Environmental impacts of coastal tourism: an overview and guide to relevant literature

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ENVIRONMENTAL IMPACTS OF COASTAL TOURISM: AN OVERVIEW AND GUIDE TO RELEVANT LITERATURE

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INTRODUCTION

Recreation and leisure now form a major component of human activity and, when combined with travel, comprise the growing tourist industry. An appreciation of the size of that industry can be gained from the fact that in 1982, a recession year, there were $2.89 \times 10^9$ tourist arrivals worldwide with a total revenue of US $983 \times 10^9$ (Anon, 1984).

Tourism can bring numerous socio-economic benefits to a region, in terms of creating local employment, stimulating local economies, generating foreign exchange, stimulating improvements to local transportation infrastructure, and creating recreational facilities (Budowski, 1976). In turn, several positive environmental effects (McNeely, 1988) are derived from these socio-economic benefits including:

- promoting conservation action by convincing government officials and the general public of the importance of natural areas for generating tourist income;
- stimulating investment in infrastructure and effective management of natural areas;
- encouraging productive use for conservation objectives of lands which are marginal to agriculture, leading to the retention of natural vegetation and/or landscapes.

The environmental effects identified above can provide incentives for effective management of the natural areas which are tourist destinations thereby enhancing the qualities of the natural resources that initially attracted tourists. Furthermore, tourism can subsidize the cost of national park management as, for example, in Costa Rica (Barborak in McNeely 1988). In this sense, properly planned and managed tourism in natural areas is both non-polluting, sustainable and compatible with conservation, and numerous examples exist where tourism has provided the incentive for conserving biological resources.

Natural areas such as mountains, forests, coral reefs, islands and beaches are major attractions for tourists and these areas are coming under increasing pressure from the tourist industry (Beekhuis, 1981; Salm, 1983; Lal, 1984). Coastal resources in particular are subject to this pressure and the appendix shows some selected population densities expressed per length of coastlines. Because of the significance of the natural resources at many of the tourist destinations, important biological resources also may be damaged by poorly planned and/or managed tourist operations. Some of these adverse impacts of tourism are identified and examined with special emphasis on coastal projects in tropical regions.

The impacts of tourism can be subdivided into those impacts from the tourist development (e.g. hotels, resorts, marinas, transport infrastructure) and those from the tourists themselves (e.g. trampling, fishing, social effects). The impacts of tourist development need to be addressed largely in the planning stages of a project, while the impacts from the tourists can be controlled by the day-to-day management of the tourists' activities. To maintain this distinction, the following sections deal with impacts from tourist developments, tourists, and tourism as appropriate.

IMPACTS OF TOURIST DEVELOPMENTS

Direct Effects on the Biota

The direct effect of tourist developments includes a loss of habitat in a specified area which invariably leads to a reduction in species diversity in and around that area, and may lead to the loss of a particular species from a region depending on the extent or intensity of land-use changes (e.g. Hockey, 1987).

Quite apart from the intrinsic value of species, both species and species diversity enhance the pleasure of visitors to an area (Everett, 1977; 1979) and as such, comprise an economic resource (Everett, 1978; Loomis, 1986). For example, in Kenya, where tourism is the leading foreign exchange earner (US $60 \times 10^6$/year), each lion in Amboseli National Park has been estimated to be worth US $27,000/year in visitor attraction, and each elephant herd is worth US $610,000/year. Net park earnings from tourism are estimated at US $40/hectare/year (Western, 1984).
Loss of terrestrial habitat results from the clearing of upland vegetation as part of the site preparation prior to the commencement of construction. While landscaping is now generally practised and may offset some losses, some permanent loss of habitat is invariably involved (Goldsmith, 1974). As many tourist developments are situated close to coastal ecosystems, interference with such habitats may lead to a destabilisation of dune systems or shoreline vegetation which may be both difficult and expensive to restabilise.

In the offshore areas, habitat losses usually result from dredging or reclamation works associated with the landward facilities or from changed circulation patterns as a result of water-based facilities. Dredging, reclamation and siltation are known to adversely affect most inshore ecosystems and the resources and services provided by these communities (Canestri and Ruiz, 1973; Amesbury, 1981; Chansang et al., 1981; Saenger et al., 1983; White 1987; Chansang, 1988). Earthworks on land in close proximity to the shoreline for industrial land, ports, airports and recreational facilities may have similar effects and, for example, are estimated to have caused the loss of over 3000 ha of coral reef and seagrass habitat in Bahrain (Madany, 1987). For localized dredging operations near coral reefs, a number of ameliorative measures may be used to contain the effects of the resultant sedimentation including silt 'geotextile' curtains (Gabrie et al., 1985).

