Context Document: Fishing Pier Installation Ecosystem Service Logic Model

Project: GEMS
http://bit.ly/NI-GEMS

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 fishing pier installation 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.

Fishing Piers Installation Description and Presence in the Gulf of Mexico

Fishing piers are installed to improve access to coastal waterfront areas, generally beaches. Fishing piers can increase access to fishing and wildlife viewing. There are several different ways to construct or restore/enhance the central body of the pier (e.g., different materials used), however, central to all pier construction is the installation of load-bearing piles in the benthos to anchor the main body of the pier (Clark 2011). Consequently, the impacts from pier installation projects, both anthropogenic and ecological, tend to be consistent across project type allowing for a unified ESLM mapping outcomes from pier installation. Successful projects improve accessibility to the waterfront, facilitating increased coastal-based anthropogenic activity in the areas around the pier. Pier projects are popular across all Gulf states and are particularly frequent throughout Florida.

Sometimes, the restoration activity also involves adding or repairing parking lots for the boat ramp area, though the effects of this construction are not included in the model.

External Factors That Influence Success

The success of a pier depends greatly on assessment of wave action and storm strength in the given area and the determination of appropriate design and materials to adapt to these factors. In making decisions about where and how to build or restore a fishing pier, it is important to assess how storm events will impact tide, wave direction, force and attenuation, and erosion and scour patterns (Clark 2011). The term scour is defined as the removal of granular substrate (such as sand) by hydrodynamic forces (such as waves and tidal surges) (Hughes n.d.). Scouring is a type

or erosion which can occur when coastline morphology is altered, impacting adjacent coastline and associated infrastructure. Threats from wave action and flooding are expected to rise as a result of climate change and sea level rise.

Model Clarifications

Water Quality/Air Quality/Light Levels/Sound Levels: The construction or repair of fishing piers results in mostly short-term changes in local air quality, water quality, and light and sound levels. However, it can also result in long-term effects on water quality and light levels if the installation of piles is not completely sturdy and if the intervention includes adding more lights.

Likewise, fishing activity and wildlife viewing can be affected by changes in air quality, water quality, sound levels and light levels, by affecting local fish populations or the overall enjoyability of pier access.

Adjacent Habitat & Wildlife Populations: The installation of piles has implications for the benthic environment, ultimately impacting both substrate and species community composition (Davis et al. 1982, Vehkova 2006, Tyrrell and Byers 2007). The change to seafloor characteristics affects quantity and quality of adjacent habitat, which is also transformed by sediment in the water column resulting from pile installation (Clark 2011). This can impact adjacent habitats such as coral and oyster reefs, salt marshes, hard bottom habitat, seagrass, dunes, and mangroves. Changes to habitat incurred by pier installation have implications for surrounding wildlife communities, and can both encourage colonization of the added pile substrate by lower trophic level communities (Vehkova 2006) and nonnative species (Tyrrell and Byers 2007) as well as disturb existing benthic communities (Davis et al. 1982).

Property Value: While there are many tangible benefits to fishing piers, the direct effects of pier installation on local property value is not well understood. The installation or repair could increase property values in communities where increased public beach access is valued, or decrease property values in communities where homeowners are drawn to a considerable amount of privacy. Successful installation projects should, therefore, consider a preliminary assessment of local beachfront property owner attitude towards the creation of a new pier in the early stages of project siting.

Access to Waterfront: Existing pier projects range in public accessibility. Some fishing pier access points are free to the public while others, such as the Gulf State Park Pier in Alabama require an entrance fee (Alapark n.d.). Similarly, in the case of privately owned piers such as Cedar Point Pier in Alabama, owners not only charge a per person fee but can restrict access on a case by case basis. These potential restrictions to accessibility should be considered in the onset of a pier installation project.

Fishing to Physical Health (excluded): Fishing activity (both on boats and from shore) can require some level of physical exertion or alternatively reduce an individual's opportunities to be physically active or dedicate effort towards physical health. However, there is limited evidence showing a demonstrable relationship between these two outcomes. While it is included in the

oyster model and evidence library, it is excluded in the recreational enhancement models as the relationship is very tenuous.

Intervention to Maintenance Costs (Excluded): The design of a new or reconstructed fishing pier could affect future maintenance costs (for dredging, pile replacement, etc) particularly in response to sea level rise in the area. Each project differs in terms of how these maintenance costs are paid for and who pays for them. A project budget could include funds for maintenance, which would fall under the "Economic impact" of restoration node in our models. We chose to exclude this link from the model because while a fishing pier could impact maintenance costs, it is far too variable and unpredictable between projects to confidently posit that this is an outcome across the region.

Intervention to Air Quality (excluded): There are several modes by which air quality can be affected by this kind of restoration project: 1) localized and short-term impact from project construction and 2) vehicle exhaust or dust particles from parking lots adjacent to the piers. While even a brief exposure to these kinds of conditions can potentially have an impact on human health, it is likely that construction workers using best management practices would utilize provisions to minimize impacts to them as well as nearby residents. The link between the intervention, air quality, and any sort of socioeconomic impact felt too tenuous to include in the model.

Nutrition for Communities: This as an expected socioeconomic outcome of restoration projects can come from two sources: changes in fish and shellfish harvesting, and changes in land-based hunting on restoration areas. For this model, the source of nutrition is mainly from changes in fish and shellfish harvesting.

Experts Consulted

Cherie O'Brien, TPWD

Fritz Wettstein, Florida DEP

References

Clark, R. 2011. Fishing Pier Design Guidance Part 2: Methodologies for Design and Construction. Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems.

Davis, N., G.R. VanBlaricom, & P.K. Dayton. 1982. "Man-Made Structures on Marine Sediments: Effects on Adjacent Benthic Communities." *Marine Biology* 70(3): 295–303.

Hughes, S.A. n.d. Design of Maritime Structures: Scour and Scour Protection. U.S. Army Corps of Engineers. https://www.oas.org/cdcm_train/courses/course4/chap_8.pdf.

Pier | Alapark. n.d. Retrieved October 4, 2019, from https://www.alapark.com/parks/gulf-state-park/fishing-and-education-pier.

Tyrrell, M.C., & J.E. Byers. 2007. "Do Artificial Substrates Favor Nonindigenous Fouling Species over Native Species?" *Journal of Experimental Marine Biology and Ecology* 342(1): 54–60.

Vekhova, E.E. 2006. "Reattachment of Certain Species of Mytilid Bivalves to Various Substrates." *Russian Journal of Marine Biology* 32(5): 308–311.