The concept of using artificial reefs as a fishery enhancement technique is not new. The first reefs known to have been deliberately deployed were in the 1860s in the USA, when hut-like structures were used to improve fishing in the coastal waters of South Carolina. Today there are over 2,000 artificial reefs in the USA alone, and in Japan many artificial reefs have been introduced to improve commercial fishing harvests.

**Artificial reef design**

There is a great variety of artificial reef design worldwide and many different materials have been used in the construction of the reefs. From tyres, scrap metal, drain pipes, scrapped cars and fridges to purposely sunk old vessels; you name it, someone has thought of using it as an artificial reef. In fact, at one stage in the USA, a great deal of rubbish was deliberately dumped at sea, all in the name of building artificial reefs. The most successful reefs are those that have been specially

---

**WHAT ARE ARTIFICIAL REEFS?**

An artificial reef is any structure that does not occur naturally on the seabed. Many early artificial reefs were ships or other vessels that sank or ran aground. Today, artificial reefs are deliberately placed to enhance fishing in a particular area by increasing the habitat available for reef associated fish or by serving as a reference point for migratory fish. Artificial reefs have also been designed to provide SCUBA divers with a wider range of dive sites, particularly in areas with few interesting features. Much scientific research has been conducted on the value of artificial reefs in improving fishery yields.

---

*Photo: Diving on an artificial reef – covered with marine life*
designed and built, preferably made of concrete. The height, spaces for shelter and siting are all important criteria and in many cases it appears that smaller scattered structures produce better results than a single large structure.

**How do artificial reefs work?**

Artificial reefs were initially thought to increase available habitat for fish and thereby increase the number of fish in an area. However, artificial reefs are also known to create problems when sited close to natural reefs, as they may attract fish away from the natural reefs and thereby act as fish aggregating devices. The total number of fish in an area may, therefore, not increase, but the fish simply become easier for fishers to find. A recent review has indicated that reef construction may even have potentially deleterious effects on reef fish populations. These problems include increasing fishing efforts and catch rates, boosting the potential for over-exploitation of stocks by increasing access to previously unexploited stock segments, and increasing the probability of over-exploitation by concentrating previously exploited segments of the stock.

In some areas, evidence suggests that artificial reefs do enhance fish production while in other areas they appear to simply attract fish from surrounding areas. The positive and negative effects of artificial reefs are still under investigation and it is generally agreed that the siting and construction of an artificial reef and the rationale for its deployment need to be carefully considered before construction. Clearly, if an artificial reef is to be used to enhance fishing, this should be done in conjunction with other fisheries management practices.

**Artificial reefs in South Africa**

Although South African fishers have long realised that some of the best angling spots along the coast are associated with shipwrecks, South Africa had no artificial reef policy until 1992, when the Oceanographic Research Institute undertook a study to evaluate the potential of artificial reefs. Three suitable structures were sited in strategic places off Durban, KwaZulu-Natal. At regular intervals divers documented the colonisation of invertebrates on the artificial reefs and the occurrence and abundance of fish. After 14 months, dense growths of mussels, numerous large lace corals, and hydrozoans, a few colonies of soft corals, some gorgonian corals and ascidians (sea squirts) were noted on one of the reefs. A total of 61 species of fish were recorded on another, with popular bait species such as pinkies, mackerel, scads and shad being the most abundant.

Although initially a number of problems were experienced with skiboat fishers anchoring on the artificial reefs and catching reef fish that had colonised the reefs, this practice has largely been stopped by agreement between various fishing clubs. The three artificial reefs off Durban have proved to be very successful in the provision of various species of bait fish for skiboat fishers. Similarly, SCUBA divers are now also using these artificial reefs as interesting and exciting dive sites. By agreement divers and anglers use the site at different times of the day.

A number of vessels have been sunk in False Bay in the Western Cape, in the hope of attracting shallow water reef fish, for fishers, and to provide new SCUBA dive sites. The reefs have certainly succeeded in their second goal and they are regularly visited by groups of divers. However, as they were sunk in the cooler water below the thermocline, they are below the natural depth range of most of the target fish species, and as they are quite isolated in the middle of a sandy area, they have been less successful in enhancing reef fish productivity.

