The Baymen of the Great South Bay, New York

A Preliminary Ecological Profile

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ABSTRACT Ecology is the study of the interactions among organisms and their environment. Various theories and concepts taken from ecology, for example, optimal foraging theory, have been used in the anthropological study of fishermen. While this approach can provide useful insights, it removes the fishermen from their environment so that potentially significant factors may be taken out of context or omitted. An ecological profile of a fishermen population would present a more comprehensive ecological study, examining the ecological processes of predation, competition and adaptation from the perspective of the fishermen. All pertinent factors would therefore be taken into account.

An ecological profile of the fishermen, known locally as baymen or clam diggers, who harvest the hard clam (*Mercenaria mercenaria*) from the Great South Bay, New York is presented. The baymen are examined from the perspective of a predator on hard clams requiring a certain amount of harvest to survive and as competitors with each other and with other predators for hard clams as well as with those seeking to control access to bay bottom for shellfish culture, among others. The adaptive responses of baymen to environmental stress, particularly an inadequate harvest, are described.

Introduction

Fishermen have been the subject of numerous ecologically oriented anthropological studies (see Harris 1986). Most of these studies use ecological models or concepts such as optimal foraging theory (McCay 1981) to describe or analyze the actions of fishermen. While this approach can provide a useful framework for testable hypotheses, it is limited in both scope and perspective. This can pose a serious interpretational problem as fishermen must deal with a variety of needs and stresses that must be resolved simultaneously. There is also the risk that the chosen ecological model may be inappropriate.

Few, if any, studies place fishermen in the context of an ecological community and consider the various interactions that occur from the fishermen's perspective. A fishermen population (i.e., fishermen in a geographically discrete area harvesting the same organism) is no different than that of any other species. Both have biological requirements and must confront the same suite of basic survival problems: securing sufficient energy (i.e., food, cash) for maintenance, growth, and reproduction, obtaining resources also being sought by others, and responding (adapting) to changing conditions. Fishermen in addition must meet various cultural constraints. If a population of fishermen is successful in meeting these challenges, like any other species, abundance will be stable or increase while if unsuccessful, abundance will decline and there is the risk that fishing as a way

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of life may have to be abandoned (extinction for other species).

An ecological profile defines the fishermen's unique lifestyle and cultural requirements and then considers them as predators on fish or shellfish, as competitors with each other and other species, and subjected to environmental variability. It shows therefore how the fishermen function within their environment and how they respond to it. The advantage to the ecological profile is that it highlights the various interactions and constraints, ensuring that all relevant factors impacting the fishermen are considered. It is a comprehensive assessment and does not consider fishermen in isolation.

The Great South Bay is an embayment located on the south shore of Long Island, New York. The bay supports a significant commercial fishery for the hard clam (*Mercenaria mercenaria*) which is harvested by fishermen, known locally as baymen or clam diggers, who are self-employed and work individually from small boats (less than 10 m) on open access public bay bottom using hand operated rakes and tongs. The bay has a long history of shellfish harvesting and in 1986, slightly more than 104,000 bushels of hard clams valued at $4.2 million were harvested by approximately 1200 full and part time baymen. This paper presents a preliminary ecological profile of the baymen who harvest hard clams from the Great South Bay.

The Baymen's Environment

The Great South Bay is the largest in a chain of bays created by a series of barrier islands that extend nearly the entire length of Long Island, New York's south shore (Figure 1). The bay is 40 km long, varies in width from 2.5 to 8.0 km and has an average depth of 1.3 m. The area of the bay is approximately 230 square kilometers.

The distribution and abundance of hard clams is influenced by a number of factors including bay salinity, weather, bottom type, harvesting effort, and predator abundance. Hard clams occur throughout the Great South Bay but are more abundant in localized areas distributed throughout the bay (WAPORA 1982). Hard clam abundance also varies from year-to-year (Buckner 1983).

There is a legal minimum harvest size for hard clams of 2.5 cm in thickness which has been in effect since the 1940s. This permits the hard clam to spawn at least once before becoming subject to harvesting (Bricelj 1979), although the illegal harvest of undersize hard clams does occur (Losee 1983). Minimum size is attained at approximately four years of age (Buckner 1984).

