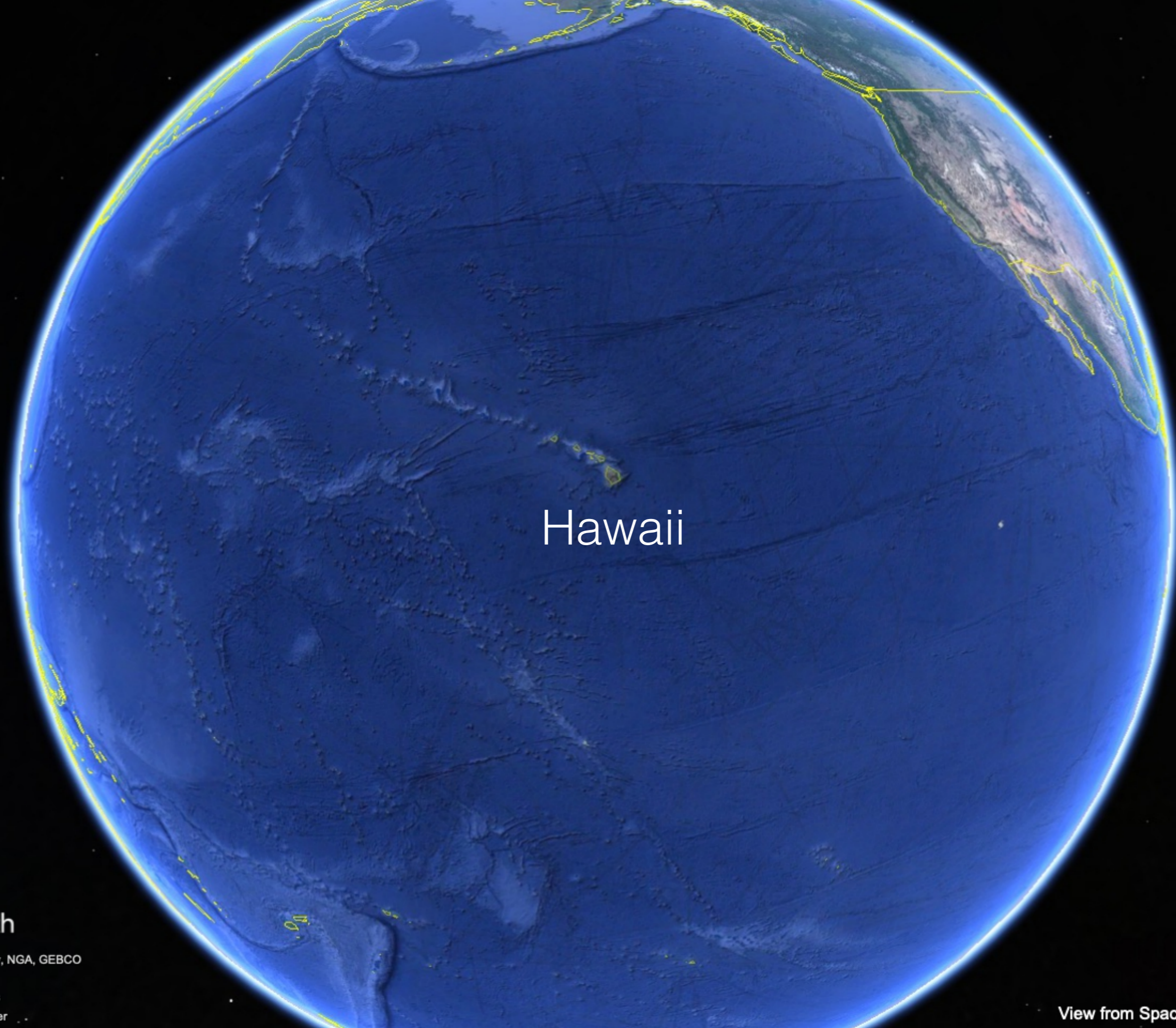


# Hawaii's Manta Rays

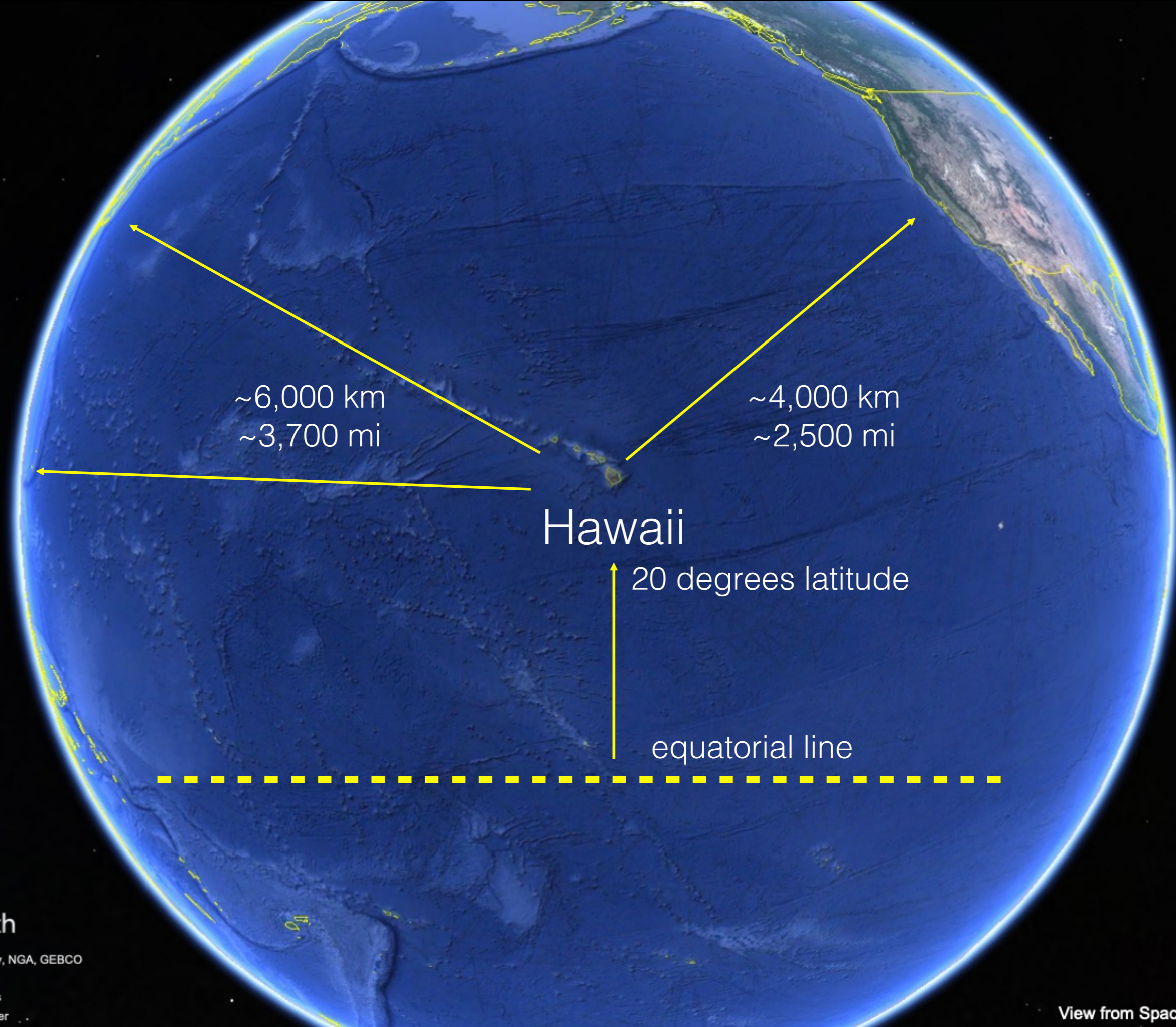


*Mark Deakos, Ph.D.  
Executive Director*

*Hawaii Association for Marine Education and Research*



Hawaii



~6,000 km  
~3,700 mi

~4,000 km  
~2,500 mi

Hawaii

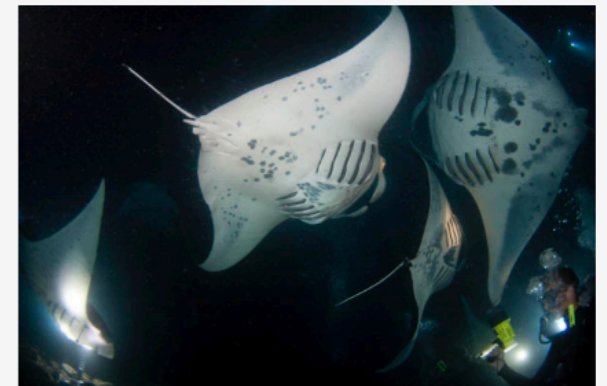
20 degrees latitude

equatorial line

# MANTA NIGHT DIVE

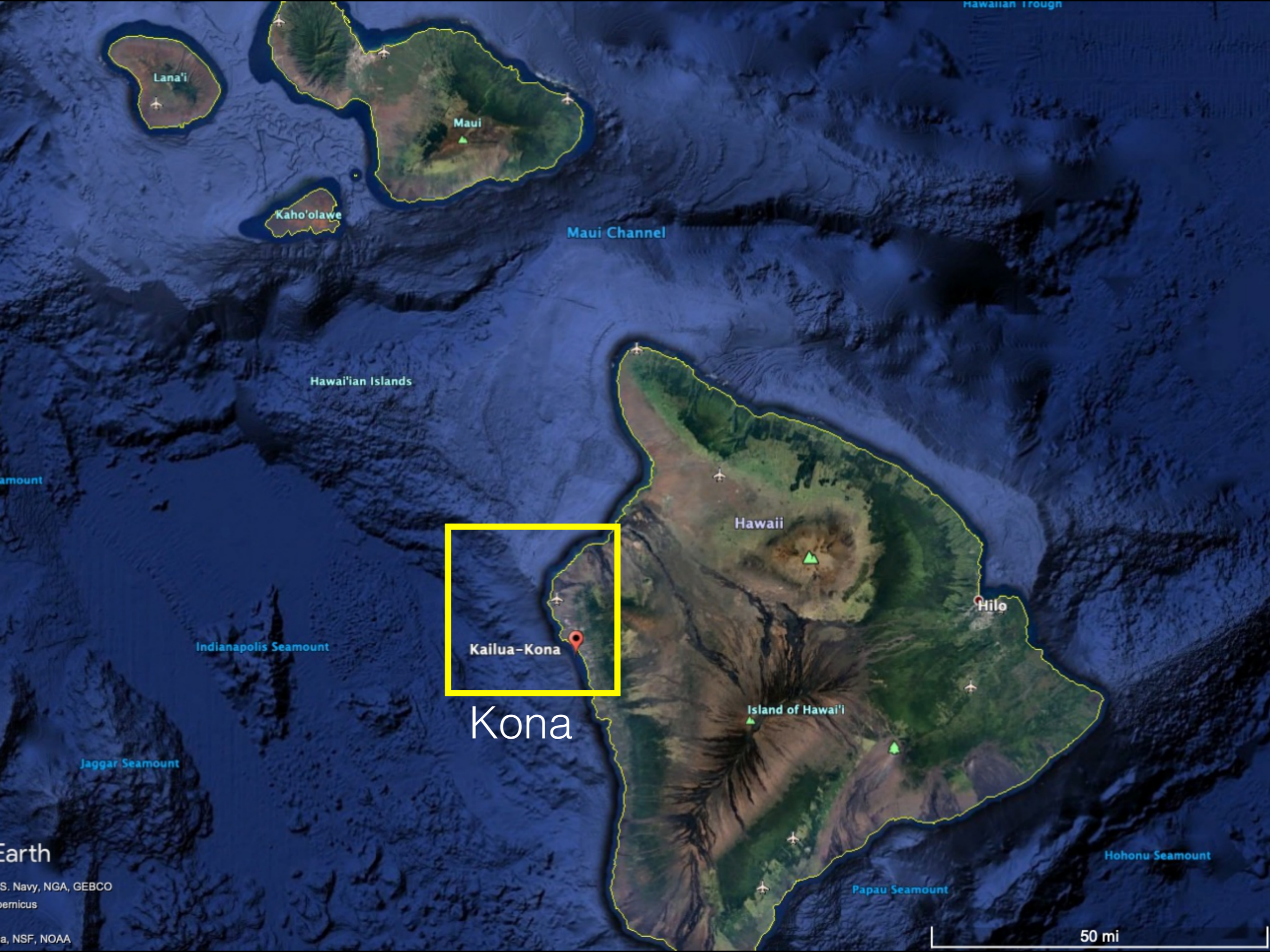
Afternoon and Night 2-Tank Trip

**Experience our famous Manta Night Dive in Kona, Hawaii for an unforgettable encounter during two dives!**





<http://i.imgur.com/dSJys6E.jpg>



Lana'i

Maui

Kaho'olawe

Maui Channel

Hawai'ian Islands

Hawaii

Hilo

Kailua-Kona

Kona

Island of Hawai'i

Indianapolis Seamount

Jaggar Seamount

Hohonu Seamount

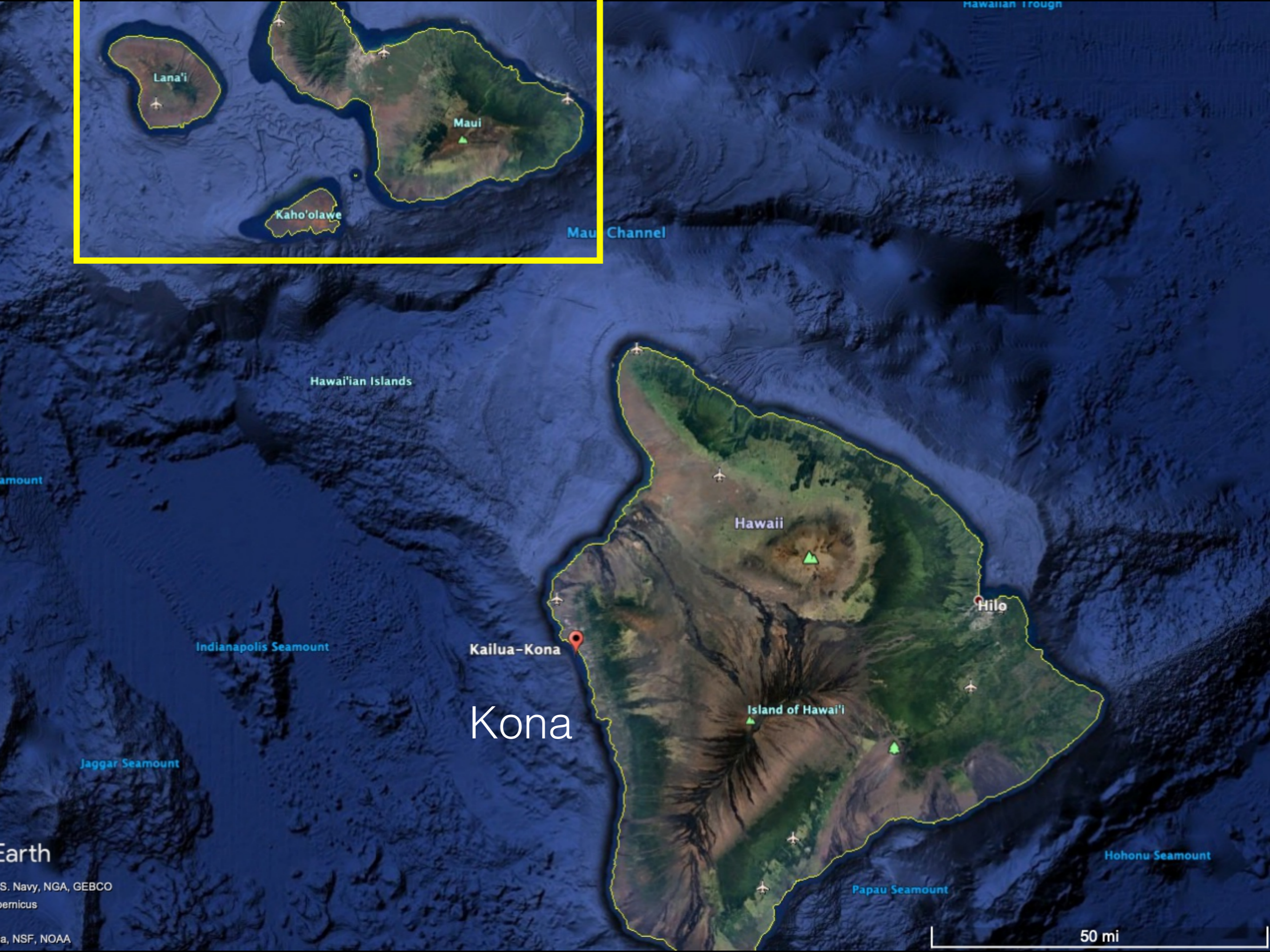
Papau Seamount

50 mi

Earth

S. Navy, NGA, GEBCO  
ernicus

a, NSF, NOAA



Lana'i

Maui

