

**Education and Awareness Activities**  
**Conducted by Fragments of Hope**  
**June 2016-December 2019**

**Repopulate Reefs within Replenishment Zones of  
Turneffe Atoll Marine Reserve and South Water Caye  
Marine Reserve with Temperature Resilient Coral  
Varieties**





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## **Executive Summary on Outreach 2016-2019**

Fragments of Hope (FoH) has given formal presentations on reef replenishment results in Belize at over 15 regional and international conference and symposiums since June 2016, including the International Coral Reef Symposium (ICRS) in Hawai'i in 2016 which resulted in a published, peer-reviewed conference proceeding. Other regional conferences where talks were given included, but are not limited to, the Associated Marine Laboratories of the Caribbean (AMLC, biennial) and the Gulf and Caribbean Fisheries Institute (GCFI, annual). Ms. Carne, Executive Director and Founder of FoH, gave a plenary talk at the Reef Futures 2018 meeting sponsored by the Coral Restoration Consortium with over 500 attendees and with an online viewers numbering over 1.5k. FoH has also presented at multiple local (Belizean) meetings and themselves hosted at least 18 public meetings/consultations since June 2016. FoH has also facilitated exchange visits specific to reef restoration work with participants from Morocco, Jamaica, Mexico, Colombia, Guatemala, Honduras, the United States Virgin Islands and the United States, as well as multiple site visits with Belizean students (primary school and high school level). FoH has participated in online webinars, panel discussions and local TV shows, and their work has been the topic of numerous international articles and videos. Each November (since 2014), FoH collaborates with Boston University and their undergraduate courses on marine ecology and reef restoration held at the University of Belize's Field Station on Calabash Caye in Turneffe Atoll Marine Reserve. FoH has maintained and updated their website since 2015 with almost 200K hits in 2019, its YouTube channel, its social media Facebook page since 2009 with over 4800 followers, and recently added Instagram and Twitter accounts. FoH also contributed regular updates to the *Placencia Breeze*, a monthly tourism newspaper (through December 2019) that is distributed digitally as well as printed copies. This report details activities related to Tasks 5.20-22 from 2016-2019: Education and dissemination: Contribute to the information dissemination activities of MCCAP; Conduct and facilitate national consultation with stakeholders, research institutions, fishers to showcase outputs of the project; and regional/international dissemination of information. One final National stakeholder consultation on results is scheduled for Belize City May/June 2020, and an abstract has been accepted for an oral presentation at ICRS 2020 in Bremen, Germany, this July.

## 1.0 Project Justification

Climate change is believed by the majority of marine scientists to be the most serious threat to corals and their ecosystems today (Aronson and Precht 2006; Baird et al. 2009; Hoegh-Guldberg and Bruno 2010; Lesser 2011), with global warming causing increased severity and frequency of bleaching and coral mortality (Hoegh-Guldberg et al. 2007). Coral reefs are generally recognized as the most vulnerable of the planet's ecosystems to the impacts of climate change (Donner *et al.* 2005). An estimated 19% of the world's coral reefs have been lost and a further 35% are seriously threatened (Wilkinson and Souter 2008), and one-third of all reef-building corals are considered to be at risk of extinction (Carpenter *et al.* 2008). Some authors estimate 60% of all live corals could be lost by 2030 and state that current management practices must undergo radical changes to become effective (Hughes *et al.* 2003).

Widespread coral loss due to thermal stress and mass bleaching has already occurred (Hoegh-Guldberg *et al.* 2007) and Caribbean reefs are particularly impacted, with lower coral cover presently than at any time in geological history (Greenstein *et al.* 1998). The Caribbean as a whole has lost an average of 40% of its absolute live coral cover since the late 1970's (Gardner *et al.* 2003) and most of this is accounted for by the wide-spread loss of two Caribbean acroporids, *Acropora cervicornis* (Lamarck 1816) and *A. palmata* (Lamarck 1816), whose mass mortality is attributed to hurricanes, bleaching and disease (Aronson and Precht 2001; Bruckner 2003). These two species are the fastest growing, main reef building species in the Caribbean, previously dominating both the shallow and intermediate depths; their combined abundance has been reduced by more than 95% Caribbean-wide and they were placed on the IUCN's Red List in 2008 as Critically Endangered, one step away from Extinction in the Wild (Aronson et al. 2008).

In Belize, coral reefs were valued for their ecosystem services (shoreline protection, nursery habitat and aesthetic/tourism value) at over US\$370million/year (Cooper *et al.* 2008). The national average coral cover is currently just 15%, yet both Turneffe Atoll and South Water Caye Marine Reserve are labeled as "poor" with coral cover between 5-9% (Kramer *et al.* 2015).

The most widely recognized climate change adaptation option for coral reefs is to increase coral reef health through the management of local stresses such as pollution, sedimentation, and overfishing (Buddemeier *et al.* 2004). But with ongoing work at Laughing Bird Caye National Park (LBCNP) in southern Belize since 2006, an additional option has been explored and now validated: the identification and propagation of bleaching resistant and/or resilient corals, their cultivation into second/third generation fragments, followed by transplantation to reefs where thermal stress has decimated coral cover (Carne 2008, 2011; Bowden-Kerby and Carne 2012). Restoration techniques have recently become more accepted as conservation tools in recognition of such rapid and continued reef degradation (Jaap 2000; Rinkevich 2005; Baums 2008; Baums *et al.* 2010; Lirman *et al.* 2010; Johnson *et al.* 2011; Young *et al.* 2012; Rinkevich 2014).

