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Anthropology, sustainability and the case of Mexico's sea turtles

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The University of Arizona, 1992

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ANTHROPOLOGY, SUSTAINABILITY AND THE CASE OF MEXICO'S
SEA TURTLES

by

Jessie Celeste Piper

A Thesis Submitted to the Faculty of the
DEPARTMENT OF ANTHROPOLOGY
in Partial Fulfillment of the Requirements
For the Degree of
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ABSTRACT

Mexico was formerly an important breeding ground for six marine turtle species. Over the last several decades, overexploitation of turtles for their meat, eggs, and hides, as well as habitat destruction, has led to alarming rates of decline in all species.

The problem of sea turtle conservation is a promising area for questions of anthropology and sustainable human systems because decline of these species is related to unsustainable development and subsistence practices that have disenfranchised small coastal fishing cooperatives. Common property resource theory aids the analysis of the context in which overexploitation takes place.

Conserving sea turtles will depend on the development of localized institutions for managing natural resources in perpetuity and for negotiating the array of regional, national, and global factors relevant to sea turtle endangerment and preservation. Anthropology can play a vital role in this process of developing sustainable interactions between human subsistence needs and natural resource conservation.

INTRODUCTION

Before overharvesting and habitat destruction drastically reduced their numbers, five species of marine turtles flourished in the waters of western Mexico, streaming into the Gulf of California in such large numbers that early navigators complained the progress of their fleets was slowed by masses of migrating turtles (Cliffton 1990:44). The turtles came ashore seasonally to lay their eggs on the sandy beaches of the southwest coast and several of the Gulf islands. In the spring, virtual flotillas of Chelonia mydas (the green turtle) migrated north to the coast of Sonora where the Seri people relied on them as a major element in their diet. (Felger and Moser 1985: 57-58).

The Seri, like the Nahua of Michoacan, harvested turtles on a subsistence basis, relying on the rich protein source of turtle eggs and meat, and utilizing the hide and carapace as well (Nietschmann 1973; Felger and Moser 1985). With the advent of commercial fisheries markets in the 1930s, fishing and turtle hunting were transformed by the gradual introduction of more efficient technology and greater numbers of fishermen. (Felger et al. 1976; Cliffton et al. 1981). Recent harvesting of sea turtles has not been for subsistence needs but largely to supply urban, metropolitan demands for luxury items such as cosmetics, leather products and aphrodisiacs (Cliffton 1990:44).

In the last few decades, human activity that impinges on sea turtle habitat as well as accelerated harvesting of sea turtles for their meat, eggs, and hides has led to a rapid decline in the populations of all Mexican sea turtle species (Cliffton et. al. 1981). Several of the species of sea turtles at risk in Mexico also make their way to the waters of the United States, where they are listed as endangered or threatened under the guidelines of the 1973 Endangered Species Act (National Research Council 1991: 1).

The Mexican government has recently enacted a moratorium on the taking and marketing of all marine turtle products (Marine Turtle Newsletter, July 1990), and turtle harvesting is now carried out as a black market activity. Japan, a major market for turtle products, recently announced that it would begin to comply with CITES (Convention for International Trade in Endangered Species) regulations and would curtail the importation of sea turtle products (Marine Turtle Newsletter, October 1991). Both of these legislative moves are significant, but they will not repair the damage already done to sea turtle populations and they do not contribute constructively to future wise use of resources.

In western Mexico the problem of sea turtle decline is directly linked to the socioeconomic condition of economically disenfranchised coastal peoples whose position

in relation to the national and global economy forces them to exploit an already depleted natural resource by denying them access to other possible sources of income. When a narrow range of economic ventures (e.g. selling sea turtles, migrating to work in border industries) exists, people tend to become more and more dependent upon those ventures to the neglect of others, leading to a decrease in the diversity of subsistence opportunities. This lack of diversity in turn forces further adherence to the pre-existing narrow range of subsistence options, creating a cycle that can lead to concentrated pressures on certain habitats or individual species.

Because human subsistence activity is involved directly or indirectly in threats to sea turtle populations, anthropology can contribute to an understanding of the issues in conservation through analysis of the elements involved in sea turtle overexploitation. While other social sciences may provide tools for analyzing certain aspects of human activity -- e.g. economic exchanges, social relationships and problems, etc. -- anthropology is unique in its ability to relate the various levels of human activity in a complex whole, studying the relationships between the material, cognitive and behavioral aspects of human systems.

Human institutions and subsistence systems operate

together to create the mode of resource utilization that produces threats to wildlife indirectly through habitat destruction and directly through predation on the species. Yet a survey of sea turtle conservation literature reveals a notable lack of emphasis on the human elements of the problem. Merely focusing on the habitat and resource needs of an endangered species, as is often the case with biological approaches, produces a conservation strategy that does not take the economic needs of local inhabitants into account. With an economically exploited species such as the sea turtle, conservationists need to gain an understanding of the human needs that conflict with the needs of the animal. Although some projects are concerned with local issues in human communities and have incorporated these into their conservation programs (see Alvarado and Figueroa 1990a, 1990b), discussion and analysis in the literature is limited.

The levels of environmental disruption that human society is now confronting call into question the nature of modern subsistence modes and the institutions that support them. Through its ability to analyze the variables at play in a given institution or subsistence mode, anthropology can contribute to the search for human production systems that are less disruptive to the environment.

ANTHROPOLOGY AND SUSTAINABILITY

The sea turtle trade can be viewed largely as a First World Demand-Third World supply problem that overrides long-term local needs and drives unsustainable modes of resource exploitation. The unsustainable mode of resource exploitation is characterized by short-term profit motives with no regard for the perpetuity of the resources or for subsistence modes that can be relied on by future generations. The exploitation of sea turtles is driven purely by economic concerns that manifest themselves without consideration for the fragile ecological conditions or longterm social and economic needs.

A sustainable system, by contrast, is one that is based on the productivity level and turnover rate of the resource base. Energy flow and cycling through an ecosystem create limits on extraction and the need for attention to the replacement time for renewable resources (Odum 1989:45). Planning for long term stability in human communities calls for concern for the ecological scale rather than the scale produced in systems driven by amounts of capital and technological inputs that cannot be absorbed without producing widespread disruption of the environment.

In a sustainable system, subsistence modes are designed as much as possible to take advantage of a diverse array of resources rather than to put pressure on a narrow range.

Also, they attempt to maximize the linkages between trophic levels in an ecosystem, to mimic the exchanges that occur in nature to the greatest extent possible rather than attempting to supercede them with inputs that overdrive the system and isolating species to exploit them with a "mining" approach. This builds some of the resiliency of the natural system into the human subsistence system (see Odum 1989:51). By creating alternate pathways for energy-harvesting, sustainable subsistence modes minimize risk and adjust production to the carrying capacity of the resource base.

In terms of social institutions, sustainability calls for management of natural resources for long term productivity rather than over-extraction for short-term profit. Although "long-term" suggests an unspecified period, populations, human and otherwise, develop interactive patterns over long periods of time. Short, rapid periods of change requiring constant adjustment may not provide the necessary foundations for sound cultural or economic development. May concluded that stability systems leads to greater complexity in natural systems (May 1973). Abruzzi was able to demonstrate a positive correlation between ecological stability and human community diversity and productivity (Abruzzi 1987:335). The nature of mobile capital and shifting natural resource demand driven by

market pressures may lead to transient socio-cultural arrangements that are not inherently stable.

Within the human community, institutions in a sustainable system attempt to allocate resources and provide for decision-making on an equitable basis to ensure greater social stability. It should be recognized, however, that there may be an inherent conflict between egalitarian goals and the efficiency of operation implied by sustainability. In fact, the entire spirit of free enterprise, and along with it the notion of personal freedom, in the socioeconomic sphere, may be ultimately challenged by concepts of sustainable human systems.

Because of the variety of variables feeding into the sea turtle problem, it is a rich area for the analysis of the anthropological aspects of a specific conservation issue and the question of sustainable futures for human communities. The problems of natural resource conservation have been addressed by anthropologists using common property resource theory (McCay 1980; Wade 1986; Berkes et. al. 1987; McCay and Acheson 1987; Acheson 1988). They have been able to demonstrate that human communities often generate local institutions that have the effect of conserving natural resources, even when they operate with some other immediate goal, such as protecting a group's resource-gathering territory. Those studies that focus on fisheries are

directly relevant to the sea turtle problem, while others provide perspective in relation to other resources. For example, Wade's discussion of property control in Indian villages demonstrates reasons for villagers' willingness to adhere to local land management agreements when there may appear to be advantages to acting opportunistically instead (Wade 1986:231-232).