Kaho'olawe

Maui Channel

Hawai'ian Islands

Indianapolis Seamount

Kailua-Kona

Hawaii

Hilo

Island of Hawai'i

Jaggar Seamount

Papau Seamount

Hohonu Seamount

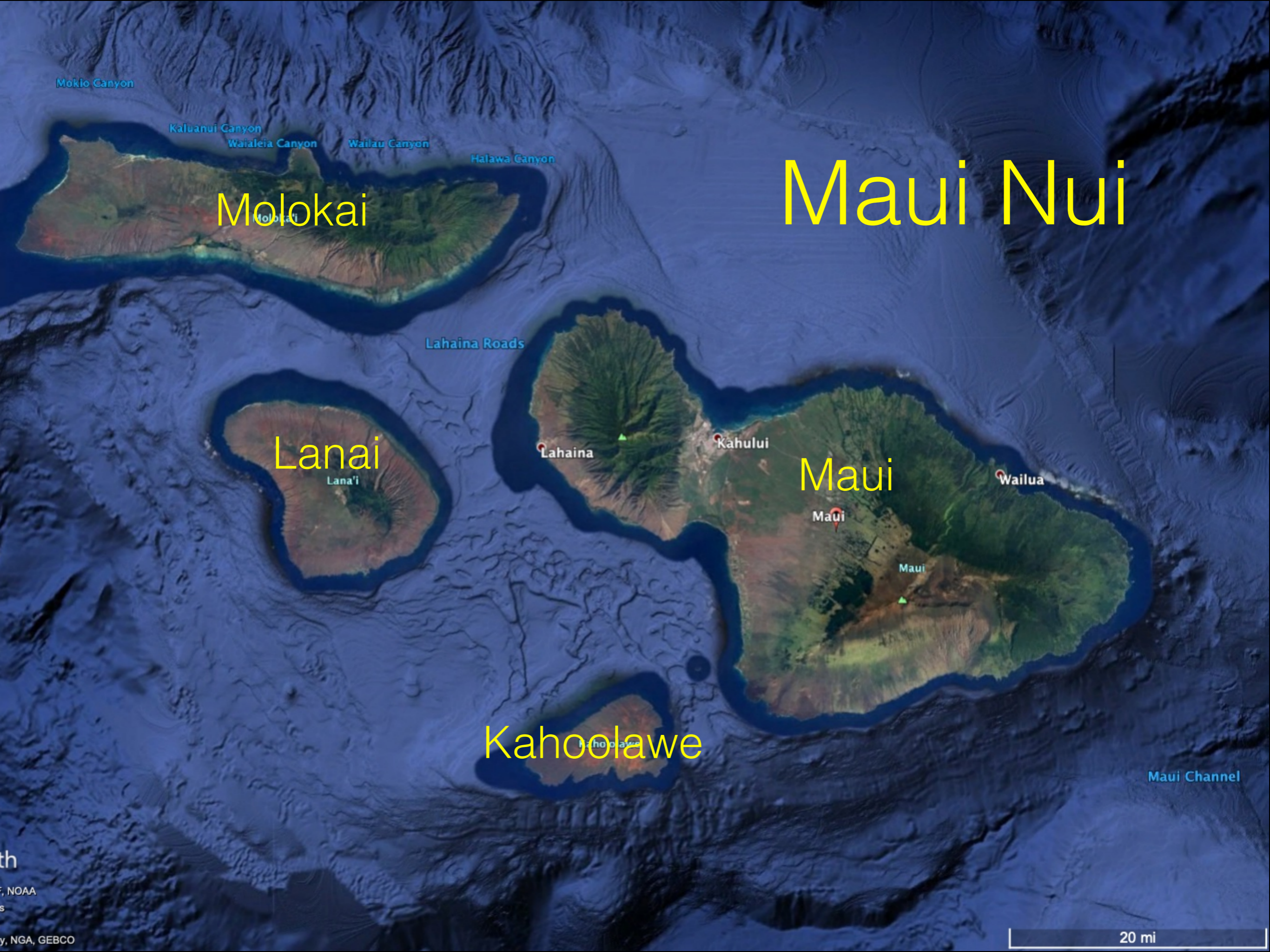
50 mi

Kona

Earth

S. Navy, NGA, GEBCO  
Bernicus

a, NSF, NOAA



# Maui Nui

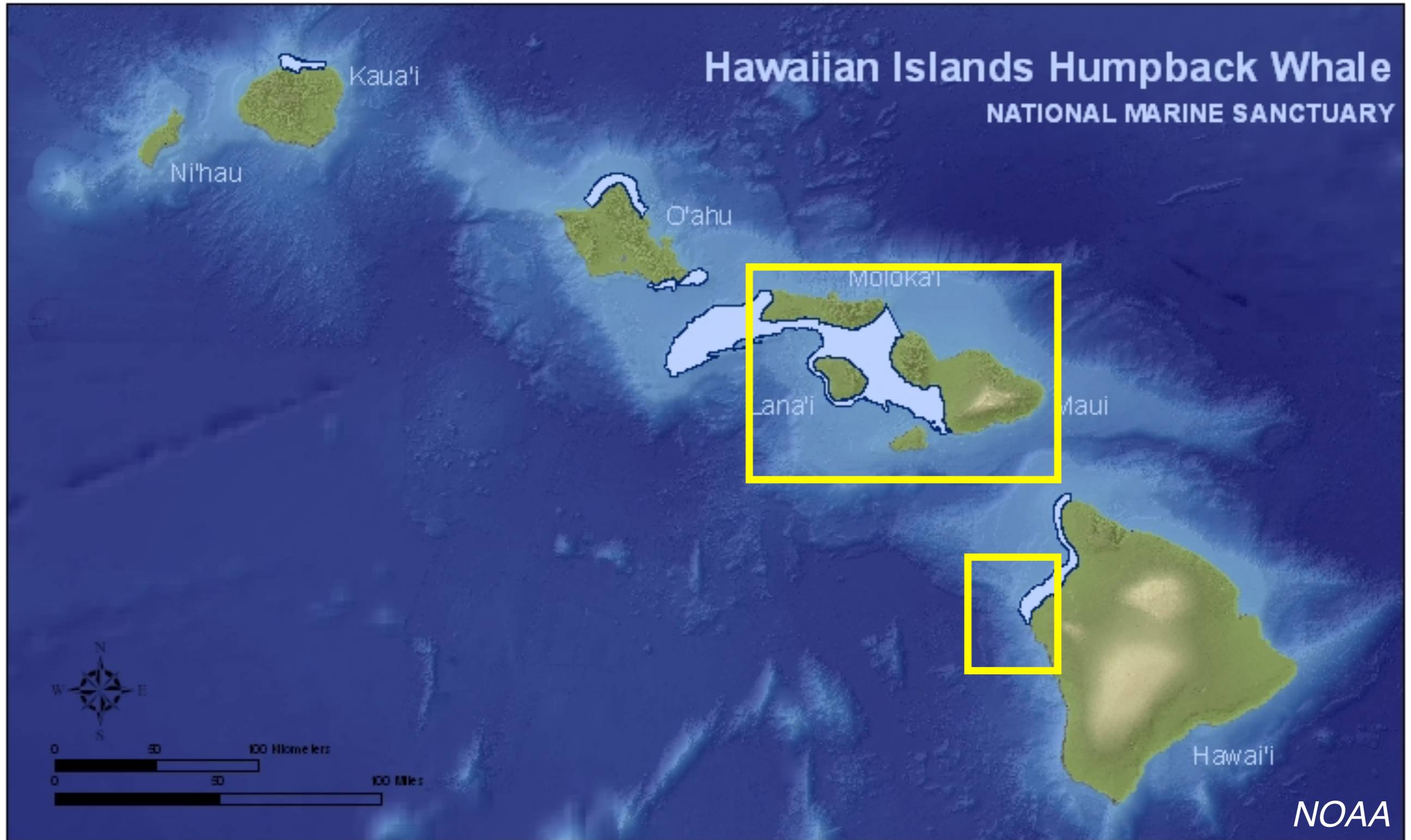
Molokai

Lanai

Maui

Kahoolawe

# Hawaiian Islands Humpback Whale NATIONAL MARINE SANCTUARY



Tala





33 Sightings since July 2017



Can we ensure Tala's survival?

Can we ensure Tala's survival,  
against us?



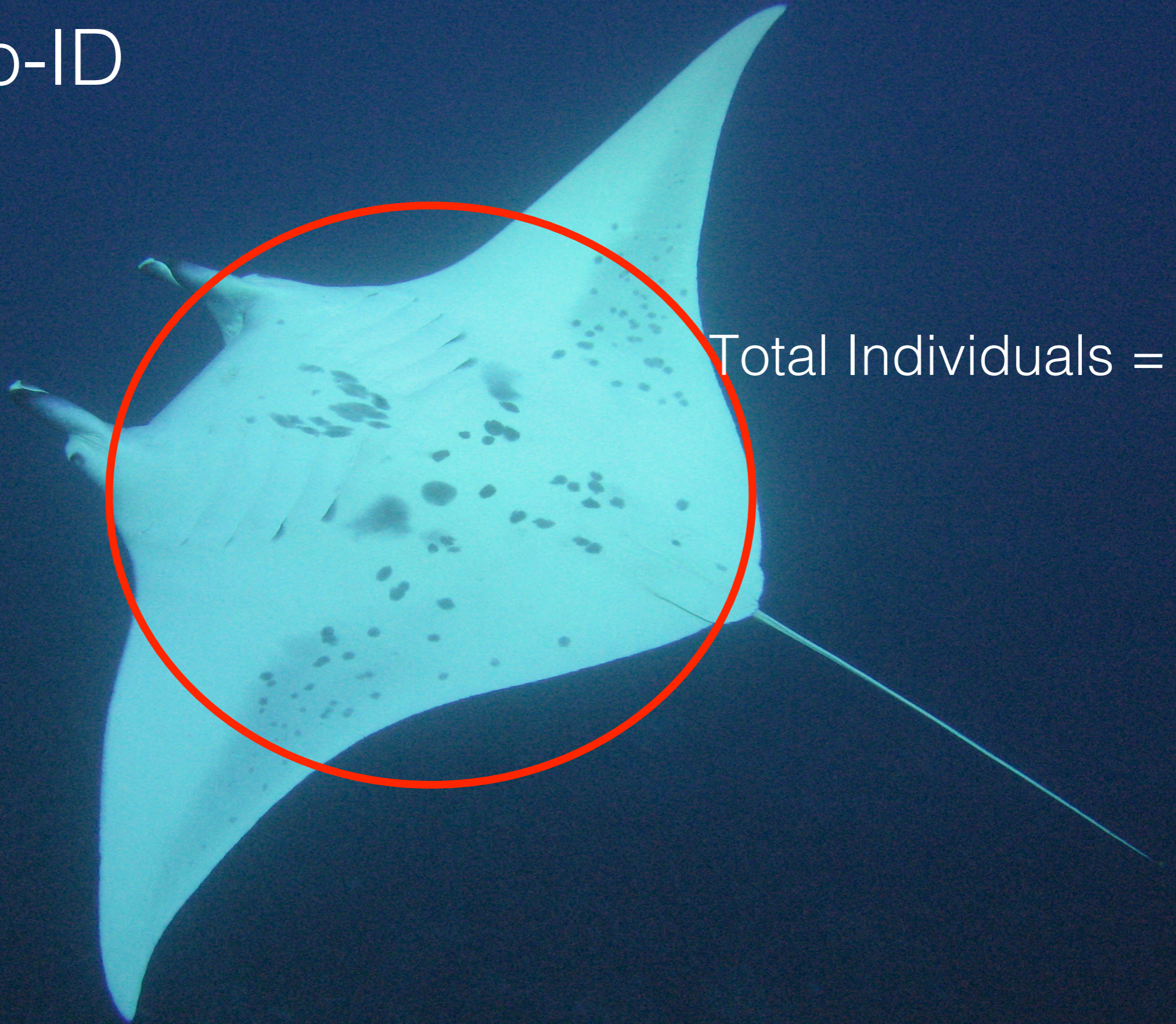




Video

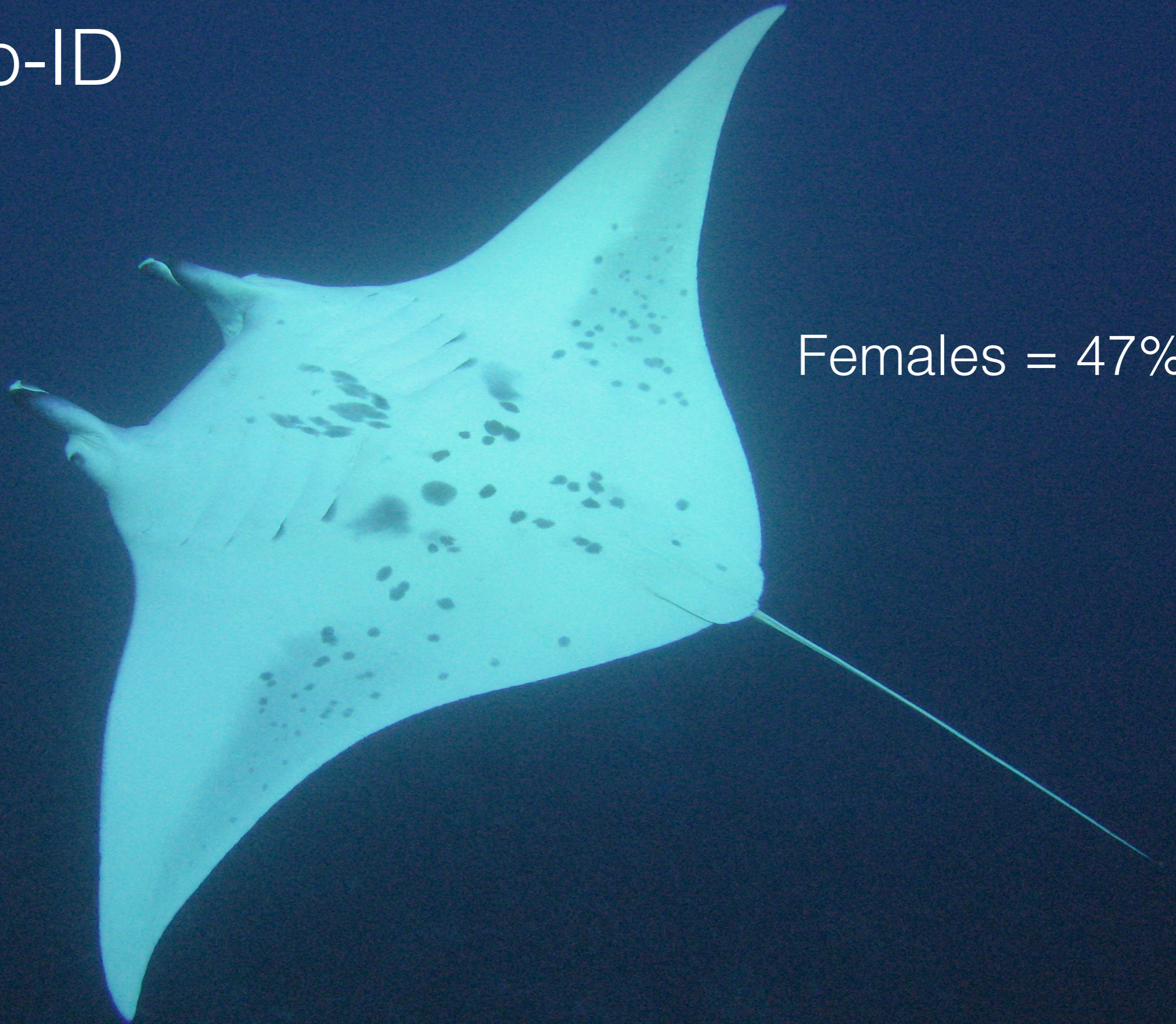
What have we learned?

# Photo-ID



Total Individuals = 499

# Photo-ID



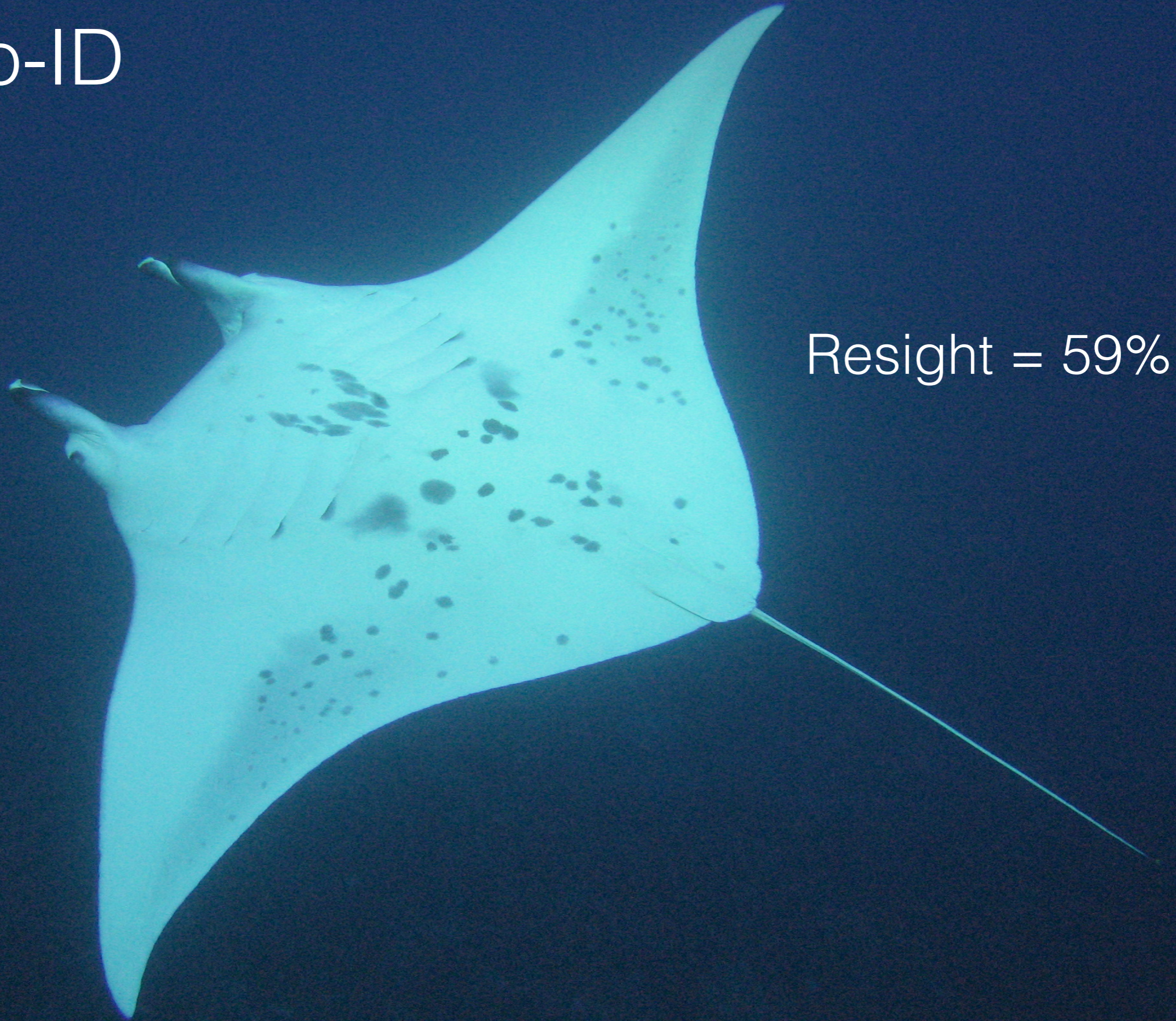
Females = 47%

# Photo-ID

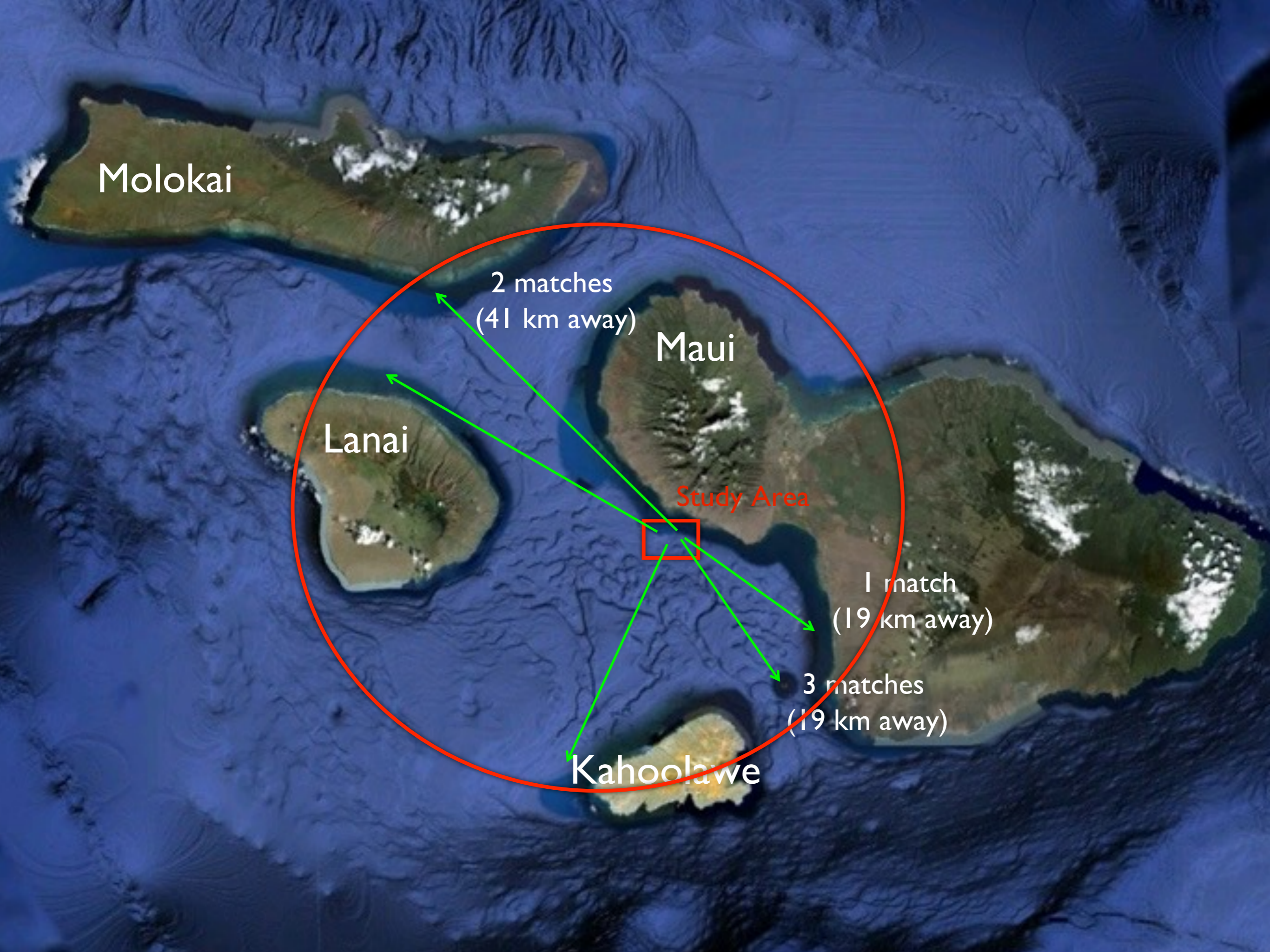


Adults = 64%

# Photo-ID



Resight = 59%



Molokai

2 matches  
(41 km away)

