

Climate Change and Health

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Great interest in health circles:

US Centers for Disease Control

www.cdc.gov/climatechange

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Climate Change and Global Warming

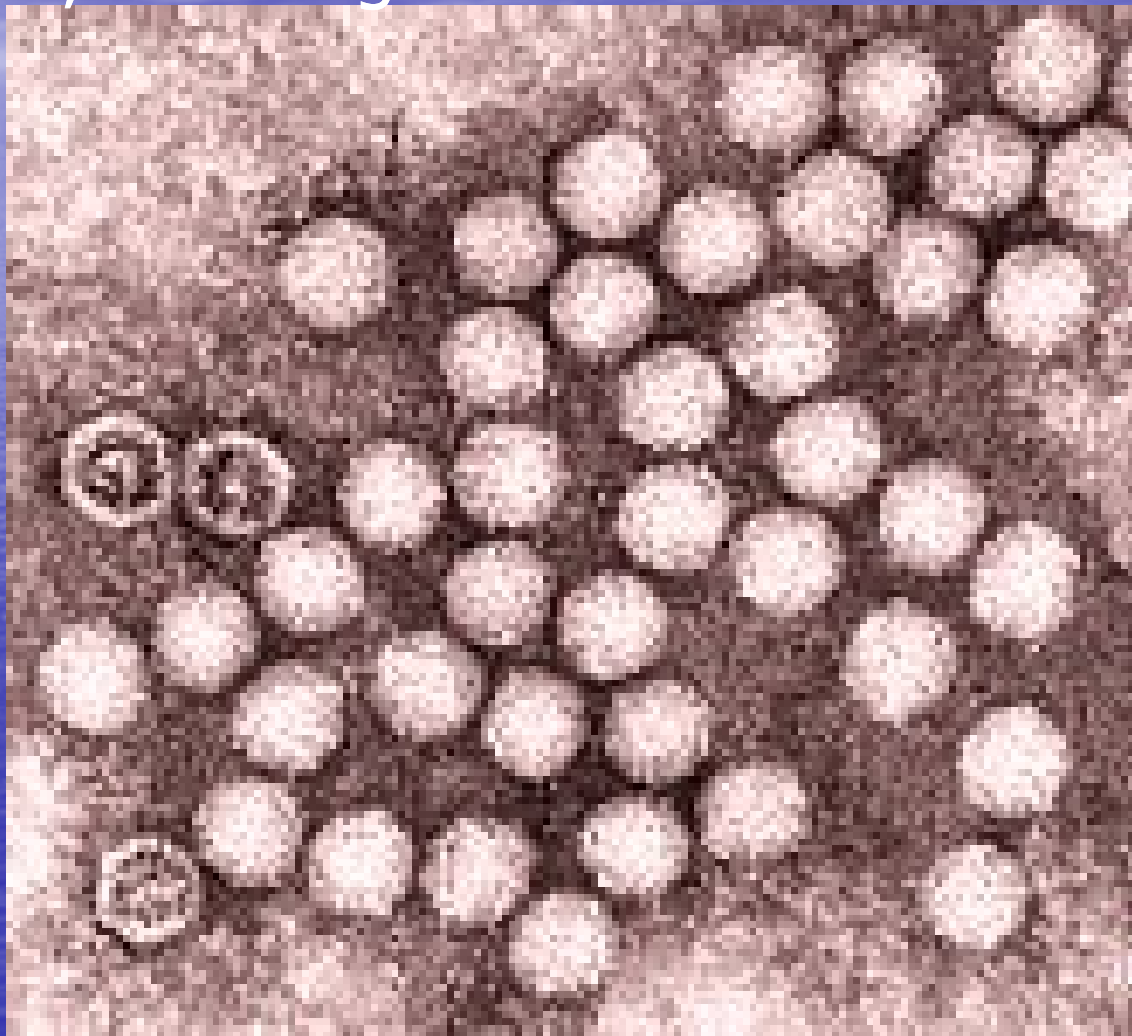
- Environmental change
- Longer beach season?
- Sea-levels rise
- Affect distribution of plants and animals



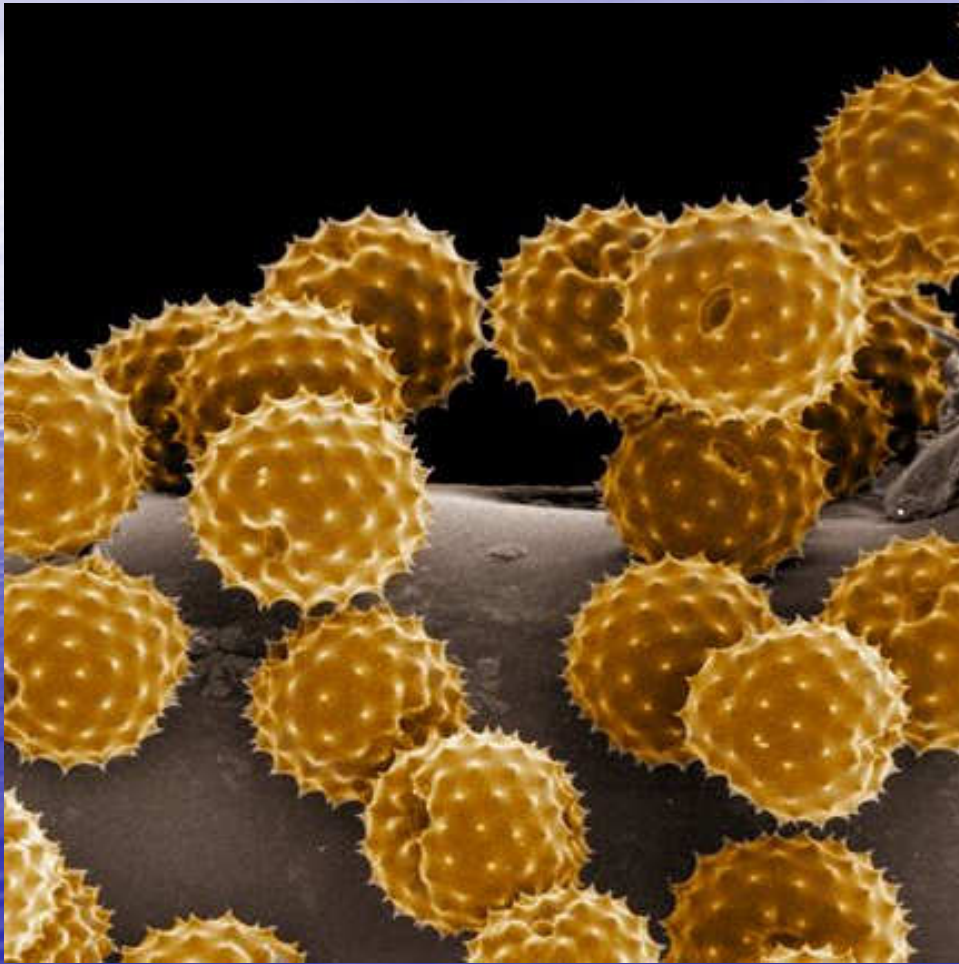
Warmer weather and more CO₂ → smog



Warmer water and weather fosters some infectious agents such as Enterovirus, found in water; causes gastroenteritis and skin rash



