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**The Fish Pot Ban.' Artisanal Overfishing  
and State Mismanagement in Bermuda.<sup>1</sup>**

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Discussion Paper - Comments are welcome.

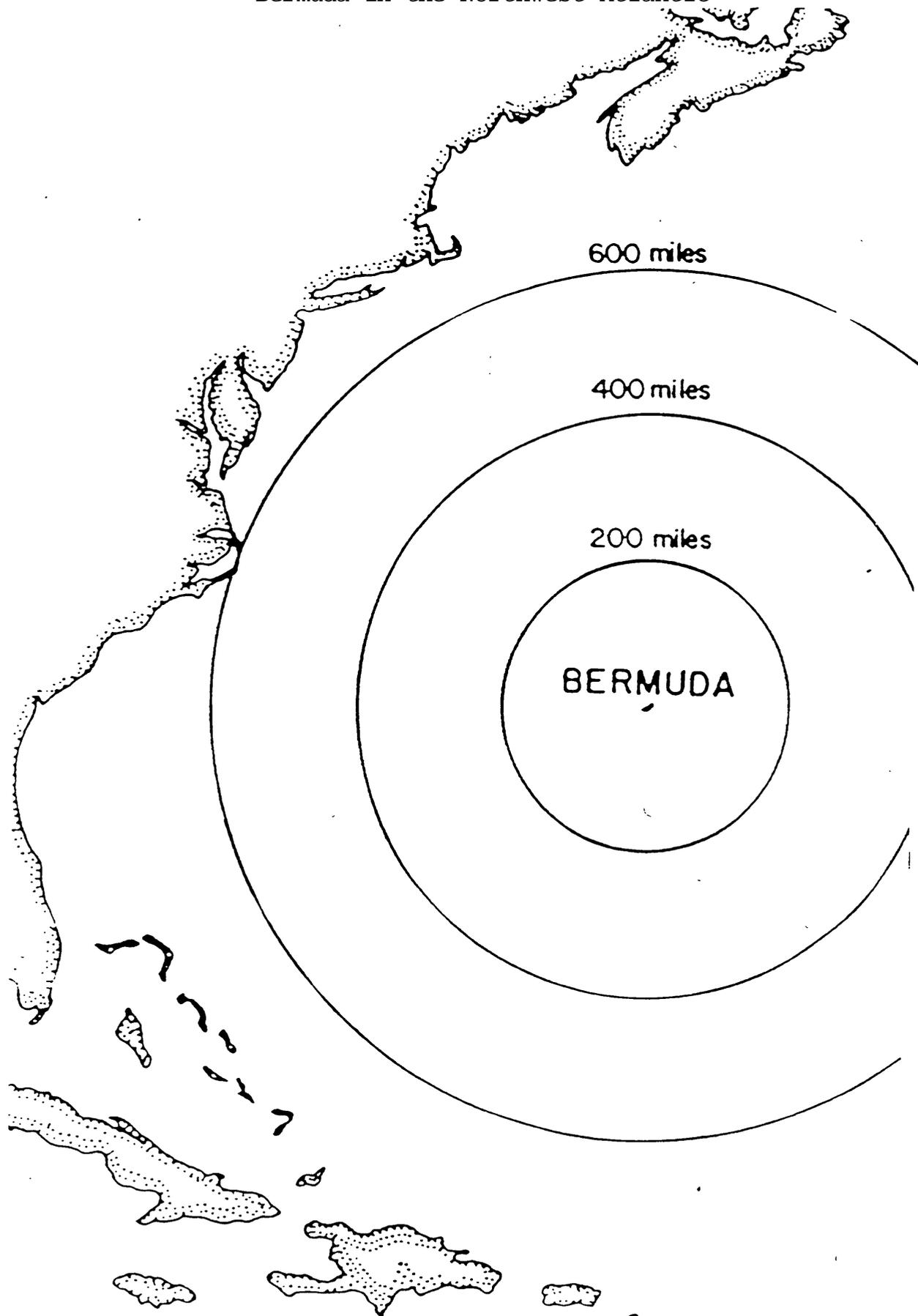
## Introduction

This paper examines the problem of artisanal overfishing in a subtropical reef fishery, the failure of limited entry management, and the prospects for fishery co-management. After a brief overview of the Bermuda fishery, traditional conservation is discussed in terms of customary tenure and generalized norms of reciprocity. Overfishing is seen to have come about as a consequence of a number of economic developments – cost-push and demand-pull – and state regulatory measures. The failure of limited entry has not put co-management on the agenda however. The rise of a significant non-fishing marine interest has provided more stringent state regulations with a new legitimacy. The paper concludes by arguing this will be short-lived and that co-management solutions need to be sought if the industry is going to be placed on a sustainable footing in the long-term.

