

Transmission Experiments

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What Controls *Pathogen* Populations Across Space and Time?

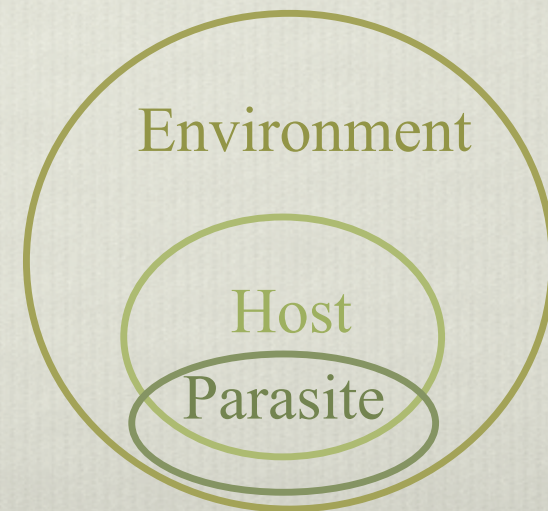
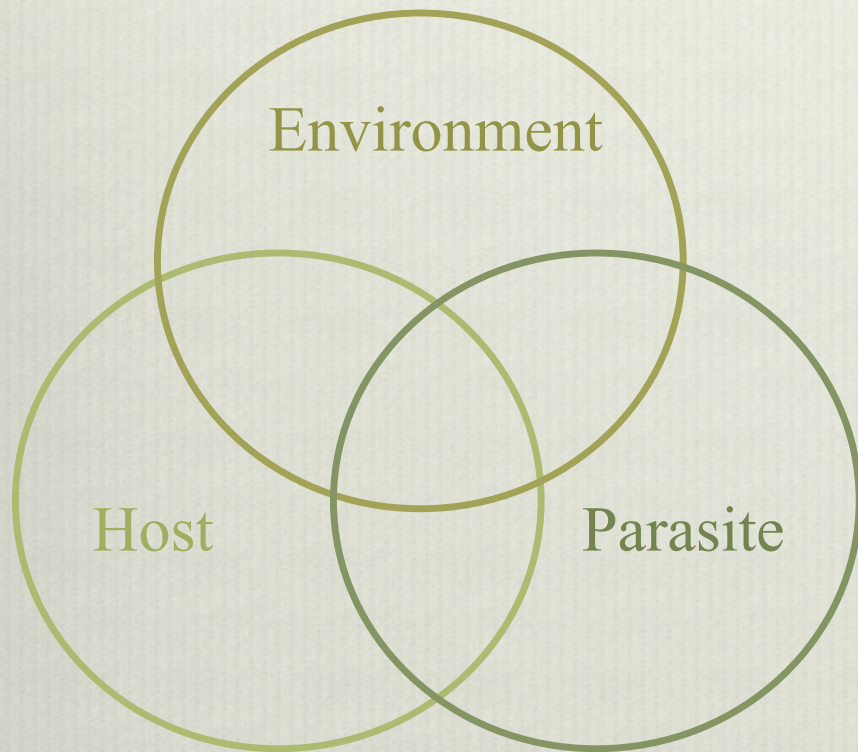
❖ Scales:

- ❖ Temporal: seasonal > interannual > decadal > longer
- ❖ Spatial: host > bed > estuary > region > continent

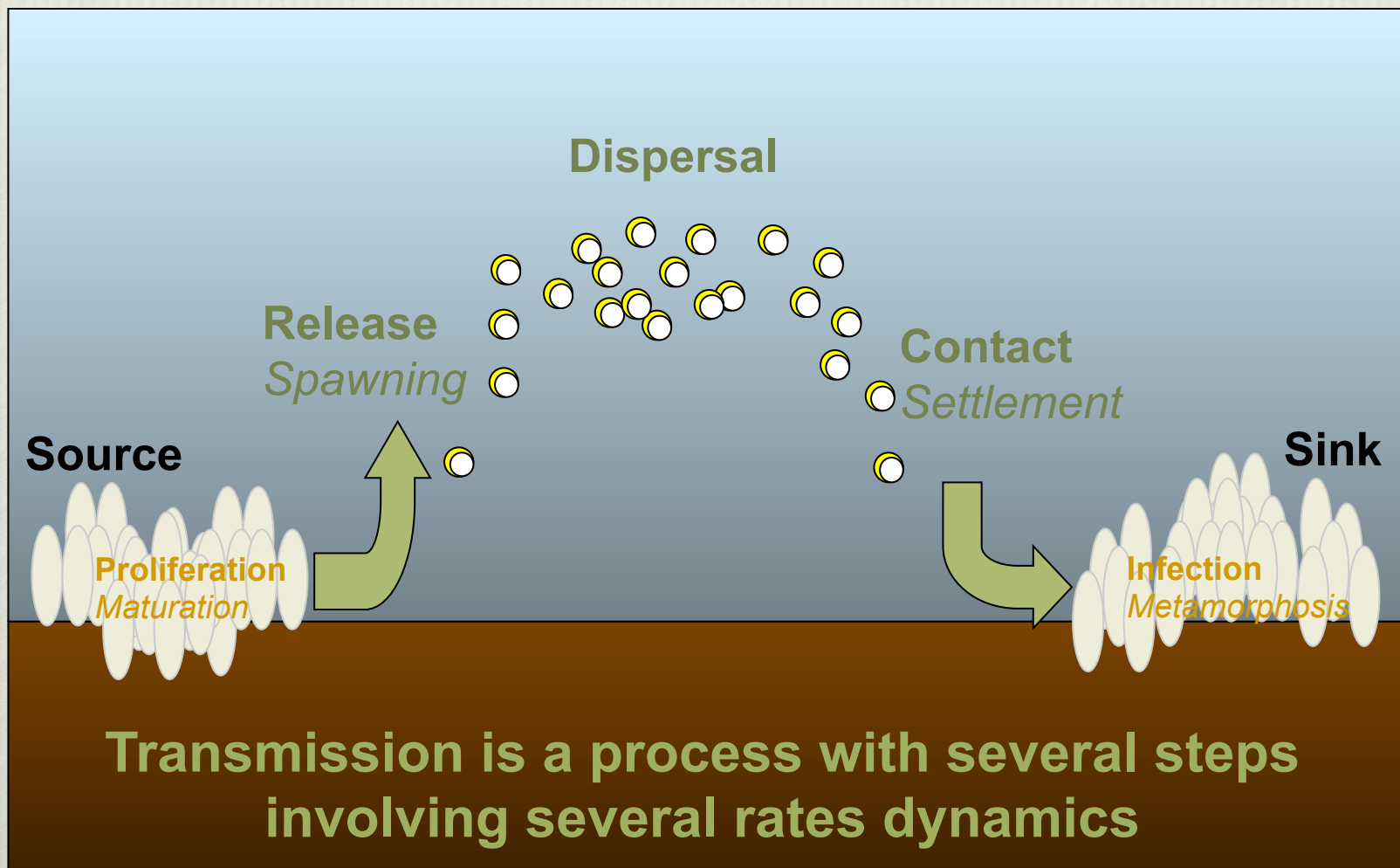
❖ Host-Pathogen-Environment Interactions:

- ❖ Physical tolerances/limits
- ❖ Transmission: Pathogen sources, dispersal, sinks
- ❖ Genetics of resistance and virulence
- ❖ Interactions with other organisms

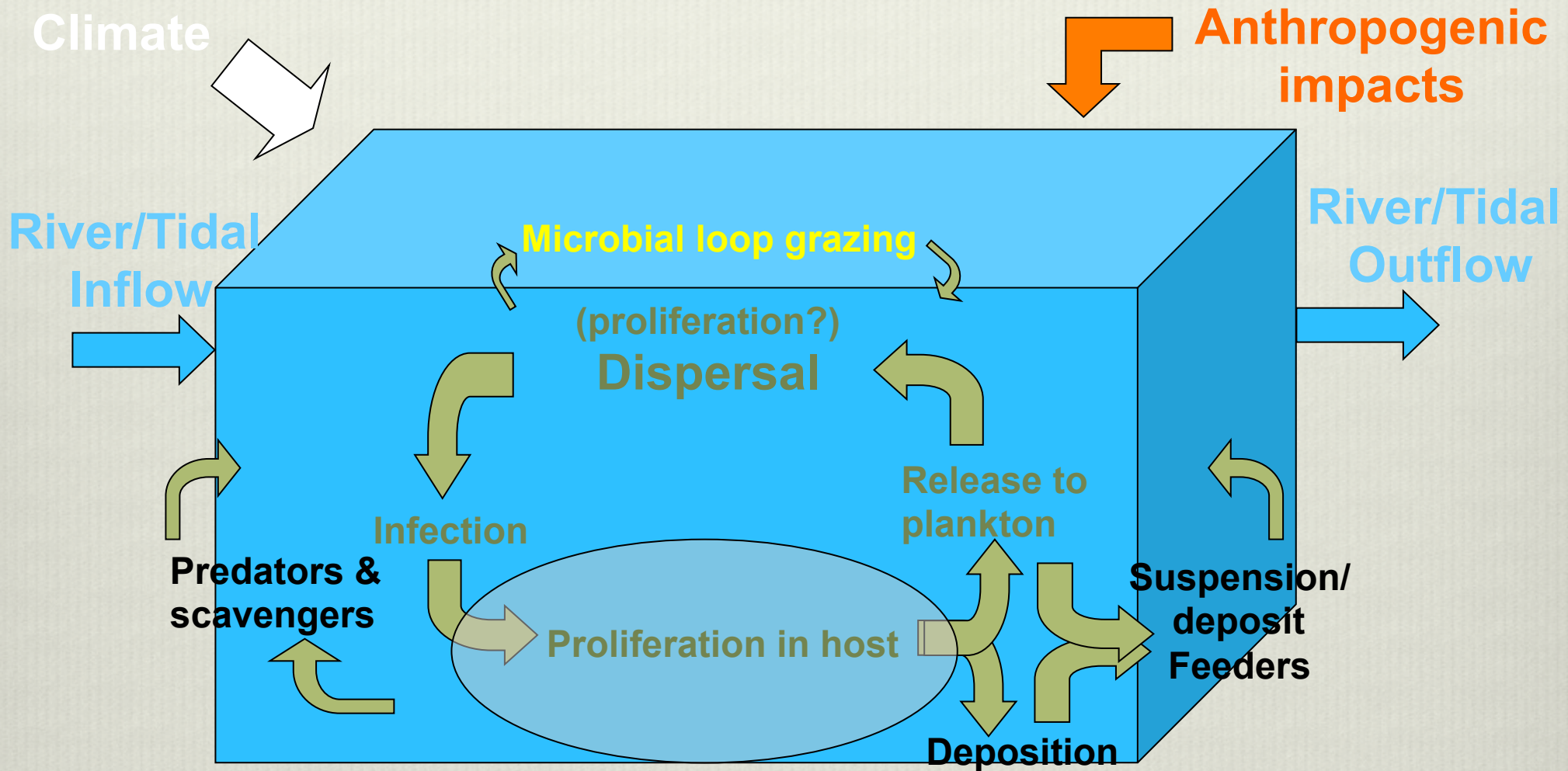
Conceptual variation in H-P-E interactions



Transmission dynamics ~ Recruitment dynamics



“Environment” component includes all ecosystem processes



To fully understand this requires a comprehensive view that considers individual to ecosystem interactions

Seasonal dermo intensity and mortality

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D. Bushek, S.E. Ford, and S.K. Allen, Jr.

