicator 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	1,589 juvenile turtles tagged-and-released in all communities over life of DI project.	i.e. Annex 7.1, Section 2 of the report
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	Ifaty (DI project community) baseline: 467. Fitsitiky (non-DI project community) baseline: 177. Baselines based on annual average harvest rates from communities over the April 2012 – March 2014 period.	Turtle mortality in the DI project community of Ifaty increased 6% to 494 turtles killed in year three. Turtle mortality rates from non-DI project community Fitsitky rose 23%, to 219 killed in year three. 485 turtles tagged-and-released in Ifaty over life of DI project.	i.e. Annex 7.2, Section 3.1, 3.2 of the report
Indicator 1.3 Workshops and training to develop the capacity of FI.MPA.MI.FA, FI.MPA.MI.FA's marine turtle protection teams, and turtle network year 1 - 3	None trained	Two FI.MPA.MI.FA representatives per participating community trained (2*6 communities = 12 persons), with continuous support provided to the thirteen Miaro Fano teams (65 fishers) involved in implementing the indigenous law (dina) to protect juvenile marine turtles. Bay-wide communication protocol developed to facilitate the rapid response of turtle tagging teams	i.e. Annex 7

Indicator 1.4 90% of juvenile marine turtles captured in the fishery are tagged and released by year 3	0% tagged	74.2% of juvenile turtles captured in the fishery were released in year 3.	i.e. Annex 7.3, section 3.1, 3.2 of the report.
Indicator 1.5 Peer-reviewed publication on the marine turtle fishery results by the end of year-3	No publications exist	Manuscript "The Turtle Fishery in the Bay of Ranobe, Madagascar" submitted to peer-reviewed publisher *Indian Ocean Turtle Newsletter*.	i.e. Annex 5

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.		
	Baseline	Change recorded by 2017	Source of evidence
Indicator 2.1 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 created restricted-use zones covering 945 hectares. Total protection provided to 154 hectares of patchy seagrass over aquaculture zones, and an additional 100 hectares of seagrass habitat in the coastal waters of the community of Andrevo.	i.e. Annex 8, *biotope Maps, dina, seagrass protected zone*
Indicator 2.2 Exclusion of beach-seine activity from sea cucumber farming areas 6 villages by year-2	No agreements exists	Agreement reached in all villages to protect Mariculture infrastructure and provide a buffer zone surrounding farms (completed in year-1)	Annex 8.2 *Signed agreement(s); reproduced from Year-1 report*
Indicator 2.3 Peer-reviewed publication on the seagrass monitoring results by the end of year-3	No publications exist	Manuscript prepared for submission	i.e. Annex 8.1, bay-wide biotope mapping *Publication; in-progress annex 5*

Output 3:	Selection of 10 community groups per year per target village (n=6) to participate in the Darwin Initiative; with a projected number of people directly participating in the training totalling 720 people and associated family units (ca. 3,600 people) indirectly benefiting by year-3.		
	Baseline	Change recorded by 2017	Source of evidence
Indicator 3.1 Workshop on aquaculture techniques	No aquaculture skills	Aquaculture skills training delivered to 720 people from 360 households	i.e. Annex 9.1,
Indicator 3.2	No aquaculture activities	124 aquaculture projects established in year 1	i.e. Annex 9.2,

60 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			
Indicator 3.3 Additional 60 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 aquaculture activities	125 aquaculture projects established in year 2. Total number of aquaculture projects: 124(YR1) + 125(YR2) – 5(drop-out) = 244	i.e. Annex 9.2,
Indicator 3.4 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	No aquaculture activities	111 aquaculture projects established in year 3. Total number of aquaculture projects: 124(YR1) + 125(YR2) + 111(YR3) – 93(drop-out) = 267	i.e. Annex 9.2, *photos, satellite maps, contracts, association letters*
Indicator 3.5 Peer-reviewed publication on seaweed growth by the end of year-3	No publication exists		i.e. Annex 5
Indicator 3.6 National symposium presenting Darwin Initiative project results hosted by ReefDoctor in the regional capital, Tulear, during the last quarter of year-3		National seaweed aquaculture symposium in March 2017.	*http://www.peche.gov.mg/2017/06/atelier-de-relance-de-lalgoculture-a-toliara/*

Output 4:	Local optimisation of aquaculture productivity through a multi-year investigation into the poorly-understood factors affecting sea cucumber / seaweed growth rates designed to provide direct benefits to local sea cucumber / seaweed farmers.		
	Baseline	Change recorded by 2017	Source of evidence
Indicator 4.1 Installation of experimental sea cucumber enclosures	None exist	3 enclosures constructed to test effects of sea cucumber stocking density; long line	i.e. Annex 10.2,

and seaweed cultivation lines to test different approaches aimed at optimising production in year 1		and off-bottom experimental farms constructed in year-1	
Indicator 4.2 Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 2	None exist	Data analyses of year-2 data	i.e. Annex 10.2,
Indicator 4.3 Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 3	None exist	Data analyses of year-3 data	i.e. Annex 10.2
Indicator 4.4 Creation of a community expansion program for aquaculture projects in-line with the exit strategy for the project by end of year-3	None exist	Integration of aquaculture activities with program partners COPEFRITO and IOT established expansion program for aquaculture projects: additional 60 households engaged in sea cucumber farming by end of 2017	i.e. Annex 10.1 *expansion program document, contract* - Section of the *MHSA report*
Indicator 4.5 Peer-reviewed publication on the optimisation of aquaculture production by the end of year-3			i.e. Annex 5
Indicator 4.6 Development of a GIS-based spatial model to predict site suitability and productivity by end of year-3		Southwest Madagascar examination of aquaculture site suitability	i.e. Annex 10.1 Section of the *MHSA report*

3.2 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.

This project was successful in achieving its intended outcome of marine turtle protection through the implementation of sustainable aquaculture-based livelihoods. While the number of turtles that were killed in the fishery increased 6% from the baseline in the DI-project community of Ifaty, in the non-DI project community of Fitsitiky, turtle mortality increased 23%,

suggesting that the project was successful in limiting the number of turtles killed (annex 7.2). The live release of 1,589 turtles through the tag-and-release component of this program provides further evidence of this project's influence in preventing turtle mortality (annex 7.1). Given that these turtles would have been killed without the intervention of the DI-project, the indicator 1 target of achieving a **50% reduction in turtle mortality (234 turtles per year) has been exceeded**. Despite this, the number of turtles caught in the fishery has increased since the baseline generated in 2012/13, albeit at a slower rate than in other communities. This is likely due to the continued pressure on marine resources, and exacerbating poverty of people not involved in this DI-project. Successive years of drought, exacerbated by El Nino climate conditions during the DI-project placed unexpected pressure on marine resources, and increased 'food-security' driven migration to the coast. Publication of the **Global Hunger Index (GHI) 2016** highlights the extent of the issues faced by rural Malagasy people with Madagascar having the 2nd highest global rate of stunting and the 5th highest rate global rate of percent population undernourished (Annex 14.1). The GHI component indicators (undernourishment, child stunting, child wasting, and child mortality) reflect deficiencies in calories as well as in micronutrients. Thus, the GHI reflects both aspects of hunger. While the impact of natural disasters was recognised in the assumptions of the original log-frame, these focused predominantly on weather events immediately impacting aquaculture production, such as cyclones, and appropriate emergency action plans were developed. The influence of continued drought and severe famine, as not impacting directly on aquaculture productivity, but rather through changing social contexts, were less amenable to mitigation. In response to high demand stemming from these social factors, the scope of the DI-project was expanded, incorporating an additional community beyond the six that were described in the original log-frame.

