

Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

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 2019-Mar 2020) and number (e.g. Annual Report 1, 2)	Apr 2019 - Mar 2020 Annual Report 1
Project Leader name	Rachel Jones
Project website/blog/social media	www.marine.science #BIOTscience on Twitter https://www.zsl.org/regions/uk-overseas-territories/chagos-archipelago
Report author(s) and date	Rachel Jones, Emma Levy, Fiona Llewellyn, Heather Koldewey, Nicole Esteban, Harri Morrall, Nadine Atchison-Balmond 30/04/2020

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 reproduce¹. 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.

1. ¹ Mortimer, J.A., Esteban, N., Guzman, A.N and Hays, G.C. (2020) Estimates of marine turtle nesting populations in the south-west Indian Ocean indicate the importance of the Chagos Archipelago. *Oryx*. DOI: 10.1017/S0030605319001108

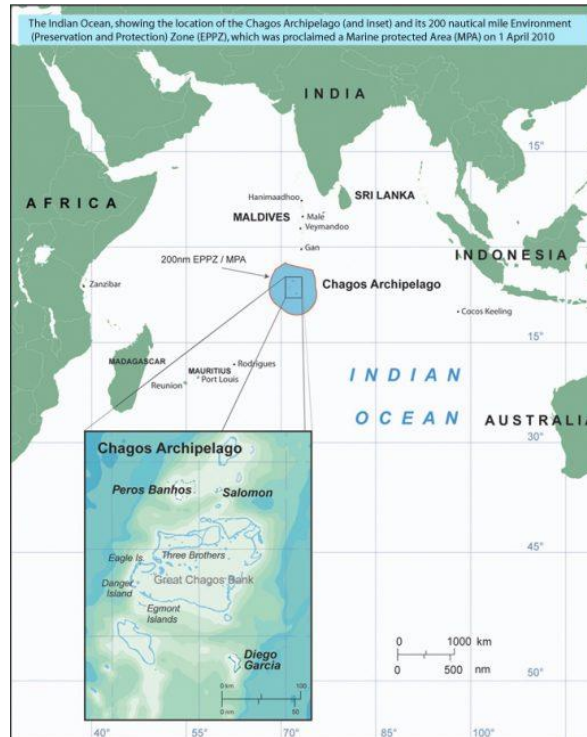


Figure 1. The British Indian Ocean Territory

2. Project stakeholders/partners

The team has sought to contact and involve key stakeholders on DG and beyond from the outset of the project, with great success to date. There is a real sense of momentum forming on this issue which is led from the top. Much of this has come from engagement by the Environment Officers (EOs) with DG decision makers which has sought to align their interest in the issue with the objectives of the Darwin project in a way that amplifies both efforts. Many component parts of this overall movement have been initiated by the team on DG, which shows a proactive interest and an ongoing commitment that will hopefully last beyond the lifespan of this project.

Stakeholders:

BIOT administration in London – Linsey Billing (Administrator until Jan 2020) then Kit Pyman (current Administrator) and Sam Bullen (Deputy Administrator). Environment Officers - Harri Morrall and Nadine Atchison-Balmond who are responsible for implementing many of the project activities on DG.

The government of BIOT is represented by the administration team in the FCO based in London. They are formal partners in the project and represent a key link to the decision-making processes on DG. The team has worked closely with them to secure access to the British Patrol Vessel and crew to support beach cleaning activities in the outer atolls. Their support for the aims of the project has been made clear to the teams on DG which has facilitated access and help for our *in situ* activities. The FCO, within which the BIOT Administration sits, formally joined the London-based #OneLess campaign, as a ‘#OneLess Pioneer’ in 2019, removing all SUP water bottles from its buildings and offices and switching to refilling instead.

British forces on DG – Kay Burbidge (British Representative, known as BritRep) and Lee Mildener (Executive Officer, known as XO). The contingent of British personnel on DG is small but has a high profile and varied responsibilities, delivering support functions such as the police force and HM customs and immigration at the airport. The BritRep and XO have been extremely supportive and helpful – the BritRep in particular has a personal commitment to plastic reduction on DG and has implemented bi-monthly beach cleans by her team.

US forces on DG – Blake Tornga (Commanding Officer, CO) and Shipor Tsui (US XO). The Darwin project team presented the SUP campaign plans to a group in DG in Feb 2020, headed by the US CO and his team. The feedback was positive, and all proposed activities were approved in principle – the CO offered help from his team to support logistics during the planned two week campaign for 2020. He also made clear the US navy’s commitment at the highest level to environmental care in general and plastics reduction in particular (see also Section 10).

Communications/Public Affairs on DG – Brandon Shelander (Mass Communications Specialist) and Jessica Vargus (American Forces Network AFN). AFN operates both radio and TV stations on DG which we have identified as a key medium for communicating our messages before during and after any campaign. In March 2020 Rachel Jones conducted a filmed interview with the mass communications specialist who leads on-island public affairs activities, to highlight the key issues with plastics and turtles. We have agreed to share all our digital assets from the design phase of the campaign with the comms team on DG and allow them to use them in their own channels.

Contractor community on DG – Faviola Antonio and William Sale. Roughly half of the personnel on DG are civilians employed by contractors such as KBR. They are the most numerous community (up to 1,350 people, mostly Filipino) and as such key stakeholders who are central to the success of the project. We have met and presented to small groups of community liaison representatives in June 2019 and February 2020 and received encouraging interest in our plans for a campaign. The team also engaged with William Sale in March 2020; William is the central person in the contractor communities charged with organising cultural social events such as DG Idol, Miss DG and the Philippines Independence Day. What we are trying to achieve has been led by the project team, but how we deliver them is largely coming from ideas from the contractor community themselves. They have identified events and methods for us to embed the campaign into existing cultural events, for example encouraging contestants for Miss DG to make statements on their personal commitments to the environment and SUP reduction.

Public Works Department – Nestor Guzman, Linda Corpus, and Marivel Cruz. The team on DG with responsibility for the environment including provision of safe drinking water. As a result of our engagement, this team has proactively begun messaging about the potability of water which we will include and amplify through our campaign messaging. See Appendix 1.

Marivel Cruz is tasked with running a drinking water compliance programme.

KBR (contractor) - Lavon Washburn (KBR/MWR Director)
KBR is the one of the lead contractors in DG and has responsibility for restaurant facilities, gym and other leisure sites including cinema. Lavon and his team are all fully supportive of measures to reduce plastic and as a direct result of our discussions, have installed a bottle refill station at the gym which has already dispensed the equivalent of 12,204 500 ml plastic water bottles in the less than six months it has been operational.



Figure 2. Bottle refill station in DG gym

Because the time the project team spend on DG is limited largely to a two-week annual visit, as well as some time in the schedule of the BIOT EO, communications can be challenging. Rachel Jones took advantage of a trip to DG for another project to advance planning for the 2020 campaign in person in March 2020, which proved to be an extremely useful additional opportunity to progress this project with the key stakeholders.

Technical specialists:

- [Forum for the Future](#) – engaged for expertise in systems analysis and behaviour change projects. See Appendix 2 for draft system map.
- [Comms Inc.](#) – engaged for expertise in messaging and campaign design. See Appendix 3 and 4.

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 (Y1Q2 – Y3Q1)

Surface debris on beaches was recorded using a) the NOAA list on the Marine Debris Tracker (MDT) app along a series of 100 m transects, at 400 m intervals and b) photo quadrat surveys within 100 m² plots.

Both surveys were carried out five times on Index beach (DG) and four times on Ile de Rats on Egmont Atoll in June 2019. A comparison of the two methods was made by an MSc student at Swansea University, Victoria Hoare, supervised by Nicole Esteban (See Appendix 5 – MSc thesis abstract). This study concluded that the MDT transects were the most suitable measurement method for this project as they give a more detailed representation of beach debris distribution.

MDT transects were repeated on the seaward side on Ile de Rats (Egmont) in March 2020 and the data compared between the two years (See Appendix 7). The result show 75% less plastic at the sample sites on Egmont nine months after the beach clean, though with the limited data the significance of this reduction should not be overstated. The team has been unable to repeat the transects on Index beach due to access issues after flooding (November 2019 - March 2020) and due to COVID-19 movement restrictions (March 2020 onwards) in DG, but these will be completed when access to DG is restored.

Surveys started on 27/07/19 to record hawksbill and green turtle nesting attempts and those that were aborted/interrupted by (sub-) surface plastic waste on Index beach (DG). Seven surveys were completed on Index beach between July 2019 – March 2020 (some intermittent survey periods due to extended leave and interrupted schedules due to lack of access from flooding and COVID-19 restrictions). Three nest excavations were reported as aborted as plastics prevented excavation see figure 3. Opportunistic surveys of incidences of stranded turtles are now routinely conducted. The data are being collected by Nestor Guzman of the Public Works Department and logged with Nicole Esteban at Swansea University for analysis.



Figure 3. The majority of turtle nesting takes place within beach vegetation amidst accumulated plastic debris. This hawkbill track [top left] ends under Beach Scaveola [top right] where nest excavation failed. Other examples of aborted nest excavations have been catalogued [middle row]. Incidences of stranded turtles like this dead hawkbill turtle found in northern DG caught in fishing line are now routinely recorded [bottom row].