**The South African Dumping at Sea Act (1980),**

based on the principals of the London convention on the prevention of Marine Pollution by Dumping of Wastes and other Matter, regulates all dumping at sea activities under a permit system. Permission from the Department of Environmental Affairs and Tourism is required in order to sink an artificial reef in South Africa.

Author: Judy Mann-Lang September 2000

**Further Information:**

- KwaZulu-Natal Wildlife (formerly KZN Nature Conservation Service) P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
- Oceanographic Research Institute, P.O. Box 10712, Marine Parade 4056. Tel: (031) 337 3536, Fax: (031) 337 2132

**Related Factsheets:**

- Recreational Angling • Marine Pollution • Reef Fisheries in KwaZulu-Natal • Ecosystems in the Sea

For more information, please contact: The Coastal Management Office, Marine and Coastal Management, Department of Environmental Affairs and Tourism, Private Bag X2, Roggebaai 8012, Cape Town, South Africa. Tel: +27 (0)21 402-3208 Fax: +27 (0)21 418-2582 e-mail: czm@mcm.wcape.gov.za Website: http://sacoast.wcape.gov.za
Worms

Worms are the archetypal bait type. Five species are commonly used along our shores, but the collection of some of these is not environmentally friendly.

- **Bloodworms** live in u-shaped tunnels in the sand in estuaries and on sheltered beaches, where they feed on organic deposits and leave tell-tale depressions on the surface. Bloodworms are pumped from the sand.

- **Moonshine worms** are predatory species also found on sheltered sandy beaches, but usually near rocks.

- **Wonderworms** are large omnivorous worms that burrow in sand under loose boulders. These worms are extracted manually with great effort, and the process is detrimental to numerous other invertebrate species.

- **Musselworms** are predatory species found in mussel beds. The collection of these worms has impacted heavily on mussel stocks in some areas.

- **Tape worms** (ribbon worms) are the only non-segmented worm used by sea-anglers. They are found in estuarine mud. Digging of tape worms has disrupted many estuarine mud banks which are important feeding grounds for birds and fish.

Molluscs

Molluscs or shellfish, include gastropods, snails, bivalves with two shells, chitons with 8 shell plates and cephalopods, octopus and cuttlefish.

- **Octopuses** are rated as the most intelligent invertebrate. They occur in a variety of habitats where they actively hunt their prey. Hundreds are collected for bait and food during each low spring tide.

- **White mussels** are the most commonly used mollusc. They are found on exposed beaches, below the low water mark on the west coast, but between the tides on southern and eastern Cape shores.

- **Pencil baits** are long slender bivalves that live in estuarine mud. They are usually extracted with a hooked wire.

- **Saddlebacks** or chitons are found on rocks throughout the country, but are most commonly used for bait in the eastern Cape.

- **Siffies** (Venus ears) and Giant periwinkles, (alkreukels), are gastropods that occur on rocky platforms along the southern and eastern coasts. Their numbers have been impacted by collectors of bait and seafood.

Anglers bait their hooks to present fishes with a copy of their natural prey in an attempt to hook them. The manufacture of artificial bait (spoons, plugs, plastic worms, jigs and flies) is a lucrative business, but most sea-anglers in South Africa prefer to use the genuine item, i.e. the prey organism itself, to lure a fish. Fresh bait is often regarded as more effective, and anglers go to great lengths to collect and preserve their bait. You may see them sifting sand in chest-deep water, turning over boulders or risking life-and-limb on an exposed rock. Many a casual observer has been bemused by the antics of bait collectors, but also amazed to see the interesting animals that they extract from the sea-shore.
Crustaceans

Crustaceans include prawns and crabs of which many are used as bait.

- **Sand prawns** and mud prawns live in the estuarine sediments from which they are ‘sucked’ and ‘blown’ respectively. These are popular bait species, and their collection led to the development of the prawn pump.

- **Rock crabs** are usually chased out of rock pools where the collector grabs them, often not without injury.

- **Ghost crabs** are swift sandy beach crabs that are used as bait along our eastern shores.

- **Mole crabs**, or sealice, are dug from sandy beaches in the surf zone, and are a very popular form of bait in KwaZulu-Natal.

