

# Evaluating Visitor Impacts on Reef Health



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**Healthy Reefs Initiative**  
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# Goal - To Reduce Visitor Impacts on Reefs

regular tourism > sustainable tourism > no tourism

4 sites where there are no visitors (controls)

**(1 N, 2 C, 1 S) similar reef habitats  
and shallow depths**



4 sites with medium visitation and some of the operators there are likely to be employing best practices

**(Coral Gardens, Goffs, Rendezvous, Ranguana)**

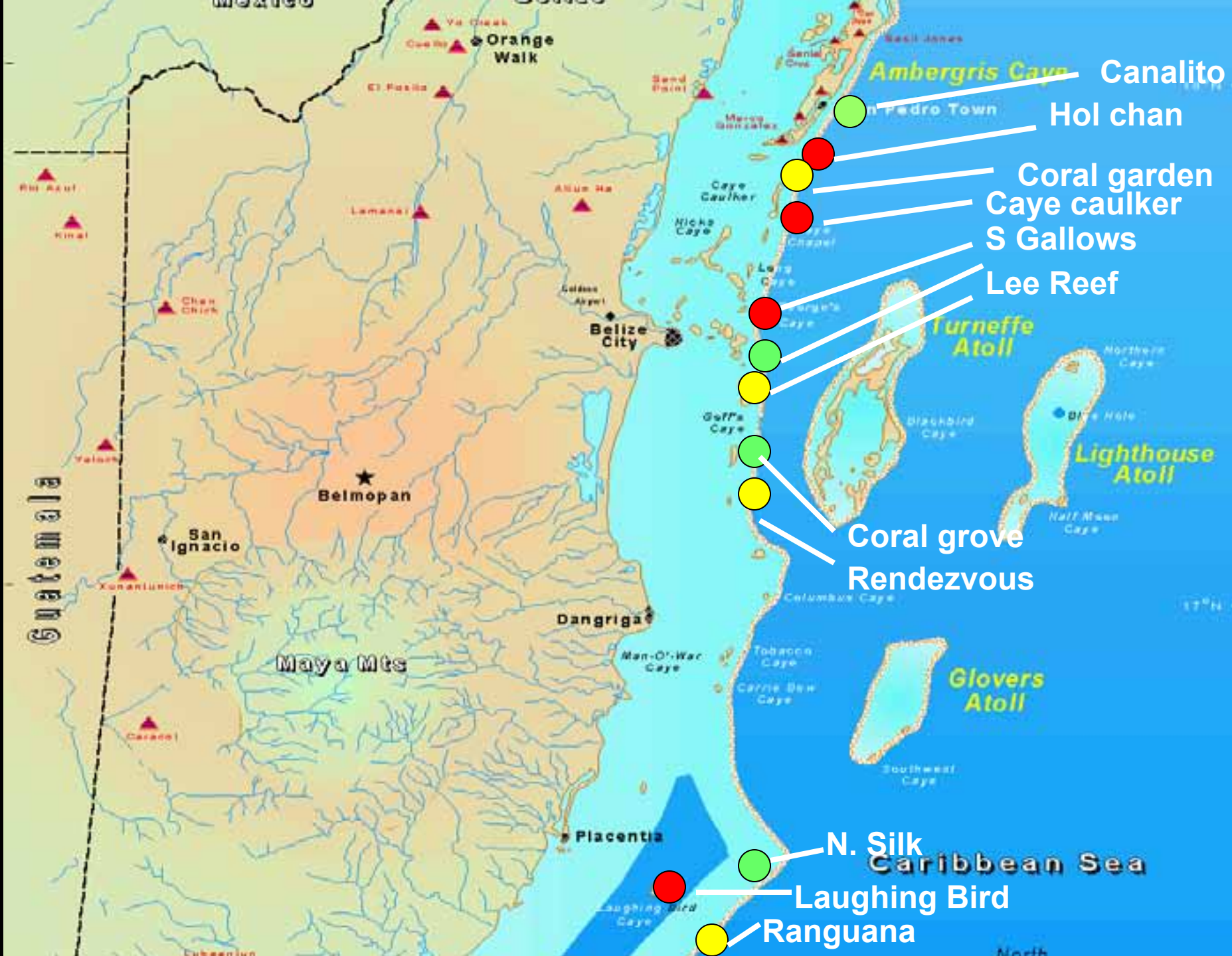
4 sites with high visitation and some of the operators there are likely to be employing best practices

**(Hol Chan, Caye Caulker, South Gallows, Laughing bird)**

*number of visitors also varies ~3,000 to 45,000 per site*

*Some differences in habitat*

*Try to balance these variables within each treatment*





## II. Indicators to Measure Impacts

### Snorkeler Surveys



Only used at the tourism sites – observer goes out with standard trip tries to be inconspicuous

Timed-swim monitoring of tourist behaviors while snorkeling

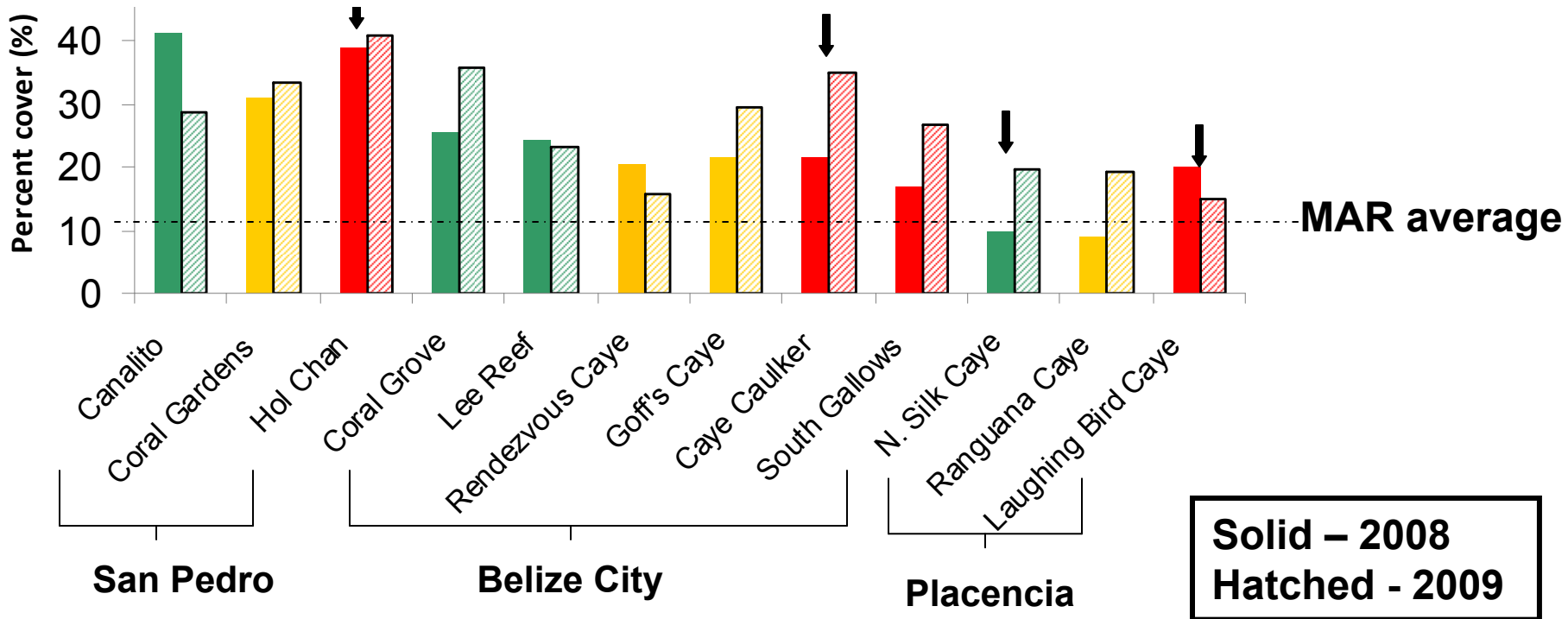
Method developed in Hol Chan study (2002)