Pollen



- Longer growing season
- Change range of crops in agriculture, e.g. Canada
- Allergies: More plant pollen for longer portion of the year; later freezes

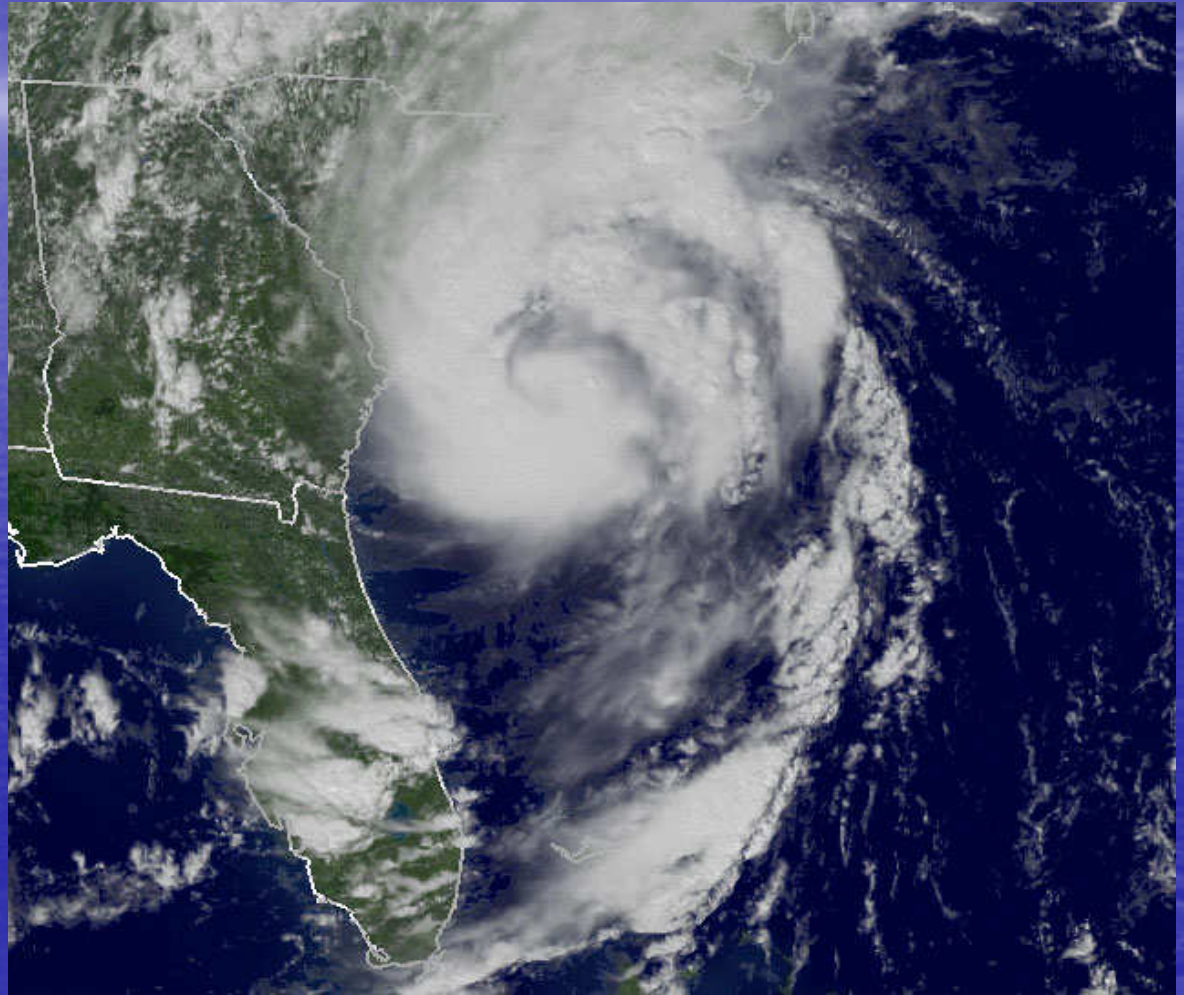


Poison Ivy

- Longer growing season and more CO₂ → growth of opportunists

