Department for Environment Food & Rural Affairs

Darwin Initiative Report

DARWIN INITIATIVE

Main Project Annual

Funded by UK Government

Important note: *To be completed with reference to the Reporting Guidance Notes for Project Leaders: it is expected that this report will be no more than 10 pages in length, excluding annexes*

Submission Deadline: 30th April 2018

Darwin Project Information

Project reference	DPLUS061
Project title	Protecting herbivorous fish to conserve Cayman Island coral reef biodiversity
Host country/ies	Cayman Islands
Contract holder institution	CCMI
Partner institution(s)	Cayman Islands Department of the Environment (DoE)
Darwin grant value	£249,096
Start/end dates of project	April 2017 to December 2019
Reporting period (e.g., Apr 2017 – Mar 2018) and number (e.g., Annual Report 1, 2, 3)	Annual Report 1
Project Leader name	Dr. Carrie Manfrino
Project website/blog/Twitter	www.reefresearch.org
Report author(s) and date	Dr. Claire Dell March 2018

1. Project rationale

Herbivorous fishes are key to maintaining coral reef health, however the specific species responsible remain unknown. This is vital information if they are to be effectively managed. We aim to determine which herbivorous species are critical to the Cayman Islands and to use this information to inform a biodiversity action plan that empowers government to establish policies to manage and sustain these ecologically important species.

2. Project partnerships

The Department of the Environment (DoE) is a key partner in our project and is integrally involved each step of the way, from approving permits to offering guidance on experimental design and implementation. This work would actually not be possible without the involvement of the Department of Environment in the regular monitoring and evaluation meetings, discussions and interactions. We have relied heavily on their local knowledge and have been directed by their priorities in the formative stages of every section of this grant. For example, the tagging phase of the project- which is commencing now- required substantial prior research and trouble-shooting to find the appropriate areas of reef, suitable fishing methods and positioning of acoustic receivers. Likewise, the research on the island Cayman Brac required extensive local knowledge prior to establishment of the experiments.

Finally, the interviews with the fishermen (which will commence in earnest in year 3) are a politically sensitive topic and one that requires a clear appreciation of the history of marine conservation in the Cayman Islands. The relationship between the government and the fishermen has at times, been tense so a sensitivity to this is vital if positive progress is to be made. To achieve this, I recruited the help of a social scientist and held extensive preliminary meetings with the DoE to obtain a more nuanced awareness of the situation. Minutes from these meetings are included in annex 4.1. We also conducted preliminary interviews (with the permission of the DoE) to gain an initial understanding of fishermen's fishing habits and priorities. The interview protocol is included as evidence in annex 4-2. In total, nine interviews have been conducted so far and several of the fishermen have commented on how much they enjoyed the interaction. A bridge is beginning to develop which is fundamental to the success of the action plan. This is a slow-moving process, but through relationships and building of trust, there is the possibility for these two groups to come to an agreement on how best to protect the reef for the future. Some quotes from the interviews are included as evidence in annex 4-3.
I have also developed a positive relationship with one of the dive shops & coral nursery managers on a neighbouring island. They have been supportive in assisting with field work and facilitating the establishment of the project on Cayman Brac. I aim for this relationship to build into the formation of the focus group.

Our project partner, Courtney Cox, left the Smithsonian to join Rare so we look forward to developing a partnership with that organisation in the years to come.

3. Project progress

3.1 Progress in carrying out project Activities

At the close of year one of the grant the project is on track and a little ahead of schedule. We are on target to complete the grant deliverables as detailed in the logframe within the time allotted. Thus far we have accomplished or are in the process of completing the following measurable indications:

0.1 Field survey data to indicate key herbivorous fish species
0.2 Public-Private partnership is in formation
1.1 Surveys of reefs across the 3 islands
1.2 Members of the focus group are being identified and contacted
1.3 300 local students reached via education module
3.1 Fishing effort quantified
3.2 Historical fishing effort recorded
4.2 The first scientific meeting will be attended in May 2018
4.3 Education module on herbivory included in CCMI curriculum

Field work and project outputs are being completed as scheduled but some modifications have been made as we continue to learn more about our subject. The modifications we have made are as follows:
1) The surveys of fishermen were scheduled to begin in year 3, but we discovered a need for this information in year 1 to help inform our experimental design, so part of that data has been collected already. There are intriguing differences between the three Cayman Islands both in terms of the reef cover and the fishing community that I expect may be linked. As explained in Section 3.1 below, I have needed to gather preliminary information to inform the development of the project into year 3.
2) The data collection in year 1 (the initial surveys across the three islands) indicated there was an unusual algal species present on Cayman Brac that warranted further investigation. This has spawned a few additional experiments that will provide further insight into the drivers of community structure in the reefs of the Caymans Islands. This information will be required to inform our experimental design moving into year 2 and 3.
3) We are currently troubleshooting the methods for the acoustic tagging section of the grant which was designed to allow us to understand ranges of herbivory. This section is also developing as we continue to refine our methods. We have not yet been permitted to carry out the fishing methods that are most suitable for our species and question, so we are currently trying to accomplish this work using the methods that have been approved.
Overall, this part of the project is progressing however and we will accomplish the intended work (potentially with different methods).

