

CIGUATERA AND CLIMATE
CHANGE:
Don't Eat The
Barracuda



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Pathogens
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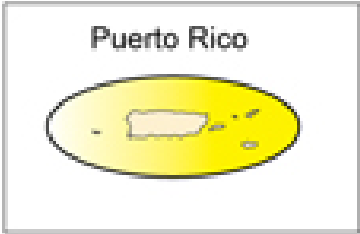
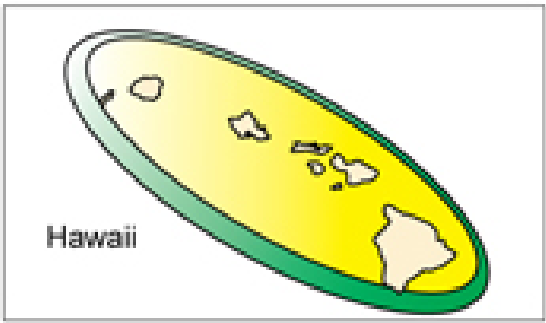
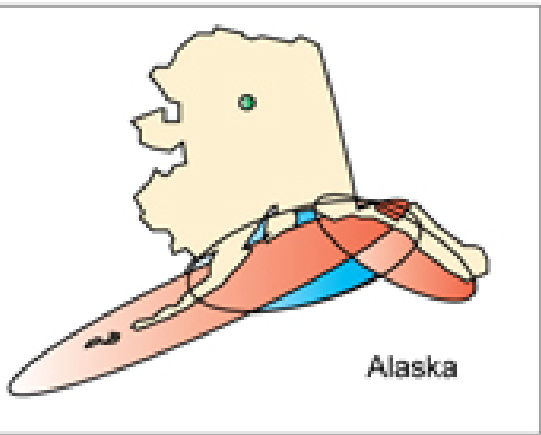
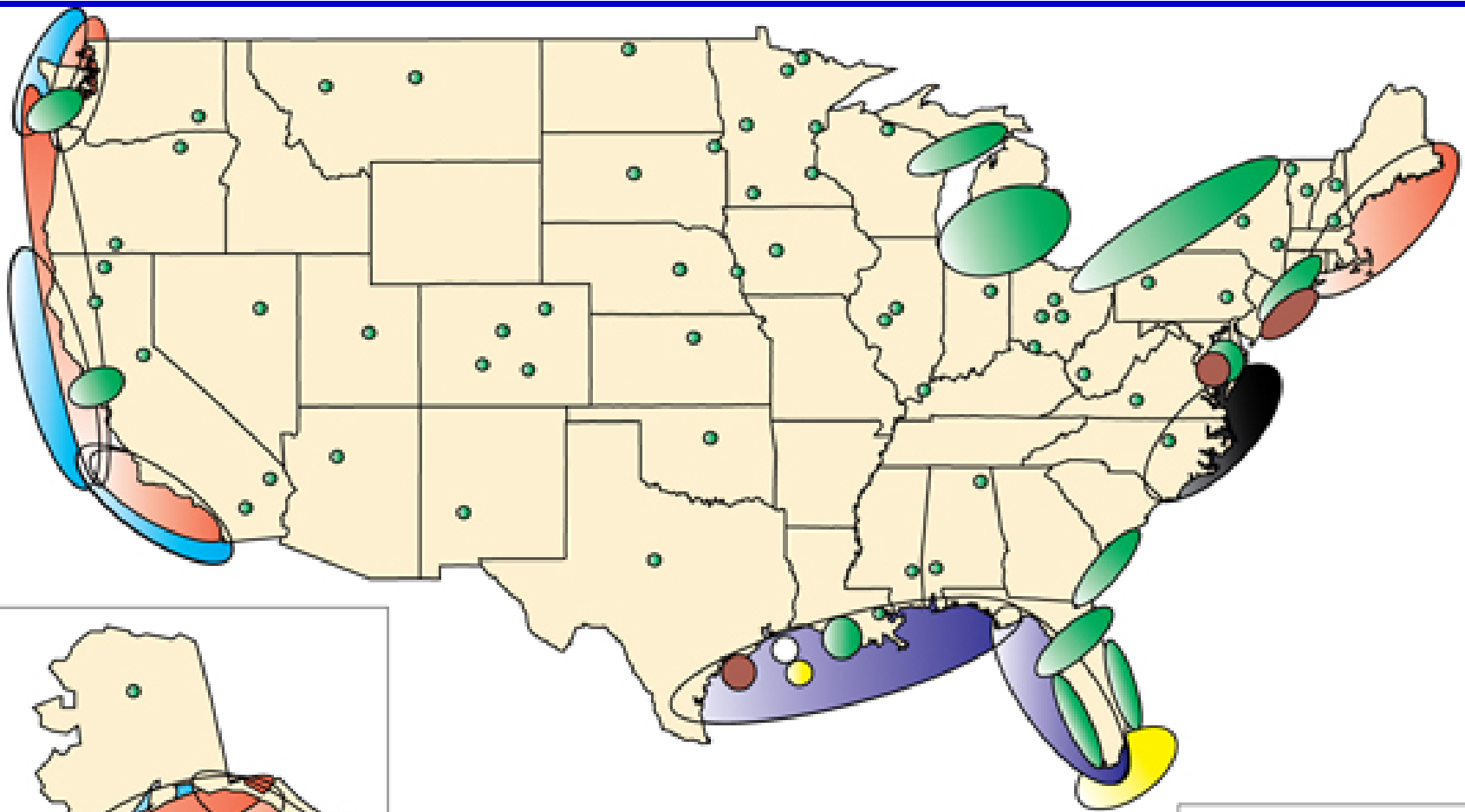
UF Emerging Pathogens Institute