Hard clams are marketed according to size with value decreasing with increasing size. Baymen sell their catch to shellfish buyers who operate at various locations along the bay. The price paid to baymen is dependent upon both local and regional supply and demand and is relatively uniform among the buyers. Efforts to establish a baymen's marketing cooperative have been unsuccessful.

The Great South Bay's shellfishery has undergone an evolution in response to various economic, political, regional and environmental factors. Subsistence fishing began soon after Long Island was settled in the early seventeenth century.

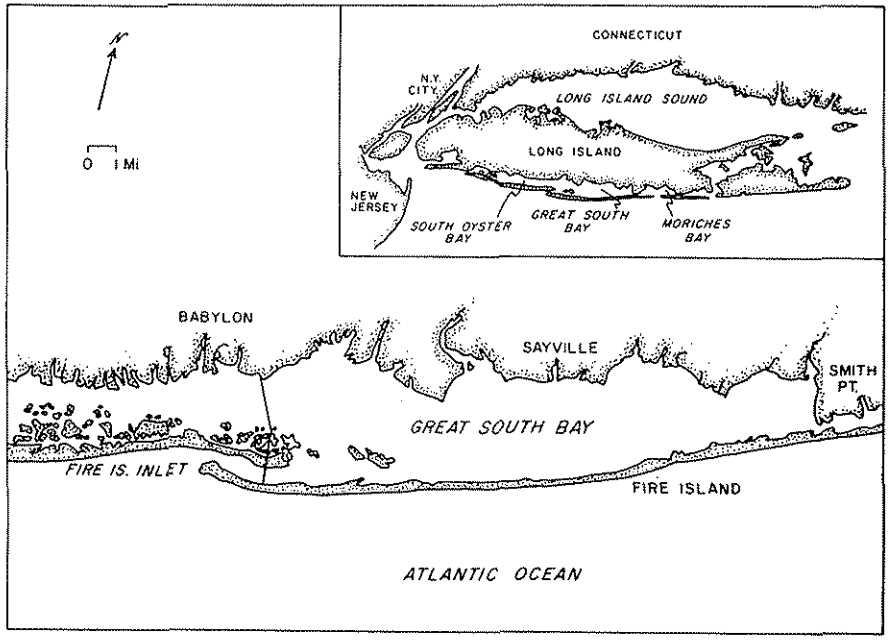

Figure 1. *Location of the Great South Bay.*

By the early nineteenth century a commercial shellfishery had developed (Gabriel 1921). A bayman, however, was a practical opportunist who shellfished in fall and winter when agricultural tasks were less demanding (Taylor 1983). By the mid-nineteenth century, baymen were harvesting shellfish full time throughout the year. The shellfish industry was centered around the oyster (*Crassostrea virginica*); many baymen worked in varying capacities for oyster companies that were leasing bay bottom at the time for oyster culture and harvested hard clams from public beds primarily when oysters were out of season (April to August) or when there was no work in the oyster fishery while other baymen harvested both oysters and hard clams only from the unleased bay bottom. Shortly after the turn of the century, the bay's oyster industry began to falter due to reduced natural reproduction in the bay and the closing of many of the oyster companies. Consequently, the shellfishery shifted to hard clams. By the 1950s, the bay's oyster fishery was nearly extinct and the shellfishery became totally dependent upon hard clams.

The management regime of the Great South Bay's hard clam fishery has been an important factor in the ecology of baymen. The situation in the Great South Bay is somewhat unique compared to other fisheries as the primary management responsibility does not lie with either Federal or state government. Rather, by virtue of seventeenth century colonial patents, ownership of the bay bottom, and by extension the shellfish growing upon it, resides at the local (township) level.

As a consequence, management is a local concern and prerogative. This has made the management decision making process very accessible to baymen and has resulted in greater baymen participation.

The Baymen

There are both full and part time hard clammers (Figure 2). Part timers are typically either students who harvest during the summer or individuals who have a primary non-fishery related job. Full time hard clammers accept students but resent those with other jobs whom they see as wanting the income from hard clamming without the commitment (Losee 1983).

