

Fall 2008 Moray Eel Mortalities on Bonaire



Photograph by Dawn Miller

Kara Kozak
Simmons College
November 26, 2008

Background

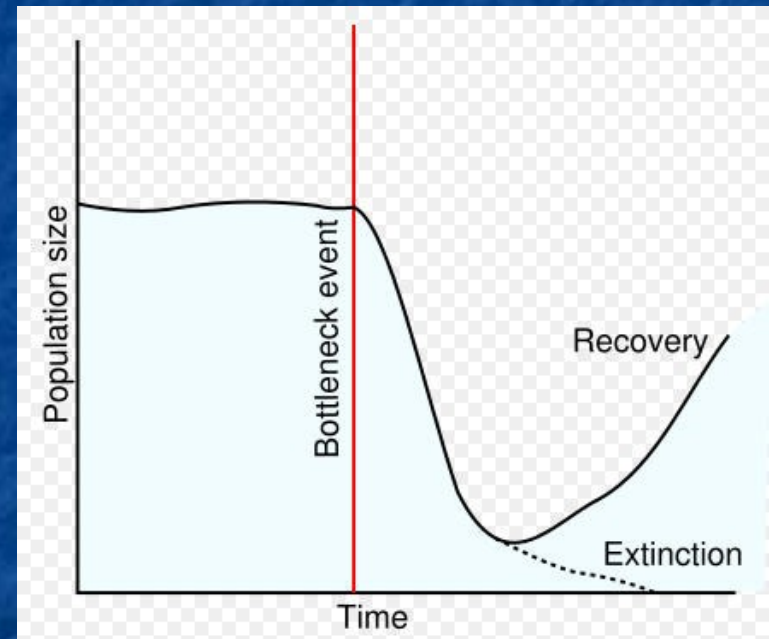
- Mass mortalities of *Diadema antillarum* (long-spined sea urchin) (Lessios 1988)



- Between 1983 and 1984, 93% of urchins died
- Deaths affected biodiversity
 - Increased algae
 - Coral death
- No other Caribbean echinoderm affected – suggests a host specific pathogen

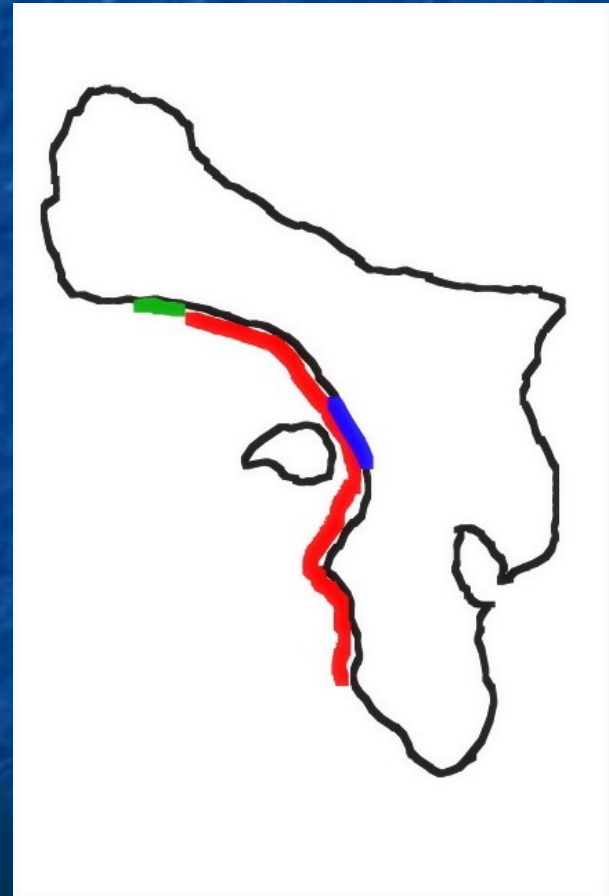
Background

- Consequences of mass mortalities
 - Bottleneck genetics
 - Significant loss of a population resulting in reduced genetic diversity
 - Organism more susceptible to disease and environmental stress
 - Affects community structure through changes in resource availability



Background

- Location and Spread of Dead Eels
 - August - found near Ol' Blue and Karpata
 - September - found as far north as 1000 steps and as far south as Tori's Reef
 - October - spread decreased, localized around Kralendijk



Background

- No marked increase or decrease in death rates for other marine organisms
- Causative agent likely pathogenic only to eels
- *Vibrio vulnificus*, serovar E (Marco-Noales et al. 2001)
 - Primary pathogen for eels
 - Has been documented in farmed populations
 - Incidence in wild populations unknown