Hodgson and Dixon (1988) have reported on the wide-ranging effects of logging operations in the catchment of Bacuit Bay on Palawan in the Philippines and were able to relate the input of silt to a decrease in various biological parameters (Fig. 1a and b) which were of significance to the local tourist industry. Dramatic changes in coral species diversity and coral cover in the adjacent reefs were immediately apparent and fish standing stock (measured as fish catch) showed an equally rapid decline. Regression analysis was used to predict the effects of continuing sedimentation from the logging operation and, as shown in Fig. 1, these effects will persist for several years beyond the time (1992) when logging of the area is expected to be completed.

Figure 1a. Effects of sediment input ($10^3$ tonnes) in Bacuit Bay and fish harvests ($10^3$ tonnes), Palawan, Philippines. (Source: Hodgson and Dixon 1988).
Dredging at the mouth of rivers or coastal lagoons is often necessary to allow boat access. When such dredging is undertaken without adequate knowledge of the dynamics of sediment movement in the area, the resultant instability of nearby channels, sand-bars or beaches can have undesirable environmental effects which may be costly to rectify. In addition, the provision of a navigable channel will open an area which was previously less accessible which, in turn, may result in increased human activity in the area.

The hydraulic consequences of dredging operations also need to be considered as changed natural flow patterns, tidal circulation or wave energy conditions may have far-reaching consequences on nearby ecosystems; these consequences may result indirectly through abiotic changes (e.g. changed salinity gradients in estuaries or erosion patterns on beaches) or directly from such factors as altered recruitment or mortality patterns, or growth conditions.

Apart from their hydraulic consequences, berthing facilities, marinas or residential canal developments may reduce local habitat values (Odum, 1970; Lindall and Trent, 1975; Saenger and McIvor, 1975; Westman, 1975; Davies and Stewart, 1984; Stallard et al., 1987) through changes in water quality (e.g. salinity and oxygen stratification, anti-fouling compounds, organic loading, and turbidity), habitat diversity (uniform depths and substrates) or food availability. In California, for example, tributyltin (TBT) concentrations were determined in 80 marinas and were found to range from 20 to 600 ppb (Stallard et al., 1987). In those marinas where the concentrations exceeded about 100 ppb, there was a conspicuous absence of organisms, especially molluscs, which are among the most sensitive organisms to TBT.

Anchor damage from large cruise ships and other vessels has been recognized as a problem where tourism is a key element of the economy. For example, in the Cayman Islands (Smith, 1988), damage from anchors contributes to significant coral destruction, which, based on Caribbean coral growth rates, has been estimated to require decades for recovery. With the rapid growth in cruise ship visitation (Fig. 2), coral destruction is likely to become a more widespread and significant problem.
Indirect Effects on Biota

Probably the single most important indirect effect of tourist developments is that of a decline in local water quality. Sewage discharges, particularly if inappropriately sited or inadequately treated, are the most common sources of adverse effects on the biota (see review by Pastorok and Bilyard 1985). Kaneohe Bay, Hawaii has been the site of the most detailed study of the effects of urban runoff and sewage on a coral reef ecosystem (Banner, 1974). In this bay, there was a drastic decline in the coral cover (particularly of *Porites compressa*) with the heavy overgrowth by algae, such as *Dictyosphaeria cavernosa*. Immediately after re-siting the sewage outfalls, some recovery was evident (Smith 1977) and six years later the coral and macroalgal cover had returned to pre-discharge levels (Maragos et al., 1985).