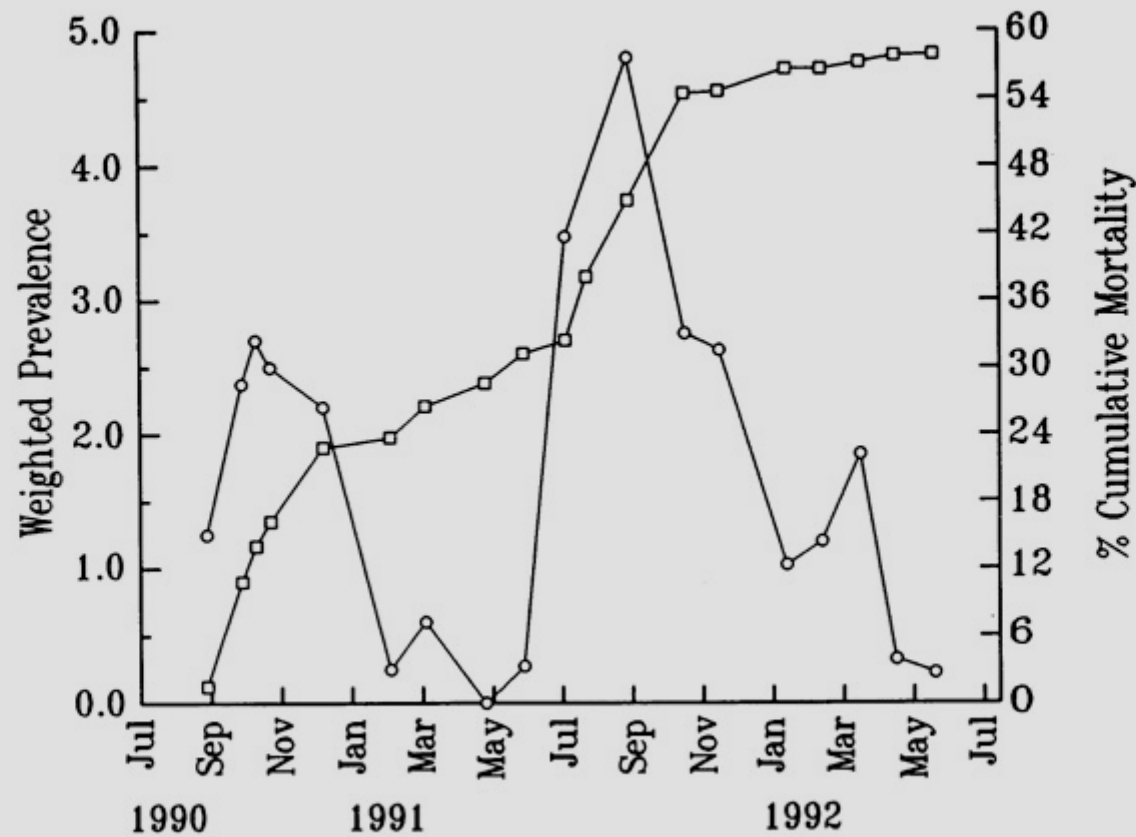
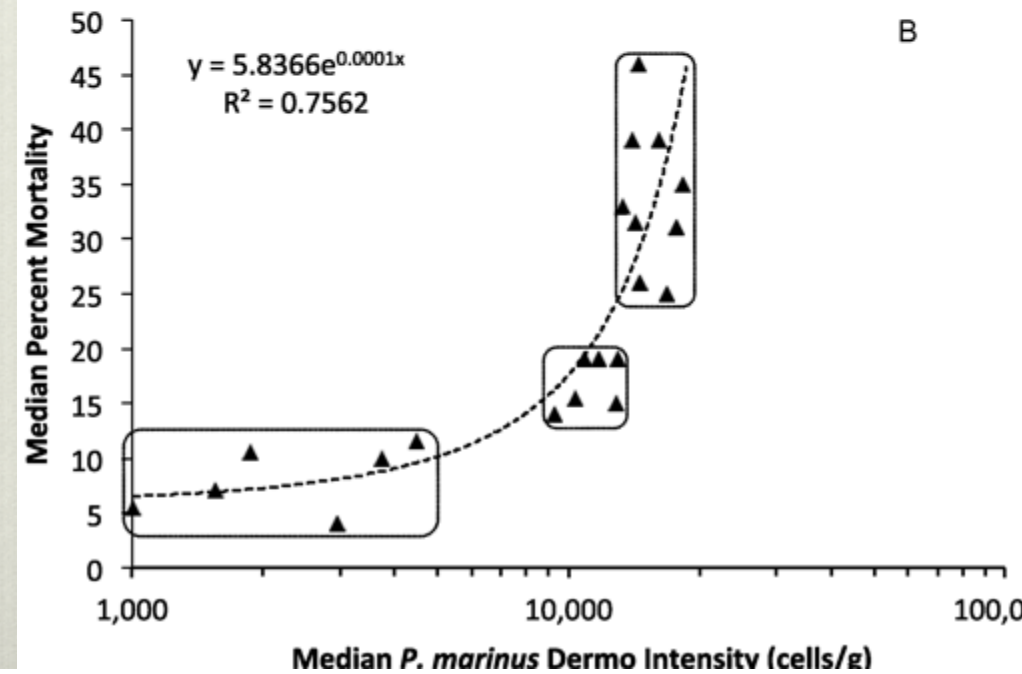
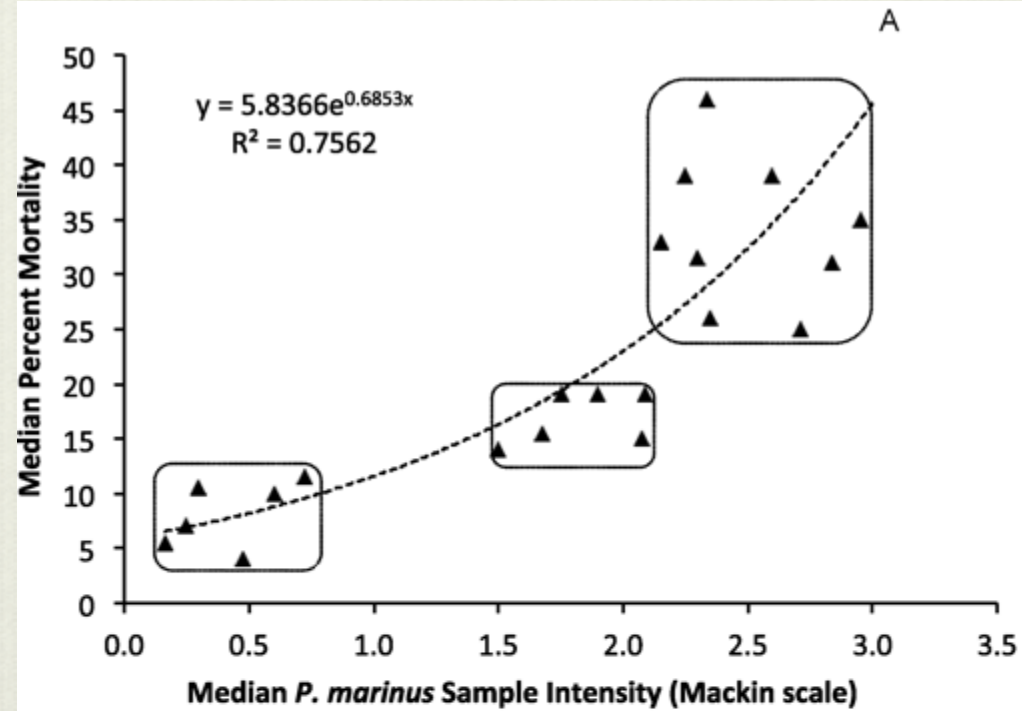
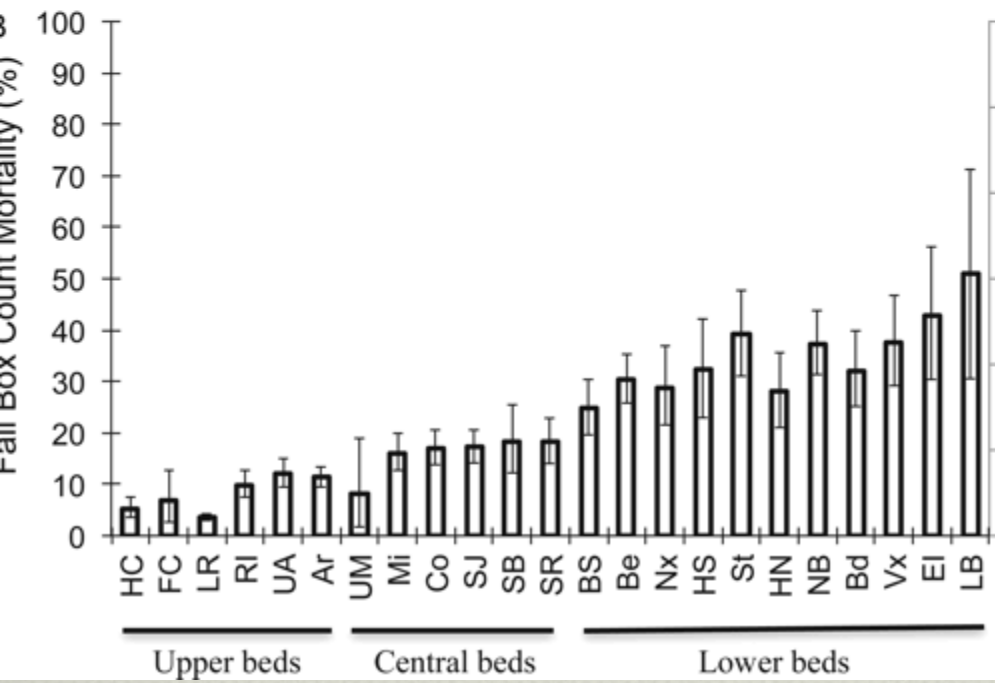
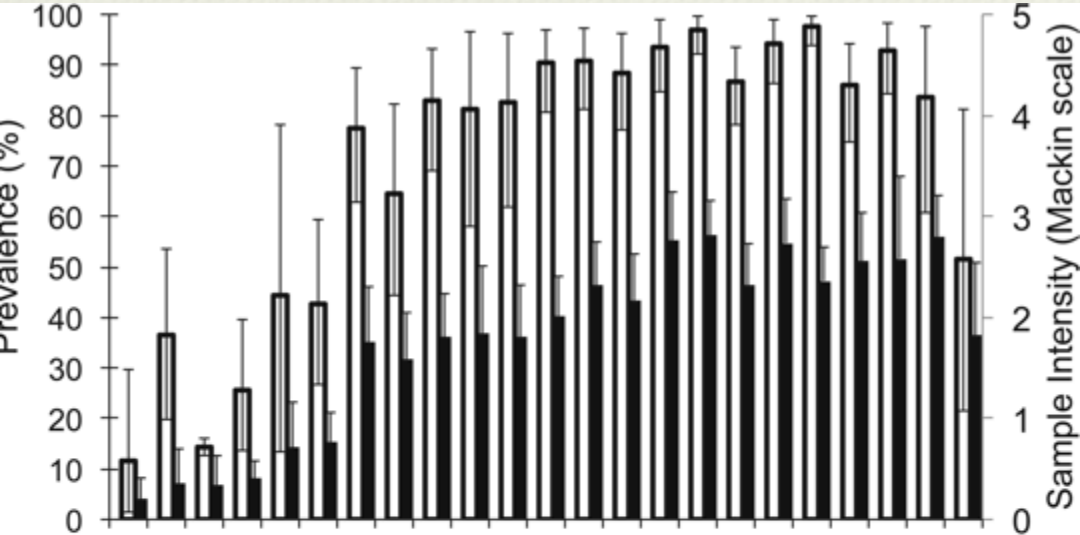
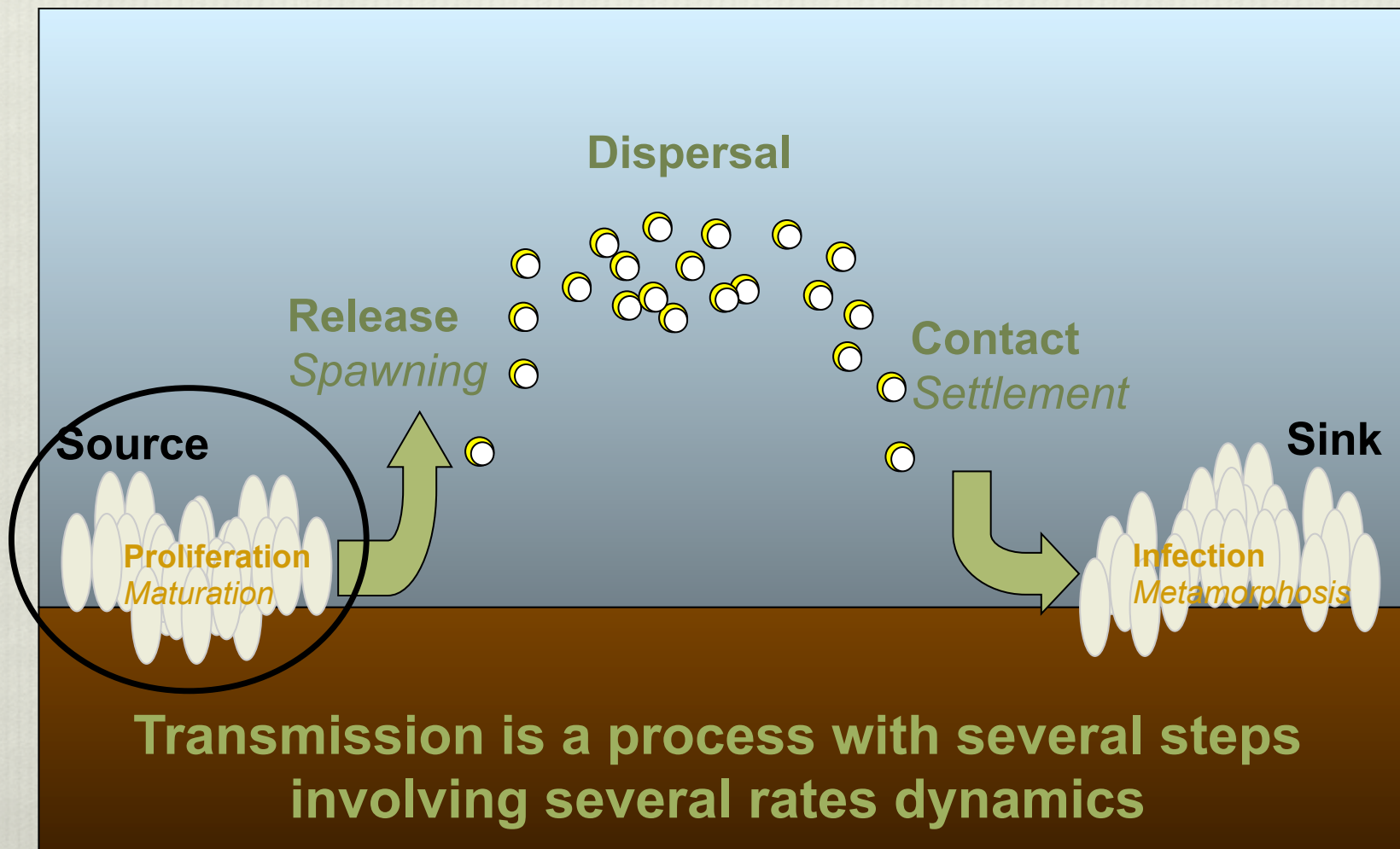
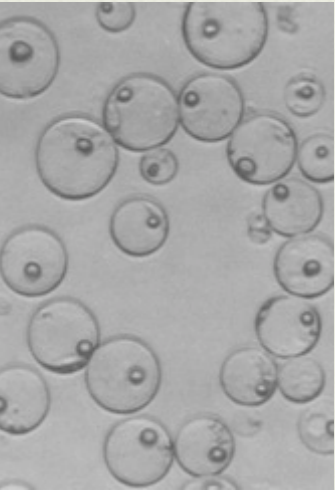


