COMPARING NEKTON ASSEMBLAGES OF SUBTIDAL HABITATS IN PIPELINE CANALS TRAVERSING BRACKISH AND SALINE MARSHES IN COASTAL LOUISIANA

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Abstract: Subtidal habitats of pipeline canals in Louisiana brackish and saline marshes were sampled seasonally (fall, spring, and summer) between October 1991 and March 1993 with a 2-m² throw trap to identify dominant natant species and test hypotheses relating habitat selection to water depth. Densities of nekton were compared among canals and between shallow (<1 m) and deep (>1 m) areas within canals to test two null hypotheses: H₀: Densities of nekton in pipeline canals are not related to maximum canal depth and H₁: Densities of nekton in shallow and deep subtidal areas of canals are equal. Daggerblade grass shrimp *Palaemonetes pugio*, bay anchovy *Anchoa mitchilli*, blue crab *Callinectes sapidus*, brown shrimp *Penaeus aztecus*, and gulf menhaden *Brevoortia patronus* numerically dominated nekton assemblages in both brackish and saline canals. Naked goby *Gobiosoma bosc*, rainwater killifish *Lucania parva*, and gulf pipefish *Syngnathus scovelli* were dominant only in brackish canals, whereas white shrimp *Penaeus setiferus* and Atlantic croaker *Micropogonias undulatus* were abundant in saline canals only. Although variation in the abundance of most numerically dominant species could not be related to maximum canal depth, the distribution of several species within pipeline canals was influenced by habitat depth and other interrelated factors. The degree of habitat segregation with depth was largely influenced by submerged aquatic vegetation (SAV) and salinity as well as water depth. Habitat segregation with depth was most pronounced in brackish canals during late spring (May) when SAV was present. Naked goby, rainwater killifish, blue crabs, and daggerblade grass shrimp were significantly more abundant in shallow water (<1 m) at this time. In saline canals, most blue crabs and daggerblade grass shrimp occupied shallow habitats in March when small juveniles of these species reached peak abundance. Bay anchovy exhibited a pattern opposite that of other species. In March, bay anchovy abundance was positively related to maximum canal depth in brackish canals, and densities were greater in deep than shallow areas of saline canals in June. Salinity may have affected the distribution of freshwater species (e.g., centrarchids) and limited their occurrence in saline canals. Increasing shallow subtidal habitat by backfilling canals may enhance the nursery habitat for some species, especially in brackish canals where the area of subtidal habitat capable of supporting SAV would be expanded.

Key Words: pipeline canals, fishery impact, Louisiana, subtidal habitat, submerged aquatic vegetation, hurricane impact, backfilling

INTRODUCTION

In undisturbed marsh systems, shallow subtidal areas along the marsh-water interface provide essential nursery habitat for fishery species (Baltz et al. 1993, Ruiz et al. 1993). Such areas are critical for those aquatic organisms that use the marsh surface and retreat to nearby subtidal habitat when the marsh drains at low tide (Zimmerman et al. 1984, Peterson and Turner 1994). In addition, light penetrates to the bottom of these shallow waters, permitting the growth of submerged aquatic vegetation (SAV) that may enhance habitat value by providing food and protection (Rozas and Odum 1988, Lubbers et al. 1990).
Pipeline canals constructed in coastal wetlands differ from natural subtidal areas in several important characteristics. Canals are usually straight, deep, and steep-sided, and their average depth (1.8–3.6 m) is substantially greater than nearby natural tidal channels or ponds (Tabberer et al. 1985, Abernethy and Gosselink 1988, Wicker et al. 1989, Rozas 1992). Most of the subtidal area in canals is too deep for SAV development, even where turbidity and salinity are favorable for its establishment.

Deep canals may provide a refuge for large predators that would otherwise be constrained by the shallow water in natural marsh systems. These deep corridors may allow predators easy access to what little shallow subtidal habitat there is along canal shorelines. Consequently, the presence of large predators in canals may reduce densities of early life stages of nekton (fishes and decapod crustaceans), either by increasing mortalities or because potential prey avoid canals with high predator densities. Therefore, we hypothesized that densities of major species of small nekton would be inversely related to canal depth (Hypothesis 1).

