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Coastal Capital: Valuing Coastal Ecosystems in the Dominican Republic

Coastal and marine ecosystems provide many valuable services to the people and economy of the Dominican Republic. Very often, these benefits can be difficult to see at a first glance—reefs and mangroves help to build beaches and slow erosion, draw local and international tourists to the coasts, and provide habitat for valuable fisheries. Unfortunately, these benefits are often overlooked in development decisions, and coastal ecosystems are threatened by pollution, over-fishing, and other local and global pressures. The four studies presented here look at a small sample of the benefits provided by the coastal ecosystems of the Dominican Republic: protection of white sand beaches in vital tourism areas, habitat for commercial fisheries, the potential for tourism growth in a small marine protected area, and local tourism dollars in the southwest of the country. The studies point to the need for greater investment in protecting coastal and marine ecosystems, including better management of marine fisheries, protection of existing reserves, and enforcement of coastal development guidelines.

For the full report and methodology, please visit www.wri.org/coastal-capital.

Case Studies:

- Economic Costs of Beach Erosion in the Dominican Republic
- A Worrying Trend: Declines in Coral Reef- and Mangrove-Associated Fisheries in the Dominican Republic
- Dive Tourism in La Caleta Marine Park: A Win-Win Opportunity for Fish and Fishermen
- Local Economic Benefits of the Dominican Republic's Biosphere Reserve

Economic Costs of Beach Erosion in the Dominican Republic

With four million overnight tourists arriving each year, the Dominican Republic is the most popular tourist destination in the Caribbean. International tourism attracts 37 percent of all foreign currency coming into the country, and more than 500,000 Dominicans—or 1 out of every 20—are employed in the tourism sector. The country's beautiful white sand beaches play a critical role in attracting tourists.

However, the Dominican Republic is losing its beaches to erosion. Erosion—caused by degradation of coral reefs, excessive construction in coastal areas, and rises in sea level—is causing the Dominican Republic and other Caribbean countries to lose about 50 cm of beachfront each year.

Corals and other organisms that inhabit coral reefs produce the sand that forms beaches. The Dominican Republic's coral reefs have suffered significant mortality in recent decades as a result of many factors, including pollution, sedimentation, overfishing and warming ocean temperatures.

In a study of the economic consequences of erosion, we found that all-inclusive resorts in the Dominican Republic could lose **US\$52-100 million** over the next ten years from beach erosion¹. The study, which looked at the many components that contribute to room prices at all-inclusive resorts in the country, found that each meter of beach in front of a resort (perpendicular to the shoreline) adds US\$1.57 to the average per-person nightly room price¹.

In a separate analysis, we assessed the role of fringing coral reefs in preventing erosion in two key tourism areas. The study estimated that if coral mortality continues, erosion rates could increase by more than 80 percent in the Punta Cana-Playa Bávaro area and by more than 50 percent in the Juan Dolio-Boca Chica area. The Dominican government has recently carried out costly sand replenishment programs in Juan Dolio and Puerto Plata, but if the causes of erosion are not addressed, this new sand will also be lost².

Slowing the pace of beach erosion in the Dominican Republic will require protecting the ecosystems that help to protect the coastline, including coral reefs, mangroves, and sand dunes. Regulations for coastal development should be strengthened and enforced, including limiting construction in sensitive areas. The protection of coral reefs will require curbing overfishing, deforestation, and pollution—both from the hotel industry and from agricultural runoff. Enforcement of existing regulations to protect mangroves is also critically important in coastal areas. For example, hotels situated in areas of Playa Bávaro where mangroves had been cleared or modified suffered severe flooding during Hurricane Jeanne (2004). Finally, local strategies should also include restoration of sand dunes, many of which have been removed to allow tourists easier access to beaches. Dunes and their native vegetation act as a barrier to wind erosion, which can further aggravate beach loss.



A Worrying Trend: Declines in Coral Reef- and Mangrove-Associated Fisheries in the Dominican Republic

The Dominican Republic has a coastline extending nearly 1,600 km and an Exclusive Economic Zone covering 238,000 km². There are approximately 9,000 fishermen in the country. Most of the fisheries are small-scale, but there are also some semi-industrial and industrial operations that target fishing banks off the northern coast. Mangroves and coral reefs provide critical habitat for many of the Dominican Republic's most economically important fish species.

This study used landing and price data for fishery groups (comprising fish species or families) to estimate the contribution of mangroves and coral reefs to fishery production in the Dominican Republic. The following table shows the average annual gross revenues obtained by fishermen during three time periods, assuming stable prices across the time periods (except for conch, which was exported until 2003 and whose export price was higher than the current domestic price).³

Table 1: Mean annual revenues obtained from coral reef- and mangrove-dependent fisheries in the Dominican Republic during three time periods. Prices are in 2009 US\$.