Fig. 3. Relationship of weighted prevalence from Ray's tissue assay with cumulative percent mortality of oysters in Delaware Bay. Circles = weighted prevalence; squares = cumulative nonpredation percent mortality.

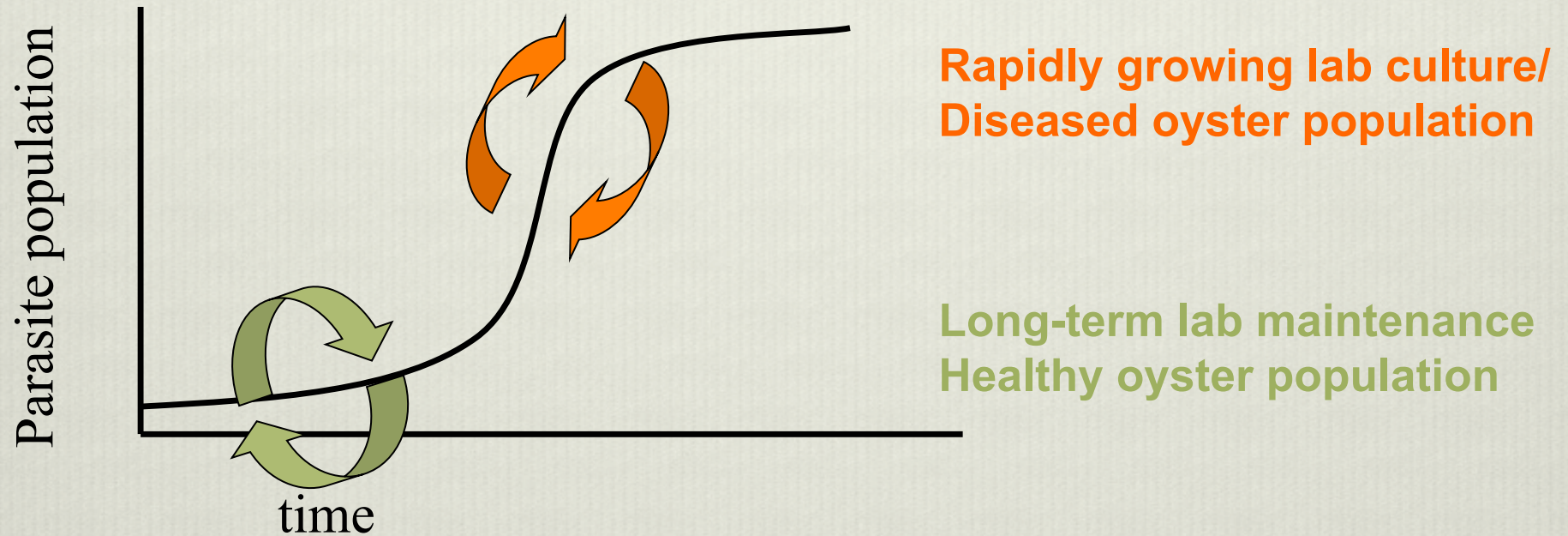


Transmission: Pathogen proliferation in host



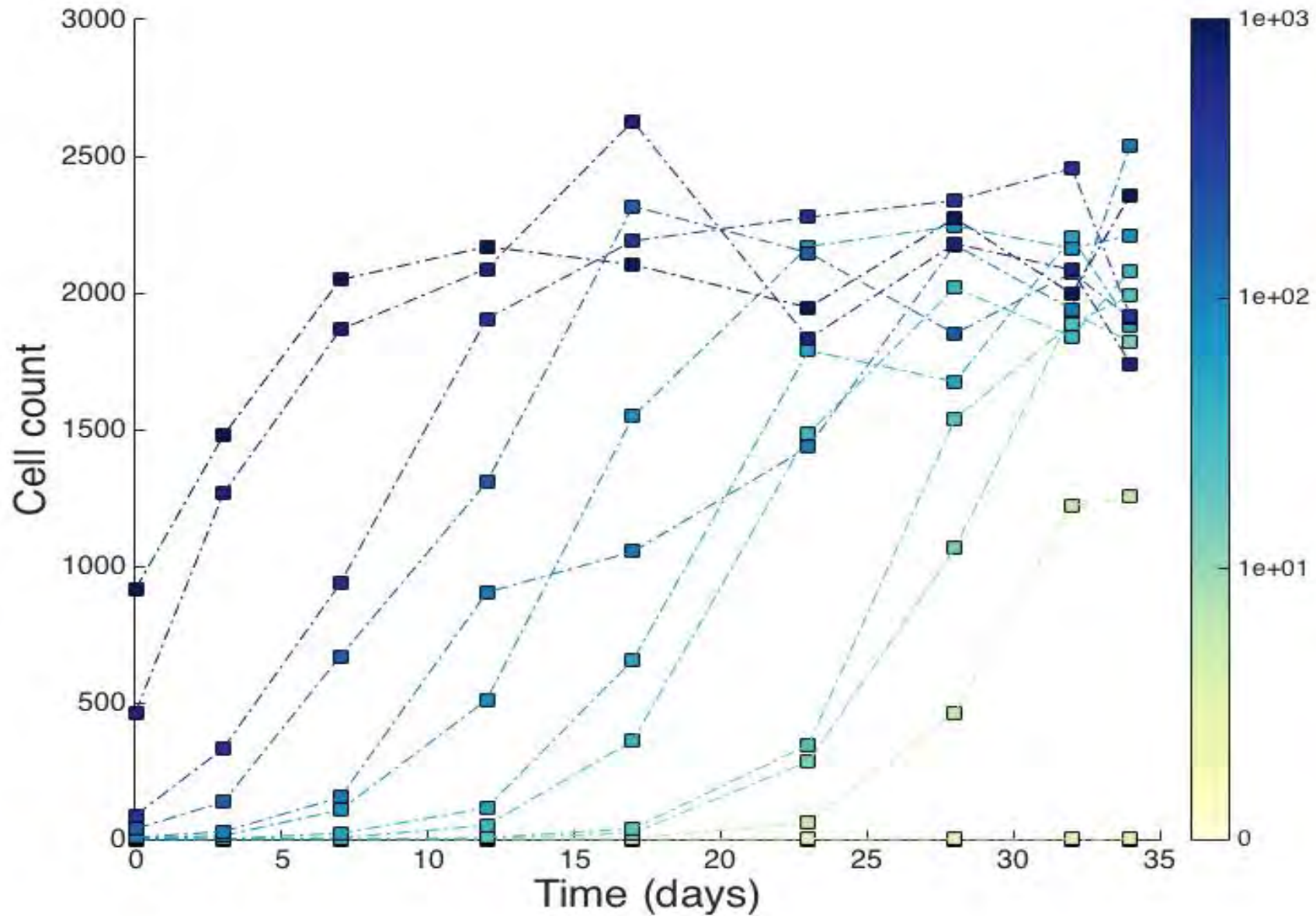


Pathogens in cell culture

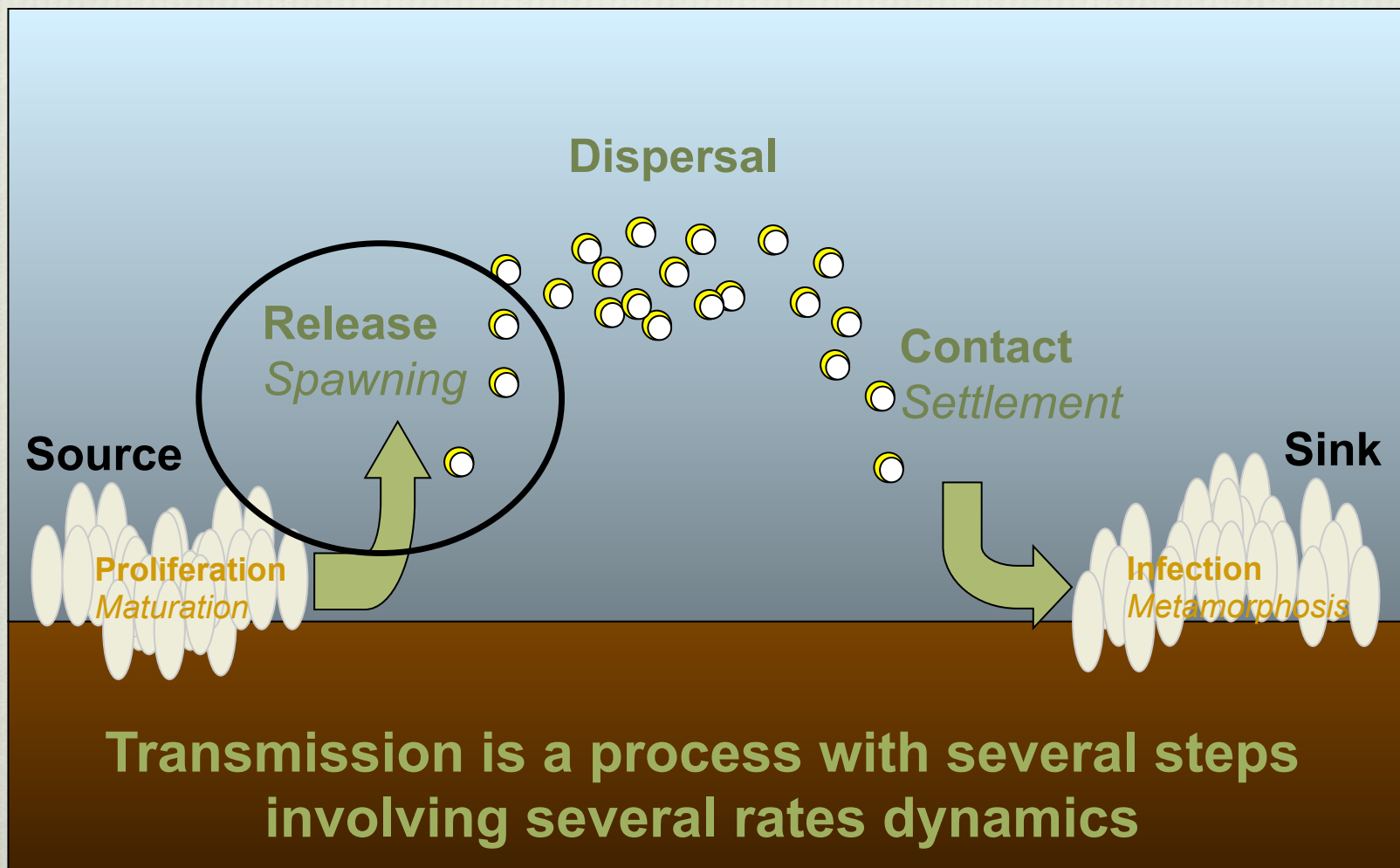


What moves the pathogen down into the lag phase?