The number of full time clam diggers is difficult to estimate as the number of annual commercial shellfishing permits issued includes both full and part time harvesters. The number of permits sold over the past 16 years has varied from slightly more than 6,000 to approximately 1,200 (Table 1). The number of baymen is dependent upon a number of factors but hard clam abundance and the resulting catch is probably the most important (Kelpin 1981).

Baymen can work everyday except Sunday when shellfishing is prohibited and they can harvest hard clams throughout the year. Hard clamming is only permitted during daylight hours and inclement weather can, at times, prevent harvesting. Hard clammers return to port each night but there is no single port out of which baymen work. West Sayville is the only community with a distinctive heri-

Figure 2. *Baymen harvesting hard clams on the Great South Bay. The baymen are concentrated on an area of high hard clam abundance.*

Table 1. *Number of commercial shellfishing permits, both full and part time, sold to baymen who can harvest hard clams from the Great South Bay by the New York State Department of Environmental Conservation.*

Year	Permits
1970	3,863
1971	4,517
1972	4,534
1973	4,796
1974	5,788
1975	6,149
1976	6,517
1977	6,694
1978	4,913
1980	4,275
1981	3,998
1982	3,145
1983	2,355
1984	1,926
1985	1,406
1986	1,282

tage centered around shellfishing which is due largely to the Dutch immigrants that had settled there (Taylor 1983).

Hard clamming requires little in the way of a sophisticated boat or harvesting gear. Almost any small powerboat can be used to harvest hard clams effectively. Only hand operated equipment, rakes and tongs, is permitted by local law (Figure 3A and 3B). In addition to several pairs of rakes or tongs, the only other equipment required are baskets and a cull box for separating sublegal size hard clams from the catch. A baymen's investment in boat and gear is approximately $8,000. Operating expenses include the cost of town and state shellfish permits at a cost of $105 annually, mooring, fuel, and insurance. Cost is not seen as a deterrant to entering the fishery (Conrad 1981).

Baymen are perceived and perceive themselves as rugged, independent individualists. The only extensive study of baymen's attitudes towards themselves and their occupation was undertaken by Kelpin (1981). She concluded that baymen have a strong dislike of anything that would impose control over their lives, including self-interest groups such as baymen organizations. Some of the reasons that clam diggers chose their occupation as opposed to other work were being one's own boss, making a good income, being paid in cash, earning extra money by working more hours and preferring physical work. From various public statements by baymen, other attitudes emerge. Baymen complain that government officials ignore the bay or are only interested in studies (Diamond 1974). Baymen feel that shellfish management has been too theoretical and not practical (O'Malley 1985). Baymen also have a mistrust of government (Nyland 1985).

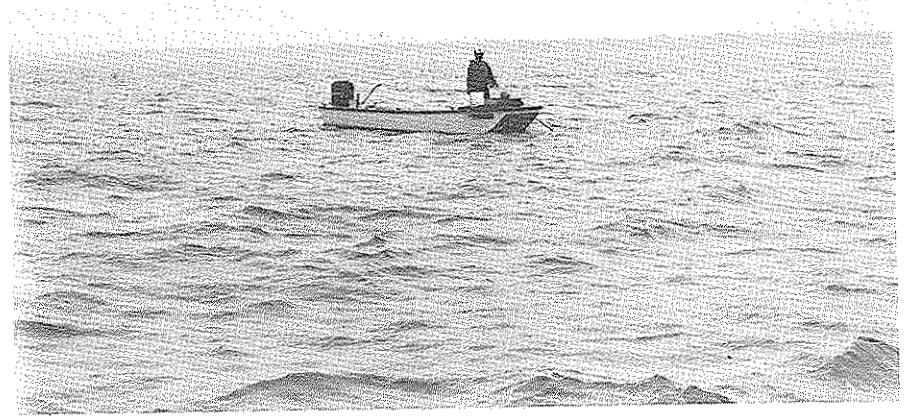

Figure 3A. *A typical boat used by the baymen who choose to harvest hard clams by raking. Most baymen are rakers.*

