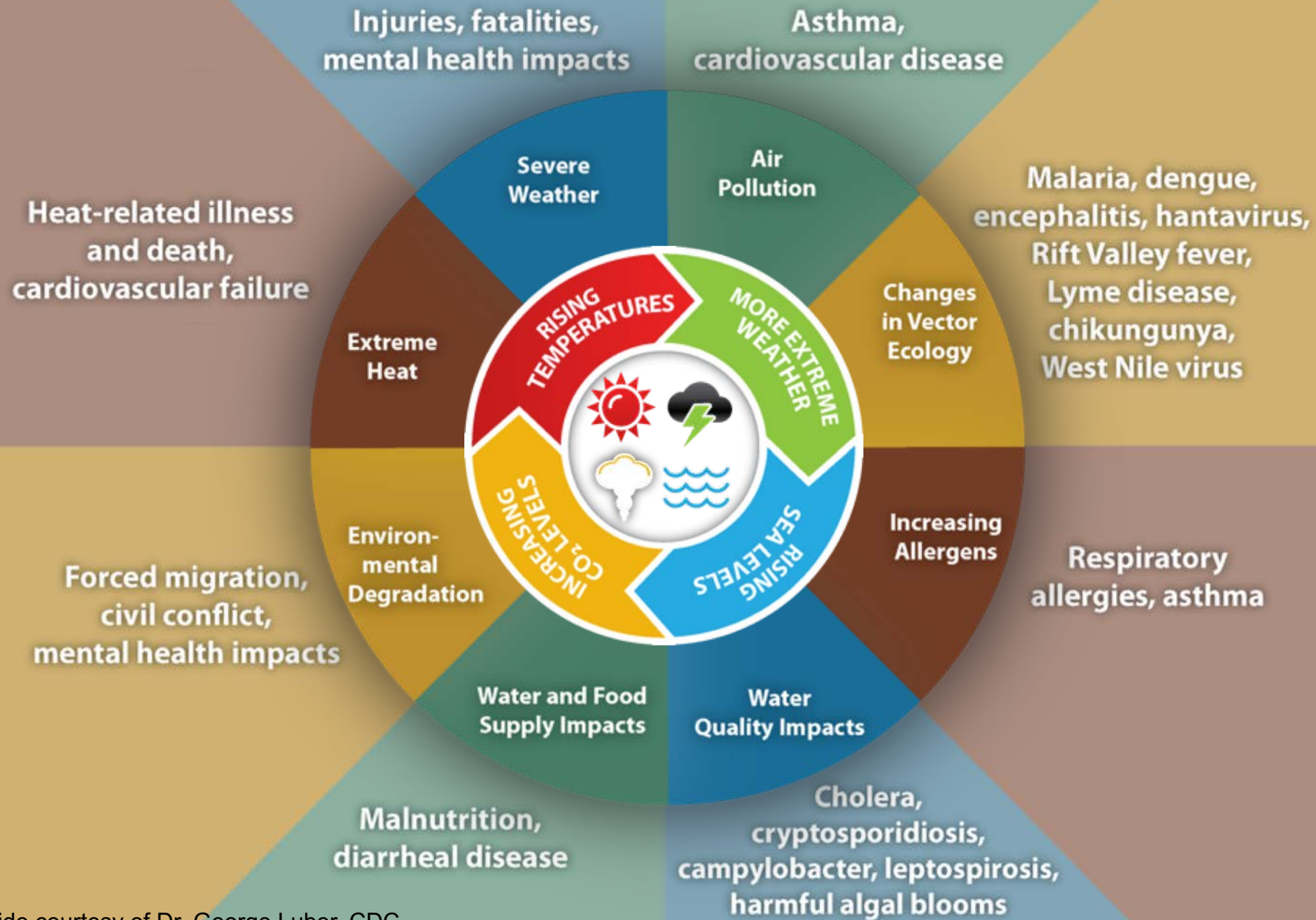


# Climate variability and change and health

Kristie L. Ebi, Ph.D., MPH

*2019 US CLIMAR Summit*  
*7 August 2019*

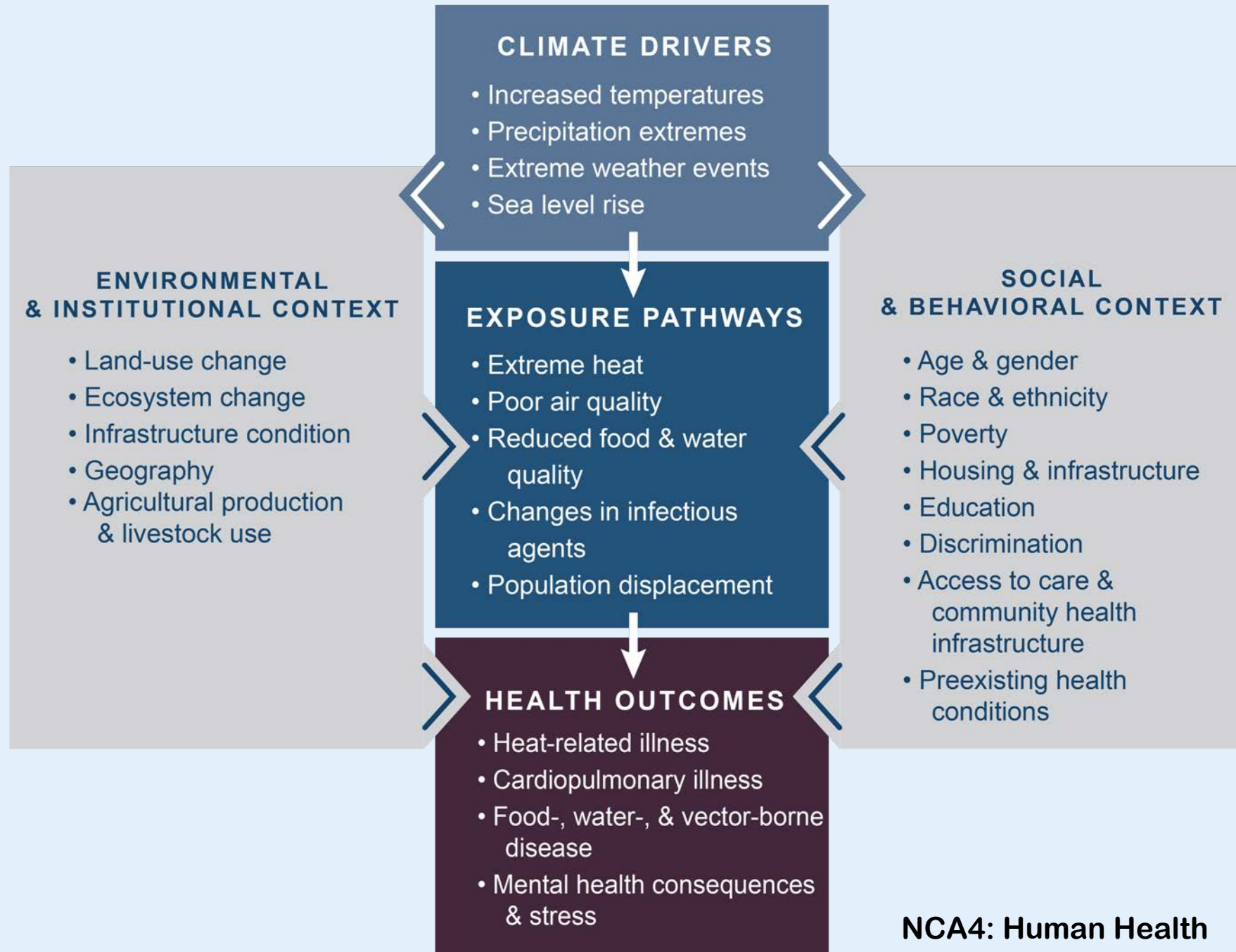
# Impact of Climate Change on Human Health



# Climate Change and Health

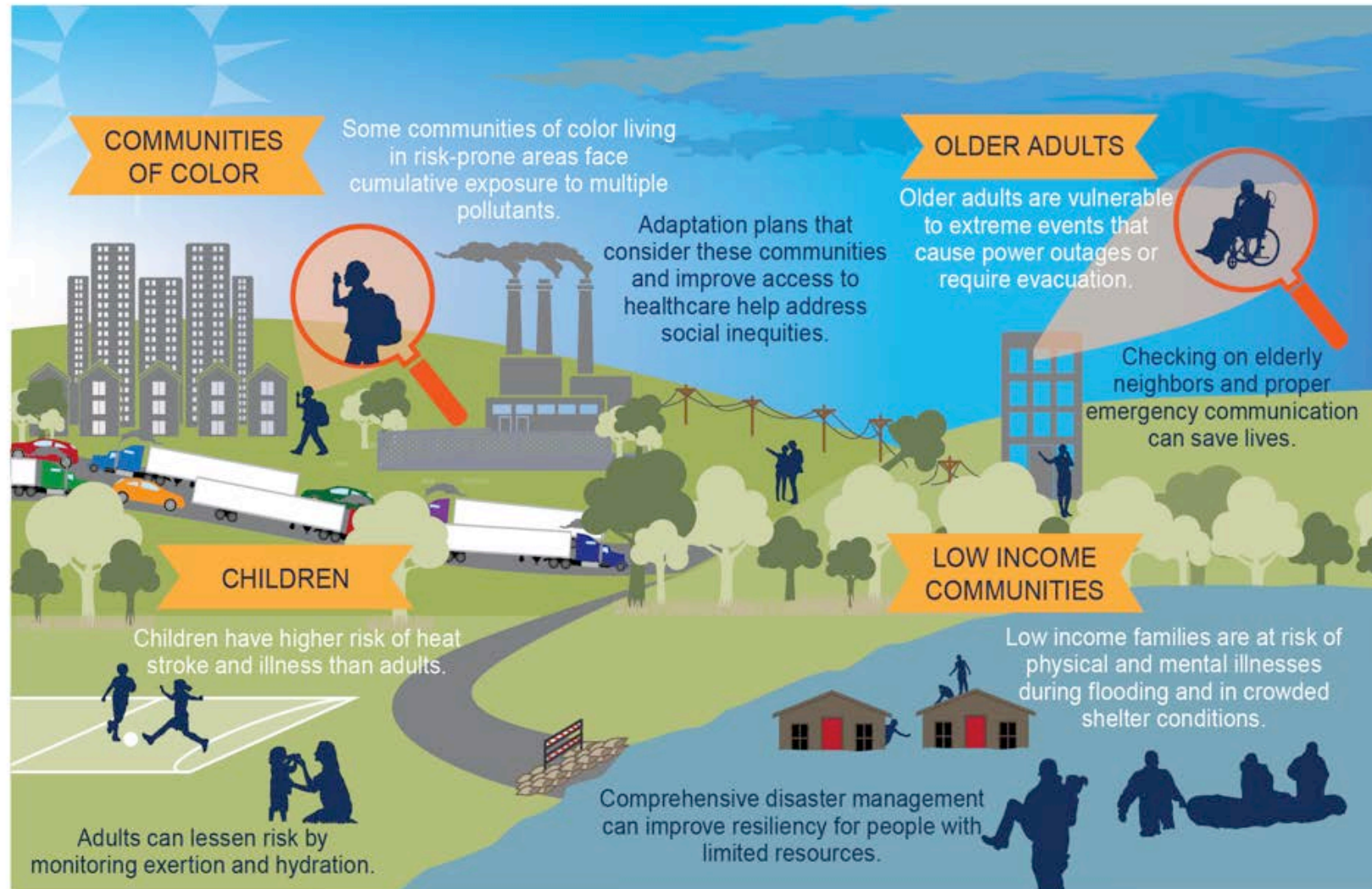
*Climate change affects the health of all Americans*

