Department for Environment Food & Rural Affairs

DARWIN INITIATIVE

Foreign & Commonwealth Office

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Darwin Plus:
Overseas Territories Environment and Climate Fund
Annual Report

Submission Deadline: 30th April 2021

Darwin Plus Project Information

Project reference	DPLUS090
Project title	Reducing the impacts of plastic on the BIOT natural environment
Territory(ies)	British Indian Ocean Territory
Lead organisation	Zoological Society of London
Partner institutions	British Indian Ocean Territory Administration Swansea University
Grant value	£330,476
Start/end dates of project	1 April 2019 - 31 March 2022
Reporting period (e.g. Apr 2020-Mar 2021) and number (e.g. Annual Report 1, 2)	Apr 2020 – Mar 2021 Annual Report 2
Project Leader name	Rachel Jones
Project website/blog/social media	www.marine.science www.zsl.org/regions/uk-overseas-territories/chagos-archipelago Twitter - @Marine.Science and @ZSLMarine Instagram - @BIOT.science
Report author(s) and date	Rachel Jones, Emma Levy, Fiona Llewellyn, Heather Koldewey, Nicole Esteban, Nadine Atchison-Balmond 30/04/2021

1. Project summary

The beaches of the British Indian Ocean Territory (BIOT) are globally significant as nest sites for sea turtles. Up to 20% of the regional population of green turtles and 51% of hawksbills come to BIOT from across the south-western Indian Ocean to breed. The high level of protection and the low level of coastal development across this archipelago provide a vital safe haven for these threatened species. BIOT's coastal ecosystems are impacted by the accumulation of large volumes of ocean-borne plastic debris. Consumption of single-use plastic (SUP) on Diego Garcia (DG) also creates waste streams that are hard to manage in this remote location. This project will empower BIOT stakeholders to implement cleaning strategies on target beaches, mitigating the impacts of plastics on nesting turtles. We will develop long-term strategies to enable systemic change, reducing DG's SUP consumption, improving disposal and recycling practices.

Figure 1. The British Indian Ocean Territory. The area in blue is a 640,000km^2 no-take Marine Protected Area which includes the entire EEZ apart from a 3nm exclusion zone around Diego Garcia.

2. Project stakeholders/partners

COVID-19 has impacted our engagement in DG with very little time spent by any of the partners in situ. Over the same time period the personnel in DG has almost entirely changed as part of normal rotations. The team has made every effort to stay connected remotely and to encourage and support stakeholder efforts to maintain momentum for the project, particularly in reference to reductions in SUP. The team has been very encouraged by on-going, measurable progress on this specific indicator despite our delays to the campaign activity planned for Year 2. Seeing our messages independently used by and incorporated into island generated communications is a positive indication that there is local commitment to the project aims.

Since the last annual report there has been a (routine) change in the DG based team as follows:

- British Representative – Steve Drysdale
- British Executive Officer – Martyn Heenan
- Environmental Officer – Milly Fellows (working alongside existing EO Nadine Aitchison-Balmond and will form part of the project team going forward).
- US Commanding Officer - Wade Blizzard
- US Executive Officer - Erin Sherry

Rachel Jones and Heather Koldewey personally briefed the incoming British Representative and Executive Officer prior to them leaving the UK for DG. They both expressed support for and commitment to the aims of the project.

A key contact Nestor Guzman, Natural Resource Manager for the US Navy during the past 26 years, retired in December 2020. Nestor contributed to the project via standardised bi-monthly surveys of the Index Beach on DG. As an interim measure, the surveys are being conducted by Holly Stokes, a Swansea University PhD student currently studying nesting ecology of sea turtles during a long-term expedition to DG (Jan-Sept 2021). It has been agreed that Holly will train Nestor's replacement when they arrive later in 2021 and, in the meantime, will familiarise the new Environmental Officer with the survey protocol.

Moshood Leshi is the Environmental Protection Specialist for KBR, the principal US Navy contractor and employer of >1000 civilians on DG. Moshood has recently engaged with the team to implement project activities and guidance via KBR events and communication on island. For example, Moshood gives a day-long environmental briefing to new employees every month and has requested that we give a 10–15-minute presentation each month about sea turtles and reducing effects of plastics on the natural environment of DG. These talks will be given by project personnel (see Fig. 2. showing presentation by Holly Stokes on

24/02/2021 repeated 24/03/21). This briefing of around 32 new starters each meeting presents a great opportunity to get our messages across to people just arriving on DG – our central message to 'drink water the DG way' is most effective when used early and before any prejudices against the safety of tap water can become too entrenched.

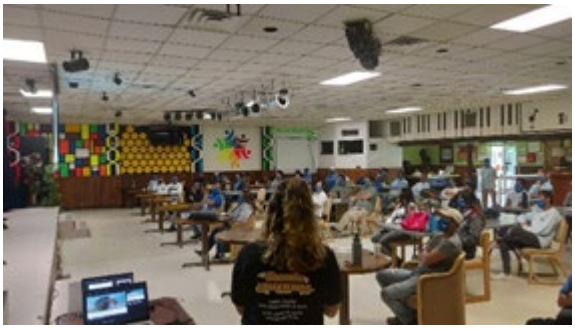

Figure 2. Project team (Nicole Esteban/Holly Stokes) presentation on turtles and plastic pollution during new contractor briefing on DG.

Throughout April 2021 an environmental email campaign quiz was conducted by the Public Works Department (PWD) for earth month. 'Envirothon 2021' is highlighting environmental practices and policies across the island with prizes offered to specific respondents. The project team contributed items to the prizes for this competition that reflected the project aims to reduce SUP (metal drinking straws etc.). Questions cover topics including safe drinking water, the issues of plastic beach debris for turtles and the Adopt-a-Beach scheme which has collected 1.7 tonnes of waste so far in 2021.

3. Project progress

3.1 Progress in carrying out project activities

Output 1. Characteristics of plastic waste pollution on BIOT marine turtle nesting beaches, and negative effects on nesting turtles and hatchlings, are understood with appropriate mitigation measures developed and implemented.

Activity 1.1 Surveys of nesting beach plastic and nesting behaviour

Surveys of nesting beach plastic and nesting behaviour were interrupted by COVID-19 related beach access restrictions in 2020. Surveys re-commenced in February 2021 during the delayed expedition visit (from June 2020) by Nicole Esteban and PhD student Holly Stokes. In 2021, survey frequency will be increased from two per month to at least two per week as part of Holly's PhD nesting ecology studies. Encounters by adults and hatchlings with plastics are being recorded during each survey. A total of 15 surveys were recorded in this reporting period and no records made of abortive nesting attempts due to plastic.

Activity 1.2 Deployment of 30 temperature data loggers on Index Beach

Temperature data loggers were deployed at four sites just outside of the Index Beach during an experimental trial to investigate the effects of sub-surface microplastics on nesting temperature, as reported previously. Additional control loggers were placed at a range of depths (30-70 cm) in the two nesting zones (shaded and unshaded) at two other sites on the beach.

In order that impacts of disturbance to the sites could be assessed, the Environmental Officers (a) set up and maintain signposted barriers requesting people to avoid the sites during beach clean-ups or visits; and (b) monitored the sites when possible, to check for disturbance by sea turtle nesting. Monitoring visits have made it possible to confirm that three of the four plots were undisturbed by people or turtles, and one plot was disturbed by nesting sea turtles after November 2020.

During the recent expedition in February 2021, the four sites (such as that shown in Fig 3a) were visited by Nicole Esteban with a team of volunteers who assisted with recovery of all temperature loggers (Fig 3b-c). Recovery of 100% of loggers from a depth of 60 cm is very unusual!

Figure 3. The experimental field trial in DG to assess the effect of sub-surface microplastics on sea turtle nesting temperature was monitored by Environmental Officers during 2020 (a) and cleared on 6-7 February 2021 when all temperature loggers were recovered (b-c).

Upon excavation, all loggers were checked and were found to be functioning beyond the expected 12-month battery life expectancy. This meant that the logger temperatures could be calibrated at a constant temperature for seven days before being stopped and data downloaded (see Fig 4). Data analysis will be carried out during the next quarter to compare temperatures in control plots versus plots seeded with micro-plastic beads.

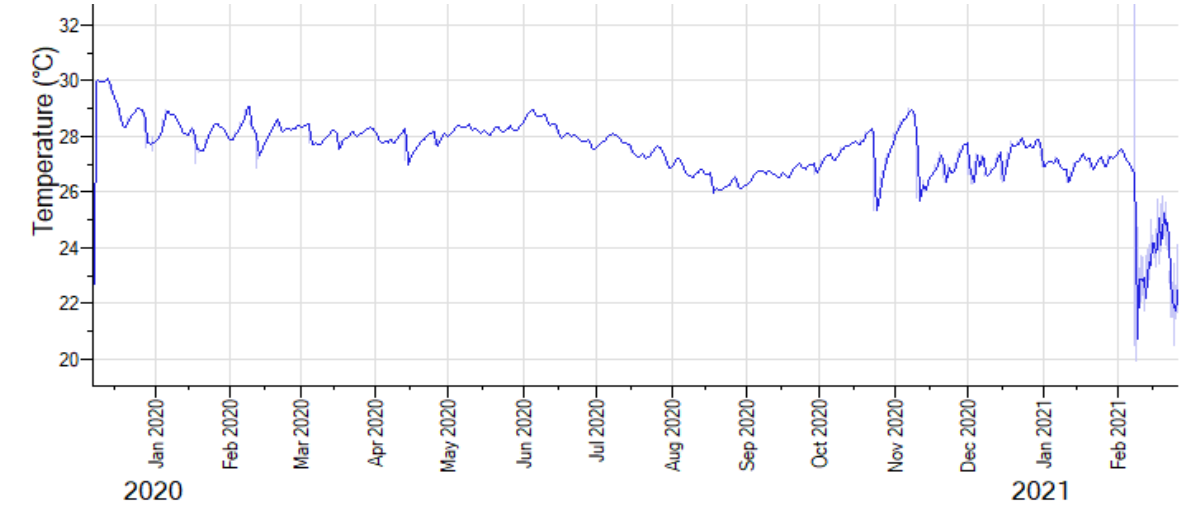

Figure 4. Example of raw data from one of the temperature loggers deployed on the experimental trial in DG between December 2020 and February 2021. Seasonal temperature variation occurs with lowest temperatures during austral winter months (notably August-October). Sharp drops in temperature occur after rainfall so that this pattern is not always clear. The sharp temperature increase, and corresponding decrease, at the start and end of the graph represent a shift from calibration temperature to deployment and back again.

