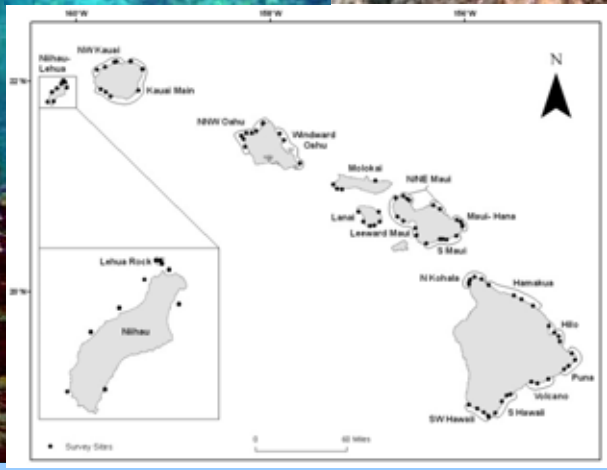


Assessing anthropogenic impacts on Hawaiian reef fish assemblages along regional-scale human population gradients

Ivor Williams — Hawaii Cooperative Fishery Research Unit & DAR
Bill Walsh, Kosta Stamoulis — DAR
Bob Schroeder, Ben Richards — NOAA-CRED
Alan Friedlander — NOAA-NOS

