

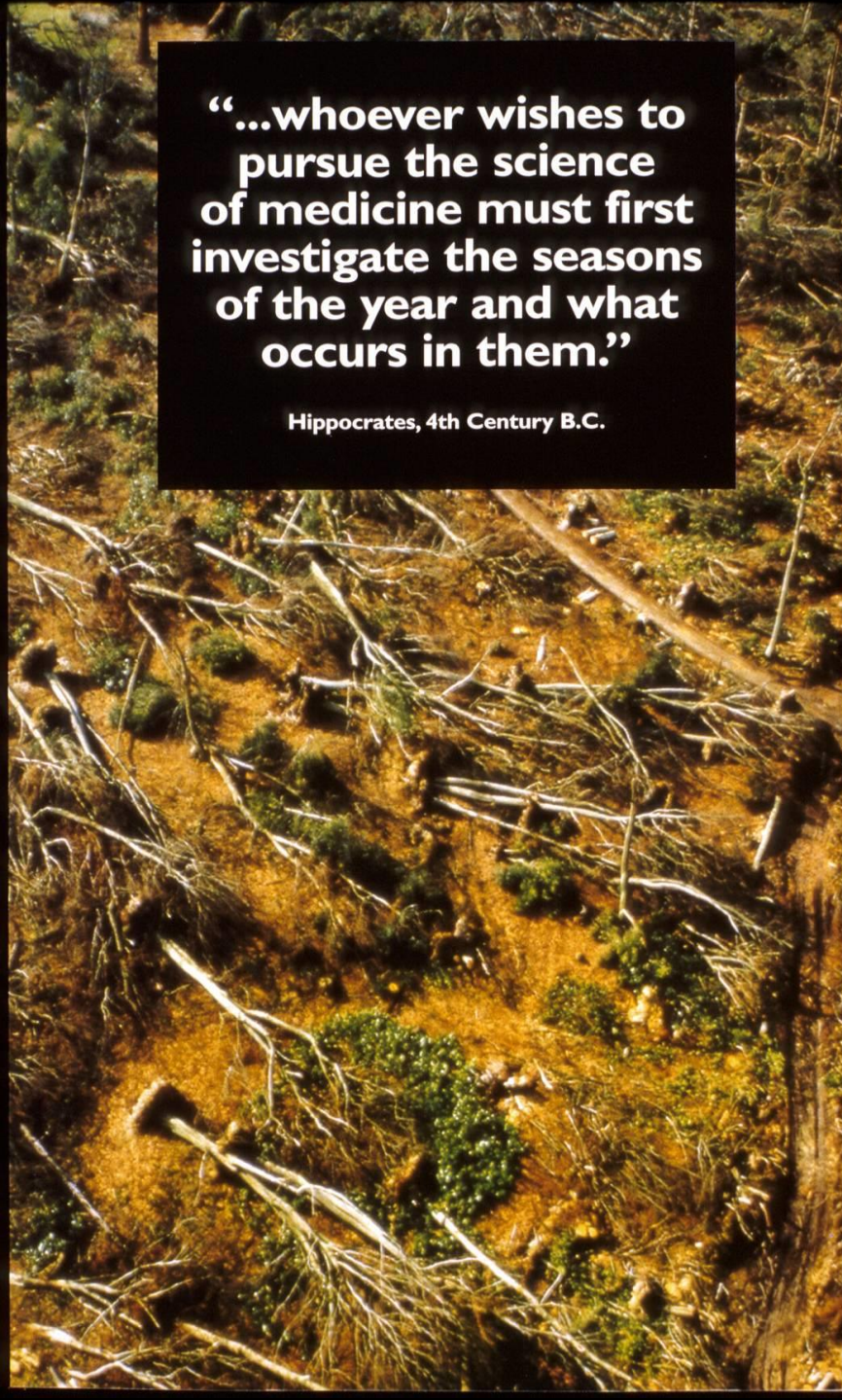


Tracking clinically active vibrios using earth observations

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“...whoever wishes to pursue the science of medicine must first investigate the seasons of the year and what occurs in them.”

