



DEVELOPMENT OF CASE STUDIES ON REEF RESTORATION IN THE MESOAMERICAN REEF (MAR) REGION

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Photo: Fragments of Hope



PROYECTO MANEJO INTEGRADO
**DE LA CUENCA
AL ARRECIFE**
DE LA ECORREGIÓN
DEL ARRECIFE MESOAMERICANO
(MAR2R)



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Fragments of Hope (FoH)

ACRONYMS & ABBREVIATIONS

ACRONYM	FULL NAME
ACER	<i>Acropora cervicornis</i>
AGRRA	Atlantic and Gulf Rapid Reef Assessment
APAL	<i>Acropora palmata</i>
APRO	<i>Acropora prolifera</i>
ARPEA	Área de Refugio y Protección de Especies Acuáticas Bahía de Akumal
CCAD	Comisión Centroamericana de Ambiente y Desarrollo
CEA A.C.	Centro Ecológico Akumal
CORALIUM	Laboratorio de Investigación Integral para la Conservación de Arrecifes
DCYL	<i>Dendrogyra cylindrus</i>
DLAB	<i>Diploria labyrinthiformis</i>
FoH	Fragments of Hope
GEF	Global Environmental Fund
MAR	Mesoamerican Reef
MAR Fund	Mesoamerican Reef Fund
MAR-RRN	Mesoamerican Reef Restoration Network
MAR2R	Integrated Ridge-to-Reef Management of the Mesoamerican Reef Ecoregion
MCAV	<i>Montastraea cavernosa</i>
OANN	<i>Orbicella annularis</i>
OCEANUS A.C.	Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano
OFAV	<i>Orbicella faveolata</i>
PPOR	<i>Porites porites</i>
PSTR	<i>Pseudodiploria strigosa</i>
SSID	<i>Siderastrea siderea</i>
WWF	World Wildlife Fund

TABLE OF CONTENTS

ACRONYMS & ABBREVIATIONS	3
TABLE OF CONTENTS	4
INTRODUCTION	5
MAIN OBJECTIVE	5
METHODOLOGY	5
FOUR CASE STUDIES	6
CASE STUDIES: GENERAL FINDINGS	7
CASE STUDIES: SPECIFIC FINDINGS	8
◉ Proyecto de Restauración Coralina en el Hábitat Arrecifal de Akumal	8
◉ Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano	13
◉ Fragments of Hope	18
◉ Laboratorio de Investigación Integral para la Conservación de Arrecifes	23
OTHER RESTORATION PROJECTS IN THE REGION	28
BIBLIOGRAPHY	31
ANNEXES	31

INTRODUCTION

The Mesoamerican Reef Restoration Network (MAR-RRN), created in 2012 as an initiative of Oceanus A.C., is the meeting point for people, governmental, non-governmental, academic, private sector, cooperation and financing organizations, dedicated to restoration, conservation, and protection of coral reefs in the MAR Region. The MAR-RRN is led by an Executive Committee (EC), represented by an expert in restoration from each country within the MAR.

The MAR-RRN aims to be the main source of up-to-date information on restoration in the MAR, and a regional platform to coordinate and share resources to promote the scientific and technical capacity of organizations that conduct restoration, rehabilitation and repopulation of reefs in the region with a scientific basis.

Therefore, in order to strengthen and promote practices associated with reef restoration in the MAR, the “Integrated Ridge-to-Reef Management of the Mesoamerican Reef Ecoregion (MAR2R-CCAD/GEF-WWF)” through MAR Fund, commissioned the development of case studies on reef restoration within the MAR. These case studies include, among other topics, the type of project, the species worked with, the location, the main results, the challenges, and lessons learned, as well as recommendations.

MAIN OBJECTIVE

The main objective for creating these case studies is to share the knowledge, experiences, best practices, and methodologies in reef restoration that exist in the MAR region with a broader audience, in the Caribbean and worldwide. These case studies will also serve as roadmaps for future projects, to allow them to be more effective and efficient, learning from others and sharing the learning curve.

METHODOLOGY

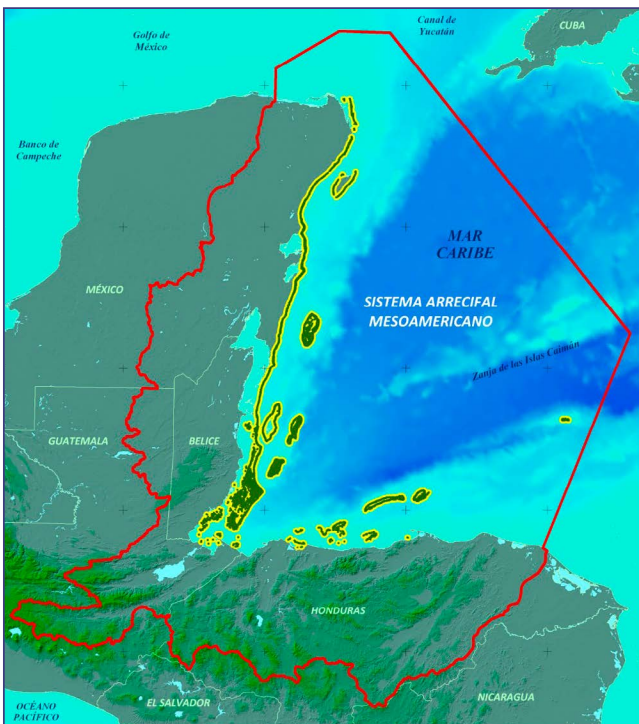
The development of case studies on reef restoration was originally based on the use of 3 methodologies: 1. Online polls; 2. Guided interviews with the selected case study entities; and 3. Personal conversations with collaborators outside the selected entities, to get a more objective vision of each entity. Due to limitations, only the first 2 methodologies were used: online polls and guided interviews.



Photo: Fragments of Hope

The online poll (called Poll A) included qualitative and quantitative questions, multiple-choice, and open-ended questions (see [annex 1](#)). The guided interviews were used to fill in any gaps that were gathered through the poll, such as requesting maps, coordinates, images, videos, etc. (see [annex 2](#)); whereas the personal conversations used a list of topics covered during a Zoom call. The purpose of these tools was to gather knowledge, experiences, best practices, and methodologies being carried out in reef restoration, in a way that made them comparable, where applicable. A second poll, called Poll B, was developed based on Poll A, to gather general information of all other existing restoration projects within the region (see [annex 3](#)). The MAR-RRN Executive Committee provided a list of all these projects per country, for a total of 22 projects (see [annex 4](#)):

Mexico	Belize	Guatemala	Honduras
12 projects	2 projects	1 project	7 projects



All answers for Poll A can be found in [Annex 5](#), and for Poll B in [Annex 6](#). All maps, images, and other relevant information per case study can be found in each [annex](#) pertaining to that particular case study.

FOUR CASE STUDIES

The MAR-RRN Executive Committee selected 4 projects to be showcased in this study. The selection was based on 4 criteria which the Executive Committee deemed appropriate as a measure of success. The 4 criteria are as follows:

- **Criteria 1: Data Availability regarding monitoring**
 - ▶ Survival rates
 - ▶ Rate of growth of project
 - ▶ Frequency of follow-up activities
 - ▶ Area restored in a certain period of time
- **Criteria 2: Involvement of local community in restoration projects (outreach)**
- **Criteria 3: Clear methodology of how restoration has been developed**
 - ▶ Project replicability
 - ▶ Have they expanded to other areas?