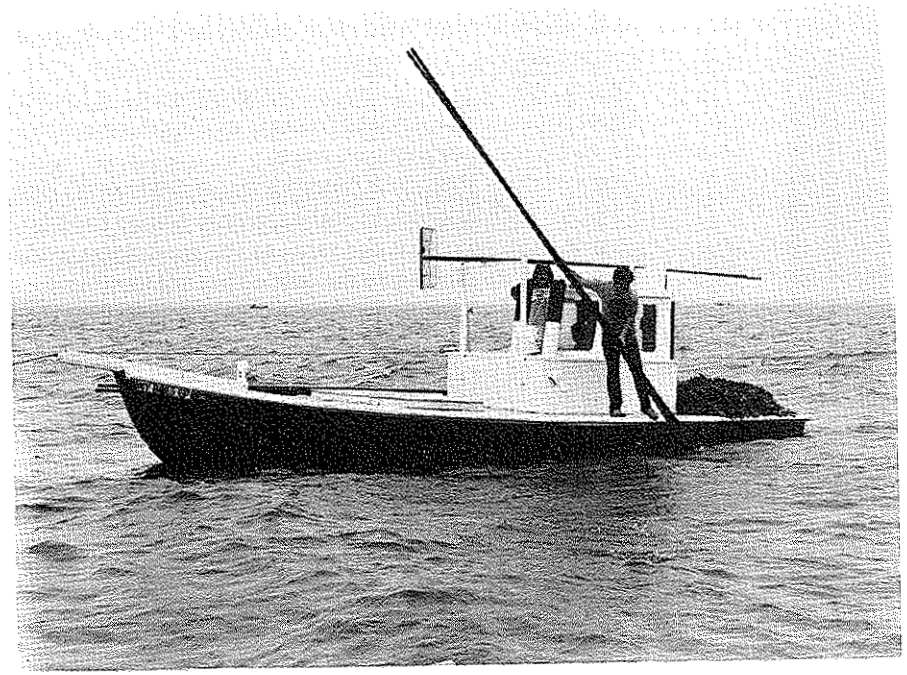

Figure 3B. *Tonging for hard clams. The boat and the tongs are similar to what was used to harvest oysters at the turn of the century.*

Baymen as Predators

Predation is the capture and consumption of one species by another. The relationship between predator and prey abundance is interrelated and fairly complex. From the predator's perspective, several factors are important. Each predator must obtain sufficient prey (food) to meet its energy demands which includes the energy expended to capture prey. At the same time, if a predator population is too efficient, it risks causing its prey population to fall below the level necessary to sustain the predator population. There are various stabilizing factors that can reduce the probability of prey collapse from occurring: the predator may be limited by some other factor, the predator may be unable to capture prey of a particular size or occurring in certain habitats, or the predator may be able to temporarily switch to another prey.

Hard clams are the principal prey of the baymen. Baymen do not, however, consume the hard clam for the energy needed to effect survival as other predators do, but rather sell the hard clams they harvest for cash. The cash is then used to purchase what is needed for the hard clammer to survive: food, shelter, other necessities and nonessential amenities.

The number of hard clams a bayman catches is dependent upon the abundance of hard clams, his skill at harvesting, and the amount of time spent in harvesting. The abundance of hard clams varies both temporally and spatially due to both natural variability and harvesting. Skill determines how well a hard clammer can locate areas of above average hard clam density and what fraction of the hard clams present are caught. The number of hours a bayman works depends upon his motivation, which includes his income needs, and is limited by his stamina, gear and boat breakdowns, and the fraction of time during which the weather is considered to be too inclement to work.

In evaluating baymen as predators, their cash (energy) requirement must first be determined. It is different for each bayman as both external and personal factors are involved. A bayman's gross income is the value of the hard clams while his net income is the value of the hard clams less the cost of hard clamming (i.e., operating expenses including fuel and insurance and capital expenses such as boat, engine and gear replacement). A bayman's financial obligations are set by family size, the prevailing cost of food and shelter, taxes, the amount of other family income, and personal living preference. Together these factors will determine the minimum, or maintenance income a bayman will find necessary if he is to remain a bayman.

