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# Sea turtles as a non-consumptive tourism resource especially in Australia

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## Abstract

There is substantial economic potential for exploiting wildlife resources for non-consumptive wildlife-oriented recreation (NCWOR) tourism and this type of tourism if well managed, can result in the long-term conservation of wildlife resources. This is especially important in cases where wildlife resources are declining due to habitat destruction, poaching and other human threats, as is so for sea turtles. In this paper, relevant ecotourism literature outlining the economic values of NCWOR activities is reviewed to show that a significant potential exists for developing sea turtle-based tourism. Duffus and Dearden's (1990. *Biological Conservation*, 53, 213–231) conceptual framework for the development of wildlife tourism and its extension and application by Higham (1998. *Tourism Management*, 19 (6), 521–531) is analysed to see if it might be applied to sea turtle-based ecotourism in Australia at Mon Repos Conservation Park. Threats to sea turtle populations are growing especially as a result of human activities and these underline the importance of finding an economic rationale to conserve the remaining species. Economic benefits from turtle-based tourism can provide such a rationale. However, such tourism must be managed appropriately if it is to be sustained. Queensland Parks and Wildlife Service has adopted management strategies at Mon Repos Conservation Park with this in mind and these strategies are outlined. © 2001 Elsevier Science Ltd. All rights reserved.

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## 1. Introduction

In the last two decades, non-consumptive wildlife-oriented recreation (NCWOR) tourism has recorded phenomenal growth popularized by ecotourism. The economic potential for exploiting wildlife resources in a non-consumptive manner is therefore undoubtedly large as studies have demonstrated (Filion et al., 1983; Hoyt, 1996; Davis & Tisdell, 1998). Such tourism offers a realistic chance for the conservation of wildlife resources in the long term, especially important when wildlife resources are dwindling due to habitat destruction, poaching and other human actions. This is because by showing a sustainable economic value for wildlife resources, habitat destruction, poaching and other threats can be reduced. Such tourism activities are also educational. Non-consumptive economic values show the op-

portunity costs of current consumptive uses (e.g. meat, eggs) and incidental destruction (e.g. from boat strikes, entanglement in prawn trawls and crab pots) of sea turtles. Given the opportunity costs involved in such activities it can become practical to apply economic instruments to improve conservation management of sea turtles and justify legal sanctions. Furthermore, non-consumptive economic values provide a strong argument for inter-governmental efforts to curb the large-scale harvesting of eggs and turtles for their meat and tortoiseshells in neighbouring countries. In this paper, the ecotourism literature dealing with the economic values of NCWOR activities is reviewed to show the potential that exists for exploiting sea-turtle-based tourism in a specialised niche market. It is argued that the revenue such tourism could generate provides an attractive alternative to unsustainable current consumptive uses of sea turtles and their incidental destruction. Additionally, Duffus and Dearden's (1990) conceptual framework for the development of wildlife tourism is applied to ecotourism based on sea turtles.

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## 2. Non-consumptive recreational tourism values of wildlife

Since the 1980s, non-consumptive recreational use of wildlife resources has attracted large numbers of visitors. This has generated direct and indirect economic benefits with local and regional multiplier effects (e.g. 1992, p. 1; Parsons, 1996; Glover, 1992; Burger, 1996 p. 94). The growth has stemmed from development of the tourism industry and the desire for tourists to see wildlife in their natural state. Rapidly dwindling wildlife species and their natural habitats have stimulated development of this trade. NCWOR tourism marks a clear shift from the traditional consumptive uses of wildlife resources.

Wagar (1969), as reported in Duffus and Dearden (1990, p. 215), defines NCWOR tourism as a “human recreational engagement with wildlife where the focal organism is not purposefully removed or permanently affected by the engagement”. According to Wagar such use provides an experience rather than a tangible product and does not preclude any other person using such a resource in the future. Non-consumptive uses of wildlife resources involve varied activities with a multiplicity of levels of organization all of which will influence the level and types of its impact (Boyle & Samson, 1985). Non-consumptive uses are distinctly different from activities that purposely seek to remove or destroy an organism (Vaske, Donnelly, Heberlein & Shelby, 1982) and do not involve non-use values (existence and bequest values) nor future use values or option values (Bergstrom, Stoll, Titre & Wright, 1990; p. 131; Pearce, 1993, p. 17).

It is worthwhile elaborating on the above point. Economists have defined the total economic value of a natural resource as being equal to its total use values plus total non-use values. Use values involve direct use values, indirect values and option values (Pearce, 1993, p. 17). All wildlife tourism involves use values. However, that tourism may be consumptive of the wildlife resource (game hunting, fishing) or non-consumptive (wildlife viewing and photography). But distinctions between these categories are blurred to some extent in practice. For example, passive wildlife tourism may result in incidental destruction of the wildlife resource (Boyle & Samson, 1985).