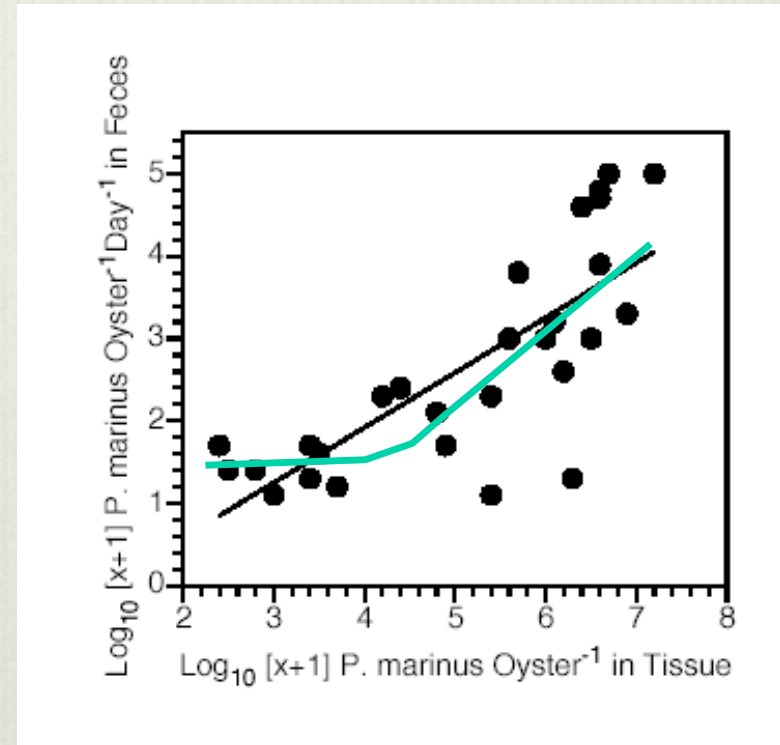
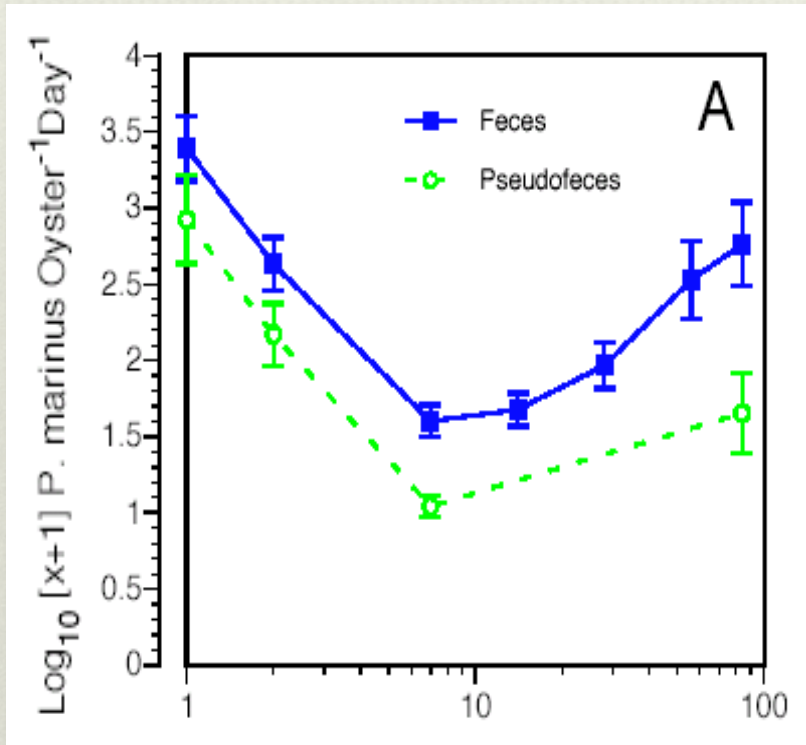
Seeding density controls lag duration



Transmission dynamics ~ Recruitment dynamics



Pathogen Release

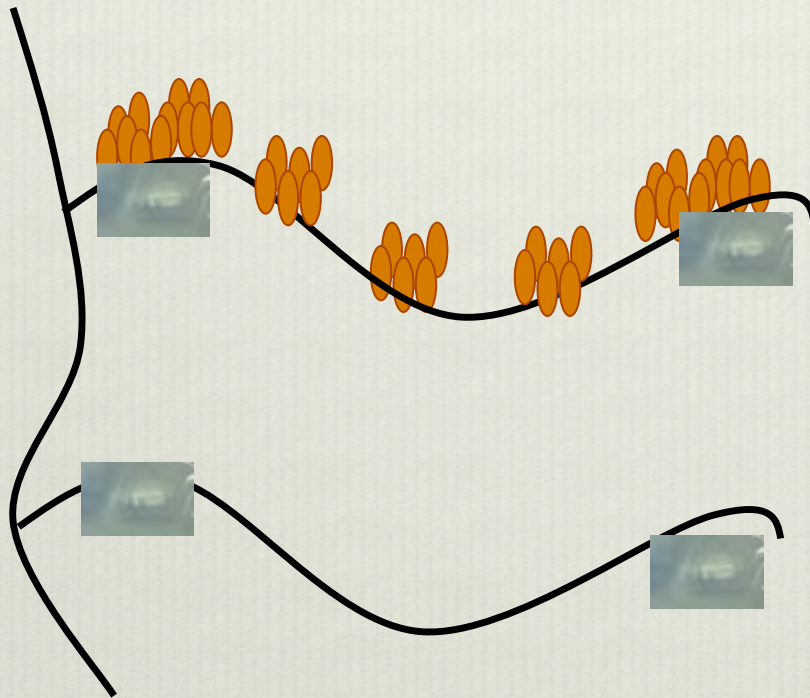


Bushek, D. S.E. Ford and M.M Chintala. 2002. Comparison of *in vitro* cultured and wild-type *Perkinsus marinus* III. Fecal elimination and its role in transmission. Dis. Aquat. Org., 51:217-225.

Are oysters sources or sinks for planktonic stages of *P. marinus*?



R. Ellin



LOCATION

MOUTH, TERMINUS

TIDAL STAGE

FLOOD, HIGH, EBB

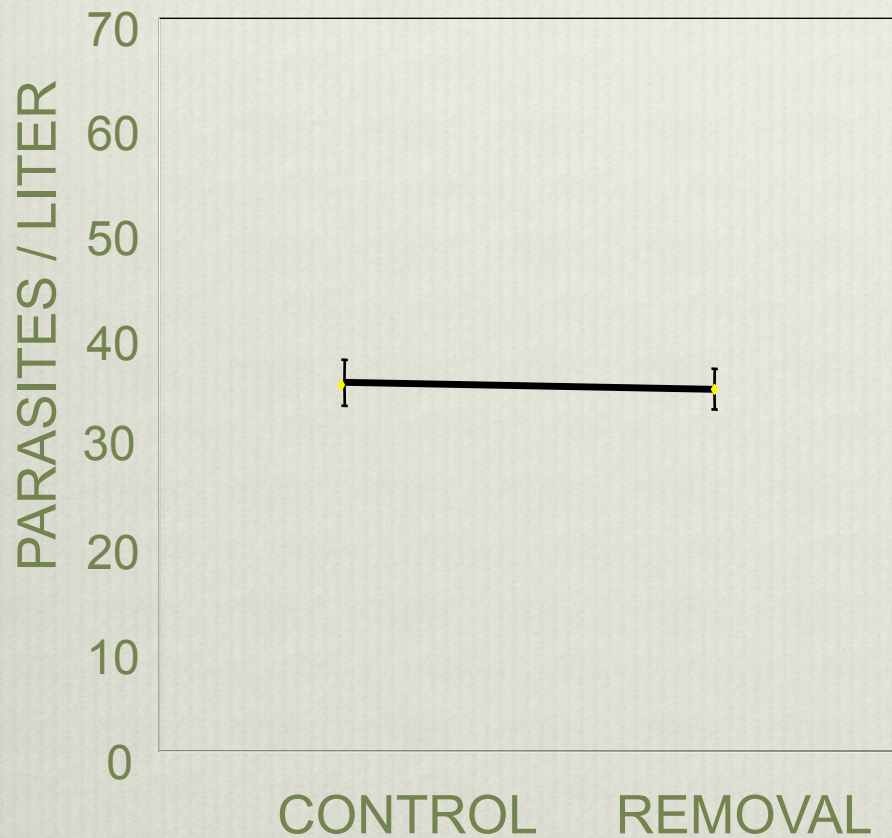
TREATMENT

CONTROL CREEKS,
REMOVAL CREEKS

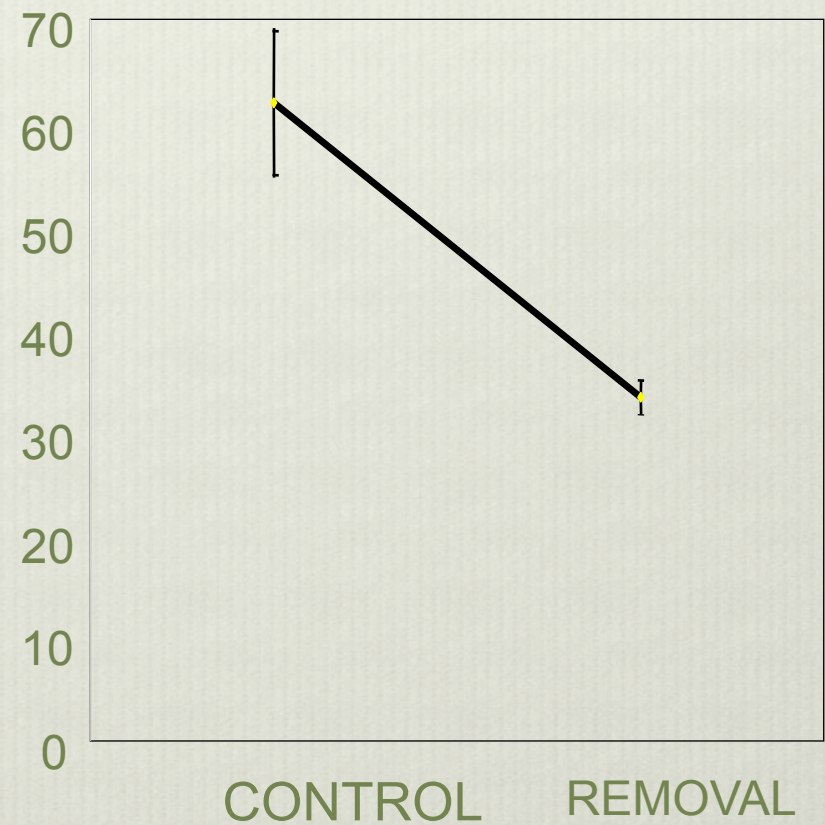
MONTH

What is the role of oysters in governing the planktonic abundance of *P. marinus*?

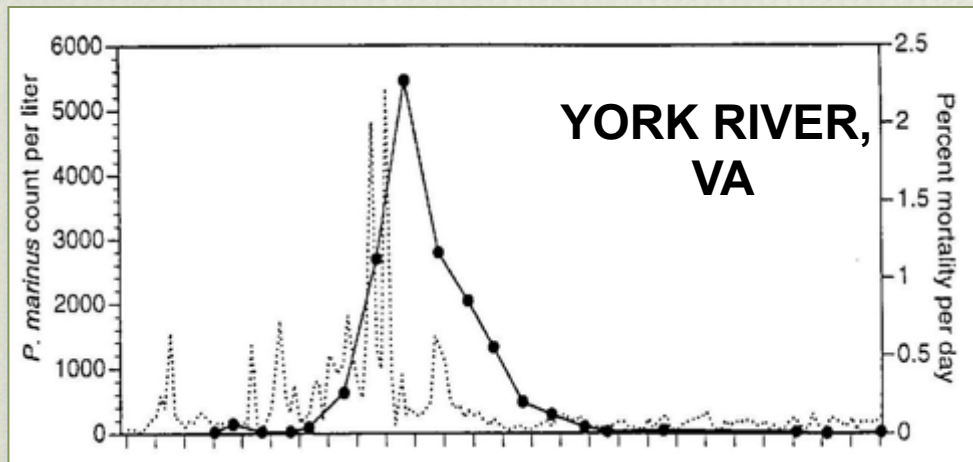
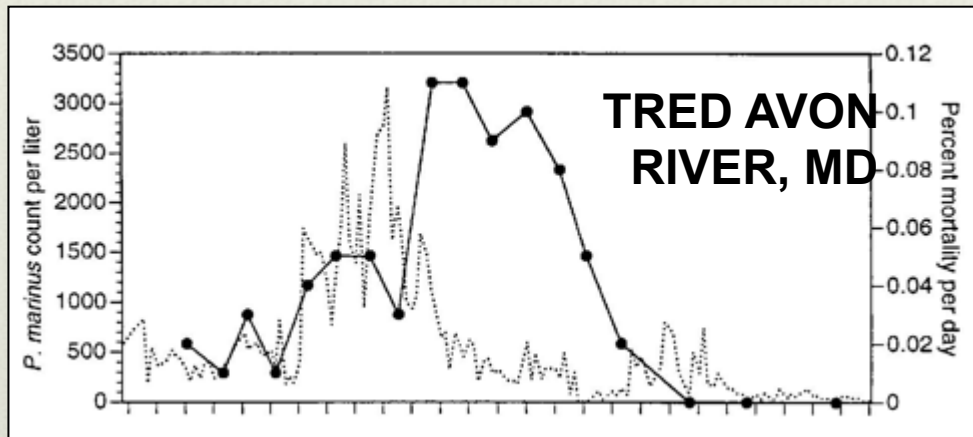
FRONT