Activity 1.3 Analysis of waste collected during beach cleans to establish main sources and composition. MSc study to analyse source/circulation of plastic debris arriving in BIOT

Surveys of beach debris continued with data contributing to the data set started in 2019. We conducted further, more detailed analysis of these data as well as writing up the 2019 data into a manuscript for submission to a peer-reviewed journal. Work has started on modelling to better understand the flows of plastic regionally. With help from PhD student intern, Helen Ford from Bangor University (match funding though the Envision PhD programme) the team analysed the Marine Debris Tracker (MDT) data from 2019 with the recent 2020 and early 2021 data collected. The analysis was able to geolocate items to create spatial plots, and to create an R code base which we can use for further analysis as we continue to collect MDT data over the rest of the project lifetime (see Annex 4). Recent data still show plastic as the primary

material being found as marine debris on beaches, including for the two transects which undergo regular beach cleans (See Fig 5 and Annex 5).

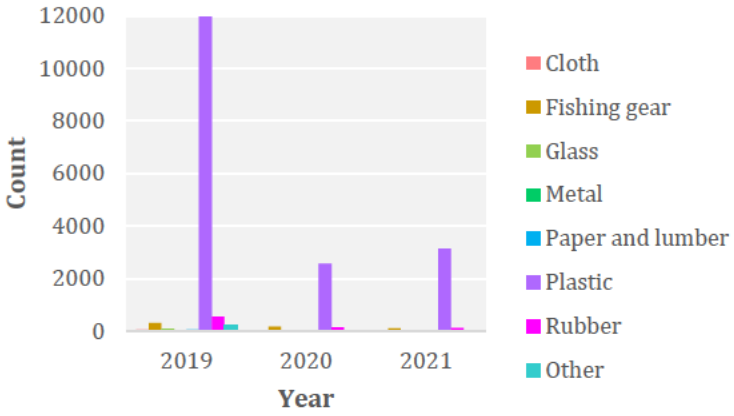

Figure 5. Items recorded by material across five 100 m transects in each year (taking average count per year where transects have been repeated during that year)

Baseline data from our surveys of beach debris in 2019 showed a large proportion of SUP water bottles with labels of Chinese origin being recorded. Given the distances from the Chinese mainland and the relatively good condition of many of these bottles (suggesting they had not spent long in the water), we believe it is possible that some of this bottle waste is coming from cargo vessels transiting the MPA on the trade route across the Indian Ocean. We plan to explore this hypothesis using 10 satellite enabled bottle tags (see Annual Report 1 section 8) which will be deployed at points along the shipping lane as it passes through the BIOT MPA in order to track their route at sea and potentially the beaching of bottles on the islands. The funding for this work is matched from other sources and is being done in conjunction with a PhD student (Jessica Savage, NERC Doctoral Training Programme) who is studying the relationship between ocean plastic and manta rays in BIOT and at other sites across the Indian Ocean. Jessica is working on a provisional model to determine the best points at which to deploy the bottle tags - we aim to deploy these tags during expeditions in Oct/Nov 2021.

Modelling work was initiated to hindcast the movement of bottles into BIOT in collaboration with researchers who had developed a model on fish aggregation devices in the MPA (Curnick 2020). This work will continue in 2021.

Anthropogenic marine debris (AMD) accumulating on beaches in BIOT was surveyed by the team using two sampling methodologies in 2019. The data were analysed as part of an MSc thesis by Victoria Hoare, as reported in the last Annual Report. Since completion of the MSc, the student (now a PhD student) has been working with Nicole Esteban to produce a manuscript reporting the results. This manuscript has been circulated to the wider team for review and submission to the Journal of Ocean and Coastal Management next quarter. The working title of the manuscript is *Plastics dominate beach debris in a remote archipelago; spatial variations in island debris accumulation can inform targeted beach management.*

Activity 1.4 Nesting beaches identified and mapped with nesting seasons recorded, optimum timings for beach cleans written into beach clean best practice guidelines. Each nesting beach assigned a beach clean team of volunteers.

Priority beaches and beach clean guidelines were developed in Year 1. Beach clean data from the Adopt-a-Beach scheme has recorded a total of at least 22.1 tonnes of waste removed from the beaches of DG (2016-2020) (Fig 6).

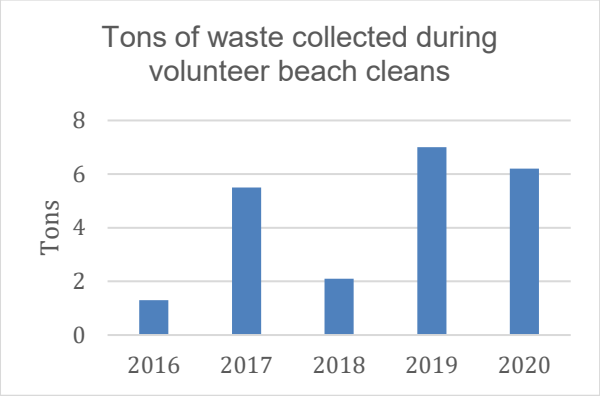

Figure 6. Tonnes of waste collected on DG by volunteers between 2016 and 2020. The 2020 data does not include any beach cleans in November and December.

Output 2. The system of SUP on DG is understood, with a proposed strategy developed to reduce SUP in identified priority areas, with pilot completed to reduce SUP water bottles, increase refilling and enhance connection between personnel and the ocean.

Activity 2.1. Collect and analyse supply chain data
Building on data analysed in Year 1 of the project (data for 2018 and 2019), the team secured 2020 data on retail sales from the 'Ship's Store' (the only grocery store on DG) for plastic bottled drinks (water and Gatorade) and for 'biodegradable' (paper and wood) and 'non-biodegradable' (plastic) disposable items (cups, bowls, plates, and cutlery). The data reveal a 35% decrease in the number of SUP water bottles sold from 2018 to 2020 (2018 n=320,448; 2020 n=206,988). Interestingly, the number of plastic Gatorade bottles sold dropped even further than water - by 67% from 2018 to 2020 (2018 n=45,444; 2020 n=14,808), suggesting that there was an overall decline in plastic bottled drinks rather than a switch from water to Gatorade. The number of SUP plates and cups decreased by 62% and 59% respectively between 2018 and 2020 sales data. At the time of writing all plates, cups and bowls are paper – with no plastic option on sale.

In contrast, the number of plastic cutlery items sold increased by 14% over the same time period. Of note is the fact that bamboo cutlery is quite expensive (4x the price of plastic) – the store managers are looking for a cheaper supplier but have not found one yet.

This activity helps us to record and communicate a metric of progress in our campaign messaging on island. For further analysis of the Ship's Store sales data see Annex 6.

Activity 2.2 Interview procurement officers, retail and waste managers
This activity was completed as planned in Y1Q1 and reported in Annual Report 1.

Activity 2.3 Conduct before and after attitudes and behaviour survey with 300 people to assess personal use of SUP and levels of awareness around environmental impacts of ocean plastic in general and effects on BIOT turtles specifically
This baseline for this activity was established in Year 1. In the current reporting period, we were able to conduct further analysis of those data with the help of a student intern, Natalie Smith (University of Plymouth undergraduate internship programme), which supported our initial analysis. This work has also provided further evidence to show that there is a link (with statistical significance) between people who take part in more water sports activities and the use of fewer SUP water bottles, but also that they drink tap water more regularly (see Annex 7). This recent analysis also included 59 newly completed surveys which were collected in November 2020. This analysis helps us to identify where and who best to target our campaign activities towards.

The ‘after’ component of this research is planned for Nov/Dec 2021 (Y3Q3). We will deliver a short survey to as many people as possible across DG (with help from the Environment Officers based there). This survey will pick up key questions around personal plastic use from the ‘before’ survey (questions 9-14) and will ask a specific question of people who have previously signed a pledge during the campaign - ‘has your use of SUP gone up, down or stated the same since you signed the pledge?’

Activity 2.4 SUP system map for DG formulated and distributed for comment that identifies current procurement, use, waste disposal and recycling strategies/barriers
This activity was completed as planned in Y1Q1-4 and reported in Annual Report 1.

Activity 2.5 System map used to identify key intervention points with most impact and for each point identify alternative behaviours/products/approaches that could be used to reduce SUP use
This activity was completed as planned in Y1Q4 and reported in Annual Report 1. An addition to the findings in Year 1 is the installation of a second, refillable bottle station in the gym complex. Counters on these two refill stations record the number of bottles filled; and the combined total to date is 66,220. These refill stations form a popular alternative to SUP water bottles and are frequently used. As we identified in our previous report, they are a positive initiative taken by the contractors on island and likely contribute to a reduction in SUP use.

Activity 2.6 Rank interventions to identify highest priority actions with greatest impact and work them into a SUP reduction campaign
This activity was completed as planned in Y1Q4 and reported in Annual Report 1.