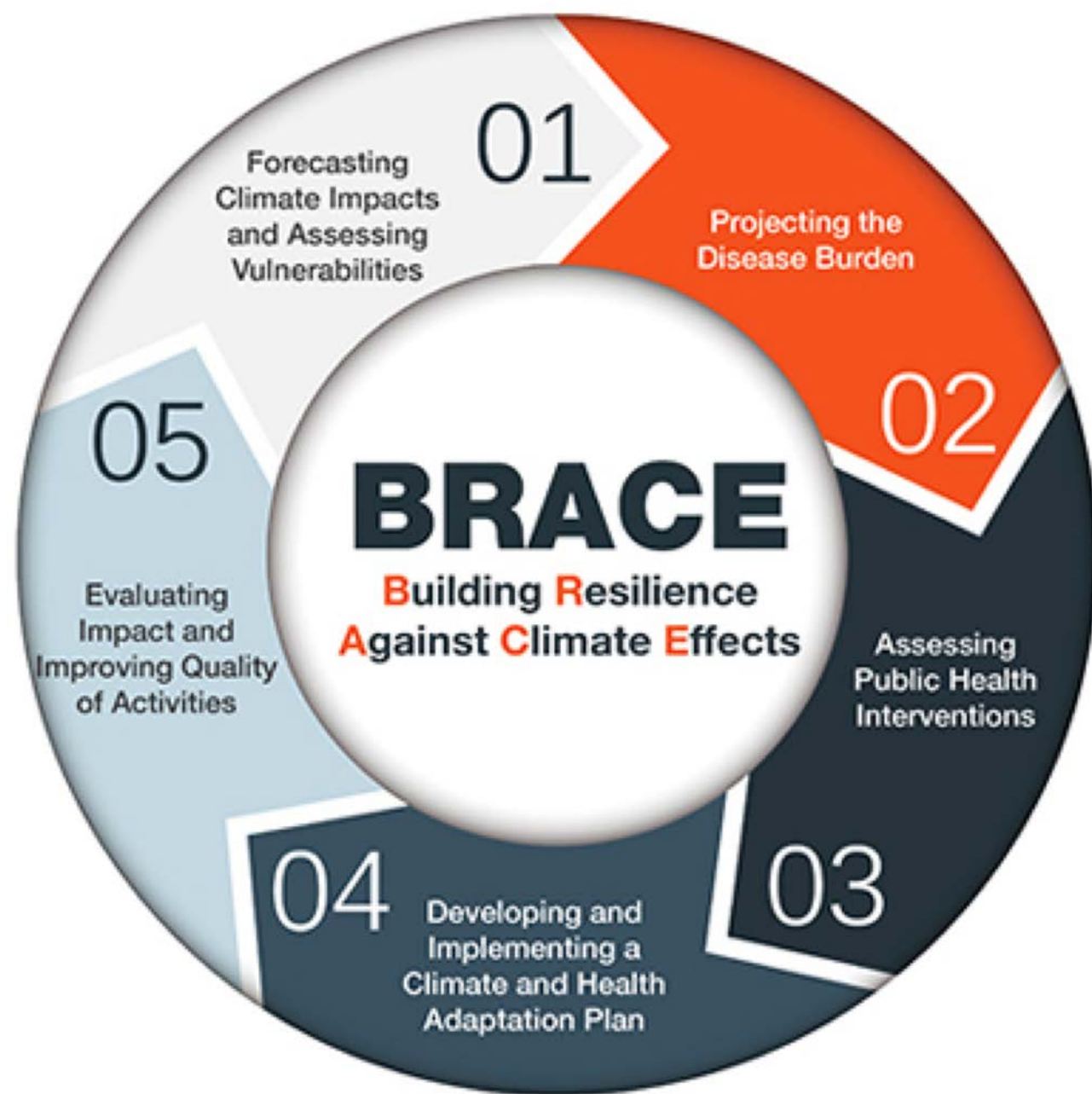
The health and well-being of Americans are already affected by climate change, with the adverse health consequences projected to worsen with additional climate change.





