A Global Survey of Sea Turtle Payment Incentive Programs

by

Paul J. Ferraro

Department of Economics

Andrew Young School of Policy Studies

Georgia State University

PO Box 3992

Atlanta, GA 30302-3992

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Abstract

Performance payment conservation approaches are based on a willing buyer-willing seller model. Sellers deliver conservation outcomes in exchange for a negotiated payment in cash or in kind. The use of performance payments to achieve conservation outcomes is increasingly being touted as an alternative to traditional regulatory and development-based approaches in low-income nations. Although payments are increasingly common in terrestrial species and ecosystem conservation initiatives, they are rare in marine conservation efforts like sea turtle protection. This report describes sea turtle incentive payment initiatives taking place around the world through an economic lens.

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1. Introduction

Direct payment conservation approaches are based on a willing buyer-willing seller model (Ferraro and Kiss 2002). Sellers deliver conservation outcomes in exchange for a negotiated payment in cash or in kind. Payments are conditional on conservation outcomes. Although direct incentive payments are increasingly common in terrestrial species and ecosystem conservation initiatives, they are rare in marine conservation efforts like sea turtle protection.

The absence of incentive payment initiatives in the sea turtle conservation community is not surprising. Creating economic incentives for the conservation of a wide-ranging, migratory species is difficult (Ferraro, 2005). Moreover, my reading of the literature suggests that the sea turtle conservation community is largely unfamiliar with the theory and practice of using economic incentives for achieving conservation objectives. For example, if one were to search the last three Proceedings of the Annual Symposia on Sea Turtle Biology and Conservation (21st – 23rd) for uses of the word "incentive," one would find only twenty-nine instances in 1000 pages of text. Furthermore, most of these references have nothing to do with specific actions to create incentives for turtle conservation. If we were to remove vague references about incentives being important, about incentives that are somehow created through education, about incentives for destroying turtles or eggs, and about (dis)incentives that come from criminal prosecution, the word "incentive" only appears ten times, eight of which are in a single paper.

This paper describes sea turtle incentive payment initiatives taking place around the world through an economic lens. The information is extracted from cited sources and conversations with project personnel. Although land purchases for turtle nesting habitat can be

considered a direct payment approach (e.g., Archie Carr National Wildlife Refuge, Playa Grande, Laganas Bay), their use as a conservation tool is well known and not discussed here. Moreover, their potential success rate in low-income nations with weak institutional settings is suspect, as is their likelihood of being politically palatable and free of substantial conflict.

Note that "eco-labeling" initiatives and "alternative livelihood" initiatives are not included here as direct payment schemes. In other publications, I have argued that these programs are not direct payment schemes (Ferraro 2001; Ferraro and Simpson 2002; Ferraro and Kiss 2002; Ferraro et al. 2005). For similar reasons, I do not consider eco-tourism approaches, unless money from the tourists is directly invested in conservation performance payments.[1] Likewise, I do not include examples in which a few local villagers are paid to patrol the beaches, because these wages are not directly tied to conservation outcomes. I do, however, contrast the general characteristics of these alternative approaches with those of payment approaches in Section 4. In the next section, I describe examples of the most direct forms of incentive payment schemes for sea turtle conservation.

[1] As in terrestrial conservation, there is some evidence that ecotourism can provide appropriate incentives when a small group of individuals receives substantial benefits from the ecotourism and can control exploitation of the species (e.g., Gandoca Beach, Costa Rica). In general, however, the same incentive problems that plague attempts to harness tourism market forces for local conservation incentives (Ferraro, 2001) will also plague sea turtle conservation efforts.

2. Sea Turtle Conservation Performance Payments

2.1. Kenya (Watamu Turtle Watch)[2]

Watamu, Kenya has a small but nationally important nesting population of green sea turtles in the Malindi/Watamu Marine Park and Reserve complex (40-60 nests/year on about 30 kilometers of shoreline). Since 1997, the local, non-governmental Watamu Turtle Watch (WTW) has run a conservation program that, in addition to conducting research on turtle population dynamics and anthropogenic pressures, implements a community conservation education program, pays villagers performance payments for nest protection and pays fishermen to release live turtles from fishing gear and to participate in a tag and recapture study.[3] To my knowledge, WTW runs the only turtle by-catch payment incentive program in the world (in other words, payments made directly for releasing turtle by-catch rather than subsidies for using gear that reduces turtle by-catch).[4]

In the nest protection incentive program, individuals who report a nest receive 500 Kenyan shillings (KSH) upon verification by the WTW (approximately two times the daily wage of a casual laborer). This payment is followed by another 500 KSH when the nest hatches successfully, as verified by the WTW or Kenya Wildlife Service employees ($1 USD = 72 KSH). The latter payment for "success" is not a function of the degree of success (i.e., not a

[2] Sources: Steve Trott, current director of WTW; Richard Zanre, former director of WTW; Zanre 2005.

[3] Technically, WTW is no longer the name of the organization. In 2002, the Local Ocean Trust was created to work on broader conservation issues. The WTW is now considered LOT's flagship operation.

[4] Note, however, that the WTW by-catch program is more akin to a wildlife damage compensation program than a payment program that rewards by-catch reductions. For a distinction between the two kinds of programs, see Nyhus et al. 2005.

variable payment that grows with the number of eggs hatched). This payment schedule has been in place since 1997 without any changes.

However, the way in which the Marine Park beaches are monitored has changed. Originally, community members were involved in night patrols on both Park and Reserve beaches. Now only two salaried patrolmen have permission from the Kenya Wildlife Service to be on the Park beach at night (they patrol each night of the year). Their salary is not a function of the number of nests found or successfully hatched. Community members continue to report nests found on Reserve beaches and on the Park beach during daylight hours. The current WTW director reports that turtle poaching on Park beaches is near zero and has been greatly reduced in the Reserve (no written reports have been generated on this program).

The turtle by-catch release incentive program began informally in 1998 as a compensation program for fishing net damage from turtle interactions. When a fisherman catches a live turtle in his fishing gear, he removes it, returns with it to one of a small number of landing sites, and reports the turtle to WTW (fishermen are trained to reduce the stress on the turtle during transport). Two-thirds of the turtles caught and released through the program are from a 7 km by 12 km estuary fishery (Mida Creek). This concentration stems from the smaller size of turtles in the estuary, the lower probability of turtle drowning (shallow waters with nets are frequently attended to), the close proximity of land sites and fishing areas, and weaker preferences for turtle meat and oil among the population there.

The fisherman receives 500 KSH for a turtle greater than 70cm CCL (curved carapace length), which corresponds to adults and sub-adults, and Ksh300 for a smaller turtle. The turtle is measured, tagged and released. Originally no payment was made for releasing a previously tagged turtles. However, it became apparent to the WTW that goodwill was not sufficiently

strong to persuade fishermen not to kill these tagged turtles. At the end of 2000, the WTW thus extended the incentive payment system to cover previously tagged turtles. Fishermen are paid 300 KSH for previously tagged turtles.

During the period from April 1998 to May 2004, 1,422 sea turtles were released under the turtle bycatch release incentive program (82.2% green turtles; 17.6% hawksbill; and 0.2% loggerheads). Each year, more turtles were being released from nets (over 500 in 2003) and this positive fisherman response was putting some financial strain on the WTW. Because of financial constraints, WTW stopped paying for untagged turtles between September 2003 and April 2004. The project only paid for tagged turtles (300 KSH) or fishing gear damage from tagged or untagged turtles (compensation was based on a negotiated estimate of the damage done to fishing gear and the time required for the fisherman to bring in the turtle and have it processed). However, the change in the payment rules reduced good will and trust between fishermen and the WTW, and resulted in time-consuming bargaining over damage claims. Thus, in April 2004, the WTW resumed payments of 300 KSH for all turtles less than 70 cm CCL.

Although there were concerns that the payment would create incentives for fishermen to deliberately set nets on turtles to receive the incentive payment, there was no evidence of this perverse outcome taking place. In particular, the program observed no evidence of the same turtle being caught repeatedly by an individual fisherman. However, this observation does not rule out an increase in deliberate net setting.

