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SEA TURTLES AS COMMON PROPERTY RESOURCES:
INTERNATIONAL, NATIONAL, AND LOCAL MANAGEMENT
FOR SUSTAINABLE DEVELOPMENT

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Introduction

In the international commons, long characterized by open access, attempts are now being made to achieve international cooperation to preserve the 'global heritage of mankind.' At the same time, sustainable local-level resource management is undermined by economic development, the expansion of commercial markets, and political expediency. As a result, the state finds itself caught between demands from both above and below for effective conservation strategies, for which it lacks necessary resources and capabilities. [A case study of the harvest, use, and commercialization of Latin American sea turtles, collective resources at the local, national, and international levels, demonstrates that sustainability is unlikely to be achieved unless greater effort is made to coordinate resource management across these levels. Not only are national and international instruments doomed to failure without complementary local institutions, but their failure may create new obstacles to local management. Conservation of multi-jurisdictional resources such as sea turtles therefore calls for greater attention to local contexts of resource use, and for a "bottom-up" approach to management.

Sustainability and the Commons

Recent interest in environmental management for conservation and sustainable development focuses considerable attention on the relationship between property rights and environmental quality. Much of this work takes the form of a debate over the nature and consequences of common versus private property, a debate fueled by Garrett Hardin's (1968) "tragedy of the commons" thesis. Hardin, along with a number of mainstream economists, argues that in a world of finite resources and growing population, collective resources are inevitably subject to competitive exploitation and

resource degradation, with consequent welfare losses for resource users.¹ Hardin's proposed solutions are privatization or state regulation; voluntary cooperation is unlikely because any cooperating individual pays the costs of self-restraint, while others reap the benefits.²

Critics of the 'tragedy of the commons' approach have pointed to a number of flawed assumptions underlying it. First, it fails to distinguish between open access resources, characterized by unlimited access in the absence of defined property and use rights, and the historically more prevalent common property resources, governed by endogenous institutions regulating ownership, access, and use. While open access often does lead to resource degradation, common property regimes typically achieve sustainable and equitable resource use.³

Failure to distinguish these distinct systems stems from a view of the individual as relentlessly pursuing his private utility while ignoring the social impact of his actions. Subsequent analysts have challenged this conception. Game theorists, for example, argue that human behavior is frequently characterized as strategic, with individuals realizing their interdependence and acting voluntarily to achieve coordination.⁴ References to sociobiology draw parallels between human behavior and mutualism in other species.⁵ Anthropologists and sociologists point to the complexity, ignored by tragedy of the commons theorists, of the social, political, economic, cultural, and ecological contexts of communal property rights. These factors are as important in determining resource use as simple classifications of private versus communal property, and often lead to the voluntary creation of well-adapted and highly effective institutions to conserve shared resources and manage conflict among resource users.⁶

The solutions proposed by Hardin have also been questioned. A number of studies demonstrate that state intervention and privatization are as often the cause as the consequence of resource degradation.⁷ Both economists and environmentalists have argued that resource degradation is a function of discount and investment rates, and is therefore as likely to occur under private ownership as under communal.⁸ The state, on the other hand, is frequently characterized as too centralized, vulnerable to political conflict, and hampered by lack of will and resources to offer a viable alternative.⁹ Furthermore, both privatization and state regulation are likely to result in inequitable access, especially in societies with highly skewed distributions of power and wealth.¹⁰

Finally, while the tragedy scenario depicts common property arrangements as obsolescent in a modern society characterized by high population density, technological development, and resource scarcity, several arguments have been made to the contrary.¹¹ Resources characterized by low and variable productivity, low possibilities for improving or intensifying yield, or high geographic dispersion or mobility are often divided only with great difficulty and can be utilized more efficiently and equitably under communal management.¹² This is true even in highly developed societies, as is demonstrated by the persistence of collective management in such countries as the United States and Switzerland.¹³ Moreover, common property systems offer particular benefits to developing countries, in part because the state lacks sufficient capacity either to regulate use efficiently and equitably, or to create the conditions under which private property can function effectively. Reliance on local control is often a preferable alternative because local

communities often already possess the requisite ecosystem knowledge and social enforcement mechanisms. Communal arrangements also offer a unique ability to alleviate environmental and income uncertainties and to achieve equitable access to resources which are distributed randomly and which are central to the livelihoods of the poor.¹⁴