# Exposure and resilience vary across populations and communities





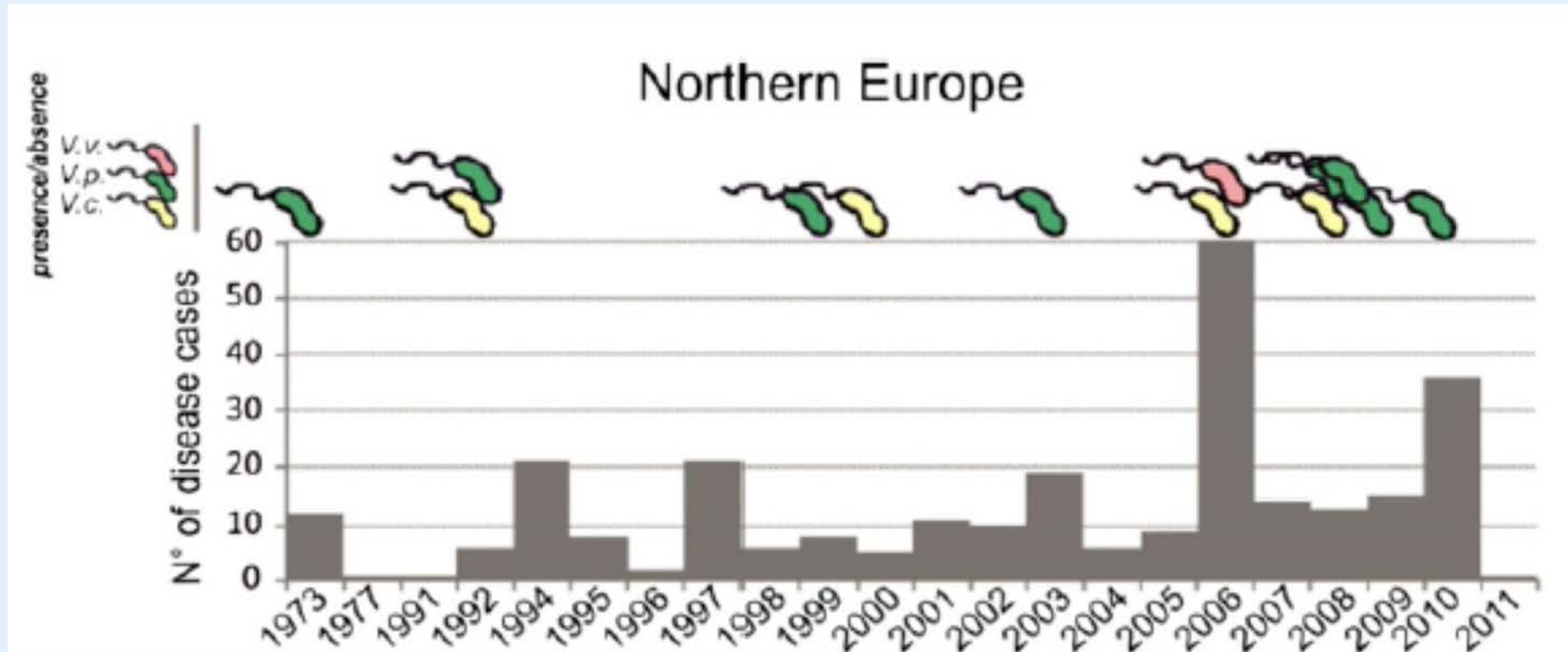


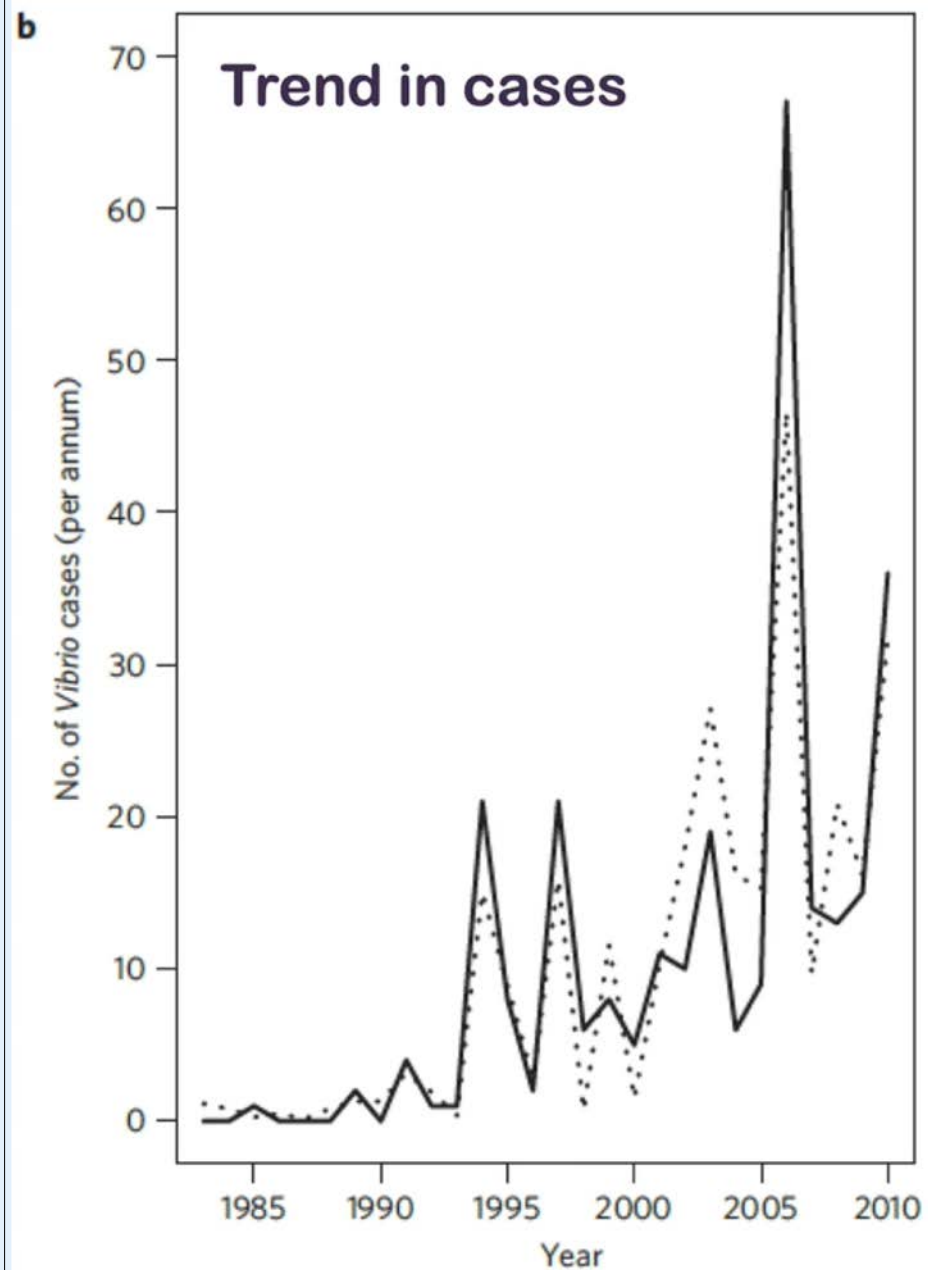
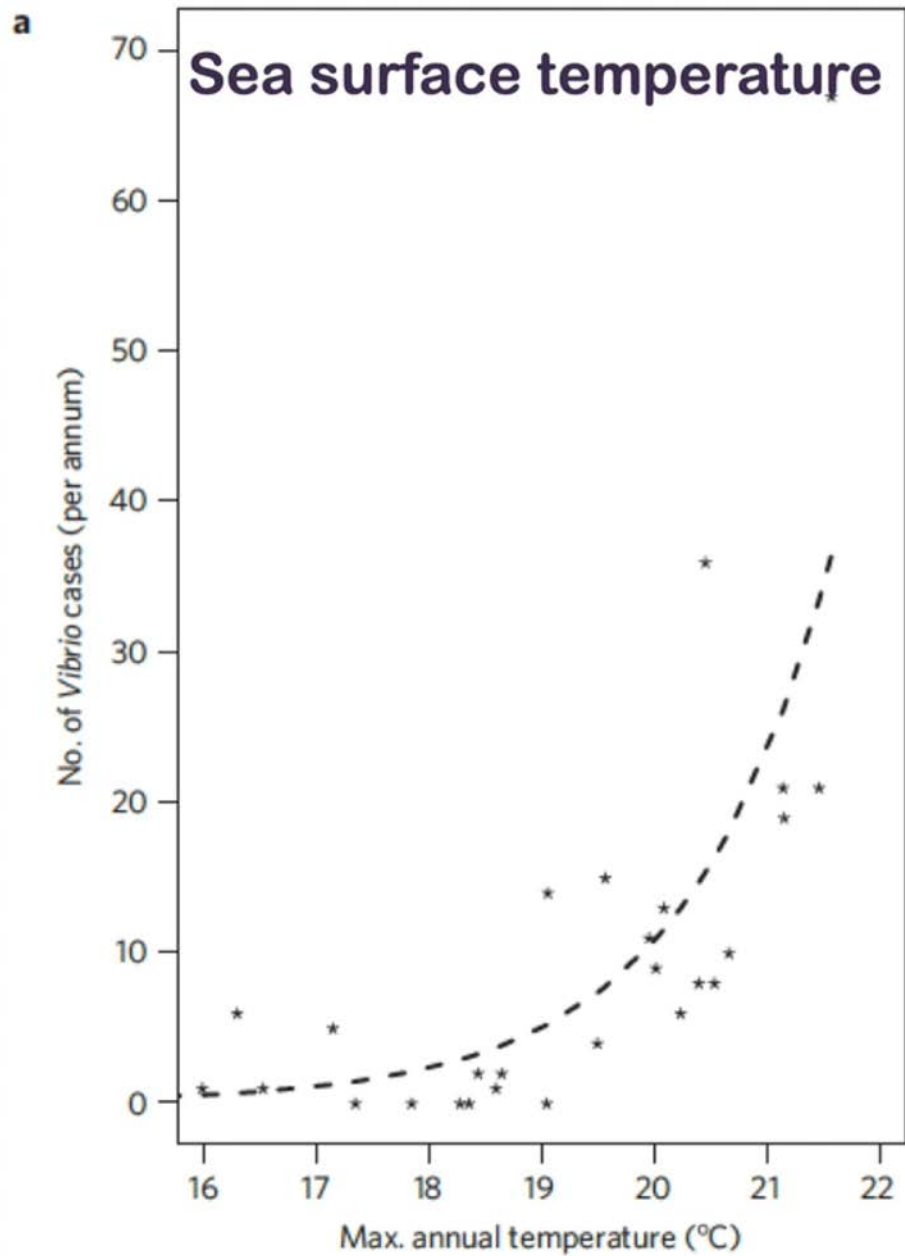
## Warming Trend

### How Climate Shapes *Vibrio* Ecology

Color-enhanced transmission electron micrograph of *Vibrio cholerae*, one of multiple pathogenic *Vibrios* whose ecology is closely tied to changes in temperature. © James Cowley/Science Source