Belize, under the leadership of the Ministry of Forestry, Fisheries and Sustainable Development (MFFSD) with fiduciary management assistance from the Protected Areas Conservation Trust (PACT) as the National Implementing Entity (NIE) and the World Bank as Multilateral Implementing Entity (MIE), is responsible for the implementation of the Marine Conservation and Climate Change Adaptation Project (MCCAP) in the coastal areas of Belize. The Project Implementing Agency Group (PIAG) housed within the Fisheries Department and staffed by full-time and part-time consultants is responsible for the coordinating MCCAP implementation. The PIAG consists of a Project Coordinator (PC), a Senior Technical Officer (STO), staff from Fisheries Department, and fiduciary staff of PACT.

MCCAP is a five year project designed to implement a priority ecosystem-based marine conservation and climate adaptation measures to strengthen the climate resilience of the Belize Barrier Reef System and its productive marine resources. Specifically, the project will support:

- i. Improvement of the reef's protection regime including an expansion and enforcement of the Marine Protected Areas (MPAs) and Replenishment (no-take) Zones in strategically selected locations to strengthen climate resilience,
- ii. Promotion of sustainable alternative livelihoods for affected users of the reef, and
- iii. Building local capacity and raising awareness regarding the overall health of the reef ecosystem and the climate resilience of coral reefs.

MCCAP will benefit three Marine Protected Areas (MPAs), namely, the Corozal Bay Wildlife Sanctuary (CBWS), the Turneffe Atoll Marine Reserve (TAMR), and the South Water Caye Marine Reserve (SWCMR). These MPAs are fished by fishermen mainly from 12 coastal communities, namely: 1) Consejo Village, 2) Corozal Town, 3) Copper Bank Village, 4) Chunox Village, 5) Sarteneja Village, 6) Belize City, 7) Dangriga Town, 8) Hopkins Village, 9) Sittee River Village, 10) Riversdale Village, 11) Seine Bight Village, and 12) Placencia Village.

The Belize Marine Conservation and Climate Adaptation Project (MCCAP) has developed a programme to conduct pilot investments into repopulating reefs within replenishment zones of Turneffe Atoll Marine Reserve (TAMR) and South Water Caye Marine Reserve (SWCMR) with temperature resilient coral varieties to support climate change adaptation measures that will improve the resilience of the reef. MCCAP contracted Fragments of Hope, Ltd., to implement the reef restoration activities in TAMR and SWCMR (Sub-Component 1.2.3), and by extension to expand the reef restoration programme in Belize. With financing from the Adaption Fund, these activities will also compliment other tasks under Component 1, such as field verification of spatial mapping activities via ground-truthing and carrying out stakeholder consultations (Sub-Component 1.2.1), and biological and water quality (temperature) monitoring of strategic and control sites (Sub-Component 1.2.2). Additionally Fragments of Hope will add to the project outcomes under Component 3, Raising Awareness and Building Local Capacity through Project Information Dissemination (Sub-Component 3.2.3) and Community Training Events (Sub-Component 3.2.4).

Fragments of Hope has increased live coral cover at LBCNP from just 6% to over 35% by outplanting nursery-reared acroporids from 2010-2016 in ~ one hectare of degraded reef, and is an international example of effective reef ecosystem restoration. Fragments of Hope has established replicable methodologies for mapping, genetics, outplanting and most importantly, created quantifiable success indicators for evaluating the replenishment process. This document outlines in detail the steps necessary to expand the reef repopulation success to Turneffe Atoll and South Water Caye Marine Reserve through 2020.



### **1.1.1 Objectives (from ToR)**

The objective of this consultancy is to support the implementation and expansion of propagation and restoration practices in TAMR and SWCMR of Belize. The firm is expected to contribute to information dissemination activities of MCCAP under component 3.

### **1.1.2 Tasks, Activities and Outputs (from ToR)**

Task 1: Initial project start-up

1. Organize briefing with PIAG staff, FD, and PACT to: (1) define the sub-project scope and activities; and (2) develop and finalize work-plan and consultation schedule.
2. Submit sub-project proposal/activities to the Department of the Environment (DOE) for environmental screening of the project.
3. Review the literature on coral reef propagation and restoration practices, review proposed MPA replenishment Zone maps/documents, and conduct initial consultations with key stakeholders to discuss the sub-project.
4. Prepare inception report, including detailed implementation plan, time-frame, and DOE report.

Task 1 **Expected Outputs:**

- **Inception report** (methodology, work plan, implementation schedule, outcome of initial consultation meetings) on how the Consultancy will be accomplished.

Task 2: Identification of reefs suitable for nurseries set-up and out-planting

5. Organize and facilitate community consultations on potential area for nursery set-up and out-planting sites (where human activity can be managed).
6. Training event (3 days) in coral restoration skills for potential reef restoration assistance.
7. Ground-truth potential sites in TAMR and SWCMR with the participation of MPA staff.
8. Collect GPS coordinates of large Acropora stands and develop larvae dispersal map.
9. Assess genome-wide adaptive trait variance in corals
10. Prepare report on suitable sites for nursery set-up and out-planting and submit to the PIAG for review.

## Task 2 **Expected Outputs:**

- Areas at TAMR and SWCMR identified as suitable for nurseries set-up and out-planting
- Maps generated showing distribution and abundance of these critical endangered coral species in the targeted MPAs.
- Monthly progress reports.
- Technical report on suitable coral nurseries and out-planting sites submitted to the PIAG.

## Task 3: Establishment of coral nurseries within TAMR and SWCMR

11. Undertake the construction on nurseries within selected sites.
12. Train MPA staff and fishers to construct, install, and monitor/maintain nursery tables at sea
13. Monitor/maintain and document coral nurseries.
14. Prepare report on established coral nurseries.

