

Coral Reef Monitoring



**HIMB Summer Education Program
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What is reef monitoring?

- Track changes in health and status of reef system over time
 - Mapping
 - Population levels
 - Information for conservation and management
- Biological
- Physical
- Socio - economic



Why do we monitor?

- Human impacts and ocean changes
 - Threat assessment
 - Management
- Ecosystem services



Why do we monitor?

Threat	Impacts	What to monitor (few resources)
Over-exploitation of marine resources	Over-fishing	<ul style="list-style-type: none"> Fisheries - catch per unit effort – fishery dependent monitoring; Impacts on populations of target species: abundance & size - fishery independent monitoring For suspected ecosystem over-fishing, monitor impacts on non-target species - cover of algae, coral, prey species etc.
	Hunting e.g. turtles & dugong	
	Destructive fishing practices	<ul style="list-style-type: none"> Physical damage to habitat - broken coral; live and dead coral cover; Impacts of over-fishing - see above.
	Coral mining	See habitat destruction below
Land based impacts	Habitat destruction: coastal development; dredging & filling; coral mining	<ul style="list-style-type: none"> Area of habitat lost; Impacts on adjacent coral communities - cover, diversity, and health.
	Point source pollution: e.g. sewage, industry outfalls etc.	<ul style="list-style-type: none"> Water quality - measure relevant pollutant e.g. sediments, nutrients, fertilisers, pesticides at source and receiving waters; Impacts on coral communities - cover, diversity, and health.
	Non-point source pollution: land clearing, agriculture, septic systems etc.	<ul style="list-style-type: none"> Water quality - measure relevant pollutant e.g. sediments, nutrients, fertilisers, pesticides in delivery mechanism (rivers/ streams during floods) and receiving waters; Impacts on coral communities - cover, diversity, and health.
Shipping based impacts	Pollution e.g. fuel spills	<ul style="list-style-type: none"> Type, quantity and distribution of pollutant; Impacts on benthic communities, particularly cover of coral and algae, diversity and health of coral communities and other indicator species e.g. clams, urchins.
	Groundings/wrecks	<ul style="list-style-type: none"> Physical damage to habitat - area of broken/smashed coral; changes to hydrology of area e.g. new channels; Type, quantity and distribution of pollutants e.g. oil, diesel, antifouling paint & and impacts on benthic communities (see above).
	Introduced species in ballast water etc.	<ul style="list-style-type: none"> Diversity, size and abundance of introduced species; Impacts on native species e.g. due to competition or predation;
	Navigation aids: lighthouses etc.	<ul style="list-style-type: none"> Physical damage to habitat - area of broken/smashed coral; area of habitat lost; changes to local hydrology; and Impact on adjacent coral communities.
Tourism & Recreation	Coastal development: resorts, marinas, jetties etc.	See habitat destruction above
	Offshore structures e.g. pontoons	<ul style="list-style-type: none"> Physical damage to coral communities - broken coral; area of habitat lost; Impacts on adjacent coral reef communities from shading - coral cover, diversity, and health; Impacts from fish feeding – fish abundance, size and diversity.
	Diving and snorkelling	<ul style="list-style-type: none"> Broken coral and coral cover at key sites.

What do we monitor?

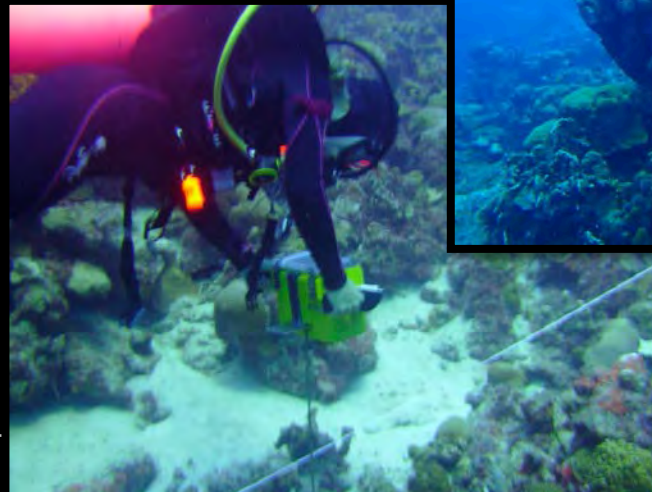


- Variables!