Sampling of sand cores took place in 2019 to assess the density and vertical distribution of microplastics in the sand column above turtle nests (typically 30-70 cm depth). Five PVC tubes were hammered vertically

into the sand to a depth of 60 cm at 20% intervals along Index beach. Sand cores were shipped to Swansea University from DG in July 2019 and finally arrived in Swansea in December 2019. Microplastics analysis will take place when access to laboratories resumes, planned for later in 2020/2021.

Activity 1.2 Deployment of 30 temperature data loggers on Index Beach (Y1Q2 & Y2Q3-Y3Q4)

In June 2019, we installed temperature loggers at two sites on Index beach for the monitoring of incubation temperature at turtle nest sites. At each site, six temperature loggers are buried at two stations: shaded and unshaded. To cover the depth range of hawksbill and green turtle nests, loggers are buried at 30, 50, 70 cm depths at each station. One of the loggers was returned to the EO in August 2019 as it was discovered during beach clean-ups, it was waterlogged and so was replaced and re-buried in November 2019.

A field trial study to assess the effects of plastics on sea turtle incubation conditions commenced in November 2019. In December 2019, four replicate experimental plots were established along the turtle nesting line (TNL), each with four treatments. The TNL is a transect through typical turtle nesting area indicated by body pits left from previous nesting attempts. In the field trial, recycled plastic pellets of fixed size were introduced to the surface 4 cm of sand. This depth was selected based on analysis of microplastics in sand from Salomon and Egmont atolls where the average number of plastic particles decreased from 80-110 per 100 g of sediment at the surface to 40-75 particles per 100 g of sediment at 4 cm depth. The locations of sites and options were agreed with the EO on DG and are just outside of Index beach (west) to decrease chances of disturbance from beach cleaning. A margin of 1 m was left between treatment plots to avoid cumulative effects. The treatments were defined as below. Loggers will be retrieved after a minimum of 12 months.

- **Control with non-sifted sand:** logger placed in undisturbed sand.
- **Control with sifted sand:** logger placed in sand that has been emptied into bucket and returned (100 x 100 x 4 cm depth) to test for difference between undisturbed versus experimentally disturbed temperature.
- **Treatment 1:** logger placed in sand that has been emptied into bucket and returned after plastic microbeads are stirred in (100 x 100 x 4 cm depth). The current worst-case scenario will be replicated (132,000 particles m^{-3} and weight 1714 g m^{-3}) from Cyprus, Mediterranean turtle nesting line sand; Duncan et al. 2018). Weight of plastic microbeads to be added to each plot = 68.56 g.
- **Treatment 2:** logger placed in sand that has been emptied into bucket and returned after plastic microbeads are stirred in (100 x 100 x 4 cm depth). Ten times the current worst-case scenario will be replicated (so 1,320,000 particles m^{-3} and weight 17,140 g m^{-3}). Weight of plastic microbeads to be added to each plot = 685.6 g.



Figure 4. Experimental field trials were set up to measure the impact of microplastics on the incubating environment of sea turtle eggs. Temperatures loggers were deployed in the middle of experimental plots with varying levels of microplastic contamination.

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. (Y1Q2 & Y2Q2–Y2Q4 & Y3Q3–Y3Q4)

Data were collected on beach waste at 12 survey sites across all five atolls of the BIOT archipelago in 2019 using methods outlined in 1.1 (See Appendix 6 – locations of BIOT beaches surveyed in 2019) as well as from an aggregated beach waste pile resulting from beach cleans on DG over the last two years.



Figure 5. Aerial photograph of pile of waste collected from beaches across DG with sub sample locations.

In total, 14,261 items of beach debris were recorded by the project team. 7,256 items of debris were logged on Index beach on 25 June. Of these, 87% of the items were plastic (n=6,332). 7,005 items of debris were logged on Egmont atoll on 29 June. Of these, 82% of the items were plastic (n=5,717). A total of 1,771 items from the beach waste pile on DG were categorised and recorded. Of this total 1,374 items (78%) fell into three plastic categories; water bottles, polystyrene pieces and flip flops. See Appendix 6 – graph of plastic as proportion of total waste at three sites.

The team used video captured by a drone to create a three-dimensional image of the waste pile using photogrammetry techniques – Appendix 8. This allowed an estimate of the total volume of the waste pile to be calculated as 349.46m³, the equivalent of 10.5 shipping containers. Using the proportions established from the sampling above would mean at least 272 m³ of this pile comprises plastic items. These data will be useful for the recycling options element of this project, giving us estimates of both quantity and type of plastic available in the waste stream (year 3).

Transects on the seaward side of Ile de Rats on Egmont atoll were repeated in March 2020 as an opportunity arose during another expedition that had one of the project team on board. The results from these transects show a reduction in the amount of waste recorded but an increase in the proportion represented by plastic. See Appendix 7 for further details on these data.

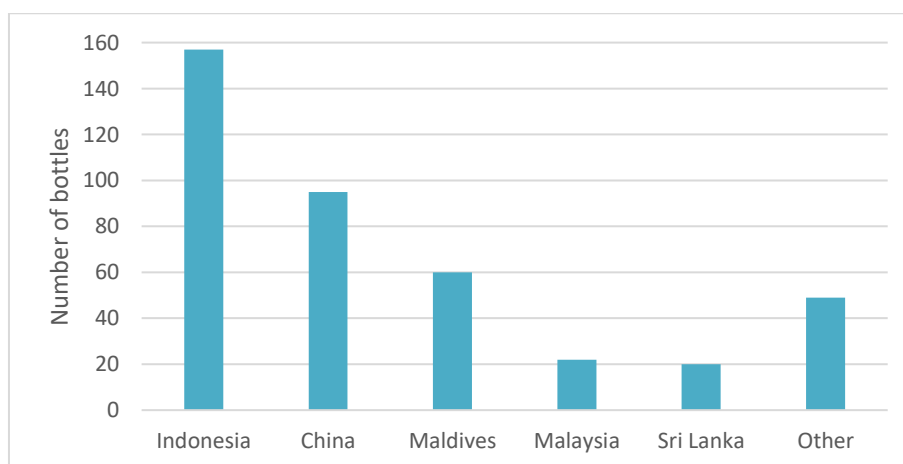


Figure 6. Countries of origin for water bottles collected during beach clean on Ile de Rats June 2019

At Ile de Rats in 2019 the countries of origin of water bottles were recorded where labels were legible. Note the countries represented in the project data above very closely tracks independent research represented

in figure 6 in section 3.4 (Jambeck et al 2015²) that shows the primary countries contributing to mismanaged plastic waste globally.

The MSc study was completed successfully (Appendix 5) with a preliminary analysis of the spatial and temporal distribution of beach waste across BIOT; some key findings were that lagoon facing beaches had a higher concentration of plastic waste than seaward facing ones, there was more plastic recorded on beaches across BIOT from transects conducted in March than in June, and that across all atolls surveyed plastic was by far the most commonly recorded material component of beach waste (Appendix 5). The team plans to conduct further analysis of these data with the intention of producing a manuscript for submission to a peer reviewed publication later in 2020.

An activity planned for early 2020 that has had to be postponed was the deployment of 10 satellite trackable tags embedded into plastic water bottles (Fig 10 in section 8) across BIOT to gather data on localised circulation patterns near to islands. The team has secured match funding for 10 of these tags and one year of satellite time (a total of £9,700 of new funding) and hope to be able to deploy them before the end of 2020. The delay was due to problems securing key electronic components due to the COVID-19 situation.

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. (Y1Q1–Y1Q2)

On DG an 'adopt-a-beach' scheme was launched in 2019 – an initiative led by the EO and supported by the BritRep and US CO. DG residents that have volunteered with the turtle team on previous trips have been motivated to join this scheme having seen the effects of plastics on nesting turtles first-hand. The scheme matches teams of volunteers with a stretch of beach along which they commit to regular beach cleans (See Appendix 9 Map of DG with beaches in scheme) with a total of 6.36 tonnes of beach debris having been collected in 2019. Data from these beach cleans (number of people/hours and metres of beach) will be logged by the EO for analysis. These data will be available for inclusion in the half year report in October 2020.

A set of beach clean guidelines was drafted in November and December 2019 for review by departmental heads in DG. The beach clean-up guide is completed (see draft in Appendix 10) and will be distributed to coordinators of beach clean teams. It describes the value of the beach cleans for turtle nesting and give clear guidance on access to beaches and timing for turtle nesting.

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 (Y1Q1–Y1Q2)

The team secured 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' and 'non-biodegradable' disposable items (cups, bowls, plates, and cutlery) in 2018 and 2019. Limited data were available for sales through 15 MWR outlets (takeaways, bars and restaurants). Analysis of these data shows that 94% of the sales of bottled water were made through the Ship's Store, making their sales data a good indicator of overall volumes in use. The total number of plastic bottles of water sold in the Ship's Store was 320,448 in 2018 and 296,640 in 2019 showing a slight reduction that will be interesting to revisit over the lifetime of the project. As an indication of the volumes of plastic represented by these figures – the sales of 1.5 litre water bottles alone (185,760 bottles containing 32 grams of PET plastic each) produce 5.9 metric tonnes of PET plastic each year, almost all of which is currently incinerated. Full analysis of these data is in Appendix 11.

Activity 2.2 Interview procurement officers, retail and waste managers (Y1Q1)

Interviews and surveys were used to canvas attitudes and opinions from a broad range of people living and working in DG. These techniques provided information on the baseline condition, how people viewed potential future scenarios and what the barriers to achieving plastic reduction might be. These responses will be integrated into the system analysis work in 2.4 when all survey data have been received.

