



Department  
for Environment  
Food & Rural Affairs



Foreign &  
Commonwealth  
Office



Department  
for International  
Development



## Darwin Plus: Overseas Territories Environment and Climate Fund Project Application Form

Submit by **2359 GMT Monday 29 August 2016**

Please read the [Guidance](#) before completing this form.

Information to be extracted to the database is highlighted blue. Blank cells may render your application ineligible

### Basic Data

<b>1. Project Title</b> (max 10 words)	<b>Characterising Bermuda's baitfish populations to improve management and fishery sustainability</b>		
<b>2. UK OT(s) involved</b>	Bermuda	<b>Letter of support from OT government attached?</b>	Yes
<b>3. Start Date:</b>	April 1, 2017		
<b>4. End Date:</b>	September 30, 2019		
<b>5. Duration of project (no longer than 36 months)</b>	30 months		

Summary of Costs	2017/18	2018/19	2019/20	Total
<b>6. Budget requested from Darwin</b>	£108,376	£75,141	£6,212	£189,729
<b>7. Total value of matched funding</b>	£71,653	£45,715	£26,227	£143,595
<b>8. Total Project Budget (all funders)</b>	£180,029	£120,856	£32,439	£333,324
<b>9. Names of Co-funders</b>	Bermuda Government, BIOS / NSF, BZS			

<b>10. Name, address and contact details of lead applicant organisation (responsible for delivering outputs, reporting and managing funds)*</b>	Bermuda Zoological Society c/o Dr. Ian Walker BVM&S MRCVS Principal Curator Bermuda Aquarium, Museum and Zoo, Flatts FL04
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\* Notification of results will be by email to the Project Leader named in Question 12

<b>11. Type of organisation of Lead applicant. Place an x in the relevant box.</b>							
OT GOVT	UK GOVT	UK NGO	Local NGO	✓	International NGO	Commercial Company	Other (e.g. Academic)

**12. Partners in project. Please provide details of the partners in this project and provide a CV for the individuals listed.** You may copy and paste this table if necessary

Details	Project Leader	Project Partner 1	Project Partner 2
Surname	Pitt	Smith	Murdoch
Forename(s)	Joanna	S. Robertson	Thaddeus
Post held	Marine Resources Officer	Curator	Chief Scientist
Institution (if different to above)	Bermuda Government	Bermuda Aquarium, Museum and Zoo	Murdoch Marine Ltd
Department	Dept of Environment and Natural Resources	Bermuda Natural History Museum	-
Telephone/Skype			
Email			

Details	Project Partner 3		
Surname	Goodbody-Gringley		
Forename(s)	Gretchen		
Post held	Assistant Scientist		
Institution (if different to above)	Bermuda Institute of Ocean Sciences		
Department	Reef Ecology and Evolution Lab		
Telephone/Skype			
Email			

**13. Has your organisation been awarded Darwin Initiative funding before (for the purposes of this question, being a partner does not count)? If yes, please provide details of the most recent awards (up to 6 examples).**

Reference No	Project Leader	Title
DPLUS001	Gretchen Goodbody-Gringley	Bermuda Invasive Lionfish Control Initiative
Darwin Initiative 9009	Anne Glasspool	Development of a Biodiversity Strategy and Action Plan for Bermuda

**14. If your answer to Q13 was No, provide details of 3 contracts previously held by your institution that demonstrate your credibility as an implementing organisation.** These contracts should have been held in the last 5 years and be of a similar size to the grant requested in this application. (If your answer to Q13 was Yes, you may delete these boxes, but please leave Q14)

N/A

**15. Key Project personnel**

Please identify the key project personnel on this project, their role and what % of their time they will be working on the project. Please provide 1 page CVs for these staff, or a 1 page job description or Terms of Reference for roles yet to be filled. Please include more rows where necessary.

Name (First name, surname)	Role	Organisation	% time on project	1 page CV or job description attached?
Joanna Pitt	Project Leader	Bda Govt DENR	yr 1: 33%, yr 2:33%, yr 3: 25%	Yes
Struan Smith	Project manager	BAMZ / DENR	yr 1:17%, yr 2:17%, yr 3: 8.5%	Yes
Gretchen Goodbody-Gringley	Genetics lead	BIOS	yr 1: 20%	Yes
Thaddeus Murdoch	Image analysis lead	Murdoch Marine Ltd	yr 1: 17%, yr 2:17%	Yes
To be hired	Technician	BZS / DENR	Yr 1: 83%, yr 2: 100%	added

#### Project Details

**16. Project Outcome Statement:** Describe what the project aims to achieve and what will change as a result. (30 words max). You can copy and paste from Q26.

