Change detection in coral reef ecosystem: strengthening community resilience and adaptation in Mahahual, México

Mahahual, Quintana Roo, México

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May 28-30, 2018

Community Conservation
Research Network

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Mahahual, Quintana Roo, México

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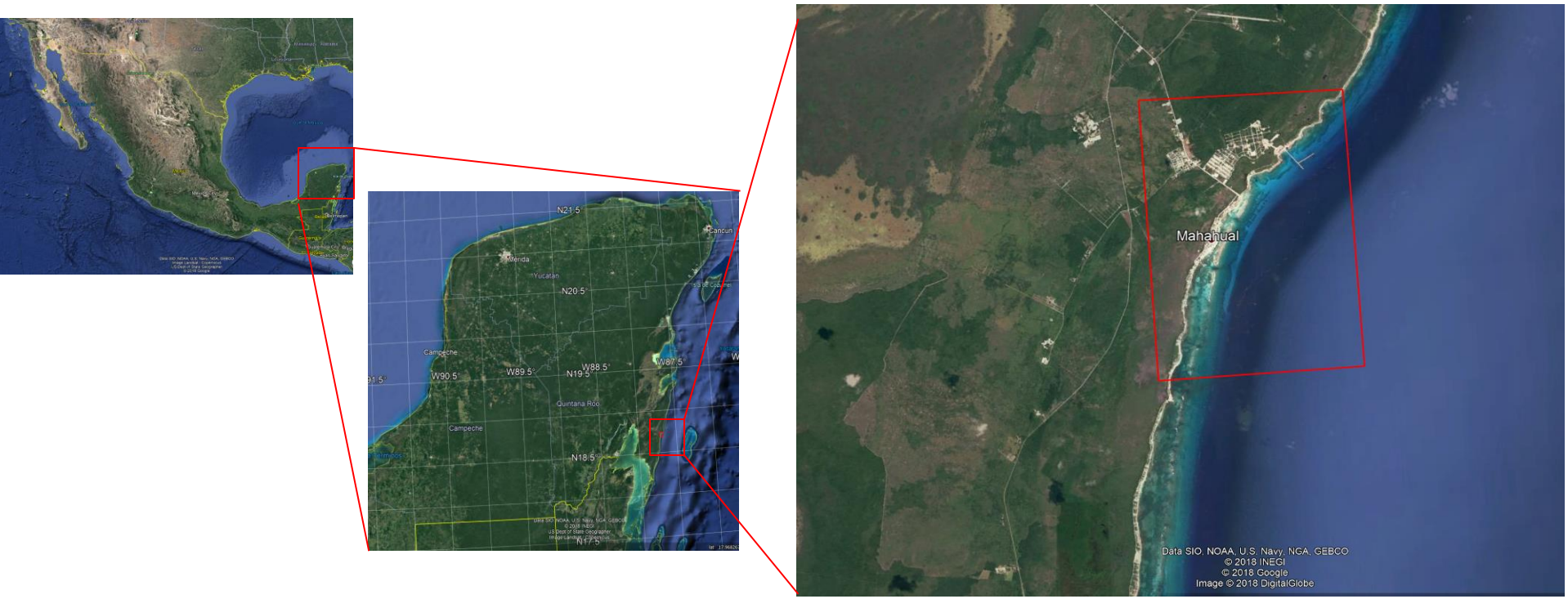
It was a small fishing village and recreational site undeveloped.

Population growth: **149** hab. (2000) **282** hab. (2005) **920** hab. (2010). **3000** hab. (2015).

Mesoamerican Reef is the 2nd largest reef system in the world.

In 2006, a tourist center was developed as alternative destination to the Riviera Maya, especially as a **cruise ship dock**.

It became an important tourist destination for snorkeling, scuba dive, and sport fishing, threating the coral reef ecosystem.



Goals

1) Changes detection analysis in reef ecosystem:
   a) Monitoring of stony corals (Scleractinian).
   b) High resolution satellite images.
2) Capacity building for tourism service providers
   a. Foster resilience
   b. Adaptation to possible effects of Climate Change