**Redbait**

Redbait is the only species of Ascidian used as bait. It is a “sea squirt” that is found on rocky shores near and just below the low water mark, or on sandy ground in quiet bays. Red bait has virtual cultural status in the Western Cape, owing to the angler’s habit of storing the bait in the garden where it ‘matures’ and its smell becomes the source of many a domestic dispute!

**Bait-fish**

Anglers often catch small fish which they later use to catch larger fish. The most common of these are mullet, sardines, strepies (karanteen) and elf (shad). Mullet are usually caught with a throw net by bait collectors.

**Responsible bait collecting**

In South Africa, intertidal resources are more productive on the west coast than they are on eastern shores yet, ironically, harvesting pressure is more intense on the east coast. The result is that the shores that are least able to provide for an intertidal harvest are those most heavily utilised. Many of the rocky shores along the east coast have been denuded of shellfish and other invertebrates, and there are examples of local over-exploitation of certain target species. For many bait species, the collection process damages the environment.

A permit is required to collect bait.

Obey the regulations for harvesting intertidal resources.

- Bag limits restrict the total harvest while ensuring that each person’s needs are catered for.
- Minimum size limits apply to some species to prevent the exploitation of animals that have yet to spawn or to put on a major part of their potential growth.
- Marine protected areas are maintained to protect intertidal habitats in their natural state, to protect spawning stocks and to seed adjacent areas. No collecting is allowed.
- Restrictions on the use of certain implements are there to protect the ecosystem from unnecessary destruction during the harvesting process.

The future of intertidal resources depends largely on the cooperation of beach users and anglers. Let’s use these resources wisely, for the benefit of present and future generations.

Author: Claire Attwood September 2000
At least 2 200 species of fish live in or migrate through South African waters. Some 200 of these are targeted by recreational anglers – people who catch fish for fun or relaxation rather than for their survival or for economic gain. There are approximately 750 000 recreational anglers in South Africa.

Recreational angling in South Africa is thought to have started shortly after the arrival of the 1820 settlers. The first angling club was formed in KwaZulu-Natal in 1885. Since then South Africa’s recreational fishery has diversified and today it comprises three distinct groups of anglers.

Shore angling is by far the most accessible form of recreational angling in South Africa. Anglers fish directly from the shore, off beaches, in estuaries or off breakwaters. A small proportion of shore anglers belong to angling clubs and fish regularly in organised competitions. Some of the most common species that are landed by shore anglers are elf (shad), galjoen, kob and white stumnopse.

Boat-based recreational fishing takes place either from small boats in estuaries (tidal rivers), or from larger vessels that target reef fish or gamefish many kilometres offshore. South Africa’s larger estuaries, such as St Lucia and the Breede River, are favourite fishing grounds for light tackle anglers who target species that are able to withstand the changing salinity of estuaries; grunter, kob and white steenbras for example.

Deep sea anglers put to sea in motorized vessels, either launching from harbours or directly from the beach. The 4 to 8-metre ski-boat, which may be launched through surf breakers, is thought to be unique to the South African recreational fishery. Ski-boat anglers in the Western Cape target mainly snoek, yellowtail and tuna. In KwaZulu-Natal the ski-boat catch is far more diverse and comprises about 40% gamefish, a variety of reef fish and other deep water species.

The spearfishery is the smallest sector of the recreational angling fraternity in South Africa. It is also the most physically demanding, requiring breath-hold diving, long swims and extended periods of water exposure. Spearfishing is practised along the entire South African coastline, from the temperate kelp beds of the Western Cape to the tropical coral reefs off northern KwaZulu-Natal. Spearfishers are able to select the species and size of the fish more accurately than anglers.

Catches are getting smaller

A conversation with any seasoned South African angler is likely to alert one to the changes that have taken place in the recreational fishery during the past century. Most anglers will tell you that their catches are getting smaller and that it is more difficult to catch fish today than it was in the past. These contentions are well supported by recent scientific studies that have shown that there has been a marked decline in the abundance of fish commonly caught by shore anglers. Associated with this decline in fish abundance is a reduction in the average size of fish landed by anglers. Fish which are subjected to heavy fishing pressure have a small chance of
living for a long time and so, markedly reduced fish sizes are usually taken as evidence of over-exploitation.