In these studies, analysis of the interplay between resource exploitation and social institutions provides important guidelines for analysis of sea turtle decline and preservation. The dynamic between institutions and subsistence activity is a crucial issue for structuring sustainable modes of resource exploitation.

Common property resources theory was developed in response to Hardin's assertion that resources held in common essentially create an open-access situation that inevitably leads to the degradation of the resource base and a decline in returns for users (Hardin 1968). Other theorists have responded by pointing out that common property arrangements vary in degrees of access and control over the resource base. Berkes et. al note two key characteristics of common property resources: 1) exclusion (i.e., control of the number of potential users is problematic) and 2) subtractability (i.e., use by any user is capable of subtracting from the yield available to others) (Berkes et.

al 1989:91). Local institutions for resource management must deal with the "potential divergence between individual and collective economic rationality in joint use" (Ibid).

The tensions between individual and communal access are dealt with in a variety of ways in indigenous resource management schemes. Privatization and government control, once seen by Hardin as the only means of preventing the "tragedy of the commons" are no longer viewed as necessary answers to resolving the tensions between individual and communal use and in many cases they may actually inhibit the formation of more viable local resource management arrangements (Berkes et. al 1989:92-92). Ostrom argues that ""Sucessful" institutions are rich mixtures of "private-like" and "public-like" institutions defying classification in a sterile dichotomy" (Ostrom 1989: 17).

Acheson's descriptions of localized sanctions in Maine lobster fishing groups illustrates an example of what seems to be a positive interplay between these institutions and resource use (Acheson 1988:153-159). He specifically demonstrates the economic and biological benefits that derive from territoriality. His definition of territory is a "perimeter defended" area, i.e. an area in which a group of users defend their exclusive right to exploitation of resources. In the case of the Maine lobstermen, a combination of coercion and appeal to traditional use of the

area is used to defend the territory. Acheson contrasts the perimeter defended area with the "nucleated" area, one in which territory is defined solely in relation to distance from the user group's home port. On the periphery, claims break down, leaving margin for conflict and unregulated access to resources (Acheson 1988:79-83).

There are several important components to Acheson's description of perimeter defended territory. First, traditional use over long periods of time leads to fishermen's knowledge of the resource base, its level of productivity, and turnover rate. This provides them with an awareness of the maximum level of extraction of resources the area can sustain without a loss in productivity. A related component is the enforcement of communally agreed upon sanctions for preventing exploitation beyond that maximum level. A third, vital component of territoriality is exclusion, or limited entry of fishermen into the territory. Together these three elements of territoriality operate as an institution that conserves fishery resources (Ibid:71-83).

With his data Acheson demonstrates that this institution can be linked to specific biological and economic benefits in the area where it functions, in contrast to nucleated areas. By regulating the number of entrants to the level of fishery productivity and turn over

rate, perimeter defended territory leads to two important biological benefits: 1) higher stock density and 2) more breeding stock left intact. The demonstrated economic benefits include 1) a greater number of larger lobsters per trap per season (larger lobsters bring a better market price) and 2) a higher gross income per fisherman. Essentially, fishermen in perimeter defended areas know how large a piece of pie is required to sustain them and how many pieces can be sliced out of a given area without damaging the resource base. This leads to greater efficiency in harvesting, with less time required to produce more lobsters. Their localized perimeter-defending institution operates to maintain this relationship, providing a greater measure of resource and economic stability than is observed in nucleated areas (Acheson 1988:153-59). Although this arrangement in some ways treats fishing territory in much the same manner as private property, the fact that it is communally agreed upon and administered makes for a critical difference that is relevant to the management of shared resource areas.

SEA TURTLE HISTORY AND ECOLOGY

The coastal waters of western Mexico have been important feeding and breeding grounds for five species of marine turtles. Four members of the family Cheloniidae are represented there: the East Pacific Green turtle (Chelonia mydas agassizii), the Pacific Loggerhead (Caretta caretta gigas), the Olive Ridley (Lepidochelys olivacea), and the Pacific Hawksbill (Eretmochelys imbricata bissa). (Another Cheloniidae, the Kemp's Ridley (Lepidochelys kempii), a species whose population level is in severe decline due to human activity, is found along the Gulf of Mexico coast.) The family Dermochelyidae is represented in Mexico by the magnificent Pacific Leatherback (Dermochelys coriacea schlegelii) (Stebbins 1985:105-108).

The turtles that breed on the beaches of southern Mexico migrate to feeding grounds in central America. Other populations of these species are found all along the Pacific coast of Central and South America. The green and the hawksbill range south to Peru. Populations of loggerhead and olive ridley are found as far south as Chile. In the past these turtles ranged north along the California coast, where they are still occasionally seen. The leatherback, an intrepid long distance swimmer, has been sighted as far north as Alaska.

In the past, sea turtles were so numerous in areas off

of Western Mexico that early explorer's accounts reported the progress of their ships slowed by "sea turtle flotillas" (Cliffton 1990:44). Reports of sea turtle nesting in the Gulf of California islands such as the Tres Marias and the Ilas Revillagigedo (Caldwell 1962; Brattstrom 1982:71, 1990:178-179), indicate that these were once important areas for rejuvenation of Mexican populations. But these islands no longer appear to support rookeries. In 1962 while surveying the Gulf waters for sea turtles, Caldwell described the green turtle as "abundant" in the central Gulf, represented by individuals of both sexes and varied ages (Caldwell 1962:4). At the time he personally examined 600 live specimens and about 2000 dead turtles (harvested locally for a turtle meat factory) (Ibid:4-5).

As late as the mid-1970s, Seri and Mexican fishermen along the coast of Sonora found commercial sea turtle hunting a lucrative practice (Cliffton et. al:203-205) but even then the annual migration of masses of green turtles the Seri had known and relied on until recent times had decreased with the overhunting (Felger et. al 1976:283). Visitors to Seri country today repeatedly hear that the numbers of green turtles have dwindled and also that when green turtles are sighted they are invariably juveniles, and large breeding age adults are seen less and less. The green turtle, the leatherback and the olive ridley still nest on

the beaches of Guerrero, Oaxaca, Colima, and Michoacan and appear at varying localities within the Gulf of California, but the little hawksbill, overhunted for its beautiful tortoiseshell beloved of artisans and collectors, is no longer thought to nest in Mexico and is rarely sighted in the area today (Cliffton et. al:200). The loggerhead is also relatively rare and is known only from incidental catch in shrimp trawls in the Gulf of California (Ibid).

The territory required by sea turtles varies because their breeding and feeding areas are often widely separated and are different in character. Females choose flat sandy beaches with specific approach characteristics for nesting (Mortimer 1981). Feeding habits vary between the species. With the exception of the green turtle, which is an herbivore, sea turtles are omnivorous. Each species has its own food inventory with specialized habitat requirements. For example, to graze on sea grasses, algae, and mangrove, the green turtle seeks out peaceful stretches of estuary and eelgrass beds (Carr 1952:360-361; Mortimer 1981:103; Stebbins 1985:105). The ridley is more of a bottom dweller and needs relatively shallow waters in protected bays and lagoons to forage for mollusks, crustaceans, sea urchins, and fish (Carr 1952:410; Stebbins 1985:106-107). The leatherback tends to remain in deeper sea unless it is nesting. Its preferred food is jellyfish (Stebbins 1985:10&-

108). Leatherbacks have been known to mistake floating plastic bags for jellyfish and have died ingesting them (Carr 1987:16; National Research Council 1991:5-6). The food supply of all these sea turtle foragers is obviously dependent upon a healthy marine environment and a productive fisheries system.

The literature on sea turtles, although extensive, is problematic due to both temporal gaps and to focus over a wide-range of geographic areas in the treatment of the variables of species ecology and life history relevant to documenting the different species. In spite of extensive research over the last decades, beginning with the pioneering work of Archie Carr (Carr 1952), major life history variables critical to the conservation of sea turtle species remain elusive (Carr 1987; Clifton 1990:44). Marine animals are hard to track and sea turtles migrate over long distances, therefore getting baseline information on population levels is difficult (Bustard 1981:523; Meylan 1981:135-38). The male-female ratio in wild populations is also an unknown due to the fact that most sightings are of females who have come ashore to nest. Males are rarely seen. As recently as the mid-1970s researchers discovered that sex differentiation in hatchlings is temperature dependent rather than being linked to an x-y chromosome factor (Mrosovsky and Yntema 1981:59).

Another crucial gap in life history is referred to as "the lost year". After hatching on nesting beaches, baby sea turtles slip into the ocean and disappear from view, emerging about a year later as "plate sized" individuals (Carr 1984:3). Where the hatchlings spend their lost year, how they feed and what rate of mortality they suffer can only be surmised.