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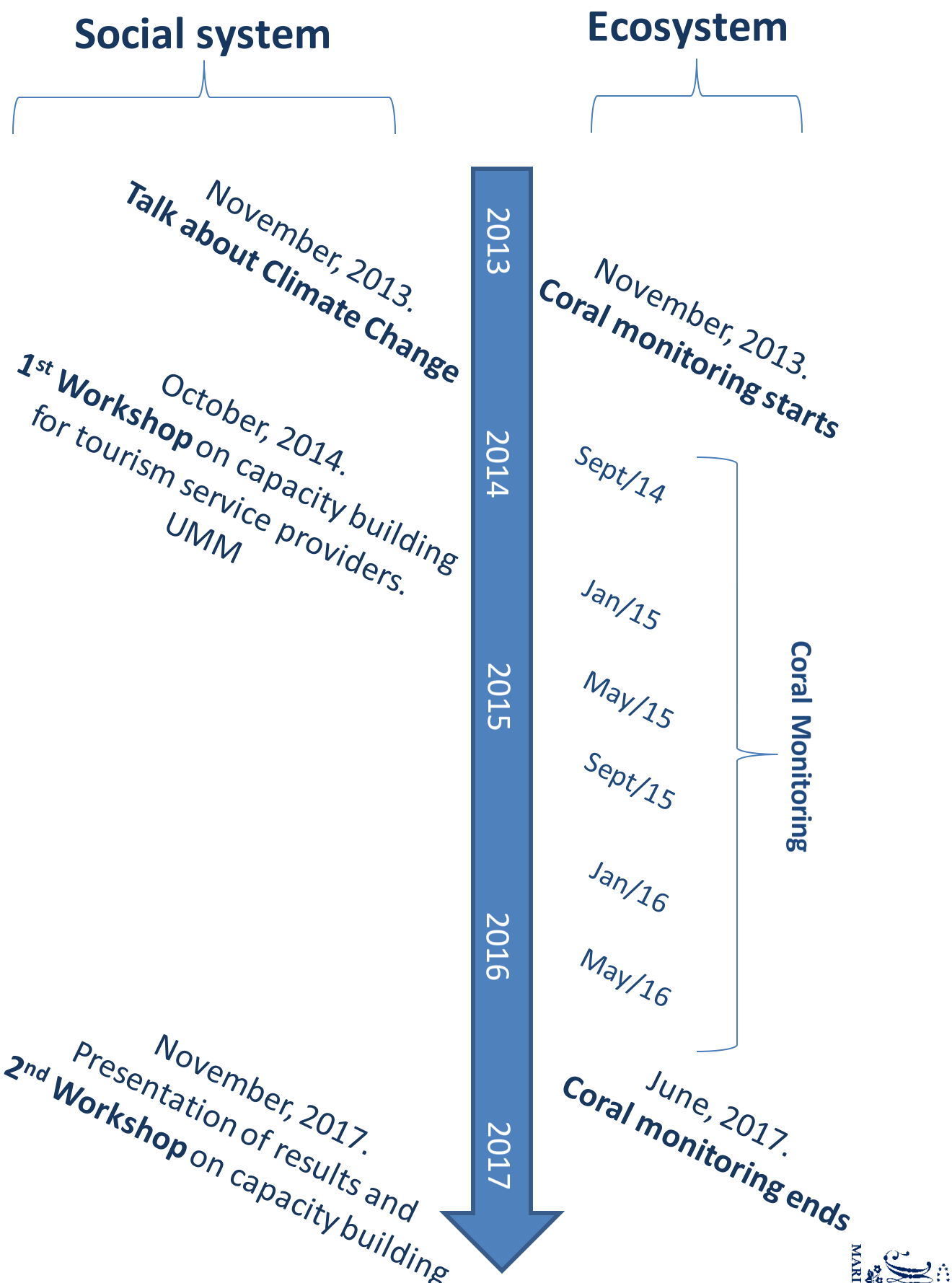
Social system
Ecosystem
November, 2013.
Talk about Climate Change
November, 2013.
Coral monitoring starts
2013
2014
2015
2016
2017
October, 2014.
1st Workshop on capacity building for tourism service providers.
UMM
Sept/14
Jan/15
May/15
Sept/15
Jan/16
May/16
Coral Monitoring
November, 2017.
Presentation of results and
2nd Workshop on capacity building
June, 2017.
Coral monitoring ends

Coral monitoring

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4 sites

- 2 Transects
  - Front reef
  - Reef lagoon
- 2 Video transects
  - Reef lagoon
  - fish assemblage

8 sampling dates

A pilot sampling

Seasons		
Nortes	**Dry**	**Rainy**
Nov/2013		Sept/2014
Jan/2015	May/2015	Sept/2015
Jan/2016	May/2016	Jun/2017