**Too many fishers!**

There are approximately 750 000 recreational anglers in South Africa today and it is estimated that this figure is increasing at a rate of six percent annually. This means that the number of anglers in our country will double every eleven years. Fisheries managers are alarmed by these statistics because the imbalance between the number of fish and the number of anglers is driving our once abundant resources to a state of collapse.

**Fishing regulations**

In reaction to the increasing pressure on fisheries resources, regulations, which control the number of fish that are harvested by recreational anglers, have been introduced. These regulations curtail the catches of red steenbras, poenskop and other long-lived, late maturing species. Some of the most important regulations that apply to recreational anglers are:

- Anglers are legally obliged to buy a recreational fishing permit. The funds generated by permit sales enable fisheries researchers to better manage stocks.
- Each angling species is regulated by a minimum size limit. Size limits are set according to the size at which a fish species is known to be sexually mature. This form of control ensures that each fish will have the chance to breed at least once before being caught, and so prevent wastage of the fish’s growth and reproductive potential.
- Each angling species is regulated by a bag limit. Bag limits ensure that catches are restricted and spread evenly throughout each sector of the fishing fraternity.
- Some angling species, such as galjoen and elf (shad) are protected by closed fishing seasons. Closed seasons give fish stocks a break from fishing pressure, particularly when they are vulnerable, e.g. when spawning.
- Marine reserves prevent anglers from fishing at certain points along the coast. These areas protect spawning fish and supplement catches in adjacent areas when fish move out.
- Recreational anglers are banned from selling their catches. This regulation prevents sport fishers from exploiting fish species for commercial gain.

Anglers who are serious about the future of their fishing keep to these regulations and assist the authorities who are charged with enforcing them.

Author: Claire Attwood September 2000

**FURTHER INFORMATION:**

- Oceanographic Research Institute, PO Box 10712, Marine Parade 4056. Tel 031 337-3536 Fax: (031) 337-2132

**RELATED FACTSHEETS:**

- Fishing Regulations • Fishing Industry • Gjeebek • Spotted Grunter • Kob • Galjoen • King Mackerel • Sex Change in Fishes • Reef Fisheries in KwaZulu-Natal

For more information, please contact: The Coastal Management Office, Marine and Coastal Management, Department of Environmental Affairs and Tourism, Private Bag X2, Roggebaai 8012, Cape Town, South Africa. Tel: +27 (0)21 402-3208 Fax: +27 (0)21 418-2582 e-mail: cm@mcwcape.gov.za Website: http://sacoast.wcape.gov.za
The reef fishery off KwaZulu-Natal (KZN) has been active since the early 1900s, with hundreds of fishers using hook and line to harvest demersal or ‘bottom dwelling’ fish from the net - work of reef systems that occur along the coast. Today this fishery accounts for approximately 35% of the total landed value of all fisheries in the province. It has a commercial component, with approximately 175 licensed boats, and a recreational component with an estimated 2,900 boats. The high number of people who participate in this fishery make it important both economically and sociologically. However, concern has been expressed about the sustainability of the fish resources when targeted by so many reef fishers.

Approximately 60 important fish species are caught in KZN. About 35 of these species are reef fish, some of which are endemic - only found off the southeast coast of South Africa. Many of these reef fish are fairly resident with limited geographic ranges and complex life-histories, such as sex-change, late maturity and slow growth, which make them particularly prone to localised over-exploitation. Species included in this category are the poenskop or black mussel-cracker (Cymatoceps nasutus), Scotsman (Polysteganus praeorbitalis) and Englishman (Chrysoblephus anglicus). Reef-associated species, such as the seventy-four (Polysteganus undulosus) and red steenbras (Peturus rupestris), are also particularly vulnerable to over-exploitation as they undertake a seasonal spawning migration and aggregate in large shoals that can be heavily fished. Between 1923 and 1995 catches of large, slow-growing species such as the seventy-four and the red steenbras have declined dramatically, and have been replaced by fish such as slinger (Chrysoblephus puniceus), soldier (Cheimerius nufar) and kob (Argyrosomus japonicus).