Hurricane Ernesto

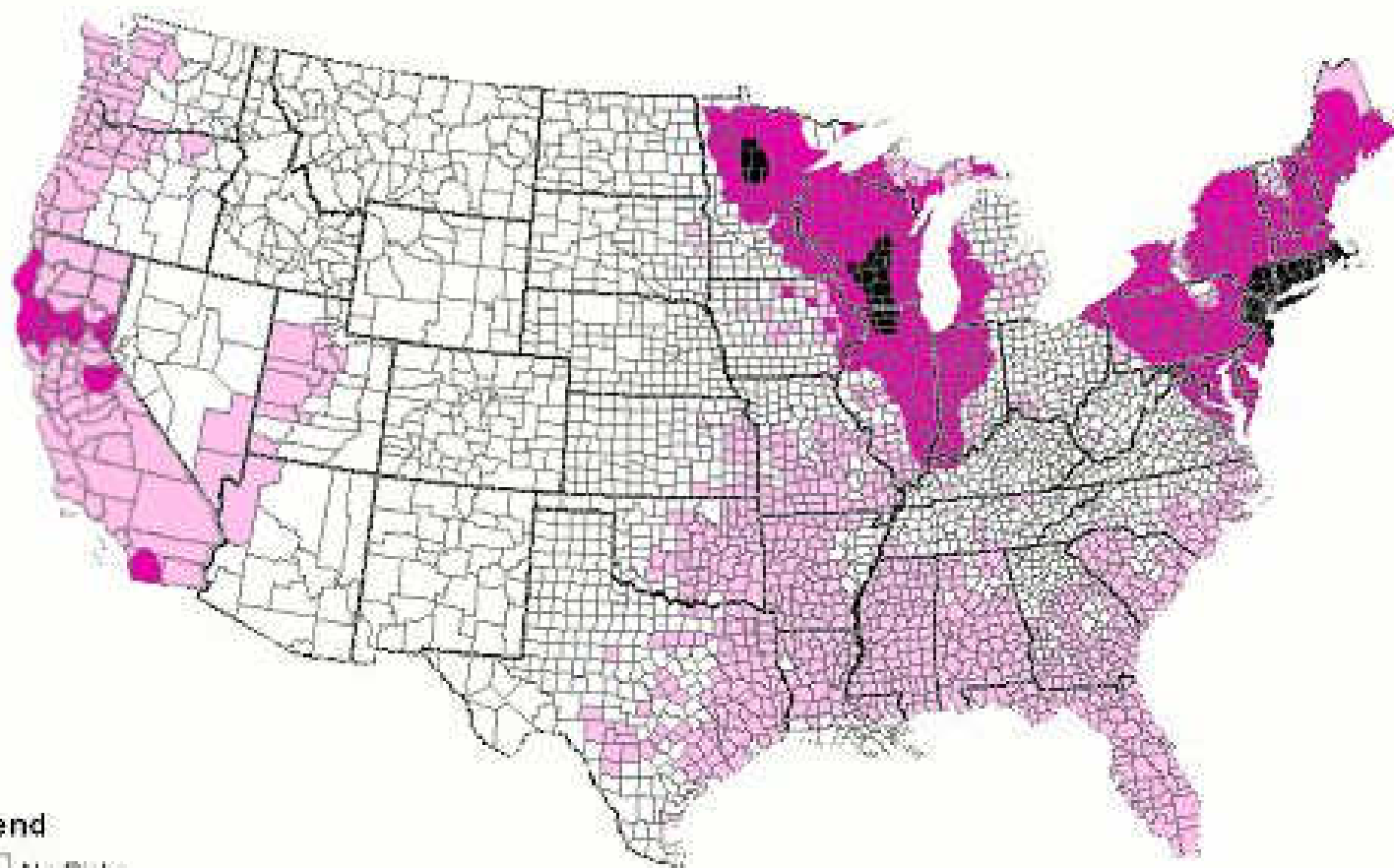
- Weather changes:
 - More variable
 - More extremes



More Floods



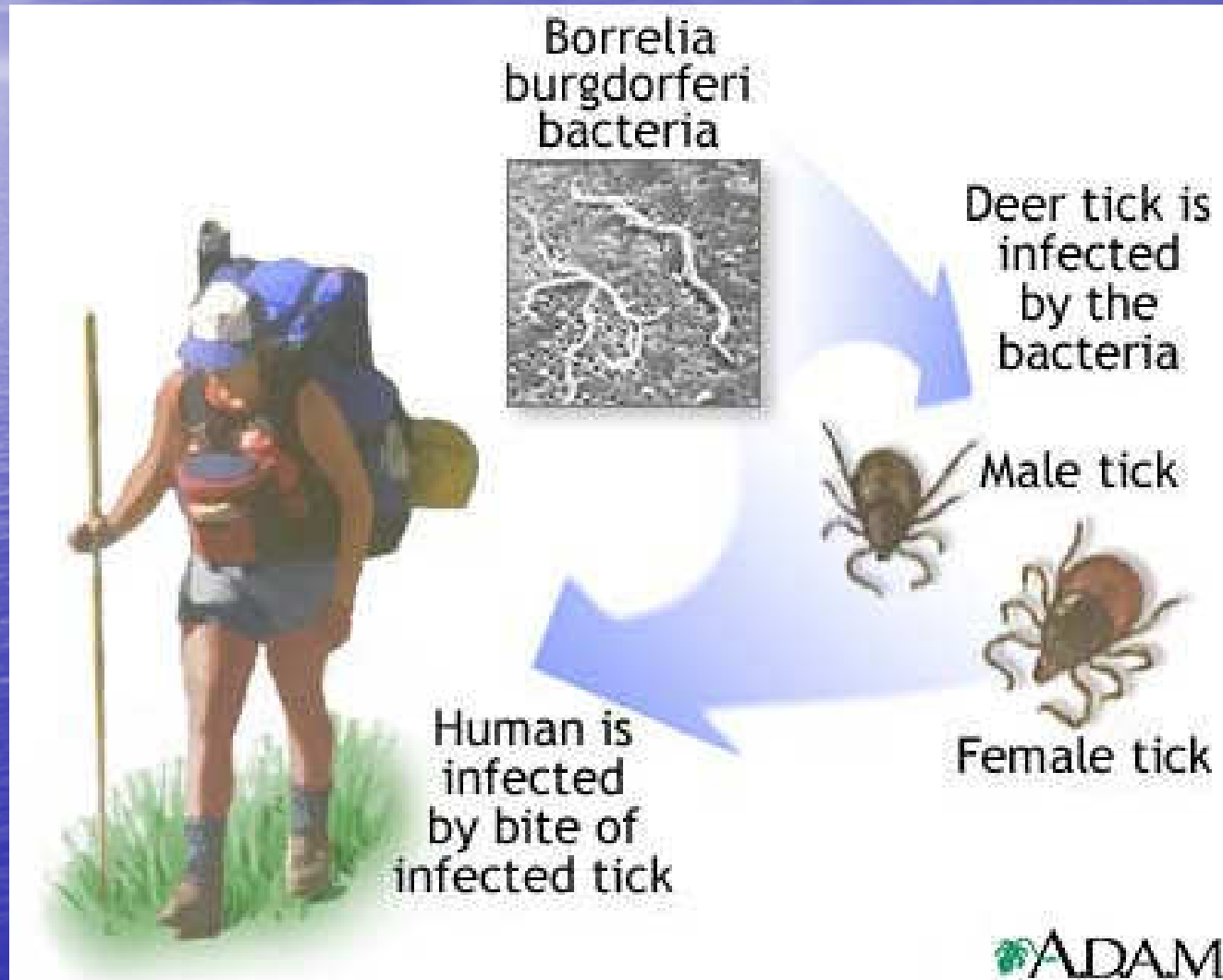
Coastal flooding → saltwater intrusion into freshwater aquifers (seen in 2007 with drought)