The transition of fishing communities to sustainable aquaculture-based livelihoods hinged upon the ability of communities to generate sufficient income from their new livelihood. Indicator 2 targets a $1 USD/day increase in revenues. This was achieved for some farmers, most notably those engaged in sea cucumber activities, with the 25 households farming sea cucumbers since year 1, earning a profit of $1.15 USD/day over the final 12 months of the project (annex 11). Recognising the profitability of this activity, and responding to the second year annual review, this form of aquaculture was amplified, with an additional 20 households commencing sea cucumber farming in the final year of the project. However, given the maturation time of sea cucumbers (approximately 12 months), these households have not yet received any income from their activities. Seaweed farming generated less income for project beneficiaries, but given the lower start-up cost, a greater number of community members were able to participate in this form of aquaculture. Given the worsening social and environmental context of the project, and faced with unrelenting demand from communities, seaweed aquaculture was widely implemented, providing smaller benefits per individual, but to a greater quantity of people than possible through sea cucumber aquaculture.

Average income generated through seaweed farming in the final month of the project was $0.15 USD/day, however incomes were highly variable, both by community and by month. The most profitable household generated $1.61 USD/day in their highest earning month, demonstrating that this type of aquaculture can provide meaningful incomes (annex 11). Governance to prevent significant losses of aquaculture product due to theft, disease or predation, was recognised in the assumptions of the outcome. For sea cucumbers this was achieved, with the construction of guard towers and nets providing protection from theft and predation. For seaweed farmers, disease was a continual problem in the final year of the project. On two separate occasions, quarantine measures required the complete removal of highly contagious, diseased seaweed afflicted with Epiphytic Filamentous Algae (EFA) found by technicians in the community-based farms. This directly impacted household incomes, as not only was the farming space required to lie fallow for three months, but once farming activities recommenced, two months minimum were necessary to return the farm to its previous production capacity. Community training in the recognition of seaweed disease, strict management protocols including a disease communication 'hotline' with other aquaculture producers in the region, and regular inspections were successful in mitigating the extent of disease impact, however it still directly influenced the income generated through this activity, and was responsible for some households leaving the project. As the spread of seaweed disease was largely related to the level of care households took in maintaining their seaweed

farm, a number of households were considered disease vectors, and were removed from the project. The combined income from both forms of aquaculture over the last year of the project was $27,385 USD, with an average daily income of $0.3 USD benefiting 247 households.

Sustainability of aquaculture activities is a critical component of this project, ensuring poverty alleviation and biodiversity benefits are maintained. Sea cucumber farmers in this project have demonstrated complete financial independence within two years (annex 11), paying for their own juvenile sea cucumbers, and guardian wages. Together with financial and business training provided to all aquaculture beneficiaries in year 3 (267 households, annex 12), communities are well positioned to maintain and grow their activities. Training incorporated: marketing, negotiation tactics, investment strategies and accountancy.

Seagrass meadows, as critical habitat for marine turtles were granted protection in excess of the indicator 3 target of 250 hectares limited use, and 150 hectares no-take zones, with 945 hectares granted restricted use protection, and a further 254 hectares granted full protection (annex 8.3). Full protection status was granted for aquaculture zones, while restricted use zones allowed for gleaning, and fishing with certain approved gears, but not the use of destructive beach seine nets.

The longevity of sustainable aquaculture livelihoods was confirmed through the creation of an expansion strategy (indicator 4, annex 10) with program partners Copefrito and IOT committing to an additional 140 sea cucumber units by the end of 2017. Optimisation of aquaculture activities through this program resulted in the first fully independent, community-managed sea cucumber farming program in Madagascar, achieved within two years. Sea cucumber farmers are now, and have been for the previous 12 months, responsible for all financial outlay, including the cost of juvenile sea cucumbers, and monitoring of pens against theft. With accountancy and business training provided as part of this program, community aquaculture participants have the skills to set investment targets and expand their farming activities according to their needs, and they exercise complete responsibility for the management of their enclosures.

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

Impact statement from logframe: 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.

This project contributed significantly to the eradication of extreme poverty, through sustainable aquaculture activities that generated a total income of $27,385 USD in year-3 of the project, through the harvest of aquaculture products. Households (247) across seven communities, two communes accrued financial benefits and knowledge. Biodiversity has been safeguarded through the direct protection of 1,589 marine turtles, the implementation of over 1,000 hectares of protected seagrass habitat, and the engagement of community members in direct conservation action.

Household surveys conducted in the final year of the project indicate that aquaculture activities established through this program are the highest income generating activity for 21% of respondents, with another 31% reporting aquaculture to be the second greatest income earning activity in which they participate (annex 13). Given that 74.2% of respondents in the same survey reported regular participation in at least 2 income-generating activities, these results suggest that the income generated from aquaculture contributes substantially to the income of households in these rural communities, and provides a sustainable alternative to income generated through fishing.19% of survey respondents indicated that aquaculture is the income generating activity in which they spend the most time, directly translating into reduced time/effort spent on extractive activities like fishing, resulting in additional biodiversity benefits.

Achieving the project impact relied on the ability of sustainable aquaculture activities to generate comparable incomes with those generated by turtle hunting. This was realised, with income from aquaculture exceeding turtle hunting by $3,935 USD in the final 12 months of the project (annex 7; annex 11). Through consideration of habitat protection, engaging

stakeholders in conservation oriented behaviours, and addressing the economic drivers of biodiversity destruction, **this project delivered a balanced and holistic impact on biodiversity and poverty alleviation**.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Contribution to Global Goals for Sustainable Development (SDGs)

Goal 1: End poverty in all its forms everywhere - In the last 12 months of this project, aquaculture activities have generated a total of $27,385 USD. This income has been realised by 247 households, representing a real and substantial boost to rural incomes, and marked progress towards ending extreme poverty, measured as those living on less than $1.25 USD.
Goal 5: Achieve gender equality and empower all women and girls – The project is designed to offer equal access to women and men. However, women generally are the top producers and it is common to have more women interested in this occupation contributing towards the full and effective participation of women in economic activities. Increased economic opportunities has provided greater occasion for women to be involved in community decision making.
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all - This project has provided new, accessible, sustainable and meaningful employment opportunities, in a region characterised by limited livelihood opportunities.
Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development - 945 ha of seagrass have received formal protection, as well as an additional 250 ha of no-take zones created through aquaculture zoning in this project. Transitioning fishermen from using destructive fishing gears to sustainable aquaculture activities promotes ecosystem recovery and maximises the productivity potential of the ocean.

4.2 Project support to the Conventions or Treaties (CBD, CMS, CITES, Nagoya Protocol, ITPGRFA))

This project has made a localised but meaningful contribution to Madagascar's objectives under the Convention on Biological Diversity. Through the establishment of a system of marine protected areas and no-take zones encompassing over 1,000 ha; local biodiversity is conserved. In promoting the link between the protection of ecosystems, healthy natural habitats, and productive aquaculture zones, communities are provided economic and social incentives to conserve biodiversity. Through the implementation of sustainable aquaculture-based livelihoods, the project achieved compatibility between sustainable resource use and the need for the conservation of biological diversity.
This project aligns with the goals and targets of the Strategic Plan for Migratory Species, under the Convention on Migratory Species, especially:
Target 2: The value of marine turtles and their seagrass habitats have been incorporated into local development and poverty reduction strategies, through the implementation of aquaculture-based livelihoods.
Target 4: Fishing practices, destructive to seagrass habitats have been discontinued as prerequisite for community access to aquaculture-based livelihoods.
Target 6: The initiation of a tag-and-release program for juvenile marine turtles caught in the fishery promotes reduction of adverse affects from fishing and hunting on this species.
Target 11: Marine turtles and their habitats are maintained, while provisioning of aquaculture-based sustainable livelihoods provides for the needs of local communities, the poor and vulnerable.
Target 14: The traditional sustainable use of marine turtles is respected.
Target 15: Biological information gathered from monitoring of the turtle fishery, as well as tag-and-release data, contributes to awareness and understanding of turtle populations in the region, and is submitted to international databases.