	1982-1986	1992-1996	2002-2006
CORAL REEF GROUPS			
Stromboid conch	13,129,200	25,234,200	4,055,590
Spiny lobster	3,330,492	4,667,850	9,267,390
King mackerel	2,721,088	4,325,008	1,104,048
Blue runner	612,920	648,560	274,560
Red grouper	545,792	1,199,168	252,560
Other reef-related fish	4,075,004	5,351,648	1,670,004
Totals (US\$)	24,414,496	41,426,434	16,624,152
Mean annual landings (t)	5,162	8,105	4,184
MANGROVE GROUPS			
Other groupers	2,404,896	3,634,896	1,792,192
Southern red snapper	1,901,744	1,585,552	581,872
Penaeid shrimps	1,619,146	1,309,956	497,228
Grunts	746,928	618,032	328,928
Yellowtail snapper	719,632	1,477,312	434,928
Other mangrove-related fish	2,354,320	1,934,800	5,455,936
Totals (US\$)	9,746,666	10,560,548	9,091,084
Mean annual landings (t)	3,536.8	3,662.8	3,074.4

As fishing effort has risen over the past two decades, there has been a marked rise and fall in the landings of commercially valuable species such as the king mackerel, red grouper, and yellowtail snapper, a probable indication that these species are being overexploited. An increase in engine-powered boats in the 1990s and subsequent overexploitation may have led to the decrease in landings in recent years. The results shown in Table 1 demonstrate that gross revenues from reef- and mangrove-dependent fisheries also exhibited a rise and fall over the three time periods. For coral reef-dependent species, mean annual revenues were 2.5 times higher during 1992-1996 than during 2002-2006.

Although annual landings of spiny lobster in 2002-2006 were twice those of 1992-1996—singling them out from the wider trend—studies conducted in Parque Nacional Jaragua and neighboring areas have found that most of the landed lobsters were below the legal size limits. The fishery seems to be supported by lobster larvae and juveniles brought by currents from the South American Caribbean. If lobster populations in that region collapse, the Dominican lobster fishery may suffer the same fate.

These results illustrate the importance of the development and enforcement of fishing regulations in order to avoid further reductions in the economic well-being of fishing communities and to safeguard fishery resources from depletion. They also highlight the importance of protecting mangroves and coral reefs, which provide critical habitats for many of the commercially significant fish species in the Dominican Republic.

Dive Tourism in La Caleta Marine Park: A Win-Win Opportunity for Fish and Fishermen

La Caleta National Marine Park is located 22 km from Santo Domingo, next to the town of Boca Chica and less than 3 km from the Santo Domingo airport. The waters in this part of the Dominican Republic are rich in coral reefs, and reef fish have traditionally been a source of food and income for the people living in the town of La Caleta and its vicinity.

In order to protect this resource, the Dominican government established a 10 km² National Marine Park in La Caleta in 1986. The park has since become a popular recreational site for people living in Santo Domingo. In particular, SCUBA divers enjoy the park's clear waters and healthy coral reefs, as well as several shipwrecks that are now teeming with marine life.

However, in recent years, Boca Chica has seen a surge of North American and European tourists, and the demand for seafood from the area's hotels and restaurants has increased greatly. Due to this increasing demand, there has been a growth in illegal fishing in the protected waters of La Caleta Park. This has negatively affected the legal fisheries outside of the park by lowering fish populations. As a result, the fishermen of La Caleta have seen a decline in fish catches in recent years, putting their livelihoods in peril.

Fishermen are aware of the importance of La Caleta as a tourist destination, and they have begun to supplement their incomes by providing services such as transportation to divers in the park. In order to increase the community's capacity to offer services to tourists, the park's co-manager, Reef Check-Dominican Republic, is helping the fishermen to establish an aquatic center that will rent diving and kayaking equipment, a restaurant, and a gift shop.

In order to maximize potential profits for the aquatic center, WRI and Reef Check conducted a study to calculate how much the center should charge for diving services. The results of the study showed that this charge should be US\$53 per trip (two dives) for local visitors and US\$59 per trip for international visitors. Based on these results, we suggest establishing diving charges of US\$50 for local visitors and US\$60 for international visitors⁴.

The decline of La Caleta's fish populations is alarming, but there is cause for hope. Studies in marine protected areas around the world have shown that populations of fish species that are attractive to divers—such as groupers and snappers—can recover in four to six years if fishing regulations are effective and enforced. If fishing around La Caleta Park is reduced and regulations inside the park are respected, fishermen who become tourism operators can expect short-term net revenues equivalent to approximately 90 percent of their current net revenues. In the longer term, the aquatic center should generate additional revenues from other recreational activities—such as snorkeling and kayaking—making it likely that fishermen will earn more from tourism than from fishing, and creating a win-win situation for La Caleta's fish and human populations.