In the Caribbean, less than 10% of the sewage generated is treated and bacterial levels regularly exceed international standards for recreational contact waters (Barnes, 1973; Ward and Singh, 1987) as in other tourist regions where treatment facilities are inadequate (e.g. the Alicante coast of Spain which is visited by 5 x 10^6 tourists per year - Zoffman et al., 1989). Wherever circulation or dispersion is restricted, sewage discharges may result in algal blooms which, in turn, reduce the benthic (including coral) diversity. For example, in the Caribbean, the mat-forming alga *Cladophora prolifera* presently covers huge areas of inshore waters although 25 years ago, it was not reported (Bach and Josselyn, 1978; 1979; Lapointe and O’Connell, 1989). This alga, with a highly active alkaline phosphatase system and, thus, a high capacity to recycle organic phosphorus, can grow well in oligotrophic waters doubling its biomass every 100 days. However, with N and/or P enrichment, the biomass doubling time of this species is reduced to 14 days, allowing extensive mats to form which cause anoxia and a reduction in infaunal and epifaunal species diversity on decomposition (Lapointe and O’Connell, 1989).

Quite apart from the eutrophication effects described above, phosphate enrichment of coral reef waters may directly inhibit hard coral growth through phosphate inhibition of calcium carbonate deposition (Simkiss, 1964), an essential process of healthy coral growth.

Seagrass and mangrove systems appear to be less susceptible to damage from sewage discharges, as they have a capacity to absorb high levels of nutrients (Nedwell, 1974a; Montgomery and Price,1979). Nevertheless, high organic loading to these systems may cause anoxia and increase the turbidity to levels where the resilience and diversity of these systems is adversely affected. Furthermore, as
Nedwell (1974b) pointed out, where the discharges contain significant amounts of heavy metals or other industrial wastes, toxic bioaccumulation, particularly in fish, crustaceans and molluscs, may occur through the adsorption and subsequent release to the foodchain of these compounds (Montgomery and Price, 1979).

Heavy metals have also been identified as emanating from other tourist activities. For example, outboard motors on recreational boats were identified as a source of mercury and lead in a coastal lagoon in Argentina (Marcovecchio et al., 1986). It was found that mercury was bioaccumulated, increasing markedly with increases in trophic level. Lead, on the other hand, became immobilized into highly calcified tissues and, thus, was not bioaccumulated. Anti-fouling paints are also a source of heavy metals (copper, mercury and lead) and TBT, and have been implicated in major community changes in poorly flushed waters such as marinas (Stallard et al., 1987).

Barnes (1973), in his analysis of Caribbean sewage effects, showed that with the increased use of package treatment plants rather than simple septic systems, the potential to minimize sewage effects existed. However, a number of factors relating to the operation of package plants were responsible for not realizing that potential. These factors need to be considered in day-to-day management planning for tourist developments. They include:

* Fluctuating loads during peak and slack tourist seasons caused problems of overload at certain times, and an inadequate load to maintain the microbial populations within the plant at other times;
* Package plants were often operated by inexperienced personnel rather than by sanitary engineers, as a result of which, package plants were poorly maintained, and subject to frequent mechanical failure;
* Virtually no monitoring of package plant function was undertaken.

Other indirect effects resulting from tourist developments include shading, night illumination, and noise and vibrations. Floating structures such as pontoons, floating marinas or floating hotels can shade significant areas of seabottom. Where such shading occurs over coral reefs or seagrass beds, significant ecological changes can be induced. For example, Inoue et al. (1984) demonstrated that under low light, two reef species of fish (Parapristipoma trilineatum and Apogon semilineatus) showed enhanced positive rheostatic movement compared with movement under bright conditions while a third, Scomber japonicus, showed a weakened rheostatic movement under low light conditions. While other reef species (Sardinops melanostictus, Engraulis japonicus, Decapterus maruadsi and Trachurus japonicus) examined showed positive rheostasis unrelated to the level of illumination, the influence of changed illumination on behaviour modification may be significant.

Although a variety of sciaphilous (shade-loving) reefal communities have been recognized (Thomassin and Richard, 1984; Latypov, 1986), some corals are adversely affected by shading. For example, under natural shading by tabular Acropora colonies, branching corals had low growth rates and high mortalities while massive and encrusting species were unaffected (Stimson, 1985). Physiological studies have shown that in shade-tolerant corals, low light conditions stimulate the accumulation of zooxanthellae in the polyp endoderm, increase the size of the zooxanthellae and lead to increases of the photosynthetic pigments (Titlyanov et al., 1981). These adaptations result in a more efficient absorption and utilization of light in these shade-tolerant species; although only branching corals were investigated, it seems likely that these adaptations may be even better developed in slow-growing massive corals.