Even if the payments do not increase the incentive to catch turtles, the structure of the payments clearly does <u>not</u> provide an incentive for fishermen to reduce turtle-gear interactions by changing their gear or the location of their fishing activities. However, any alternatives that generate such incentives, such as tradable by-catch quotas or lump-sum payments that decline

with turtle by-catch, would require on-board verification of turtle by-catch (observers or cameras). Such verification would be difficult in Kenya.

The WTW funds the nest protection and by-catch release payment schemes through grants and through individual contributions to its Turtle Nest Adoption Program[5] and its Turtle Net Release Adoption Program. In the latter programs, the WTW tells contributors that a $25 USD donation ensures the protection of one nest or one turtle released from a net.[6]

2.2. Kenya (Kiunga Marine National Reserve Conservation and Development Project)

The Kiunga Marine National Reserve Conservation and Development Project, a partnership between the Kenya Wildlife Service (KWS) and WWF, started in late 1996. The Kiunga nest protection payment program is similar to the WTW program, but the Kiunga nest protection program is targeted at women. Women report nests and sightings of turtles nesting to KWS or WWF employees. In return they are paid 500 KSH upon verification of the report. They are then paid a variable payment conditional on hatching success: 20 KSH for each successful egg hatched and 10 KSH for an unsuccessful one (Flintan 2002). There are eight nesting beaches in the Kiunga Marine Reserve. In total, there are approximately 50 nests per year, of which 94% are made by green turtles (S. Nzuki, per comm., 2005). Approximately 70% of the nests are translocated because they are made below the high water mark or are deemed to be at high risk from predation (Flintan 2002).

[5] Most nest adoption programs in the world are simply mechanisms for raising money for traditional conservation interventions. The money is not actually used to protect an individual nest that has been adopted by contributor.

[6] The adopter is also provided with details on the adopted turtle or nest, as well as a small locally produced gift (key ring, bookmark, or pendent).

2.3. Kenya (Mombasa)

The idea of paying Kenyan villagers for nest identification and protection dates back to initiatives in the early 1990s (at least to 1994) on nesting beaches in and around Mombasa, Kenya (Wamukoya, 1995).[7] In fact, aspects of the payment rates used in the Watamu and Kiunga nest protection incentives programs (see descriptions above) derive from these earlier incentive schemes in Kenya. Sketchy reports filed in outlets such as the Marine Turtle Newsletter and in NGO brochures and reports indicate that nest protection payment systems were being used at three beaches in the Mombasa area in the 1990s (as well as Malindi/Watamu and Kiunga). The number of nests in this area typically number about fifty (S. Nzuki, per. comm. 2005) and payments were made through a conservation organization (Baobab Trust) or private hotels.[8] These initiatives are still in operation (Okemwa et al. 2004; A. Wamukota, per. comm., 2007). In Mombasa, the Baobab Trust pays 500 KSH for a reported nest, and 2 KSH for every successful hatchling. All eggs are translocated to a hatchery run by the Trust. The Serena Hotel pays 500 KSH for a reported nest, but no variable payment. Nests are hatched in situ as well as translocated, depending on the threats identified by the hotel naturalist.[9]

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[7] The use of nest payments in Watamu, Kenya appears to have also begun in the early to mid-1990s (prior to the formal establishment of the WTW nest payment incentive program), but there are no recorded details on the structure of this program.

[8] Based on one source (http://www.safariweb.com/safarimate/turtle.htm), it appears that some of the hotels paid people who collected eggs and brought them to a hatchery in Bamburi (the argument being that the eggs are not safe from natural and anthropogenic threats if they remain in the nest).

[9] A. Wamukota (of KESCOM-Kenya) reports that on Funzi Island, a tourist resort pays 3 KSH for every egg brought to it by local community members (thus all eggs found in the program are translocated), but I could find no other details on this program.

2.4. Tanzania (Mafia Island)[10]

Along Tanzania's 1400 kilometers of coastline are feeding, breeding and nesting habitat for five species of sea turtles: green, hawksbill, loggerhead, leatherback, and olive ridley. Green and hawksbill turtles nest on Tanzanian beaches. Mafia Island, located 10 kilometers off the mainland and 120 kilometers south of the capital (Dar es Salaam), is an important turtle nesting area for Tanzania, primarily for green turtles, but also for a small number of hawksbill turtles (fewer than five nests per year). About 150 nests per year are made on the island and surrounding small islands (densities in 2005 were about 50 nests per km of beach). The island and surrounding waters are recognized as important sites for marine biodiversity and are included in Tanzania's first marine park, established in 1995 (822 km^2).

Although turtle egg collection and the killing of adults has been illegal in Tanzania since the 1970s, the practices continue today. Threats to turtles on Mafia Island included poaching of eggs and nesting females, capture in gill-nets and fence traps, disturbance from seasonal fisher camps, predation by monitor lizards and beach erosion. Prior to 2001, surveys of residents imply a 100% egg poaching rate on nests discovered by residents.[11] In 2001, the Mafia Island Turtle Conservation Program was initiated through a collaboration of the Mafia Island Marine Park, Mafia District Council, and WWF. The program worked with communities on Mafia Island to elect turtle monitors in 2001. This initiative led to the establishment of a Tanzanian NGO called the Tanzania Turtle & Dugong Conservation Programme (TTDC, now called Sea Sense), which ran the turtle conservation activities. TTDC then trained these elected monitors to patrol the main

[10] Sources: Site visit by author in November-December 2005, and conversations with TTDC employees, particularly Catharine Muir, the director.

[11] Given the activity is illegal, any strategic bias on the part of respondents would presumably be in the negative direction and thus there is no reason to believe that this poaching rate is inaccurate.

nesting beaches, relocate nests when necessary and assist with data collection and tagging. The monitors received salaries, which varied depending on the frequency of their contractual monitoring obligations (high density nesting beaches were monitored more frequently).

TTDC employees perceived that the monitors were not sufficient to reduce poaching of nests. Using only monitors and education, poaching was still around 50% of the nests laid.[12] Thus, in January 2002, they initiated a nest protection incentive scheme. The total payment is of a two-part performance payment: (1) a fixed payment for finding and reporting a nest to the appropriate project monitor; and (2) a variable payment that is a function of the nests hatching success.

Under this scheme, individuals who report a nest to a monitor receive an initial payment of 3000 Tanzanian shillings (TSH; $1 = 1200 TSH) once the nest is verified by the monitor. They then receive a variable payment once the nest hatches: 40 TSH for each successful hatching and 20 TSH for each unsuccessful (rotten) egg. The mean total payment per nest in 2004 was about 6350 TSH (including nests that saw no hatching).[13] In Tanzania, the casual laborer daily wage is about 1000 TSH. When the program was first implemented, monitors who found nests before residents found them were not paid a performance payment in addition to their salaries. In 2004, this rule was changed and anyone who found a nest received the same payment incentives. In 2004, the payments summed to a little less than $1000 USD, and the

[12] The number may in fact have been higher because some poached nests may not have been found by monitors on beaches on which nests were infrequently created.

[13] If a nest completely fails to have a single egg hatched, or is poached or predated, no variable payment is made. About 9% of nests in 2004 (n = 159) had this outcome.

overall budget including administrative costs was approximately $25,000 (not including housing for director on Mafia Island, which was provided by the marine park).[14]

With the combined program of nest monitoring (variable depending on the beach), nest protection payments, and education programs to raise awareness and concern about sea turtle conservation, the poaching rate dropped dramatically. As noted above, poaching rates were 100% prior to 2001, and about 50% with paid and unpaid monitors in 2001. With the implementation of the performance payment scheme, the poaching rate decreased to 3% in 2002, 2% in 2003 and less than 1% in 2004 (nest predation during the 2001-2004 period stayed relatively constant at about 3-4%).

