

## A Global Review of Incentive Payments for Sea Turtle Conservation

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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 used 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 such as sea turtle protection. This paper describes sea turtle incentive payment initiatives taking place around the world, most of which are found in projects focusing on nesting beach protection. We find that many of these initiatives have achieved substantial results for a very low annual cost. The potential for expanding payment incentive schemes beyond nest protection to reduce bycatch and hunting pressures on juvenile and adult turtles is unknown but should be further explored.

**KEY WORDS.** – incentives; sea turtles; payments; marine conservation; concessions; cost-effectiveness; conditionality

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 such as sea turtle protection.

This paper describes sea turtle incentive payment initiatives taking place around the world. The information is from cited sources and conversations between the authors and project personnel. Although land purchases for turtle nesting habitat can be considered a direct payment approach (e.g., Archie Carr National Wildlife Refuge, Florida, USA), their use as a conservation tool is well known and not discussed here. Further, “eco-labeling” initiatives and “alternative livelihood” initiatives are not included here as direct payment schemes because no direct payment occurs in these situations (Ferraro 2001; Ferraro and Kiss 2002; Ferraro and Simpson 2002; Ferraro et al. 2005). For similar reasons, we do not consider eco-tourism approaches, unless money from the tourists is directly invested in conservation performance payments. We also 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. We briefly contrast the general characteristics of these alternative approaches with those of payment approaches. In the next sections, we describe examples of the most direct forms of incentive payment schemes for sea turtle conservation. Table 1 presents all known sea turtle conservation performance

payments projects. Figures 1 and 2 show the location and increase over time in the implementation of these projects.

### SEA TURTLE NESTING PERFORMANCE PAYMENTS

*Kenya (Watamu Turtle Watch).* — Watamu, Kenya has a small but nationally important nesting population of green sea turtles (*Chelonia mydas*) in the Malindi/Watamu Marine Park and Reserve complex. The local, nongovernmental Watamu Turtle Watch (WTW) has run a conservation program that, in addition to conducting research, implements a community conservation education program and pays villagers performance payments for nest protection. Technically, WTW is no longer the name of the organization, as the Local Ocean Trust (LOT) was created in 2002 to work on broader conservation issues and the WTW is now considered LOT's flagship operation.

In the nest protection incentive program, individuals who report a nest receive a payment upon verification by the WTW. This is followed by another payment upon verification of the nest hatching successfully. This payment schedule has been in place since 1997 without any changes. However, the monitoring program of the Marine Park beaches has changed. Originally, community members were involved in night patrols on both Park and Reserve beaches. As of 2007, only 2 salaried patrolmen had 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. In 2007, the WTW director

**Table 1.** Reviewed sea turtle conservation performance payments projects.

Project	Country	Year started	Year ended	Project lead	Species
Watamu Turtle Watch	Kenya	1997	Ongoing	Local Ocean Trust	Green
Kiunga Marine National Reserve Conservation and Development Project	Kenya	1996	Ongoing	Kenya Wildlife Service/WWF	Green
Mombasa	Kenya	By 1994	Ongoing	Baobab Trust and hotels	Green
Mafia Island	Tanzania	2002	Ongoing	Sea Sense	Green, also some hawksbill
Rendova Island	Solomon Islands	2002	Ongoing	Tetepare Descendants Association	Leatherback
Sangalaki Island, East Kalimantan	Indonesia	2000	2002	Sangalaki Dive Lodge	Green
Derawan Island, East Kalimantan	Indonesia	Late 1990s	2006	WWF	Green
Redang Island	Malaysia	1993	2005	SEATRU <sup>a</sup>	Green
La Flor Wildlife Refuge	Nicaragua	2008	Ongoing	Paso Pacifico	Olive ridley, hawksbill leatherback