Among the mitigation options available for pipeline canals in coastal Louisiana is backfilling, by removing the dredged material levee and returning the material to the canal (Neill and Turner 1987a). Backfilling has been used for mitigation on a number of oil and gas access canals in Louisiana but, until recently, rarely applied to longer pipeline canals. Although backfilling can return the entire levee to the canal, oxidation of the dredged material through time results in an insufficient amount of material to fully restore the marsh habitat that was originally destroyed. Rather, shallow water bodies typically < 1 m deep are produced (Neill and Turner 1987a, Abernethy and Gosselink 1988).

In a recent survey of pipeline canals in coastal southeast Louisiana, we measured canal bathymetry and calculated the volume of dredged material contained in levees and available for backfilling (Reed and Rozas 1994). From these data, we estimated that backfilling the canals in our study area would decrease the average depth of most canals to < 1 m. Similar results were reported in studies of backfilled canals in coastal Louisiana (Neill and Turner 1987a, Abernethy and Gosselink 1988).

Backfilling may enhance the nursery value of pipeline canals by expanding the area of shallow subtidal habitat and reducing the density of large predators (McIvor and Odum 1988, Baltz et al. 1993, Ruiz et al. 1993). Ideally, one could test this hypothesis by comparing nekton densities in pipeline canals before and after backfilling. However, when we began this study, backfilling pipeline canals was rarely practiced in Louisiana, and the opportunity for collecting pre- and post-backfilling data did not exist. Therefore, we compared nekton use of shallow (< 1 m) and deep (≥ 1 m) subtidal areas in canals as a means of predicting the effect of backfilling on the nursery value of pipeline canals. We hypothesized that densities of nekton, and hence habitat use, would be greater in shallow than deep areas of canals (Hypothesis 2).

The major goals of our study were to determine whether the abundance of nekton in subtidal habitat is influenced by maximum canal depth (Hypothesis 1) and if subtidal habitat selection within pipeline canals is influenced by habitat water depth (Hypothesis 2). In addition, our sampling protocol allowed us to identify the major species of nekton using subtidal nursery habitats of pipeline canals within brackish and saline marshes of the Mississippi River deltaic plain.

**MATERIALS AND METHODS**

**Study Area**

We studied pipeline canals in the Terrebonne-Timbalier Basin of southeastern Louisiana (Figure 1). In a previous study, we divided each OCS (Outer Continental Shelf) canal in the study area into 1 km sections using quad maps (Reed and Rozas 1994). We separated each canal section into two types (saline and brackish) according to the marsh type in which they occurred (Chabreck and Linscombe 1978). Saline marshes were dominated by *Spartina alterniflora* Loisel, but *Juncus roemerianus* Scheele, *Distichlis spicata* (L.), and *S. patens* (Aiton) Muhl. were also present. Brackish marshes were dominated by *S. patens*. Although SAV was absent in saline canals, Eurasian watermilfoil *Myriophyllum spicatum* L. and widgeon grass *Ruppia maritima* L. occurred in subtidal areas of brackish canals. The predominant bottom type in all canals was soft mud. The system is microtidal. Tides are predominantly diurnal and have a mean range of approximately 0.4 m near the Gulf of Mexico, but tides are greatly diminished landward of the major bays, especially within brackish marshes (Shirzad et al. 1989).

**Environmental Parameters**

Immediately after a sample was enclosed (and before SAV or animals were removed), water temperature and salinity were measured at the site using a Beckman RS5-3 salinometer. If present in the sample area, SAV was removed before organisms were collected. Vegetation was placed into sample bags and transported to the laboratory in a cooler. Samples were washed in running water, dried to constant weight at 105 °C (48 h), and weighed (±0.1 g). Because roots broke off during sampling, they were not included in the biomass measurements.