A number of recent developments have combined to increase academic and official interest in increasing the role of common property systems in conservation and development.¹⁵ The first is the accelerating destruction of traditional communities, both indigenous and non-indigenous, as a result of the opening of previously isolated territories, market penetration, and political, economic, and cultural conflict. Many studies suggest that their historical economic and environmental sustainability is due not merely to low population density, but also to effective techniques and institutions for resource use and management. Communal systems are therefore frequently offered as models for community development programs, adding weight to demands for their protection.¹⁶

Second, environmental degradation, coupled with new norms of environmental responsibility, have given rise to considerable pressure on national governments to protect resources and ecosystems.¹⁷ However, the regulatory approach generally taken in response has thus far proven ineffective, raising fears that the failure of state resource management may be inevitable as a result of conflict between political and development goals, ecological demands, and the survival strategies of those being regulated.¹⁸ The manipulation of economic incentives is often suggested to achieve desired results with fewer transaction costs, despite criticism by environmentalists that even adjusted markets are incapable of fully

taking into account ecological values, and that market reform is likely to have an adverse impact on the poor.¹⁹ Out of this debate has grown an increasing awareness of the benefits of community participation in resource management, which offers the benefits of decentralization while alleviating the inequalities and externalities of unregulated markets.²⁰

Third, the interdependence and global extent of environmental problems such as deforestation and acid rain are increasingly obvious, and new resources, such as biodiversity and wildlands, have emerged on the list of those in which the international community as a whole considers itself to have a stake. As a result, new international agreements have been developed to manage trans-boundary resources. While some (e.g., Exclusive Economic Zones) are achieved through privatization, most emphasize collective action.²¹ Although students of international relations stress the uniqueness of agreements among nations, deriving from the absence of a central authority and the dual demands of global action and domestic enforcement, the functions of these collective institutions (minimizing conflict, implementing norms of equitable ownership and use, and achieving sustainability), and their components (property rights, use rights, and social choice mechanisms), are essentially the same as those of small-scale common property regimes.²² Similarly, although international regimes offer potential for enhancing sustainability, they too are often overridden by national development needs, and founder on the inability to restructure local resource use. Thus, while the theory of international common property regimes is more recent and less sophisticated, it has revealed the same conflicts over centralization and the use of economic incentives.²³

While the complexity of these issues has generally led to their separate analytical treatment, changes at each of these levels are obviously closely linked. The same advances in production, technology, trade, and geographic mobility trigger changes at all three system levels, through both direct and cumulative effects. The form of public intervention which responds to these changes affects the survival chances of local communities and their members, as well as determining whether the transnational effects of resource use will be expanded or minimized. International agreements affect local resource use by pressuring national governments to act in certain ways (and not necessarily in compliance), and by changing international and national market relationships. And resource relationships at the local level influence the effectiveness, if not always the choice, of national and international instruments.

Unfortunately, early strategies tended to focus on national and international measures, while taking for granted the response of domestic societies. Lack of compliance, the stubbornness of environmental problems, and the unanticipated effects of these policies have led to greater awareness of the contradictory cues generated by the international economy, domestic development strategies, regulatory mechanisms, and the context of local resource use.²⁴

Despite these new analytical directions, less attention is paid to the need to integrate local, national, and international common property regimes. Instead, the search for new approaches is frustrated by a tendency to either focus on one jurisdiction or to pitch the discussion at a level too general to be enlightening. The following discussion attempts to move beyond these limitations by exploring the linkages between resource

use, environmental impact, economic relations, and political action in each jurisdiction. It calls attention not only to the need for local management institutions, but to the importance of designing national and international regimes which create a favorable context for local management. These analytical purposes are achieved by focusing on a relatively narrow resource issue: the use and conservation of Latin American sea turtles.

Wildlife in general, and sea turtles in particular, rarely figure in discussions of the development needs of the poor. Yet sea turtles have long provided meat, eggs, oil, skins, leather, and shell for coastal populations, and have figured prominently in international trade since the first European exploration in the region. They remain central to the livelihoods of a few remaining indigenous communities, provide subsistence and cash income for coastal populations throughout the tropics, and earn foreign exchange for the countries which continue to export them. Their extensive migrations and status as endangered species have meant that they have been the object of local, national, and international conservation efforts, while the failure of these efforts clearly calls for innovation rather than intensification of traditional approaches. In particular, the diversity of uses and users call for greater flexibility in management strategies, while the importance of the resource to coastal communities and failure to control local use point to the need for community participation in management. Evaluation of sea turtle use and conservation thus allows simultaneous treatment of the issues raised by multijurisdictional resource management and clarification of the links between them.

The following sections describe in greater detail the characteristics of the resource, the difficulties of achieving effective international,

national, and local management, and the possibilities for integrating common property regimes in each jurisdiction in order to achieve a coherent and consistent approach to sustainable use.

