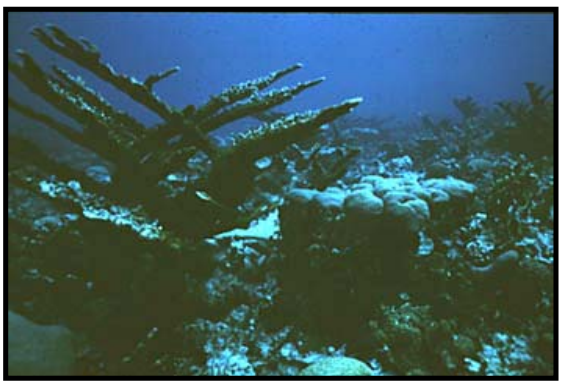
Does the Olympia oyster function as a foundation species in Tomales Bay, CA?

David Kimbro[1,2] and Edwin D. Grosholz[1]

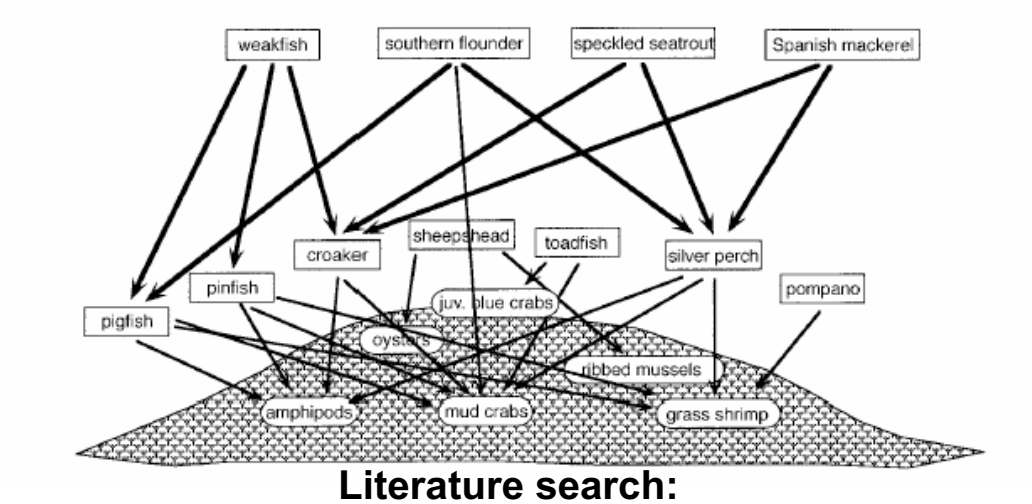
[1]Dept. of Environmental Science and Policy, One Shields Ave., University of California, Davis, Davis, CA 95616.
[2]Bodega Marine Laboratory, 2099 Westside Road, Bodega Bay, CA 94923

Foundation Species create habitat



Atlantic and Gulf coast oysters (*Crassostrea virginica*) create habitat in soft bottom estuaries.