This project will describe the life history, genetics, abundance and distribution of Bermuda's baitfishes, and the fishery for them, facilitating more sustainable management of these economically and ecologically important species.

**17. Background:** (What is the current situation and the problem that the project will address? How will it address this problem? What key OT Government priorities and themes will it address? (200 words max)

In Bermuda, small bony fishes provide food for larger fishes and waterbirds, but are also exploited by recreational and commercial fishers for bait. The reef silverside, dwarf herring and endemic Bermuda anchovy are presumed to be annual species, but information on their life history characteristics is poor. They form multi-species schools, and catches are reported in aggregate by commercial fishers. Catches of three larger herring and sardine species are reported individually. Reported catches of all baitfish groups have declined over the past 25 years, but it is unclear whether this indicates declining populations or changes in fishing practices. Current management restricts the size and type of nets that may be used, and prohibits net fishing in four inshore bays. We will describe the annual cycles in abundance and distribution of baitfishes around Bermuda, and the life cycles and population genetics of the three small-bodied baitfish species. We will also engage commercial and recreational fishers to examine bait fishing and bait use practices, including attitudes towards alternative baits. This information will improve management of baitfish species by facilitating temporal and spatial management measures, improving the sustainability of the fishery while ensuring that these species continue to fulfil their key ecological role.

**18. Methodology:** Describe the methods and approach you will use to achieve your intended outcomes and impact. Provide information on how you will undertake the work (materials and methods) and how you will manage the work (roles and responsibilities, project management tools etc). Give details of any innovative techniques or methods. (500 words max)

GoPro cameras (from DPLUS001) will monitor the annual cycle of baitfish populations in two bays where net fishing is prohibited and two bays where it is permitted. Cameras will be mounted and serviced monthly (JP, technician) to capture images of baitfish schools from above, to evaluate school area, and underwater, to estimate species composition and density, and ground-truthed to calibrate area and volume. Images will be analysed using digital imaging software (TM, staff). Water temperature and light levels will be monitored by *in situ* loggers for correlation with baitfish population cycles (JP, technician).

Based on year 1, a broad scale survey of baitfish abundance and distribution (50-60 bays) will be conducted during the peak of abundance in year 2 using an aerial drone (contractor: AS), in conjunction with underwater cameras (JP, technician). This survey will follow ground-truthing, work flow and analytical processes from year 1.

In year 1, baitfishes will be sampled weekly (contractor: CF) for age, growth and reproduction studies of the endemic Bermuda anchovy, *Anchoa choerostoma*, the reef silverside, *Hypoatherina harringtonensis*, in which sex may be determined by temperature, and the dwarf herring, *Jenkinsia lamprotaenia*. Twice-monthly sampling in year 2 will confirm whether year 1 patterns are representative. Samples will be iced for euthanasia and preservation, and tissues for genetic analyses will be preserved in ethanol.

Each week, specimens of the three focal species from a range of size classes will be measured, weighed, and dissected under a microscope to remove otoliths and gonads (JP, technician). Otoliths will be hand-polished to reveal daily growth rings, which will be counted using a compound microscope, camera and computer-assisted image analysis to determine age and back-calculate spawning dates (JP, technician). Gonads will be staged macroscopically, ovaries will be weighed to calculate Gonado-Somatic Index, and, each month, 20 mature ovaries from each species will be preserved in formalin for histological evaluation of spawning condition, while 20 additional ripe ovaries will be used for egg counts to estimate batch fecundity, either fresh or preserved. (JP, technician, contractor: WCE) The annual spawning cycles of the three species will be described and, for each species, the sex ratios and growth rates of fishes spawned during different seasons will be compared (JP).

Genetic barcoding will confirm taxonomic identity of the reef silverside and dwarf herring, and mitochondrial DNA markers will be sequenced and analysed for within-population genetic diversity and connectivity for all focal species (GGG, REU). Standard extraction and PCR protocols will be followed by single pass Sanger sequencing. Sequencher5.4 software will be used to analyse sequences using standard population genetics approaches (*F*<sub>st</sub>,  $\Phi$ <sub>st</sub>, AMOVA).

Bait fishing activities will be described (JP, intern) via 1) semi-structured interviews with specialised bait

fishers; 2) a mail survey of other commercial fishers, focusing on bait fishing, bait use, and attitudes towards alternative baits; and 3) a similar in-person survey of 25 recreational fishers engaging in bait fishing.