3.2 Progress towards project Outputs

1.1 Partners assess fish from 15 reefs across the three Cayman Islands; Historic reef trends quantified and key species reducing algae growth are identified by the end of year 2.
The collection of survey data from 15 sites across the three islands was completed as planned in 2017, as were the feeding assays & fish observations. Historic trends have been identified and graphs from these efforts are included in annex 4-4, 4-5 & 4-6. We are ahead of schedule as we had identified the key species responsible for reducing algal cover by the end of year one (while initially we had aimed for the end of year two).
Following from the surveys of the islands, we found that the benthic community on the North side of Cayman Brac was unusual and warranted further attention. To accomplish this, additional data is being collected from 3 sites on the N and 3 sites on the S of Cayman Brac. Additionally, sensors were deployed so abiotic conditions (temperature) can be monitored, permanent plots were established at 4 sites and are being maintained to assess the impact of key algal species on corals and other members of the benthic community over the year.

1.2 Number of members in an expert Herbivorous Fish Focus group by end of year 2
The Focus group is building at a reasonable speed and will be formed as planned by the end of year two. There are a number of interested parties including 2 members of the diving community, 4 from the National Trust, 5 local residents, 6 from the government and the 3 from the fishing community who I have identified through interviews and outreach events. They have expressed their interest in being involved and I will continue nurture their interest and involvement over the coming year.

1.3 Empower 300 local students through new educational modules about herbivory, (specifically taught to students in grades 5 and 6) by the end of year 2.
After developing a full lesson plan, script, and activities for primary school children, I held an underwater class (in March. The programme aimed to describe the processes and mechanisms of herbivory and how specific fish species help maintain coral dominance in the ecosystem. The presentation was offered live as an underwater broadcast as part of CCMI's 'Reefs Go Live' series. This was viewed by 18 grade 5 & 6 classes from schools in the Cayman Islands. While exact metrics are not available yet, average class

sizes are around 25 students per class so we have already reached 450 school children as well as others around the world. A screen shot of the number of viewers is included in annex 4-7.
This output has been accomplished a year ahead of intended and we will host another such class next year to reach a different age group.
The link below provides evidence of this class taking place:
https://www.facebook.com/reefresearch/videos/2046920078670785/?hc_ref=ART81MtCnhKLfGV5MwFGS9pxfnFEP9H_aXfR9YcSVj_CiUvg36Crz9_q3nuU8J0eDi

2.1 Project data and map is posted and partner media pages and newsletters raise awareness (from 0 to 2000) via partner networks including DoE, CCMI, school groups by end of project
Data is currently being collected for the spatial map on herbivory and this will be compiled into the map by the end of the project (as proposed).

2.2 Regional connectivity (tagging and genetics) of herbivore fish determined by end project
We have begun collecting samples for the genetic & diet analyses and this will continue throughout the remainder of the year so that processing of samples can begin at the beginning of year 3.

3.1 Fishing effort surveyed (data on catch and effort at 6 landing sites across the Cayman Islands by end of year 2

The interviews with the fishermen commenced a year ahead of schedule because preliminary research indicated this information should be used to inform the work of the grant. Not only is there a need to know the threats to herbivore populations, but we need to understand the attitudes of the fishermen and also encourage their involvement in the protection of their resources. How amenable are fishermen to altering their behaviours -and very importantly- how can we encourage this attitude? Thus, we need to expand on the interviews and incorporate this forward-looking perspective into discussions with them. A further modification of this output is necessary as we have realised that attitudes from different cultural groups should be included as part of the study sample. Hence, interviews will be conducted with fishermen from all three islands, rather than just Little Cayman. Additionally, 6 Western expatriates, 6 Caribbean expatriates and 6 Caymanians will be interviewed to give a more accurate picture of fishing pressure. This work is currently underway and will be completed on schedule, by the end of year 2. Quotes from the interviews are included as is the interview protocol.

