USE OF A PERIODICALLY ANOXIC *TRAPA NATANS* BED BY FISHES IN THE HUDSON RIVER

A Final Report of the Tibor T. Polgar Fellowship Program

Thomas W. Coote

Polgar Fellow

Doctoral Program in Environmental Studies
Antioch New England Graduate School
Keene, NH 03431

Project Advisors:

Robert E. Schmidt
Simon's Rock College of Bard
Gt. Barrington, MA 01230

Nina Caraco
Institute for Ecosystem Studies
Box AB
Millbrook, NY 12545

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ABSTRACT

Trapa natans is an exotic plant that competes with *Vallisneria americana* for habitat along the Hudson River. Previous research demonstrates that one of the differences that have taken place occurred in the associated fish community. In addition, recent research by Nina Caraco has shown that tidal beds of *T. natans* may reach lethal levels of dissolved oxygen at low tide, possibly forcing resident fish into open water. Behavior of local fishermen lends merit to this hypothesis, since it is common knowledge that it is productive to fish the edge of *T. natans* on an ebb tide where, presumably, large predators are utilizing this phenomenon.

We set out to test this hypothesis by setting up a fish weir within the *T. natans* bed of Inbocht Bay, Catskill, NY (RM 109.5). By sampling every hour of the ebb tide we were able to demonstrate the movement of fish out of the bed. Movement of the fishes was not related to low dissolved oxygen levels, but, rather, was uniform throughout the ebbing tide. We did demonstrate that the fish community of Inbocht Bay is different than the other *T. natans* communities that have been studied. It also appears, surprisingly, that the *T. natans* bed at Inbocht Bay is dominated by young of year (YOY) anadromous fishes, mostly blueback herring. These fishes were feeding heavily on epiphytic invertebrates on *T. natans*.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

INTRODUCTION

Trapa natans is an exotic aquatic plant, which since its introduction in the 1860s, has invaded much of the shoreline of the Hudson River (Gilchrest and Schmidt 1998). Prevented from moving south of Iona Marsh due to the increased salinity of the river (Schmidt and Kiviat 1988), its range is otherwise not constrained except by high water velocities and water depth. Due to its considerable reproductive capabilities combined with an abundance of appropriate habitat, it has managed to cover a great deal of what was once native submerged aquatic vegetation (SAV) community habitat. The primary species that it appears to have replaced is *Vallisneria americana*, resulting in a fundamentally different community.

A distinct difference between the two communities is the presence of sub-surface oxygen producing structures in *V. americana* beds, whereas *T. natans* is primarily producing oxygen on the surface, thus not contributing to oxygen production within the water column. Also, *T. natans* produces very dense surface mats, preventing the penetration of light and reducing or eliminating the presence of sub-surface autotrophs. One possible result of this change in habitat structure is an associated change in the fish community. Several researchers have addressed this issue and have demonstrated that there are, in fact, differences between *V. americana* and *T. natans* fish communities (Gilchrest and Schmidt 1998; Hankin and Schmidt 1992; Pelczarski and Schmidt 1991). Their work has also demonstrated that there are differences among *T. natans* communities, which we address here as well.

It has been known locally for sometime that an outgoing tide is a good time to fish the edges of *T. natans* beds for largemouth bass. *T. natans* may provide excellent cover for smaller fish due to its thick growth, which might prevent larger fish from entering and

which provides protection from birds. In addition, Nina Caraco (unpublished data) has been looking at various environmental factors within *T. natans* beds and, in 1999, recorded lethal dissolved oxygen (DO) levels within tidal *T. natans* beds at low tide. The question was then raised whether low DO levels were forcing fish out of *T. natans* beds, possibly explaining the presence of predators on the edges of the beds during ebb tide.

Originally the *T. natans* bed at Esopus Meadows was selected for this study. However, due to problems with the Esopus site, a new site was picked at Inbocht Bay. The point of this project was to address two main questions. First, are fish being forced out of the bed by declining levels of dissolved oxygen and second, what is the fish community within the Inbocht Bay *T. natans* bed. The specific question of the presence of predatory fish utilizing the edges of the *T. natans* bed was not investigated other than by casual observations of sport fishing behavior at the site.