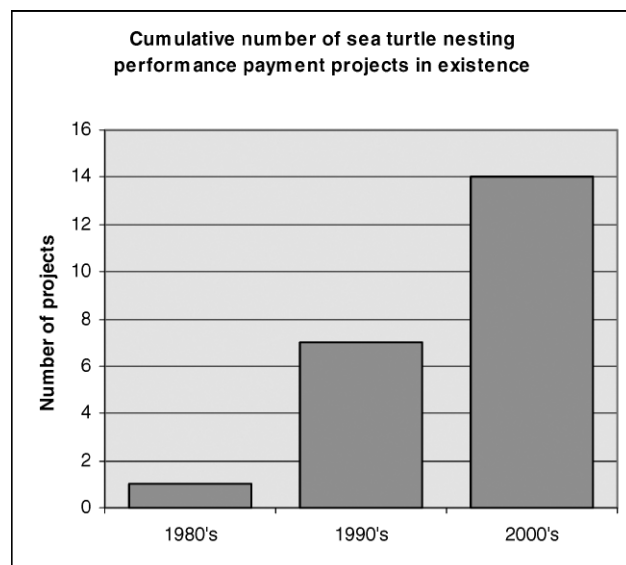
<sup>a</sup> SEATRU: Sea Turtle Research Unit.

(Steve Trott) reported that turtle poaching on Park beaches was near zero and had been greatly reduced in the Reserve (no written reports have been generated on this program).

*Kenya (Kiunga Marine National Reserve Conservation and Development Project).* — The Kiunga Marine

National Reserve Conservation and Development Project is a partnership between the Kenya Wildlife Service (KWS) and World Wildlife Fund (WWF). The Kiunga nest protection payment program is similar to the WTW program, but the Kiunga nest protection program targets women. Women report nests and sightings of nesting turtles to KWS or WWF employees. In return they are paid upon verification of the report. They are then paid a variable payment conditional on hatching success (Flintan 2002). Approximately 70% of the nests are translocated because they are deposited below the high water mark or are deemed to be at high risk of depredation (Flintan 2002).

*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). 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. Short reports in outlets such as the Marine Turtle Newsletter and in nongovernmental organization (NGO) brochures and reports indicate that nest protection payment systems existed at 3 beaches in the Mombasa area in the 1990s (as well as Malindi/Watamu and Kiunga). Payments were made through a conservation



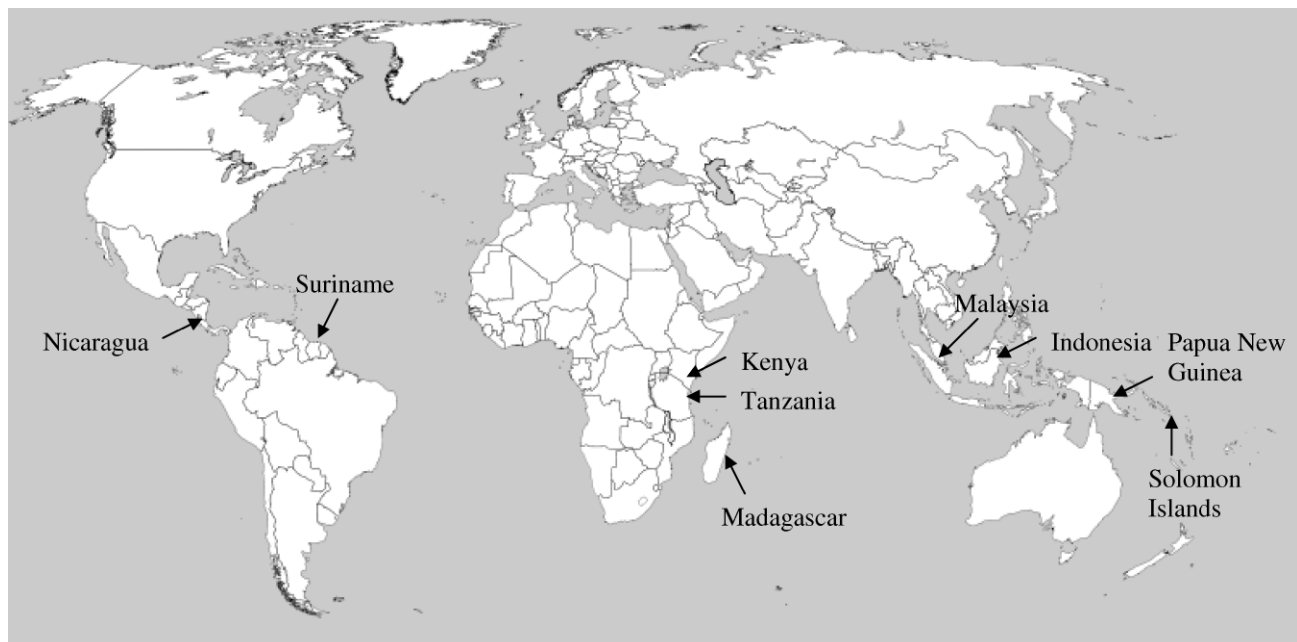
**Figure 1.** Cumulative number of sea turtle nesting performance payment projects in existence.