Starting Position

- MHI Reef fish populations are depleted
- Lack of consensus on cause(s)

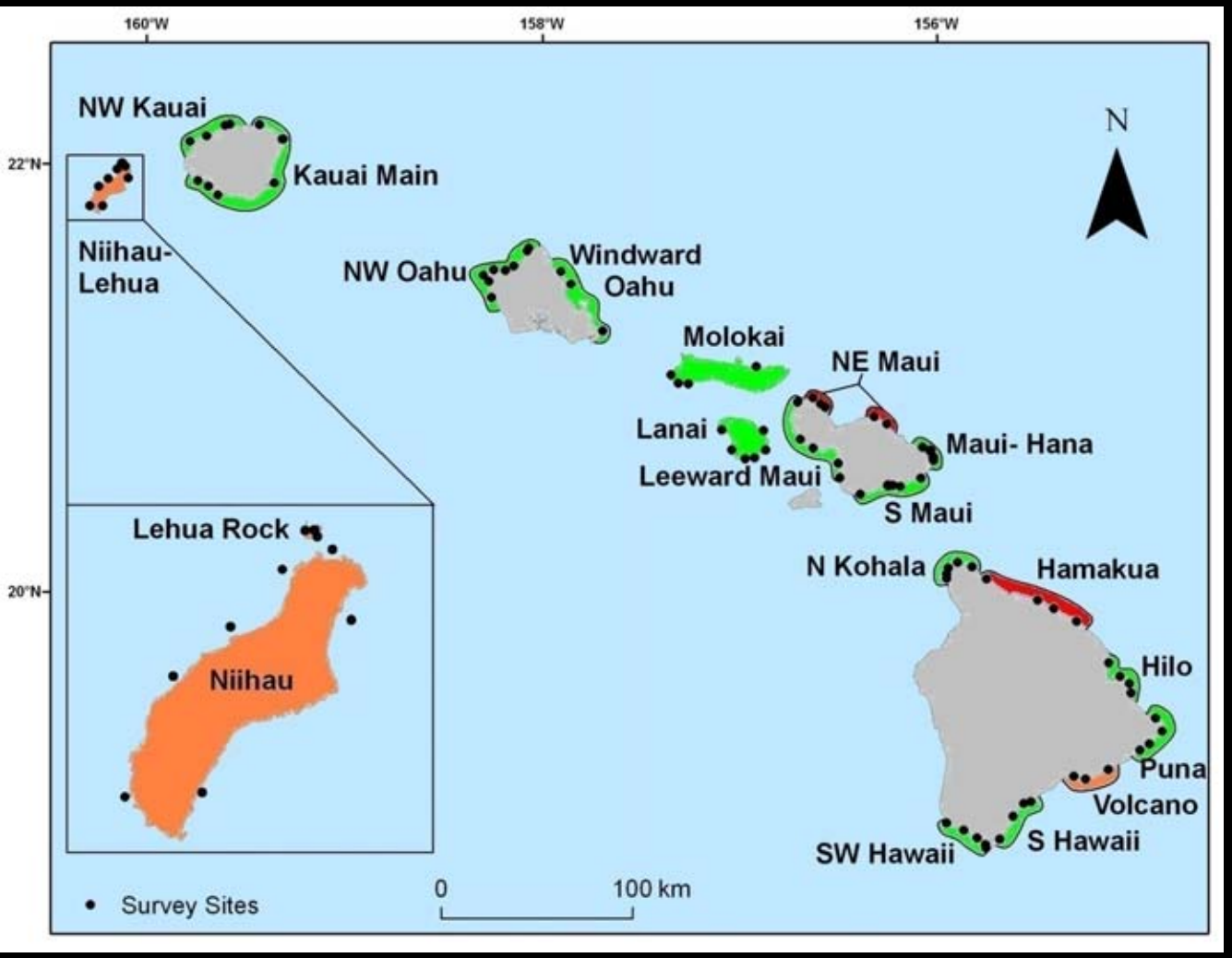
THREAT	AVERAGE SCORE (0-10)	% THINKING THREAT A "10"
Pollution from Land	8.9	62%
Overfishing	7.9	40%
Coastal Development	7.9	39%
Disease	7.8	39%
Alien Marine Species	7.6	41%
Nearshore Recreation	5.9	14%