- **Criteria 4: Is the project innovating in its use of species and methodologies?**

Based on the 4 criteria and on information provided by each project to the previous MAR-RRN Coordinator, the Executive Committee assigned points to the projects in the MAR region, and ultimately chose those scoring highest in each country. Originally, the selection included 2 projects in Mexico, 1 project in Belize and 1 project in Honduras. MAR Fund, decided that one of the selection criteria to be elected as a case study, was having all pertinent government permits in place. As such, the project in Honduras was not eligible, due to permits that are still pending for approval. The final selection stands as 3 projects in Mexico and 1 in Belize.

The selected projects and implementers are:

MEXICO

- Proyecto de Restauración Coralina en el Hábitat Arrecifal de Akumal - ARPEA (CEA)
- Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano (OCEANUS)
- Laboratorio de Investigación Integral para la Conservación de Arrecifes (CORALIUM-UNAM)

BELIZE

- Fragments of Hope (FoH)

CASE STUDIES: GENERAL FINDINGS

The four case studies reflect similar situations, such as the species they work with (see acronyms and abbreviations), sources of funding, quantifying out-planting, etc. Below is a table that shows the overlap between projects as stated in Poll A.

Poll Question	CEA	OCEANUS	FoH	CORALIUM-UNAM
Sources of funding: Private/personal/family	x	x	x	
Sources of funding: Grants	x	x	x	x
Sources of funding: Donations	x	x	x	x
Species: ACER	x	x	x	x
Species: APAL	x	x	x	x
Species: APRO	x	x	x	
Species: MCAV	x	x	x	
Species: SSID	x		x	
Species: OFAV	x		x	x
Species: OANN	x	x	x	x
Species: PSTR		x	x	x
Species: PPOR	x			
Species: DCYL			x	
Species: DCLI			x	
Species: DLAB				x
Type of nursery used: Table	x		x	x
Type of nursery used: Clothesline	x	x	x	
Type of nursery used: Other		x (grill, pyramid, reef stars)	x (domes)	x (tables in lab)
Out-planting method: Cement	x		x	x
Quantifying out-planting: Number of fragments	x	x	x	
Monitoring survival of out-planted colonies: Number of fragments	x		x	
Published a how-to manual		x (Annex 7)	x (Annex 8)	x (Annex 9)
Novel methodology		x	x	x
Work with volunteers: Yes	x	x		x
Background of volunteers: Local community	x	x	x	x
Background of volunteers: Dive masters	x		x	x
Engages the local community	x	x	x	x
Works with local stakeholders	x	x	x	x
Type of stakeholders: Dive shops	x	x	x	x
Type of stakeholders: Tour guides	x	x	x	x
Type of stakeholders: Marine recreation providers	x	x		x
Type of stakeholders: Local NGO	x	x	x	x
Type of stakeholders: Local government	x		x	x
Type of stakeholders: Regional government	x	x		x
Type of stakeholders: National government	x	x	x	x
All permits in place	x	x	x	x
Legal background of the project: Local NGO/Non-profit	x	x	x	
Implements best practices	x	x	x	x

CASE STUDIES: SPECIFIC FINDINGS

A. Proyecto de Restauración Coralina en el Hábitat Arrecifal de Akumal - ARPEA (CEA)

The Coral Restoration Project in Akumal (ARPEA) is a project that began in 2019 and is lead by Baruch Figueroa Zavala at Centro Ecológico Akumal (CEA) in Akumal, Quintana Roo, Mexico.



GENERAL INFORMATION

Name	Restauración Coralina en el Hábitat Arrecifal de Akumal
Country	Mexico
Area of influence	Quintana Roo
Type	Local NGO / Non-profit
Year begun	2019
All legal permits	Yes

CONTACT INFORMATION

Principal	Baruch Figueroa Zavala
Position	Coordinador del Programa de Ecosistemas Costeros y Marinos
Email	baruch.figzav@gmail.com
Website	https://ceakumal.org
Instagram	NA
Facebook	@Baruch Figueroa-Zavala

EMPLOYEES, VOLUNTEERS, STAKEHOLDERS

Employees	2
Gender distribution	50/50
Volunteers	Yes
Background	<ul style="list-style-type: none"> • Dive Masters (certified or in-training) • Volunteer interns
Internship	Yes
Background	<ul style="list-style-type: none"> • Paying interns
Local stakeholders	Yes
Background	<ul style="list-style-type: none"> • Local community members, from dive shops and tourism cooperatives, trained in coral reef ecology and restoration techniques (Restoration Allies – Aliados de Restauración)
Creating engagement	Through workshops where project is presented to local stakeholders and decision makers

BUDGET AND SOURCES OF FUNDING

Yearly budget	\$20,000 – 30,000
Sources	<ul style="list-style-type: none"> • Private/personal/family funding • Grants • Donations • User fees

SPECIES AND METHODS

Species		
• <i>Acropora cervicornis</i>	ACER	Yes
• <i>Acropora palmata</i>	APAL	Yes
• <i>Acropora prolifera</i>	APRO	Yes
• <i>Siderastrea siderea</i>	SSID	Yes
• <i>Montastrea cavernosa</i>	MCAV	Yes
• <i>Orbicella faveolata</i>	OFAV	Yes
• <i>Orbicella annularis</i>	OANN	Yes
• <i>Porites porites</i>	PPOR	Yes
• <i>Porites astreoides</i>	PAST	Yes

Nurseries

	Nursery types	# of Nursery Type	Fragments/nursery
Tables	X	2	50
Clothesline	X	6	30-100

How to manual	Yes
Novel methodology	No
Out-planting methods	
• Cement	Yes
• Epoxy	Yes
• Nails	Yes
• PVC couplings	Yes
• Zip ties	Yes
• Clothes-line laying	Yes
Success measurement	
• Number of fragments	Yes
• Length of living tissue	Yes

Success of the Project

The following section is based on the rubric created by the MAR-RRN in order to determine which 4 projects would be showcased in this document. It is based on the following questions within the rubric:

- Number of coral reef restoration and/or conservation projects
- In-situ and ex-situ coral reef nursery
- Number of coral reef fragments planted
- Percentage of survival rate
- Parameters to evaluate the success of restoration activities

The Restauración Coralina en el Hábitat Arrecifal de Akumal project has 5 reef restoration sites and 5 in-situ coral reef nurseries. To date, they have planted 7,500 coral fragments, have measured their success or survival rate at 70%, and the parameters they use to evaluate this success are percentage of survival, growth (in size) of fragments, and coral cover gained (%).

Main Results

This project has been key in involving the local community in coral restoration. The entity that houses this project, Centro Ecológico Akumal, is seen as an essential part of the community which spearheads conservation in the area. CEA is a valuable resource within Akumal, and community members then become trainees, volunteers, and even staff to carry out different projects.