Hippocrates, 4th Century B.C.

Tracking clinically active vibrios using earth observations

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Epidemic Cholera

- Sporadic deadly outbreak
- Usually occurs following floods or inundation of large landscape
- Warm temperatures may increase growth of bacteria in aquatic bodies.

Typical cholera seasonality



Mixed-mode Cholera

- Usually two seasonal peaks
- One peak related to seawater intrusion; Second peak associated with widespread inundation
- Specific to Bengal Delta region

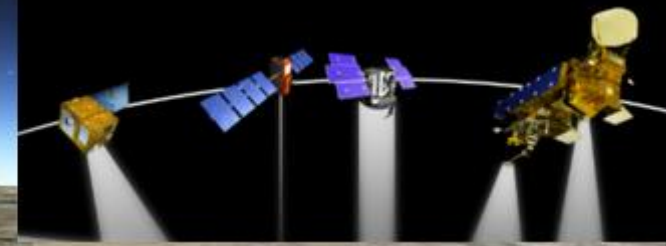


Endemic Cholera

- Cholera persists throughout year in coastal regions
- Seawater intrusion from coasts to inland
- Cholera outbreaks occur during low river flow season



Bacterial movement from coastal niches to inland

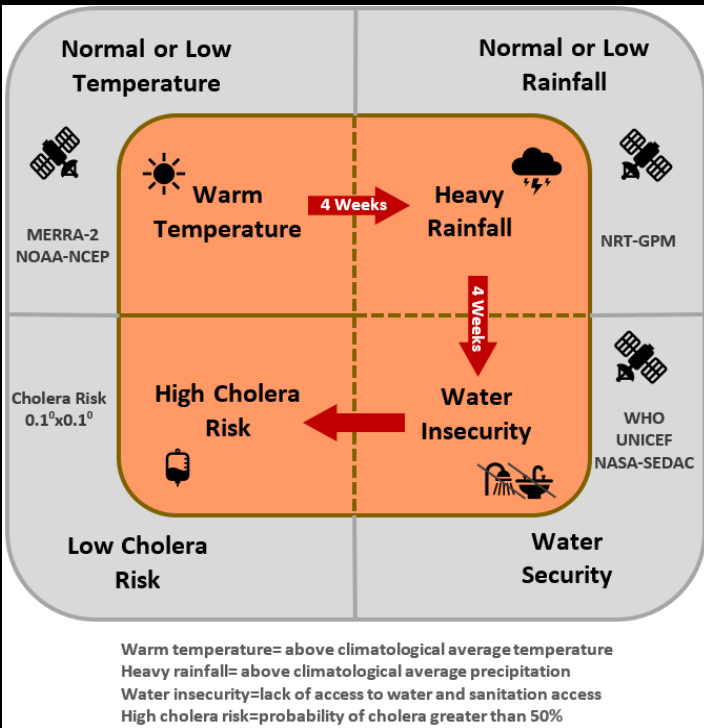


Satellites data and products

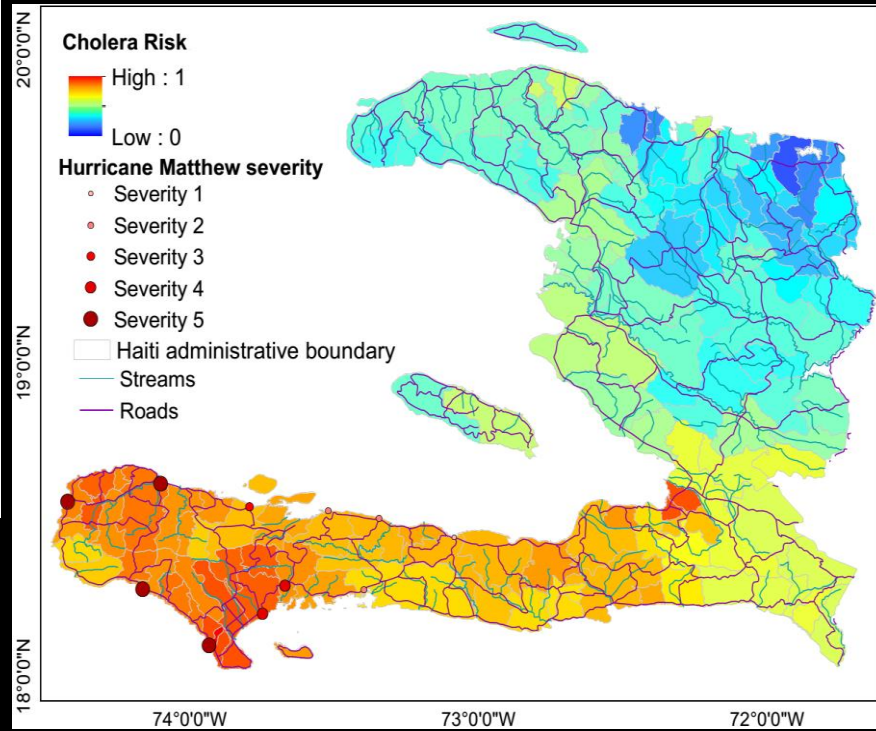
- LANDSAT: ▲ ▲
Land Use, NDVI
- MODIS/ MERIS: ▲ ▲ ▲ ▲
Surface Temperature, Ocean Color
- SWOT: ▲ ▲ ▲
River Discharge
- GRACE: ▲ ▲ ▲
Water Storage, River Discharge
- TRMM/GPM: ▲ ▲
Precipitation
- TOPEX/JASON: ▲ ▲
Sea Surface Height
- AVHRR: ▲ ▲
Sea surface temperature

