

# Effectiveness of a Marine Protected Area Network To manage the West Hawai'i Aquarium Fishery



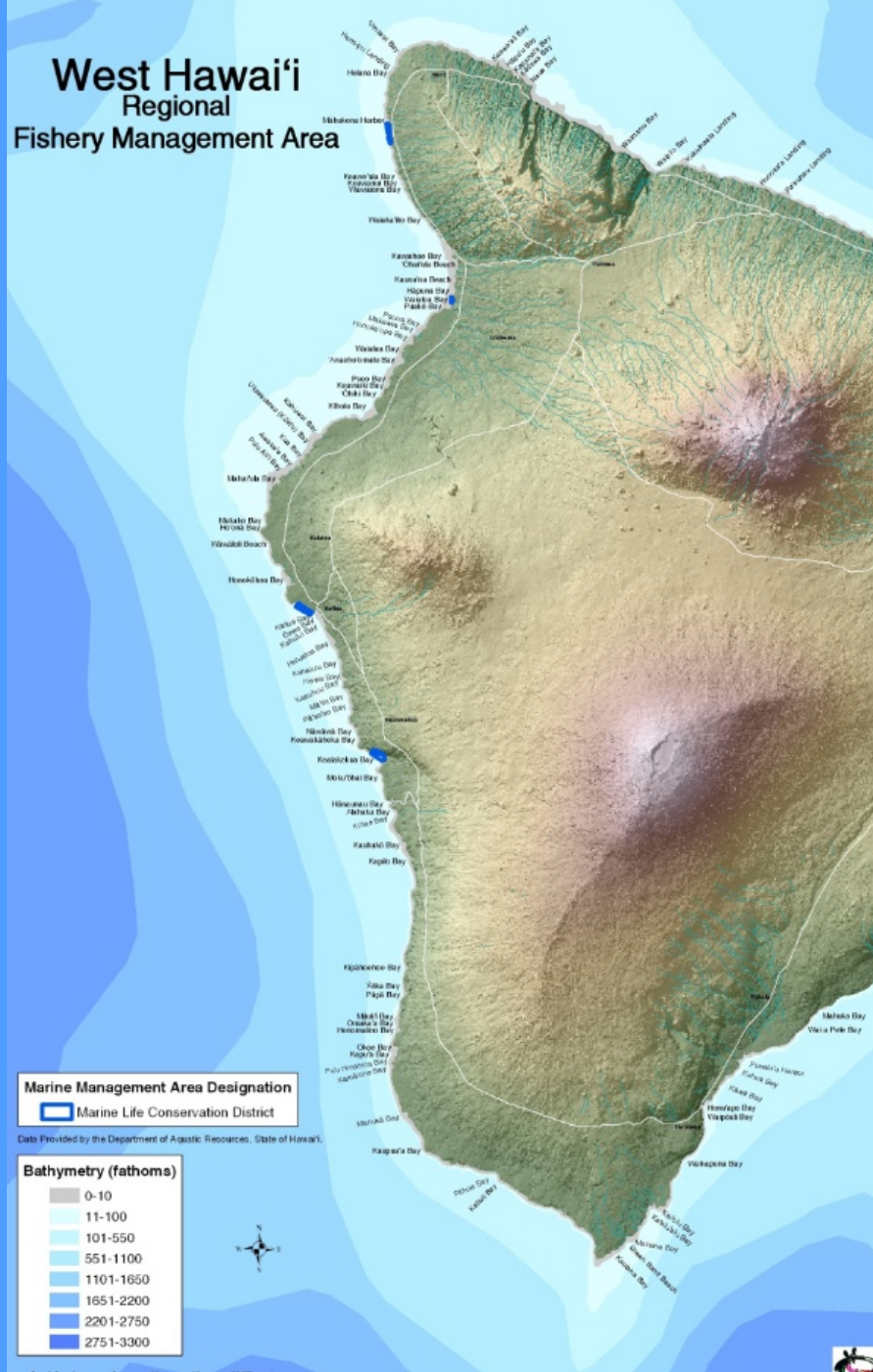
William Walsh  
Ivor Williams

Hawai'i Division of Aquatic Resources  
Hawai'i Cooperative Fisheries Research Unit & HDAR





# West Hawai'i Regional Fishery Management Area





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**Marine Management Area Designation**  
 Fishery Management Area

Data Provided by the Department of Aquatic Resources, State of Hawaii.

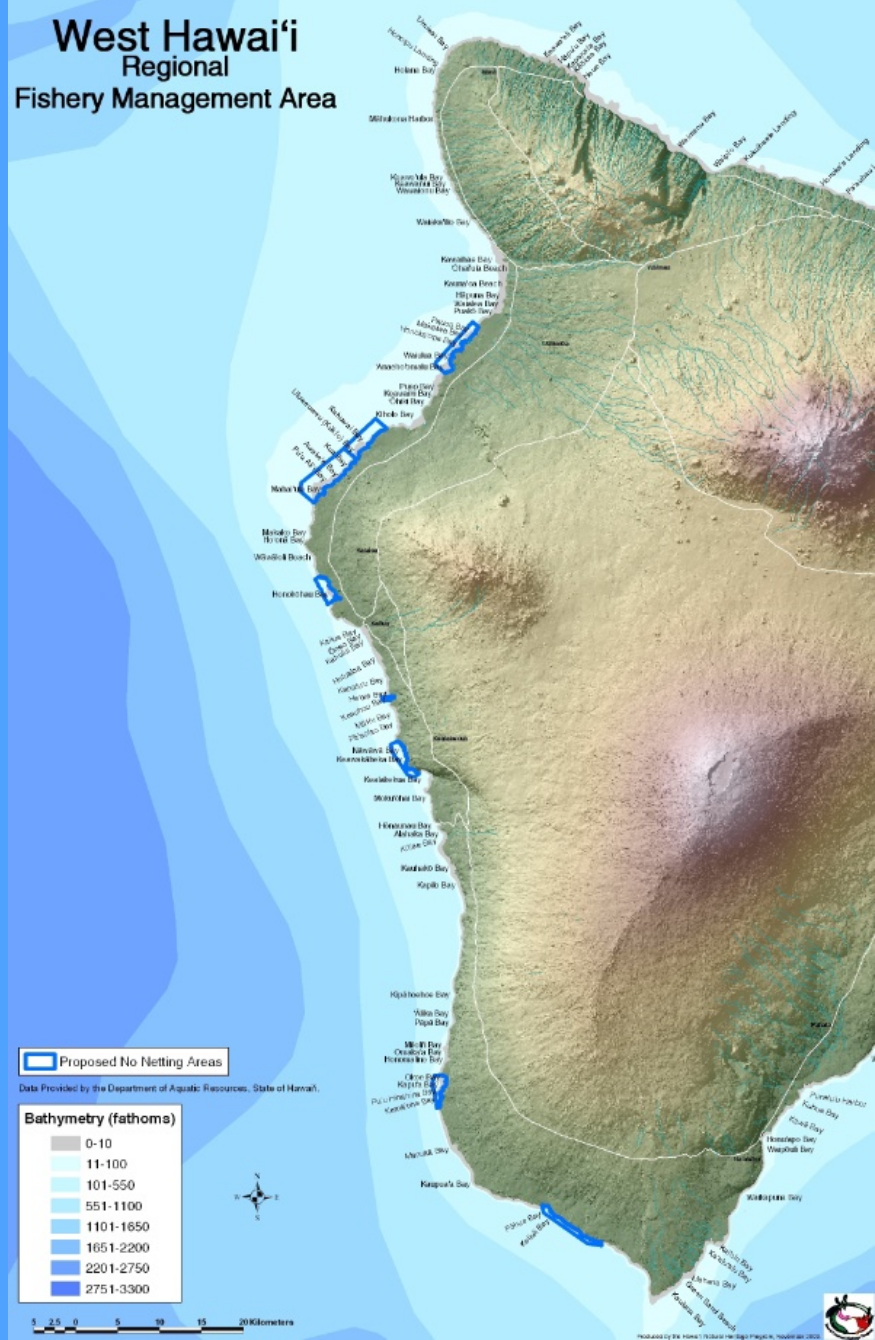
**Bathymetry (fathoms)**


0-10
11-100
101-550
551-1100
1101-1650
1651-2200
2201-2750
2751-3300



0 2.5 5 10 15 20 Kilometers









# West Hawai'i Regional Fishery Management Area



 Proposed No Netting Areas

Data Provided by the Department of Aquatic Resources, State of Hawai'i.