- Created with \$60 million appropriation from Florida state legislature, focusing on human, animal, and plant pathogens
- Over 150 faculty members, from 8 UF colleges (including medicine, public health, veterinary medicine, and agriculture)
- Strong global emphasis, taking advantage of Florida's sub-tropical location



Harmful Algal Blooms (HABs) Associated with Human Disease

- Paralytic shellfish poisoning (PSP)
 - *Alexandrium* spp./saxitoxins
- Neurotoxic shellfish poisoning (NSP)
 - *Karenia brevis*/brevetoxins
- Diarrhetic shellfish poisoning (DSP)
 - *Dinophysis* or *Prorocentrum* spp
- Amnesic shellfish poisoning (ASP)
 - *Pseudo-nitzschia* spp./domoic acid
- Ciguatera
 - *Gambierdiscus toxicus*/ciguatoxin



- PSP ○ ASP ○ CFP
- NSP ○ *Karlodinium & Pfiesteria*
- CyanoHABs ○ Brown tide ○ DSP

Florida Red Tide: Neurotoxic Shellfish Poisoning

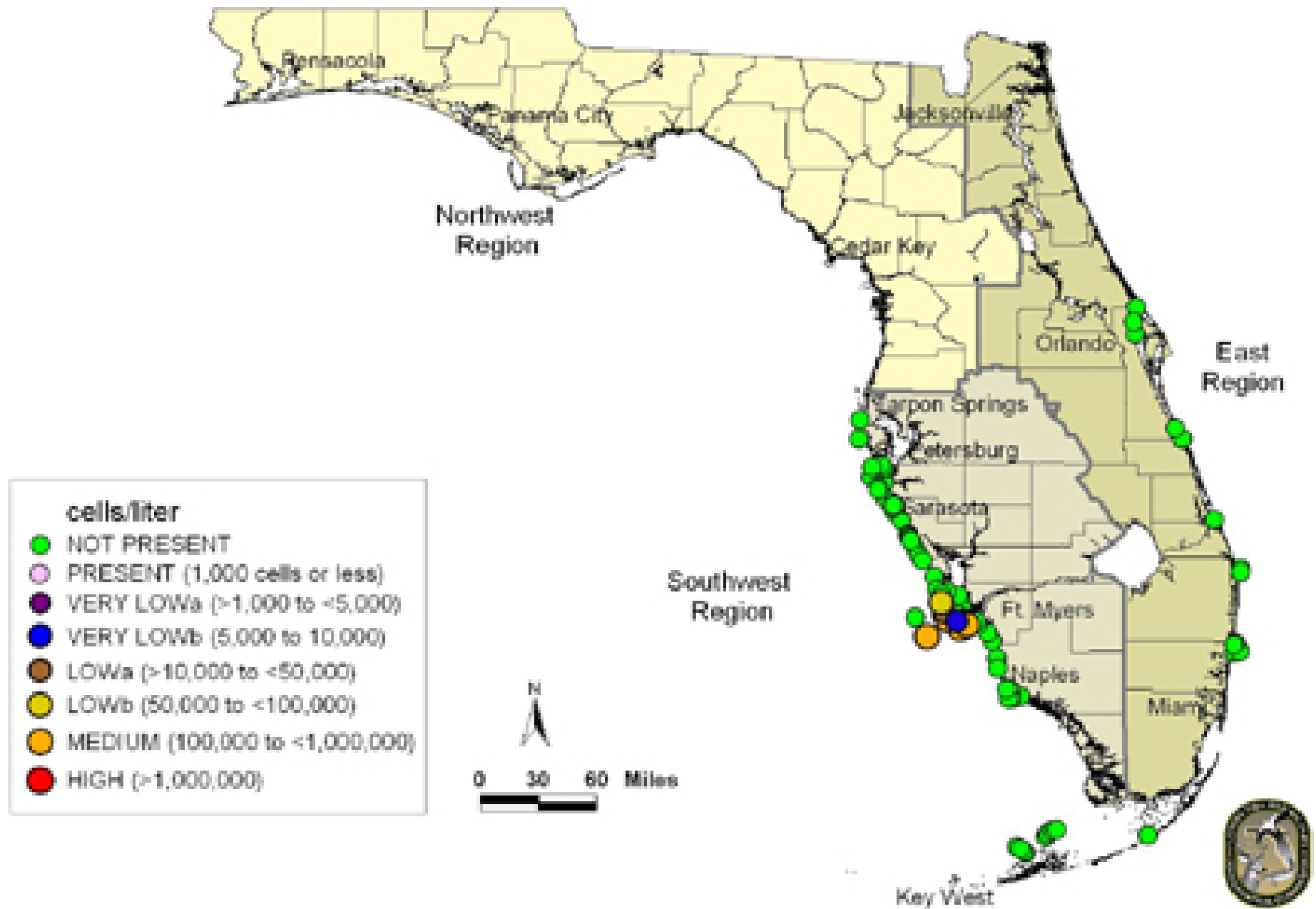
- Manifestations
 - Eating shellfish from contaminated areas
 - Gastrointestinal symptoms
 - Neurological symptoms/paresthesias
 - Walking on beach during red tide
 - Respiratory and eye irritation