Epidemic Cholera

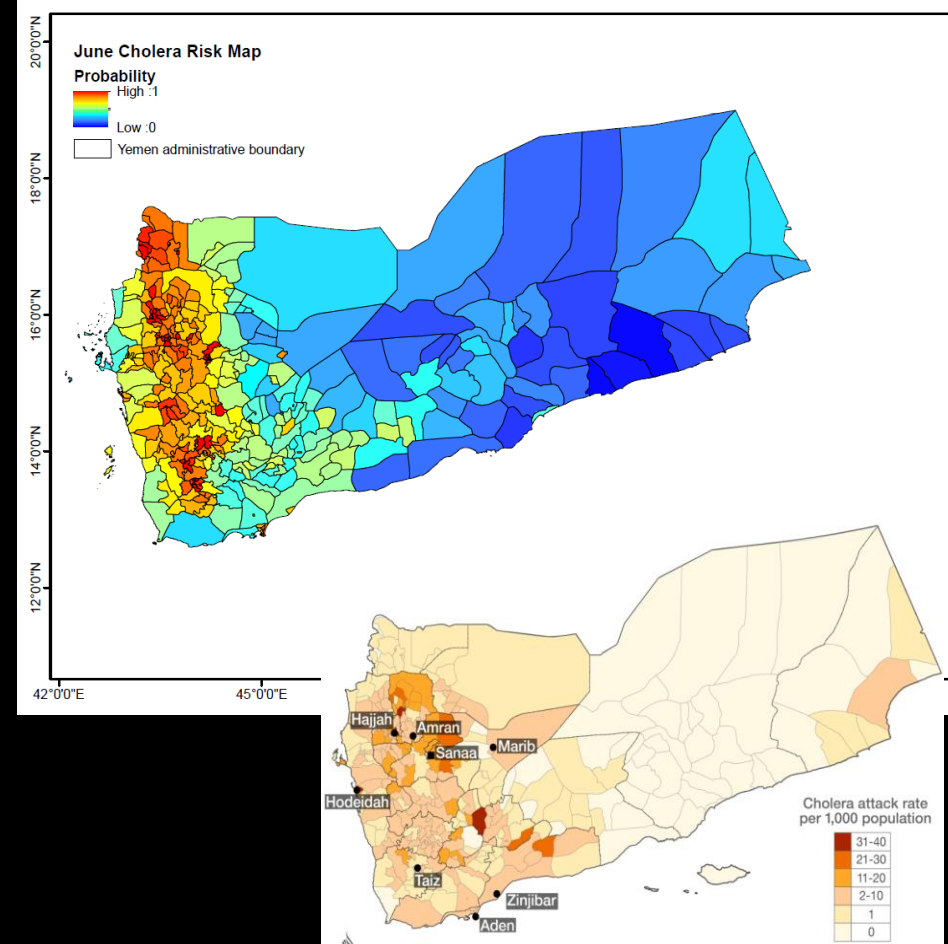
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