4.3 Project support to poverty alleviation

As the humanitarian situation deteriorates in Madagascar (Annex14.1), success in conserving the marine environment is unequivocally linked to the ability of fishers to obtain sufficient profits from aquaculture to halt fishing activities. This project's investement in community-based aquaculture is directly concerned with poverty alleviation, providing communities with the

foundation for a sustained pathway out of poverty, while promoting re-investment into rural community facilities to provide a healthy and happy living-environment for families. Indicator 2 of the project outcome relates to improved livelihoods: targeted households will benefit from a 1 USD/day increase in revenue by year three. Poverty, in monetary terms is directly monitored through the harvesting and sale of aquaculture products. Sea cucumber farming proved to be the more profitable aquaculture activity for communities, with farmers generating an average profit $1.15 USD/day. Seaweed farming was less profitable on average, but still offered communities the opportunity to generate considerable income, with the most profitable household generating $1.61 USD/day in their best month. In total, impoverished communities generated $27,385 USD in the final 12 months of the project, with an average benefit of $0.30 USD/day going directly to 247 households (annex 11). 21% of respondents in household surveys across the zone of intervention indicated that aquaculture is the greatest income earning activity for that household (annex 13).

4.4 Gender equality

This project was specifically designed to be accessible to both men and women, by utilising the intertidal region of the ocean for aquaculture activities (women are usually restricted from extracting marine resources by water depth). To ensure active participation of women, households were required to be represented by at least 50% women. Although surveys conducted in the final year of the project indicated only 29% of women were actively making an income from aquaculture activities (annex 13), intent to participate is much higher according to the number of women formally submitting signed demands to enter the project; per-ob.. This is suggested to be on account of the ethnic norms of low risk taking behaviour and or contextual vulnerability of fisherwomen in Atsimo-Andrefena in contrast with fishermen, for whom **ethnic norms of risk taking** are much higher due to the probability of loss, injury, or death every time they go fishing (Huff 2014, Tucker *et al* 2011).

> *"Among the ethical dimensions of risk in southwestern Madagascar is the shared understanding that risk is an inevitable part of subsistence. In contrast to Western ideals of a risk-free world, Malagasy understand that living requires facing risk, and working hard to live well demonstrates bravery in face of probable loss, injury, or worse—death without possibility for funeral, if one's body is lost at sea, at night, or in distant lands. This dread risk speaks to the social and emotional sides of risk for rural Malagasy" -* ***Beyond mean and variance:Bravery, danger, dread, and magic in southwestern Malagasy perceptions of risk. Tucker et al 2011***

Initially, the project had to address issues around the notable NGO and university aquaculture failures in this region – Between September 2008 and September 2010 the NGO Trans'Mad-Développement (http://www.transmad.org) implemented community-based sea cucumber farming projects and in 1989, under the aegis of the Institut Halieutique et des Sciences Marines (IH.SM, Toliara) implemented community-based seaweed farming, both in the area of intervention and both proved unsuccessful. Community-perception of the initial risk was too high for most women, however after three years of success, more and more women are taking the decision and/or risk to invest into aquaculture. We expect this to increase participation by women in aquaculture to over 50%. Despite the current shortfall, there is clear evidence that this project meaningfully contributed towards the effective participation of women in economic activities, and provided an opportunity for women to develop an independent source of income. Increased economic opportunities provided greater occasion for women to be involved in community decision-making. This is exemplified by Madam Perline; president of the community association of seaweed farmers established through the DI-project.

4.5 Programme indicators

- Did the project lead to greater representation of local poor people in management structures of biodiversity?

Through this project, FIMIHARA, the community-based association of local fishermen for the zone of intervention, were officially recognised by the Regional Director of Fisheries and Marine Resources, as the governing body responsible for aquaculture activities in constituent communities.

- Were any management plans for biodiversity developed? **Yes**

Seagrass protection is under the community-based marine management program; the ban on destructive gear 'beach seine (annex 8.2) and seagrass protected areas (annex 8.3; PV seagrass)

- Were these formally accepted? **Yes**

The seagrass protection objectives were accepted by the community-based associations FI.MI.HA.RA, FI.MPA.MI.FA, and the local community in semi-formal meetings held by FI.MI.HA.RA, FI.MPA.MI.FA and RD.

- Were they participatory in nature or were they 'top-down'? How well represented are the local poor including women, in any proposed management structures?

Management plans are **'bottom-up' and participatory** in nature through FI.MI.HA.RA, FI.MPA.MI.FA (male and female association members) and the seaweed association who's president is a woman. Support was also provided by; commune mayors of Belelanda and Manombo; regional ministry of fisheries DRRHP and ministry environment DREEF.

- Were there any positive gains in household (HH) income as a result of this project? **Yes** See section 4.3
- How many HHs saw an increase in their HH income? **All HH; total 247** received direct cash benefit's. See section 4.3 for more details
- How much did their HH income increase (e.g. x% above baseline, x% above national average)? How was this measured?

Current regional incomes fluctuate between $0.7-1.4USD/day, with the majority of incomes derived from fishing and the extraction of marine resources. Average incomes increased by $0.30 USD/day. See section 4.3 for more details.

4.6 Transfer of knowledge

This project transferred knowledge to practitioners and policy makers through a number of mediums. Quarterly progress reports submitted directly to the Regional Director of Fisheries and Marine Resources, provided policy makers a clear understanding of the benefits and knowledge associated with this project. Presentation of the project work at a National Symposium in Madagascar (http://www.peche.gov.mg/2017/06/atelier-de-relance-de-lalgoculture-a-toliara/) provided further opportunity to transfer knowledge to a wide audience. The lead organisation presented the benefits of community-based aquaculture on biodiversity and poverty alleviation to ministry, visiting dignitaries and industry experts at a second symposium in May 2017. The host organisation is a founding member of a regional seaweed aquaculture platform, drawing members from NGO's, research institutions, commercial aquaculture producers and government ministries. Meeting regularly, this platform provides an opportunity to share experiences, transfer knowledge of new farming techniques, and improve the farming system to maximise biodiversity and poverty alleviation gains throughout the region. Submission of research to the Indian Ocean Turtle Newsletter, and submission of turtle tag-and-release information to an international database (TOORSOI) promotes knowledge sharing and provides information about marine turtle populations. Submission of academic abstracts to the Western Indian Ocean Marine Science Symposium, to be held in September 2017, further provides opportunities to share knowledge regarding this project. This project has always sought to serve as a working model for the conservation of biodiversity in the region, with transfer of knowledge a key facilitator in developing practical conservation solutions.

Did the project result in any formal qualifications?

Seven Malagasy people (male) received formal qualifications as aquaculture technicians.

4.7 Capacity building

During this project, Lavitra Thierry (male), in-country project partner as director of the research institution Institut Halieutique et des Sciences Marines (IHSM) was promoted to the position of Director of a newly created government ministry, the Ministry of Ocean Governance – SEMer

5 Sustainability and Legacy

All poverty alleviation achievements will continue after the end of the project period. Throughout this project, the host organisation has committed to developing a robust and viable aquaculture industry, with training delivered to community members to ensure they have the skills and expertise necessary to maintain their aquaculture activities beyond the conclusion of the project. All aquaculture technicians will continue in their current roles, with funding provided by the host organisation. As poverty alleviation benefits continue to accrue to the community, biodiversity conservation is also expected to continue. Recent commercial investment into Indian Ocean Trepang (IOT) by Aqua-Spark (*an investment fund with a focus on sustainable aquaculture businesses around the world*) who invested $2.75 million in January 2017 to be put towards a new site – positioning the company to become the world's leader in growing sea cucumbers - http://www.aqua-spark.nl/portfolioitem/indian-ocean-trepang/. IOT were also awarded the Blue Economy Challenge (grants of up-to *US$550,000*) to invest into the development of the commercial sea cucumber operation, including the development of community-based farming model http://theblueeconomychallenge.com/fellow/indian-ocean-trepang/. The current success of regional aquaculture also attracted the investment of the World Bank ***Pôles Intégrés de Croissance (PIC2)*** who intend to invest in seaweed and sea cucumber farming and aim to provided substantial development opportunities for community-based aquaculture farming in Atsimo-Andrefena.