If a bayman is to earn a typical income (an approximation of opportunity cost), the average annual income for all U.S. workers in 1983 was $17,549.00 which included both full and part time workers (Anonymous 1986). The median regional family income, which shows how a bayman relates to the regional population, in 1983 was approximately $24,000.00, but this includes many two wage earner families. Based on newspaper interviews, the typical bayman's gross income appears to be in the range of $20,000.00 to $25,000.00 per year (Firstman 1983). An annual gross income of $25,000.00 is probably a reasonable estimate for a bayman's income.

Having estimated income, the number of hard clams that must be harvested to achieve it can be determined. In 1982, the average price paid to baymen for a 500 individual count bushel of littleneck size hard clams, the most valuable, was $82.44 (Brown and Folsom 1983). Therefore, if a bayman is to make a gross income of $25,000.00, he would have to harvest 303 bushels or 151,625 hard clams. The price of hard clams is not constant so that if the price of hard clams goes up, less hard clams would need to be harvested but if the price were to drop, more would need to be gathered.

One of the key problems predators must resolve is what to do if the energy (cash for baymen) obtained falls below what is needed for survival. There are several possible options: a predator could shift to another more abundant prey, relocate to another area, reduce energy needs or rely upon stored energy. Failure to accommodate less than needed energy will result in death or extinction. For baymen, the analogous options are switch to other fish or shellfish species or take a second job, leave the Great South Bay for other shellfishing areas, defer fishing or living expenses or use savings accumulated from previously good times. Failure will result in a bayman giving up hard clamming. One other option available to baymen is to supplement hard clamming income with social services which would lower the amount of income necessary from shellfishing. A bayman's choice is very complicated and not all options are viable. Among the factors that will determine the individual option are work preferences and values, future expectations, amount of investment and the alternative income options available.

The collapse of the oyster industry had a significant consequence for baymen as predators. When both oysters and hard clams were present, baymen were 'generalists,' able to switch from one to the other. When the oyster industry failed, baymen were forced to become 'specialists,' totally reliant upon hard clams. The baymen thus lost their flexibility in switching prey so that their fortunes became tied to fluctuations in hard clam abundance.

A second aspect of predation that must also be resolved by baymen is controlling the harvesting (exploitation) rate so as not to reduce hard clam abundance below what is necessary for the baymen's long term survival. The hard clam fishery has been traditionally open access so that the only way to prevent overharvesting from occurring is to control individual efficiency. This has been accomplished, to a limited extent, by the restriction to hand operated gear and establishing a minimum size. However, this has not prevented overfishing from occurring in the past (Buckner 1984).

Baymen as Competitors

Competition occurs when a common resource is used by a number of organisms. Two of the underlying implications of competition are how can an organism gain an advantage over its competitors and how can competition be reduced. The primary common resource with respect to the Great South Bay hard clam fishery is the hard clam. Baymen compete for hard clams with each other (intraspecific

competition) and with other species (interspecific competition), such as oyster drills and crabs, that prey upon the hard clam. In addition to competition for hard clams, baymen also compete with other human groups for access to bay bottom. For example, individuals and corporations have expressed interest in leasing bay bottom to culture shellfish and if this were to occur, baymen would be forced to compete with this group for access to underwater lands and hence hard clams.

Each bayman harvesting hard clams competes with all the other baymen for the resource. It is very difficult for a bayman to gain a competitive advantage over the other baymen. Clam diggers can only work a finite amount of time and because of legislation, only hand operated rakes and tongs can be used which limits technological improvements. The only limited advantages that can be gained are from increased skill, working during more inclement weather than others and locating better clamming areas.

Competition between baymen has been minimized to a certain extent by town imposed residency requirements. There are ten townships on Long Island but only residents of the three townships adjoining the Great South Bay can legally harvest hard clams from the Great South Bay. This, in effect, limits the number of baymen, although because of the fairly large population of the three towns, not to an appreciable extent. Changing town of residency is an option but is very costly. The residency requirement is advantageous to Great South Bay clam diggers when hard clam abundance is high but a serious disadvantage when it is low because other townships with underwater land have similar exclusionary residency requirements.

Baymen working the Great South Bay are also in competition with baymen from other regions of the east coast of the United States for a share of the country's hard clam market. The price baymen receive rises and falls depending upon the supply from other areas. There is very little Great South Bay clam diggers can do to increase the price they receive.