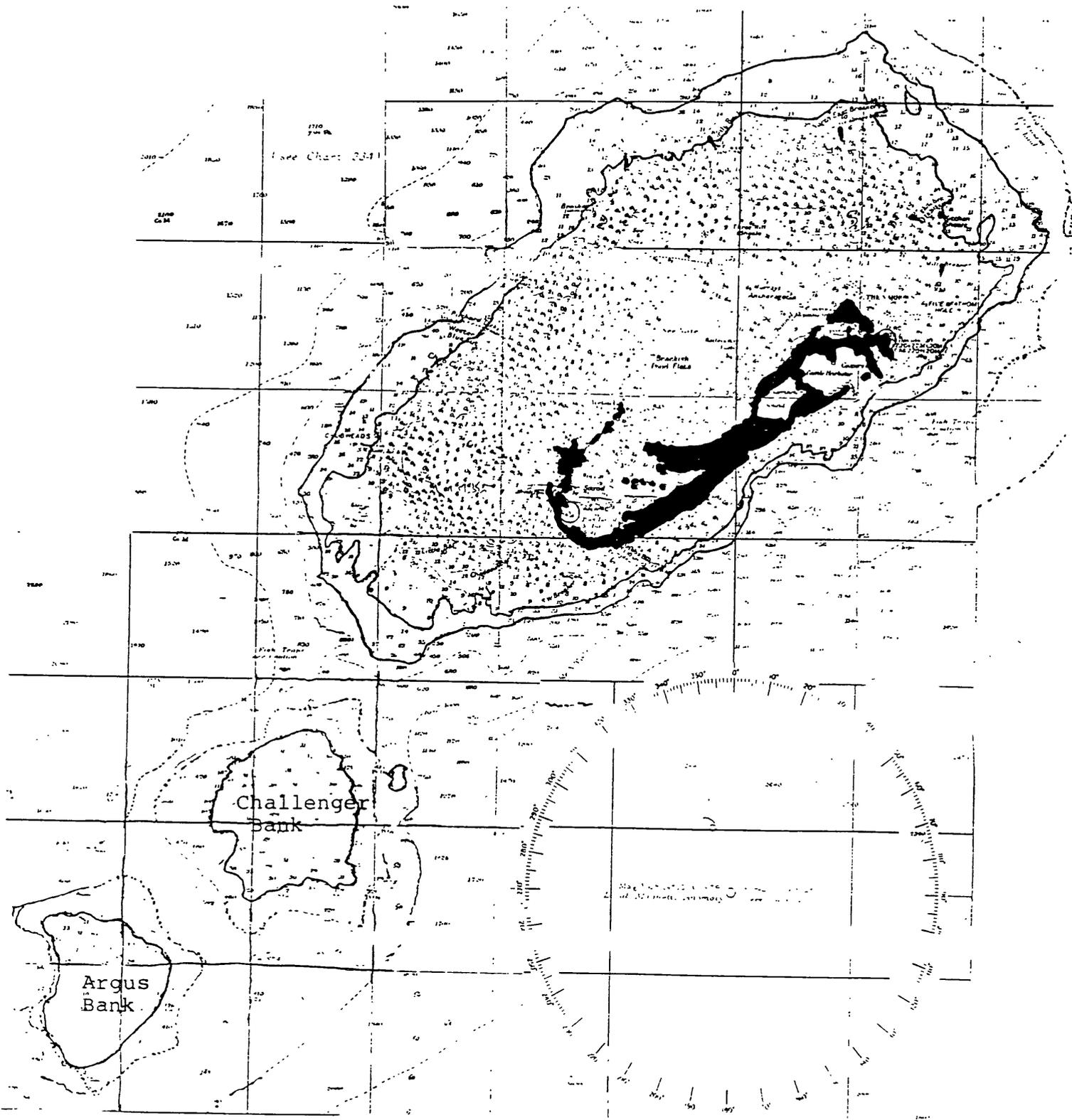
## The Fishery

At 32 degrees north latitude, Bermuda is the world's most northerly coral atoll (Ward, 1988:58). (See Map 1). This is a consequence of subtropical sea surface conditions under the influence, in summer and fall, of the North Equatorial Current and during winter and spring, of Gulf Stream eddies<sup>2</sup>. (Morris, et al, 1977:42). Geologically, Bermuda is a pedestal rising 4000 meters above the ocean floor composed of 138 small islands with a land mass of 21 square miles. This is surrounded by 450 square miles of inshore waters (called the Platform) and two offshore banks of 91

'Bermuda in the Northwest Atlantic'



'The Bermuda Pedestal'



square miles (see Map 2) . This is divided into various marine isotopes based on specific coral reef communities, bottom type, water temperature and salinity, tidal fluctuations, and depth (see Lowe-McConnell, 1977:20,33-34; Morris et\_al, 1977:9,29-30)<sup>3</sup>.

The fishery in Bermuda has three broad biological divisions: pelagic/oceanic, reef/demersal, and reef/lobster. Commercially, yellowfin tuna, little tunny, wahoo and three species of jacks - amberjack, bonita and gwelly - are the most important pelagics. Wahoo and tuna frequent the edge of the platform and the two offshore banks, jacks are caught along with reef demersal species in inshore waters. Thirty-four percent of the foodfish catch in 1988 was composed of tuna and jacks (Bermuda, Department of Agriculture and Fisheries [DAF], 1989). These pelagics are migratory and therefore highly seasonal to Bermuda waters, they school - at least occasionally - and are relatively large in average individual sizes.<sup>4</sup> The reef/demersal fishery is dominated commercially by eight species - parrotfish, various types of snapper, porgy, grunt, four species of grouper - redhind, coney, barber, and black rockfish - chub, triggerfish and hogfish. These frequent various ecological zones both on the platform, the edge, in deep water, and on the banks. The important points about these species is that they tend to be territorial, to travel and feed either singly or in pairs, and, with the exception of some snapper, grunt, coney and barber, are large in size.<sup>5</sup> Sixty-four percent of foodfish landings in 1988 were demersal reefish (Bermuda, DAF:1989). While mussels and conch were important in the past,

spiny lobster and guinea chick are the only shellfish of importance in Bermuda. These are found individually, or in migrating 'processions' inshore, on the edge of the platform and on the banks. No figures are available for shellfish landings by weight. However 51.5 thousand 'individuals' were reported caught (Bermuda, DAF:1989) . Spiny lobster average from 6 to 10 pounds individually.

Reflecting the two major changes in weather and oceanographic conditions, as well as seasonal migratory and spawning behavior of various fish species, the fishermen in Bermuda pursue two basic seasonal patterns. During the summer and early fall, pot and trolling fisheries are pursued around the edge of the platform and on the banks. During the winter and spring, pots are moved inshore - largely for lobster - and the trolling fishery is greatly reduced. For non-pot fishermen, the winter and spring is often a time when wage work is undertaken (see below) .

Based on licencing criteria, the fishing industry was divided in 1988 into three groups: a charter fleet, the pot fishery, and a residual category of non-pot-'N'-commercial fishermen (usually part-time) . The charter boat fishery is highly seasonal - between May and October. The charter boats in my sample averaged 42 feet in length and are typical sports fishing boats - e.g. Bruno or Bertram - of fibreglass or wood construction with flying bridge, outriggers, downriggers and fighting chairs. Most had a crew of two with between 4 and 20 rod and reel and gear to troll for dolphin, wahoo, tuna and, in the cases of the largest boats, marlin. Mean capital investment ranged around \$300,000 U.S. In an

average fishing day they would land between 8 and 15 wahoo and 8-10 tuna. Over 100 trips was considered a good year. Full day charters were between \$600 and \$700 a day, a half-day charter was \$450 and fish sales averaged between \$500 and \$1,000 U.S. a month. Sales were almost entirely in the wholesale sector to hotels and 'tourist' restaurants. There were 28 charter boats registered in Bermuda in 1988.

Pot boats were considerably smaller in size averaging 27 feet. While the numbers of legal pots per boat was highly regulated, fishermen reported a varying range: small-scale fishermen from 8 to 10; most averaged 20 to 30; a few had more than 50.<sup>6</sup> In addition, most boats would have hook and line gear either for trolling, drift fishing, or handlining. In addition, pot fishermen hauled bait in inshore grassy bays and inlets using cast nets and beach seine. Capital investment in the pot fishery averaged \$200,000 U.S. Pot fishermen since 1984 were legally obligated to fish minimally 100 days a year. I found that this was a low minimum as averages ran 120 to 150 days a year (see below). During the average fishing day, 4-5 hours would be spent tending pots and 4 to 6 hours would be spent preparing the catch for sale. A good summer trip catch was 1,000 lbs. of large fish, 800 lbs. of small 'fillet' fish, and 200 lbs. of lobster. A good winter catch was 300 lbs. of large fish, and 100 lbs. of small fish. Pot boats were heavily oriented to the direct sale retail market and to a lesser extent the wholesale 'local' restaurant trade. Summer sales were often comprised of 40 to 80% lobster. Average summer monthly

receipts were worth \$4,000 - \$6,000 U.S., while \$2,000 U.S. a month was a high average for the winter. There were 88 vessels with a pot fishery licence in 1988.