Resource Characteristics

Sea turtles emerge on land only to deposit their eggs. Adult females nest once every 2 to 3 years, laying between 1 and 11 egg clutches per season, each containing roughly 100 to 150 eggs. Mating also occurs offshore during the season, so that females are followed by males into nearshore waters.²⁵ While nesting occurs in scattered locations throughout the region, green turtles (Chelonia mydas), Pacific green or black turtles (Chelonia agassizi), olive ridley turtles (Lepidochelys olivacea), and Kemp's ridley turtles (Lepidochelys kempi) tend to return to the same nesting sites season after season, arriving in large aggregations known as arribadas. The green turtle returns to specific feeding sites as well. Thus, green nesting colonies at Tortuguero, Costa Rica are frequently found feeding off the Miskito Coast of Nicaragua, nesting populations from Aves Island travel to several Caribbean islands, Nicaragua, and Quintana Roo, and feeding grounds along the Brazilian coast support nesting colonies in Surinam and at Ascension Island, 2200 km away. Those nesting in Michoacan, Mexico feed off Baja California and in the Gulf of California, as well as in scattered areas throughout Central and South America.²⁶

Nesting by olive ridleys is more concentrated. Nesting sites in Mismaloya, Tlacoyonque, Chacahua, and Escobilla, Mexico, and in Nancite and Ostional, Costa Rica, are thought to support much of the population of the entire East Pacific,²⁷ and large numbers of this population feed off the coast of Ecuador.²⁸ Kemp's ridleys nest mainly in Rancho Nuevo in

Tamaulipas, Mexico, and then return to feeding grounds throughout the northern Gulf of Mexico and in Campeche.²⁹

The leatherback (Dermochelys coriacea) is also highly migratory, but because it inhabits deeper waters than the other species, little is known of its routes. Its nesting is more dispersed, although large aggregations occur in French Guiana and Michoacan and Oaxaca, Mexico, with smaller sites in Colombia, Surinam, and Costa Rica.³⁰ The hawksbill turtle (Eretmochelys imbricata) is found throughout tropical reef areas, nesting on adjacent beaches. Nesting behavior is therefore relatively dispersed, and the only large nesting beach in Latin America, Chiriqui in Panama, is now severely depleted.³¹ The loggerhead (Caretta caretta) nests in small sites throughout the Caribbean, especially in Cuba, Honduras, Quintana Roo, and the United States, and is also found in the Pacific.³²

The nesting behavior of sea turtles not only raises jurisdictional difficulties for management, but also makes them easiest to harvest at the precise time that they should be protected: when females are gravid. A number of other factors raise difficulties for conservation efforts. First, population counts can be made only when females come ashore to nest, so that only rough estimates can be made. Second, the long maturation period, typically 5 to 7 years until reproductive age, makes the impact of any management option highly uncertain, and raises the possibility that ineffective management could bring about an abrupt and irreversible population crash. Third, the long life cycle of the turtle, and its size (over 300 pounds for green, up to 100 pounds for ridleys, 100 to 200 pounds for hawksbills, 200 to 350 pounds for loggerheads, and up to 1300 pounds for leatherbacks), create problems for farming or ranching operations, as

the cost of maintaining the turtles until they are mature enough to breed or be butchered are quite high. Fourth, possibilities of artificial incubation to reduce egg predation, or of headstarting hatchlings to improve their 1 to 2% survival rate in the wild, are complicated by the difficulty of transporting and storing the eggs without damaging them; the need to manage the temperature, which affects the sex ratio of the hatchlings; and the unknown effects of moving eggs and hatchlings on the turtles' subsequent homing mechanisms.³³ Attempts to establish farming operations have thus far been unsuccessful.³⁴

Sea Turtles and the International Commons

The most critical problems demanding international collaboration are the migratory behavior of the species and the lucrative international trade in sea turtle products. Two international agreements offer the most likely frameworks for cooperation on these issues: the Convention on International Trade in Endangered Species and the Bonn Convention on Migratory Species.