In this paper, the activities of NCWOR tourism are grouped into two main categories. In category one (NCWOR I tourism), tourists visit a national park or protected area to watch wildlife in their natural environment without a focal species in mind. This involves an excursion in the park and viewing whatever wildlife can be watched, although visitors may have preference for some species over others. The majority of ecotourists fall into this category and the number of visitors is usually large. The second category (NCWOR II tourism) involves visiting a designated area with the intention of watching a focal species in its natural habitat. This involves visiting an area (most often a protected area) and

waiting for the species to appear for viewing. Usually, this involves small groups of individuals viewing from a designated place such as a platform or hide. The individuals may be the wildlife specialists or the wildlife generalists (Duffus and Dearden, 1990, p. 222). Examples include the viewing of fairy penguins on Phillip Island, Victoria, and watching the Northern Royal albatross colony at Taiaroa Head in New Zealand. However, whilst engaging in one species, incidental contact with other species may occur, for example, seeing short-tailed shearwaters (Tasmanian mutton-birds) during the breeding season on Phillip Island, or the presence of cormorants with the Royal albatross colony. The first category (NCWOR I) is not a new phenomenon. Even in the 19th century, safaris to wild places in Africa to view wildlife were popular among explorers and adventurers from Western Europe (Orams, 1995, p. 4). However, the commercialization of the second category (NCWOR II) is rather a new phenomenon, perhaps dating back to the late 1960s. For example, the right to operate guided tours on a restricted basis to the Northern Royal albatross colony was granted in 1967<sup>1</sup> (Higham, 1998, p. 525), Mon Repos for sea turtles in 1968<sup>2</sup> (Kay, 1995, p. 6), Hervey Bay for humpback whales in 1987<sup>3</sup> (Kleinschmidt, 1996, p. 97); and whale sharks in the Ningaloo Marine Park in 1993 (Davis & Tisdell, 1998, p. 162). In this paper the focus is on the second category of non-consumptive wildlife-oriented recreation.

Duffus and Dearden (1990) propose a conceptual framework for wildlife tourism in which they identify the dynamic nature of tourism involving the non-consumptive uses of wildlife. They point out that wildlife resources evolve and change over time in terms of both users and sites where activities take place. Duffus and Dearden (1990, p. 222) state:

“Through time, a site particularly attractive for wildlife viewing may develop a public image through the growth in publicity and facilities designed to service the visitors who arrive at the area to encounter wildlife.

<sup>1</sup> Phillip Island parade is an exception where organized viewings of fairy penguins took place as early as the 1920s (Glover, 1992). However, the present day viewing stands and other facilities began to appear in the 1960s when the Shire of Phillip Island and the National Parks and Wildlife Service took control of the management of the present reserve. Since then the facilities and visitors have been systematically increased. The reserve has also been extended since the 1960s.

<sup>2</sup> It must be mentioned here that viewing of turtles took place long before the dates mentioned in this paper but since the commencement of work by Queensland Turtle Research Program at Mon Repos in 1968, research staff have taken the opportunity to explain turtle behaviour to visitors. The present day turtle-watching programme was started in 1985 (Kay, 1995, p. 6). A service fee was introduced in the 1994–1995 season.

<sup>3</sup> Whale watching in Hervey Bay has occurred for many decades but the whale-watching industry commenced in 1987 (Kleinschmidt, 1996, p. 97).

As the facilities expand, this in turn influences the types of individuals who visit a site, the expectations, and the satisfaction derived from the attraction”.

Fig. 1 shows the dynamics of wildlife tourist typologies as illustrated by Duffus and Dearden (1990) using a combination of Butler’s model of tourist area evolution (Butler, 1980) and Bryan’s (1977, 1980) leisure specialization continuum. The evolution of tourist areas is based on a product life cycle roughly following a logistic curve.

Bryan’s (1977, 1980) specialist/generalist leisure specialization continuum (Fig. 1) suggests that the types of tourists visiting a specific wildlife setting changes over time. Incidentally, the types of visitors to a specific wildlife setting are usually wildlife specialists who as Duffus and Dearden (1990, p. 222) point out “require little infrastructure or interpretive facilities, and their presence is usually absorbable by existing social and ecological systems at the site”. They further claim that these exploratory users are “likely to have pre-knowledge about the site and constituent wildlife attraction derived from other specialized explorers and are few enough in number to require little management intervention”. However, as time passes and awareness of the site grows, and infrastructural development and publicity occurs, the specialist wildlife viewer is replaced by wildlife generalists as shown in stage C of Fig. 1. The latter development, however, will apply pressure on the “social system and the ecosystem of the host area” (ibid). This requires increased management intervention (Duffus & Dearden, 1990, p. 222). As Fig. 1 shows, there is rapid growth after stage A which continues past B before slowing down. According to Duffus and Dearden (1990, p. 222) “at the most mature end of