Indicator is the number of different impacts per hour

Higher likelihood of measuring an impact of BMPs



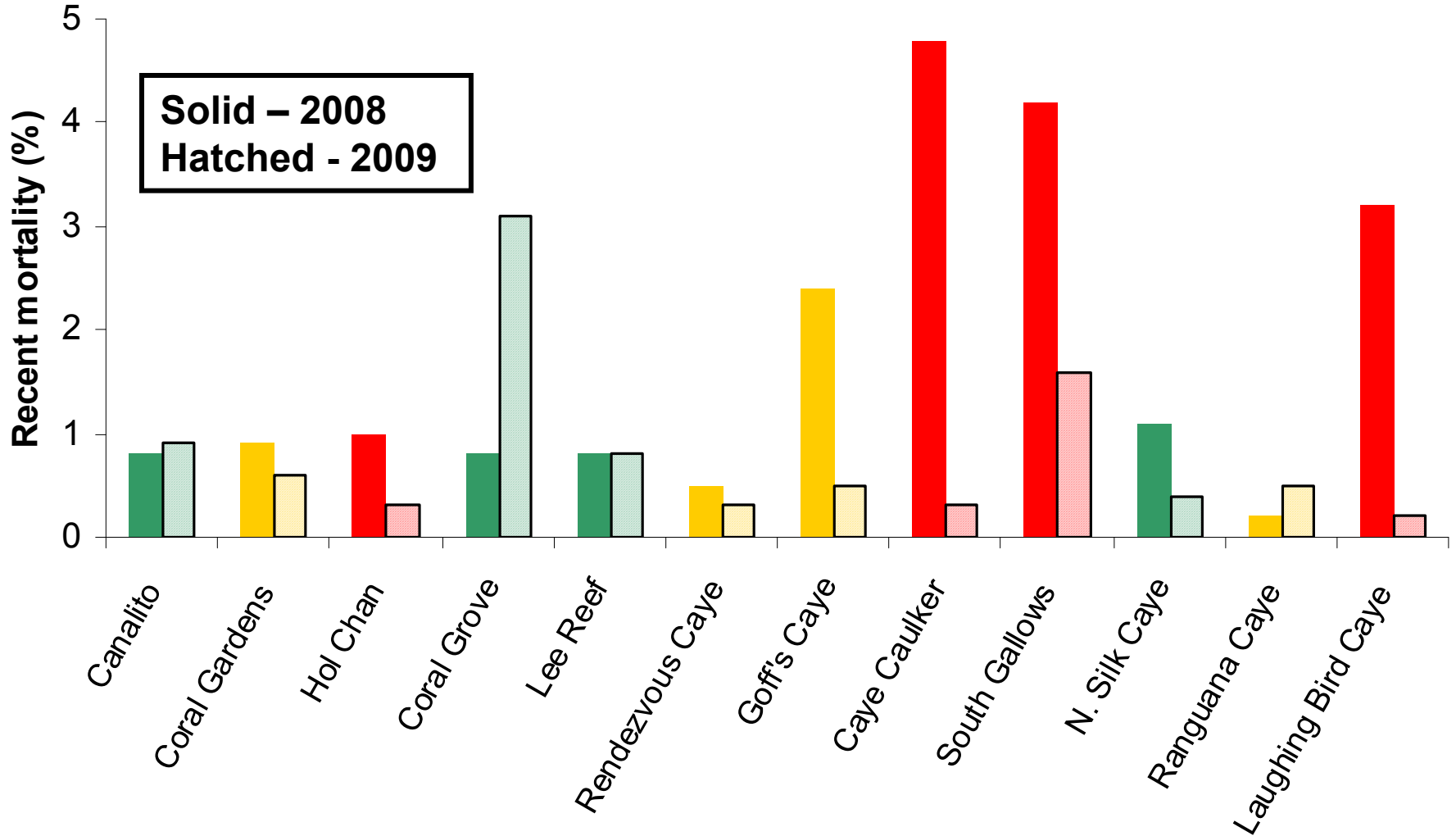
# Variations in Coral Cover not Consistent with Visitor Use Levels



Coral cover (%)	2008
Low # visitors =	25%
Medium # visitors =	21%
High # visitors =	24%
Protected areas =	23%
Non-protected areas =	24%

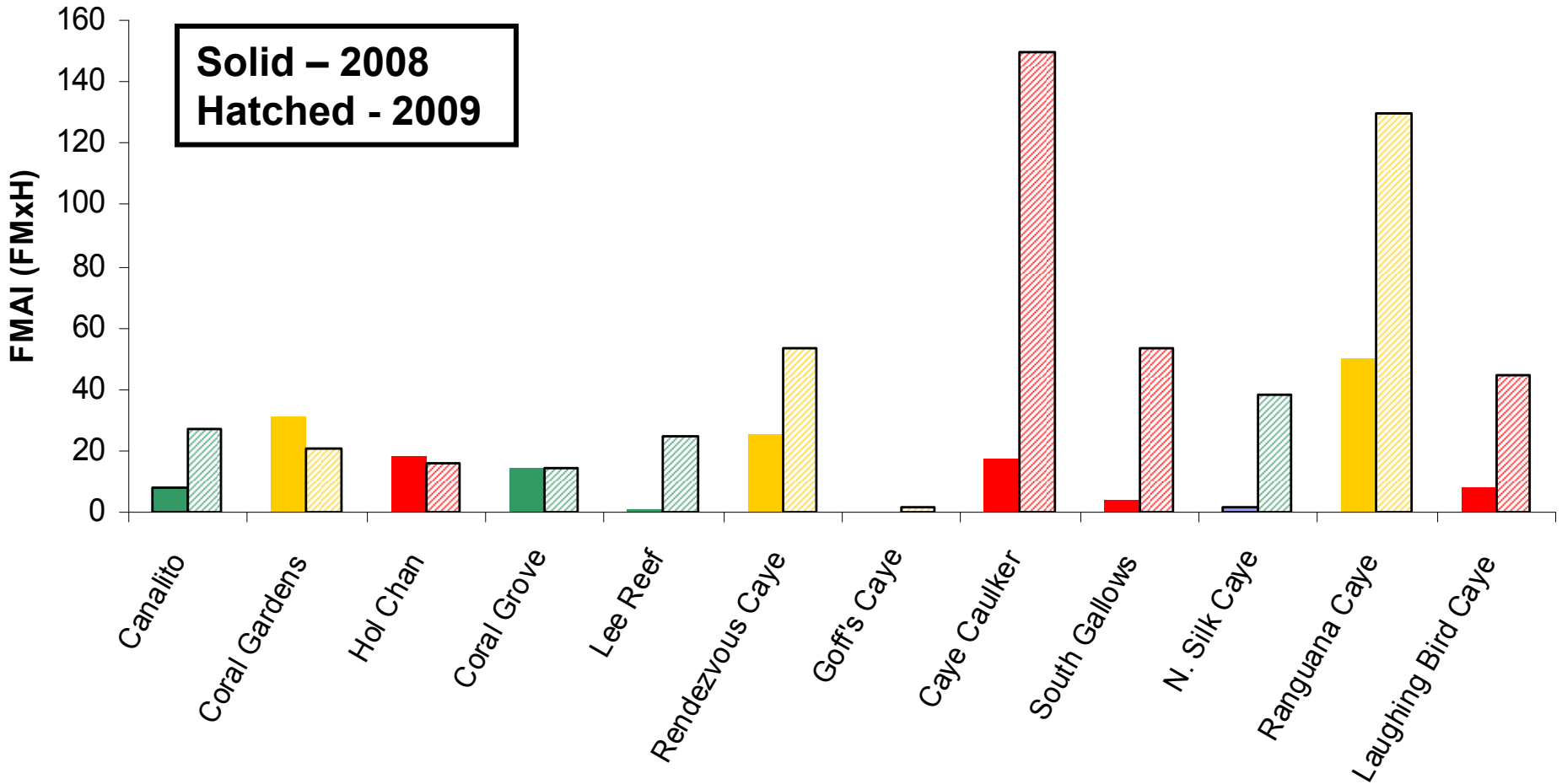
- = Low # of visitors
- = Medium # of visitors
- = High # of visitors
- = Protected area