The international trade in sea turtle products began in Bermuda, en route between the West Indies and Europe. In the 19th and early 20th centuries, the United States and Britain were the region's largest markets for hawksbill shell, green turtle meat, and calipee for soup.³⁵ After a temporary lull in the 1940s and 1950s due to World War II and the development of plastic substitutes for hawksbill shell, worldwide demand for shell and meat intensified, and new markets developed in olive ridley skins and leather (largely as a result of the exhaustion of crocodile and alligator populations), and for oil used in the manufacture of cosmetics. By the time CITES was signed in 1973, all sea turtle species were threatened.³⁶

CITES regulates international trade in wildlife and wildlife products according to the degree of threat to the species. All species of sea turtles are listed in the Convention's Appendix I, the most stringent classification, which prohibits trade except for exceptional circumstances, and for non-commercial purposes only. The Convention is administered by the International Union for the Conservation of Nature and the World Wildlife Fund, which monitor trade flows and, with the aid of numerous NGOs, publicize compliance failures. Despite the Convention's large membership (106 as of July, 1990) and effective implementation by a number of large importers such as the U.S. and Britain, a number of Latin American nations, parties and non-parties, continue to participate in the trade.³⁷

The bulk of Latin American exports goes to Japan, which listed reservations on hawksbill, ridley, and green turtles when it acceded to the Convention. Japanese imports of hawksbill shell from parties continued in the 1980s from Costa Rica, Ecuador, Puerto Rico, Cayman Islands, Nicaragua, Panama, and the Bahamas, and from non-parties Barbados, Belize, Cuba, Dominica, Dominican Republic, Haiti, Honduras, Jamaica, and Mexico. Most Caribbean nations are not CITES members, and the shell sells there for \$50 to \$100 per pound. Both Panama and Jamaica have been identified as conduits for illegal products from throughout the region.³⁸

Japan has also continued to import green and olive ridley skins and leather from parties Ecuador, Cayman Islands, Panama, and Nicaragua, and from non-parties Cuba, Dominican Republic, Mexico, and Jamaica.³⁹ The trade has been dominated by Mexico and Ecuador, although Mexico officially outlawed the harvest and export of all species in May 1990. Between 1966 and 1977, roughly 1.4 million olive ridleys were killed in Oaxaca,

Michoaca, and Jalisco for the trade, and the leather of over 300,000 Mexican ridleys was exported to Japan between 1976 and 1986.⁴⁰ While the Mexican ridley industry has been closed, largely as a result of international pressure, the processing facilities are still intact and it remains to be seen whether domestic pressures will result in its reopening.

In Ecuador, an estimated 132,000 to 147,000 olive ridleys were killed for the skin trade between 1970 and 1977. From 1978 to 1981, another 290,000 to 320,000 were exported, primarily to Japan, Italy, Switzerland, and Mexico.⁴¹ In 1981, a ban was placed on exports and the processing plants in Manta closed. However, the fishery survives, and large volumes of illegal skins have continued to flow to Japan, either directly or through Panama.⁴² In 1987, two turtle processing plants were reopened, and exports of turtle products to Mexico were officially authorized.⁴³

The difficulties in controlling the trade are legion. Continued demand by Japan, and to a smaller extent by Europe, offer substantial incentives to countries like Mexico and Ecuador which either refuse to accede to the Convention or fail to implement it, and draws exports even from areas with vigorous enforcement effort. Nesting concentration offers an easy harvest, and rising prices due to scarcity make this a highly profitable trade. The fisheries in Mexico and Ecuador have traditionally supported large populations of fishermen and other employees, and both countries face strong domestic pressure to continue the trade. The foreign debts of countries throughout the region offer little incentive to close an industry which earns foreign currency. The substantial costs of implementing CITES regulations, and doubts as to the Convention's efficacy -- even substantial implementation and enforcement efforts are unable to

stop smuggling, especially through non-party states -- offer further disincentives.⁴⁴ With the end of Mexico's ridley export trade, however, Mexico is more likely to accede to CITES, although substantial time for preparation will be needed. Another source of hope is that Japan can be pressured by the international community to curtail its imports, although Japan has an important domestic industry based on these imports, and has thus far resisted such demands.⁴⁵

The exploitation of Mexican and Ecuadorian turtles is believed to have contributed to population declines along the Pacific coast of Central America, Colombia, and Peru, where exploitation is primarily for domestic consumption.⁴⁶ Furthermore, domestic management of other Mexican species has been hindered by the turtles' migrations to the coasts of Central America and the United States, where, as in Mexico, they are threatened by coastal development as well as exploitation. Another problem is incidental capture in fishing nets, which has generated U.S. - Mexican conflict over the use of TEDs (turtle excluder devices, or trawling efficiency devices).