Activity 2.7 Develop and implement SUP water bottle reduction campaign, including drive for residents to sign the #OneLess pledge
Originally planned for June 2020 the campaign delivery is now planned for June 2021 (Annex 22). Separate fieldwork by the turtle team in January 2021 provided an opportunity for a ‘soft launch’ of some of the campaign messaging and a pilot trial of the pledge signing form.

Campaign materials were designed and produced to aid the activities during the campaign launch. These include reusable water bottles as our main campaign material, supplemented with t-shirts, postcards, posters, two pop-up banners and a flag (see Annex 9). Posters along with key messages have been translated into Tagalog due to the large number of Filipino contractors on island. Based on the findings from the systems diagnosis work (supported by Forum for the Future in Year 1), three key messages were developed based on the opportunities for leverage within the system and to help inform where to focus project energy and resources (see Annex 10).

Our online pledge system was trialled on DG in February 2021 and proved successful in allowing the community on the island to make a pledge offline which could then later be linked to a secure online database to be GDPR compliant. The option to provide contact details for a follow-up survey is voluntary. This trial collected 46 individual responses with 30 people (65%) agreeing to be contacted again in the future about their progress in reducing their consumption of SUP water bottles (see Annex 11). Assuming this (65%) is indicative, we anticipate having a strong network of contacts to gather data from, by which to monitor the impact and legacy of the campaign. This trial was also linked to the first phase of our campaign roll-out which consists of a soft launch to share the campaign branding and create brand familiarity before the main launch in June/July 2021.

Activity 2.8 SUP water bottle amnesty held in DG to raise awareness of project and distribute refillable bottles with information - a stand at the July 4th street celebrations
Delayed by 12 months but scheduled to be delivered in its original form in June 2021. More information about the campaign can be found in Activity 2.7.

Activity 2.9 Film commissioned, produced and shown in cinema, radio materials produced, and interviews given on MWR radio station and in Tropical Times newsletter
The film was completed in Y1Q4 and reported in Annual Report 1. It has been shared in turtle volunteer presentations in Feb and March, as well as in briefings for new contractors and shared with the DG HQ team. It will be shown as part of campaign activities in June 2021 (see Annex 12).

Activity 2.10 Plastic waste sampled quarterly from waste storage area and numbers of plastic bottles/ tonne of waste estimated
The annual use of SUP items and specifically that of SUP bottles has been estimated from the sales records obtained from the Ship's Store. The procurement, use and subsequent disposal of plastic on DG is a very linear and closed process, i.e. the plastic enters through retail mainly via one outlet (Ship's Store), travels through sales, and after use is efficiently collected and disposed of by incineration. There is very little 'leakage' from this system, for example from littering, nor is there any significant recycling of plastic materials on DG. This analysis, combined with difficulties in estimating waste plastic safely at the waste management site, led the project team to conclude that the use of retail sales data was a reasonable indicator for overall volumes of SUP going through the DG system.

Data from 2020 (Year 2 of the project) compared with data from 2018 (before the project started), shows a **35% reduction in the total number of SUP water bottles sold** in the Ship's Store. Additionally, the amount of other SUP items from the Ship's Store decreased over the same time period as follows: bottles of Gatorade drink - sales down by 67% from 45,444 units in 2018 to 14,808 units in 2020; SUP plates - sales down by 62% from 984 units in 2018 to 375 units in 2020; SUP cups - sales down by 59% from 3,732 units in 2018 to 1,532 units in 2020.

The only SUP item for which data were provided that showed an increase in sales was plastic cutlery, which increased by 14% from 2,968 items in 2018 to 3,380 items in 2020. It is useful to note the disparity in pricing between cutlery of different materials here – the bamboo cutlery is four times the price of the plastic items. This observation may account for why the trend with this item alone is up, when sales of all other SUP items measured are down. Further analysis of the Ship's Store sales data can be seen in Annex 6.

Activity 2.11 Report produced that analyses changes in attitudes and behaviours, as well as actual number of SUP water bottles used on DG, over lifetime of project
The baseline data for this report has been established via methods outlined in Activities 2.2 and 2.3 and reported on in Annual report 1. Data collection via survey in Y3Q3 will form the comparison for analysis at the end of the project.

As noted above, we have already seen a measurable reduction in sales of most SUP items over the lifetime of this project. The use of campaign messages and posters on the main entrance door to the Ship's Store and on the doors of the fridges containing chilled bottled water for sale would suggest some impact on this indicator (see Annex 12 for pictures). Refill culture is starting to become established on DG, with reports of frequent observations of personnel, including (significantly) contractors, using their own refillable bottles (see Annex 12).

Output 3. Strategy for recycling DG-generated plastic waste and plastic waste collected during beach cleans developed and recommendations made to BIOT administration.

Activity 3.1 Design sampling strategy based on estimates of total plastic waste collected annually
This activity was completed as planned in Y1Q2 and reported in Annual Report 1.

Activity 3.2 Samples taken from beach cleaned plastic and DG generated plastic and most common items sorted and quantified by plastic waste stream type
This activity was completed as planned in Y1Q2 and reported in Annual Report 1.

Activity 3.3 Each plastic type assessed for suitability for circular economy type approach - all alternative reuse and recycling options considered against matrix of cost, benefit and environmental impact (Y3Q3)
A summary of the materials and waste streams was produced for discussion during meetings with colleagues at Imperial College's Centre for Environmental Policy, which has helped to steer the direction of our report (3.4) (see Annex 20). This has also formed the basis for part of a major new programme grant proposal exploring the impacts of plastic in BIOT and the wider region – this is under consideration for future funding. If awarded, this project will build on the existing Darwin work, including the same team, and address many of the issues raised by (but outside of the scope of) our current project.

The team has had meetings with two innovative plastic waste management companies; Ecobooth and Thermal Compaction Group. Both harness technologies that use plastic waste streams to produce a range of materials, products, and energy sources. Comparative analysis of the costs, operational feasibility, and environmental impacts of these approaches to waste management will be included in the report below. Rachel Jones met the team from Portsmouth University's 'Revolution Plastics' a multi-disciplinary group including the team that has developed research into a plastic-dissolving enzyme.

Activity 3.4 Report produced summarising options and making recommendations for plastic waste management to BIOT managers (Y3Q4)
Progress was made on this activity ahead of schedule (Y3Q4). The team's inability to travel for the two week campaign in 2020 allowed them to spend some time outlining the structure of this report instead as a substitute activity (see Annex 13).

Activity 3.5 Convene a workshop to host practitioners and stakeholders from the UKOTs to discuss their approaches to plastic waste management, discuss new technologies and propose innovative solutions (Y3Q2)
Refer to Year 1 Annual report for notes for notes on the 'Plastic waste in the UKOTs' discussion group on 1 August 2019 at the Blue Belt Symposium at Exeter University (Penryn campus). As meeting international contacts in-person remains uncertain at this time, we are building on the contacts made through the earlier workshop and engaging remotely with representatives of the UKOTs. We will be asking them to participate in a survey to gather information on the challenges they face with plastic pollution and their efforts to deal with it. The survey will be conducted via structured interviews on Zoom, with the appropriate officials in a selection of other UKOTs / other island locations (see Annex 14). Our findings will be delivered in an accessible public-facing format for this audience at the end of the project; this could be via an on-line meeting.

3.2 Progress towards project Outputs

1. **Characteristics of plastic waste pollution on BIOT marine turtle nesting beaches, and negative effects on nesting turtles and hatchlings, are understood with appropriate mitigation measures developed and implemented.**

Progress on this output is good. COVID-19 caused a gap in data collection of nesting surveys, but they have now resumed, and more were completed in total in Year 2 than in Year 1. All the temperature loggers from experimental plots have all been recovered intact and their data will be analysed in the next quarter. Delays to analysis of sand cores were caused by closure of university labs but students have been engaged to conduct this analysis in the next year.
Mitigation of the negative impacts of plastics has continued on DG and Egmont Atoll, with removal of beach debris by teams of volunteers using the best practice guidelines produced by the team in Year 1. 1.7 tonnes of debris has been cleared from DG alone in the first four months of 2021.

The team has built on the baselines established in Year 1 with additional data on plastic pollution on turtle nesting beaches in DG. Surveys of Index beach in 2021 show that areas of the beach regularly cleared of debris show an 80% reduction in the average number of items recorded per 100m, compared to those completely cleared once in 2017 but not subsequently. Those areas not cleared since 2017 show an average of 3,188 items/100m, 91% of which are plastic. Whereas those areas regularly cleaned showed an average of 720 items/100m, 93% of which were plastic (Fig 7). The ***proportion*** of items counted that are plastic remains consistent whether beaches are cleaned or not, however - the ***overall quantity*** of beach debris found in-situ is dramatically reduced where beaches have been cleared regularly.

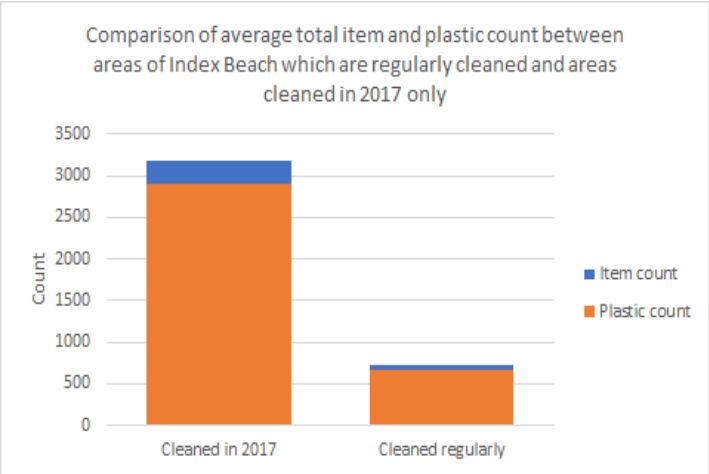

Figure 7. Comparison of total items recorded and proportion that are plastic on transects from beaches not cleared since 2017 vs those that are regularly cleared by the Adopt-a-beach scheme teams.