'N' boats are similar in average size to pot boats but usually have considerably less equipment reflecting the largely part-time nature of this fishery and lower incomes earned. Fishing gear is wholly hook and line - rod and reel, handline and occasionally surface longline - and net. Average capital investment is \$80,000 U.S. These fishermen indicated they averaged between 50 and 100 trips per year. A good summer catch was 50 to 200 lbs. per trip, while winter averages were 10 to 50 lbs. per trip. Fish sales were correspondingly low with a high summer monthly average to be \$500 to \$1,000. These fishermen were almost entirely subsistence or direct sale retail market focused. There were 98 'N' fishermen in Bermuda in 1988.

### Conservation Dynamic

Anthropologists in recent years have explored in detail the relationship between patterns of communal resource tenure and incipient management (see Acheson 1988; Johannes, 1978; Berkes, 1987; Durrenburger and Palsson, 1987). The most balanced accounts have outlined the factors, both direct and indirect, that have a conservation effect in this context. Examples of measures that have direct conservation effects are restrictions on access - e.g. ingroup-outgroup territorial or seasonal restrictions - and catch quotas in terms of either overall catch or particular species.

Indirect measures relate to customs such as cultural taboos, economizing behaviour that has a latent conservative effect, norms of social conduct that discourage rampant competition or waste and encourage co-operation, sharing and reciprocity (see McCay and Acheson, 1987:10-15).

Bermuda up to the late 1960's was characterized by a marginal commercial fishery. Technology was simple, incomes were low, and effort was limited by the part-time nature of fishing. The fishery was self-regulated on a community and kinship basis through various patterns of customary tenure. Territoriality was an integral part of a normative structure of sharing and reciprocity, respect and generocity that characterized working class communities. Wages were low, especially for blacks. Working people, irrespective of trade or occupation, had to pursue a number of different activities to make ends meet. The market for fish was particularly weak as Bermudians had relatively easy access to fish if they needed it. Abundant supplies, fairly narrow tastes, and low incomes constrained market growth dramatically. Consumers only wanted premium white-flesh meat - grouper and snapper - and would or could only pay very low prices. Since the prospects for earning cash were limited, subsistence production - gardening, fishing, raising chickens or pigs, home production, and so on - were vital to most working class households. Households, particularly with water access, would have a few fish pots that they tended on a regular basis for their own use. Moonlighting and multiple job holding was and is a common household strategy as well. In many

respects economy and society at this time was based on the informal sector: subsistence that provided for basic needs and reciprocal exchanges that knit the community together. (See Barrett, 1989). Courtesy and respect, sharing, and mutual assistance were cultural expressions that cemented horizontal class and community ties. The renowned Bermudian 'friendliness', which has been so instrumental in making Bermuda an attractive tourist destination (see Manning, 1979) , was born out of an egalitarian ethic rooted in community but also the struggle to survive.

Up to the early 1970's, self-regulation was accomplished through three patterns of customary tenure: communal, territorial, and positional. All three patterns reflected the sedentary nature of the reef-pot fishery. Communal tenure was a pattern that emerged around at least four grouper spawning grounds. Specific groups of fishermen would attempt to hold grouper in these areas by intensively baiting the ground over long periods of time. My information indicates that access was limited to certain fishermen (nucleated-defense) and that this was enforced by various measures notably cutting away non-member pots (perimeter defense). Territorial and positional tenure were two forms that corresponded to kinship-based fishing territories. The former were permanent fishing areas that would be baited up and used by particular families (see Anderson, 1984; 1986). The latter were based on inherited 'marks' which fishermen used on a seasonal basis. In contrast to the fixed cultivation strategy inherent in communal and territorial tenure, this pattern was analogous to shifting

cultivation with spacing etiquette and secrecy attached to it.

I had a clear sense from my respondents that in the past latent and overt practices related to effort and the catch were the basis for an indirect conservation dynamic. Prior to the mid-1970's, the fishery was necessarily pursued in a much more diversified manner and on a more occasional basis. The underlying dynamic was a function of the market. Prices and incomes were so low that fishermen were hard-pressed to modernize, this prevented technology and effort from reaching disruptive thresholds. Low incomes also meant that fishing was pursued on a part-time or subsistence basis as part of a general pattern of plural activity. This also kept overall effort levels low. Prior to the professionalization of the fishery, diversification within the fishery was greater, and had a similar latent conservation effect by providing certain areas and species a regenerative period each year. One fisherman remembered how he would haul his pots out of the water during the summer (spawning season) to concentrate on other activities related to tourism. The demand structure was not only price inelastic but fairly rigid in terms of consumer preferences. Fishermen could only sell 'prime' rockfish and grouper. The 'trash' and 'fillet' fish that now comprises the lion's share of the catch had only a limited value as bait, or was not targeted at all. The retail trade was a whole-fish trade so that the undersized fish that would now be filleted were generally thrown back. Customary tenure had the effect of limiting overall entry levels, and ensuring that fishing practices followed

established patterns. This was especially true in terms of pot-setting etiquette which again kept a check on effort levels. Positional tenure had an especially interesting conservation effect by encouraging 'fallow' cultivation of fishing grounds. The upshot of these factors meant there were more fish around. And, with more fish available, fewer pots and less effort was required to catch the fish.

The downside of traditional conservationism was its relationship to low income. Fishermen in the 1950's and 1960's faced the kinds of problems that characterize Third World economies today. Poor and inefficient technology accentuated seasonal fluctuations in supply. Fishermen lacked vessels of a size and engine type that would allow them to increase their catch, particularly during the winter by utilizing the offshore banks. Price inelasticity made fishermen largely price-takers, particularly during periods of peak supply in the summer months<sup>7</sup>. Low overall prices meant low incomes, low incomes meant low investment levels as well as reduced effort levels since fishermen had to pursue other jobs and activities to survive. From an economic standpoint therefore the traditional fishery was far from idyllic. It was characterized by an underemployment-underinvestment cycle that perpetuated poverty and marginality. Neither fishermen nor the state were happy with this state of affairs.