An estuarine food web centered around Atlantic coast oyster reefs



Literature search:
2,105 papers found

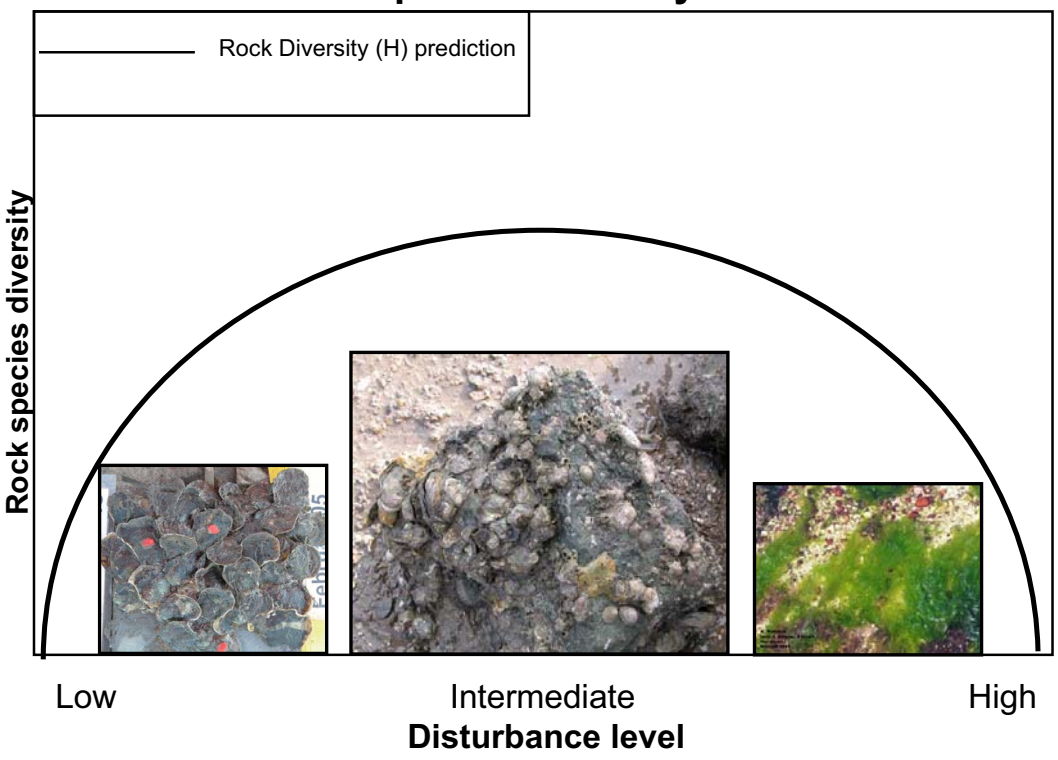
C. virginica is a foundation species

Lenihan, H. S., C. H. Peterson, J. E. Byers, J. H. Grabowski, G. W. Thayer, and D. R. Colby. 2001. Cascading of habitat degradation: Oyster reefs invaded by refugee fishes escaping stress. Ecological Applications **11**:764-782.

Do oysters in Pacific coast estuaries also increase biodiversity?

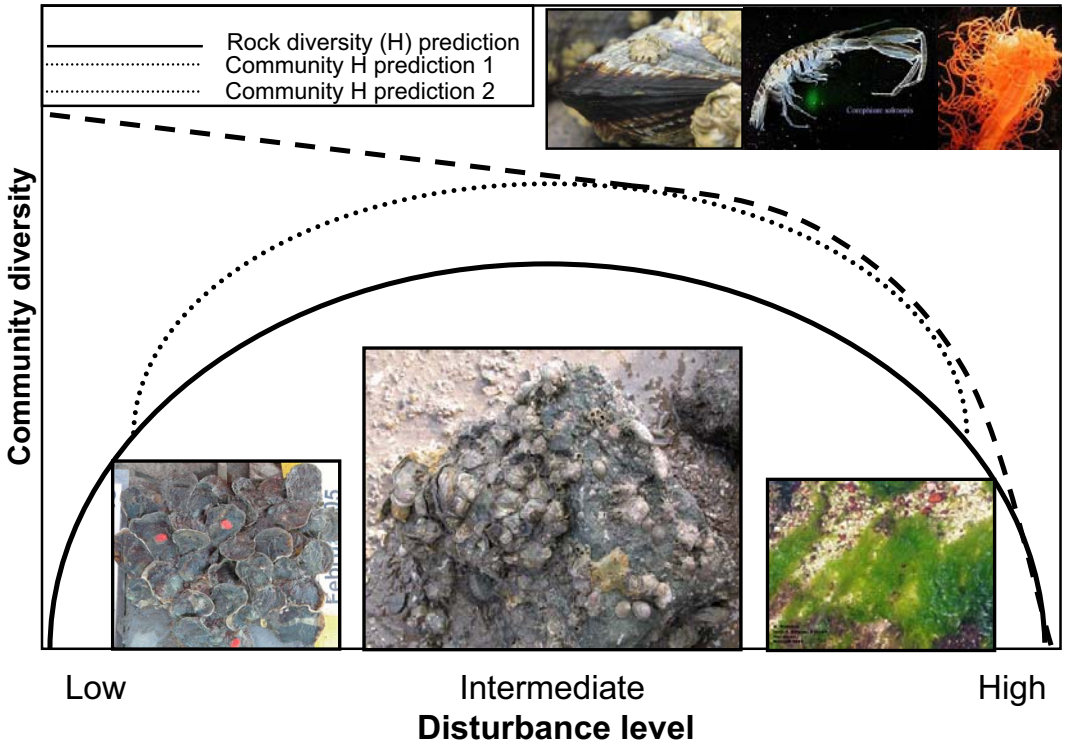
Olympia oysters are smaller (6 cm), flat-shaped, and require rocks.