3.2 Historical effort and catch data compiled by end of year 2 (interviews with (6) local Little Cayman fishermen

As above, this data has already been collected by cultural anthropologist Dr. Marilyn White and is due to be presented at the American Folklore Society conference in Buffalo USA this year. A sample of transcripts have been included as evidence in annex 4-9 and the abstract is as follows:

FS 2018—Buffalo, NY
Short Abstract

FISHING FOR COMPLEMENTS:
MARITIME CULTURAL COMMUNITIES OF THE UNITED STATES AND THE CAYMAN ISLANDS

This panel explores three fishing communities in the US and one in the Cayman Islands. Generally, we will look at their connection to fishing activities, the fishing industry, weather phenomena, the environment, and/or other communities. Specifically, the topics are (1) overcoming disaster through preservation and restoration, (2) preserving a location in the face of internal and external challenges, (3) negotiating intercultural relationships in a changing business environment, and (4) balancing cultural and financial needs with coral reef preservation. Implicitly or explicitly, we also address the conference theme of “No Illusions, No Exclusions.”

4.1 Results incorporated into the BAP
We will complete this output in year 3 as the data is currently being collected and analysed.

4.2 Scientific papers (2 submitted for publication, 2 meetings attended by end of project
The first meeting will be attended in May 2018 by Dr. Carrie Manfrino who will be representing the Darwin Initiative at the 3rd Caribaea Initiative Research and Conservation Workshop in Guadeloupe. Dr. Marilyn White will also be presenting the historical fishing data at the Historical Society Conference in Buffalo (USA) this year.

4.3 Completion of public education curriculum with herbivory modules for all K-12 CCMI programs

The education module that Darwin has been delivered to the teachers of the Cayman Islands as part of the public education curriculum requirements and has been incorporated into CCMI's education programme. Through CCMI's education programme, we have reached 10 students in the Young Leadership course (ages 16-17) and 12 adult volunteers, as well as the 18 grade 5 & 6 classes as mentioned above (annex 4-7). In addition, Dr. Carrie Manfrino was the keynote speaker at the Rotary Science Fair and she presented the initial project outline to over 200 science fair students and families on Grand Cayman.

3.3 Progress towards the project Outcome

Our intended outcome is to identify the key herbivorous fish species and to inform an action plan that the government can develop to sustainably manage these fish populations effectively.
By the conclusion of year 1, through 2 major experiments, a regional survey (across all three islands) and observations we have now identified that 2 key fish species play a role in mediating coral-algal competition. Graphs are included to support this progress (annex 4-6). The information required to form an action plan will continue to be compiled over the course of this grant, as we learn more about these key species, their movements and their population structure.

Relationships with community members are being cultivated that will lead into the formation of a focus group. We originally aimed for two such meetings however I will have held four by the end of year 1. Pictures and minutes are included in annex 4-8. These indicators are appropriate for verifying that the work is being done and progress is being made; but they are also appropriate for showing the outcome is being accomplished. The minutes from the meeting with the DoE on 6th December (annex 4-1) for example, show the commitment CCMI and the DoE have in working together and in achieving the outcome to the benefit of the country.
As mentioned previously, we are on target to accomplish the grant objectives by the end of funding.

3.4 Monitoring of assumptions

At the end of year one, the outcome assumptions still mostly hold true.
Outcome Assumptions (section 0):
Substantial evidence is available indicating that herbivorous fish are key to maintaining reef health (0.1). Similarly, we are certainly using past data to inform the decision making and execution of the grant and I feel confident that the fishermen have been honest in the interviews to date (0.2). However, we assumed that the establishment of marine protected areas (MPAs) has led to long term increases in herbivorous fish and we have not seen that. Instead we have seen a decline. (Graphs are included as evidence.) This highlights shortcomings in the method of management and indicates more must be done to safeguard our reefs. This Darwin grant comes at a very opportune time as it enables us to investigate the situation further and research potential solutions.
Section 1 Assumptions: We have certainly found that some fish are more important than others in removing algal cover so assumption 1.1 holds true. Similarly, we have seen a change in the populations of herbivorous fishes over the last 20 years. Unfortunately, this is not a positive change, but this grant will assist in understanding why we see these trends and to make recommendations for improvement.
The assumption for section 2 is that: Movement patterns can be generalised for a range of herbivorous fishes with similar life history traits to facilitate broad management and conservation plans/action.
This is still to be determined as we are just commencing this section of the grant
Section 3 Assumptions: So far, no fishermen have reported fishing in the protected areas, so this may well be an accurate assumption and the fishermen may indeed be reluctant to report such activities (3.1). The assumption that illegal fishing does not occur is therefore difficult to test. We have not measured fishing at landing sites yet.