# Cases of reported *Vibrio* infections



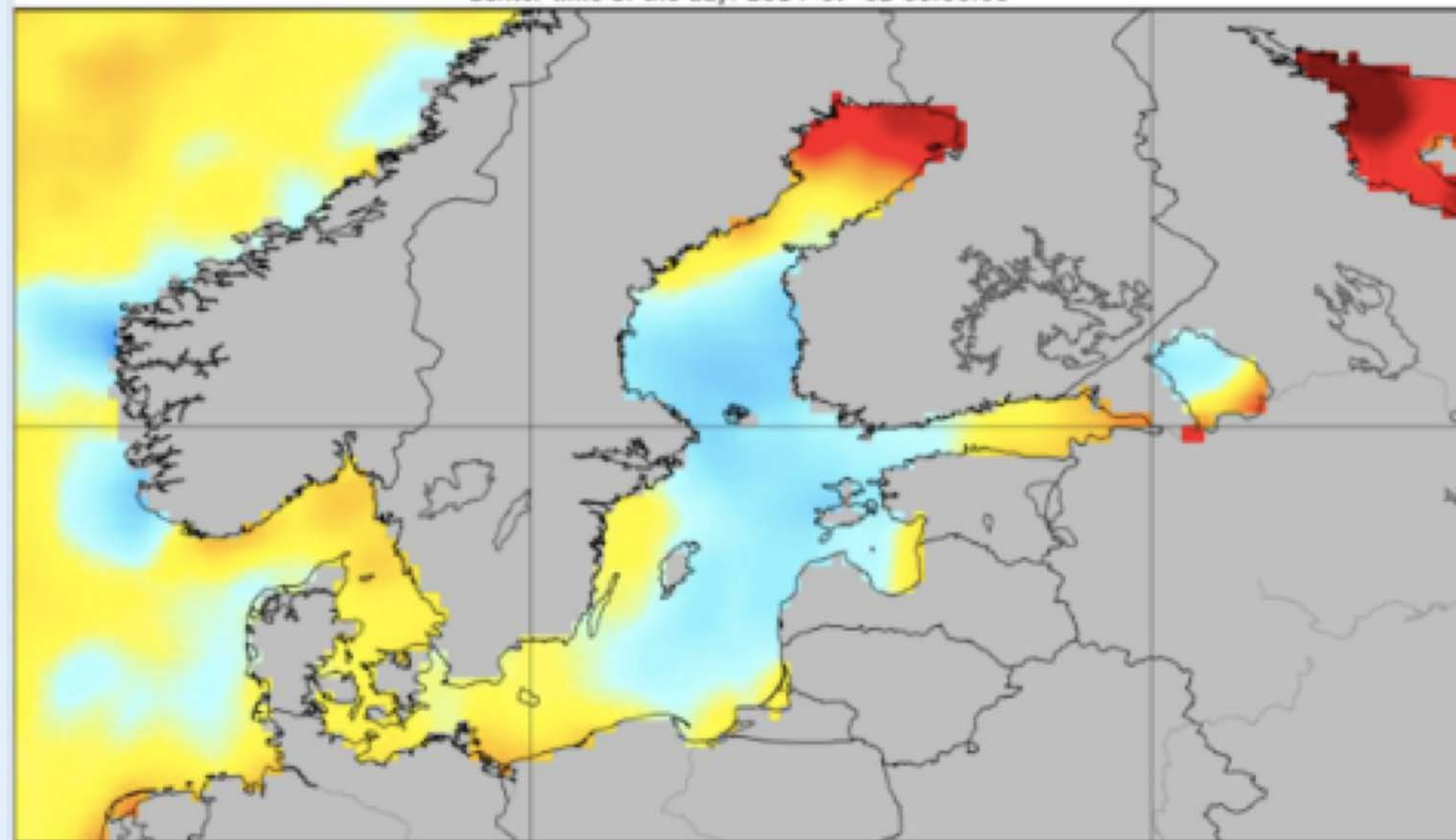


## Vibrio cases in the Baltic Sea

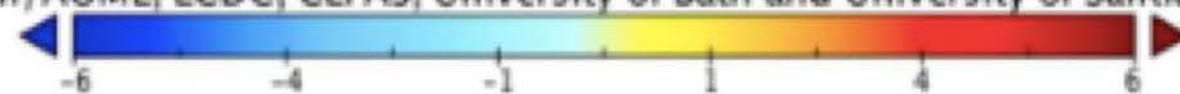


# Daily sea surface temperature anomalies

Center time of the day: 2014-07-02 00:00:00



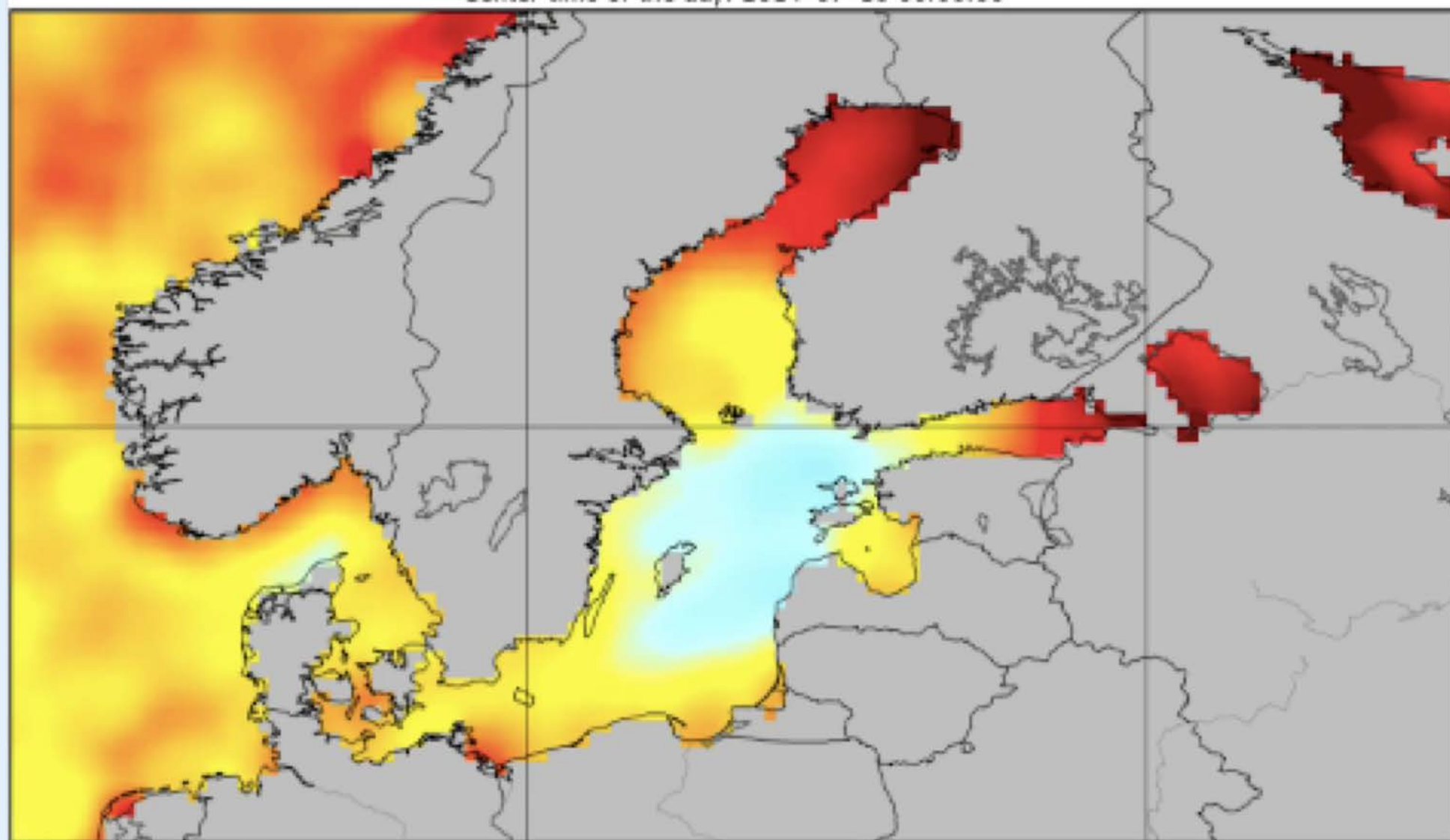
NOAA CoastWatch/AOML, ECDC, CEFAS, University of Bath and University of Santiago de Compostela



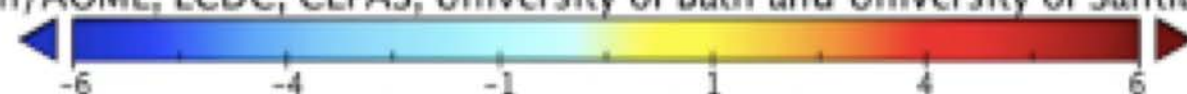
Data Min = -4, Max = 7

# Daily sea surface temperature anomalies

Center time of the day: 2014-07-16 00:00:00



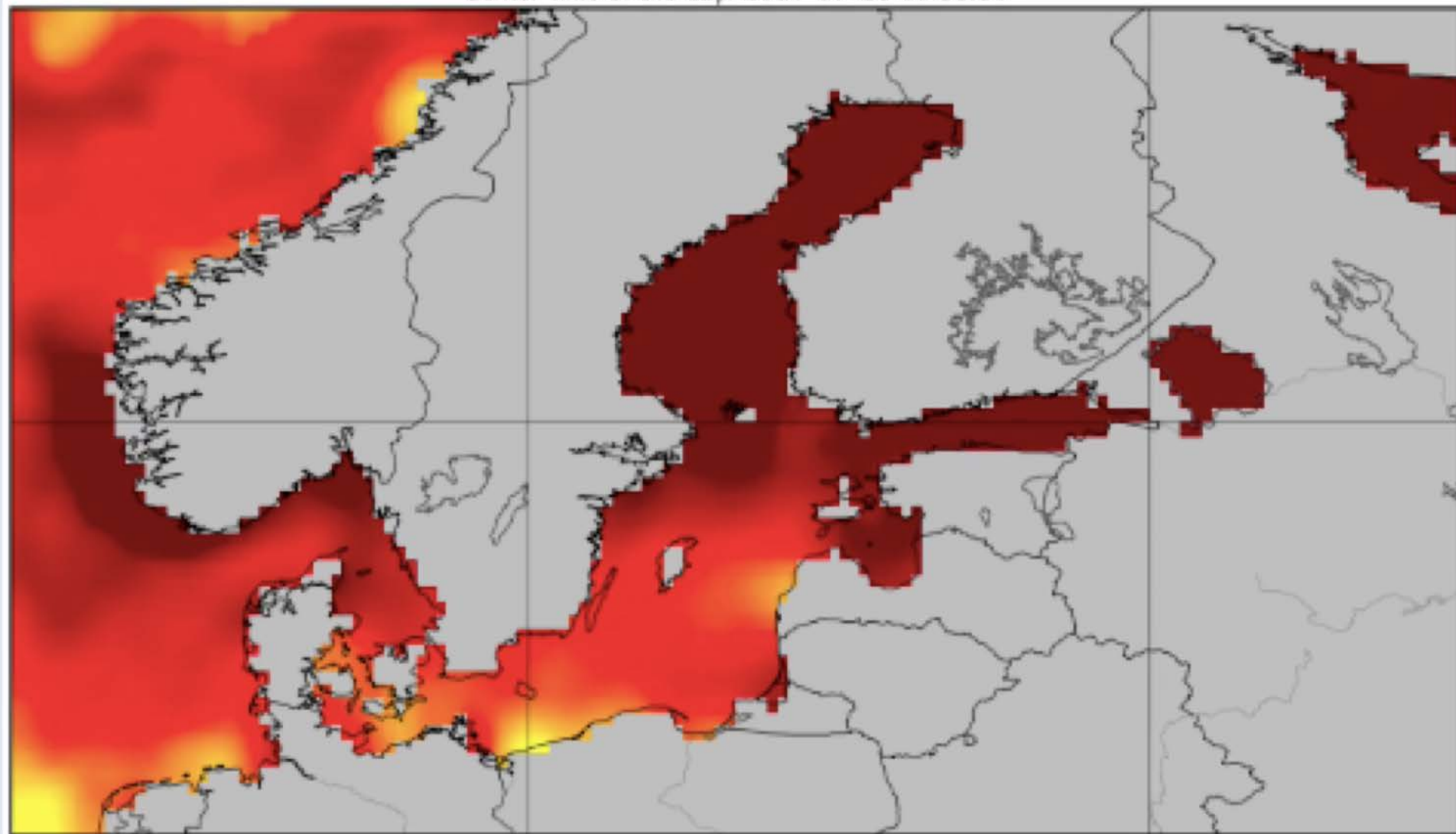
NOAA CoastWatch/AOML, ECDC, CEFAS, University of Bath and University of Santiago de Compostela