K. breve Tides

- Blooms most common on west coast of Florida: reported in this area for 21 of the last 22 years
- Blooms initiated at continental shelf, with currents and winds determining whether a bloom will move onshore
- Once near shore, *K. breve* uses land-based nutrients to grow rapidly, provided salinity does not drop below 24 parts/1000
- Dense blooms inshore generally can not be sustained without inputs of new nutrients from human sources

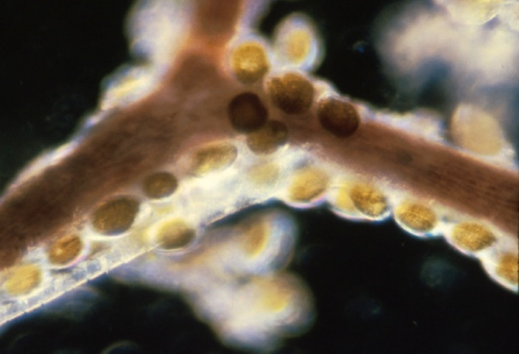
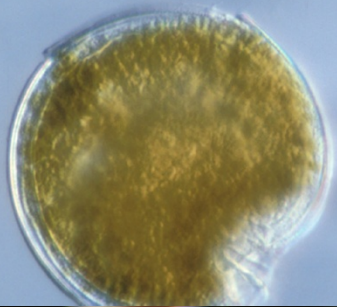
Karenia brevis Counts, October 24-30, 2009





Ciguatera Fish Poisoning

- Results from eating tropical reef fish that carry “ciguatoxin”



Ciguatoxins, human illness

gambiertoxins
(precursor compounds)

herbivorous fish

carnivorous fish

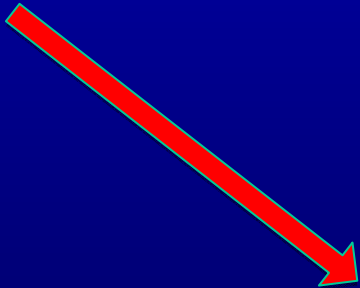
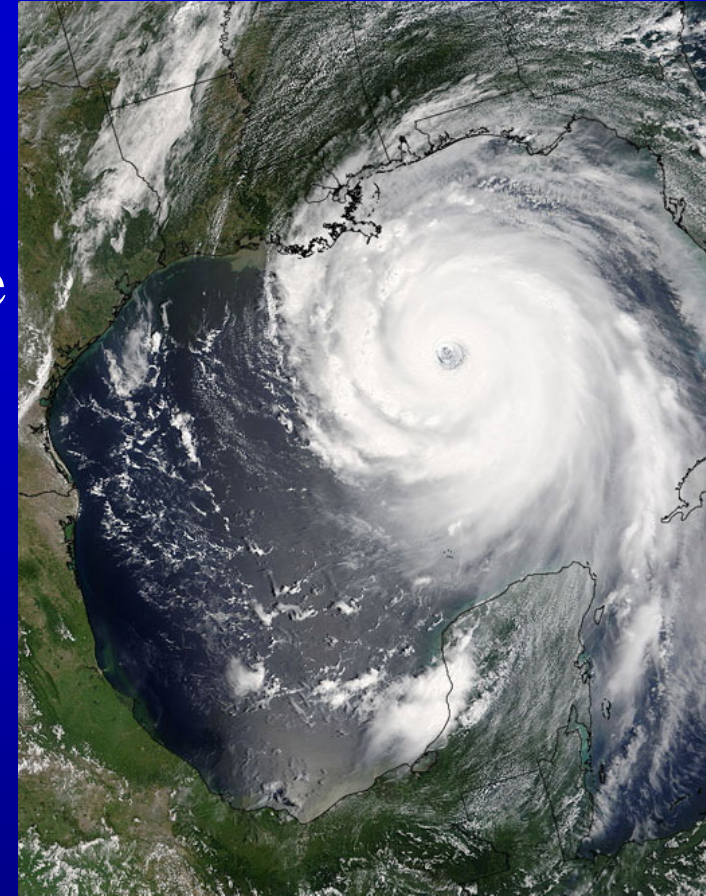
Most frequently reported marine toxin disease in the world, affecting > 50,000 people per year