BACK

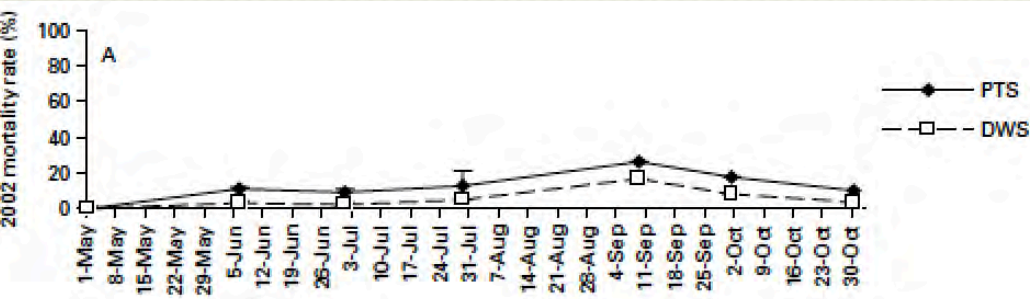


Planktonic abundances of *P. marinus*

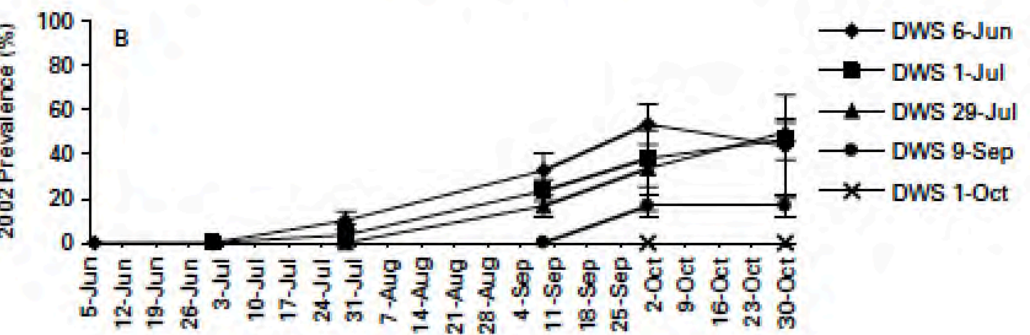
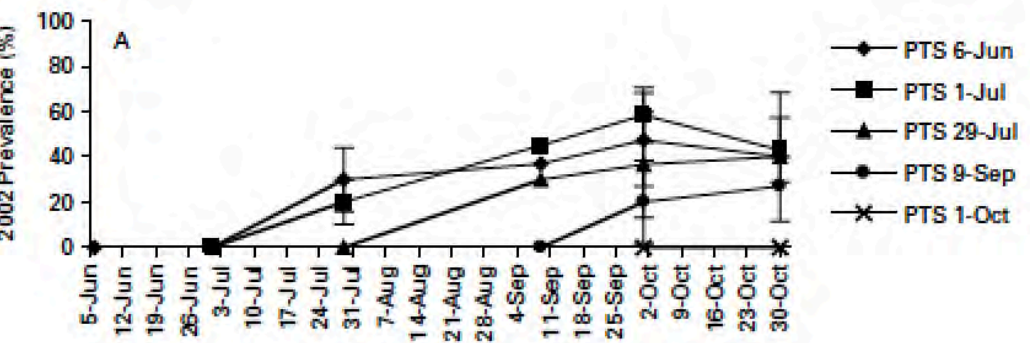


- Peak abundance occurs before mortality
- Parasites present throughout year
- Source?

Source: Ragone Calvo et al. 1995



C. Audemard and others



Perkinsus marinus transmission dynamics

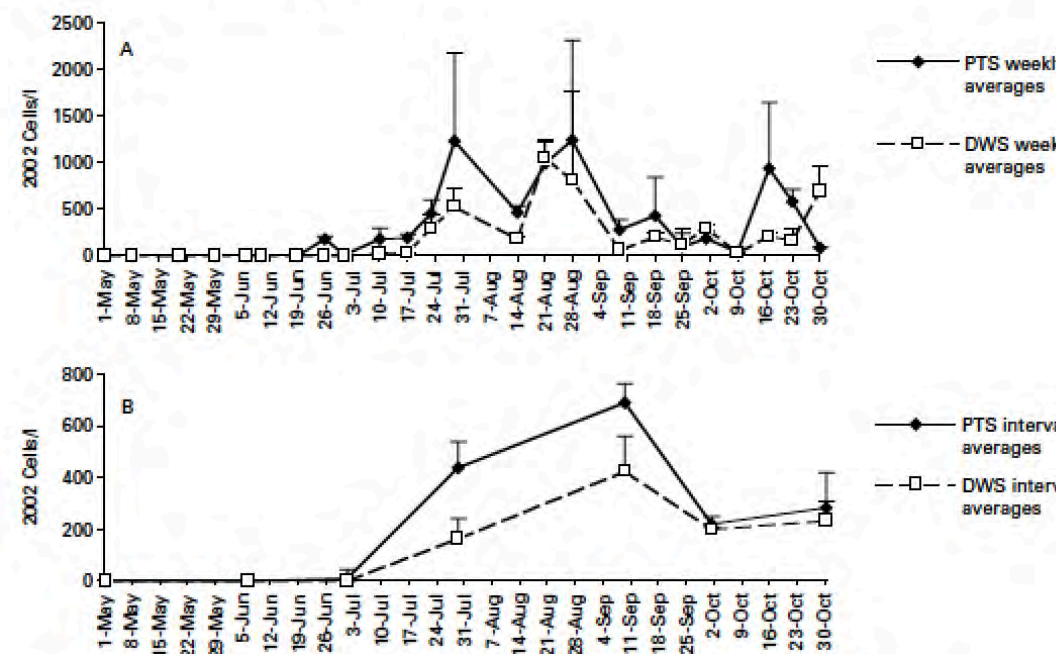
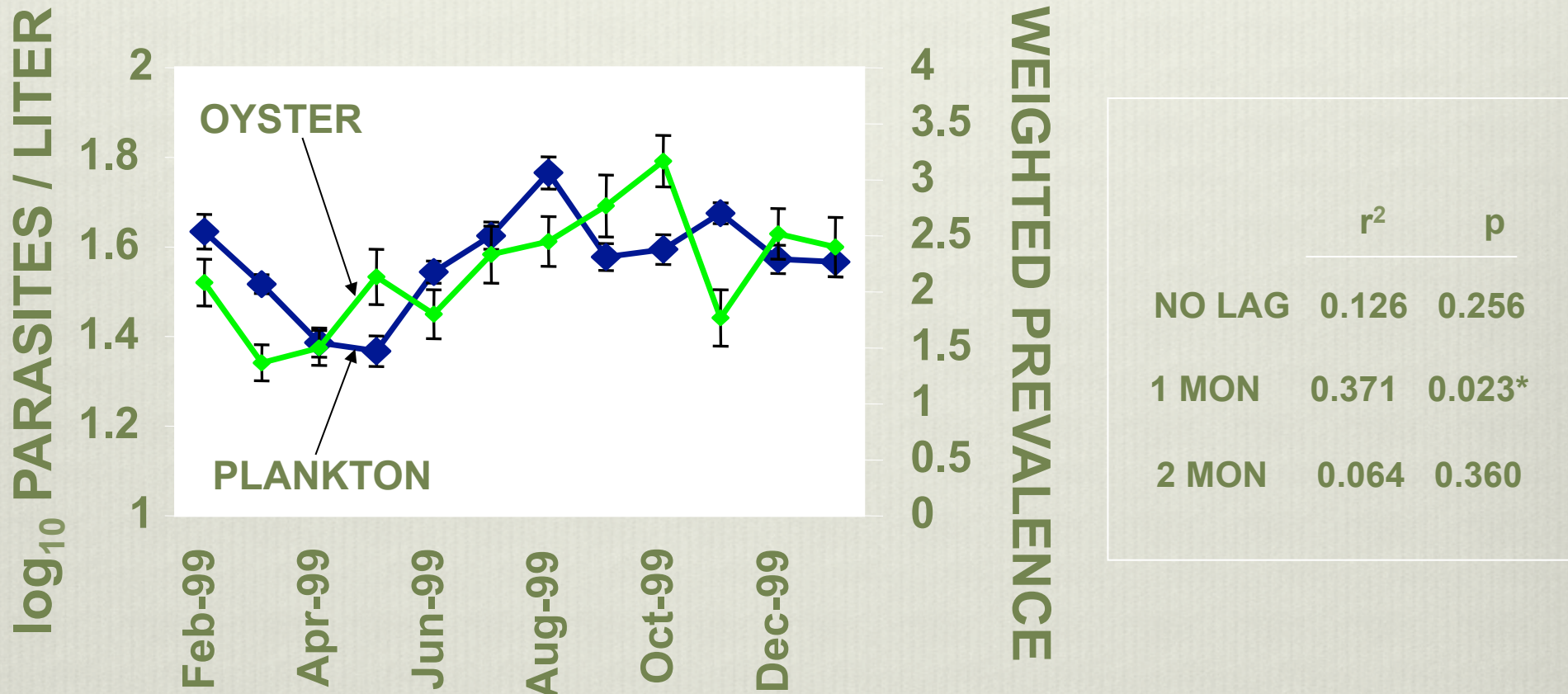


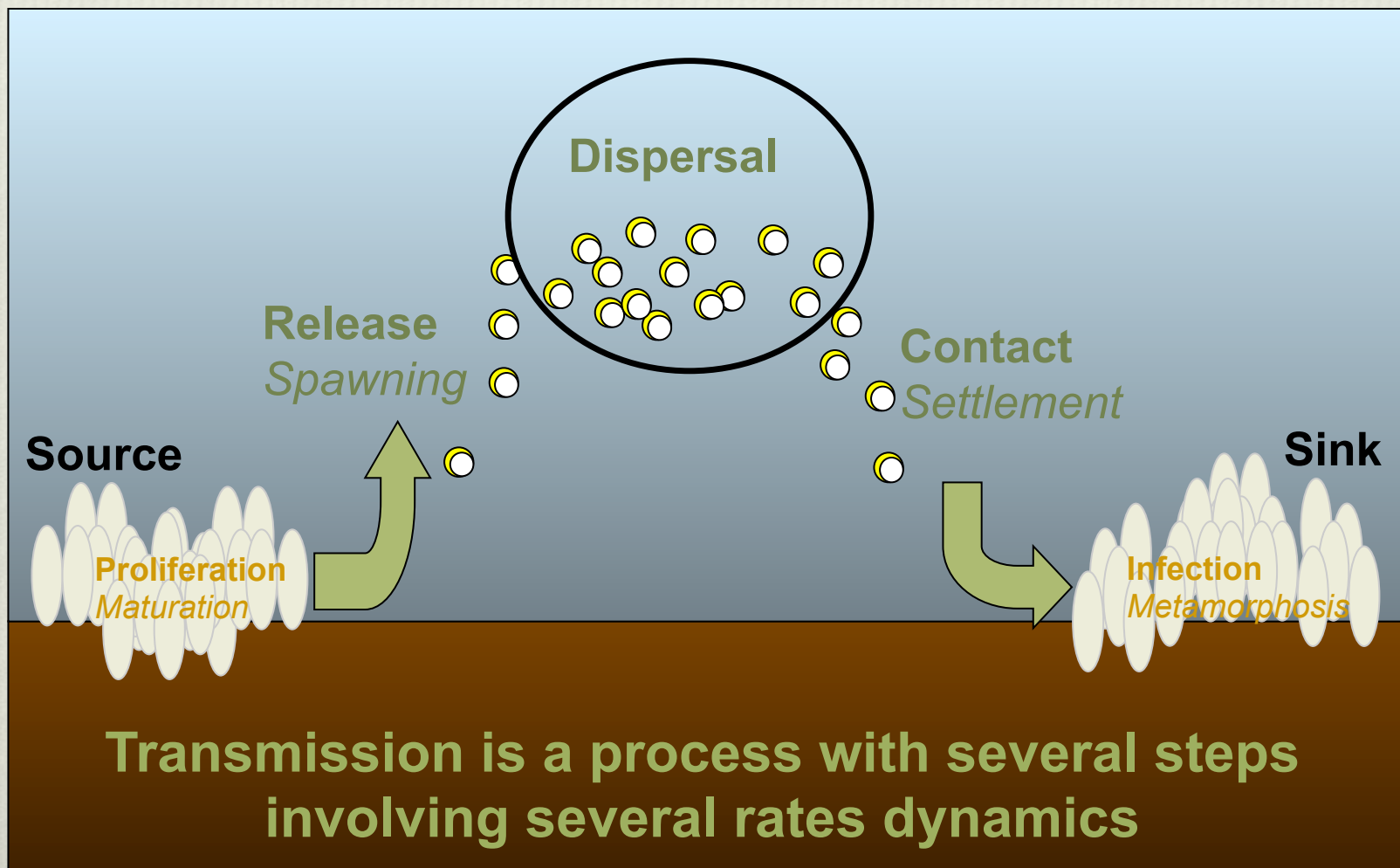
Fig. 7. *Perkinsus marinus* abundance in the water column in 2002. (A) Weekly average parasite abundance. (B) Interval average parasite abundance. Error bars correspond to standard deviations. Averages correspond to back-transformations of the averaged transformed data.

