Why were saltmarsh species assemblages so resilient to the Deepwater Horizon oil spill?

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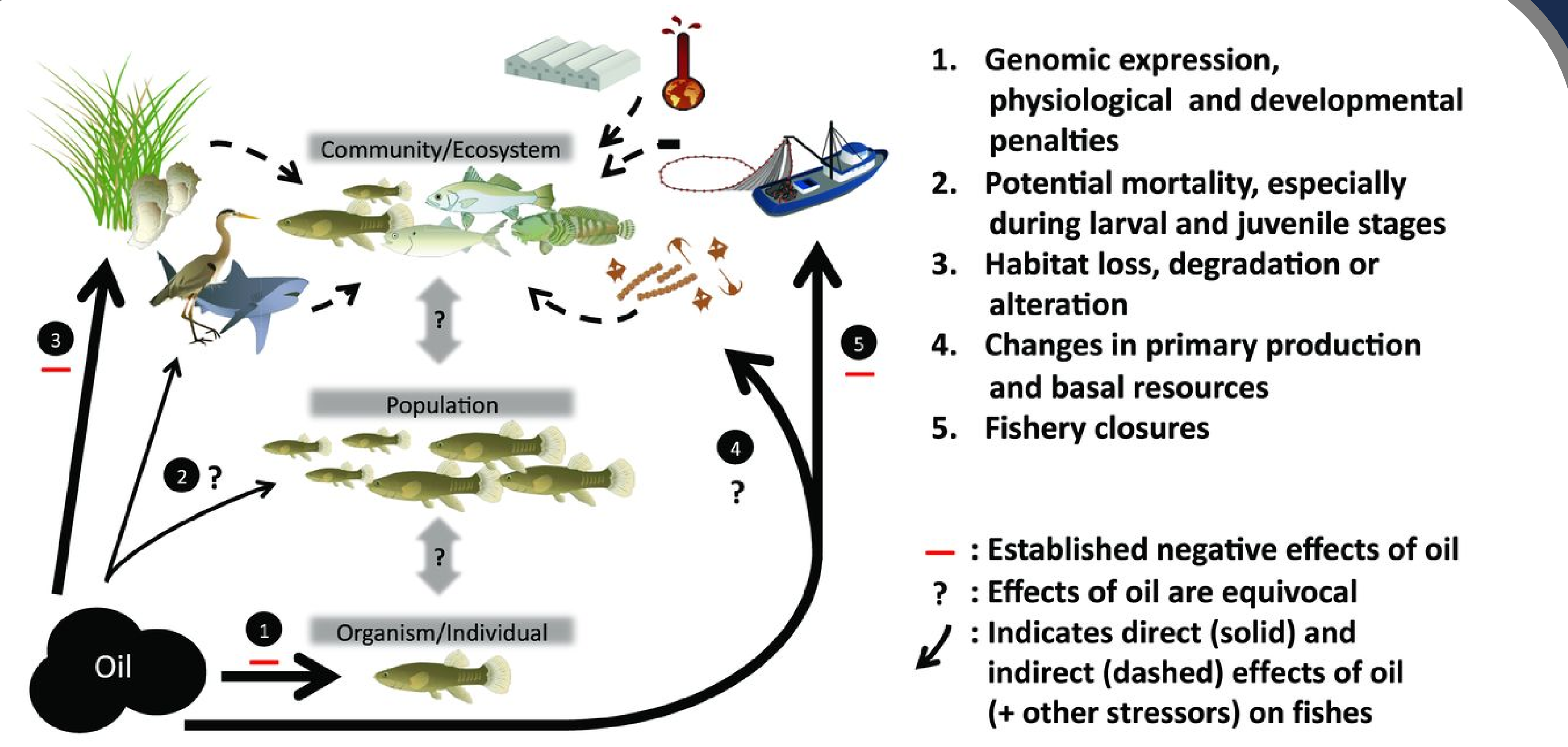
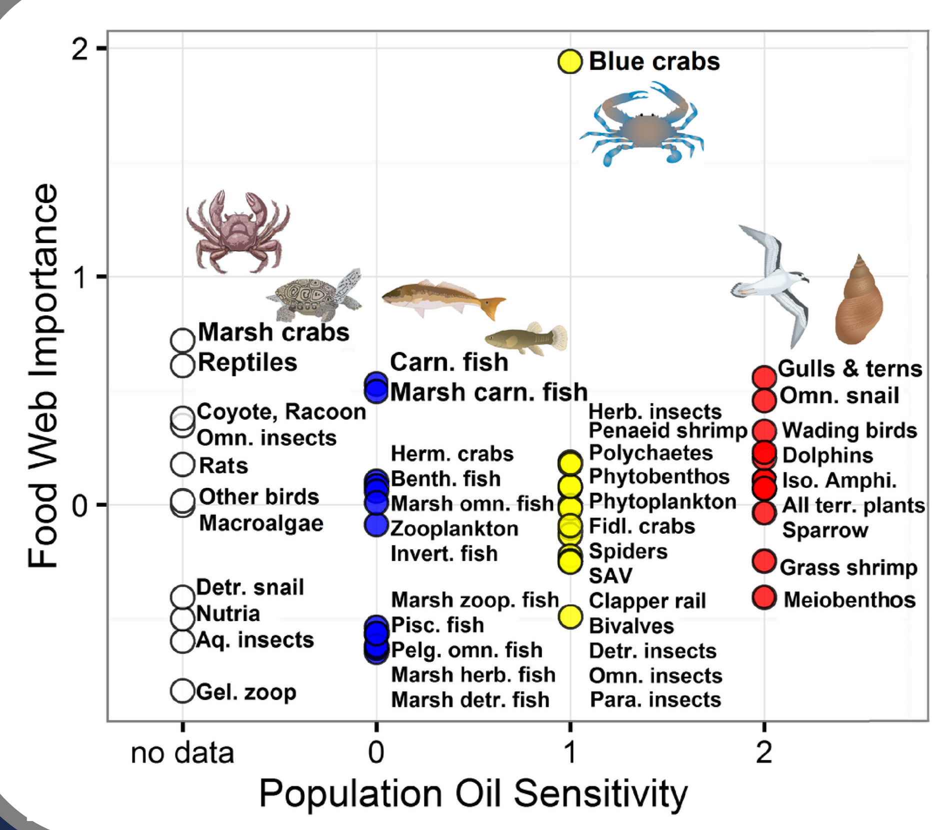
Background