The coral restoration project, as well as their turtle protection project, have become catalysts for other pressing matters, such as marine water quality, wastewater treatment, sustainable growth or development and spatial planning. The projects are not seen as individual or single-species projects, but as a holistic approach to better management of the valuable resources that attract tourism to the area, as these are the attractions that visitors want to experience when thinking of visiting Akumal.

Challenges and Lessons Learned

As with any project that involves the local community, be it conservation or otherwise, it is very challenging to change perspectives and modify behaviors.

Conflict of uses and conflict between the users themselves, stresses projects, staff and organizations, and can be very complicated to navigate through. Even more so in areas where tourism has bloomed at a very fast pace.

Consistency is key. Projects have to be seen as long-term. Investing in the community, and having a clear and constant message are key lessons that have been learned through time in these projects.

Conclusions

1. The reef naturally responds to restoration efforts.
2. These efforts can influence co-management.
3. These efforts can influence the local community towards better stewardship of their resources.
4. Use hard science, where all elements can be measured as closely as possible.
5. Lack of knowledge (or deliberately turning a blind eye) of the problems by decision makers.
6. Factors such as water quality and related ecosystem health should be taken into account when defining/ identifying outplanting sites, in order to create enabling conditions for success.
7. Restoration should be seen as a whole ecosystem approach to reef health.
8. These are long-term projects that need continuity in order to be effective.

Recommendations

- Foster continuous funding.
- Increase awareness and environmental consciousness in the general population.
- Foster adequate response by decision makers.
- Allow access to federal funding.
- Begin implementing the national norm for water quality.
- Allow the private sector to become involved in the implementation of the water quality norm, with strict Govt oversight.
- View and fund these projects with a long-term view.
- Increase the implementation time allocated in order for projects to be more successful.
- Promote better alliances with donors, to insure the longevity of the projects.
- Share experiences, downfalls, and achievements.
- Carry out more peer-to-peer exchanges.
- Unify strategies across the MAR.

Guided Interview with Baruch Figueroa

Baruch Figueroa, coordinator of the Restauración Coralina en el Hábitat Arrecifal de Akumal project, has a master's degree in marine and coastal resource management and has been working in this field since 2005. He first got involved in reef restoration back in 2011/12 when he began to see the loss of coral cover in Akumal, where he works. He felt pushed towards carrying out efforts that would strive to restore these species, as he felt a commitment towards his community, and towards the fact that he wanted his daughter to enjoy the same reefs he had. What drives him is to be able to see how the reef naturally responds to restoration efforts, and how these can influence co-management of these areas, but most importantly, how this can influence the local community towards better stewardship of their resources. He has gleaned the most personal satisfaction in seeing how this project first began, how it has evolved and changed, and how it has contributed and gained hands-on knowledge.

He identifies lack of continuous funding as the most challenging aspect of restoration efforts, as these are long-term projects that need continuity in order to be effective. Another important factor he mentions is to make sure hard science is used, where all elements can be measured as closely as possible. And in order to create enabling conditions for success, factors such as water quality and related ecosystem health should be taken into account when defining/identifying replanting sites. Restoration should be seen as a whole ecosystem approach to reef health.

An obstacle Figueroa identifies is the lack of awareness and environmental consciousness by the general population; but most alarming is the lack of

knowledge (or deliberately turning a blind eye) of the problems by decision makers. These have the power to make changes in factors such as deforestation, development and water quality, much little to nothing is being done to address these impacts. There isn't adequate or timely response. Facing these challenges, he states that restoration would be more effective if there was an adequate response by decision makers, access to federal funding and willingness to address them at the government level.

His direct request to the president of México would be to foster adequate adjustments to the national water quality control norm, seeking to avoid marine pollution with sewage waste. To please allow the private sector to become involved in this important matter, and to show that for it to be successful, it cannot only rely on the central and local governments, that it needs to be done in conjunction with the private

“Restoration should be seen as a whole ecosystem approach to reef health.”

sector. And his direct request to the MAR-RRN is three-fold: 1. To view and fund these projects with a long-term view, to increase the implementation time allocated in order to be more successful; 2. Promote better alliances with donors, to insure the longevity of the projects, with continuous revision of achievements, of course; and 3. What this document strives to carry out: to share experiences, downfalls and achievements, to carry out more peer-to-peer exchanges and, most importantly, to unify strategies across the MAR.

Figueroa wraps up the interview by stating that the most significant lesson he has learned over the years has been to integrate stakeholders and local communities/partners in all aspects of the project. As they then become agents of change and feel they are part of the project, appropriation happens, and they take ownership.



► **Photo 1.** ACER fragments recently outplanted.



▼ **Photo 2.** ACER colonies 3 years after outplanting.



▼ **Photo 3.** Outplanting APAL fragments on clean substrate.



▼ **Photo 4.** ACER fragments collected in a basket for transportation to nursery or outplant site.



► **Photo 5.** Classifying and re-fragmenting APAL fragments on-board a boat.



▼ **Photo 6.** Maintenance of fragments on "clothesline" type nursery.



► **Photo 7.** Maintenance of fragments on "tree" type nursery.



◀ **Photo 8.** Group picture after a successful training.

B. Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano

The Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano is a project begun in 2009 and spearheaded by Gabriela Nava from Oceanus A.C. It operates in Quintana Roo and Veracruz, Mexico.



GENERAL INFORMATION

Name	Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano
Country	Mexico
Area of influence	Quintana Roo and Veracruz
Type	Local NGO / Non-profit
Year begun	2009
All legal permits	Yes

CONTACT INFORMATION

Principal	Gabriela Nava
Position	Co-responsible
Email	gnavo01@gmail.com
Website	www.oceanus.org.mx
Instagram	oceanusac
Facebook	OceanusAC

EMPLOYEES, VOLUNTEERS, STAKEHOLDERS

Employees	8
Gender distribution	50/50
Volunteers	Yes
Background	• Local community
Internship	No
Background	• NA
Local stakeholders	Yes
Background	• Dive shops; Tour guides; Marine recreation providers; Local NGO; Regional government (state); National government
Creating engagement	Offers trainings and certifications; Creating local restoration groups & certified guides with volunteers and members of the local community

BUDGET AND SOURCES OF FUNDING

Yearly budget	\$150,000
Sources	<ul style="list-style-type: none"> • Private/personal/family funding • Grants • Donations • Governmental funding

SPECIES AND METHODS

Species		
• <i>Acropora cervicornis</i>	ACER	Yes
• <i>Acropora palmata</i>	APAL	Yes
• <i>Acropora prolifera</i>	APRO	Yes
• <i>Siderastrea siderea</i>	SSID	Yes
• <i>Montastrea cavernosa</i>	MCAV	Yes
• <i>Orbicella annularis</i>	OANN	Yes

Nurseries			
	Nursery types	# of Nursery Type	Fragments/nursery
Trees	X	14 installed (13 in-process)	60-80
Clothesline	X	1	40
Vivero de Parrilla (grill-type nursery)	X	15	70
Vivero de Pirámide (Pyramid nursery)	X	7	40
Reef Stars	X	350m ²	350m ²

How to manual	Yes
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Novel methodology	Yes
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Out-planting methods	
• PVC couplings	Yes
• Other	ibulb: small concrete bases with a screw-on female PVC coupling, where the male coupling has a coral fragment that has been reared in the grill or pyramid type nursery.