## Recent coral mortality



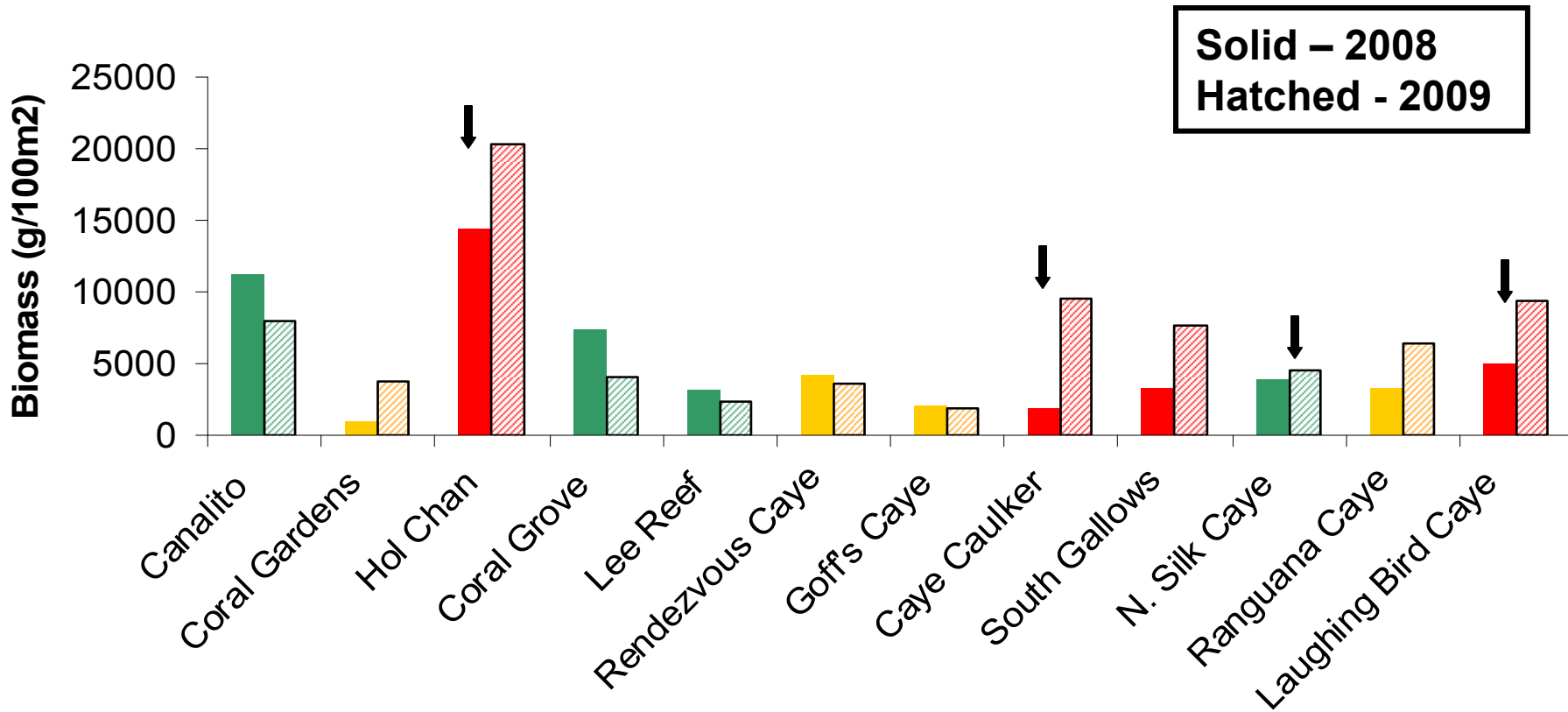
**Most sites showed less recent mortality in 2009,  
But highly visited sites had more mortality than controls.**

## Fleshy macroalgal index



**Fleshy macroalgae increased at 9 of the 12 sites. There is no relationship with visitor use.**

# Total fish biomass



## 2008

Low # visitors = 6,400  
 Medium # visitors = 2,567  
 High # visitors = 6,105  
 Protected areas = 6,270  
 Non-protected areas = 4,401  
 T. Fish biomass (avg.) = 5,024

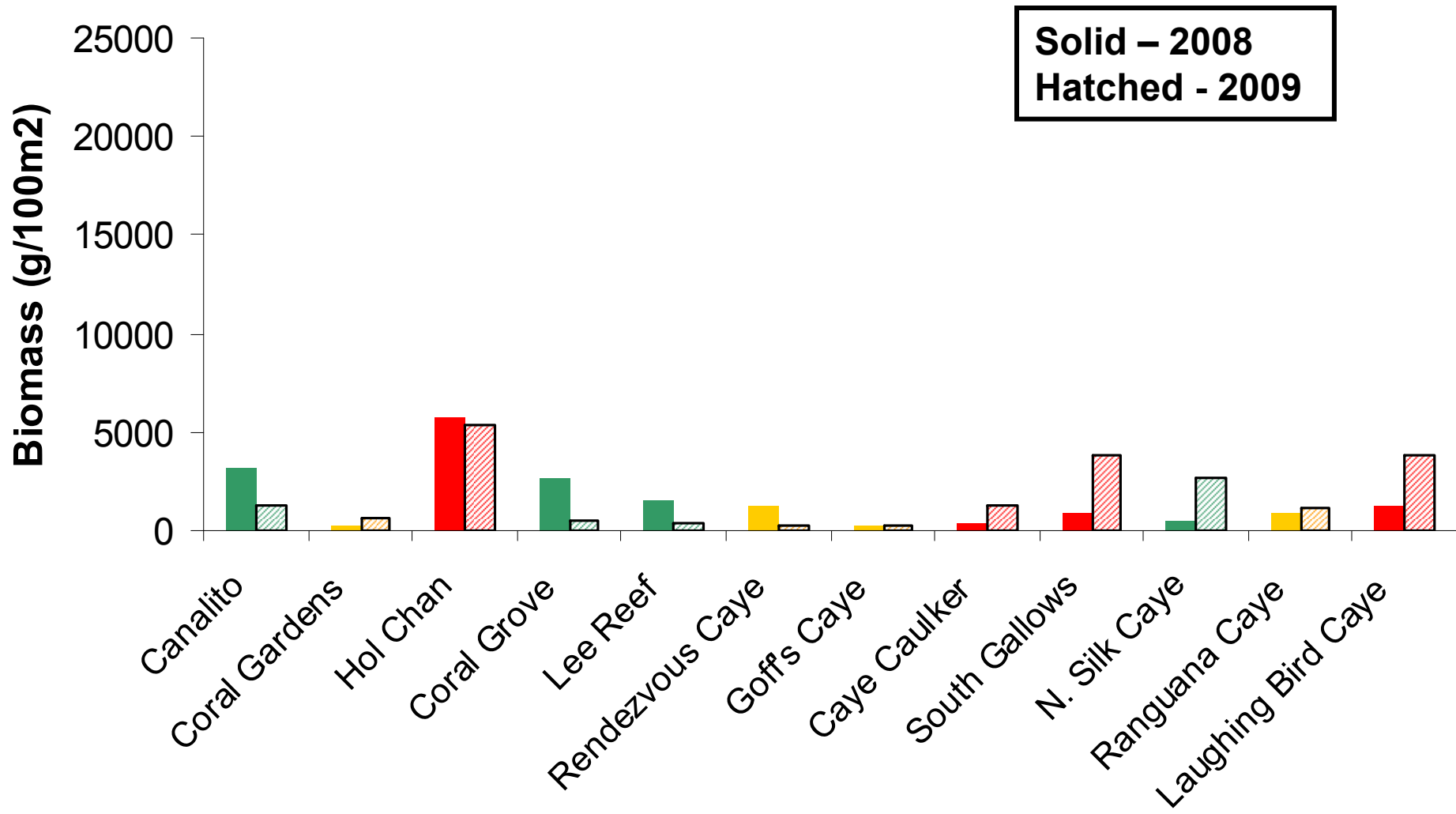
## 2009

6,785

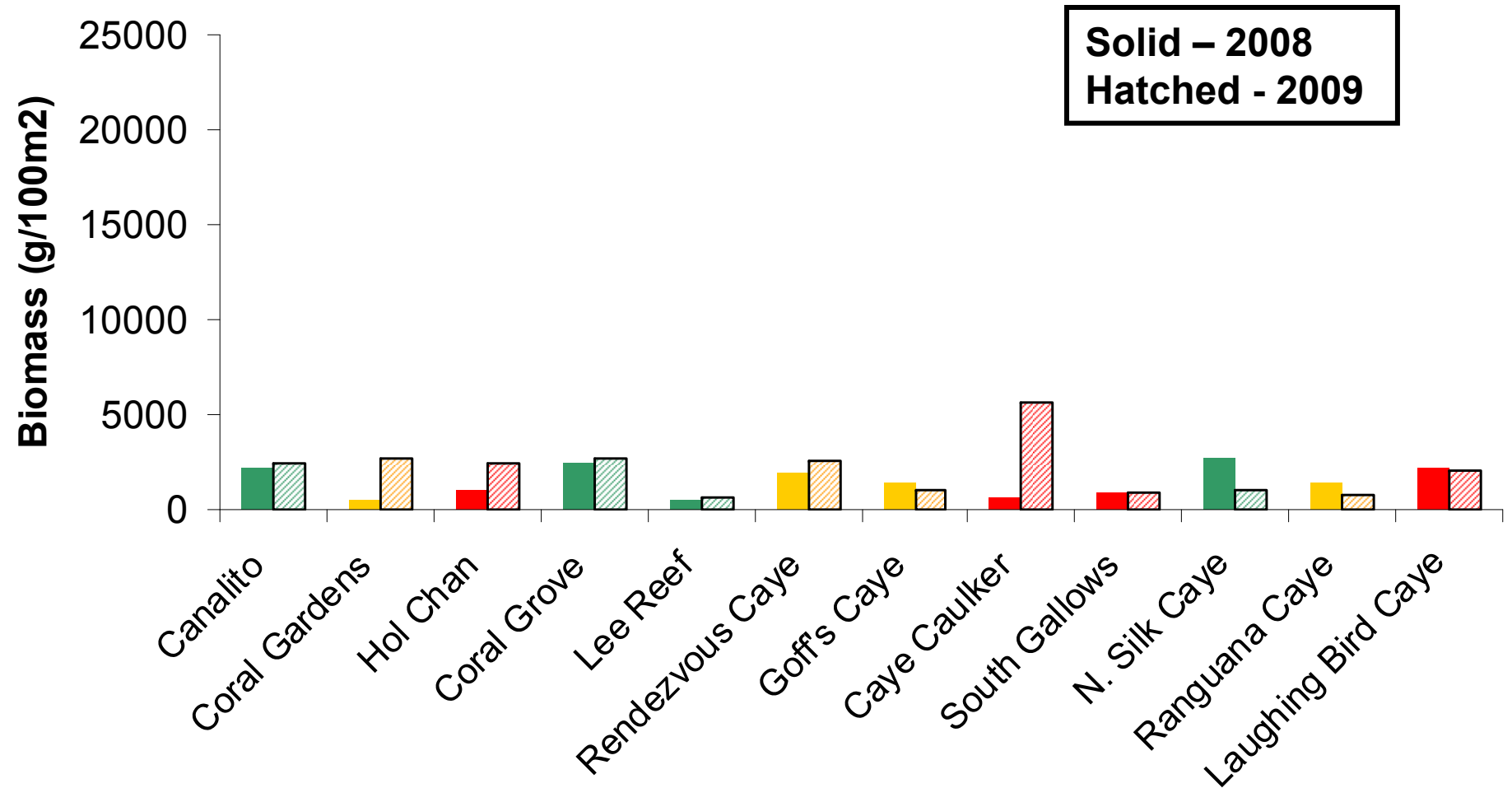
■ = Low # of visitors  
 ■ = Medium # of visitors  
 ■ = High # of visitors  
 ↓ = Protected area

