

Context Document: Oyster Reef Restoration Ecosystem Service Logic Model

Project: GEMS
<https://bit.ly/GEMSorr>

Ecosystem Service Logic Models (ESLMs) are conceptual models that summarize the effects of an intervention, such as a habitat restoration project, on the ecological and social systems. Each model links changes in biophysical systems caused by an intervention to measurable socioeconomic, human well-being, and ecological outcomes. ESLMs assume that the restoration is successful and include all potentially significant outcomes for the intervention; not all outcomes will be relevant to each individual project, depending on location and environmental conditions.

The direction of an outcome (whether the restoration will have a positive or negative influence) often depends on the specific situation or is unclear due to multiple links (arrows) leading into an outcome that may have opposite effects. Thus, language like “increased” or “decreased” is not included in the models. These models are often used to consider management with or without an intervention or to compare different interventions.

This context document includes additional information about the restoration approach and details about some of the relationships in the oyster reef restoration ESLM. It also includes a list of the references used to develop the ESLM and names of experts with whom we spoke to refine the model.

Oyster Reef Restoration Description and Use in the Gulf of Mexico

Specific techniques for oyster reef restoration vary in the process and materials used; we identified six techniques that are widely used across the Gulf of Mexico. More information about each technique, including its use in five focal estuaries in the Gulf of Mexico, is available [here](#).

- Structurally simple, subtidal, intensively harvested
- Structurally complex, subtidal, intensively harvested
- Structurally complex, subtidal, not intensively harvested
- Structurally complex, intertidal, not intensively harvested
- Protection or enhancement of existing oyster reef
- Aquaculture

External Factors That Influence Restoration Success

A number of factors, including environmental factors (salinity, sedimentation) and social factors (institutional constraints, overharvesting), can affect the success of an oyster reef restoration project but are outside of the project’s control. More information about these external factors can be found [here](#) (scroll to end of page).

Model Notes and Clarifications

Harmful algal blooms (HABs): While it is often suggested that oyster restoration will reduce the incidence of HABs by removing nutrients from the water column, the literature and experts we consulted did not believe that reasonably sized oyster restoration projects will change nutrient levels enough to influence algal blooms, especially given the many other factors that drive bloom occurrence. Because nutrient concentrations are often monitored following restoration, nitrogen concentration was included in the ESLM as a commonly measured component.

Carbon sequestration: Oysters may act as a carbon sink under certain circumstances, but research shows high variation in individual reefs' carbon balances, and the amount of carbon that could be sequestered or emitted by oyster reefs is relatively low. Therefore, these effects are not included in the ESLM.

Shellfish poisoning and vibriosis: Human consumption of oysters can cause adverse human health effects like shellfish poisoning and vibriosis. However, focal estuary workshop participants did not think that this was important to include in the ESLM because shellfish harvest regulations prevent harvesting from areas when conditions are unsafe, and oyster restoration is not likely to have an effect on these human health outcomes.

Adjacent habitats: Oyster reef restoration can have effects on other types of habitat close to the project site. Changes to these habitats will have their own suite of ecological and socioeconomic effects. In the ESLM, these are referred to under the heading, "Outcomes related to adjacent habitat." If a project is expected to have substantial effects on other habitat types, we recommend referring to the separate ESLM for that habitat type.

Experts Consulted

Seth Blitch, The Nature Conservancy

Steve Giordano, NOAA

Paul Mickle, Mississippi Department of Marine Resources

George Ramseur, Mississippi Department of Marine Resources

Bill Walton, Auburn University

Mark Woodrey, Mississippi State University

Participants in five focal estuary workshops held in fall 2018 ([list](#) of participating organizations)

References

The literature used to develop and refine the oyster reef restoration ESLM is summarized in an evidence library, available for download [here](#).