### Task 3 **Expected Outputs:**

- At least six coral nursery tables constructed per MPA (or as required), in accordance to findings from the ground-truthing efforts.
- Monthly progress reports (Keep record on identified challenges, limitations, threats-for coral growth)
- Technical report on established coral nurseries submitted to the PIAG for review.

## Task 4: Out-planting of selected reefs

15. Undertake reef propagation in selected sites in the marine protected area of TAMR and SWCMR.
16. Conduct and facilitate training events/workshops for MPA staff, fishers, diving centres, and other MPA co-managers.
17. Conduct biodiversity analysis (as required) including potential predators.
18. Monitor and document out-planting progress (including survival rates, growth rates, colonization of the selected site by fish and invertebrates).
19. Prepare report on reef propagation in TAMR and SWCMR

### Task 4 **Expected Outputs:**

- At least three restored coral sites, with resilient varieties grown in coral nurseries, within TAMR and SWCMR by the end of the project, with each site measuring 300 m<sup>2</sup>.
- Monthly progress reports
- Technical report on coral out-planting at selected sites submitted to the PIAG for review
- MPA staff and fishermen trained to enable their routine construction, monitoring of corals within nurseries, and tracking the health status of out-planted corals as well as progress towards the building of reef resilience.
- The transfer of knowledge on successful propagation techniques and lessons learnt.
- Expansion of coral reef propagation work in Belize

Task 5: Education and dissemination

20. Contribute to the information dissemination activities of MCCAP, under component 3

21. Conduct and facilitate national consultation with stakeholders, research institutions, fishers, etc., to showcase outputs of the project

22. Regional/international dissemination of information

**Task 5 Expected Outputs:**

- Increased awareness of reef restoration and preservation with focus on climate change adaptation benefits.

## **1.2 Details of Education and Awareness Activities Outputs completed (June 2016-December 2019)**

### **1.21 Task 5.20 Contribute to the information dissemination activities of MCCAP, under component 3**

Activities specifically related to MCCAP dissemination include site visits with the World Bank to South Water Caye (April 2018, Figures. 1a-b) and TAMR (March 2017, Figures. 2a-b) respectively, as well as field visits to the older restoration sites in southern Belize, such as Laughing Bird Caye National Park (LBCNP, June 2017, Figures. 3a-b). Fragments of Hope (FoH) also hosted an LBCNP site visit for the MCCAP Technical Advisory Committee (March 2018) and high school students from Georgetown in the Stann Creek District, via Ecology Projects International (April 2018, Figure 4a). Via MCCAP FoH also facilitated an exchange

visit at LBCNP with Moroccan participants (October 2017). The Adaptation Fund team visited TAMR in October 2018, and FoH also collaborated via the New York Film Academy to produce a short video for MCCAP at TAMR (May 2019), housed on YouTube<sup>1</sup>, and the FoH website, and has made site visits to TAMR in collaboration with Turneffe Atoll Sustainability Association (TASA) for a Caribbean Community Climate Change Centre (CCCCC) workshop on ecosystem based adaptations (November 2019).

In addition to the field site visits, FoH also contributed to the Component 3 dissemination activities by providing images and input for the educational brochures (Annex I), rash guards (Figure 1) and other items (folders, posters, see Annex I).

FoH has also made presentations at the MCCAP sponsored Women Fishers' Forum in Belize City (June 2018), and at a smaller fishers' meeting in Hopkins Village (February 2019, Figure 5).



**Fig. 1.** Dwayne Garcia, far left, from the Belize Fisheries Department, wearing the rash guard created with FoH replenished reef image, during the 2019 FoH Reef Replenishment workshop training event at LBCNP.

<sup>1</sup> [https://www.youtube.com/watch?v=5d\\_rNmPzHoQ](https://www.youtube.com/watch?v=5d_rNmPzHoQ)



**Figs. 1a-b.** The World Bank team at SWCMR with FoH, April 2018



**Figs. 2a-b.** The World Bank team at TAMR with FoH, MCCAP, TASA and the Belize Fisheries Department (March 2017).



**Figs. 3a-b.** The World Bank team at LBCNP June, 2017.



**Figs. 4a-b.** The EPI Georgetown school visit to LBCNP, April 2018 (L) and a Moroccan visitor to LBCNP, October 2017 (R).



**Fig. 5.** MCCAP fishers' event in Hopkins Village with FoH posters and images (February 2019).

**1.22 Task 5.21 Conduct and facilitate national consultation with stakeholders, research institutions and fishers, to showcase outputs of the project**

While initial (2016-2017) community consultations under Task 2.5 were multi-purpose: 1) to inform stakeholders of past and planned reef replenishment work, 2) to seek anecdotal information on presence of healthy, natural acroporid stands, and 3) to seek/engage coastal community members in the training and field work (details shared in Technical Report I, suitable sites for nurseries set-up and out-planting), subsequent public meetings served more as updates on the reef replenishment work and related issues (e.g. bleaching/disease events, upcoming training dates, etc.). Although the training events (Tasks 2.6 and 3.11) are reported on separately, the first evening of the 2019 training event was made a public meeting as there were invited speakers/experts Dr. David Vaughan of Plant a Million Corals (formerly at MOTE Marine

laboratory, expert on micro-fragmenting), Dr. Mark Butler (lobster expert) and Dr. Jason Spadero (crab expert) both at Old Dominion University (at that time). Therefore that meeting date is listed in Table I below, which breaks down each of the public meetings by date, locations, relevant MPA, who attended, total number of participants and ratio of male/female participants. The merged attendance sheets for each of these meetings is in chronological order and housed on Google drive as PDF document, Annex II<sup>2</sup>. See Figures 6a-c below for examples of FoH Annual General meeting turned public meeting with invited UB students (November 2018), how FoH advertises its public meetings widely on social media and via email, and image from March 2019 public meeting requested by the private boater community.