The feeding capability of some corals may also be light-dependent. For example, in Pocillopora damicornis colonies exposed to identical densities of Artemia salina nauplii, those colonies maintained at low light were unable to ingest as many nauplii as the colonies maintained under high light levels (Clayton and Lasker, 1982). Clearly, the amount of zooplankton available to the colonies maintained at low light levels was insufficient to meet their metabolic requirements, suggesting that feeding in this coral was dependent on the photosynthetic subsidy from the zooxanthellae. In contrast to shading, shoreline night lighting or illuminated floating structures may influence the movement of light sensitive species including fish (Inoue et al., 1984), squid and turtle hatchlings. Night lighting on foreshores, for example, attracts turtle...
hatchlings resulting in an inland movement rather than towards the water. A recent study with the loggerhead turtles hatchlings, however, seems to suggest that the use of low-pressure sodium lights induces a negative reaction to the monochromatic yellow light (Anon, 1989) and may reduce turtle hatchling disorientation.

Underwater noise or vibrations may cause behavioural changes such as avoidance in locally resident or migratory species of invertebrate, fish, birds and marine mammals (Mills and Renouf, 1986; Bleckmann and Lotz, 1987; Hanlon and Budelmann, 1987; Heinisch and Wiese, 1987). Above-water noise, particularly low-flying planes and helicopters, may also affect these organisms, particularly birds (Hicks et al., 1987).

IMPACTS FROM TOURIST ACTIVITIES

Effects on natural resources

Perhaps the most obvious effects from tourists are those due to such extractive activities as fishing and souvenir collecting.

Olson and Wood (1983) provide one of the few characterizations of Caribbean marine recreational fisheries, contending that such fishing in the US Virgin Islands is representative of sportfishing in other Caribbean Island nations. They conclude that marine recreational fishing is composed of subactivities as shown in Table 1.

Table 1: Proportion of recreational activity spent on various fishing techniques together with catch-per-unit-effort (CPUE) in the US Virgin Islands (Source: Olson and Wood 1983)

<table>
<thead>
<tr>
<th>Subactivity</th>
<th>% Total Recr.</th>
<th>CPUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine life observation (snorkelling)</td>
<td>23.5</td>
<td>-</td>
</tr>
<tr>
<td>Trolling</td>
<td>18.3</td>
<td>9.3</td>
</tr>
<tr>
<td>Lobster diving</td>
<td>17.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Spearfishing</td>
<td>12.7</td>
<td>10.5</td>
</tr>
<tr>
<td>Conch diving</td>
<td>7.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Whelk diving</td>
<td>7.3</td>
<td>6.9</td>
</tr>
<tr>
<td>Fish and marine life photography</td>
<td>6.4</td>
<td>-</td>
</tr>
<tr>
<td>Bottom fishing</td>
<td>4.9</td>
<td>11.3</td>
</tr>
<tr>
<td>Other activities</td>
<td>2.3</td>
<td>-</td>
</tr>
</tbody>
</table>

Furthermore, Olson and Wood (1983) report that the total recreational landings (93 tonnes or 12% of the total marine landings in 1982) were comprised largely of shallow water reef fishes (Table 2).

Although no comparative data are available from the Indo-Pacific, if similar effort and catches are made in the recreational fishery there, then clearly, the potential for localized overfishing exists; indirect evidence in support of this comes from such studies as that of Russ (1984), who found that the abundance of fish in the Sumilon Island municipal reserve in the Philippines increased with a reduction in fishing effort (see also White, 1986). In Florida, Davis (1977b) documented the legal removal of $26.5 \times 10^3$ lobsters by recreational divers from Florida reefs in an 8 month period - estimated to be half of the entire lobster population. Clearly, where such concentrated effort is expended, regulation of the activity needs to be introduced to sustain the fishery.