Monitoring

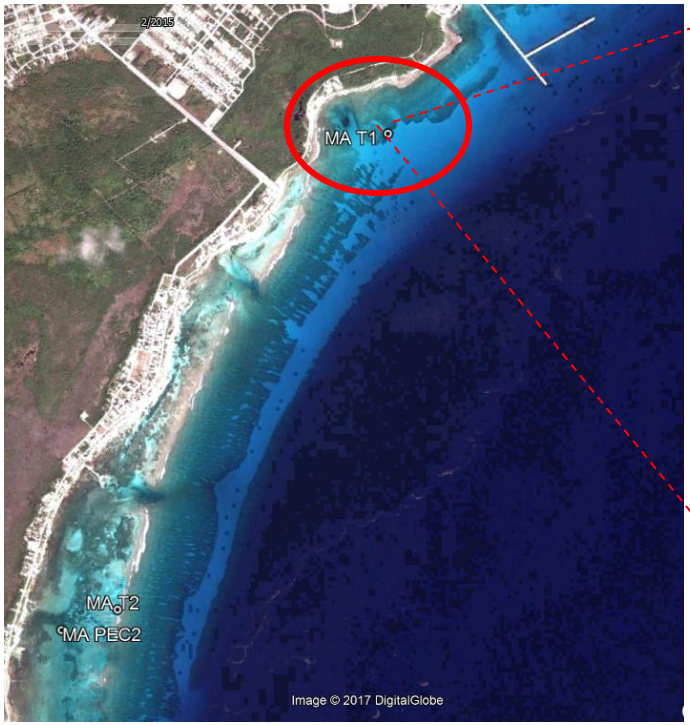
Photographic samples

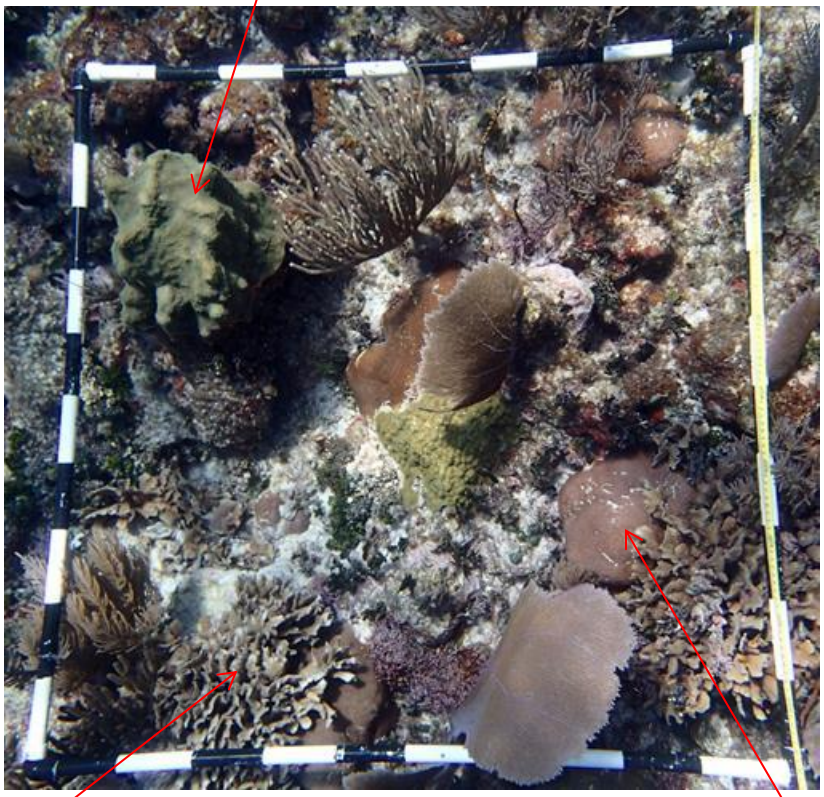
Sampling by transects and permanent photographic quadrats and video transects.

Transects of 20m length

Quadrats of 1m^2 as scale control.

Transect 1
Photo quadrat 7





Orbicella annularis

Undaria tenuifolia

Siderastrea siderea

Stony Coral Threatened

- **Bleaching**
- **Competition overgrowth** (Bioerosion)