Major constraint on fisheries in many regions

Coral reef health

Gambierdiscus abundance and toxicity

Climate change
Disease
Storms
Pollution
Other stresses



Fish toxicity



Patterns of CFP illness

Ciguatera: Incidence

- U.S. Virgin Islands:
7.3 cases/1,000 population/year*
- Miami:
0.05 cases/1,000 population/year
- South Pacific:
0.97-2.19 cases/1,000 population/year
- Reunion Island:
0.08 cases/1,000 population/year

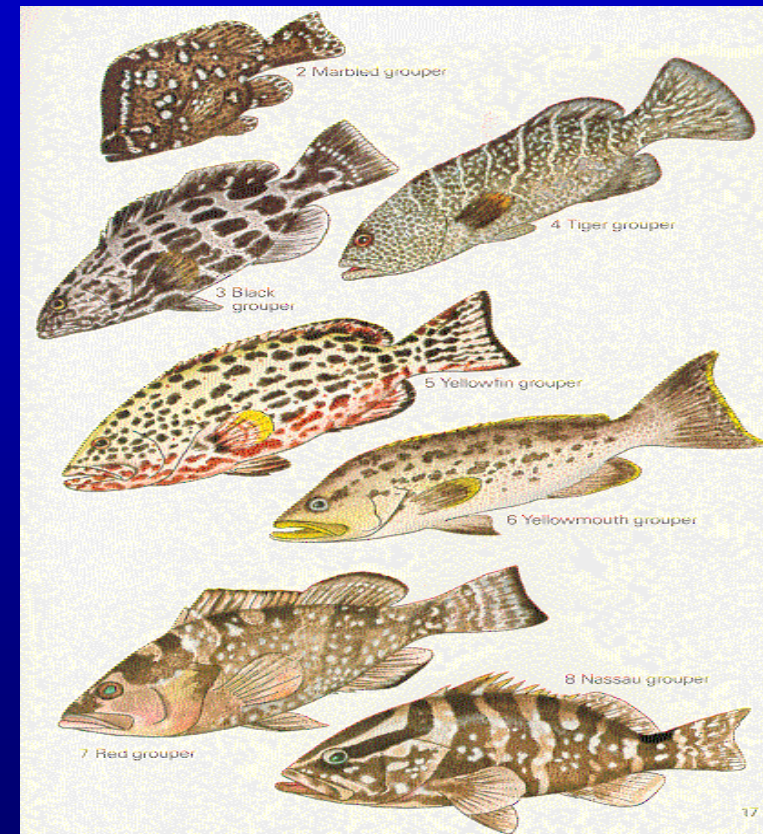
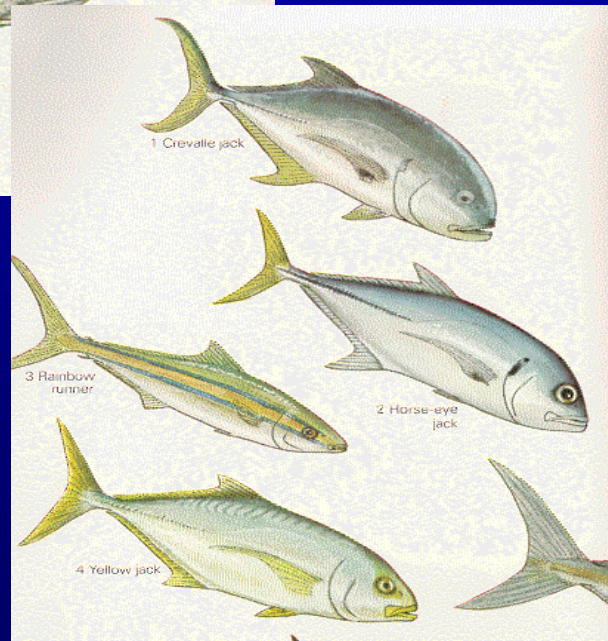
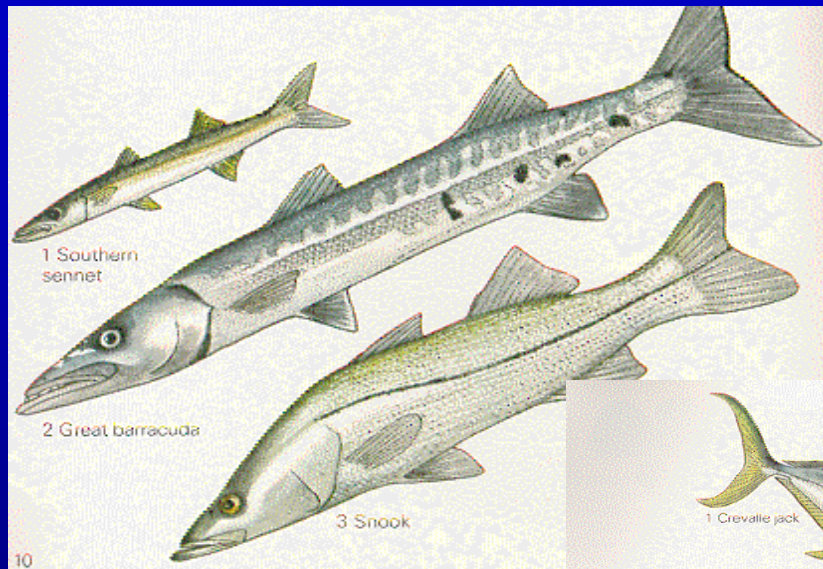
*population-based survey