These conflicts call for implementation of the Bonn Convention on Migratory Species, which entered into force in 1983. The Bonn Convention imposes obligations for strict conservation measures for species listed on Appendix I (which is similar to that of CITES and which lists all species of sea turtles), and also calls for the negotiation of separate bilateral or multilateral agreements for Appendix I or other species which would benefit from them.⁴⁷ Such agreements are needed for Pacific states from Mexico to Peru, and to regulate domestic harvest in Central America, where large populations of green turtles migrate between nesting beaches in Costa Rica and feeding grounds in Honduras, Nicaragua, and Panama. The

substantial domestic, inter-island, tourist, and export trade among the Caribbean island nations also points to the need for coordinated controls, possibly with the participation of the United States.

Unfortunately, the Convention's newness and the small membership (22 contracting parties and 12 signatories in 1988) have limited its impact thus far, and Chile is the only coastal nation in the Western Hemisphere to have ratified it.⁴⁸ However, CITES experienced a similar lag, and the Bonn Convention may soon play a role in regional management. In the interim, expanding national efforts to monitor and protect the resource may lead to similar arrangements outside the Convention.

Problems for National Management

Several obstacles inhibit the willingness and ability of national governments either to respond to international demands or to achieve their own purposes through domestic instruments. These include conflict between the goals of growth and sustainability, the prevalence of short-run concerns in official policy-making, lack of resources to design and implement effective conservation measures, and the virtual impossibility of enforcing controls on illegal harvest or egg collection. The result has been contradictory, ineffective, and often inequitable allocation of rights among those who earn their livelihood from the resource.

Mexico provides a good example of these difficulties. The central government began consistent conservation efforts in the 1960s with protective legislation, beach patrols, and hatchery programs. At the same time, however, it promoted exploitation of the Pacific ridley fishery by supporting the private company PIOSA, which began by exporting Oaxacan ridley skins to Europe and later utilized the entire carcass, processing

meat, shell, leather, oil, and ground cartilage for fertilizer. In 1980 the company was purchased by the state-owned Propemex, which until May, 1990 continued to buy turtles from local fishing cooperatives.⁴⁹

Management of Pacific ridleys consisted of quotas on harvests of adults, reserved to 19 cooperatives in Oaxaca, Michoacan, and Guerrero; a ban on the taking or marketing of eggs; and hatcheries for eggs taken from slaughtered females. But the yearly quotas (20,000 in 1989) were widely considered unsustainable, the illegal harvest exceeded the legal catch, the survival rate for incubated eggs was exceptionally low, and the prevention of egg poaching was, and still is, virtually impossible, so that nesting populations have declined markedly.⁵⁰

Publicity both at home and abroad led to the presidential decree ending the annual quota and mandating the closing of processing facilities, but the demands of conservationists are not the only pressures the Mexican government faces. On the one hand are international markets offering both demand and price and international creditors demanding payment; on the other are fishing cooperatives which have depended for decades on the turtle fishery, in addition to employees of slaughterhouses, warehouses, and transport systems, those involved in illegal exploitation and trade, and Propemex administrators. An agreement signed between federal and state governments and the fishing cooperatives promised a wide range of fisheries development and social assistance programs in exchange for support for the permanent closed season, but these programs have yet to be implemented. The timing and impact of assistance programs, and the response of the cooperatives to the adjustment period, remain to be seen.

The taking of eggs or adults of other species has for several years been prohibited, but protection of each of the species conflicts with the promotion and industrialization of fishing cooperatives. Credit and other support for the purchase of outboard motors, larger boats, nylon nets, and diving gear increase the ability of fishermen to overharvest more abundant resources (fish, lobster, shrimp), but also allow a larger take of adult sea turtles, whether purposeful or incidental. Especially threatening is the large incidental catch of all species by shrimp trawlers along many Mexican (and other Central and South American) coasts. In either case, the turtles are often cut open to extract eggs, the meat eaten or sold, and the oil used to make creams and soaps, while leatherbacks are also used as shark bait and hawksbills for tortoiseshell.⁵¹ Ironically, closed seasons designed to protect other fishery species such as lobster and shrimp fall during the sea turtle nesting season; while these closed seasons are equally difficult to enforce, they only serve to increase turtle harvests.

The economic benefits of this incidental catch make its reduction unlikely. Although a threatened U.S. shrimp embargo has prompted the circulation of Secretary of Fisheries bulletins encouraging the use of TEDs, their purchase is expensive and would undoubtedly require scarce government assistance. The inability of the Mexican government to control foreign fishing boats serves as another disincentive for a more intensive government program. Fishermen in both the United States and Mexico have also objected that TEDs reduce shrimp catch, thus increasing resistance to their use.⁵² And finally, as experience in both countries has demonstrated, use requirements for large populations of fishermen scattered throughout the coast are impossible to enforce.