**Increase in MPAs**

# Commercially significant fish biomass

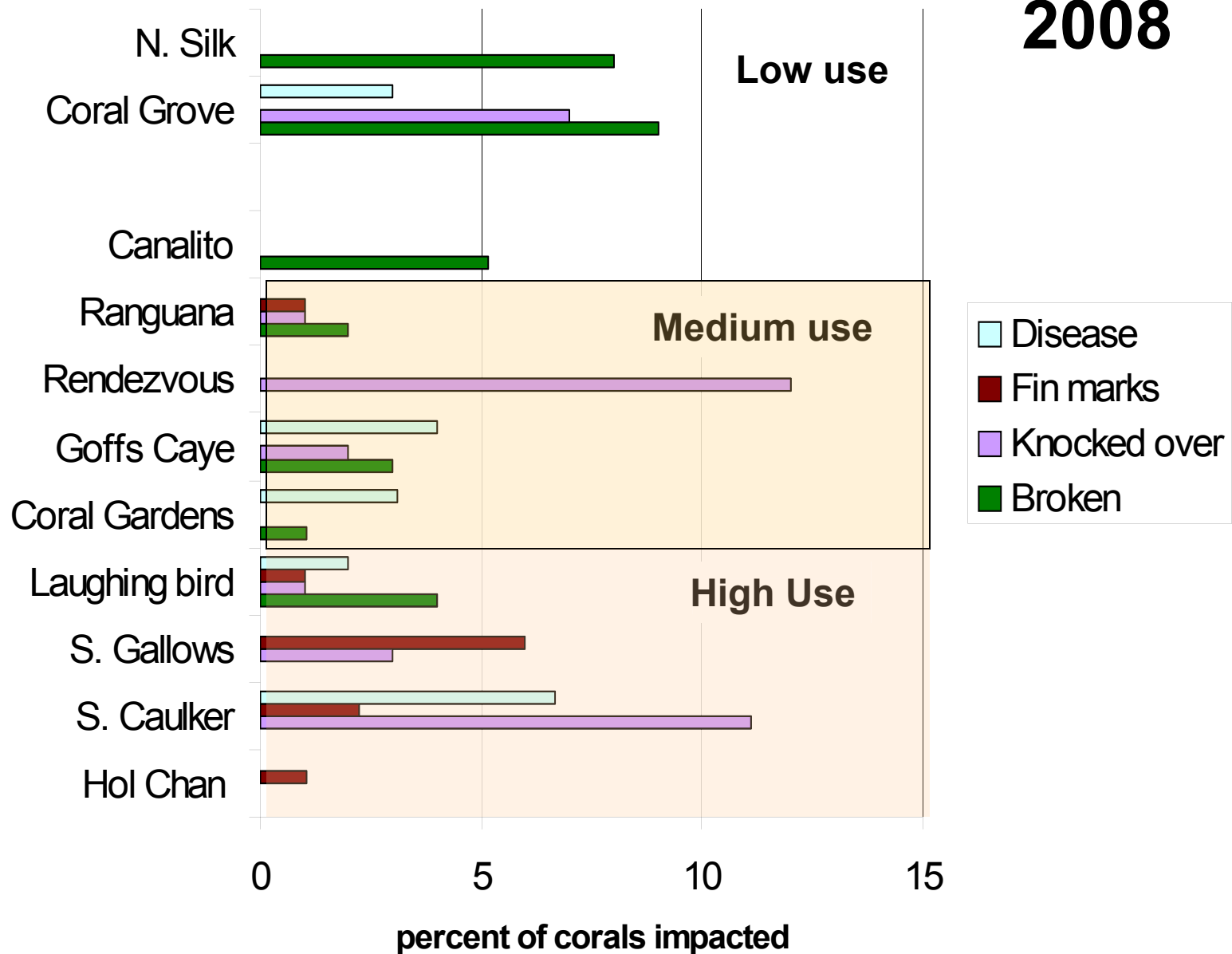


# Parrot and surgeon fish biomass



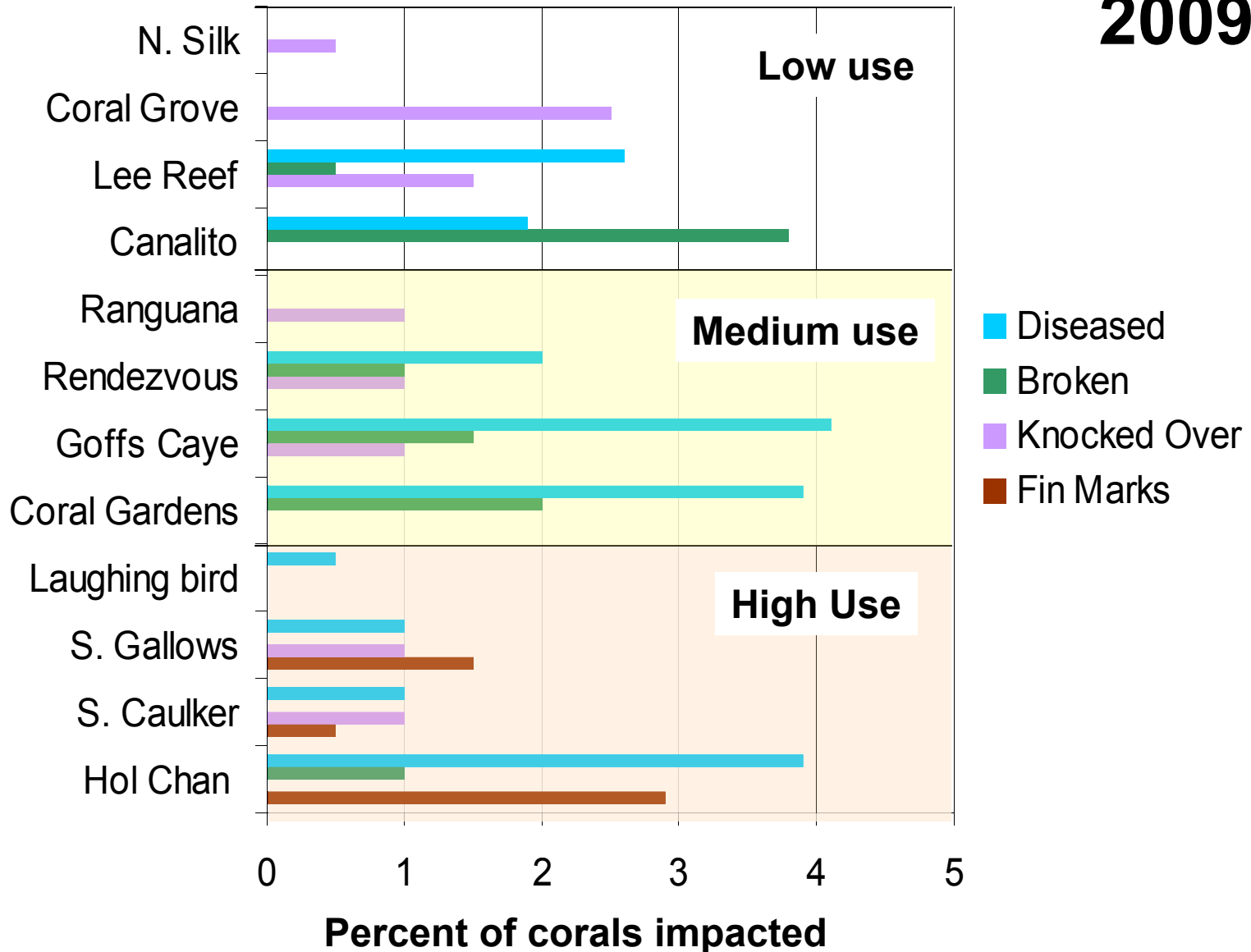
# More Impacts Seen at Highly Visited Sites