Catch trends
The total mass of fish caught each year has been sustained through a variety of factors. There has been a considerable increase in offshore linefishing effort over the past century. This increase in effort has been both nominal, through dramatic increases in the number of vessels and fishers, and effective, through vastly improved technology. In the early years the only boats in the fishery were the large steam-powered lineboats which operated from Durban harbour. The advent of the skiboat in 1945 and, more recently, inflatables and semi-rigid craft (‘rubber ducks’), has contributed to a widening of the spread of effort. These boats can be launched through the surf almost anywhere along the coast and there are now few areas that are inaccessible to fishers. This has meant that areas that previously served as refuges for the fish are now almost all exploited. The use of
Echosounders and global positioning systems has enabled fishers to locate reefs with great accuracy, and improved technology has also facilitated night fishing. As the large, more desirable species (seventy-four and red steenbras) decreased in abundance, fishers started to exploit other, more accessible species, such as slinger, kob and geelbek (Atractoscion aequidens).

Although signs of overexploitation were first noticed in the fishery during the 1960s, the government was slow to react and the first management proposals for the reef fishery were only promulgated in 1985. Although the regulations resulted in considerable controversy, because of the disparity between the controls placed on commercial and recreational fishers, they were an important step towards improved management of the fishery. Management of the linefishery is under the control of the Department of Environmental Affairs and Tourism, through the Chief Directorate: Marine and Coastal Management. In KZN, responsibility for implementation of the fishery regulations has been delegated to the KwaZulu-Natal Wildlife. The South African Marine Linefish Management Association (SAMLMA), launched in 1990, co-ordinates organisations interested in the promotion, protection and utilisation of marine linefish. Recommendations, based on scientific research, concerning changes to current legislation are discussed by SAMLMA and are made to the Chief Directorate: Marine and Coastal Management. Final decisions are taken by the Minister of Environmental Affairs and Tourism.

The solution

A number of strategies for the improved management of the reef fishery are under discussion. These include the implementation of stock rebuilding strategies, improvement of the current network of marine protected areas and better law enforcement of species-specific regulations. A revised management plan has recently been developed for the reef fishery. This management plan is based on a defined set of procedures that can assist managers in determining the optimal level of exploitation to ensure sustained use. In order to succeed, this management plan will require the support of all those involved in the fishery - from the fishers themselves.

For more information, please contact: The Coastal Management Office, Marine and Coastal Management, Department of Environmental Affairs and Tourism, Private Bag X2, Roggebaai 8012, Cape Town, South Africa. Tel: +27 (0)21 402-3208 Fax: +27 (0)21 418-2582 e-mail: czm@mcm.wcape.gov.za Website: http://sacoast.wcape.gov.za

FURTHER INFORMATION:
• South African Network for Coastal and Oceanic Research (SANCOR) P.O. Box 2600, Pretoria 0001, Tel: (012) 481 4107, Fax: (012) 481 4005.
  E-mail annette@frd.ac.za http://www.uct.ac.za/depts/zoo/ocean/sancor/
• KwaZulu-Natal Wildlife (formerly KwaZulu-Natal Nature Conservation Service) P.O. Box 13053, Cascades, Pietermaritzburg 3200, Tel: (033) 8451999
  • Oceanographic Research Institute, P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132

RELATED FACTSHEETS:
• Maputaland Coast • Sustainable Use of Coastal Resources • Recreational Angling • Fishing Industry
Impacts of ORVs

Dunes are important to sandy beach ecosystems as they act as a buffer against high seas, thereby protecting the areas behind them from wave damage and saltwater intrusion. The foredunes also act as a natural sand reservoir, supplying sand to the beach during periods of erosion. However, driving on bare, unvegetated dunes which are unstable and dynamic features, displaces sand downwards. This can result in dune breaches and the destruction of the protective buffer function provided by the dunes. In contrast, the pioneer vegetation of the foredune area helps to anchor the sand, and also provides habitat for earthworms, insects, spiders, lizards and small mammals. This vegetation is extremely sensitive to disturbance, with the greatest damage occurring after the first few passes of an ORV. It can take years to recover if damaged, with negative consequences for the natural functioning of the dune-beach ecosystem.

Furthermore, many seabirds, such as oystercatchers, terns and plovers, breed in the foredune area. Apart from the danger of crushing the eggs and chicks, ORV traffic can disturb the adult birds from the nest, threatening the survival of the young. The Damara Tern and African Black Oystercatcher are listed as threatened species, and can ill-afford this added pressure.