Other examples of national outreach activities include the FoH appearance on the morning television show Open Your Eyes (April 2019, Figure 6d) and requested lectures at local schools, like the Independence High School (February 2019, Figure 6e).



**Figs. 6a-b.** FoH AGM (November 2018) with invited UB students and example of digital flyer for public meeting announcements.

<sup>2</sup> <https://drive.google.com/open?id=17CFldTmye2sDldsEfSkDxDJY3PU16hoB>



**Fig. 6c.** Public meeting in March 2019, requested by the private boaters community.



**Figs. 6d-e.** FoH partners Healthy Reef Initiatives and FoH on the morning TV talk show, OpenYour Eyes, April 2019, and Ms. Carne giving an invited guest lecture to an Independence High school class, February 2019.



**Table I.** Fragments of Hope hosted community consultations and public meetings June 2016-December 2019.

<b>Community Consulted, MPA, Date</b>	<b>Participants (organizations, individuals, schools, etc)</b>	<b>Total number Attendees</b>	<b>Number male/female</b>
Dangriga, SWCMR, 11 October 2016	Fishers, resorts, tour guides, students, educators, Fisheries Dept.	26	15 /11
South Water Caye, SWCMR, 16 October 2016	Fishers, resorts, tour guides, educators, Fisheries Dept.	18	10/8
Hopkins, SWCMR, 20 October 2016	Tour guides, fishers, community members, MCAPP, Fisheries Dept.	35	24/11
Coral Caye, SWCMR, 3 November 2016	Tour guides, fishers, resort owners, community members, WWF & GEF staff	46	24/22
San Pedro , TAMR, 1 February 2017	Tour guides, fishers, Hol Chan MR staff, community members, tourists	24	17 /7
Chunox, TAMR, 16 February 2017	Fishers, MCAAP, Belize Audubon Society	25	21/4
Belize City, TAMR, 26 July 2017	Fishers, tour guides, MCAPP, TASA, MAR Fund, CCCCC, Fisheries Dept	21	13/8
Placencia, SWCMR, 31 August 2017	Fishers, tour guides, local NGO's, tourists & community members	52	30/22
Placencia, 6 October 2017	Moroccan exchange visit	17	11/6
Placencia, SWCMR, 3 November 2017	Fishers, tour guides, local NGO's, community members, Fisheries Dept	38	16/22
Dangriga, SWCMR, 27 November 2017	Island Expeditions (kayaking tour company) staff/guides	22	20/2
Placencia, SWCMR, 14 June 2018	Fishers, tour guides, local NGO's, community members	30	13/17
Seine Bight, SWCMR, 20 August 2018	Fishers, tour guides, local NGO's, community members, Seine Bight's Women's group	43	19/24
Placencia, SWCMR & TAMR, 12 September 2018	Mexico, Honduras, Guatemala, US scientists exchange participants, Fisheries Dept	25	12/13
Placencia, SWCMR, 16 November 2018	Fishers, tour guides, local NGO's, UB students, resort owners, community members	54	30/24
Placencia, SWCMR, 14 January 2019	Fishers, tour guides, local NGO's, CCCCC, Fisheries Dept, community members	35	23/12
Placencia, SWCMR, 19 March 2019	The international private boaters community, sailing tour companies, local community members	43	22/21
Placencia, SWCMR, 30 August 2019	Fishers, tour guides, local NGO's, Independence Junior College, Fisheries Dept, community members	37	19/18

## **1.23 Task 5.22 Regional/international dissemination of information**

All events are described in chronological order, 2016-2019 and links to articles and videos, webinars and recorded events are provided in Annex III.

### **2016**

The International Coral Reef Symposium (ICRS) is held every four years, and the 13<sup>th</sup> ICRS was held in Hawaii in June 2016. NOAA held an all day side session on reef restoration, where the work in Belize was highlighted by several presenters/collaborators, and Lisa Carne gave a full oral presentation in session 42b, Propagation and Active Reef Restoration - Distribution, Transplantation, Monitoring and Evaluation of Restoration Activities, entitled, “Defining success in active Caribbean acroporid population replenishment efforts: Results from over nine years of work in southern Belize”. The peer-reviewed paper is now published in the proceedings available online here: <http://coralreefs.org/wp-content/uploads/2016/12/Session-42-B-2-Carne-et-al..pdf>. Also shared in Annex IV. Lisa Carne was also a co-author on Les Kaufman’s oral presentation entitled, “Community and ecosystem aspects of reef restoration” held in session 77: Corals and the US Endangered Species Act: Bridging the gap between science, management and conservation action. The past and current reef replenishment work in Belize was also highlighted by presenters and partners Austin Bowden-Kerby (Corals4Conservation) and Brook Gintert (University of Miami). Slides from the work in Belize were also shared in the “Report Out” final session, under Reef Recovery. The entire two hours session is online: <https://vimeo.com/groups/342636/videos/189186894>.

The Mesoamerican Society for Biology and Conservation Congress is regional and annual, and the XX Congress was held August 22-26 2016, in Belize City, Belize. Lisa Carne also presented an updated oral session on the reef replenishment work here; the agenda is available online at: [https://drive.google.com/file/d/0B8uut\\_m-LjJqWHVPVm54bHZfZnc/view](https://drive.google.com/file/d/0B8uut_m-LjJqWHVPVm54bHZfZnc/view).