METHODS

Selection of Esopus Meadows was based on the previous year's extensive bed of *T. natans* combined with oxygen data recorded from Esopus Meadows in 1999. We first inspected Esopus on July 7th expecting to find an extensive *T. natans* bed. It turned out to be quite thin for reasons unknown, although we speculated that high spring flow or disease were possible explanations. We decided to change locations to Inbocht Bay, which we also had data for and where there was an extensive *T. natans* bed. As it turned out, Inbocht Bay was an ideal location, being protected from the wind and the Hudson's current; from the north and west sides by surrounding land, from the south by a jetty, and partially protected from the east by an island (Figure 1). In 1995 the *T. natans* bed within Inbocht Bay covered 100 ha, based on aerial photos (Nieder, pers. comm.). Caraco took

additional aerials during this project and the bed appears to have increased by about 20%. The bed actually extends further north beyond the bay for an additional 3,000 m but we do not include that portion of the bed in our discussion. We chose one of the small channels cutting into the bed northwest of the island to set up our sampling station. The purpose of utilizing the channel was to reduce the possibility of picking up fish that may have wandered into the *T. natans* from the main river versus those fish that routinely inhabit the weeds for food or protection on a prolonged basis. The channel extended approximately 50 m into the bed and tapered from 15-m wide, at the opening, down to 3-m wide where the box trap was placed.

The sampling method consisted of a weir type netting system where fishes within the *T. natans* were funneled into a removable box trap (Figure 2). All netting was ¼-inch mesh, weighted on the bottom with floats on the surface. Each wing was 50-ft long by 6-ft deep and double leaded and extended into the *T. natans* from the box trap at about a 45° angle. Once on site we anchored the boat a few feet from the edge of the *T. natans* and slipped into wets suits used to conserve our energy but also to protect us from the *T. natans* nuts. Before or during peak high tide, 1-inch diameter slotted pvc pipe anchor posts were driven into the sediment. The ends of the wings, which were attached to ½-inch diameter pvc pipe with duct tape, were slid into the anchor posts (Figure 2). The wings were dragged through the plants until taut, with the ends left unanchored but well tangled within the *T. natans*. Once set, the wings were cleared of any obstructions such as logs and *T. natans* and we carefully checked to be sure the lead line was on the bottom. When the tide began to ebb, the box trap was slipped into the slotted anchor posts in the same manner as the wings. The box trap itself was 4-ft wide by 6-ft tall and 6-ft deep ¼-inch mesh, with two vertical wings extending into the center of the trap creating a slotted

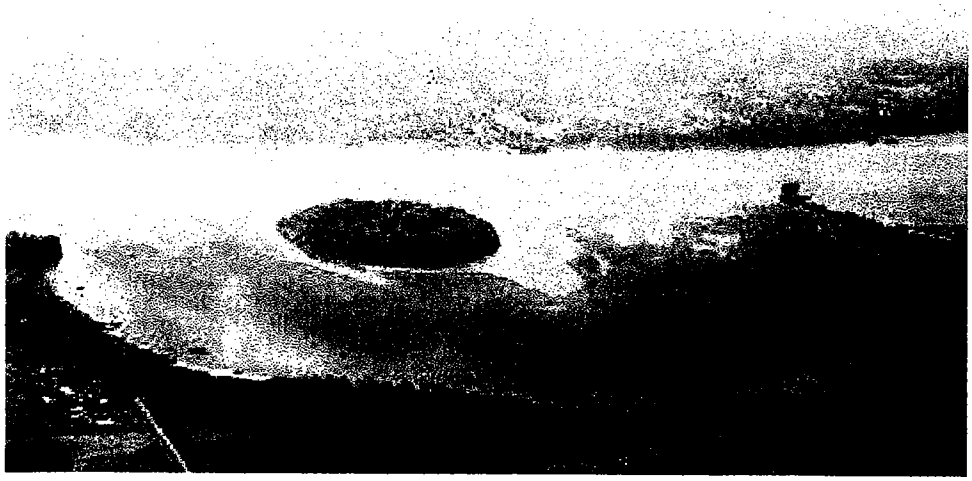

Figure 1. Inbocht Bay, Hudson River, NY, August 2000. This aerial is looking southeast across the river. The sample site is northwest of the island at the end of the shallow channel. The cement jetty is located at the far right. (Photo courtesy Nina Caraco).