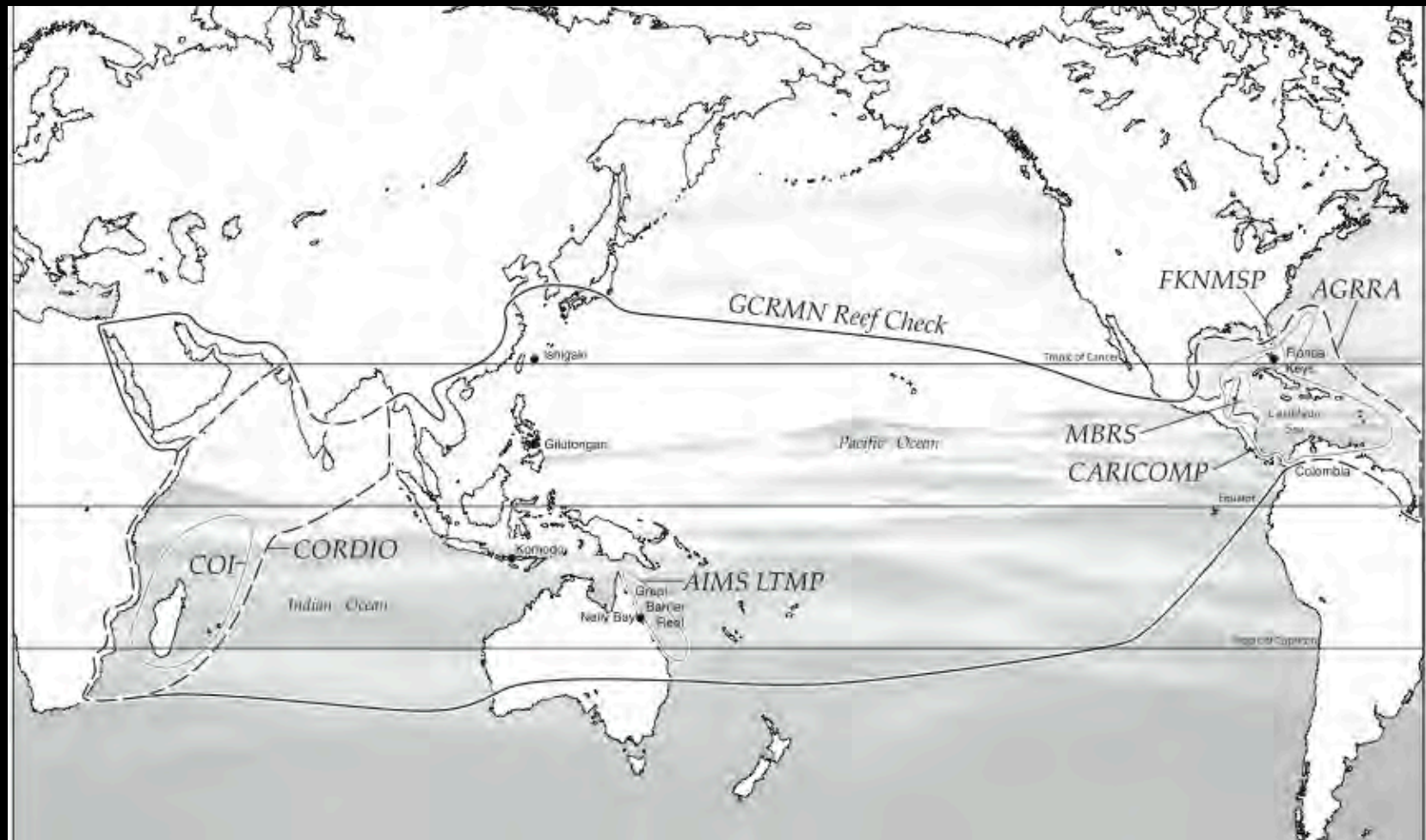
- Abundance
- Diversity
- Percent coral/algae cover
- Habitat type
- Substrate type
- Diseases
- Recruitment levels
- Invasive species

How do we monitor?