The Gulf and Caribbean Fisheries Institute (GCFI) is a larger and broader, annual event. Traditionally it had focused on commercial species, but in recent years sessions on marine protected areas management and ecosystems have been added. Lisa Carne presented orally on the past and current reef replenishment work in Belize at the 69<sup>th</sup> GCFI held in Grand Cayman

November 7-11, 2016 in the “Ecosystem based management, habitat and coastal management” session.

NOAA held a much more technical, focused workshop to “Advance The Science & Practice of Caribbean Coral Restoration” in Ft. Lauderdale November 15-17, 2016. While NOAA was at the forefront of designating the Caribbean acroporids as Endangered Species in the US (2006), which led to their placement on the IUCN Red List as Critically Endangered in 2008, and released a Recovery Plan for the Acroporids in 2015, criticism has been their limitation to US territory/waters. This workshop was a culmination of recognizing those limitations, with regional participants, and had a technical focus of sharing methods primarily to upscale replenishment efforts. Another objective was to broaden the collaboration in the coral restoration community, which has grown significantly in recent years. Although most of the presentations, including those given by Lisa Carne on outplanting techniques and using a community workforce, were short and technical, the work in Belize was again highlighted by two longer talks on the first day: Dr. Les Kaufman (Boston University) spoke on the “big ideas in restoration” and Dr. Nicole Fogerty (then at NOVA Southeastern University) also showcased the work in Belize since only in Belize has the acroporid hybrid, *A. prolifera*, been documented to sexually reproduce, and *A. prolifera* has been included in the nurseries since 2009 and outplanting sites since 2010. More details on the workshop are available here:

<http://www.st.nmfs.noaa.gov/coralrestoration/index.html>.

## **2017**

The 10<sup>th</sup> annual Natural Resources Management symposium was held at the University of Belize, 30-31 March 2017. Ms. Carne’s abstract entitled, “Update on reef replenishment efforts in Belize: Success indicators and expansion plans” was accepted and the talk presented on 30 March, 2017. The attendance was mostly local/national. The same talk with some updates was given at a regional meeting: the Association of Marine Laboratories in the Caribbean (AMLC held every two years) on 25 May, in Merida, Mexico (Figure 7a).

Both talks were well received, and besides disseminating the work in Belize, attendance at regional conferences are important for updated information on other reef sites: for example in Florida, they have lost most of their pillar corals (*Dendrogyra cylindrus*), one of the species that has been in the southern Belize nurseries since 2009, and targeted for future micro-fragmenting experiments.

In May 2017 FoH hosted a journalist from the Guardian (UK), and her article, with a focus on the restoration work at LBCNP was released in August 2017:  
[https://www.theguardian.com/environment/2017/aug/22/belize-coral-reefs-improving-grassroots-restoration?CMP=share\\_btn\\_link](https://www.theguardian.com/environment/2017/aug/22/belize-coral-reefs-improving-grassroots-restoration?CMP=share_btn_link).

In September 2017, two FoH members attended a MAR Fund hosted workshop in Mexico to revitalize the Mesoamerican Restoration Network, which had been formed in 2012 (L. Carne was a participant at the 2012 meeting), also with MAR Fund support, but had gone dormant. The meeting had over 60 participants, with only a handful of actual restoration practitioners, from Belize and Mexico. As part of a workshop activity, the Belize contingent, which included the Fisheries Department, UB, WWF and HRI, identified an additional 14 sites in Belize where they wanted to see restoration activities occur. The focus of the workshop was to create a Steering Committee for a new MAR Restoration Network, and L. Carne was elected as the Belize country representative. Other outcomes included discussing a Reef Rescue plan, for training partners in all four member countries for emergency reef response, in the event of hurricanes, a website for the Network, potential reef insurance options, more regional sharing/training events, and the next meeting was scheduled for September 2019; all members voted to hold it in Belize.

In November 2017, two FoH members accompanied Boston University for their ecology and restoration course work at Calabash Caye in TAMR (Figure 7b), a collaboration years old now. Also in November 2017, two FoH members attended COP23 in Germany to receive an award issued by the UN Secretariat for Climate Change under their Momentum for Change Lighthouse activities (Figure 7c). The entire ceremony, with only the FoH portion is on Youtube (~4minutes): <https://www.youtube.com/watch?v=rX6A-qdouNE&t=118s>. This also led to an interview on the BBC Women's Hour, link here: <https://www.facebook.com/matrotz/videos/10107263186393091/> and an article in the Independent (UK) : <http://www.independent.co.uk/review%20of%20the%20year/review-of-the-year-extraordinary-women-2017-female-groundbreakers-sexism-me-too-feminism-sheroes-a8103171.html>.



**Fig. 7a.** Ms. Carne presenting on the work in Belize at the 38<sup>th</sup> AMLC in Merida, Mexico (May 2017).



**Figs. 7b-c.** FoH team with Boston University class at TAMR (November 2017) and announcement of 2017 Momentum for Change award.

## 2018

In January 2018, Fragments of Hope was awarded a small grant from GEF-SGP/OAK Foundation for activities including (but limited to) a Jamaica/Belize exchange for restoration practitioners, outreach programs in the Placencia primary schools, and an updated version of the coloring book “More corals=More Fish. In March 2018, three restoration practitioners from Jamaica (Oracabessa Bay and Sandals/Beach Resort) visited LBCNP and several other restoration sites including SWCMR, and learned the outplanting methods used here with hands on participation and training. In May, four FoH members visited Jamaica and assisted with their outplanting, and the Belize Fisheries Department issued the first regional certificates of completion from FoH’s Reef Replenishment training, a significant step in dissemination of the lessons learned in Belize (Figures 8a-b).