Rock species diversity



Connell 1978, Sousa 1979

Rock community diversity



Connell 1978, Hutchinson 1959, Bruno et al. 2003

Experiment

Response variables:

1. Structural complexity and rock species diversity

2. Associate species diversity

Treatments:
high disturbance = 0-5% sessile species cover
intermediate disturbance = 20-45% sessile species cover
low disturbance = 65-100% sessile species cover
N=10

Most research focuses on the diversity index or richness

Invasion resistance

Stachowicz et al. 2002

Primary production

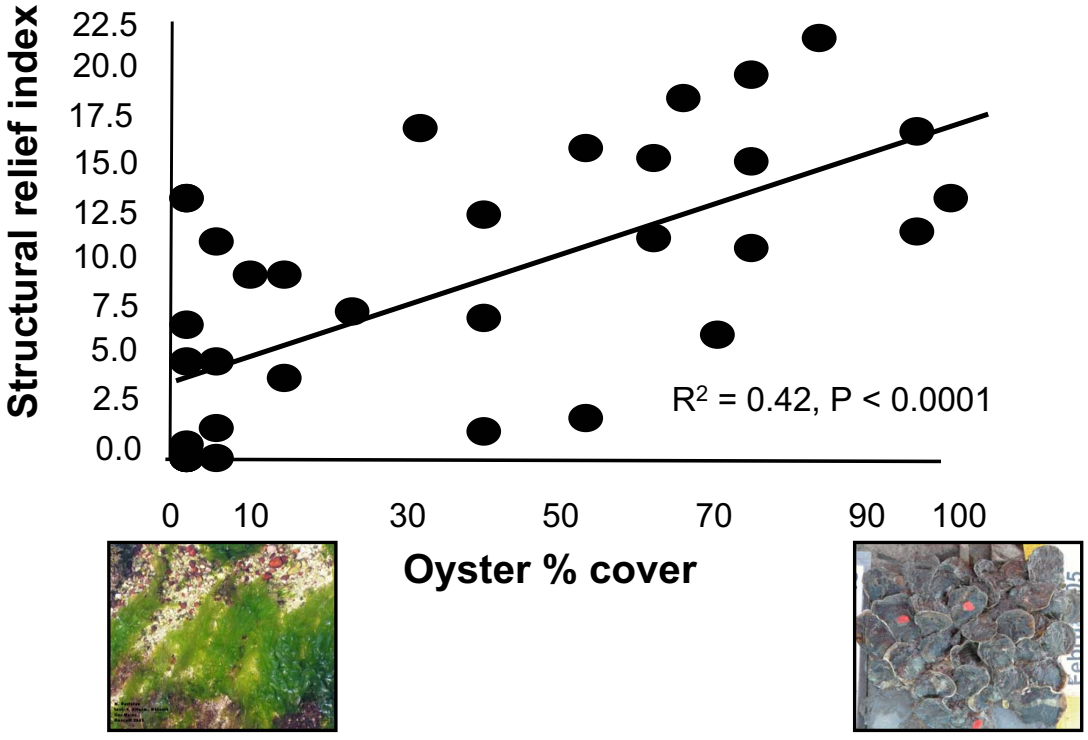
Tilman et al. 1997

Diversity ~ Richness + Evenness

Resistance/resilience to disturbance

Hughes and Stachowicz 2004

Olympia oysters increase structural complexity



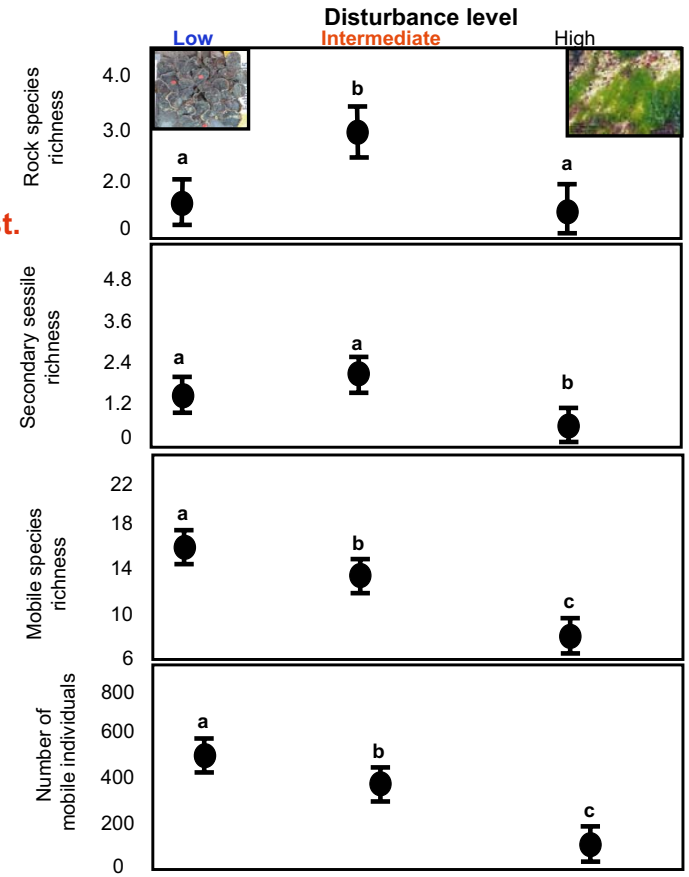
Olympia oysters do create habitat in Tomales Bay's intertidal

Appendix A. Taxa present in Olympia oyster community. **1S** = primary sessile species, **2S** = secondary sessile species, and **M** = mobile species.

