**NATURAL RESOURCES SYSTEMS PROGRAMME**

***PROJECT REPORT***[1]

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Policy and management brief 5: Impacts of tourism on coral reefs and options for management.

Annex A2, Appendix 5, of the Final Technical Report of project R7668.

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# Appendix A2.5

# Brief 5: Impacts of tourism on coral reefs and options for management

Coral reefs are valuable resources but are vulnerable to damage. Tourists diving and snorkelling on coral reefs cause damage, although usually inadvertently. Sustainability of tourism, and associated revenue from it, is dependent on managing impacts caused by tourists. This brief quantifies the direct impacts of tourism on St. Lucian coral reefs, explores management options, and looks at future options for tourism growth under different management regimes.

## KEY FINDINGS

To determine the effects of scuba divers on St. Lucian coral reefs, 353 divers were observed underwater and all their contacts with the reef recorded. Immediately following a dive, divers were approached and asked to participate in an interview. Contact with the reef by divers was common (74% touched the reef during their dive). Certain diver, dive and site characteristics were correlated with higher levels of damage to the reef. Divers using a camera had significantly more contacts with the reef than those not using a camera (average 0.4 versus 0.2 contacts per minute), as did shore versus boat dives (average 0.5 versus 0.2 contacts per minute), and night versus day dives (average 1.0 versus 0.4 contacts per minute). Contact rates by divers were highest at the beginning of the dive (average of 0.6 contacts per minute) and reduced as the dive progressed (average of 0.04 contacts per minute).

Most diver contacts were caused by fin kicks causing minor damage (a touch or a scrape), with almost half of all contacts resulting in the re-suspension of sediment (sediment kicked up by fins or hand movement). Very few divers broke corals (4%), but scrapes and sediment damage cause cumulative stress to reefs at dive sites.

Management options to reduce damage to reefs were explored. Short briefings were given by dive staff prior to the dive explaining the vulnerability of the reef and asking tourists not to touch. However, they appeared to have no effect on reducing damage levels to the reef by divers. But when briefings were followed up by dive leader intervention underwater when a diver was seen to touch the reef, they did reduce damage. When dive leaders reminded divers not to touch the reef underwater it reduced rates of contact with the reef from 0.3 to 0.1 contacts per minute.

To determine the effects of snorkellers on reefs, 180 snorkellers were also observed and their contacts with the reef noted. Few snorkellers contacted the reef (20.6%), averaging 0.05 contacts per minute. The highest rates of contact (up to 1.10 contacts per minute) occurred at the beginning of the snorkel. Snorkellers using a camera caused more damage and had more than twice as many contacts as non camera users (average of 0.12 versus 0.04 contacts per minute).

Giving snorkellers a briefing prior to their swim did not significantly reduce their contact with the reef but wearing a life-vest reduced mean contact rates by 20 times, from 0.06 to 0.003 contacts per minute. Contact rates were similar whether snorkellers were being guided by a staff member of the watersports company or snorkeling on their own.

The above research and studies from other parts of the world show that the impact of divers and snorkellers can be significant, especially when there is a concentration of activity in popular areas. The term ‘carrying capacity’ is often used to refer to the number of people that can use a resource without causing “unacceptable impacts” to a particular environment. Estimates of sustainable diver carrying capacities for reefs range from 4,000-7,000 dives per dive site per year (Table 1). These estimates are based on the premise that above those intensities of use, reefs would suffer high frequencies of colony damage significant loss of coral cover. However, the figures may be conservative as the reefs on which those carrying capacity estimates were based had little or no management of in-water impacts by divers and snorkellers.

TABLE 1: ESTIMATES OF SCUBA DIVER CARRYING CAPACITY FOR CORAL REEFS

| No. dives per site per year | Location where study was carried out | Reference |
|---|---|---|
| 4000 – 6000 | Bonaire, Netherland Antilles | Dixon et al. 1993, 1994 |
| UP TO 5,000 | Eastern Australia | Harriott et al. 1997 |
| 5000 – 6000 | Egypt, Bonaire and Saba | Hawkins & Roberts 1997, Hawkins et al. 1999 |
| 5000 – 6000 | Eilat, Israel | Zakai & Chadwick-Furman, 2002 |
| maximum of 7000 | Sodwana Bay, South Africa | Schleyer & Tomalin, 2000 |