Other critical life history variables for which information is incomplete include territorial requirements, hatchling imprinting mechanisms, and nesting beach approach preferences. Without this basic information on sea turtle needs, conservationists lack understanding of how much variation in nesting, migrating, and feeding patterns constitutes natural variance or is a result of habitat disturbance. Because sea turtle populations are declining rapidly and so much remains unknown, it is crucial to take protect habitat and take strong measures against any disturbance to turtles in their environment.

The literature on human use of sea turtles includes accounts of traditional uses by coastal peoples (Nietschmann 1973; Felger and Moser 1985; 1987; Felger 1990a, 1990b), reports of early explorers use of turtles as an easily-transported food staple (Cliffton 1990:44), and commercial harvesting in recent decades (Felger et. al 1975; Cliffton et. al 1981; Alvarado and Figueroa 1990a). Ethnographic

material on traditional uses of sea turtles stresses the fact that exploitation was for subsistence of local groups (Felger et. al 1975:1283; Felger and Moser 1987:19; Felger 1990a:42). Traditional groups such as the Seri relied on the abundant green turtles in the waters off coastal Sonora as their single most important food resource (Felger and Moser 1985:42; Felger et. al: 1253). These groups were small hunter gatherer bands with no incentive to generate surplus until the 1930s and 1940s when commercial markets for sea turtles developed (Felger and Moser 1985:44-45). With the decline of sea turtles in their area and the growth of cottage industry native crafts, the Seri turned away from turtle hunting. The Nahua of coastal Michoacan also exploited sea turtles for subsistence (Kim Cliffton, personal communication). They also made the transition to commercial turtling but had difficulty competing with Mexican fishermen with more efficient equipment and better market access (Cliffton et. al:1205). The advent of commercial markets for turtle leather, shell, eggs, and oil led to the rapid decline of various species. At the same time it removed a basic protein source from subsistence level communities. Although outside the study area of this paper, Nietschmann's cultural geographic work on the Miskito Indians of the Nicaragua coast (1973) is a valuable study providing information on the effects of the shift from

subsistence to commercial turtling that occurred among many coastal groups.

The history of sea turtle decline is documented by various researchers who have concentrated on some species such as the hawksbill (King 1981), the ridley, leatherback and loggerhead (Ross 1981), or on an area such as western Mexico (Cliffton et. al 1981). Overexploitation occurs as a result of overharvesting of breeding adults as well as through poaching of sea turtle eggs from the nesting beaches. Contraband turtle products are marketed through middlemen who assume responsibility for transport and distribution through their contacts in larger urban areas. Along with overexploitation, habitat disruption, especially of nesting beaches, is a major cause of sea turtle decline (Witham 1981).

AIMS OF THE RESEARCH

A review of literature on sea turtle exploitation and economic factors in western Mexico demonstrates the character of the relationship between economic development and decimation of the marine turtle population. The advent of commercial fishing that led to unrestrained harvesting of sea turtles and destruction of other marine fisheries resources is seen in the larger context of Mexico's uneven modernization process. Specific factors have operated together to put undue pressure on sea turtles. The threats to their existence are symptomatic of a larger complex of socioeconomic imbalances. Although these animals, with their long history of existence and unique biological attributes, have intrinsic value as species, their present predicament also serves as an indicator of unsustainable subsistence patterns. Analysis of the factors at work in the threats to their existence therefore has importance not only to their own survival but for the general understanding of factors that contribute to the overharvesting of species and destruction of vital linkages in the ecosystem.

From a review of literature pertaining to sea turtle exploitation, fisheries resources, and economic development in western Mexico, I see the loss or absence of localized institutions for resource conservation deriving from unsustainable elements in the development process that have

led to socioeconomic disenfranchisement of coastal fishing communities where sea turtle overharvesting occurs. These unsustainable elements can be identified specifically as 1) overcapitalization (particularly of the export sector) and 2) lack of diversity in economic development. I define overcapitalization as the application of capital out of proportion to the scale of the ecosystem and human community abilities to cope with sudden transformations. Lack of diversity in economic development is characterized by dependence on a narrow range of modes of resource exploitation. Although I do not define these terms with empirical data, I believe they can be demonstrated with reference to their effects in descriptive terms which will become more apparent later in this discussion. These two unsustainable elements of development lead to a skewed distribution of income and political power that contributes to loss or absence of local institutions for regulating the use of natural resources. In the coastal fisheries environment, they lead to a situation where fishermen are forced to rely on the most lucrative species at a given moment rather than being able to maintain an ongoing, sustainable relationship with the resource base.

It is my aim in this analysis to delineate the framework in which sea turtle survival is imbedded by analyzing the context in which the actors involved in sea

turtle overexploitation operate. Once this framework is established, its variables can be used in conjunction with biological information on sea turtle species as a point of departure for devising conservation strategy. Furthermore, this strategy will be more viable for having addressed issues in human community. The study of the sea turtle and human populations in this way can provide an understanding of the interface between human and sea turtle populations, the critical areas in which human response to the environment breaks down and the effects of socioeconomic activity lead to a cycle of ecosystemic degradation. It is in this area, where lack of sustainability in resource exploitation is highlighted, that critical questions on sustainability can be addressed.

I believe the information derived from this study will point toward the contribution anthropology can make in further assessment and implementation of a sustainable human community-sea turtle interface. This highlights some of the general problems inherent in coordinating local, regional, and global inputs to conservation strategy in order to work toward a sustainable future.

Several questions link the variables with which I am concerned:

- 1) Are overcapitalization and lack of economic alternatives operative in the development process in the area of fishing

cooperatives?

- 2) Have these elements led to the socioeconomic dislocation of fishing communities and cooperatives?
- 3) Has this dislocation resulted in uneven distributions of income and political power?
- 4) Has there been a resultant loss of pre-existing institutions for conservation of resource conservation?
- 5) How are the components of Acheson's territoriality involved within the operating context of these variables?

I have checked the validity of my suppositions against evidence of these specific links between the development and socioeconomic variables. I have been especially concerned with the relationship between the components of Acheson's territoriality institution and economic and biological conditions in the Gulf of California fisheries.

The data required to test the validity of these suppositions came from interviews and literature on fishing cooperatives of western Mexico as well as on other economic development in the study area. Information from ethnographic works was also surveyed to provide information on the shift from subsistence to commercial turtling for comparative purposes. Also, general information on sea turtle utilization was used to provide a general framework for the analysis. Because this analysis does not focus on a specific community, cooperative or fisheries

resource or technological standard, it is difficult to gather statistics that relate to the general argument. Also, there is an on-going problem of gathering reliable statistics on Mexican fisheries production, community population and other relevant aspects of the economic situation. Such data-gathering would be better suited to the kind of specific community or fisheries resource study that may emerge in future work in relation to questions raised here.

Several basic assumptions underlie my analysis of the sea turtle conservation issue. I assume that the perpetuity of natural resources and long term stability for human communities are positive values, and that subsistence modes based on these values are preferable to accepting the destruction of resources and the ecosystem for short term profit. Another assumption is that to be viable, conservation strategies must be based on a coincidence of needs that insures survival of both sea turtle and human communities, that a sustainable future for Mexico's sea turtles is one that links their destiny with that of the human communities who have relied on them.

DIMENSIONS OF THE SEA TURTLE PROBLEM

The issue of sea turtle survival points to the need to view a conservation problem from both the micro and macro perspectives. Localized sea turtle exploitation takes place within a specific social, cultural, political and economic setting that reflect national and international factors. For example, fisherman in a Mexican village must cope with the local availability of resources and their own means to exploit them but are also constrained by shifts in national fisheries policy, such as species quotas and seasonal moratoriums. Anyone engaged in sea turtle conservation must become cognizant of local conditions as well as the policy shifts and bureaucratic inputs from federal agencies and how these policies are expressed at federal, state and local levels. Realities of the local economy must be seen in relation to Mexico's overall economic condition and especially in relation to its dominant market relations with Japan and the United States. At present, Japan is the leading external market for sea turtle products (Howard Lawlor, personal communication 2/10/90). Although the United States outlaws importation of sea turtle products, it is a major importer of Mexico's seafood and agricultural products.

Because sea turtle populations are not localized but migrate through wide-ranging territory to nest and feed,

devising strategies for their conservation is a local and regional as well as an international issue. Also, the sea turtle population is a natural resource that has changed over time in direct relationship to changes in human subsistence modes. Therefore, a historical perspective is also relevant to the present day picture.