There are twenty-two different species of hard clam predators in the Great South Bay that baymen must compete with for hard clams (Buckner 1984) and predation is a major factor in determining if a particular area is a productive shellfish bed (Mackenzie 1977). Hard clam predators have an advantage over baymen in that they prey upon hard clams that are smaller than can be legally taken by baymen. Consequently, baymen harvest whatever the other predators have not.

To put predation into perspective, consider the following comparison. Two of the more abundant hard clam predators of sublegal size hard clams are the oyster drills *Eupleura caudata* and *Urosalpinx cinera* which have a mean bay density of 3.4 per square meter (WAPORA 1982). According to WAPORA (1982), an oyster drill consumes 2.1 hard clams per year (it can consume other prey) or approximately seven sublegal hard clams per square meter per year. The mean density of legal size hard clams is 2.4 per square meter (WAPORA 1982) so that oyster drills may consume nearly three hard clams for every hard clam that could be harvested by a bayman.

Baymen are also in competition for access to the hard clams. Because of potential economic returns, individuals and corporations have expressed interest in leasing bay bottom for shellfish mariculture. If this were to occur, areas of bay bottom would be turned over to private interests from which baymen would more than likely be excluded. As leasing increased, the area available for baymen to harvest would decrease which would, in turn, reduce the number of baymen the bay could support.

The leasing of Great South Bay bay bottom for oyster mariculture was a major issue for baymen in the latter part of the last century (Kassner 1986). Oyster cultivation was economically attractive but it required the leasing of bay bottom upon which small oysters could be 'planted' and then allowed to grow to market size. Oyster cultivation thus created two different harvesting regimes in the bay: leased bottom upon which access was limited to the planter (lessee) and unleased or public bottom upon which baymen could harvest.

By the 1880s, considerable capital had been invested in oyster cultivation, the oyster industry was thriving and a sizable fraction of the bay bottom had been leased. Access to bay bottom resulting from oyster cultivation became a major source of conflict between the 'planters' and the 'free baymen.' The planters supported the leasing of bay bottom for oyster culture. The free baymen, baymen who worked the areas of the bay that were not leased, fearing that they would soon be totally excluded from the bay, wanted leasing ended and unrestricted access to all the bay. The conflict was bitter and a major political issue. The proponents of the free bay, after extensive lobbying, were able to prevail with local government and by the turn of the century, no new leases were being issued.

Other Factors Affecting the Baymen

All organisms are subjected to environmental (external) factors that can impact baymen. The price baymen receive for their hard clams, for example, is set by the regional economy as well as supply and demand. Changes in any number of government regulations and policies can increase operating costs. Baymen must obtain mooring for their boats and there is the possibility that the shellfishery will be closed because of pollution. Weather can affect both hard clam abundance and working conditions.

These and other factors have the potential to reduce the viability of hard clamming as a livelihood. For example, if a bayman cannot get mooring because all of the waterfront has been developed for private housing, he will be unable to hard clam. The nature, timing, and importance of these other factors are variable and most are not well anticipated by baymen. They can, however, pose a serious threat to baymen.

Adaptation and the Baymen

The ability to survive (both for the individual and the population) changing conditions and circumstances (stress) is contingent upon adaptive responses. The

adaptive responses vary with the degree of stress imposed and if the stress is too severe, death or extinction will result. Each adaptation has a consequence (i.e., lower growth, reduced activity, and decreased reproduction) and it should be noted that the range of an organism's adaptive response is limited. In the case of fishermen, the adaptive response is constrained to what is consistent with the fishermen's attitudes towards their occupation. Also, what was adaptive in the past may not be adaptive or even maladaptive in the future.

The most serious and omnipresent stress confronting baymen is a decline in the abundance of hard clam. This is accepted by baymen as an occupational hazard (Keplin 1981) but at the same time baymen believe that some action should be taken to increase abundance. The baymen's adaptive response is to use their potential power to have government take actions to either increase the hard clam harvest or provide some form of financial aid to the fishermen. The various actions are broadly categorized as 'shellfish management.'