Table 2: Composition of recreational landings in the US Virgin Islands (Source: Olson and Wood 1983)

<table>
<thead>
<tr>
<th>Category</th>
<th>% Landings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow water reef fishes</td>
<td>67.3</td>
</tr>
<tr>
<td>Coastal pelagics</td>
<td>15.9</td>
</tr>
<tr>
<td>Ocean pelagics</td>
<td>12.2</td>
</tr>
<tr>
<td>Lobster</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Whether for recreation, bait, souvenirs or subsistence, collecting in shallow waters or intertidal areas can have large local impacts (Cryer et al., 1987; Duran and Oliva, 1987; Catterall and Poiner, 1987). In fact, Hockey (1987) has suggested that the extinction of the Canary Island oystercatcher was probably precipitated by increasing disturbance and competition with man for intertidal marine food resources. As with recreational fishing, where collecting is concentrated (e.g. around tourist resorts), prohibition or regulation needs to be part of the day-to-day management plan.

Non-extractive activities which may affect the environment significantly include trampling, use of off-road vehicles, noise and disturbance on fauna, anchor and flipper damage, vandalism and littering.

Trampling and the use of off-road vehicles leads to damage to fragile vegetation and soil changes which are likely to remain permanent (Liddle and Greig-Smith, 1975; Webb et al., 1978; Jim, 1987). Off-road vehicles on beaches have also been implicated in modifying the littoral fauna (Steiner and Leatherman, 1981; Wolcott and Wolcott, 1984). In sensitive areas such as dunes and mangroves, boardwalks may be used to reduce trampling effects while enhancing access. Trampling also may damage corals and coral reefs (Woodland and Hooper, 1977; Liddle and Kay, 1987), particularly branching and tabular species, and intertidal reef walking may require strict regulation if coral damage is to be contained. To view corals at low water, walking trails can be laid out on sand among coral areas - thus providing convenient access without undue trampling effects.

The frequent presence of people, particularly in large numbers, can disturb faunal populations such as nesting seabirds (Anderson and Keith, 1980; Hicks et al., 1987) and tortoises (Stoddart et al., 1982; de Groot, 1983). Stoddart et al. (1982) report on the apparently successful transplanting of a land tortoise population as a means of deflecting tourist pressure from their primary habitat.

Anchor and flipper damage to corals from recreational use may be local problems in heavily used areas (Davis, 1977a), although other studies in Florida suggest that such damage is almost negligible when compared with natural damage from phenomena like wave action and cyclones (Tilmont and Schmahl, 1981). Nevertheless, a number of mooring systems have been designed and installed to minimize anchor damage from small craft (Salm and Robinson, 1982; Halas, 1985). Roped underwater trails have also been used to minimize diver damage to corals while enhancing user education.

Vandalism is a phenomenon which has rarely been studied and which, thus, is difficult to quantify. However, vandalism has been identified as a major factor in destroying the limestone caves in Bermuda (Iliffe, 1979), which attract approximately 3.2 x 10^5 visitors each year and generate approximately US $10^5/year. In addition, these caves are being affected by infilling, water pollution and littering (Iliffe, 1979).

Littering is also a form of vandalism with both ecological and aesthetic consequences (Siung-Chang and Deane, 1984; Coulton and Mocogni, 1987). In Trinidad, the deposition rate on four of the most popular beaches was estimated at 0.87 tons/week (Siung-Chang and Deane, 1984), which, without daily maintenance, would soon render these beaches unsuitable for recreational purposes. The average litter load was 74 g/m^2, with about 60% being material deposited by beach users. Soft drink cans and pull tabs constituted 42%, plastic bags, containers and sheeting 30%, and glass about 4%. As most of these materials are resistant to chemical and biological degradation, they are likely to cause persistent problems of injury and entanglement to the coastal biota.

**Effects on other users**

The effects of tourist activities need to be considered in terms of other present users, and on potential effects on future users of the particular resource. The concerns of present users are mainly centred on the sustainability of the resource, continuing access to the resource, and equity considerations arising from conflicting uses of the resource, and aesthetics.

The sustainability of resources (and thus, activities) is generally assessed by some measure of carrying capacity. The concept of carrying capacity, borrowed from agricultural stocking rates, embodies *inter alia*, optimum sustainable yield for fisheries.
resources, environmental capacity for the tolerance of pollutants by aquatic systems, social carrying capacity for recreational satisfaction, physical carrying capacity for varying forms of land-use, and 'ultimate environmental thresholds' for specific environmental features (Yapp and Barrow, 1979; Jackson, 1986; GESAMP, 1986; Boteler and Lucas, 1986; Rosier et al., 1986; Salm, 1986; Sowman and Fuggle, 1987). Assessing the sustainability of tourist activities requires that some or all of the above measures are considered at the planning stages of a tourist development, and adjusted through prohibition or regulation in the day-to-day management of tourist operations.