**Table 1.** Extended.

Annual no. of nests	Who patrols	Payments for nesting	Payments for hatching	Eggs in situ or hatchery
40–60	2 patrollers with permission of Kenya Wildlife Service	\$7	\$7 per nest	In situ
50	Kenya Wildlife Service/WWF	\$7 (only women are eligible)	\$0.28 per successful egg hatched, \$0.14 per unsuccessful egg	In situ, but 70% of nests are relocated
50	No patrollers	Baobab Trust: \$7; Serena Hotel: \$7; \$0.04 per egg given to hatchery on Funzi Island	Baobab Trust: \$0.03 per successful hatchling, Serena Hotel: none	Baobab Trust: hatchery; Serena Hotel: both; Funzi Island: hatchery
150	7 paid community monitors	\$2.50 per nest	\$0.03 per hatchling and \$0.01 per unsuccessful egg	In situ
85–90	Unpaid community monitors	Finder: \$2 if nesting turtle, \$1.33 if nest only; Monitor: \$1.33; Community fund: \$1.33	\$4 per hatched nest to finder and to community fund; \$1.33 per hatched nest to monitor	In situ, but recently being relocated
5000	Unknown	\$0.33 per egg to collectors who give to dive resort	\$0	Both
Unknown	Unknown	\$0	\$1.11 per 4-month hatchling	Reared by villagers
500	Unknown	\$30–50 per nest	Per hatchling payment to individuals, rangers, and community fund of \$0.10 for olive ridley, \$0.25 for green, \$0.35 for hawksbill or leatherback	In situ
Unknown	6 rangers paid by project	Per nest payment to individuals of \$10 for olive ridley, \$17.50 for green, \$20 for hawksbill or leatherback		

organization (Baobab Trust) or private hotels. Some of the hotels paid people who collected eggs and brought them to a hatchery in Bamburi. These initiatives are still in operation (Okemwa et al. 2004; A. Wamukota, *pers. comm.*, 2007). In Mombasa, the Baobab Trust pays for a reported nest and a payment for every successful

hatchling. All eggs are translocated to a hatchery run by the Trust. The Serena Hotel pays 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. According to KESCOM-Kenya, on Funzi Island, a tourist resort pays for every egg brought to it by

**Figure 2.** Location of sea turtle nesting performance payment projects.

local community members, and all eggs are translocated (A. Wamukota, *pers. comm.*, 2005).

*Tanzania (Mafia Island).* — Mafia Island, located 10 km off mainland Africa and 120 km south of Dar es Salaam, is an important turtle nesting area for Tanzania. 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<sup>2</sup>).

Although turtle egg collection and the killing of adults has been illegal in Tanzania since the 1970s, these 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 conducted by WWF-Tanzania suggest a 100% egg poaching rate of nests discovered by residents. 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. This initiative led to the establishment of a Tanzanian NGO called the Tanzania Turtle & Dugong Conservation Programme (TTDC, now called Sea Sense), which conducted the turtle conservation activities. TTDC then trained these elected monitors to patrol the main 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.

TTDC employees perceived that the monitors were not sufficient to reduce poaching of nests (~ 50% of deposited nests). The number may have been higher because some poached nests on beaches with low nesting density may not have been encountered by beach monitors. In January 2002, TTDC initiated a nest protection incentive scheme. Under this scheme, individuals who report a nest to a monitor receive an initial payment once the nest is verified. They then receive a variable payment when the nest hatches. If a nest completely fails to have a single egg hatched, or is poached or depredated, no variable payment is made. When the program was first implemented, monitors who were the first to find a nest 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 just under \$1000 USD, while approximately \$5400 per year was spent on the 7 community monitors.