Success measurement	
• Number of fragments	Yes
• Other	By site, taking into account indicators such as: intervention area (m ²), number of transplanted colonies and % of survival in transplants and nurseries, as well as condition of the colonies.

An evaluation of the condition of the reef site before and after the transplant activities is also carried out, evaluating reef health indicators such as:

- percent coverage of the main components of the substrate
- condition and structure of the fish community (adults and recruits)
- abundance of invertebrates
- abundance of coral recruits

Success of the Project

The following section is based on the rubric created by the MAR-RRN in order to determine which 4 projects would be showcased in this document. It is based on the following questions within the rubric:

- Number of coral reef restoration and/or conservation projects
- In-situ and ex-situ coral reef nursery
- Number of coral reef fragments planted
- Percentage of survival rate
- Parameters to evaluate the success of restoration activities

The Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano project has 10 reef restoration sites and 20 in-situ coral reef nurseries. To date, they have planted 1000 coral fragments, have measured their success or survival rate at 85%, and the parameters they use to evaluate this success are: for outplants: percent of surviving fragments, growth rates, and percent tissue cover in cm²; whereas within the restoration area, they use coral colony density, substrate cover, structure, coral community condition, fish community and associated invertebrates to measure their success.

Main Results

Watching an area bloom, full of live coral, has been one of the main results of this project. Becoming an example for others to follow, as well as training other groups and projects within and outside the MAR is a great success. Being able to watch areas that once had very low- to critical- coral cover become sources of spawning and fragments for other areas is a great result.

Involving the local community is a must when carrying out these kinds of projects, as they adopt the idea, turn it into something that belongs to them and where they see the fruits of their labor. Being seen as an example to follow and replicate.

Challenges and Lessons Learned

Working with local and national decision makers is a challenge that every project faces, as these people need to be first convinced and then taken in and nurture the relationship. But this challenge is one that needs to be faced every 4-5 years, as sometimes these people change, as elections come and go. It's an investment that needs to be carried out, as these folk can become the best of allies or the worst of foes, and they always need to be kept close.

Conclusions

1. There is a need to create conditions where natural restoration can be fostered/helped, by mitigating existing impacts at a restoration site.
2. Long-term thinking and funding are imperative factors in order for a project to be successful.
3. Projects should have a holistic approach, with decision makers highly involved, in order to reduce sedimentation, upstream pollution, implementing best practices and fostering sustainable development.
4. That restoration IS working, but the pace is too slow and the scope/scale are too small.
5. Climate change and a shifting baseline are obstacles for reef restoration.
6. Adoption of restoration projects by the local communities makes them more effective, as it creates a sense of ownership and belonging.
7. These projects need perseverance, constant and continuous efforts.
8. Reef restoration should be seen as a long-term investment, not as a single action.

Recommendations

1. More actions need to be carried out, more corals need to be replanted.
2. The private sector needs to be highly involved in safeguarding their natural capital and actively participating in restoration projects in their area of influence.
3. Immediately declare all coral species as endangered/protected under National Norm 0059, which would enable conditions for coral restoration to be seen as imperative.
4. Long-term and continuous funding of these projects is needed.
5. Create more situations for peer-to-peer exchanges, to foster collaboration and not competition.
6. See all the projects as sections of one whole, region-wide restoration effort.

Guided Interview with Gabriela Nava

Gabriela Nava, co-director of the Programa de Restauración de Arrecifes del Golfo de México y el Caribe Mexicano, has a master's in science and began her restoration efforts in 2008 in Veracruz, Mexico. She saw the decline in cover of APAL, due to boat groundings, and saw the need to help restore these populations. Doing so, she noticed that many colonies were now isolated patches, where they once were large interconnected strands. She feels that her role is to make the world a better place, to create conditions where natural restoration can be fostered, and to share a conservation message with others. That it should not be seen as planting a coral, but as a message of hope and actions that actually make changes that are visible. What she likes most about working in reef restoration is seeing coral colonies grow and flourish, to actually carry out the in-water work and think of new methods to innovate constantly. She feels that her work through Oceanus has been one of a pioneer and leader, becoming a spearhead project that can then be replicated and used as a comparison.

She identifies that mitigating existing impacts at a restoration site, long-term thinking and funding are imperative factors to be successful. Which means it should have a holistic approach, with decision makers highly involved, in order to reduce sedimentation, upstream pollution, implementing best practices and fostering sustainable development. Nava considers that more actions need to be carried out, more corals need to be replanted, and that the private sector needs to be highly involved in safeguarding their natural capital.

She sees climate change and a shifting baseline as the biggest obstacles reef restoration faces. That

restoration IS working, but the pace is too slow and the scope/scale are too small. That the world-wide ecological changes we are seeing are moving much faster than our restoration actions. And her direct message to the president of Mexico would be to immediately declare all coral species as endangered/protected under National Norm 0059, which would enable conditions for coral restoration to be seen as imperative.

Nava firmly believes that adoption of restoration projects by the local communities makes restoration effective; and this creates a sense of ownership and belonging, making quicker and longer lasting positive impacts. Parallel to this, is the need for long-term and continuous funding of these projects. She has seen that restoration is effective, when evaluated through tools such as HRI's Reef Health Index, with more abundant fish and higher coral cover in areas that have been intervened.

Her message or request to MAR-RRN is to create more situations for peer-to-peer exchanges, to foster collaboration and not competition. To see all the projects as sections of one whole, region-wide restoration effort, and to focus on long-term funding, rather than quick interventions.

Gabriela wraps up her interview by stating there is an urgent need for collaboration, and to drop the need to compete and compare. That these projects require perseverance, constant and continuous efforts; that reef restoration should be seen as a long-term investment, not as a single action. No site can be restored in the short-term. And that one must not lose hope, but to have faith and to continue striving for success!

“Adoption of restoration projects by the local communities makes restoration effective.”



► **Photo 1.** “Table” type nursery ready for harvesting with ACER fragments.

Photo 2. ►
“Tree” type nursery that has recently been populated with ACER fragments.