- Legend**
- No Risk
 - Low Risk
 - Medium Risk
 - High Risk

Lyme Disease Distributed

The range of the deer tick expanded to Canada. Lyme Disease



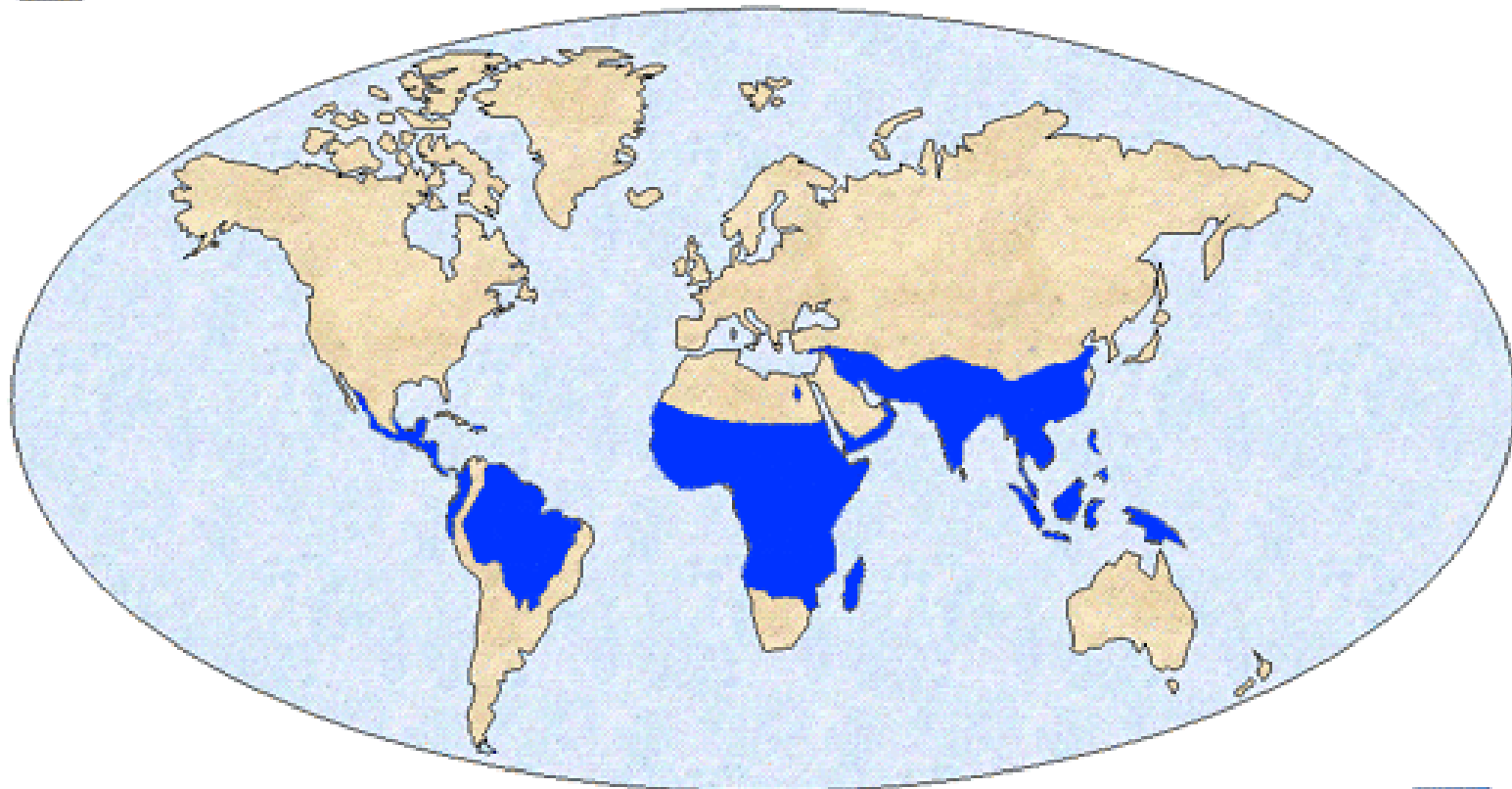
More water, later frosts:



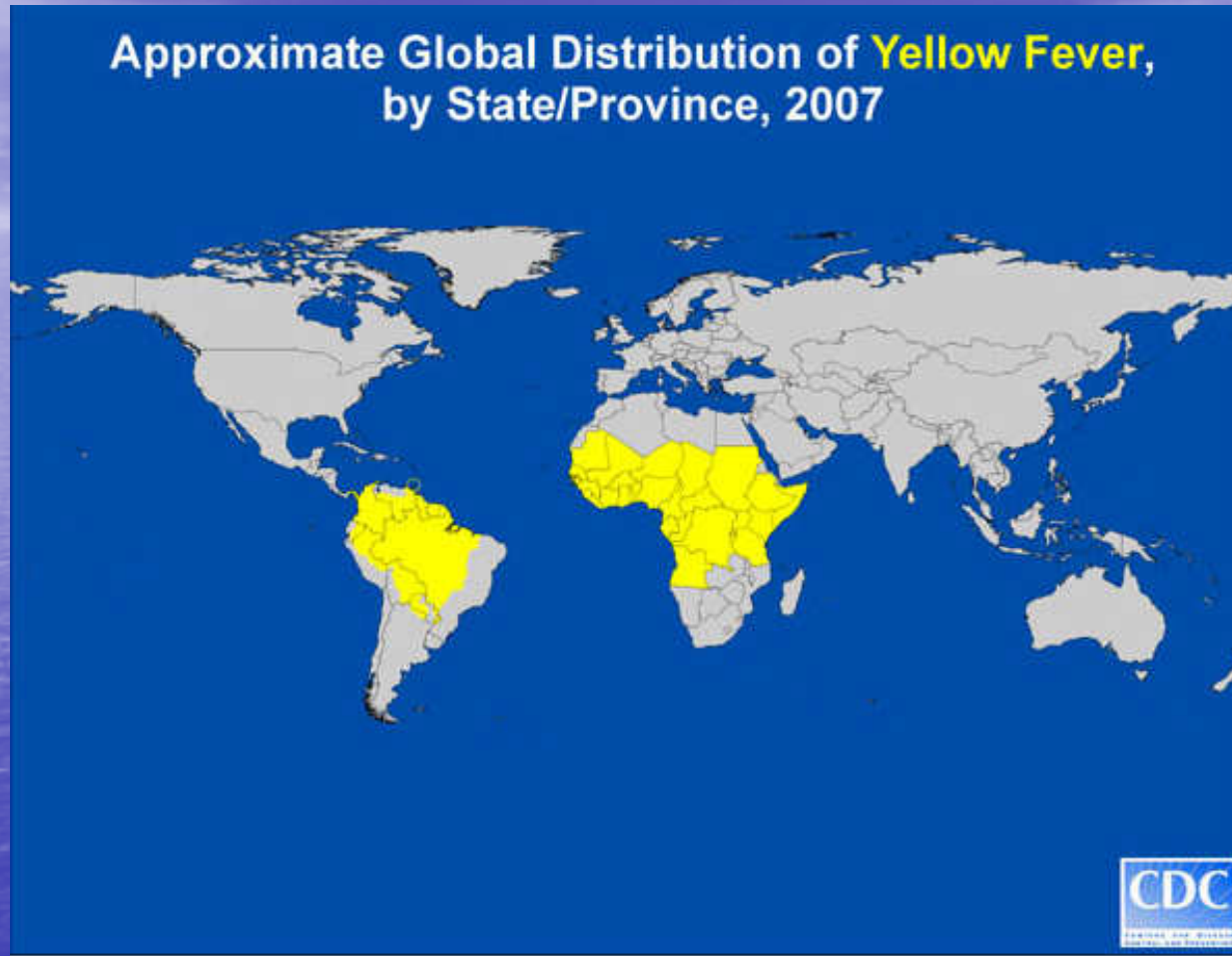
- Fewer insects die off in cold
- Increased range of insects
- Some of which carry disease