MEXICO'S ECONOMIC CRISIS

During the period from the mid-1950s through 1972, Mexico experienced rates of economic growth that were unrivaled in the developing world. The oil boom of 1978-1981 was the prelude to economic crisis that began in the early 1980s and hit its culmination with the crash of world petroleum prices in 1986 (Ramirez 1989:1-2). With a rapidly growing population of 80 million and an external debt of \$100 billion dollars, the country found itself in the midst of the worst economic crisis it has had to face since the 1910 Revolution (IBID:2). The current era is one of "open door policy", manifested in economic moves such as the new free trade agreement with the United States and the call for privatization of ejidos and other economic collectives.

Mexico's economic and development crisis has been documented in a number of works in recent years (Sanderson 1986; Austin and Esteva 1987; Ramirez 1989; Solis 1986). Income disparity between urban and rural segments of the population, a dichotomy in political power and income-generating capacity between large-scale vs small-scale agricultural endeavors, and a focus on the export sector and external linkages are major themes that emerge. Solis refers to the 1980s as a "lost decade" in Mexico, noting the downward trend in living standards since the financial crisis of 1980. He cites a decline in real wages, public

sector revenues, and spending on social welfare programs (43). Another researcher points out that the country's per capita gross domestic product in 1988 was 16.6% below the 1980 level (Pastor 1990:53) and that according to the government's own surveys, 50% of the rural population suffer from malnutrition (56).

In a 1980 work on fishing cooperatives, McGoodwin discusses the living situation in Mexico's Pacific coast region. In Sinaloa, average annual personal income of household heads was less than \$400. Incomes of members of fishing cooperatives were just under \$700. Nearly 100% of the seafood harvested in the area was exported out of the region to larger urban markets (McGoodwin 1980a:26). Lack of sanitary facilities and fresh water supplies contributed to a high rate of infant mortality and endemic disease. With the decline in household incomes and government spending for social services throughout the past decade, these conditions have deteriorated to an even more critical state, creating, in Barkin's words, "a panorama of misery and destitution behind a thin veneer of showcase industrialization and modernity" (Barkin 1986:106). It is in these coastal areas where illegal capture of sea turtles has provided an irresistible source of sustenance and revenues for fishermen who either hunt them intentionally or come upon them in the course of other fishing activities.

Sanderson's work, although it focuses on the agricultural sector, is one of the most thorough analyses of the current economic crisis. It provides insights into the fragmentation and separation of production and consumption patterns, with attendant consequences for the rural population in particular (Sanderson 1986). Once relatively self-sufficient in food production, Mexico became a net importer of basic foodstuffs in the last two decades (Ibid:6). Sanderson describes the food crisis in Mexico in the context of a general economic crisis that has produced skewed income distributions, uncontrolled urbanization, migration, unemployment and underemployment, and shortages in basic staples for a large part of the population (Ibid:8). A Mexican government survey in the mid-1970s revealed that 33% of the rural population never eat meat, 37% never eat wheat bread, and 59% never drink milk (Ibid:9). Ironically, the production of these products has often replaced production of staple foods.

Meanwhile, agribusiness production for the export sector and elite home markets expands with deeper penetration of international market structures that drive the level of capital and technology beyond the reach of small, subsistence-oriented farmers and their markets. In recent years joint venture companies have proliferated, especially in the agricultural regions of the northern

border. Through this arrangement Mexican producers and US distributors link up, offsetting the constraints each of them faces in the production and marketing of agricultural products. Market access in the United States and low labor costs in Mexico are the major respective benefits of this partnership. It also provides access to external credit and technology for the Mexican producers, drawing them deeper into US marketing structures.

In Sanderson's view, it is Mexico's integration with the world capitalist system and especially its economic dependence on US markets that is at the root of the current economic crisis. Ramirez suggests that "pervasive cultural and historical differences" and the basic "economic assymetry" of the two countries make it difficult to effectively coordinate policy (Ramirez 1989:xi). Barkin also sees foreign economic penetration as a major contributor to current socioeconomic problems. In his view, US interests have overtly molded Mexico's economic structures (Barkin 1986:107). He points to the widening gap between classes as evidence of the damage wrought by "unbridled capitalist development" (Ibid). In the mid 1980s, the average monthly income of the richest 5% of the families in Mexico was 36 times as great as that of the poorest 10%, with the richest tenth of the population receiving about one-half the total personal income and the poor receiving less than 20% (Ibid).

Lack of data for the communities near turtle nesting beaches makes it impossible to specify how this is manifested in terms of village and household incomes, but the regional disparities in economic development that accompany the government's focus on export-oriented agriculture and industry are evident in the low state of economic development in nesting area states such as Michoacan and Oaxaca (Ibid:109-110). In general, except for tourist spots like Acapulco, the coastal areas have been neglected in favor of inland development.

Literature on fisheries production reveals a similar dichotomy between the subsistence and export sectors. Fisheries cooperatives exploiting the lucrative cash species (e.g. shrimp, sardines, and tuna) monopolize government inputs in capital, credit, marketing arrangements and fisheries policy while the inshore cooperatives, like the small-scale and subsistence farmers, receive less government support and have declined (McGoodwin 1980a, 1980b; McGuire 1983).

UNDERDEVELOPMENT IN INLAND AGRICULTURE

A discussion of agricultural production may seem like a digression, but there is good documentation of general problems in this economic sector that are also operative in the fisheries sector. Core inadequacies of Mexico's development process are illustrated in the analysis of agricultural development strategy and its differentiated effects on different classes of producers.

The pattern of Mexico's agricultural development has been described as "bimodal" because of the juxtaposition of large-scale, highly commercialized farms to a large number of small-scale farms (Rochin 1985:10). An estimated 85% of Mexico's agricultural enterprises are small farms which contribute no more than 25% to total national production. The pattern of bimodalism in conjunction with autonomous spheres of production -- the export and the domestic -- operates in an environment where land areas for basic food crop production is decreasing and prices for basic grains fluctuate with changing subsidy policies as well as with climate and season. In the countryside, inadequate diet, unemployment and outmigration contribute to growing instability (Sanderson 1986:8-9). The growing agroexport market and the domestic market for beef and luxury food items have resulted in shifting patterns of land use and changes in production with different consequences for

different types of producers (Sanderson 1986:243-6). Small holders and ejiditarios producing for local or regional markets must operate alongside the owners of large-scale agribusiness complexes producing for urban or export markets. The profitability of agroexports has led to a shift away from basic food crops, e.g. maize, beans, rice and wheat, which have a low market value, partially because of government policies that have kept prices for basic food grains low (DeWalt 1988:35). With this shift, large areas of rainfed land, formerly worked by subsistence-level farmers with traditional methods, have fallen out of cultivation, while the nation turns to high-level imports to satisfy domestic demand for staples (DeWalt 1988:36). In the period from the mid-1960s to the mid-1980s, the area planted in maize and beans dropped from three-quarters of the total crop area cultivated to less than one-half.

The dynamic nature of the export market for high value crops and the scale of enterprise on which producers participate contrasts sharply with conditions in the stagnant rural economy. The value of Mexico's total agricultural exports increased from 1.4 billion dollars in 1982 to 2.0 billion dollars in 1987 (Mielke 1988:10). Yet an estimated 40-50% of the country's population is undernourished (DeWalt 1988:41). Small farmers, once the main cultivators of basic foods such as maize and corn, find

themselves increasingly disenfranchised by a "demand-driven model of agricultural production" (Ibid:43).

"Local decisions are increasingly influenced by the relative profitability of alternative crops, regardless of local or national needs. The crops that benefit from this mechanism are those commodities, like sorghum or some fruits and vegetables, that are destined for social groups with the highest- and fastest-growing incomes rather than for the workers and peasants who comprise the majority in Third World countries" (DeWalt 1988:43).

There is ongoing debate as to whether integration into the international commodities trade has been beneficial or harmful to Mexico. Mares claims that this integration is mutually beneficial to the United States and Mexico and that it has stimulated a shift in production from unremunerative food crops to those with high value, generating export revenues and leading to greater diversity in agricultural products (Mares in Grindle 1983:3).