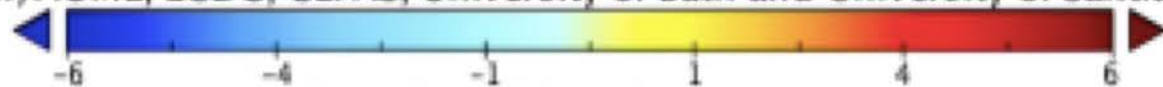
Data Min = -5, Max = 9

# Daily sea surface temperature anomalies

Center time of the day: 2014-07-26 00:00:00



NOAA CoastWatch/AOML, ECDC, CEFAS, University of Bath and University of Santiago de Compostela

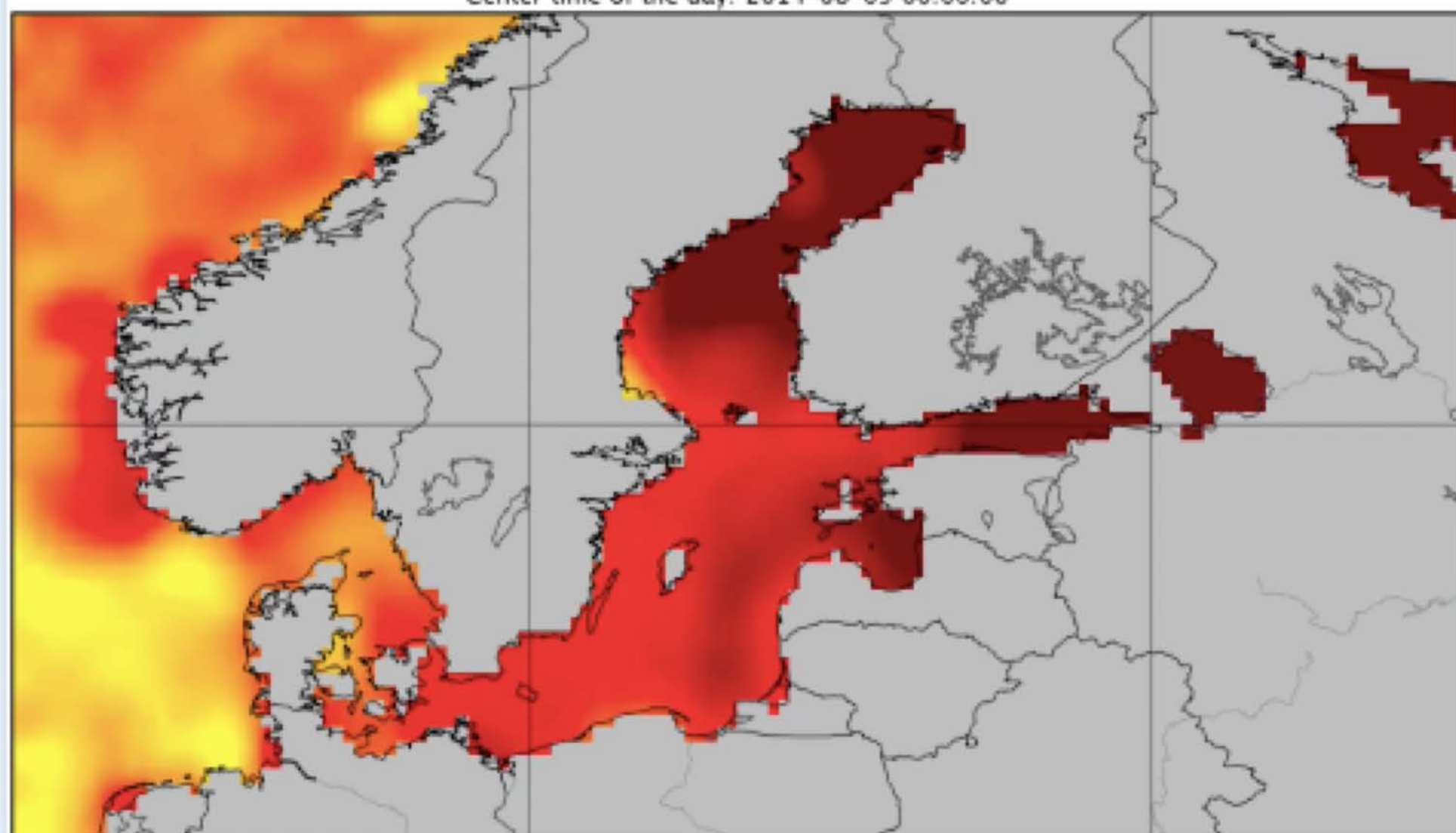


Data Min = -3, Max = 10

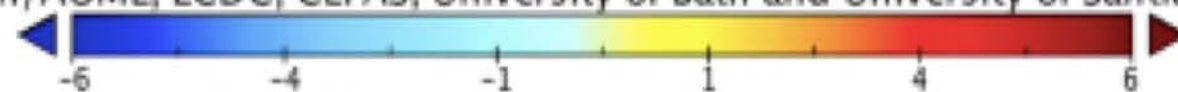


# Daily sea surface temperature anomalies

Center time of the day: 2014-08-09 00:00:00



NOAA CoastWatch/AOML, ECDC, CEFAS, University of Bath and University of Santiago de Compostela



Data Min = -3, Max = 12

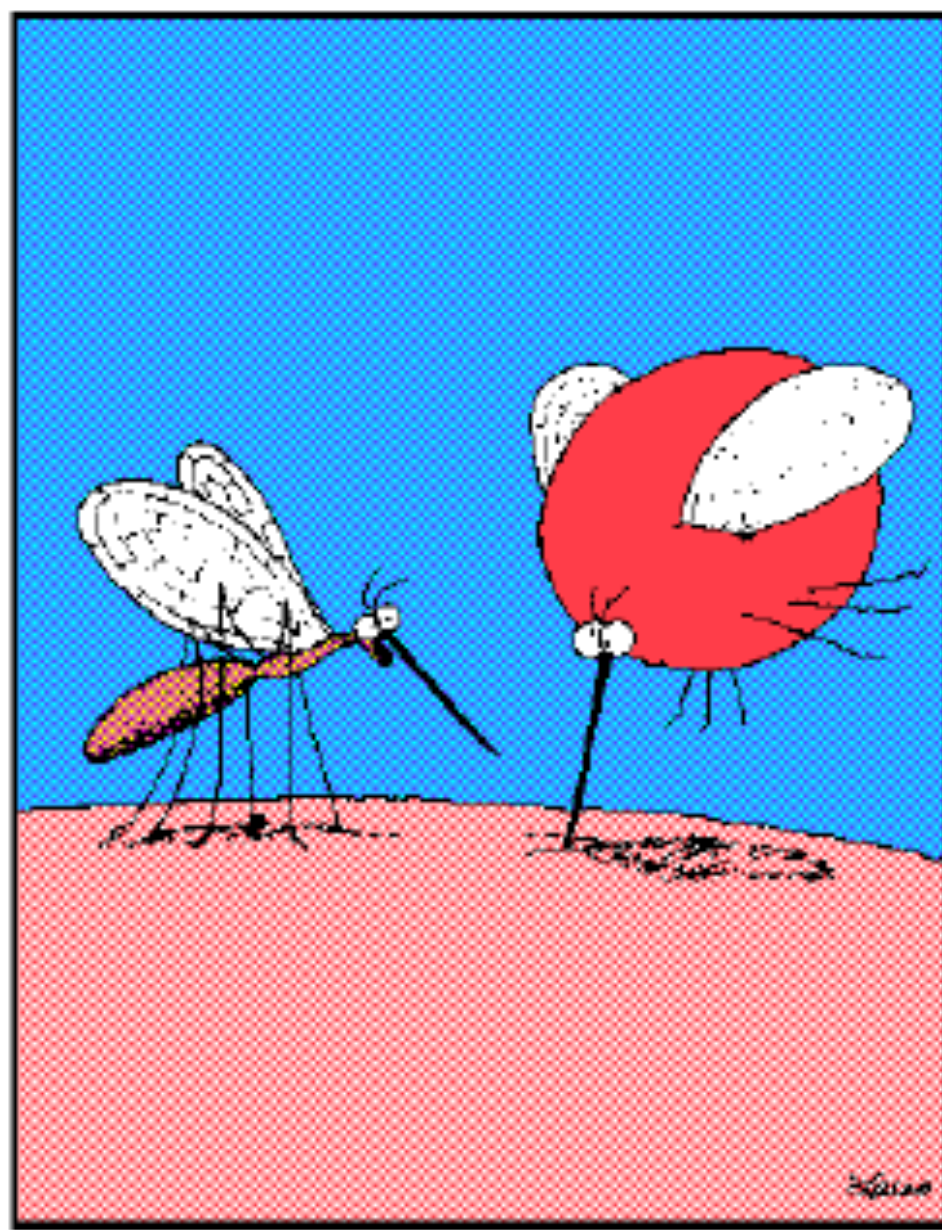
# 2014

- Hottest year in Sweden since observations began in 1860, with a mean annual temperature  $0.18^{\circ}\text{C}$  higher than the preceding record in 1934
- Second warmest year on record in Finland and  $1.6^{\circ}\text{C}$  warmer than the long-term average for the period 1981-2010
- In July and August, the SST in the northern part of the Baltic exceeded historic records; in some areas the SST exceeded the long-term average by approximately  $10^{\circ}\text{C}$