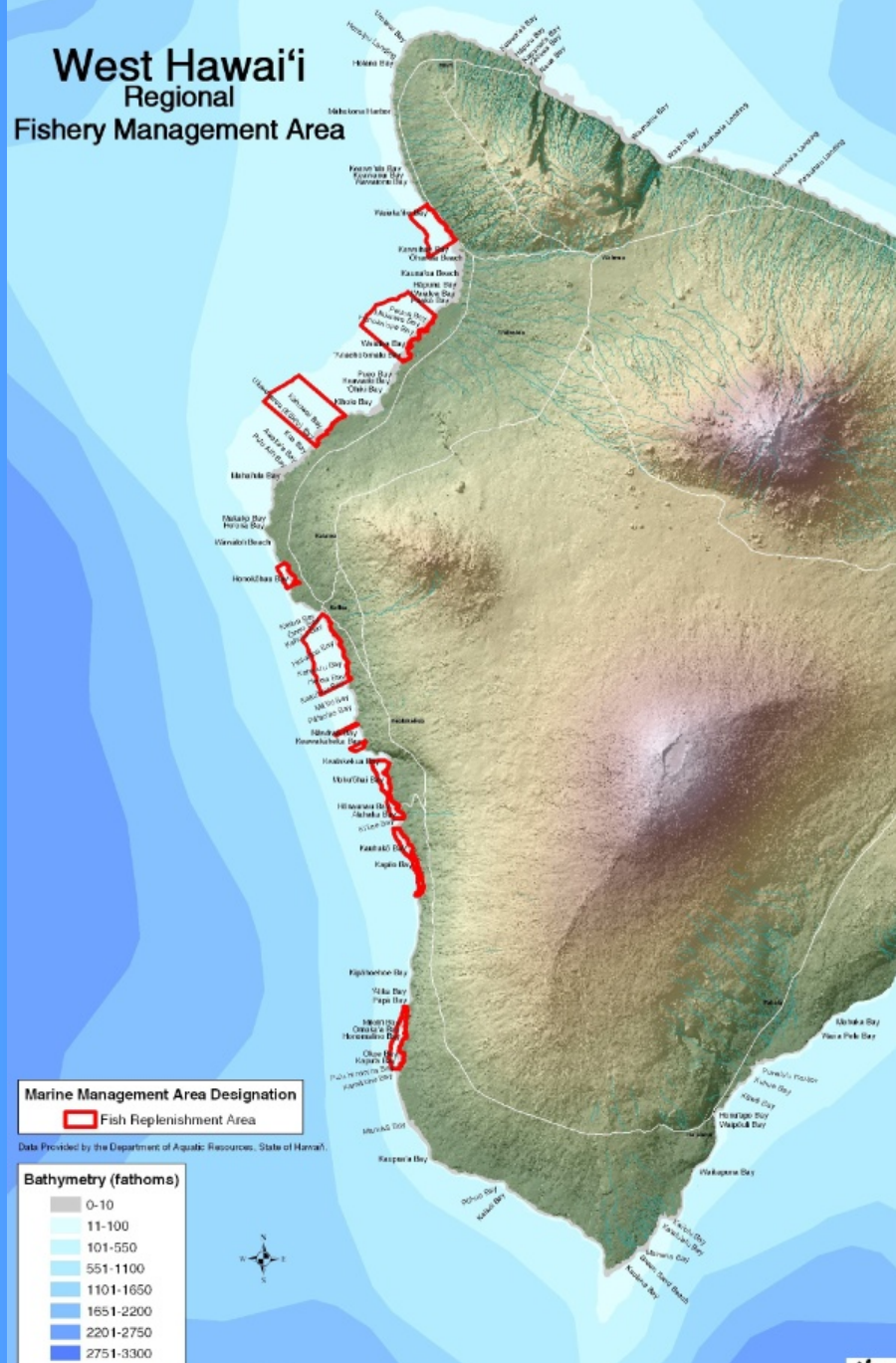
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# West Hawai'i Regional Fishery Management Area



**Marine Management Area Designation**  
 Fish Replenishment Area

Data Provided by the Department of Aquatic Resources, State of Hawaii.

**Bathymetry (fathoms)**

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11-100
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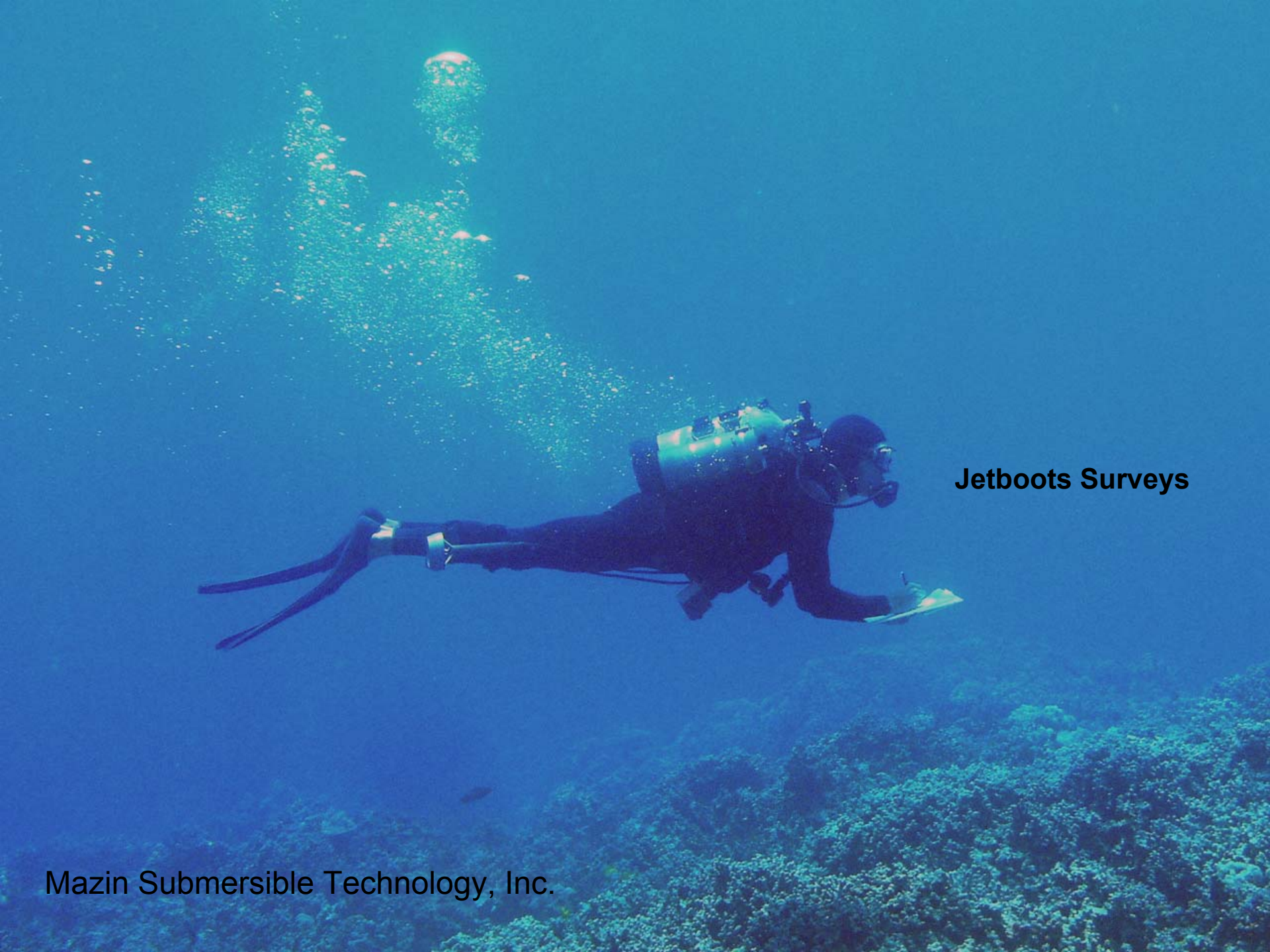




# West Hawai'i Coral Reef Monitoring

- Fixed Belt Transects
- Timed Free Swim Surveys
- Resource Fish Surveys
- Benthic Habitat Surveys
- Coral Disease Surveys
- Jetboots Surveys





**Jetboots Surveys**

Mazin Submersible Technology, Inc.



# WHAP Study Sites

- Open Sites
- MPA Sites
- FRA Sites
- ∧ 100 Fathom Contour
- Fish Replenishment Areas