- Exposure to Deepwater Horizon oil was observed across saltmarsh-associated species
- Lab experiments show oil exposure alters physiological rates connected to demographic processes
- There were changes in lower trophic level communities that are important food sources for fish and aquatic invertebrates
- But fish and aquatic invertebrates did not exhibit population-level declines following the spill. **Why not?**



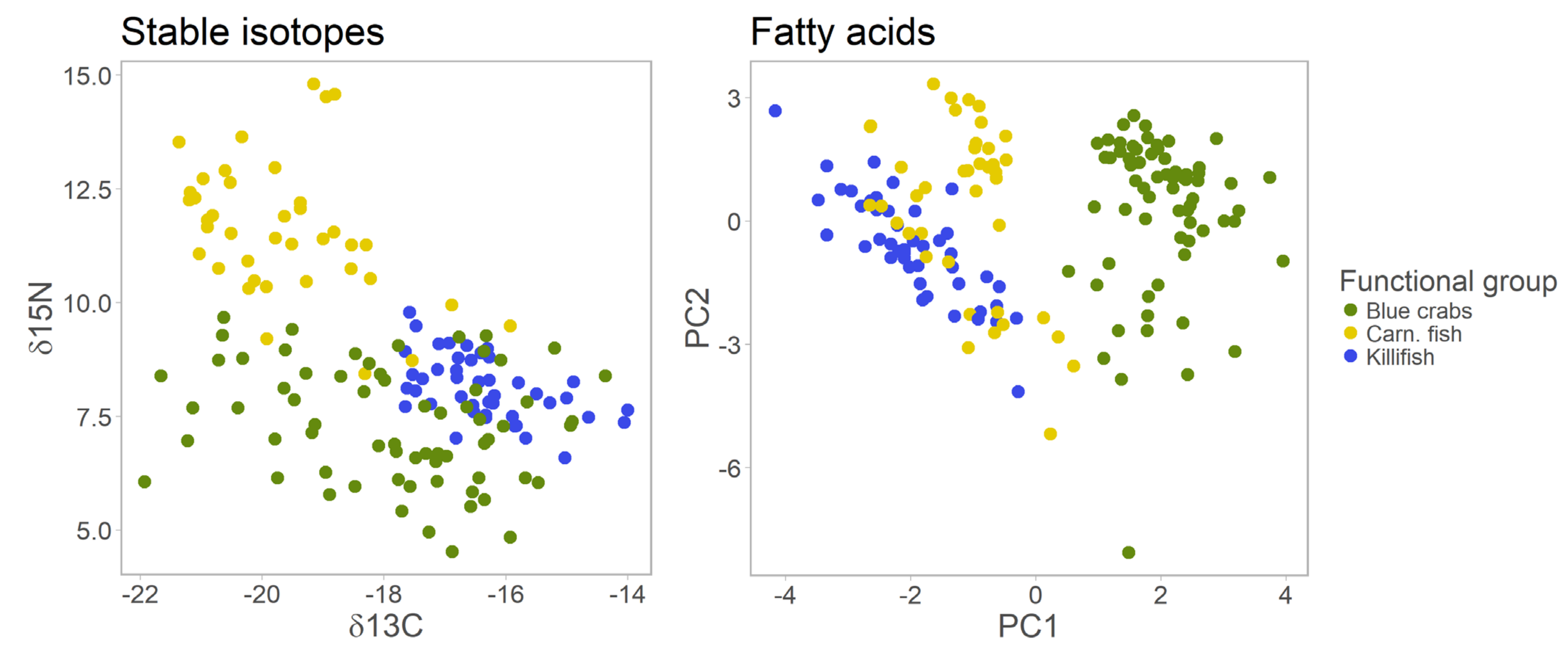
Fodrie et al., 2014

Oil can impact populations through many different pathways. Some pathways may mitigate the effect of oil.



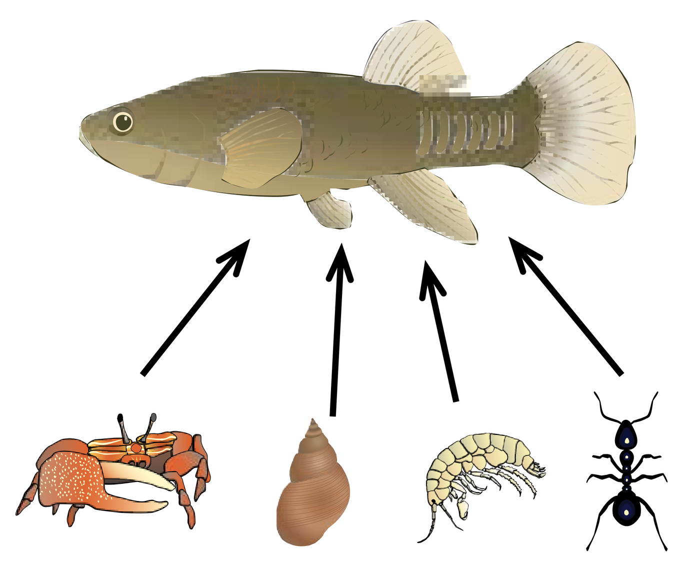
Network models have identified potential **keystone species** in saltmarsh food webs that may be important for energy transfer.

McCann et *al.*, 2017



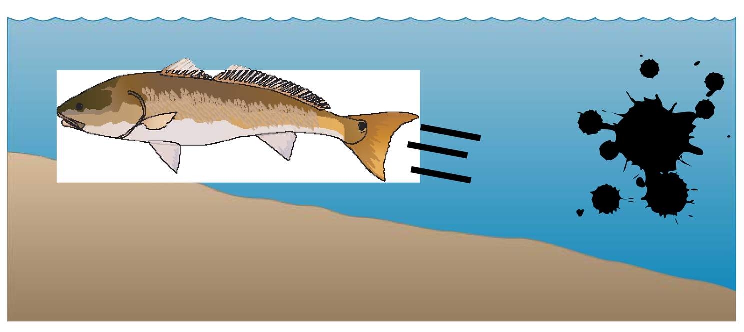
Biomarker data from stable isotopes and fatty acids can help quantify the **strength of trophic connections** between functional groups

