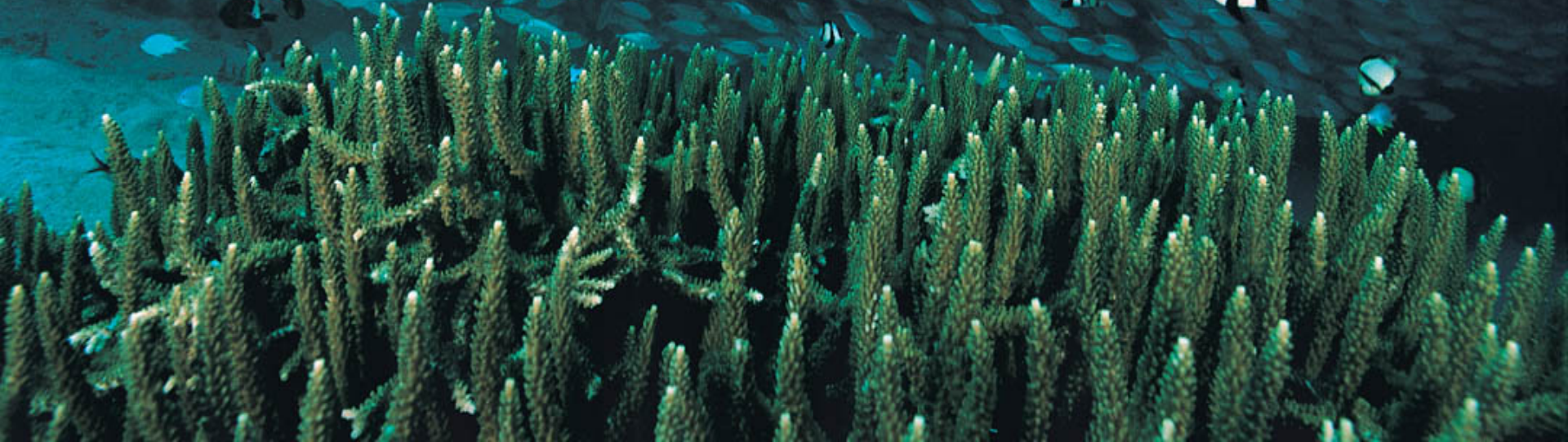


Overfishing on Caribbean and Pacific Coral Reefs and Potential Solutions

Alan Friedlander

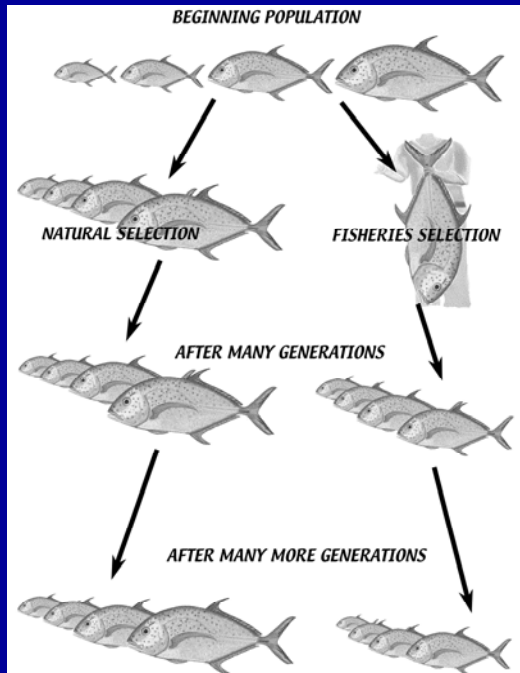
NOAA/NOS/NCCOS/CCMA – Biogeography Branch

Oceanic Institute, Waimanalo, Hawaii



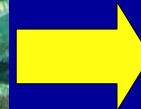
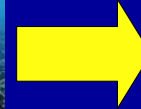
Direct Effects

- Declines in:
 - abundance
 - size
 - reproductive output
- Changes in:
 - sex ratio
 - behavior & distribution



Ecosystem Effects

- Changes in:
 - Trophic structure
 - Predator-prey dynamics
 - Habitat
 - Algal & inverts
 - Phase-shift



Increases in Fishing Capacity in the US Virgin Islands

1930s

St. John, P. W. I.

Drawing: Fish Pots



1958



1980s

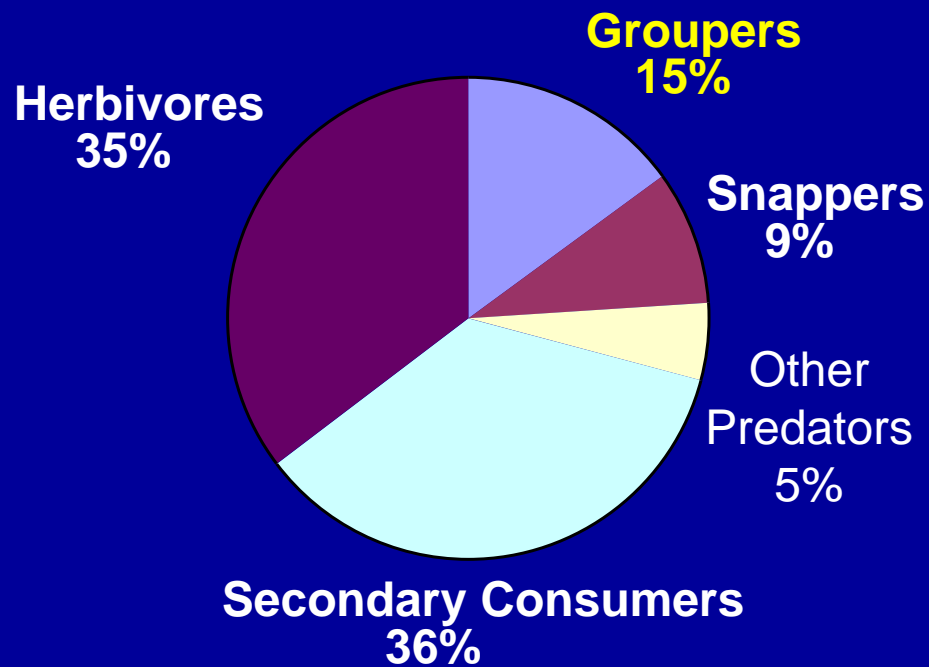


Today

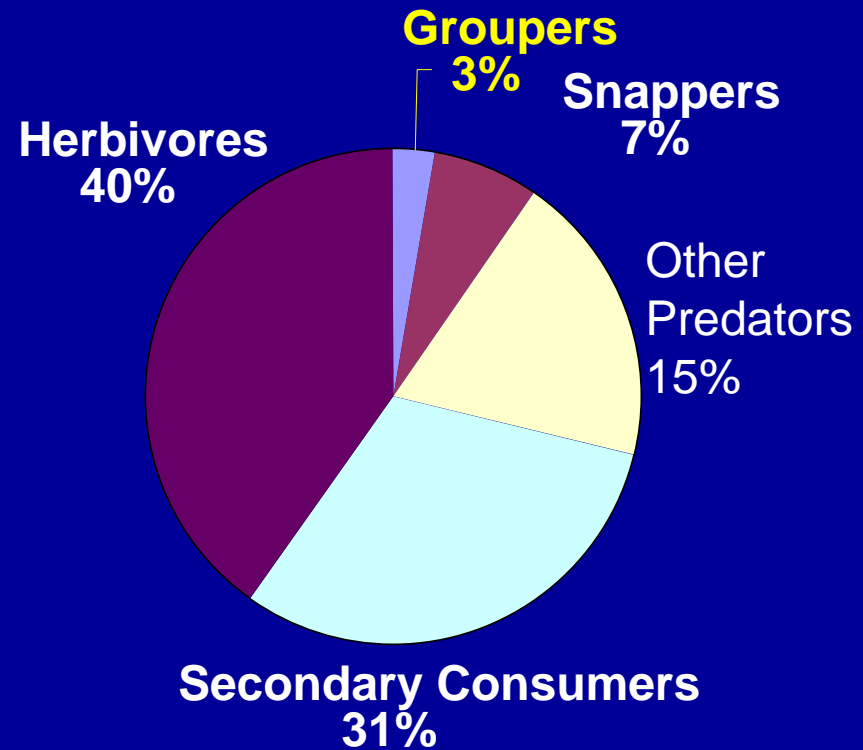


Historical biological data in Virgin Islands provide earlier baseline for comparison w/ recent monitoring