Prohibition of turtle exploitation is also difficult because of large internal markets for meat, and especially for eggs. This demand is partly cultural -- both meat and eggs have a reputation throughout Latin America for enhancing vitality and virility.⁵³ Mexico has devoted more resources than most countries in the region to patrolling beaches, but there are never enough Marines to effectively cover the long, isolated stretches of beach, and even increased penalties -- now including fines, jail sentences, and confiscation of fishing gear -- are insufficient to deter poachers. Instead, efforts are often made to speed egg collection by carrying turtles up the beach or killing them to extract the eggs.⁵⁴ Both Marines and biologists are often accused of raiding the nests themselves. There also exists a significant demand for hawksbill shell handicrafts to feed the tourist and export trade, and for turtle oils used in creams and ointments. And unfortunately, even present enforcement efforts often come at the expense of other, equally threatened species.

The difficulties faced by Mexico are compounded elsewhere by still greater scarcities of central government resources. In Peru, for instance, little is known of turtle populations and legal protection is weak and rarely enforced.⁵⁵ In Colombia, little effort has been made to study or protect nesting beaches, and it is reported that virtually every turtle leaving the water is captured and killed, and the eggs taken.⁵⁶ In Ecuador, effective protection in the Galapagos National Park (a World Heritage Site) contrasts sharply with unsustainable exploitation off the mainland coast.⁵⁷ In Belize and Honduras, closed seasons are simply ignored.⁵⁸ In Panama, harvest of eggs on the Pacific coast for domestic use continues despite its prohibition, while on the Atlantic coast an

intensive industry trades and transships ornamental stuffed juvenile hawksbills and hawksbill shell.⁵⁹ Costa Rica and Guatemala have undertaken strong legislation and efforts in research, education, hatchery programs, and beach protection, but the lack of funds for enforcement undermines all of these measures, and egg poaching and sale are widespread.⁶⁰

The Local Context of Exploitation

The most common obstacle to effective protection of sea turtles is local overexploitation for consumption and small-scale sales. In some areas, dependence on fishing for adult turtles makes prohibition of taking or effective enforcement unlikely, while prevention of egg collection has proven difficult everywhere. The following section explores the obstacles to community participation in conservation programs, the most important of which include high prices for eggs and adult turtles, the importance of sea turtle products to coastal livelihoods, the opening of previously remote areas to new settlement, and increasing resource scarcity.

No information exists on property regimes existing prior to European contact, and the few studies available on later systems offer little evidence of institutions governing access and use. However, rarely has attention been paid to local harvest and consumption patterns, and such institutions may well have been simply ignored. It is therefore not certain whether indigenous use of sea turtles prior to European exploration was sustainable only because of low intensity, or because of conscious management. At any rate, by the time sea turtles began to receive attention from biologists, they were generally exploited under open access.

Turtling is still central to the livelihoods of a few indigenous communities, such as the Miskito of Nicaragua and Honduras, the Carib of

the northern Gulf of Mexico, the San Blas Cuna of Panama, the Seri of Baja California, the Nahuatl of Pacific Mexico, the Maya of the Yucatan, and the Galibi of Surinam.⁶¹ Most of these communities have been periodically disrupted by the expansion of domestic or export markets, which probably upset any existing property arrangements and which unquestionably have encouraged indigenous populations to overexploit their fisheries. For example, while the Carib on the northern Gulf coast of Mexico staked out rights to separate beach areas in the 1960s, they harvested nearly all of the Kemp's ridley eggs laid there.⁶² In the 1970s, the establishment in Nicaragua of plants for processing green turtles for export led the Miskito to intensify their fishing effort and to deplete local populations.⁶³ In the 1960s, dealers from interior cities offered the Nahuatl Indians high prices for green turtle eggs and adults, and by the late 1970s the population had nearly been exterminated.⁶⁴ The Seri have responded similarly to the growth of internal markets for meat.⁶⁵ These communities have also been very responsive, however, to conservation efforts. For example, the Nahuatl now cooperate in protecting nesting beaches and hatcheries in return for a small subsistence take,⁶⁶ and the Miskito have returned to subsistence harvest following Nicaragua's accession to CITES.⁶⁷