SRS and JP will manage the project and report results to DENR's Marine Management Team, facilitating improved management of baitfish in Bermuda.

**19. How does this project:**

- a) Deliver against the priority issues identified in the assessment criteria
  - b) Demonstrate technical excellence in its delivery
  - c) Demonstrate a clear pathway to impact in the OT(s)
- (500 words max)

a) This project will facilitate **an improved management plan** for Bermuda's baitfishes, **allowing a more ecosystem-based approach**, and **promote a sustainable fishery for these species**.

Current management depends on gear restrictions and limited spatial management, with four bays closed to net fishing. However, these bays are not evenly distributed. Utilizing population genetics to evaluate genetic heterogeneity will determine whether a more even spread of closed areas would help conserve genetic diversity and resilience in key species, particularly the endemic Bermuda anchovy.

Understanding the distribution of baitfish populations around Bermuda, and their seasonal cycles, would allow more precisely directed temporal and spatial management measures for these species (e.g. complete or area-based fishing closures during key reproductive periods), while data on abundance makes it feasible to set catch limits. For species near the base of the food chain, limiting catch retains a portion of the biomass for forage, maintaining their critical contribution to the marine ecosystem.

The expanded range of management approaches available will result in a more comprehensive, data-driven management plan for this group. Incorporating fishing practices and fishers' opinions into the discussion at an early stage will be key.

Further, preliminary data suggest that the reef silverside may undergo temperature-dependent environmental sex determination, which would make this species particularly vulnerable to climate change. Acquiring data on size and sex at age for this species, and back-calculating spawning dates, will help determine whether this is the case, so that plans can be made for mitigation. Clarification of this issue would also be valuable for other countries and territories across this species' range.

b) All project partners are highly qualified, with extensive experience planning and applying the proposed techniques. Utilising up-to-date methods and taking advantage of remote technology will provide large amounts of data for a limited amount of field time, and time for methods testing has been included in the schedule. Schedules are realistic in terms of workload, safety and weather contingencies. The range of approaches used will ensure adequate data to meet the desired goals.

Engaging with resource users is a key part of resource management, and vital to the successful introduction of alternative management measures. The fisher surveys and interviews for this project will be based on approaches used successfully in previous studies and conducted with the input of the Fisheries Extension Officer, who is very supportive of the project.

c) The project leader, JP, is part of the Marine Management Team of the Bermuda Government's Department of Environment and Natural Resources (DENR) that is responsible for managing Bermuda's fisheries as well as the wider marine environment. She will carry the data from this project forward into an improved baitfish management plan to be developed by the team. Such data-driven management plans are a key component of the Department's 'Strategy for the Sustainable Use of Bermuda's Marine Resources'.

Importantly, the Marine Management Team's connection with the commercial fishery, and the surveys and interviews incorporated into this project, will enable us to gauge the feasibility and acceptability of proposed management changes.

**20. Who are the stakeholders** for this project and how have they been consulted (include local or host government support/engagement where relevant)? Briefly describe what support they will provide and how the project will engage with them. (250 words max)

DENR's Marine Management Team, of which JP is a member, is responsible for managing Bermuda's fisheries, as well as the wider marine environment. Improved understanding and more sustainable management of Bermuda's baitfish populations have been identified as priorities by both the Marine Management Team and by the Marine Resources Board, Bermuda's marine stakeholder consultation group. This project aims to address data deficiencies recognised by these entities.

DENR is prepared to commit JP's time for 11 months over the course of this two and half year project, for field work, lab work, analyses and reporting. Laboratory space at DENR's Marine Management facility at Coney Island will be available for this project. DENR is also supporting the role of SRS as project manager, as his years of experience managing large projects will contribute to the successful completion of this project. BAMZ vessels may be utilised for collecting activities at times that are not in conflict with their designated usage.

Other key stakeholders are the commercial and recreational fishermen that utilise baitfishes to greater or lesser degrees to make their living and enjoy their hobby, and many of them have already recognised the need for improved management of these species. Engaging with resource users is a key part of resource management, and vital to the successful introduction of alternative management measures. The fisher surveys and interviews planned for this project will play a key role in engaging these stakeholder groups, and will be conducted with the input of the Fisheries Extension Officer.