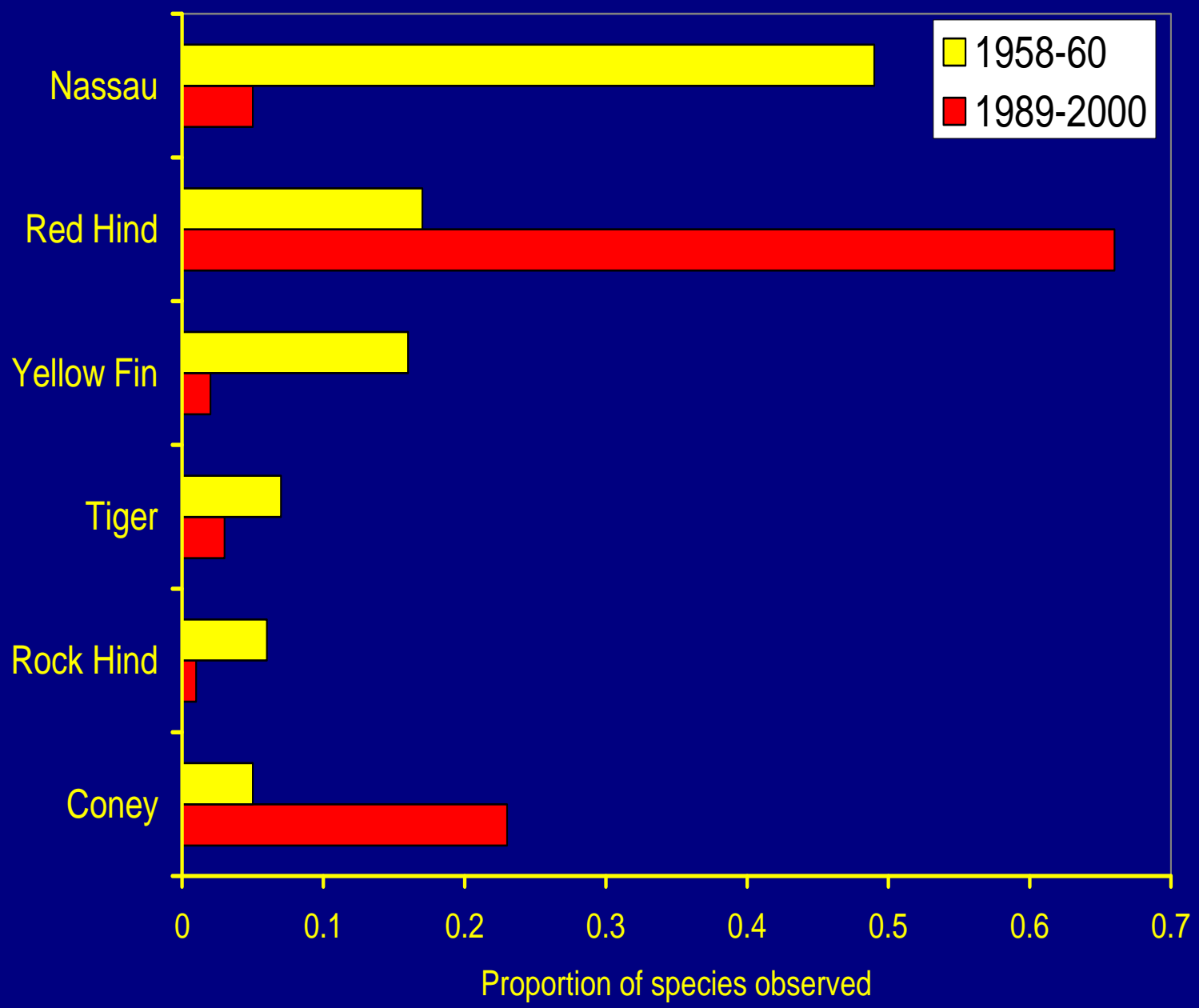
1960 – Greater Lameshur Bay



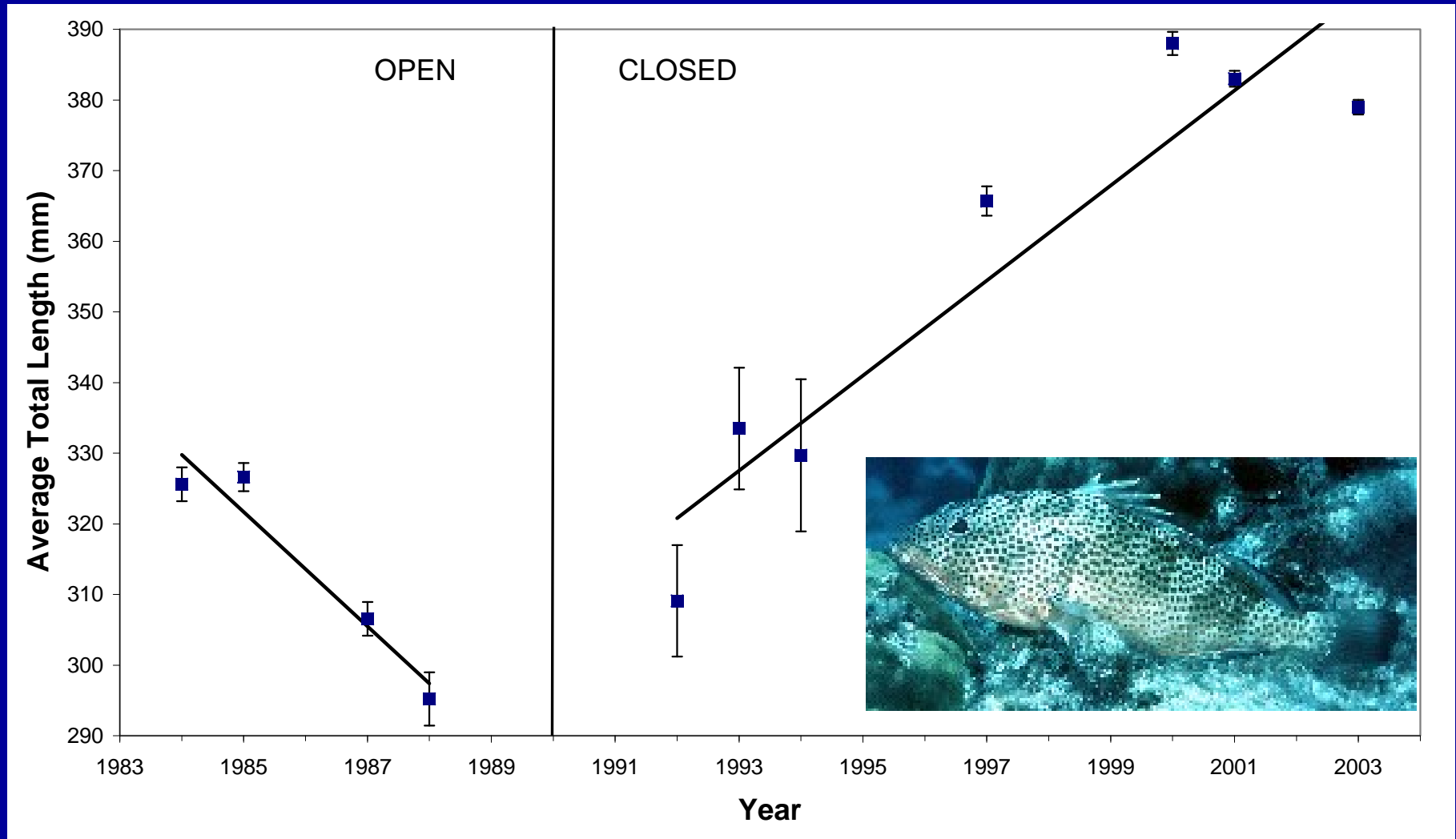
1989-2000 – Monitoring Data