Local Economic Benefits of the Dominican Republic's Biosphere Reserve

The Biosphere Reserve of Jaragua, Sierra de Bahoruco, and Lago Enriquillo provides habitat for a diverse range of rare and threatened plant and animal species. Parque Jaragua harbors coral reefs, mangroves, and sea grass beds, and its beaches are used as nesting grounds by the hawksbill, loggerhead, green, and leatherback turtles. The beach at Bahía de las Águilas, in Parque Jaragua, contains white sand produced in a coral reef that fringes the shoreline and is considered one of the most beautiful and best preserved beaches in the country. The mountains of Sierra de Bahoruco contain some of the last remaining primary forests in Hispaniola, ranging from dry forest in the lowlands to broadleaf rainforests and pine forests at higher elevations. Lago Enriquillo is the largest lake in the insular Caribbean. It is home to the two endemic iguana species in Hispaniola and to a critically endangered population of the American crocodile.

Each year, the reserve receives over 24,000 visitors—mostly Dominican citizens. This is in contrast with most other tourism destinations in the country, where international visitors predominate. Dominican visitors travel to the reserve by land from all over the country, stopping at different locations along the way to purchase gasoline and food. These travel expenses are important economic benefits to the communities at which stopovers are made, some of which are located in poor, rural areas. The map below illustrates the annual expenses in gasoline, food, and hotel accommodation made at different locations in the country by visitors to the reserve.

Dominican visitors spend approximately US\$523,000 during stopovers between their cities of origin and the reserve and US\$511,000 in lodging (hotel rooms and food) each year. An additional US\$136,000 is paid in park fees, which help cover the management activities of the reserve⁵.

There is currently a debate in the country between proponents of developing the southwest—including areas in and around the reserve—for mass tourism and mining, and supporters of maintaining ecologically-friendly tourism as the mainstay of the region. Any ecological damage to the reserve or its buffer areas would diminish the area's unique recreational value. Moreover, if the southwest region follows the previous tourism-development model, which focuses on attracting foreign visitors, it is likely that the value of the area as a center for recreation and enjoyment for Dominicans will be degraded, which will also cause negative economic impact to communities along the route.

Map 1: Estimated spending on food, fuel, and accommodation by visitors to the reserve



Technical Notes

¹We used the hedonic-prices method to study the contribution of beach width and other resort attributes (location, size, distance to nearest airport, star rating, value, cleanliness) to room prices. Information on room prices and resort attributes was obtained from the Trip Advisor website (www.tripadvisor.com), and beach width was estimated in Google Earth (earth.google.com).

²We used a model that relates the condition of coral reefs that are adjacent to the coastline with the wave energy dissipated by the reefs (Sheppard, C., Dixon, D.J., Gourlay, M., Sheppard, A., Payet, R., 2005. Coral mortality increases wave energy reaching shores protected by reef flats: examples from the Seychelles. *Estuarine, Coastal and Shelf Science* 64, 223-234). To estimate increases in net offshore transport of sand from a beach (erosion), we used a mathematical relationship found in Dean, R.G., Galvin, C.J., 1976. Beach erosion: causes, processes, and remedial measures. *Critical Reviews in Environmental Science and Technology* 6, 259-296.; and CETS (Commission on Engineering and Technical Systems of the National Research Council), 1987. Responding to changes in sea level: engineering implications. National Academy Press, Washington, D.C.

³From FAO fisheries data, we selected the groups that rely on coral reefs or mangroves at some point in their life cycle. To identify fish families that use mangroves as habitats, we used the information on habitat use by different fish families available in Rönnbäck, P., 1999. The ecological basis for the economic value of mangrove forests in seafood production. *Ecological Economics* 29, 235-252. Species or families that are dependent on coral reefs for habitat were identified in the databases FishBase (available at www.fishbase.org) and SeaLifeBase (available at www.sealifebase.org). We included species and families that depend on both ecosystems in the mangrove category only.

⁴During June 2009, 67 tourist divers and 35 domestic divers completed a survey at the Santo Domingo airport and dive centers. The survey elicited the willingness of divers to pay for diving at La Caleta, which was used to estimate a linear demand function and a revenue maximizing fee. Assuming a linear demand function, this fee is the median willingness to pay of the sample.

⁵We interviewed 55 people to calculate the expenses in gasoline and food made at different locations throughout the Dominican Republic by visitors traveling by car to the reserve. Surveys were conducted at Parque Nacional Jaragua during two national holidays, in April and October 2009.

WRI and Economic Valuation of Coastal Resources

The World Resources Institute (WRI) launched the Coastal Capital project in the Caribbean in 2005. The project works with local partners to produce national and sub-national assessments of the economic contribution of coral reefs and mangroves. WRI aims to increase local capacity to perform ecosystem valuations, to raise public awareness of the economic and social benefits of marine resources, and to provide dollar value estimates that can be used to inform planning and decision-making.

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