As noted in a companion report (Ferraro 2007), estimating the precise number of eggs that hatched because of the program is difficult because of several confounding events and because the payments may induce greater effort by villagers to find nests. The latter implies that some nests are being discovered that may not have been harvested by local residents in the absence of the program. Moreover, even if the estimate of avoided poaching were precise, one could not separate out the individual effects of the three program components: payment, monitors and education. This difficulty in isolating the effects of payments is common in all of the payment initiatives described in this report. No sea turtle conservation initiatives are initiated with payments as the only or main component of the field interventions.

In July 2004, TTDC extended the program to the mainland in the Temeke District, south of Dar es Salaam, where green turtle nesting activity takes place along 27 km of nesting beach. In 2005, 68 green turtle nests were recorded at eight sites (low density compared to Mafia

[14] About $5400 per year was spent on the seven community monitors. Note that the expatriate director was receiving the equivalent to a market-rate, host-country national salary, rather than a typical expatriate salary.

Island). There is no baseline data that begins before the project and thus one cannot examine any trends in nesting or poaching. During 2005, only three nests were poached (4%), which Sea Sense employees view as an indicator of the success of their program.

2.5. Solomon Islands (Rendova Island)[15]

In 2002, Australian biologists, in collaboration with host-country nationals, began an "incentive-based monitoring program" on the leatherback nesting beaches of Rendova Island, which is in the Western Province of the Solomon Islands. The program began in the largest community on the island (Baniata, with about 500 people). In 2003, the program was extended to two more communities (Havila, with about 300 people, and Retavo, with about ten). Each participating village selects an unsalaried turtle monitor who is responsible for recording nesting activity data. If the monitor or other villager observes a leatherback nesting, they have the opportunity to receive payments conditional on outcomes. A villager observing a leatherback nesting contacts the monitor. If the monitor successfully tags the turtle and records relevant data, the observer is paid $15 Solomon Islands Dollars (SBD) and the monitor is paid $10 SBD (about one-third the daily wage for casual laborers; $1 = 7.5 SBD). Verification of successful tagging and nesting is intended to be done through photographic documentation, but this verification system has not worked well. If a villager finds a nest, but no turtle, the villager is paid $10 SBD and the monitor is paid $10 SBD. In addition to the individual payments, $10 SBD is placed in a community fund for every nest found, managed by a board of community members with expenditure reports provided to the community. If at least one hatchling emerges from a nest, the villager who found the nest is paid $30 SBD, the monitor is paid $10 SBD, and the community fund receives an additional $30 SBD.

[15] Source: Gjertsen and Stevenson 2005

2.6. East Kalimantan, Indonesia (Sangalaki Island)[16]

Sangalaki Island is a small island (a little less than 14 ha) in the East Kalimantan province of Indonesia. The island has no permanent settlement except the staff of the Sangalaki Dive Lodge and, since 2002, a small, rotating staff at a government marine turtle monitoring station. The island beaches serve as a nesting site for green turtles, which lay about 5000 nests per year with about 90 eggs per nest and a hatching success rate of about 70% when the nest is not harvested by egg collectors (2001 data from Latorra and Latorra, n.d.).

Between 2000 and 2002, there was a short-lived nest protection payment program on the island. The program was initiated by the owners of the Sangalaki Dive Lodge, and funded by the Lodge and its clients. In Indonesia, as in other nations in Southeast Asia, there is a long history of the government selling concessions to citizens for turtle egg harvesting. When the dive resort began operations on the island, a concession existed as it has, almost uninterrupted, since the 1950s (Latorra and Latorra, n.d.). Egg harvesting was believed to be nearly 100% of the eggs laid.[17]

Thus the resort operators believed they had no other options for protecting the eggs other than to pay egg concession holders to leave each egg to hatch *in situ* rather than to harvest it and sell it on the open market (a hatchery also was used as a conservation tool). In order to compete effectively with market forces, the resort paid a price per egg that was higher than harvesters

[16] Additional sources: Communication with Nicolas Pilcher, Director of Marine Research Foundation, Sabah, Malaysia, and information provided by Sangalaki Dive Lodge.

[17] A rule to conserve 20% of the nests in 2001, to be monitored by volunteers from the Turtle Foundation and the Indonesian Biodiversity Foundation, was not widely honored because the government also announced that all harvesting would be prohibited in 2002, which lead to more intense efforts to harvest the eggs before the close of the market.

could obtain in the egg consumption market, about 3000 IDR/egg ($1 USD = 9000 IDR). In order to fund the payment system, the resort established a "Baby Turtle Nest Adoption Program." Resort clients and other interested parties could pay to adopt a nest, whereby they would receive a certificate and photo of the nest when it hatches. These funds were used to pay the egg collectors. The resort never raised enough funds to pay for more than 20% of the nests.

The resort found the payment system cumbersome and inappropriate and thus worked with conservationists to lobby local government officials to end the granting of concessions on this island. Ban proponents argued that the collection of turtle eggs was incompatible with the government's plan to promote ecotourism on the island. In 2002, the granting of egg harvesting concessions was ended and so too was the payment system. A 2002 newspaper article in the Jakarta Post (cited in Latorra and Latorra, n.d.) claimed that lost income would amount to 1 billion IDR (about $100,000 in 2002 exchange rates), but it is unclear how this number was generated.[18] The Nest Adoption Program continued to operate after the 2002 regulation was implemented. Funds from the program were used for other conservation projects on the island, such as providing the government's conservation rangers with a boat and motor to patrol for illegal fishing.

After the ban of human egg collecting on the island, conservation personnel discovered that an introduced population of black rats were predating on the turtle eggs and hatchlings. With human collectors gone, the rats were able to eat about 90% or more of the eggs (Meier

[18] Based on the retail and wholesale market prices for eggs in this region, I suspect that this number was generated by summing market prices at different points in the marketing chain (e.g., if the collector received $1 per egg and the retailer received $3, the newspaper estimates the egg's value at $4). Thus the figure is a gross overestimate of the foregone value of the egg harvesting ban (because of double-counting).

2003). In 2003, about 3000 Euros were raised by the Turtle Foundation for a German pest control company to come in and eradicate the rats through a selective poisoning campaign.

Note that a similar nest incentive program was implemented on Derawan Island with the assistance of WWF (Sangalaki and Derawan are part of the Derawan Islands group). As on other turtle nesting beaches in Indonesia, the local government has auctioned off a turtle harvesting concession for decades. Incentives were provided for local people to rear and release the hatchlings. WWF has helped to train residents to do this rearing, which has been encouraged since the late 1990s when it was considered largely a failure because local residents were ill-trained for turtle rearing. In 2003, the incentive payment amounted to 10,000 IDR for each four-month old hatchling that made it to the sea (Keulartz and Zwart, 2004). Although higher than the price of an egg sold, this incentive payment is low given the effort and risk required to rear a hatchling. The concessions and rearing incentive programs are expected to be completely ended in 2006 (Newman 2006).

2.7 Malaysia (Redang Island)[19]

The Malaysian Island of Redang is located in the South China Sea about 22 km from the mainland (Terengganu). The island is 7 km long and 6 km wide in and is part of the Redang archipelago, which was gazetted as the Pulau Redang Marine Park in 1991. The island is home to the largest aggregation of nesting green turtles in Peninsular Malaysia, as well as a minor nesting area for hawksbill and olive ridley turtles.

In Malaysia, as in other nations in Southeast Asia, there is a long history of the government selling concessions to citizens for turtle egg harvesting. Concessions have long

[19] Additional sources: Websites of SEATRU and KUSTEM, and communication with Nicolas Pilcher, Director of Marine Research Foundation, Sabah, Malaysia..

existed in the Redang archipelago. The Terengganu government has awarded one to a village cooperative for the main nesting beach on Redang Island. In Malaysia, the laws dating from the 1970s dictated that 10% of the eggs were to be protected or sold to a government hatchery. The remainder of the eggs is marketed legally by the concession holders. In 2001, the percentage of eggs protected in Peninsula Malaysia was increased to approximately 50% (Shankar and Pilcher, 2003), but compliance was questionable (Tan 2004).