Through this project and associated transfer of knowledge with ministerial bodies, aquaculture is now firmly recognised within Malagasy government, as a priority area for development. This is evidenced by the formulation of an Annual National Symposium of Fishing and Aquaculture in 2016, the first such symposium in 4 years. Following this symposium, the national minister of Fisheries and Marine Resources visited the host organisation, and presented the community with aquaculture materials to demonstrate governmental support to this growing industry. In-country project partner Lavitra Thierry was lead author on a feasibility report investigating the potential to expand aquaculture in the Southwest of Madagascar, a report commissioned by the World Bank, ***Pôles Intégrés de Croissance (PIC2)*** in the final year of the project – further evidence of the increased recognition and role of aquaculture in poverty alleviation and biodiversity conservation, in regional policy.

6 Lessons learned

The core premise underpinning this DI-project is that the provision of sustainable livelihood opportunities will result in positive conservation-oriented behaviour from impoverished communities. The assumption that income generated from sustainable aquaculture will replace income generated from unsustainable, destructive or illegal fishing, as an act of choice by communities was not immediately validated. Although among the ethical dimensions of risk in southwestern Madagascar is the shared understanding that risk is an inevitable part of subsistence, people are often reluctant to adopt perceived 'high-risk' livelihood options. It is suggested previous failed aquaculture operations may have influenced risk preferences and behavior even if evidence supported aquaculture in generating increased wealth, compared with fishing activities that provide less income. Thus, attempts to offer access to aquaculture activities through forfeiture of destructive fishing activities was initially poorly received. Had the benefits of aquaculture livelihoods been more widely accepted, this proposal would have been more readily accepted. It was not until the second year of the project, when benefits from aquaculture were consistently observed, was it possible to meaningfully discuss discontinuation of destructive fishing methods and protection of seagrass habitats with communities.
While promotion of the link between healthy ecosystems and productive aquaculture farms was effective in establishing seagrass protection, it provided little incentive for the direct protection of marine turtles, the targeted species for biodiversity conservation in this project. Without a tangible benefit that turtles provided to aquaculture activities, and the continued high market value offered for them, it remained a challenge to reduce turtle hunting. While increased time spent on aquaculture activities necessarily resulted in less time available for fishing, a stronger feedback mechanism between the conservation of turtles and increased aquaculture production would have benefited the program design.

The project timeframe described the addition of 60 households to the project each year, meaning in the final year, participants had less than 12 months to accrue benefits. As with learning any new skill, communities were slow to develop expertise, and incomes in the initial stages of farming were typically low. As communities developed competency in aquaculture, they invested more time in the activities, and their incomes increased along with the size of their farms. The result being that many beneficiaries recorded minimal income gains by the conclusion of the project, despite progress made. A greater focus during the first year of the project to incorporate more beneficiaries would have allowed more time for benefits to accrue, and more tangible poverty alleviation results at the project's conclusion.

While attempting to provide a comprehensive project, the research component was overly ambitious, and detracted from the core objectives of marine turtle conservation and poverty alleviation. Resources for community support and development were under allocated in the project budget, with resources instead directed towards research components. A more streamlined project allowing greater support to community development would have proven beneficial.

6.1 Monitoring and evaluation

Internal - The project design has not changed significantly from the proposed log-frame. The fishing gear exchange program planed for year 1 (output 2.1) was revised, as it was not required to achieve the output of seagrass protection. The submission of annual working papers was also not required under an approved revision.

The lead organisation's monitoring and evaluation purpose was to generate objective evidence of progress in the implementation of planned activities, and in the achievement of prescribed outcomes. To this end, we established a tiered monitoring approach linking routine program monitoring, targeted studies and annual performance reviews. Routine program monitoring was an ongoing process to track core indicators over time, document progress and identify areas requiring special attention. Data for routine monitoring was collected from field-based technicians and evaluated by project leaders. Examples of such data are the number of ropes employed by communities to grow seaweed, the quantity of sea cucumbers harvested every month and the number of marine turtles captured in the fishery. The indicators for evaluation of routine program monitoring are based on the outcomes and outputs of the log-frame.

Targeted studies formed the second level tier, and represent short-term, specific efforts to assess impacts of particular project objectives and fill gaps identified by routine monitoring. They address precise questions to foster organisational learning and provide feedback on program policies and initiatives. Examples of targeted studies involve a cross-method comparison into the productivity of multiple techniques for growing seaweed, and questionnaire surveys of families to determine the perceived impact of aquaculture on employment.

Poverty alleviation was practically monitored and evaluated through the monthly harvesting and sale of aquaculture products, leading directly to income generation for participating communities. Difficulties arose from the discrepancies between observed yields in trial aquaculture activities conducted by the lead organisation, and those observed by communities. A continual challenge for the project was finding the balance between providing as much support to communities as possible so they can maximise their income, while still ensuring the communities are responsible for their own outcomes. A farmer evaluation formula based on specific performance criteria was developed to track the progress of aquaculture activities, and identify those farmers that required additional support or merited increased materials. This formula proved to be highly practical and despite the requirement of increased data collection, the project would have benefited from its application sooner.

Recognising the multidimensional nature of poverty, this project conducted the first in-depth, multidimensional poverty survey of the Bay of Ranobe, as a targeted study, to asses project influence beyond the purely monetary sphere (annex 14). Following the Oxford Poverty and Human Development Initiative, Acute Multidimensional Poverty Index, indicators across the dimensions of health, education and standard of living identified 88% of respondents as living in acute multidimensional poverty. Standard of living deprivations were the most widespread.

Given the investment in resources required to conduct and analyse the multidimensional poverty survey, and the longer than expected time required for benefits to accrue to beneficiaries, it was not practical to conduct this survey a second time within the life of the DI project. A second round of surveys is expected in 2017, to capture the extent of project change on multidimensional poverty.

Monitoring of the turtle fishery has been on-going in a single community within the Bay of Ranobe since 2008, and in a second community since 2012, providing baseline levels of turtle harvest. During the life of the DI project, monitoring increased to six communities, incorporating those both within and external to the project. This allowed comparison of turtle mortality rates in both project and no-project communities, and the detection of external stressors on harvest levels. The juvenile turtle tag-and-release program, initiated through this DI project, was limited to communities involved in aquaculture activities, providing direct evaluation of the number of turtles protected through the program, but without comparison of the relationship between aquaculture activities and turtle tagging by the community.

Internal/external cross-sector - Annual performance reviews comprised the third tier of the monitoring and evaluation strategy. These comprehensive meetings with core program staff, partners, and organisational directors provided opportunity to re-assess project design, targets, and timelines, with consideration of the results of regular monitoring and targeted studies. Review sessions allowed a forum to comprehensively evaluate activities, outcomes, and outputs with respect to the project impact and changing project context.