2. **The system of SUP on DG is understood, with a proposed strategy developed to reduce SUP in identified priority areas, with pilot completed to reduce SUP water bottles, increase refilling and enhance connection between personnel and the ocean.**

Progress towards this output is good though slightly delayed. The system analysis, pilot study, 'before' surveys, and campaign design and asset production activities are all complete. Delivery of the two-week campaign itself has been delayed from June 2020 to June 2021 but will otherwise be delivered in its original format. 'After' surveys will be conducted within six months of the campaign instead of the originally planned 12 months.
Our indicators have recorded a 35% reduction in the sales of SUP water bottles and similar or greater reductions in many other SUP items. The messages of the campaign – that tap water is safe to drink and that refillable bottles should be preferred to SUP bottles - are already having an effect on the quantities of SUP passing through the DG system as noted in Annex 6. Stakeholders on DG are combining the messages and assets produced for the Darwin project campaign with their own locally produced communications to amplify these messages and ensure their visibility at the point of sale (see Annex 12).

3. **Strategy for recycling DG-generated plastic waste and plastic waste collected during beach cleans developed and recommendations made to BIOT administration.**

The team continues to make good progress on this output - monitoring the quantities and composition of waste streams available for recycling using the methods outlined in the activities section, as well as exploring possible recycling/re-purposing technologies (see 3.3). The report due at the end of the project has been outlined (Annex 13) earlier than scheduled. Time due to be spent conducting fieldwork in Year 2 was instead redirected to this activity due in Year 3.

3.3 Progress towards the project Outcome

Effective beach cleaning reduces plastic waste on BIOT beaches, improving turtle nesting success, while DG personnel, better connected to the ocean and conservation, drive a decline in SUP.

Overall progress against the project outcome is good. We have seen continued beach cleaning activity on DG despite the limitations of the COVID-19 pandemic on group activities. The Adopt-a-beach scheme removed >6347 kg of plastic in 2020 and 1700 kg so far in 2021. Despite COVID-19 impacts on beach access, the Environmental Officers were able to continue monthly turtle surveys in 2020 and a further six bi-monthly surveys have been conducted so far in 2021. Nesting activity data will be analysed at the end of the green turtle season.

We have seen engagement with some of our central messages on island by communications teams and the Public Works Department who have both incorporated content about turtles and the effects of plastic pollution into their own materials (see Annex 12) and into briefings for new contractors on arrival to DG. Campaign posters have been posted at key locations across the island, including directly next to the retail sales points for bottled water in the Ship's Store and at food outlets. The campaign video is shown routinely at various locations including the C-Street food outlet building. Most encouragingly our key indicator of the rate at which SUP is consumed on DG is down. Retail sales of SUP water bottles through the Ship's Store in 2020 is on average down 30% on 2019, and 35% down on 2018 (before the project started). While we expect to see further reductions in this indicator after our campaign activities, it is very encouraging to see this early behaviour change.

3.4 Monitoring of assumptions

Assumption 1.1: Reduction in SUP on DG is reflected in a reduction in proportion found in waste streams.

Comments: The project views the volumes of plastic waste entering the DG system through retail sales to be a reasonable alternative measure of efforts to reduce consumption. Retail sales data as shown in Annex 6 is detailed and by commercial necessity, accurate. We therefore believe it is a realistic assumption that a significant drop in demand will be reflected by a drop in retail sales.

Assumption 1.2 Level of plastic waste accumulating on BIOT beaches from non-DG sources remains constant during the lifespan of the project.

Comments: This assumption remains true as measured by continued surveys showing the consistent return of beach debris, dominated by plastic items, even on beaches that have been recently cleared (see Annex 5). A particular observation is the high number of small plastic fragments being encountered in the turtle nesting zone – with implications for nest conditions that we are testing experimentally.
Research into plastic waste management shows plastic pollution emissions estimates as high as 53 million metric tons per year by 2030 if current rates of production are maintained (Borrelle et al 2021). We have also laid out a comparison of the legislative instruments and initiatives being used by Indian Ocean basin countries to address this issue nationally (see Annex 15).

Assumption 1.3 SUP water bottles are an effective flagship item to represent the issue of marine plastic pollution and connect people better to the ocean, as has been the case in the London-based #OneLess campaign.

Comments: The sales of SUP plastic items are trending in the right direction with SUP water bottles showing very encouraging reductions averaging 35%. The combination of our campaign messaging, taken up by individuals and departments on DG with the availability of drinking water has resulted in a measurable impact on the number of SUP bottles used annually over the lifetime of the project. Campaign messaging – best illustrated in the simple messages of the film – reinforces the link between the SUP water

bottle and ocean health, and we believe this is still a strong and effective way to link these issues in people's minds in a way that affects their personal behaviour.

Assumption 1.4 A values-based approach increases engagement in marine conservation.

Comments: We continue to work towards the assumption that communicating the full value of the ocean in all its rich diversity connects with peoples' deeply held, personal values and leads to more impactful ocean conservation. Data collected through the systems diagnosis work, e.g. the surveys conducted on DG contributes towards our understanding of some of the specific values held by our target audience for the SUP reduction campaign on DG. We can confirm the correlation between the relationship with the ocean and people's use of bottled water and/or drinking tap water (see Annex 7). This information has helped to inform the development of the campaign and will influence the targeting of our campaign. This assumption will be tested as part of the follow-up surveys and evaluation to be conducted after the campaign has run, in years 2-3 of the project.

Assumption 1.5 Project team can continue to access DG through military flights during the project period within the same parameters and constraints known from over five years of conducting research on DG.

This assumption has changed since the last annual report. The frequency of AMC flights from Bahrain to DG has reduced from five/fortnight to one/fortnight. This limits access due to demand for seats and creates the potential for long delays should flights be cancelled – an event that happens not infrequently. An additional constraint has also been put in place which is the requirement to undergo a two-week quarantine on arrival in DG. This incurs considerable extra costs on the project; doubling the length of time we would normally spend in DG with associated accommodations costs. We have been able to match fund these extra costs at no further cost to Darwin as our project team also works in DG on other projects and has been able to combine activities. This has enabled us to be confident we can continue with our project activities as planned within a shortened time frame as indicated in the logframe.

Assumption 2.1 Data available from retail outlets and surveyed stakeholders accurately captures volumes and movement of SUPs.

Comments: We have previously established that retail sales from the Ship's Store represents the single greatest source of plastic waste generated on DG, including 94% of the SUP water bottles (Annual report 1 Annex 11). This provides us with a simple but powerful indicator to measure changes in the volume of SUP passing through DG and straight into waste. We have data from before the project started (2018) and in each of the for first two project years (2019-2020) showing reductions in sales of SUP items over the project lifetime to date (see Annex 6 further analyses of these data). This assumption remains true – this metric is useful in identifying changes to the volume of SUP waste generated in DG.

Assumption 2.2 Beyond SUP water bottles, additional priority intervention points and practical alternatives can be identified.

Comments: Alternative products have been identified and are available for sale – though there are some caveats to their utility (See Annex 6), such as the sale of biodegradable plastics for which there is no opportunity for bio-degradation. On-going pressure to reduce the amount of SUP given with takeaway food continues to have mixed results and while drinking straws are not routinely offered as commonly with beverages, they are still available on request. The bottle refill stations in the gym provide a useful and popular alternative for those with their own refillable water bottles. Our key intervention to support SUP education is to make refillable bottles available for free to everyone willing to pledge to use them. The availability and cost of refillable bottles has been identified as a barrier which we seek to overcome by distribution of these items to the majority of the DG population during our campaign activities.

Assumption 2.3 An effective campaign can be implemented in an environment with relatively high turnover of military personnel.

Comments: The impacts of COVID-19 have been felt most keenly in the timing of our campaign. Where we had originally planned to run the campaign in Year 2 and test the results in behaviour change in Year 3 we have now compressed that timeline; the campaign will be delivered in early July and follow up surveys will be distributed in Nov/Dec 2021. This gives enough time for the pledges that people signed to be tested in terms of whether they reduced their SUP use over that 5-6 month period. It also gives us an opportunity to analyse those data and produce results by the final report in 2022. In respect of the assumption above, this gives us an opportunity to capture repeat surveys with people while they are still on the same deployment on DG which we believe is an advantage and more likely to provide follow up information. We will be able to test this assumption in our final analysis of these data.

Assumption 2.4 Majority of individuals pledging to go #OneLess will maintain behaviour change beyond the life of the project.

Comments: Our follow up survey will include a question asking respondents to estimate their likelihood of continuing their reduced use of SUP into the future. Our pilot of pledge signing indicates that 65% of pledge signers are happy to share their contact details for follow up communications enabling us to test this assumption for an estimated 920 people

Assumption 2.5 More 'ocean friendly' alternatives can be procured and supplied to DG.

Comments: See 2.2 replacement of SUP items in the Ship's Store has already begun (See Annex 6). The report we will produce at the end of the project that seeks to compare alternatives for plastics reduction and waste management will prioritise reduction as the primary and preferred mechanism for achieving that. A comparison of products currently in use and proposal of alternatives will form a key part of that approach.

Assumption 2.6 Waste sorting and management allows for data collection and analysis.

Comments: This assumption was not met – the project team cannot get regular enough access to the waste management site to make this data collection feasible, nor is there currently sufficient sorting in place to make this a viable method. As described in assumption 2.1 the sales of SUP are now being used as an alternative indicator that measures plastics in rather than plastics out of the system and this indicator has performed well to date and this was confirmed as an acceptable change by the reviewer of our first annual report.