Telephone survey of 1600 Households.

Hamnett, M., M. Lui, and D. Johnson. 2006. Fishing, ocean recreation, and threats to Hawaii's coral reefs: Social Science Research Institute, University of Hawaii at Manoa

Data Sources

- NOAA/DAR MHI RAMP cruises 2005-6
- ArcGIS for population density & shoreline accessibility



- 89 survey sites

Data per site:

- Fish & benthic survey
- Human population resident w/in 15 km
- Shoreline accessibility (1-3)

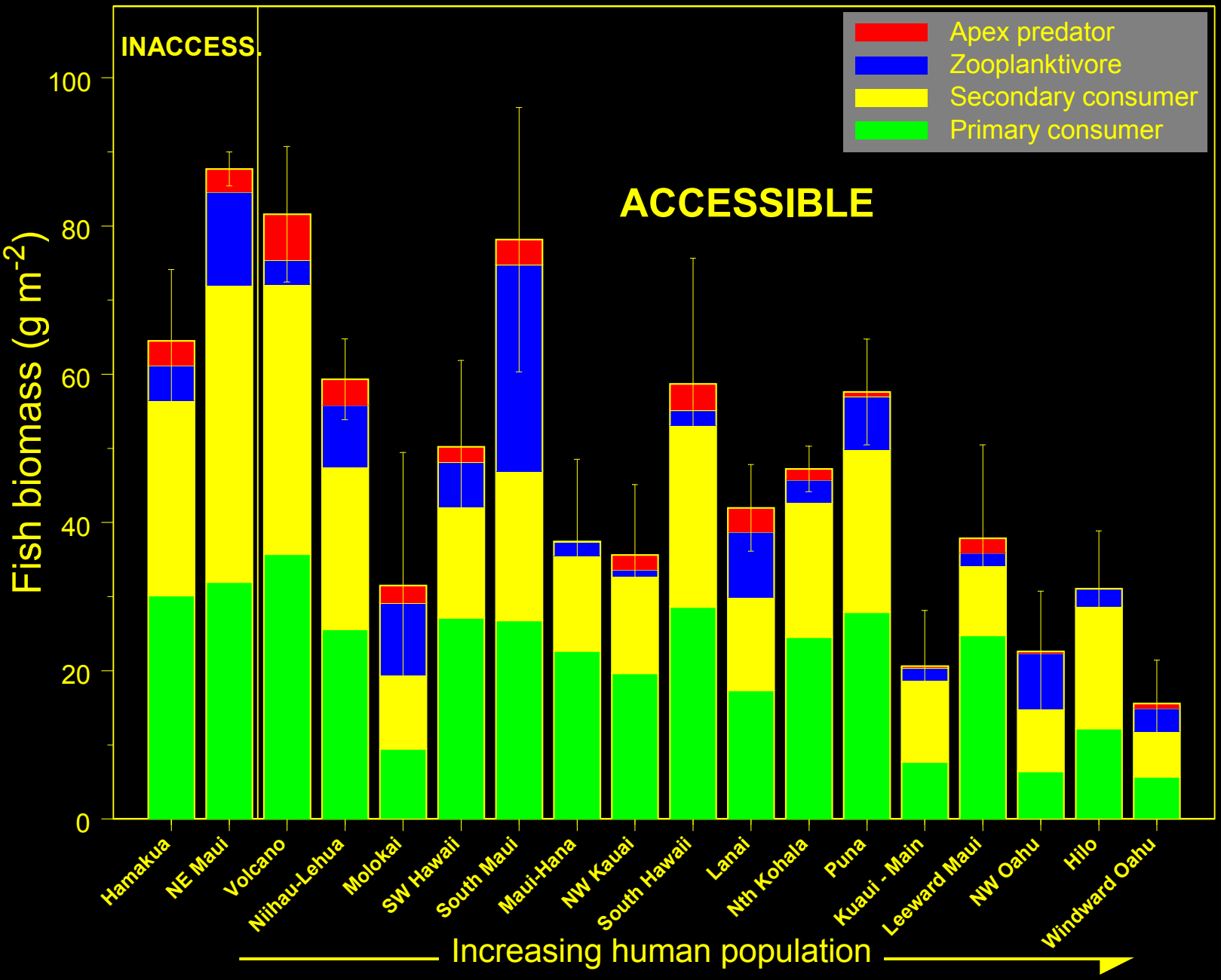
Site Pooling:

- 18 locations
- 2 'Inaccessible'