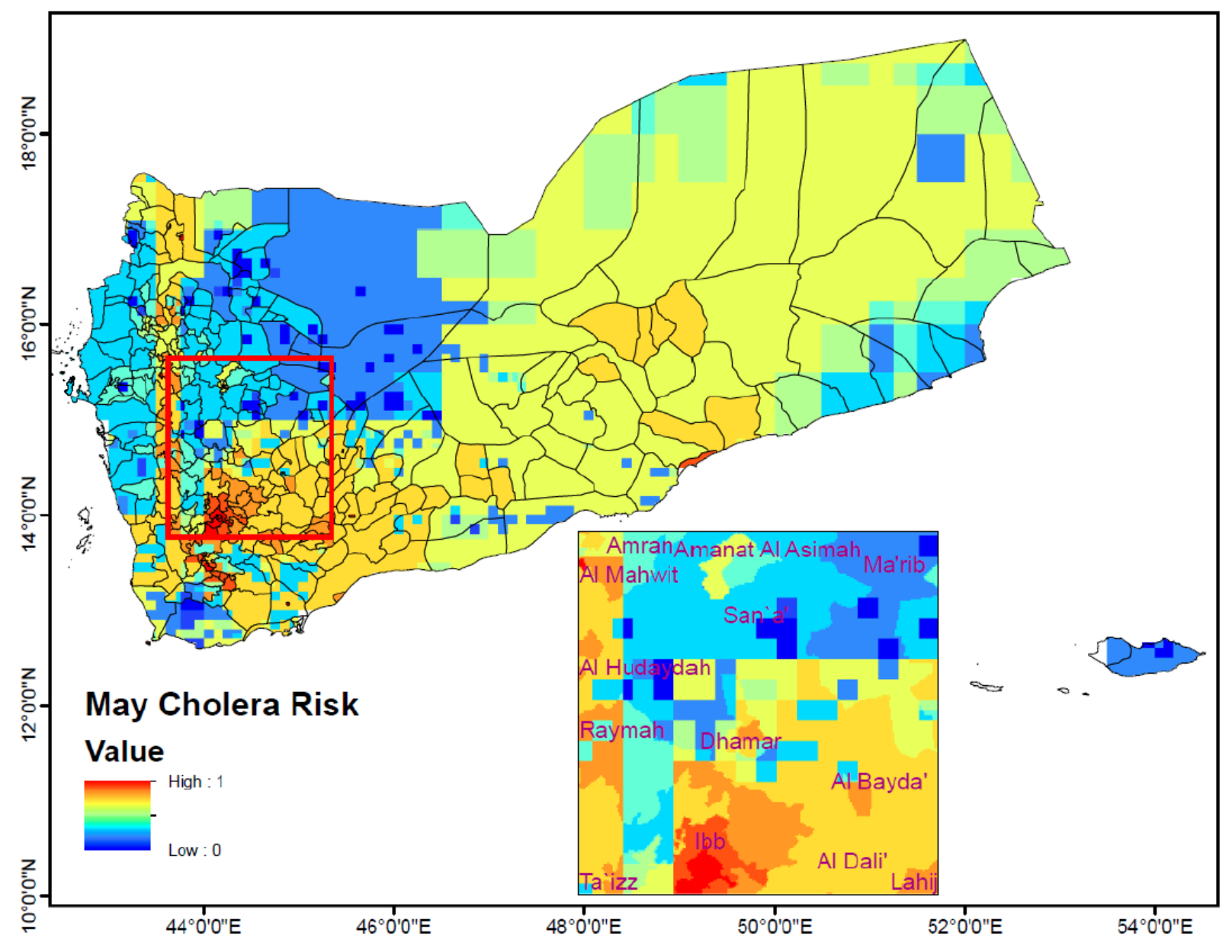
Prediction of October 2015 cholera depending on Hurricane Matthew severity