Necropsy Methods

- Examined externally for abnormalities or pre-mortem injuries
- Placed in lateral recumbency for incision along ventral midline, from anus to the point ventral to the gills



Photograph by Rita Peachey

Necropsy Methods

- Viscera (all inner organs collectively)
 - Separated from peritoneal lining
 - Final cut made proximal to esophagus, distal to lower intestines



Photograph by Rita Peachey

Necropsy Methods

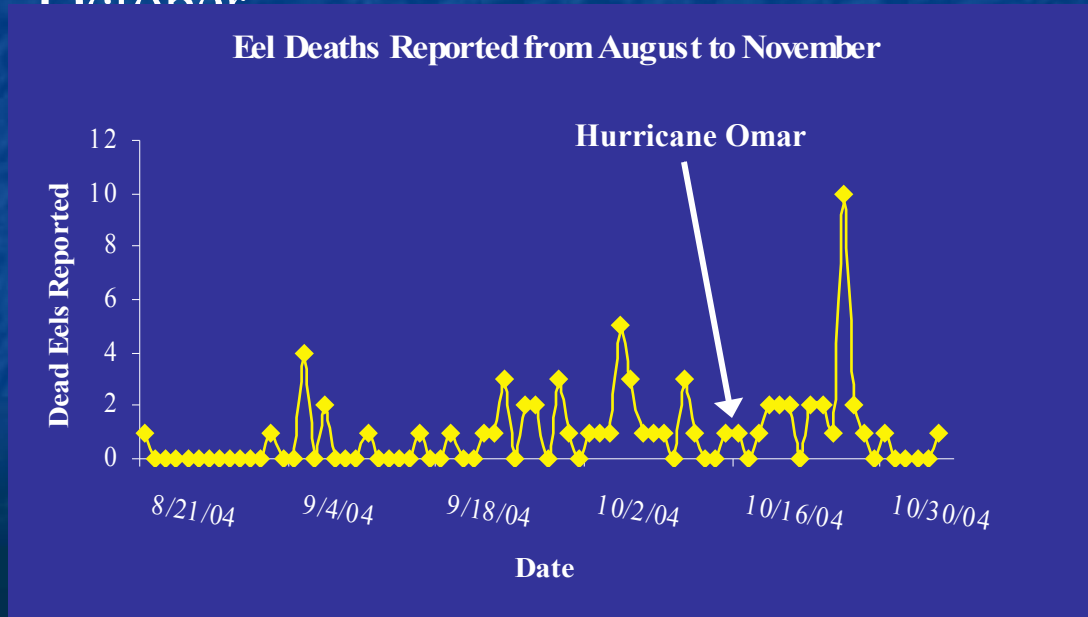
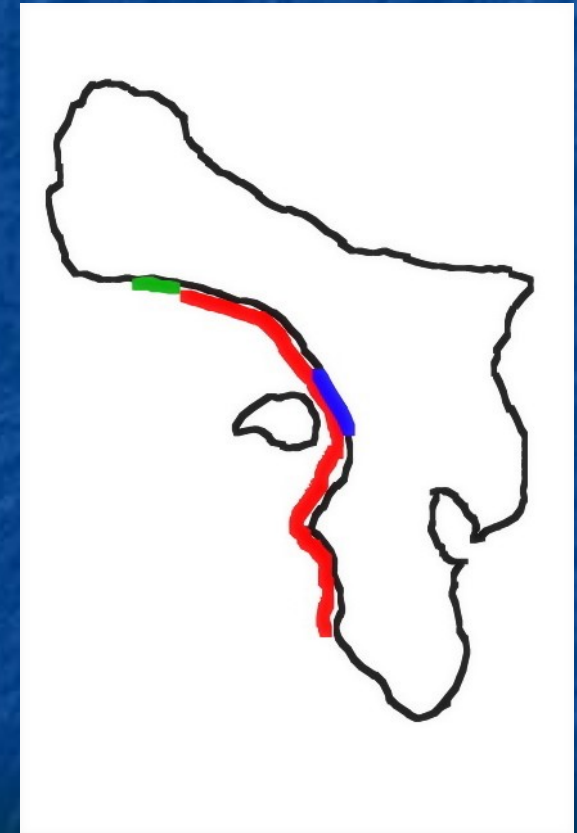
- Inner organs examined for abnormalities
- Photographed for record
- Air bladder and gastrointestinal tract both opened with lateral incision
- Material found in stomach, intestines, and swim bladder collected for microscopic evaluation