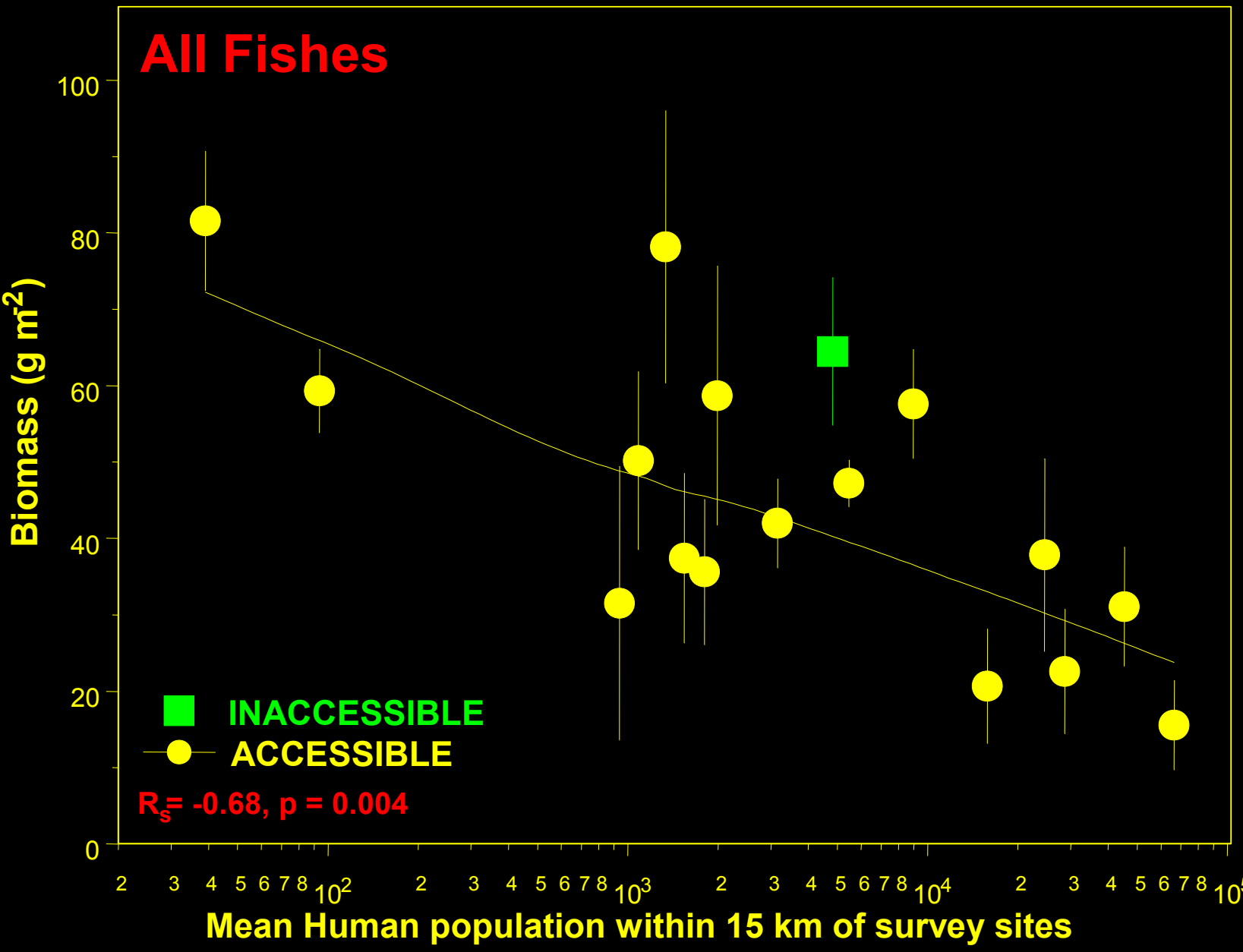
Study Locations

	N	Human Population within 15 km	Distance to nearest boat ramp (km)
INACCESSIBLE LOCATIONS			
Hamakua	4	4,823	23.9
NE Maui	5	24,898	8.0
ACCESSIBLE & REMOTE			
Volcano	3	39	32.6
Niihau-Lehua	10	94	48.8
ACCESSIBLE & POPULOUS			
Molokai	4	938	13.0
South Maui	5	1,086	24.2
SW Hawaii	5	1,340	14.3
Maui-Hana	4	1,544	3.1
Kauai-NW	4	1,804	16.3
South Hawaii	4	1,987	4.2
Lanai	6	3,159	7.1
North Kohala	5	5,463	27.9
Puna	4	8,974	9.0
Kauai Main	6	15,822	4.4
Leeward Maui	5	24,570	5.1
NW Oahu	8	28,700	8.9
Hilo	4	45,251	12.1
Windward Oahu	3	66,504	8.0

Fish Biomass By Location



Fish Biomass v Human Population



Distinguishing Impacts of Fishing and Habitat Degradation

- Fishing: Impacts Target Taxa
- Habitat Degradation: Impacts Target & Non-Target Taxa