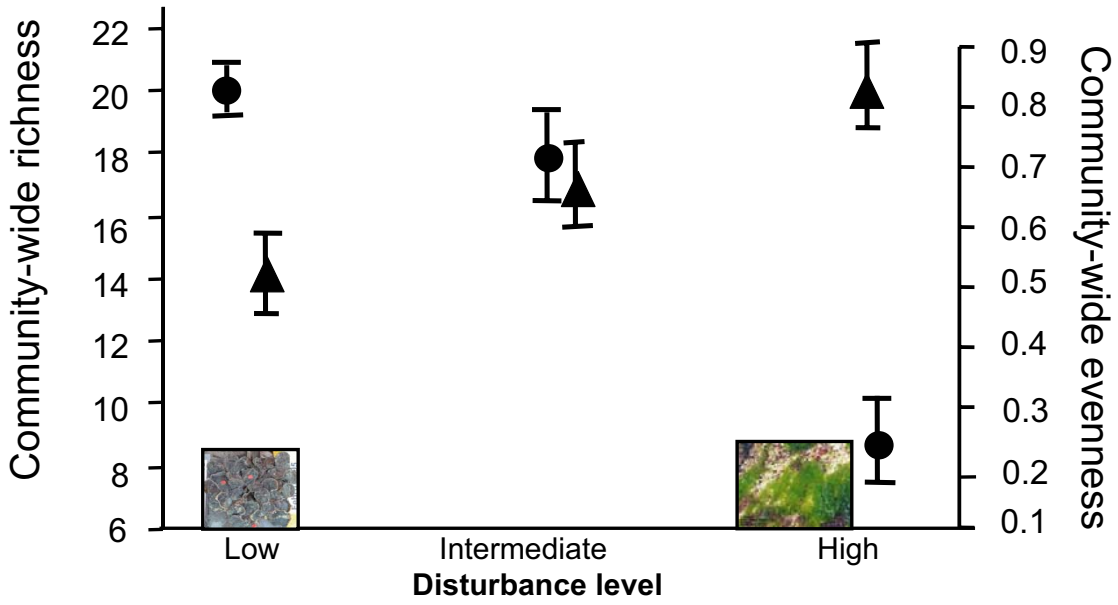
Taxa	Identification
Mollusca	*Lasaea adansoni* (**M**), *Haminoea vesicula* (**M**), Modiolus sp. (**2S**), *Mopalia muscosa* (**M**), *Musculista senhousia* (**2S**), *Mytilus galloprovincialis* (**1S and 2S**), Odostomia sp. (**M**), *Ostreolacon chaphila* (**1S**), *Polinices lewisii* (**M**), *Postastrope bamesi* (**M**), *Tectura scutum* (**M**), and *Urosalpinx cinerea* (**M**).
Arthropoda	Ampithoidae sp. (**M**), *Balanus glandula* (**1S**), *Caprella californica* (**M**), *Carcinus maenas* (**M**), *Emphysostes fucicola* (**M**), *Gnorimosphaeroma luteum* (**M**), *Laticorophium baconi* (**M**), *Nebaliapugettensis* (**M**), *Paranthura elegans* (**M**), *Tethymysaptena* (**M**), and *Zeuxo normani* (**M**).
Polychaeta	*Boccardia probo scidea* (**M**), Brania sp. (**M**), *Cirratulus multiculatus* (**M**), Eunicidae, (**1S**), *Exogone lourei* (**M**), *Harmothoe praeclara* (**M**), Maldanidae, (**M**), *Protocirrineris socialis* (**M**), Sphaerosyllis sp. (**M**), *and Thelepus setosus* (**M**).
Bryozoa	*Bugula californica* (**2S**), *Schizoporella unicornis* (**2S**), *Watersipora subtorquata* (**2S**)
Urochordata	Botrylloides sp. (**1S and 2S**), *Didemnum lahillei* (**2S**), *Molgula manhattensis* (**2S**)
Nemertea	*Emplectonema gracile* (**M**) and Nemertea (**M**)
Porifera	Halichondria sp. (**1S and 2S**) and Hymeniacidon sp. (**1S and 2S**)
Oligochaeta	Oligochaeta (**M**)
Cnidaria	*Anthopleura elegantissima* (**1S and 2S**)
Chlorophyta	Enteromorpha/Ulva spp. (**1S and 2S**)
Rhodophyta	*Gracilaria verrucosa* (**1S and 2S**)