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

The fundamental aim and outcome of this project is to determine the key species responsible for maintaining healthy coral reefs. Therefore, the very outcome is to positively impact biodiversity in the Cayman Islands and the Caribbean region. This entire grant and all submitted evidence directly relates to this objective.
Considering the huge role coral reefs play in food provision, protecting the island from storms and generating revenue through tourism (0.5 Billion dollars in 2017), losing the reefs would detrimentally impact the nation severely. Nearly 90% of the fish caught in Grand Cayman are from the reef, so if we are not able to ensure the reefs survive, we will lose an important food source and potentially see people become deprived of food. Likewise, losing the protection from storms and erosion will mean the country spends more on sea wall defence; money which will no long be available for other issues. The loss of the reefs will mean the country and its people are far worse off. This grant is aiming to prevent that by informing the government about the critical fish species that help maintain reef health.

4. Contribution to the Global Goals for Sustainable Development (SDGs)

1- No Poverty
2- Zero Hunger
3- Good Health & Well-being
11- Sustainable Cities & Communities
12- Responsible Consumption & Production
14- Life Below Water
17- Partnerships to Achieve the Goal

Of the 17 SDGs, our project is directly addressing 4 of them (11, 12, 14 & 17) and is indirectly working towards 1, 2 & 3.

The role that coral reefs play in human health through provision of food, protection from storms, medicinal benefits and generation of income, is mentioned in section 3.5 and cannot be overstated. Our project aims to ensure this ecosystem persists so that future generations can make use of the benefits reefs bring.

5. Project support to the Conventions, Treaties or Agreements

As mentioned in section 3.5 and 4, our project is investigating a critical role in maintaining a coral dominated reef ecosystem. Despite not defining the specific convention in the application, the results of our work will be seen in human health and well-being as well as biodiversity measures and protection of endangered species. Our work specifically addresses Strategic Goal C: to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. We aim to safeguard coral reef ecosystems by ensuring the species that perform a key role in maintaining the system are identified and understood. As can be seen in the graphs submitted, we have identified the key species and the next phase is to discover their genetic population structure and their movements. This is critical information if these species are to be properly managed.

Similarly, we are also addressing Strategic Goal E: to enhance implementation through participatory planning, knowledge management and capacity building. The formation of our focus group and the interviews that have taken place with the fishermen, all serve to include the stakeholders in the management of their reefs. Questions that have been asked can be seen in the interview protocol that is included in annex 4-2).

We are also fulfilling Strategic Goal D: to enhance the benefits to all from biodiversity and ecosystem services. In our case, the 'all' refers to coming generations as we aim to ensure the reefs and the benefits they bring continue into the future.

The Aichi Target refers to National Biodiversity Strategies and Action Plans (NBSAPs) as the principal instruments for implementing the Convention at the national level. Through the work of this grant, we will develop an action plan (as can be seen in the logframe) to protect species critical to the persistence of coral reef ecosystems that will be implemented at a national level.

As mentioned in the CBD, the present programme of work focuses heavily on protected areas and includes goals and activities specific to them. Protected areas are recognised as important in reducing biodiversity loss, but by themselves are not enough. Additional management strategies are required to assist the areas not under protection, but what these measures look like will depend on the situation and the species in question. Through this grant, we will acquire the information to assist in preserving coral reefs throughout the Cayman Islands, not just in the protected areas. In this way, this work forms an important supplement to the current network of protected areas in the country.

6. Project support to poverty alleviation

Answered in section 3.5

7. Project support to gender equality issues

CCMI has a strong focus on gender equality supporting and empowering women in science as well as on underrepresented groups. CCMI leadership is 75% female and the scientific team has historically (and currently) been dominated by female scientists. Similarly, this Darwin grant has given employment and training to several women who otherwise would not have had the opportunity to work for and grow with CCMI.

8. Monitoring and evaluation

An important part of our monitoring and evaluation has been quarterly meetings with the Cayman Islands Department of the Environment (DoE) and additional meetings as needed. This has been a most validating exercise as they are extremely interested in our results and supportive of our progress. The time they have contributed and the input they have volunteered has helped shape the project and

improved the specificity of our questions immeasurably. For example, the design of the fishermen's interview protocol is the direct result of multiple meetings with the department. Both the interview protocol as well as minutes of those meetings have been included as evidence. As we proposed, we are continuing to discuss progress quarterly. Meeting attendees, minutes and notes are being kept.
The data we have collected and analysed so far (graphs are submitted in annex 4-4, 4-5 & 4-6) has allowed us to evaluate our progress toward addressing the questions we have outlined for this project. New questions have emerged due to the presence abd dominance of rare algae on Cayman Brac. Addressing the mechanisms and processes that result in the major differences between the island will be important so that we can better understand whether additional species of fish need to be protected. Likewise, the minutes from our meetings indicate how the project is being successfully monitored and evaluations are iterative.
Another indicator that we are monitoring and evaluating is the number of schools attending our various education activities which are recorded via our livestreaming programme and facebook metrics (submitted in annex 4-10). While this gives no information on their gain in knowledge or change in perspective, the live broadcasts provide opportunities for interaction through a Q&A with children in schools. This allows us to evaluate levels of engagement. We have just completed the final 'Reefs Go Live' broadcast for this year and have distributed surveys which will be returned to us over the next few weeks. Once we have this information we will assess the extent of learning that has taken place as a result of these interactive, underwater classes.