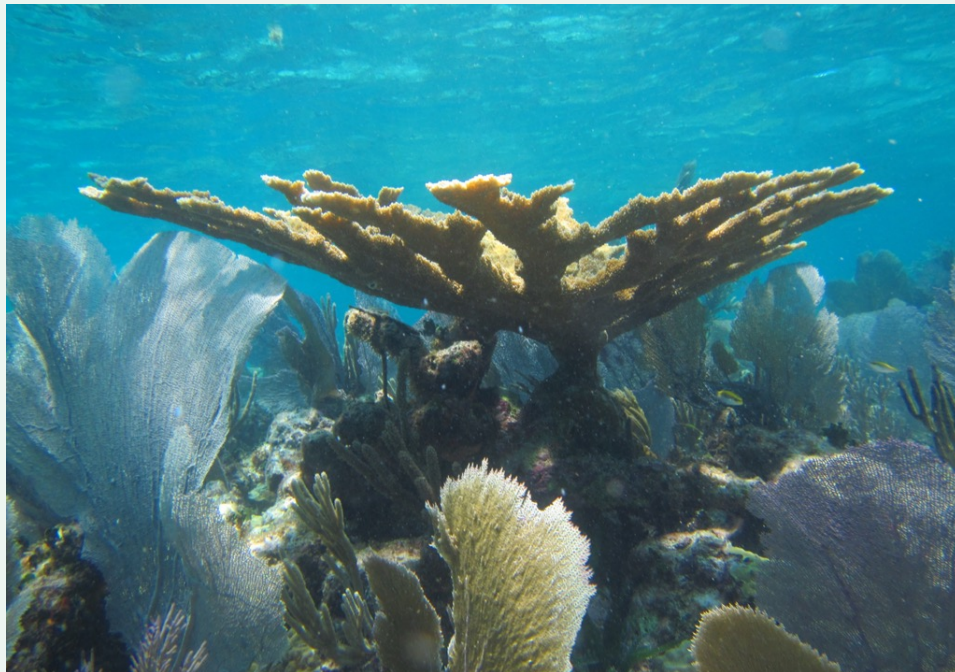


► **Photo 3.** APAL fragment on a “tree” type nursery. Notice how the living tissue has grown over the zip tie that holds the fragment.



► **Photo 4.** APAL fragment outplanted on the reef. Notice the tag on the second colony, used for monitoring purposes.

Photo 5. ►
An outplant area with growing colonies of 3-4 year old fragments.



► **Photo 6.** An outplanted APAL, approximately 6-7 years old.

C. Fragments of Hope

Fragments of Hope is an organization that has been working on reef restoration projects for over 15 years. It is spearheaded by Lisa Carne, Executive Director and Founder, in Belize, based in Placencia.



GENERAL INFORMATION

Name	Fragments of Hope
Country	Belize
Area of influence	Belize
Type	Local NGO/non-profit; International NGO/non-profit
Year begun	2006
All legal permits	Yes

CONTACT INFORMATION

Principal	Lisa Carne
Position	Executive Director and Founder
Email	lisasinbelize@gmail.com
Website	www.fragmentsofhope.org
Instagram	Foh-belize
Facebook	Fragmentsofhopebelize

EMPLOYEES, VOLUNTEERS, STAKEHOLDERS

Employees	None full time, other than ED
Gender distribution	100% female (ED is female)
Volunteers	The ORG does not work with volunteers
Background	<ul style="list-style-type: none"> But does train local community members and dive masters, both certified and in-training
Internship	No
Background	<ul style="list-style-type: none"> NA
Local stakeholders	Yes
Background	<ul style="list-style-type: none"> Dive shops; Tour guides; Local NGO; Local government; National government; Co-manager or similar entity
Creating engagement	Trains local community members and dive masters

BUDGET AND SOURCES OF FUNDING

Yearly budget	\$100,000 - \$120,000
Sources	<ul style="list-style-type: none"> Private/personal/family funding Grants Donations

SPECIES AND METHODS

Species		
• <i>Acropora cervicornis</i>	ACER	Yes
• <i>Acropora palmata</i>	APAL	Yes
• <i>Acropora prolifera</i>	APRO	Yes
• <i>Montastrea cavernosa</i>	MCAV	Yes
• <i>Orbicella faveolata</i>	OFAV	Yes
• <i>Orbicella annularis</i>	OANN	Yes
• <i>Pseudodiploria strigosa</i>	DSTR	Yes
• <i>Dendrogyra cylindrus</i>	DCYL	Yes
• <i>Pseudodiploria clivosa</i>	PCLI	Yes

Nurseries			
	Nursery types	# of Nursery Type	Fragments/nursery
A-frames	Not anymore	3-4	51 back in 2009
Tables	X	26	Varies
Domes	X	6	Varies

How to manual	Yes
Novel methodology	Yes
Out-planting methods	
• Cement	Yes
• Nails	Ropes with nails
• Wedging	Yes
• Other	Ropes without nails
Success measurement	
• Number of fragments	Yes
• Photo mosaics	Yes
• Drone ortho-mosaics	Yes
• Spawning documentation	Yes

Success of the Project

The following section is based on the rubric created by the MAR-RRN in order to determine which 4 projects would be showcased in this document. It is based on the following questions within the rubric:

- Number of coral reef restoration and/or conservation projects
- In-situ and ex-situ coral reef nursery
- Number of coral reef fragments planted
- Percentage of survival rate
- Parameters to evaluate the success of restoration activities

The Fragments of Hope project has 4 reef restoration sites and 26 in-situ coral reef nurseries. To date, they have planted 151,634 coral fragments, have measured their success or survival rate at 80%, and the parameters they use to evaluate this success are percent coral cover change over time, bleaching history, growth rates, genetics, and if outplanted colonies are carrying out spawning, or sexual reproduction.

Main Results

Fragments of Hope has become an iconic project in the Mesoamerican Reef System, due to the changes in coral cover that have become evident at Laughing Bird Caye and Moho Caye. The numbers speak for themselves, and this is why Fragments of Hope was selected by the United Nations as one of 50 Forming Initiatives dedicated to ecosystem restoration around the world.

Challenges and Lessons Learned

One of the main challenges identified is access to recurring funding, which affects the project's ability to plan and achieve goals in the long term. However, through perseverance and consistency, FoH has been able to demonstrate that this project is worth investing in, which sets it aside from other "short-term" focused projects. Thus helping garner support and funding along the way.

Conclusions

1. Coral restoration projects are not short-term. Projects need to be long-term oriented, reaching sexual reproduction of the replanted corals.
2. Projects need constant training, as there usually is a quick turnaround of staff.
3. Investing in people is important to continue restoration efforts.
4. Training should not be fully subsidized, as trainees will take it more seriously if they have invested into it.
5. Trainees must possess good diving skills and experience working underwater.
6. Most funding available is limited and short-term.
7. The rules and regulations need to be in place, where all projects are held to the same standards.
8. Success needs to be measured equally and should have the proper science-based approach in place.

Recommendations

1. When planning a training program that seeks to train 6 people, you should budget for 12 or more.
2. Donors and funders need to understand that these projects should not be limited to small time windows, but need to be seen as long-term investments.
3. Recurring funding should reduce paper-work and reporting, once a relationship between grantor and grantee has been established.
4. Restoration needs to be up-scaled, not just at the site level, but country-wide.
5. Simplify the follow-up process and paperwork.
6. Increase the amounts awarded at each call for proposals and to extend the amount of time for project execution.

Guided Interview with Lisa Carne

Lisa Carne is the founder and Executive Director at Fragments of Hope, and she holds a masters in biodiversity conservation. She has been working in reef restoration since 2006 in Belize, and first got involved in this line of work because she saw the imperative need of restoring reef ecosystems. She firmly believes that reef restoration is effective, as she has seen it happen over the 10 years that FoH has intervened in areas such as Laughing Bird Caye and other sites. She believes that the keys to successful restoration are three-fold: 1. having strict criteria for selecting nursery put outplant sites before nurseries and out-planting sites; 2. using a science based approach and relying on genetic information of the species being used; and 3. not being afraid to try novel approaches: learning by doing.