Richness Score Board

Low Dist.	Intermediate Dist.
0	0
1	0
1	0



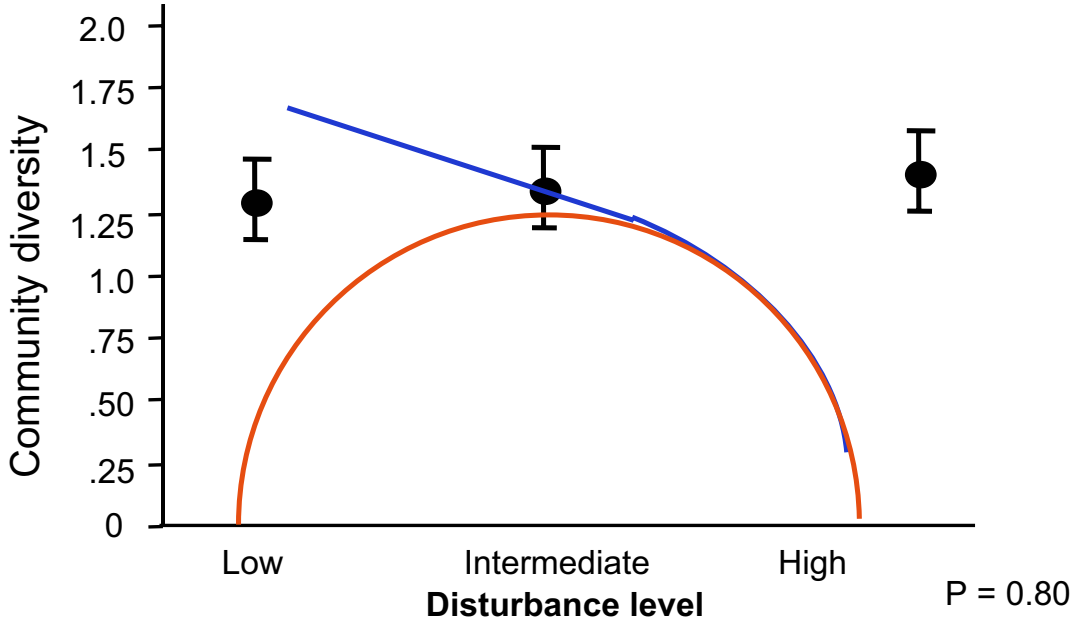
Community results



Community richness (●)supports low disturbance prediction: $P < 0.0005$

Community evenness (▲)does not support either community prediction: $P < 0.01$

Results for community diversity



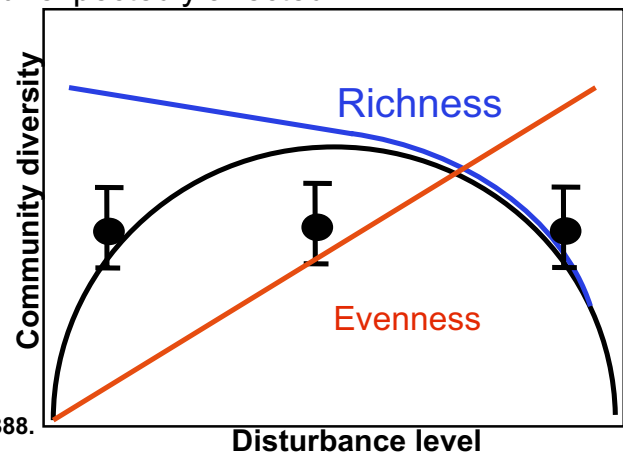
Intermediate prediction
Low prediction

Conclusions

1. Rock species richness did not maximize associate species richness

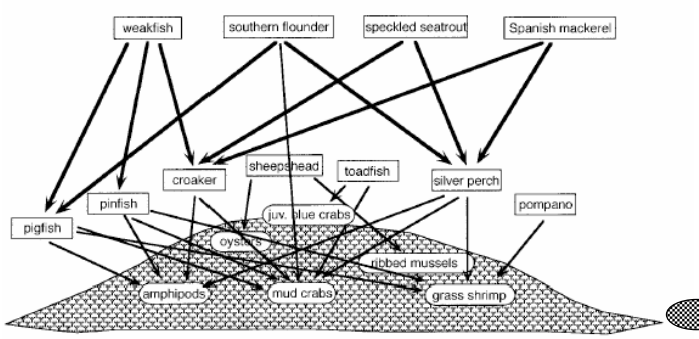
Foundation species (oysters) and their structural complexity may better predict overall species richness and numbers of individuals

2. Low disturbance and lots of oysters unexpectedly affected community evenness and diversity

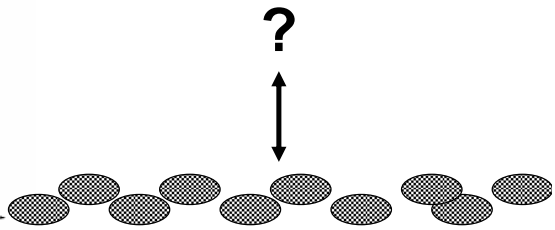


Kimbro and Grosholz (2006). Ecology 87(9): 2378-2388.

What next?



C. virginica reef



O. conchaphila reef

Literature search:
2,105 papers found

Literature search:
15 papers found

Physical gradients

Habitat interactions

Salinity, temperature, and food, gradients create an oyster structural complexity gradient

Adjacent seagrass beds

Acknowledgements

Permitting: Gulf of the Farallones National Marine Sanctuary, Point Reyes National Park Service, California State Park Service, and The California Department of Fish and Game
Funding: Bodega Marine Laboratory,UC Davis Graduate Group in Ecology, UC Davis Public Service Research Program, Center for Invasive Species Research, NOAA, and NSF.
Field Assistance: Adam Baukus, Sarikka Attoe, Dorthy Yip, Julia Blum, Andy Chang, and Bodega Marine Operations.
Advice dispensers: Eric Sanford, Randall Hughes, Ben Miner, and the Stachowicz lab.