## *Vibrio* cases 2014

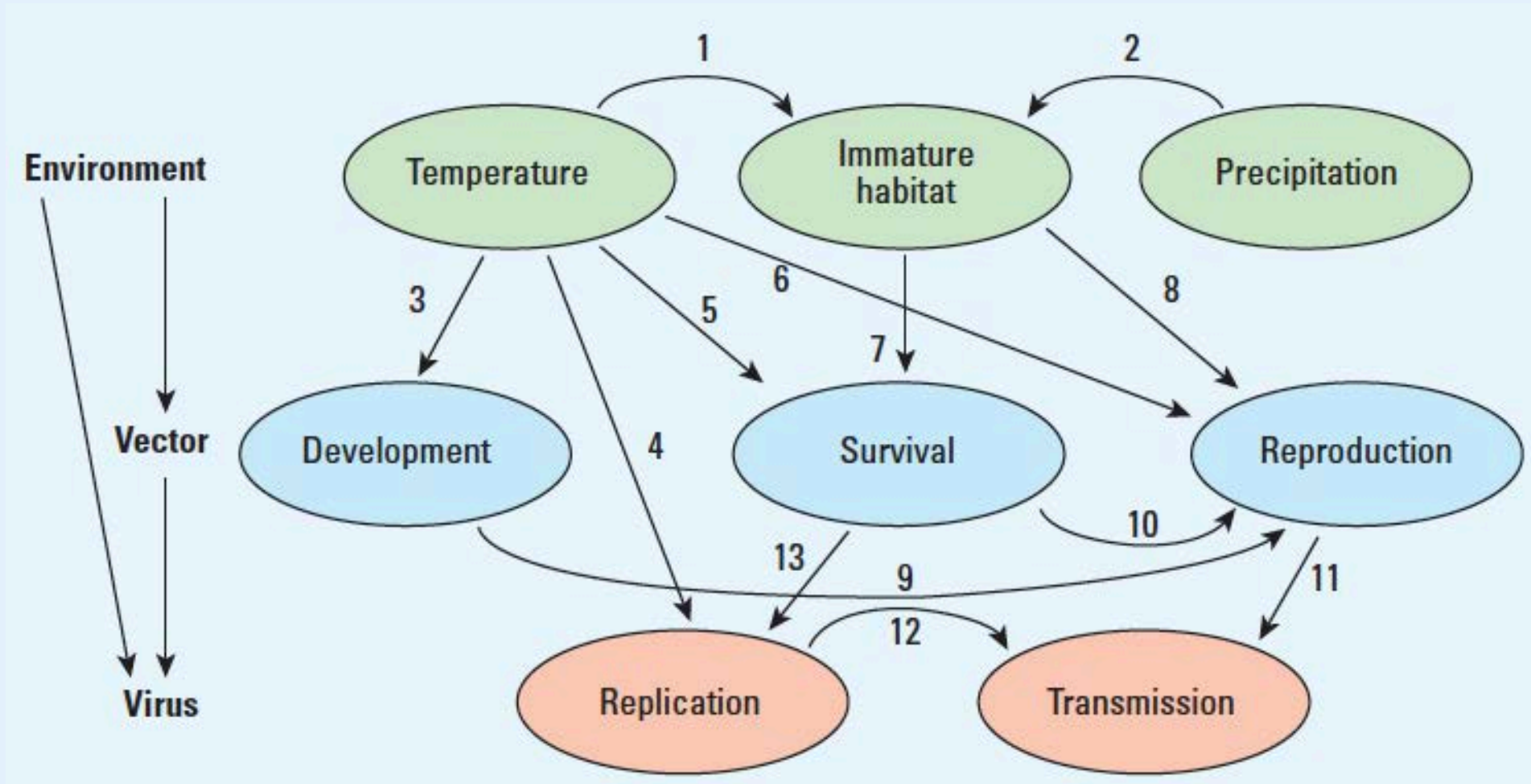
- Across the Baltic Sea, 89 cases of *Vibrio* infections were recorded in Sweden and Finland alone.
  - Cases were also detected in the north of Scandinavia in the subarctic region that was affected by the 2014 heatwave
- Maximum SST explained a significant amount of the variance
- SST anomalies correlated with the spatial and temporal distribution of *Vibrio* cases



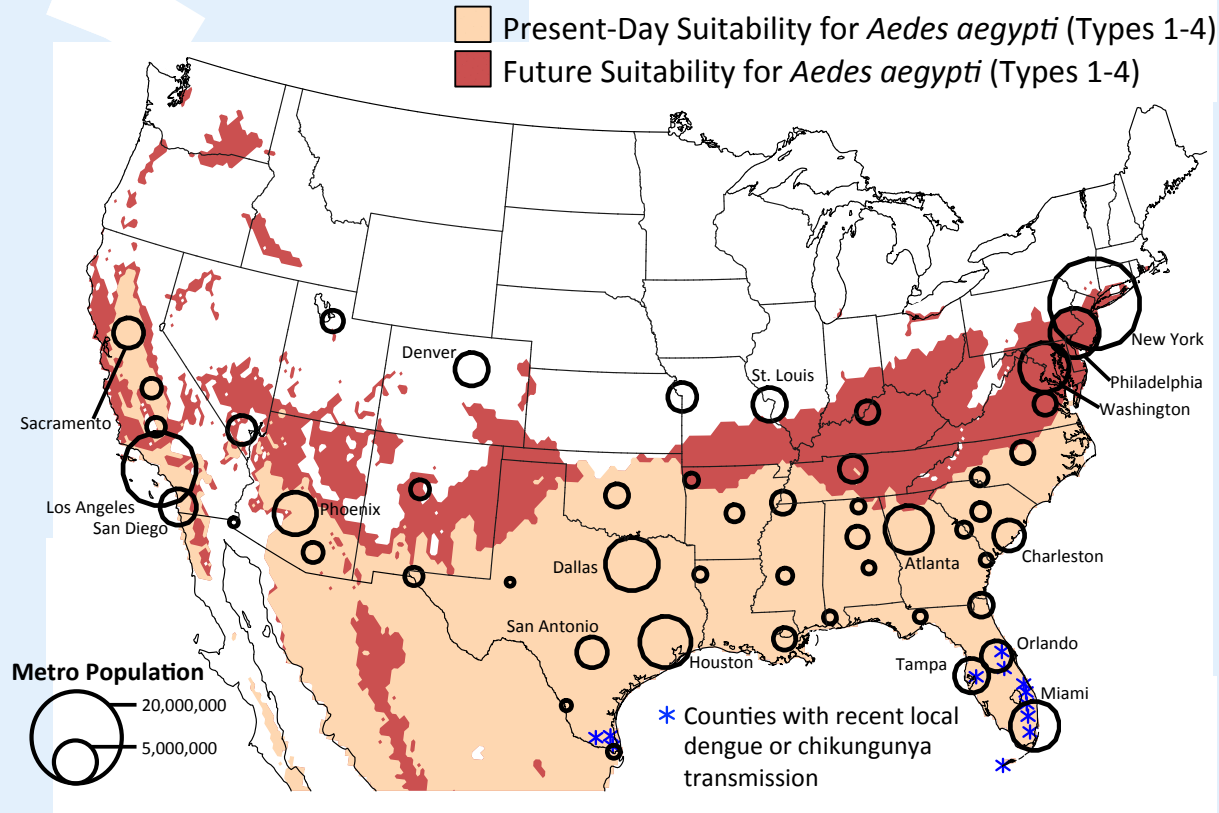


"Pull out, Betty! Pull out! ...  
You've hit an artery!"

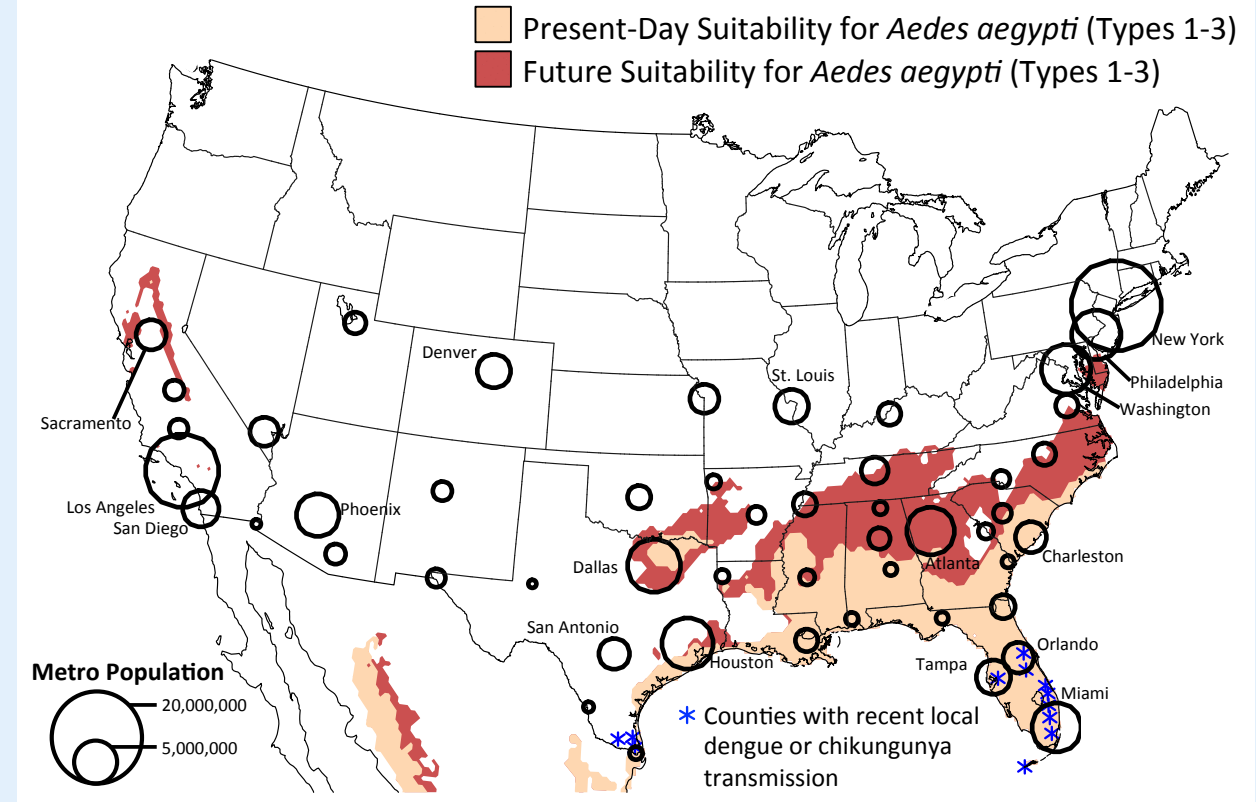
# Biophysical influences on dengue ecology showing the interactions between climate variables, vectors, and the virus