**21. Institutional Capacity:** Describe the implementing organisation's capacity (and that of partner organisations where relevant) to deliver the project.  
(500 words max)

The Bermuda Zoological Society (BZS), formed in 1978, is the support charity for the Bermuda Aquarium, Museum & Zoo (BAMZ), a Bermuda Government institution within the Department of Environment and Natural Resources (DNER). BZS supports resident scientists, and has had fiduciary responsibility for funding from past Darwin Plus, Darwin Initiative and OTEP projects (e.g., DPLUS001, "Bermuda Invasive Lionfish Control Initiative"; Darwin Initiative 9009, "Development of a Biodiversity Strategy and Action Plan for Bermuda").

The BZS Accounting Office will assist Dr. Smith and Dr. Walker in monitoring the project budget, all expenditures, and the annual financial audits. BZS personnel will ensure timely progress and will assist Dr. Smith, as project manager, with administrative issues related to its implementation.

BAMZ was founded in 1926 and is one of the world's oldest aquariums. It is an important centre for science education, research, and species conservation. The Association of Zoos & Aquariums (AZA) has accredited BAMZ since 1994.

The Marine Management Team of the Bermuda Government Department of Environment and Natural Resources (DNER) is responsible for fisheries and marine resources legislation, policy and management. It conducts applied research and monitoring on a wide range of marine species of local, regional, and international importance. The Section also provides extension services to the fishing industry, and these connections will be leveraged to assist with the fisheries sector surveys. Further, it is the Marine Management Team that will carry forward the data acquired by the project and incorporate it into a data-driven Baitfish Management Plan.

The Bermuda Institute of Ocean Sciences (BIOS) is a prominent oceanographic research institution, founded in 1903. It maintains facilities for field and laboratory studies that encompass the proposed project activities. BIOS maintains state of the art research laboratory space, including a fully equipped molecular laboratory for population genetic assessments.

Murdoch Marine Ltd. is a respected environmental consultancy firm that provides expertise on a wide range of marine environmental topics, conducting environmental impact assessments and monitoring, as well as leading a popular reef-based citizen science program, ReefWatch. Murdoch Marine personnel have over 25 years of experience with applied marine image analysis techniques.

**APPLICANTS SEEKING £100,000 OR OVER CAN PROCEED TO QUESTION 26**

**22. Expected Outputs – N/A**

Output ( <i>what will be achieved e.g. capacity</i> )	Indicators of success ( <i>how we will know if its</i> )	Status before	Source of information ( <i>where will you obtain the</i> )
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<i>building, action plan produced, alien species controlled)</i>	<i>been achieved e.g. number of people trained/ trees planted)</i>	<i>project/baseline data (what is the situation before the project starts?)</i>	<i>information to demonstrate if the indicator has been achieved?)</i>
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**23. Expected change:** How will each of the outputs contribute to the overall outcome of the project? (100 words max)

N/A

**24. Main Activities – N/A**

**25. Risks – N/A**

It is important that you and your partners consider all potential risks to the project and how these risks could be mitigated. Please identify risks you have considered, the potential impact on the project and explain how you can mitigate against them. Risks may include working in a volatile region, staff retention, lack of engagement with local communities or Governments. You should always consider the risk of fraud, error or bribery.

**APPLICANTS SEEKING LESS THAN £100,000 ARE NOT REQUIRED TO COMPLETE THE LOGICAL FRAMEWORK AT QUESTION 26 HOWEVER YOU MAY FIND IT A USEFUL EXERCISE TO HELP YOU STRENGTHEN YOUR PROJECT**

## 26. LOGICAL FRAMEWORK

Darwin Plus projects will be required to report against their progress towards their expected outputs and outcome if funded. This section sets out the expected outputs and outcome of your project, how you expect to measure progress against these and how we can verify this.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<b>Impact:</b>			
This project will describe the life history, genetics, abundance and distribution of Bermuda's baitfishes, and the fishery for them, facilitating more sustainable management of these economically and ecologically important species.			
<b>Outcome:</b> Information on the genetics, life history, abundance and distribution of Bermuda's baitfish species, and the fishery for them, will be provided to DENR for incorporation into an improved management plan.	0.1 Five reports / publications completed and provided to DENR's Marine Management Team.  0.2 Using information in the reports / publications, the project leader will work with senior DENR staff to develop a draft of a revised baitfish management plan by December 2019, to go to consultation by January 2020.	0.1 Reports provided to DENR and made available at <a href="http://www.environment.bm">www.environment.bm</a>  0.2 Draft baitfish management plan presented to the Marine Resources Board and Commercial Fisheries Council, and available at <a href="http://www.environment.bm">www.environment.bm</a>	Publication schedules do not delay completion of reports or availability of scientific paper
<b>Outputs:</b> 1. Report describing the annual cycle of baitfish populations	1.1 Report completed	1.1 Report provided to DENR	Baitfish can be identified to species from underwater images. Mitigation: Samples will help to confirm species ID.  Weather does not interfere with cameras or compromise images for any extended period.
2. Report and scientific publication describing the age, growth and reproduction of Bermuda anchovy, reef silverside, and dwarf herring, with	2.1 Report completed 2.2 Scientific publication	2.1 Report provided to DENR 2.2 Publication in press or available online	Adequate numbers of each species available for sampling throughout the year.  Publication schedules do not delay completion of reports or availability of