Peak planktonic abundance precedes infection intensity in North Inlet, SC

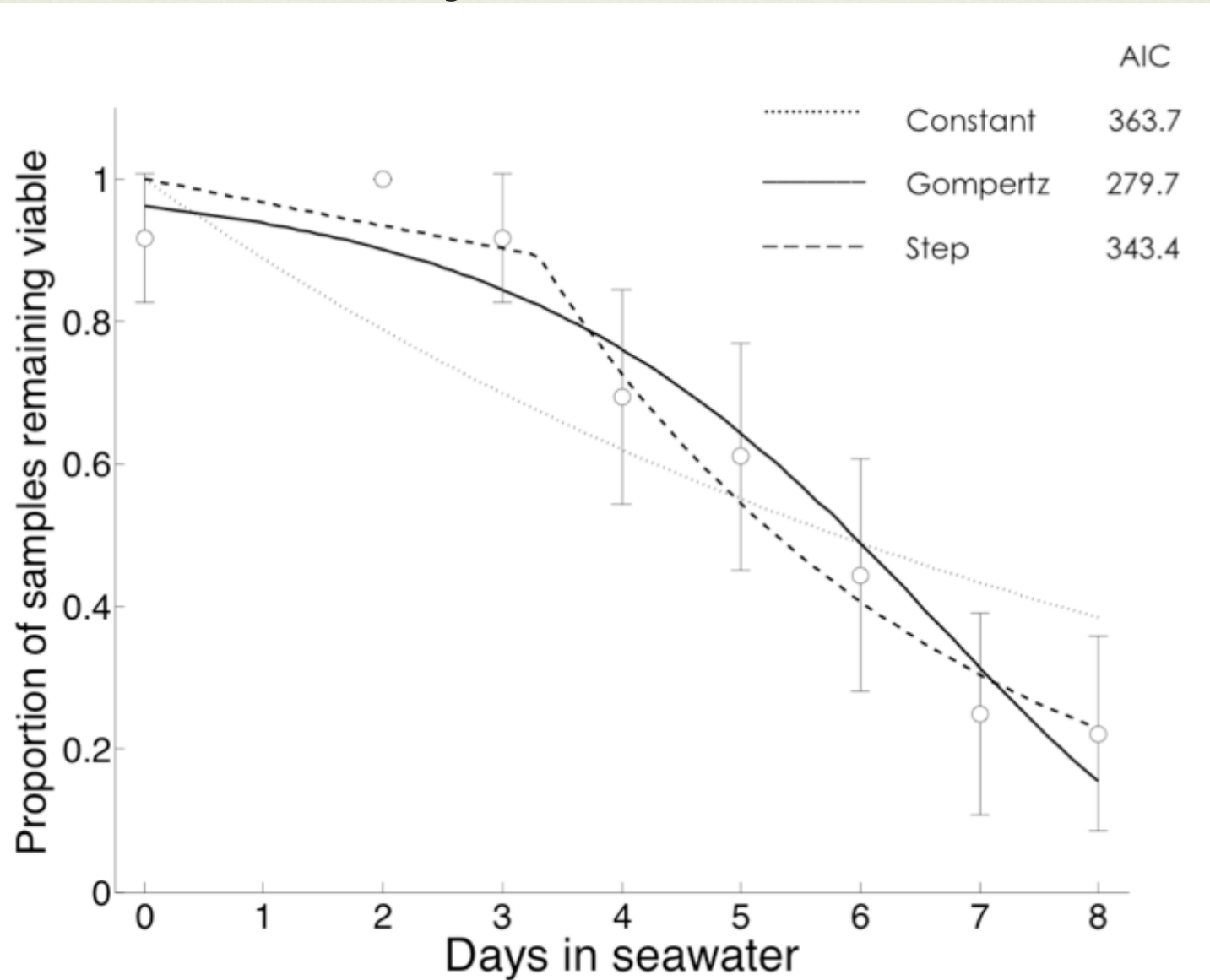


(R. Ellin 2000)

Transmission dynamics ~ Recruitment dynamics

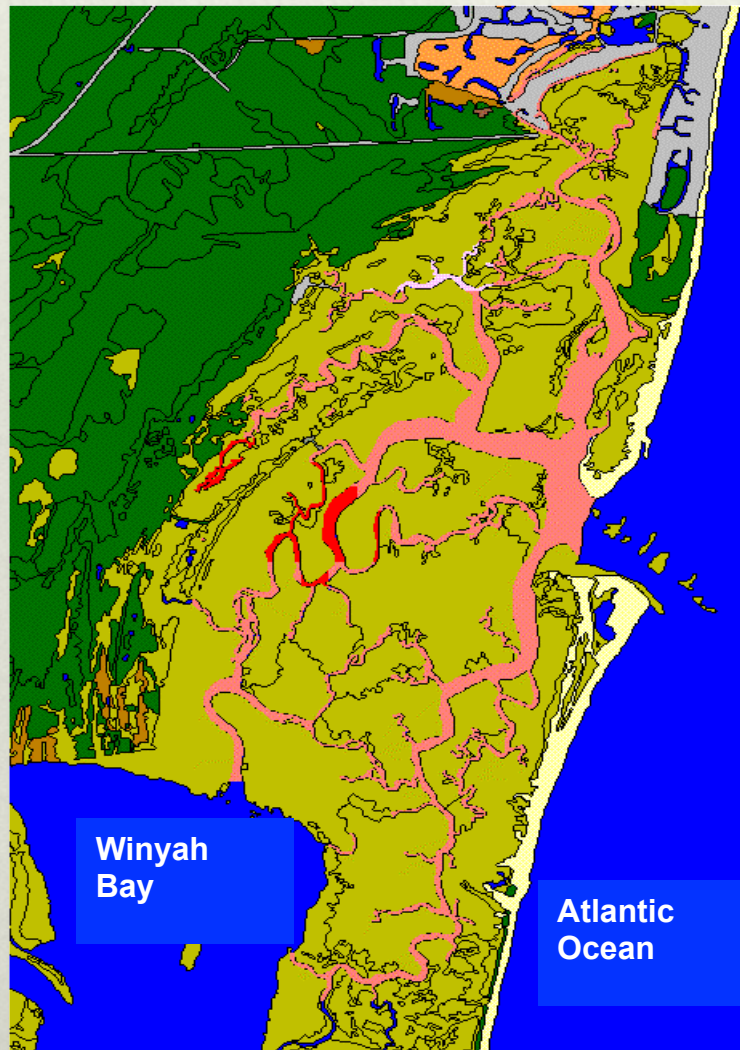


Viability outside host

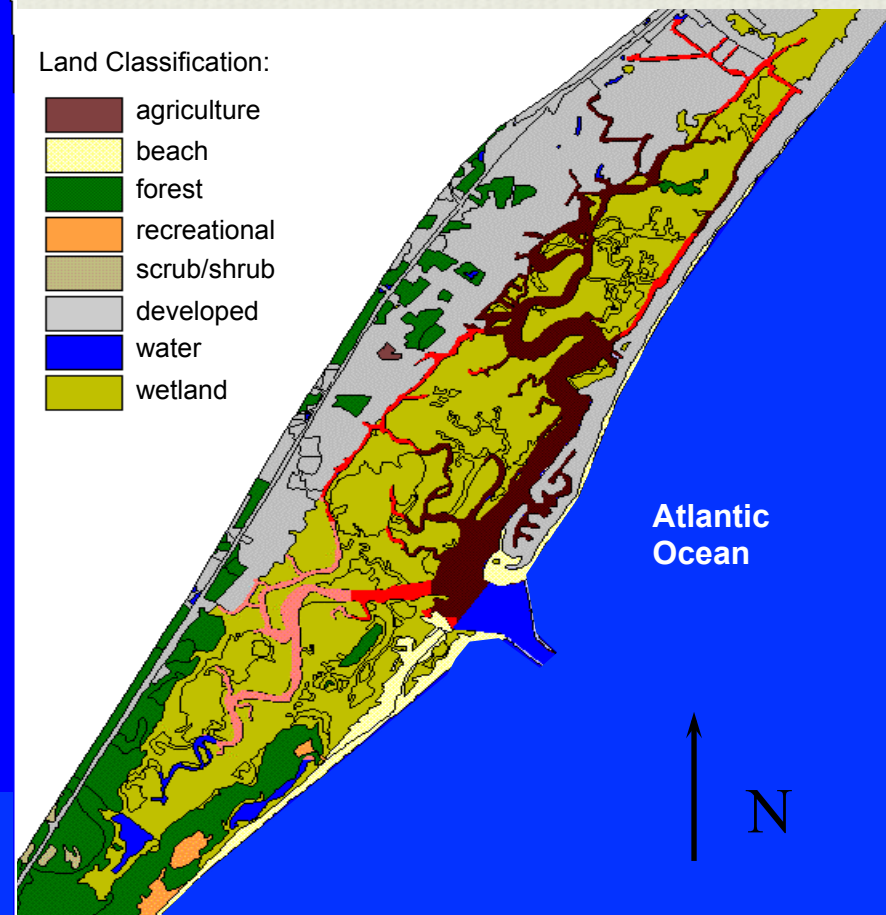


Circulation controls on dispersal

North Inlet, SC



Murrells Inlet, SC



Land Classification:

- agriculture
- beach
- forest
- recreational
- scrub/shrub
- developed
- water
- wetland

Atlantic
Ocean

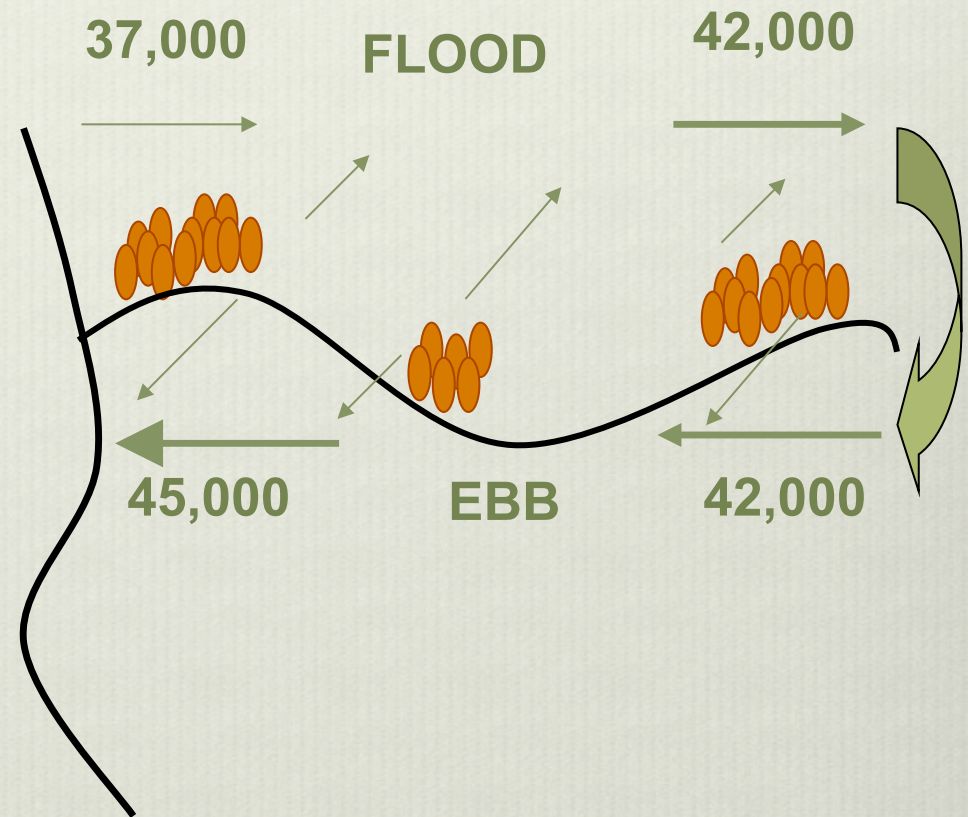
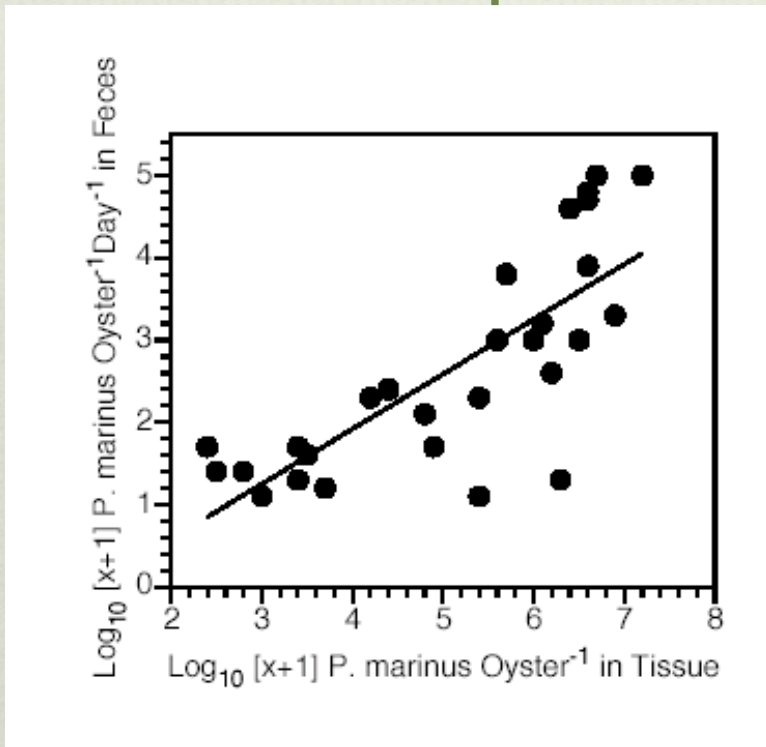
Winyah
Bay