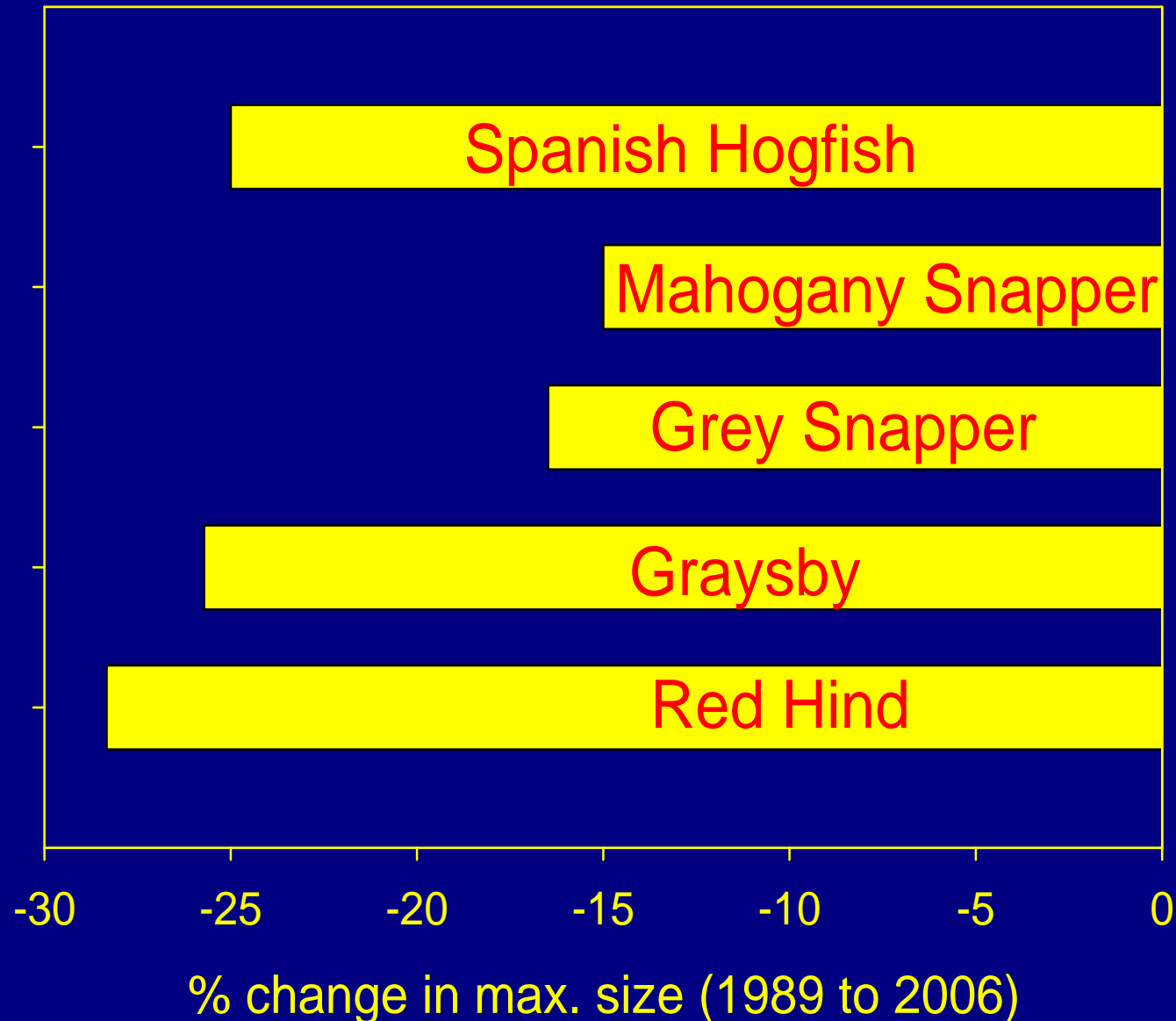
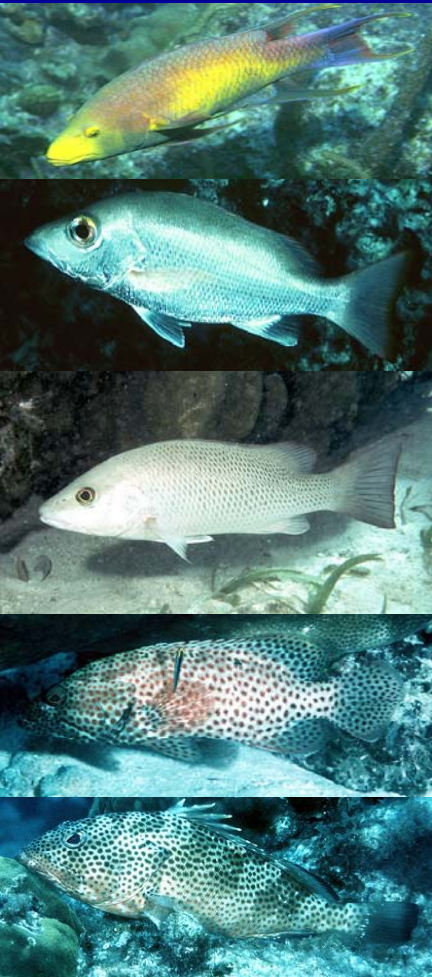
Changes in Grouper Species - U.S. Virgin Islands