Direct competitive interactions with a Sponges (*Chiona sp.)*, over a hard coral (*Siderastrea siderea*).

Sampling date: May, 2016

Bioerosion

Nortes

Dry

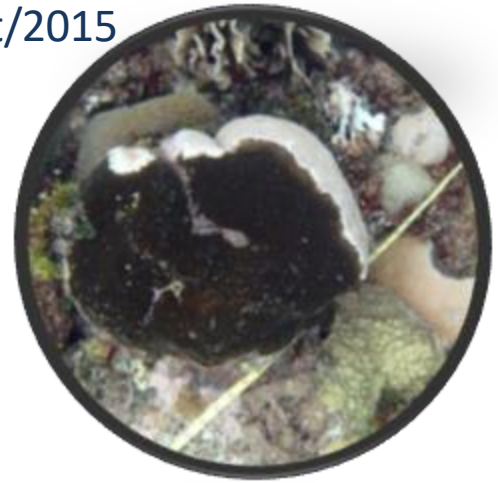
Rainy

Sept/2014

Jan/2015

May/2015

Sept/2015



Jan/2016

May/2016

Jun/2017

Community analysis of reef fish
(Reef lagoon)

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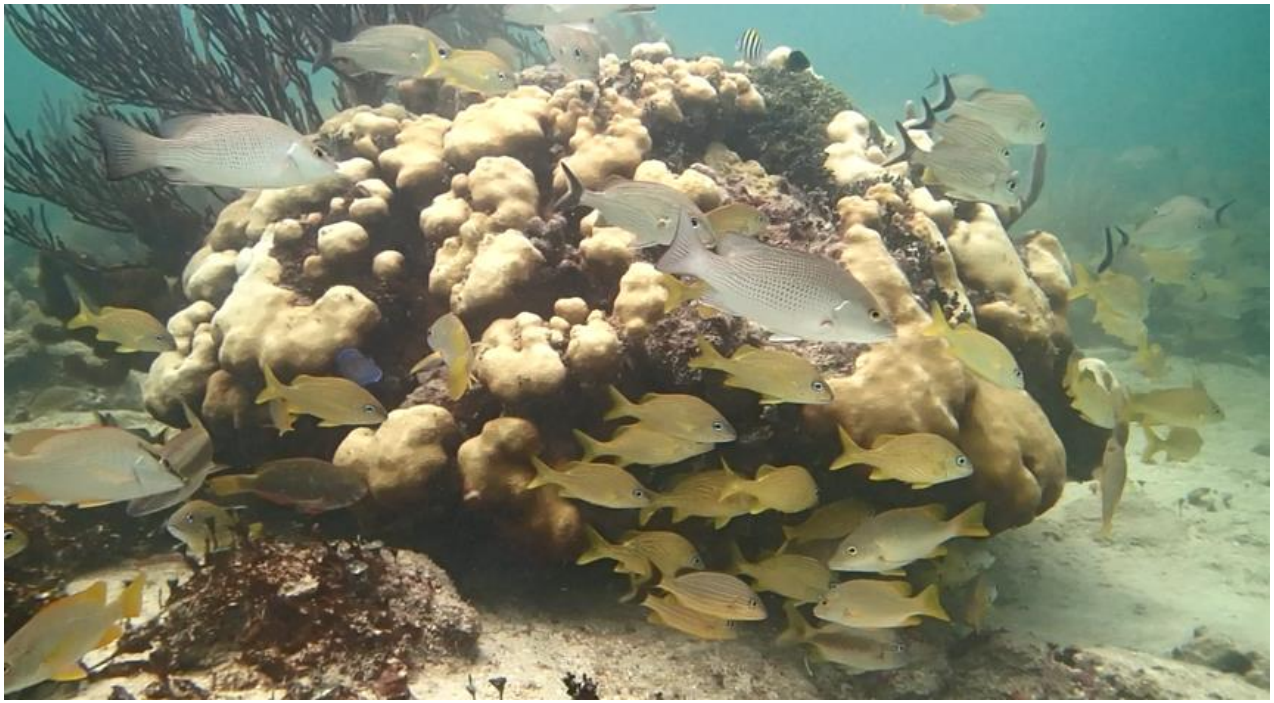
Video sampling of a site with fish aggregation in the reef lagoon.