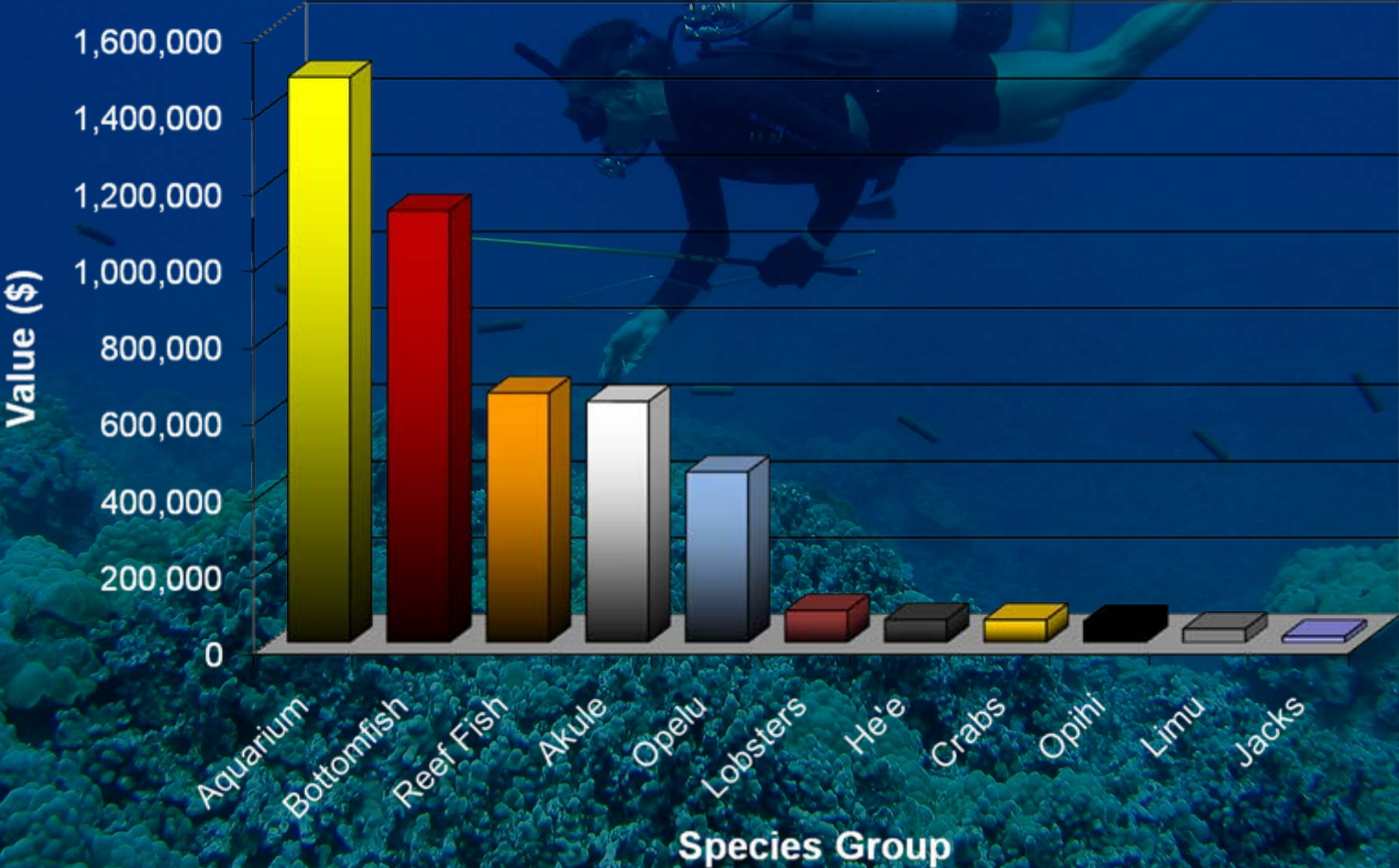


Map Projection: UTM Zone 4 1:600,000  
Data Provided by: State of Hawaii  
Map Created by: Lisa Wedding 6/27/02



# Value of MHI Inshore Fisheries

Fiscal Year 2007





## Change in West Hawai`i Aquarium Fishery Over 24 Years

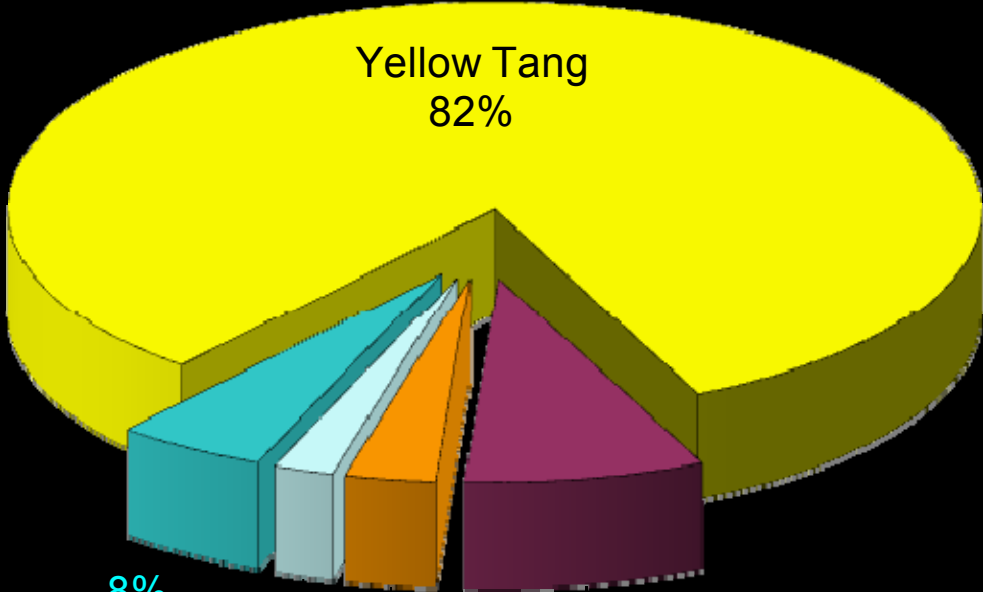
	<b>1983</b>	<b>2007</b>	<b>Δ</b>
No. Permits	5	72	<b>1440% ↑</b>
Total Fish Catch	30,000	360,686	<b>1203% ↑</b>
Total Value	\$159,756	\$1,140,425	<b>714% ↑</b>
% of State Fish Catch	27%	83%	<b>293% ↑</b>

## Change in West Hawai`i Aquarium Fishery Over 24 Years

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# Big Island Aquarium Catch Fiscal Year 2007



8%  
Kule

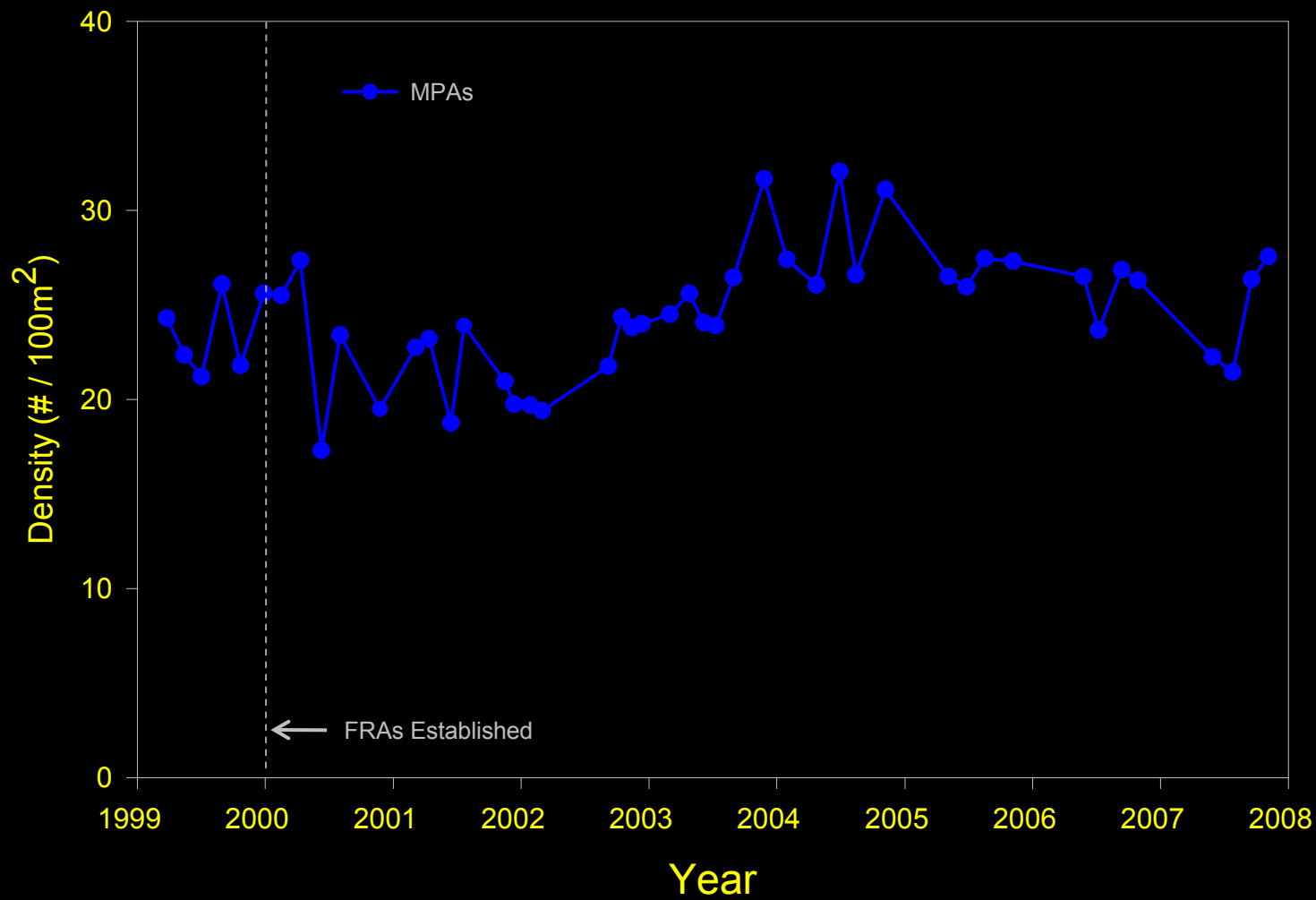
3%  
Achilles

2%  
Chevron

5%  
110 Other spp.