Assumption 2.7 Personnel are willing and able to participate in multiple surveys.

Comments: We anticipate participation in the behaviour survey will be impacted by COVID-19. The lack of access to DG had delayed this activity and a limit on the size of groups that can be gathered may also slow down our access to people. However, as well as our immediate campaign team we will have additional help on island in July (Environment Officers Nadine Atchison-Balmond and Milly Fellowes and Holly Stokes PhD student from Swansea University) and two full weeks to secure as many pledges as possible. We will design a short and efficient follow up survey and work with the DG teams to ensure this is delivered to as many of the pledge signers as possible – making it easy and accessible to maximise the number of participants.

Assumption 2.8 Personnel on short rotations can be contacted once off DG to complete follow up surveys,

Comments: See assumption 2.7 the shortened time frame for this activity has changed this assumption slightly – we now anticipate many of our pledge signers will still be accessible on DG within the lifetime of

the survey period, making them, theoretically, easier to follow up with. The compressed period between making the pledge to reduce SUP use and evaluating progress (from 12 months to 4/5) gives long enough for behaviour change to be established and reported on without being so long that follow up contact becomes less likely to be responded to at all.

Assumption 3.1 DG beach cleans continue and beach cleans in Northern atolls from patrol vessel are conducted as planned.

Comments: This assumption has been met in part with the DG Adopt-a-beach scheme continuing over the last year despite the restrictions from COVID-19. The regular clearing of debris from key nesting beaches on DG (the site of most turtle nesting in the MPA) has resulted in much lower levels of macroplastic relative to the baseline established at the start of the project. We see this in the comparison between the cleaned part of Index beach and the beach without regular cleaning where there is an 80% reduction in the number of items recorded on cleaned areas of the beach (see Fig 7 and Annex 5). Access to the patrol vessel in contrast has not been possible over the last year, meaning that the surveys run at our study site on Egmont atoll in March 2020, were the team's last access.

Assumption 3.2 Dependent on resources for beach cleans in DG remaining available from US authorities and patrol vessel is available and not required for enforcement duties.

Comments: See Assumption 3.1 – support and resources for the Adopt-a-beach scheme on DG have remained available. We have not been able to have access to the BPV for beach cleans as planned. We are working with the teams on DG to identify opportunities to support a volunteer team to return to Egmont in the next six months led by the DG Environment Officers.

Assumption 3.3 Plastic types are identifiable, and condition of plastics are suitable for treatments under consideration in great enough quantities.

Comments: As reported in Annual report 1, an initial investigation into the quantities and types of plastics available in the two waste streams on DG has been conducted. Further research is on-going to explore options for further waste treatments and are to be reported on at the end of the project.

Assumption 3.4 Report is considered by BIOT administration and findings incorporated into decision making framework

Comments: Assumption remains the same as in Year 1. The new personnel coming into the British team on DG have all expressed their enthusiastic support for the aims of this project. The final reporting from the project will feed into the Interim Conservation Management Plan with particular reference to turtle conservation and aims to make practical suggestions to the BIOT administration as managers of this MPA that will help to mitigate the negative effects of plastic as laid out in the project logframe.

4. Project support to environmental and/or climate outcomes in the UKOTs

The UK Government's 25-year Environment Strategy identifies the status of endemic and globally threatened species and the extent and condition of terrestrial and marine protected areas in the UKOTs as indicators relevant to the Convention on Biological Diversity Aichi Targets 11 and 12 and Sustainable Development Goals 14 and 15 – see section 5. It is particularly relevant to SDG 15 via the restoration of healthy shoreline habitat to prevent biodiversity loss.

The relationship between plastic pollution and climate change has not been well documented, so we have written a scientific review paper with experts on both topics that documents the relationships between them. Heather Koldewey is senior author on this paper which is due for submission to Science of the Total

Environment in May 2021, with this Darwin project acknowledged. We will be exploring opportunities to share the findings in the lead up to COP26.

The two species of sea turtle this project focuses on are both globally threatened; green turtles are Endangered, and hawksbills are Critically Endangered according to the IUCN Red List of Threatened Species (2021), and both are heavily exploited across the western Indian Ocean. The team's research into the effects of sand temperature and humidity on turtle hatchlings will increase knowledge of the potential effects of climate change on turtle nesting success and will result in a manuscript in a peer-reviewed journal.

In associated research funded by the Bertarelli Foundation, members of the team have been exploring the effects of extreme weather events that cause anomalously warm temperatures during marine heatwaves (MHW). The 2016 MHW in BIOT resulted in high sea surface temperatures leading to major coral bleaching. Recent comparisons between data collected for sea surface temperatures around DG and turtle nest depth on the Index Beach demonstrate that this MHW also caused high sand temperatures on sea turtle nesting beaches. Model predictions suggest that the 2016 MHW caused the highest female-skewed hatchling sex ratio and the lowest hatchling emergence rates in the past 70 years. These results are currently in press in Biology Letters (Hays et al. in press) and will be featured in the next report.

5. OPTIONAL: Consideration of gender equality issues

The demographic of the human population on DG does not reflect a natural gender or age distribution as that population is one of appointed employees (military and contractors), rather than a normal community. The population is therefore skewed in age (younger) and gender (more male – 86% of the total) than a natural population. Where the project surveys the DG population randomly, we request optional information on gender to establish the relative proportions of respondents. We also design all project activities to be inclusive of all genders. The gender distribution of people signing the campaign pledge will be tracked and controlled to ensure that there is equal opportunity of participation across genders despite an unequal distribution in the DG population. It is worth noting that 100% of the core project team across all partners (ZSL, Swansea, BIOTA) and technical consultants, are female.

6. Monitoring and evaluation

Monitoring and evaluation of the project continues to be shared amongst the three main project partners, ZSL, Swansea University and BIOTA with information and project work stored on a shared Dropbox. Any sensitive data are stored separately on ZSL's OneDrive account which is only accessible to four ZSL team members. Most communication between the team during the last year has primarily been either online (email or online meetings) or over the phone due to COVID-19 restrictions limiting in-person meetings. We continue to collect both quantitative and qualitative data to track project progress. In Year 1, we identified the beaches important for turtle nesting and this has led to regular beach cleaning activities in these areas. We continue to track sales data which capture plastic items and so far over the lifetime of the project we have generally seen a decline in their sales, this will be a key measure of achievement for the project.

Monitoring of beach debris throughout 2020 has been limited due to the project team being unable to travel to DG. However, we have started regular fortnightly beach debris surveys on Index Beach, beginning February 2021, thanks to PhD student Holly Stokes. Holly will be based in DG for at least seven months, with assistance provided by the BIOT Environment Officer. Following the standardised data collection techniques developed in Year 1, we have started using a bespoke #OneLess debris list instead of the NOAA list for categorising plastic items on the Marine Debris Tracker (MDT) app. This allows us to collect

more detailed data, such as SUP water bottles, rather than just 'beverage bottles.' A PHD student worked with us to develop an R code script that allowed us to translate previous data (collected on the NOAA list), to the new categories (on the #OneLess list), enabling robust comparison across years. This allows us to compare and track the change in debris recorded during the lifetime of this project (see Annex 4).

Qualitative indicators of achievement particularly focus on the uptake of our messaging provided as part of the campaign on DG. We have images and records of our campaign posters being used across the island (ahead of the main campaign launch) (see Annex 12). We also began tracking the popular social media channels used by personnel on DG to record how often messaging related to the campaign is shared, for example, encouragement by personnel on DG to stop using SUP water bottles, drink tap water and use a reusable bottle.

We continue to receive support from Forum for the Future who worked with us in Year 1 to create a system map which has informed the development of the campaign. We have their ongoing support over Years 2 and 3 of the project to advise and support our monitoring activities (see Annex 3). This will also include any advice and support for the follow-up survey we run to measure the impact the project has had on DG. Reflecting work plan changes due to the movement of fieldwork, we adjusted salary time on the project which has allowed us to cover some additional costs related to the fieldwork due to the pandemic, such as COVID-19 PCR testing, PPE, and 14 additional nights' accommodation for quarantine. We increased Fiona Llewellyn's time on the project for the first few months of 2021 to help support the development of the main recycling report brought forward from Year 3 to Year 2. We have also been fortunate to have additional support from Natalie Smith, a BSc placement student from the University of Plymouth (September 2020 to August 2021), and Helen Ford, a PhD student intern from Bangor University (January to March 2021), who have both supported project work including the evaluation of data collected over the project year (beach debris survey data and questionnaire responses) as well as logging qualitative data collection (mentions on social media).

7. Lessons learnt

Throughout 2020 we maintained a dynamic framework of conditions that needed to be met in order to enable the project team's access to BIOT. This framework was updated monthly and provided a useful central reference for risk assessment and mitigation planning between multiple project partners. See Annex 16.
We took note of suggestions in the review of our first Annual Report that we should plan more for alternative strategies and mapped out a scenario plan that allowed us to consider alternative ways of delivering our project should access remain limited or impossible- see Annex 17.

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

a. **Darwin legacy** – project mentioned and Darwin Initiative thanked for their support in the 2018/19 ZSL Annual report. Note the report for 2019/2020 was very truncated so we intend to include data from the project in the 2020/21 report and will include the Darwin identity there. See also section 11.

b. **Evidence of alternative strategies being considered in light of COVID-19 and therefore, risk mitigation plans should there be further issues with risks of this nature.**

See section 7 and Annex 17

c. **Clearer budget alignment to M&E**

See table in Annex 21 detailing budget alignment which considers budget for years 1 to 3.