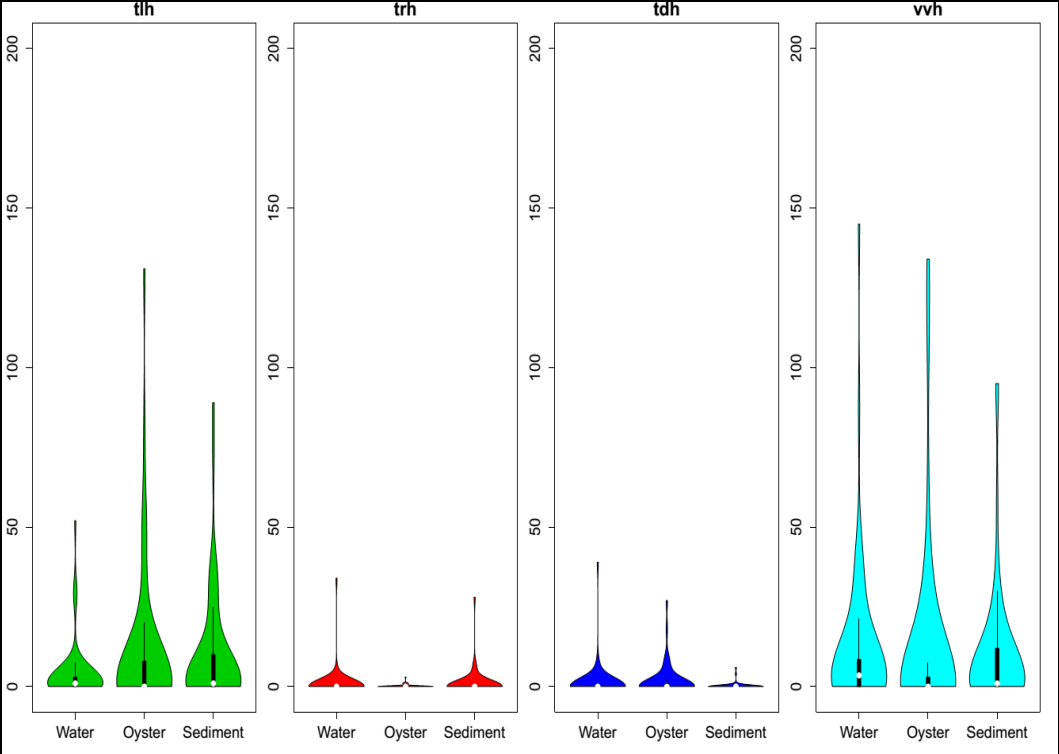
Real-time cholera prediction for Yemen



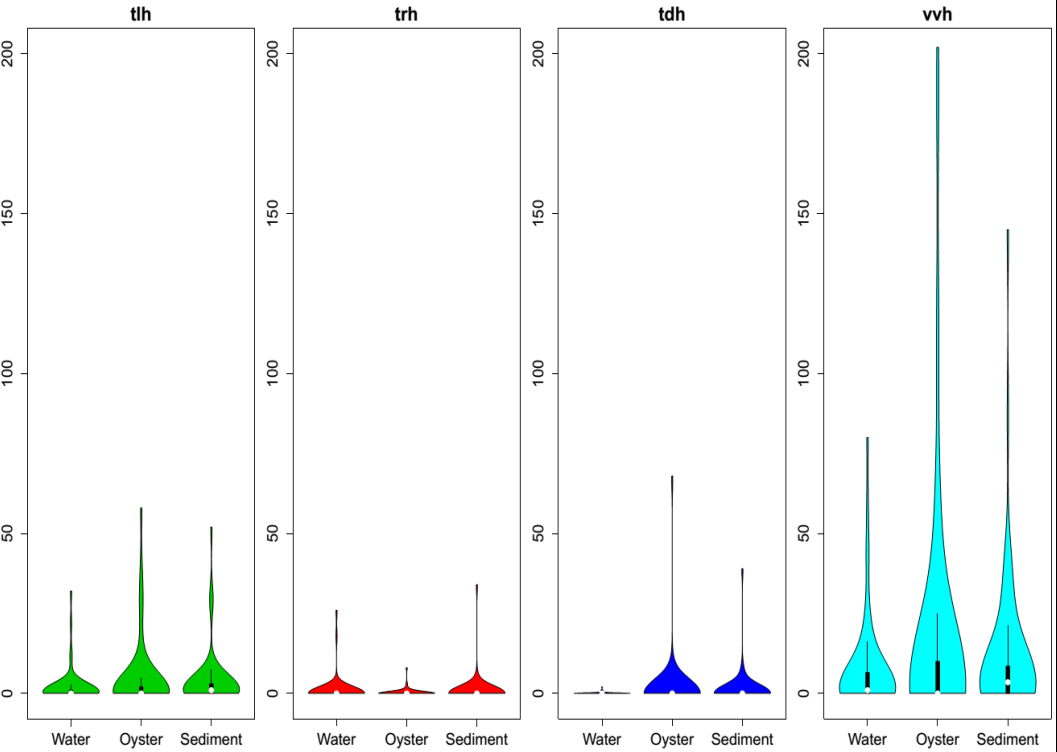
Yemen: May 2018 Outlook