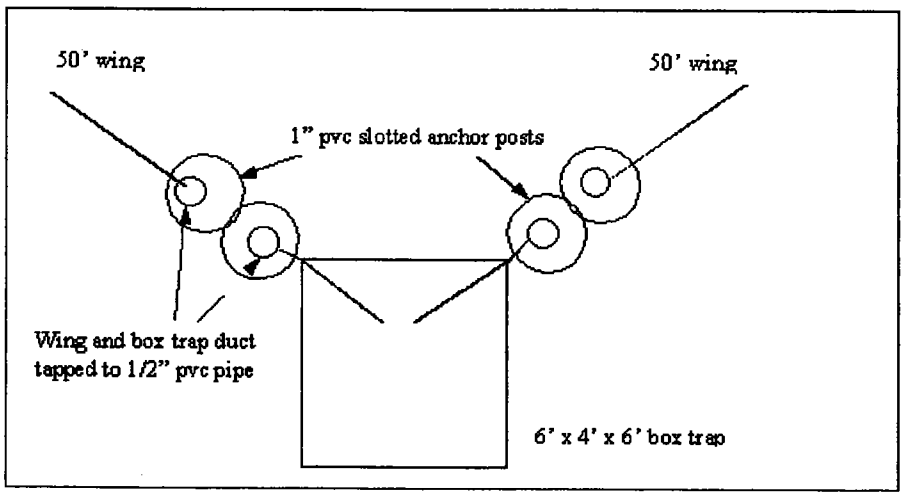

Figure 2. Diagram of the weir from above. The anchor posts were set right on the edge of the *T. natans* with the wings extending into the bed.

opening from top to bottom. This vertical slot was 15-cm wide, keeping fish in the box once entering but also allowing fish to enter at all tide levels. To collect fish from the box trap we stepped over the wings a few feet away from the box trap and approached the

trap on its open side. We then quickly slipped the trap up until the bottom was just out of the water. Fish were removed from the box trap using a dip net and placed in a bucket for transport to the boat. As soon as the trap was empty we slipped it back down, the entire process taking less than 10 minutes.

While initially two hours were allowed to pass before pulling the box trap, after the first sampling day the routine was switched to pulling it every hour. Due to concerns about getting stranded on the mud flats the first three samples were only taken 4 hours into low tide. On the fourth sampling day we were caught in a thunderstorm and had to leave the site after the fourth hour. On the fifth sampling day we kept the boat at the site through the fourth hour, as we had done on previous sampling days, then pulled anchor and walked the boat over 1,500 ft around the island and anchored it on the edge of the open river. We then had to walk back and forth from the boat to the nets, carrying gear and fish. Once back on the boat the fish were identified and measured if they were to be released, or preserved in 10% formalin. Generally the larger fish were measured and released. We kept records for each pull of the box trap recorded at the hour the net was lifted. Once back in the lab the original identifications were confirmed, lengths were recorded, and the stomach contents of the anadromous fishes were removed and identified. All specimens were transferred to alcohol and labeled. Besides the collection of fish there was some effort to record temperature and dissolved oxygen levels on site but the main data were collected by a sonde (water quality data logger). The sonde was set on a fixed post 0.5 m above the sediment. It was located approximately 3 m into the *T. natans* bed just off the channel next to the cement jetty. Depth, temperature, and dissolved oxygen measurements were taken every ten minutes from 6-12 days at a time.