Over the years Lisa has learned that investing in people is important to continue restoration efforts. When planning a training program that seeks to train 6 people, you should budget for 12 or more, as not everyone will finish the training or continue working on these activities. And this training should not be fully subsidized, as trainees will take it more seriously if they have invested into it; and these trainees must possess good diving skills and some experience with working underwater, as reef restoration is very work intensive.

A limiting factor Carne identifies is funding, both amounts and short-term funding. Donors and funders need to understand that these projects should not be limited to \$50K, and that recurring funding should reduce paper-work and reporting, once a relationship between grantor and grantee has been established. And for restoration to be more successful, the rules and regulations need to be in place, where all projects are held to the same

standards, success measured equally and having the proper science-based approach needs to be in place. This will allow identifying blue-washing programs that should not be permitted to operate. These “fake” not my word- say one- off or short term-projects, when they fail, give a bad reputation to all projects, negatively affecting real projects, which can scare funders away and cause the permitting process to become even more complicated at the government level.

If Lisa had a chance to talk to the Prime Minister, she would invite him to Laughing Bird Caye to see and experience first-hand how successful a restoration project can be. That projects need to be

“Coral restoration projects are not short-term, quick-turn-around results, they need many years.”

long-term oriented, reaching sexual reproduction of the replanted corals; and that restoration needs to be up-scaled, not just at the site level, but country-wide. She expressed that what brought her personal satisfaction was seeing Belizeans getting to visit restoration sites and more reef areas in their own country.

And the greatest professional satisfaction has come from being recognized by the United Nations as one of 50 Forming Initiatives dedicated to ecosystem restoration around the world. Also FoH time series photos were chosen for the cover of David Vaughan’s Active Reef Restoration textbook.

Her request to the MAR-RRN is to please simplify the follow-up process and paperwork, as there already is a relation between the grantor and grantee, increase the amounts awarded at each call for proposals and to extend the amount of time for project execution. Coral restoration projects are not short-term, quick-turn-around results, they need many years. And these projects also need constant training, as there usually is a quick turnaround of staff, and then new team members/volunteers/staff need to be trained in order to ensure success.



► **Photo 1.** Aerial view of one of FoH's outplant sites in Belize.



▼ **Photo 2.** ACER and APRO fragments on a "table with ropes" type nursery.



▼ **Photo 3.** Staff and volunteers at a "table with ropes" type nursery. Notice the small size of the fragments recently installed at the nursery.



► **Photo 4.** An outplanted APAL, approximately 11 years old.

Photos: Fragments of Hope



▼ **Photo 5.** Outplanted APRO colony, approximately 4-5 years old. Notice the small fragments on the substrate, which can easily be harvested and taken to a nursery or fixed directly to the substrate.



▼ **Photo 6.** An entire “rope” with medium sized ACER that was harvested from a “table with ropes” type nursery. The rope holding the colonies is then secured to the substrate with cement nails.



▼ **Photo 7.** The stunning view at the Laughing Bird Caye outplant site. FoH’s crown jewel of achievements.



Photo 8. ▶ Grunts and snappers hiding under large colonies that were out planted in December 2010.

D. Laboratorio de Investigación Integral para la Conservación de Arrecifes (CORALIUM-UNAM)

The Laboratorio de Investigación Integral para la Conservación de Arrecifes (CORALIUM-UNAM) has been operating for 15 years in Puerto Morelos, Mexico. It is spearheaded by Dr. Anastazia Banaszak, of the Universidad Nacional Autónoma de México (UNAM).



CORALIUM

LABORATORIO DE INVESTIGACIÓN INTEGRAL
PARA LA CONSERVACIÓN DE ARRECIFES

GENERAL INFORMATION

Name	Laboratorio de Investigación Integral para la Conservación de Arrecifes (CORALIUM-UNAM)
Country	Mexico
Area of influence	Yucatán Peninsula
Type	A project within the Universidad Nacional Autónoma de México (UNAM)
Year begun	2007
All legal permits	Yes

CONTACT INFORMATION

Principal	Anastazia Banaszak
Position	Leader
Email	banaszak@cmarl.unam.mx
Website	https://www.icmyl.unam.mx/puerto_morelos/es/investigacion/laboratorio-de-investigacion-integral-para-la-conservacion-de-arrecifes
Instagram	Coraliumlab
Facebook	Coralium: La Vida de un Coral

EMPLOYEES, VOLUNTEERS, STAKEHOLDERS

Employees	7
Gender distribution	4 are female
Volunteers	Yes
Background	<ul style="list-style-type: none"> Local community, Dive Masters (certified or in-training), Volunteer interns, students (national and international)
Internship	Yes
Background	<ul style="list-style-type: none"> Paid interns
Local stakeholders	No, it does not work with local stakeholders, but it does include some of these in creating engagement
Background	<ul style="list-style-type: none"> Local community, Dive shops, Tour guides, Marine recreation providers, Local NGO, Regional government (state), National government, International, and regional NGOs

Creating engagement

Capacity building of brigades within the project and through the local stakeholders

BUDGET AND SOURCES OF FUNDING

Yearly budget	\$40,000-50,000
Sources	<ul style="list-style-type: none"> Grants Donations Governmental funding

SPECIES AND METHODS

Species	
• <i>Acropora cervicornis</i>	ACER
• <i>Acropora palmata</i>	APAL
• <i>Orbicella faveolata</i>	OFAV
• <i>Orbicella annularis</i>	OANN
• <i>Pseudodiploria strigosa</i>	PSTR
• <i>Diploria labyrinthiformis</i>	DLAB

Nurseries

	Nursery types	# of Nursery Type	Fragments/nursery
Tables	X	2	
Lab nursery	X	2	

How to manual	Yes
Novel methodology	Yes
Out-planting methods	
• Cement	Yes
• Epoxy	Yes
• Nails	Yes
• Wedging	Yes

Success measurement

• Number of fragments	
• Yield	How many coral larvae settle in growth medium in the lab, which are then outplanted onto the reef.

Success of the Project

The following section is based on the rubric created by the MAR-RRN in order to determine which 4 projects would be showcased in this document. It is based on the following questions within the rubric:

- Number of coral reef restoration and/or conservation projects
- In-situ and ex-situ coral reef nursery
- Number of coral reef fragments planted
- Percentage of survival rate
- Parameters to evaluate the success of restoration activities

The Laboratorio de Investigación Integral para la Conservación de Arrecifes project has 3 reef restoration sites, 1 in-situ and 1 ex-situ coral reef nurseries. The project does not outplant fragments, as most other reef restoration projects do, but instead carry out assisted sexual reproduction of corals. They measure their success with the following parameters: reproduction capacity of the corals, growth rates, and survival in the wild once they have been taken out of the lab. One comment made by Dr. Banaszak is in relation to how to measure success of the project, and that is reflected in the fact that some of the outplanted corals, grown from gametes in her lab, have reached a large enough size to carry out sexual reproduction. This is a great success from such a small beginning as a series of cells reared in a lab.

Main Results

The project spearheaded by Anastazia and her team have gone above and beyond what is considered to be the regional standard. Through their implementation of new techniques like cryo-preservation and assisted fertilization, the team at CORALIUM are revolutionizing restoration and achieving incredible things through increasing genetic diversity at the same time as coral cover.