Abundance of *Vibrio vulnificus*, *Vibrio parahaemolyticus* in Chesapeake Bay

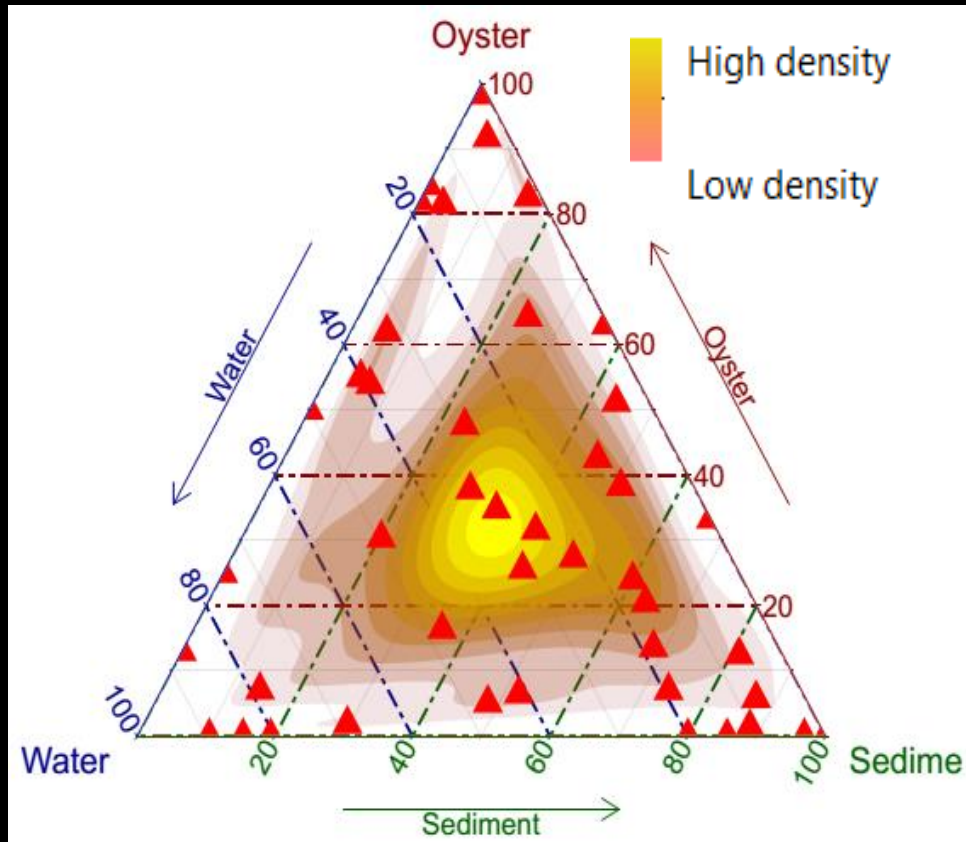


Chester River (CR)