These levels of monitoring and evaluation were linked, with synthesis of information across tiers. Annual performance reviews utilised the indicators of routine monitoring to track broad-scale progress, while also supporting the implementation of targeted studies. When feasible, project partners were included in the monitoring and evaluation process. Quarterly reports, generated through routine program monitoring were submitted to project partners, including Malagasy ministries, providing regular progress updates. Quarterly review sessions with aquaculture partners COPEFRITO and community farmers allowed contextual comparisons of progress and identification of challenges. Evaluation from COPEFRITO indicated the need to increase the amount of materials to productive farmers, and this was useful in increasing farmers' profits. Bi-annual site inspections of aquaculture farms by COPEFRITO provided further routine feedback, with a mid-project aquaculture site evaluation by international food and industrial producer Cargill; providing improvements to the farming system.

External evaluation - Reef Doctor hosted multiple project evaluation site-visits from the European Union, World Bank, Madagascar's Minister of Fisheries (MRHP), Minister of Ecology, environment, and Forests (MEEF). During 2016 Reef Doctor, along with all organisations involved in aquaculture, was requested by the Malagasy government to provide open-access privileges, (Inc. personal interviews) to the World Bank group '***Pôles Intégrés de Croissance***' (PIC2) commissioned to provide an in-depth evaluation of aquaculture community-based and commercial projects (Annex 10).

6.2 Actions taken in response to annual report reviews

The second year annual review asked for a clear description of the monitoring and evaluation strategy. This is provided in section 5.1. The review asked for details on the roles of partners, specifically the IH.SM. This is provided in section 3. The review also asked for details on sea cucumber optimisation and seagrass studies. These are discussed in section 2. Sea cucumber optimisation studies were restricted by the longer time required to produce adult sea cucumbers, and thus to provide meaningful conclusions, and by the expense of materials needed to build test facilities. The previous annual review questioned the viability of seaweed as a sustainable alternative livelihood, given the larger incomes witnessed by sea cucumber farmers, and encouraged greater investment in the sea cucumber aspect of aquaculture activities. Despite the large time frames necessary to achieve profitability via sea cucumber farming (minimum time to initial harvest – 12 months), in the final year of the project twenty (20) new households were provided sea cucumber farming materials and juvenile sea cucumbers to commence the farming process, bringing the total number of household to 45. Supply issues of juvenile sea cucumbers with IOT were resolved quickly following the previous annual report, and existing sea cucumber farmers have been regularly stocking juveniles *at their own expense*

(over 25,000 juveniles stocked in the previous 12 months), demonstrating the sustainability of this activity after the life of the DI-funding. Construction of a watchtower in the sea cucumber community of Andrevo provided further support to farmers, allowing for nightly monitoring of theft and a platform from which to survey maintenance of the structures. To promote productivity of seaweed farmers, seven (7) COPEFRITO trained aquaculture technicians were employed by Reef Doctor, with an additional farmer employed as a technician after successful completion of training. Integration of seaweed farming into COPEFRITO's technician evaluation program provided timely feedback and promoted good guidance to farmers with increases in productivity and associated incomes the result.

The previous annual review encouraged the strengthening of relationships with project partners to ensure sustainability after the DI-project, and this has been achieved with Memorandums of Understanding developed between IOT, COPEFRITO and the lead organisation. A student internship program has been developed with the IH.SM to provide students practical experience in marine research, while a lasting relationship has also been fostered with the Ministry of Fisheries and Marine Resources. See section three for full details on project partnerships.

The previous review recognised achievement in the protection of juvenile turtles, but requested attention to the protection of adult marine turtles. As the consumption of turtle meat is a traditional practice in the southwest of Madagascar, and this project respects the traditional sustainable use of this marine resource under the Convention on Migratory Species, a complete ban on the harvest of marine turtles was not feasible. Instead, the lead organisation has met with ministers from the Department of Fisheries and Marine Resources, as well as regional and local law enforcement agencies (Dina-be) to enact policies on the sale of turtles and their products. This policy is aimed at stopping the commercialisation of marine turtle meat without infringing on traditional user-rights of indigenous communities. These policy changes will be integrated into regional and community-level laws within the next 12 months.

The previous review requested further detail on the sustainable tourism aspect of this project. Community-based aquaculture and turtle protection initiatives undertaken through this project are at the core of an international volunteer program that is distinctly separate to other volunteer programs offered by the lead organisation. This program allows visitors the opportunity to work alongside community aquaculturalists, assisting with sea cucumber monitoring and harvests, maintaining a seaweed nursery to provide seedlings to new farmers, and support sale events. Community aquaculture volunteers are provided a cultural immersion experience, including intense language lessons in the local dialect, and transitory homestays with project beneficiaries. Visitors on shorter trips are offered guided excursions to aquaculture farms, with presentations on the DI-project to promote awareness. Tourists are also trained in turtle tagging procedures and where practical, assist in the release of tagged individuals. All money accrued through tourist and volunteer programs are directed back into project activities that directly benefit the community, such as the building of a watchtower around sea cucumber pens. Tourism activities surrounding this DI project satisfy sustainable tourism principles in being environmentally sound, socially and culturally respectful, and economically beneficial for the well being of the community.

7 Darwin identity

The Darwin Initiative funded program is a distinct body of work with a clear identity grounded in its objectives and timeframe. The program utilised a team of national and international staff, employed on a full-time basis to specifically achieve the objectives of this program. The DI-program is distinctly separate to other programs initiated by the lead organisation, with separate staff and office space ensuring a clear identity. An international volunteer internship program was established by the lead organisation to promote the project and provide additional funding and skills, and this program was distinct from other internship programs offered by the lead organisation.

The Darwin logo appeared on uniforms worn by staff engaged on the DI-funded program and on all program plaques and signs throughout the communities involved. Quarterly progress reports submitted to the Malagasy Ministry of Fisheries and Marine Resources visibly displayed

the DI logo, and identified DI as the lead funding organisation of the work. At national symposiums the DI logo was displayed on all banners and print media, as well as presentations delivered both externally and within the lead organisation to visiting volunteers and delegates. As a result, ministerial bodies, program partners and conservation and development practitioners are familiar with the Darwin Initiative.

Throughout the three-year program, updates on this project have been published four times in the DI newsletter, with a submission to the latest edition in-press. The support of DI was recognised in a feature story published on the Indian Ocean – South East Asian Marine Turtle Memorandum of Understanding website, and in the academic article submitted to the Indian Ocean Marine Turtle Newsletter (annex 5). The DI is further publicised on the lead organisation's website and social media, including Twitter, Instagram, and Facebook, with links to the Darwin account. With over 2,200 contacts on Facebook, this appears to be an effective medium for publicising the results of this project, and the contribution of the UK Government and the Darwin Initiative.

8 Finance and administration

8.1 Project expenditure

Project spend (indicative) since last annual report	2016/17 Grant (£)	2016/17 Total actual 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			0	
Capital items (see below)			0	
Others (see below)			0	
TOTAL	52500	52500		

Staff employed (Name and position)	Cost (£)
Emma Gibbons – Project Leader	
Cale Golding - Project coordinator	
Oriana Wauters – Aquaculture manager/project scientist	
RAMANJEHIMANANA Livatiana – Aquaculture project coordinator	
VIJAY KUMAR Jivan – Socioeconomic team leader	
ZAFIMANDALA Lin Telesphore – socioeconomic team/technician	
Busko – Fisheries team leader	
TOTAL	**19000**

Capital items – description	Capital items – cost (£)
TOTAL	0

Other items – description	Other items – cost (£)
Aquaculture material for community-based farmers (rope, cement, chain, rebar)	
TOTAL	21000

8.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
The Rufford Foundation	
European Union; Madagascar Regional Foundation for Agriculture Development (FRDA)	
Reef Doctor	
TOTAL	**73720**

Source of funding for additional work after project lifetime	Total (£)
Indian Ocean Trapang (IOT) – 24 months	
World Bank; Pôles Intégrés de Croissance (PIC2) 24 months	
GEF Small Grants Programme - Global Environment Facility (GEF SGP), implemented by the UNDP – 24 months	
TOTAL	**90,000**

8.3 Value for Money

Reef Doctor, based in Madagascar was predominantly successful because of the strong community relationships that had already been established. Project funding was therefore directed and used to build on the existing framework by the dedicated team at Reef Doctor, providing value for money. This document records the huge achievements made by the Reef Doctor team on the relatively small funding allocated. The innovative way the project objectives have been achieved has provided sustainability and commercial investment for expansion.