Challenges and Lessons Learned

A main challenge identified is the lack of a holistic approach to restoration. Coral restoration alone cannot help our reefs recover, and there has been a consistent lack of intervention in other areas and ecosystems whose health is crucial to reefs as well.

Conclusions

1. Restoration is no longer an option, but something that needs to be done.
2. Projects are truly successful when scientifically rigorous and when outplanted corals grow healthy and then themselves carry out sexual reproduction.
3. CORALIUM is the only project in the MAR that carries out assisted fertilization and cryo-preservation.
4. Factors that impact restoration projects:
 - a. Global factors such as climate change
 - b. Regional factors such as poor water quality;
 - c. Local ones, such as localized pollution.
5. Lack of knowledge on the part of decision makers negatively impacts projects.
6. At the current rate, coral degradation is faster than coral restoration. We need to be more effective with our efforts.
7. Coral restoration success should not be only measured in square meters of area replanted (m^2), but that it is also important to measure in cubic meters (m^3).

Recommendations

1. Lack of long-term funding should be addressed.
2. Funds should be focused towards training others and the younger generations.
3. A holistic approach where forests, mangroves, dunes, beaches, seagrass meadows and other related ecosystems are being actively restored.
4. Immediately reduce all industrial green-house gas emissions.
5. Enforce all wastewater levels and parameters, nation-wide, based on the new National Norm.
6. Build a restoration center, one with the latest in technology, where experts teach courses to the youth (the future is restoration). Where meetings and symposiums can be held and where the public can come and learn about the importance of ecosystem restoration.

Guided Interview with Anastazia Banaszak

Anastazia Banaszak is the head of the Laboratorio de Investigación Integral para la Conservación de Arrecifes (CORALI-UM-UNAM), and she holds a doctorate in aquatic population biology. She has worked in reef restoration since 2011, and got involved in it because life and destiny led her to it. She states that she began growing different life stages of corals for photobiology experiments, it was successful, and she saw the great need to carry out restoration: It is no longer an option, but something that had to be done.

Working alongside like-minded professionals, collaborating with others across the region and the globe, training people in reef restoration, and showcasing the projects' success has brought Ania the most professional satisfaction. Her project has been successful due to being scientifically rigorous, and being the only project in the MAR that carries out assisted fertilization and cryo-preservation. But mostly, she knows that the project has been a great success when she has seen outplanted corals grow healthy and then these corals themselves carry out sexual reproduction in the wild. To her, this closes the cycle of the work she does, that nature takes over and does the job without further human intervention.

The challenges Banaszak identifies are: global factors such as climate change; regional factors such as poor water quality; and local ones such as localized pollution. Lack of long-term funding should be addressed, and these funds focused

towards training others and particularly the younger generations. Lack of knowledge on the part of decision makers highly impacts projects. She also sees coral restoration as an activity that will not cease unless climate change and water quality are addressed adequately. There needs to be a holistic approach where forests, mangroves, seagrass meadows and other related ecosystems such as dunes and beaches are being actively restored. She also states that at the current rate, coral degradation is faster than coral restoration, therefore

we need to increase efforts, and we need to make sure our restored corals reach sexual maturity.

“At the current rate, coral degradation is faster than coral restoration, therefore we need to make sure our restored corals reach sexual maturity.”

The message she would give the president of Mexico would be to immediately and significantly reduce industrial green-house gas emissions. She would also request complete enforcement of all wastewater levels and parameters, nation-wide, based on the

new National Norm. And her requests to donors and the MAR-RRN would be to build a restoration center, one with the latest in technology, where experts can, in person or virtually, have meetings and symposiums and where the general public can learn about the importance of ecosystem restoration. As a general observation, she states that coral restoration success should not be only measured in square meters of area replanted (m^2), but that it is also important to measure in cubic meters (m^3), as that can give us a more accurate measure of the habitat volume created for fish and other aquatic creatures that live and thrive within coral reefs and depend on corals.



► **Photo 1.** Coral gametes being collected on a night dive using nets specially designed by Coralium.



▼ **Photo 2.** At the lab that same evening, teaching students from around the world how to culture embryos and monitor fertilization rates of the gametes collected.



► **Photo 3.** A “tetrapod” cement substrate designed by SCORE International on the reef. Notice the bundles of white “balls”, which are settled coral recruits.

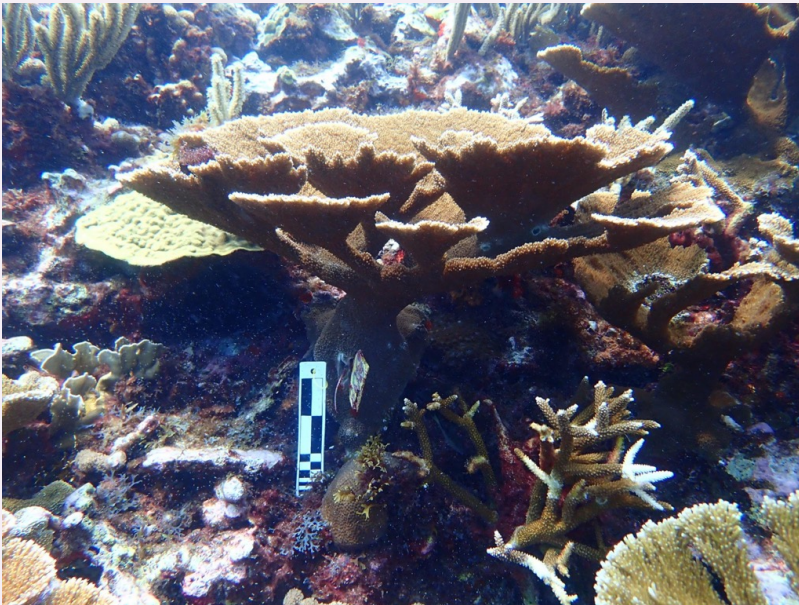


Photo 4. ►
A single coral polyp (OFAV) growing on a ceramic substrate. Note that on each side of this polyp, new polyps are forming.



► **Photo 5.** A small OANN recruit grown from wild-caught gametes grown in the lab and outplanted onto a degraded reef in Mexico.

Photo 6. A 3 year old APAL colony growing in its natural habitat; This colony was produced from wild-caught gametes, settled onto a concrete tetrapod and out-planted onto the reef at just 4 weeks old.



▼
Photo 7. An adult APAL colony at approximately 8 years old. This colony was produced from wild-caught gametes, cultured by Coralium to 3 years old and out-planted onto a reef destroyed by a ship grounding. This colony is one of 30 colonies that are mature and producing their own gametes.



► **Photo 8.** A small DLAB recruit produced from wild-caught gametes, growing on an artificial substrate that was out-planted onto the reef and is being monitored for health and growth.