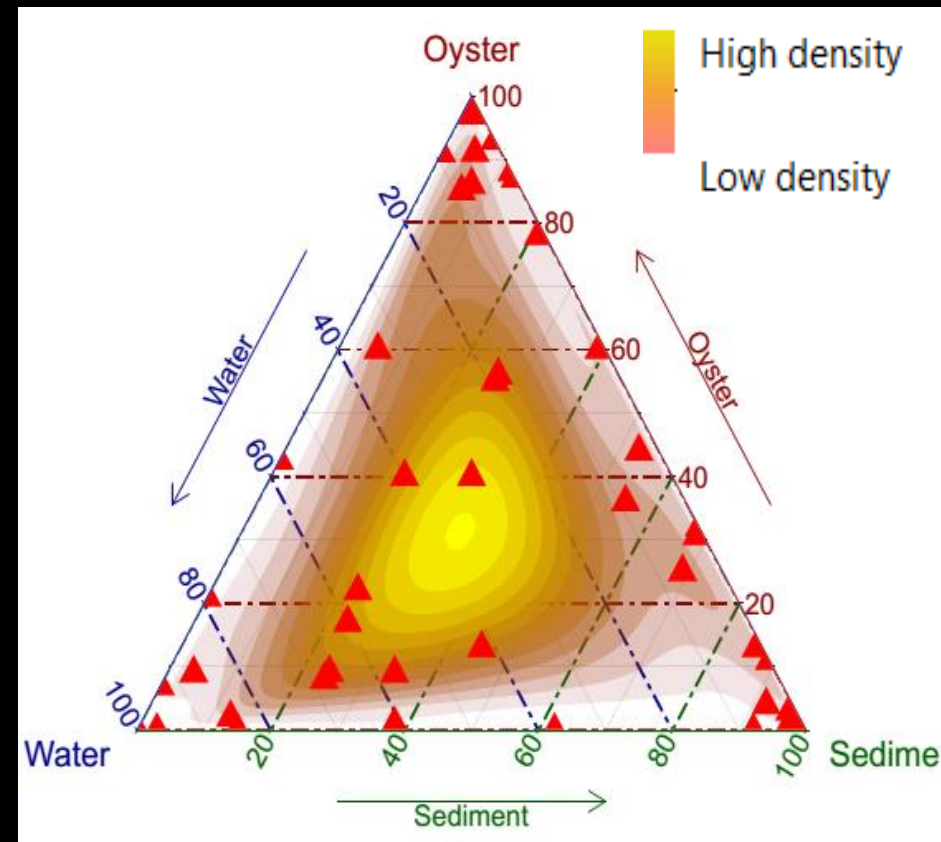


Tangier Sound (TS)