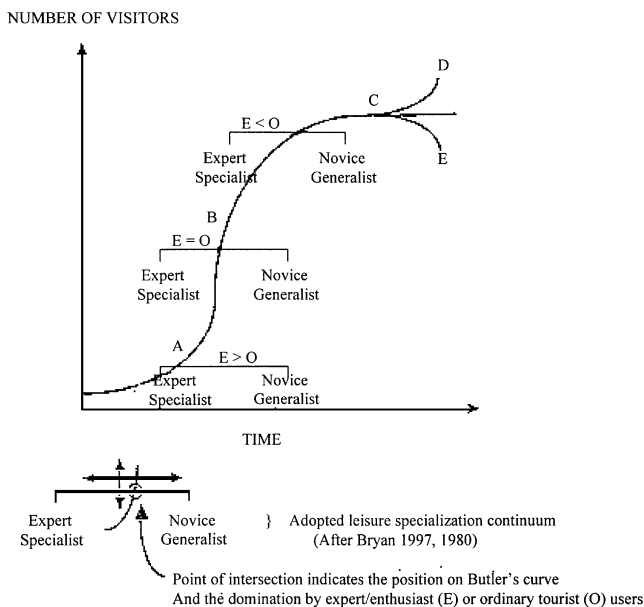


Fig. 1. Duffus and Dearden’s (1990) conceptual framework for wildlife tourism.

this spectrum lies domination by general tourists, or wildlife generalists in this context, with little special interest in the site’s attraction, relying heavily on the development of supportive infrastructure”.

Many studies have been completed to determine the economic and recreational benefits of NCWOR tourism. Estimates from North America show that the values of non-consumptive wildlife uses are large and have grown significantly over the years. Filion et al. (1983) estimated that in 1981 alone, 3.6 million Canadians spent a total of Can \$2.1 billion on non-consumptive wildlife-oriented trips. In Canada, income generated from whale-watching in Vancouver Island was estimated at Can \$4.2 million in 1988 (Duffus & Dearden, 1990). Statistics maintained by the US Fish and Wildlife Service (1987) show that wildlife viewing as a primary recreational activity increased from 83.2 million to 104.7 million user-days between 1980 and 1985. In Australasia, NCWOR tourism of both categories is popular and in recent years has recorded phenomenal growth (Bureau of Tourism Research, various issues, 1989–1995). In Asia, NCWOR I tourism is popular, with NCWOR II tourism also recording rapid growth during the last decade. For example, in India, Nepal and Bangladesh, special wildlife tours organized to view the Bengal Tiger are popular (Mishra, 1995, p. 204; Connolly, 1999, pp. 436–437). Specialized tours to watch the last remaining Asian lions in the Sasan Gir Forest National Park and rhinoceroses in India and Nepal are well known (Connolly, 1999, pp. 773–774). Some specialized bird-watching tours are also conducted in the region (e.g. see Oriental Bird Club (OBC), 1998, p. 63). In New Zealand, in addition to NCWOR I, NCWOR II tourism is extremely popular. New Zealand stands out as a country that make extensive use of this specialized niche market given the limited but unique biological resources it is endowed with. Many bird species such as the penguins (yellow-eyed and little blue), Royal albatrosses, gannet colonies, petrels, kiwis, wading birds, white herons and marine mammals such as dolphins, whales and sea lions have been exploited in recent years as NCWOR resources. Higham (1998, p. 523) provides a complete list of non-consumptive wildlife tourism in New Zealand and their locations and settings.

The number of visitors to sites to view specific wildlife species has increased in recent times. For example, at the Taiaroa Head Northern Royal albatross colony, visitors numbers increased from less than 1000 in 1972 to more than 40,000 by the end of 1992 (Higham, 1998, p. 526). Tisdell (1990, pp. 88–98) discusses the economic potential of some of these wildlife resources and shows the revenue generated from the Northern Royal albatross colony alone runs into hundreds of thousands of dollars each year.

In Australia, NCWOR II tourism, like NCWOR I tourism, has grown rapidly in recent years. Some examples of non-consumptive wildlife viewing in Australia include: Fairy penguins and fur seals on Phillip Island in

Victoria (Glover, 1992); humpback whales in Hervey Bay and Tangalooma, Queensland (Pollard, 1996, p. 49); whale sharks in the Ningaloo Marine Park (Davis & Tisdell, 1998); dolphins at Monkey Mia, Shark Bay (Thompson, 1998, p. 2), Western Australia; and crocodiles in the Northern Territory (Australian Geographic Society, 1999, p. 50). The income and employment generated directly from these ventures are substantial and these activities complement and support other tourist attractions by adding value to tourist spending. For example, estimates for 1994 put the direct value of cetacean-based tourism (mainly dolphins) in Australia at approximately A\$8.9 million (Anderson, Forbes & Pirzl, 1996, p. 11). Direct income from ticket sales alone in 1995 from Hervey Bay whale-watching cruises was estimated at A\$ 3.5 million (Burger, 1996, p. 94).