### Overfishing Dynamic

#### (1) Modernization phase

Bermuda went through a modernization phase in the fisheries beginning in the late 1950's with the sponsorship of a seminal series of biological and economic reports on the state and potential of the fishery by J. E. Bardach. In some respects the 1960's and early 1970's represented a honeymoon in the relationship between fishermen and the state in Bermuda. Fishermen were primarily concerned with improving their incomes and professional status and this coincided with a clear modernization thrust to government policy. This period ended in the late 1970's with growing efforts by that state to regulate fishery activity.

The state, or more to the point, the local Board of Trade, sponsored a scientific assessment of fish stocks and economic problems in the industry in the late 1950's. As in many other areas, the business elite in Bermuda was clearly intent on modernizing and developing its local economy. J. E. Bardach produced a number of seminal studies on reef fish stocks and a pioneering policy document which led to the organization of a fisheries portfolio in the government. On the one hand, he put forward a highly optimistic stock assessment, particularly of grouper stocks on the offshore banks projecting in fact that 2.5 million pounds of fish could be caught in Bermuda waters with a modernized industry<sup>8</sup> (Bardach, 1958:1; 1959). This required a modernized fleet, onshore processing and storage capacity, and a rationalized grading and distribution system. He also strongly

promoted government research and development and the formation of fishermen's associations and cooperatives. To facilitate this he called for a new government department with full-time staff, government assistance to help fishermen organize, co-operative or state owned cold storage and marketing facilities, and financial assistance for the mechanization of boats and gear (Bardach, 1958:30-35).

During the next fourteen years, fishermen received custom exemptions on gear and vessels, gasoline tax rebates, and access to low interest loans for vessels and equipment purchases. A vast majority of fulltime fishermen that I interviewed who had been in the industry through this period went through two and three boats, buying and trading up and improving their capability with hydraulic equipment, diesel engines, VHS radios, depth sounders, cold storage capacity, and, in some cases, navigational aids and fish finders. The most dramatic improvements were in fishing equipment and materials however: monofilament line, nylon and fiberglass materials, steel mesh, and reinforcing rod.

Beyond a certain scale, Bermuda fishermen showed prudence in their investments. Increases in vessel size, for example, does not seem to have been a significant type of expansion<sup>9</sup>. An optimal intermediate scale vessel was largely dictated by the proximity of the lucrative inshore lagoon and reef fisheries, and, prohibitive fuel costs. Nor did the industry, even after the extension of an exclusive fishing zone and territorial limit in 1972, experience a dramatic influx of new entrants. Unlike other areas where fishing

has an important labour absorption function, in Bermuda, a boom economy and full employment have created labour shortages in fishing<sup>10</sup>. This is now clearly reflected in the age structure of the industry.

This is not to say that conservative investment decisions had a conservation effect. A general inflationary trend through the 1970's and 1980's at all levels of the economy, had a significant 'push' effect on fishing effort. This began with monetary conversion to the dollar system, and continued with increases in import duties, higher wage settlements, and rising housing costs associated with an explosion in the international business sector. Basic costs of living, apart from rising operating costs, propelled fishermen to increase work and effort levels. The impact of these changes on traditional working class reciprocity was dramatic: sharing and generosity were replaced by the 'hustle' (see Barrett, 1989). One normative pillar of customary tenure started to crumble.

Had the domestic market for local fish remained price inelastic, modernization efforts by the government would not have had much impact since increasing catches would have only lowered prices, and the added costs to fishermen could not have been recovered (see Rodman, 1987). As it was, however, two developments improved the marketing structure creating a significant 'pull' effect on fishing effort. First, incomes and the general standard of living of the working class improved dramatically and the tourist industry - and wholesale market for fish - exploded,

improving demand and the overall price structure. Second, through a newly formed fishermen's association, fishermen successfully lobbied with the government for professionalization. 'Amateur' fishermen were seen by fulltime fishermen as cutting into their retail market. By 1972 the state had restricted the lucrative pot fishery to licenced commercial fishermen only. So not only were prices better but fewer fishermen were taking larger shares of an expanding pie. The underemployment-underinvestment cycle had been reversed but in the process had ignited an overfishing dynamic that threatened traditional conservation.

While the burgeoning market of this period underwrote the modernization of the fleet, it undermined nascent government and fishermen's attempts to organize co-operative marketing strategies. The retail market expanded in the mid- and late-1970's based on direct sale and fish peddling. Decentralizing technology in the form of small freezers and ice chests, small trucks, and mini-vans allowed an age-old tradition - originally based on house to house peddling by wheelbarrow - to flourish. Individualism became the new ideological sinew of the industry frustrating efforts to organize co-operative markets and posing a significant new normative basis for fishing itself. For if one could make a good living<sup>11</sup> through individual competition in the marketplace it was only a matter of time until one would approach catching fish in the same way.

Fishermen reported that the first form of self-regulation to go was communal tenure. Grouper were very vulnerable during

spawning aggregations and only remained protected as long as local groups practices nucleated-defense. When this ended my informants told me the old members of the nucleated group were the first to overfish grouper in these areas to prevent others from reaping 'their' harvest. Fishermen also reported regional shifts in effort by a number of big-boat fishermen with extraordinarily large pots. Violations of positional tenure etiquette was the most common complaint in this regard. Fishermen reported that people would carefully monitor how well others were doing and then invade their areas if they were successful. Others reported they had to give up traditional territorial tenure when fishermen would drop pots in their baited areas when they were not around. This period was also characterized by a widespread rise in poaching, gear conflict between trolling charter boats and pot fishermen, and intergenerational fights between younger 'cowboy' fishermen and the older 'farmer' fishermen.

By the late 1970's, nearly all preferred species were under substantial stress. This was especially true of the dominant grouper catch. Between 1975 and 1978 black rockfish landings had declined by 44.6%, monkey rockfish by 42%, gag rockfish by 63.4% and nassau grouper by 68.2% (Bermuda, DAF, 1989). In addition, lucrative stocks of red hind and snapper were also in decline (Bermuda, DAF, 1984:14). Under the circumstances of collapsing self-regulation, a classic 'tragedy of the commons' had been unleashed. The stage was set for a shift in state policy: away from modernization toward regulation.

(2) Regulatory phase

I will argue that the ultimate effect of state conservation policies from the late 1970's onwards was the opposite of what was intended. This can be understood at two different levels: at the level of decision-making a structure emerged designed ostensibly to improve fishermen organization and consultation but which had the effect of delegitimizing state policies and officials, and atomizing fishermen. At the level of regulations, management policies designed to reduce effort and limit entry led to an exaggerated state of overfishing.