Malaria if temp $>65^{\circ}$ in winter

 Distribution of Malaria

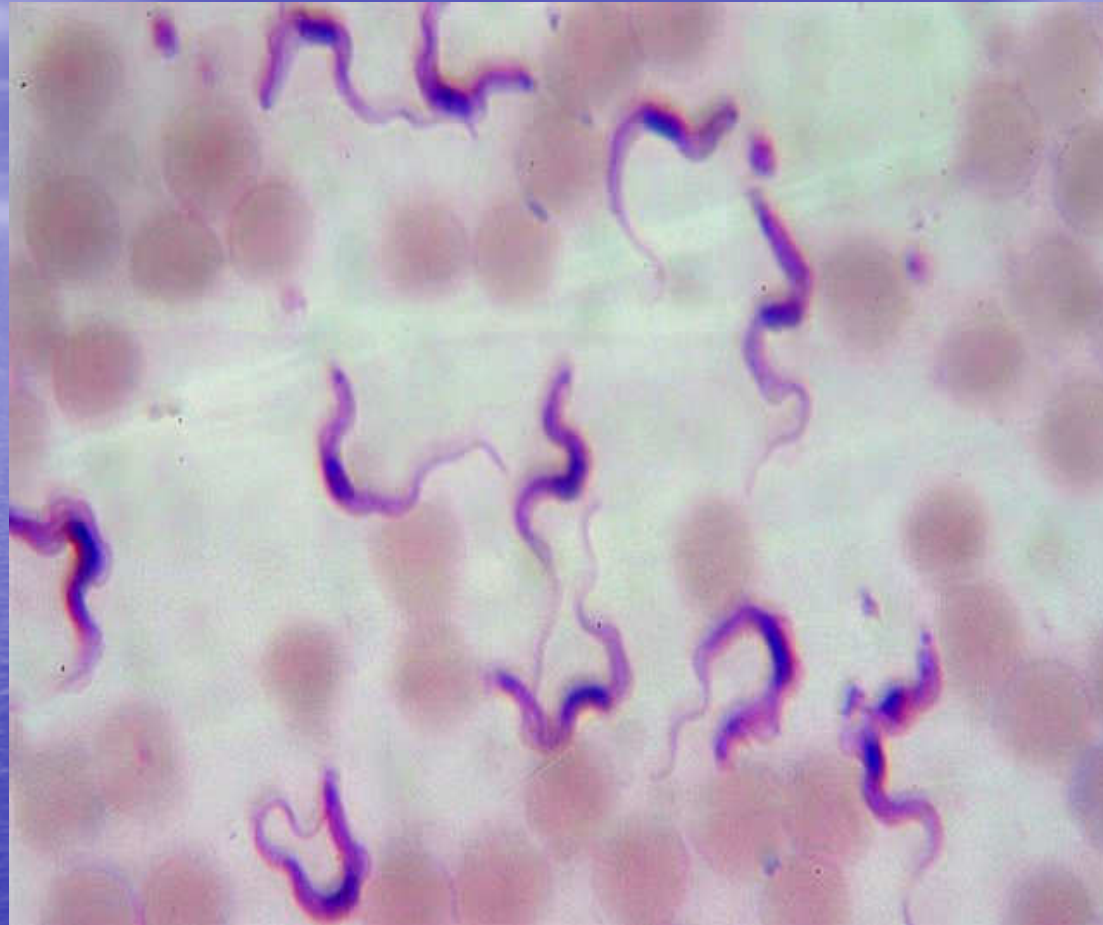


Yellow Fever Global Map



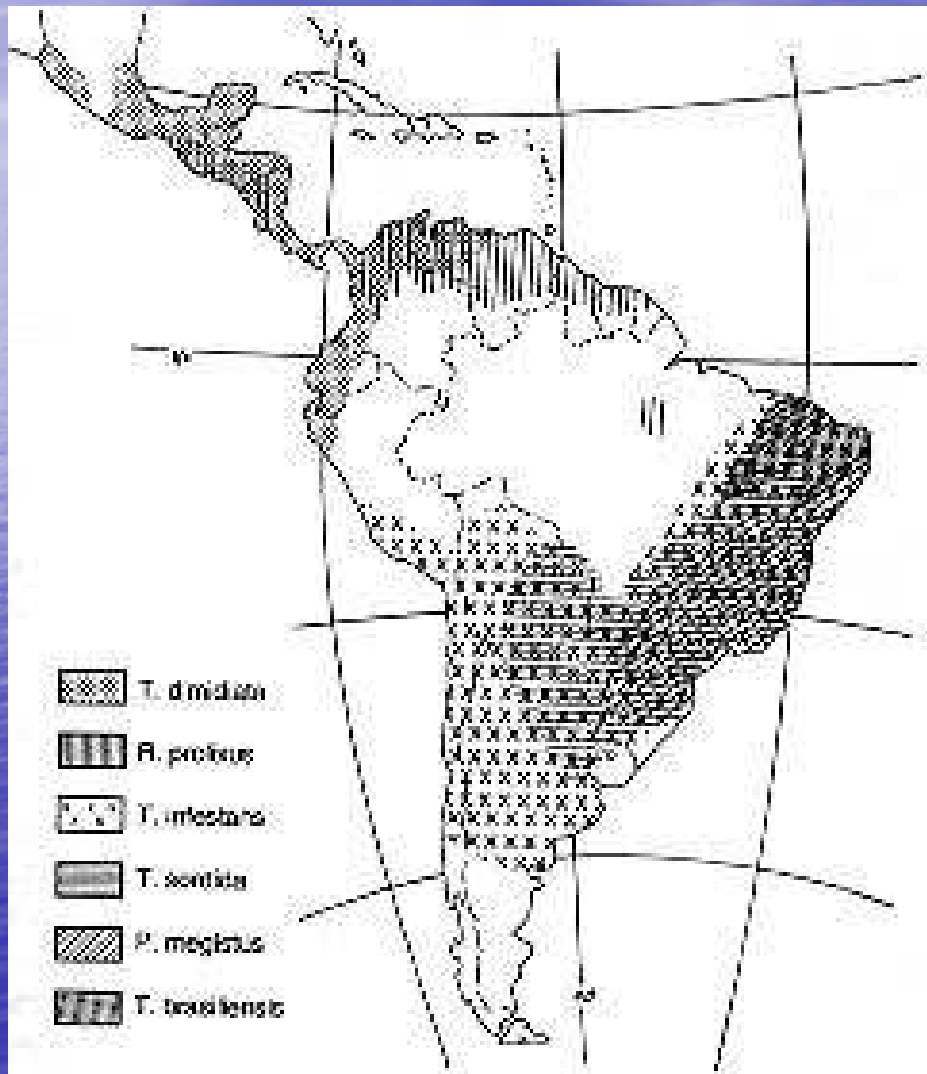
- Yellow fever was seen in Philadelphia in 1800's
- In 1878 in US "El Nino"

Chaga's Disease



- Trypanosome is a parasite carried by a certain bug.
- Historically seen in South America.
- Causes infection of heart muscle, GI tract.

GEOGRAPHICAL DISTRIBUTION OF MAJOR TRIATOMINE VECTORS



Parasite is now found in dogs in Texas



Harmful Algal Blooms

Red tides in Florida have been a common occurrence for many years.

Characteristics of Human Illnesses and Conditions Caused by HAB-toxins Known or Suspected In US Waters

Toxin	Vector	Occurrence	Short-term Health Consequences	Long-term Health Consequences	Susceptible Populations	Susceptible Regions
Ciguatoxins	Reef fish	High	Ciguatera Fish Poisoning: Abdominal pain, nausea, vomiting, diarrhea, paresthesias, temperature dyesthesia, pain, weakness, bradycardia, hypotension	Recurrent symptoms from months to years of chronic depression	Islanders subsistent on local fisheries, tourists	Florida Keys, Caribbean, Hawaii, Pacific Islands
Okadaic Acid	Shellfish	Low	Diarrhetic Shellfish Poisoning: Nausea, vomiting, diarrhea, abdominal pain accompanied by chills, headache, fever	Gastrointestinal tumor promoter in laboratory animals	Recreational shellfish harvesters	Northeast
Yessotoxins Pectenotoxins	Shellfish	Unknown	Not documented as toxic in humans, but co-occur in DSP shellfish and are highly toxic to mice	Unknown	Unknown	Unknown
Azspiracids	Shellfish	Unknown	Azspiracid Shellfish Poisoning: Nausea, vomiting, severe diarrhea, stomach cramps	Unknown	Unknown	Unknown
Brevetoxin	Shellfish	Low	Neurotoxic Shellfish Poisoning: Numbness of lips, tongue, and throat, muscular aches, fever, chills, muscle pains, abdominal cramping, nausea, diarrhea, vomiting, headache, reduced heart rate, pupil dilation	Unknown	Recreational shellfish harvesters	Gulf of Mexico
	Inhalation	High	Acute eye irritation, respiratory distress, asthma exacerbation	Unknown	Lifeguards, beachgoers, asthmatics	Gulf of Mexico
Saxitoxins	Shellfish	Low	Paralytic Shellfish Poisoning: Tingling, burning, numbness, drowsiness, incoherent speech, respiratory paralysis leading to death	Unknown	Children, recreational harvesters	Alaska, Northeast, Florida, Northwest, California
Domoic Acid	Shellfish	Low	Amnesic Shellfish Poisoning: Vomiting, diarrhea, abdominal pain, confusion, disorientation, memory loss	Anterograde memory deficit, seizures leading to coma and death	Elderly, children, kidney disease, subsistence and recreational harvesters	Northwest, Northeast, Gulf of Mexico, California
Microcystins	Drinking water Swimming Dietary supplements	High	Abdominal pain, vomiting and diarrhea, liver inflammation and hemorrhage, acute pneumonia, acute dermatitis	Hepatocellular carcinoma, liver failure leading to death	Children, dialysis patients, liver disease, water recreation	Great Lakes, Continental US, ponds & lakes
Cylindrospermopsins	Drinking water Swimming	Medium	Abdominal pain, vomiting and diarrhea, liver inflammation and hemorrhage, acute pneumonia, acute dermatitis	Malaise, anorexia, liver failure leading to death	Children, liver disease, water recreation	Great Lakes, Continental US, ponds & lakes
Anatoxin-a	Drinking water Swimming	Low	Tingling, burning, numbness, drowsiness, incoherent speech, respiratory paralysis leading to death	Cardiac arrhythmia leading to death	Water recreation	Great Lakes, Continental US, ponds & lakes
Cyanobacterial LPS	Drinking water Swimming	Medium	Abdominal pain, vomiting and diarrhea, acute dermatitis	Unknown	Water recreation	Great Lakes, Continental US, ponds & lakes

- Spectrum of Harmful Algae Blooms:
 - Coastal waters with dinoflagellates
 - Freshwater with Blue-green algae
- ↑ Temperature and nutrients (sewage or agriculture) foster massive blooms

Major Harmful Algal Bloom Events in the Coastal U.S. 1985- 1997



There are very few areas of the US coast that are unaffected by HABs. This graphic shows not only the geographic areas that are affected, but the frequency of those events. Larger symbols denote more frequent occurrences, and colors denote the different HAB impacts.