Atlantic
Ocean



Tidal flushing exports dermo

Fecal release of parasites

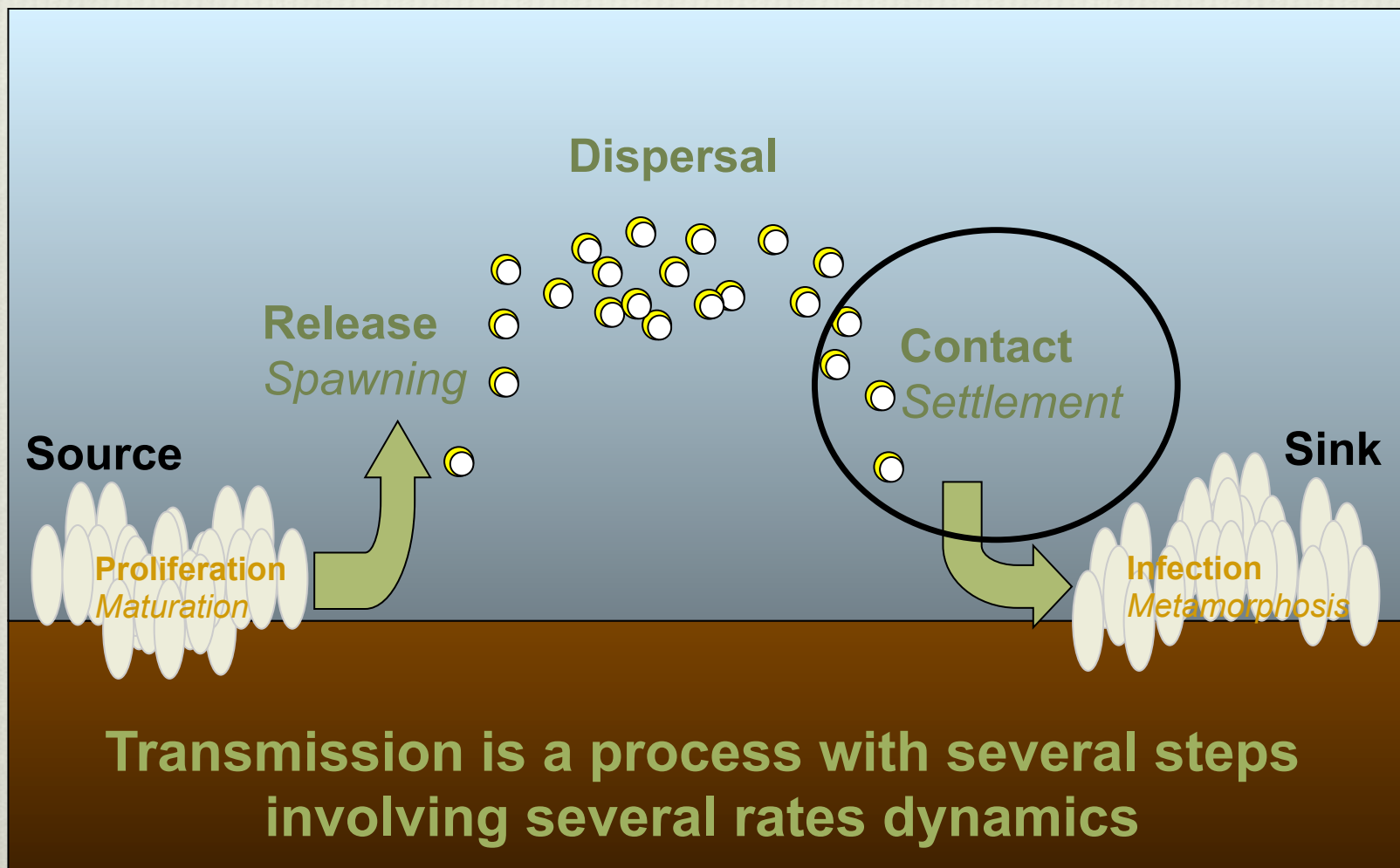


Bushek, D. S.E. Ford and M.M Chintala. 2002.

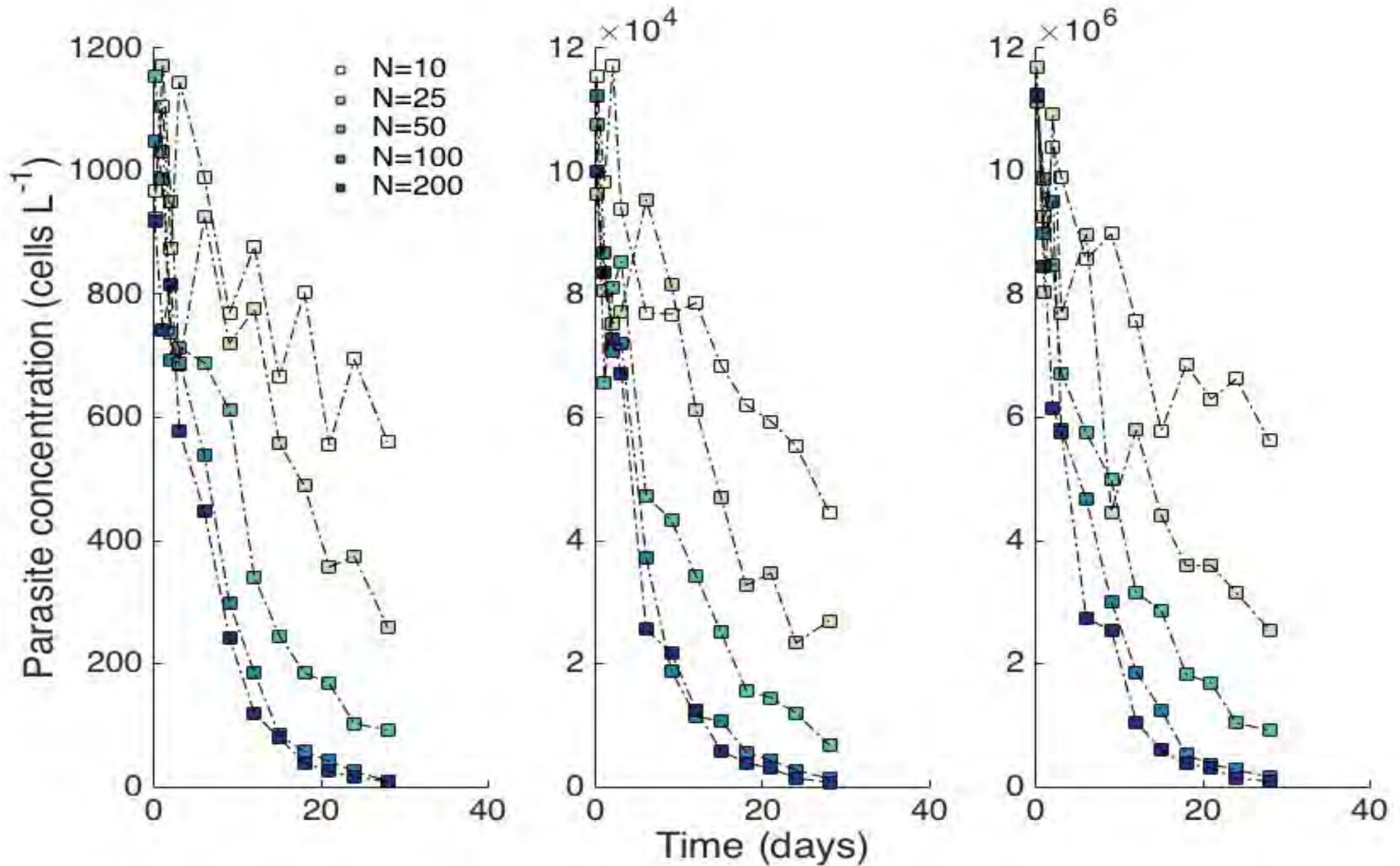
Ellin, R – USC Thesis

Result is a reduction in transmission

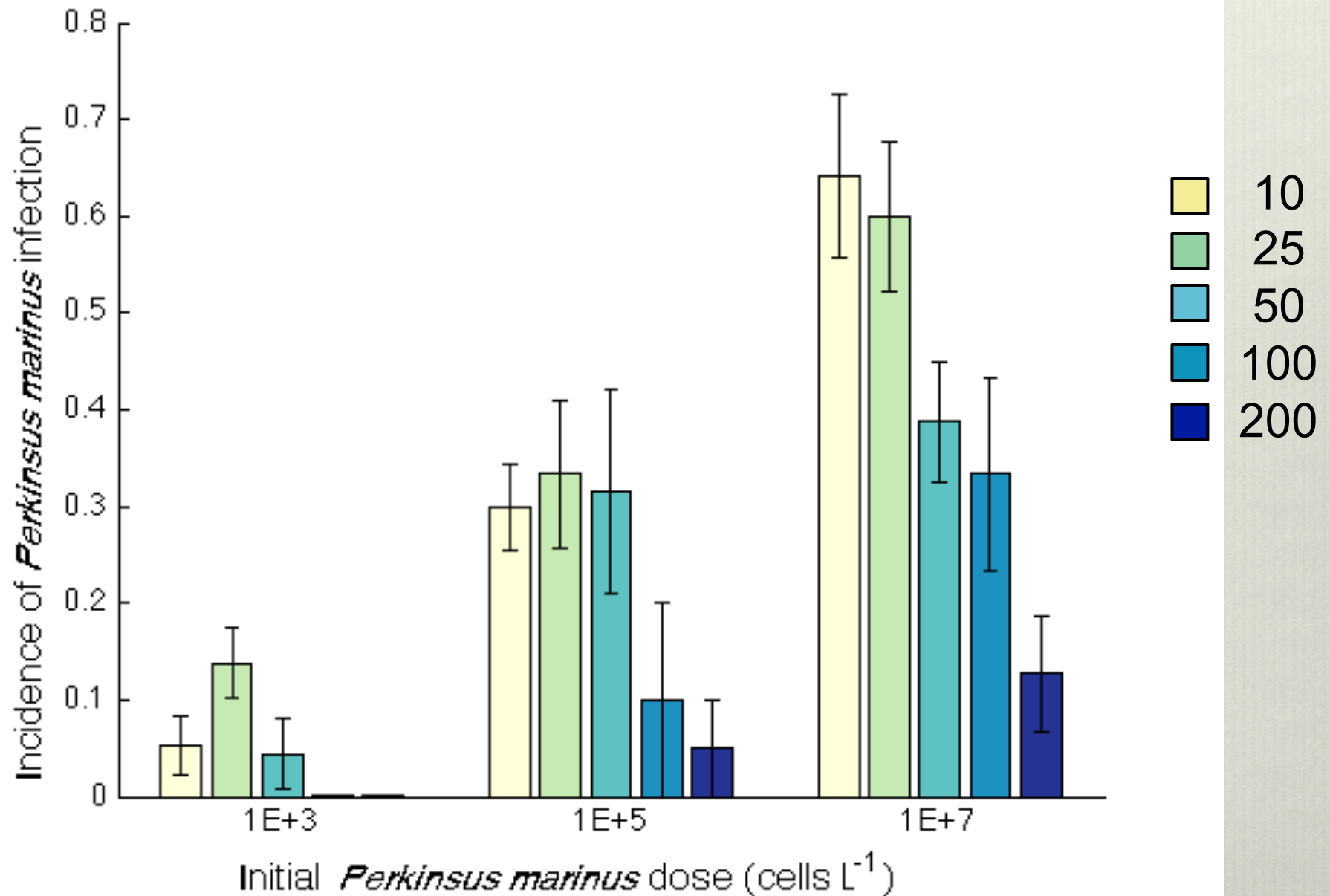
Transmission dynamics ~ Recruitment dynamics