Because management of the Great South Bay's hard clam fishery is at the local level together with the nature of the fishery, baymen are in a position to play a particularly active role in the management process. Elected government officials, eager to satisfy an important and vocal constituency, generally seek to satisfy the baymen. The relationship between baymen and government has even been institutionalized by local government through the creation of 'shellfish advisory commissions' comprised of baymen to provide advice on matters pertaining to the industry.

Fishery management is, in theory, rational decision making. Through the management process, the baymen are in a position to control their own destiny rather than be subjected to the vagaries of the resource. The baymen have considerable political power and as a consequence, have been able to block any management action they find unacceptable, even if it is based on merit. Management has become more often a political issue than a scientific matter.

The critical management issue is how to ensure the long term sustained harvest of hard clams. As Hardin (1968) points out in the 'tragedy of the commons,' in an open access resource (such as the hard clam fishery of the Great South Bay), there is a tendency to expand exploitation (harvesting) beyond the capacity of the resource to sustain itself. Overfishing of the hard clam did occur in the late 1970s (Buckner 1984) and no action has since been undertaken to prevent this from reoccurring. There are two basic solutions: either limit the harvest (i.e., catch quotas and limited entry) or augment hard clam stocks to increase hard clam abundance and sustained yield.

Augmentation does not interfere with open access or restrict baymen and maximizes the number of clam diggers that are employed in the fishery. Restricting harvest increases governmental involvement, limits traditional baymen freedoms, and reduces the number of people that can be employed. Augmentation is consistent with baymen attitudes while restricting effort is not. Baymen favor augmenting the natural abundance of hard clams but have successfully opposed any action to restrict harvesting. The prevailing management policy has thus emphasized augmentation.

Considerable sums are expended for augmentation and augmentation can be a successful strategy for addressing depressed hard clam abundance if implemented correctly. Augmentation measures, however, have not been rigorously evaluated. The planting of sublegal size hard clams, for example, is a major program but it may not be able to make a significant impact on the fishery as practised (McHugh 1981). In addition, for enhancement to be successful, some type of harvest restriction is necessary or else the additional hard clams will lead to more baymen without any individual bayman benefiting.

There are many other issues facing baymen. Their adaptive response is the same: bring the matter to local government and urge government to take action. Government is generally supportive of the needs of the baymen and will act at their behest. The baymen, however, are only likely to endorse and government likely to implement those actions which are consistent with baymen attitudes even if the actions are the less effective options. Baymen consider this to be good management even though at times it provides a less than optimal solution.

Discussion

The ecological profile of the Great South Bay clam diggers defines their environmental requirements and identifies their various interactions. This information provides the background and framework for understanding how the baymen adapt to their environment and can be used to assess baymen adaptive responses. It can thus be both descriptive and predictive.

For the baymen, the abundance of hard clams is perhaps the most critical factor in their survival. If hard clams decline below a bayman's maintenance catch, he will be forced to make adjustments and if the drop is severe enough, probably leave the shellfishery. Baymen ask government to solve this problem on their behalf but will only endorse options that are consistent with their occupational attitudes. For this reason, increasing hard clam abundance is favored over control over the exploitation rate. While augmentation can be a viable option, unless properly implemented it can be of little or no value.

The proper role of government in management needs to be assessed. Government is in a position to implement technically valid management actions even if they are opposed by baymen. Government more often choses to defer to the baymen. While this has resulted in overexploitation and economic inefficiency, it has minimized government interference in the dynamics of the baymen and their interrelationships. Thus, the baymen population is free to evolve, even if it leads ultimately to their extinction.

The ecological profile approach to fishermen presents a comprehensive portrait of the fishermen and can be expanded as necessary. It does not test ecologically based hypotheses but these can be derived. For example, in considering the baymen as predators, the question of the advantages of being a specialist or generalist is covered in terms of the oyster-hard clam fishery that had existed. The benefit with the ecological profile is that the concept is presented in the proper context.

Once ecological profiles have been done for several fishermen populations, comparisons of the various fishermen populations could be made. These could reveal important similarities and differences among fishermen. These, in turn, may lead to a better understanding of fishermen in general. The ecological profile also has potential management applications as it reveals fishermen dynamics and it could be used to predict how fishermen respond to management imposed externalities.

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