management suggestions			scientific paper
3. Population genetics analysis of 3 small-bodied baitfish species published and sequences uploaded to publicly available databases.	3.1 Advisory report completed 3.2 Scientific publication 3.3 Sequences uploaded	3.1 Report provided to DENR 3.2 Publication in press or available online 3.3 Sequences available online	Publication schedules do not delay completion of reports or availability of scientific paper
4. Report describing broadscale survey of peak baitfish abundance / distribution	4.1 Report provided to DENR	4.1 Report provided to DENR	
5. Report on baitfishing, bait use and fisher perceptions, with management suggestions	5.1 Report provided to DENR	5.1 Report provided to DENR	Commercial and recreational fishers will co-operate and provide information and opinions during interviews and surveys.
6. All imagery curated and stored at BAMZ library for other researchers to access upon request	6.1 Images provided to BAMZ library	6.1 Images provided to BAMZ library on external storage media	
<p><b>Activities</b> (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 Test and install fixed time-lapse cameras for 'bird's eye' view of 4 bays – 2 bays that are closed to nets and two that are 'open'. Calibrate images for area. Service monthly over 1 year to change batteries and SD cards and download to external storage media.</p> <p>1.2 Install in-water temperature loggers at the same 4 bays. Retrieve data quarterly. Download, describe and compare annual temperature cycles across bays.</p> <p>1.3 Test and place fixed underwater cameras in the same bays for half a day on two occasions each month. Calibrate observed area to allow calculation of fish density.</p> <p>1.4 Select and analyse up to 37,000 'bird's eye' images for presence and spatial extent of baitfish schools.</p> <p>1.5 Select and analyse 1,040 underwater images for species composition and density of baitfish schools. Validate using species composition data from collected samples (Activity 2.1)</p> <p>1.6 Identify the time of peak baitfish abundance to optimise the broadscale survey in year 2.</p> <p>1.7 Complete report describing the annual cycle of baitfish abundance, comparing species, locations and temperature.</p> <p>2.1 Sample baitfishes at a variety of locations on a weekly basis in year 1, and twice a month in year 2. Ensure that monitored bays are included in the sampling locations at least once per month.</p> <p>2.2 / 3.1 During initial processing, take tissue samples for genetics analysis from 40 individuals of Bermuda anchovy, <i>Anchoa choerostoma</i>, reef silverside, <i>Hypoatherina harringtonensis</i>, and dwarf herring, <i>Jenkinsia lamprotaenia</i>, ensuring that each species is represented by samples from the widest possible range of locations.</p> <p>2.3 Measure (total length) and weigh at least 10 individuals from each 1cm size class present for each of Bermuda anchovy, reef silverside, and dwarf herring from each sample.</p> <p>2.4 Dissect specimens to remove gonads and otoliths. Stage gonads visually. Preserve at least 20 mature ovaries from each species each month for histology.</p> <p>2.5 Evaluate batch fecundity for up to 20 ripe ovaries per month, as available.</p> <p>2.6 Prepare and read daily growth rings from at least 10 individuals from each 1cm size class present for each of Bermuda anchovy, reef silverside, and dwarf herring for</p>			

each month. Calculate growth rates and back-calculate spawning dates.

2.7 Have monthly ovary samples processed for histological analysis and read slides to evaluate spawning condition.

2.8 Write report on the age, growth and reproductive characteristics of Bermuda anchovy, reef silverside, and dwarf herring, including an assessment of the evidence for temperature-dependent sex-determination in the reef silverside. Include potential management measures based on these characteristics.

2.9 Present results at an international conference and prepare scientific publication(s).

3.1 (See sampling note above, in 2.2)

3.2 Extract DNA with Qiagen Extraction Kit, amplify via PCR, and sequence using single pass Sanger sequencing (Beckman Coulter Genomics).

3.3 Use Sequencher5.4 to align and edit sequence results, and analyse using standard population genetic approaches ( $F_{st}$ ,  $\Phi_{st}$ , AMOVA).