Between 1993 and 2005, the Malaysian Sea Turtle Research Unit (SEATRU) ran a nest protection payment program on Redang's major nesting beach, Chagar Hutang (about 300 m long). Payments were made to licensed collectors from the village cooperative that owns the nesting beach concession. Payments were made for both for *in situ* incubation on the beach and for incubation at SEATRU's hatchery (incubation is about 55 days). In part because of concerns about hatchery incubated turtles, the program focused more on in situ incubation. Payments varied each year depending on the SEATRU's budget, the number of eggs per nest and on market conditions. In later years, payments ranged from 120 Malaysian ringgits (MYR) to 200 MYR per nest (MYR; $1 USD = 4 MYR). The payments tended to be less than market prices because of SEATRU's budget constraints (Tan, 2004, reports a price of 2 MYR/egg and a nest can have more than one hundred eggs). In the last five years, the program made payments on about five hundred nests per year, which resulted in the release of over 120,000 hatchlings.

The payment scheme was funded by donations from private corporations and the public. Until recently, the former made up the bulk of its budget. For the latter, funding was generated by an Adopt-a-Nest program. Malaysian and foreign donors could adopt a nest for 100 MYR

(foreign donors pay in dollars and are charged $40).[20] In 2005, all major nesting sites were formally declared sanctuaries and the payment scheme ceased (but the Adopt-a-Nest program continued as a fundraising tool).

2.8 Proposed or Pilot Programs

i) Madagascar: A pilot program in southeast Madagascar (Fort Dauphin/Tolagnaro region) to pay collectors double the market price per egg to leave nests intact was described briefly in a presentation by Rakotonirina et al. (2004), but I could obtain no further details on this program.

ii) Papua New Guinea: Leatherback turtle nesting takes place at four sites on the Huon coast, Morobe Province in Papua New Guinea. At one of the sites, Kamiali, there has been an Integrated Conservation and Development Program since the 1990s. With financial support from the U.S. Western Pacific Regional Fishery Management Council, conservationists have been putting money into a community fund at Lababia village for community projects. The intention is that this annual payment covers the market value of the eggs the community could have harvested. However, this "incentive agreement" is not a formal payment scheme with performance measures and performance monitoring. Some researchers involved believe that the villagers do not see the payment as a performance fee for protecting nest but rather as a rental or access fee for researchers (Pilcher 2006: 5). There is also concern that a single individual was diverting much of the money so that the community did not see it as a collective benefit. There

[20] Donors receive an Adoption Certificate, a T-shirt, and information about the adopted nest, such as the total number of eggs deposited and the number of eggs successfully hatched.

is a currently a proposal to use available funds for a community incentive that supports the school fees for children (preschool to grade 8; Pilcher 2006: 31). The payment would go directly to the school (three communities would be involved). No details have been offered on how payments will be connected, if at all, to performance. The special characteristics of this project in comparison to some of the projects discussed above highlight the importance of examining the details of purported "incentive initiatives" before declaring that incentives "work" or "don't work" to achieve conservation outcomes.

iii) Solomon Islands: Conservation International is proposing to implement a conservation incentive agreement on the island of Santa Isabel in the Solomon Islands (D. Rice, pers. comm. 2007). The incentive agreement will pay communities conditional on protection of leatherback nesting beaches.

iv) Suriname: A payment example in Suriname from 30+ years ago is described in sketchy detail in Schulz (1975).

v) Zanzibar: I have seen vague references to a turtle nest protection payment initiative in the 1990s in Zanzibar, but I was not able to find any information about it. Conservation practitioners with whom I spoke in Tanzania, and who were not involved in the Zanzibar program, believed that the program stopped because it was deemed to be "counterproductive" in obtaining public participation for sea turtle conservation. I have no details on whether the counterproductive aspects were real or perceived.

3. Opportunities for Building Performance Payment Schemes into the Nesting Beach Concession Systems of Southeast Asia

In Malaysia, Indonesia and Thailand, there is a long history (since at least the 1950s) of the government selling concessions to citizens for turtle egg harvesting. In some cases, these concession systems no longer function well because of the precipitous decline in turtle nesting numbers on beaches (e.g., leatherbacks in Malaysia; N. Pilcher, per. comm., 2005). In other cases (e.g., Derawan Islands, Indonesia), the concessions are being phased out because scientists do not believe turtle populations can survive in the presence of any exploitation. However, where concession systems continue to function, they offer an opportunity for nest protection incentive schemes.

Nest protection payment schemes are difficult to implement when local residents who have the rights to receive a payment conditional upon nest protection cannot establish *de facto* property rights over the nest and prevent others from exploiting it. In payment programs in Kenya, Tanzania and the Solomon Islands, *de facto* rights are established not through any legal mechanism, but through social norms and reciprocity. An individual will not exploit a neighbor's nest, thereby denying the neighbor his or her payment, because of the social stigma associated with this action if caught, or, when the individual is also receiving payments, because of an expectation of mutual reciprocity.

In Southeast Asia, however, there is a history of acquiring legal rights to the eggs in turtle nests. This history may make a system of payments conditional on successful hatching easier to support in large coastal communities. To date, however, the rewards from holding a nesting concession are a function of how many eggs the concession holder can harvest. Thus despite rules that require a percentage of the eggs to be left in the nest or brought to a hatchery, local

incentives are to harvest as much as possible for sale (see also next section on conservation-through-exploitation schemes).

However, there is no reason that performance payments could not be used in the context of these concessions. Instead of earning revenues for harvesting eggs, the concession holders could earn revenues for allowing them to hatch *in situ*. Of course, the payments would probably have to be much higher than the egg market price in order to account for the time delay (i.e., forgoing revenues soon after the eggs are laid for revenues that appear only after the eggs are hatched) and for the additional risk associated with earning revenues based on hatching performance (risks of human and animal predation, erosion, inundation).[21] In areas where local residents may not trust conservationists to actually make the payments upon hatching, the payment may have to be even higher to account for the additional risk associated with the irreversible decision of letting eggs develop to maturity. As noted above, such schemes already exist, but they are few and do not always seem to function well because they do not always pay sufficient prices to induce conservation behavior.

In areas where natural threats (predators, inundation) are substantial, the payments could be made for eggs to be collected and brought to hatcheries. This kind of payment program has been existence for a long time throughout the world. A hatchery payment system solves the problem of time delay and risk associated with letting the eggs hatch *in situ*. However, it raises a host of known problems associated with hatchery rearing of turtles for release into the wild (Frazer 1992). Much of the debate over hatchery programs revolves around the nature of the status quo in the absence of the hatchery program: if residents are not paid to bring the eggs to a

[21] If buyers were price discriminating among sellers, the competition from conservation buyers may also raise the market price, but this outcome seems unlikely in most contexts with which I am familiar.

hatchery, will the eggs be simply eaten or destroyed? Note, also that verification of hatching success is easier in a hatchery. It would be worthwhile, however, for some formal comparisons of the cost-effectiveness of hatchery payments versus *in situ* hatching performance payments.

Finally, it should be noted that conservation groups can compete for the concessions themselves. However, such competition is likely to be less politically palatable than performance payments (outside groups competing against local residents for the residents' livelihood). Just as importantly, it is not clear that conservation groups can enforce their property rights as easily (cheaply) as local residents. Thus, in a sense, performance payment schemes can be seen as outsourcing of the protection activities. As with the comparison between paying for *in situ* versus hatchery incubation, the comparison between performance payments and concession buying requires some formal cost-effectiveness comparisons.

4. Additional Observations on Payment Schemes versus Other Incentive Schemes

As noted in the Introduction, the use of economic incentives in sea turtle conservation is rare. As one can observe in Section 2, the use of performance payments in sea turtle conservation is rarer still. Most incentive programs in sea turtle conservation use one of three mechanisms: 1) conservation through "sustainable" exploitation; (2) the provision of alternative livelihoods; and (3) goodwill gestures (for examples of the first two, see Troëng and Drews, 2004)..