Also in March 2018, Ms. Carne (FoH) organized a women’s delegation from Belize to attend the World Ocean Summit in Mexico, with travel support from the OAK Foundation (Figure 8c ). Included in the group was Ms. Beverly Wade, Belize Fisheries Administrator, who was able to confirm government support of FoH’s restoration work to the Commonwealth Secretariat representative in Mexico. This has led to a formal partnership with Belize, Australia and Mauritius for reef restoration under their Blue Charter Action groups. FoH wrote a one-pager (Annex IV) describing the history of the work in Belize, and the Commonwealth Secretariat is now requesting FoH’s training materials for wider dissemination in Commonwealth nations.

Ms. Mariko Wallen (FoH) was nominated to speak at the 62<sup>nd</sup> Session of the Commission on the Status of Women (CSW62) at the United Nations headquarters in New York City (Figure 8d). Ms. Wallen shared her experiences with coral reef restoration and capacity building for marine tour guides: the GOB press release is in Annex IV.

Another outcome from attending the World Ocean Summit in Mexico (March 2018) was connecting with Dr. Victor Zycov, Director of Research at the Schmidt Ocean Institute (SOI). Dr. Zycov then organized a work shop with Ms. Carne’s input (participant suggestions and presentation on Belize’s work shared), summarized as follows: On June 19-21, Schmidt Ocean Institute held a focused planning workshop on Data Analytics to Restore Coral Reefs and

Rehabilitate Coastal Marine Ecosystems<sup>3</sup>. The highlight of the workshop was the realization that all major puzzle pieces are in place for financially sustainable large scale reef restoration: from cost-efficient outplanting methodologies to high resolution hydrographic coastal flooding and erosion models, cm-scale large area coverage shallow bathymetry scanning methods, effective risk management business models, and substantial amounts of government and private funds currently held for disaster relief that are waiting to be unlocked for coastal ecosystem restoration and management through practical demonstrations of favorable benefit to cost ratios of such efforts to the appropriate agencies. The workshop also explored opportunities for the application of microbial, molecular, and visual survey data to up-scaling coral reef and related coastal ecosystem management and conservation. The common thread across the discussions on data driven conservation and management was that there are powerful ways to leverage the strengths and achievements of multiple ongoing R&D efforts in this field by structuring such data-driven analytical workflows and platforms in an open, inter-operable manner to keep the broader user and developer community engaged and empowered (Figure 8e).

Crucial at the SOI workshop were updates on mapping tools, and discussions on how to improve and speed up the use of photo-mosaics for restoration practitioners. SOI has also opened up their proposals/funding plan, and has stated that all workshop participants will be eligible to apply for SOI funds by then end of this year. Dr. David Vaughan (MOTE Marine laboratory) has already received some SOI funds, and will to return to Belize in January 2019 to assist FoH with their planned Reef Replenishment Workshop, to officially incorporate micro- fragmenting into FoH's training materials and agenda.

Other new partnerships formed over this report period include with the Healthy Reefs Initiative (HRI) and the Smithsonian Institution, for crab/macroalgae experiments and assistance with the bi-annual AGRR (Atlantic Gulf Rapid Reef Assessment) surveys that feed into HRI's Mesoamerican Report Cards. FoH has also partnered with GCFI (Gulf and Caribbean Fisheries Institute) and TIDE (Toledo Institute for Development and Environment) to better analyze 2017's bleaching data in Belize and compare *in situ* temperatures with NOAA's predictive online tools. Community researcher training for 2018 bleaching surveys was also planned for

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<sup>3</sup> [https://docs.google.com/document/d/1y1TdaPdAhB\\_A95CMccdkp-NiW-kJMXo9hHnhOLFslOs/edit#heading=h.px5k4i56noa0](https://docs.google.com/document/d/1y1TdaPdAhB_A95CMccdkp-NiW-kJMXo9hHnhOLFslOs/edit#heading=h.px5k4i56noa0)

SWCMR and PHMR (Port Honduras Marine Reserve), as well as conducting bleaching surveys in both MPAs later in 2018.

FoH continued to host and collaborate with groups as requested for field site visits. (e.g. American Girl Scouts, Citizen Science GIS team, etc).

FoH hosted an exchange with Mexican restoration practitioners, and invited experts, Dr. Baums, Dr. Gleason, Dr. Banaszak and Ken Nedimyer, founder of Coral Restoration Foundation, joined FoH and the Belize Fisheries Department to tour restored and natural acroporid stands south to north, inclusive of sites in SWCMR and TAMR, via small grant from MAR Fund. A summary of that exchange is shared as a PPT, here

<https://drive.google.com/open?id=1GDyLUHLNTbi-X-aH7p0nXDBXbMBZF56U>. A short video was compiled for sharing at the 71<sup>st</sup> GCFI Cinefish festival, that captures the experts declaring LBCNP the best reef restoration site in the Caribbean. Within the PPT shared in the link above, experts were equally impressed by the new direct-outplanting method for micro fragments; results were showcased from in SWCMR and TAMR.

Ms. Carne was invited to give an overview of the work to date at the Healthy Reefs Initiative partner meeting, held in Caye Caulker, October 2018, with over 60 participants from Mesoamerican countries (Figure 9a).

FoH was featured in the SGP's 25<sup>th</sup> Anniversary celebration November 2018: in the video, accessible here: <https://www.youtube.com/watch?v=aCwXJ14dhYM> and in the MPA Atlas produced (housed on the FoH website<sup>4</sup>). FoH also won a "Women as Agents of Change Award" (Figure 9b).