**2008**



# More Impacts Seen at Highly Visited Sites

**2009**



# Visitor Impact Study

Project assesses the effectiveness of these management programs

Focusing on these activities



- Visitor Behavior (Intentional and Unintentional)
  - Ecological Assessments (impacts to reef)

# The methodology used was the Hol Chan Snorkeler Impact survey

20 minute surveys record the following actions every minute per visitor visitor:

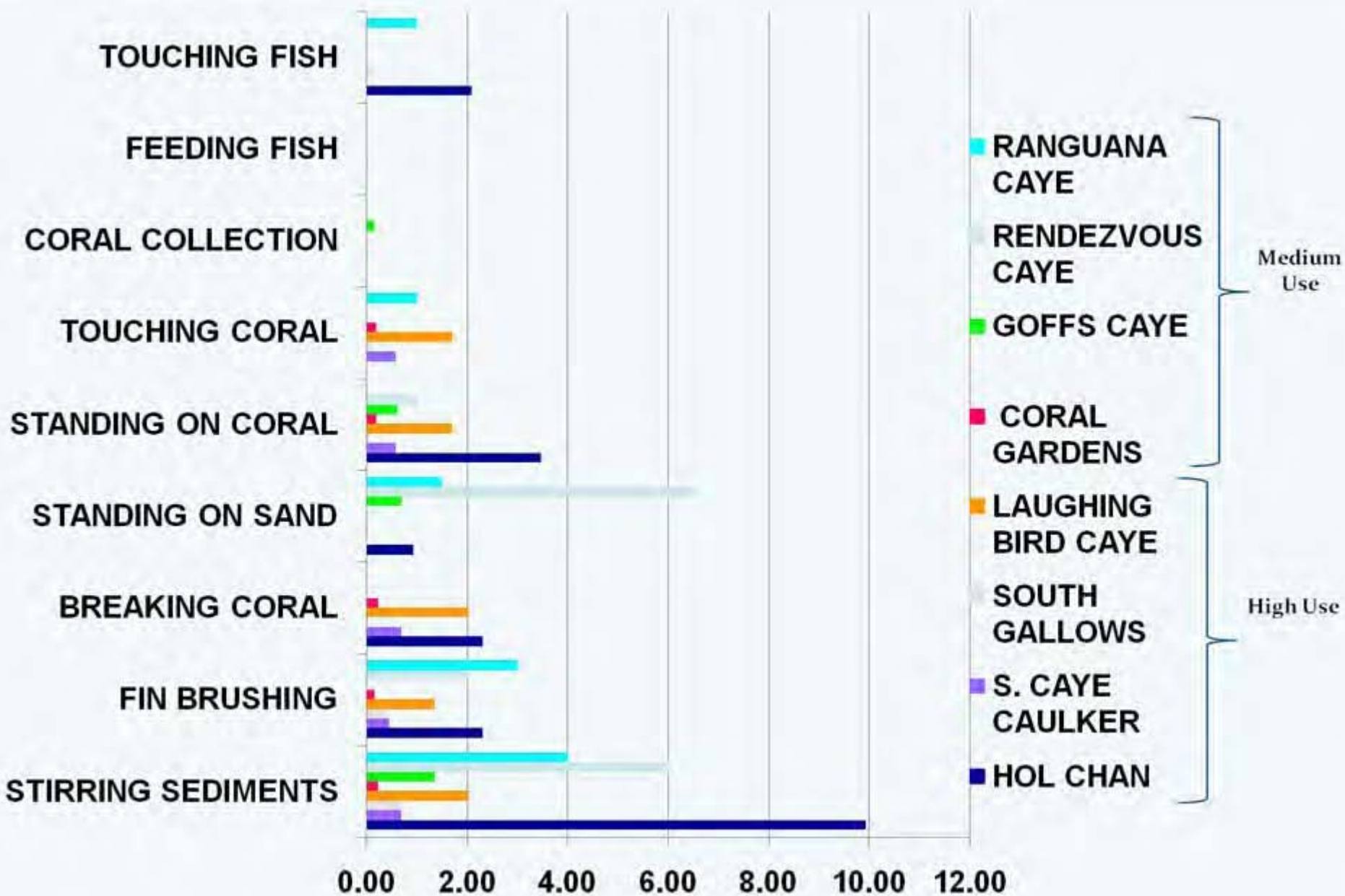


# Study Sites for Visitor Behavior

SITES	# OF SURVEYS
Ranguana Caye	14
Goff's Caye	12
Caye Caulker Coral Gardens	14
Laughingbird Caye	13
S. Gallows	80
S. Caye Caulker	14
Hol Chan	34
Rendezvous Caye	5

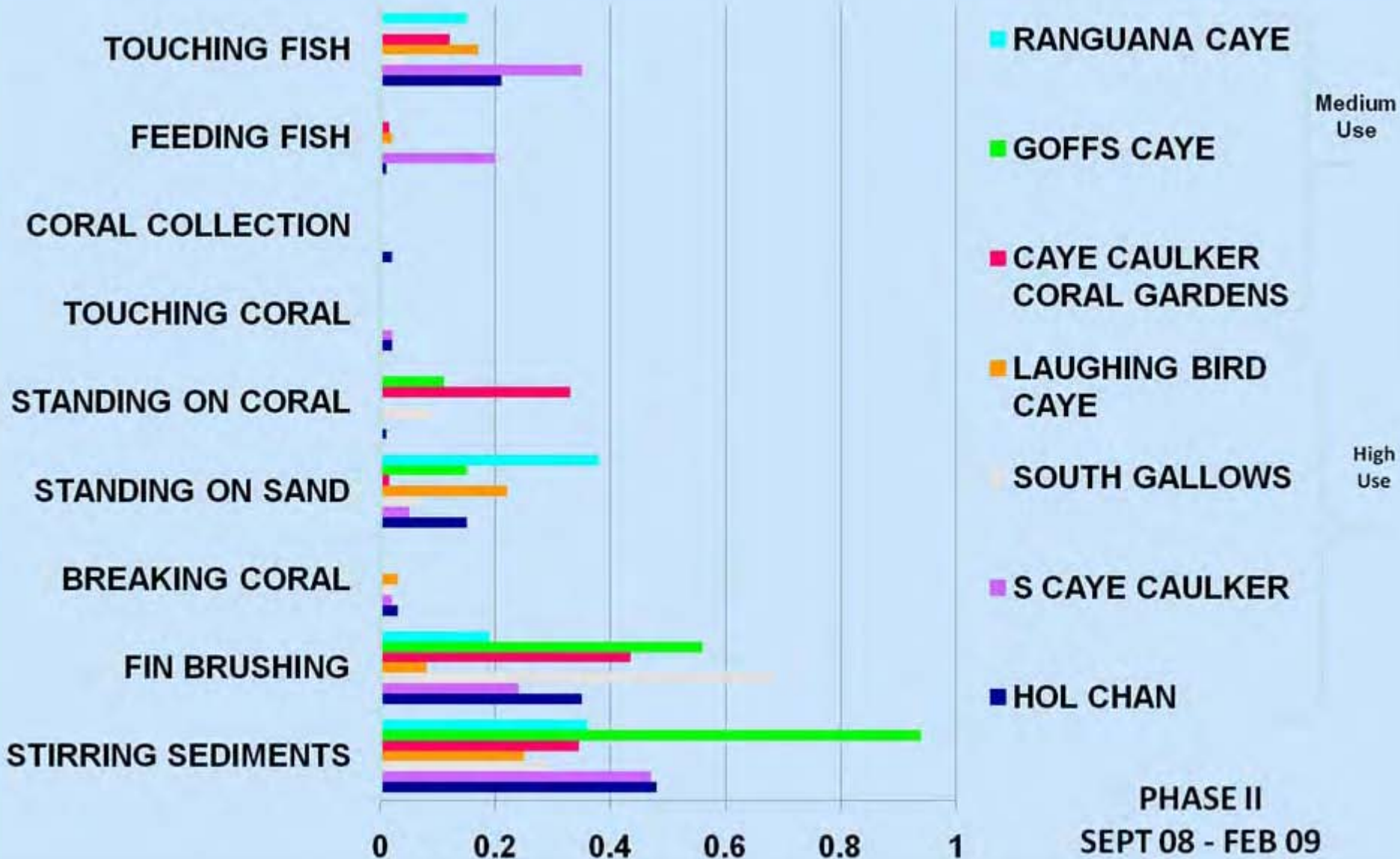
**4 CONTROL SITES WITH LITTLE TO NO VISITORS**