The policy formulation structure in Bermuda is typical of many countries, notably Canada. It is based on a consultative process whereby statutory advisory committees composed of representatives of various interest groups and community leaders make recommendations to the Minister on licencing and effort regulations and arbitrate disputes (Bermuda, DAF, 1984:28-30). In effect the Fisheries Advisory Committee, created in 1972, and the Fisheries Commission, created in 1984, were groups that thrashed out and fine-tuned policies developed by bureaucrats and scientists. Their primary purpose was to legitimate and administer policies by giving a facade of consultation. These Committees also ran interference for fishery managers and politicians by taking the blame for practical decisions on cutbacks and licence cancellations once policies were in place. Policy-makers argued the general merits of regulations, but would not be culpable for their practical effects, (see Valdes - Pizzini, 1990:165).

Fishermen had seats on each committee but were largely powerless to affect policy changes being in the minority on each committee and not representative of any coherent constituency. When an issue illicited collective opposition, as occurred in 1978 to fishing area closures, fishermen's structural impotence was clearest - their associations formally lost their seats on the Advisory Council. While this was an exceptional case, and short-lived, government officials realized the importance of having individual fishermen in the consultation process who were 'reasonable', representing interests that were more in line with the thrust of government policy. The effect was to coopt fishermen rather than give them real representation despite the longstanding rhetoric by government officials decrying fishermen's disunity and the need for greater organization. The structure relied on an age old patronage tradition in Bermuda (see Manning, 1973). Fishermen turned to individual appeals of either a flattering or intimidating type to get special consideration.<sup>12</sup> A number of policy flipflops over licencing and area access both exaggerated the cynicism of fishermen in the entire process and increased the level of clientism.

Regulatory policies in Bermuda began with the introduction of compulsory daily logs for fishermen in 1972. In the same year closed seasons on conch and lobster and a protected spawning ground for red hind and nursery stocks in grassy bays and inlets were introduced. Extended area closures in 1973, 1974 and 1977, pot fishing licencing on Argus Bank in 1978, and a total ban on conch

and turtle fishing led to the dramatic break between fishermen and government at the moment when government officials needed their cooperation the most with the establishment of Sargasso Seafoods.<sup>13</sup>

The 1980's saw the introduction of a second round of regulations designed to control entry and effort, particularly in the pot fishery. Two regulations had the most dramatic effect. In 1982 a significant number of part-time pot fishermen were forced out of the industry as the government imposed a 100-fishing-day<sup>14</sup> rule. At the same time, the number of pots in use was frozen. In 1984 a management plan was passed designed to bring the level of pot fishing to within sustainable limits by reducing the numbers of pots held by fishermen through four annual cuts. Predictably, the unintended effects of these regulations led to a third round of regulations, the most notable of which were regulations limiting pot sizes and regulations placing a minimum on fish size caught.<sup>15</sup>

The area closures and closed seasons led to a rise in the numbers of fishermen in other zones. Normative controls completely disintegrated in a scramble for the best areas as fishermen became even more conflictive, suspicious, and jealous. The elimination of part-time fishermen increased poaching and gear conflict since the part-timers now had lost a significant source of livelihood. Full-timers, on the other hand, increased their effort since extra-fishing income opportunities were now largely closed to them. If they were to keep their licences, they had to fish 100-days; if they were to earn a decent income from fishing, they had to increase their effort either by fishing more intensively, having

more and larger pots, or fishing illegally. In other words, the 'fallow' cycle associated with customary tenure and plural activity disappeared. The competitive and cost pressures to increase effort, came at a time when the state decided to enforce reduced effort.<sup>16</sup> As the numbers of legal fish pots was reduced, illegal fishing increased: the falsification of catch and effort statistics,<sup>17</sup> fishing too many pots, poaching and so on.

By the late 1980's, cynicism with government policies and officials alike, had reached a new low. There was a general feeling that stock collapse, or a fishing ban, were imminent. An 'anything goes', 'open season' mentality became more common by the late 1980's. If the future was lost anyway, one was a fool not to fish as intensively as possible in the present. An overfishing frenzy ensued threatening not only fish stocks but the reef ecology itself.<sup>18</sup>

Into the fray stepped a new player in 1987-88. An organization called 'Friends of Fish' was formed to represent non-fishing marine-user interest groups: conservationists, recreational fishermen, tourist boat operators, diving shops, and so on. Most charter boat fishermen implicitly supported this group as well. Over a two-year period, the group was highly successful in establishing in the public mind that pot fishermen were largely to blame for the declining condition of Bermuda's reefs and that fish pots should be banned. While the government attempted to appear the moderate interest in the ensuing conflict, it launched a 'marine user' survey to 'quantify' the value of the total

resource to all Bermudians (Bermuda Sun, 17 March, 1989). In 1990 a fourth round of regulations was launched to buy out all pots and ban the technology. This plan ultimately reflected the failure of the fishery management plan and the ascendance of non-fishing marine constituency for fishery policy decisions.

In a desperate attempt to protect their right of access fishermen turned to the trade union movement for support. The response of the Bermuda Industrial Union was interesting. Fishermen were welcomed with open arms and promised the full support of Bermuda's working class in their fight. Predictably this promise was not as weighty as it sounded and government defused the crisis by launching an official inquiry. However, what was interesting was the willingness of the BIU to seize on the issue in the first place. While there was an element of political opportunism in the radical discourse that was forthcoming (see Valdes-Pizzini, 1990:168-169) the support was real and reflected the importance of fishing, fishermen and fish to the working class of Bermuda. Fishing has long represented an important part of working class life: in the early days as a source of subsistence and reciprocity, in later years as an important connection to traditional culture and the focus of leisure life. Fishermen were not historically a 'class' apart from the working class, they were an intrinsic part of it on an occupational and cultural basis. They lived together, worked together, helped each other out and so on. The tertiarization of Bermuda has eroded working class traditions and led to the romanticization of what little there is left:



activities, events – both cultural and practical – and cuisine – especially 'fish'. In fact the two are linked. A real sign of status is for a truck driver, a taxi driver, or a mason is to drop \$500 for some Bermuda fish to throw a party for his mates. In the course of keeping such traditions alive, important social bonds are maintained between fishermen and their working class customers that are far richer and more meaningful than the anonymous clerk-customer relations of the new supermarkets springing up around the island. It is an important source of esteem and status for a person to have a personal relationship with his or her supplier: someone who will personally guarantee and deliver a certain amount of fish at a certain time every week. While less well organized and less articulate, the working class constituency is a significant source of support for fishermen, but unlike places like Puerto Rico, a constituency that lack's formal power.