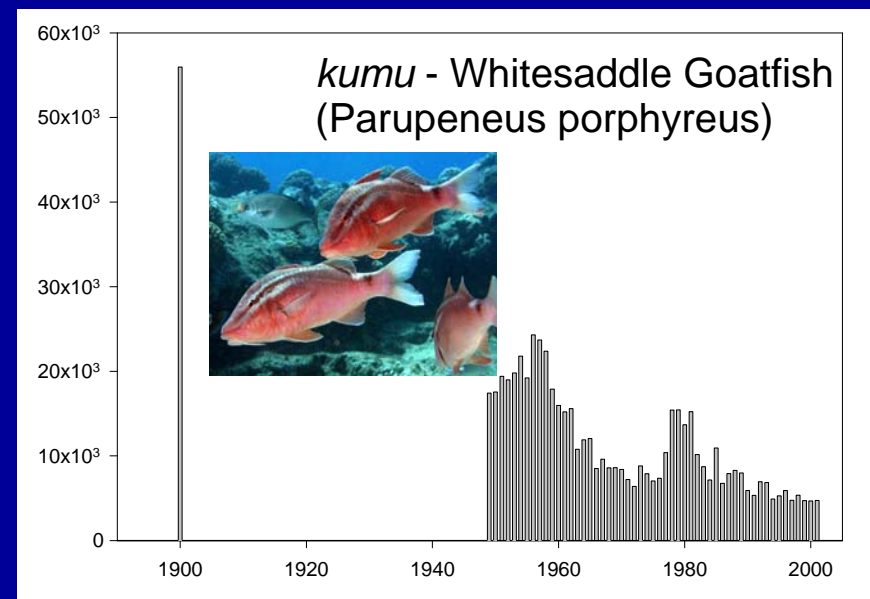
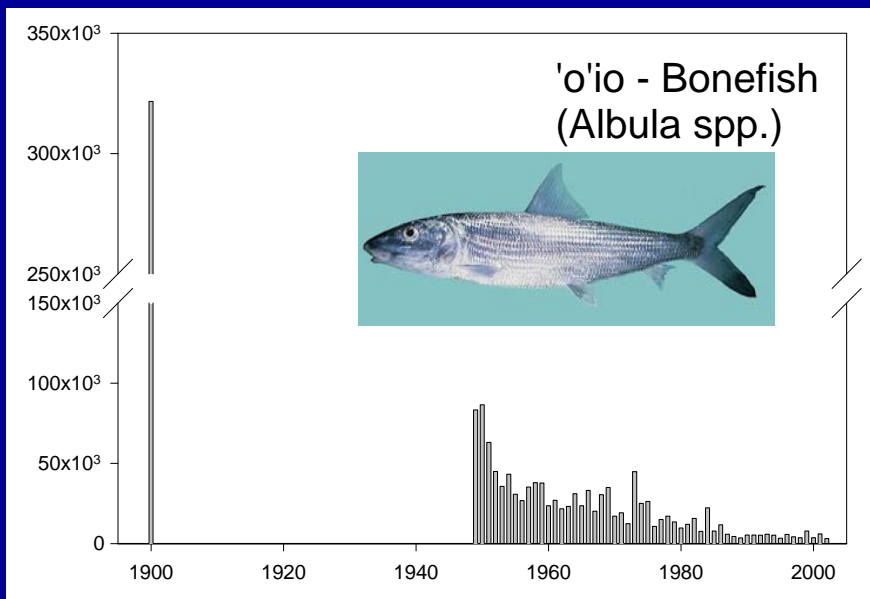
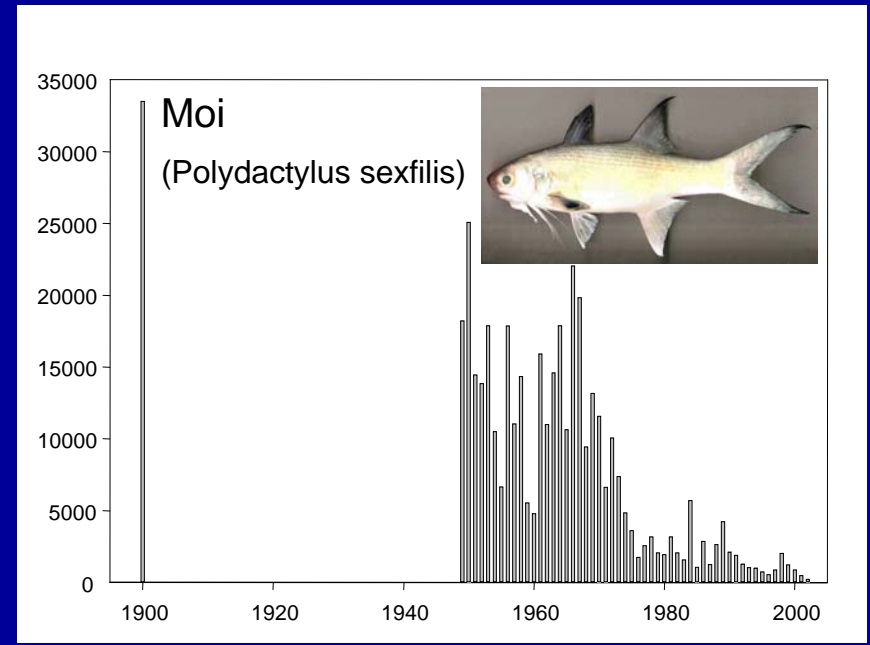
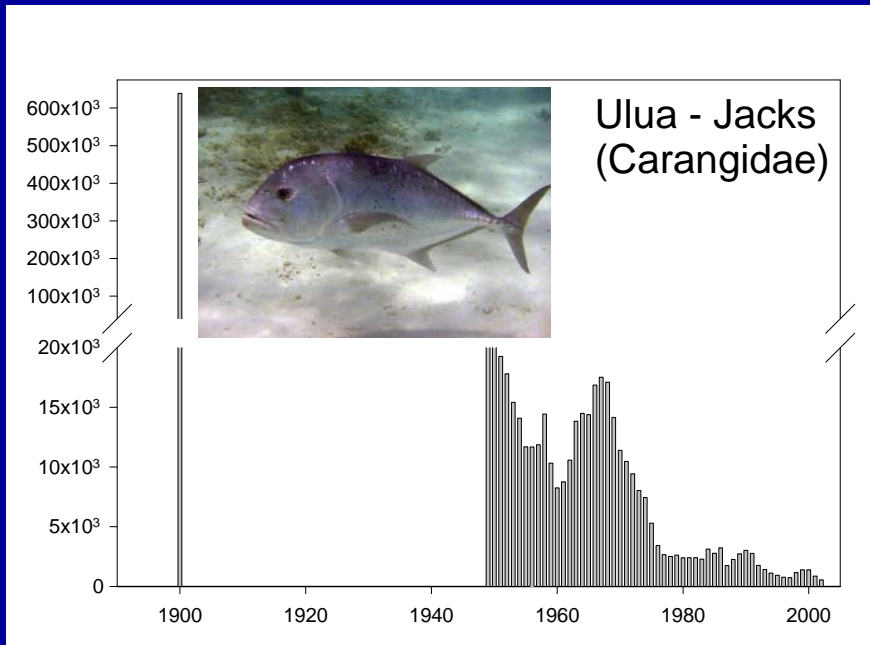
Spawning aggregation closure for red hind in the US Virgin Islands resulted in increased fish size and more males over time



Changes in Max. Size of Important Species in Virgin Islands National Park from 1989 to 2006

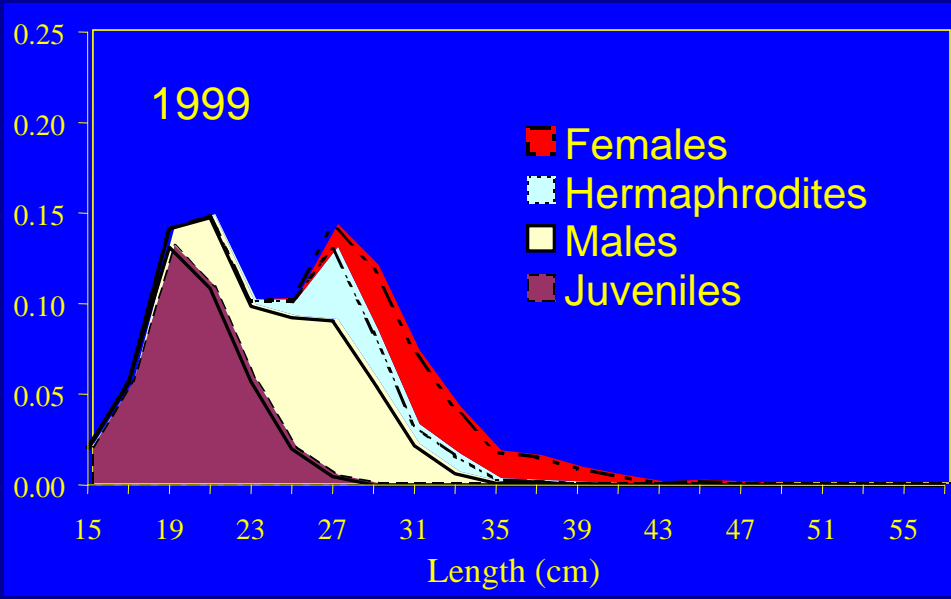
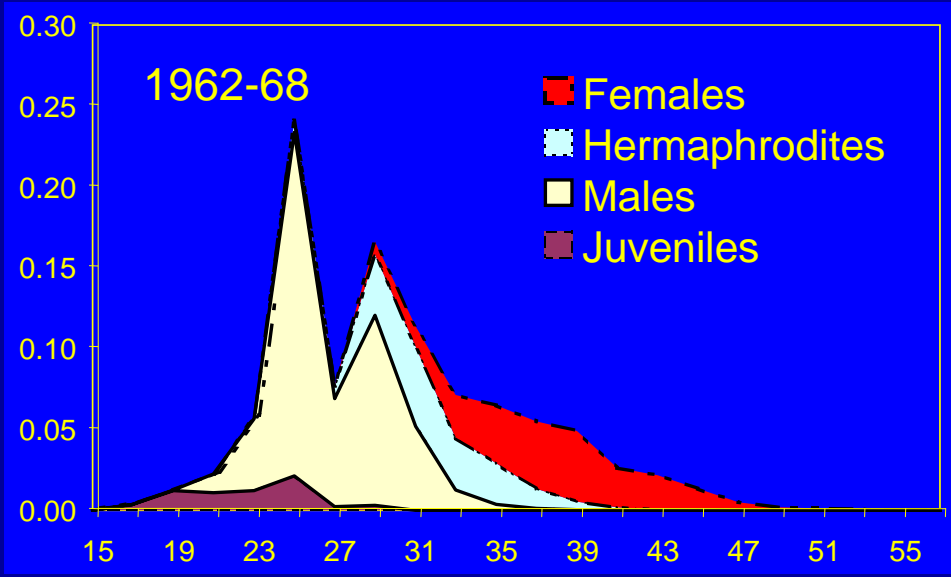