Photograph by Amanda Hollebone

Results

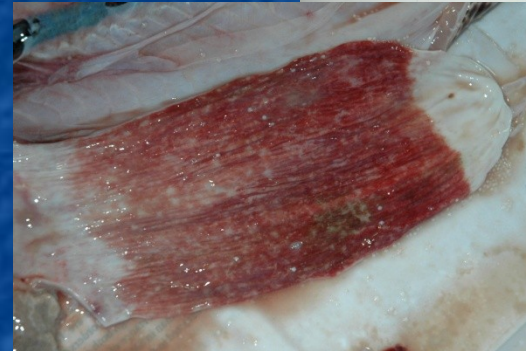
- Reports of dead moray eels began surfacing as early as July 2008
- 20 eel mortalities report in September
- Over 45 eel mortalities reported in October



Data collected by Jerry Ligon

Results

- Necropsy
 - Specimens in overall good appearance
 - Inner lining of gastrointestinal tract hemorrhaged
 - No food present in stomach
 - Intestines filled with either liquid fecal matter or mucus



Results

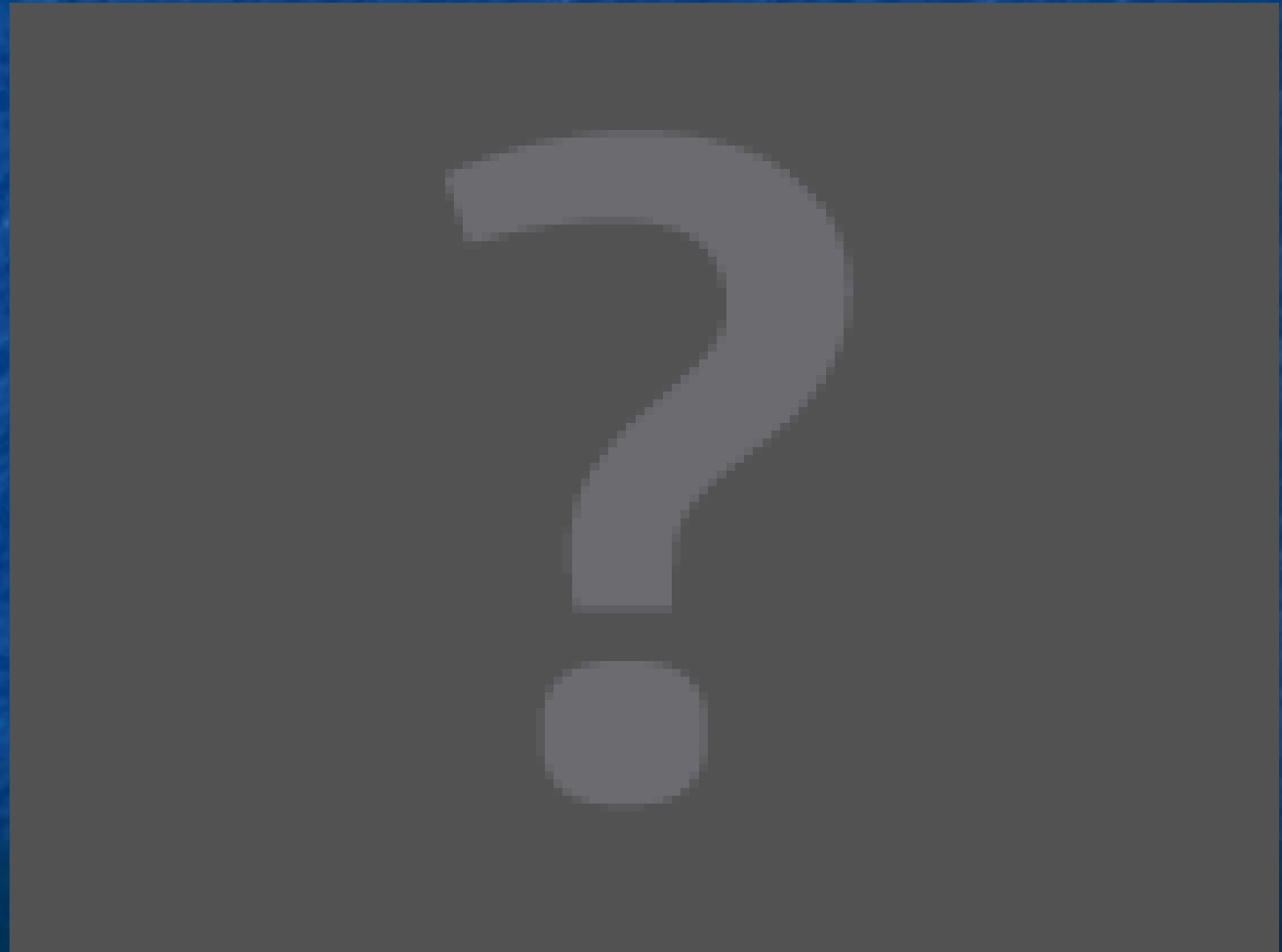
- Necropsy
 - Pale liver
 - Bloody fluid in abdominal cavity
 - Viscous material in air bladder