# Visitor Impacts per person per hour Phase I

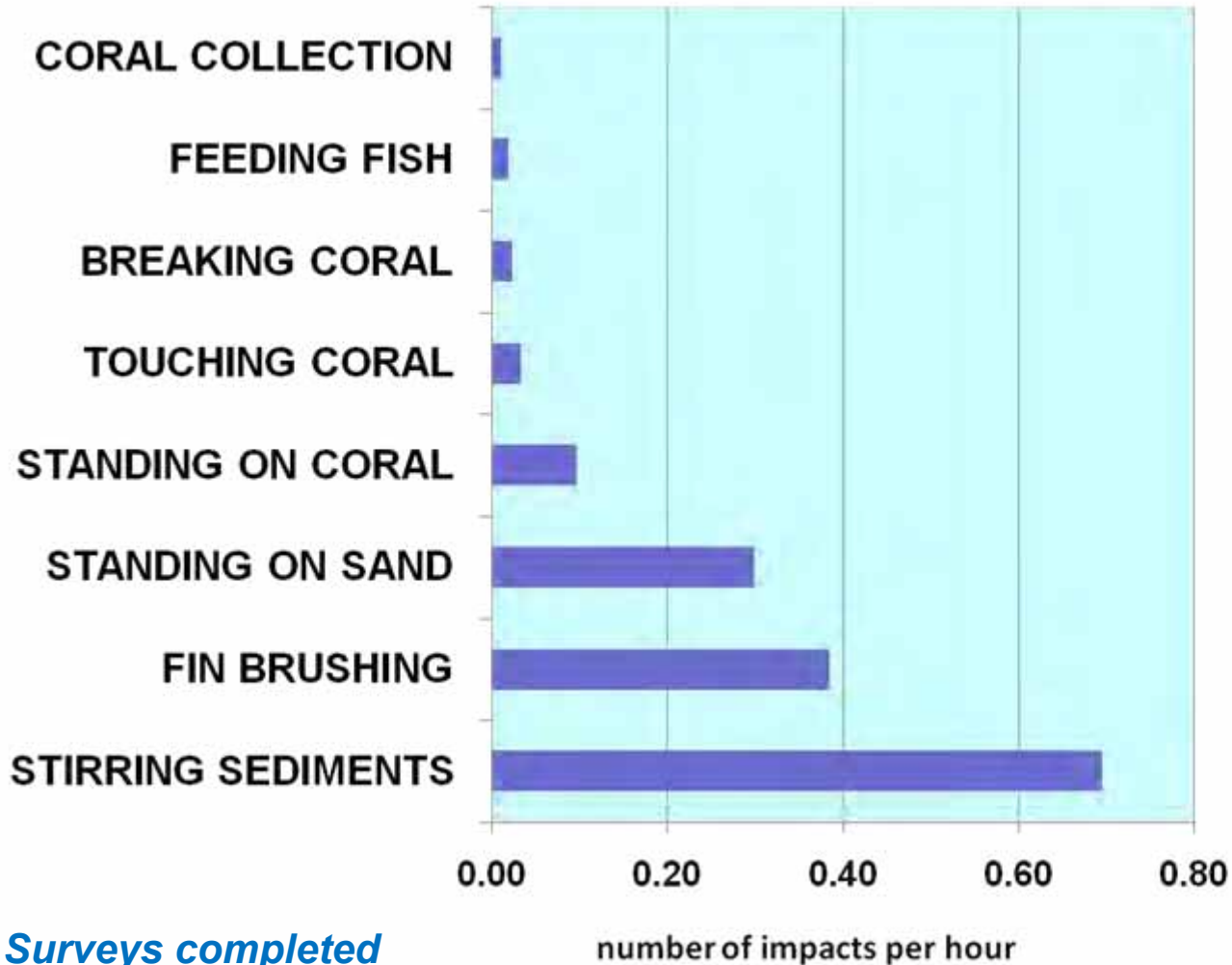


# Visitor Impacts per hour per person

## Phase II

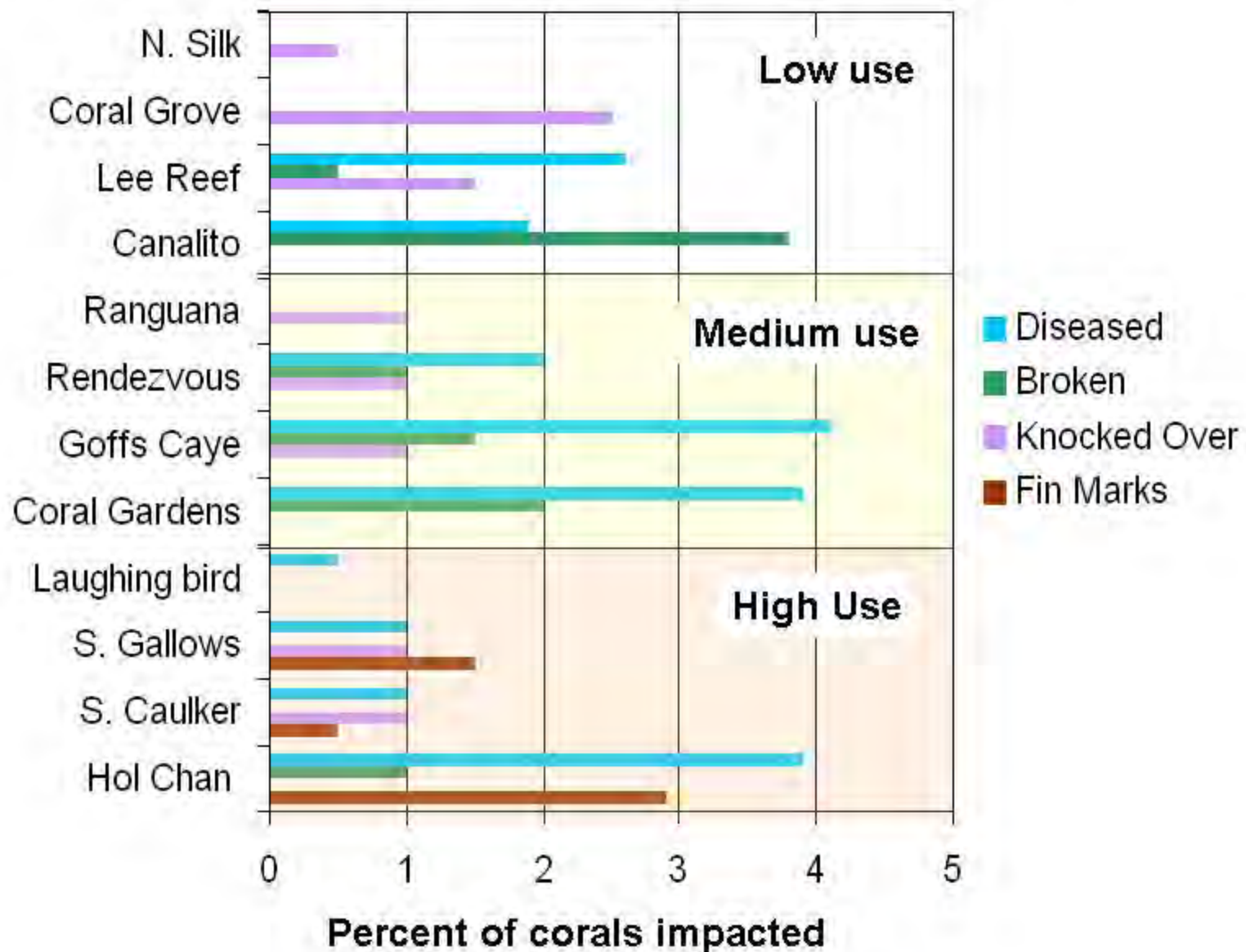


# Average Visitor Impacts per Hour



*186 Surveys completed*

# More Impacts Seen at Highly Visited Sites



# FIN MARKS OBSERVED ON CORALS CAN BE ATTRIBUTED TO FIN BRUSHING AND STANDING ON CORAL

## FIN MARKS ON CORAL

S. Gallows > S. Caulker > Hol Chan

## STANDING ON CORAL

PHASE I

Hol Chan > Laughingbird Caye > S Caulker

## FIN BRUSHING

Hol Chan > Laughingbird Caye > S Caulker

## FIN MARKS ON CORAL

Hol Chan > S. Gallows > S. Caulker

PHASE II

## STANDING ON CORAL

Hol Chan = Laughingbird > S Caulker = S Gallows

## FIN BRUSHING

S Gallows > Goffs Caye > Coral Gardens = Hol Chan

# Many Impacts were above average during Phase I of the study

*Unintentional Behaviors*

*Intentional Behaviors*

SITE	<i>Unintentional Behaviors</i>			<i>Intentional Behaviors</i>					
	STIRRING SEDIMENTS	FIN BRUSHING	BREAKING CORAL	STANDING ON SAND	STANDING ON CORAL	TOUCHING CORAL	CORAL COLLECTION	FEEDING FISH	TOUCHING FISH
HOL CHAN	9.92	2.31	2.31	0.92	3.46	0.00	0.00	0.00	2.08
S. CAYE CAULKER	0.68	0.45	0.68	0.00	0.56	0.56	0.00	0.00	0.00
SOUTH GALLOWS	0.69	0.36	0.01	0.01	0.05	0.07	0.01	0.02	0.14
LAUGHING BIRD CAYE	2.03	1.35	2.03	0.00	1.69	1.69	0.00	0.00	0.00
CORAL GARDENS	0.23	0.15	0.23	0.00	0.19	0.19	0.00	0.00	0.00
GOFFS CAYE	1.35	0.00	0.00	0.69	0.60	0.00	0.15	0.00	0.00
RENDEZVOUS CAYE	6.00	2.00	0.00	6.50	1.00	0.00	0.00	0.00	0.00
RANGUANA CAYE	4.00	3.00	0.00	1.50	0.00	1.00	0.00	0.00	1.00