Maui

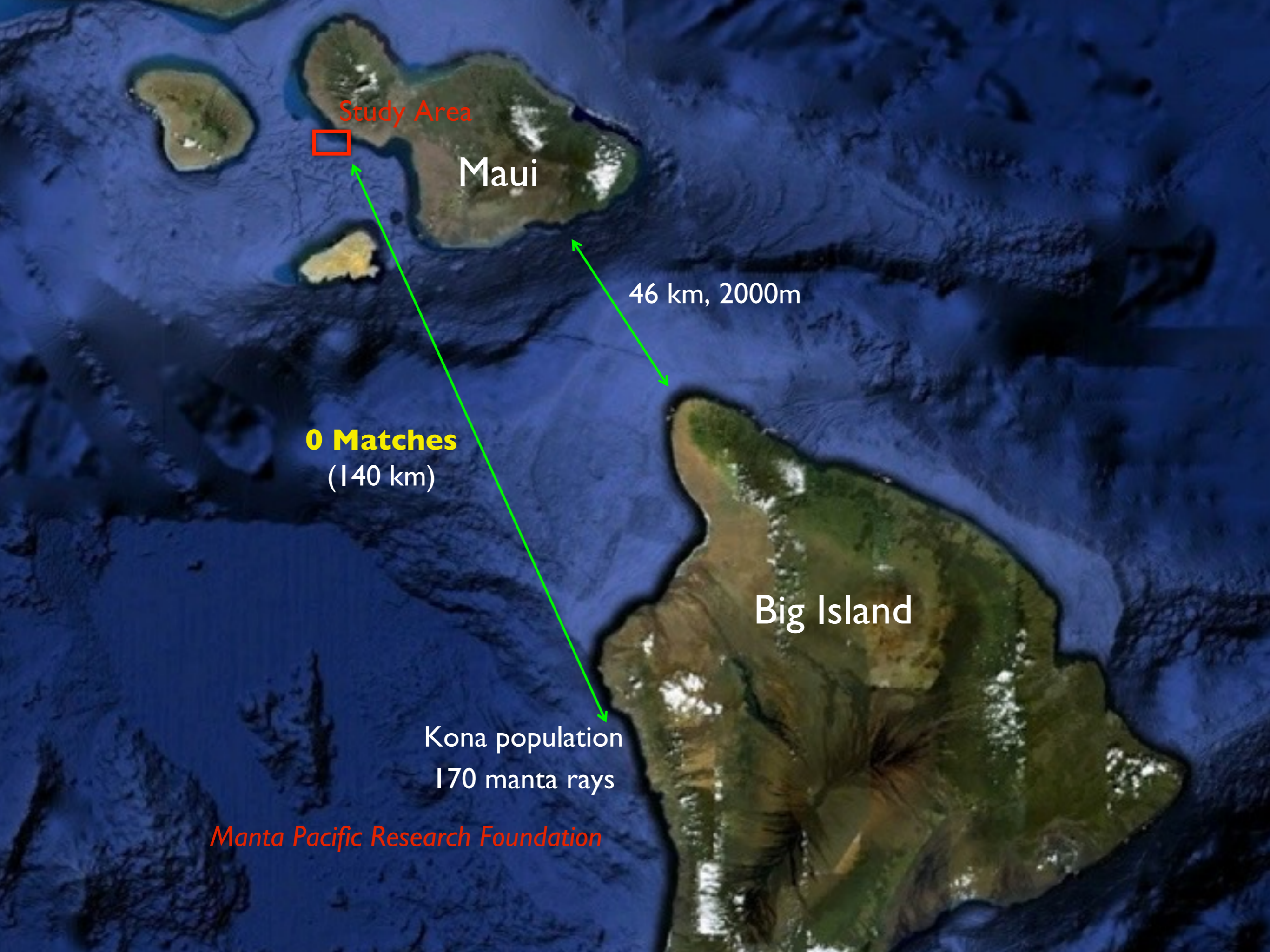
Lanai

Study Area

1 match  
(19 km away)

3 matches  
(19 km away)

Kahoolawe



Study Area



Maui

46 km, 2000m

**0 Matches**  
(140 km)

Big Island

Kona population  
170 manta rays

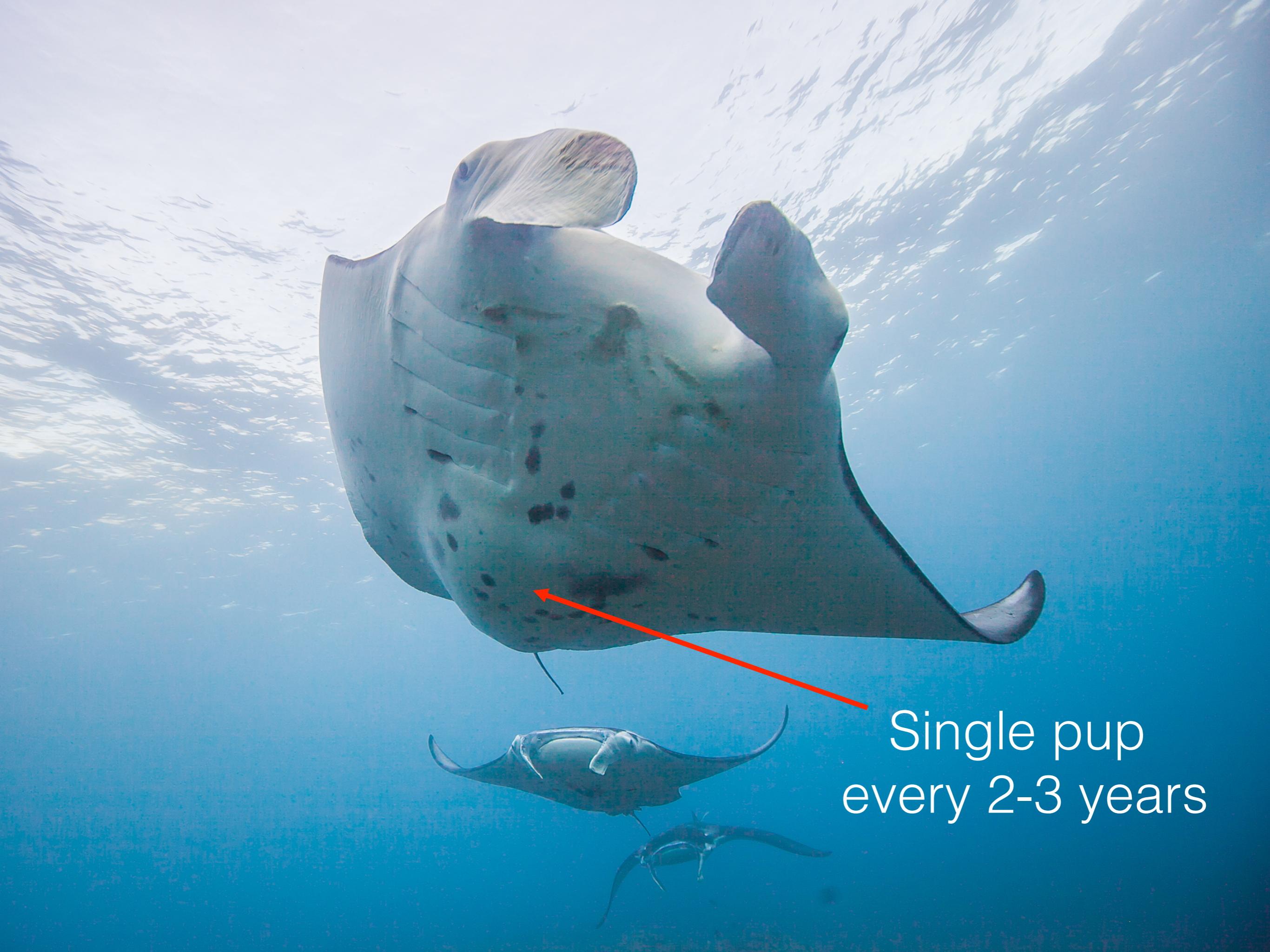
*Manta Pacific Research Foundation*



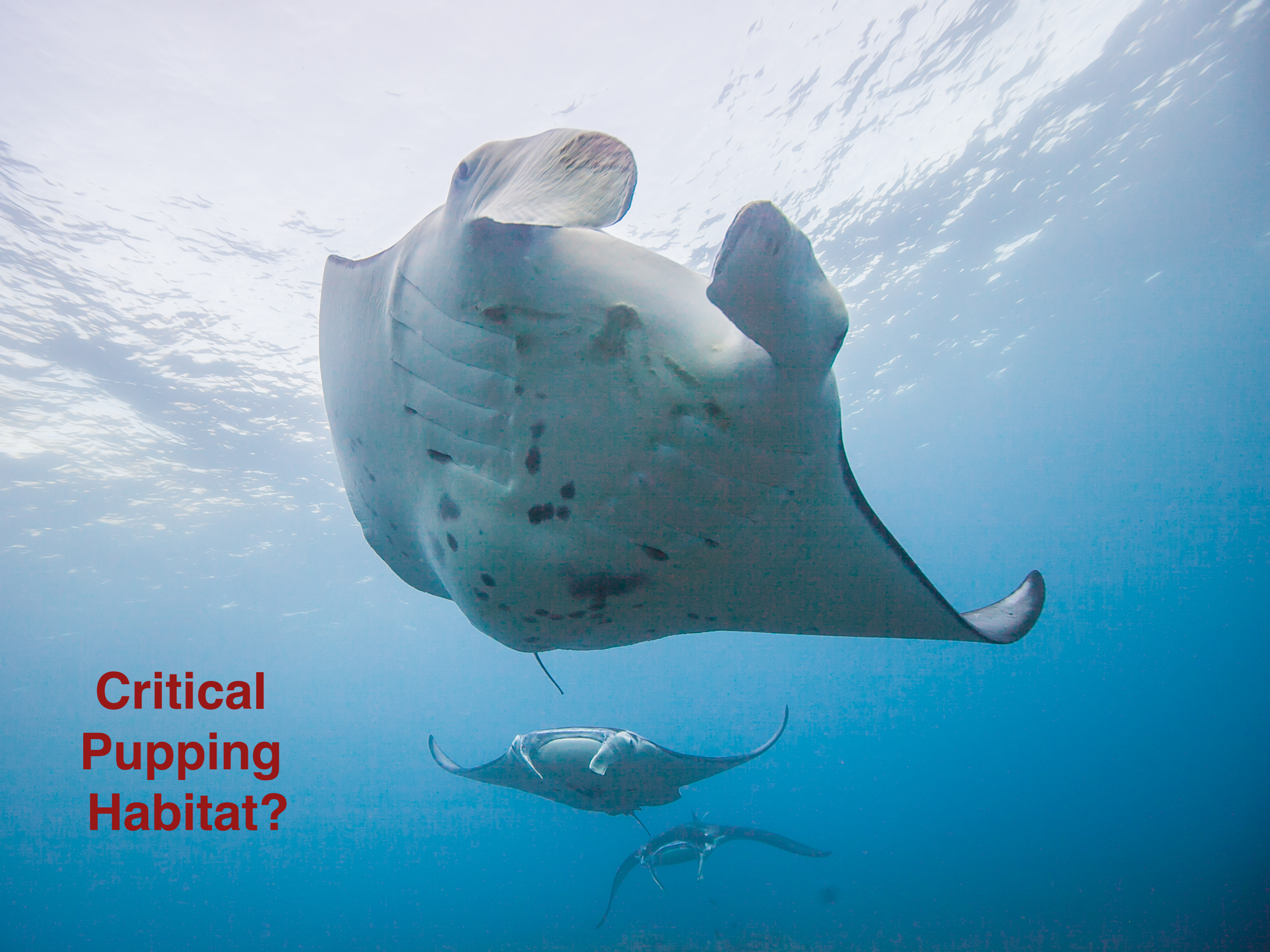
Reproduction



Mating Season  
December - April



Single pup  
every 2-3 years



**Critical  
Pupping  
Habitat?**

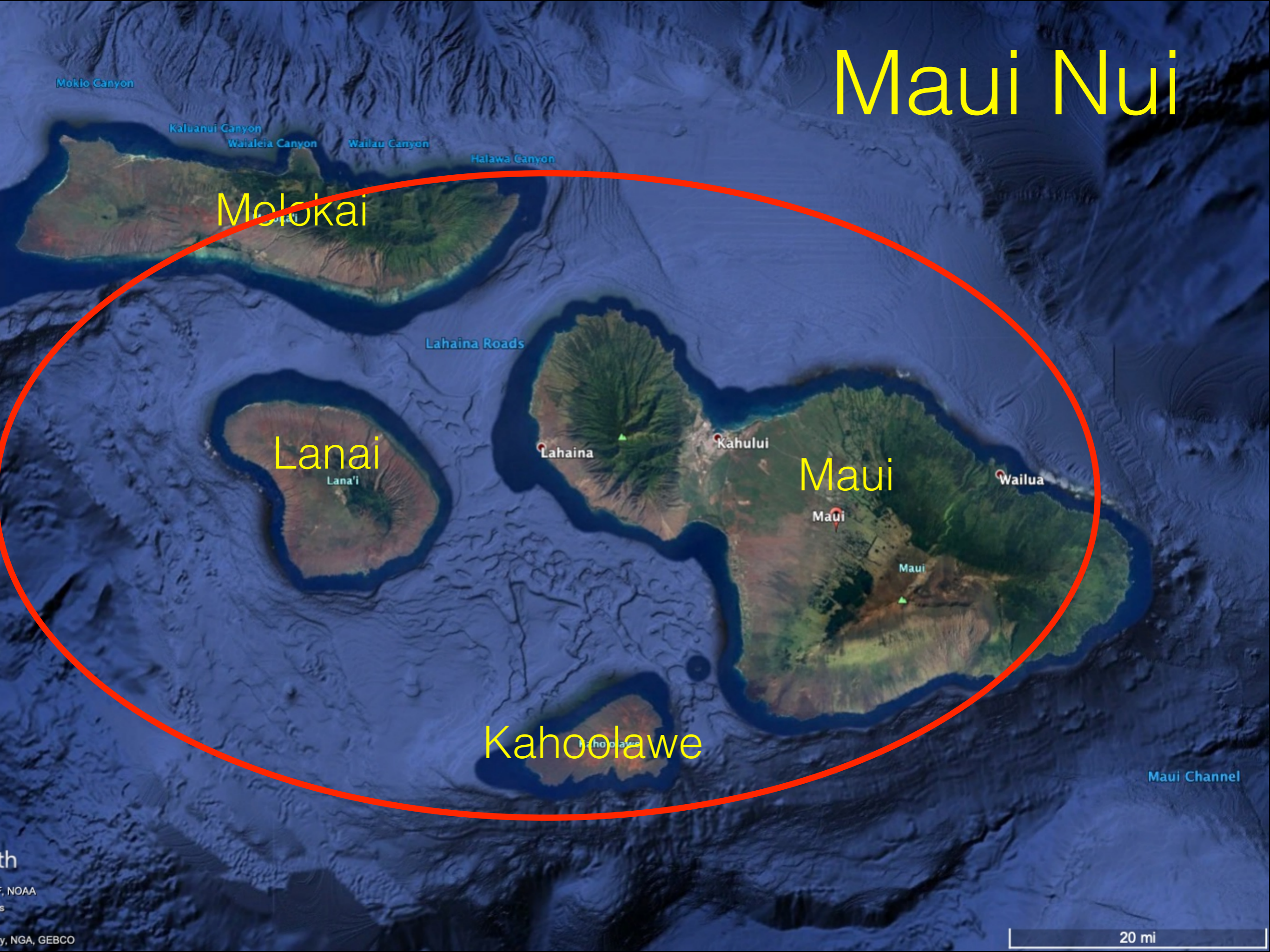
# Satellite Tagging





11 Tags Deployed

# Maui Nui



Molokai

Lanai  
Lana'i

Lahaina

Kahului

Maui

Wailua

Maui

Kahoolawe

Maui Channel

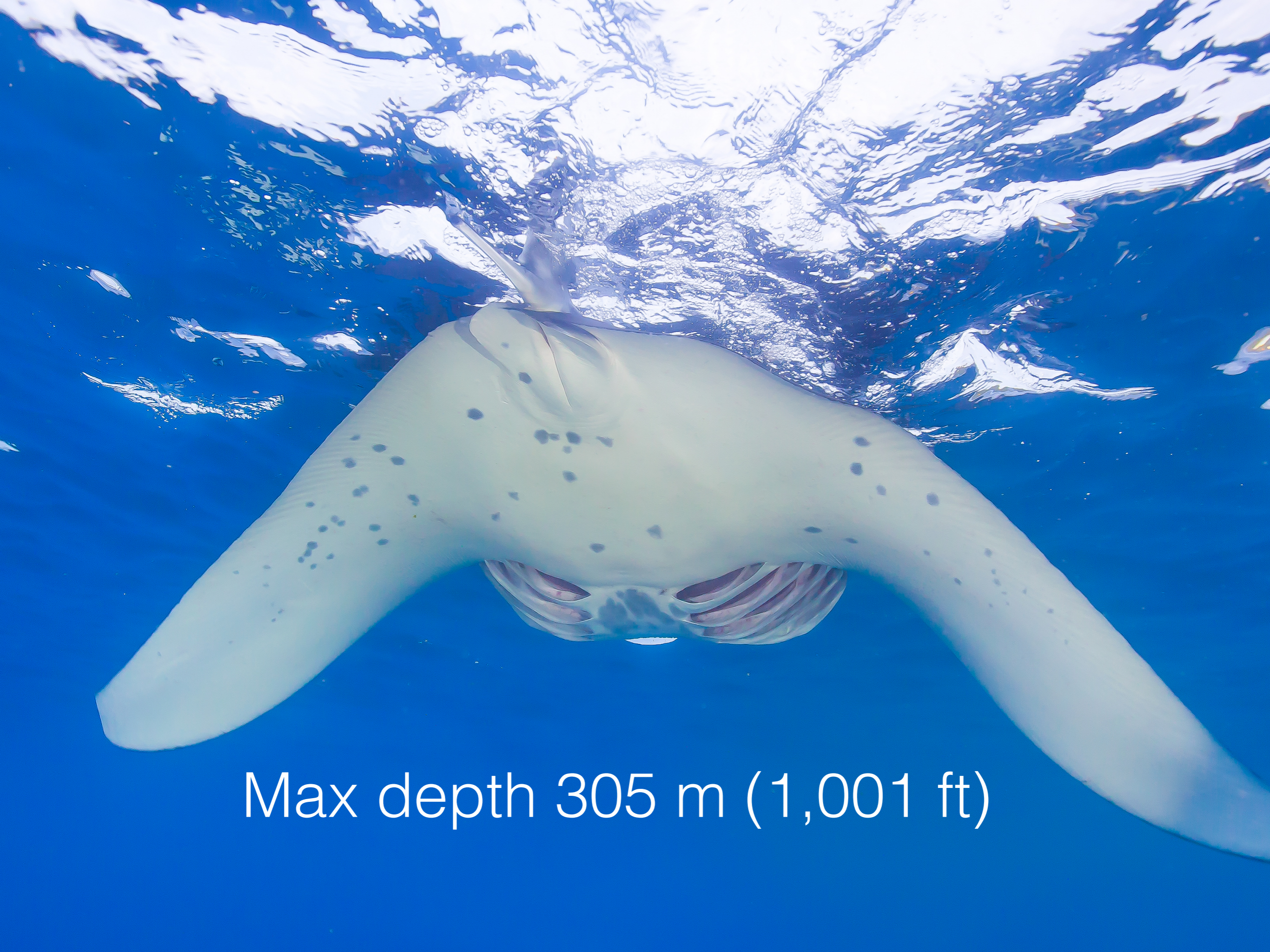
th

, NOAA

s

y, NGA, GEBCO

20 mi



Max depth 305 m (1,001 ft)