9. Lessons learnt

During this first year we have learned the importance of monitoring and evaluating and then adapting by modifying methods if needed. This process led to opportunities to address our questions more effectively. For example, the methods we initially employed to assess fish diet were not completely reliable. Initially, we followed fish for 20 minutes and tried to identify what they had just eaten. However, this technique allows a certain amount of bias that led to ambiguous results. Subsequent fish feeding assays (graphs are included) that were less open to such bias in observation have led to more robust results. Avoiding those methods would be one recommendation for other researchers wanting to run a similar project.
As far as running the grant goes, maintaining a team of collaborators is an important element of any project. Excellent field support and timely government responses has allowed us to accomplish far more than would otherwise be possible. On the other hand, losing the staff who had knowledge of acoustic tagging has slowed us down in the execution of that part of the grant. These sorts of events are perhaps hard to predict, but a recommendation for the future would be to build in some extra time so that such setbacks can be accounted for.

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

N/A

11. Other comments on progress not covered elsewhere

None

12. Sustainability and legacy

Knowledge of this project and of the Darwin Initiative is growing throughout the Cayman Islands as a result of multiple of CCMI's activities. Not only have the education efforts with the local schools increased exposure of the Darwin Initiative, but the CCMI employees involved in this grant have made a number of appearances on television so giving the Darwin Initiative positive exposure.
Examples of such appearances can be seen here-
https://cayman27.ky/2018/04/ccmi-to-present-herbivorous-fish-study-findings-in-lecture/

And here-
https://cayman27.ky/2018/04/scientist-behind-ccmis-reef-vegetarian-research-shares-findings/

Likewise, we have held a number of outreach events both to disseminate results to the public, as well as to engender/stimulate interest in this project. These events have been well attended and have introduced us to a number of people interested in becoming part of the focus group.
Photos from these events have been included in annex 4-8) as evidence.

Our commitment to long term monitoring can be seen in the almost 20 years of data we have on the reefs of the Cayman Islands. These surveys will continue into the future and the results from the Darwin project will inform this monitoring and bolster its usefulness. For example, we may find other sites or other metrics should be included; we may also be able to find explanations and potential solutions for the

trends we see. The data collected from the 2018 reef surveys will be shared with the wider scientific community on the website that compiles results from the methodology (AGRRA).

The key output from this grant is to inform an Action Plan that can be developed by government to improve management and policy design. This will mean the Darwin Initiative leaves a lasting legacy in the Cayman Islands that protects coral reef biodiversity. Similarly, the education of Cayman's youth is another avenue through which impact is made and legacy is achieved. We have already accomplished the education objectives through CCMI's 'Reefs Go Live' series and will continue to build on our efforts over the coming two years. In this way, the Darwin Initiative has a direct impact on the future of the Cayman Islands by educating and informing the generation who will become the policy-makers and governors of the future.

13. Darwin identity

The Darwin logo and Darwin Initiative have been publicised in multiple different formats over the past year in various forms of media and have been recognised as a distinct project being run by CCMI in conjunction with the Cayman Islands Department of the Environment. I have appeared on television broadcasts and publicised Darwin in all talks with the community as detailed in section 12. The Darwin Initiative has also been publicised on CCMI's social media outlets, a list of these is included as evidence. From these efforts there is a growing understanding of the Darwin Initiative within the Cayman Islands and this is evident in the conversations I have with the media. Both government employees as well as journalists ask me how the 'Darwin project' is going.

14. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2017 – 31 March 2018)

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2017-2018

Project summary	Measurable Indicators	Progress and Achievements April 2017 - March 2018	Actions required/planned for next period
Impact Herbivorous fish that are key to maintaining coral reef health are incorporated into a biodiversity action plan that empowers government to establish policies to manage and sustain ecologically functional fish.		The fundamental aim and outcome of this project is to determine the key species responsible for maintaining healthy coral reefs. Therefore, the very outcome is to positively impact biodiversity in the Cayman Islands and the Caribbean region. This entire grant and all submitted evidence directly relates to this objective. Considering the huge role coral reefs play in food provision, protecting the island from storms and generating revenue through tourism, losing the reefs would detrimentally impact the nation severely. Nearly 90% of the fish caught in Grand Cayman are from the reef, so if we are not able to ensure the reefs survive, we will lose an important food source and potentially see people become deprived of food. Likewise, losing the protection from storms and erosion will mean the country spends more on sea wall defence; money which will no long be available for other issues. The loss of the reefs will mean the country and its people are far worse off. This grant is aiming to prevent that by informing the government about the critical fish species that help maintain reef health.	[redacted]
Outcome Herbivorous fish species that are key to maintaining reef health are incorporated into a draft biodiversity action empowering government to establish policies to sustainably manage herbivores.	0.1 Field survey data to indicate key herbivorous fish that is compile and used in a spatial map to inform plans which are endorsed by the Department of Environment managers	At the close of year one the project is on or a little ahead of schedule and we are on target to complete the grant deliverables as detailed in the logframe within the time allotted. Field work and project outputs are being completed	The second year of the grant will focus on determining the population structure and movements of the critical herbivorous fish species as well as continuing with the reef surveys and the interviews of fishermen.