Photographs by Rita Peachey

Results

- Behavior
 - Out during daylight hours
 - Seizuring or lethargically laying exposed
 - Biting abdomen



Video provided by Dawn Miller

Conclusion

- Relative location and spread of eel mortalities
 - Causative agent likely introduced end of July or beginning of August
 - Rapid increase in deaths from August to October, shows how quickly the disease spread
 - Water quality not likely issue
 - Hurricane Omar flushed the coastal waters of Bonaire
 - Mortalities continued after storm

Conclusion

- Bacterium causes rapid death within 4 to 48 hours after exposure (Biosca and Amaro 1996)
- Virus possible suspect due to rapid death
- However, gross abnormalities concur with pathophysiology of vibriosis caused by *Vibrio vulnificus*, serovar E

Conclusion

- One of the first studies done on *Vibrio vulnificus* in eels found (Biosca et al. 1991)
 - Inflammation of internal tissues and intestines
 - Pale hemorrhagic liver
 - Fluid within the abdominal cavity (Biosca et al. 1991)
- Simulated “natural outbreak” (Marco-Noales 2001)
 - External hemorrhages near the head and ventral parts of the body.
 - Hemorrhagic intestines and pale liver
- Other symptoms of vibriosis (Cholera 2005)
 - Watery fecal matter
 - Weakness
 - eel lethargy
 - Abdominal pain
 - biting at abdomen

Conclusion

- Future work
 - Currently have only symptomatic diagnosis
 - Use of PCR - definitively diagnose *Vibrio vulnificus*, serovar E as causative agent

Acknowledgements

- CIEE Research Station
- Local Divers, Albert, Yellow Submarine, and my classmates for collecting eel specimens
- Ramon and BNMP for allowing eel specimens to be removed from the park for necropsy
- Jerry Ligon for providing data on the eel deaths
- Dawn Miller, David Tilzer, and Jeanne Chin for providing video and photographs of sick eels
- My advisor - Rita Peachey

References

- Amaro, C., B. Fouz, E. G. Biosca, E. Marco-Noales, and R. Collado. 1997. The lipopolysaccharide O side chain of *Vibrio vulnificus* serogroup E is a virulence determinant for eels. *Infection and Immunity* 65:2475-2479.
- Bacterial Diseases. 2008. In *The Merck Veterinary Manual*. Retrieved November 18, 2008, from <http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/170414.htm>
- Biosca, E. G., C. Amaro, C. Esteve, E. Alcaide, and E. Garay. 1991. First record of *Vibrio vulnificus* biotype 2 from diseased European eel, *Anguilla anguilla* L. *Journal of Fish Diseases* 14:103-109.
- Biosca, E. G. and C. Amaro. 1996. Toxic and enzymatic activities of *Vibrio vulnificus* biotype 2 with respect to host specificity. *Applied and Environmental Microbiology* 62:2331-2337.
- Biosca, E. G., B. Fouz, E. Alcaide, and C. Amaro. 1996. Siderophore-mediated iron acquisition mechanisms in *Vibrio vulnificus* biotype 2. *Applied and Environmental Microbiology* 62:928-935.
- Cholera. 2005. In *The Merck for Healthcare Professionals*. Retrieved November 18, 2008, from <http://www.merck.com/mmpe/sec14/ch173/ch173e.html#sec14-ch173-ch173e-702>
- Gastroenteritis. 2007. In *The Merck Manual for Healthcare Professionals*. Retrieved November 18, 2008, from <http://www.merck.com/mmpe/sec02/ch016/ch016a.html>
- Lessios, H. A. 1988. Mass mortality of *Diadema antillarum* in the Caribbean: what have we learned? *Annual Review of Ecological Systems* 19:371-393
- Ligon, J. 2008. Data on species, date, and location of deceased eels collected.
- Marco-Noales, E., M. Milan, B. Fouz, E. Sanjuan, and C. Amaro. 2001. Transmission to eels, portals of entry, and putative reservoirs of *Vibrio vulnificus* serovar E (biotype 2). *Applied and Environmental Microbiology* 67:4717-4725.
- Meyers, R. M. 2006. Standard necropsy procedures for finfish. *National Wild Fish Health Survey – Laboratory Procedures Manual. 4.0 Ed.* U.S. Fish and Wildlife Service, Onalaska, WI