The number of international tourists (in addition to local tourists) engaged in NCWOR II activities has also increased in recent times (Bureau of Tourism Research, 1995). For example, international visitor numbers to Phillip Island/Penguin Parade have increased from 187,600 in 1989 to 266,400 in 1995 (Bureau of Tourism Research, various issues, 1989–1995). In 1999, the entrance fee to view fairy penguins and the visitor centre was A\$10.50 per adult and A\$ 5.50 per child (4–16 yr). In addition to direct income generated from entry fees to these sites, the indirect and multiplier effects are large (e.g. see Burger, 1996; Kleinschmidt, 1996). Some of the indirect benefits include revenue from sale of souvenirs, accommodation and catering, transport services, photography, postcards, books and other merchandise (Glover, 1992, p. 4; Burger, 1996, p. 94).

Although wildlife resources are increasingly being utilized for non-consumptive wildlife oriented recreation, both in Australia and elsewhere, and despite the large earnings and employment generated, some wildlife resources such as sea turtles have remained until recently a relatively untapped resource. These wildlife resources offer the opportunity for further expansion of non-consumptive wildlife utilization. Until recently, sea turtles had mostly a consumptive appeal only. However, the tourism value of sea turtles has now been revealed judging from the large numbers of visitors to Mon Repos Conservation Park and Heron Island National Park during the Australian summer to view the egg-laying spectacle of these marine reptiles. These two relatively small beaches in the southern Great Barrier Reef attract as many as 35,000 visitors each year during the summer (Limpus, 1994, p. 138).

### 3. Non-consumptive wildlife-oriented recreational tourism: use of sea turtles in Australia

Sea turtles are living fossils that have navigated the world's oceans from the time of dinosaurs. These ancient

giant marine reptiles have long fascinated people and figured prominently in mythology and folklore of many cultures including the Aborigines and Torres Strait Islanders. Seri Indians, who still live on the shores of the Gulf of California, believe that the world began on the back of a gigantic (leatherback) turtle. In the Miskito Cays of the eastern coast of Nicaragua, the natives still believe in the story of a kind "Turtle Mother" (a benevolent spirit), who acts as an intermediary between the worlds of animals and humans (Ripple, 1996, p. 10). Turtle folklore is also well known in Fiji (Guinea, 1993, p. 11). Besides the mythology that surrounds the sea turtles, they are considered by many as mystical, uncommon, a unique sea reptile and a source of living wonder and of curiosity. These attributes make sea turtles a valuable NCWOR resource for ecotourism development. Six of the seven species of sea turtles visit the Western, North-Western, North-Eastern and Eastern beaches of Australia for nesting, mostly during the summer months of October–March, depending on the species (Limpus & Miller, 1993, p. 135). Some beaches have large numbers of nesting turtles each night during the nesting season. The important rookeries are visited by turtles in their hundreds or even thousands. In fact, Australia has some of the most important major and minor rookeries of turtles in the world (see Fig. 2 for distribution of the six species of sea turtles in Australia). Limpus (1994, p. 100) points out that "Australia is one of the few countries that still has large breeding aggregations of marine turtles



Fig. 2. The primary breeding areas of sea turtles in Australia.

Fig. 2 is adapted from Limpus and Miller (1993, p. 138). The Figure shows the primary breeding areas of flatback [1], green [2], hawksbill [3], loggerhead [4], olive ridley [5] and leatherback [6] turtles in Australia. Shaded areas indicate the primary breeding areas of all turtles recorded in Australia (obviously the breeding areas overlap). Major nesting colonies (> 1000 females/yr) and minor colonies (hundreds of females/yr) are indicated by large and small numerical numbers, respectively. Leatherback turtles occur in Australia in very small numbers.

comparable to what they would have been like 200 years ago.”

In addition, the flatback sea turtle is unique to the Australian continental shelf (Limpus, 1988, p. 63) which is an added attraction to ecotourists, including wildlife specialists from overseas. Four species of turtle (green, flatback, loggerhead and hawksbill) occur in globally significant numbers in Australian rookeries (Limpus, 1994, p. 100) while two species (leatherback and olive ridley) occur in smaller numbers. The size of Australia's visiting populations and the variety of its species makes turtle-based tourism attractive for Australia.

However, there are additional reasons why Australia is well placed to take advantage of this sustainable marine resource. The major nesting season of turtles coincide with the summer holiday season in Australia and the winter months in Europe and North America. Bureau of Tourism Research (1989–1995) statistics show that the largest proportion of international nature-based tourists to Australia come from Europe and North America and their numbers have increased in recent years. Hence, the potential to attract both local and international visitors for watching sea turtles is large. Furthermore, Australia's tourism infrastructure is well developed for the exploitation of this resource and it has a considerable amount of experience in ecotourism. At Mon Repos Conservation Park and Heron Island National Park not only do visitors get an opportunity to view these sea reptiles dragging their heavy bodies ashore, but may also witness the egg-laying spectacle. Baby turtles emerging from their nests and then making their way to the sea are an added attraction. Hence, turtle viewing not only offers an opportunity to view sea turtles in their natural habitat, but also provides an opportunity to study them.