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 by Ferraro (2007), estimating the precise number of eggs that hatched due to the operation of the program is difficult because of several confounding events and because the payments may induce greater effort by villagers to find nests. 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; however, there is no baseline data that begins before the project, and thus, one cannot examine any trends in nesting or poaching. During 2005, only 3 nests were poached (4%), which Sea Sense employees view as an indicator of the success of their program.

*Solomon Islands (Rendova Island).* — In 2002, Australian biologists, in collaboration with host-country nationals, began an "incentive-based monitoring program" on the leatherback turtle (*Dermochelys coriacea*) nesting beaches on Rendova Island, which is in the Western Province of the Solomon Islands. 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 and monitor are paid. A photographic documentation system was implemented for verification of successful tagging and nesting. If a villager finds a nest, but no turtle, the villager and monitor are paid slightly less. The project also pays an additional amount to the villager who found the nest and the monitor if at least one hatchling emerges from a nest. In addition to the individual payments, the project supports a community development fund that is managed by a board of community members, with expenditure reports provided to the community. Payments are made to the fund for every nest found and every nest that hatches.

In 2002, hatchling leatherbacks were recorded locally for the first time in many years, as previously all of the eggs and many of the adults that were found were eaten. More than 200 nests have been monitored and protected since 2002. Project staff indicate that only one leatherback turtle has been consumed (and villagers reported this incident) during the early phases of the project in 2003, and increased awareness by community leaders has resulted in a complete halt of the turtle harvest. (A. Bero, *pers. comm.*, 2005; Gjertsen and Stevenson 2009).

*East Kalimantan, Indonesia (Sangalaki Island).* — Sangalaki Island is a small island (slightly 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. 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. Egg harvesting was believed to remove nearly 100% of the eggs laid. A rule to conserve 20% of the nests passed 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. This led to more intense efforts to harvest the eggs prior to the market closure.

The resort operators believed the only option for protecting eggs was to pay concession holders to allow 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 could obtain at market. The resort never raised enough funds to pay for more than 20% of the nests and found the payment system cumbersome and inappropriate; it thus worked with conservationists to lobby local government officials to end the granting of concessions on this island. In 2002, the granting of egg harvesting concessions was ended and so too was the payment system.

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). Incentives were provided for local people to rear and release the hatchlings with training from WWF. This assistance had been encouraged since the late 1990s, prior to which the program was largely considered a failure because local residents were ill-trained for turtle rearing. Although higher than the price of an egg sold, this incentive payment is low given the effort and uncertain outcome of rearing a hatchling. The concessions and rearing incentive programs were expected to cease in 2006 (Newman 2006).

*Malaysia (Redang Island).* — The Malaysian Island of Redang is located in the South China Sea, approximately 22 km from the mainland (Terengganu). The island is home to the largest aggregation of nesting green turtles in peninsular Malaysia, as well as a minor nesting area for hawksbill turtles (*Eretmochelys imbricata*) and olive ridley turtles (*Lepidochelys olivacea*).

The Terengganu government awarded a concession to a village cooperative for the main nesting beach on Redang Island in 1984 (H.C. Liew, *pers. comm.*, 2009). In Malaysia, the laws dating from the 1970s dictated that 10% of the eggs were to be protected or sold to a government hatchery, while the remainder of the eggs be

marketed legally by the concession holders. In 2001, the percentage of eggs protected in Peninsular Malaysia increased to approximately 50% (Shankar and Pilcher 2003), but full compliance was questionable. This increase in protection was a political decision by the State to increase the allocation (H.C. Liew, *pers. comm.*, 2009).

Between 1993 and 2005, the Malaysian Sea Turtle Research Unit (SEATRU) ran a nest protection payment program on Chagar Hutang. Payments were made to licensed collectors from the village cooperative that owns the nesting beach concession for both for in situ incubation on the beach and for incubation at SEATRU's hatchery. However, the program focused more on in situ incubation, due in part to concerns about the viability of hatchery-incubated turtles.

Payments varied each year depending on the SEATRU's budget, the number of eggs per nest, and market conditions. The payments tended to be less than market price because of SEATRU's budget constraints. From 2000 to 2005, the program made payments for about 500 nests per year, which resulted in the release of over 120,000 hatchlings. In 2005, all major nesting sites in Redang were formally declared sanctuaries and the payment scheme ceased.