The project team used a tiered approach to gathering qualitative and semi-quantitative data from people living in DG. The first tier was a series of formal in-depth interviews conducted with five key stakeholders in decision-making positions and with the ability to influence or communicate with large groups of people.

Respondents were given an explanation on how their responses would be recorded and analysed and assurances that no personal data other than name and role would be collected at this stage. See Appendix 12 for details of stakeholders interviewed for the project.

The second tier was a focus group conducted with eight attendees plus the project team – mostly people interested in attending the weekend beach clean in Egmont atoll. This was a self-selected group of military personnel, with an interest in the project activities and aims. The project team used a structure of open-ended questions around attitudes to the ocean and use of SUP to explore barriers to change.

The third approach was the attitudes questionnaire designed to be delivered to large numbers of people and with a Tagalog translation to increase access for the Filipino community (see Activity 2.3).

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 (Y1Q1–Y1Q2 & Y2Q1 & Y3Q1–Y3Q2)

The survey was piloted in June 2019 with 43 respondents. Results from the pilot were used to develop the final survey (Appendix 13), distributed in Tagalog and English between January and March 2020.

Completed surveys are still being collected, however, with DG personnel occupied with COVID-19 related tasks it has been challenging to achieve the target of 300 responses. As this survey data forms a central part of the systems analysis, the team proposes to seek further responses to the survey when access to DG is restored.

The 127 responses received so far are being analysed (Appendix 14) for input to the development of the systems map and campaign strategy. A couple of key points from the analysis so far:

- SUP water bottles are the most common SUP item used, followed by take-away drinks and plastic bags.
- Tap water has been identified as the least popular source of drinking water, with 48% of respondents saying they don't like the tap water due to the taste.

Activity 2.4 SUP system map for DG formulated and distributed for comment that identifies current procurement, use, waste disposal and recycling strategies/barriers (Y1Q1–Y1Q4)

An initial system diagnosis of the SUP challenge in BIOT has been completed by Forum for the Future, based on analysis of the interviews and surveys undertaken by the fieldwork team, as well as workshops with the project team in London to review and evolve the analysis outputs. The diagnosis focused on the overarching research question of 'How might we reduce the harm of SUP impact while connecting people with the value of the ocean?'

A draft map of the system has now been developed (Appendix 2), laying out the structure of the current system of procurement, use and disposal of SUP in DG and was integrated with data from residents on their beliefs and behaviours connected to ocean health, drinking water and plastics use. The diagnosis has revealed three key dynamics – a lack of ownership over whose waste it is, lack of trust in the water supply and a complex procurement system. These in turn are connected to deeper patterns, including a lack of connection to the ocean – either visually, physically or emotionally.

The key 'barriers to change' were identified as:

- Currently high levels of SUP use
- Drinking water from taps is mistrusted and perceived to taste bad
- Low personal engagement with the ocean

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 (Y1Q4)

The system diagnosis and resulting systems map, developed by Forum for the Future are now being used to address how to move from the current system to a new system of reduced SUP use on DG, with specific intervention points identified as:

1. Creating a refill culture through messaging around drinkability of tap water using reduction in access to water bowlers as a key trigger – distribution of free refill bottles to overcome current price barriers.
2. Communicating with and through the contractor communities via cultural/social events – using their status as a 'trusted voice' on DG matters to reinforce safe drinking water messages.

3. Leveraging sense of pride through messaging around safe stewardship and protection of precious natural resources on DG and using the time personnel spend on DG as an opportunity for creating ocean ambassadors.

Activity 2.6 Rank interventions to identify highest priority actions with greatest impact and work them into a SUP reduction campaign (Y1Q4)

The SUP reduction campaign planning is underway with technical specialist Communications. Inc. partnering to deliver graphic design and messaging materials (Appendix 4) with the central logo 'Hello DG - Goodbye Ocean Plastic'. This built on a similar campaign delivered in London by the #OneLess team, which enabled us to use tested effective messaging (adapted for DG) and optimise our design expenditure. Highest priority actions are:

- Pledge signing – up to 800 people sign an on-line pledge to reduce their SUP use in exchange for a refillable bottle. Email addresses collected for follow up activities.
- Communications campaign around message of safe drinking water – media channels including phased poster campaign across DG, radio and TV recordings.
- Recruit volunteers for a DG-wide beach clean and repeat beach clean on Egmont atoll from the British Patrol Vessel.
- Engaging contractor communities through involvement in cultural and social events during campaign.

Activity 2.7 Develop and implement SUP water bottle reduction campaign, including drive for residents to sign the #OneLess pledge (Y1Q4–Y3Q3)

The SUP reduction campaign had originally been planned for a two-week period in June 2020, anchored around two key dates: 8 June - World Oceans Day, and 12 - June Philippines Independence Day. See Appendix 3 for the draft programme – now in revision. Restrictions on access to DG put in place since March due to COVID-19 have meant this activity will now be delayed and the project team is developing an alternative set of dates in November should access to DG be restored - see Appendix 3 for draft timetable. The campaign will comprise a series of stand-alone activities but was also timed to take advantage of any existing cultural and social events happening in that period. As many events are being postponed, we hope we will be able to align with similar activities later in the year. The campaign aims to reach a range of different audiences across DG, so the medium and tone of the messaging will vary but the central messages themselves, developed from the research conducted in year one of the project, are consistent:

- DG's amazing beaches are very important for turtles, help them by joining a beach clean and saying goodbye to SUP.
- 'Drink water the DG way' - refill your own reusable bottle; it's safe and drinking water is freely available everywhere.
- Do your part and help reduce ocean plastic '#OneLess' plastic bottle at a time.
- Leave DG as an ambassador for the ocean.

The project team has been working with Communications Inc. an agency with specialist experience in ocean communications and campaigning to develop a comms strategy and timetable for delivery (Appendix 3).

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 (Y2Q1–Y2Q2)

The exchange of a branded refillable water bottle (Hello DG, Goodbye ocean plastic) for the signing of a pledge to reduce personal SUP use over the following year will be a key part of the campaign activity. Up to 1,200 bottles will be distributed and a target of half the 800 people signing the pledge will be asked to volunteer their email addresses for follow up communications from the project team, including a survey to establish how many people fulfilled the pledge. The timing will be reorganised within Year 2, once travel restrictions are lifted and we can deliver a meaningful campaign in DG.

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 (Y1Q1 & Y2Q1–Y2Q4)

The film has been commissioned from Taylor Made Media. Footage was collected by the team during the June-July 2019 expedition to Diego Garcia, and additional footage opportunistically collected during another expedition in November-December 2019. Editing was completed in Q4. The film has been finalised and we are now waiting to receive the high-resolution version to be shared during the campaign. The final draft version can be viewed at [this link](#) with password TMM.

Rachel Jones conducted a filmed interview with DG communications lead Brandon Shelander in March 2020 which will form the basis of future communications on the project.

Activity 2.10 Plastic waste sampled quarterly from waste storage area and numbers of plastic bottles/ tonne of waste estimated (Y1Q1–Y3Q2)

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 on DG. 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 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 plastics 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. See Appendix 11 for analysis of SUP plastic and alternatives in retail sales on DG.

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 (Y3Q2–Y3Q3)

Baseline established via methods outlined in Activities 2.2 and 2.3 – the data planned for collected in year 3 of the project will form the comparison for analysis.

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 (Y1Q1–Y1Q2)

Sampling data to describe the volumes and proportions represented by different plastic materials has been compiled from three sources; the retail sales figures, sampling of beach waste in-situ across BIOT and the waste collected during the DG atoll-wide beach clean in 2018 and stored at the waste management site (Appendix 6). As noted in section 2.10, difficulties identified in accessing the waste management site regularly to access waste streams for sampling necessitated a change of approach and retail sales data were selected as a suitable alternative indicator. Data from retail sales and the data from waste collected during beach cleans will be analysed annually for changes in volumes.

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 (Y1Q2–Y3Q2)

There are two main waste streams of plastic on DG; the first is that supplied through procurement channels into retail sales as described in 2.10. These items are collected via waste channels but are not sorted either at the collection point or at the waste management centre. They are then disposed of via incineration. This waste stream is largely composed of food-grade SUP, intact and in relatively good condition at the point of incineration.

The second waste stream is plastic items collected during beach cleans on DG and moved to a large holding pile near the waste management centre (Figure 5 in section 1.3). Sub-samples (n=7) were taken from this aggregated pile and sorted into categories, counted and weighed. These items have generally been at sea for many months if not years before being washed up over coral reefs and onto beaches. They are damaged by saltwater and UV exposure and often covered with calcifying aquatic organisms and algae. In many cases the plastic has aged and become brittle and fragile.

The materials composition and quality of this waste stream is quite different to DG retail waste. Polyethylene terephthalate (PET) in the form of water bottles alone still represents more than 20% of the total waste items recorded, however materials such as Polyethylene (PE), Polystyrene (PS), Ethylene Vinyl Acetate (EVA) and Polyvinyl chloride (PVC) are also common based on materials commonly used in the

manufacture of the top plastic items recorded. Data on materials composition and volume (recorded in Activity 1.3) will help inform potential recycling strategies in year 3.