It allowed to determine abundance and diversity of reef fish.



Sampling date: May, 2016.

Change rate:
- 0.143m^2 /year

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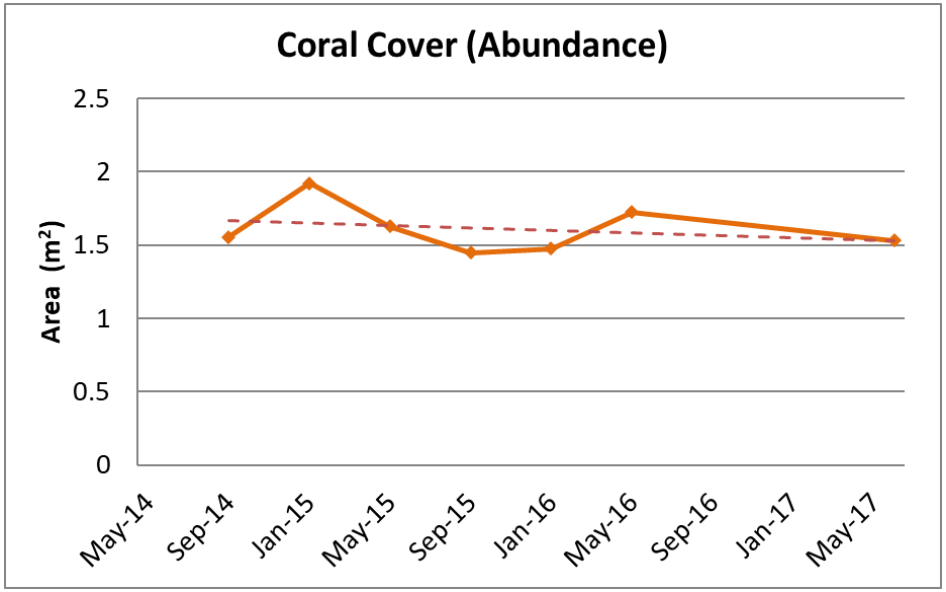
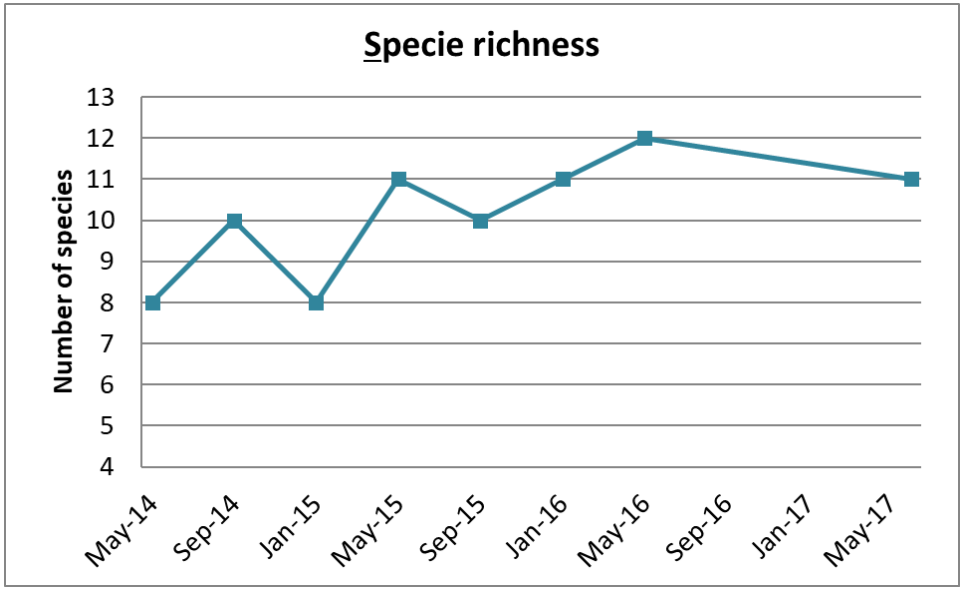
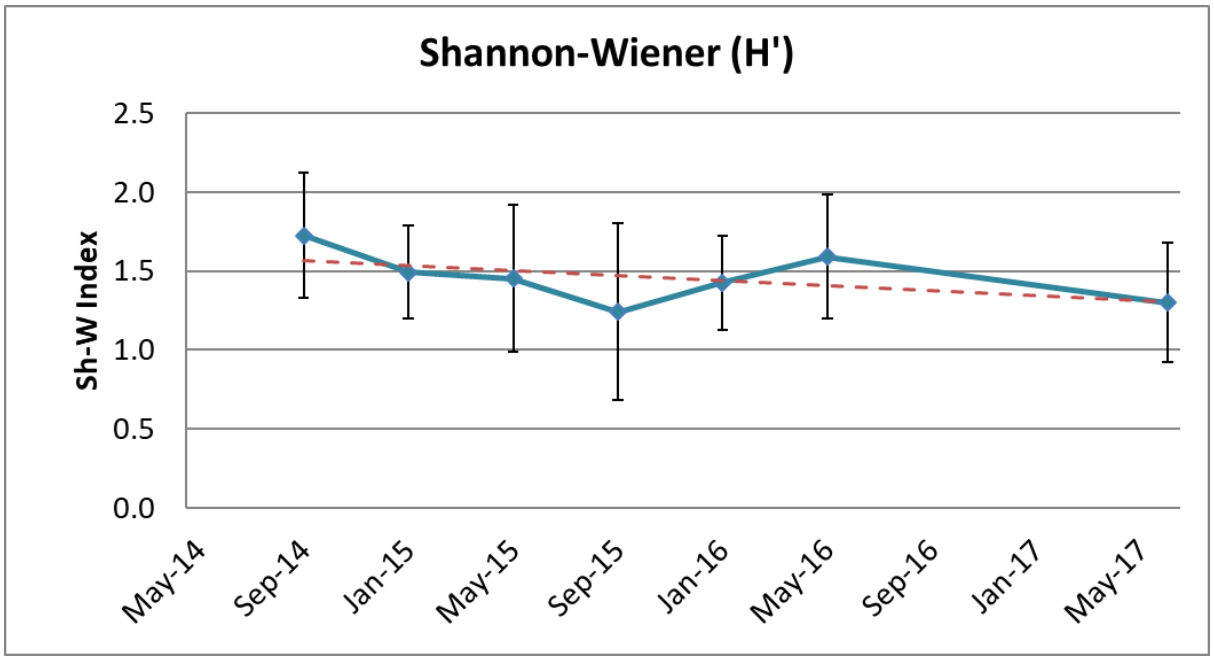