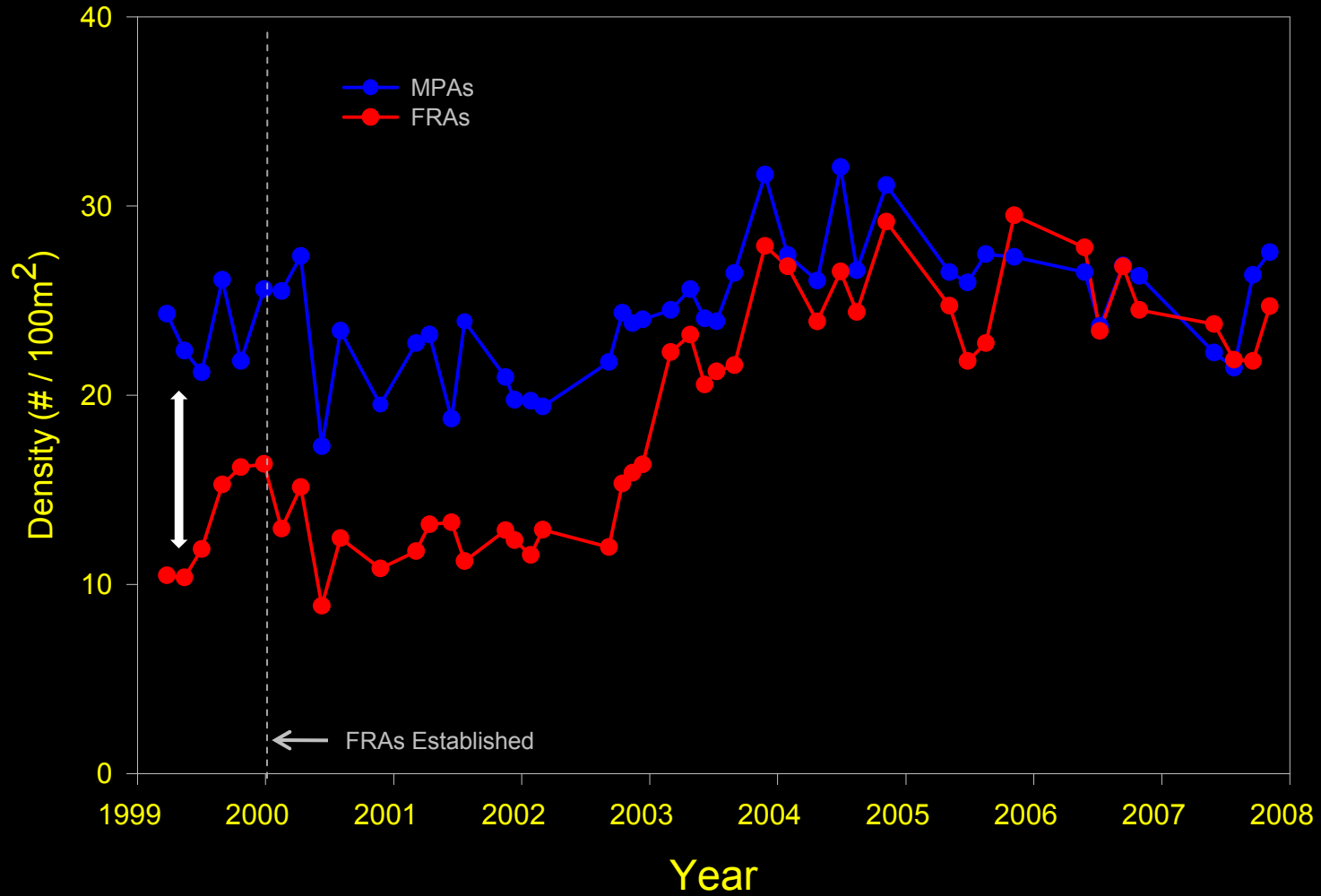


# West Hawai'i Yellow Tang Abundance

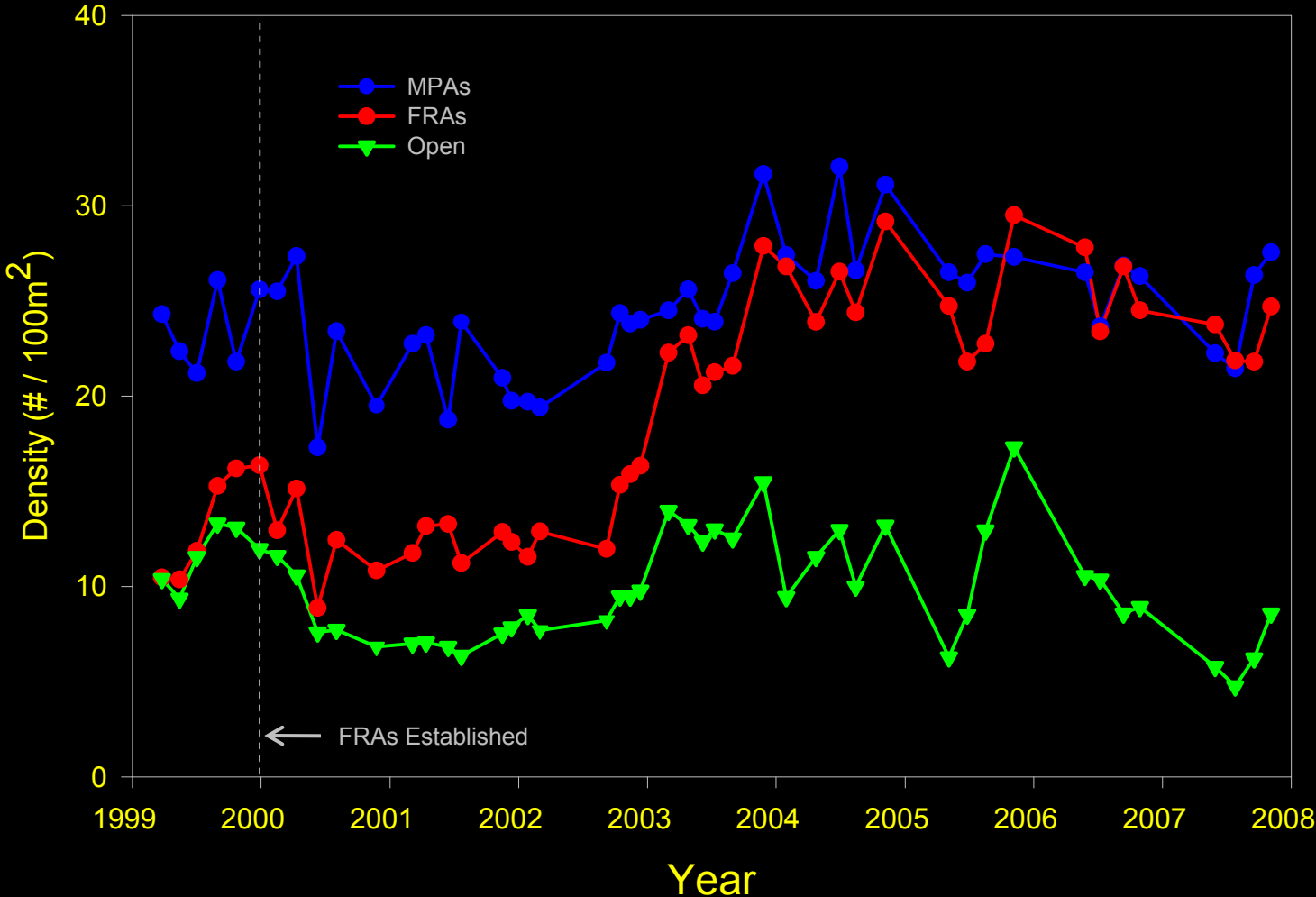









# West Hawai'i Yellow Tang Abundance



# West Hawai'i Yellow Tang Abundance

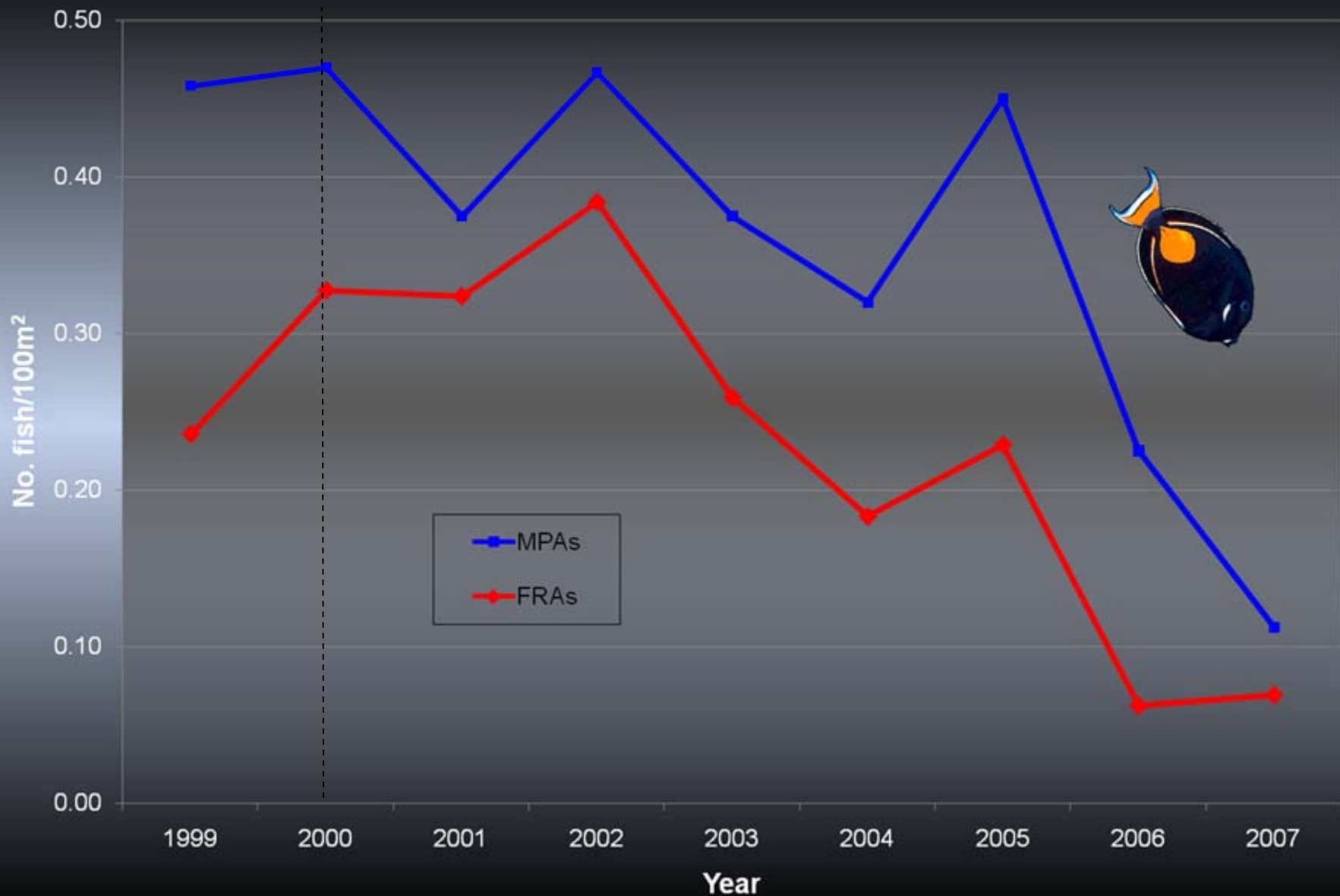


# Change in Abundance of Top 5 Aquarium Species 1999/00 to 2006/07 Excluding YOY

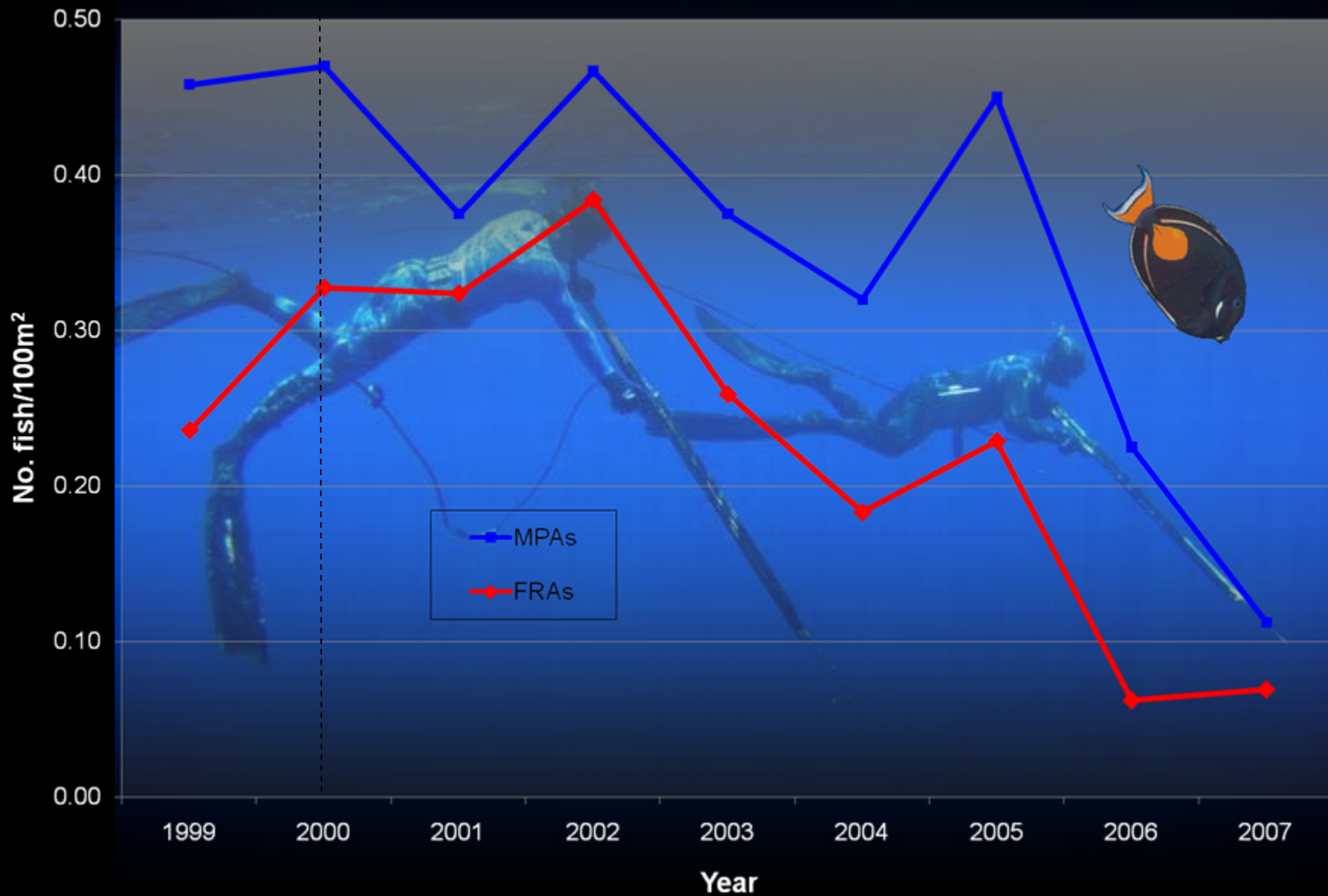
Species	FRAs	$\rho$	Coast
 <i>Zebrasoma flavescens</i>	+90%	<b>0.01*</b>	+19%