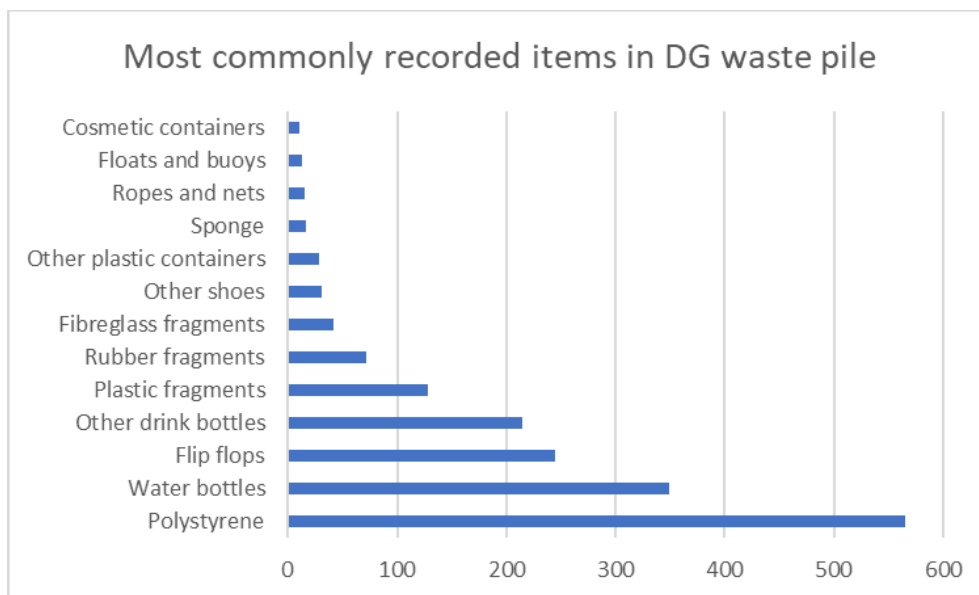


Figure 7. Top 12 most commonly recorded items in samples taken from DG beach waste pile

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 (Y2Q4–Y3Q3)

The project team has started to build the foundations of this activity through establishing a network of colleagues working in plastics analysis in partner organisations such as National Geographic and Exeter University. The experience of recycling alternatives used at other comparable sites such as other island UKOTs has been explored (See activity 3.5).

Additionally, the team has been exploring alternative recycling options, and has begun conversations with [Ecobooth](#), a sustainable events company that transforms plastic waste into engaging and useful products and exhibits.

Activity 3.4 Report produced summarising options and making recommendations for plastic waste management to BIOT managers (Y3Q4)

No activity scheduled in this period.

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)

Note that this activity is scheduled for the final year of the project but the project team took advantage of the group convened for the Blue Belt Symposium at Exeter University (Penryn) to hold an informal half day 'Plastic waste in the UKOTs' discussion group on 1 August 2019. The event provided an opportunity for representatives of six UKOTs as well as the University of Exeter, CEFAS and the project team to discuss issues, challenges and innovations around plastic management issues. Commonalities in managing plastic waste in remote island locations with poor waste infrastructure were established and the group shared some potential solutions. The project team distributed resources relevant to sampling plastic beach waste to the group after the meeting. See Appendix 15 for notes from Plastics in the UKOTs Workshop.

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.

Very good progress has been made on this output. Baseline conditions have been established: The distribution of waste along beaches across BIOT was quantified of which an average of 84% was composed of plastic items. Priority beaches for turtle nesting were also identified (Appendix 16). Temperature loggers, sand cores and experimental plots were used to gather data on the effects of plastics on nest conditions and observations made on nesting attempts impeded by sub-surface plastic. Well managed mitigation measures implemented reduced surface plastic on nesting beaches, see Appendix 7.

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. The system of SUP use on DG is now understood and mapped (Appendix 2). This mapping exercise has in turn identified priority intervention points and messages which have been incorporated into our campaign design and strategy. The campaign designed for year 2 will deliver activities to reduce personal SUP use, increase refilling and create positive links with ocean health. Alternative products to replace plastic items are already being offered for sale in the Ship's Store, polystyrene food containers are being replaced by metal 'tiffins' in the central restaurant and food take away points are being guided to reduce the inclusion of plastics cutlery with orders unless requested.

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

Progress towards this output is good. Beach waste collected to date on DG was analysed for approximate quantity (total volume) and item categories with further work required on materials composition. Quantities of SUP items in the DG system were described over a three-year period prior to the project and will be made available annually through the project. Further analysis planned for year 2 with final reporting 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 very good.

A scheme of allocated beaches and regular team beach cleans has been put in place across the DG atoll, informed by best practise and maximum utility for turtle nesting seasons. A quantifiable analysis of estimated volumes of beach waste removed by this scheme will follow in the next report. In addition, 13 volunteers with seven science/project team members cleared approximately 1.4 kilometres of beach heavily used for nesting by green turtles on Ile de Rats in Egmont atoll in June 2019.

Continued monitoring of beach debris will be conducted along Index beach bi-monthly through year 2 and at Egmont atoll at least once annually to assess the rate of plastic returns and build on the initial observations in Appendix 7.

In addition, the first year of data on turtle nesting completion on Index beach has been collected which will contribute to a peer-reviewed manuscript in year 3 of the project.

Our survey, interviews and observations have provided information on views and behaviours in regard to ocean health and plastic use and guided the evolution of campaign messaging that resonates with people's local concerns over safe drinking water. The baseline of SUP use on DG has been established both in volume and type of plastic used.

We are reviewing whether the indicator that measures a reduction in the sale of SUP water bottles by 75% over the life of the project is realistic - the withdrawal of water bowsers in March 2020 may drive an increase in sales of bottled water if the messaging around safe tap water does not get through. Additionally, attitudes and behaviours may be affected by COVID-19. We are reviewing this as we plan how to most effectively implement the campaign in year 2, both in timing and content.

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 Appendix 11 is detailed and by commercial necessity, accurate. The high costs of import of food items to DG (such as drinking water) means the inward flow is carefully managed to match demand. 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 lifespan of the project.

Comments: There is no evidence to the contrary at this stage. Mismanaged plastic waste is common in the countries bordering the Indian Ocean (see Figure 8) and this same study projects forward to 2025 with little change to the contribution of countries such as Indonesia, China and Malaysia which are well represented in the countries of origin recoded from water bottles collected on BIOT's beaches in 2019.

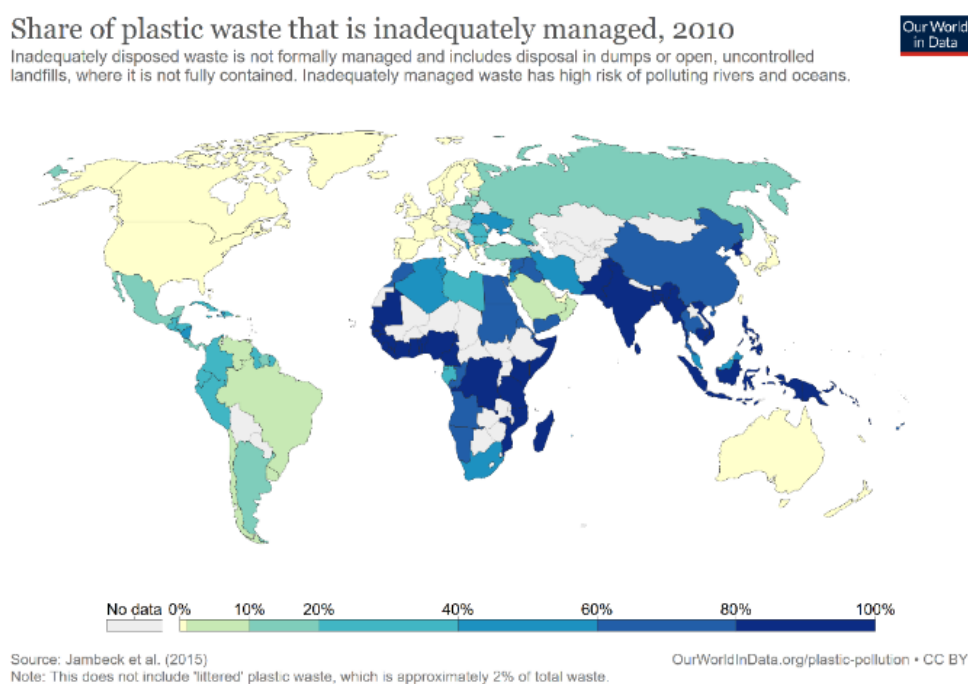


Figure 8. Countries in dark blue indicate where between 80 and 100% of plastic waste is inadequately managed showing concentration in countries around the Indian Ocean basin². The cluster of countries to the north east of BIOT is reflected in the data on water bottles collected during beach cleans in 2019 see figure 6 in section 1.3

Efforts to improve waste management systems and reduce plastic consumption are underway through the region but given the estimated 1.3 trillion³ floating surface plastic particles currently in the Indian Ocean basin, the lag time between source and sink (BIOT's beaches), and the longevity of plastics (100s to 1,000s of years to break down), there is unlikely to be any major changes in the next 24 months.

² Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., ... & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768-771.

³ Eriksen, M., Lebreton, L. C., Carson, H. S., Thiel, M., Moore, C. J., Borerro, J. C., ... & Reisser, J. (2014). Plastic pollution in the world's oceans: more than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. *PloS one*, 9(12), e111913.

Macroplastics in the surface ocean

Macroplastics are buoyant plastic materials greater 0.5 centimeters in diameter. Future global accumulation in the surface ocean is shown under three plastic emissions scenarios: (1) emissions to the oceans stop in 2020; (2) they stagnate at 2020 emission rates; or (3) continue to grow until 2050 in line with historical plastic production rates.