# Genetics



# Genetics

Dr. Jonathan Whitney  
*NOAA Marine Ecologist*

Dr. Richard Coleman  
*Ford Found. Post Doc Fellowship*  
*University of Central Florida*



20 samples from Kona  
20 samples from Maui



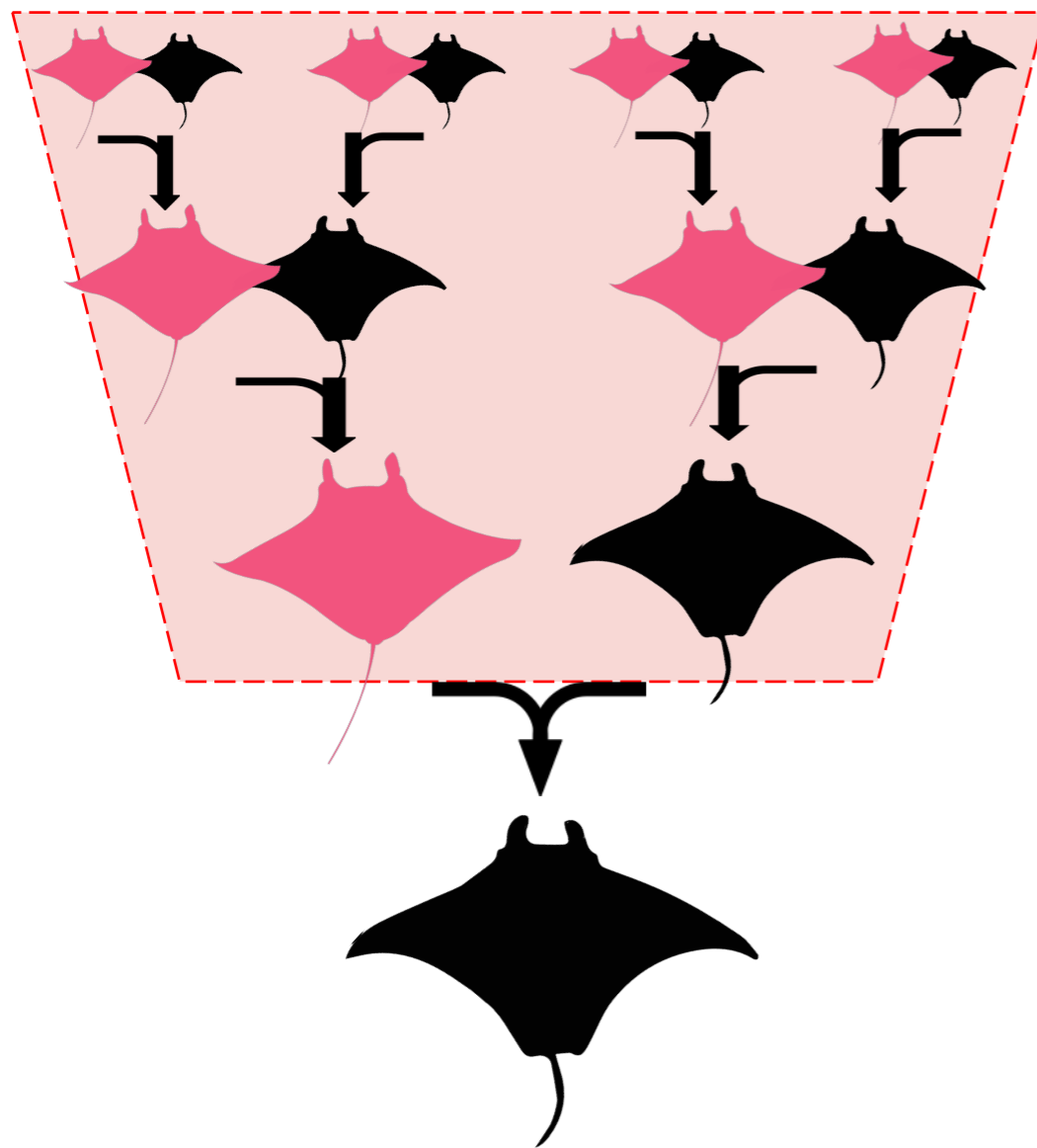
Compared ~459  
random sites on genome



Mom + Dad

### **Nuclear DNA**

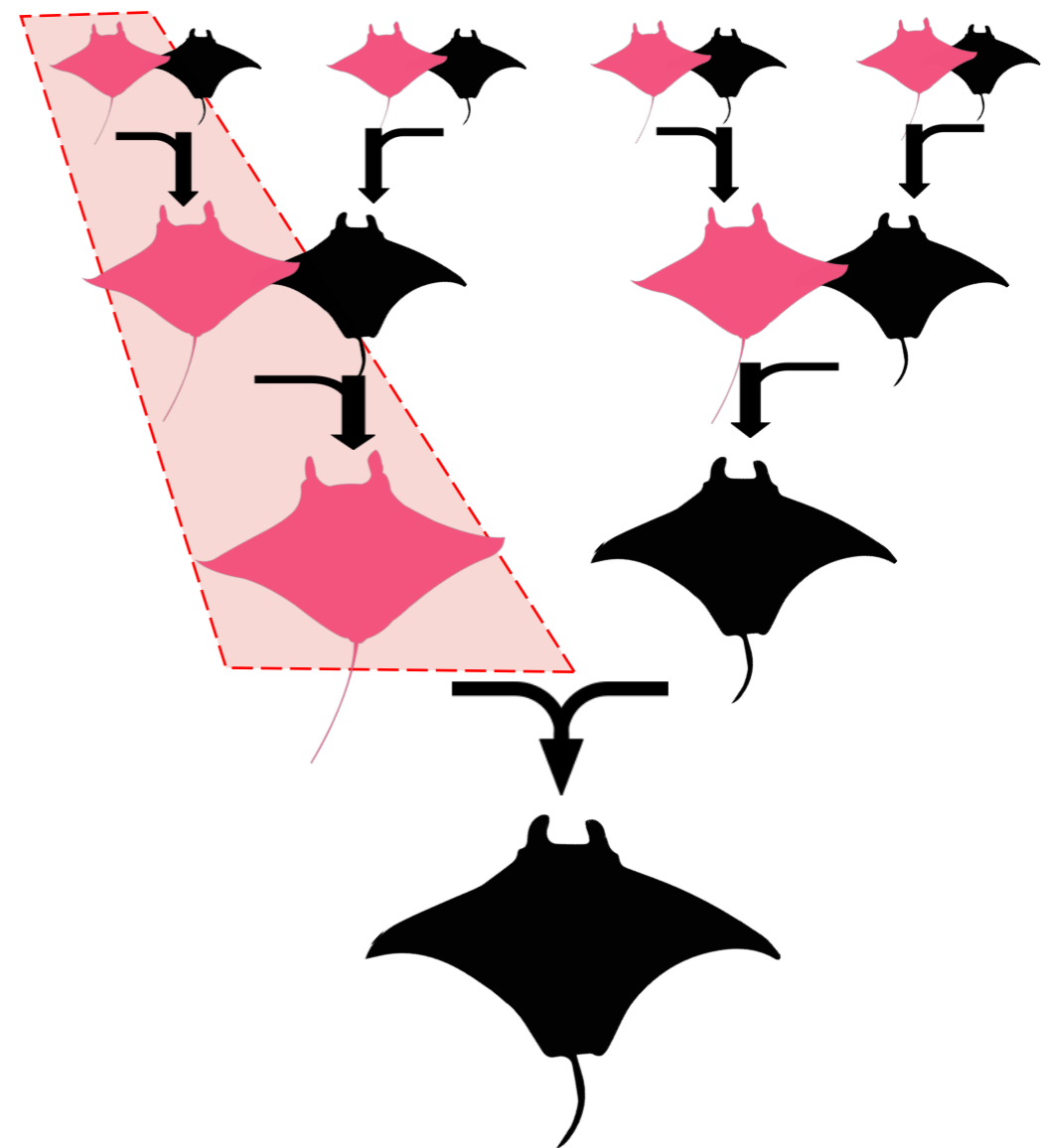
Inherited from **all** ancestors



Mom Only

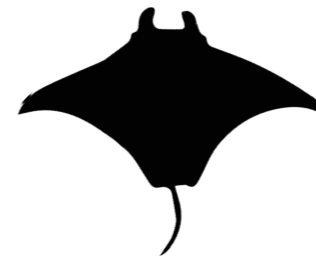
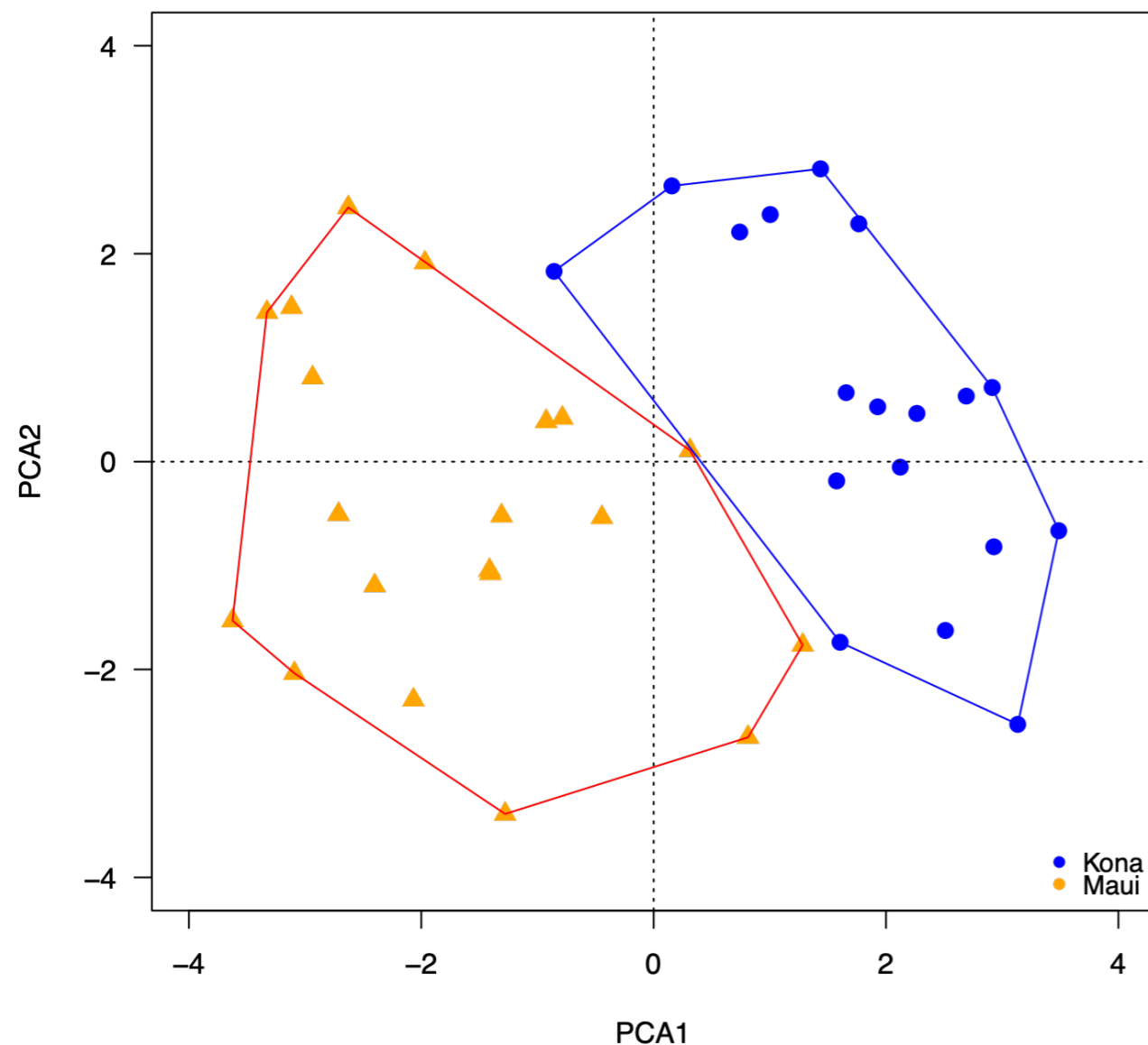
### **Mitochondrial DNA (mtDNA)**

Inherited from a **maternal** lineage



# Maui and Hawaii Islands are distinct genetic stocks

Dataset	Inheritance	$F_{ST}$	P-value
Nuclear	Bi-parental	0.028	$P < 0.001$
Mitochondrial	Maternal	0.499	$P < 0.0001$

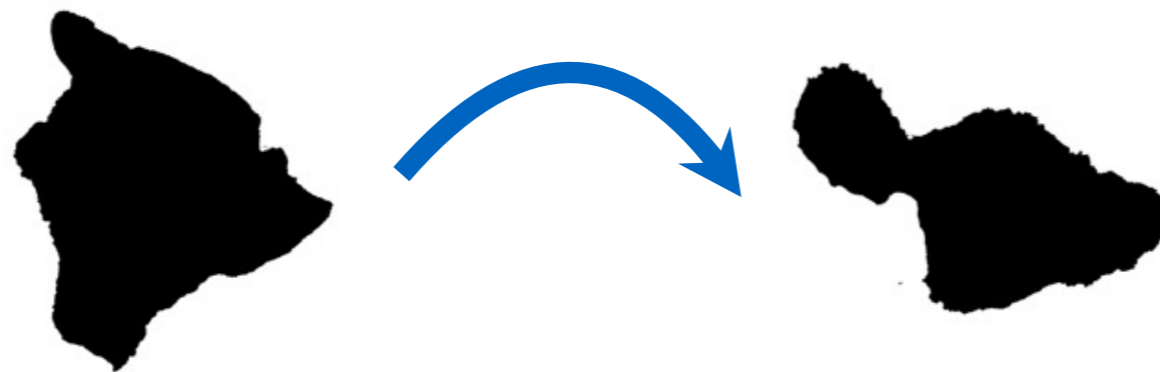
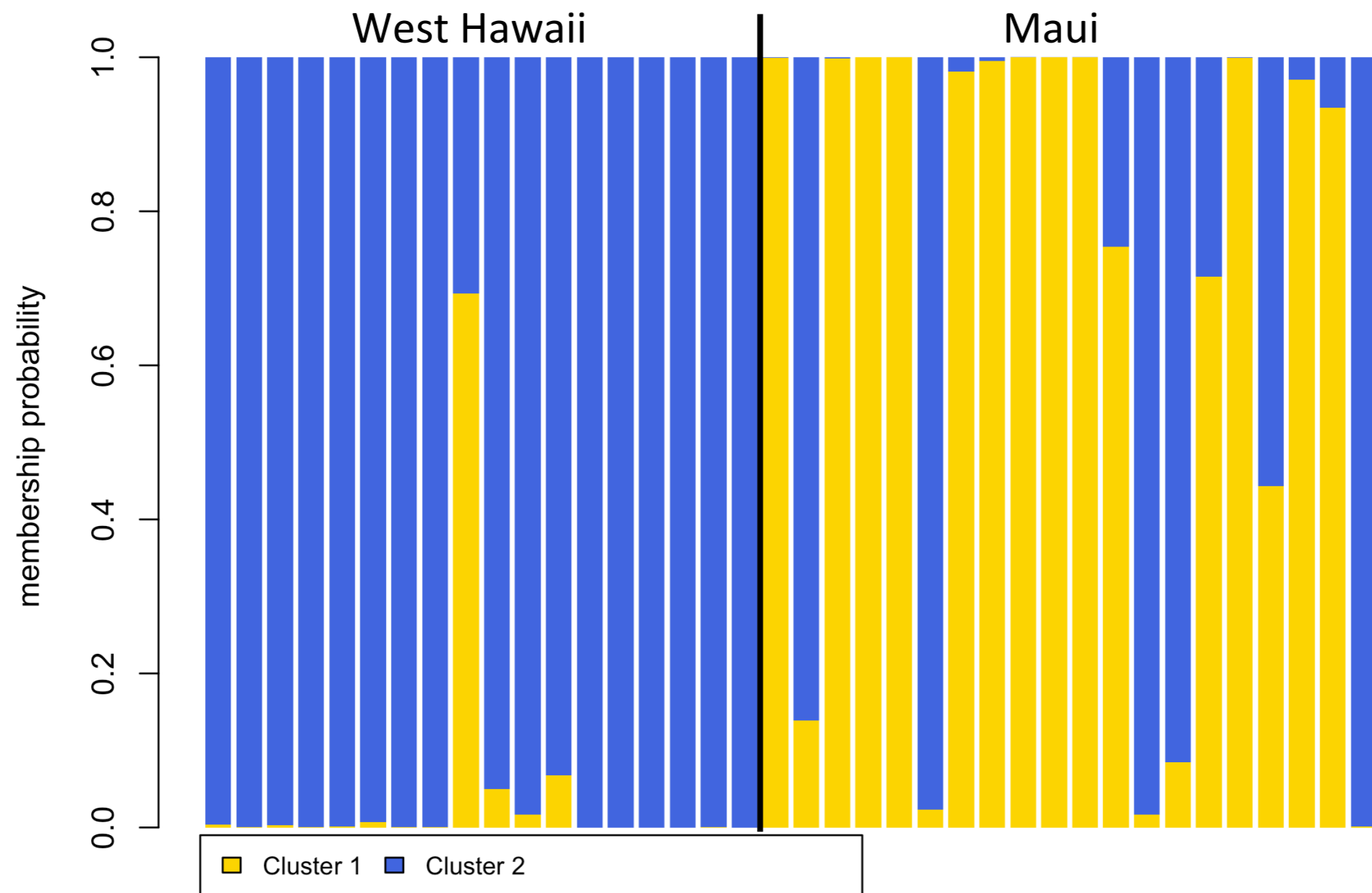