9. Other comments on progress not covered elsewhere

10. Sustainability and legacy

This project supports and encourages the growing interest in plastics reduction on DG and aims to amplify and support the efforts on-island by publicising them and providing additional resources and activities. The project campaign assets will be made freely available for use on DG and all the digital assets produced so far have already been shared with key stakeholders on-island. People on DG have used their own initiative to independently print out the campaign posters and display them ahead of our arrival and the main campaign launch (see Annex 12). We have also recorded communication of some of the core campaign messages via the normal DG communications channels, such as their radio station, short films, and on social media. The project also provided additional items as prizes for the on-island Earth day competitions run by PWD (Annex 18).

The Adopt-a-Beach programme continues to run successfully and is fuelled by the team on DG. They have been proactive at re-energising the programme once COVID-19 restrictions on-island allowed. With continued good support from senior management figures and enthusiasm from people on DG, this initiative has a good chance of being sustained following the end of the programme and will continue to produce positive impacts on the turtle nesting habitat. We are also looking at how some of the Year 3 campaign budget can be best used to help support ongoing work on DG to continue to encourage the reduction in use of SUPs on DG.

11. Darwin identity

The Darwin Initiative is acknowledged as the funder on communication and project outputs. The Darwin logo is used in presentations and on campaign materials including the campaign video (see Annex 9). The Darwin Initiative social media accounts are also tagged in relevant posts and mentioned in other communications outputs, such as the blog by Fiona Llewellyn in summer 2020 (see Annex 19). In project year two, we have had a soft launch of the campaign to build brand familiarity which means the materials, in particular the campaign posters, have been printed and displayed around downtown DG (see Annex 12). Rachel Jones also represented the project during the March online seminar organised by the Bertarelli Foundation's Marine Science Programme. In this seminar she shared information about our findings as well as acknowledging funding by Darwin Initiative to allow this work to happen (recording available here). This project continues to sit within the Bertarelli Marine Science Programme and is amplified by their communication channels. Through the programme the team has also been invited to appear on their podcast series, Ocean Matters, and feature in their April 2021 podcast episode on plastics. The Darwin Initiative is acknowledged in the three scientific papers that will be submitted to journals within the next quarter.

12. Impact of COVID-19 on project delivery

COVID-19 has primarily impacted the project by making physical access to our study site impossible for more than a year. We responded by rescheduling further deadlines hoping to be able to complete the work in the year for which the campaign was originally planned. We reviewed alternatives with our stakeholders *in situ* and came up with a scenario plan for various eventualities (see Annex 17). Ultimately, we requested a formal change to the delivery dates of Year 2 activities, which was approved see Annex 2 – logframe. The outputs and outcome of our project remain unchanged, and we still plan to deliver all activities within the original three years of the project. The turtle team returned to site at the earliest possible opportunity (first week of Jan 2021) and have been able to extend their time on DG via another project – this enabled them to catch up on data collection.

For travel to BIOT a negative PCR test is required before leaving the UK and another one in Bahrain during transit. On arrival in DG another PCR test is done and everyone has to undergo a 14-day quarantine period

alone before being allowed into general circulation. We assess the risk of infection on DG to be very low but follow all local protocols (mask-wearing, limits on groups gathering etc). Considerable time and effort has gone into seeking appropriate medical advice, developing risk assessments and evacuation protocols that have been approved by BIOTA, the partner organisations and insurers. These protocols provide support and confidence for the various scenarios of implementing fieldwork in an extremely remote location during a pandemic. The additional costs incurred by 14-day quarantine will be covered by an underspend in salary in Year 2 and as match funding by the Bertarelli Foundation.

13. Safeguarding

ZSL has invested heavily in its safeguarding policies and procedures both in the UK and globally. The Council of Trustees and Executive Management Committee have formally recognised safeguarding as a key area of responsibility and are fully committed to strengthening and rolling out ZSL safeguarding approach. Where necessary these efforts are applicable to staff, partners and other stakeholders ZSL works with. Relevant policies have been updated and new policies and procedures implemented and aligned to this commitment including; Dignity and Respect at Work ,Global Safeguarding Policy; Safeguarding Policy for UK staff; Global Whistleblowing Policy and Procedure; Global Code of Conduct; DBS and Criminal Convictions Policy; Employing Younger Workers Policy; Disciplinary Policy and Procedure; Reference Request Policy; Violence and Aggressive Behaviour Policy; The 4 Rs safeguarding procedure; Staff handbook.

These policies are easily accessible on ZSL's internal intranet and have been translated into languages relevant to our work. Existing and newly joined staff, consultants and partners are made aware of the requirements of these policies and ZSL standards. They participate in an induction into the policies, related procedures and implications irrespective of the length of time they will be working/collaborating with ZSL.

ZSL has also implemented measures to ensure the effective delivery of these policies by:

- designating a Safeguarding Lead (Head of Legal, Governance and Risk Management, Simon Lee).
- a number of Designated Safeguarding Officers and Deputies.
- DSL meets DSOs and DSDs quarterly & with the DG monthly to consider the rollout of safeguarding and to provide direction. Our Safeguarding Trustee, Designated Safeguarding Lead, along with a wider working group to help lead implementation.
- receiving updated global safeguarding training from independent experts including 'train the trainer' sessions to allow safeguarding leads to provide this training in-house in ZSL; and
- raising awareness of the updated Global Whistleblowing Policy by creating posters in different languages to be distributed amongst ZSL staff.
- rolling out more formal feedback mechanisms to report any safeguarding issues as part of international programming.

14. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2020 – 31 March 2021)

Project spend (indicative) in this financial year	**2020/21 D+ Grant (£)**	**2020/21 Total actual D+ Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistenc				
Operating Costs				
Capital items				
Others (Please specif				
TOTAL				

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2020-2021 – <u>if applicable</u>

Project summary	Measurable Indicators	Progress and Achievements April 2020 - March 2021	Actions required/planned for next period
Impact Effective waste management, near-zero single-use plastic, and a refill culture that connects personnel to the ocean, eliminates BIOT marine plastic waste, whilst maintenance achieves plastic-free beaches supporting thriving marine life.		Reductions in use of SUP and increases in use of refill bottles recorded. Surveys show a connection between personnel that participate in water sports and concerns around ocean health. On-going programme of beach cleans removing multiple tonnes of waste from turtle nesting beaches.	
Outcome Effective beach cleaning reduces plastic waste on BIOT beaches, improving turtle nesting success, while DG personnel, better connected to the ocean and conservation, drive a decline in SUP.	0.1 Number of abandoned nesting attempts by hawksbill and green turtles recorded on the 2.75km DG Index Beach (BIOT turtle nesting reference site) is reduced by Q4 Yr3 from baseline set by Q2 Yr1.	0.1 15 surveys completed on Index Beach between March 2020 and Mar 2021. No records of abandoned nesting attempts due to plastic debris was zero - down from three last year.	0.1 Surveys continue bi-monthly.
	0.2 Hatchling sex ratios of hawksbill and green turtles maintained close to 2016 baseline of 50:50 on the 2.75km DG Index Beach by Q4 Yr3.	0.2 All 30 temperature loggers installed on Index Beach to monitor nest temps in experimental plots retrieved successfully. Plots not disturbed over last year. Manuscript published showing links between turtle nest temps and water temps and effects of marine heatwaves on sex ratio and nest success.	0.2 Temp logger data and sand core data to be analysed for manuscript due in Q4Y3.

	0.3 Estimated proportion of DG-generated waste comprising SUP water bottles reduced by min of 75% by Q4 Yr3 from baseline established by Q3 Yr1.	0.3 Volume of plastic waste comprising SUP water bottles estimated from retail sales data shows a 35% reduction over project lifetime.	0.3 Sales data will be monitored annually for change. Campaign aims to push sales of SUP even lower to the 75% reduction target
	0.4 75% of personnel on DG (approx 2250) understand the impact of their use of single use plastic on marine wildlife by Q4 Yr3 and have implemented pledges to reduce their single-use plastic consumption by at least three different items (e.g. bottles, bags, straws) Q4 Yr3 as a result.	0.4 Surveys conducted to establish baseline attitudes in Year 1. Analysis of data from surveys incorporated into systems analysis and from there to campaign design. Pilot of pledge system run in Feb 21 shows willingness to engage in follow up surveys by 65% of pledge signers.	0.4 Plan for #OneLess pledge as part of a campaign to be delivered in June/July 2021.
Output 1. 1. Characteristics of plastic waste pollution on BIOT marine turtle nesting beaches, and negative effects on nesting turtles and hatchlings, are understood with appropriate mitigation measures developed and implemented.	1.1 Nesting beach plastic monitoring strategy developed and in place by Q2 Yr1 with regular surveys on 2.75km DG Index Beach (BIOT turtle nesting reference site) to quantify nesting activities that were unsuccessful due to presence of surface and subsurface plastic.	1. 15 surveys completed between April 2020 and end of March 2021. No records of any turtle nesting attempts aborted due to debris.	
	1.2 Effect of subsurface macro and micro plastics on sand temperature and humidity at turtle nesting depth and	1.2 All temperature loggers deployed a year ago successfully and data downloaded. Student recruited for temp. data analysis starts in June. Sand cores collected Year 1 but delays to lab access have paused analysis. MRes student now recruited for sand cores analysis. Manuscript planned for Q4Y3.	

	effects on turtle hatchlings is understood by Q4 Yr3. 1.3 Volume, types, source and pathways of plastic occurring on three target nesting beaches understood by Q2 Yr3. Source and ocean circulation of plastic debris around BIOT understood by Q4 Yr3. 1.4 Nesting beach cleaning strategy developed and implemented on 2.75km DG Index Beach (BIOT turtle nesting reference site) and two pilot Northern Atoll beaches by Q2 Yr1 with cleans carried out by teams of eight people (supervised by EO), one-four times a year, timed to coincide with start of peak green and hawksbill nesting periods (June & November).	1.3 Three target nesting beaches identified- Index and Ile de Rats lagoon and seaward. Marine Debris Tracker app used to record plastic was on transects along nesting beaches and data analysed. Beach waste identified by country of origin – see last annual report. Working with new PhD student to explore modelling of oceans currents and use of satellite enabled bottle tags to inform flow of plastic debris around BIOT>. 1.4 Adopt-a-beach programme in place for Index Beach, DG and resulting in measurable reductions in the volumes of waste recorded compared to uncleaned stretches of the same beach. Ile de Rats, Egmont atoll beaches (seaward and Lagoon) cleaned in March 2021 (by volunteers not project team).	
Activity 1.1 Regular surveys to record hawksbill and green turtle nesting attempts and those that were aborted/interrupted by (sub-) surface plastic waste on 2.75km Index Beach on DG.		**Completed** 15 surveys completed in total and happening bi-monthly since Feb.	Surveys will continue over the following year with help of EOs.