 <i>Ctenochaetus strigosus</i>	+23%	<b>0.02*</b>	+18%
 <i>Acanthurus achilles</i>	-74%	0.15	-30%
 <i>Naso lituratus</i>	-10%	0.65	-8%
 <i>Ctenochaetus hawaiiensis</i>	+45%	0.23	+10%



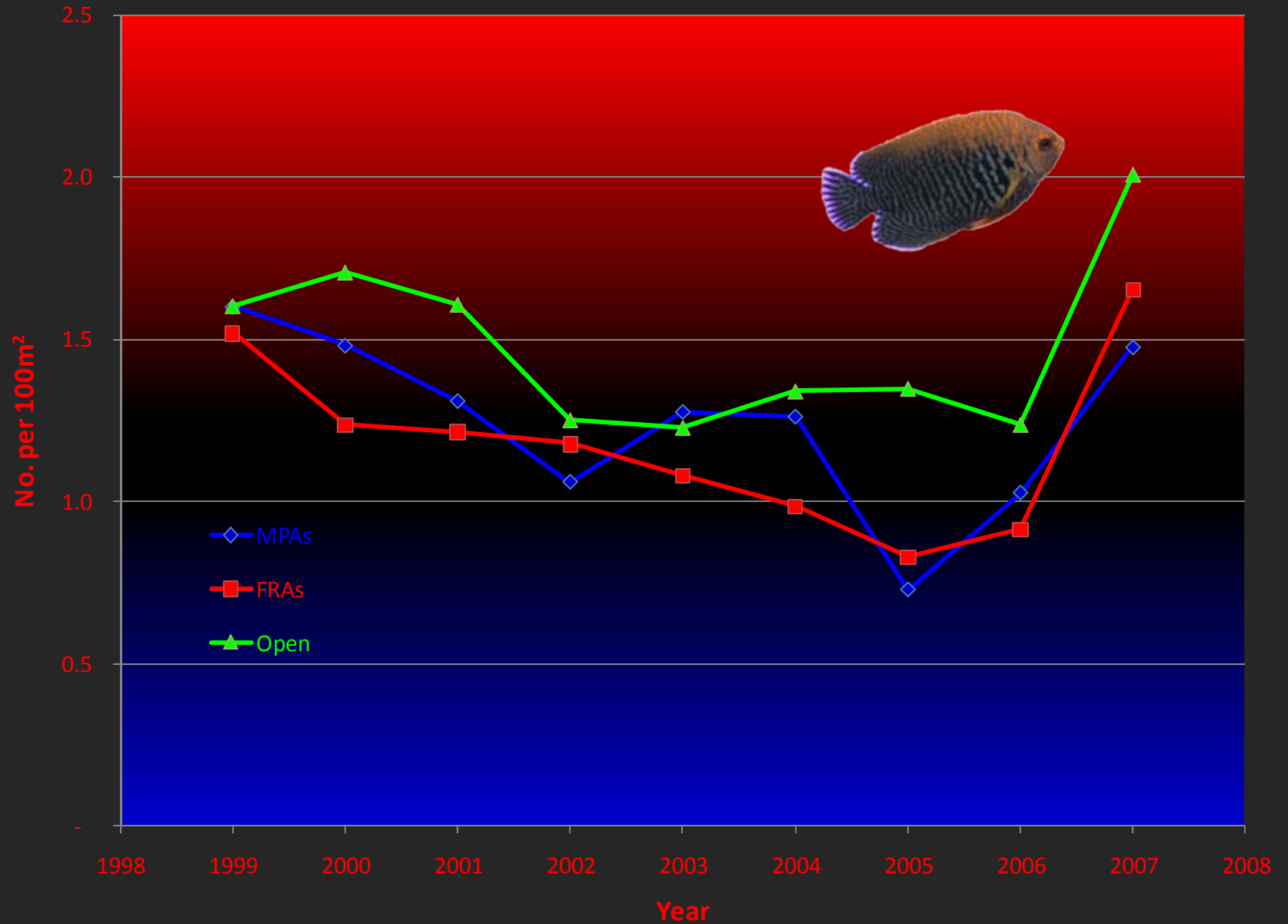
# Pāku'iku'i Abundance



# Pāku'iku'i Abundance



# *Centropyge potteri* (Potters Angel) Abundance





# Age at First Reproduction:

4-7 years



Life Span: at least 40 years!