*Nicaragua: La Flor Wildlife Refuge.* — Paso Pacifico, a nonprofit conservation organization working along the Pacific coast of southwestern Nicaragua, has been working with communities near the La Flor Wildlife Refuge, a globally important sea turtle nesting site for olive ridley, leatherback, and hawksbill turtles. They have initiated a program that involves education, turtle monitoring, and eco-tourism led by local people, and recently implemented a payment scheme for turtle conservation at beaches outside the reserve where there are many solitary nesters, particularly leatherback turtles. The program includes individual incentive payments managed by local general stores where the store owners receive a commission and commit to abstain from egg trade and a payment to a community fund tied to the incentive payment. Because the program was recently implemented, measures of project success are not yet available.

*Additional Incentive Projects.* — In addition to the aforementioned projects, we are aware of some proposed projects that have not yet been implemented or which are no longer operational. For example, a pilot program in southeast Madagascar (Fort Dauphin/Tolagnaro region) was implemented to pay collectors double the market price per egg to leave nests intact. In Papua New Guinea (Kamiali), an annual payment has been made into a community fund to replace the foregone market value of eggs the community could have harvested. There have been proposals to implement a conservation incentive agreement on the island of Santa Isabel in the Solomon Islands and pay communities conditional on protection of leatherback nesting beaches. There are also some vague references in the literature to previous payment schemes in Suriname and Zanzibar, Tanzania.

## SEA TURTLE BYCATCH RELEASE PERFORMANCE PAYMENTS

*Kenya (Watamu Turtle Watch).* — In addition to its nesting program, Watamu Turtle Watch pays fishers to release live turtles from fishing gear and to participate in a tag and recapture study (Zanre 2005). To our knowledge, this is 1 of only 2 turtle by-catch payment incentive programs in the world (where payments are made for releasing bycaught turtles rather than for using gear that reduces turtle by-catch).

The turtle by-catch release incentive program began informally in 1998 as a compensation program for fishing net damage from turtle interactions. When a fisher catches a live turtle in fishing gear, the turtle is removed and returned to one of a small number of landing sites, and a report is made to WTW. The fisher receives 500 KSH (\$1 USD = 72 KSH) for a turtle with a greater than 70-cm curved carapace length (CCL), which corresponds to adults and subadults, and KSH 300 for a smaller turtle. The turtle is measured, tagged, and released. Originally no payment was made for releasing previously tagged turtles. However, it became apparent to the WTW that goodwill was not sufficiently strong to persuade fishers not to kill these tagged turtles. At the end of 2000, the WTW thus extended the incentive payment system to cover previously tagged turtles.

From April 1998 to May 2004, 1422 sea turtles were released under the program. Each year, more turtles were being released from nets (> 500 turtles in 2003 only) and this positive fisher response was creating financial strain for WTW. Because of financial constraints, WTW stopped paying for untagged turtles between September 2003 and April 2004; the project only paid for tagged turtles or fishing gear damage from tagged or untagged turtles. Compensation was based on a negotiated estimate of the damage to fishing gear and the time required for the fisher to bring in the turtle and have it processed. However, the change in the payment rules reduced good will and trust between fishers and the WTW and resulted in time-consuming bargaining over damage claims. Thus, in April 2004, the WTW resumed payments for all turtles.

Although there were concerns that direct payments would create incentives for fishers to deliberately set nets on turtles to receive the incentive payment, there was no evidence of this unintended response. Even if the payments do not increase the incentive to catch turtles, the structure of the payments clearly does not provide an incentive for fishers 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 may be difficult in Kenya.

*Congo (RENATURA).* — In Congo, fishers accidentally catch turtles in their traditional fishing nets and sell

these turtles in markets to recuperate the costs they incur from the damage to their nets. RENATURA began a program whereby a fisher that accidentally catches a turtle in its net can notify an agent who will release the turtle and estimate the damage to the net. The turtle is tagged after being released. The organization will provide the materials to fix the net, or if the damage is great enough, they will replace the net. To receive these materials, the turtle must be released from the net in the presence of the agent. The fisher is responsible for making the repairs, and he is not compensated for his time because the organization believes this creates a real collaboration between the organization and the fisher. The association receives several requests each day from fishers wishing to liberate turtles. On average, 107 turtles are released each month. Since the beginning of the project in 2000, more than 3727 turtles have been released. Due to funding shortfalls in some years, RENATURA has been only able to offer partial compensation. Some fishers accepted this, but others chose to sell the turtle meat instead. In addition to the turtle release program, RENATURA conducts many other activities including monitoring and enforcement, research, and education and awareness.