TABLE 2: DISTRIBUTION OF DIVE SITE USE IN ST. LUCIA (YEAR 2000) AND CORRESPONDING ESTIMATE OF NUMBER OF DIVES DONE AT EACH USING 2001 DATA. SITES IN BOLD ARE THOSE WITHIN THE SOUFRIERE MARINE MANAGEMENT AREA (SMMA)

| | Site | No. dives (to nearest hundred)** | % dives* | | Site | No. dives (to nearest hundred)** | % dives* |
|---|---|---|---|---|---|---|---|
| **1** | **Anse Chastanet** | **28,100** | **20.5** | 23 | Le Wash | 600 | 0.4 |
| 2 | Anse Cochon (n) | 14,000 | 10.2 | 24 | The Arch | 500 | 0.4 |
| 3 | Lesleen M | 11,300 | 8.3 | 25 | Other | 500 | 0.4 |
| **4** | **Coral Gardens** | **8,300** | **6.1** | 26 | Oceron Point | 500 | 0.3 |
| **5** | **Pinnacles** | **7,400** | **5.4** | 27 | Saline Point | 300 | 0.2 |
| **6** | **Trou Diable** | **7,100** | **5.2** | 28 | Petit Trou | 200 | 0.2 |
| **7** | **Piton Wall** | **6,000** | **4.4** | 29 | Bourget Rocks | 200 | 0.2 |
| **8** | **Malgretoute** | **5,900** | **4.3** | 30 | Rosmund's Trench | 200 | 0.1 |
| **9** | **Turtle Reef** | **5,600** | **4.1** | 31 | North Beach | 200 | 0.1 |
| 10 | Virgin Cove | 5,200 | 3.8 | 32 | Anse Galet | 200 | 0.1 |
| **11** | **Grand Caille** | **5,100** | **3.7** | 33 | Cariblue Bay | 200 | 0.1 |
| **12** | **Fairyland** | **4,500** | **3.3** | 34 | Secret Garden | 100 | 0.1 |
| **13** | **Superman's Flight** | **3,700** | **2.7** | 35 | Smuggler's Cove | 100 | 0.1 |
| 14 | La Toc beach | 3,400 | 2.5 | 36 | Blue Water | 0 | 0.0 |
| 15 | Anse la Raye Wall | 3,200 | 2.4 | 37 | Cutty Cove | 0 | 0.0 |
| **16** | **Jalousie** | **3,100** | **2.2** | 38 | Jambette Point | 0 | 0.0 |
| 17 | Virgin Point | 3,000 | 2.2 | 39 | Barrel O' Beef | 0 | 0.0 |
| 18 | Choc Reef | 2,500 | 1.8 | **40** | **Hummingbird Wall** | **0** | **0.0** |
| 19 | Pigeon Island | 1,800 | 1.3 | **41** | **Blue Hole** | **0** | **0.0** |
| 20 | Anse Cochon (south) | 1,600 | 1.2 | 42 | Wauwinet Wreck | 0 | 0.0 |
| 21 | Rust Cove | 1,400 | 1.0 | 43 | Fish Feeding Point | 0 | 0.0 |
| 22 | Daini Koyomaru | 700 | 0.5 | 44 | Fond Blanc | 0 | 0.0 |

*Based on SMMA data (2000). **Estimates based on interview data, calculated by multiplying the average number of divers by the average number of dives done per trip.

Interviews with all existing dive companies in 2001 showed that there is a great disparity in dive site use. Certain sites, particularly those within the SMMA received many more tourists than others (Table 2). In 2000, six sites supported more than half of all dives (50.3%) and one site in particular, Anse Chastanet, received 20.5%. Using the most recent data obtained from interviews with dive operators (2001), the total number of dives done in St. Lucia was estimated at 137,000 dives per year. If one assumes that site use followed the same distribution as in 2000 (Table 2), approximately 84,800 dives would have been within the SMMA, with 28,000 dives at Anse Chastanet alone. For the year 2000, the number of dives at most sites were below researchers' estimates of carrying capacity set at between 4,000 to 7000 dives per site per year (Table 1), but some sites greatly exceeded these

values. Five sites had above the maximum of 7,000 dives per site per year suggested by Schleyer & Tomalin (2000) and the most popular site, Anse Chastanet, received four times the maximum recommended capacity.

## MANAGEMENT OPTIONS

There is currently no management of scuba diving or snorkeling in the SMMA. Such management is now needed to reduce impacts, especially in high-use areas.

**Spread scuba diving pressure more equitably among sites:** At present there are a sufficient number of sites to support all the divers visiting St. Lucia without exceeding recommended carrying capacity estimates. Redistributing diving pressure will reduce impacts on the most attractive and most heavily used sites around the island. Unless numbers of divers at the most intensively used sites is reduced, they will degrade and the appeal of St. Lucia as a diving destination will decline.