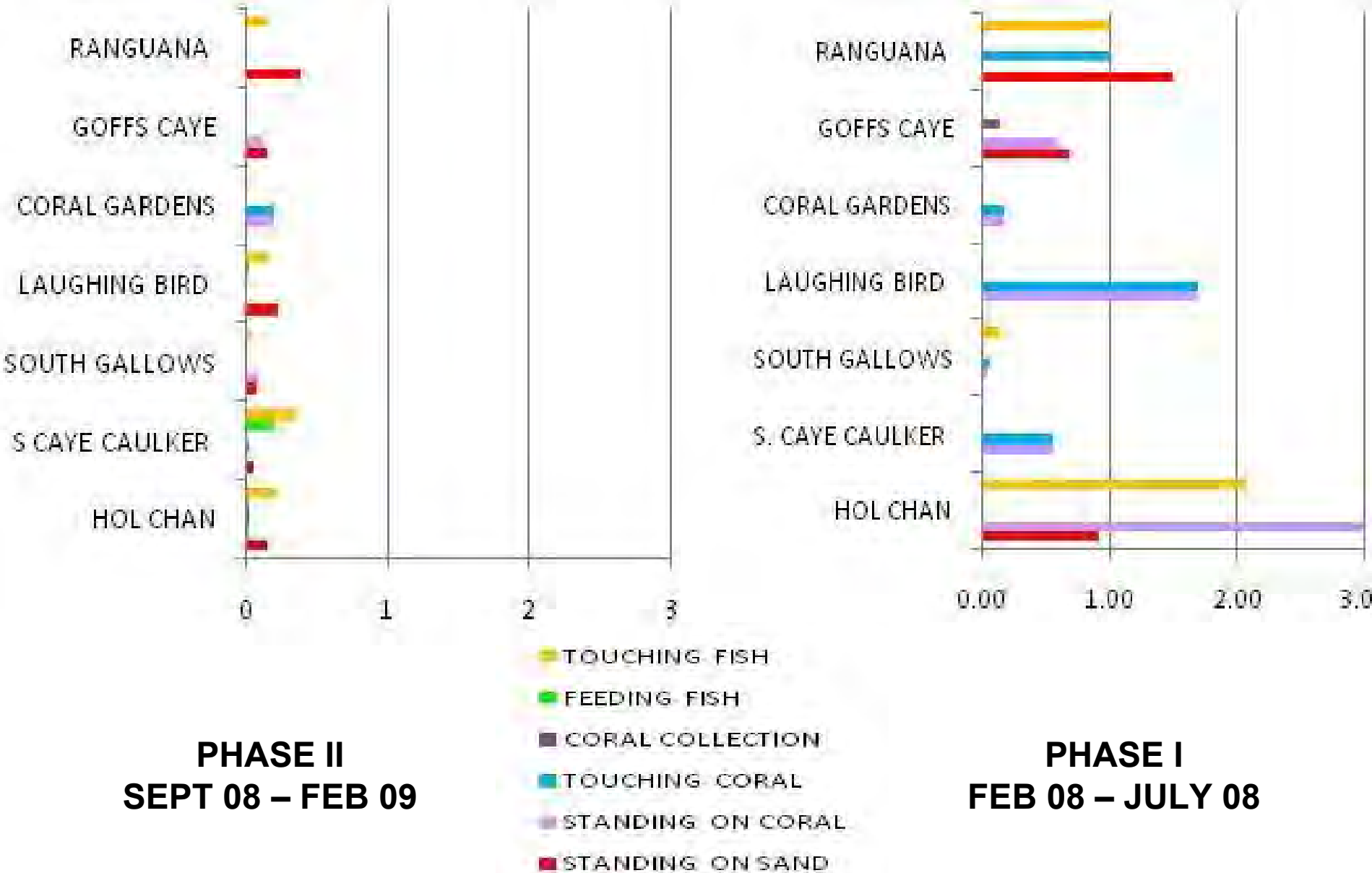
# A Decrease in Impacts Per hour per person was witnessed in Phase II of the study

*Unintentional Behaviors*

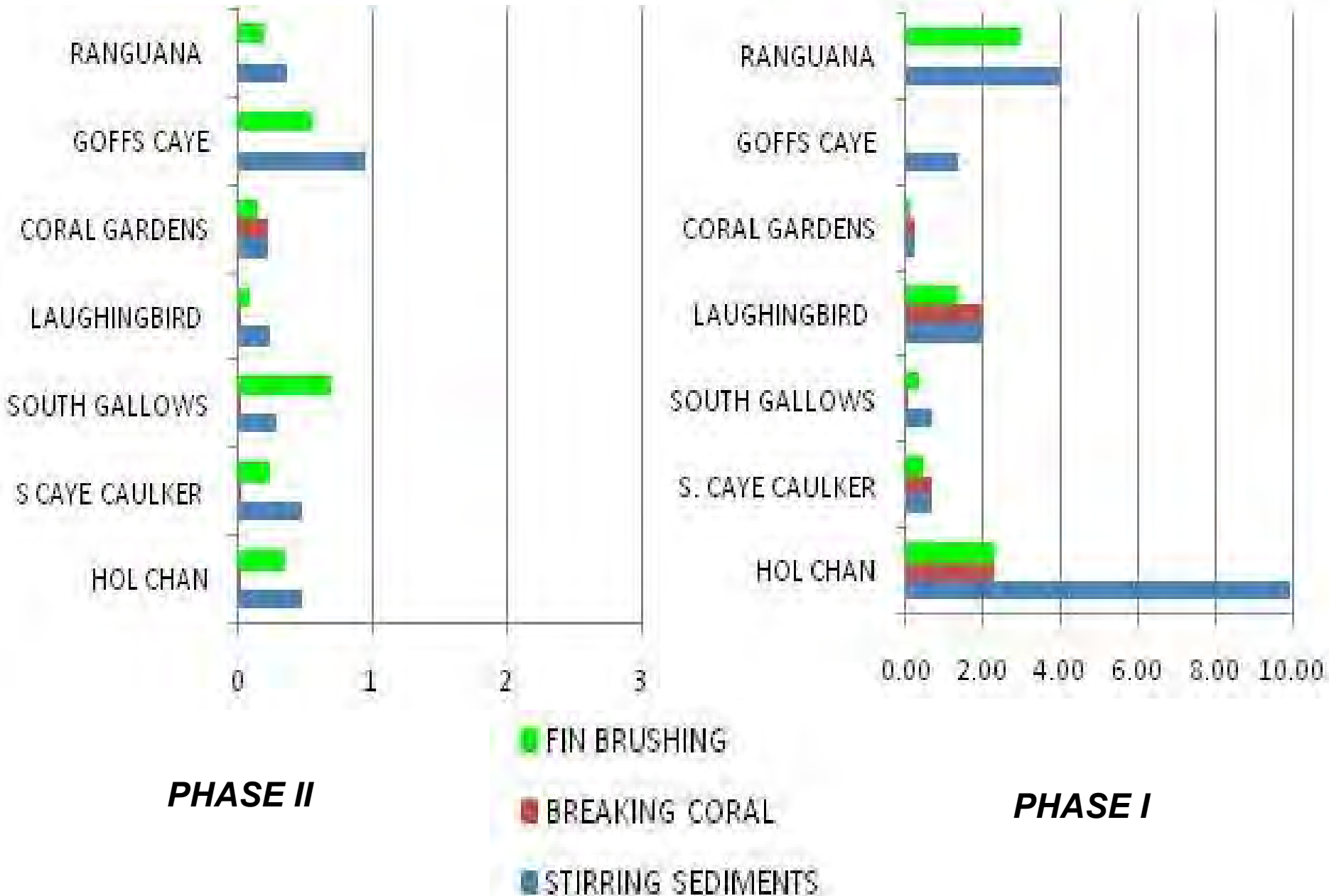
*Intentional Behaviors*

SITE	<i>Unintentional Behaviors</i>			<i>Intentional Behaviors</i>					
	STIRRING SEDIMENTS	FIN BRUSHING	BREAKING CORAL	STANDING ON SAND	STANDING ON CORAL	TOUCHING CORAL	CORAL COLLECTION	FEEDING FISH	TOUCHING FISH
HOL CHAN	0.5	0.4	0	0.2	0	0	0	0	0.2
S CAYE CAULKER	0.5	0.2	0	0.1	0	0	0	0.2	0.4
SOUTH GALLOWS	0.3	0.7	0	0.1	0.1	0	0	0	0
LAUGHING BIRD CAYE	0.3	0.1	0	0.2	0	0	0	0	0.2
CAYE CAULKER CORAL GARDENS	0.35	0.44	0	0.02	0.3	0	0	0.02	0.12
GOFFS CAYE	0.9	0.6	0	0.2	0.1	0	0	0	0
RANGUANA CAYE	0.4	0.2	0	0.4	0	0	0	0	0.2