Target Taxa


i. Target APEX


ii. Large Parrotfish


iii. Large Wrasse


iv. Trgt Surgeon


v. Red Fish


vi. Goatfish

Non-Target Taxa


i. Sm Wrasse Damsels


ii. Sm Surgeons


iii. Hawkfish

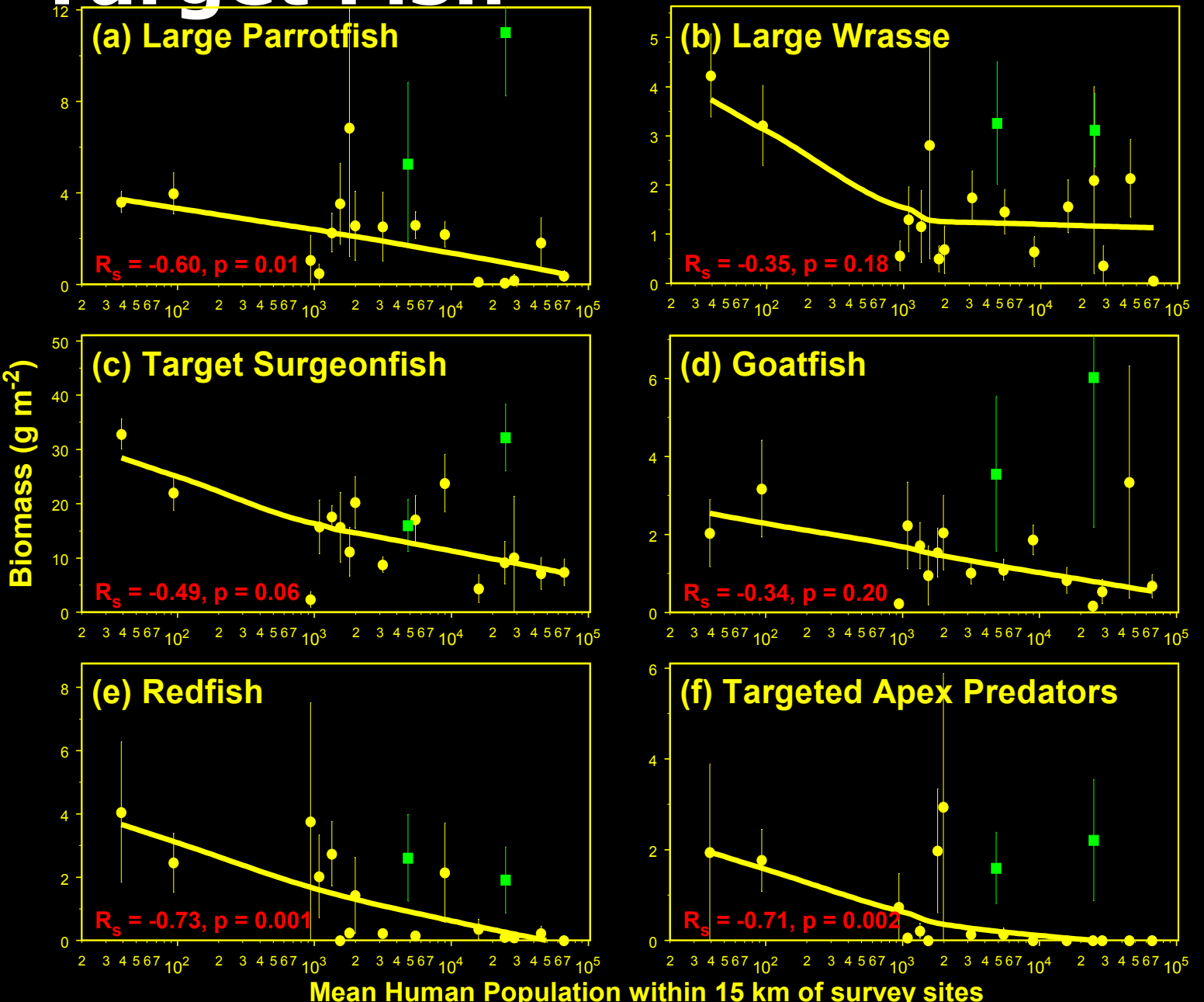

iv. Triggers


v. Butterflyfish


vi. Benth

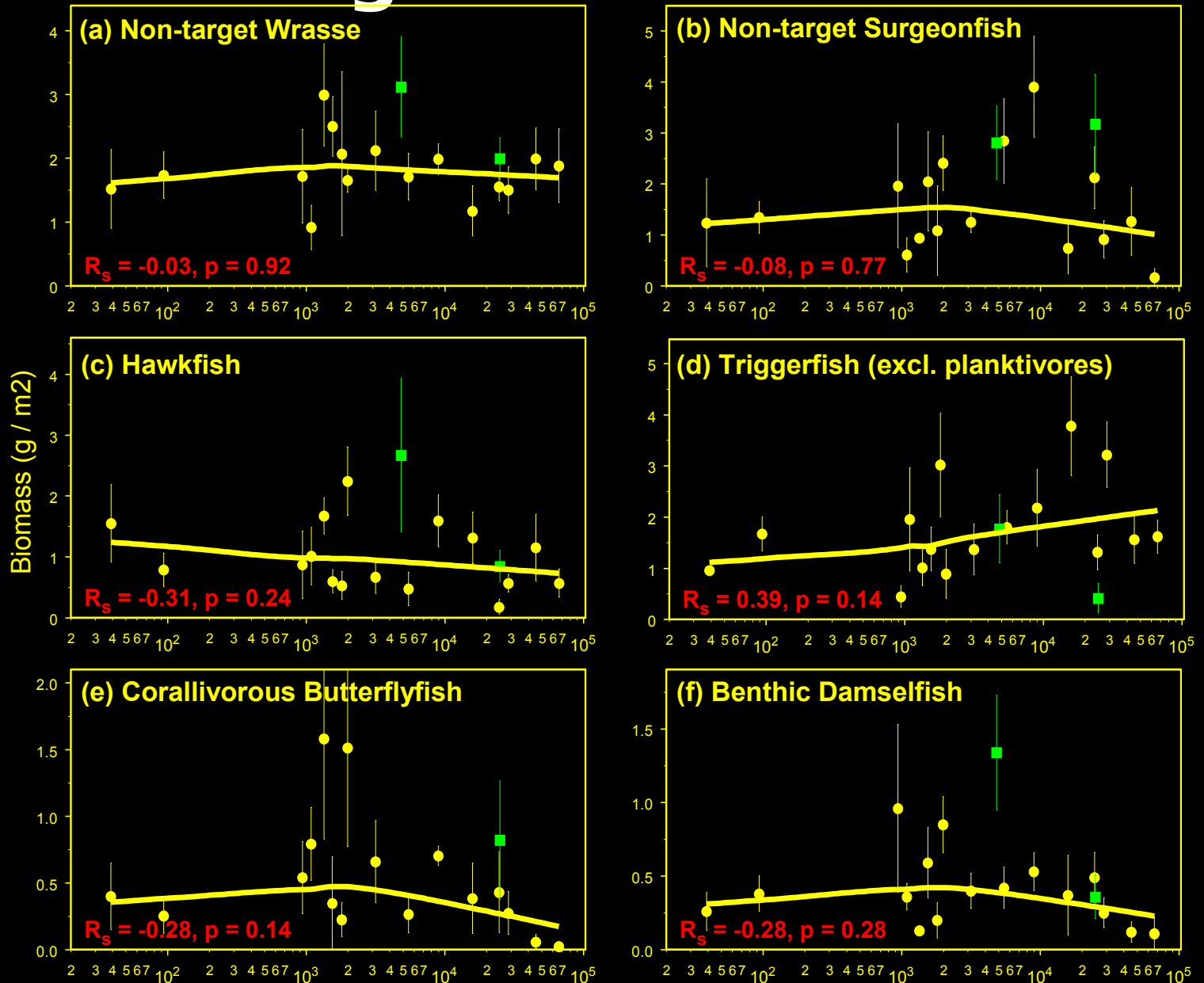
Photos: Kosta Stamoulis, John Coney, UH

Target Fish



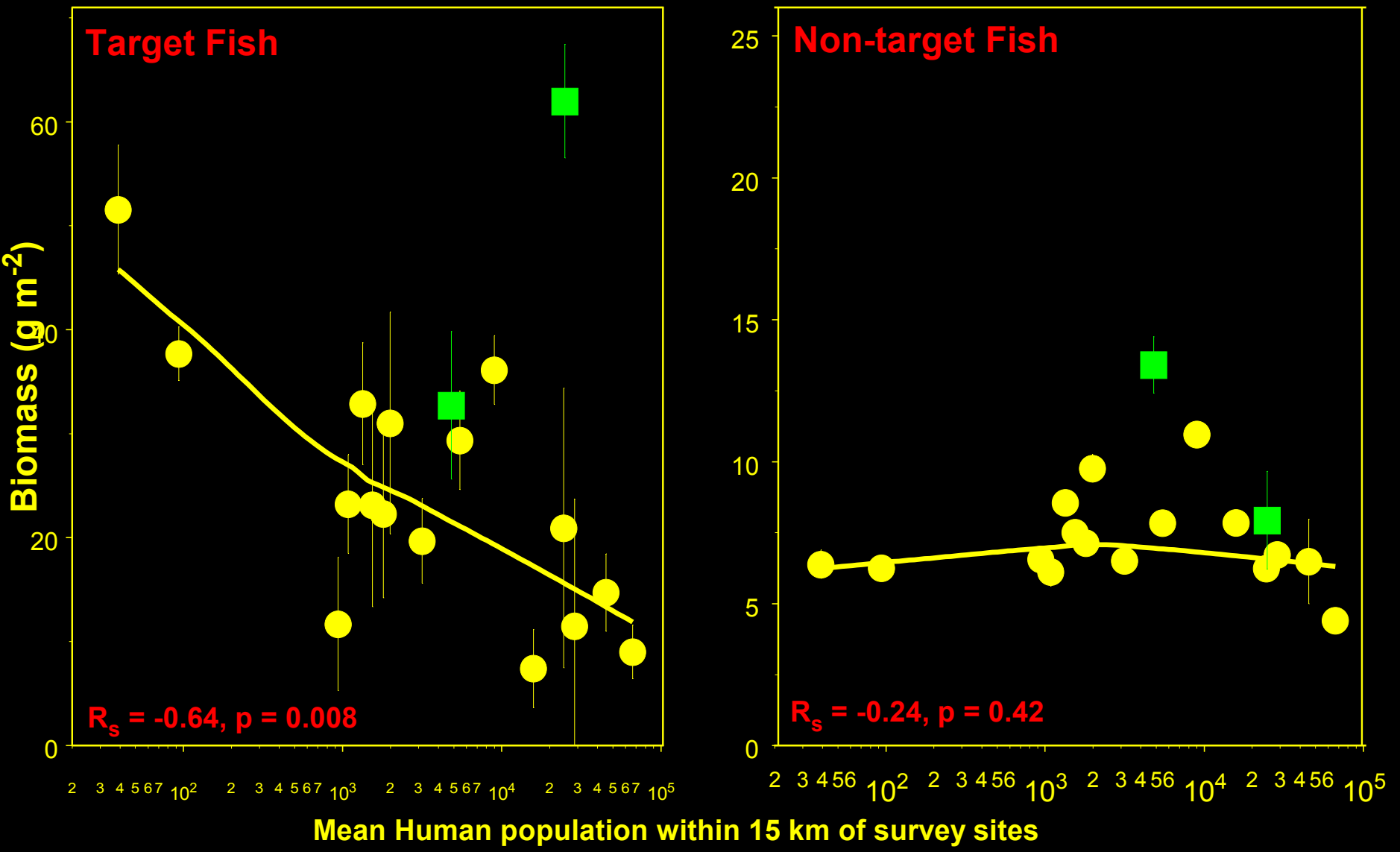
Photos: Kosta Stamoulis, John Coney, UH

Non-Target Fish



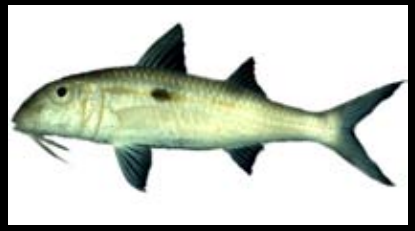
Photos: Kosta Stamoulis, John Coney, UH

Bottom Line …


Target Fish
Biomass (g m-2)
60
40
20
0
Rs = -0.64, p = 0.008
2 3 4 5 6 7 10^2 2 3 4 5 6 7 10^3 2 3 4 5 6 7 10^4 2 3 4 5 6 7 10^5
Non-target Fish
25
20
15
10
5
0