Three FoH team members attended the 71<sup>st</sup> GCFI conference in San Andrés, Colombia, where Ms. Carne had an accepted talk on reef resilience, assisted evolution and reef restoration<sup>5</sup>, the full PPT is accessible at the link in the footnote. The new group Corales de Paz, and old colleagues from CORALINA, and Dr. Valeria Pizarro invited FoH to visit the nurseries and outplanted sites in San Andrés (Figure 9c). This was Ms. Carne's fourth trip to San Andrés-previous trips were funded by the World Bank (2010), CORALINA (2012), and ECOMARES (2014). We were able to revisit and show Corales de Paz, the coral outplants from the training workshop held in 2014. FoH is now planning an exchange for the Colombians to visit Belize,

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<sup>4</sup> <http://fragmentsofhope.org/case-study-manuals/>

<sup>5</sup> [https://drive.google.com/file/d/1xi\\_xUJD97oHZot09vocGiHNNNyZYPRxg/view](https://drive.google.com/file/d/1xi_xUJD97oHZot09vocGiHNNNyZYPRxg/view)



with proposed funding provided by Conservation International. At GCFI, FoH also met Jake Kheel, Vice President Grupo Puntacana Foundation in the Dominican Republic, where restoration has been occurring for many years with FoH colleagues Dr. Diego Lirman and Dr. Austin Bowden-Kerby. FoH is now in discussion with Mr. Kheel for an exchange with the Dominican Republic reef restoration practitioners at Punta Cana (Figure 9d).

FoH continued its annual tradition of collaboration with Boston University at UB's field station in TAMR (November 2018, Figure 9e).

Ms. Carne was invited to be a plenary speaker at the REEF Futures meeting in Key Largo, December 10-14, 2018 (Figure 9f). Attendees numbered over 500 and the talks were live streamed. Ms. Carne was the first speaker on Wednesday, December 12, 2018, after opening remarks by Tom Moore of NOAA. The link for that day's plenary speakers is:

<https://www.facebook.com/CoralRestorationConsortium/videos/442867676246522/>

and the intro and Ms. Carne's talk is at -3:35 to -3:16 minutes. That live video has more than 1.4K views. FoH work (pictures and credits) was also featured several times in the first day's plenary talks (by Tom Moore, NOAA, and Iliana Baums, Penn State) and by several others in the side session talks, including but not limited to Ken Nedimyer's and Dr. David Vaughan's talks. In addition to the plenary talk at Reef Futures, Ms. Carne also gave a side session talk on the micro-fragmenting work at REEF Futures, co-authored with Dr. David Vaughan<sup>6</sup>, the full PPT can be accessed at the link in the footnote.



**Figs. 8a-b.** Jamaican restoration practitioners (Ms. Layne of Boscabel Marine Sanctuary and Mr. Wilmot of Oracabessa Bay Marine Sanctuary) awarded training certificates from FoH and the Belize Fisheries Department (L) and the FoH team in Jamaica (2018).

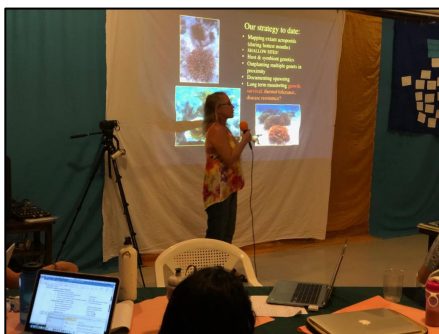
<sup>6</sup> [https://drive.google.com/file/d/1-5J\\_RCmcR2a25kYcjIF\\_\\_Abu5D2vuRsH/view](https://drive.google.com/file/d/1-5J_RCmcR2a25kYcjIF__Abu5D2vuRsH/view)



**Figs. 8c-d.** Ms. Carne (FoH), Ms. Wade (Belize Fisheries Department), Ms. Bood (WWF) and Dr. McField (HRI) at the World Ocean Summit in Mexico (L, 2018), and Ms. Wallen at the 62<sup>nd</sup> Session of the Commission on the Status of Women (CSW62) at the United Nations headquarters in New York City (R, 2018).



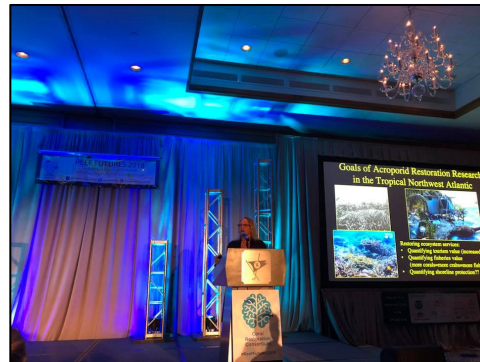
**Fig. 8e.** The speakers on the final day of the SOI workshop (L-R): L. Carne (FoH), D. Vaughan (MOTE), B. Reguero (TNC), G. Asner (Carnegie), M. Beck (TNC), H. Wendt (IUCN, Fiji).



**Figs. 9a-b.** Ms. Carne at the HRI regional partner meeting, Caye Caulker (October 2018) and receiving the GEF women as agents of change award from CEO of Ministry of Forestry, Fisheries and Sustainable Development, Dr. Percival Cho.



**Figs. 9c-d.** The FoH team in San Andrés, Colombia (L) and meeting with Mr. Jake Kheel, Vice President Grupo Puntacana Foundation in the Dominican Republic, in San Andrés, at the GCFI meeting.



**Figs. 9e-f.** The FoH team with Boston University’s course at Calabash Caye, TAMR (November 2018, L) and Ms. Carne delivering a plenary talk at REEF Futures in FL (R, December 2018).