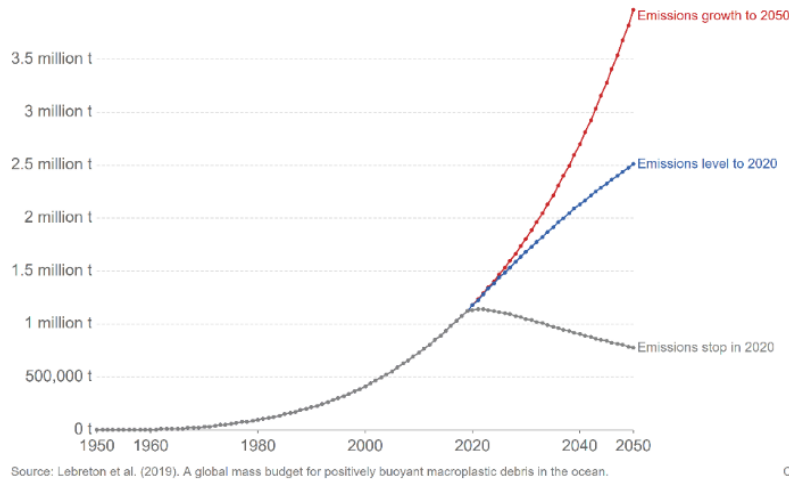


Figure 9. Floating ocean macroplastic projections to 2050⁴

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 project team continues to feel that SUP water bottles are the single best flagship item for the project – particularly in its campaign phase on DG. Not only do they represent a significant proportion of the total plastic consumed on DG, they represent a problem with a simple, alternative solution (tap water) and are a small change that any individual can easily make. In addition, our beach clean data show they are one of the most abundant items in marine litter on DG (and across BIOT). Behaviour change that is accessible, achievable and personal is a very useful bridge to engaging audiences with large and complex issues such as ocean health. This has been demonstrated by the success of the #OneLess campaign in London, which has engaged over 90 businesses and organisations in the city and so far eradicated 4.3 million bottles from circulation^{5,6}.

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 (Appendix 14), will contribute towards our understanding of some of the specific values held by our target audience for the SUP reduction campaign on DG. This information is now informing the development of the campaign, incorporating values-specific messaging into the campaign assets and outreach activities. A key aim of the SUP reduction campaign will be to make people on DG feel more connected to the ocean so that they more fully understand, appreciate and care about the impacts of plastic on the ocean, and on the turtle populations in BIOT. 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 project period within the same parameters and constraints known from over five years of conducting research on DG.

Comments: AMC flights to DG only run at an approximate 60% consistency at the best of times so delays and cancellations are not infrequent. Recent events around the COVID-19 pandemic have now completely shut down access to DG for civilians. At the time of writing it seems unlikely that the project team would be able to complete the campaign activities as planned in June, but planning will continue and the team is working on a provisional revised campaign in November. With a campaign strategy and assets in hand and

⁴ Lebreton et al. (2019). A global mass budget for positively buoyant macroplastic debris in the ocean. Nature Scientific Reports.

⁵ Environment Audit Committee. 2017. Plastic Bottles: Turning Back the Plastic Tide First report of Session 2017-2019

⁶ London Evening Standard. 2019. 50 new water fountains to be installed across London, Sadiq Khan announces. Accessed 15/04/19: <https://www.standard.co.uk/futurelondon/theplasticfreeproject/50-new-water-foundtains-thames-water-mayor-of-london-sadiq-khan-a4192716.html>

ready to go the team can be mobilised whenever access to DG is restored and will work with the BIOT administration to identify suitable alternatives as they become available.

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

Comments: As documented in Assumption 1.1., we are confident that data received on retail sales does accurately describe the patterns of SUP flow through DG both in terms of volumes and of types of product. These data are available for analysis over the course of the project.

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

Comments: The system diagnosis process revealed clear points of intervention around perceptions and availability of drinking water (Appendix 2 and 17). Alternative products have been sourced for sale in the Ship's Store (bamboo disposable cutlery, paper plates and straws) and initiatives have been put in place to reduce the automatic dispensing of plastic items with takeaway food and drinks.

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

Comments: The project aims to change not just a cohort of people passing through DG but the system itself so that each new cohort of people being inducted into the DG processes is taught that the 'DG way' of doing things is to reduce plastic where possible and be responsible for ocean health by acting on local efforts. As part of the campaign activity materials and assets will be shared with individuals conducted on-boarding and induction sessions with new starters. We have also identified that the support staff employed through contractors spend far longer on DG (many years) and therefore have been identified as a key stakeholder group for this project.

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

Comments: The pledge signing strategy includes an element of follow up designed to re-contact a proportion of those signing to reassess their plastic use a year on. We are embedding this behaviour in a wider set of messaging around how people behave when they leave DG, as ocean ambassadors.

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 though continuity of supplies may be an issue.

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.

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

Comments: Participation on the behaviour survey has been lower than hoped for and has been impacted by the on-island response to the COVID-19 pandemic. With no access in person for the project team, follow up on retrieving completed surveys has been hindered. The ability to complete tasks remotely is harder to achieve on DG than in other working situations as there is a high dependency on in-person communications. Work will continue on this task as soon as access to DG is restored.

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

Comments: The pledge-signing process will include a request for a voluntary sign up to a contact database (all data to be collected and held in accordance with GDPR guidelines and processes will be developed with ZSL's legal team). If 800 pledges are signed (roughly half the DG population) and 50% of those signing agree to be contacted, the aim will be to get 20% of those contacts to respond to short follow up surveys 12 months on from the pledge signing.

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

Comments: This assumption is being well met so far – the DG-led initiative the Adopt-a-Beach scheme has been running on DG since the beginning of 2020 and has beach teams signed up to regular beach cleans every two months. Beach cleans in Egmont atoll are scheduled annually through the three years of the project (year 1 complete). The high costs of diesel fuel for the patrol vessel has meant that Egmont is the atoll most feasible for this activity, it also allows for the involvement of volunteers from DG as a beach clean can be conducted over a weekend. Access limitations may impact this assumption in year 2.

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 for details on Adopt-a-beach scheme. This programme is being supplied with PPE and collection bags by the BIOT administration and is supported by volunteers from DG personnel overseen by the EO and Nestor Guzman from PWD. The BIOT administration has confirmed that the British Patrol Vessel will be available for a two-day beach clean on Egmont atoll annually to be scheduled around its commitments to enforcement of the BIOT MPA.

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

Comments: An initial investigation into the quantities and types of plastics available in the two waste streams on DG has been conducted. Further materials investigations will follow later in the project.

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

Comments: The BIOT administration has been an enthusiastic partner through all stages of the planning and first year of delivery of the project. The recycling options feasibility and cost benefit analysis stage of the project in year 3 will be conducted in close partnership with that team in order that the final report is appropriate for their needs.

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

Improved waste management generally and that of plastics specifically is laid out as a priority in the BIOT Draft Conservation Management Plan. The data and findings of this project will support those efforts by making practical and locally relevant recommendations for management options.

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. The two species of sea turtle this project focuses on are both globally threatened; green turtles are Endangered and hawksbills are Critical according to the IUCN and are heavily exploited across the western Indian Ocean. The 640,000 km² BIOT EEZ represents one of the world's largest no-take MPAs in one of the world's most over-exploited ocean basins. The outcome of this project aims to improve the status of coastal habitat by removal and mitigation of marine litter thereby improving the reproductive output of threatened species which directly supports the indicators outlined above.

OPTIONAL: Consideration of gender equality issues

The demographic of the 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.

5. Monitoring and evaluation

The monitoring and evaluation of the project is shared between the partners, with each partner focused on their primary project activities. Information and updates on the project are available on a shared Dropbox

where project work is stored. Project team meetings are held to update and share progress as well as more frequent communication through channels such as email and Slack. The first year has involved the development of research practices and agreement of some standardised data collection techniques such as the use of the Marine Debris Tracker for beach transects. Most data (quantitative and qualitative) is stored in Excel databases, with some qualitative data from interviews and focus group discussions held in Word documents stored on the project Dropbox, all personal data on survey respondents has been removed from these documents and is stored separately and securely on the ZSL OneDrive. This year has focussed more on the collection of baseline data which are necessary for us to monitor our impact in year 2 and 3 of the project.

To ensure behaviour change is captured during this project, micro-indicators have been developed to track reductions in use and sale of SUP items and increases in the availability of SUP alternatives in retail outlets. For example, by recording the increase of non-plastic items for sale in the store in DG and the reduction in 500 ml water bottles available to purchase. One change has been made from the original monitoring plan, due to difficulties accessing the waste site to collect samples of plastic waste generated in DG, the team are instead using the retail data to understand the type of plastic entering the waste centre.

As part of the wider Bertarelli Marine Science Programme, the project team already monitors the number of students involved in projects and contributions they make. One MSc student completed their dissertation with Nicole Esteban at Swansea University for four months during this first project year. Their research will be included in a manuscript for submission to a peer reviewed journal in year 2. The number of workshops organised by the team is recorded as well as the different dissemination opportunities such as presentations at conferences, workshops, universities, etc. Time spent on this project by researchers outside of the project team is recorded so that their contribution in kind can be quantified. This is added to any additional funding we have received such as from the Bertarelli Foundation which has supported four field visits to DG by members of the project team in June 2019, November 2019, Feb 2020 and March 2020.