Sanderson counters this view, citing the deep class inequalities that have allowed some elements of the population to consolidate "increasingly rational linkages" with external capital and markets while leading to the "proletarianization of the campesino" (Sanderson in Grindle 1983:2). Small producers, who are politically and economically weak, have little access to outside resources and technology. Those agriculturalists who operate in the internationalized sector are exposed to and have access to

innovations arising there (e.g., improved seed varieties, chemical fertilizers, pesticides, and machinery). The others operate in the less dynamic world of domestic agriculture, their exposure to innovation limited to those generated by domestic research institutions which are increasingly affected by limited funding. Institutions find themselves challenged to respond to the new conditions in land use and production and to keep pace with the trends imported by agribusiness elements. The levels of capital and technology associated with the export agribusiness complex are beyond the level that can be generated by the Mexican government. There is a reoccurring argument in the literature that technological packages must be flexible enough to meet the needs of different producers and their growing conditions (Austin and Esteva 1987:372), but the special features of traditional Mexican agricultural practices have not always been given serious attention. For example, the traditional system of mixed cropping (e.g. maize and beans in a mixed cropping system) has been shown to enhance land productivity with limited addition of labor and fertilizer application. Yet government credit and crop insurance programs are generally limited to cropping practices or crop varieties that preclude the use of traditional methods (Johnston et. al 1987:305).

While agribusiness producers can be assumed to be

seeking to maximize profits, this cannot be assumed for small-scale and ejido producers, who may be more concerned with sustainability and minimization of risk (Bell 1972:137). Maximizing profits and minimizing risks are approaches to production that require different processes of decision-making, and the policies and innovations that serve one aim may severely handicap the other.

In recent years export agribusiness has expanded in response to the demands of U.S. and other foreign markets. With its huge external debt, the Mexican government has favored the export sector, providing it with high level capitalization in hopes of generating export high revenues for loan repayment capital. The small scale and subsistence areas of agriculture have continued to atrophy as the government focuses on exports (Sanderson:14-63; 277-79).

The focus on the export sector at the expense of the domestic market and the disenfranchisement of small-holders is repeated in the fisheries sector. In the coastal fisheries areas, small-scale, subsistence oriented production has been disenfranchised by the same competitive forces. Impoverished fishermen along the coastal areas are driven to exploit whatever resources they find, including the sea turtles which wander ashore to lay eggs or stray into fishing nets.

INSHORE VS OFFSHORE FISHERIES COOPERATIVES

The Revolution of 1910 and the series of land reform laws associated with it led to high expectations among Mexico's rural peoples. They anticipated that their needs would be respected and that a level of autonomy would be assured for the pueblos whose relationship to the land and control over their own resources was rooted in historic use. For the coastal villages where agriculture was not feasible, the state established fishing cooperatives to meet the needs of groups that had traditionally exploited the resources of the sea and the coastal marshes and estuaries.

The fishing cooperatives were established in the 1930s, on the basis of the Ejidal Law of 1920, with the goal of raising incomes and improving the living conditions of populations of coastal fishing villages (McGoodwin 1980b:44). Most analysis indicates that these goals have not been fulfilled but that unequal distribution of political and economic power have resulted from the development of fisheries cooperatives (McGoodwin 1980a; 1980b; McGuire 1983).

McGoodwin (1980a, 1980b) and McGuire (1983) have both discussed some of the critical differences between the offshore and inshore fisheries that have arisen over the past decades. The offshore fisheries are those established to exploit lucrative export marine species such as sardine,

shrimp and tuna. Today they are large, urban-based trawler fleets that generate high revenues through export of products to the United States and other foreign markets (McGoodwin 1980a:25). The inshore fishing cooperatives tend to be smaller, subsistence level groups tied to specific coastal areas. They exploit a variety of species, including shrimp in the estuary phase of their life cycle. McGoodwin reports that in his study area in Sinaloa, 100% of the seafood catch was destined for the export market in spite of the unmet needs of the local population (McGoodwin 1980a:26). This situation is far from unusual.

The problems of fishing cooperatives are both economic and political but can be related to the general focus of the Mexican state on development for the export market. This has resulted in greater concentration of capital and political power in offshore fishing cooperatives just as in the agricultural sector power and capital has accrued to the large-scale externally-oriented agribusiness elements. The offshore fishing cooperatives exploit the lucrative commercial species at the expense of the inland fisheries which produce for urban or underdeveloped regional markets. The lack of diversity in economic development created by the focus on the export sector further disenfranchises the expanding coastal populations. Along with the declining conditions in coastal fisheries, there is a general lack of

opportunity in agriculture and industry in these areas.

As in agriculture, the Mexican government has favored export producers in its development process because of their ability to generate high revenues. The offshore coops have therefore received a large input of government capital, allowing them to expand and to upgrade their technology. Their profit-making capacity allows them access to government credit and loans.

In contrast, the inshore coops, like the small-scale, subsistence-oriented farmers, have been disenfranchised in the development process. They have not received heavy government financing and have been unable to keep up with technological advances. Also, like their agricultural counterparts they have lacked access to credit and loans.

Organization in the fishing cooperatives was based on that of the agricultural ejido. This style of organization, with joint ownership and credit arrangements but often calling for individual production, has proved to be unsuitable to the fisheries situation. The small inshore coops were never able to overcome these organizational inefficiencies and remained in a weak position in relation to government policy. The large offshore cooperatives were able to overcome these problems because of their income-producing ability and the dynamism of their fisheries. When a downturn in world prices or demand leads to a decline in

profits, they have been able to lobby the government for favorable shifts in fisheries policy. The government, dependent on them for repayment of loans, responds by pressuring inshore groups (McGoodwin 1980b:44) with catch restrictions and shifts in open seasons. One area in which this has a strong consequence is in the shrimp fishery. Since shrimp spawn in inland estuaries and spend part of their life cycle in coastal waters before moving out to deeper waters, they are exploited by both inshore and offshore fishermen (See McGuire 1983). If shrimp catches out at sea are not lucrative, offshore fishermen blame overharvesting of the young shrimp by inland fishermen and call for government restrictions on inshore cooperatives and increases on their own quotas. In the era of Mexico's enormous debt crisis, dependence on export crops and fisheries products has become even more pronounced, giving offshore fisheries a degree of political power not equalled in the inshore cooperatives.

These differences in degrees of political power and income-generating potential have led to clashes between coastal and offshore fishermen who tend to blame one another for shortfalls in harvest and disruption of fisheries production.

In reality, declines in offshore yields stem from the lack of exclusion in these fisheries. Membership in

cooperatives is passed on to descendents, therefore there is a potential for continual growth of cooperatives due to expanding populations. The high level of profits available to offshore coops has led to continual expansion of fleets, drawing new members into the cooperative's fishery operation. Pressure on government restrictions altered the effects of unlimited entry on incomes (as more fishermen enter the area, per capita yields and individual profits decline). The inshore coops, unable to generate such profits could not absorb additional members without severely affecting incomes. With no power to negotiate for increased quotas or fishing season extensions, they are forced to subsist on dwindling profits and driven to supplement their incomes by opportunistic catch, such as sea turtles.

In the case of the fishing cooperatives, as in agriculture, Mexico's land reform laws have not delivered on revolutionary demands for land and autonomy but instead have led to deep political and economic inequities and loss of autonomy. In addition, in recent years there has been a noticeable decline in fisheries production and disruption of the coastal ecosystem resulting from mismanagement of coastal resources (Arizona Daily Star, 26 December 1990; Alejandro Robles 1992).

TERRITORIALITY IN INSHORE FISHING COOPERATIVES

In his discussion of Maine lobster fishing groups, Acheson demonstrates that the mechanisms leading to economic benefits also result in biological benefits. The fact that there is a positive link between what people expect out of the environment and what the environment can provide on an on-going basis indicates a realistic link between the economic base and resource use, mediated by the institution of territoriality. Vital components of Acheson's territoriality model are absent in the fishing cooperatives of western Mexico. Their absence is accompanied by low economic returns and disruption of the resource base.

Mexico's inshore cooperatives find themselves in a nucleated territorial situation, i.e., they operate in territory more or less defined by default and over which they do not have powers of enforcement. Although ostensibly these coops were formed within pre-existing fishing areas of coastal towns and villages, the growth of commercial markets and the introduction of government policy for regulating fisheries activity has altered the fishermen's relationship with the environment in a variety of ways, most notably, by providing more capital (and attendant political power) to the export-based offshore fisheries. This essentially leaves the inshore coops with no power for enforcing territorial claims or local sanctions that may have existed to integrate

population and resource use. The ability for fishing groups to devise their own sanctions and modes of enforcing them is a vital aspect of Acheson's territoriality model.

Exclusion is another vital factor in the Acheson model. With their capital base and their strong voice in policy formulation, the large-scale, export-oriented fishing coops can monopolize the lucrative resources such as sardine, tuna, and shrimp. Their economic power and the degree of technological proficiency it allows puts these operations beyond the scale of what the small inshore coops can achieve. The territory in which they operate is in a sense defended by this inequality in political-economic power.