Turtle-based tourism viewing can generate income and provide employment and at the same time support the conservation efforts of sea turtles. The experience imparted from viewing is educational and this can assist in preserving and conserving sea turtles for future generations. Turtle viewing can be used to increase public awareness on the threats facing sea turtles and their habitats as is done in Sri Lanka (Gampell, 1999, p. 54). For example, edu-tourism (see Tisdell, 1998, p. 109) can go a long way in educating the public about threats to sea turtles and can also help to raise money for conservation. Sea turtle viewing can be further complemented by establishing visitor centres and museums dedicated to turtles, depicting all aspects of sea turtles ranging from their biology, life at sea, current turtle research, main threats to sea turtles, history of commercial sea turtle harvesting (both Australia and world-wide) and what tourists can do to help the species, as has been done at Mon Repos since 1993–1994 (Kay, 1995). The success of Phillip Island is a good example of how public awareness can be increased through ecotourism and the education imparted (Glover, 1992). Visitor centres and museums can

enhance the visitors knowledge of turtles and the need to protect them. Information gathered from satellite tracking can be shown as is done with fairy penguins on TV screens on Phillip Island or even display live sea turtle tracking taking place in the oceans.

Many turtles and their rookeries in Australia are located in traditional territories of Aborigines and Torres Strait Islanders. Sea turtles play an important role in the traditions and culture of these native people. These people have traditionally hunted sea turtles although some groups exclude hunting because of spiritual beliefs (Great Barrier Reef Marine Park Authority, 1994, p. 3). Making use of the knowledge of these people in sea-turtle-based tourism can not only provide new employment and income-generating avenues for them but also help in the conservation of turtles. Possibly, when native communities experience the economic benefits from turtle-based tourism, they will be discouraged from their consumptive uses of sea turtles. In addition, sea-turtle-based tourism can be complemented with Aboriginal and Torres Strait Islanders cultural attractions, for example, conducted tours to learn more about their culture, lifestyles and art works. The sale of Aboriginal art-works can be an added source of revenue. Cultural activities such as dance can be organized to accompany turtle viewing and study.

Sea turtle breeding can be encouraged as is now being done with the hawksbill turtle in the Northern Territory or with the green turtles in the Cayman Islands (Ripple, 1996, p. 20). Breeding farms can be tourist attractions.

Sea turtles that come ashore mostly at night to nest can be easily disturbed by noise, artificial lights and other human activities (Arianoutsou, 1988, pp. 331–332; Ripple, 1996, pp. 23–25). This can result in sea turtles returning to the sea without nesting. Hence, turtle-viewing has to take into consideration the sensitivity of these creatures if it is to be a success. At Mon Repos and Heron Island, park wardens guide visitors in batches to watch the egg-laying spectacle as well as hatchlings leaving the nests under supervision. In areas where this form of activity is considered sensitive, other methods can be employed. One option is in the form of building innovative hides that are noise and light proof to the turtles while also making the visitors comfortable. Night vision equipment can also be used. In some instances, live footage of egg laying and other aspects of turtle nesting and hatchlings leaving the nest can be shown inside the hides as is done for other species in some Royal Society for the Protection of Birds (RSPB) nature reserves in Britain, especially with large birds such as the ospreys, golden eagles or with the Royal albatrosses at Taiaroa Head, New Zealand (Higham, 1998, p. 528). Such an exercise can enrich an experience of visitors watching turtles. The number of visitors for each site may also be limited as is done at Mon Repos and Heron Island.

Most sea turtles come ashore throughout the night for nesting. This nocturnal habit may be considered as a potential drawback for tourist viewing. However, ecotourists are known to go on safaris or bird-watching in the early hours of the morning and rest during the day. In fact, the hot summer weather makes it all the more attractive to view sea turtles during the night rather than by day in the tropics. High visitor numbers at Mon Repos and Heron Island indicate that night-time viewing is not a major drawback.

Some of the revenue generated from tourism can be used for conservation purposes, not only to carry out further research, but also to bring more beaches under full protection and to address the threats that are facing sea turtles. For example, the revenue generated can be used to reduce populations of introduced predators such as foxes and feral pigs that are a major threat to turtle eggs and hatchlings. On Phillip Island, for example, the money generated from fairy penguin-based tourism is not used only for research, but also to purchase land in the surrounding areas, as well as to control predators such as foxes. In addition, the money is used to fund other conservation activities such as habitat improvement.

Promoting the non-consumptive economic potential of turtles can also be used as a lever to reduce various threats faced by turtles. Non-consumptive economic values show the opportunity costs of current consumptive practices which appear to be unsustainable. Tourism economic values of turtles can be used as an argument to provide alternative sources of fresh meat and eggs to those communities who are dependent on turtles to meet these requirements. Alternative supplies of food may not only be cheap but can be made more easily accessible throughout the year. Economic arguments may also support legal action. The non-consumptive economic potential creates opportunities to make turtle excluder devices mandatory by law on fishing trawls and to limit high boat speeds which have been identified as some of the major causes of turtle deaths in Australia (Limpus & Reimer, 1990). Fines or perhaps compensation schemes can also be introduced. The argument here is similar to the polluter pays principal (PPP) where the polluter compensates for any damage caused. Non-consumptive economic values provide a strong argument for inter-governmental efforts to curb the large-scale harvesting of eggs and turtles for their meat and tortoiseshells in neighbouring countries.