# Ae. aegypti suitability



# Ae. aegypti transmission suitability



Map shows the range of the *Aedes aegypti* mosquito for present-day (1950-2000) and future (2061-2080; RCP8.5) conditions. Larger cities have higher potential for travel-related virus introduction and local virus transmission. Adapted from: Monaghan et al. (2016)

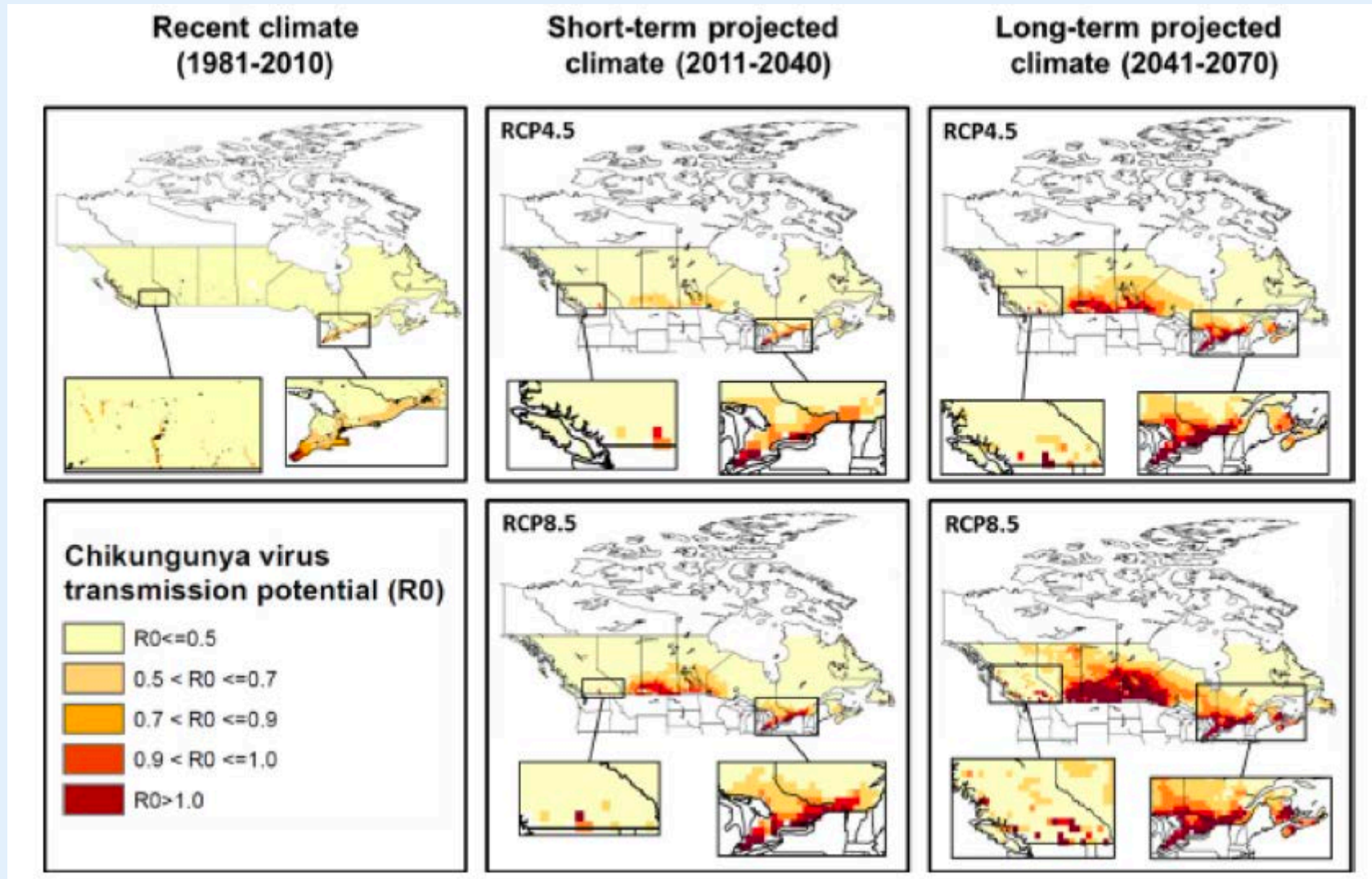


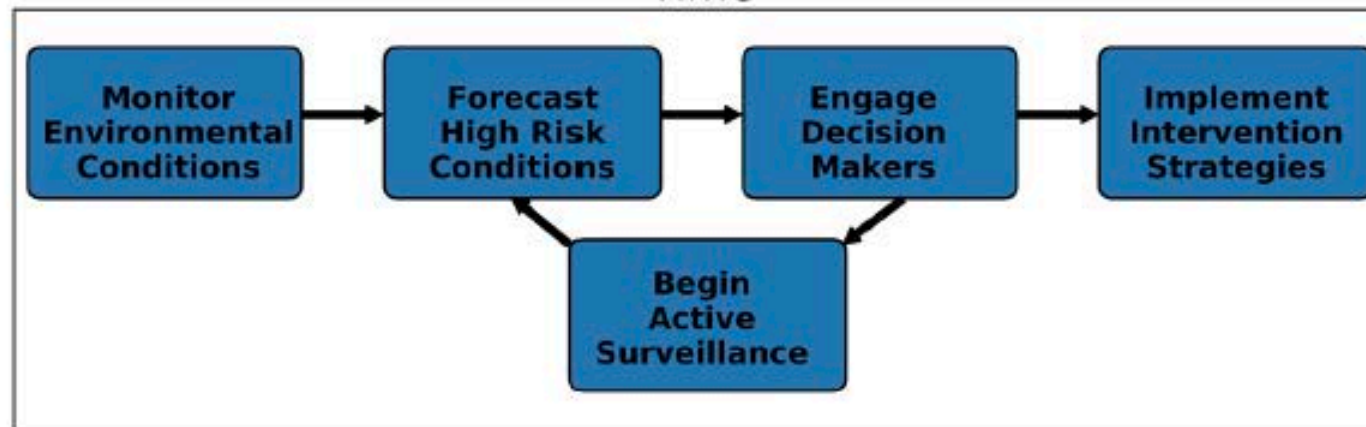
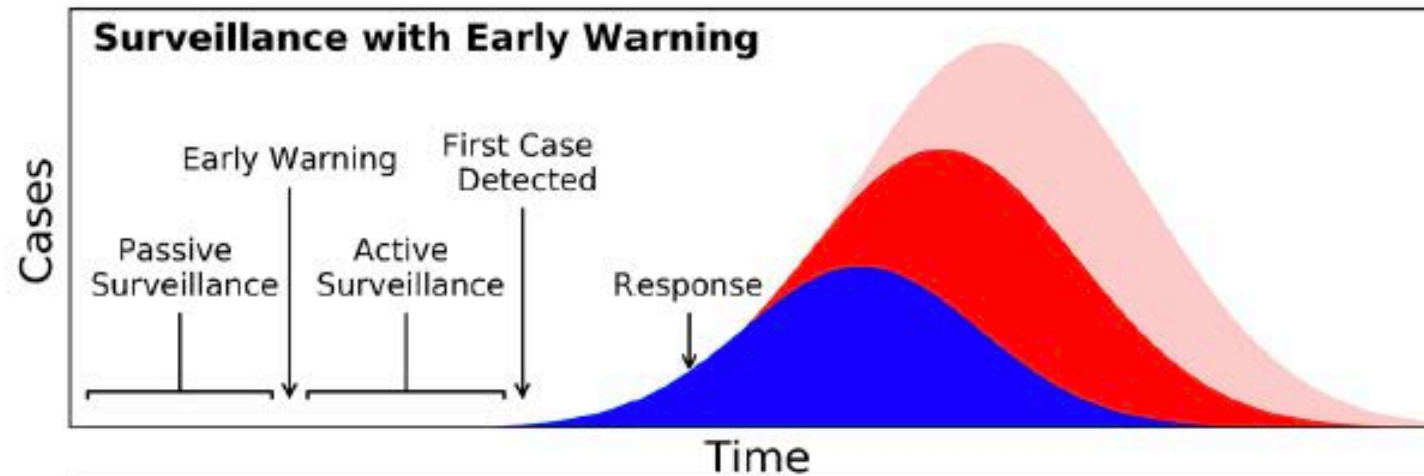
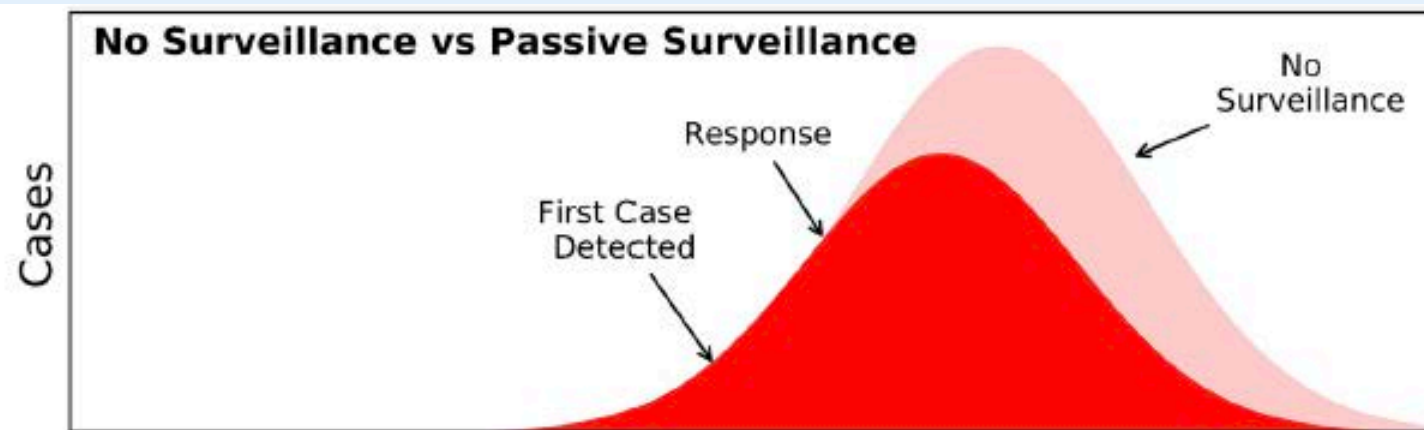
# **Mosquito species capable of carrying Zika virus found in Ontario**