Rs = -0.24, p = 0.42
2 3 4 5 6 10^2 2 3 4 5 6 10^3 2 3 4 5 6 10^4 2 3 4 5 6 10^5
Mean Human population within 15 km of survey sites

Status of MHI Reef Fish Assemblages

APEX



SECONDARY

PRIMARY

Fish Biomass ($g\ m^{-2}$)

0 20 40 60 80

Fish Biomass ($g\ m^{-2}$)

40 80 120 160 200 240

% of MHI REEFS:	20%	37%	16%	28%
	Remote/Inaccess	Moderate Pop	Populous	Oahu
		NWHI*		

* Friedlander & DeMartini 2002 [Marine Ecology Progress Series 230:253-264]

State of Oahu Reefs

- Total Fish Biomass : 28% of 'Remote' and 'Inaccessible'
- Target Fish Groups: 23% of RI
  - Target Surgeons 34%
  - Apex Predators 10%
  - Goatfish 16%
  - Large Wrasse 6%
  - Red Fish 2%
  - Parrotfish 3%
- Breeding Stock of Target Fishes
  - 'Prime Spawner' Bio 2%
- Loss of Key Grazers

Parrotfish Biomass v Macroalgal Cover

Parrotfish Biomass g m^{-2}

Seaweed %

Manele-Hulopo'e MLCD
Ahihi-Kinau NARS
Olowalu
Big Isle Shallow
Lanai Lighthouse
Honolua MLCD
Molokini MLCD
La Perouse Bay
Waikiki MLCD
Makena
Hanauma Bay MLCD
Kahekili BP
Kapalua Bay
Paia
Kihei
Ala Moana

DECREASING BIOMASS OF PARROTFISH

Source: MHI shallow water surveys Hawaii DAR 2006-7

Conclusions

1) Clear evidence of MHI-wide fishing impacts

2) No indication of increasing anthropogenic habitat or environmental degradation at MHI-wide scale

.. but …

Survey locations did not include the worst areas in MHI

Very heavily populated parts of MHI are likely both overfished & suffering from habitat degradation

3) Quite large parts of MHI still in fairly good condition

Acknowledgements:

Marine Surveys: Greta Aeby, Bernardo Varga-Angel, Brian Zgliczynski, Craig Musburger, Darla White, Jeff Eble, Jason Leonard, Jill Zamzow, Steve Cotton, Paul Murakawa, and Tony Montgomery on cruises in 2005 and 2006 aboard NOAA Ships OSCAR ELTON SETTE and HI'IALAKAI.

Fishing Intensity: Jeff Muir, Hawaii Marine Recreational Fishery Survey manager, and Michael Lameier, NOAA Honolulu Fishery Extension Agent, assisted with pooling of fish species into target and negligibly-fished groupings.

Photos: Kosta Stamoulis, John Coney, UH MOPS QUEST CD

MHI Fish Assemblage v Human Population Study:

In press *Environmental Conservation*

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