Commercial Landings (lbs) for Select Targeted Fisheries Species in Hawai'i



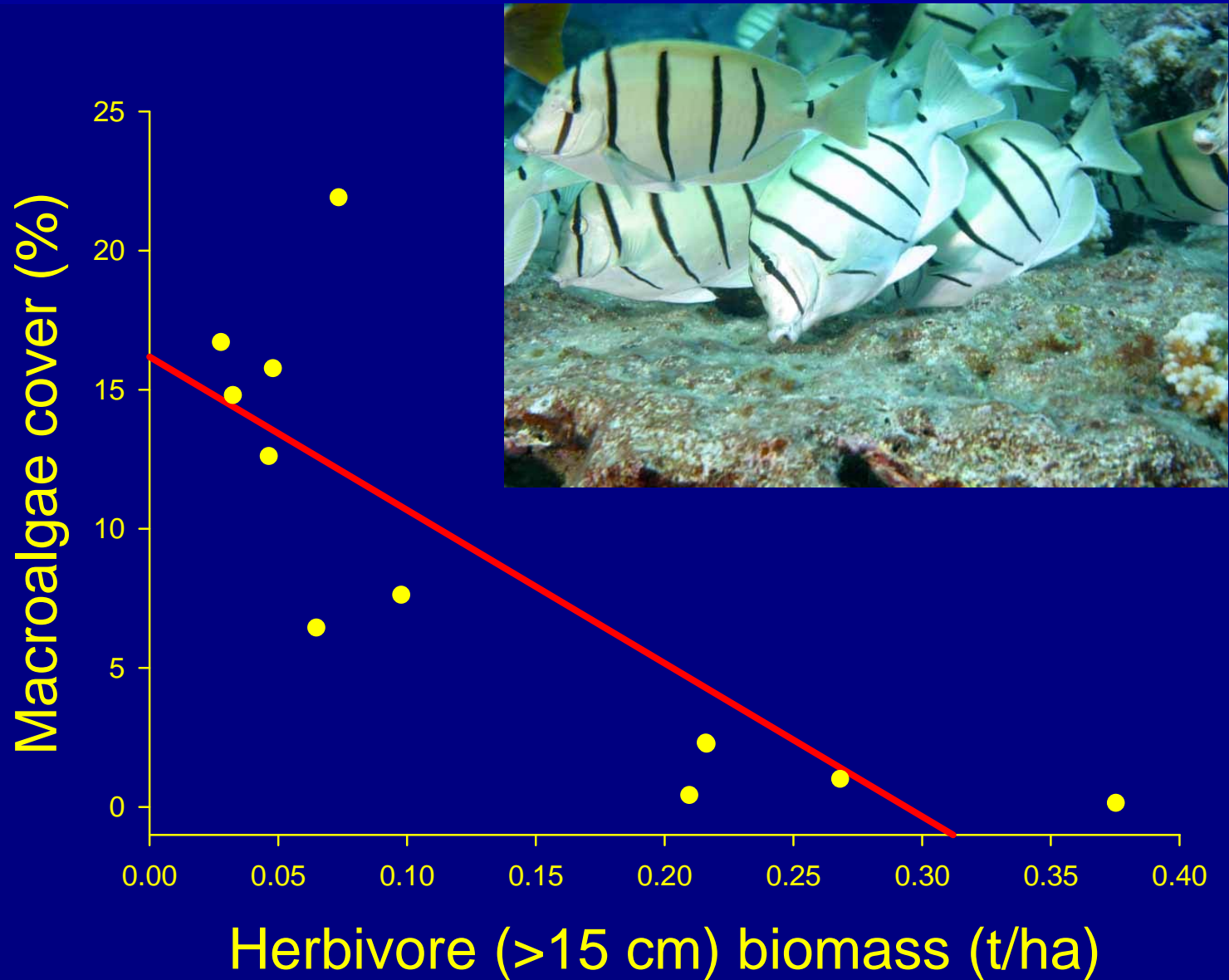
Change in Size and Sex Ratio of Harvested *Moi* (*Polydactylus sexfilis*) on Oahu since the 1960's

Proportion of total

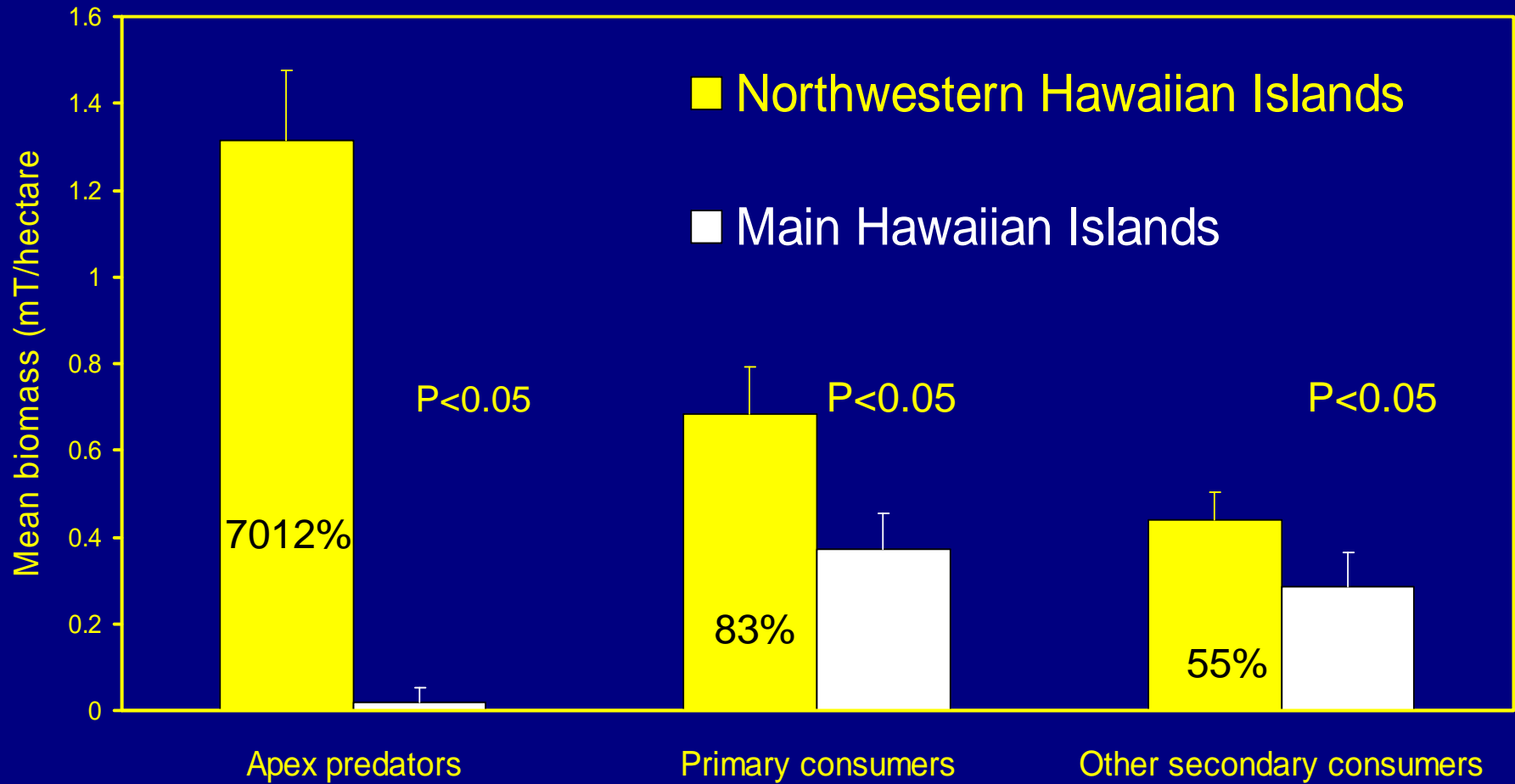


Sex	1960s	1999	Size
Juv	6.4%	39.70%	***
M	52.3%	33.80%	***
H	17.8%	10.30%	***
F	23.5%	16.20%	***