The inshore fisheries areas are those in which sea turtle overharvesting and illicit marketing has been a problem. The impoverished members of inshore communities find it difficult to resist the opportunity provided by the demands of markets for sea turtle products. In some areas, sea turtles sell for anywhere between US\$20-100 (Alvarado and Figueroa 1990a:75-8). In the past during periods of high demand, a single animal sometimes brought as much as US\$1000 (Cliffon, personal communication 2/29/1990). This lucrative market in the face of socioeconomic powerlessness creates a sound formula for the destruction of a species. Hunting of a species as sluggish and easily captured as a nesting female sea turtle is simply too tempting under such circumstances.

In the mid-1970s, as Seri and Mexican fishermen in Sonora competed in the then-legal market for sea turtle products, a whole population of overwintering green turtles was discovered and essentially wiped out in several short seasons. Previously this green turtle population, which lay dormant in shallow waters through the winter season in the northern Gulf, was hunted in small numbers by Seri using traditional harpooning methods. When other fishermen discovered the existence of these turtles, at a time when turtle harvesting was lucrative but catches were already declining, they hunted them with diving gear and other modern equipment, quickly destroying the population (Felger et. al 1976:283-284).

With offshore fisheries closed to them and inshore fisheries resources increasingly threatened by overfishing, members of coastal fishing coops find their mobility further restricted by lack of regional economic diversity which prohibits their expansion into other economic areas. The export agribusiness complex inland has forged continually stronger external links, especially with the US, for distribution, technology, credits and other inputs (Sanderson 1986:277). As a result, backward and forward linkages to industry that would normally arise with a dynamic domestic agricultural sector have not evolved. Barkin points out that patterns of concentration and

external linkages are also evident in the industrial sector in general (Barkin 1986:109). There is also a great regional disparity in industrialization (Ibid:111). Furthermore, the industries with the highest rates of growth are those which use the least amount of labor. Therefore, increasing industrialization does not translate to higher employment levels or broader distribution of income (109). As a result of the above factors in both industry and agriculture, local and regional development is stifled, leading to very little diversity in the economic sphere.

The Yaqui fishing cooperative of southern Sonora is a case that provides interesting comparison in relation to the territoriality model. McGuire uses McGoodwin's analyses as a base for contrasting the Yaqui coop with the other inshore coops (McGuire 1983:139-43). In the Yaqui area, important elements of territoriality are present. As an ethnic group with a fisheries territory based on traditional habitation and exploitation, the Yaquis possess 1) long term experience and knowledge of the resource base and 2) the ability to exclude non-Yaquis. Significantly, the government has supported the legitimacy of their ethnic appeal to territory. In addition, traditional tribal organization was adapted to fisheries administration and provided some continuity that seems to have overridden the organizational and administrative problems (related to the tensions between

individual and communal roles) experienced by other coops. Some elements of the traditional sanctions on resource overuse also have remained intact. Largely as a result of these factors, the Yaquis, unlike other coastal cooperatives, have maintained a relative balance between population and resource use and have been able to provide an adequate income for coop members. In addition, they have reinvested profits to upgrade equipment, to provide loans and to create social services. The comparative dynamism of this fishery coop is evidenced by the creation of new fisheries employment opportunities in administration, processing and transport (Ibid:139-40). This contrasts with the lack of linked economic endeavors in other inshore fisheries areas.

TRADITIONAL INSTITUTIONS

Several examples from ethnic groups formerly involved in subsistence turtling provide additional insights into the relationship between local institutions and natural resources. The Nahua of coastal Michoacan formerly lived inland in agricultural villages. They journeyed periodically to the coast to catch turtles for village consumption. With the rise of commercial markets for fisheries products in the 1960s, the Nahua moved their villages to the coast and entered into commercial turtling (Alvarado and Figueroa 1990a:69-70).

A conservationist involved in turtle preservation in one of these villages observes that two significant changes took place in the shift from subsistence to commercial turtling. First, the advent of a cash economy with heavy capitalization into other fisheries areas overpowered traditional institutions that had prevented overexploitation of sea turtles in the past. Second, he observed that a crucial change took place in the philosophy of the local fishermen, changing their relationship to sea turtles. "If you want to know what's killing turtles now," he told me, "it's an attitude...a basic, fundamental, philosophical attitude" (Kim Clifton, personal communication). A change in philosophical attitudes is also cited in the case of the Miskito of coastal Nicaragua. One of the notable

effects of the shift from a subsistence to a cash economy was the breakdown of the traditional food-sharing system. In former times, catches of sea turtles and other game were divided up, first among kin groups and then among the general community, according to specific rules (Nietschmann:193-4). Tribal elders stressed that this sharing was not simply a mechanistic exchange system but engendered a philosophy of generosity and gift giving critical to their way of life (Ibid:183; 193-4). One elder lamented that "through de money, de young begin to give up sharing. Through dat selling we'll lose the luck of de gift (202).

A food sharing system was also an integral part of Seri turtle hunting in the past, with turtles or parts thereof claimed according to specific rules. Seri elders also lament the breakdown of this sytem with the shift to a cash economy that was partially entered through commercial fishing (Felger and Moser 1985:48).

DEGRADATION OF THE FISHERIES ENVIRONMENT

The problem of declining sea turtle populations should not be viewed as that of a species that requires "saving" through special conservation action but must be viewed in the deeper context of a breakdown between the economic base and resource use. With external market demand driving resource use, the link between subsistence and the resource base is not governed by mechanisms that either guarantee subsistence or prevent overexploitation of natural resources on which human communities depend.

The capriciousness of market demand and the power of mobile capital are evident in the current Japanese market for sea cucumbers. This species, found in great numbers along the coast of Sonora, is a delicacy of Japanese cuisine (Kim Clifton, personal communication). Coastal fishermen, offered ready cash by the brokers who seek out this species for the Japanese buyers, have been drawn into this new market. Harvesting is done by dragging an area of the shallow sea floor, retrieving the cucumbers and discarding unwanted incidental catch. The cucumbers are slit to remove a longitudinal gut muscle--the only part of the animal consumed! According to one observer, sea cucumbers are being gouged out by the thousands to be shipped off to Japanese luxury food markets (Ibid).

A conservation official working in the Gulf of

California points out the weakness of models used in devising fisheries regulation in the area. Management models do not take the entire ecosystem into account and lack a holistic basis (Alejandro Robles 1992). Management, he emphasizes, should be a dynamic process that changes with changing conditions.

Lack of an integrated approach, a reflection of the market-driven approach to resource utilization, results in targeting of specific species in isolation from their place in the ecosystem or the effects of fishing operations on the larger chain in which species are involved. For example, shrimp trawlers net about 50 other species as incidental catch in the course of their shrimp harvesting activities (Alejandro Robles 1992). Recent studies in other marine fisheries indicate that the effects of commercial dragging on marine sediment have important consequences for the environment of the sea floor. In some cases it is seen to lead to a shift toward microbial and anaerobic food chains (Mayer et. al 1991:249) and away from food chains important to fisheries productivity (Ibid:259). Sea turtles, who rely on a wide variety of these latter species, are only one marine animal potentially affected by such a shift.

In a discussion of farmers living along waterways in a shared irrigation environment, Worster writes:

"...the market place is an institution that

teaches self-advancement, private acquisition, and the domination of nature...Ecological harmony is a nonmarket value that takes a collective will to achieve. It requires that farmers living along a stream cooperate to preserve it and pass a fertile world down to another generation" (Worster 1984:67).

Along the coastal area of western Mexico human communities are being driven to overexploit their resources to the point of degrading the environment, yet they share relatively little in the rewards of the market. I would argue that this degree of removal is a critical feature of the lack of linkage between economic activity and monitoring of resource use.

CONCLUSION

A contradiction between unsustainable elements of the development process and the loss of institutions that facilitate resource conservation can be seen to operate in the Mexican fishing cooperatives and has had a detrimental effect on local economy, pushing coastal fishermen to overexploit the environment. The destruction of once-thriving populations of sea turtle species is one of the major, high-profile consequences of this situation.

Capitalization focused on the export-oriented sectors of fisheries and agricultural production, and lack of economic alternatives have led to the economic and political disempowerment of populations in coastal fishing areas, the place where sea turtle overexploitation takes place.

The uneven distribution of income and political power that derives from these unsustainable elements of the development process place the inshore fishing coops in a nucleated position viz-a-viz government policy, the offshore cooperatives, and inland agriculturalists and industrialists. The political power and income stability required to defend their territory and to regulate utilization of local resources is lacking. An absence of local and regional economic diversity forces new members of the population to be absorbed into the fishing coops, leading to income decline for all members and greater

pressure on resources. In some cases, the philosophies and attitudes that helped to perpetuate traditional institutions for resource management have been obliterated by the entrance into commercial fishing and turtling. In the Yaqui fishery, where some elements of traditional institutions have remained intact within a perimeter-defended area resource exploitation and income levels have experienced more stability.