Activity 1.2 Deployment of 30 temperature/humidity data loggers on Index Beach by Q2 Yr1, retrieval after 12 months. Data analysis at Swansea University and submission of manuscript about the effect of macro and micro plastic on turtle incubation conditions in BIOT.	**Delayed – partially completed** Loggers all retrieved after >12 months. Analysis delayed by access to University labs.	Separate students engaged for temp data and sand core analysis with manuscript expected next year.
Activity 1.3 Analysis of waste collected during beach cleans to establish main sources and composition i.e. type of item and plastic materials. MSc study of ocean currents to increase understanding of source/circulation of plastic debris arriving in BIOT.	**Completed.** Analysis of beach waste on Index Beach DG and Ile de Rats beaches Egmont done. Combined with data from surveys across five atolls into manuscript. 10 satellite- enabled bottle tags built ready to be deployed.	Manuscript draft with co-authors for comment. Working with PhD student to establish where and when to deploy bottle tags.
Activity 1.4 Nesting beaches identified and mapped with nesting seasons recorded, optimum timings for beach cleans written into a programme. Each nesting beach assigned a beach clean team of volunteers. Beach clean best practice guidelines written, distributed and followed by teams.	**Completed.** Adopt-a-beach scheme on-going. See Annual report one for map showing location of each team's beach. All teams following best practice guidelines.	Regular recording and analysis of data from beach cleans. Explore potential for occasional targeted cleans of plastic only on high priority beaches in northern atolls. Design signage for Index Beach.

Output 2. The system of SUP on DG is understood, with a proposed strategy developed to reduce SUP in identified priority areas, with pilot completed to reduce SUP water bottles, increase refilling and enhance connection between personnel and the ocean.	2.1 SUP system of retail (supply and sale) and usage (purchase and use) on DG audited, analysed and mapped.	2.1 Flow of plastics through DG 'system' analysed and mapped. See Annual report 1.
	2.2 A minimum of three potential intervention points for change (retail and sale) are identified by Q1 Yr2, with assessment of appropriate alternatives completed by Q4 Yr2 and recommendations made by Q1 Yr3.	2.2 Intervention points identified (see Annual report 1): ● Reduction in sale of SUP water bottles, particularly smaller sizes ● Refillable bottles widely available, affordable and used ● Drinking water trusted and accessible via refill points
	2.3 Behaviour change campaign aimed at reducing SUP water bottle consumption by DG personnel (military and civilian) developed by Q1 Yr2 and launched by Q2 Yr2.	2.3 Plastic reduction campaign strategy designed including messaging, materials and communications plan planned for June/July 2021.
	2.4 A minimum of 75% of personnel (2250 people) pledge to 'go #OneLess' and stop using SUP water bottles and switch to refilling by Q4 Yr2, and: A minimum 75% of people signed up to go #OneLess state they have adhered to it by Q4 Yr4 (on DG at the time or assessed remotely).	2.4 Campaign strategy includes provision of refillable water bottles in exchange for pledge signing. Collection of email addresses (under GDPR) allows follow up enquiries. Pilot pledge signing exercise shows willingness of participants to share contact details for follow up. Follow up survey due Nov/Dec 2021.
	2.5 No new imports of SUP water bottles to DG for sale by Q1 Yr2; and all retail outlets on DG to run down the sale of SUP water bottles by Q4Yr4	2.5 Purchase and sale of SUP water bottles continues but analysis of retail data over the lifetime of the project shows an average 35% reduction in sales of bottled water specifically and reductions in the sale of other disposable plastic items. New bottle refill station installed at the gym and combined with the original one (installed in year 1 of the project) shows use equalling the equivalent of 66,220 small water bottles.

	2.6 A minimum of 75% reduction in SUP water bottles found in waste sampling by Q4 Yr4 from baseline set established by Q3 Yr1. 2.7 A minimum of 75% of DG personal surveyed demonstrate understanding of the link between plastics use and ocean health in surveys carried out Q3 Yr3, from baseline survey in Q1/2 Yr1.	See above and assumption 2.6 above. 2.7 Baseline surveys conducted in Year 1. Comparison survey to be conducted in Y3Q3.	
Activity 2.1. Collect and analyse supply chain data.		**Completed** Data from 2020 added to data series (2018-2020) showing an average of 35% reduction in sales of water bottles over lifetime of project.	Retail data will be analysed annually to assess changes over time. Final data through to end of 2021 expected by Y3Q3.
Activity 2.2 Interview procurement officers, retail and waste managers.		**Completed** See Annual report 1.	
Activity 2.3 Conduct before attitudes and behaviour survey with 300 people to assess personal use of SUP and levels of awareness around environmental impacts of ocean plastic in general and effects on BIOT turtles specifically.		**Completed** Analysis of survey data complete.	Follow up survey planned for Y3Q3 see 2.11.
Activity 2.4 SUP system map for DG formulated and distributed for comment that identifies current procurement, use, waste disposal and recycling strategies/barriers.		**Completed** See Annual report 1.	

Activity 2.5 System map used to identify key intervention points with most impact and for each point identify alternative behaviours/products/approaches that could be used to reduce SUP use.	**Completed** See Annual report 1.	
Activity 2.6 Rank interventions to identify highest priority actions with greatest impact and work them into a SUP reduction campaign	**Completed** See Annual report 1	
Activity 2.7 Develop and implement SUP water bottle reduction campaign, including drive for residents to sign the #OneLess pledge	**Partially completed but delayed** Campaign designed for delivery in 2021. Campaign schedule proposed from 2 – 14 July	Campaign delivery delayed due to COVID-19 crisis – currently rescheduled for Y3Q2.
Activity 2.8 SUP water bottle amnesty held in DG to raise awareness of project and distribute refillable bottles with information - a stand at July 4th street celebrations	**Partially completed but delayed** Refillable bottles designed, produced and shipped.	Campaign planned for July 2021
Activity 2.9 Film commissioned, produced and shown in cinema, radio materials produced and interviews given on MWR radio station and in Tropical Times newsletter	**Completed but dissemination delayed**. Film produced and ready to go once the campaign gets underway in DG Y2Q2. Has been used in contractor presentations	Comms activities to be tied to delayed campaign. See main report
Activity 2.10 Plastic waste sampled quarterly from waste storage area and numbers of plastic bottles/ tonne of waste estimated.	**Completed** Updated retail sales analysis includes data from 2018- 2020.	Retail sales will be monitored over the lifetime of the project with annual changes analysed.

Activity 2.11 Report produced that analyses changes in attitudes and behaviours, as well as actual number of SUP water bottles used on DG, over lifetime of project: Findings from #OneLess pledge data and before and after surveys of self-reported awareness of issues raised by campaign and use of SUP. Analysis of data from waste analysis showing reduction in SUP water bottles component.		**Yr 1/2 activity completed** Baseline data collected for this report. Report due in Y3Q4.	#OneLess pledges collected and follow-up survey with respondents in Y3Q3. Analysis of retail sales data of SUP water bottles through to the end of 2021.
Output 3. Strategy for recycling DG-generated plastic waste and plastic waste collected during beach cleans developed and recommendations made to BIOT administration.	3.1 System for analysis of all collected plastic (beach and DG-generated) to determine utility for recycling and inform sorting in place by Q2 Yr3. 3.2 Minimum of three suitable options for reduction, reuse or recycling plastic waste (methods and products) defined by Q3 Yr 3. 3.3 Report produced summarising options and making recommendations for plastic waste management to BIOT managers Q4 Yr 3.	**3.1 Completed** See Annual report 1. **3.2 – Underway** Some initial research done into recycling options. **3.3 – Underway** Report structure outlined in Annex 13	Continue use of MDT transects on Index Beach surveys. Further research (Y3Q3) and report production (Y3Q4).
Activity 3.1 Design sampling strategy based on estimates of total plastic waste collected annually.		**Completed** See Annual report 1.	Ongoing beach cleans and data collection.
Activity 3.2 Samples taken from beach cleaned plastic and DG generated plastic and most common items sorted and quantified by plastic waste stream type.		**Completed** See Annual report 1. .	Repeat transects on DG Index Beach every two months and on Egmont atoll annually assuming access is restored.

Activity 3.3 Each plastic type assessed for suitability for circular economy type approach - all alternative reuse and recycling options considered in against matrix of cost, benefit and environmental impact.	**Underway early** Some initial research done in preparation for report writing in Y3Q4 see Activity 3.3 above.	If funding successful for further plastics project we will work with their project team members at Imperial College to develop this research to a much higher level.
Activity 3.4 Report produced summarising options and making recommendations for plastic waste management to BIOT managers.	**Underway early** Report structure outlined. See Annex 13	Complete report.
Activity 3.5 Convene a workshop to host practitioners and stakeholders from the UKOTs to discuss their approaches to plastic waste management, discuss new technologies and propose innovative solutions.	**Completed** See annual report 1. Opportunistic meeting held at Blue Belt Workshop in 2019.	Additional surveys to assess current developments in OTs plastic management. Public facing project summary and or on-line meeting to disseminate.