Change rate:
- 0.156 /year

Nortes

Dry

Rainy

Sept/2014

Jan/2015

May/2015

Sept/2015

Jan/2016

May/2016

Jun/2017

Nortes

Dry

Rainy

Sept/2014

Jan/2015

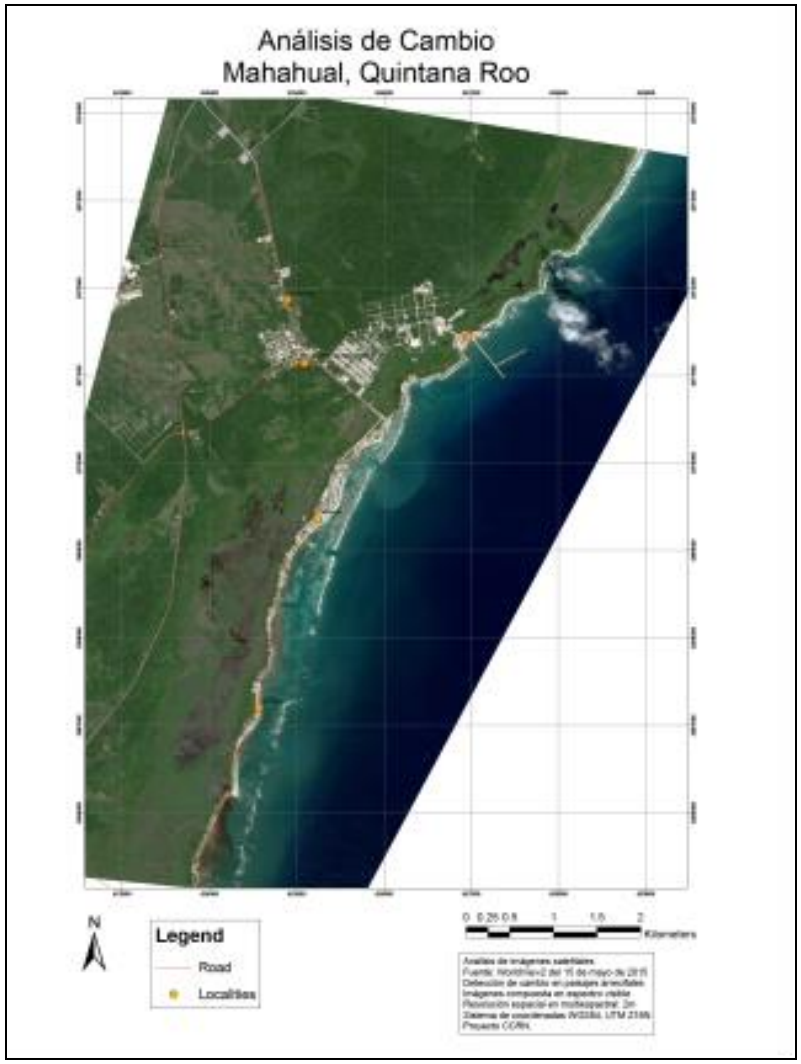
May/2015

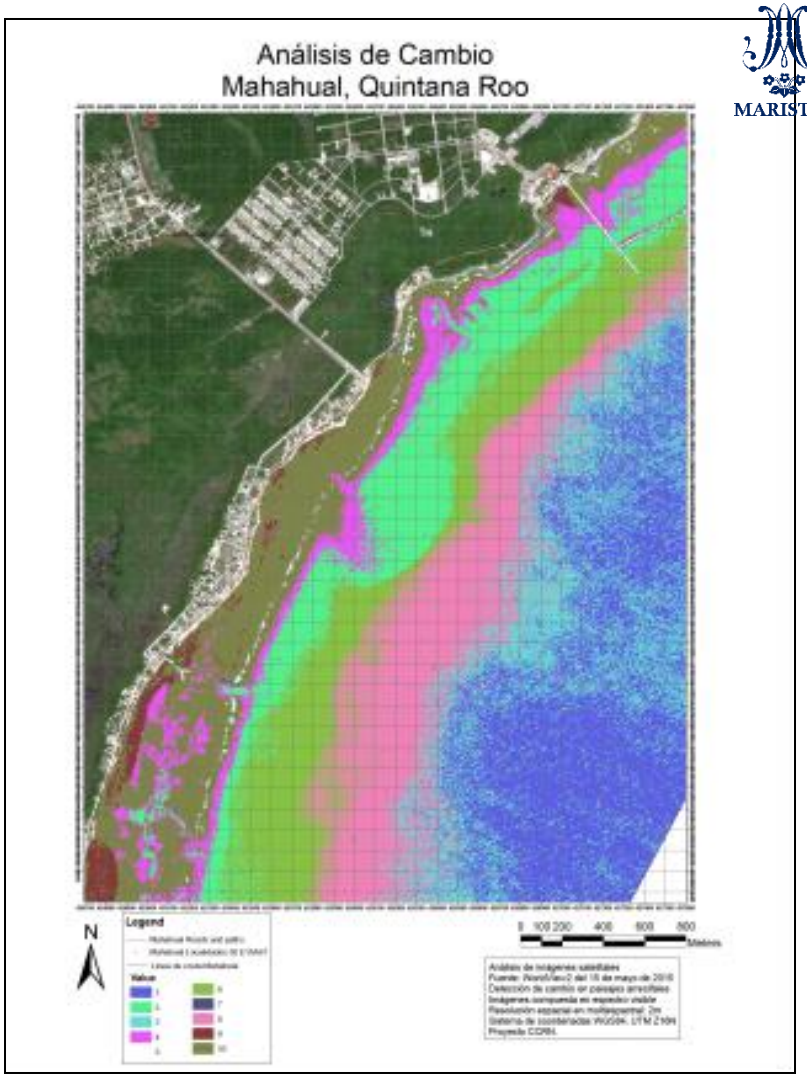
Sept/2015

Jan/2016

May/2016

Jun/2017



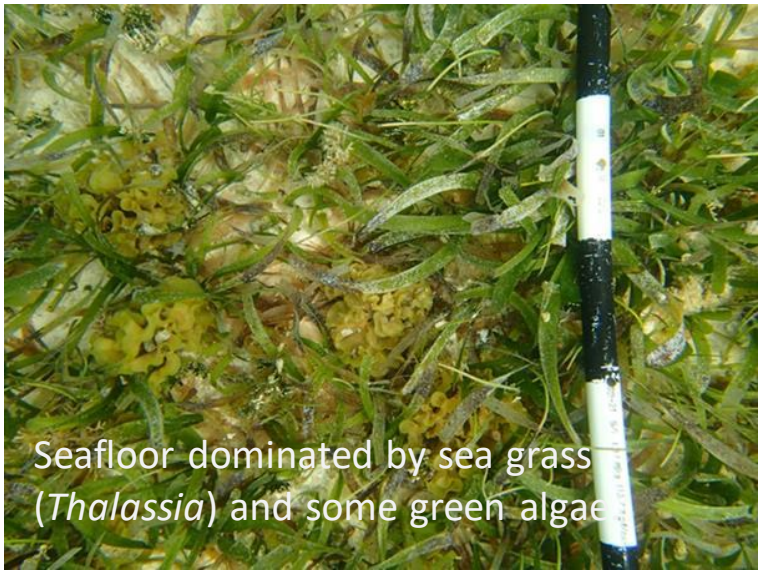


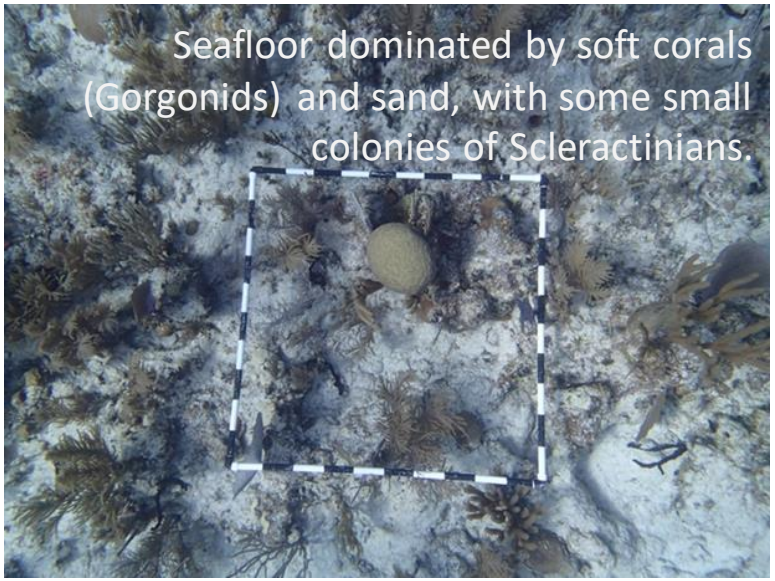
Composite image in true color and unsupervised classification to identify types of seafloor. Change analysis with a multispectral satellite imagery.

WorldView2, 8 bands. Dated 1/April/2015. Spatial resolution: Pan: 0.5m /multispectral: 2m.
QuikBird 4 bands. Date: 21/May/2005. Spatial resolution: Pan: 0.6m /multispectral: 2.4m.

Ground truthing

Classifying the types of sea bottoms detected by the multispectral image.

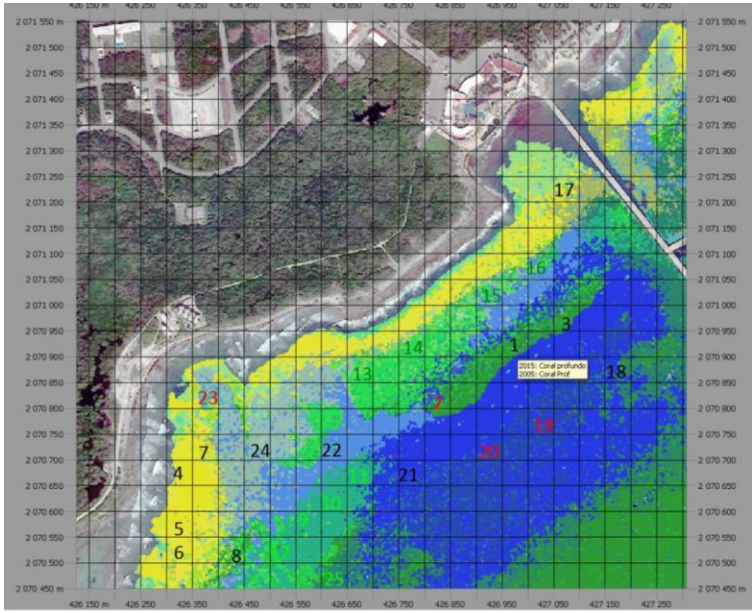




In a preliminary analysis

T1: May/2005
T2: April2015

Areas without changes,	36%
Areas with changes,	64%
Total	100%



Areas with changes

1) Sand to seagrass,	22%
2) Seagrass to sand,	53%
3) Lost of coral cover,	25%