As pointed out by Duffus and Dearden (1990, p. 222), in the formative years exploratory users or wildlife specialists tend to visit the wildlife setting. However, with increasing awareness of the attraction and with development of facilities, less ambitious or “generalist” visitors will dominate as shown at point C in Fig. 1. For the Taiaroa Head Northern Royal albatross colony, Higham (1998) shows that the tourist development of the albatross colony site supports the conceptual framework by

Duffus and Dearden. For turtle-based tourism in Australia, too, this could well be the case. At Mon Repos the initial stages of sea turtle watching (exploratory users and wildlife specialists) has passed stage A. Awareness of the site has grown due to publicity given and infrastructural development since 1974 (Kay, 1995, pp. 2, 6) and sea-turtle-based tourism there may now be well into stage B.

Mon Repos Conservation Park was purchased by the Queensland Government in the 1980s to forestall a proposed real estate development which would have seen the establishment of a road on the foreshore of the beach with disastrous environmental consequences for the turtle rookery. Mon Repos Conservation Park is the prime focal point for turtle-based tourism in Australia. It is located on the coast near Bundaberg in Queensland north of the coastal township of Bargara. This means that the site is reasonably accessible for most Australians and overseas visitors via Bundaberg by air. The Turtle Sands Caravan Park and a café complex are located just outside the Conservation Park.

The Mon Repos Conservation Park is managed by Queensland Parks and Wildlife Service (QPWS). Use of the area by the public is restricted. Visitors are taken to the beach to view sea turtles at night under guidance of QPWS rangers and volunteers. Each group consists of not more than 70 persons. The use of torches is restricted and visitors are guided so as to have minimal adverse impact. An interpretative programme is conducted by QPWS staff on the beach to explain the egg-laying process of sea turtles and hatchling behaviour. A display centre and audio-visual presentations provide further information on sea turtle nesting behaviour and breeding migrations, life history, biology and evolution, sea turtle research and conservation problems.

Sustainable sea-turtle-based tourism becomes all the more valuable and important considering the increasing threats to sea turtles during the last few decades. These have contributed to a sharp decline in populations of turtles world-wide.

#### **4. Threats to sea turtles and the need to counter these threats**

Although sea turtles are still found in large numbers in Australian waters and visit the beaches for nesting, they are being severely threatened (Limpus, 1994, p. 100). The threats facing turtles in Australia and world-wide vary from species to species. In this section, the threats facing sea turtles with special reference to Australia are outlined. These threats underline the urgency of developing a sustainable economic activity such as sea-turtle-based tourism to underpin their conservation.

Sea turtles are harvested for their meat, tortoiseshells and many other by-products. Turtle meat and eggs form an important part of the diet of many island and coastal

native communities including the Aborigines and Torres Strait Islanders. The green turtle is favoured for eating and is actively hunted by indigenous Australians in the tropics (Limpus, 1994, p. 100), where considerable harvesting of sea turtles take place each year in Torres Strait, the Northern Territory and Queensland. It is a traditional food item for the region (Limpus & Parmenter, 1986, p. 98).<sup>4</sup>

Numerous turtles are harvested in areas neighbouring Australia such as Eastern Indonesia, Irian Jaya, Southern Papua New Guinea, Solomon Islands, Vanuatu and New Caledonia, posing a significant threat to the long-term survival of the species in Australia (Limpus, 1994, p. 100). As many as 100,000 green turtles are slaughtered each year in these countries (Limpus, 1988, p. 64). Loggerheads are also sometimes harvested for food (Limpus & Parmenter, 1986, p. 98; Limpus & Reimer, 1990, p. 43).

Turtle eggs are harvested for food by many native communities and in some cultures are believed to be an aphrodisiac and to promote healthy skin. In some countries, turtle eggs are regularly sold and are a valuable source of cash income. Hawksbill turtle eggs are commonly gathered for eating by Torres Strait Islanders (Limpus & Parmenter, 1986; Limpus, 1994, p. 103) and Australian Aborigines and Torres Strait Islanders harvest green turtle eggs on a regular basis. Excessive harvesting of leatherback turtle eggs by native communities in Southeast Asia is a major threat for this species (Limpus, 1994, p. 103). Eggs of flatbacks are also taken (Limpus, 1988, p. 63).

In Australia, native communities (Aborigines and Torres Strait Islanders) are permitted by law to harvest sea turtles for non-commercial purposes (Great Barrier Reef Marine Park Authority, 1994, p. 3). However, the illegal and in some cases legal slaughter of sea turtles and poaching of eggs, mainly in developing countries, are major problems endangering the survival of these ancient sea reptiles, but are not the only threats.

