Investigating Feasibility of Acoustic Telemetry and Habitat Use of Adult Hickory Shad, *Alosa mediocris*, in the Mullica River/Great Bay Estuary, New Jersey

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**Abstract**

Hickory shad, *Alosa mediocris*, is an anadromous fish classified with its more abundant congeners as “river herring”. Little is known about the ecology of hickory shad because of low abundance and false identification. We utilized acoustic telemetry to track the movements of hickory shad within the Great Bay/Mullica River estuary. Mobile distribution tracking following an established protocol for other species in a contained grid failed to relocate any tagged hickory shad; however, they were tracked by a complementary fixed-hydrophone array in the estuary. Hickory shad retained gastrically implanted tags in tanks and at liberty. Captive tagged specimens experienced mortality similar to untagged captives probably related to captivity, but tags may interfere with eating over long scales. Hickory shad entered a small embayment at night near or on high tides. This behavior and others may make the species cryptic to established hypodermic sampling designs.

**Introduction**

The hickory shad is an anadromous fish that shares similarities with other closely related river herring species. It is a small species, easily overlooked in acoustic data, but it may play an important role in the estuarine community. The hickory shad is anadromous and enters the Great Bay/Mullica River estuary to spawn in freshwater; this period may be relatively long (Bigelow and Schroeder 2002). Hickory shad are most abundant in the Chesapeake Bay and in North Carolina. Additionally, Roenette and Able (1997) found a single sub-adult cohort of hickory shad around Little Egg Harbor Inlet in a night-time gill net study, however, no conclusions about habitat or tidal movements were made. Because of their low abundance, hickory shad are considered of little importance to commercial fisheries, but they may cryptically contribute to other “herring” catches. Hickory shad have recently become popular as sport fish and in some regions their ease is prized above that of all other herring (Bigelow and Schroeder 2002).

The related American shad is a species tagged during spring migration; however, they do not feed during this time (Olney et al. 1998). Use of this technique for tagging hickory shad during the summer growth phase may stress or starve the fish. Because so little is known about the ecology of hickory shad, establishing an appropriate protocol for acoustic tagging and tracking, as well as understanding basic movement and habitat utilization within an estuarine system is critical information for future studies on this species.

Because Atlantic coast estuaries are so productive, hickory shad may utilize fresh waters, estuaries, and sandy bottom beyond upwelling (Roenette and Able 1997). The Mullica River and Great Bay Estuary (Fig. 1) is one of the most diverse and undisturbed estuaries on the northeastern Atlantic coast making it an ideal location to study the behavior and movement of hickory shad (Good and Good 1984).

**Methods**

**Tagging** Hickory shad (*n* = 10) were caught by hook and line. Individually coded acoustic (76.8 KHz) transmitting tags (CATT 11-3, Lorette Wireless Inc., St. John, Canada) were gastrically implanted through the mouth (Fig. 2) (see Dodson et al. 1972; Adams et al. 1998; Bridger and Booth 2003; Olney et al. In Press). Transmission was 1 to 20 dB below maximum in an acoustic pulse every two seconds (Fig. 3). Additionally, a recognition tag (Flory Inc., Seattle, WA) was inserted into the dorsal margin, anterior to the dorsal fin (Fig. 2c). An injection of oxytetracycline (Livemarin®) at 0.1 mg/kg fish into the dorsal musculature guarded against infection (Fig. 2d).

**Feasibility** Tagged hickory shad (*n* = 9) were retained in captivity to examine amenable carrying capacity of gastrically implanted transmitters. Active or inactive (“dummy”) tags were inserted into the experimental fish as for released fish, but these were held in recirculating, ambient seawater at RMFS. Control fish (not tagged) were caught by hook and line, identified and tagged with 3 times during experiment at approximately 10 day intervals and the intervals was changed or cleared 5 times at approximately 5 day intervals. The health of all fish and response to tagging were monitored over 4 weeks and qualitative observations noted. Noted tags included tag infection, retraction, abnormal behavior, and feeding. After 4 weeks, surviving fish were sacrificed and dissected to investigate internal responses to tagging (or no tagging).

**Telemetry** A tracking protocol commonly in use for other fishes including smooth dogfish and striped bass was applied. A baffled hydrophone (LBP-1) coupled with an SRK-400 receiver/processor (Lorette, Inc., Santa Clarita, CA) was deployed while tracking tagged fish from a boat (Fig. 4). A fix (meter scale) was attempted on the position of fish by triangulation when a power level of >115 dB was reached at a gain of no more than 15. Listening stations covering the Great Bay/Mullica River estuary area at 1 km intervals were visited approximately three times a week (Fig. 5). A fixed array of hydrophones (including a hydrophone in the RMFS boat basin) tagged fish passage between tracking events (Fig. 6 & 7) (Grothues et al. 2005). Continuous effort on fixed hydrophones was calculated for fish 120 for all times found within the hydrophone array by dividing total movement points by the total fixed time period given a second burst tag by the actual number of contacts recorded in that time period.}

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