Annex 1 Project's original (or most recently approved) log frame, including indicators, means of verification and assumptions.

Note: Insert your full log frame. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

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.			
Outputs: **1**. 50% reduction in the baseline marine turtle exploitation rate and a, potential, exit from the fisheries	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. Workshops and training to develop the capacity of FI.MPA.MI.FA, FI.MPA.MI.FA's marine turtle protection teams, and turtle network year 1 - 3	1a. Presentation of results at a regional scientific symposium—Western Indian Ocean Marine Science Association (WIOMSA) bi-annual symposium 1b. Peer-reviewed publications / reports 1c. National symposium hosted by ReefDoctor at a venue in the regional capital, Toliara, Madagascar	Agreement reached on land-use rights: MoUs signed and Dina's created

	1d. 90% of juvenile marine turtles captured in the fishery are tagged and released by year 3 1e. Peer-reviewed publication on the marine turtle fishery results by the end of year-3		
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; agreement reached on intertidal land-use rights related to the conflict between beach-seine fishing activities and aquaculture activities;	2a. 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 2b. Exclusion of beach-seine activity from sea cucumber farming areas 6 villages by year-2 2c. Peer-reviewed publication on the seagrass monitoring results by the end of year-3	2a. Presentation of results at a regional scientific symposium—Western Indian Ocean Marine Science Association (WIOMSA) bi-annual symposium 2b. Peer-reviewed publications / reports 2c. National symposium hosted by ReefDoctor at a venue in the regional capital, Toliara, Madagascar	Agreement reached on land-use rights: MoUs signed and Dina's created. Annex 8.3
3. Selection of 10 community groups (1 group / aquaculture unit (a.u.)) per year per target village (n=6) to participate in the Darwin Initiative; each group is comprised of two family units (2 men / 2 women per a.u.) with a projected number of people directly participating in the training totalling 720 people and associated family units (ca. 3,600 people) indirectly benefiting by year-3.	3a. Workshop on aquaculture techniques 3b. 60 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 3c. Additional 60 aquaculture projects (sea cucumber/seaweed) in-place and stocked in targeted villages, with priority	3a. Presentation of results at a regional scientific symposium—Western Indian Ocean Marine Science Association (WIOMSA) bi-annual symposium 3b. Peer-reviewed publications / reports 3c. National symposium hosted by ReefDoctor at a venue in the regional capital, Toliara, Madagascar	Natural mortality rates remain within a range that allows for economic sustainability. Given that sea cucumbers are a commercially valuable species, effective measures are put into place to avoid major losses due to theft. 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. Community groups remain committed to the aquaculture-farming project.

	given to all other interested community members, by year-2 3d. 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 3e. Peer-reviewed publication on seaweed growth by the end of year-3 3f. National symposium presenting Darwin Initiative project results hosted by ReefDoctor in the regional capital, Toliara, during the last quarter of year-3		
4. Local optimisation of aquaculture productivity through a multi-year investigation into the poorly understood factors affecting sea cucumber / seaweed growth rates (i.e. environmental tolerances, nutritional requirements, etc.) designed to provide direct benefits to local sea cucumber / seaweed farmers. Integration of environmental, growth rate, and satellite imagery data into a GIS for the creation of a spatial predictive model could provide indirect benefits in allowing for the prediction of highly-productive sites throughout the developing world	4a. Installation of experimental sea cucumber enclosures and seaweed cultivation lines to test different approaches aimed at optimising production in year 1 4b. Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 2 4c. Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 3 4d. Peer-reviewed publication on the optimisation of aquaculture production by the end of year-3	4a. Presentation of results at a regional scientific symposium—Western Indian Ocean Marine Science Association (WIOMSA) bi-annual symposium 4b. Peer-reviewed publications / reports 4c. National symposium hosted by ReefDoctor at a venue in the regional capital, Toliara, Madagascar	

	4e. Development of a GIS-based spatial model to predict site suitability and productivity by end of year-3		

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 sea grass 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 10 community groups (1 group/enclosure) per year per target village; training of 4 elected group members in sea cucumber/seaweed farming techniques
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 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
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.		\$29,555 USD generated in the last 12 months of project contributing directly towards poverty alleviation of coastal communities. 1,589 juvenile marine turtles protected through direct conservation action in the three years of the project. 267 viable aquaculture units operational at the end of the project period, with training in aquaculture techniques delivered to 720 people over the life of the project.
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. 50% decline in turtle mortality associated with the targeted fishery by year-3 2. Improved livelihoods: targeted households will benefit from a 1 USD/day increase in revenue by year-3 3. Protection of 10% (ca. 400ha) of critical seagrass habitat throughout the Bay by year-3 4. Local optimisation of aquaculture production and creation of expansion strategy by year-3.	1. 1,589 turtles protected through direct conservation action. 2. Average household income from aquaculture activities was \$0.43 USD/day over previous 12 months. 3. 1,199 hectares of seagrass habitat received formal protection. 4. Modified 'long-line' seaweed technique increased growth rates by 282% over traditional 'off-bottom' method. Expansion strategy developed with project partners Copefrito and IOT.
Output 1. 50% reduction in the baseline marine turtle exploitation rate and a, potential, exit from the fisheries	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 1.2 Continuous biological monitoring of the marine turtle fishery to evaluate success of recently created management strategies,	1.1 Continued enforcement of indigenous law resulted in 1,589 juvenile marine turtles submitted to the tag-and-release program over the life of the project. As these turtles would otherwise have been killed, this indicator is an appropriate measure of turtle conservation efforts. Evidence provided in annex 7.1. 1.2 Continued monitoring of the turtle fishery indicated a 6% increase in absolute turtle mortality in the DI project community, compared to a 23% increase in non-DI project community, from baseline to year-3. Comparison of DI project community to non-DI project community allows results of project activities to be distinguished from change in fishing

	and the 50% targeted decrease in exploitation of marine turtles in the 6-targeted villages of the BRB year 1 – 3. 1.3 Workshops and training to develop the capacity of FI.MPA.MI.FA, FI.MPA.MI.FA's marine turtle protection teams, and turtle network year 1 – 3. 1.4 90% of juvenile marine turtles captured in the fishery are tagged and released by year 3. 1.5 Peer-reviewed publication on the marine turtle fishery results by the end of year-3	levels due to other causes, and thus, is a good indicator. However, the targeted reduction of 50% fails to consider the influence of external pressures, which may affect turtle hunting. A more appropriate indicator may have been "50% reduction in turtle exploitation rate, in comparison to non DI project community exploitation rate, with no displaced fishing effort between communities". Evidence provided in annex 7.2 and section 3 of the report. 1.3 Workshops and training successfully completed. Expansion of turtle monitoring program from 2, to 7 communities following training. Development of bay-wide communication protocol facilitating rapid response by turtle tagging teams. Good indicator. Evidence provided in annex 7 1.4 74.2% of juvenile turtles captured in the fishery in year three were tagged and released. Given that before the DI program, no turtles were released alive, this represents a marked benefit for turtle conservation, despite falling short of the targeted 90%. The targeted indicator may have been overly ambitious to achieve in the designated time frame. Evidence provided in annex 7.3 and section 3 of the report. 1.5 Manuscript "The Turtle Fishery in the Bay of Ranobe, Madagascar" submitted to peer-reviewed publisher *Indian Ocean Turtle Newsletter*. Evidence provided in annex 5
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		Complete – An extensive series of general meetings were held in all the 13 villages of the Bay to introduce the DI project. Focused meetings held with those involved in the turtle fishery.
Activity 1.2. Marine turtle protection team training on dina management and enforcement		Complete – The turtle fishermen's association, FIMPAMIFA, have received continual training on "best practices" in implementing local laws created to manage the turtle fishery.
Activity 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		Complete – Annual meetings held by Reef Doctor and FI.MPA.MI.FA update region stakeholders on monitoring of the turtle fishery, conservation efforts and discuss evolving challenges.
Activity 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		Complete – Biological monitoring of the turtle fishery increased from 2 to 7 communities.
Activity 1.5 Meetings and focus groups held with those involved in the marine turtle fishery in the 6-targeted villages to introduce Darwin Initiative		Complete – An extensive series of general meetings were held in all the 13