4.1. Conservation-Through-Exploitation Schemes

Some sea turtle conservation initiatives attempt to indirectly promote nest protection through controlled exploitation. A well known example is the olive ridley harvesting and

marketing scheme in Ostional, Costa Rica (Arauz Almengor et al. 2001). This "valorization" approach is common in terrestrial species conservation initiatives (Ferraro 2001). The underlying assumption is that if local residents see that they can profit from "sustainable" exploitation of eggs, they will have an incentive to protect nests and adult turtles to maintain future income flows. Valorization approaches usually require rules that allow only limited exploitation of the valued species and preclude using harvesting methods that scientists deem destructive. Based on theory and experiences in common property management elsewhere, turtle nest valorization approaches are most likely to work when there are strong local institutions that are capable of using force or moral suasion to enforce management rules. These institutions will find enforcement easier when either the ratio of eggs to collector is high (so the marginal utility of an additional egg harvested is low) or when this ratio is very small (so that the production activity has essentially ceased to be a going concern for most people).

Valorization schemes for turtle nest conservation are made difficult by two factors:

(1) The long time horizon over which benefits will be realized from investments made today. Residents of coastal, low-income nations likely have high discount rates (i.e., benefits in the distant future are worth very little today) and thus do not find the prospect of forgoing consumption now for (potential) benefits many years into the future enticing;

(2) The public good aspects of turtle nest conservation, which imply that the private benefits to an individual's decision to forgo harvesting a nest are very small (the benefits are shared by everyone in the harvesting community), while the private costs are larger and incurred only by the individual forgoing the nest harvest.

Valorization schemes for adult turtle conservation are subject to the same two problems (the public good aspect is even worse because of the migratory behavior of the adults).

Although performance payments and valorization approaches are both subject to the same issues regarding the ability of residents to establish property rights over nests and regarding the need to monitor behaviors, the two approaches differ in several ways:

1) In nest conservation-through-exploitation schemes, residents reap low-risk rewards immediately from harvesting eggs, as well as highly uncertain rewards in the distant future from forgoing harvesting some of the eggs, a few of which presumably become reproducing adults that will help maintain or increase egg production in the future.

In performance payment schemes, residents reap intermediate-risk rewards over the incubation period of the eggs (when these rewards arrive depends on the contract details). The rewards from the performance payment schemes are more risky because one has to wait until eggs hatch to reap full the rewards, and the hatching success is subject to factors such as temperature, erosion, inundation, and predators (human and animal).

2) In nest conservation-through-exploitation schemes, higher egg prices make the incentives for harvesting greater. In a performance payment scheme, the higher the payment, the greater is the incentive for conservation. Of course, the level of the performance payment is dictated by the market (or shadow) price for eggs.

3) In egg conservation-through-exploitation schemes, property rights over the nest need only be enforced between the laying of the eggs and the harvesting of the eggs. In nest performance payment schemes, property rights have to be enforced over the entire incubation period. Thus the enforcement of property rights is more expensive under the nest protection scheme.

4.2 Alternative Livelihoods Schemes

Alternative livelihood schemes are usually motivated by the following logic: egg collectors collect eggs because they have no options and thus if we can provide them with an alternative way of earning a living they will no longer "need" to harvest the eggs (or adult turtles). Similar logic holds for programs that try to find alternative sources of protein for egg and turtle subsistence consumption. These kinds of efforts have been referred to as "conservation by distraction" (Ferraro and Simpson 2002). In some cases, an attempt is made to connect the alternative livelihoods to the conservation goals, usually through eco-tourism markets or through employment (i.e., locals will no longer be egg collectors, but rather turtle guides or monitors).

To function, alternative livelihood schemes require outside funding to search for livelihood possibilities about which local residents are unfamiliar ("information and technology transfer") or to subsidize the start-up costs of alternative livelihood operations ("physical and human capital investments"). The argument against alternative livelihood schemes can be captured in two simple rhetorical questions:

- Why is any subsidy required to induce a private citizen to undertake a profitable commercial or subsistence activity?
- If a subsidy *is* required to make an activity viable, would it not make more sense to use the amount of the subsidy to pay for conservation directly?

Before undertaking an alternative livelihoods approach to conservation, all practitioners should answer the first question. Conservation advocates often accuse profit-seeking individuals of destroying turtle populations. Many of these same advocates also claim that alternative livelihoods can be financially viable and self-sustaining if they are provided with initial funding.

If, however, profit-seeking individuals are so eager to turn a profit, why have they failed to recognize the profit-making opportunities that conservation advocates claim lie waiting to be exploited?

I do not dispute that there are *some* "win-win" opportunities in which alternative livelihoods make local residents better off while assisting the achievement of conservation goals. However, I do not believe that these opportunities are widespread, or that conservation practitioners can identify them simply through some field work and introspection (see, for example, the review by Salafsky et al. 2001). Conservation advocates who claim that eco-friendly enterprises are commercially viable with just a modicum of external funding face at least four challenges to their credibility (Ferraro and Simpson 2005):

- They are not experts in investment;
- They have a powerful ulterior motive that interferes with their ability to identify the profit-maximizing use of an ecosystem: they want to conserve biodiversity, rather than to make money;
- Given the magnitude of the problem they face, they may be unusually susceptible to wishful thinking; and
- Indirect approaches to conservation investment present more opportunities than direct payment initiatives present for interested parties to enrich themselves at the expense of the project's stated objectives.

When large numbers of people benefit from turtle exploitation, alternative livelihoods schemes become more difficult (not simply more expensive). This difficulty is particularly acute in livelihood schemes focused on eco-tourism or project employment: the alternative livelihoods are unlikely to benefit large numbers of people. For example, it is well documented that eco-

tourism initiatives tend to benefit only a small proportion of local residents and these residents are not necessarily the ones in the best position to provide conservation gains (Walpole and Goodwin 2000; Wunder 2001; Kiss 2002). Even if the few beneficiaries were indeed threats to conservation goals, the alternative livelihoods scheme has not changed the returns to biodiversity exploitation and thus there may be other members of the community who will find exploitation profitable (i.e., exit of some induces entry by others).

In the context of project employment, similar problems arise and my own personal experience suggests that projects tend to hire the more educated, dynamic members of the community, who are often not the main threats to conservation. For example, Gjertsen and Hitipeuw (2006) conducted household surveys to explore the impacts of paying villagers to patrol leatherback beaches in Saubeba, Papua, Indonesia (Jamursba Medi). They found that approximately forty percent of households receive income from patrolling (relatively high for a conservation employment initiative), but there were significant differences between households with and without patrollers. Patrolling households owned significantly more and better quality assets than non-patrolling households.

As another example, consider the Seychelles, where a project was implemented in 1993 to prevent the killing of hawksbill sea turtles. Jointly funded by the Seychelles Government and the GEF, the project aimed to compensate and retrain artisans who made their living working hawksbill shell. Twenty-one businesses employing forty artisans were identified. Negotiations were conducted and the artisans agreed to be compensated at an average rate of US$15,000 per artisan. The artisans also agreed to sell their remaining stocks of raw shell to the Seychelles Government.' (Mortimer 2004). Mortimer (2004), however, reports that the turtles are still threatened through sales on the black market. Thus either other artisans filled the void vacated by

the compensated artisans or the compensated artisans may have decided to take the compensation payment and continue with their original livelihoods. The payment was lump-sum and not (in practice) conditional on performance (see section 4.3).

One must also be aware that alternative livelihoods may not only fail to generate conservation gains, they may induce conservation losses. In the terrestrial context, a number of authors have documented instances in which ecotourism, eco-friendly harvesting of ecosystem products, and related initiatives can do harm to the environment (Davis and Tisdell, 1995; Ferraro and Simpson 2005). Tourists can "love an area to death" by overrunning it, harvesters can remove too much, etc. And, of course, once an alternative livelihood is introduced, conservation practitioners may find it quite difficult to remove.