Distribution of *Vibrio vulnificus*, *Vibrio parahaemolyticus* in Chesapeake Bay

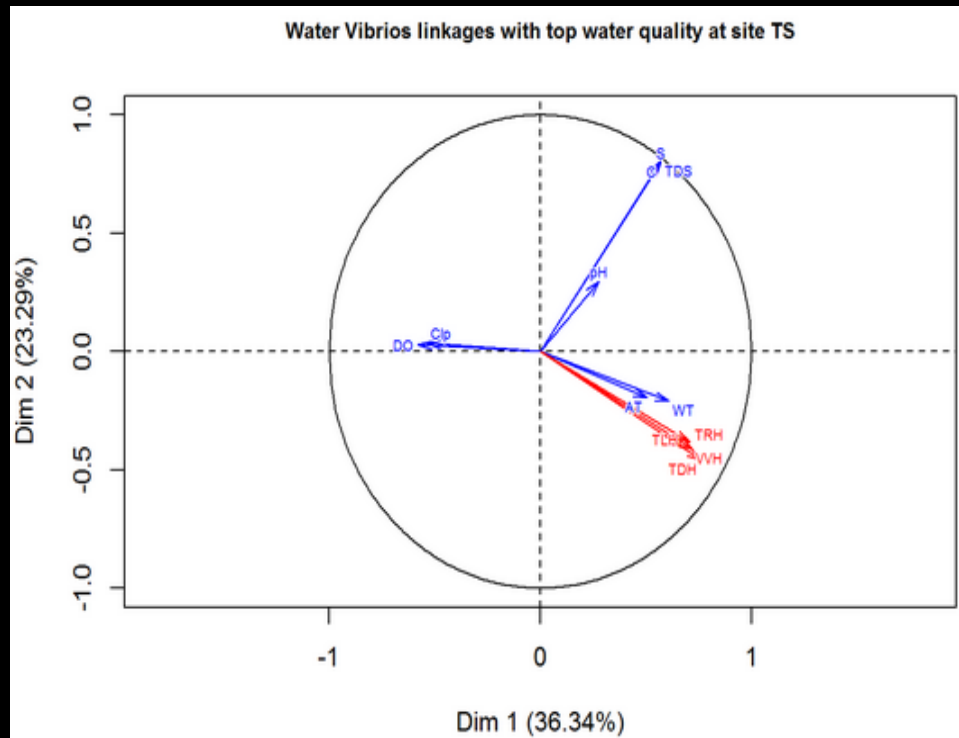


Chester River (CR)

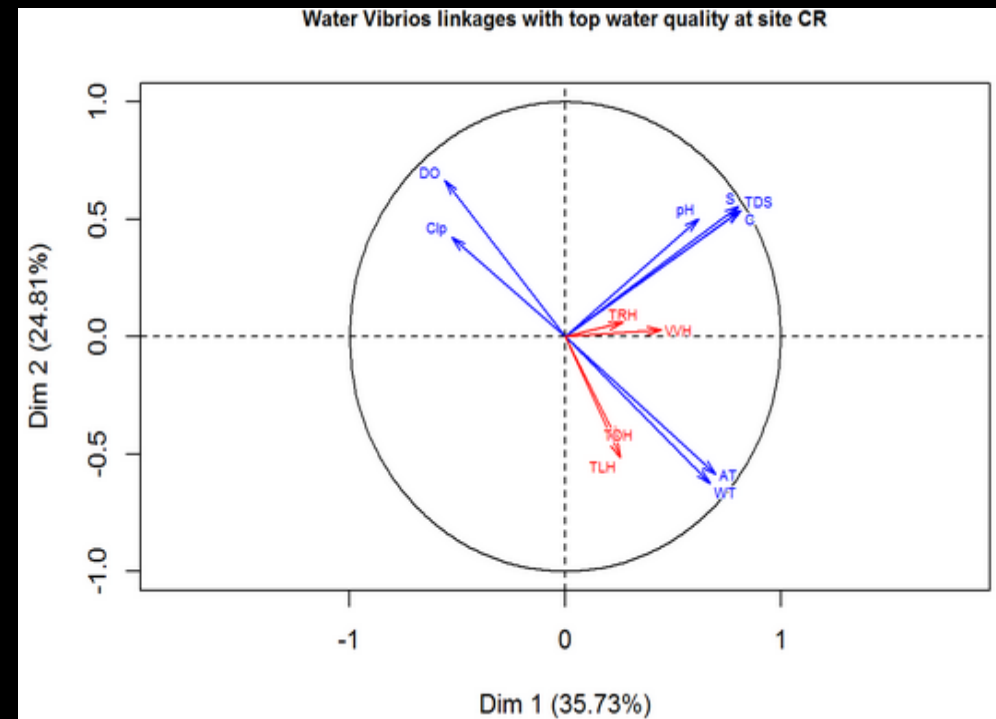


Tangier Sound (TS)

Vibrio vulnificus, *Vibrio parahaemolyticus* in Chesapeake Bay



Chester River (CR)



Tangier Sound (TS)

Thank you.

- <https://www.youtube.com/watch?v=Gf9iww8YhSY>

Time period for opportunity to predict water-borne infections