Evidence for linkage between my established sets of variables (e.g., capitalization focused on the export sector, narrow range of economic opportunities, absence of resource management institutions) did appear in the literature and interviews. Conversely, I found no evidence for operation of the variables in a linkage that lead to sustainable outcomes. For example, there is no evidence in the information gathered for the case of export capitalization leading to balanced management of inshore fisheries resources. All evidence points to the conclusion that uneven distribution of political and economic power, through favoring of the export sector, is a critical element of unsustainable resource use in fisheries areas and contributes to environmental degradation. While there is ongoing debate in development literature about the merits of export-oriented economic endeavors, it is the lack of articulation between the export and domestic sectors that

may be a crucial weakness of the development situation. To test these conclusions thoroughly, however, I believe field studies of fishing cooperatives in the sea turtle nesting areas are required. Information on the internal political configurations (e.g., institutional arrangements, rules, and structure of authority in cooperatives), village and household economic activities and incomes, and local attitudes to resource conservation would help to determine the local components of territoriality that are present or absent and to assess the variable affect of these components. Although past studies have included some of these areas of inquiry, information needs to be updated because of changing political and economic circumstances. McGuire has stressed "the divergent political-economic contexts in which these systems of production are imbedded" (McGuire:143). McGoodwin warns against reductionist statements about "complex socioeconomic phenomena" and calls for attention to the particular historical factors leading to fisheries decline (McGoodwin 1980b:40). This kind of contextual analysis is lacking for the fisheries of Oaxaca, Michoacan and other nesting beach areas. A thorough review of ethnographic materials would provide historical information on traditional institutions related to resource use and allocation, whether in the study area or elsewhere.

Several key areas for reconfiguring the interface

between human subsistence systems and natural resource exploitation emerge from these conclusions. Anthropology has valuable tools to offer in all these areas and is a unique discipline with its propensity for viewing human activity on the individual, social and cultural levels and in both the material and affective realms.

In terms of government development policy, analyses geared toward economic alternatives are crucial. Industrial and service linkages from revitalized fisheries could provide local and regional opportunities in employment and economic diversification, as the Yaqui example illustrates. Research on individual cooperatives and the local and regional market structure is a good beginning point for this kind of study. The scale of economic enterprise most suited to regional realities needs to be a primary consideration in any study of this type if there is hope of bringing development into line with what an ecosystem can provide in a given socio-cultural context.

Input of capital has not always been a positive factor and is not the primary contribution the Mexican state can make. Government support for the legitimacy of local claims to territory and control over resources can be a positive factor in its own right. Also, government support of local institutions for policy and decision-making and enforcement of local sanctions can confer a level of legitimacy on these

cooperatives as political entities. Anthropological analysis of institutional and policy processes can inform this objective.

Strengthening of local institutions is a primary area for further anthropological study. Without some degree of local autonomy, the direct link between resource utilization and resource availability cannot be monitored. Common property resource analysis of indigenous institutions can provide valuable insights into the process of building or strengthening local institutions.

A third area for changing the current relationship to resource utilization, in sea turtle nesting beach areas and other areas of heavy environmental stress, is environmental education. It is particularly important that children begin to understand their personal relationship to natural resources and their responsibility as community members. This kind of educational experience can also create an awareness of local as well as global problems and gives children a head start in community involvement. In the village of Colola in Michoacan, school children are involved in protection of nests and release of hatchlings (Alvarado and Figueroa 1990b). Through such involvement they can begin to identify their own welfare with that of the resource, which in their eyes becomes a community asset. The sense of identity that comes of involvement with local assets, in my

opinion, feeds into the sense of political empowerment and autonomy required for participation in local institutions. It also develops the philosophy required to perpetuate these institutions.

The above areas of change all deal with elements of the microenvironment, but there are other important loci involved. In the macroenvironment, where industrial world-urban consumer demands, capital and technology, and policy constraints originate, there is a need for interdisciplinary and intercultural dialogue. This dialogue should take place not only in the context of core-periphery relations but along the chain of actors involved. For example, anthropologists active in conservation issues should be concerned with dialogue between biologists and fishermen, conservationists, the members of small communities involved in the resource exploitation, and citizen lobbyists. The mental constructions required to mediate sustainable futures for human communities and the natural resources they exploit for their subsistence will rely on this kind of diversity in input to search for the areas of consensus in which stable strategies for survival can be devised.

In his book on agrarian revolt in a Michoacan village, Friedrich describes the diversified subsistence base of the town of Naranja before its loss of local control over pueblo lands. The diverse plant and animal resources of the local

marsh and woodlands supplemented small-scale subsistence farming and home industries. Besides producing for local subsistence, the Naranjenos were integrated in a regional market system that allowed area towns and villages to exchange surplus goods (Friedrich 1977:10-16).

In the late 19th century, two Spanish entrepreneurs gained title to the land supporting the vital marshland of the village. They drained it, began a large-scale maize-growing operation on the rich underlying soil and established powerful haciendas that came to dominate the villagers. "Within fifteen years the village had been essentially deprived of the ecological niche where it had nestled for hundreds of years" (Ibid: 43). In their struggle to survive, the poorest villagers worked as sharecroppers on the haciendas while other villagers were forced to migrate in search of wage labor.

"Thus did the villagers pass through a classic sequence. They had been forced out of the subsistence economy of their village and away from a world-view built of sacred connotations and age old indigenous traditions. They were cast into a large, impersonal labor market, not of rising industrialization, but of the efficient, large-scale maize haciendas and sugar plantations, producing for the national and international markets (Friedrich 1977:46).

As agrarian unrest spread throughout the region in the first decade of the 20th century, the villagers of Naranja

eventually joined in the struggle for land reform. Years of ethnic, religious, political and economic division marred the struggle, which eventually led to a series of reforms which returned land to the control of villagers (Friedrich 1977:48).. However, the powerful hacienda families and their allies survived, and in time American industrial development penetrated the area, weakening the spirit and power of agrarismo (Ibid:134).

By gearing production to the export market and favoring those elements of the population who were well-placed to enter into and remain in the export sector, the Mexican state has helped to alienate rural people from the diverse resources available to them and has drawn them into a struggle for survival based on levels of capital and technology with which they cannot compete and for which there was little pre-existing production infrastructure. The loss of autonomy that derives from control over diverse local resources and productive strategies, and the regional intergration they support, not only has led to the disempowerment of Mexico's rural people but has created escalating ecological threats by divorcing people from a sense of connection with and responsibility toward the resource base.

LITERATURE CITED

- Abruzzi, William S.
 1987 "Ecological Stability and Community Diversity during Mormon Colonization of the Little Colorado Basin". Human Ecology (15)3.
- Acheson, James M.
 1988 The Lobster Gangs of Maine. Hanover and London: University Press of New England.
- Alvarado, Javier and Alfredo Figueroa
 1990a "The Economic Recovery of Sea Turtles at Michoacan, Mexico, Special Attention: The Black Turtle Chelonia agassizii". Report to U.S. Fish and Wildlife and World Wildlife Fund. Morelia, Michoacan.
 1990b "Promoting community participation in the conservation of Mexico's sea turtles". In World Wildlife Fund Report. p. 8-11. Gland, Switzerland. June/July.
- Austin, James and Gustavo Esteva
 1987 Food Policy in Mexico: the Search for Self Sufficiency. Ithaca and London: Cornell University Barkin, David
 1986 "Mexico's Albatross". In Modern Mexico: State, Economy and Social Conflict. 1986. Nora Hamilton and Timothy F. Harding, eds. Pp. 106-127. Beverly Hills: Sage Publications.
- Bell, Clive
 1982 "The Acquisition of Agricultural Technology: its Determinants and Effects". Journal of Development Studies. 9:23-159. October.
- Berkes, F., D. Feeny, B.J. McCay and J.M. Acheson
 1989 "The Benefit of the Commons". Nature 340:91-93. 13 July.
- Bjorndal, Karen A., Ed.
 1981 Biology and Conservation of Sea Turtles. Proceedings of the World Conference on Sea Turtle Conservation. Washington D.C.: Smithsonian Institution Press and World Wildlife Fund.
- Brattstrom, Bayard H.
 1990 "Biogeography of the Islas Revillagigedo". Journal of Biogeography 17:177-183.