6. Lessons learnt

A lesson learned from year 1 of this project is that the project team has found it harder to communicate with and get responses from people on DG remotely than anticipated. Internet access is often unreliable, and it is difficult to send digital documents as attachments. In addition, the working culture is based around in person interactions on base, making remote communications often a lower priority.

Making logistical plans and getting timely responses has been far more successfully done in person. The project team has made use of other work funded in DG that required visits in person to leverage some time for this project as well. Changes that could be made in retrospect would be to include an additional annual planning visit to DG.

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

From our original application feedback:

The targets for Outcome indicators need to be quantified; many means of verification currently read as activities. Means of verification are the data sources you will use to provide evidence that indicators have been met.

Our outcome indicators are:

0.1 Number of abandoned nesting attempts by hawksbill and green turtles recorded on the 2.75km Diego Garcia Index Beach by Q4 Yr3 from baseline set by Q2 Yr1

Action taken: Number of abandoned nesting attempts by hawksbill and green turtles recorded on the 2.8 km Diego Garcia Index Beach is reduced over the course of the project by sustained programme of beach cleans. Bi-monthly surveys record nesting activity and any abandoned attempts caused by sub-surface plastic.

0.2 Hatchling sex ratios of hawksbill and green turtles maintained close to 2016 baseline of 50:50 on the 2.75km Diego Garcia Index Beach by Q4 Yr3

Action taken: This will be indicated by data from three sources: 1) 12 temperature loggers in long-term study to compare temperature during project to 2016 baseline 2) 16 temperature loggers in field trial to test the effect of plastics on incubation conditions. 3) Five sand cores taken for analysis of the density and

distribution of plastic particles through the sand column. Limiting plastic accumulation will maintain sand temperature within a range conducive to a balanced sex ratio in hatchlings.

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.

Action taken: Proportion of DG SUP comprising SUP water bottles for sale gives a baseline against which to measure change over the next two years. See Appendix 11.

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.

Action taken: DG population is currently nearer to 1,500 in total (variable but on average) so 75% is nearer 1,125. We have budget for 1,200 refillable bottles, and we intend to ask for a pledge in return for at least 800 of these as well as sign people up to allow us to follow up with their progress one year later.

8. Other comments on progress not covered elsewhere

Section 1.3 reports on an additional source of funding (£9,700) secured for the build and deployment of 10 bottle tags and a year of satellite time to track them. These tracks will produce valuable data on the behaviour of floating plastic items in and around the complex system of reefs and islands of the archipelago. Delays to supply chains due to COVID-19 have delayed the production of the bottles but this activity is planned for later in 2020.

A complimentary activity in development is work with colleagues at ZSL who have a paper in review modelling the tracks of drifting fishing gear across BIOT. We are exploring how this model might be re-purposed to track plastic bottles in the same way with the bottle tags deployed to ground-truth some of the assumptions made in the model. This work is also complementary to another study made of the behaviour of SUP water bottles leaving the Ganges River and entering the Indian Ocean basin – see Figure 11 for the track of one of these bottles deployed in the Ganges estuary in Bangladesh in 2019.



Figure 10. Satellite trackable bottle tags

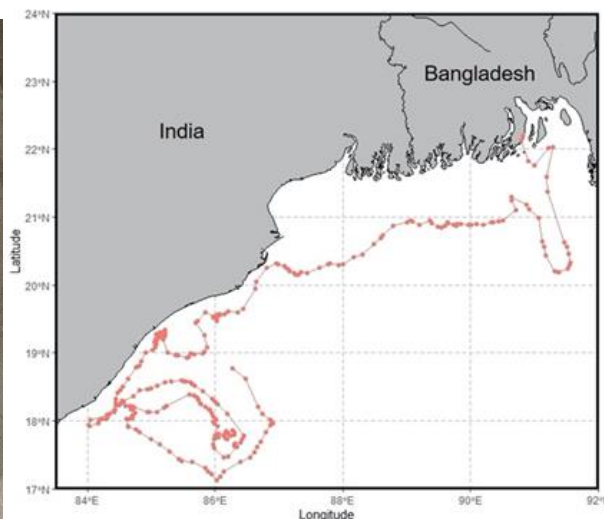


Figure 11. Track of one floating bottle tag over 6 months from its release in the Ganges estuary. **Not for publication.**

The removal of water bowsers may create a short-term increase in use of SUP water bottles unless proactive planned measures are taken to counter the narrative that drinking water is not safe or healthy. There is a risk that if we are prevented from intervening with a timely positive message (because of access restrictions) the negative behaviours may become entrenched and therefore harder to subsequently change.

The restrictions on civilian access to DG are a risk to the timely continuation of the project activities as planned. At the current time the project team plans to continue with campaign strategy development with a view to re-scheduling the work for later in Year 2 (currently anticipated to be Q3 rather than Q1) but if by the end of Q1 this looks unlikely or unclear a more fundamental reordering of project activities may be required. For example, recycling research activities planned for year 3 may be brought forward.

9. Sustainability and legacy

The plastics project has supported and been encouraged by a growing interest in plastics reduction on DG more generally. The project aims to amplify and support these efforts by publicising them in campaign materials and branding. All campaign digital assets/film etc are to be made freely available for use on DG. The US CO has articulated a commitment to plastics reduction in the Commanding Officer's Environmental/Energy Conservation Policy, a summary of which is hung in every room and which includes a commitment to "Implement pollution prevention measures with special emphasis on reducing the use of single use plastic."

The Adopt-a-beach programme was conceived by the EO and is delivered in conjunction with the Public Works Department on DG. As a DG led initiative with good support from senior management figures, it has a good chance of becoming a lasting operation with very tangible results for turtle habitat.

A new copy of the DG Environmental Protection Handbook was published in January 2020 and makes a feature of SUP reduction ideas on the front cover.

10. Darwin identity

The Darwin Initiative is acknowledged as the funder on communications and project outputs, for example this includes use of the Darwin logo in presentations, and the official Darwin Initiative Twitter account is tagged in relevant social media posts (see Appendix 18). The logo is also being used in the development of the campaign assets, including the campaign film which will be shown on screens across DG, and posters which will be displayed around DG (see Appendix 4). At this stage of the project there is relatively low recognition of the Darwin programme on the island, apart from those who are directly working on this project. When the campaign is launched there will be much more exposure of the Darwin Initiative on the island. This project works with the Bertarelli Marine Science Programme and uses its communications channels to amplify the communication of this project through its Twitter account @BIOTscience and website (www.marine.science).

11. 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 policies to align to this commitment including; Global safeguarding policy; Safeguarding policy for UK staff; Global whistleblowing policy and procedures; Global code of conduct; DBS and criminal record check policy; Employing younger worker policy; Disciplinary Policy and procedures; Reference request policy; Violence and aggressive behaviour policy; The 4 R's safeguarding policy; Staff handbook.

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

- designating a named 'Safeguarding Trustee' who meets regularly with the Designated Safeguarding Lead (HR Director, Fiona Evans).
- a number of Designated Safeguarding Officers.
- a strategic group which meets every few months to consider how the rollout of our safeguarding is going and to provide direction (our Safeguarding Trustee, Designated Safeguarding Lead, and Head of Legal) along with a wider working group to help lead implementation.
- received updated global safeguarding training from independent experts including s of 'train the trainer' sessions to allow safeguarding leads to provide this training in-house in ZSL; and
- raised awareness of the updated Whistleblowing Policy by creating posters in different languages to be distributed amongst ZSL staff.

ZSL's Global Safeguarding Policy aims to ensure that our staff and other representatives, and the communities and other beneficiaries we engage with in our projects, are protected from all forms of abuse

and harm, either direct or indirect, intentional or unintentional as a result of unintended consequences; and to ensure that our organisational integrity and reputation, and that of our partners, is also protected from harm. This policy is mandatory for, and requires compliance from, all ZSL staff and partner and contractor organisations are expected to agree to work under this policy as a condition of their involvement with ZSL or demonstrate their own equivalent policy standards.

All these policies apply to the project team and partners as a minimum set of standards. Other institutional policies may also be in use by the other partners on this project but they should be at least equivalent to the ones outlined above all of which are available on request from the project lead Rachel Jones .

12. Project expenditure

The figures provided below are indicative of the first year spend. Partners have been paid their portion of the grant funding from ZSL. Final receipts and confirmation of final partner spending is pending and will be confirmed for actual spend form.