A male may switch islands once every 50 - 150 years



A female may switch islands once every 500 - 1500 years

# Evidence suggests males migrate from West Hawaii to Maui



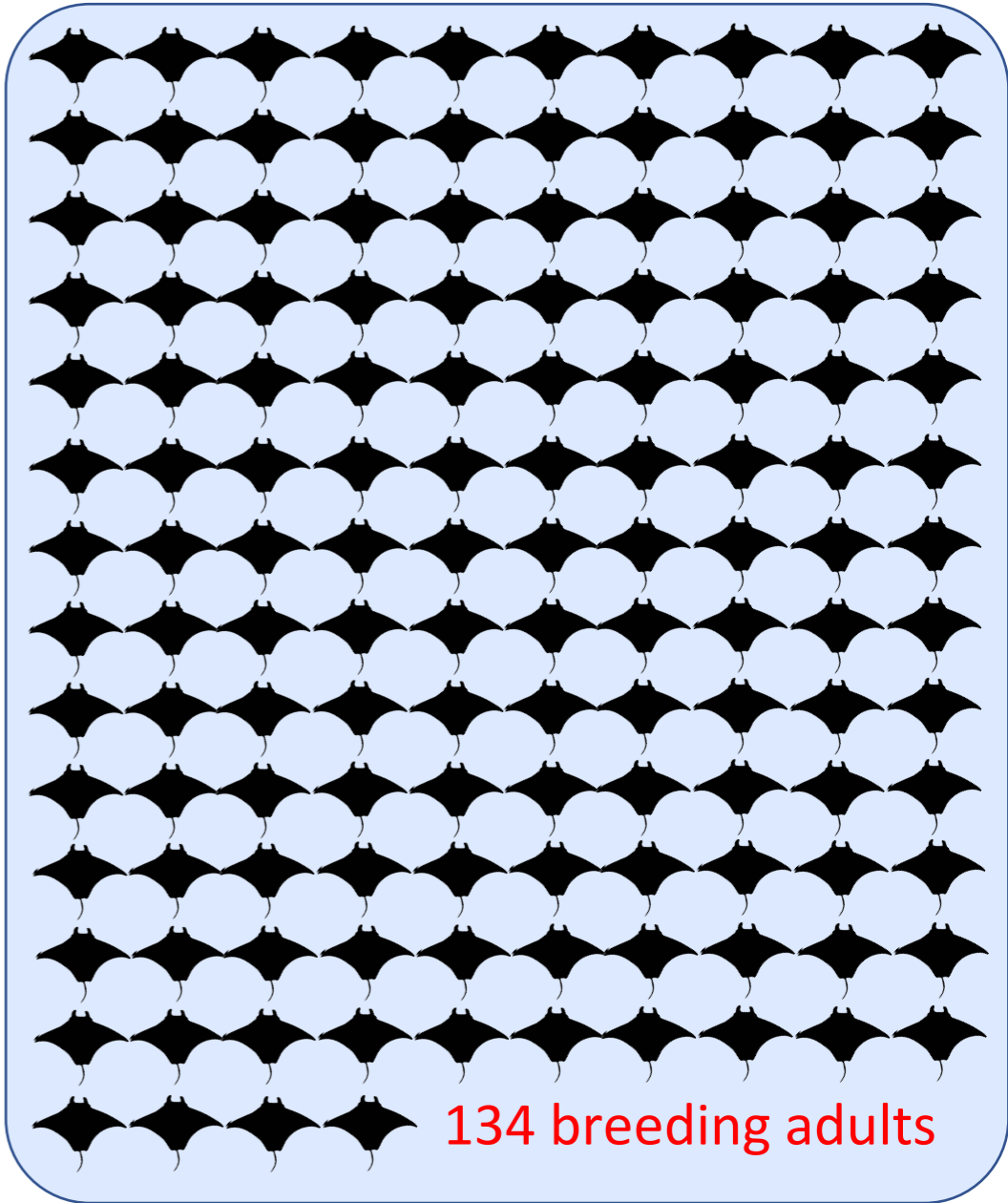
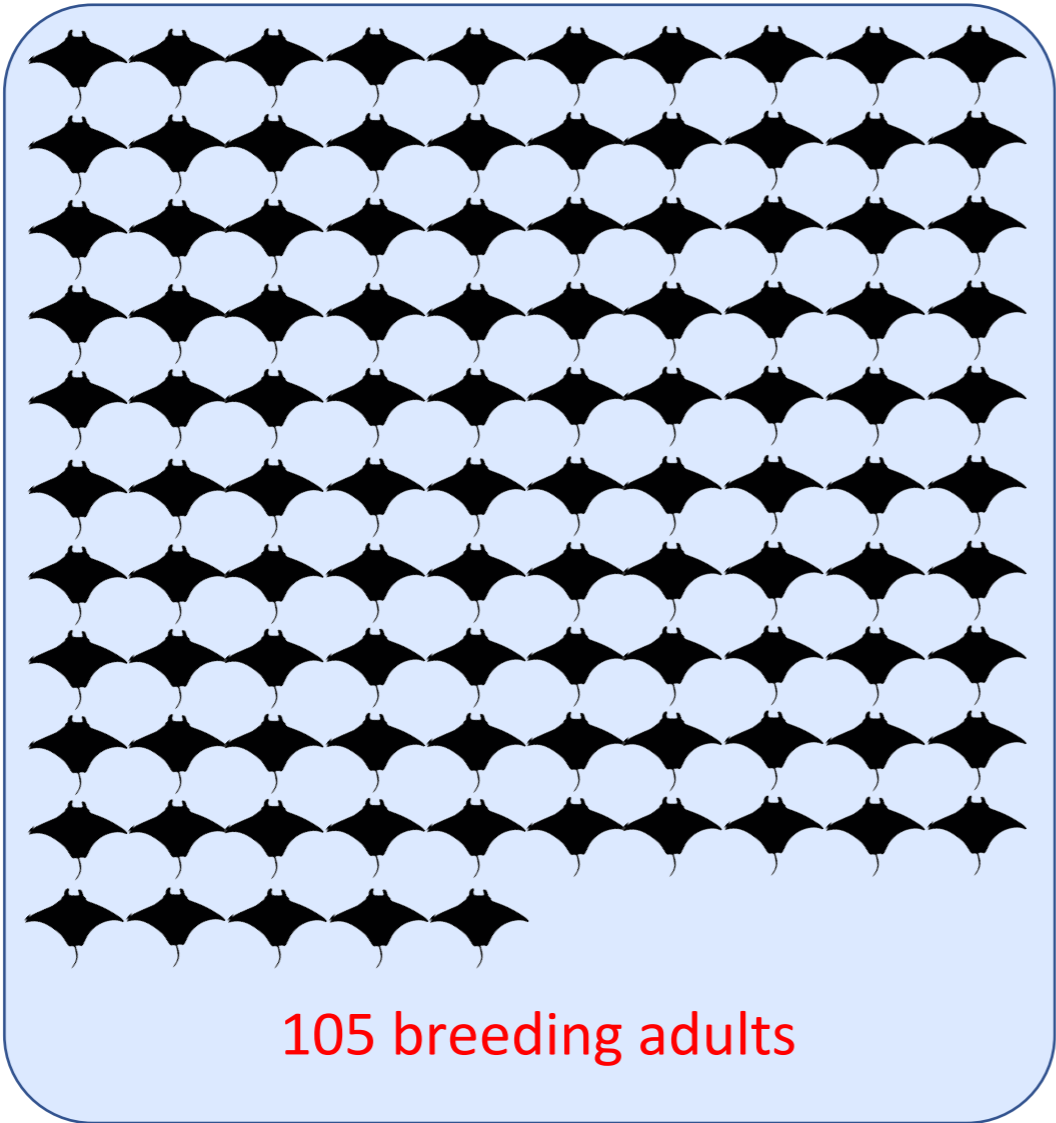
## Results from Adegenet – DAPC – 459 SNPs

# Estimates of Effective Population Size

Island	Effective Population Size ( $N_E$ ) +/- 95% CI	Estimated Population Size
Hawaii	105 (100-111)	~300
Maui	134 (127-142)	~500

Maui estimate

Kona estimate





Tala?

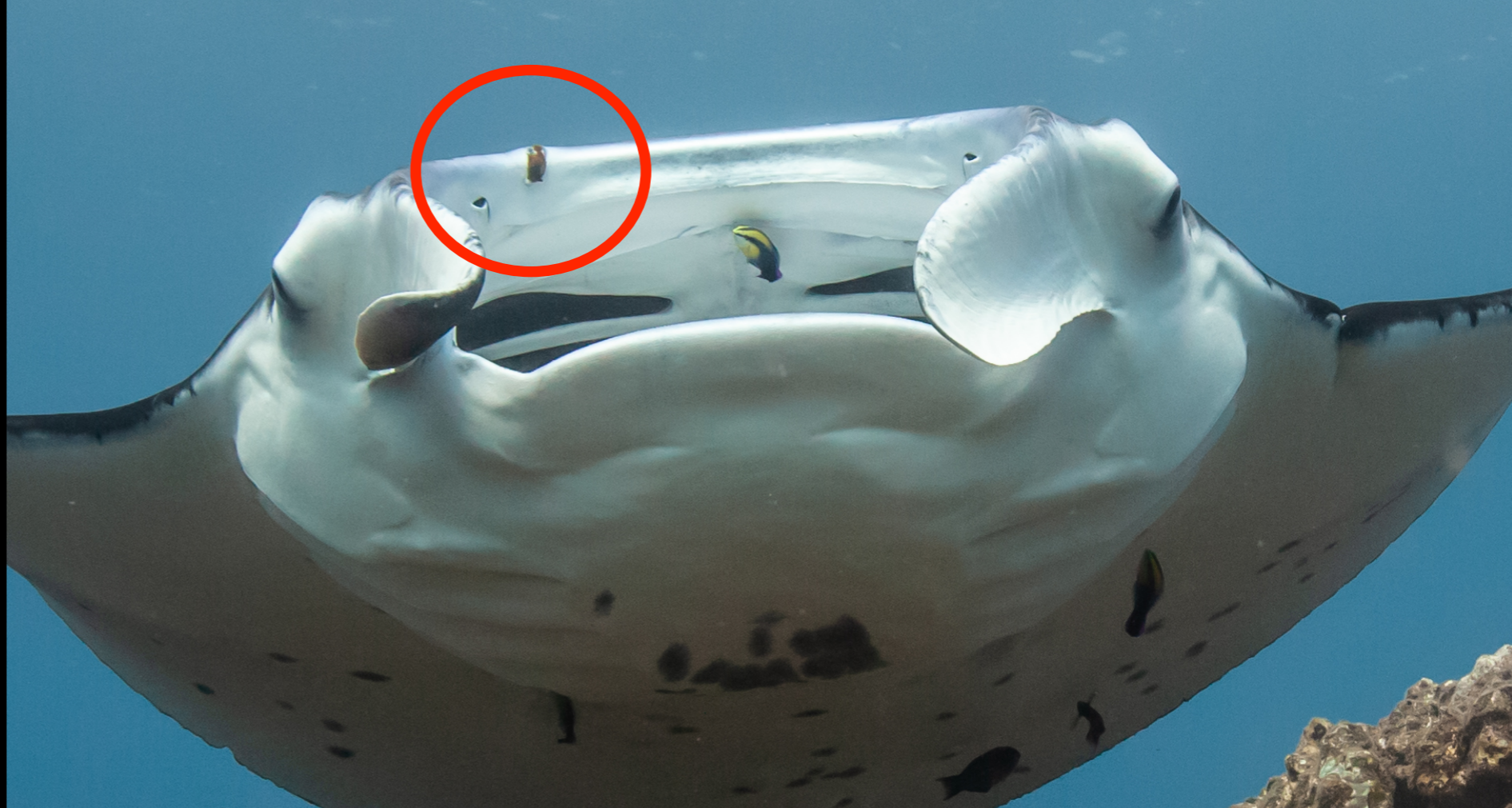


Tala?

May 2019



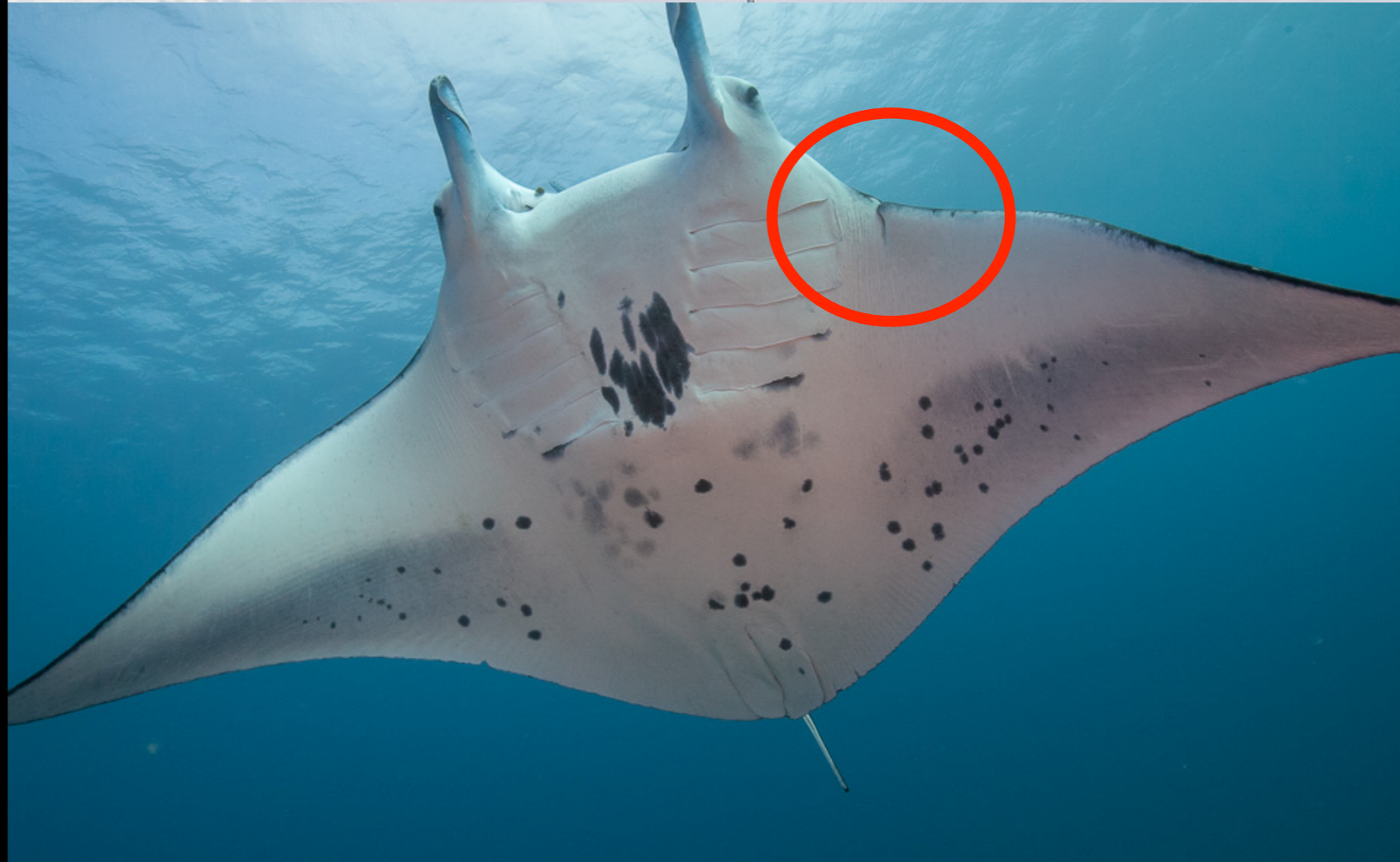
May 2020



June 2018

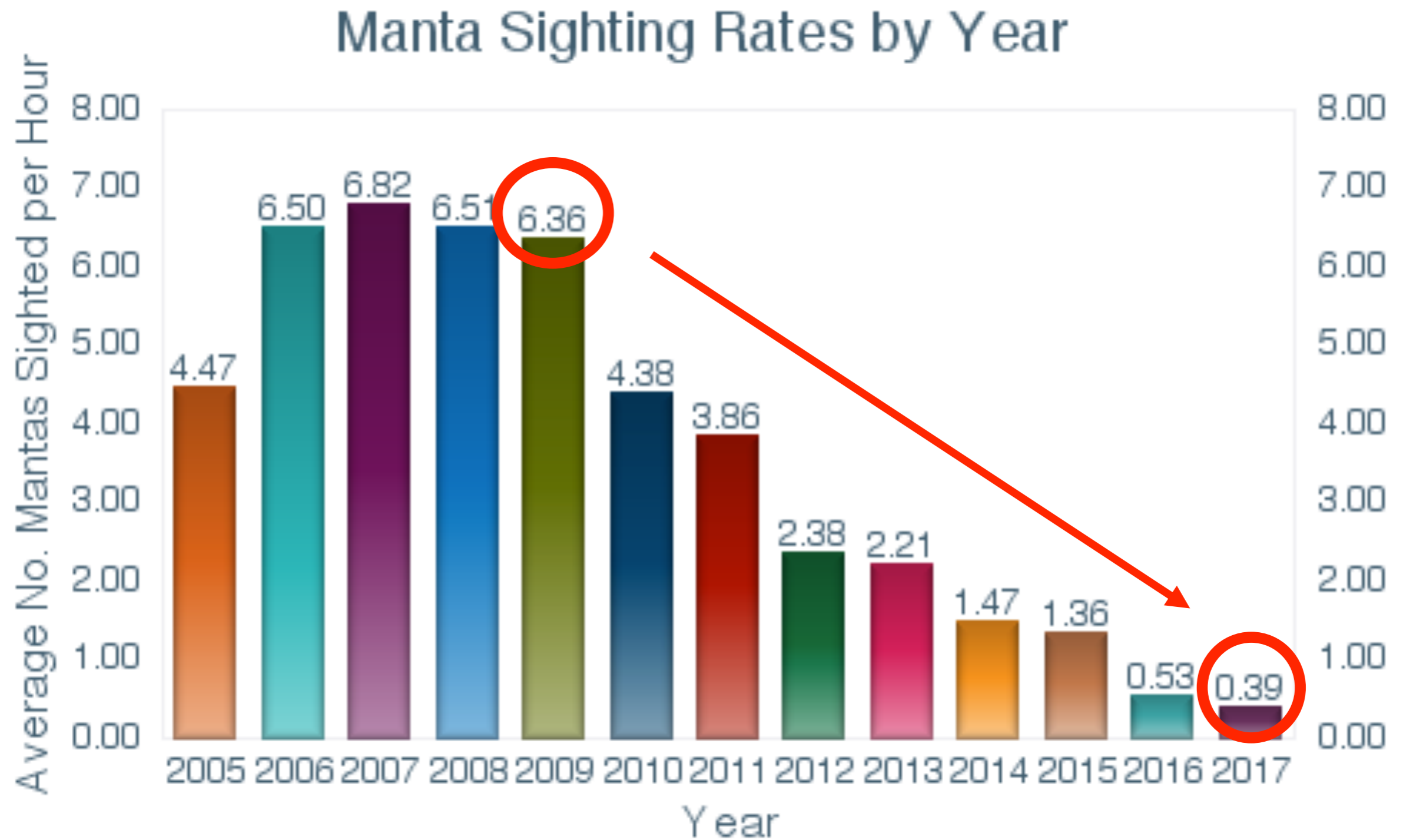


May 2020





# Sighting Rates by Year



Can we ensure Tala's survival?

# Hope?





2020

“Year of Perfect Vision”



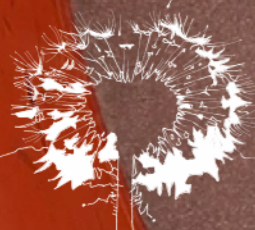
1. Living Buildings
2. Living Products
3. B-Corps



# 1. Living Buildings



BASICS OF THE  
**LIVING BUILDING  
CHALLENGE 4.0**  
A VISIONARY PATH TO A REGENERATIVE  
FUTURE



INTERNATIONAL  
**LIVING FUTURE**  
INSTITUTE<sup>SM</sup>





1. Living Buildings
2. Living Products

# Your Guide to Healthier Products

What if products improved your quality of life and  
helped ecosystems thrive?