#### Sustainable Development and Co-management

The fish pot ban in Bermuda is unacceptable as a fishery management solution. It was unnecessary in terms of conservation goals and was instituted first, for political reasons to appease non-fishing interests and second, as a consequence of the failure of earlier forms of limited entry management. The problems of the fishery have not disappeared with such draconian measures.<sup>19</sup> Coercion may seem effective in the short-term but in the long-term the chronic absence of legitimacy, and high enforcement costs will prove more costly. The problem will not disappear simply because

it has been legislated away. The issue is far from settled. What went wrong? Why did limited entry policies fail? While it is easy to blame fishermen for being dishonest and greedy, one intent of this essay has been to show that this behavior, to the extent that it is a factor in stock depletion at all, is rooted in significant 'push' factors stemming from both the economy generally and the nature of state regulations and decision-making specifically.

The fishery in Bermuda needs to be reorganized on a stable self-sustaining basis in terms of effort and conservation measures. To do this requires a restructuring of the management and fishing structures in order to add legitimacy to each. Fishermen have to accept and abide by conservation measures, managers and the state have to accept and protect the right of fishermen to fish. Co-management and co-operative fishing structures have to be established that reconstitute the kinds of relations that led to a conservationist dynamic in the past. Clearly the new co-management regime I am talking about is not simply a return to self-regulated customary tenure where enforcement was based on community norms. The new system while attempting to recapture some aspects of that self-regulating system would be contractually-based on a rule of law - albeit law rooted in custom. The idea is to provide fishermen with a security of tenure that gives them a real sense of self-determination and the objective prospect of reaping the long-term benefits of their own actions. At the same time conservationist regulations have to be relegitimized since they will only work if fishermen believe in them and enforce them. To

accomplish this a structure has to provide fishermen with a direct role in at least four areas: data collection, harvesting decisions, allocation decisions and enforcement policies (see Pinkerton, 1989a; Jentoft, 1989). For this to happen, fishermen-government attitudes and decision-making structures have to change.

(1) , Attitudes and Perceptions.

Managers have to change their attitude. They have to be convinced of the political and economic benefits of co-management but they also have to see fishermen as potential co-operators and custodians of the resource rather than antagonists and saboteurs. To a great degree, this stems from a scientific bias amongst fishery managers. They are biologists and oceanographers concerned with fish and the marine resource. While they need fishermen for data collection, their interests in fact are often with the fish rather than the people who fish. This makes them particularly ineffective managers of fishermen. They are trained to do science not run bureaucracies, respond to political agendas, resolve crises, mediate interpersonal conflicts. Their orientation to precision, order, a moral realist world of value-neutrality and fixed laws is not particularly helpful in coping with highly imprecise, conflict-ridden and chaotic reality.

A second professional bias stems from the very nature of science itself. The tragedy of the commons thesis argues fishermen are necessarily competitive and rapacious and must be regulated in the long-term interest of stock preservation. Such views present

substantial ideological obstacles to fishermen-manager cooperation. On the one hand, managers view fishermen as, at best, suspect, and, at worst, untrustworthy. On the other hand, management models based on MSY projections and stock by stock assessments rarely correspond with fishermen's experience and therefore lead to their constantly challenging the validity and scientific basis of the one thing the managers think they know well: fishery science. Managers rely on fishermen for catch and effort statistics but are unwilling or unable to consider fishermen's knowledge in other areas as legitimate. Ethnoscience is viewed as anecdotal and biased. The value of indigenous knowledge is however increasingly recognized as vital by ecologists and development agencies in efforts to achieve sustainable development. In the fishery, knowledge about spawning behavior, migration, stock interaction, and so on is invaluable in understanding basic questions about the state of the resource. This will often form the basis of ongoing scientific research. Fishermen's knowledge about catch methods and locations, and about how fishermen interact and allocate access under various conditions is particularly important in formulating conservation policies that will have a high degree of consensus. To accomplish this in practical terms it has been found that social barriers that isolate bureaucrats in their offices and scientists in their labs need to be broken down. McCay (1989) remarks on the importance of 'hands on' experience in fishermen-scientist interface. If managers felt less personally threatened by fishermen and more affinity in terms

of joint goals and problem-solving, they would benefit greatly and be more inclined to venture out 'into the human field'.

For their part, fishermen have to work on changing their image in order to be taken seriously by managers, government officials, and non-fishing marine interests alike. Their image problem stems to a large degree from their exclusion from the decision-making process to begin with but some effort of good will is needed to change people's impressions at the outset. Social scientists have stressed the importance of making a concrete commitment to co-management and conservation in the form of time, effort and money. This is perceived by others as a change from the selfish, greedy, stereotypic fishermen. Fishermen are not any more greedy than anyone else, given their circumstances. The difficulty in making this kind of commitment often stems from past experience within fishermen's associations (see Davis and Jentoft, 1989). Inept leadership, mismanagement, inappropriate or directionless-focus, and worse have made fishermen wary of investing energy and money in collective action. Effort at solid grass-roots organization is the first step in this process.<sup>20</sup>

Fishermen also have to change their attitude to the management process and authority in general. If they are going to be given a role in decision-making and implementation, the 'we-they' dichotomy has to change. Managers are often scapegoats for everything that goes wrong. Fishermen when given the opportunity to benefit from individual conservation efforts, will find they have less reason to blame others. Similarly, poaching and illegal fishing which relied

so much on the neutralization of guilt through externalized authority structures (see Taylor, 1987) will now have a very different meaning for the perpetrator as well as other fishermen (see below). While the active participation of fishermen in management policy-making will greatly change attitudes, it is incumbent on fishermen and their organizations to improve general levels of education and knowledge about the fishery and environmental issues. This will help not only improve harvesting, but aid in husbanding the commons generally. This is particularly vital for fishermen in their ongoing interaction with recreational, tourist and shipping interests.

## (2) Structures

The structure of decision-making needs to be changed to reflect the right of fishermen to manage their resource in cooperation with government interests. First, political arbitrariness and patronage needs to be removed from the selection and decision-making process. Legislation should reflect decisions fishermen and managers reach rather than consultative committees being charged with implementing decisions politicians formulate for extraneous reasons. Similarly appointments to consultative boards based on these criteria should end. Positions should be based on representative criteria. Hard decisions need to be taken as to the relative legitimacy and weight that should be given to different interest groups in the marine environment but clear mandates should differentiate forums of discussion. The most controversial

question in countries like Bermuda concerns the relative importance of non-fishing interests such as tourism in marine life forums, and the various divisions among fishing interests. In terms of the first, it is not entirely clear that tourist and fishing interests will be necessarily opposed once a conservationist dynamic is re-established. However, it is important at a political level for the state to safeguard a way of life that represents indigenous production, self-sufficiency, and diversification on an island as dependent on tourism as Bermuda. It is also important to avoid a vulgar economic judgement of the importance of the two interests by simply looking at the relative contribution of each to GNP.<sup>21</sup> Fishing is an important element in the traditional social fabric of working class culture and needs to be preserved as much as any other form of Bermuda heritage. The resolution of fishermen conflict should be accomplished outside the co-management forum to a large degree.<sup>22</sup> The bases of this in Bermuda are threefold: licencing, allocation and gear-conflict. Each of these problems can be resolved through the formulation of a coherent and equitable harvesting and allocation plan (see below).