		villages of the Bay to introduce the DI project. Focused meetings held with those involved in the turtle fishery.
Activity 1.6 Working paper and submission for publication		Complete - Manuscript "The Turtle Fishery in the Bay of Ranobe, Madagascar" submitted to peer-reviewed publisher *Indian Ocean Turtle Newsletter*.
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; agreement reached on intertidal land-use rights related to the conflict between beach-seine fishing activities and aquaculture activities	2.1 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. 2.2 Exclusion of beach-seine activity from sea cucumber farming areas 6 villages by year-2. 2.3 Peer-reviewed publication on the seagrass monitoring results by the end of year-3	2.1 1,199 hectares of coastal zone provided protection, with 945 hectares of seagrass provided partial protection, and a further 254 hectares provided complete protection. Good indicator for the protection of seagrass. Evidence provided in annex 8.2 and 8.3 2.2 Dina in place preventing the use of beach seine activity from sea cucumber and seaweed farming areas. Indicator does not account for illegal beach seine activity, otherwise is an appropriate indicator. Evidence provided in annex 8.3 2.3 Manuscript submitted to peer-reviewed publisher WIOMSA. Good indicator. Evidence provided in annex 5
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		Complete – MoU achieved and additional aquaculture materials offered in exchange for beach seine gear, rather than for entry to the program.
Activity 2.2. Formation and implementation of a bay-wide local indigenous law (dina) protecting 10% (400ha) of seagrass meadows		Complete – 945 hectares provided partial protection. An addition 254 hectares provided complete protection. Evidence provided in annex 8.2 and 8.3
Activity 2.3. Community training on dina management and enforcement		Complete – Dina Be representatives from relevant communities underwent training in dina management and enforcement.
Activity 2.4. Periodic stakeholder meetings to facilitate a smooth social transition from capture fisheries to aquaculture and resolve any minor conflicts		Complete – Quarterly meetings were held in each community, addressing the transition to aquaculture, progress and challenges.

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		Complete – seagrass surveys undertaken for seaweed farming and seagrass protected areas. Evidence provided in annex 8.1
Activity 2.6. Working paper and submission for publication		Complete - Manuscript submitted to peer-reviewed publisher. Evidence provided in annex 5
Output 3. Selection of 10 community groups (1 group / aquaculture unit (a.u.)) per year per target village (n=6) to participate in the Darwin Initiative; each group is comprised of two family units (2 men / 2 women per a.u.) with a projected number of people directly participating in the training totalling 720 people and associated family units (ca. 3,600 people) indirectly benefiting by year-3.	3.1 Workshop on aquaculture techniques. 3.2 60 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. 3.3 Additional 60 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 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. 3.5 Peer-reviewed publication on the seaweed growth by the end of year-3. 3.6 National symposium presenting Darwin Initiative project results hosted by ReefDoctor in the regional capital, Toliara, during the last quarter of year-3	3.1 Workshops and training were on-going, with training delivered to 720 project participants. Good indicator. Evidence provided in annex 9.1. 3.2 124 aquaculture units established in year 1. Good indicator. Evidence provided in annex 9.2. 3.3 125 aquaculture units established in year 2. Good indicator. Evidence provided in annex 9.2. 3.4 111 aquaculture units established in year 3. Good indicator. Evidence provided in annex 9.2. 3.5 Combined with activity 4.3. Good indicator. Evidence provided in annex 5 3.6 National symposium held. Good indicator. Evidence provided in (http://www.peche.gov.mg/2017/06/atelier-de-relance-de-lalgoculture-a-toliara/)

Activity 3.1. Meetings and focus groups held in the 6-targeted villages to implement Darwin Initiative		Complete – meetings held to introduce project, and invite participants.
Activity 3.2. Selection of 10 community groups (1 group/enclosure) per year per target village; training of 4 elected group members in sea cucumber/seaweed farming techniques		Complete – 720 project participants received training in farming techniques. 360 farming groups established throughout the program, with 2 representatives per unit instead of 4. Farming groups are not evenly distributed between communities, but rather based on interest within each community.
Activity 3.3. Sea cucumber/seaweed farming workshops held; construction and stocking of sea cucumber enclosures in each village		Complete – aquaculture workshops held in each participating community. Sea cucumber activities restricted to two communities, with seaweed activities in six communities.
Activity 3.4. Continual technical and logistical support for maintenance of enclosures/cultivation lines and sale of sea cucumbers/seaweed		Complete - Project staff work with participants to ensure the proper maintenance of mariculture materials and health of sea cucumbers / seaweed.
Activity 3.5. Socio-economic surveys: changes in poverty level resulting from Darwin Initiative		Partially complete – baseline multidimensional poverty survey conducted in all project communities.
Activity 3.6. Working paper and submission for publication		
Output 4. Local optimisation of aquaculture productivity through a multi-year investigation into the poorly-understood factors affecting sea cucumber / seaweed growth rates (i.e. environmental tolerances, nutritional requirements, etc.) designed to provide direct benefits to local sea cucumber / seaweed farmers. Integration of environmental, growth rate, and satellite imagery data into a GIS for the creation of a spatial predictive model could provide indirect benefits in allowing for the prediction of highly-productive sites throughout the developing world	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 Continued data collection on experimental aquaculture projects to test different approaches aimed at optimising production in year 2. 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 projects in-line with	4.1 Completed in year 1. Good indicator for seaweed, however limited availability of juvenile sea cucumbers in year-1 and the longer than expected time to maturation, limited practicality for sea cucumbers. Evidence provided in annex 10.2 4.2 Completed in year 2. Good indicator for seaweed. 4.3 Completed in year 3. Good indicator for seaweed. Evidence provided in annex 10.1 4.4 Community expansion program with project partners Copefrito and IOT project an additional 60 sea cucumber units established in 2017, with technical support ensured by IOT in line with exit strategy. Good indicator. Evidence provided in annex 10.1 4.5 Submitted to Western Indian Ocean Marine Science Association; WIOMSA. Evidence provided in annex 5 4.6 Aquaculture site productivity predictive report prepared by project partner. Good indicator. Evidence provided in annex 10.1

	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	
Activity 4.1 Construction and stocking of experimental sea cucumber enclosures/seaweed cultivation lines		Complete. Evidence provided in annex 10.2 and section 3.
Activity 4.2 Continuous biological and environmental assessment of productivity		Complete. Evidence provided in annex 10.2 and section 3.
Activity 4.3 Working paper(s) and submission of manuscript(s) for publication of sea cucumber/seaweed optimisation studies		
Activity 4.4 Development of a GIS-based spatial model to predict site suitability and productivity		Complete – "Inventaire et Etudes de Faisabilite de Sites Propices a L'algoculture, L'holothuriculture, La Gestion de L'exploitation de Poulpes et Crabes Dans La Region Atsimo Andrefana" Evidence provided in annex 10.1
Activity 4.5 End-of-project national symposium to present the results of the Darwin Initiative project		Complete – National symposium held with all national stakeholders, presenting results of the Darwin Initiative project. Evidence provided http://www.peche.gov.mg/2017/06/atelier-de-relance-de-lalgoculture-a-toliara/