Table 1: Project expenditure during the reporting period (1 April 2019 – 31 March 2020)

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2019-2020 – if applicable

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
<p>Impact</p> <p>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.</p>		<p>Increase in scope and frequency of beach cleans across DG has removed mostly plastic waste from turtle nesting beaches. Surveys of beach waste across all atolls in the archipelago have identified priority sites for beach cleans that most benefit turtle nesting. Efforts to reduce SUP use on DG supported by key stakeholders there.</p>	
<p>Outcome</p> <p>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</p>	<p>0.1 Number of abandoned nesting attempts by hawksbill and green turtles recorded on the 2.75km Diego Garcia Index Beach (BIOT turtle nesting reference site) is reduced by Q4 Yr3 from baseline set by Q2 Yr1.</p> <p>0.2 Hatchling sex ratios of hawksbill and green turtles maintained close to 2016 baseline of 50:50 on the 2.75km Diego Garcia Index Beach by Q4 Yr3</p> <p>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.</p> <p>0.4 75% of personnel on DG (approx 2250) understand the impact of their use of single use plastic on marine</p>	<p>0.1 Seven surveys were completed on the Index beach between July 2019 – March 2020. Three nesting attempts aborted due to plastic.</p> <p>0.2 24 temperature loggers installed on Index beach to monitor nest temps.</p> <p>Sand cores taken from Index beach for microplastics analysis at Swansea University</p> <p>Experimental plots assess the effects of plastics on sea turtle incubation conditions commenced in November 2019.</p> <p>0.3 Volume of plastic waste comprising SUP water bottles estimated from retail sales data.</p> <p>0.4 Surveys conducted to establish baseline attitudes.</p>	<p>0.1 Surveys continue bi-monthly</p> <p>0.2 Temp loggers to be collected in 2021 and data analysed</p> <p>Sand cores to be analysed.</p> <p>Temp loggers to be excavated in 2021, data analysed. Disturbance of experimental plots to be noted.</p> <p>0.3 Sales data will be monitored annually for change.</p> <p>0.4 Analysis of data from surveys to be analysed and added to systems</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
	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.		analysis. Plan for #OneLess pledge as part of campaign - detail in report
<p>Output 1.</p> <p>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.</p>	<p>1.1 Nesting beach plastic monitoring strategy developed and in place by Q2 Yr1 with 24 bimonthly surveys on 2.75km Diego Garcia Index Beach (BIOT turtle nesting reference site) to quantify nesting activities that were unsuccessful due to presence of surface and subsurface plastic.</p> <p>1.2 Effect of subsurface macro and micro plastics on sand temperature and humidity at turtle nesting depth and effects on turtle hatchlings is understood by Q4 Yr3.</p> <p>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.</p> <p>1.4 Nesting beach cleaning strategy developed and implemented on 2.75km Diego Garcia Index Beach (BIOT turtle nesting reference site) and two pilot Northern Atoll beaches by Q2 Yr1 with</p>	<p>1.1 Bi-monthly surveys of nesting activity on Index beach included observations of unsuccessful nesting due to plastic from July 2019.</p> <p>1.2 The effects of sub-surface plastic particles on the temperature and humidity turtle nests is being explored using three methods:</p> <ul style="list-style-type: none"> • 24 temperature loggers installed on Index beach to monitor nest temps. • Five sand cores taken from Index beach for microplastics analysis at Swansea University • Four experimental plots (each with four treatments) to assess the effects of plastics on sea turtle incubation conditions commenced in November 2019. <p>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 – see report</p> <p>Beach waste identified by country of origin – see report.</p> <p>Details of deployment of bottle tags – manufacture delayed by Covid-19</p> <p>1.4 Adopt a beach programme in place for Index beach, DG – awaiting data on frequency and weight of waste removed. Five 100m transects on beach debris conducted prior to beach cleans. Unsuccessful in getting follow up transects completed – these are scheduled to commence in 2020 once access to DG is restored.</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
	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)	Ile de Rats, Egmont atoll beaches (seaward and Lagoon) cleaned in June 2019, scheduled to be done June 2020 but that effort now delayed. Transects conducted before beach clean and again in March 2020 show reduction in quantities of beach waste of 75% in latter data.	
Activity 1.1 Bimonthly 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 Diego Garcia.		Completed Surveys conducted as planned (between July 2019 and March 2020). Seven surveys conducted. Three aborted nesting attempts recorded.	Surveys will continue over following year.
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.		Completed and extended 24 temperature loggers deployed Five sand cores taken. Four experimental plots set up. Data from above will form basis of manuscript.	Loggers to be retrieved early 2021, sand cores analysed and data from experimental plots analysed.
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. MSc study completed	Data collected across 5 atolls in 2019 for further analysis and production of manuscript for peer review. Developing plan for flow modelling with ground truthing element via 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. Most significant beaches for turtle nesting identified. Beaches on all atolls of the archipelago surveyed. Adopt a beach scheme has assigned a team per beach across most of DG atoll (map).	Regular recording and analysis of data from beach cleans.

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
		Beach clean guidelines written – ready for distribution.	
<p>Output 2.</p> <p>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.</p>	<p>2.1 SUP system of retail (supply and sale) and usage (purchase and use) on DG audited, analysed and mapped by Q4 Yr1.</p> <p>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.</p> <p>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.</p> <p>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)</p> <p>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</p> <p>2.6 A minimum of 75% reduction in SUP water bottles found in waste</p>	<p>2.1 Flow of plastics through DG 'system' analysed and mapped</p> <p>2.2 Intervention points identified:</p> <ul style="list-style-type: none"> • 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 <p>2.3 Plastic reduction campaign strategy designed including messaging, materials and communications plan – planned for June 2020 now re-scheduled for November 2020 if access to DG is restored.</p> <p>2.4 Campaign strategy includes provision of refillable water bottle in exchange for pledge signing. Collection of email addresses (under GDPR) allows follow up enquiries.</p> <p>2.5 Data on retail sales over the coming 12 months will be carefully tracked – at the time of writing there had been no reduction in retail sales.</p> <p>2.6 This indicator proved unsuitable due to problems with access to waste site. An alternative indicator is to monitor the sales figures via the main retail outlet. This dataset will give a clear indication of the volume of SUP water bottles flowing into the DG system over time.</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
	<p>sampling by Q4 Yr4 from baseline set established by Q3 Yr1.</p> <p>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.</p>	2.7 Baseline surveys conducted.	
<p>Activity 2.1.</p> <p>Collect and analyse supply chain data</p>		<p>Completed</p> <p>Retail data on DG secured from main shopping outlet including all SUP items common sale. Annual use of SUP estimated including elements comprised by water bottles specifically. DG physical environment mapped to detail provision of drinking water. See Appendix 17.</p>	Retail data will be analysed annually to assess changes over time.
<p>Activity 2.2</p> <p>Interview procurement officers, retail and waste managers</p>		<p>Completed – see section 3.1</p> <p>In depth interviews conducted with 14 key stakeholders.</p>	
<p>Activity 2.3</p> <p>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</p>		<p>Partially completed</p> <p>Pilot survey conducted in 2019 with 36 respondents. Final survey distributed (in English and Tagalog) in Feb 2020. 127 responses analysed so far to give baseline data – more still to collect. Progress on this indicator impeded by COVID-19 crisis. See Appendix 13 and 14.</p>	Continue to use survey to canvass opinions of incoming contractors as they go through induction to DG.
<p>Activity 2.4</p> <p>SUP system map for DG formulated and distributed for comment that identifies current procurement, use, waste disposal and recycling strategies/barriers</p>		<p>Completed</p> <p>See Appendix 2.</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
<p>Activity 2.5</p> <p>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</p>		<p>Completed.</p> <p>See key intervention points in report section 3.1.</p>	
<p>Activity 2.6</p> <p>Rank interventions to identify highest priority actions with greatest impact and work them into a SUP reduction campaign</p>		<p>Completed</p> <p>Interventions identified and used to create messaging in campaign materials. See section 3.1</p>	
<p>Activity 2.7</p> <p>Develop and implement SUP water bottle reduction campaign, including drive for residents to sign the #OneLess pledge</p>		<p>Partially completed but delayed</p> <p>Campaign designed for delivery in June 2020.</p> <p>Campaign programme and timetable – Appendix 3</p>	<p>Campaign delivery delayed due to COVID-19 crisis – currently rescheduled for Year 2 Q3.</p>
<p>Activity 2.8</p> <p>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</p>		<p>Partially completed but delayed</p> <p>Refillable bottles designed and procured to be exchanged for pledges signed during campaign. Production delayed.</p>	
<p>Activity 2.9</p> <p>Film commissioned, produced and shown in cinema, radio materials produced and interviews given on MWR radio station and in Tropical Times newsletter</p>		<p>Partially completed but delayed</p> <p>Film commissioned, shot end edited. At time of writing voice overs being recorded. Interviews given on DG.</p>	<p>Comms activities to be tied to delayed campaign.</p>
<p>Activity 2.10</p> <p>Plastic waste sampled quarterly from waste storage area and numbers of plastic bottles/ tonne of waste estimated</p>		<p>Sampling method changed and completed</p> <p>Systems analysis indicated the closed nature of plastic flow through DG i.e. what comes in for retail is what goes into waste with very little 'leaking' along the way. It is proposed that an analysis of retail sales is an accurate and more accessible alternative to analysis of</p>	<p>Retail sales will be monitored over the lifetime of the project with annual changes analysed.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
		waste streams and produces a measurable indicator of plastic flow.	
<p>Activity 2.11</p> <p>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</p>		<p>Yr 1 activity completed</p> <p>Baseline data collected for this report.</p> <p>Report due in year 3.</p>	<p>#OneLess pledges collected and follow up with respondents. Analysis of retail sales data of SUP water bottles.</p>
<p>Output 3.</p> <p>Strategy for recycling DG-generated plastic waste and plastic waste collected during beach cleans developed and recommendations made to BIOT administration</p>	<p>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.</p> <p>3.2 Minimum of three suitable options for reduction, reuse or recycling plastic waste (methods and products) defined by Q3 Yr 3</p> <p>3.3 Report produced summarising options and making recommendations for plastic waste management to BIOT managers Q4 Yr 3</p>	<p>3.1 Data collected on plastic categories in beach waste across all atolls and on DG generated plastic.</p> <p>3.2 Some research done into manufacturers of products created from beach plastic. One potential partner visited.</p> <p>3.3 No activity planned in this period.</p>	<p>Continue use of MDT transects on Index beach and Egmont atoll.</p> <p>Ongoing research and compilation of possible methods and products.</p>
<p>Activity 3.1</p> <p>Design sampling strategy based on estimates of total plastic waste collected annually</p>		<p>Sampling method changed and completed</p> <p>See notes in 2.10. Difficulties identified in accessing the waste management site regularly to access waste streams for sampling. Alternative strategy proposed is to combine data from beach waste transects, Adopt-a-beach cleaning programme with retail sales data to identify overall volumes and categories of plastic waste available in DG.</p>	<p>Ongoing beach cleans and data collection.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
<p>Activity 3.2</p> <p>Samples taken from beach cleaned plastic and DG generated plastic and most common items sorted and quantified by plastic waste stream type</p>		<p>Completed</p> <p>Transects conducted on all atolls across BIOT through 2019 using Marine Debris Tracker app to create dataset categorising plastic beach waste. These data combined with retail sales data and analysed by plastic waste stream category.</p>	<p>Repeat transects on DG Index beach every two months and on Egmont atoll annually assuming access is restored.</p>
<p>Activity 3.3</p> <p>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</p>		<p>No activity planned in this period.</p>	
<p>Activity 3.4</p> <p>Report produced summarising options and making recommendations for plastic waste management to BIOT managers</p>		<p>No activity planned in this period.</p>	
<p>Activity 3.5</p> <p>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.</p>		<p>Completed</p> <p>Opportunistic meeting held at Blue Belt Workshop in 2019. Appendix 15. No other activity planned in this period.</p>	