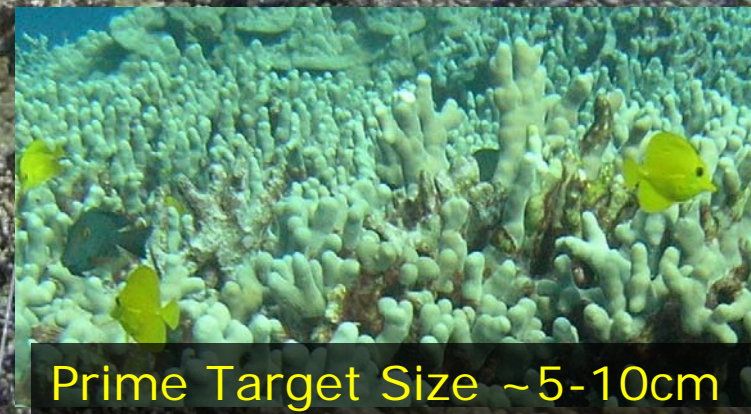


# Yellow Tang Recruit & Juvenile Habitat

- Mid-depth - 30-60ft
- Finger coral



Recruits ~ 3-4 cm



Prime Target Size ~ 5-10cm

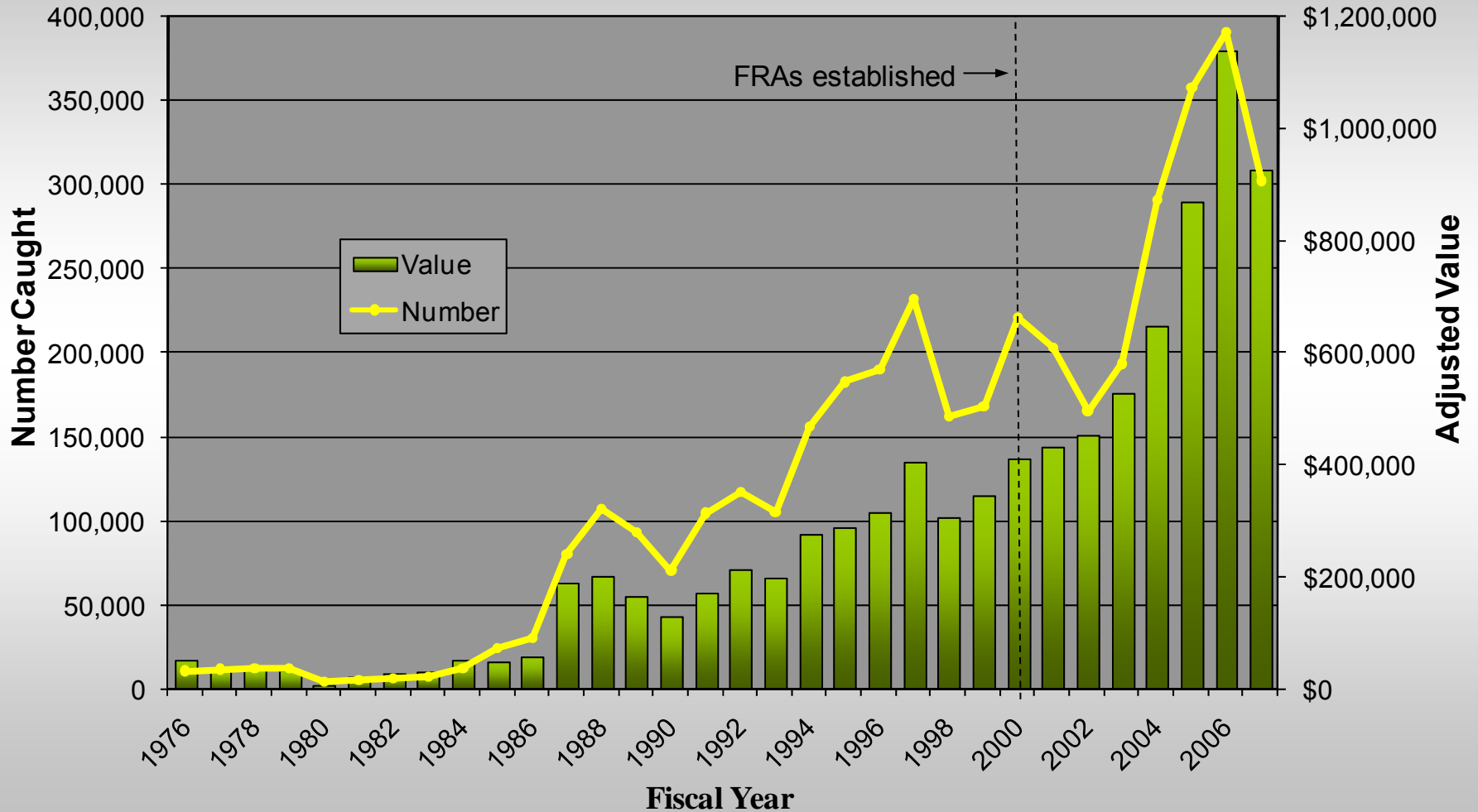


# Yellow Tang Adult Habitat

- Shallow - 10-20ft
- Boundary between Pavement – upper coral zone

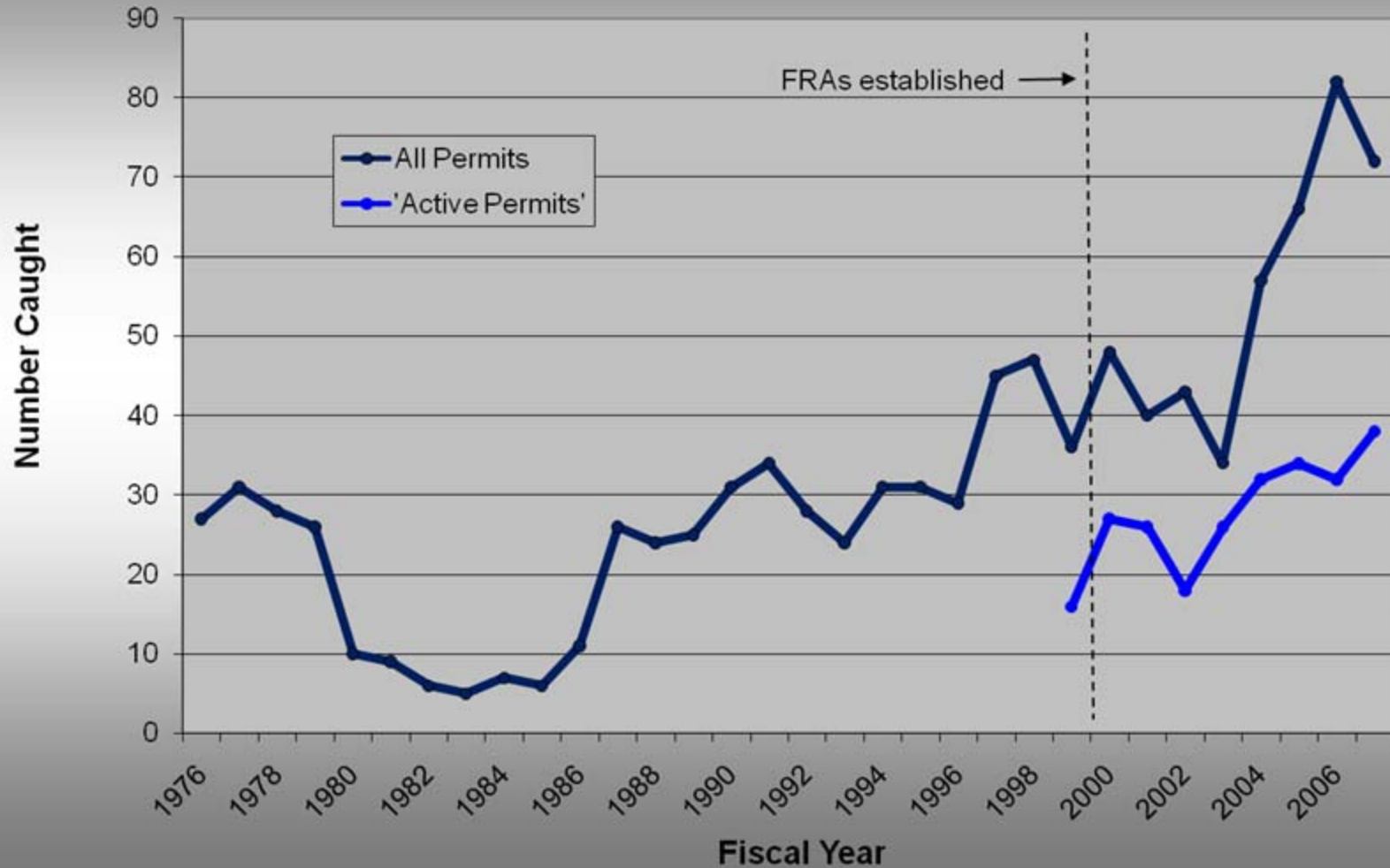
Y-Tang Move to Adult Habitats at ~ 4-7 yr old  
Maximum Lifespan >40 yrs  
Not Targeted As Adults