## LIVING PRODUCT CHALLENGE<sup>SM</sup> 1.1

A Visionary Path to a  
Regenerative Future



INTERNATIONAL  
LIVING FUTURE  
INSTITUTE™



**Humans use**  
**350 polymers**

**to make**  
**“stuff”**

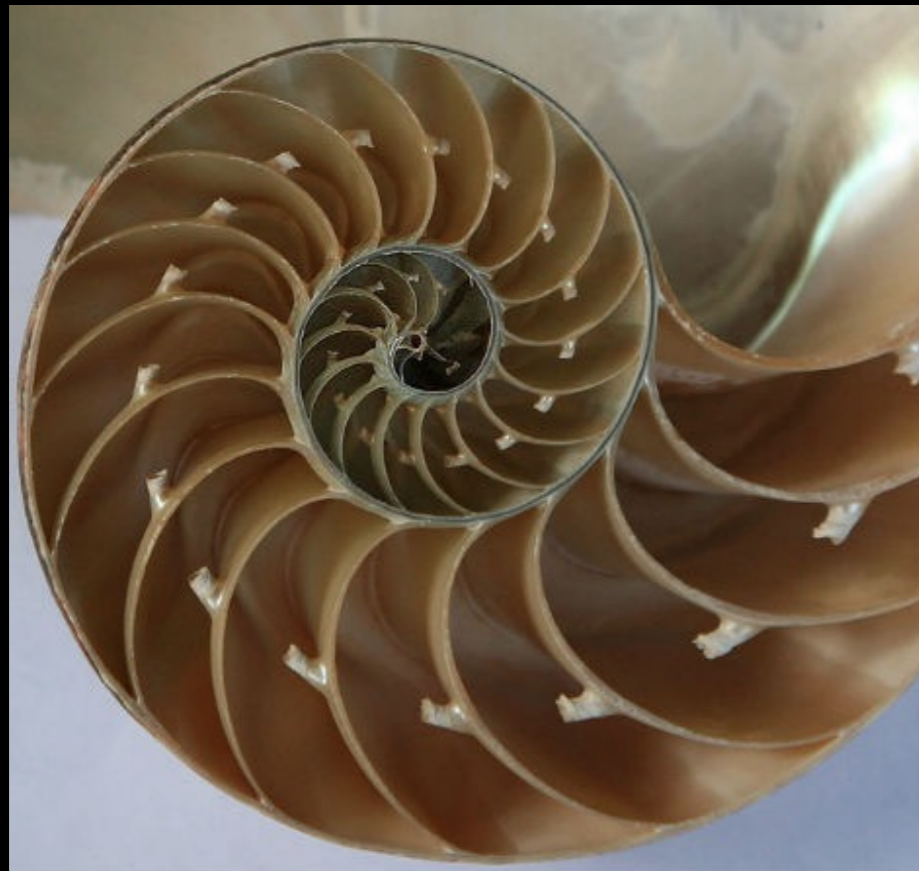


**Heat,**  
**Beat and**  
**Treat**



**Nature uses**

**5**



**3.8 Billion Years of  
Research & Development**

**10-30 Million Species**

A close-up photograph of a young child's face, focusing on the eyes and nose. A vibrant blue butterfly with dark brown and black markings on its wings is perched on the bridge of the child's nose. The child's eyes are wide open, looking directly at the camera. The background is softly blurred, showing more of the child's face and hair.

WHAT CAN WE LEARN  
FROM THE WAY NATURE  
MAKES THINGS?



1. Living Buildings
2. Living Products
3. B-Corps

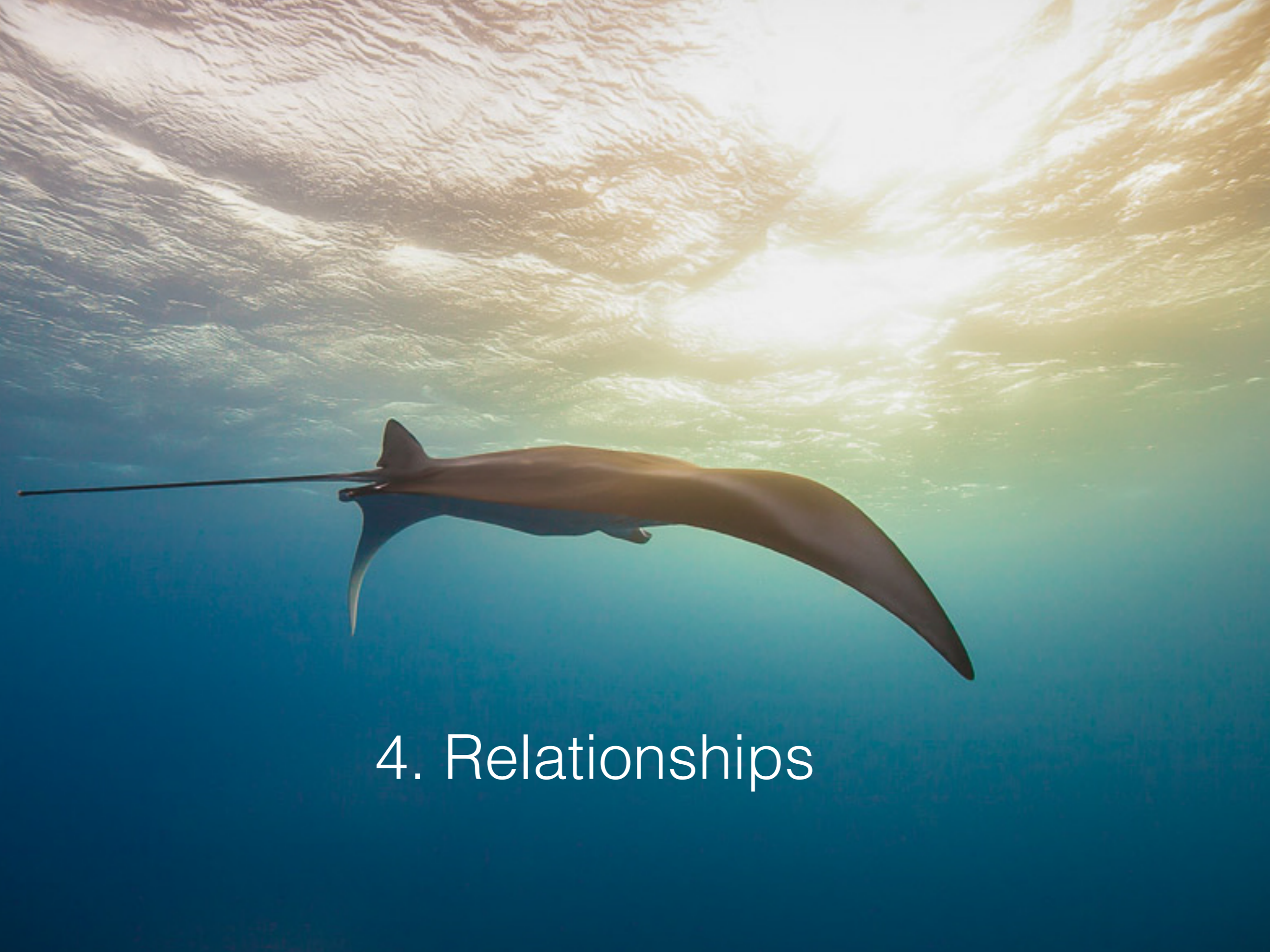


USING  
BUSINESS  
..... AS A .....  
FORCE  GOOD





1. Living Buildings
2. Living Products
3. B-Corps



## 4. Relationships

**724 men  
for 75 years**



What Makes Us Happy,  
According To A 75-Year  
Harvard Study

**724 men  
for 75 years**

**RELATIONSHIPS**

What Makes Us Happy,  
According To A 75-Year  
Harvard Study

Video

There is hope!  
Now let's get  
to work!

Mark Deakos, *Ph.D*  
Executive Director  
[deakos@hawaii.edu](mailto:deakos@hawaii.edu)



*Hawaii Association for Marine Education and Research, Inc*





*Categorized* | **News**

## Manta ray protection bill becomes law

Posted on June 8, 2009. Tags: [dlnr](#), [manta ray](#), [rep. denny coffman](#)



*A new law protects manta rays in Hawaii waters and sets monetary penalties for killing or capturing them. (Photo courtesy of Wayne Burger/www.jacksdivinglocker.com)*

## PROTECTED RESOURCES REGULATIONS AND ACTIONS

# Final Rule to List the Giant Manta Ray as Threatened Under the Endangered Species Act

[Final Rule](#) | [National](#)

## Overview

**Authority**

Endangered Species Act

**Action Status**

Final Rule

**Effective**

02/21/2018

**Affected Species**[Giant Manta Ray](#)

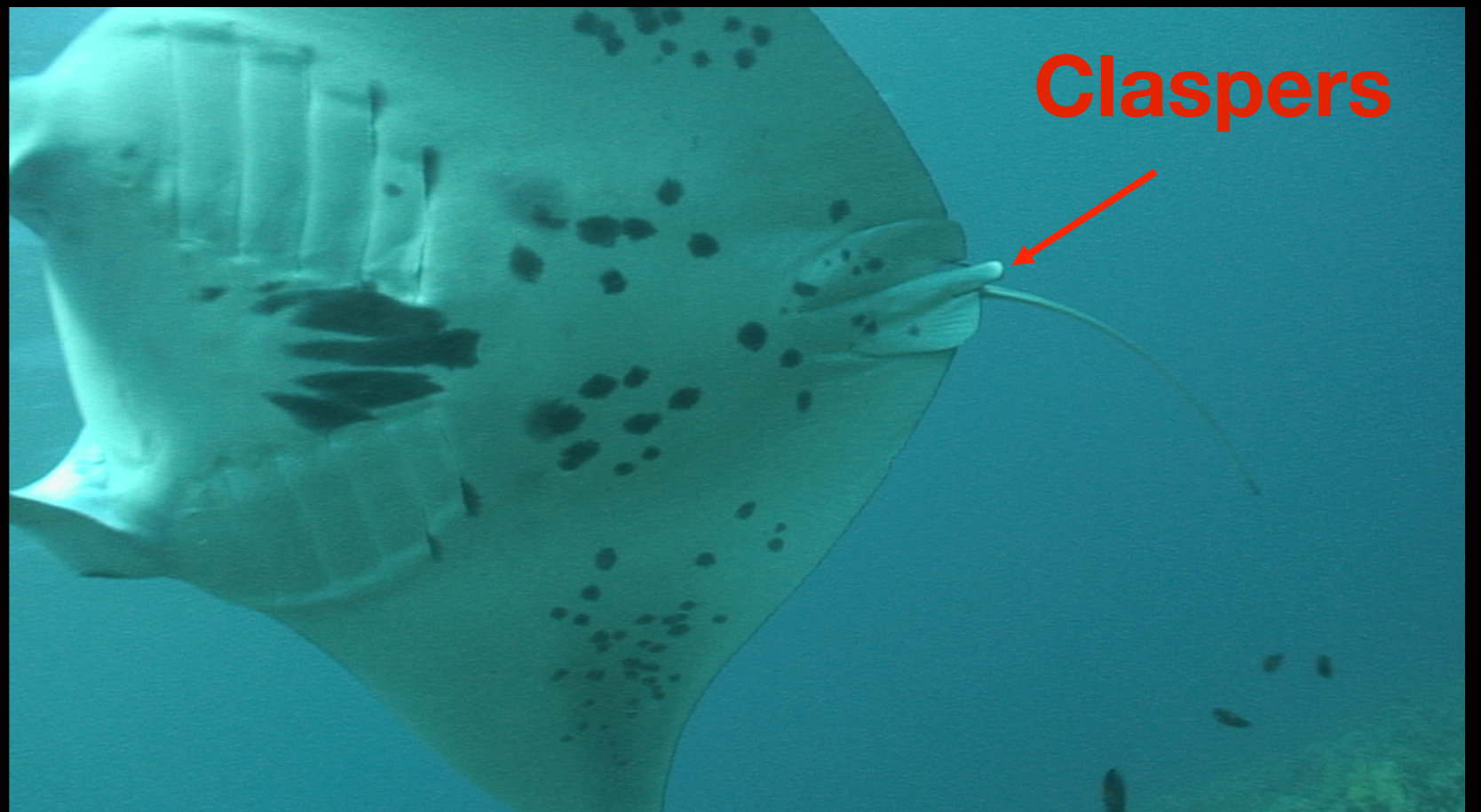
## Summary

We, NMFS, announce a final rule to list the giant manta ray (*Manta birostris*) as threatened under the Endangered Species Act. We have reviewed the status of the giant manta ray, including efforts being made to protect this species, and considered public comments submitted on the proposed rule as well as new information received since publication of the proposed rule. We have made our final determinations based on the best scientific and commercial data available. At this time, we conclude that critical habitat is not determinable because data sufficient to perform the required analyses are lacking; however, we solicit information on habitat features and areas in U.S. waters that may meet the definition of critical habitat for the giant manta ray.

## Federal Register

- [Final Rule \(83 FR 2916, January 22, 2018\)](#)
- [Proposed Rule \(82 FR 3694, January 12, 2017\)](#)
- [90-day Finding \(81 FR 8874, February 23, 2016\)](#)