	100%

1st Workshop on capacity building aimed at tourism service providers, Mahahual. October, 2014, UMM in Mérida

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Program	
Welcome to tourism service providers, Mahahual. To CCRN Project	Dr. Juan Carlos Seijo
Coral reef ecology. Main concepts	M.Sc. Leopoldo E. Palomo
System of ocean currents at Caribbean and Gulf of Mexico and coast of Quintana Roo	Dr. Alfonso Cuevas
Global climate change: A current reality	Dr. Alfonso Cuevas Jiménez
Effect of climate change on marine fisheries. Vulnerability in coastal communities: Adaptation and resilience	Dr. Juan Carlos Seijo
Adaptation and resilience case study: Punta Allen	Dr. Raúl Villanueva Poot
Preliminary results of Mahahual coral reef monitoring	Dr. Alfonso Cuevas Dr. Raúl Villanueva
Integration activity	M.Sc. Javier Aranda Nah

1st Workshop on capacity building, aimed at tourism service providers, Mahahual, Quintana Roo. (October, 2014).

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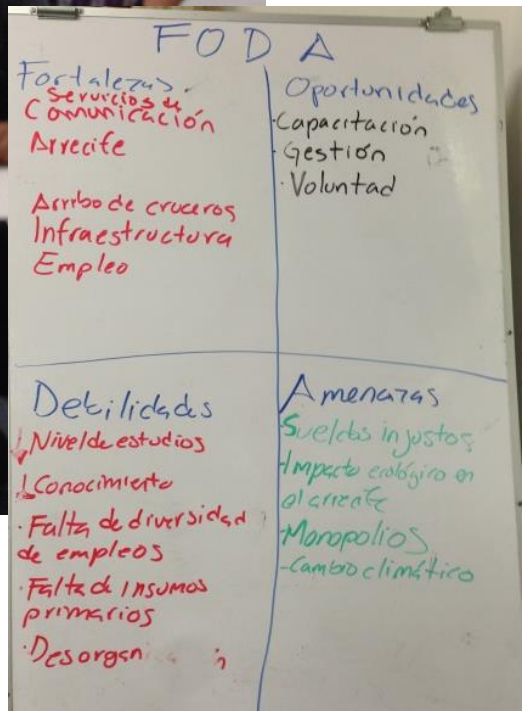