The procedures for decision-making need to incorporate three principles: sound scientific information that utilizes biological and conservation criteria (rather than political expediency), equity of fishermen and manager participation in working groups and statutory bodies, authority to formulate and implement regulations.

The content of regulations, to be effective, need to be perceived as reasonable and equitable. They will be if fishermen

are involved in their formulation and if they correspond to what is broadly defined as relevant and acceptable (Jentoft and Mikailson, 1991). My discussions with fishermen in 1988 brought forward a number of interesting proposals which might be an indication of the kinds of options available under a co-management regime. In terms of harvesting decisions, fishermen argued for pot limits based on the basic needs of fishermen, and greater educational efforts in terms of their effective and efficient deployment - baiting, soaking period, location, construction material, overall size, mesh size and so on. It was argued that if used properly, 50 pots per fisherman could earn them a good living, given equitable access to lobster and fishing grounds. They also argued strongly for a ban on the 'fillet' trade by establishing minimum sizes and banning certain species and equipment such as grinders altogether. This could be coupled with conservation practice incentives such as graded price structures for various sizes of whole fish and so on. The recinding of the 100-day rule was also widely promoted by fishermen as a way of reducing costs and effort, and encouraging a return to better fishing practices such as fallow cultivation and more efficient pot soak times. It was also felt that fuel subsidies and guaranteed ice supplies would go a long way to encouraging fishermen to diversify and switch away from vulnerable reef stocks, particularly during spawning periods (see Townsend and Wilson, 1987) .

In terms of allocation decisions, fishermen felt all should be allocated an equal pot quota, but that fishermen should be

registered for particular areas in order to rejuvenate patterns of customary tenure and to restrict competition from recreational fishermen. Fishermen also felt that seasonal area closures should be instituted during the summer in spawning areas inside the reef line with due compensation to fishermen as an incentive to practice conservation. In addition some felt that to reduce gear conflict, one offshore bank might be reserved for hook and line fishermen to see the effects of reduced potting efforts on stocks.

Enforcement under co-management regimes is an interesting issue. It is felt by some that co-management serves to rekindle and resuscitate dormant or weakened authority structures associated with customary tenure particularly amongst ethnic or tribal communities (see Pinkerton, 1987; 1989a). Other kinds of communities are seen to present different problems. Some argue that the egalitarianism of small fishing communities prevents them from policing their own commons (see Taylor, 1987). Indeed in my research, Bermuda fishermen felt one of the major shortcomings of the limited entry system was the government's failure to enforce the regulations. Some called for the separation of management and policing functions. The norms of community and working class life in Bermuda still make it difficult for fishermen to see themselves turning in their 'mates'. This is one of the hard choices faced by fishermen for co-management depends not only on taking responsibility for one's own actions but making others accountable for theirs. This will in many respects be an important test of the sincerity and responsibility of fishermen by outsiders. Can they

effectively enforce their own regulations?

Lastly, larger issues concerning the viability of co-management in Bermuda need to be raised. One is the reef fishery itself. Much is made in the scientific literature of the inability of a reef ecosystem to sustain a commercial fishing effort (see Lowe-McConnell, 1977; Pauly and Murphy, 1982). This has been linked in many minds with the Antillean trap design as a non-selective, destructive technology. This is an important area for scientific research not only in Bermuda but world-wide. How much fishing effort can a given reef environment take on a sustainable basis? What are overall conservation limits for such a dynamic multispecies fishery? What are optimal pot mesh sizes, funnel designs, locations? What is the nature of the by-catch problem in terms of parrotfish or small reef fish?

A second issue concerns the effect of market-driven influences. The inflated demand for Bermuda fish represents the greatest potential threat to the co-management structure since fishermen are individual entrepreneurs who are vulnerable to enticements to increase effort by insatiable customers. This market structure has already been blamed for the collapse of a cooperative and processing and marketing venture sponsored by the United Nations (UNDP/FAO, 1981). It is a vexing issue in underdeveloped countries (see Johannes, 1978). On the one hand, cost push factors clearly impelled fishermen to charge higher prices through the late 1970's and early 1980's, particularly when fishermen lost their fuel subsidy. The involvement of a

fishermen's association in input purchasing would greatly alleviate this source of increased effort. On the other hand the pull factors associated with direct retail sales is not simply avarice. As we have seen fish peddling is an institution in Bermuda and fisherman and customer alike relish the personal contact and interaction. This aspect need not be eliminated in an effort to control the negative effects of demand. Fish prices generally conform to an island-wide average and little price-cutting exists therefore it would be relatively easy for a fishermen's association to take a more formal role in regulating the market by imposing price ceilings.<sup>23</sup> In addition an association could become involved in the wholesale import of fish (for resale by individual fishermen) in order to allow them to maintain an income during seasonal area closures. These measures might save the best aspects of the existing marketing structure while neutralizing the worst effects of demand pull on fishing effort and customary tenure. In a fundamental sense such controls may be as institutionally important to the success of co-management as the organization of fishermen. Indeed all three things are closely interrelated.

ENDNOTES

1. The information on which this paper is based was gathered during a 16-month research project in Bermuda in 1988-89. The initial focus of the study was the failure of a UNDP/FAO fishery project, however, it burgeoned into a broader examination of modernization and management problems facing the artisanal reef fishery. The study entailed participant observation research and a survey of 43 fishermen. The latter represented a 79.6% completion rate on a 25% random sample of 214 fishermen. The sample was stratified by vessel licence and location. The average length of these interviews was 80 minutes. I also conducted a short self-administered, mail-out survey of the wholesale fish market in Bermuda. This involved a 50% random sample of 246 restaurants, hotels and guest houses, and supermarkets and groceries. The completion rate in this study was 24.2% overall. This paper represents an abbreviated analysis of some of the data gathered. A book-length manuscript is currently under preparation. The research was supported by a grant from Saint Mary's University and privately by Susan Price Barrett. While they bear no responsibility for any interpretations in this paper, I owe a tremendous debt of gratitude to the fishermen of Bermuda and the staff of the Division of Fisheries. I would also like to thank Mrs. Margaret Cheyne, Mrs. Anne Greaser, for clerical assistance at various stages, and Mrs. Olwen Price, for keeping me up to date on developments in the fishery since I left.
2. Bermuda lies 250 miles south-east of the nearest edge of the Gulf Stream.
3. Like most oceanic marine atolls, Bermuda's oceanographic environment is a paradox. It is a marine oasis located in the middle of one of the world's great oceanic deserts, the Sargasso Sea. Primary and secondary productivity on the Bermuda platform are estimated to be ten times that of the surrounding sea as a consequence of the island mass upwelling effect, land runoff and sewage input, and, most importantly, the self-sustaining coralline environment (see Longhurst and Pauly, 1987: 124-131; 137-144).
4. The tuna range from 20-60 lbs, the wahoo from 30-60 lbs, and jacks from 20-70 lbs.
5. For example, parrotfish range from 20-40 lbs, porgy, chub, triggerfish and hogfish from 7-30 lbs, while the larger species of grouper can be over 100 lbs.

