Virginia Rhea Shervette

Department of Wildlife & Fisheries

Nature of the Problem

Currently, I am working on three projects that apply to Texas water resources concerns. The first project is entitled: Resource polymorphism in estuarine Sciaenid fishes of Texas. Estuaries of Texas are defined as semi-enclosed coastal bodies of water, which have free connection with the open sea, and within which seawater is measurably diluted with freshwater from land drainage (Pritchard 1967). As a result of the connection to freshwater inputs, the sea, and the land, estuaries are extremely susceptible to human disturbances. Commercial fishing activities, industrial and housing development, as well as other human impacts significantly alter estuarine habitats through the exploitation of both fish and invertebrates, introduction of exotic species, industrial waste, and land conversion. Understanding how species utilize estuarine habitats is critical for future conservation efforts in estuaries.

Many fish from the family Sciaenidae, such as red drum (Sciaenops ocellatus), atlantic croaker (Micropogonias undulatus), and spot (Leiostomus xanthurus) inhabit estuaries on the Gulf and Atlantic coasts of the United States. They are economically important for their commercial and recreational value as baitfish, sportfish, and food fish (Minello 1999, Swingle 1990). All of these species spawn in estuaries or nearby coastal waters, while tidal movement and currents facilitate the movement of eggs and larva into the back reaches of estuaries where food sources are abundant and predation levels are low. As a result, many of these areas have been coined nursery habitats (Boesch and Turner 1984, Minello et al. 1994; Baltz et al. 1998; Zimmerman et al. 2000). However, few studies have adequately defined species use in many of the habitats found in the back reaches of estuaries and conclusive evidence identifying essential habitats used for the recruitment of individuals to the adult population is still lacking (Minello 1999, Beck et al. 2001).

A fundamental premise of the nursery-role concept is that some estuarine juvenile habitats contribute disproportionately to the production of individuals recruiting to adult populations (Edgar and Shaw 1995, Heck et al. 1997). Beck et al. (2001) expounded on this assertion by developing a nursery-role hypothesis from which clear and testable predictions can be made. In their hypothesis they define a nursery habitat as one that recruits more individuals per unit area to the adult population than other habitats containing juveniles of the same species. There are several reasons why habitats may contribute disproportionately to recruitment. Different habitat types offer varying degrees of complexity to shelter juveniles from predation (Vince et al. 1976, Van Dolah 1978, Minello et al. 1989). Likewise, variations in quantity and quality of food resources across habitat types affect the rate of development, which has consequences on survival (Virnstein et al. 1983, Williams et al. 1990). Juvenile red drum, atlantic croaker, and spot are found across simple and complex habitat types including seagrasses, marsh edge, oyster reefs, and sandy bottom making them model organisms for the study of the nursery role hypothesis through morphological measurement.

Previous studies have indicated that for many fishes, morphology and ecology are highly correlated (Day 1994, Douglas and Matthews 1992, Swain and Holtby 1989, Ehlinger and Wilson 1988, Schluter 2000, Wainwright 1988, Webb 1984). Close examination of body morphology with relatively new techniques such as geometric morphometrics might elucidate morphological variation across habitats within a given species (Rohlf and Marcus 1993). Such intraspecific morphological variation between habitats may be the result of ecological characteristics specific to ones habitat and are referred to as resource polymorphisms, which derive from within population genetic variations, phenotypic plasticity or a combination of both (Robinson and Wilson 1996, Day et al. 1994). Phenotypic plasticity is defined as the production of multiple phenotypes by a given genotype in response to an environmental cue and may be responsible for much of the observed intraspecific variation found throughout nature (West-Eberhard 1989, Stearns 1989, Via 1993). Resource polymorphisms often arise as a result of resource partioning in response to intraspecific competition for resources.

Many studies have found evidence of resource polymorphism in freshwater fishes, but few have examined marine fishes, (Ehlinger and Wilson 1988, Schluter 1993, 1995, Robinson et al. 1996, Cutwa and Turingan 2000, Wainwright et. al. 1991, Mittelbach et. al. 1992). This project will compare juvenile body morphology of three fish species, red drum, atlantic croaker, and spot among four common habitat types: seagrasses, marsh edge, oyster reefs, and sandy bottom. We will address two questions: 1) Does body morphology differ among habitat types? 2) What is the nature of the morphological divergence? I am conducting this project with another student at Texas A&M University.

The second project I am working on that concerns Texas water resources concerns is called: Differences in fish and invertebrate assemblages in natural versus restored marshes. Three other students and I are comparing nekton and infaunal assemblages and densities between a natural and a created salt marsh in the Galveston Bay system of Texas to test whether these marshes are functionally equivalent.

The third project that applies is entitled: Assessment of Essential Fish Habitat as nurseries for economically important fishes: tools for management and conservation. Essential Fish Habitat (EFH) is identified as waters and substrates for spawning, breeding, feeding, or growing to maturity and includes marshes, seagrasses, oyster reefs, and soft bottom to name a few. Without these habitats, fishery species would be unable to maintain the productivity essential in sustaining a fishery. A paucity of information exists concerning the nursery value of EFHs for juvenile fishes. This study evaluates the potential of several EFHs in Grand Bay NERR in Mississippi to serve as nurseries by quantifying density, biomass, growth, and survival of juvenile fishes in the aforementioned habitats. I will quantify and compare juvenile density and biomass among habitats through quantitative drop sampling over three seasons. I will examine growth rates within each habitat by using field enclosures. To evaluate the relative survival of juveniles within habitats, I will employ tethering techniques. The information pertaining to the use of EFHs by juvenile fishes will aid managers (in both Mississippi and Texas) in development and implementation of a successful management plans geared towards water resources concerning habitats of economically important fishes.

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Intended Career Path Statement

A revolution has taken place over the last 30 years that has centered on the relationship between humans and their environment. The broad policy problems this revolution has illuminated have become the focus of the environmental movement. The applied scientific problems stemming from this are the focus of environmental science and the basic *science behind it all is the science of ecology. --Charles J. Krebs, 1994*

I am motivated by the notion that I can make a difference in the way we-as humans-perceive and interact with our environment. Through my continued research, education, and activism, I believe I can contribute to an ongoing environmental revolution that seeks to curb the incessant degradation of our world's ecosystems. My career goals are to conduct research for a non-profit or governmental organization with an emphasis on the conservation of marine ecosystems, to continue in the educational aspects of scientific and conservation issues as well as continue to play an active role in the environmental policy process. Hopefully my enthusiasm and interactions with others will encourage people to join in the environmental revolution of this new century. With the assistance of TWRI, through the Mills Fellowship, we can make a difference.