23 Aug 2017



# Risks maps for autochthonous Chikungunya virus transmission in Canada

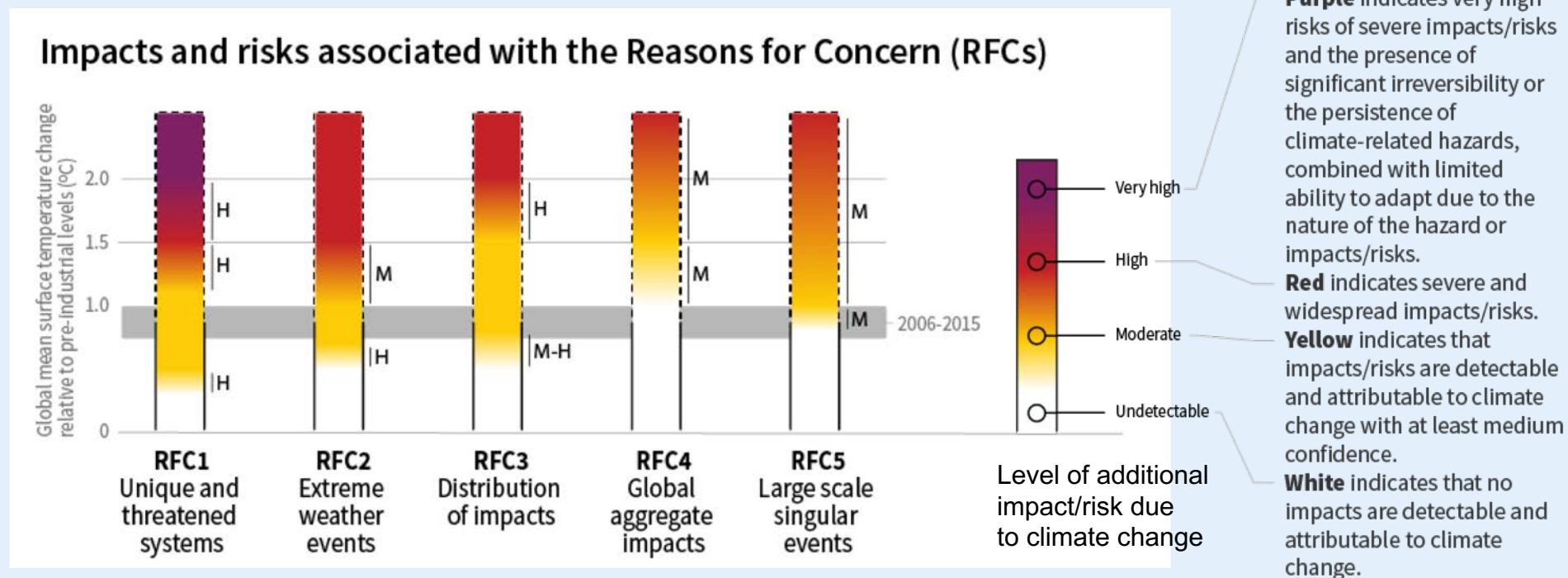






# SPM2

How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed, and human systems

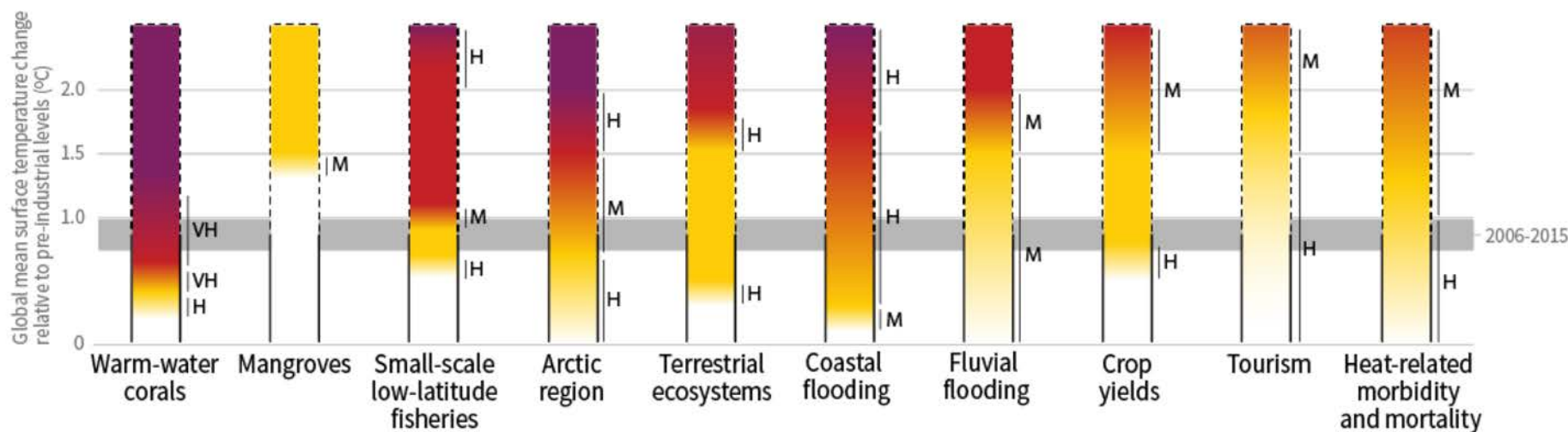


Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high

# SPM2

How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed, and human systems

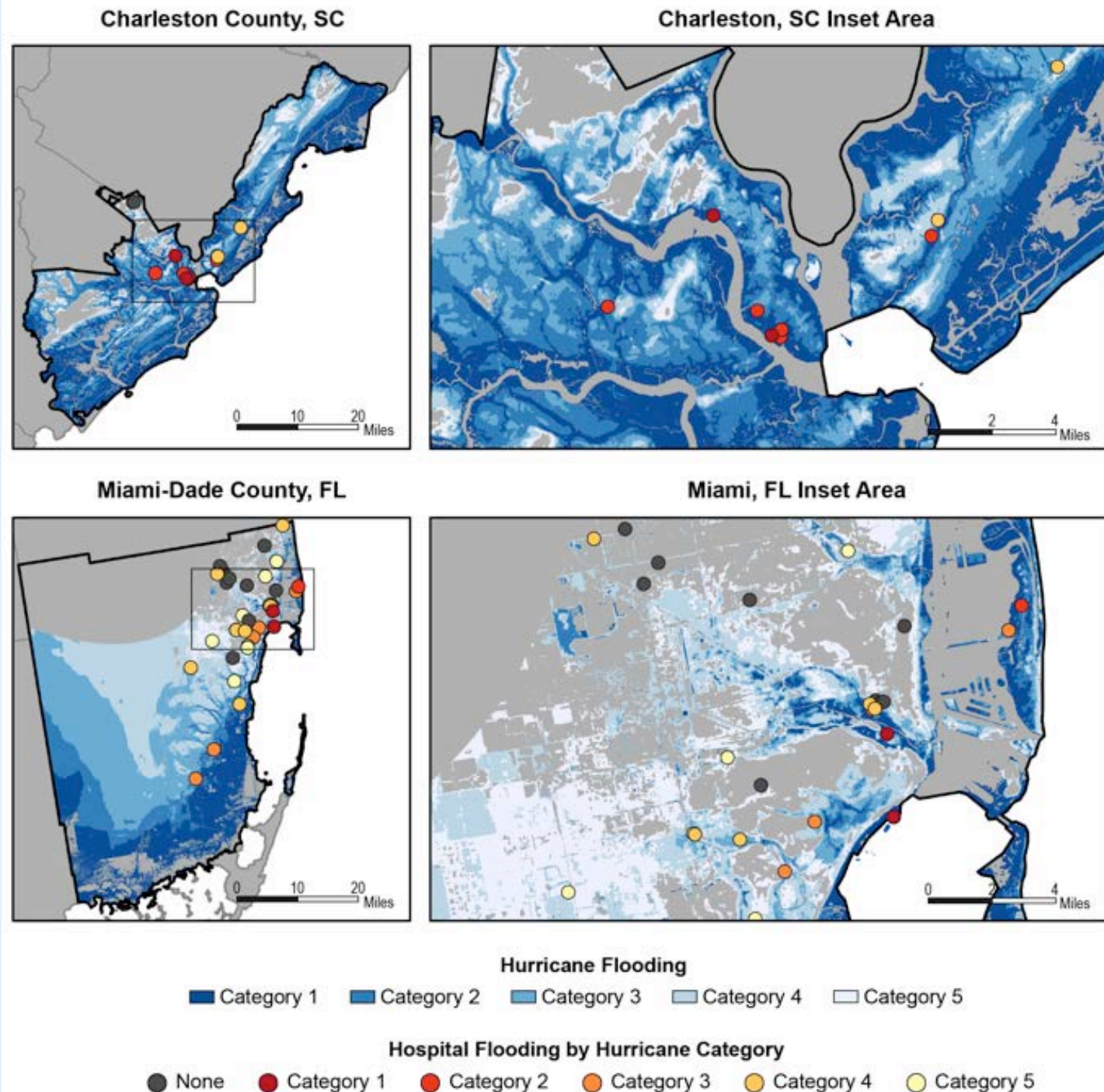
Impacts and risks for selected natural, managed and human systems



Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high

# Adaptation reduces risks and improves health

Proactive adaptation policies and programs reduce the risks and impacts from climate-sensitive health outcomes and from disruptions in healthcare services. Additional benefits to health arise from explicitly accounting for climate change risks in infrastructure planning and urban design.







U.S. Global Change  
Research Program

# Fourth National Climate Assessment, Vol II — Impacts, Risks, and Adaptation in the United States

*Chapter 14 | Human Health*