6. Fish pots were a variation on the classic Antillian arrowhead design. Octagon in shape and constructed of 2" hexagon wire mesh and framed, traditionally, using spice sticks but more recently using reinforced rod. Sizes ranged from 3 x 3 x 1 1/2 to 8 x 8 x 4. Fish enter by means of a funnel of either horse-neck or straight design. Funnel opening sizes are varied for fish or lobster.
7. Interviewed by the press in 1964, one local fisherman remarked, "The price of fish cannot go any higher or people will buy other things"...(Mid-Ocean News. 4 January, 1964).
8. At their peak in 1987, total recorded fish landings only reached 1.7 million lbs. Grouper landings peaked at 452,000 lbs in 1975 (Bermuda, DAF, 1989).
9. There was a dramatic failure of one locally promoted trawler venture in 1982 as testament to this trend (see Royal Gazette. 22 March, 1982).
10. For an Island of only 20 square miles with a population of 60,000, Bermuda boasts a number of records. It has the highest income and GNP per capita of any country in the world (Gurr, 1984; Manning, 1979; Murphy and Gomez, 1981; Smith 1988). Bermuda is domicile for 1,337 captive insurance companies or 93 percent of the world's total number (Bermuda Sun. 17 April, 1989; Royal Gazette. 13 April, 1989); and is, reputedly, the world's second most successful tax haven (Royal Gazette. 16 January, 1989). Bermuda's labour force participation rate for men and women is 91 and 73 percent respectively, making it the highest in the world (Bermuda, Ministry of Finance (MF), 1984; Royal Gazette, 10 April, 1989; Smith, 1988). Unemployment has hovered between 1.5 and 2.5 percent since the early 1960's (Bermuda, MF, 1984:38; Richardson, 1963:5). Bermuda has no foreign debt and in 1987 declared a record \$9 million on its balance of payments (Royal Gazette. 7 June, 1989).
11. To earn a good living and support one's family was the clear measure of success in the artisanal fishery. I estimate that less than 10 percent are involved in fishing or other ventures in a manner that would normally be considered petty capitalist. At most this would be buying a share in a restaurant operation or importing fishing gear or fish for resale. In a few cases it involved having more than one boat and licence. On the other hand these few cases were considered by fishermen to be the initial culprits in the disintegration of customary norms.

12. This is also a common experience elsewhere. Pinkerton (1989b) observes,  
Advisory committees made up of fishermen's representatives often become unworkable when some groups withdraw from the committee to protest government actions they consider unfair. Lacking a rationale for allocating more to one group than another, government managers may follow the path of least resistance and respond to the largest and loudest lobby. Such a response is not necessarily the most desirable one for conservation or equity.
13. In the late 1970's the UNDP and FAO sponsored a fishery development project designed to modernize and rationalize the industry on a co-operative basis. The failure of this effort and the relationship between co-operativism and co-management are explored elsewhere (see Barrett, in preparation).
14. In one of the great ironies of the period this 'conservation-minded' measure was justified using the old modernization rationale of the 1960's. Plural activity was seen as a source of inefficiency and excessive entry. Overcapitalization, it was argued, could be reduced by forcing fishermen to specialize (see Bermuda, DAF, 1984:16). In fact, of course, it is quite the reverse (see Townsend and Wilson, 1987).
15. The practical contradictions elicited by fisheries regulations around the world are staggering. Gear restrictions and licencing increase unequally among fishermen and the incentive on the part of the disenfranchized to poach. Area closures exacerbate over-capitalization of vessels since the greater the mobility the larger the catch. This in turn aggravates gear and area conflicts among fishermen as customary tenure is upset. Quotas and seasonal closures increase the intensity of fishing effort and overinvestment by putting a premium on certain stocks, in particular locations, for a limited period of time. Quotas, closures and restrictions inhibit accurate self-reporting of catch and effort statistics undermining the quality of data available to managers and the further lack of confidence fishermen have in the ability of managers to regulate the industry (Jentoft, 1989:138-139; Townsend and Wilson, 1987:318-321; Bannister, 1989). As the viciousness of the circle increases, state managers entrench, faced with the imminent collapse of fish stocks in spite of limited entry programs. More and more resources are poured into more complex regulatory regimes that are less and less theory-directed and increasingly coercive. Overfishing, poaching and other forms of 'primitive' rebellion emerge as predictable responses to what is defined as an illegitimate external authority. (Taylor, 1987; Davis and Kasdan, 1984; Hobsbawm, 1959).

16. A fuel subsidy was recinded at this time by the Ministry of Finance. This reduced greatly the ability and willingness of fishermen to venture offshore or experiment with alternative fishing methods.
17. Once fishermen begin falsifying statistics, the legitimacy of state policy is further undermined since regulations are seen to be based on incorrect information. (Pinkerton, 1989b:13).
18. A variety of previously untargeted herbivore - parrotfish - came under heavy pressure. These fish are instrumental in the maintenance of a healthy reef environment. (see Lowe-McConnell, 1977).
19. Predictably, there is already some evidence that the increased numbers of fishermen now forced to concentrate on the line fishery have led to heightened gear conflict between commercial and charter fishermen, and to exaggerated pressures on certain species such as white water snapper (Royal Gazette. 28 August, 1990; 28 September, 1990).
20. The circumstances under which fishermen organize and the type of organizations they form are broad issues indeed. The ideological constraints on collective organization and the implications this has for co-management are explored elsewhere (see Barrett, in preparation).
21. Even using multipliers, such estimates discount the value of non-monetary transactions and social benefits in a broader social economy.
22. Pinkerton (1979b) notes that the internal resolution of differences is more likely to produce equitable criteria for allocating harvesting rights than letting differences prevail in the representation of competing interests on co-management committees.
23. Although as Bailey and Jentoft (1990) point out, under conditions of resource scarcity, price controls will often lead to a black market (339) . This underscores even more the importance of an organizational integration of co-management and co-operation structures (see Barrett, in preparation).

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