Male

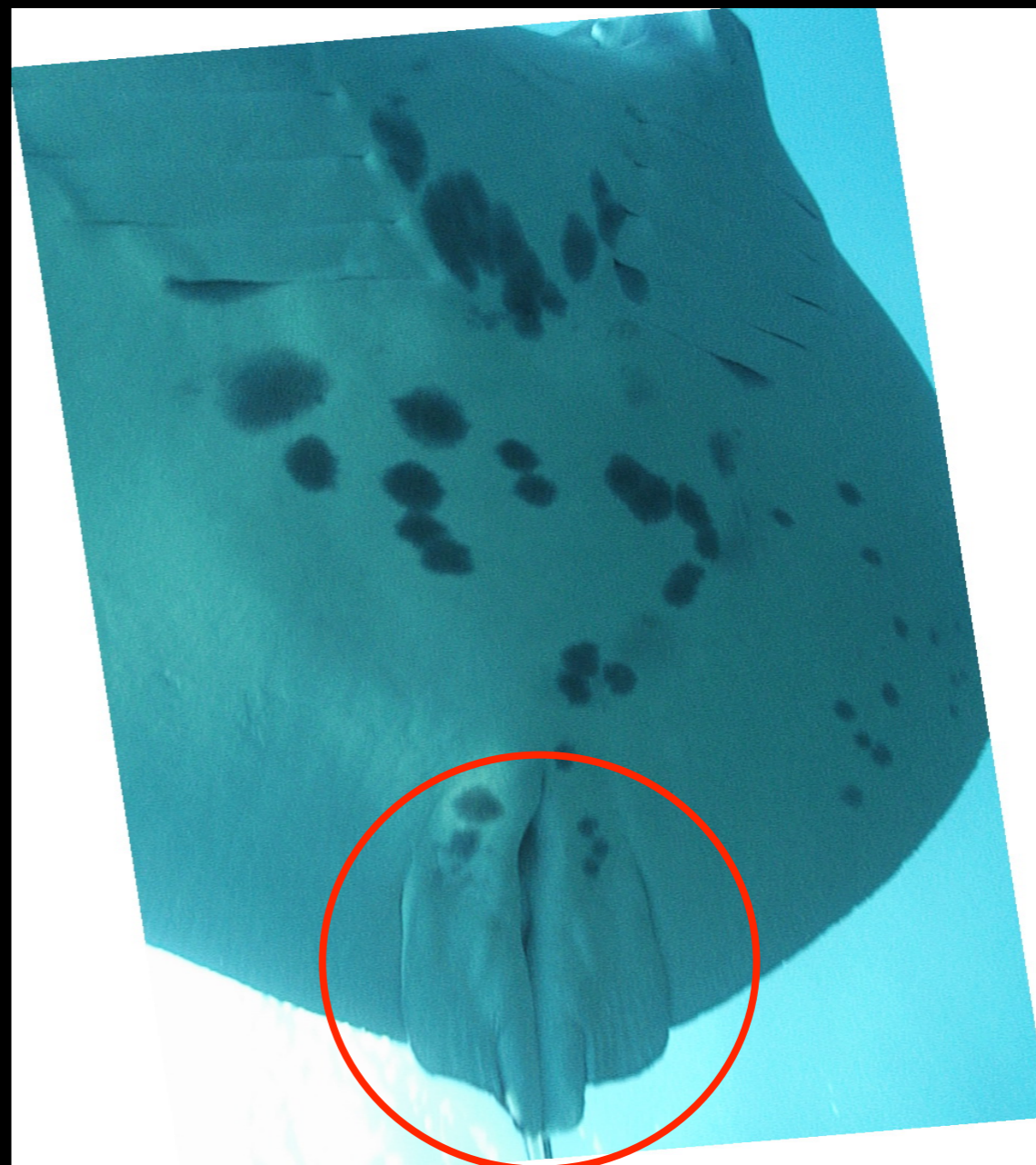


Female



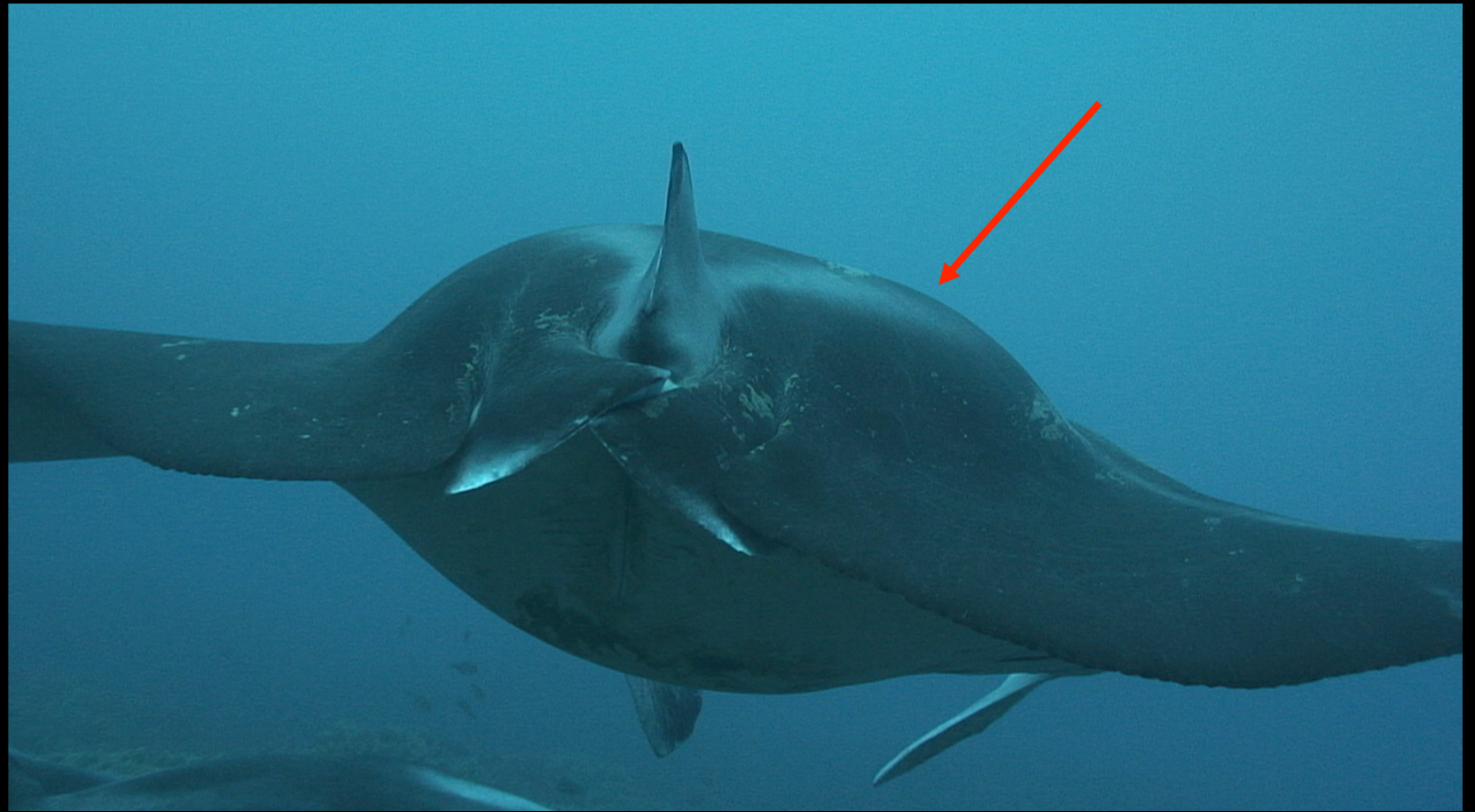


Immature male



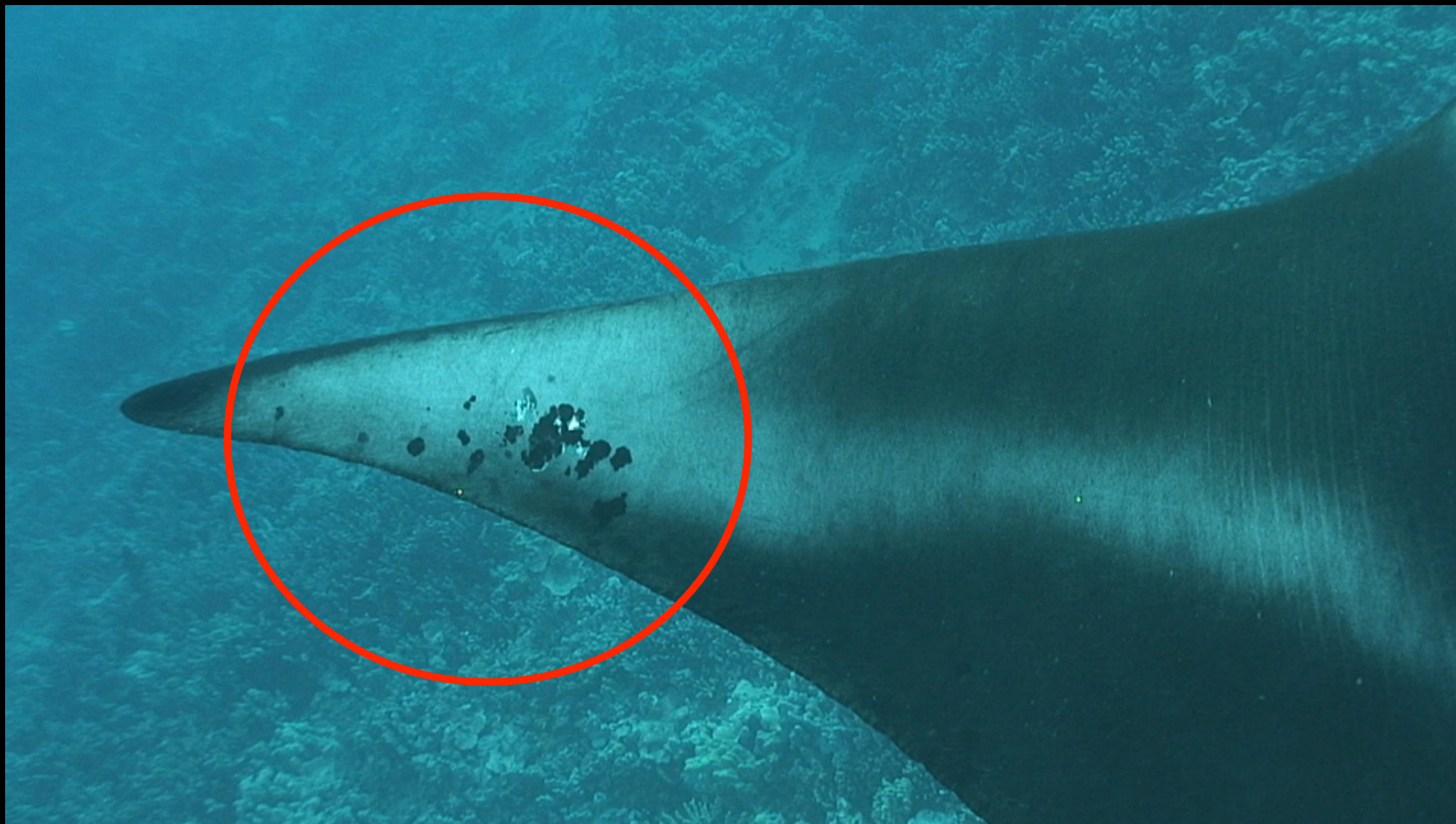
Mature male

Pregnant



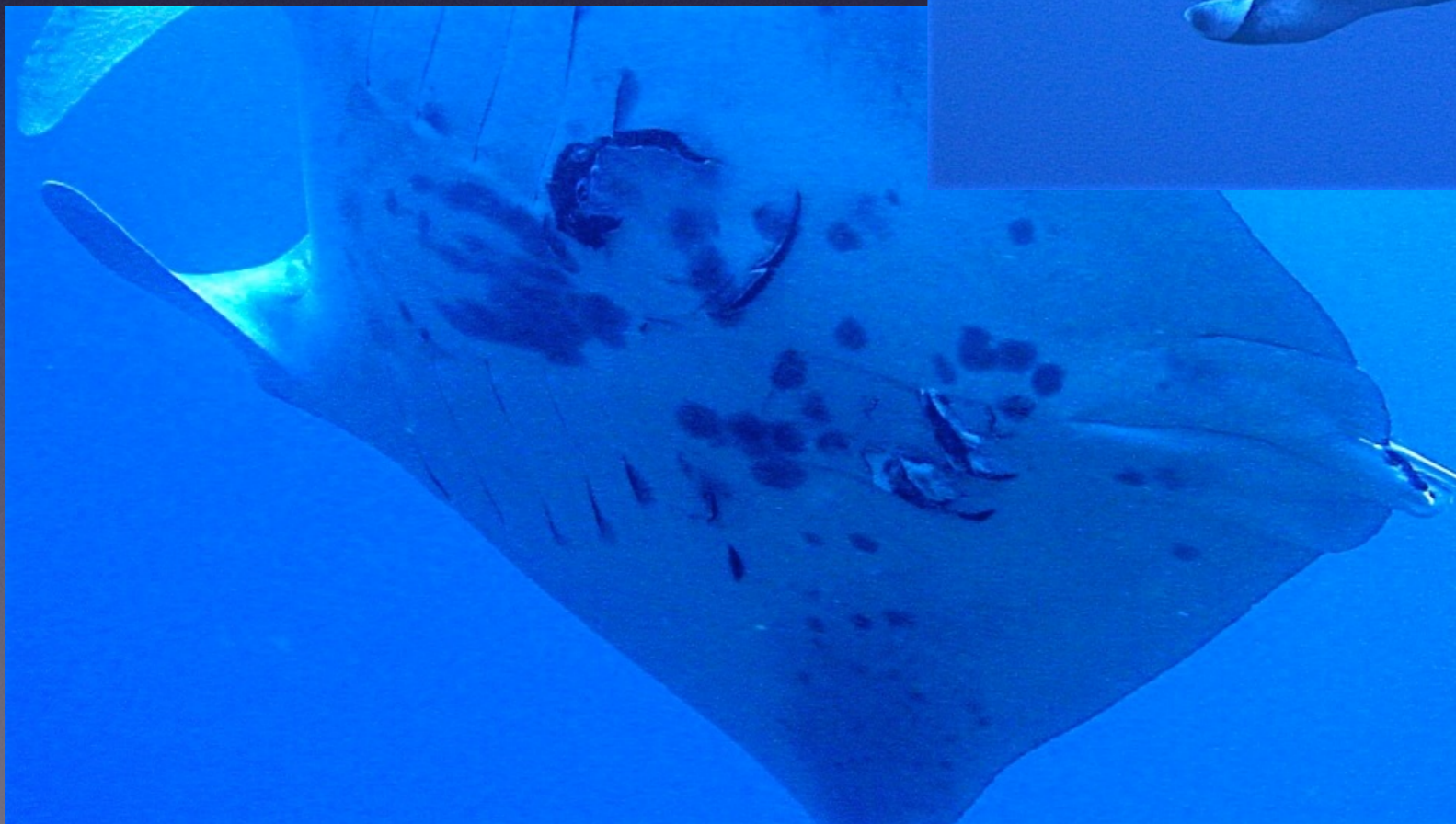
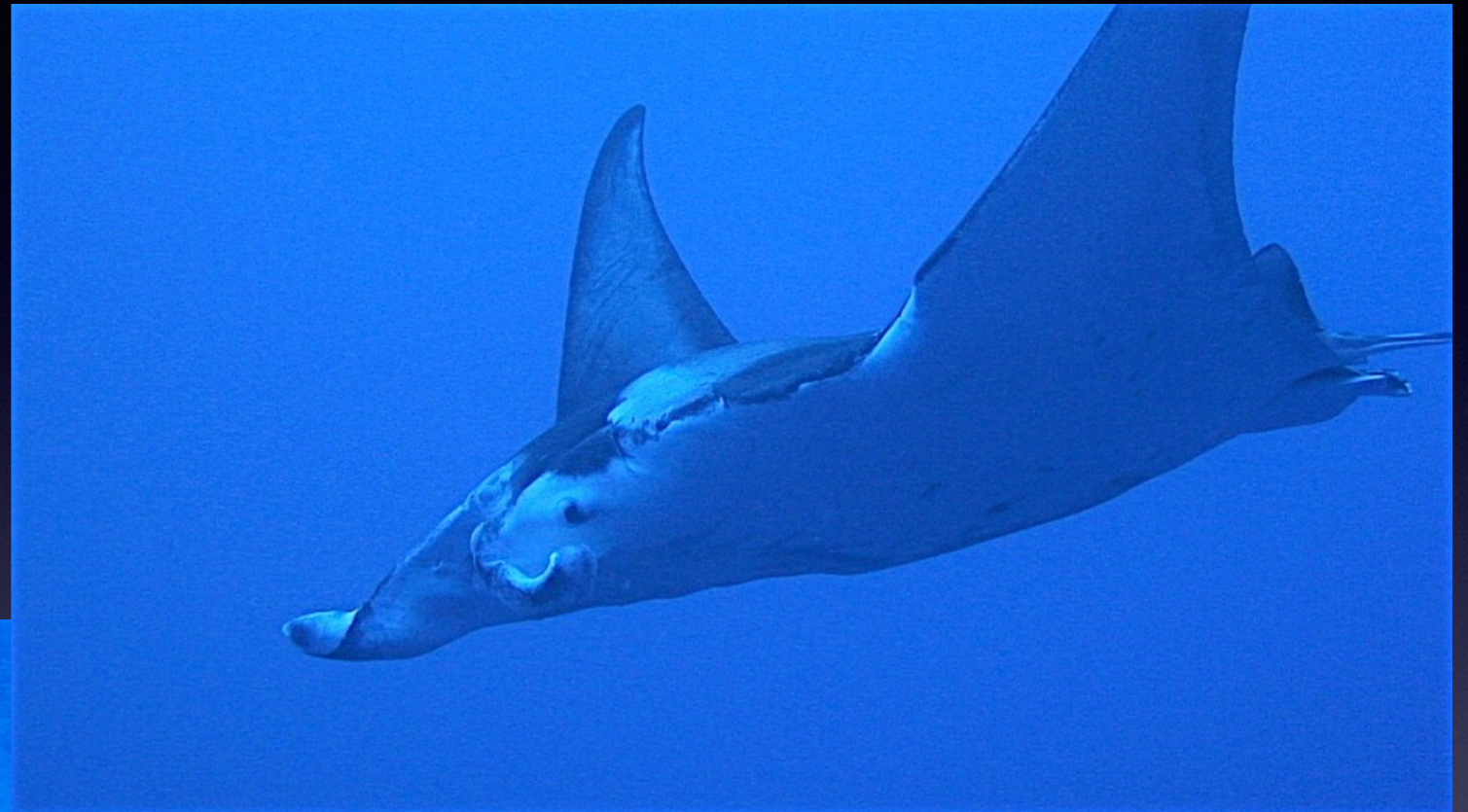
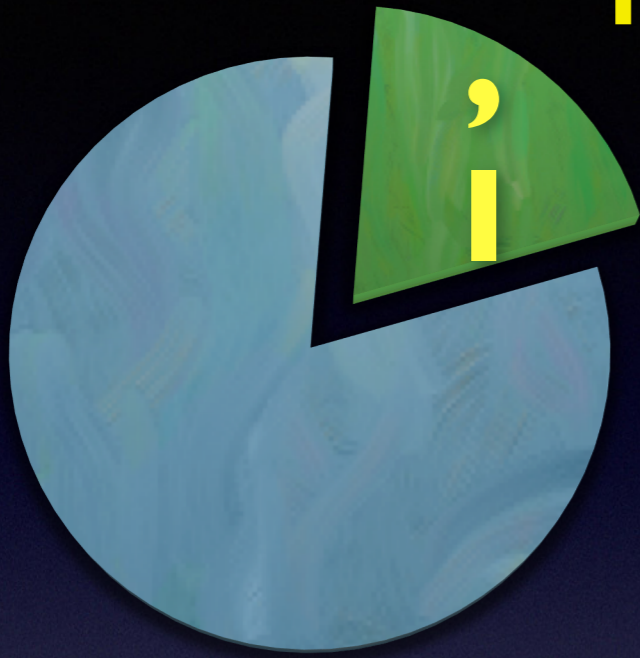
Nuclear Female in  
Mating Train





Mating Scars

# Natural Threats





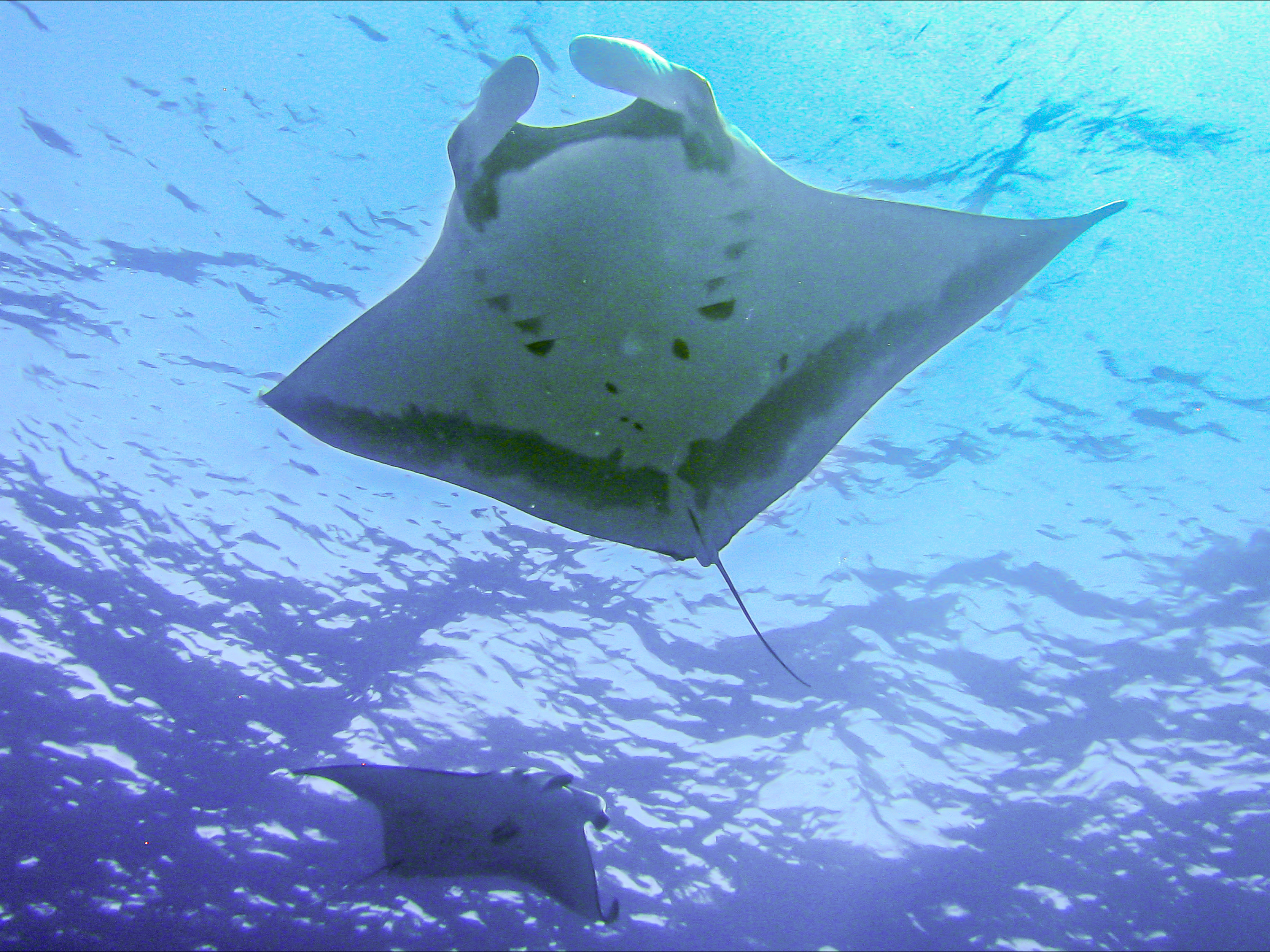
Size

Females 15% larger  
up to 3.7 m (12.1 ft)



Size

Females mature at 3.3 m (10.8 ft)  
Males mature at 2.7 m (8.9 ft)