	during a meeting by the end of the second year.; 0.2 Creation of a public- private partnership as an expert fish focus group including members from National Trust, environmental, business, and tourism to empower new policy and protection; 0.3 Draft Biodiversity Action Plan (BAP) agreed internally and draft of management plan for key herbivores by the end of the project.	more or less as scheduled but some modifications have been made as we continue to learn more about our subject. Substantial evidence is available indicating that herbivorous fish are key to maintaining reef health (0.1). Similarly, we are certainly using past data to inform the decision making and execution of the grant and I feel confident that the fishermen have been honest in the interviews to date (0.2). However, we assumed that the establishment of marine protected areas (MPAs) has led to long term increases in herbivorous fish and we have not seen that. Instead we have seen a decline. (Graphs are included as evidence.) This highlights shortcomings in the method of management and indicates more must be done to safeguard our reefs. This Darwin grant comes at a very opportune time as it enables us to investigate the situation further and research potential solutions	The indicators we have selected appear to be appropriate because they clearly show the work has taken place. The graphs showing the results from field work, the minutes from meetings and follow up emails, the transcripts from the interviews and the web links to the education class and TV appearances are all robust indicators.
Output 1. Draft biodiversity action plan to protect key herbivores is approved internally by the Dept. of Environment.	1.1 Report on herbivorous fish; 1.2 Final Report on knowledge gained over duration of project by focus group; 1.3 Pre and post surveys indicating students empowered with knowledge and utilising CCMI resource;	We are still in the data collection phase so will be able to compile the report once that is completed and the results are analysed The surveys are being collected by CCMI now that the final 'Reefs Go Live' broadcast has taken place	
1.1 Partners assess fish from 15 reefs across the three Cayman Islands; Historic reef trends quantified and key species reducing algae growth are identified by the end of year 2;		The collection of survey data from 15 sites across the three islands was completed as planned in 2017, as were the feeding assays & fish observations. Historic trends have been identified and graphs from these efforts are included as evidence. We are a bit ahead of schedule as we had identified the key species responsible for reducing algal cover by the end of year one (while initially we had	

		aimed for the end of year two). Following from the surveys of the islands, we found that the benthic community on the North side of Cayman Brac was very unusual and warranted further attention. To accomplish this, additional data is being collected from 6 sites on the N and S of Cayman Brac. Additionally, sensors were deployed so abiotic conditions can be monitored, permanent plots were established at 4 sites and are being maintained to assess the impact of key algal species on corals and other members of the benthic community over the year.
1.2 Number of members in an expert Herbivorous Fish Focus group by end of year 2;		The Focus group is building at a reasonable speed and will be formed on target by the end of year two. There are a number of interested parties including 2 members of the diving community, 4 from the National Trust, 5 local residents, 6 from the government and the 3 from the fishing community who I have identified through interviews and outreach events. They have expressed their interest in being involved and I will continue nurture their interest and involvement over the coming year.
1.3 Empower 300 local students through new educational modules about herbivory, (specifically taught to students in grades 5 and 6) by the end of year 2.		Last month I held an underwater class to describe the processes and mechanisms of herbivory and how specific fish species help maintain coral dominance in the ecosystem. The presentation was offered live as an underwater broadcast as part of CCMI's 'Reefs Go Live' series. This was viewed by 18 grade 5 & 6 classes from schools in the Cayman Islands. While exact metrics are not available yet, if we presume there are around 25 students per class then we have already reached 450 school children as well as others around the world.
Output 2. Spatial map establishes the levels of herbivory and regional connectivity of key herbivorous fish and supports regional benefit of protecting herbivores.	2.1 Web analytics and newsletter opens with project views; 2.2. Fish connectivity report with data and photographs;	As we are still in the very early stages of this section of the grant, it is too early to say whether the indicators are appropriate. The assumption for section 2 is that: Movement patterns can be generalised for a range of herbivorous fishes with similar life history traits to facilitate broad management and conservation plans/action. This is still to be determined as we are just commencing this section of the grant
2.1. Project data and map is posted and partner media pages and newsletters raise awareness (from 0 to 2000) via partner networks including DoE, CCMI, school groups by end of project;		Data is currently being collected for the spatial map on herbivory and this will be compiled into the map by the end of the project (as proposed).
2.2. Regional connectivity (tagging and genetics) of herbivore fish determined by end project;		We have begun collecting samples for the genetic & diet analyses and this will continue throughout the remainder of the year so that processing of samples can begin at the beginning of year 3.