One of the major (and resented) effects of tourism on other users is through the pre-emption of access, either by design, through heavy traffic, congestion or overcrowding, or by ignorance of local custom. This is best summarized by Lusigi (1984:141), in describing the attitudes of tribal Africans to parks situated on their traditional lands: "It is an ironical situation; these people have moved for generations on foot among the animals in what are now called parks, but they must now have a permit and a car to do the same thing." Exclusive use of foreshores or the restriction of certain activities by tourist operators generally leads to conflict with other local users. In some areas, foreshore development has restricted public access to such an extent that beaches have had to be repurchased by government agencies (e.g. Florida - Fischer, 1988).

Some tourist activities may be incompatible or compete with the activities of other user groups, thus giving rise to conflict; recreational fishing may compete with the artisanal fishery, or the mass influx of tourists onto a reef may conflict with other users seeking a wilderness experience. Many of these conflicts can be resolved through suitable zoning arrangements and by involving a range of other user groups in tourism planning. It should be pointed out that situations also arise where, after tourist developments have been established, other and conflicting uses may affect the tourist operation. For example, coastal tin mining conflicts with tourism in Phuket, Thailand, where tourist numbers have increased from 195,000 in 1982 to 580,000 in 1987 (Ruyabhorn and Phantumvanit, 1988). Similarly, logging operations in Bacuit Bay, Palawan, are threatening local coral reefs and the dependant tourist economy of the area (Hodgson and Dixon, 1988).

Recreational satisfaction and scenic quality are related (Calvin et al., 1972) and need to be conserved (Deardon, 1980) for tourists and residents alike. Although a range of techniques are available to assess the visual impact of shoreline development (Wohlwill, 1982), aesthetics and recreational satisfaction are highly personal and variable, even within single individuals. For example, an individual's perception of crowding would vary by several orders of magnitude between a football stadium and a wilderness trail. Thus, while assessment of visual impact and recreational carrying capacity may provide some general guidelines, these are goal-orientated and subjective, and will vary over time both in relation to the user and the resource.

Resource sharing and other equity considerations may also be influenced by tourist activities. As such concerns are generally economically based, thus affecting entire local communities, they are discussed in more detail below.

The effects of tourism on future users is often overlooked in impact analyses. However, any allocation of land (or sea) involves choice. For example, whether establishing a tourist development is the best use for a particular area will depend on the total costs and benefits associated with that development compared with the potential costs and benefits that would have been attainable with some other use of the area. This concept of 'opportunity cost' can also be applied to future uses (or users) of the particular area. Thus, the benefits and costs of using a particular area for a particular purpose now, must be considered against the benefits and costs which are potentially attainable for a particular use of the area in the future.

For conservation purposes, McNeely (1988) has defined opportunity cost as 'the benefit foregone by using a scarce resource for one purpose instead of for its best alternative use'. The cost of foregoing a future benefit needs to be considered during tourism planning.

**EFFECTS OF TOURISM ON LOCAL COMMUNITIES**

**Flow-on effects**
A specific tourist development or activity may require the development of some specific infrastructure. For example, the construction of airports, roads and/or port
facilities is often precipitated by the demand created by a tourist development. Such infrastructure developments may have separate and distinctive impacts on the local community over and above those of the tourist development itself. Where such flow-on developments are foreseeable or predictable, they should be assessed as part of the overall impact of the specific tourist development, in that they add to the overall costs and benefits to the local community.

Cumulative effects
Cumulative effects are those resulting from the accumulation of effects from a number of small developments, where the environmental impacts of individual developments are negligible, but where the sum of numerous small developments is significant on the local or regional community. Odum (1982) has termed this the 'tyranny of small decisions' where significant decisions are made concerning natural resources by the cumulative effect of numerous almost insignificant decisions. In this way, numerous major decisions on land-use or life-style, for example, may be made without the central issues really being addressed. For instance, extensive land-use changes have virtually created artificial coastlines in parts of Italy (Cencini et al., 1988), on the Madeira Islands (Moreira, 1988) and elsewhere (Odum, 1982) without specific decisions having been made. Obviously, these cumulative effects must be addressed prior to the detailed planning stages, and preferably through broad-scale or strategic regional planning instruments.