- Broad, medium, fine scale
- Types of monitoring
 - Timed swim
 - Line intercept
 - Point intercept
 - Video transects
 - Visual transects
 - Photo quadrats
 - Visual quadrats
 - Belt transects



Monitoring Programs



Hill and Wilkinson 2004

Benthic cover at Yellow Sub reef: progression of coral-algal phase shift



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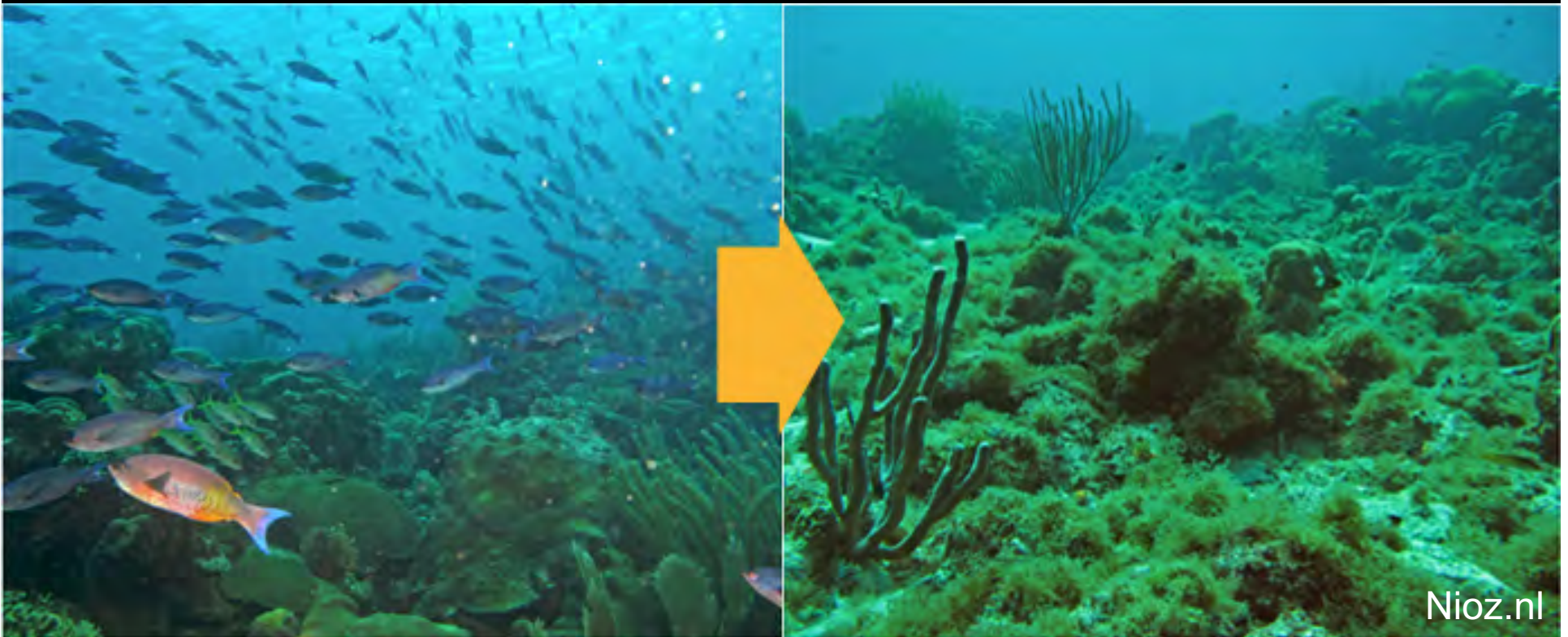
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Background

- Coral reef degradation
- What is a coral – algal phase shift?