4.3 Payments for Goodwill

Some conservation projects may superficially look like a performance payment initiative because they involve transfers, in cash or in kind, from outside conservation agents to the community members. These transfers are often framed as "compensation" or "local benefits." They may be in the form of cash, although more typically they are physical (schools, wells, clinics, etc.), technological (new ways of producing food through agriculture or fishing), or market-based (access to overseas specialty markets). Such "gift exchanges" are not *quid pro quo* payments for performance, but rather are seen by conservation practitioners as a means of encouraging communities to cooperate through mutual reciprocity: "We gave you these things, and now we would like you to change your behavior in ways that help us achieve our conservation goals."

Although there may be some cases of conservation success glued together by nothing more than reciprocity (good will), my experience leads me to believe that, in most cases, such

glue is only a short-term solution and tends to crack and fall apart over time without more substantial and tangible incentives (unless the conservation outcome causes little sacrifice; Ferraro 2006).

These gestures of goodwill typically suffer from two problems: (1) they are often not sufficient to cover the opportunity costs of the desired changes in local resident behavior (which is why they are cheap interventions); and (2) they happen *before* performance is rendered and cannot easily be retracted if the local residents do not abide by what the conservation practitioners feel was an implicit contract. One cannot retract information once it has been transferred, and although market access and physical infrastructure can be denied or destroyed, doing so can create more conflict than existed before the conservation project began. In other words, conservation practitioners have no credible threat for retracting their payment if conservation performance is not rendered. Practitioners have no means of inducing the desired behavior other than a hoped-for reciprocity by poor, rural villagers toward wealthier outsiders. Such reciprocity is rare in practice, particularly over long periods of time.

4.5 A Note on the Supply and Demand of Turtle Eggs in the Presence of Performance Payments

In my research for this report, I often had discussions with sea turtle conservation practitioners who raised the same question with regard to the use of incentive payments for nest protection: won't a payment program raise the price of eggs and make people want to supply more through the illegal market? The answer for most contexts is "No."[22] Most importantly, the

[22] It is also worth pointing out that regulatory-based approaches (fines and punishment for collection activities) have the same effect of decreasing the supply and increasing the market price as protection payment schemes do.

total amount of eggs collected with a payment incentive scheme will always be less than or equal to the amount of eggs collected without a payment scheme. The reason people raise this question is because they tend to confuse changes in the demand and supply curves with movements along the demand and supply curves.

Performance payments for egg protection raise the cost of egg harvesting. In other words, the payments induce collectors to demand higher compensation in the form of higher prices in return for forgoing the conservation payment and supplying the eggs to the consumption market. If the price stayed the same as before the payment scheme was implemented, there would be excess demand for eggs. Thus the price rises in order to clear the market: there is no additional incentive for entry into the market because of the price change (such an incentive would occur if the price change were a result of *demand* increasing, but in this case the price increases because *supply* decreases).

The intuition above works well for markets in which all egg collection is illegal or where payments will be made for all nests, whether the harvest of the eggs would be legal or illegal. In markets like Southeast Asia, where harvesting from legal concessions may exist contemporaneously with illegal harvest from protected beaches, a little more discussion is warranted if only legally harvestable nests will receive payments. In this case, there is a supply curve for legal harvesting and a supply curve for illegal harvesting, but only the former will be affected by the payment system. Assume that consumers do not know or care about the source of their eggs (otherwise, we are back in the situation in the paragraph above) and assume that legal harvesters can enforce their property rights.[23]

[23] If they cannot, then the supply simply does not decrease by the full amount of the payment because legal harvesters discount the payment because of the risk of an illegal poacher collecting the egg before it hatches.

Table 1. Supply and Demand for Turtle Eggs

Price	*Legal Q*	*Illegal Q*	***Market Supply***	***Market Demand***
$0	0	0	0	550
$1	100	40	140	545
$2	200	60	260	530
$3	300	80	380	500
$4	350	120	470	450
$5	375	135	510	375
$6	380	145	525	290
$7	400	150	550	150
$8	400	150	550	0
$9	400	150	550	0

To make this example concrete, consider the following simplified example of the retail market for sea turtle eggs. The first column in Table 1 shows the price per egg, the second column shows the number of eggs that would be legally supplied, and the third column shows the number of eggs that would be illegally supplied. The fourth column shows the overall market supply and the last column shows the market demand. The example assumes there is a total harvestable stock of 400 legal eggs and 150 illegal ones (the proportions are chosen to make the performance payment have a large effect on the market price).

The corresponding market supply and demand curves for this market are presented in Figure 1. The green downward curve is the market demand curve. The red upward sloping curve is the total market supply curve (the supply curve closest to the X-axis). Without a performance payment system, the market price would be $4 per egg and the quantity bought and sold would be between 380 and 450 eggs.

Table 2 shows what happens to supply when legal harvesters are paid an incentive payment of $2 per egg to leave each egg in the nest. The blue upward sloping supply curve (above the red curve) in Figure 1 is the corresponding market supply curve. Note that the market

price increases ($5) and overall turtle consumption and sales decreases (320-375). If one assumes that wholesale buyers (who typically know the origin of the egg) prefer a legal egg to an illegal egg *when the price per egg is exactly the same*, then the collection of both illegal and legal eggs goes down in the presence of performance. If there is no way to distinguish legal from illegal eggs, then the number of illegal eggs may increase, but the overall number of eggs supplied in the market goes down.[24] Note that the conclusions would not change if Figure 1 used continuous supply and demand curves (e.g., legal $Q = 2P$; illegal $Q = P^{1/2}$), rather than step curves. The only thing that would change is that we would not have ranges of possible equilibrium quantities (or prices if the curves were different) and would not have to discuss implications of wholesale buyer preferences for legal and illegal eggs.

Table 2. Supply and Demand for Turtle Eggs with Performance Payment

Price	*Legal Q*	*Illegal Q*	***Market Supply***	***Market Demand***
$0	0	0	0	550
$1	0	40	40	545
$2	0	60	60	530
$3	100	80	180	500
$4	200	120	320	450
$5	300	135	435	375
$6	350	145	495	290
$7	375	150	525	150
$8	380	150	530	0
$9	400	150	550	0

If consumers preferred legally purchased eggs from illegally purchased ones (i.e., their willingness to pay for an illegally harvested egg is lower), then the any increase in the quantity

[24] With the "buy-legal-first" assumption in the absence of payments, 350 are provided legally and 30 to 100 are provided illegally. With the "buy-legal-first" assumption in the presence of payments, 300 are provided legally and 20 to 75 are provided illegally. With "buy-illegal-first" assumption in the absence of payments, 260-330 are provided legally, and 120 are provided illegally. With "buy-illegal-first" assumption in the presence of payments, 185-240 are provided legally, and 135 are provided illegally.

supplied by illegal harvesters would be further attenuated. However, if the market for sea turtle eggs is not competitive and buyers are able to act as monopsonists by holding down the price, which lowers the quantity supplied, then conservation performance payments will serve as competition and could increase the market price and the total number of eggs supplied and demanded in the market.