3.4 Write advisory report for DENR and scientific publication on genetic diversity and rates of connectivity of Bermuda anchovy, reef silverside, and dwarf herring. Present results at an international conference.

3.5 Upload sequences to publically available databases: the NCBI database, GenBank, and the barcoding of life data systems database, BOLD.

4.1 Test drone flyover technique for baitfish school detection, area calibration and calibration with underwater cameras as placed for Activity 1.3.

4.2 Survey 50-60 sites over 10 days during the period of peak baitfish abundance, as identified in Activity 1.6.

4.3 Select and analyse 300 aerial images for presence and spatial extent of baitfish schools.

4.4 Select and analyse 600 underwater images for species composition and density of baitfish schools.

4.5 Prepare report on the abundance and distribution of baitfish around Bermuda.

5.1 Develop survey instrument for commercial fishers to examine bait fishing and bait use practices, and attitudes towards alternative baits. Mail survey out to all commercial fishers.

5.2 Develop questions and conduct semi-structured interviews with specialised bait fishers.

5.3 Develop survey instrument and conduct roving, opportunistic in-person surveys of at least 25 recreational fishers engaging in bait fishing.

5.4 Analyse and summarise results and prepare report, including any potential management measures suggested by the results.

6.1 Assemble all images on external storage media

6.2 Catalogue media and metadata in BAMZ library

**27. Sustainability:** How will the project ensure benefits are sustained after the project has come to a close? If the project requires ongoing maintenance or monitoring, who will do this? (200 words max)

Improved understanding and more sustainable management of Bermuda's baitfish populations have been identified as priorities by the DENR Marine Management Team and by the Marine Resources Board, which includes representatives of various marine stakeholder groups. This project is for a fixed term (2.5 years), and aims to provide information that has been identified by these entities as necessary for implementing a more comprehensive approach to the management of baitfish species in Bermuda. Project leader JP will work with the rest of the Marine Management Team to develop an improved management plan using this information. With the support of the Marine Resources Board, the political will is in place for such a plan to be implemented. By engaging with the various fisheries sectors and incorporating fishing practices and fishers' opinions into the discussion at an early stage, this management plan should be accepted by the commercial and recreational fishing communities. A more sustainable baitfish fishery will have lasting economic and ecological benefits.

**28. Open access:** All outputs from Darwin Plus projects should be made available on-line and free to users whenever possible. Please outline how you will achieve this. (200 words max)

Technical reports arising from this project and presented to DENR's Marine Management Team will be made available on the DENR website, [www.environment.bm](http://www.environment.bm).

While the website does not have the capacity to host all the aerial and underwater images that will be generated in the course of this project, these will be available upon request to other researchers at no cost once the data have been published. This will be noted on the website and contact information included.

Allowances for the open access publication of 3-4 research papers resulting from this project have been built in to the final months of the funding proposal.

All genetic sequences resulting from the genetic analyses in this project will be publicly available online via the NCBI database, Genbank and the Barcoding of Life Database, BOLD.

**29. Monitoring & Evaluation:**

Describe, referring to the Indicators above, how the progress of the project will be monitored and evaluated, making reference to who is responsible for the project's M&E. Darwin Initiative projects are expected to be adaptive and you should detail how the monitoring and evaluation will feed into the delivery of the project including its management. M&E is expected to be built into the project and not an 'add' on. It is as important to measure for negative impacts as it is for positive impact.

(Max 500 words)

SRS is the project manager and will be responsible for the project's monitoring and evaluation, committing 33 days (~3 days per month) in Year 1 and Year 2 and a final 14 days in Year 3

SRS and JP will meet weekly to evaluate progress on science goals and plan for the following week with technicians and interns. They will maintain weekly contact with sub-contractors in regards to science and data acquisition. JP will meet with the Fisheries Extension Officer on a monthly basis to review progress on the bait fishermen interviews

SRS will meet with each sub-contractor on a monthly basis in Year 1 and 2 to review progress on effort and expenditures. He will ensure that the sub-contractors are reporting data and expense receipts on a monthly basis and resolve any issues of payment and reporting. (~1.5 days per month). SRS and JP will meet with TM and GGG every 2 months to review science progress and to review and share data analyses in Year 1. SRS and JP will meet with TM every two months in Year 2 to review data analyses.

SRS will request monthly reports from the BZS accounting office and produce an internal report on grant expenditures across all components of the grant. This will ensure a timely reporting of the funds expended to date for the annual financial audit and at the conclusion of the project. (~1.5 days per month). Dr. Ian Walker will support SRS in monitoring financial reports and approving expenditures on a timely basis.