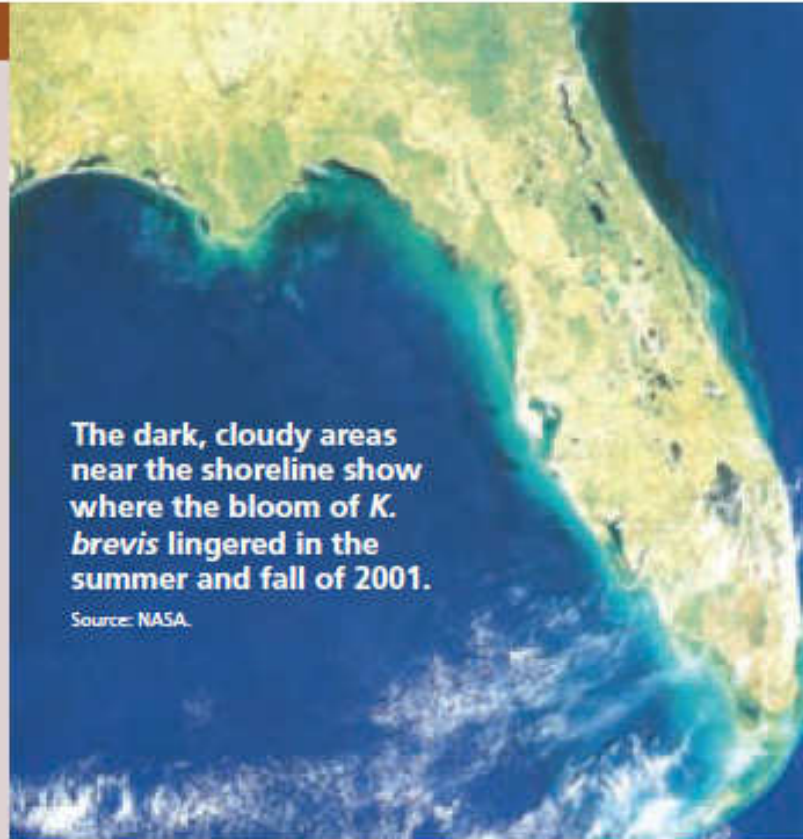
Source: D. Anderson.

SPOTLIGHT

Living and Breathing Brevetoxins on Florida Beaches

Many HABs cause human health problems before they are visible by satellite or the human eye. In the case of Florida's common *Karenia brevis* blooms, respiratory distress can occur when cells are present at about 1,000 cells/liter and fish kills begin at about 100,000 cells/liter, but visible discoloration of the water requires orders of magnitude more cells.

We know a considerable amount about the biochemical and neurophysiological activities of brevetoxins as shellfish poisons. However, we know much less about human health effects from environmental exposures, such as those from aerosols along beaches. Preliminary results suggest aerosols can have adverse effects on respiratory and lung function, particularly among the elderly and those with chronic respiratory illnesses.



- Discolor the water
- Inhibit swimming, fishing, clamming, recreation
- Economic impact
- Organisms die, consume O₂, fish die