Ciguatera Symptoms

CLINICAL PRESENTATION, DURATION

| | % with symptom | onset, hrs | duration, days |
|--------------------------|----------------|------------|----------------|
| diarrhea | 91% | 6 | 1 (1-20) |
| vomiting | 70% | 5 | 1 (1-7) |
| <hr/> | | | |
| malaise | 70% | 6 | 7 (1-21) |
| itching | 58% | 12 | 3 (1-14) |
| pain, weakness lower ext | 58% | 8.5 | 10.5 (1-82) |
| arthralgias | 52% | 12 | 6 (1-30) |
| circumoral paresthesias | 36% | 6 | 21 (3-74) |
| Hot and cold reversal | 36% | 12 | 14 (6-21) |
| extremity paresthesias | 33% | 6 | 18 (3-28) |

Ciguatera: Fish Commonly Reported to be Toxic



Ciguatera Fish Poisoning

- Toxins produced by *Gambierdiscus toxicus* and related algal species
 - overgrowth in areas with disturbed reefs
 - toxin passed up food chain
- Fish are unaffected by toxin
- Fish look and taste normal
- Toxin is not affected by cooking
- Internal organs more likely to be toxic
- Larger fish more likely to be toxic



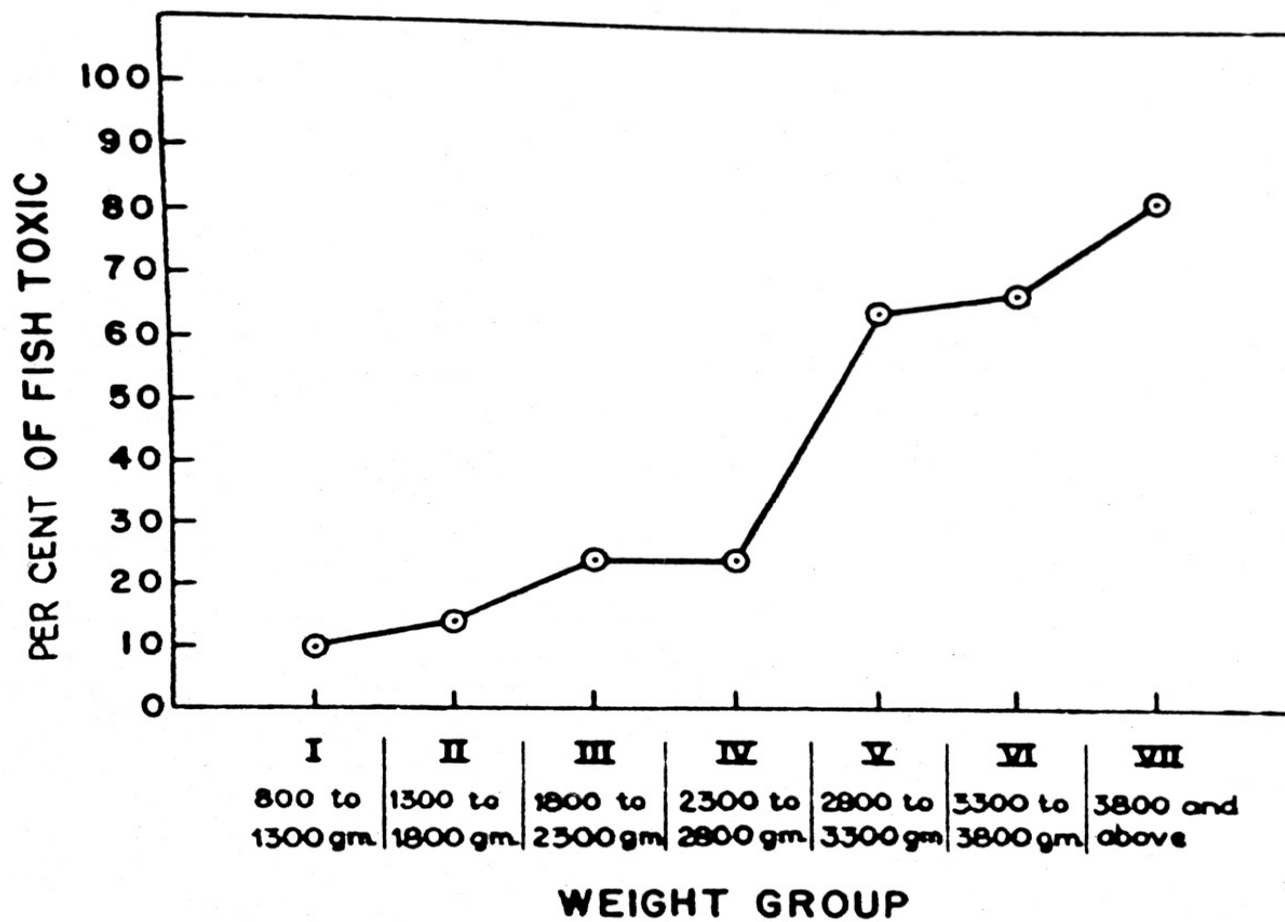
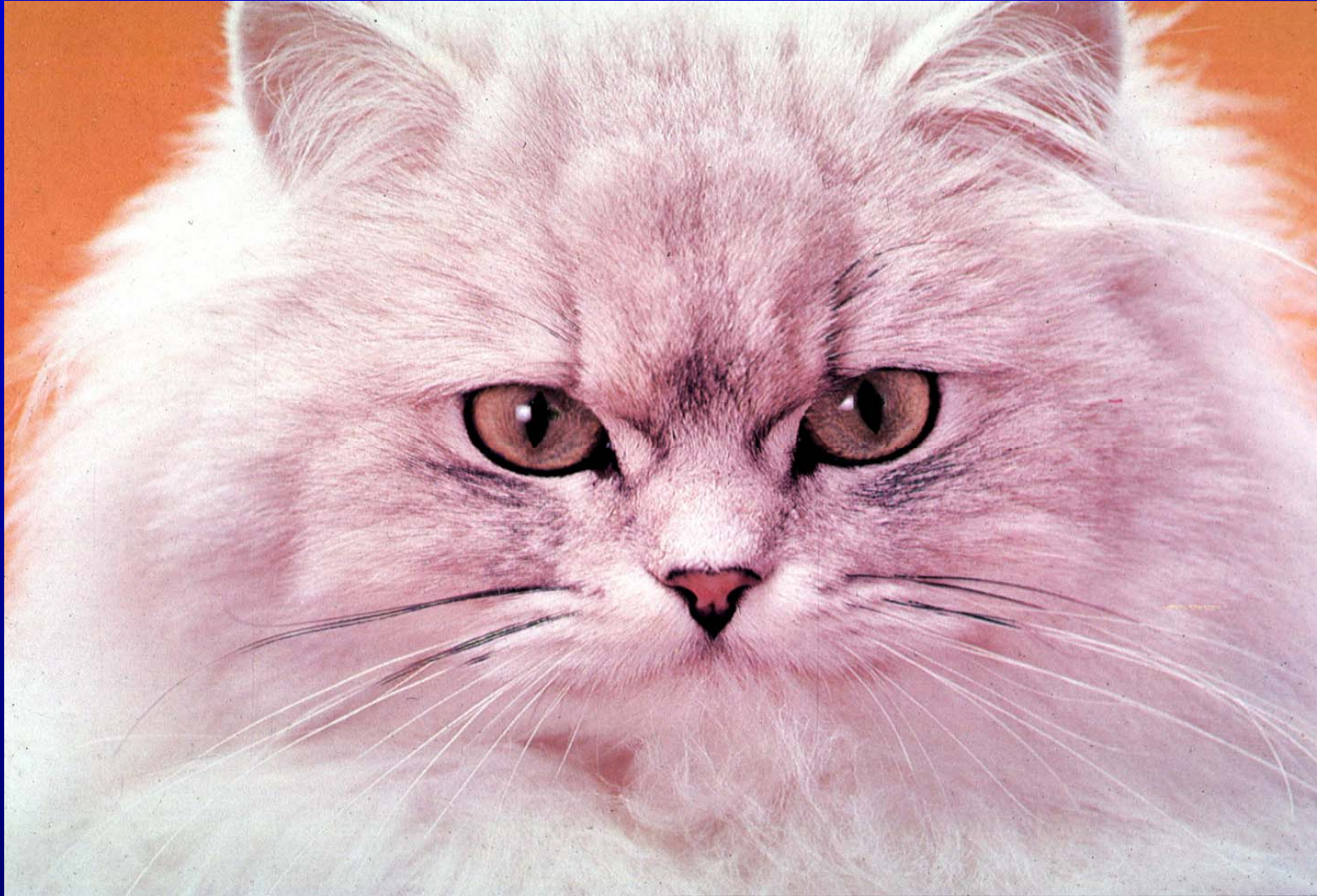
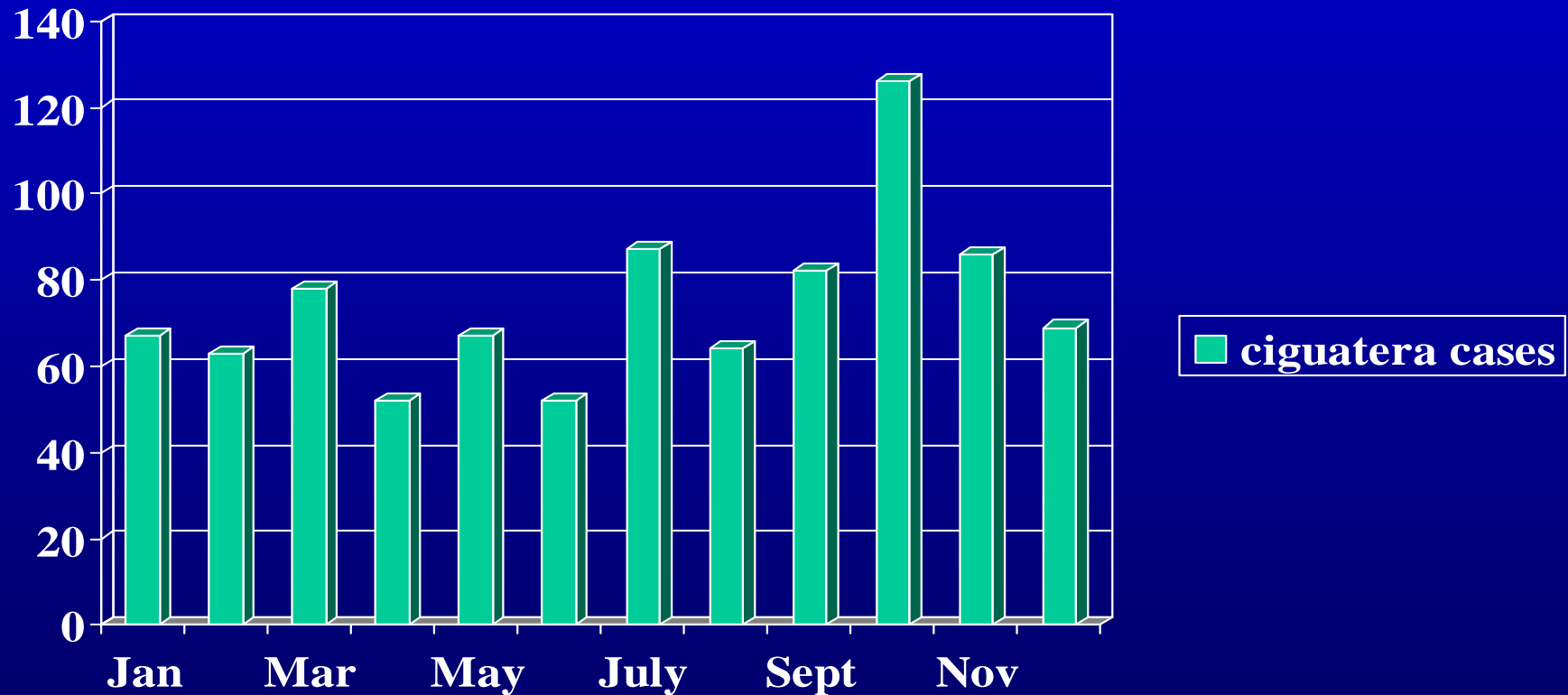
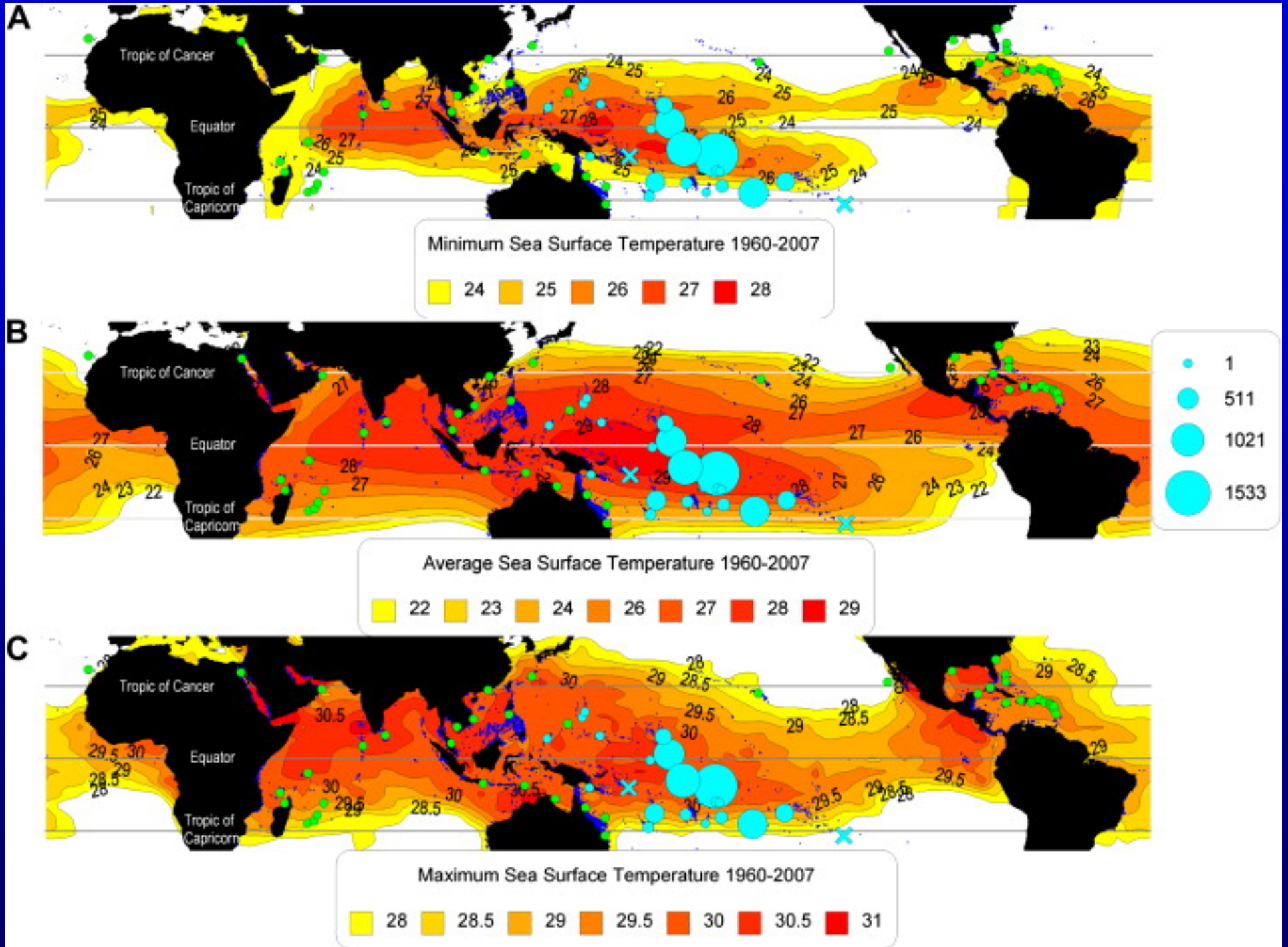