OTHER RESTORATION PROJECTS IN THE REGION

According to MAR-RRN's database, there are **22 restoration projects** in the region, as follows:

- 12 in Mexico
- 2 in Belize
- 1 in Guatemala
- 7 in Honduras

Through the creation of this document, a short poll (see Poll B in [Annexes](#)) was created and shared with these other projects, in order to have a short compilation that describes each in general terms. There were 10 responses to the poll, which equals to 50% of the projects so far identified in the region. The participating projects are located in the following manner:

- 3 in Mexico
- 1 in Belize
- 1 in Guatemala (this project is no longer operational, as it was a pilot project)
- 5 in Honduras

Below are some general findings of these projects, whereas the complete answered poll can be found in [Annexes](#) under Poll B Replies.

Location

- All 3 projects in Mexico are located in Quintana Roo
- The project in Belize is located in Belmopan
- The project in Guatemala was located in Puerto Barrios
- All 5 projects in Honduras are based in the Bay Islands

Species

- 7 projects work with ACER
- 8 projects work with APAL
- 4 projects work with APOR
- 3 projects work with OANN and OFAV
- Other species stated:
 - PSTR
 - PCLI
 - DLAB
 - MCAV

- PAST
- SSID
- SINT
- FFRA
- PPOR
- AGAR

Budget & Monetary

- 5 projects have a yearly operating budget of between \$5,000 and \$10,000
- 2 projects have a yearly operating budget of between \$10,000 and \$15,000
- 1 project has a yearly operating budget of between \$20,000 and \$30,000
- 2 projects did not state their yearly operating budget
- 7 projects partly depend on grants
- 2 projects partly depend on government funding
- 6 projects partly depend on private/personal/family funding
- 3 projects partly depend on user fees

Nursery Types

- 2 projects use "lab" nursery type
- 6 projects use "tree" nursery type
- 5 projects use "table" nursery type
- 3 projects use "PVC structure" nursery type
- 2 projects use "A-frame" nursery type

Outplanting

- 2 projects use cement
- 5 projects use epoxy
- 2 projects use wedging
- 2 projects use zip-ties
- 2 projects use nails
- 8 projects quantify outplanting by number of fragments outplanted
- 3 projects quantify outplanting by measuring length of living tissue

Main Results of all Restoration Projects

22 projects were contacted to participate in this study, and 10 of these replied to the poll. All of these work with the genus *Acropora*, as it is the fastest growing species, and which fragments most easily. It is also a critically endangered species according to IUCN's Red List. There is a great information gap from the other 10 projects, which should be further addressed by the MAR-RRN. The results show that all the respondents work with coral reefs, which showcases that there is a need to work on restoring other ecosystems, such as seagrass beds, mangrove forests, wetlands and coastal vegetation.

70% of the funding that keeps these projects operating comes from grants, which is usually a 1-2 year cycle, and this does not create the needed long-term planning necessary to function. Responses show that 50% of funding comes from private sources and donations. This is a situation that could be solved/improved upon by having funds allocated within national budgets. MAR2R could become a catalyst in creating this, taking into account that this is the Decade of Restoration according to the UN.

There are several nursery types used, but the most common among respondents are trees and tables. These have proven to be the most sturdy, easy to maintain and build, as well as cheaper, with all materials being locally sourced. Due to the extensive use of these nurseries, which work best with fragments, and based on the extended use of *Acroporids*, the most used method to measure success is the number of fragments outplanted.

Challenges and Lessons Learned

Based on the fact that most of the projects work with *Acroporids*, this can easily become a large challenge, as basically 3 species are most commonly used for reef restoration. *Acroporids* do create fish habitat and fare better in areas with high wave action, but they are also highly susceptible to diseases such as White Band, which could easily decimate a restoration site in a few months. More focus needs to be made on massive or reef building corals, as these are the structures upon which a coral reef grows.

Funding for long-term projects, such as any restoration project, is limited and mostly based on 1-2 year grant cycles. This makes planning much harder, as the economic standing is shaky at best. And there is almost no government funding in place for these important activities.

Relying on volunteers is also an unsustainable situation, but is mostly needed due to the lack of long-term or national funding. This is a situation that could be solved with more active support from MAR2R and the 4 ministries of environment that encompass it. CCAD can play a pivotal role in promoting restoration in the MAR.

General Conclusions

- The vast majority of restoration projects work with *Acroporids*.
- Long-term thinking and funding are imperative factors in order for a project to be successful.
- All 4 MAR countries need to fully and forcefully implement water quality norms, especially in the treatment of wastewaters.
- The reef naturally responds to restoration efforts and these efforts can influence co-management and the local community towards better stewardship of their resources. Adoption of restoration projects by the local communities makes them more effective, as it creates a sense of ownership and belonging.
- Lack of knowledge (or deliberately turning a blind eye) of the problems by decision makers needs to be addressed.
- Factors such as water quality and related ecosystem health should be taken into account when defining/identifying replanting sites, in order to create enabling conditions for success.
- These are long-term projects that need continuity in order to be effective. These projects need perseverance, constant and continuous efforts.
- Restoration should be seen as a whole ecosystem approach to reef health. Projects should have a holistic approach, in order to reduce sedimentation, upstream pollution, implementing best practices and fostering sustainable development.
- That restoration IS working, but the pace is too slow and the scope/scale are too small.

- Investing in people is important to continue restoration efforts. Projects need constant training, as there usually is a quick turnaround of staff. Training should not be fully subsidized, as trainees will take it more seriously if they have invested into it.
- The rules and regulations need to be in place, where all projects are held to the same standards. Success needs to be measured equally and should have the proper science-based approach in place.
- Coral restoration success should not be only measured in square meters of area replanted (m^2), but that it is also important to measure in cubic meters (m^3).

General Recommendations

- Use hard science, where all elements can be measured as closely as possible.
- Foster continuous funding, and identify more sources of funding, such as national budgets and through regional projects, similar to MAR2R.
- Increase awareness and environmental consciousness in the general population.
- View and fund these projects with a long-term view. Increase the implementation time allocated in order for projects to be more successful. Promote better alliances with donors, to insure the longevity of the projects. The private sector needs to be highly involved in safeguarding their natural capital and actively participating in restoration projects in their area of influence.
- Share experiences, downfalls, and achievements. Unify strategies across the MAR. Create more situations for peer-to-peer exchanges, to foster collaboration and not competition.
- See all the projects as sections of one whole, region-wide restoration effort.
- Restoration needs to be up-scaled, not just at the site level, but country-wide.
- Simplify the follow-up process and paperwork.
- Immediately reduce all industrial green-house gas emissions.
- Build a restoration center, one with the latest in technology, where experts teach courses to the youth (the future is restoration). Where meetings and symposiums can be held and where the public can come and learn about the importance of ecosystem restoration.



Photo: Fragments of Hope

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ANNEXES

- **ANNEX 1** Poll A Questions
- **ANNEX 2** Guided Interview Questions
- **ANNEX 3** Poll B Questions
- **ANNEX 4** MAR RRN Project Directory
- **ANNEX 5** Poll A Replies
- **ANNEX 6** Poll B Replies
- **ANNEX 7** Oceanus Manual
- **ANNEX 8** Fragments of Hope Manual
- **ANNEX 9** Corallium Manual



Photo: Fragments of Hope



PROYECTO MANEJO INTEGRADO
**DE LA CUENCA
AL ARRECIFE**
DE LA ECORREGION
DEL ARRECIFE MESOAMERICANO
(MAR2R)