**Limit scuba diving intensities to levels below recommended carrying capacities:** Keeping numbers of dives per site per year below 7000 will greatly increase the sustainability of diving in St. Lucia and should safeguard reefs from serious damage by tourists. With additional in-water management of diving (see below) site capacities could be increased.

**Implement in-water intervention by dive and snorkel leaders:** Based on this research, it is clear that damage levels could be significantly reduced if all dive and snorkel businesses provide environmental briefings and in-water intervention by leaders to prevent divers and snorkellers from touching the reef. In water intervention when leaders see guests touching the reef is essential if environmental briefings are to be made effective.

If dive leaders consistently intervened when they saw their clients damaging the reef, they could reduce contact rates significantly and sites within the SMMA may be able to withstand use greater than the maximum carrying capacity estimate of 7000. If one assumes dive leader intervention could reduce contact rates by a third or a half, carrying capacity could be increased to 9,000 and sites could possibly withstand use of up to 10,000 dives per site per year in well-regulated areas. These estimates do not include impacts to the reefs from other sources, and therefore a precautionary approach would be to use the lower carrying capacity estimate of 9,000 dives per site per year. Such numbers represent revenues of EC$972,000 per site per year in trip fees alone.

Implementing dive leader intervention would be virtually cost free. Yet if introduced it would mean that each site could potentially earn EC$216,000 more per year. As tourism on the island increases, more and more sites will reach their carrying capacity. If all sites were used to full capacity, with 44 dive sites this amounts to an extra EC$9.5 million per year in dive trip costs alone. Added to this would be all the additional spending of the additional divers the island could support. Close in-water management of divers could make a substantial contribution to the St. Lucian economy.

**Consider a tradeable permit system to control dive site use:** To implement such a scheme, dive carrying capacity for each site must be determined. This could be set at the same figure for all sites, or lower figures could be set for sites considered more vulnerable or in need of restoration. The corresponding number of tradable permits would then be sold to dive operators, which in total allow no more than the decided dive levels at each site during the specified period for which permits are valid. As permits are in limited supply they obtain a scarcity value and any business can sell their excess permits to another business.

**Establish designated snorkelling areas in low risk sites:** Setting up snorkelling areas like those at Anse Chastanet and Jalousie could help contain damage by people snorkeling independently. Suitable areas of reef for snorkelling are those where the depth is great enough to be avoided by snorkellers' fins (i.e. 2.5 to 3m minimum). Buoys could be used to mark snorkelling areas. Adding floating platforms could provide a safe entry point and give snorkellers an area to rest instead of standing on the reef.

**Reduce pollution levels to reefs:** Sediment pollution from land-based sources is causing severe degradation to St. Lucia's reefs and has already reduced the number of available dive sites. Rubbish washed from the streets of villages restricts use of other sites. As tourism expands, these degraded

sites will impose a growing cost on the St. Lucian economy. At present day values (EC$108 per dive), and a carrying capacity of 7000 dives per site, the cost is up to EC$756,000 per site per year. That cost is conservative because it does not include other foregone income to businesses from providing transport, accommodation, food or other goods and services to visitors staying in St. Lucia. Recovery of sites damaged by sediment and clearing reefs affected by rubbish (and preventing new inputs) would expand the area available for tourism and would reduce pressure on sites being used now.

**Manage coral reefs closely to maintain high-value, low-impact tourism:** Under close management St. Lucia's reefs could maintain high-value, low-volume tourism, with tourists paying a premium for diving in well-managed, high environmental quality sites. A study of two Red Sea diving resort areas (Medio 1996) found that regulating access and controlling development reduced damage and maintained quality of coral reefs. One resort allowed unlimited reef use for tourism and fishing as well as unrestricted coastline development, while the other imposed careful controls. Tourist businesses in one resort were able to charge almost double the prices in the other. The Seychelles has adopted the policy of promoting high-value, low-volume tourism. To attract wealthy visitors they have put their efforts into maintaining a high quality environment. Accordingly, they have put half of their land under protection and have closely regulated development on the rest (Gössling et al. 2002). The Maldives specifically target the up-market tourist (Inskeep 1992) and the government encourages resorts to upgrade to attract a higher-spending tourist clientele. The Mauritian government also promotes selective tourism, targeting affluent visitors, and resisting charter flight operations that cater to the masses of lower-spending tourists (Ramsamy 1992). Under unmanaged regimes, St. Lucia will only be able to sustain its reef-tourism industry by increasing the volume of tourists. This will result in a lower quality of environment and correspondingly reduced quality of life and employment opportunities for St. Lucians. Deliberate policies need to be adopted to avoid the slide into environmental degradation and high impact, low value tourism.

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