BIOS will also conduct an independent assessment of the expenditure and performance of their sub-contractor, Dr. Goodbody-Gringley.

Additional independent assessment will also be provided by the Marine Management Team and the Marine Resources Board through monthly reporting by JP. Another assessment mode is via the international scientific community in the peer-review process of project publications, and in feedback acquired during presentations of project results and implications at international science meetings.

Number of days planned for M&E	80
Total project budget for M&E	£29,022
Percentage of total project budget set aside for M&E	8.7%

**30. Financial controls:** Please demonstrate your capacity to manage the level of funds you are requesting. (Who is responsible for managing the funds? What experience do they have? What arrangements are in place for auditing expenditure?)

Dr. Ian Walker and the BZS accounting office, staffed by a certified accountant, are responsible for establishing and maintaining effective internal control over financial reporting and transactions for all funds managed by BZS. Summary and detailed transaction reports are prepared monthly by the BZS accounting office and the BZS Treasurer (a qualified CPA), and distributed to the Program Managers and supervisory staff. Quarterly financial reports are distributed to the BZS Executive committee and Senior Managers. SRS will work with the BZS accountant for ~1.5 days each month to develop his monthly report on expenditures.

The independent auditing firm, PriceWaterhouseCoopers, audits the BZS accounts annually, as required by Bermuda charities legislation. Their audits are performed in accordance with Canadian auditing standards. They report on their audits to the BZS Executive committee who approve them. BZS financial statements and the audit reports thereon are available.

**Please complete the separate Excel spreadsheet which provides the Budget for this application. Some of the questions earlier and below refer to the information in this spreadsheet. If you are requesting over £100,000 from Darwin Plus, you must complete the full spreadsheet.**

**31. Value for Money**

Please explain how you worked out your budget and how you will provide value for money through managing a cost effective and efficient project. You should also discuss any significant assumptions you have made when working out your budget. (200 words max)

This project has been planned to make the most of remote monitoring technology, resulting in lower field work and personnel costs overall. Due to the labour-intensive nature of dissecting small fishes, funding has been requested for a technician level position. This hire will work with the project leader, a salaried civil servant, to process samples and service field equipment. This will ensure that the time of higher paid project partners whose work will be paid for by grant funds will be used effectively. All non-NGO partners have agreed to charge for their participation in this project at their non-profit rates, a significant discount on typical consultancy rates.

Importantly, this project has a considerable amount of co-funding, at 43% of the total budget.

The budget was developed based on Bermuda dollar costings (equivalent to US Dollars), and the budget submitted is based on an exchange rate of \$1.32 to £1.00, the rate on August 25<sup>th</sup>, 2016. We have to assume that the exchange rate will not vary significantly from this during the course of the project, although if the pound weakens further we may have to reduce the scope of the project or seek additional funding.

**32. Provide a project implementation timetable that shows the key milestones in project activities. Complete the following table as appropriate to describe the intended workplan for your project**

Please add/remove columns to reflect the length of your project. For each activity (add/remove rows as appropriate) indicate the number of quarters it will last, and shade only the quarters in which an activity will be carried out. The workplan can span multiple pages if necessary.

Activity	No. of months	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Output 1 Report on the annual cycle of baitfish abundance	14												
1.1 Test and install cameras at 4 locations; Service monthly	12	x	x	x	x								
1.2 Install temperature loggers at same 4 locations. Retrieve data quarterly	2	x	x	x	x								
1.3 Test and place underwater cameras fortnightly for 3 hours													
1.4 / 1.5 Analyse images for school size / density and species composition	12	x	x	x	x	x							
1.6 / 1.7 Identify peak baitfish abundance / Prepare report	1					x							
Output 2 Age, growth and reproduction study	30												
2.1 Weekly sampling in year 1, Twice monthly sampling in year 2	24	x	x	x	x	x	x	x	x				
2.2-2.5 Dissections and staging; Gonad sample prep; Fecundity	24	x	x	x	x	x	x	x	x				
2.6 Otolith ageing	21		x	x	x	x	x	x	x				
2.7 Gonad histology	4				x	x	x						
2.8 / 2.9 Analysis and write-up; Publication; Presentation	12							x	x	x	x		
Output 3 Population genetics analysis published	18												
3.1 Samples in conjunction with Output 2	9	x	x	x									
3.2 Extract, PCR, Sequencing	2			x									
3.3 Analysis and write up	2			x	x								
3.4 Publication and conference presentation	1.5					x	x						
3.5 Upload sequences to publicly available databases	1						x						
Output 4 Broadscale survey of peak baitfish abundance / distribution	4												
4.1 Test methods and calibrate against stationary cameras	1			x									
4.2 Survey 50-60 sites over 10 days – timing based on Output 1	1						x	x					
4.3 / 4.4 Analyse images for school size and species composition	1							x					