Hypotheses

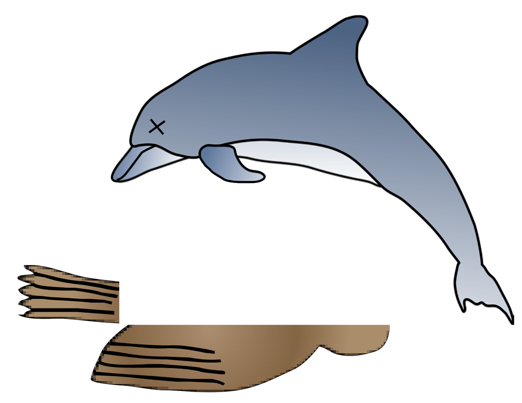


Although some food sources declined in abundance, **alternative trophic pathways** satisfied metabolic needs.

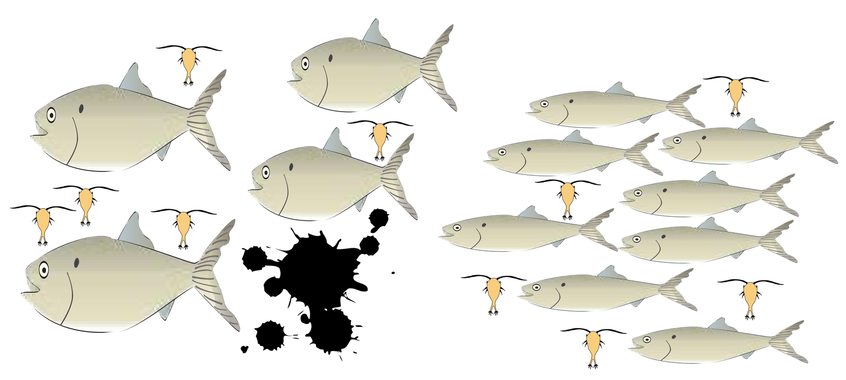
Reduced fishing mortality due to **fishery closures** counteracted increased natural mortality due to oil



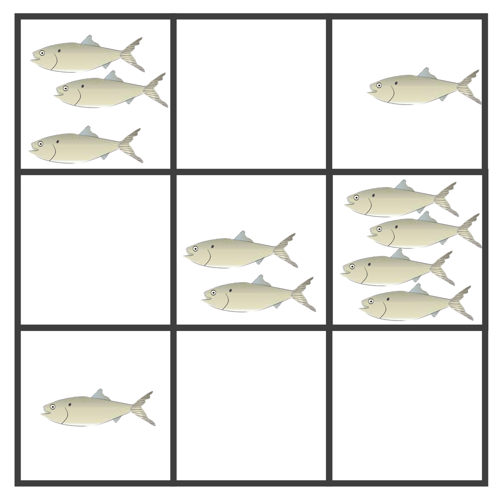
As **mobile organisms**, fish and aquatic invertebrates were able to avoid the most heavily oiled areas



High predator mortality allowed for a temporary **release from predation**.



Density-dependence during early life history compensated for any reductions in spawning output



Estuarine ecosystems display enormous **spatiotemporal variability** that may obscure population-level impacts.

Next steps

- Finalize functional groups for model
- Approximately quantify interaction strengths among functional groups using mixing models (e.g., Neubauer & Jensen, 2015)
- Test which hypotheses can lead to no changes in population abundance despite oil-induced changes in vital rates.
- Explore sensitivity of results to both high and low oil tolerance

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References

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Martin (2017) Marine Ecology Progress Series. 10.3354/meps12084
McCann et *al.* (2017) Frontiers in Ecology & the Environment. 14(3):142-149
Neubauer & Jensen (2015) PeerJ. 3:e920

Images courtesy of Integration and Application Network, University of Maryland Center for Environmental Science