## 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, *pers. 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 turtle eggs. 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. These systems exist to some extent in Central America (e.g., at the olive ridley arribada nesting beach in Ostional, Costa Rica).

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 depredation, erosion, inundation). As noted above, such schemes already exist, but they are few and do not always function well if they do not pay sufficient prices to elicit conservation-friendly behavior.

In areas where natural threats (i.e., predators, inundation) are substantial, the payments could be made for eggs to be collected and brought to hatcheries. 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). Although verification of hatching success is easier in a hatchery, it would be worthwhile to conduct 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 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.

#### **ADDITIONAL OBSERVATIONS ON PAYMENT SCHEMES VERSUS OTHER INCENTIVE SCHEMES**

As noted above, the use of economic incentives in sea turtle conservation, particularly through direct payments, is rare. Most incentive programs in sea turtle conservation use either conservation through "sustainable" exploitation,

the provision of alternative livelihoods, or goodwill gestures. The problems with these approaches are numerous and are discussed in the theoretical and empirical literature. We thus do not review them in detail here but instead offer the payment approach as an alternative that should be investigated. Further experimentation and improved data will reveal whether or under what conditions it outperforms these other approaches. Below we briefly mention the approaches and some of their principal challenges.

Some sea turtle conservation initiatives attempt to indirectly promote nest protection through controlled exploitation. A well known example is the olive ridley egg harvesting and marketing scheme in Ostional, Costa Rica (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. One of the main challenges with valorization approaches is that higher egg prices make the incentives for harvesting greater. In contrast, in a performance payment scheme, the higher the payment, the greater is the incentive for conservation.

Alternative livelihood schemes are usually motivated by the following logic: egg collectors collect eggs because they have no other 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. To function, alternative livelihood schemes generally require outside funding to search for livelihood possibilities about which local residents are unfamiliar or to subsidize the start-up costs of alternative livelihood operations. The conditions necessary for successful alternative livelihoods are difficult to meet (Salafsky et al. 2001; IMM 2008). We 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, we do not believe that these opportunities are widespread, or that conservation practitioners can identify them simply through field work and introspection (Salafsky et al. 2001). 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 2000; Kiss 2004). 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).

Some conservation projects may superficially appear to be 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, clinics, etc.), technological (alternative fishing gears), 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. The main problem with these gestures of goodwill is that 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.

## 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), some conservation practitioners involved in these programs wish to eliminate the payment programs in favor of more education-based and regulatory-based programs (“fences and fines”). This appears to be due to a perceived burden in terms of finances (payments) and staff time (verification), as well as the approach being philosophically suspect (applying to economic motivations rather than ethical ones) (Swart 2003).

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; Abrahamse et al. 2005). The only specific techniques that have shown some promise for long-term behavior changes are commitment, goal-setting, social norms, and feedback (DeYoung 1993; Dwyer et al. 1993; Syme et al. 2000; Abrahamse et al. 2005). Thus it is unlikely 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 initiatives 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. For example, Gjertsen and Stevenson (2009) found that the Rendova egg payment project protects on the order of 90 leatherback nests per year at a cost of approximately \$2500. When translated into costs per hatchling protected, this is one of the least expensive nesting beach projects evaluated by Gjertsen (2008). Given that many of these nest protection payment initiatives have achieved substantial results for a very low annual cost, we hope that these nest protection programs will continue to be initiated and tested.

Which factors determine the success of a performance payment initiative? Given that these initiatives are so inchoate, we must depend on theory and field observations to draw speculative conclusions. 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 or collective monitoring and social sanctions. This capacity may be more likely in more homogenous communities 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, 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 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, we are aware of only 2 projects that use payments to reduce by-catch (Kenya and Congo). Using payments in this context is much more difficult and potentially costly than the use



of payments to protect nests. In nations in which fishing licenses are well controlled, paying fishers to relinquish their licenses and surrender their gear in a buyout 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 fishers. Leasing protected areas from private citizens and communities has been attempted in terrestrial ecosystems, but has rarely been tried in the marine environment.

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