# Number and Value of Yellow Tangs Caught in West Hawai'i

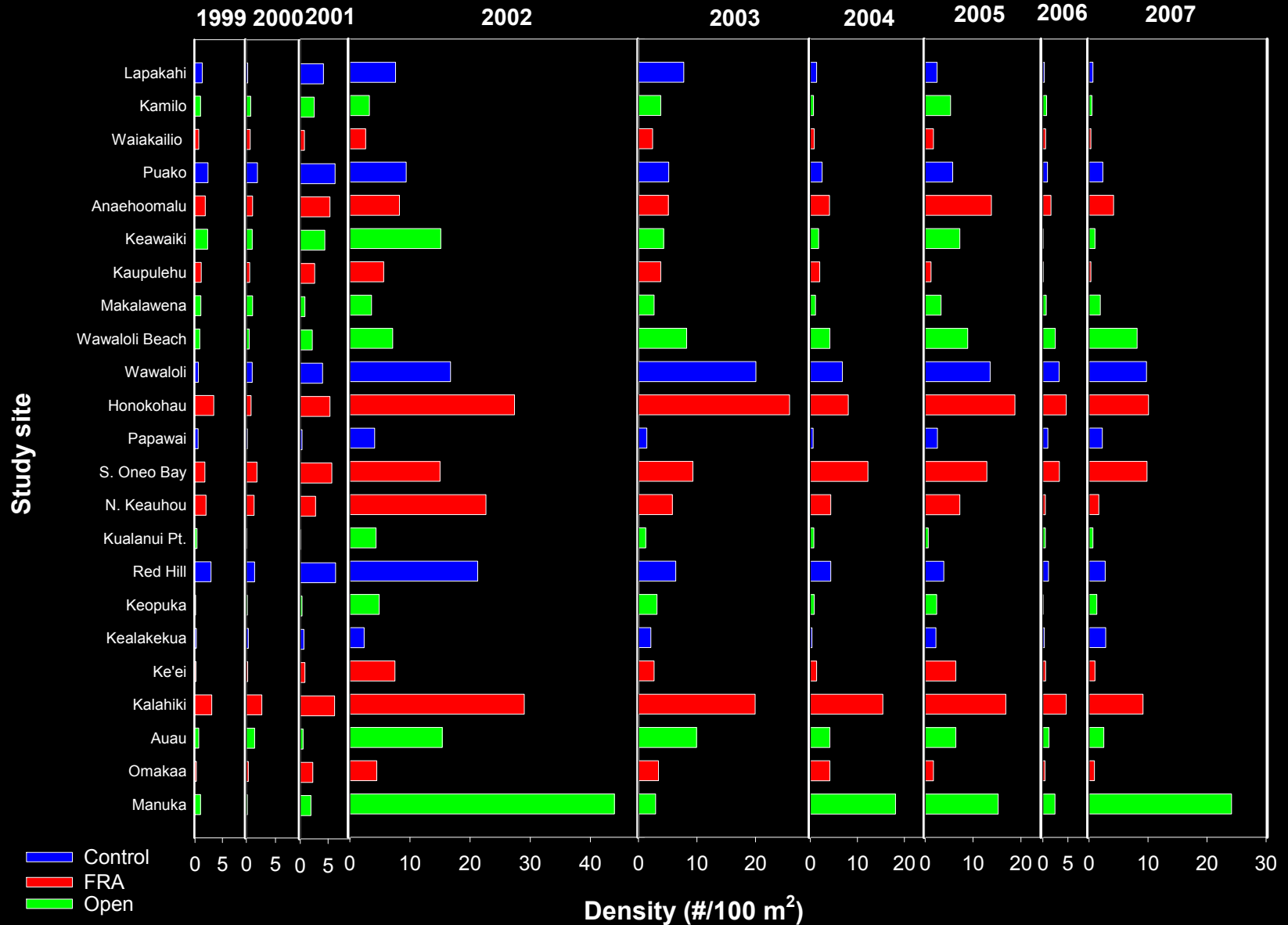




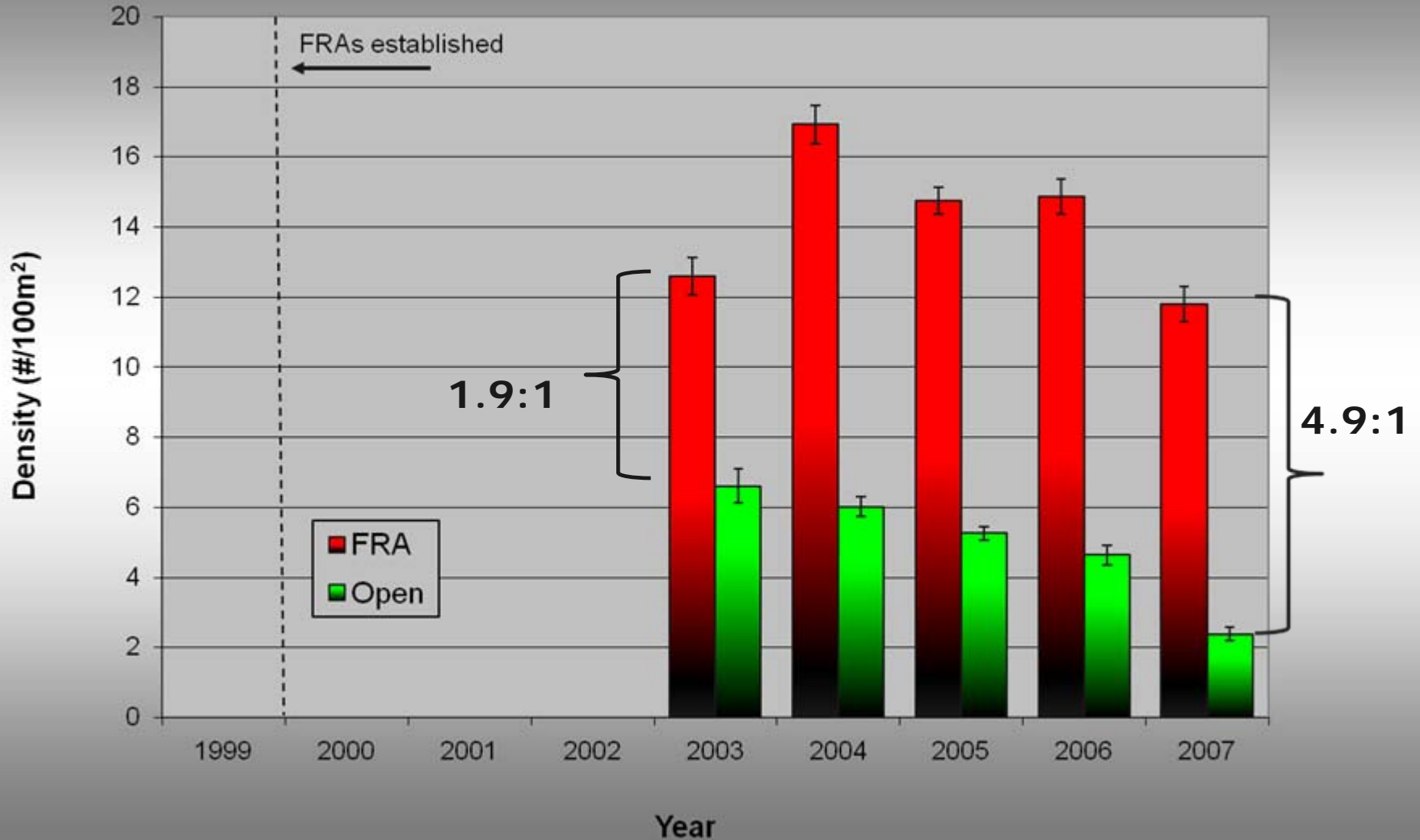
# Number of Aquarium Permits and Active Fishers in West Hawai'i