More common, however, is intensifying exploitation and commercialization. In Honduras, coastal peoples harvest virtually all of the eggs laid, and sell 100% of the eggs collected. Turtle eggs are more expensive than chicken eggs, and therefore provide more protein by being sold than by being consumed. While traditional harvest involved marking off exclusive sections of beach, population growth, the influx of collectors from other areas, and the decline in nesting populations has led

to a new system. During the nesting season, egg collectors line the beach to wait for turtles. When the female emerges, she is picked up and carried up the beach, where she is guarded until the eggs are laid; sometimes the collector even helps to dig the nest.⁶⁸ Women must wait in groups of 2 or 3 in order to be able to carry the turtles and to guard them from men, who may snatch them from lone females.⁶⁹ In Guatemala as well, growing demand and the building of roads to the coast have led to overexploitation. One nest may yield \$32.00 worth of eggs, while income from most fishing and agricultural averages \$2.00 per day; unsurprisingly, almost all of the eggs are taken.⁷⁰ Poachers on the Pacific coast of Costa Rica stake out group territories, remove up to 80% of the leatherback eggs, and wait for the trucks of buyers and distributors to arrive at the beach.⁷¹ Poachers in Oaxaca, who received roughly US\$.65 per egg in 1990, are reported to work together to evade beach patrols (or to work together with beach patrols).⁷²

Widespread failures in initial government attempts to control harvesting have already prompted a greater willingness to increase community participation in conservation. A number of programs offer hope for such an approach, although their impact is still uncertain. For example, in Guatemala, several coastal communities collect a portion of each season's eggs and place them in hatcheries in order to protect them from poachers. Eggs are often obtained from the poachers themselves, who receive a receipt for the eggs which grants them informal immunity from police harassment. Because the hatchery techniques are simple and the collection of eggs free, few employees are needed, and these are usually local men who receive a small stipend from the government for their efforts.⁷³ In Playa Ostional, Costa Rica, the concentration of nesting

ridleys is so high that those nesting later in the season often dig up older nests. The government has therefore permitted the harvest of eggs laid early in the season. Local residents are hired to guard the beach, collect the eggs, package them, and transport them to interior markets; part of the profit from their sale is used for community development.⁷⁴

The success of such projects varies widely, however, depending on a number of variables: the social and economic profile of the community concerned, the importance of the resource, and the presence or absence of the requisite regulatory flexibility to permit the development of such programs. In Mexico, for example, the previously-mentioned Nahuatl project in Michoacan partly owes its success to a wide scope made possible by assistance from World Wildlife Fund and the U.S. Fish and Wildlife Service. The exchange of harvests for assistance in nest relocation and poaching control were supplemented by training and development projects for a population composed of fugitives from deforestation, dependent on turtles primarily due to a lack of skills needed to harvest other species.⁷⁵ Furthermore, the continued success of the program is uncertain in the face of the new ban on the taking of eggs and adults. In Oaxaca, on the other hand, continuation of the legal quota was made dependent on assistance from the fishing cooperatives in beach patrols and nest relocation, in spite of which egg poaching was so uncontrolled as to attract worldwide attention. And even this assistance has ended with the removal of the quota.

In other communities in the Yucatan peninsula, biologists working with the government and Mexican NGOs have enlisted fishermen as volunteers in beach protection, egg relocation, and the capture of juvenile hawksbills for tagging. However, the fishermen volunteer in part to engage in

unofficially-permitted removal of some of the eggs, an arrangement prohibited by law and therefore dependent on the willingness of individual biologists to risk disclosure and possible penalties. Furthermore, volunteer activities are found primarily in more prosperous communities which not only have been exposed to public education campaigns, but in which the turtle population has already been overexploited to such a degree as to make it commercially insignificant. This tendency is especially clear in the prosperous Caribbean tourist zones, where the primary threat to sea turtle populations is habitat destruction. In this region, hotel owners volunteer their employees for nest relocation and protection, and individuals are developing community education and beach patrol programs.

Integrating Local, National, and International Management

As became clear in the 1960s and 1970s, sea turtle populations are incapable of supporting an international luxury trade, and its decline with the creation of CITES may be the most important protection yet provided. While the present trade is much smaller, however, its effects are magnified by the depleted status of current populations, and effort must be paid to achieving further reductions. The Bonn Convention, if it achieves the degree of cooperation experienced in CITES, should not only strengthen domestic efforts, but aid in the establishment of the coordinated management programs so clearly needed for a species with such extensive migratory patterns. Furthermore, international concern over the protection of endangered species has encouraged governments of the region to curtail the trade and to establish research, beach protection, incubation, and headstarting programs, and governments and NGO's have channeled considerable resources into these programs.