Sea turtles are highly migratory reptiles (moving between feeding and nesting grounds) which spend most of their time at sea and among coral reefs (Carr, 1980; Limpus, 1991). Hence, they are vulnerable to many dangers, which range from predation in the oceans by larger fish and sharks to marine pollution, accidents caused by motorized boats (boat strikes) and accidental entanglement and eventual drowning in fishing, crab, shark and gill nets (Limpus & Reimer, 1990). The commercial fishing industry, in particular the prawn trawling industry, has been the most frequently identified cause of mortality of loggerhead turtles (Poiner & Harris, 1990). The harvesting of the Sargassum sea weed which pro-

vides essential shelter and food for the turtle hatchlings and post-hatchlings (see Musick & Limpus, 1997) as a cheap additive to livestock feed is now a major threat to the survival of sea turtles in some regions. The ingestion of plastics floating in the oceans by turtles (especially the leatherbacks) which mistake some plastics and plastic bags for jelly fish results in many deaths among turtles (Limpus & Reimer, 1990).

Apart from the demand for turtle meat, leatherback turtles (the only turtle without a hard shell) are killed for their body oil which is used for fuel and medicinal purposes. The olive ridley is harvested for its leather (Limpus & Miller, 1993, p. 137). Hawksbill turtles are harvested for their beautiful shells (bekko in Japanese) which are used to make expensive jewellery and ornamental products, especially in Japan, and occasionally cosmetics. Although no tortoiseshells are exported from Australia, hawksbills that breed in Australia and migrate to neighbouring countries, such as the Solomon Islands and Eastern Indonesia, are harvested for the bekko trade. Thousands of hawksbills are harvested each year for this purpose (Limpus, 1988, p. 65).

The destruction of coastal beaches due to natural erosion, human settlement, resort development and recreation has deprived turtles of quality nesting grounds (National Research Council, 1990). Apart from the harvesting of eggs by native communities, predation of eggs by introduced foxes and feral pigs in Australia takes place on a large scale (Limpus & Reimer, 1990, p. 42; Chaloupka & Limpus, 1997). Limpus and Reimer, (1990, p. 42) state that during the 1970s and 1980s, annual fox predation rates of egg clutches laid along the 22 km beaches at Wreck Rock increased to over 90 per cent and it became rare to observe hatchling emergences.

There is also natural predation by dingoes and land reptiles such as goannas. Hatchlings are vulnerable to a vast array of predators ranging from sea birds, especially large gulls and skuas, raptors (such as sea-eagles, kites), to crabs, and the above-mentioned mammals and reptiles. Artificial beachfront lights from buildings, streetlights, dune crossovers, vehicles, campfires and flashlights disorientate turtle hatchlings towards land thereby exposing them to further predations and accidents (e.g. motor vehicles) and exhaustion from heat and eventual death from starvation (Arianoutsou, 1988; Ripple, 1996, p. 24). At sea, turtle hatchlings are highly vulnerable to predation from sea birds, large fish and sharks (Limpus, 1991). Apart from the above-mentioned factors, turtles also die of diseases. The main disease affecting them is a tumour-causing disease called fibropapillomatosis (Papillomas).

Thus, it can be seen that turtles are vulnerable to many hazards (natural and man-made) from the time the eggs are laid. As a result of the high mortality of turtle hatchlings, only a few survive to adulthood from each clutch of eggs. The man-made problems affecting sea turtles are increasing and the problems confronting

<sup>4</sup> Limpus and Parmenter (1986, p. 98) state that around 10,000 green turtles were harvested in the late 1970s. Harris, Dews, Bishop and Pitcher (1995) state that 9000 are harvested for meat in the Torres Straits each year.

turtles vary from country to country and from region to region.

Because turtles are a shared international resource, laws enacted and enforced in one country are insufficient for their total protection if no or little protection is afforded in neighbouring and other countries to which turtles migrate. For example, the feeding grounds and migratory pathways of some turtles that breed in Australia span the territorial waters of three or more nations (Limpus & Parmenter, 1986, p. 100) which make turtles vulnerable to mass slaughter. Tens of thousands of these turtles are harvested annually in countries near Australia. It is estimated that 90 per cent of the harvest of green turtles breeding in Australia occurs outside Australia because of migration (Limpus, 1988, p. 64). The protection and conservation of sea turtles seem more difficult than for land mammals because of their wider ranging movements. The complex and secretive life of sea turtles (they spend most of their lives at sea), make it all the more difficult and expensive to study sea turtles to devise strategies to protect and conserve them.

##### **5. Problems associated with the sustainability of non-consumptive wildlife tourism, especially sea-turtle-based tourism**

Wildlife-based tourism can provide strong economic incentives for wildlife conservation. Nevertheless, the development of ecotourism, is not without problems, as illustrated in Duffus and Dearden's (1990) conceptual framework of wildlife tourism and confirmed by Higham's (1998) examination of the Northern Royal albatross colony at Taiaroa Head, New Zealand. As pointed out by Duffus and Dearden (1990, p. 225), exceeding point C in Fig. 1 is most serious and likely to cause irreparable damage to the wildlife resource. Wildlife tourism must be carefully managed if the resources on which it depends are to be utilized on a sustainable basis.