Output 3. Herbivorous fish impact assessment based on levels of fishing	3.1 Report of interviews quantify current levels of fishing pressure by end of year 3.2 Report documenting oral history with photographs;	These indicators are appropriate as they provide clear evidence of the interview taking place. The assumptions for section 3 also hold true. So far, no fishermen have reported fishing in the protected areas, so this may well be an accurate assumption and the fishermen may indeed be reluctant to report such activities (3.1). The assumption that illegal fishing does not occur is therefore difficult to test. We have not measured fishing at landing sites yet.
3.1 Fishing effort surveyed (data on catch and effort at 6 landing sites across the Cayman Islands by end of year 2.		The interviews with the fishermen commenced a year ahead of schedule because preliminary research indicated this information should be used to inform the work of the grant. Not only is there a need to know the threats to herbivore populations, but we need to understand the attitudes of the fishermen and also encourage their involvement in the protection of their resources. How amenable are fishermen to altering their behaviours -and very importantly- how can we encourage this attitude? Thus, we need to expand on the interviews and incorporate this forward-looking perspective into discussions with them. A further modification of this output is necessary as we have realised that attitudes from different cultural groups should be included as part of the study sample. Hence, interviews will be conducted with fishermen from all three islands, rather than just Little Cayman. Additionally, 6 Western expatriates, 6 Caribbean expatriates and 6 Caymanians will be interviewed to give a more accurate picture of fishing pressure. This work is currently underway and will be completed on schedule, by the end of year two. Quotes from the nine surveys are included as is the interview protocol.
3.2 Historical effort and catch data compiled by end of year 2 (interviews with (6) local Little Cayman fishermen		As above, this data has already been collected (by Dr. Marilyn White) and is due to be presented at the Historical Society Conference in Buffalo USA this year.
Output 4. Dissemination and application of results	4.1 Draft of Biodiversity Action Plan. 4.2 Peer reviewed publications; 4.3 Teaching modules and curriculum developed and posted to the CCMI website	There were no assumptions for this output
4.1 Results incorporated into the BAP.		We will be able to complete this output once the data has been collected and analysed. As we are currently in the data collection stage of the grant, this will be undertaken later in the project.
4.2 Scientific papers (2 submitted for publication, 2 meetings attended by end of project;		The first meeting will be attended in May 2018 by Dr. Carrie Manfrino who will be representing the Darwin Initiative at the 3rd Caribaea Initiative Research and Conservation Workshop in Guadeloupe. Dr. Marilyn White will also be presenting the historical fishing data at the Historical Society Conference in Buffalo (USA) this year.

4.3 Completion of public education curriculum with herbivory modules for all K-12 CCMI programs;	The education module that Darwin has funded has been delivered to the teachers of the Cayman Islands as part of the public education curriculum requirements and has been incorporated into CCMI's education programme. Through CCMI's education programme, we have reached 10 students in the Young Leadership course (ages 16-17) and 12 adult volunteers, as well as the 18 grade 5 & 6 classes as mentioned above.

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

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Targeted management of functionally important herbivorous fish and direct fisheries policies that improve coral reef biodiversity.			
Outcome: Herbivorous fish species that are key to maintaining reef health are incorporated into a draft biodiversity action empowering government to establish policies to sustanably manage herbivores. (Max 30 words)	0.4 Field survey data to indicate key herbivorous fish that is compile and used in a spatial map to inform plans which are endorsed by the Department of Environment managers during a meeting by the end of the second year.; 0.5 Creation of a public- private partnership as an expert fish focus group including members from National Trust, environmental, business, and tourism to empower new policy and protection; 0.6 Draft Biodiversity Action Plan (BAP) agreed internally and draft of management plan for key herbivores by the end of the project.	0.1 By the end of Year 1, minutes from 2 partner meetings and report describes and quantifies the role of herbivorous fish in reducing competitive algae and improving reef health, and that elucidates species trends over the last 2 decades; 0.2 Meeting minutes that record the establishment and meetings of such group; 0.3 Final report with meeting minutes and attendee lists from 3 partner meetings (initial, review, final) discussing draft BAP and management plan;	0.1 Herbivorous fish are key to maintaining coral reef health; 0.2 Unknown trends for herbivorous fish on all three islands over the last 20 years of data collection will inform the paln and effectively impact decision making; Fisherman will support this effort and provide accurate data; Fish may be overfished in areas unknown to us; MPA has led to long term increases in herbivorous fish. Draft fish species protection plan which has parrotfish included has never progressed so we are starting from 0.
1. Output: Draft biodiversity action plan to protect key herbivores is approved internally by the Dept. of Environment.	1.4 Partners assess fish from 15 reefs across the three Cayman Islands; Historic reef trends quantified and key species reducing algae growth are identified by the end of year 2; 1.5 Number of members in an expert Herbivorous Fish Focus group by end of year 2; 1.6 Empower 300 local students through new educational modules about herbivory, (specifically taught to students in grades 5	1.1. Report on herbivorous fish; 1.2. Final Report on knowledge gained over duration of project by focus group; 1.3. Pre and post surveys indicating students empowered with knowledge and utilising CCMI resource;	1.1 Hierarchy of herbivores, with some species playing larger roles in reducing algae; Populations of herbivorous fish species richness and fish biomass has changed over the last 20 years;