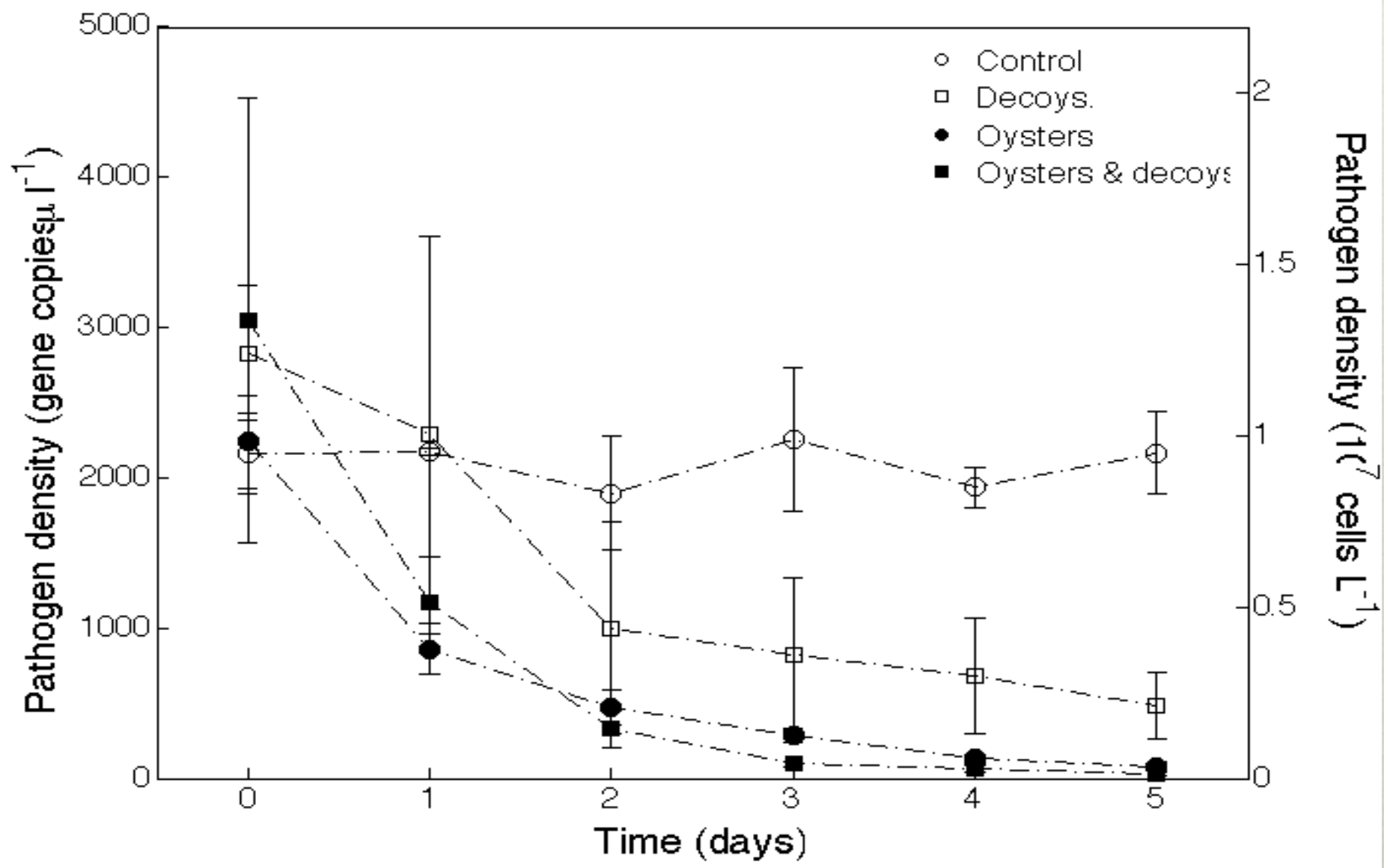


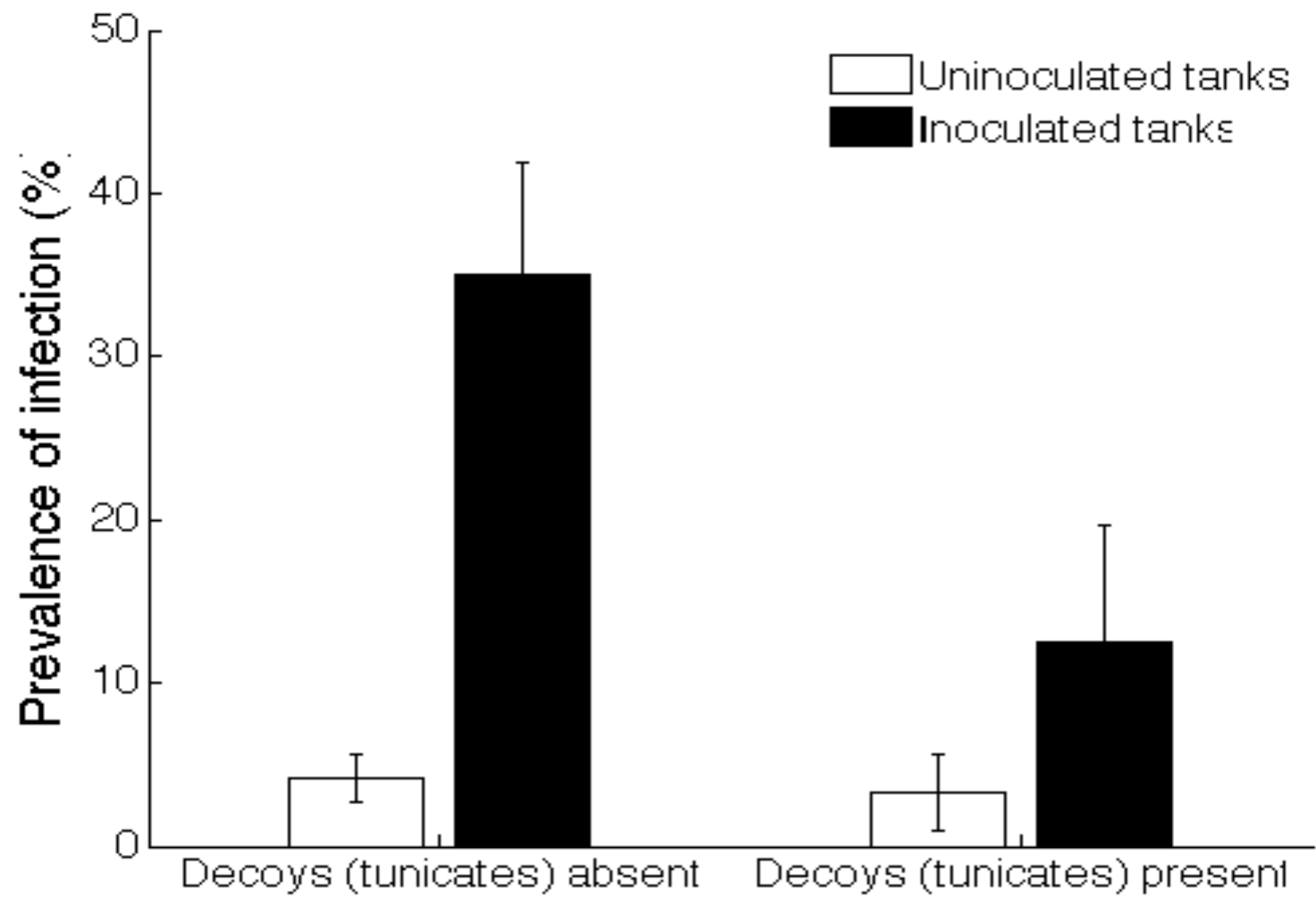
Host density changes contact rate



Host density changes infection rate







Parasite transmission in bivalve hosts

Are there additional sources of infective parasites?

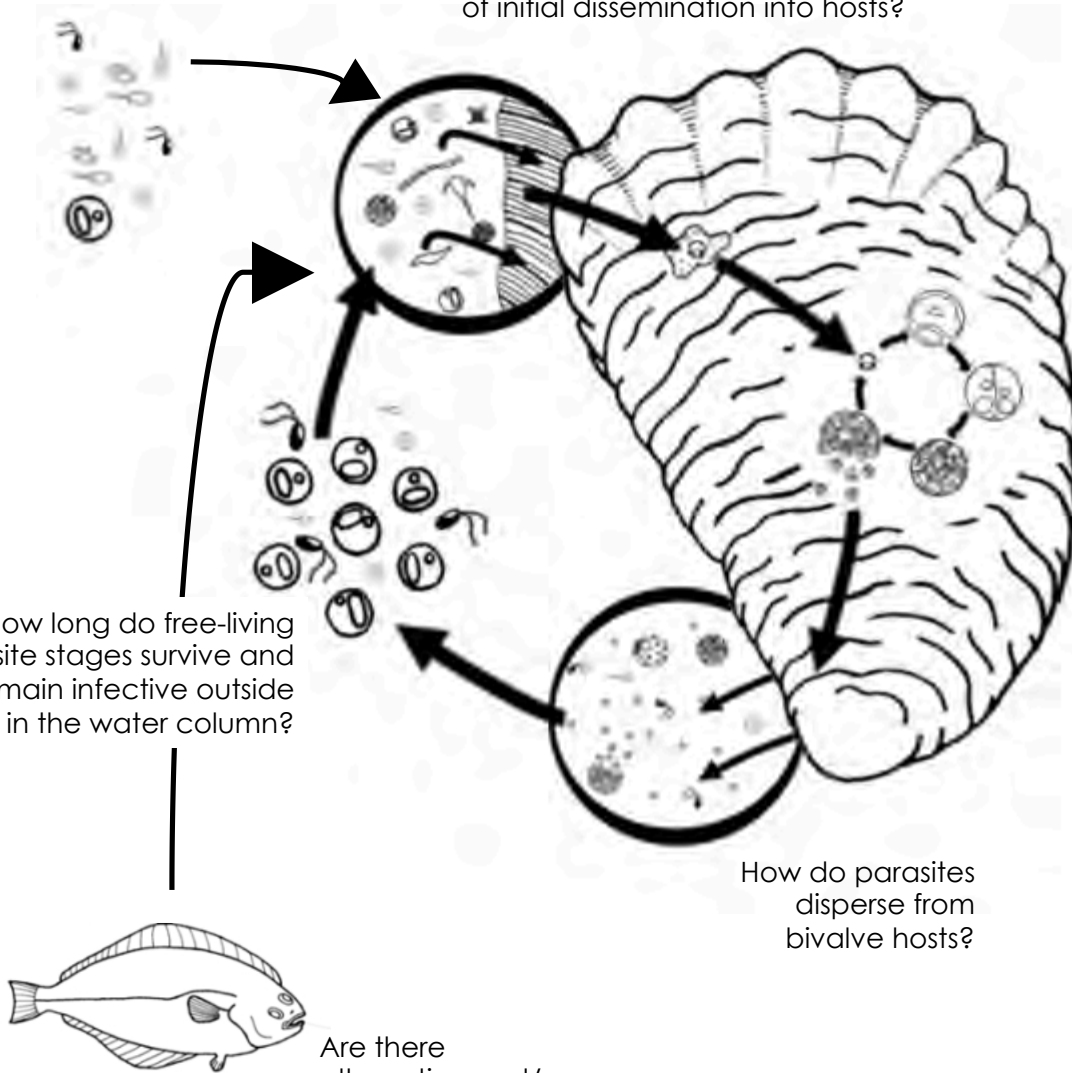
What are the portals of entry and processes of initial dissemination into hosts?

What are the processes of parasite proliferation and reproduction within hosts?

How long do free-living parasite stages survive and remain infective outside hosts in the water column?

How do parasites disperse from bivalve hosts?

Are there alternative and/or intermediate hosts?



Questions?

Stop before you get into more trouble