- Brothers, Dwight S. and Adele E. Wick
1990 Mexico's Search for a New Development Strategy.
Boulder: Westview Press.
- Bustard, H. Robert
1981 "Population Dynamics in Seas Turtles". In
Turtles: Perspectives and Research. p. Marion
Harness and Henry Morlock, eds. Pp. 523-540.
Chichester, Brisbane and Toronto: John Wiley and
Sons.
- Caldwell, David K.
1962 "Sea Turtles in Baja California Waters (With
Special Reference to Those of the Gulf of
California) and the Description of a New
Subspecies of North Pacific Green Turtle". Los
Angeles County Museum Contributions in Science
No.61. December 7.
- Carr, Archie
1952 Handbook of Turtles. Ithaca and London:
Comstock Publishing Associates.
- 1984 "The Voice of the Turtle". Calypso Log. June.
Newsletter of the Calypso Society.
- 1987 "Secrets of the Sea Turtle". Animal Kingdom. Dec-
Jan.
- Cliffton, Kim
1990 "Leatherback Turtle Slaughter in Mexico".
Tucson Herpetological Society Newsletter 3(5):44-
46.
- Cliffton, Kim, Dennis Cornejo and Richard S. Felger
1981 "Sea Turtles on the Pacific Coast of Mexico".
In Biology and Conservation of Sea Turtles.
Proceedings of the World Conference on Sea Turtle
Conservation. Karen A. Bjorndal, ed. Pp. 199-
210. Washington D.C.: Smithsonian Institution
Press and World Wildlife Fund.
- DeWalt, Billy
1988 "Sorghum and the Mexican Food Crisis". LARR
23(3).
- Felger, Richard S.
1990a "The Seri Indians and Their Herpetofauna". Tucson
Herpetological Society. 3(5):41-44.

- 1990b "History of the Puerto Penasco Area, Part 5: The Seri Indians, Sea Turtles, and the Desert". CEDO News. 3(1) Spring/Summer. Tucson: Intercultural Center for the Study of Deserts and Oceans, Inc.
- Felger, Richard Stephen and Mary Beck Moser
1985 People of the Desert and Sea: Ethnobotany of the Seri Indians. Tucson: University of Tucson Press.
- 1987 "Sea Turtles in Seri Indian Culture". Environment Southwest. San Diego, California: San Diego Natural History Museum.
- Felger, R.S., Kim Clifton and P.J. Regal
1976 "Winter dormancy in sea turtles: their independent discovery and exploitation in two local cultures". Science 191:283-285.
- Friedrich, Paul
1977 Agrarian Revolt in a Mexican Village. Chicago and London" University of Chicago Press.
- Grindle, Merilee
1983 "Issues in U.S. Mexican Agricultural Relations: A Binational Consultation". La Jolla: Center for U.S.- Mexican Studies, University of California.
- Hardin, Garrett
1968 "The Tragedy of the Commons". Science 162 13 December.
- Johnston, Bruce F., Cassio Luiselli, Celso Cartas Contreras, and Roger Norton, eds.
1987 U.S.-Mexico Relations: Agriculture and Rural Development. Stanford: University of California Press.
- King, Wayne F.
1981 "Historical Review of the Decline of the Green Turtle and the Hawksbill". In Biology and Conservation of Sea Turtles. Proceedings of the World Conference on Sea Turtle Conservation. Karen A. Bjorndal, ed. Pp. 183-188. Washington D.C.: Smithsonian Institution Press and World Wildlife Fund.
- Mares, David
1981 "The Evolution of U.S.- Mexico Agricultural Relations: The Changing role of the Mexican State

and Mexican Agricultural Products". San Diego:
Program in U.S.- Mexican Studies, University of
California.

Marine Turtle Newsletter. LaJolla: National Marine Fisheries
Service.

May, R.M.

1973 "Stability and Complexity in Model Ecosystems".
Princeton: Princeton University Press.

Mayer, Lawrence M., Daniel F. Schick, Robert H. Findlay, and
Donald L. Rice

1991 "Effects of Commercial Dragging on Sedimentary
Organic Matter". Marine Environmental Research. 31.

McCay, Bonnie J.

1980 "A Fisheries Cooperative, Limited: Indigenous
Resource Management in a Complex Society".
Anthropological Quarterly. 53(2): 29-38.

McCay, Bonnie J. and James M. Acheson

1987 The Question of the Commons: the Culture and
Ecology of Communal Resources. Tucson: University
of Arizona Press.

McGoodwin, James Russel

1980a "The Human Costs of Development". Environment.
22(1):25-31.

1980b "Mexico's Marginal Inshore Pacific Fisheries
Cooperatives". Anthropological Quarterly.
53(1):39-47.

McGuire, Thomas R.

1983 "The Political Economy of Shrimping in the Gulf of
California". Human Organization. 42(2):132-145.

Meylan, Anne

1981 "Estimation of Population Size in Sea Turtles".
In Biology and Conservation of Sea Turtles.
Proceedings of the World Conference on Sea Turtle
Conservation. Karen A. Bjorndal, ed. Pp. 135-138.
Washington D.C.: Smithsonian Institution Press and
World Wildlife Fund.

Mielke, Myles J.

1988 Transcript of papers presented at "On the Border:
the Present and the Future for Sonora and Arizona"
conference. Tucson, Arizona.

- Mortimer, Jeanne A.
1981 "Factors Influencing Beach Selection by Nesting Sea Turtles". In Biology and Conservation of Sea Turtles. Proceedings of the World Conference on Sea Turtle Conservation. Karen A. Bjorndal, ed. Pp. 45-52. Washington D.C.: Smithsonian Institution Press and World Wildlife Fund.
- Mrosovsky, I. and C.L. Yntema
1981 "Temperature Dependence of Sexual Differentiation in Sea Turtles: Implications for Conservation Practices". In Biology and Conservation of Sea Turtles. Proceedings of the World Conference on Sea Turtle Conservation. Karen A. Bjorndal, ed. Pp. 59-65. Washington D.C.: Smithsonian Institution Press and World Wildlife Fund.
- National Research Council
1990 Decline of the Sea Turtles: Causes and Prevention. Washington D.C.: National Academy Press.
- Nietschmann, Bernard
1973 Between Water and Land: the Subsistence Ecology of the Miskito Indians, Eastern Nicaragua. New York: Seminar Press.
- Odum, Eugene
1989 Ecology and Our Endangered Life-Support System. Sunderland, Massachusetts.
- Ostrum, Elinor
1989 Governing the Commons: the Evolution of Institutions for Collective Action. Bloomington: Indiana University.
- Pastor, Robert
1990 "Comments". IN Dwight S. Brothers and Adele E. Wick Mexico's Search for a New Development Strategy. Pp. 53-58. Boulder: Westview Press.
- Ramirez, Miguel D.
1989 Mexico's Economic Crisis: Its Origins and Consequences. New York, Westport and London: Praeger.
- Robles, Alejandro
1992 Presentation on Fisheries in the Gulf of California, Caring for Sonoran Coastal Waters Session of Sonoran Desert Peoples Summit. Tucson.

January 24.

Rochin, Refugio I.

- 1985 "Mexico's Agriculture Along the U.S. Border: Problems and Prospects". El Paso: University of Texas Center for Inter-American and Border Studies.

Ross, James Perron

- 1981 "Historical Decline of Loggerhead, Ridley and Leatherback Sea Turtles." In Biology and Conservation of Sea Turtles. Proceedings of the World Conference on Sea Turtle Conservation. Pp. 189-195. Washington D.C.: Smithsonian Institution Press and World Wildlife Fund.

Sanderson, Steven E.

- 1986 The Transformation of Mexican Agriculture: International Structure and the Politics of Rural Change. Princeton, New Jersey: University of Princeton Press.

Solis, E.

- 1990 IN Dwight S. Brothers and Adele E. Wick Mexico's Search for a New Development Strategy. Pp. 43-52. Boulder: Westview Press.

Stebbins, Robert C.

- 1985 A Field Guide to Western Reptiles and Amphibians. Boston: Houghton Mifflin Co.

Wade, Robert

- 1986 "Common Property Resource Management in South Indian Villages". In Common Property Resource Management. Pp. 231-257. Washington D.C.: National Research Council, National Academy of Sciences.

Witham, Ross

- 1981 "Disruption of Sea Turtle Habitat with Emphasis on Human Influence". Pp.519-522. In Bjorndal Biology and Conservation of Sea Turtles. Proceeding of the World Conference on Sea Turtle Conservation. Washington D.C.: Smithsonian Institution Press and World Wildlife Fund.

Worster, Donald

- 1984 "Thinking Like A River". Pp. 57-234. In Meeting the Expectations of the Land. Wes Jackson, Wendell Berry, Bruce Coleman, eds. San Francisco: North Point Press.