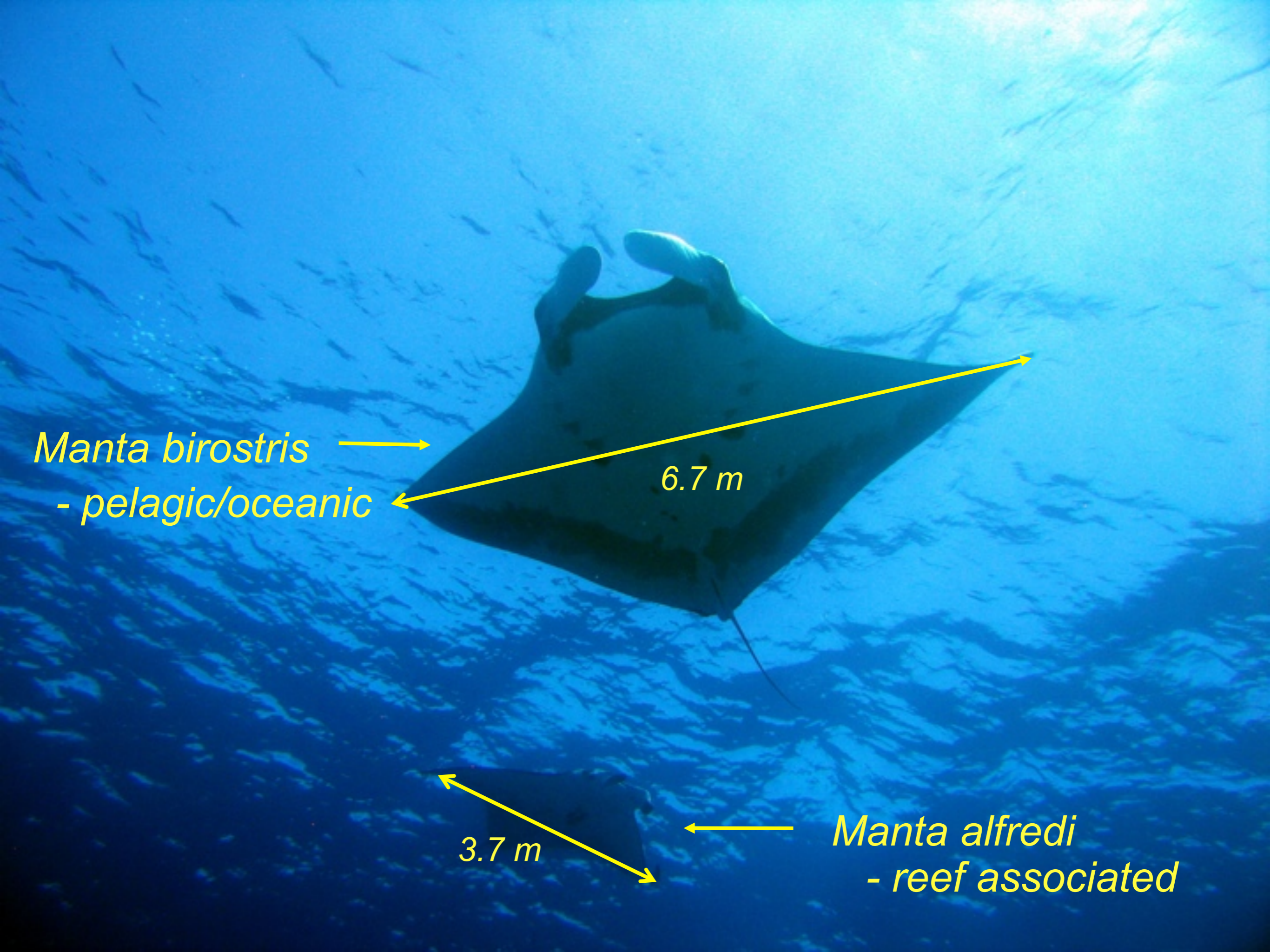


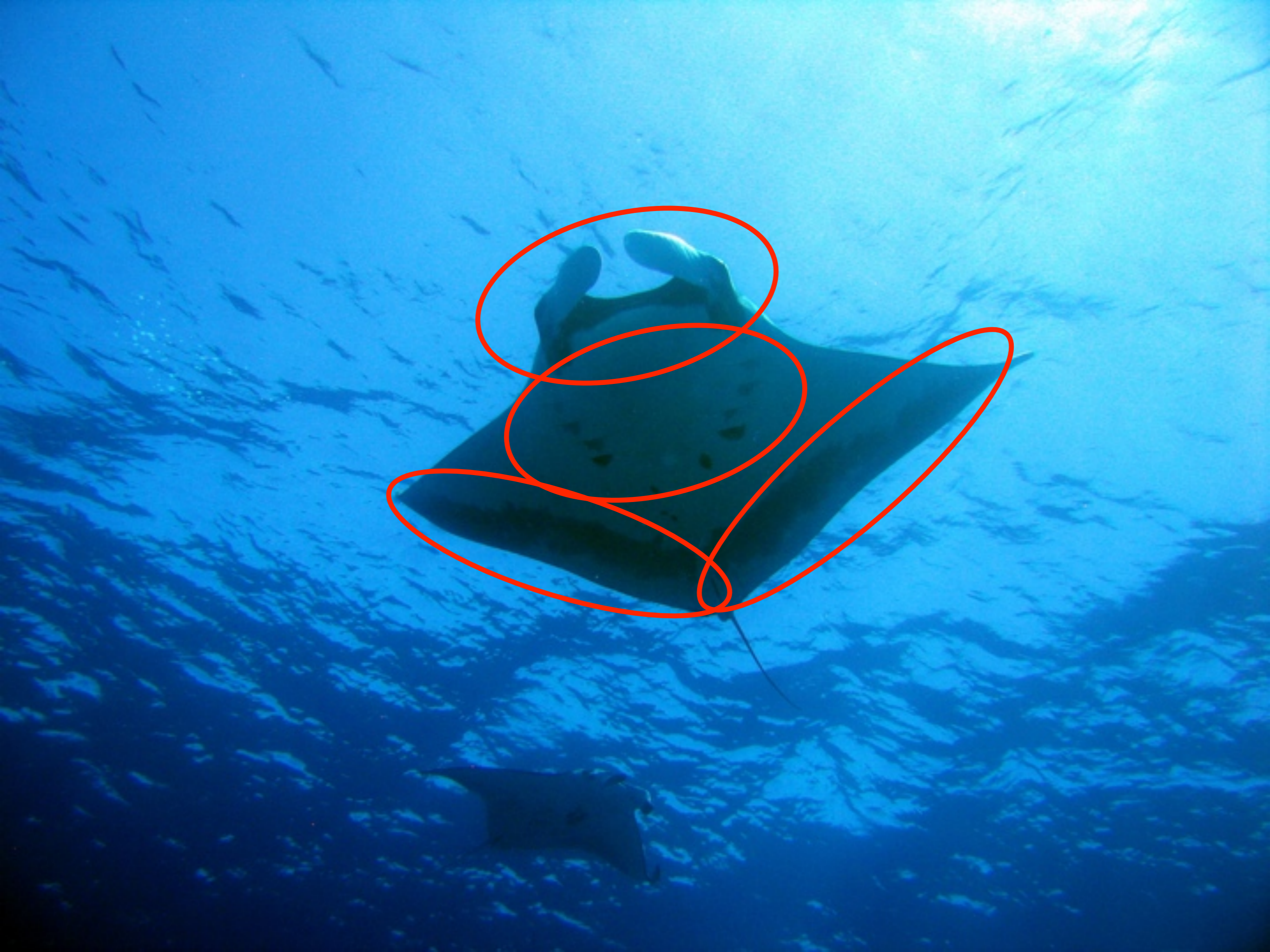
*Manta birostris* →  
- pelagic/oceanic ←

6.7 m

3.7 m

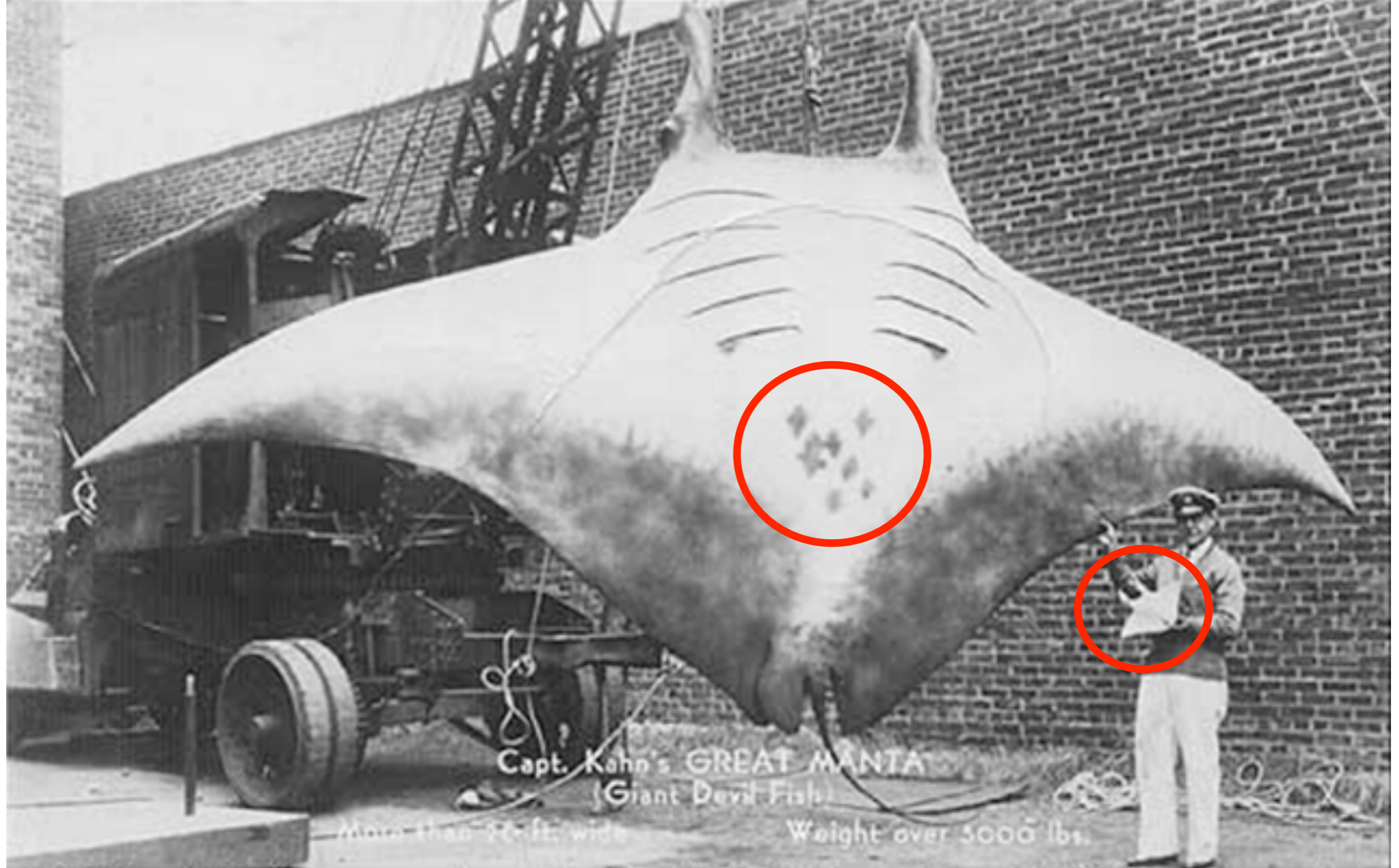
← *Manta alfredi*  
- reef associated







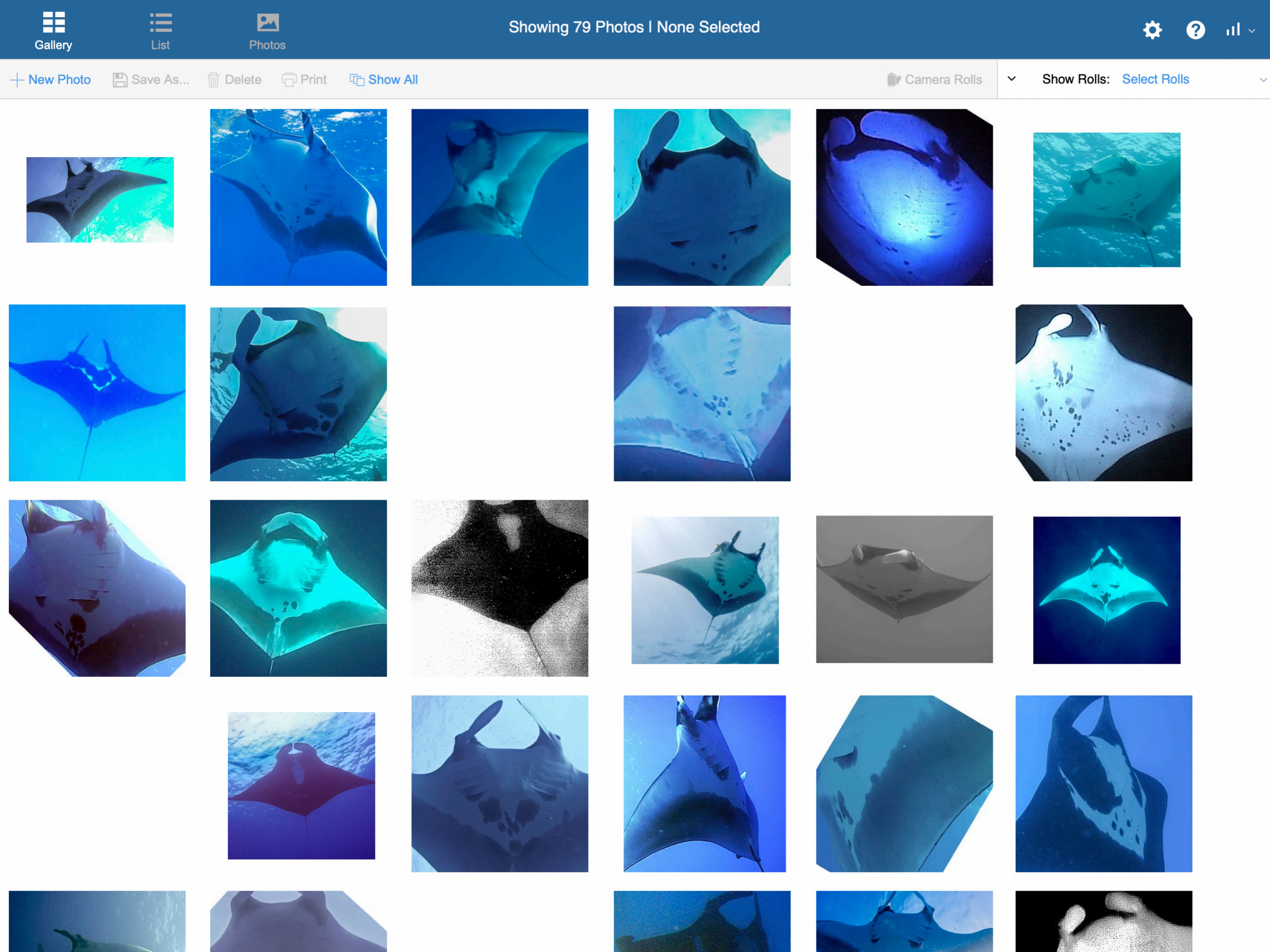
**Oceanic Manta Rays**



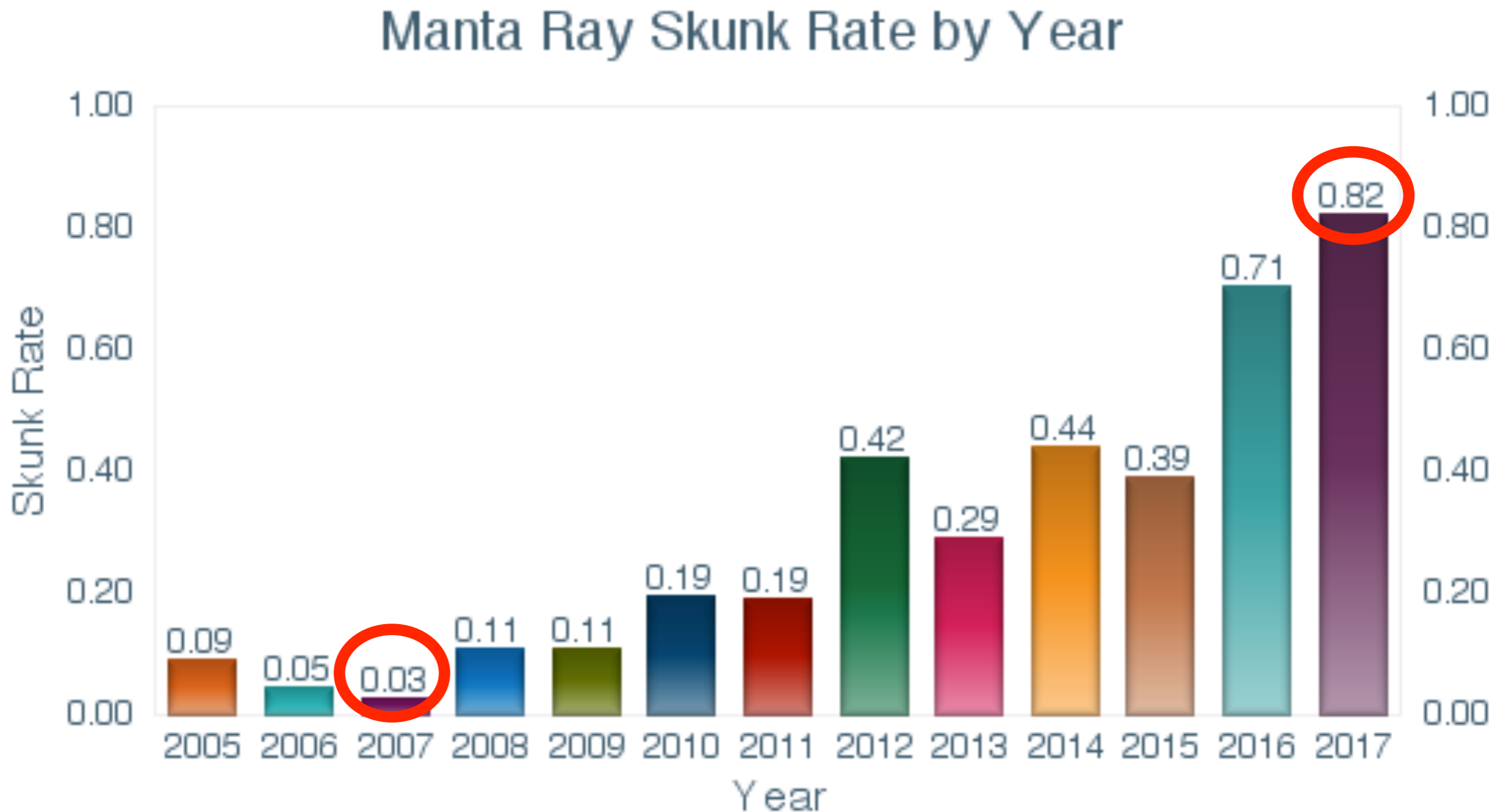
**This Great Manta was captured by Capt. A.L. Kahn 7 miles off Brielle on August 26, 1933. It weighed over 5,000 pounds and was over 20 feet wide. The baby Manta Capt. Kahn is holding was born after the giant fish was captured.**

# Black Morph



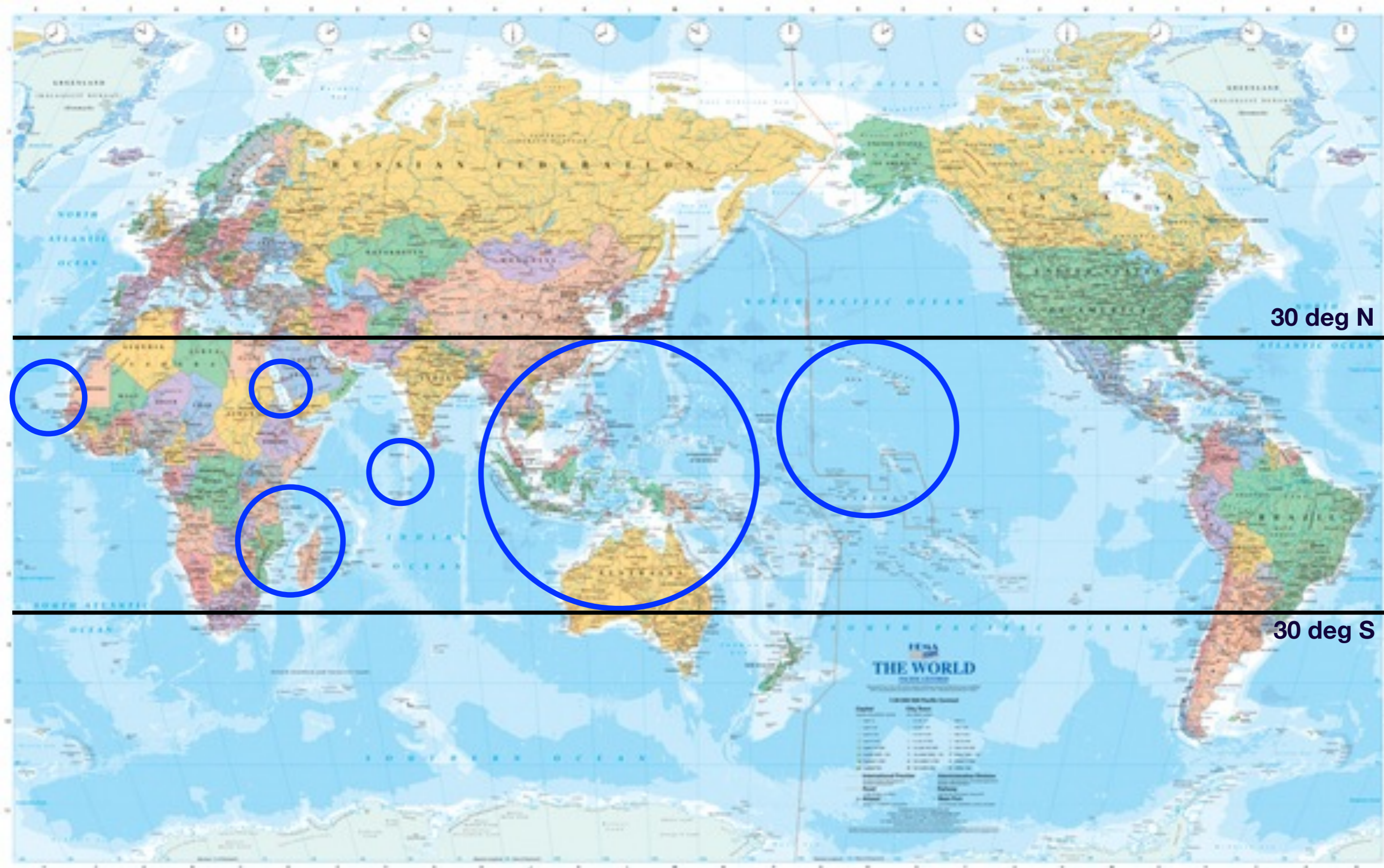


# Proportion of Dives No Mantas Seen



# *Distribution*

MapCenter.com





# Trash



# Trash



# Ocean Acidification