The difficulty lies in the political, economic, and social context facing local resource users; in most cases, this context is such that no amount of enforcement effort, even if the resources were available, would be able to achieve compliance with central regulations, especially when they place absolute bans on harvest and sale. The success of national and international programs thus depends on the ability of those harvesting sea turtles to exercise collective control over access, use, and conservation. It would appear from the foregoing discussion that many communities would respond well to programs allowing small, equitable harvests of eggs in return for contributions to conservation programs, such as guarding nests from poachers or natural predators, headstarting juveniles, or contributing eggs to hatcheries. Enhancing community control over marketing, which becomes possible only if some trade is permitted, also offers a way to return the benefits of harvest to the community, thus increasing the incentive to cooperate in conservation. Compared to the loss of all eggs laid and the drain on government resources represented by beach patrols, such programs appear as an attractive alternative. They may also provide the basis for alternative uses, such as tourism promotion.

This is not to suggest, however, that easy solutions are at hand. Cooperative management may be difficult to achieve in communities undergoing rapid growth, as many coastal areas are. Furthermore, although egg protection is the most urgent requirement for saving the species, it must be complemented by conservation on the part of fishermen who harvest adults. These resource users may have no stake in nest protection, which is likely to take place elsewhere, and monitoring and enforcement, even by community members, is much more difficult. Attempts to develop a

'negative' stake in cooperation, for example by imposing fines on both fishing cooperatives and individual poachers for illegal taking, may simply fail to encourage community enforcement, as it has in Mexico.⁷⁶

The success of community management also depends on the willingness and ability of national agencies to create a flexible and supportive framework for these efforts. While simple prohibitions of harvest and sale are the easiest means of responding to demands for protection, they fail to take into account the diversity of use patterns which is particularly evident in developing countries. Government willingness to grant control and autonomy to local communities is a necessary ingredient, but may conflict with national political strategies. National and areawide guidelines on harvest quotas, conservation programs, and marketing would need to be established, demanding considerable research on use patterns and local needs, coupled with local participation in decision-making. Assistance is also needed in meeting the equipment and information needs of local hatcheries, and in providing TEDs to local fishermen, but poses a substantial drain on scarce government resources.

The responsiveness of national governments to these needs is highly uneven at best, and the efforts of the most effective agencies may founder on the current lack of information on the human and ecological aspects of resource use. Little effort is made to examine patterns of use and domestic trade in any detailed or systematic fashion; most of what is known is provided by the incidental observations of biologists and technicians whose primary responsibilities lie elsewhere. Greater research in this area is needed for appropriate policy responses, and given the complexity of use patterns, demands local input. And unfortunately, even substantial

biological research has been unable to determine the effects of various management strategies on turtle populations. While hatcheries presently offer the most likely means to restore turtle numbers, evidence of their impact on sea turtle populations is inconclusive. Thus, not only do the programs suggested offer uncertain results for the species, but they may not show any measurable benefit to communities, thus weakening their attractiveness to resource users.

Adjusting the international context of species management involves similar difficulties. Exporting nations may be unwilling to curtail the trade because of domestic interests, the costs of active enforcement efforts, and the lack of assurance that others will behave similarly. In the latter cases, the role of international organization is to offer not only social pressure, but also necessary resources, including scientific data, technologies, and experience with policy innovations.

The conflict between international pressure and domestic demands, however, is more difficult to resolve, and demands greater sensitivity to the political and socio-economic environments of local resource-users. The effects of international activity at the national and local levels must be continually evaluated to this end. For example, while the reduction of international demand for sea turtles has relieved much of the pressure on their populations, little is known of the unpredictable, and possibly negative, impact of trade bans on small-scale users. The pressures of international conservationists may also lead to domestic programs suited more to public opinion than to the needs of species or local communities. Finally, international demands must be matched with efforts to channel

resources and entrepreneurship directly to local users, for local control is the necessary precondition for both national and international control.

Conclusion

The foregoing discussion has attempted to reveal the linkages between the local, national, and international contexts of sea turtle use and conservation, and to suggest both constraints and opportunities for action at each of these levels. The experience of national and international efforts demonstrates the continued relevance of local common property institutions in contemporary societies concerned with sustainable resource use, and particularly in developing countries. While this conclusion echoes several recent writings on the subject, the need to establish complementary national and international regimes based on the needs of such local institutions is, surprisingly, a rather novel addition to both the common property and sustainable development literatures. Furthermore, it remains foreign to national and international management efforts; attempts by Latin American governments to prohibit sea turtle harvests, by CITES to ban international trade in turtle products, or by the Bonn Convention to coordinate regional conservation efforts are oriented toward the preservation of species, not the development needs of the coastal poor. The integration of local, national, and international common property regimes therefore suggests a new approach to resource management, one which takes local needs rather than species status as its starting point.

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