Annex 3 Standard Measures

Code	Description	Total	Nationality	Gender	Title or Focus	Language	Comments
Training Measures							
1a	Number of people to submit PhD thesis						
1b	Number of PhD qualifications obtained						
2	Number of Masters qualifications obtained						
3	Number of other qualifications obtained						
4a	Number of undergraduate students receiving training						
4b	Number of training weeks provided to undergraduate students						
4c	Number of postgraduate students receiving training (not 1-3 above)	6	International	Male 1 Female 5	Aquaculture	English	Aquaculture internship
4d	Number of training weeks for postgraduate students	84	International	Male 1 Female 5	Aquaculture	English	Aquaculture internship
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification (e.g., not categories 1-4 above)	25	Malagasy	Male	Aquaculture	English	
6a	Number of people receiving other forms of short-term education/training (e.g., not categories 1-5 above)	727	Malagasy	Male: 367 Female: 360	Aquaculture	French/Malagasy	
6b	Number of training weeks not leading to formal qualification	23	Malagasy	Male: 367 Female: 360	Aquaculture	French/Malagasy	1 week of training per village per year (6+6+7) + 4

							weeks advanced technician training
7	Number of types of training materials produced for use by host country(s) (describe training materials)	3				Malagasy	Video, reference card, poster
Research Measures		**Total**	**Nationality**	**Gender**	**Title**	**Language**	**Comments/ Weblink if available**
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (ies)						1 – combined with national institutes, NGO's and commercial enterprise
10	Number of formal documents produced to assist work related to species identification, classification and recording.						
11a	Number of papers published or accepted for publication in peer reviewed journals	1	Australian	Male	The Turtle Fishery in the Bay of Ranobe, Madagascar	English	http://www.iotn.org/
11b	Number of papers published or accepted for publication elsewhere						WIOMSA; Annex 5
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1					Marine turtle tagging data
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country						
13a	Number of species reference collections established and handed over to host country(s)						

13b	Number of species reference collections enhanced and handed over to host country(s)						

Dissemination Measures		**Total**	**Nationality**	**Gender**	**Theme**	**Language**	**Comments**
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	3					Annual marine turtle meeting
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	2					National aquaculture symposiums, 2016, 2017.

Physical Measures		**Total**	**Comments**
20	Estimated value (£s) of physical assets handed over to host country(s)		
21	Number of permanent educational, training, research facilities or organisation established		
22	Number of permanent field plots established		Please describe

Financial Measures		**Total**	**Nationality**	**Gender**	**Theme**	**Language**	**Comments**
23	Value of additional resources raised from other sources (e.g., in addition to Darwin funding) for project work						

Annex 4 Aichi Targets

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	Aichi Target	Tick if applicable to your project
1	People are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	
2	Biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	Y
3	Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	Y
4	Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	
5	The rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	
6	All fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	Y
7	Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	Y
8	Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	
9	Invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	
10	The multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	Y
11	At least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	Y
12	The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	Y
13	The genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	

14	Ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	Y
15	Ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	
16	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	
17	Each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	
18	The traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	Y
19	Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	
20	The mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

Annex 5 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. web link, contact address etc)
IOSEA TURTLE -The IOSEA Marine Turtle Memorandum of Understanding intergovernmental agreement concluded under the auspices of the UNEP / Convention on Migratory Species (CMS).	Marine turtle conservation challenges in southwest Madagascar Emma Gibbons 12 Sep 2016	British	British	Female	IOSEA Marine Turtle MoU Secretariat, c/o UNEP Regional Office for Asia and the Pacific, United Nations Building, Rajdamnern Nok Avenue, Bangkok, 10200, Thailand	Tel: + (662) 288 1471 ; Fax: + (662) 288 3041 / 288 1029; E-mail: IOSEA Secretariat
IOTN newsletter peer reviewed	Project profile Emma Gibbons January 2014	British	British	Female	ANDREA D. PHILLOTT Co-editor, Indian Ocean Turtle Newsletter Asian University for Women, Chittagong, Bangladesh iotn.editors@gmail.com	http://www.iotn.org/wp-content/uploads/2015/09/IOTN-19.pdf
Darwin newsletter	Transitioning to sustainable livelihoods – a seaweed farmer's perspective Cale Golding June 2017	Australian	Australian	Male	The Darwin Initiative – Darwin newsletter; Department for Food and Rural Affairs	http://www.darwininitiative.org.uk/assets/uploads/2017/06/Darwin-Newsletter-June-2017-Sustainable-Tourism-FINAL.pdf
Darwin newsletter	Addressing biodiversity conflicts through sustainable livelihoods Cale Golding January 2017	Australian	Australian	Male	The Darwin Initiative – Darwin newsletter; Department for Food and Rural Affairs	http://www.darwininitiative.org.uk/assets/uploads/2017/01/Darwin-Newsletter-January-2017-Conservation-Conflict-Final.pdf
Darwin newsletter	A multi-faceted approach to conservation and	Australian	Australian	Male	The Darwin Initiative – Darwin newsletter; Department for Food and Rural Affairs	http://www.darwininitiative.org.uk/assets/uploads/2016/09/Darwin

	poverty alleviation in Southwest Madagascar Cale Golding September 2016					-Newsletter-September-CITES-CoP17-FINAL.pdf
Darwin newsletter	Conservation and sustainable use of marine turtles, southwest Madagascar Cale Golding February 2016	Australian	Australian	Male	The Darwin Initiative – Darwin newsletter; Department for Food and Rural Affairs	http://www.darwininitiative.org.uk/assets/uploads/2016/02/February-2016-SDG-Newsletter-FINAL.pdf

WIOMSA SYMPOSIA - SUBMISSIONS OF ABSTRA

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Active Submissions

ACTIVE ARCHIVE

ID	MM-DD SUBMIT	TRACK	AUTHORS	TITLE	STATUS
1183	04-28	Biodiversity	Gibbons, Golding, Kumar, Duchene,...	LONG-TERM MONITORING OF THE MARINE TURTLE FISHERY OF THE...	ABSTRACT IN REVIEW
1271	04-28	Socio-ecology	Golding, Gibbons, Stein-Rostaing	MULTIDIMENSIONAL POVERTY OF COASTAL COMMUNITIES IN THE...	ABSTRACT IN REVIEW
1279	04-28	Resources	Golding, Gibbons, Kumar, Stein-Rostaing	POVERTY ALLEVIATION AND BIODIVERSITY CONSERVATION: THE...	ABSTRACT IN REVIEW
1289	04-28	Vulnerability	Komeno, Stein-Rostaing, Gibbons	TRIALS OF LOW-COST, REPRODUCIBLE ARTIFICIAL HABITS...	ABSTRACT IN REVIEW

1 - 4 of 4 Items

Submissions for this conference were closed on 2017-06-20.

Annex 6 Darwin Contacts

Ref No	21-018
Project Title	Conservation and sustainable use of marine turtles, Southwest Madagascar
Project Leader Details	
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Role within Darwin Project	Project Leader
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Fax/Skype	
Email	
Partner 1	
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Organisation	FI.MPA.MI.FA
Role within Darwin Project	Community Leader
Address	Ifaty
Fax/Skype	
Email	
Partner 2 etc.	
Name	Dr. Thierry Lavitra
Organisation	IH.SM
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