FIGURE 3. The relationship between weight and incidence of toxicity in *L. bohar* from Palmyra, Line Islands.



Ciguatera Cases, Emergency Department, Roy Lester Schneider Hospital, St. Thomas, by Month, for Five Year Period 1995-1999





Ciguatera and Climate Change

- South Pacific
 - Sea surface temperature needs to be above a lower threshold long enough to generate enough ciguatoxin in the ecosystem for ciguatera to be widely observed in a human population
 - If sea surface temperature exceeds an upper limit long enough, ciguatera occurrence decreases
- Caribbean: studies underway

UF Virgin Islands Study

- Surveillance through Emergency Department on single hospital on St. Thomas for ciguatera cases
- Annual island survey for ciguatera cases
- Monitoring of reef in 6 locations around island
 - Assessment of reef health
 - Sampling for *Gambierdiscus*
 - Strain identification by molecular markers
 - Screening for toxin production
 - Sampling of reef fish for toxicity
- Correlation of temperature/climate changes (Atlantic warm pool) with reef/dinoflagellate populations and human cases

Summary: HABs and Climate

- Complex natural systems, subject to disruption from a variety of factors
 - Most HABs – nutrient availability primary driver
 - Ciguatera
 - Reef disruption
 - Climate change – positive and negative
- Predictive capabilities currently limited