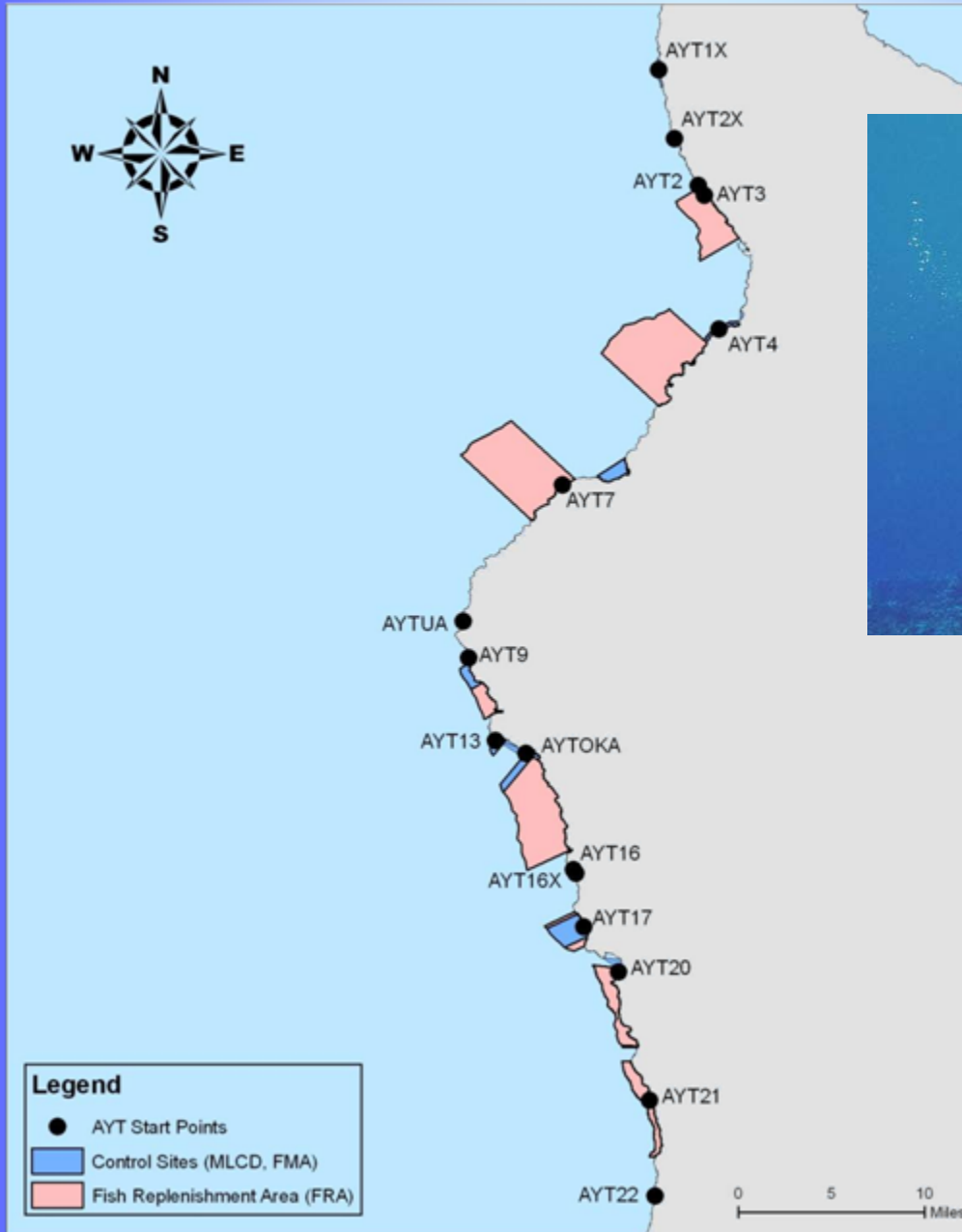
# *Zebrasoma flavescens* YOY



# Prime Target Size Fishes (~<2 yr old)



# Adult Yellow Tang Survey Sites

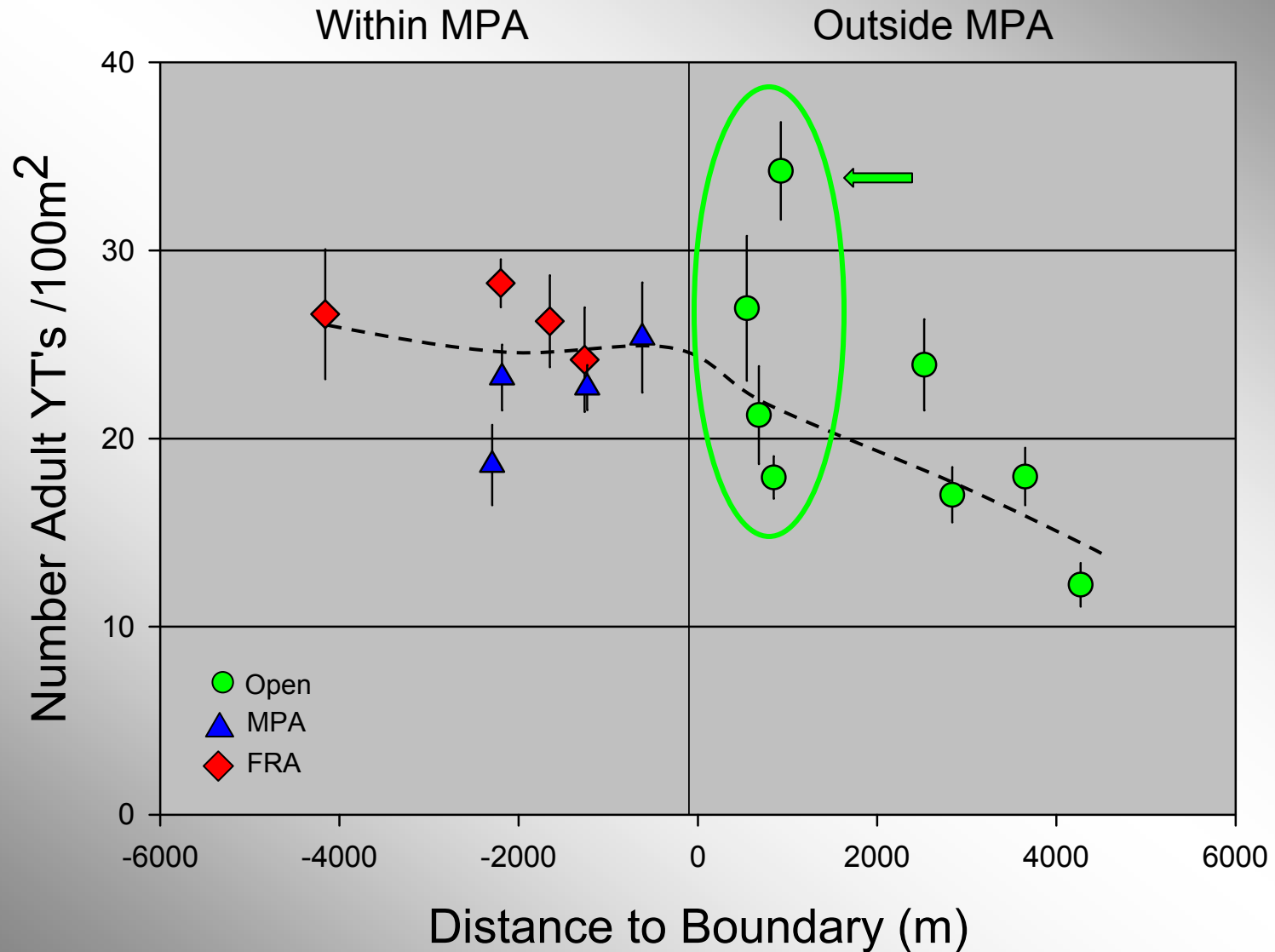


## Jetboots Surveys

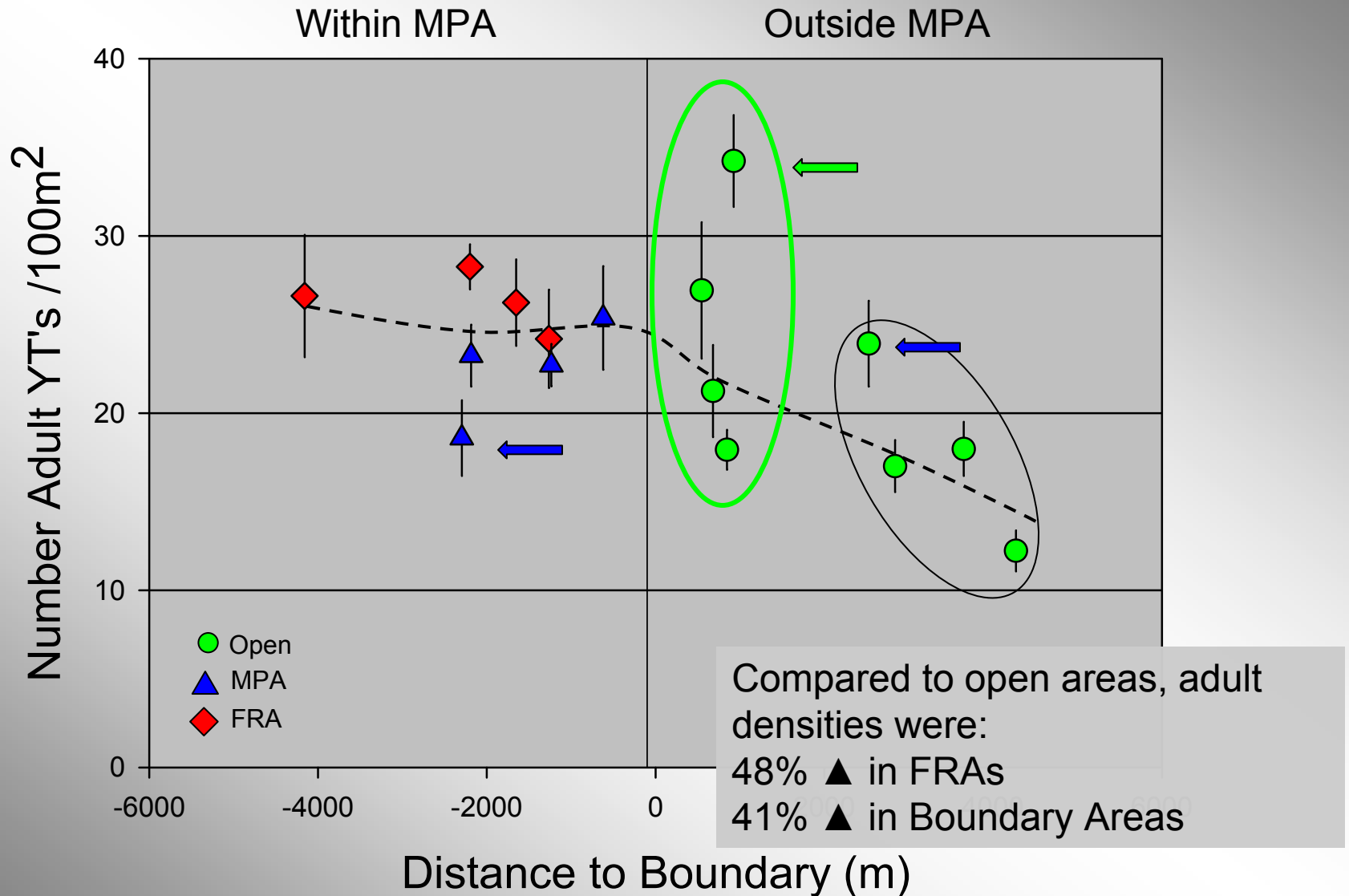
18 min / survey  
600 - 1000 m by 5m  
~500 -1500 fish / survey



# Spillover of Adults into Boundary Areas



# Spillover of Adults into Boundary Areas



## West Hawai'i MPA Network Impacts on Sustainability of Stocks and of AQ Fishery

- Increases in Catch and Effort Since FRAs established
- Increasing impacts of fishing on target size classes
- Reserves boost adult stocks
- Duration of protection is short relative to y-tang lifespan

Conclusion: West Hawai'i reserves sustain adult stocks over large part of coastline and act as a bulwark against overexploitation

# DAR West Hawai'i



**William Walsh**

Ph.D. University of Hawai'i Mānoa

**Ivor Williams**

Ph.D. University of Newcastle Upon Tyne



**Brent Carman**

B.S. Humboldt State University

**Steve Cotton**

B.S. University of Hawai'i Hilo



**Laura Livnat**

B.S. Washington State University

**Kosta Stamoulis**

B.S. University of Hawai'i Hilo



**Kara Osada**

B.S. University of Hawai'i Hilo