DPLUS064 app rev Nov2016

4.5	Prepare report	1									x			
Output 5	Report on baitfishing, bait use and fisher perceptions	15												
5.1	Develop mail survey and send to registered fishers	4			x	x								
5.2	Semi-structured interviews with commercial bait fishers	2				x	x							
5.3	Develop and conduct roving survey of recreational bait fishers	3						x	x					
5.4	Analyse and summarise results for report	4					x	x	x	x				
Output 6	Images curated and available to other researchers	1												
6.1	Assemble images on external storage media	1										x		
6.2	Catalogue media and metadata in BAMZ library	1										x		



### CERTIFICATION

On behalf of the trustees of The Bermuda Zoological Society  
 (\*delete as appropriate)

I apply for a grant of £189,279 in respect of **all expenditure** to be incurred during the lifetime of this project based on the activities and dates specified in the above application.

I certify that, to the best of our knowledge and belief, the statements made by us in this application are true and the information provided is correct. I am aware that this application form will form the basis of the project schedule should this application be successful. (*This form should be signed by an individual authorised by the lead institution to submit applications and sign contracts on their behalf.*)

- I enclose CVs for key project personnel and letters of support.
- I enclose the most recent 2 years of signed and audited/independently verified accounts.

<b>Name (block capitals)</b>	Richard Winchell
<b>Position in the organisation</b>	President

**Signed** Please see pdf of signature page **Date:**

**If this section is incomplete the entire application will be rejected. You must provide a real (not typed) signature. You may include a pdf of the signature page for security reasons if you wish. Please write PDF in the signature section above if you do so.**

**Application Checklist for submission**

	Check
Have you read the <a href="#">Guidance</a> ?	✓
Have you read the current <b>Terms and Conditions</b> for this fund?	✓
Have you <b>checked the Darwin Plus website</b> immediately prior to submission to ensure there are no late updates?	✓
Have you provided <b>actual start and end dates</b> for your project?	✓
Have you provided your <b>budget based on UK government financial years</b> i.e. 1 April – 31 March and in GBP?	✓
Have you checked that your <b>budget is complete</b> , correctly adds up and that you have included the correct final total on the top page of the application?	✓
Has your application been <b>signed by a suitably authorised individual?</b> (clear electronic or scanned signatures are acceptable in the email)	✓
Have you included a <b>1 page CV for all the key project personnel?</b>	✓
Have you included a <b>letter of support from the applicant organisation, main partner(s) organisations and the relevant OT Government?</b>	✓
Have you included a <b>copy of the last 2 years' annual report and accounts</b> for the lead organisation?	✓

Once you have answered the questions above, please submit the application, not later than midnight **2359 GMT Monday 29 August 2016** to [Darwin-Applications@ltsi.co.uk](mailto:Darwin-Applications@ltsi.co.uk) using the first few words of the project title **as the subject of your email**. If you are e-mailing supporting documentation separately please include in the subject line an indication of the number of e-mails you are sending (e.g. whether the e-mail is 1 of 2, 2 of 3 etc). You are not required to send a hard copy.

DATA PROTECTION ACT 1998: Applicants for grant funding must agree to any disclosure or exchange of information supplied on the application form (including the content of a declaration or undertaking) which the Department considers necessary for the administration, evaluation, monitoring and publicising of Darwin Plus. Application form data will also be held by contractors dealing with Darwin Plus monitoring and evaluation. It is the responsibility of applicants to ensure that personal data can be supplied to the Department for the uses described in this paragraph. A completed application form will be taken as an agreement by the applicant and the grant/award recipient also to the following:- putting certain details (i.e. name, contact details and location of project work) on the Darwin Initiative and Defra/FCO/DFID websites (details relating to financial awards will not be put on the websites if requested in writing by the grant/award recipient); using personal data for the Darwin Initiative postal circulation list; and sending data to Governor's Offices outside the UK, including posts outside the European Economic Area. Confidential information relating to the project or its results and any personal data may be released on request, including under the Environmental Information Regulations, the code of Practice on Access to Government Information and the Freedom of Information Act 2000.