# COMPARISON OF INTENTIONAL IMPACTS PER HOUR IN BOTH PHASES



# COMPARISON OF UNINTENTIONAL IMPACTS PER HOUR BY PHASE



# RECOMMENDATIONS

- **What stakeholders can do Makes Business Sense**
- **Tour Operators/Tour Guides, Civil and Private Society, CZMAI, BTB**



# RECOMMENDATIONS

## •Tour Operators/Tour Guides

- **Monitoring Consumer Feedback-  
*Reef related activities*=\$\$\$\$**
- **Development of New Tours  
(changing path of tours to lessen  
impacts of stirring sediment,  
standing on coral**
- **Involvement of More operators in  
CORAL EWT**
- **Strong Mention of Stirring  
Sediment in Environmental  
Briefings**



# RECOMMENDATIONS

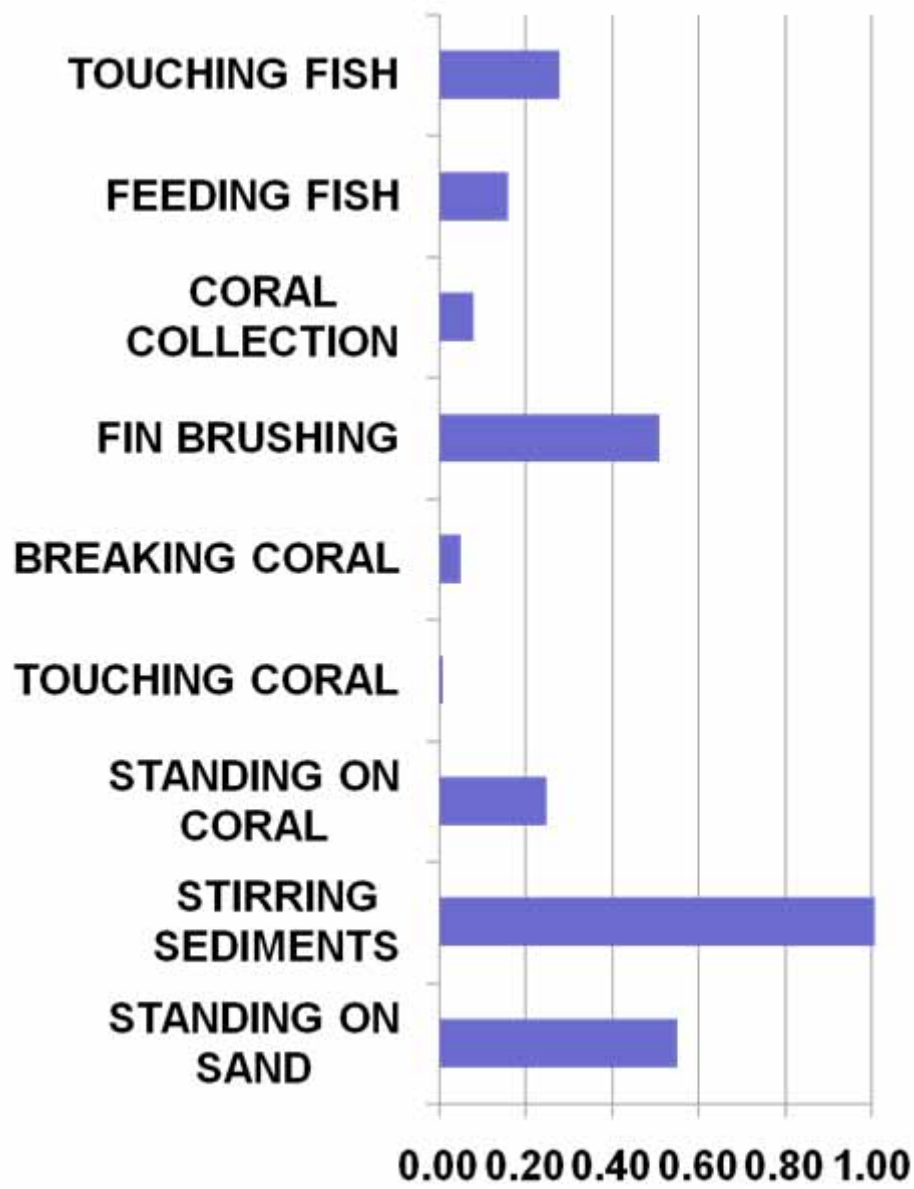
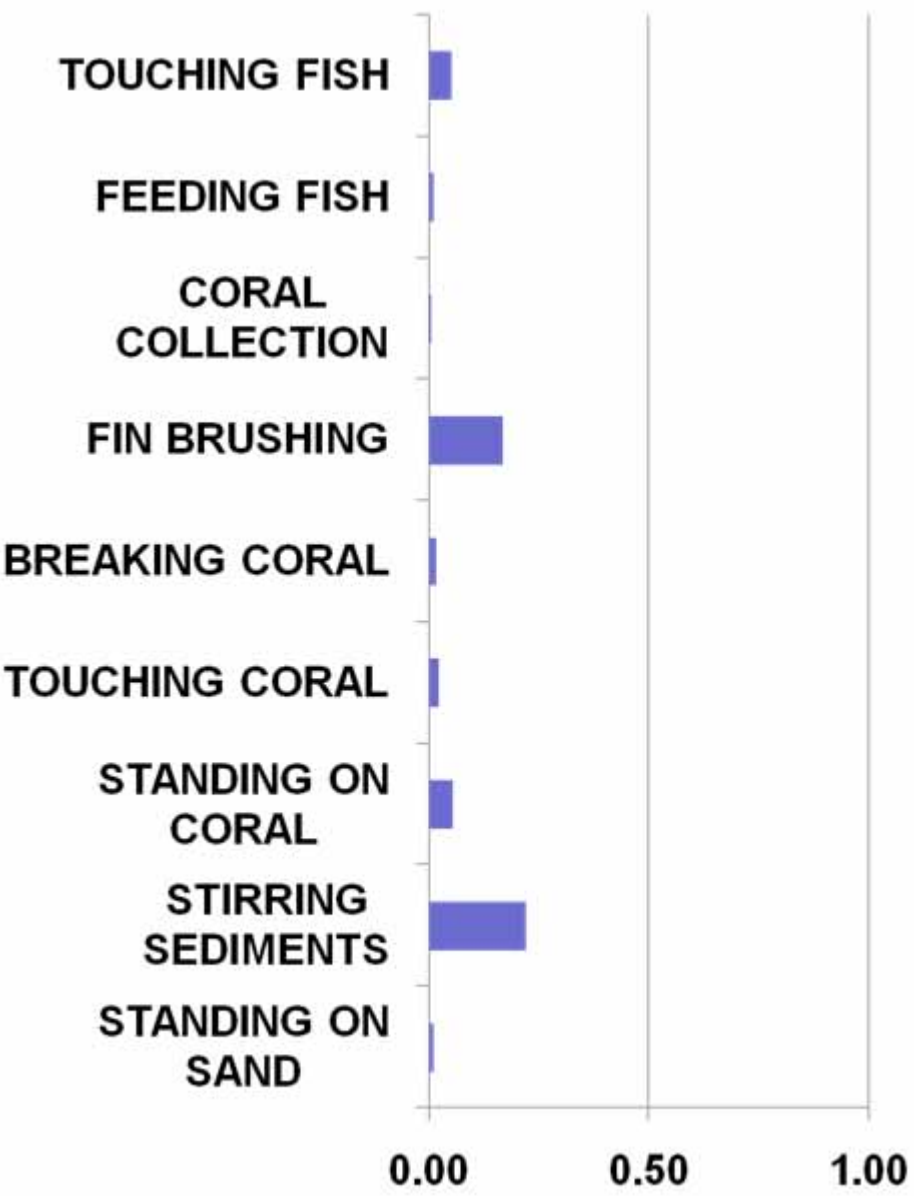
## •CZMAI,HCMR,CCMR

- Increase zonation to include South Gallows and charge park fees
- Fees can go towards monitoring and patrol
- Tap into student base (UB, Galen) to continue monitoring, and data analysis



# Operators Involved in CORAL

# Operators not involved in CORAL



# RECOMMENDATIONS

## •Civil and Private Society

- **Acceptable Levels of Change (standardization of safety protocols for snorkel gear – ie vests)**
- **Possibility of Bigger Boats moving to different sites that can accommodate a greater capacity of in water visitors**
- **Smaller boats and tour operators**



# RECOMMENDATIONS

## Belize Tourism Board

- **National Survey at airports**
- **Monitors consistent delivery of environmental briefings (survey)**
- **Monitored and Implemented by students (UB, Galen)**
- **Incorporation of Visitor Impact study (ppt) into the National Snorkel Guide Course**
- **Incentives to tour operators involved in the CORAL EWT program**



# ACKNOWLEDGEMENTS

**Hammerhead Tours, Fab  
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BNTGA,  
SPTGA**



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***AKA the sneaky snorkeler***



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# THANK YOU!!