Social costs
Tourism brings with it a number of social costs which require consideration both at the planning and day-to-day management stages of any project (Budowski, 1976; Bosselman, 1978; Beekhuis, 1981; Goodwin, 1986; Silva, 1986; Barbier, 1987). Some of the major effects are changed age-structures, altered patterns of wealth distribution, increased land prices, and aspects of language, tradition and public health.

These effects may be particularly pronounced on village communities with relatively little prior exposure to tourism. For example, Goodwin (1986) has identified the impact of tourism on village communities in Mexico which were exposed to a large and unplanned influx of tourists after the opening of road access. The changes observed included:

* loss of political and economic autonomy, including loss of real property through massive land price increases;
* loss of folklore and important institutions of traditional folk culture;
* social disorganization including loss of parental control, increased materialism and drug use, and modified sex behaviour; and, finally leading to
* hostility towards tourists (e.g. thievery, verbal aggression, prostitution).

Many of these problems can be ameliorated, minimised or avoided through adequate public participation in all stages of the planning process (Geoghegan, 1985).

EFFECTS OF TOURISM ON NATIONAL INTERESTS
Earning foreign exchange is probably the most beneficial impact of tourism. For example, Caribbean Island nations overall earned approximately 40% of their gross domestic income from tourism in 1984, estimated at US $4.6 x 10^9 in the region (CTRDC, 1985). Table 3 provides specific data from some selected countries, showing the significance of foreign exchange to their gross national product. While this is generally viewed as desirable, the presence of considerable numbers of foreign visitors (Table 3) highlights the need to consider the associated socio-economic costs of tourism. Beekhuis (1981) has identified the following economic and social factors as of particular importance in the Caribbean:

* seasonal lay-off and unemployment;
* dependence on a market beyond the control of the national government;
* many of the jobs are at a low-level with few opportunities for management participation;
* development of an attitude of ‘subservience’ amongst employees; and
* little opportunity for local ownership.

Table 3: Estimated population, annual tourist arrivals and income generated in selected countries. (Various sources including CTRDC, 1985).

<table>
<thead>
<tr>
<th>Locality</th>
<th>Population (000’s)</th>
<th>Tourists (000’s)</th>
<th>Percentage*</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Virgin Is.</td>
<td>96</td>
<td>718</td>
<td>20.49</td>
<td></td>
</tr>
<tr>
<td>Cayman Is.</td>
<td>15</td>
<td>67</td>
<td>12.24</td>
<td></td>
</tr>
<tr>
<td>Bahamas</td>
<td>218</td>
<td>965</td>
<td>12.13</td>
<td>54.9</td>
</tr>
<tr>
<td>Hawaii</td>
<td>1,000</td>
<td>4,000</td>
<td>10.96</td>
<td></td>
</tr>
<tr>
<td>Barbados</td>
<td>248</td>
<td>269</td>
<td>2.97</td>
<td>18.9</td>
</tr>
<tr>
<td>Belize</td>
<td>139</td>
<td>95</td>
<td>1.87</td>
<td></td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>3,300</td>
<td>1,376</td>
<td>1.14</td>
<td>5.2</td>
</tr>
<tr>
<td>Fiji</td>
<td>588</td>
<td>184</td>
<td>0.86</td>
<td>14.0</td>
</tr>
<tr>
<td>Jamaica</td>
<td>2,100</td>
<td>265</td>
<td>0.35</td>
<td>4.4</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>2,417</td>
<td>225</td>
<td>0.26</td>
<td>1.6</td>
</tr>
<tr>
<td>Dominican Rep.</td>
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<td>181</td>
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<td>3,237</td>
<td>0.13</td>
<td>3.3</td>
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<td>652</td>
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<tr>
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<td>3.4</td>
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<tr>
<td>Cuba</td>
<td>9,604</td>
<td>80</td>
<td>0.02</td>
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</tbody>
</table>

(* Calculated on mean length of stay of 10 days)

Clearly, these socio-economic factors are likely to be similar in other regions and they need to be balanced against the earnings of foreign exchange by deliberate policies of the national governments.