	and 6) by the end of year 2.		
2. Spatial map establishes the levels of herbivory and regional connectivity of key herbivorous fish and supports regional benefit of protecting herbivores.	2.1 Project data and map is posted and partner media pages and newsletters raise awareness (from 0 to 2000) via partner networks including DoE, CCMI, school groups by end of project; 2.2 Regional connectivity (tagging and genetics) of herbivore fish determined by end project;	2.1 Web analytics and newsletter opens with project views; 2.2. Fish connectivity report with data and photographs;	2.1 Movement patterns can be generalised for a range of herbivorous fishes with similar life history traits to facilitate broad management and conservation plans/action.
3. Herbivorous fish impact assessment based on levels of fishing	3.1 Fishing effort surveyed (data on catch and effort at 6 landing sites across the Cayman Islands by end of year 2. 3.2 Historical effort and catch data compiled by end of year 2 (interviews with (6) local Little Cayman fishermen.	3.1 Report of interviews quantify current levels of fishing pressure by end of year 3.2 Report documenting oral history with photographs;	3.1 Fishing effort measured at landing sites reflect overall fishing efforts; Illegal fishing does not occur in protected zones; Fishers provide accurate data through face to face interviews. Fishers are reluctant to report fishing effort due to a potential perception of restricted access to certain herbivorous fish species.
4. Dissemination and application of results	4.1 Results incorporated into the BAP. 4.2 Scientific papers (2 submitted for publication, 2 meetings attended by end of project; 4.3 Completion of public education curriculum with herbivory modules for all K-12 CCMI programs;	4.1 Draft of Biodiversity Action Plan. 4.2 Peer reviewed publications; 4.3 Teaching modules and curriculum developed and posted to the CCMI website.	None

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)

Output 1: Draft biodiversity action plan to protect key herbivores

1.1 Survey reefs at 15 sites on the north sides of all three islands to determine fish biodiversity and benthic (algae and coral) community structure, abundance, and health, and identify key fish for protection.

1.2 Herbivorous Fish Focus stakeholder group meet with partners and expand their knowledge and grow support for a BAP.

1.3 Create and deliver new educational modules about herbivory that empowers 300 grade 5 and 6 students.

Output 2: Spatial map of key herbivorous fish.

2.1 Manipulation experiments determine dietary patterns and key herbivores are identified also using surveys (from Output 1.1).

2.2 Tag fish to determine range and impact on reducing algae on the reefs; genetics (fin clips) of selected species expand our knowledge on connectivity across the region.

Output 3: Herbivorous fish impact assessment.

3.1 12 Fisherman are surveyed for catch and effort data;

3.2 Historical fishing effort and catch is documented through oral history interviews which are available online.

Output 4: Dissemination and application of results.

4.1 Develop draft Biodiversity Action Plan with partners

2 Write and submit 2 scientific papers to peer reviewed journals and attend 2 international meetings to present research results.

4.2 K-12 Educational curriculum is developed and used for residential programmes; 200 additional students participate by end of project.

Annex 3: Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
Established codes								
9	1 action plan produced for the Cayman Islands government to help protect coral reef biodiversity (by focusing on the role of key herbivorous fish Species)					1	0	
11A	2 scientific papers					2	0	

	published by end of grant							
14B	2 conferences attended by end of grant					2	0	

Table 2 Publications

Title	**Type** (e.g. journals, manual, CDs)	**Detail** (authors, year)	**Gender of Lead Author**	**Nationality of Lead Author**	**Publishers** (name, city)	**Available from** (e.g. weblink or publisher if not available online)
Protecting Coasts & Communities	Darwin Newsletter	Dell, 2017	Female	British		Darwin website