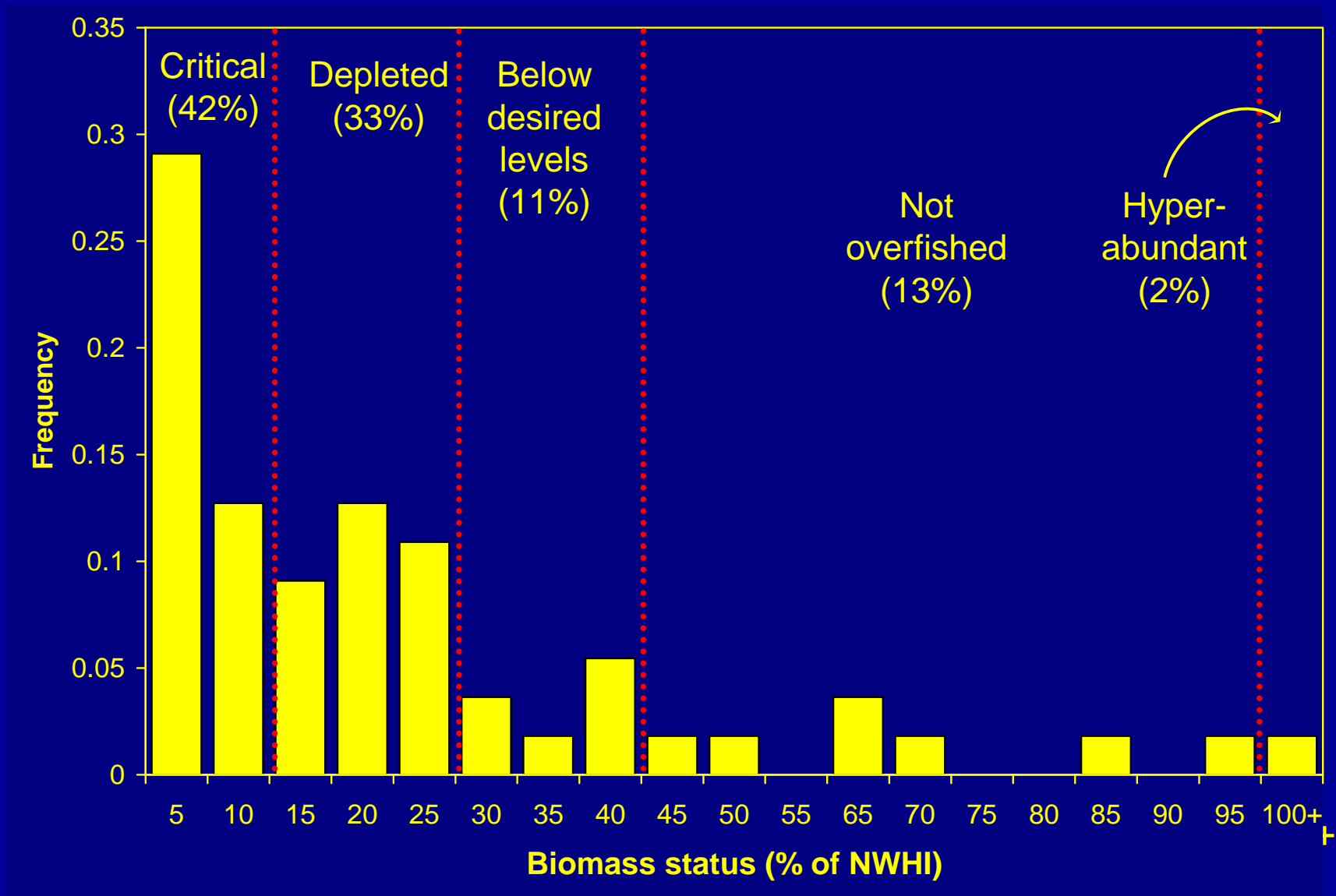
Loss of Herbivores lead to Algal-dominated Reef



Comparison of feedings groups in the MHI & NWHI



Status of 55 MHI Reef Fish Stocks relative to Unfished, Virgin Stocks in the NWHI