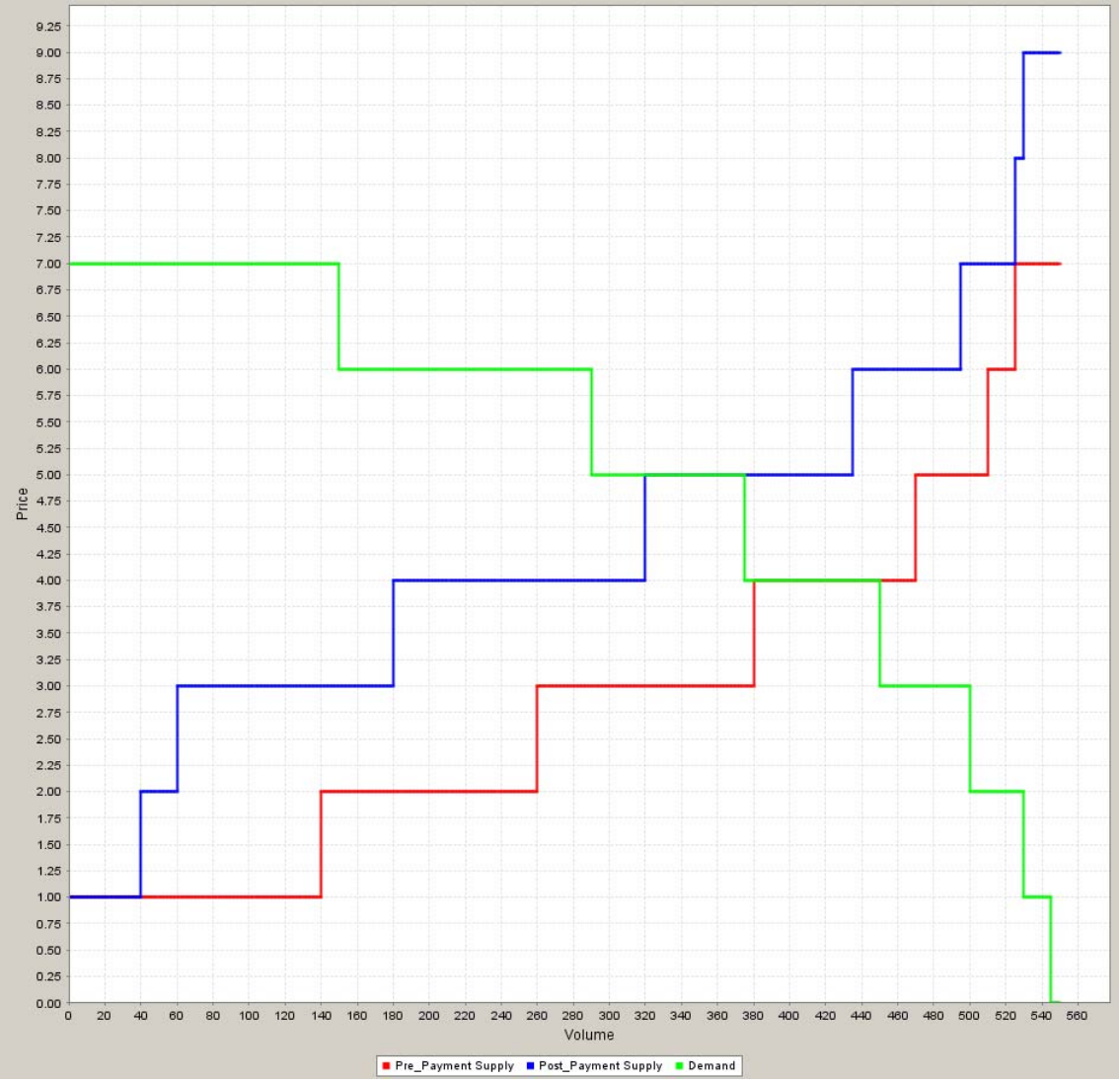

Figure 1. Supply and Demand Curves for Turtle Egg Market

One additional, and related, concern is that nest protection incentive programs could end up paying individuals to protect nests that did not need any protection (for related issues in terrestrial conservation, see Ferraro and Pattanayak 2006). This outcome could happen in areas with less than 100% poaching, or in areas with dispersed nesting activity where payments induce additional effort by residents to find and report nests that they otherwise would not have found (see description of Tanzania initiative above).

Although this is a possible outcome, payments in these areas are likely to be low (because demand for eggs is low). Moreover, the additional effort exerted to find and report nests has conservation benefits: the provision of scientific information that otherwise would not have been collected and the opportunity to protect from natural threats nests that would otherwise have not been observed by conservation personnel.

5. Conclusion

Direct payment initiatives in the realm of sea turtle conservation are few and are most likely to be found in initiatives to protect nests. Fewer than a dozen of these payment programs exist in the world. Despite their low cost and their apparent success in inducing behavioral changes (when the payments cover the opportunity costs of behavioral change), my impression from speaking with conservation practitioners involved in these programs is that many of them wish to eliminate the payment programs in favor of more education-based and regulatory-based programs ("fences and fines"). I have the impression that many of the field personnel find these payment programs to be a burden in terms of finances (payments) and staff time (verification), as well as philosophically suspect (paying people for what they should already be doing).

Education-based initiatives remain attractive because, if successful, they avoid the sustained financial commitment that payment schemes require. However, the mechanisms through which education, information and persuasion can affect behavior are poorly understood. Much empirical and narrative evidence implies that such initiatives typically do little to change behaviors and, when they do, the changes are temporary (e.g., DeYoung 1993; Dwyer et al. 1993; Syme et al. 2000; Schultz, 2004; Abrahamse et al. 2005).[25] Thus I find it hard to believe that education-based programs can achieve the same behavioral outcomes as payment schemes have achieved in as short of a time period.

In contrast, regulatory-based outcomes may be equally or more effective than payment schemes, but they are unlikely to be more *cost-effective* unless nesting activity is concentrated. In more dispersed nesting environments, local residents have better information on nest location and better capacity to enforce property rights over nests than the government or an outside conservation group does.

What is important to achieve success through a performance payment initiative? Because these initiatives are so inchoate, I can only speculate based on theory and field observations. First, the ability for citizens to impose and enforce property rights is critical. Given the high costs of actively guarding a nest (or any other marine habitat), property right enforcement will most likely stem from a community's capacity for indirect reciprocity ("I won't harvest this nest because I don't want others to harvest my nest.") or collective monitoring and social sanctions ("I won't harvest this nest because if someone sees me, I will be socially stigmatized by other community members."). This capacity may be more likely in more homogenous communities

[25] They may, however, have impacts on attitudes, and although changes in attitudes do not translate into behavioral changes, they may facilitate the imposition of collective regulations (i.e., with changes in attitudes, people will not make independent changes in behavior, but will be less likely to fight a decision to impose collective restrictions on behavior). . I have seen no evidence to confirm or disconfirm this hypothesis.

with long-standing social ties, and may well be a function of the number of beneficiaries (i.e., if only a few people receive benefits from the payment scheme, the social pressures to respect property rights may be limited).

Second, the more directly linked the payment is to the desired environmental outcomes, the more likely the program is to succeed (e.g., payments that vary as a function of hatching success). The less a program must rely on reciprocity from citizens whose behavior the program wishes to change (e.g., "I gave you some money, now please don't go harvest those eggs."), the more likely one will see the desired results.

Third, and often in opposition to the conditionality emphasized in the previous point, a payment scheme must be designed to satisfy the risk and time preferences of the targeted community. The members of the target communities are often highly risk averse with short-term time horizons. If a program tied payments exclusively to hatching success, over which the citizen only has partial control, and forced payees to wait until hatching before receiving any benefits, the program would likely be unattractive to many coastal citizens. The contracts should reflect the fact that payers are typically less risk averse (they are paying for many nests and one nest's failure will have only a minor effect on the aggregate outcome) and more patient (they are wealthier and have access to more efficient credit markets) than payees.

Given that many of these nest protection payment initiatives have achieved substantial results for an annual cost much lower than what a conservation donor would pay for a group of scientists to attend one of myriad conservation solution workshops or to pay consultants to write about conservation solutions, I hope that these nest protection programs will continue to be tried and experimented with in the world.

The potential for expanding payment incentive schemes beyond nest protection to reduce by-catch and hunting pressures on juvenile and adult turtles is unknown, but should be further explored. As noted above, Kenya is the only nation using payments to reduce by-catch. Using payments in this context is much more difficult and potentially costly than the use of payments to protect nests. Systems of tradable by-catch quota might be promising if the monitoring can be done relatively cheaply. In nations in which fishing licenses are well controlled, paying fishermen to dry dock their boats and lock up their nets is another potential payment initiative. A final possibility for incentives that should be considered in future economic and biological research is the potential to lease "protected areas" from fishing communities in locations (e.g., sea grass beds) in which turtles congregate and interact with fishermen. Leasing protected areas from private citizens and communities has been tried in terrestrial ecosystems, but to my knowledge, has never been tried in the marine environment.