## 2019

Ms. Carne presented a summary of Fragments of Hope’s reef restoration work in Belize to date regionally at the 39<sup>th</sup> AMLC meeting (Association of Marine Laboratories in the Caribbean), held in the Dominican Republic mid-May 2019 (Figures 10a-b). Ms. Carne also presented on the results from the 2017 coral bleaching event in Belize, and how that relates to restoration work, at the University of Belize’s Natural Resource Symposium end of May 2019. FoH was featured in an article published last May in the Christian Science Monitor entitled,

“Reef restored: How Belize saved its beloved coral”<sup>7</sup>. FoH’s work was also highlighted on a German public news show<sup>8</sup> and invited to showcase their results using photo-mosaics in a webinar hosted by the Coral Restoration Coalition and the Reef Resilience Network, which was recorded and is accessible here:

<http://reefresilience.org/photomosaics-as-a-tool-for-monitoring-coral-restoration-success/>.

Since Belize is co-champion with Australia and Mauritius for the Commonwealth Blue Charter Reef Protection and Restoration action group, FoH along with the Belize Fisheries Department was invited to present results at the Commonwealth Blue Charter Reef Restoration meeting in Townsville, Australia early July 2019.

FoH was featured in the Caribbean Culture & Lifestyle magazine, shared on the local Maya Island airlines and in most hotel rooms, <https://caribbeanlifestyle.com/a-race-to-save-the-reef/>. FoH was also featured on Swiss Radio by journalist Max Bohnel in September<sup>9</sup>.

Ms. Nicole Craig represented FoH in New York City at the United Nations Climate Summit on “Solutions for Implementing Gender-Responsive Climate Action” in September<sup>10</sup>.

In October, a series of meetings was held (October 7-10, 2019) in Belize City with the first day for National stakeholders, the second day including regional stakeholders and focused on the emergent disease Stony Coral Tissue Loss (SCTLD) and the final two days were the Second Biennial Mesoamerican Reef Restoration Network, which FoH co-hosted with MAR Fund. Ms. Carne gave a different presentation on the work in Belize each day and coverage was featured on the local channel 5 news:

<https://edition.channel5belize.com/archives/192259> and <https://www.youtube.com/watch?v=KhrKfS9uRBU>. Ms. Carne was re-elected as the Belize representative on the Mesoamerican Reef

Restoration Network Executive committee. Following the October meetings in Belize City, FoH hosted Dr. Dave Gulko from the Hawai’i State Government and Dr. Johanna Calle from Iberostar Resorts (in Mexico and the Dominican Republic) at Laughing Bird Caye National Park (LBCNP). Channel 5 interviewed both visitors at LBCNP where they each declared it the best

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<sup>7</sup> <https://www.csmonitor.com/Environment/2019/0515/Reef-restored-How-Belize-saved-its-beloved-coral>

<sup>8</sup> <https://www.daserste.de/information/politik-weltgeschehen/weltspiegel/videos/Belize-das-gerettete-Riff-video-100.html?fbclid=IwAR0wcWoHxKd8RTMEFXdss-9pkLxxYfa3k7Vdw72tUEfB4XW0Mfm-COtw3QQ>

<sup>9</sup> <https://oe1.orf.at/player/live>

<sup>10</sup> Aired on Facebook live:

<https://www.facebook.com/GEFSsmallGrantsProgramme/videos/515586912540066/UzpfSTExNjgzMTQ0NjI6MTAyMTg1Njc4MzA2MDQ4MzA/>

restoration site they had ever seen. Dr. Gulko’s edited video is here:

<https://www.youtube.com/watch?v=bqYJ3pcDya0>

Dr. Calle’s unedited footage (in Spanish & English) is here:

[https://drive.google.com/open?id=1q6AHDjQQY2SfdB7wg\\_uY3bj1Vdwjq3Fr](https://drive.google.com/open?id=1q6AHDjQQY2SfdB7wg_uY3bj1Vdwjq3Fr)

FoH again teamed with Boston University for their restoration course in TAMR (Figure 10d).

The abstract entitled “Challenges in evaluating reef restoration success: how long do we need? Lessons learned in Belize the past decade” was accepted as an oral presentation to the ICERS 2020 conference in Bremen, Germany under the theme “Interventions and restoration” and in the Session: How can interventions and restoration help coral reefs survive the next few decades?



**Figs. 10a-b.** The presentation given at the 38<sup>th</sup> AMLC in the Dominican Republic, May 2019.



**Fig 10c.** Regional participants at the 2<sup>nd</sup> Binennial MAR Reef Restoration network meeting, Belize City (October 2019) displaying their FoH stickers/support.



**Fig. 10d.** The FoH team with the annual Boston University reef restoration course in TAMR, November 2019. FoH member demonstrating newly learned drone skills for this group photo.

## 2.0. Conclusions and Recommendations

While there is much value in public meetings, television and print/online articles and videos, nothing takes the place of field site visits when it comes to explaining the reef restoration work in the context of climate change issues such as erosion, coral bleaching and disease events. And even though attendance at regional and international meetings, conferences and symposiums can expose many to the work in Belize, most of these events are limited to 10-15 minute talks/presentations. Because of this, Fragments of Hope has changed its catch phrase from “more corals=more fish” to “seeing is belizeing” and in recent years made regional exchanges a funding focus (e.g the Jamaica and Mexico exchanges). Therefore we highly recommend the following:

- Future dissemination efforts on coral reef restoration efforts and the effects of climate change be focused on field site visits for every level/category of national, regional and international stakeholders including but not limited to: funders, government decision makers, relevant conservation NGO partners, academia, other restoration practitioners, the private sector, fishers, tour guides, community members, and students of all ages.
- All required progress reports be made public as PDF downloads on the FoH website for ‘grey literature’ contribution to regional and global reef restoration initiatives.