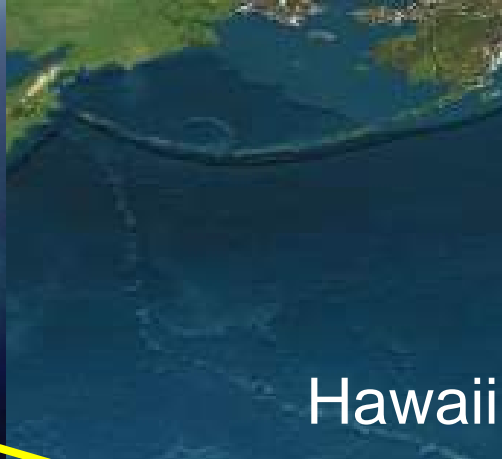


KINGMAN REEF



0 people

Photo by Rob Shallenberger/USFWS

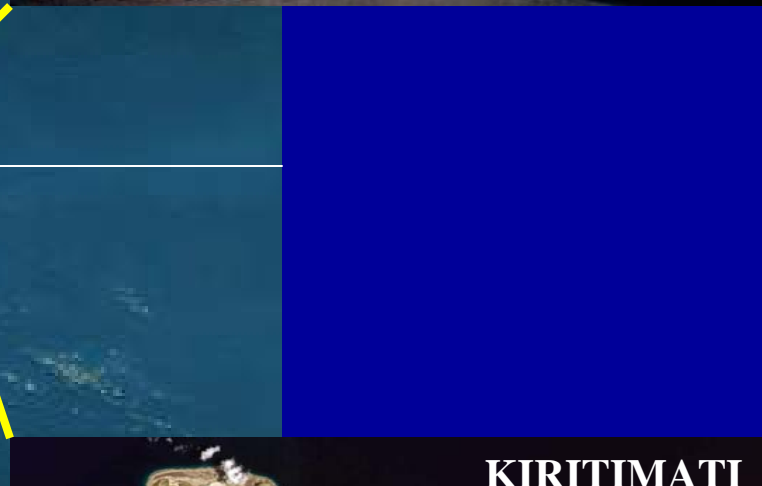


Hawaii

PALMYRA ATOLL



10 people



TABUAERAN

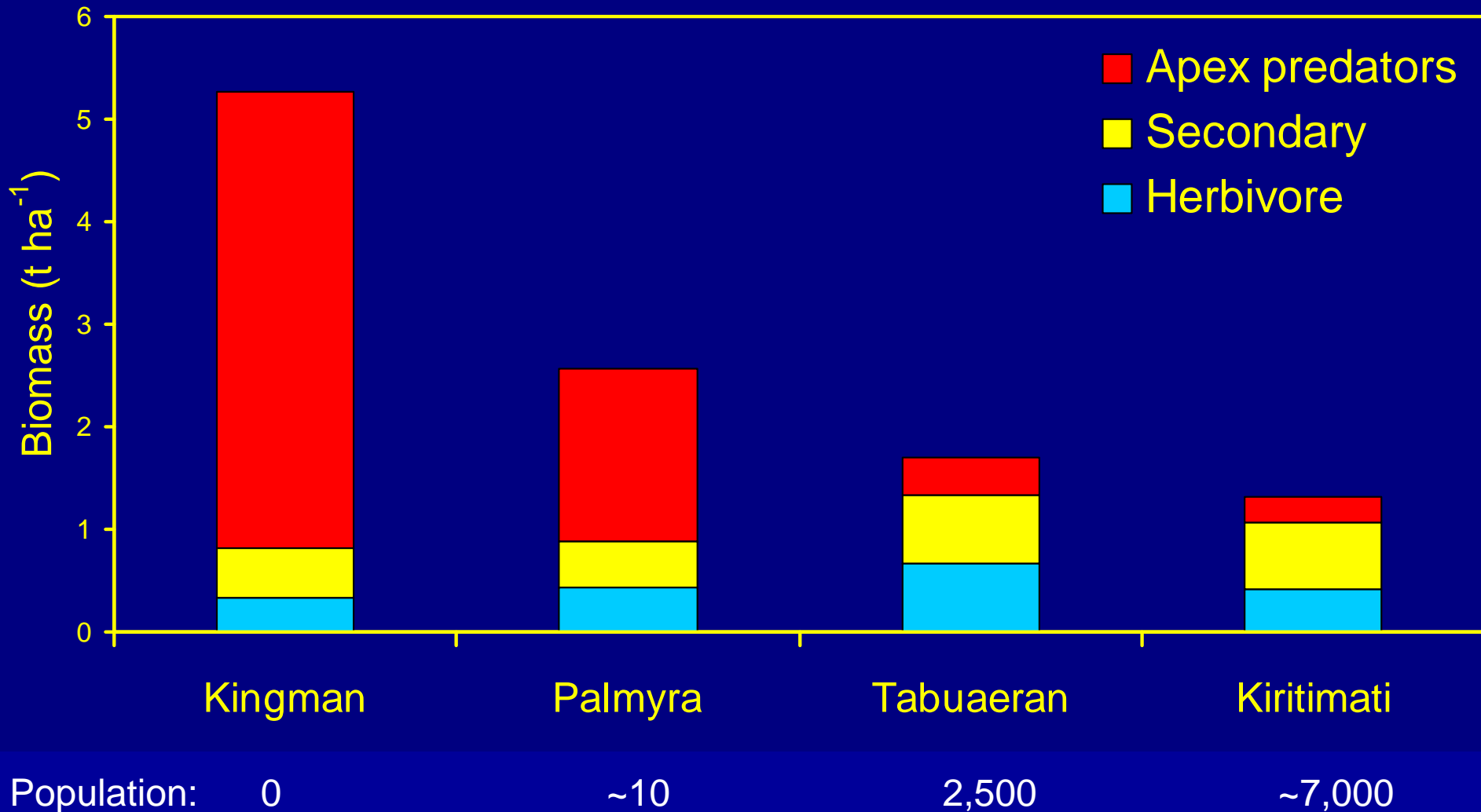
2,500 people



KIRITIMATI

6-8,000 people

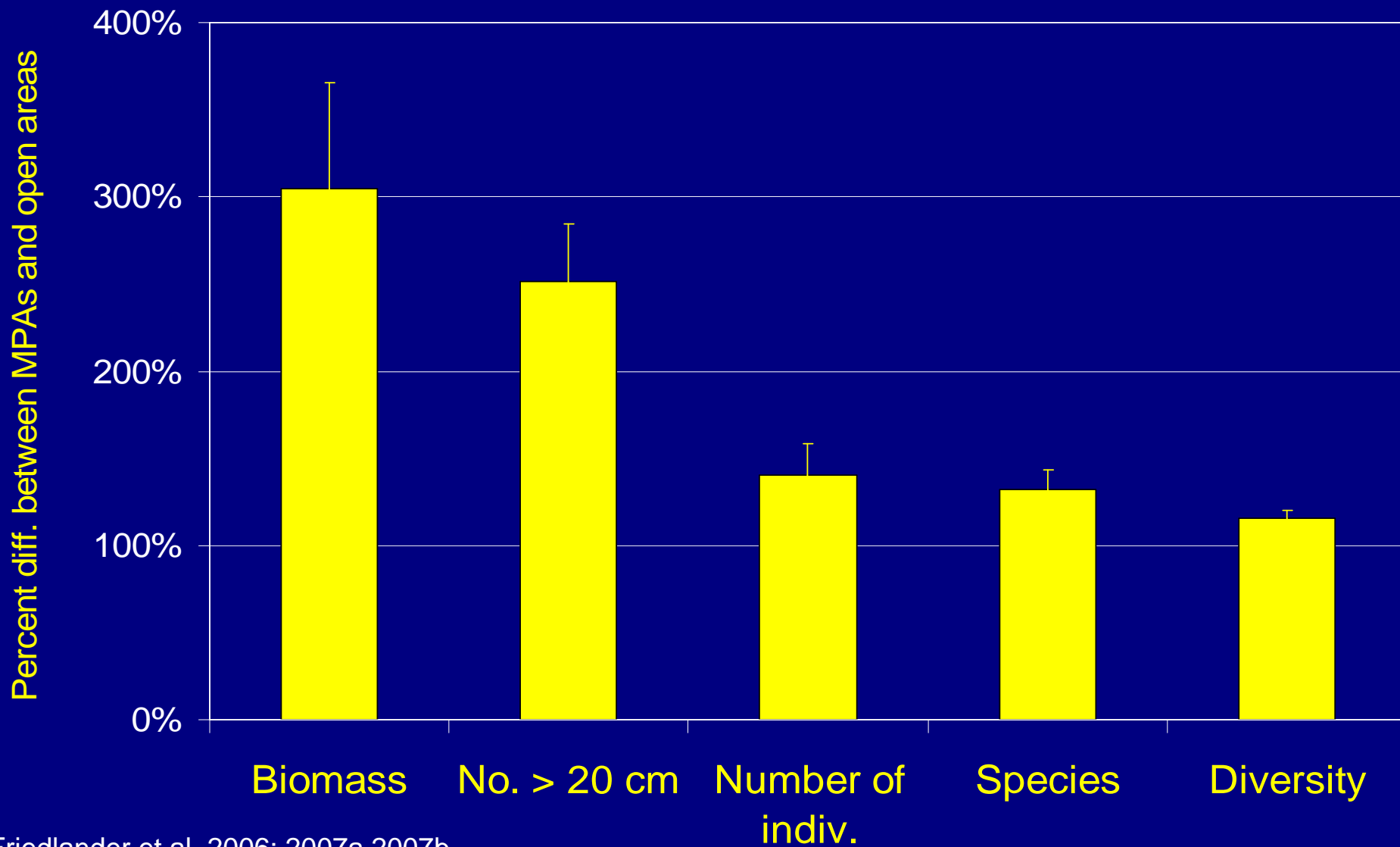
Declines in Fish Biomass across a Gradient of Human Impact in the Line Islands





Advances in fishing technology have reduced natural refuges

Percent Difference in Fish Assemblage Characteristics between MPAs and Open Areas in Hawaii



Traditional Hawaiian Marine Resource Use

A sepia-toned photograph of a person standing on a rocky shore, looking out at the ocean. A large, intricate fishing net is draped across the rocks and extends into the water. The scene is set against a backdrop of a cloudy sky and a calm sea.

- Recognize natural rhythms
- Do not disturb basic renewal processes
- Monitor cues (moon, season, habitat)
- Resource knowledge
 - Intimacy
 - Ancestors

Hawaiian Names for Nights of the Rising (*ho'onui*), Full (*poepoe*), and Falling (*emi*) Moon Phases and Kapu Periods

[.....Kapu - Ku.....]