NCWOR tourism can adversely affect wildlife as a result of human disturbances, infrastructural development and pollution arising from such tourism. Higham (1998) notes that although Northern Royal albatrosses of Taiaroa Head are tolerant of human presence, significant negative impacts have been observed. Roberston (1992) using nesting records collected since the 1930s confirms that the nesting distribution of Northern Royal albatrosses at Taiaroa Head has gradually shifted from optimal to sub-optimal nesting areas in terms of nest availability due to human presence. This has taken place despite these birds being conservative in nature in site-selection (for a discussion on some other human impacts on the Northern Royal albatross colony, see Higham 1998, pp. 529–530). In North America, too, the effects of NCWOR activities have been studied for a wide range of wildlife resources. For example, Boyle and Samson (1985)

review the 536 studies concerning the effects of non-consumptive outdoor recreation on wildlife.

A few studies have been conducted to determine the impact of tourism on breeding sea turtles, but no scientific studies have been specifically related to sea-turtle-based tourism. For instance, Hosier, Kochhar and Thayer (1981) and Arianoutsou (1988) have studied the impact of tourism (i.e. use of beaches by tourists during the day) and tourism infrastructural development of coastal areas on turtle nesting. Their findings are useful in identifying some potential problems and threats that can arise from turtle-based tourism. Arianoutsou (1988, pp. 330–332) from a study on Zakynthos Island, Greece, points out that bright lights and noise can discourage adult females from coming ashore to lay eggs or interrupt the egg-laying process. He further points out that tourists using the beaches during the day, vehicles on the beach (close to the waters edge), motor boats close to the beach and planting of trees on the beaches can in one way or another adversely affect the nesting of sea turtles. Hatchlings can also be affected by bright lights because such lights cause disorientation (ibid). Hosier et al. (1981) showed that vehicular tracks on a nesting beach increase the time taken by hatchlings to reach the sea by 35 per cent at which time they can be exhausted and hence become more vulnerable to predation. Excessive trampling of beaches by people can damage turtle eggs as well as the emergence of hatchlings (Bustard, 1972). Arianoutsou (1988, p. 332) further points out that night-time disturbances may be caused to turtles by people who come to the beach in groups to watch nesting animals. Dean and Talbert (1975) observed that loggerhead nesting activity in South Carolina was lowest in areas where beach houses are present, even if the beach appears ideal for nesting. Declines in nesting population of loggerheads in Florida have been attributed to urban development (Worth & Smith, 1976). Bustard (1972) considers coastal development and construction in nesting areas to be the greatest threat to the loggerheads in Queensland, Australia.

No detailed study has been carried out to determine the impacts of tourism on sea turtles on Mon Repos, Heron Island or South Africa where turtle-based tourism has been encouraged. Nevertheless, disturbances of nesting turtles by high tourist numbers at Mon Repos have been mentioned (Limpus & Reimer, 1990). Limpus (1994, p. 103) states that increasing negative impacts on turtle breeding sites are taking place as a result of increased numbers of tourists wanting to watch nesting turtles.

The above-mentioned studies demonstrate that sea-turtle-based tourism can adversely impact on breeding sea turtles if insufficient safeguards are adopted. If sustainable use of this valuable resource is to be expanded, then strict guidelines have to be adopted for tourism development. These need to be developed in consultation with marine biologists experienced in this field. Overall



the long-term success of sea-turtle-based tourism depends on how well the wild stocks are managed. Experience at Mon Repos is providing important pointers to appropriate methods of managing turtle-based tourism and the lessons learnt may be transferable to other regions where sea turtles are used or can be used for tourism.

## 6. Conclusion

Considerable potential exists to exploit sea turtles as a non-consumptive sustainable resource in sea-turtle-based tourism, especially but not exclusively in Australia. The economic benefits of sea-turtle-based tourism, therefore, promise not only to be a strong argument to reduce the current high consumptive uses of sea turtles but also to take appropriate action to reduce other impacts that are threatening the survival of these unique ancient reptiles in Australia as well as world-wide. Sea-turtle-based tourism can complement conservation work and be educational. The authors intend to undertake an in-depth survey of tourism at Mon Repos Conservation Park with this in mind. The non-consumptive economic potential can strengthen arguments to make “turtle excluder” devices mandatory by law on fishing trawls and to limit boat speeds. Furthermore, non-consumptive economic values provide a strong argument for inter-governmental efforts to curb the large-scale harvesting of eggs and of sea turtles for their meat and tortoiseshells in neighbouring countries. In conclusion, it must be pointed out that if the current high harvesting and incidental destructive practices are not curbed, sea turtles are likely to disappear depriving native communities of their present consumptive uses and extinguishing a valuable resource which could be sustained by improved managerial practices.

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