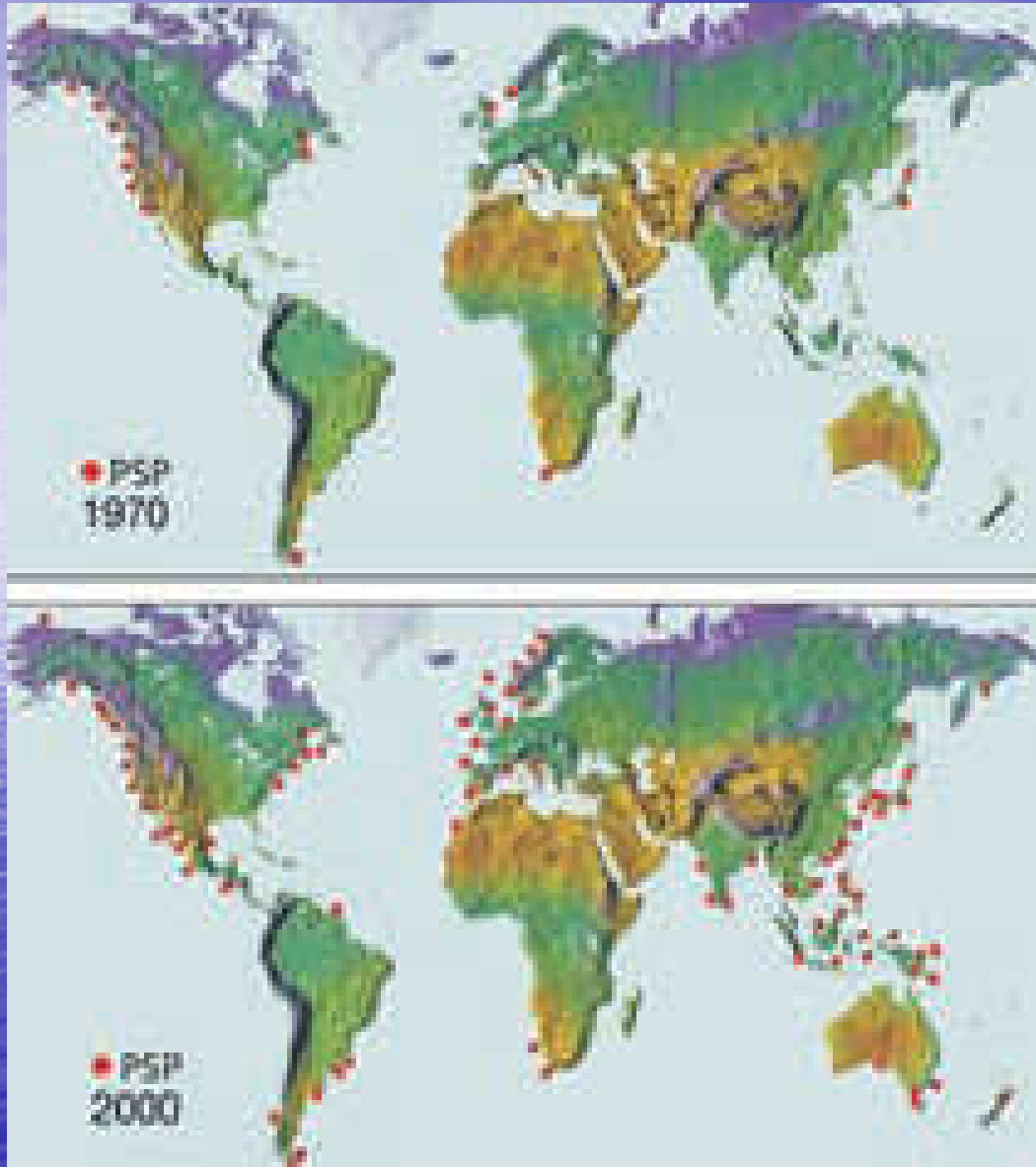


Usually only affect humans who eat
affected shellfish

PSP



Others enter food chain and affect marine mammals



Paralytic shellfish poisoning (PSP) is a toxin syndrome caused by consumption of seafood contaminated by certain HAB species. The above maps show the cumulative global increase in the recorded distribution of the causative organisms and the confirmed appearance of PSP toxins for the years 1970 and 2000.

**Temperature ↑ and
↑ nutrient loads due to
human activity?**

Karenia brevis bloom off the Florida coast.



Break up organisms in surf at coastline.

Particles are respiratory irritant → asthmatic attack at beach

MIND CIGUATERA FISH POISONING



- Fish eats algae, eaten by predator (concentrates toxin in tissues)
- Ciguatera Fish Poisoning: Caribbean Hawaii (eating warm-water reef fish) toxin not destroyed by cooking



Grouper, jack,
snapper,
mackerel,
trigger fish.

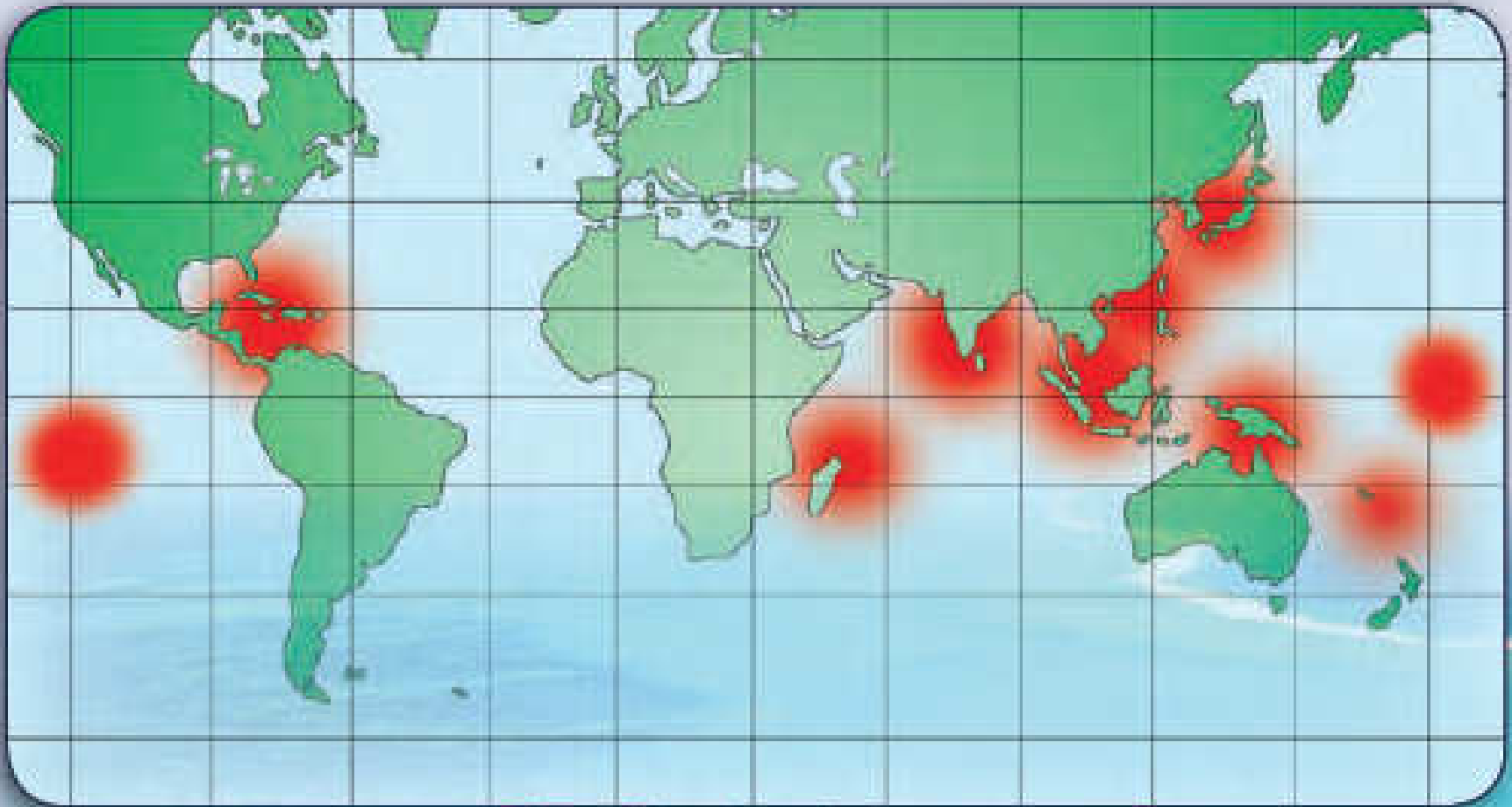


Figure 3. Incidence de la ciguatera. Ciguatera hot spots.

- May start to see off Hatteras if waters warm?



Adaptations and Adjustments

Day at the Beach