[Kapu - Hua]

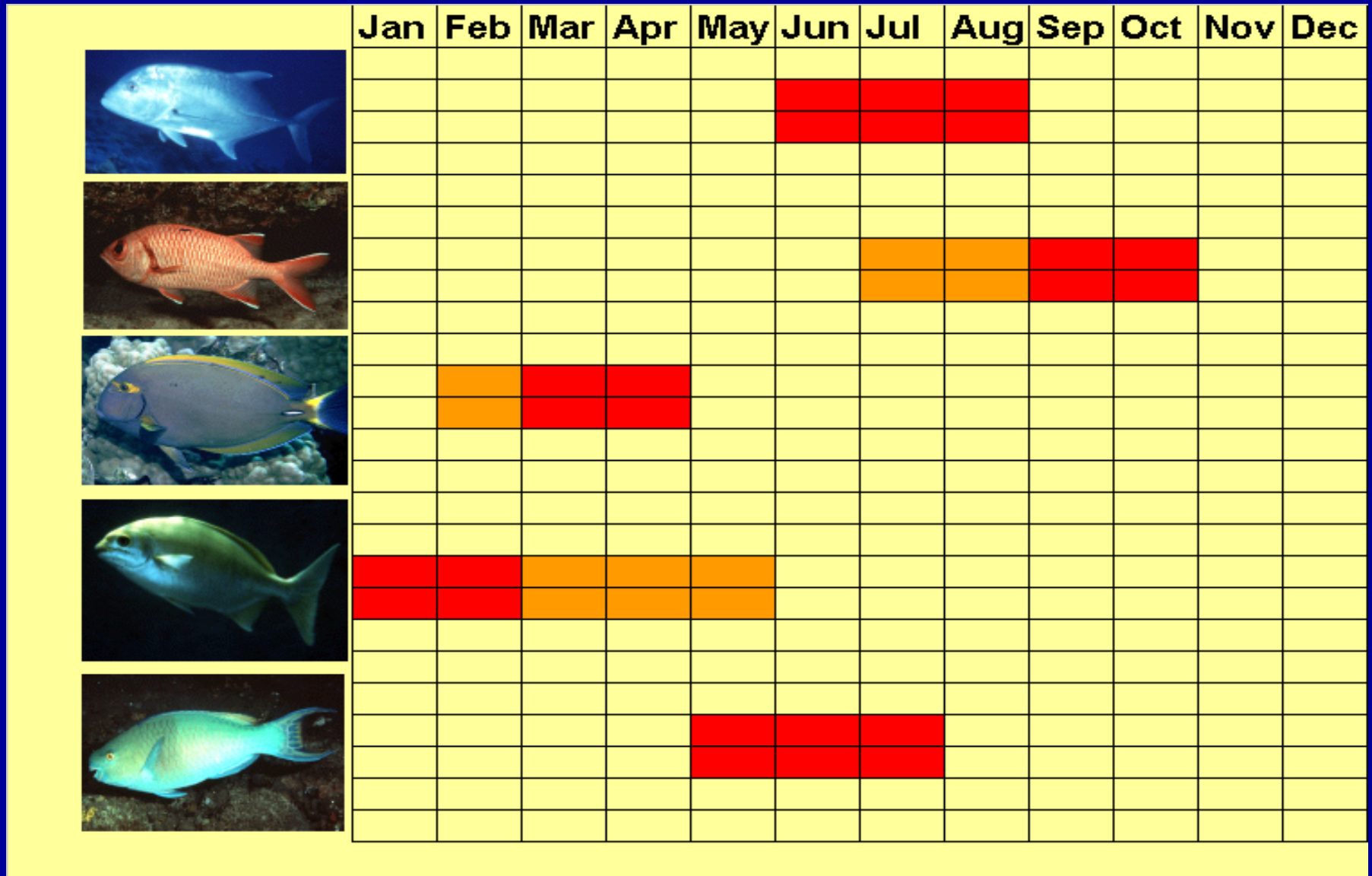


[...Kapu - Kaloa...] [Kapu Kane]

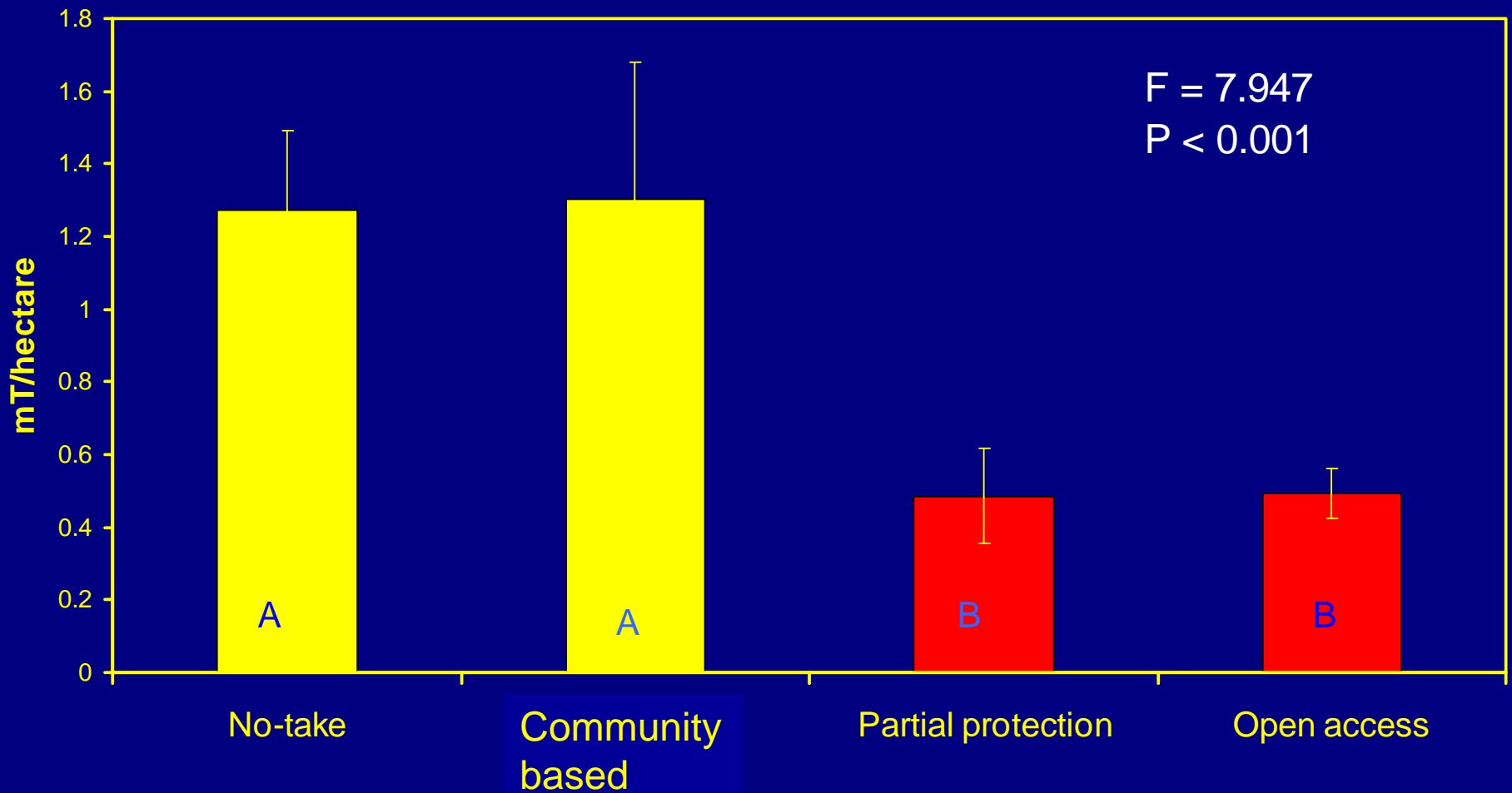



Mo'omomi Fish Spawning Calendar (2000)

Red = Peak Spawning Months, Orange = Other Spawning Months



Comparison of Fish Biomass in Areas under Various Management Regimes in Hawaii



- 
- Overfishing has led to:
 - Reduced abundance, size & sex ratios of key sp.
 - Loss of ecosystem function
 - Loss of top-down control by predators
 - Loss of herbivores lead to algal overgrowth
 - MPAs highly effective in conserving populations
 - Traditional community-based management effective in appropriate locations