In the Caribbean, as elsewhere, much of the tourism income is directly attributable to the coastal zone, generated by divers and other visitors to marine and coastal protected areas (Table 4). Because of this relationship to marine and coastal protected areas, it is obvious that national policies are needed to ensure the sustainability of the resource, the resultant activity, and ultimately the tourist industry. To assist in the formulation of such policies, Barbier (1987) has defined sustainable economic development by suggesting that a number of human ascribed goals must be met; for the biological system, these goals must include:

* Maintaining the genetic diversity of the area or region involved;
* Maintenance of the resilience of the ecological systems affected; and
* Maintaining the biological productivity of the area or region.

Table 4 Economic value of tourism in selected Caribbean marine and coastal protected area. (Source: Anon 1988)

<table>
<thead>
<tr>
<th>Area</th>
<th>Income generated/year (10^6 US$)</th>
<th>Visitation/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonaire Marine Park</td>
<td>30</td>
<td>85,000 dives</td>
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<tr>
<td>Bahamas</td>
<td>80-90</td>
<td></td>
</tr>
<tr>
<td>British Virgin Is.</td>
<td>14</td>
<td>45,000 divers</td>
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<tr>
<td>Caroni Swamp National Park</td>
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<td></td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>53.2</td>
<td>168,000 divers</td>
</tr>
<tr>
<td>Montego Bay National Park</td>
<td>0.4</td>
<td>96,000 visitors</td>
</tr>
<tr>
<td>Morrocoy National Park</td>
<td>1,500,000 visitors</td>
<td></td>
</tr>
<tr>
<td>Pitons National Park</td>
<td>0.5</td>
<td>116,000 visitors</td>
</tr>
<tr>
<td>Virgin Islands National Park</td>
<td>23.4</td>
<td>75,000 visitors</td>
</tr>
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</table>
McNeely (1988) has provided four general principles to ensure that tourism developments are linked with the conservation of natural resources, to achieve the above biological goals:

* Planning for tourism development must be integrated with other planning efforts, particularly in national parks and other natural areas which are potential tourist destinations;
* Tourism authorities working with protected area managers should determine the level of visitor use that an area can accommodate with high levels of satisfaction for visitors and few negative impacts on the environment, and to ensure that this level is not exceeded;
* National policy should require environmental impact assessment for all tourism development projects or programs, and specify the ways and means that the tourism development can provide economic benefits to both the local people and the natural areas which are the primary tourist destinations; and
* For each major tourist destination based on the attractions of biological diversity, a management plan should be developed to specify objectives for both tourism and resource management, and to determine how sufficient income from tourism can be provided to the natural area to provide an incentive for improved management.

The human ascribed goals to be achieved for the economic system (Barbier, 1987) must include:

* Satisfying the basic needs of the resident population and reducing poverty;
* Enhancing equity through ownership, management responsibility and participation in decision-making; and
* Increasing the useful goods and services available in the area or region.

For the social system, the human ascribed goals for sustainability must include:

* Maintenance of the cultural diversity of the area or region;
* Sustaining local and national institutions and traditions;
* Ensuring social justice; and
* Ensuring full participation through decision-making, employment and training.

If tourism, conservation and national interests are to beneficially co-exist in the long-term, the above goals must be incorporated into all tourist developments and be supported by appropriate policies of the respective national governments.

ACKNOWLEDGEMENTS

This review was prepared while the author was on study leave at the Rosenstiel School of Marine and Atmospheric Science, Miami, and the library staff at that institution are gratefully acknowledged for their assistance. The review has benefitted from discussions with, and critical reading by John R. Clark, Sam C. Snedaker and Ian Dutton.

LITERATURE CITED


Bosslman, F.P. 1978. *In the wake of the tourist.* The Conservation Foundation, Washington, DC.


APPENDIX

Length of coastline and population density expressed per kilometre of coastline of selected countries (Compiled from various sources)

<table>
<thead>
<tr>
<th>Country</th>
<th>Coastline Length (km)</th>
<th>Popn. Density (N/km)</th>
<th>Country</th>
<th>Coastline Length (km)</th>
<th>Popn. Density (N/km)</th>
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</thead>
<tbody>
<tr>
<td>Bangladesh</td>
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<td>163,190</td>
<td>Nicaragua</td>
<td>910</td>
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<td>104,240</td>
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