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed) - <u>if applicable</u>

N.B. if your application's logframe is presented in a different format in your application, please transpose into the below template. Please feel free to contact Darwin-Projects@ltsi.co.uk if you have any questions regarding this.

Project Summary - Outcome	Measurable Indicators	Means of Verification	Important Assumptions
Effective beach cleaning reduces plastic waste on BIOT beaches, improving turtle nesting success, while DG personnel, better connected to the ocean and conservation, drive a decline in SUP.	0.1 Number of abandoned nesting attempts by hawksbill and green turtles recorded on the 2.75km DG Index Beach (BIOT turtle nesting reference site) by Q4 Yr3 from baseline set by Q2 Yr1.	0.1 Regular surveys by AVFAC record turtle nesting activities including tracks, species and abandoned bodypits with any obvious interference from plastic waste. Data returned to Swansea University for analysis.	Abandoned nest attempts are primarily due to plastic obstruction. Temperature loggers are successfully retrieved after a minimum 12-month deployment in beach. Relocating buried loggers after a year can be challenging. Plastic particle accumulation in sand will result in temperature increase, as has been recorded elsewhere. Limiting plastic accumulation will maintain sand temperature within a range conducive to a balanced sex ratio in hatchlings. Reduction in SUP on DG is reflected in a reduction in proportion found in waste streams. Level of plastic waste accumulating on BIOT beaches from non-DG sources remains constant during the lifespan of the project. SUP water bottles are an effective flagship item to represent the issue of marine plastic pollution and connect people better to the ocean, as has been the case in the London-based #OneLess campaign.
	0.2 Hatchling sex ratios of hawksbill and green turtles maintained close to 2016 baseline of 50:50 on the 2.75km DG Index Beach by Q4 Yr3	0.2 Scientific publication submitted by Q1 Yr3.	
	0.3 Estimated proportion of DG-generated waste comprising SUP water bottles reduced by min of 75% by Q4 Yr3 from baseline established by Q3 Yr1.	0.3 Volume of single use plastic measured in the BIOT waste management system biannually and retail sales and procurement figures for SUP water bottles.	
	0.4 75% of personnel on DG (approx 2250) understand the impact of their use of single use plastic on marine wildlife by Q4 Yr3 and have implemented pledges to reduce their single-use plastic consumption by at least three different items(e.g. bottles, bags, straws) Q4 Yr3 as a result.	0.4 Before After Control Impact surveys of DG personnel (military and support). 0.4.1 DG achieves Surfers Against Sewage ‘Plastic Free’ community status which validates reduction measures, stakeholder engagement and action plan.	

			A values-based approach increases engagement in marine conservation
Output 1			
1. Characteristics of plastic waste pollution on BIOT marine turtle nesting beaches, and negative effects on nesting turtles and hatchlings, are understood with appropriate mitigation measures developed and implemented.	1.1 Nesting beach plastic monitoring strategy developed and in place by Q2 Yr1 with 24 bimonthly surveys on 2.75km DG Index Beach (BIOT turtle nesting reference site) to quantify nesting activities that were unsuccessful due to presence of surface and subsurface plastic.	1.1 Four month period of regular surveys (delivered by Swansea team) to record nesting attempts and those that were aborted/interrupted by plastic waste, with data submitted to and analysed by Swansea University.	**Change Accepted:** A gap in data collection due to COVID-19 restrictions means surveys have not been bi-monthly in 2020. A team member from Swansea University will be in situ for 4 months in 2021 (Feb-May) and will be catching up on data collection then
	1.2 Effect of subsurface macro and microplastics on sand temperature and humidity at turtle nesting depth and effects on turtle hatchlings is understood by Q4 Yr3.	1.2 Data loggers are buried to quantify temperature/humidity at a range of plastic % content (in sand over the nest) and a range of turtle nesting depth at 3 stations on Index Beach in DG by Q2 Yr1 retrieved Q4 Yr 2. Scientific publication submitted by Q4 Yr3.	Access to laboratories restricted due to COVID-19 so delay in analysis of microplastics samples collected in Year 1 and in retrieval of temperature loggers. Overall analysis still due in Q4 Yr 3
	1.3 Volume, types, source and pathways of plastic occurring on three target nesting beaches understood by Q2 Yr3. Source and ocean circulation of plastic debris around	1.3 Analysis of waste collected during beach cleans to establish main sources and composition i.e. type of item and plastic materials. MSc thesis published Q3 Yr 1.	

	BIOT understood by Q4 Yr3.		
	1.4 Nesting beach cleaning strategy developed and implemented on 2.75km DG Index Beach (BIOT turtle nesting reference site) and two pilot Northern Atoll beaches by Q2 Yr1 with cleans carried out by teams of eight people (supervised by EO), one-four times a year, timed to coincide with start of peak green and hawksbill nesting periods (June & November)	1.4 Nesting beaches identified and mapped on DG and northern atolls. Nesting timings recorded and optimum times for beach cleans written into best practice guidelines and an annual work plan for beach cleans. Each nesting beach assigned a beach clean team of volunteers. Beach clean best practice guidelines written, printed distributed and followed by volunteer teams conducting future beach cleans.	
Output 2			
2. The system of SUP on DG is understood, with a proposed strategy developed to reduce SUP in identified priority areas, with pilot completed to reduce SUP water bottles, increase refilling, and enhance connection between personnel and the ocean.	2.1 SUP system of retail (supply and sale) and usage (purchase and use) on DG audited, analysed, and mapped by Q4 Yr1.	2.1 Audit of SUP usage undertaken. Stakeholder interviews conducted. System analysis and ‘systems map’ produced.	
	2.2 A minimum of three potential intervention points for change (retail and sale) are identified by Q1 Yr2, with assessment of appropriate alternatives completed by Q4 Yr2	2.2 Assessment of alternatives completed, and report produced. Strategy produced that identifies and recommends key intervention points and reduction activities, with cost benefit analysis.	

	and recommendations made by Q1 Yr3.		Travel restrictions mean campaign launch delayed from Q2 Yr 2 to Q1 Yr 3
	2.3 Behaviour change campaign aimed at reducing SUP water bottle consumption by DG personnel (military and civilian) developed by Q1 Yr2 and launched by Q1 Yr3.	2.3 Campaign materials developed. Outreach plan developed and implemented. Film produced, including testimonials from pledges, and shown to personnel.	
	2.4 A minimum of 75% of personnel (2250 people) pledge to 'go #OneLess' and stop using SUP water bottles and switch to refilling by Q2 Yr3, and a minimum 75% of people signed up to go #OneLess state they have adhered to it by Q4 Yr4 (on DG at the time or assessed remotely).	2.4 Pledges to 'go #OneLess' collected. SUP water bottle usage surveys completed (before and after). Survey data 'before and after' compared (on DG and through online surveys for those who have left during the project period).	
	2.5 No new imports of SUP water bottles to DG for sale by Q1 Yr2; and all retail outlets on DG to run down the sale of SUP water bottles by Q4 Yr4	2.5 Retail data analysed every six months to determine any changes in the number of SUP water bottles sold.	
	2.6 A minimum of 75% reduction in SUP water bottles found in waste sampling by Q4 Yr4	2.6 Sampling and analysis of DG generated waste streams to identify number of SUP water bottles.	

	from a baseline set established by Q3 Yr1.		
	2.7 A minimum of 75% of DG personal surveyed demonstrate understanding of the link between plastics use and ocean health in surveys carried out Q3 Yr3, from baseline survey in Q1/2 Yr1.	2.7 Survey data 'before and after' compared (on DG and through online surveys for those who have left during the project period).	
Output 3			
3. Strategy for recycling DG-generated plastic waste and plastic waste collected during beach cleans developed and recommendations made to BIOT administration.	3.1 System for analysis of all collected plastic (beach and DG-generated) to determine utility for recycling and inform sorting in place by Q2 Yr3.	3.1 Analysis of beach plastic as collected + analysis of DG generated plastic.	Work will commence on this output early Q4 Yr 2 i.e. brought forward
	3.2 Minimum of three suitable options for reduction, reuse or recycling plastic waste (methods and products) defined by Q3 Yr 3	3.2 Identify the top 3-5 plastic types Comparative study of strategies for those plastic types based on waste reduction reuse or recycling.	
	3.3 Report produced summarising options and making recommendations for plastic waste management to BIOT managers Q4 Yr 3	3.3 Compare options in criteria matrix and produce report/ make recommendations	

List of Annexes – sent as a separate file

#	Annex
3	ZSL – Forum For The Future agreement
4	MDT analysis - R code
5	Summary of recent MDT analysis
6	Updated summary of plastic items sold on DG
7	Summary of questionnaire responses – water sports and plastic behaviour
8	Final campaign strategy document
9	Catalogue of campaign assets
10	Campaign messaging document
11	Summary of pledge system trial
12	On island communications
13	Outline of waste management report
14	Survey for UKOTs
15	Indian Ocean policies for plastic
16	Framework of conditions for marine science teams to access BIOT
17	Scenario planning for campaign delivery
18	Enviro-thon competition in November
19	Project Communications – examples throughout year 2
20	Plastic waste in BIOT summary
21	Budget alignment to M&E
22	Expedition and campaign delivery schedule

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	X
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	X
Do you have hard copies of material you need to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	
Have you involved your partners in preparation of the report and named the main contributors	x
Have you completed the Project Expenditure table fully?	x
Do not include claim forms or other communications with this report.	