2nd Workshop on capacity building

Based ecosystem monitoring results

(August, 2017, in Mahahual)

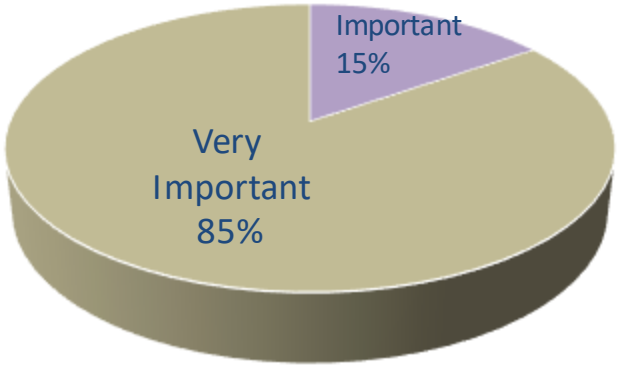
Topics: Coral reef status; Environmental protection. Resilience and Adaptation

Questionnaire:

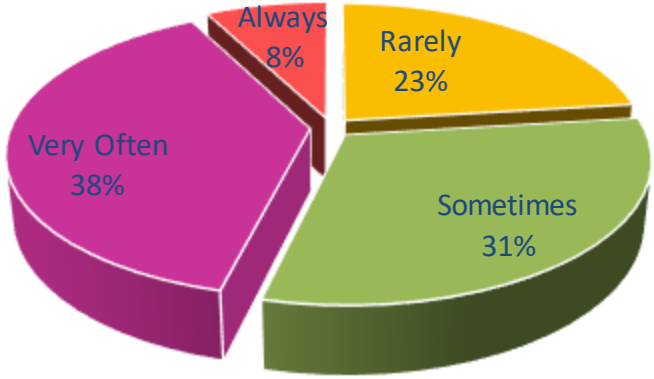
- Section I. Personal data
- Section II. Level of importance in environmental conservation
- Section III. Frequency of their participation in environmental protection
- Section IV. Open questions

2nd Workshop results

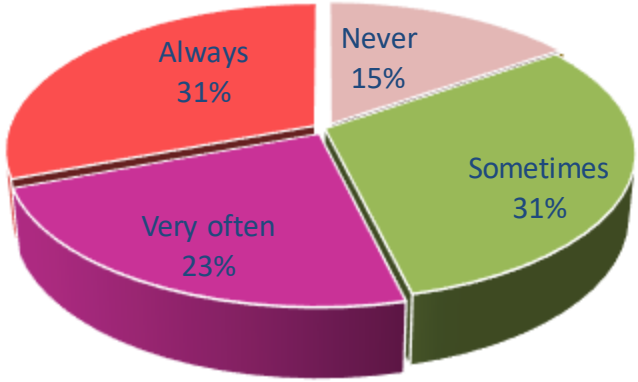
How important do you consider participating in community work related to ecology / security?



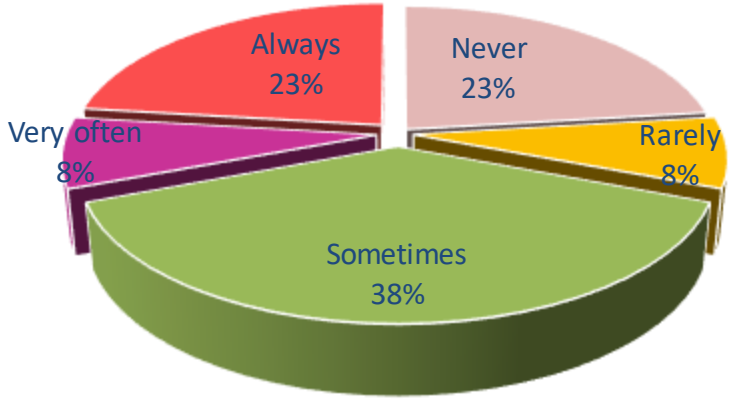
1) **How often do you participate** in community work related to ecology / security?



3) **How often do you actively participate** in meetings with government authorities?



4) **How often do you take training courses** in reef care and good diving practices?



Final remarks

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- The community was informed through a workshop that coral reef 3-year monitoring project indicated that the diversity index did not show major changes. Nevertheless, there were losses of hard coral colonies by bleaching and sponge invasion. This negative effect was compensated, at least partially, by new coral colonies.

- Minor changes were recorded by Satellite imagery analysis in hard coral cover.

Final remarks

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- The community workshops were aimed at strengthening resilience and adaptation of the communities to climate change effects that could threaten their livelihoods.

- Also, they acknowledged the importance of strengthening their integration and coordination. They recognized the need to continue their training for improving their reef ecosystem conservation actions.

- They also recognized that greater efforts needed to improve coordination with local and federal government for protecting the Mesoamerican Reef Ecosystem.

Thanks