References

Abrahamse, W., L. Steg, C. Vlek, T. Rothengatter. 2005. A review of intervention studies aimed at household energy conservation. Journal of Environmental Psychology 25 (2005) 273–291.

Almengor, M.A., Claudette, L. and E. Vargas. 2001. Preliminary Evaluation of Olive Ridley Egg Commerce from Ostional Wildlife Refuge, Costa Rica. Marine Turtle Newsletter 63:10-13

Creusa et al. 2006. Update on Population Status and Development of Multi-Stakeholder Management of Leatherbacks in Papua, Indonesia. Sea Turtle Symposium abstracts.

Davis, D. and C. Tisdell. 1995. Recreational scuba diving and carrying capacity in marine protected areas. *Ocean and Coastal Management* 26(1): 19-40.

De Young, R. 1993. Changing Behavior and Making it Stick: The Conceptualization and Management of Conservation Behavior. *Environment and Behavior* 25(3): 485-505.

Dwyer, W. O., F. C. Leeming, M. K. Cobern, B. E. Porter, and J. M. Jackson. 1993. Critical Review of Behavioral Interventions to Preserve the Environment: Research since 1980. *Environment and Behavior* 25(5): 275-321.

Flintan, F. 2002. Flip-flops and Turtles - Women's Participation in the Kiunga National Marine Reserve ICDP, Kenya. Working Paper No 5 for the Engendering Eden Project.

Frazer, N.B. 1992. Sea turtle conservation and halfway technology. Conservation Biology 6, 179.

Ferraro, P.J. 2001. Global Habitat Protection: Limitations of development interventions and a role for conservation performance payments. *Conservation Biology* 15(4): 990-1000.

Ferraro, P.J. 2005. Guest Editorial: An Economist's Reflections on the 25th Annual Symposium for Sea Turtle Biology and Conservation: Empirical Program Evaluation and Direct Payments for Sea Turtle Conservation. *Marine Turtle Newsletter* 109: 2-6.

Ferraro, P.J. 2006. Response to Comment by Peter C.H. Pritchard. *Marine Turtle Newsletter* 111: 4-5.

Ferraro, P.J. 2007. *Performance Payments for Sea Turtle Nest Protection in Low-income Nations: a case study from Tanzania*. A Report to the Southwest Fisheries Science Center, National Marine Fisheries Service.

Ferraro, P.J. and R.D. Simpson. 2002. The Cost-effectiveness of Conservation Performance Payments. *Land Economics* 78(3): 339-353.

Ferraro, P.J., and A. Kiss. 2002. Direct Payments for Biodiversity Conservation. *Science* 298: 1718-1719.

Ferraro, P.J. and R.D. Simpson. 2005. Protecting Forests and Biodiversity: are investments in eco-friendly production activities the best way to protect endangered ecosystems and enhance rural livelihoods? *Forests, Trees and Livelihoods* 15(2): 2-10.

Ferraro, P.J., T. Uchida and J.M. Conrad. 2005. Price Premiums for Eco-friendly Commodities: Are 'green' markets the best way to protect endangered ecosystems? *Environmental and Resource Economics* 32(3): 419-438.

Gjertsen, H. and C. Hitipeuw. 2006. Using Socioeconomic Surveys to Design Community Incentives For Conservation. Presentation at the 26th Annual Symposium on Sea Turtle Biology and Conservation.

Gjertsen, H. and T. Stevenson. Forthcoming. Direct Incentive Approaches for Leatherback Turtle Conservation. In Conservation of Pacific Sea Turtles. University of Hawaii Press.

Ismuranty, C. 2006. The Challenges for Sea Turtle Conservation: Lessons from the Derawan Islands – Indonesia. Proceedings of the 23rd Annual Symposium on Sea Turtle Biology and Conservation (complied by Nicolas Pilcher.)

Keulartz, J. and H.A.E. Zwart. 2004. Boundaries, Barriers and Bridges: philosophical fieldwork in Derawan. Working Paper.

Latorra R. and K. Latorra. n.d. Green Turtle Nesting at Pulau Sangalaki, (east Kalimantan, Indonesia)

Lumes, K.C.T. 2004. Stop Eating Eggs? What children on two islands in Malaysia think about sea turtles as an endangered species. Lund University
Lund, Sweden.

Meier, G. 2003. Turtle Foundation. Eradication of invasive rats on Sangalaki-Island, East-Kalimantan. InGrip-Report No.1, prepared for Turtle Foundation.

Muir C., St John F. and O. Abdallah. 2006. Peliminary Results of Village-Level Turtle Conservation From Mainland Tanzania, East Africa. Sea Turtle Symposium.

Newman, K. 2006. WWF Matching Grant Annual Report. Sulu Sulawesi Seas Marine Ecoregion Program.

Nyhus, P.J., S. A. Osofsky, P.J. Ferraro, H. Fischer and F. Madden. 2005. Bearing the Costs of Human-wildlife Conflict: the challenges of compensation schemes. In *People and Wildlife: Conflict or Coexistence?* edited by R. Woodroffe, S. Thirgood & A. Rabinowitz. Cambridge University Press, Cambridge, U.K.

Okema, G.M., S. Nzuki, and E.M. Mueni. 2004. The Status and Conservation of Sea Turtles in Kenya. Marine Turtle Newsletter 105:1-6.

Pilcher, N.J. 2006. Final Report: The 2005-2006 Leatherback Nesting Season Huon Coast, Papua New Guinea. Western Pacific Regional Fishery Management Council.

Rakotonirina, B.P., Razafinjara, A.L. and S.P. Harding. 2004. Madagascar Status Report. Western Indian Ocean (WIO) Region. Marine Turtle Workshop.

Salafsky, N., H. Cauley, G. Balachander, B. Cordes, J. Parks, C. Margoluis, S. Bhatt, C. Encarnacion, D. Russell, and R. Margoluis. 2001. A Systematic Test of an Enterprise Strategy for Community-Based Biodiversity Conservation. *Conservation Biology* 15(6): 1585-1595.

Schulz, J. P. Sea turtles nesting in Surinam. 1975. Zoologische Verhandelingen 143: 1-143

Schultz, P. W. Knowledge, Information, and Household Recycling: Examining the Knowledge-Deficit Model of Behavior Change. In *New Tools for Environmental Protection: education, information and voluntary measures*, T. Dietz and P. Stern, eds. National Academy Press, Washington, DC, pp. 67-82.

Shanker, K. and N.J. Pilcher. 2003. Marine Turtle Conservation in South and Southeast Asia: Hopeless Cause or Cause for Hope? Marine Turtle Newsletter 100:43-51.

Syme, G.J., B.E. Nancarrow, and C. Seligman. 2000. The Evaluation of Information Campaigns to Promote Voluntary Household Water Conservation. *Evaluation Review* 24(6): 539-578.

Troëng, S. and C. Drews. 2004. *Money Talks: Economic Aspects of Marine Turtle Use and Conservation,* WWF-International, Gland, Switzerland. www.panda.org

Walpole, M. J. and H. J. Goodwin. 2000. Local Economic Impacts of Dragon Tourism in Indonesia. *Annals of Tourism Research* 27(3): 559-576.

Wamukoya, G.M. 1995. Kenya's "Turtle Awareness Walk" Raises Awareness And Money. Marine Turtle Newsletter Vol 69 :20-21.

Wamukoya, G.M, Mbendo, J.R. and F.P. Kaloki. 1996. Sea Turtle Conservation and Community Participation in Kenya. Proceedings of the 16th Annual Symposium on Sea Turtle Biology and Conservation (compiled by R. Biles and Y Fernandez).

WWF. 2004. Recent News from the WWF Africa & Madagascar Marine Turtle Programme. Marine Turtle Update Number 1.

Zanre, R. 2005. Report on Watamu Turtle Watch's Sea Turtle By Catch Release Programme, Watamu, Kenya.