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

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@Itsi.co.uk if you have any questions regarding this.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>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.</p>			
<p>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.</p>	<p>0.1 Number of abandoned nesting attempted by hawksbill and green turtles recorded on the 2.75km Diego Garcia Index Beach (BIOT turtle nesting reference site) by Q4 Yr3 from baseline set by Q2 Yr 1</p> <p>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</p> <p>0.3 Estimated proportion of DG-generated waste comprising SUP water bottles reduced by minimum of 75% by Q3 Yr3 from baseline established by Q3 Yr1</p> <p>0.4 75% of personnel on DG (approx 2250) understand the impact of their use of SUP on marine wildlife by Q4 Yr3 and have implemented pledges to reduce their SUP consumption by at least three different items (e.g. bottles, bags, straws) Q4 Yr3 as a result</p>	<p>0.1 Regular bimonthly surveys by NAVFAC record turtle nesting activities including tracks, species and abandoned body pits with any obvious interference from plastic waste. Data returned to Swansea University for analysis.</p> <p>0.2 Scientific publication submitted by Q1 Yr3</p> <p>0.3 Volume of SUP measured in the BIOT waste management system biannually and retail sales and procurement figures for SUP water bottles</p> <p>0.4 Before After Control Impact surveys of DG personnel (military and support).</p> <p>DG achieves SAS 'Plastic Free' community status which validates reduction measures, stakeholder engagement and action plan</p>	<p>Abandoned nest attempts are primarily due to plastic obstruction.</p> <p>Temperature loggers are successfully retrieved after 12 month deployment in beach. Relocating buried loggers after a year can be challenging.</p> <p>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.</p> <p>Reduction in SUP on DG is reflected in a reduction in proportion found in waste streams.</p> <p>Level of plastic waste accumulating on BIOT beaches from non-DG sources remains constant during lifespan of the project.</p> <p>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.</p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
			A values-based approach increases engagement in marine conservation
<p>Output 1</p> <p>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</p>	<p>1.1 Nesting beach plastic monitoring strategy developed and in place by Q2 Yr1 with 24 bimonthly surveys on 2.75km DG Index Beach to quantify nesting activities that were due to presence of surface and subsurface plastic</p> <p>1.2 Effect of subsurface macro and micro plastics on sand temperature and humidity at turtle nesting depth and effects on turtle hatchlings is understood by Q4 Yr3</p> <p>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.</p> <p>1.4 Nesting beach cleaning strategy developed and implemented on 2.75km DG Index Beach and two pilot Northern Atoll beaches by Q2 Yr1 with cleans carried out by teams of 8 people (supervised by EO), one four-times a year, timed to coincide with start of peak green and hawksbill nesting periods (June & November)</p>	<p>1.1 Bimonthly surveys (coordinated by BIOT, delivered by NAVFAC) to record nesting attempts and those that were aborted/interrupted by plastic waste, with data submitted to and analysed by Swansea University</p> <p>1.2 Data loggers are buried for 12 months to quantify temperature/humidity at a range of plastic % content (in sand over nest) and a range of turtle nesting depth at 3 stations on Index Beach in D by Q2 Yr 1. Scientific publication submitted by Q3 Yr3.</p> <p>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</p> <p>1.4 Nesting Beaches identified and mapped on DG and northern atolls.</p> <p>Nesting timings recorded and optimum times for beach cleans written into best practice guidelines and an annual workplan for beach cleans.</p> <p>Each nesting beach assigned a beach clean team of volunteers.</p> <p>Beach clean best practice guidelines written, printed, distributed and followed</p>	<p>Reduction in SUP on DG is reflected in a reduction in proportion found in waste streams.</p> <p>Level of plastic waste accumulating on BIOT beaches from non-DG sources remains constant during lifespan of the project.</p> <p>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.</p> <p>A values-based approach increases engagement in marine conservation.</p> <p>Project team can continue to access DG through military flights during project period within the same parameters and constraints known from over 5 years of conducting research on DG.</p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
		by volunteer teams conducting future beach cleans.	
<p>Output 2</p> <p>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.</p>	<p>2.1 SUP system of retail (supply and sale) and usage (purchase and use) on DG audited, analysed and mapped by Q4 Yr1.</p> <p>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.</p> <p>2.3 Behaviour change campaign aimed at reducing SUP water bottle consumption by DG personnel (military and civilian) developed by Q1 Yr2 and launched Q2Yr2.</p> <p>2.4 A minimum of 75% of personnel (2250 people) pledge to 'go #OneLess' and stop using SUP water bottles and switch 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)</p> <p>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 sale of SUP water bottles by Q4 Yr4.</p> <p>2.6 A minimum of 75% reduction in SUP bottles found in waste sampling by Q4 Yr4 from baseline set established by Q3 Yr1.</p>	<p>2.1 Audit of SUP usage undertaken. Stakeholder interviews conducted. System analysed and 'systems map' produced.</p> <p>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.</p> <p>2.3 Campaign materials developed. Outreach plan developed and implemented.</p> <p>Film produced, including testimonials from pledges, and shown to personnel.</p> <p>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).</p> <p>2.5 Retail data analysed every six months to determine any changes in number of SUP water bottles sold</p> <p>2.6 Sampling and analysis of DG generated waste streams to identify number of SUP water bottles</p>	<p>Data available from retail outlets and surveyed stakeholders accurately captures volumes and movement of SUPs.</p> <p>Beyond SUP water bottles, additional priority intervention points and practical alternatives can be identified.</p> <p>An effective campaign can be implemented in an environment with relatively high turnover of military personnel.</p> <p>Majority of individuals pledging to go #OneLess will maintain behaviour change beyond life of project.</p> <p>More 'ocean friendly' alternatives can be procured and supplied to DG.</p> <p>Waste sorting and management allows for data collection and analysis.</p> <p>Personnel are willing and able to participate in multiple surveys.</p> <p>Personnel on short rotations can be contacted once off DG to complete follow up surveys.</p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	2.7 A minimum of 75% of DG personnel 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 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 Yr3. 3.3 Report produced summarising options and making recommendations for plastic waste management to BIOT managers Q4 Yr3.	3.1 Analysis of beach plastic as collected + analysis of DG generated plastic. Report 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 Compare options in criteria matrix and produce report/ make recommendations	DG beach cleans continue and beach cleans in Northern atolls from patrol vessel are conducted as planned. Dependent on resources for beach cleans in DG remaining available from US authorities and patrol vessel is available and not required for enforcement duties. Plastic types are identifiable and condition of plastics are suitable for treatments under consideration in great enough quantities. Report is considered by BIOT administration and findings incorporated into decision making framework.
<p>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)</p> <p>1.1 Bimonthly 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 Diego Garcia.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>2.1 Collect and analyse supply chain data</p> <p>2.2 Interview procurement officers, retail and waste managers</p> <p>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</p> <p>2.4 SUP system map for DG formulated and distributed for comment that identifies current procurement, use, waste disposal and recycling strategies/barriers</p>			

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>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</p> <p>2.6 Rank interventions to identify highest priority actions with greatest impact and work them into an SUP reduction campaign</p> <p>2.7 Develop and implement SUP water bottle reduction campaign, including drive for residents to sign the #OneLess pledge</p> <p>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</p> <p>2.9 Film commissioned, produced and shown in cinema, radio materials produced and interviews given on MWR radio station and in Tropical Times newsletter</p> <p>2.10 Plastic waste sampled quarterly from waste storage area and numbers of plastic bottles/ tonne of waste estimated</p> <p>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</p> <p>3.1 Design sampling strategy based on estimates of total plastic waste collected annually</p> <p>3.2 Samples taken from beach cleaned plastic and DG generated plastic and most common items sorted and quantified by plastic waste stream type</p> <p>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</p> <p>3.4. Report produced summarising options and making recommendations for plastic waste management to BIOT managers</p> <p>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.</p>			

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 need 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 want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. 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.	