Materials and methods



Materials and methods

Field research

- Videography transects (n=20)

Laboratory research


- Still frame generation (n=300)
- Coral Point Count analysis (n=4,500)
- Disease survey



Materials and methods

CPCe (point count image): C:\Users\Student\Desktop\Ariana IR\Area 5\15m\5.15m.15.cpc [C:\Users\Student\Desktop\Ariana IR\Area 5\15m\5.15m.15.jpg] Codefile: C:\CPCe_40_inst\shallow_coral_codes_40_40.txt

File Mark border Point Overlay Measurement Image Tools Utilities Options Help

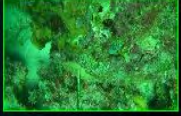


Point Data (15)

POINT	ID	NOTES
A	TURF	
B	TURF	
C	TURF	
D	TURF	
E	TURF	
F	TURF	
G	AG	
H	CALG	
I	AG	
J	TURF	
K	TURF	
L	TURF	
M	TURF	
N	TURF	
O	TURF	

CACHE HEADER DATA
RETRIEVE HEADER DATA
VIEW/EDIT HEADER DATA
SAVE IMAGE WITH POINTS

Zoom: 100%
Lolick Rollick Mwheel
100% 300% 600%

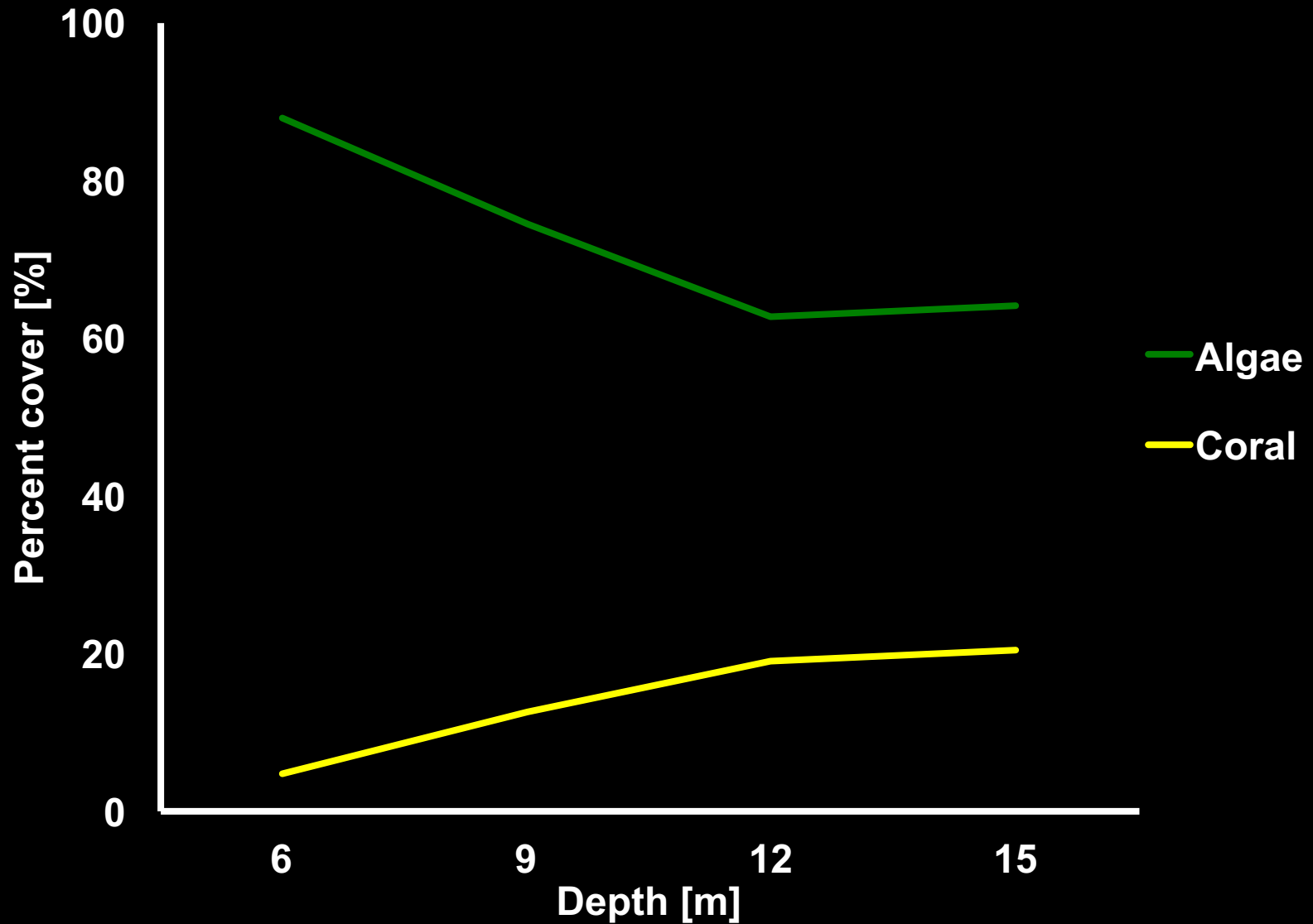


AG	AC	AMP	AP	APR	CALG	CB	CN	CORAL	CORJU	DC	DCY	DL	DS	DSO	DST	EF	SFN	SRD	FF	GORG	SPL	IS	LC	MA	MACA	MAL	MAN	MAR	MC	MD	MDA	MF	MFAV	MFRN	MILA
MILC	MILS	ML	MM	MME	SWP	OD	PA	PAD	PAL	GZO	TRD	CYB	PB	PD	PF	PP	POR	R	S	SB	SC	SH	SL	SI	UKS	VS	BRS	TBS	BLS	ECB	BGS	RPS	EES	AVS	BBS
SRS	TNS	SR	STY	TA	TURB	TURF	WRAN	DICT	LIAG	LOBO	SCHIZ	HALI	SARG	UNK	O	DG	DCOR	DCA	DSP	ODC	TAPB	WAND	SHAD	ASP	BL	BBD	DSD	OD	PLA	VBD	YBD	PFB	DFB	FVP	LO

NCRI
NATIONAL CORAL REEF INSTITUTE

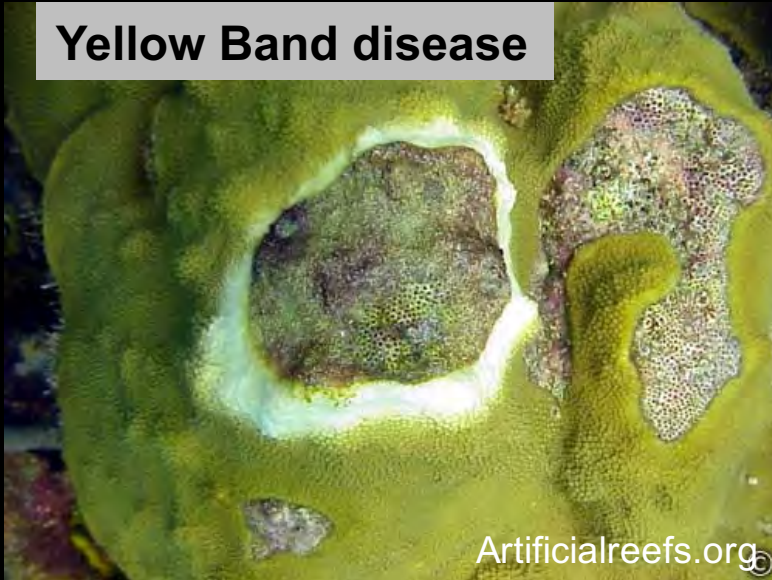
Results

Percent cover by depth



Results

Yellow Band disease



White Plague



Dark Spot disease

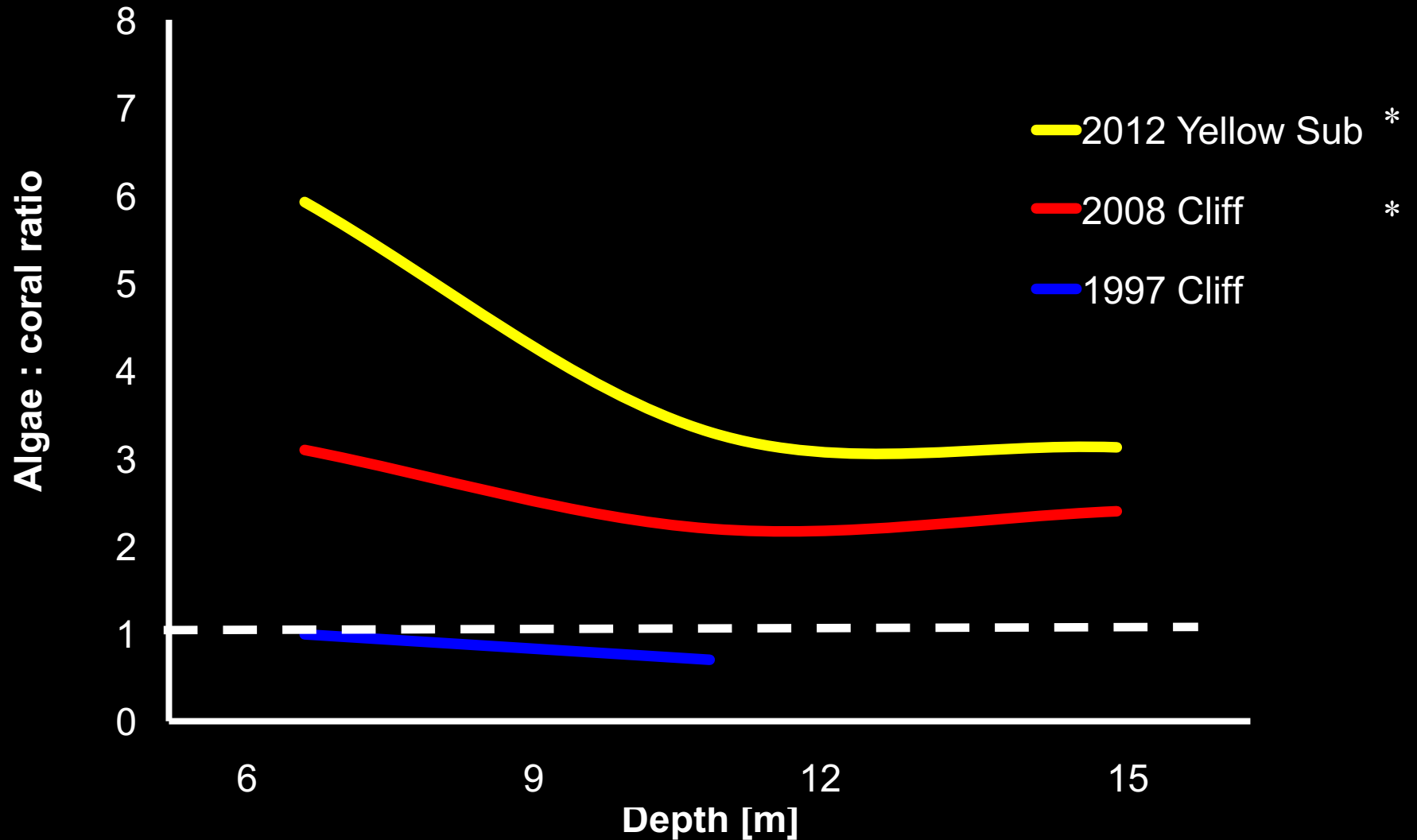


Bleaching



Comparison to historical data

Algae : coral ratio by depth



Conclusions

- Rapid progression of phase shift
- Stresses on coral reefs
 - Natural and human-caused
- Importance of reef system
- Preservation, conservation, and action



Questions?

References and Acknowledgements

Hill, J and C Wilkinson (2004). Methods for Ecological Monitoring of Coral Reefs V1. Global Coral Reef Monitoring Network, Australian Institute of Marine Science Press.

Leujak W, Ormond RFG. Comparative accuracy and efficiency of six coral community survey methods. 2007. Journal of Experimental Marine Biology 351: 168-187.

Stokes MD, JJ Leichter, SJ Genovese (2010) Long term declines in coral cover at Bonaire, Netherlands Antilles. Atoll Research Bulletin 582

CIEE Bonaire staff and students

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Dive Friends Bonaire dive shop

STINAPA

Oregon State University