Historically important shell middens are also found in dunes, yielding considerable information about the prehistoric people who lived along our coast up to 120 000 years ago, as well as the climate and animal life of the time. Besides shells (the remnants of a seafood diet), middens may contain the bones...
of hunted animals, bone fragments shaped into tools, stone artifacts, ostrich eggshell fragments and beads, seashell beads and pendants, pottery fragments, rounded stones with signs of burning, and charcoal or ash. Damage caused by ORV traffic compromises the integrity of South Africa's historical record.

The intertidal zone, the area between the high- and low-water marks, is fairly resistant to the impact of ORVs, although the soft sand close to the driftline is easily compacted, crushing small animals on and below the sand surface. Much of the life on the beach is concentrated in and around the driftline which consists of accumulating of organic debris left by the high tides. In addition, the deep tracks left by the vehicles act as an impassable barrier to some animals migrating up and down the beach. For example, on the northern coast of Kwazulu-Natal, loggerhead and leatherback turtles lay their eggs in the soft sand just behind the driftline, and after hatching the young must make their way down the beach to the sea. Hatchlings that fall into the tracks may become trapped on the beach, leaving them exposed to predation and dehydration.

The least sensitive part of the beach is the lower intertidal zone, which has to be resilient to pounding waves. Here the hard sand protects animals burrowing beneath the surface hard enough for driving, although animals feeding on stranded material, such as ghost crabs, plough snails, isopods and insects, are at risk of being crushed.

In estuarine areas, ORVs rapidly destroy sensitive saltmarsh vegetation that provides habitat for crabs, shrimps, fish and birds, while the burrowing organisms of the intertidal sand- and mudflats, such as prawns and worms, are easily crushed to death. Vehicle traffic can also compact the sand into a hard, inhospitable surface, preventing settlement by young plants and animals.

ORV Policy

In 1994 the Minister of Environmental Affairs & Tourism introduced a policy for controlling ORV use in order to protect the coastal environment and minimise conflict between ORV users and non-users. The Policy, which was promulgated in terms of the Environment Conservation Act (no. 73 of 1989) in the Government Gazette on 29 April 1994, stipulates that recreational use of off-road vehicles (ORVs) must in principle be excluded from the coastal zone. Specific demarcated areas are identified where controlled access by vehicles may be allowed subject to the conditions of a permit.

The Director-General of the Department of Environmental Affairs and Tourism (DEA&T) is responsible for ensuring that the relevant provincial and national authorities comply with the Policy. In addition, each province’s Member of the Executive Committee responsible for environmental matters must ensure that all local authorities and government institutions within the province comply with the Policy.

The following areas must be closed to vehicles:

- Bathing areas, i.e. beaches where facilities have been provided for the convenience of bathers.
- Beaches adjacent to bathing areas that are used by the public for strolling.
- Ecologically sensitive areas, including dunes, estuarine salt marshes, estuarine inter-tidal sand and mud flats, bird- and turtle-nesting areas, beaches with steep gradients and any other area deemed by the provincial conservation authorities to be ecologically sensitive. A local authority may also designate ecologically sensitive areas after consulting the provincial conservation authority concerned.
- Protected areas that have been established to conserve the coastal environment, such as national parks, nature reserves and wilderness areas.
- Any other site with historical or palaeontological importance.

These control measures apply to vehicles used for recreational access, while vehicles used for official business, emergency response, approved scientific research projects or diamond-mining activities are exempt.

Due to various shortcomings concerning the Policy and its implementation, the DEAT is currently drafting national regulations for controlling off-road vehicle use on the South African coast.

Author: Claire Attwood September 2000

FURTHER INFORMATION:
- Off-road vehicles and caring for our coast. Booklet published by Coastcare, Marine & Coastal Management, Private Bag X2, Roggebaai 8012

RELATED FACTSHEETS:
- Sandy Shores • Oystercatchers • Impacts of Human Activity on the Coast • Strandlopers and Shell Middens • Dune Vegetation • Turtles

For more information, please contact: The Coastal Management Office, Marine and Coastal Management, Department of Environmental Affairs and Tourism, Private Bag X2, Roggebaai 8012, Cape Town, South Africa. Tel: +27 (0)21 402-3208 Fax: +27 (0)21 418-2582 e-mail: czm@mcm.wcape.gov.za Website: http://sacoast.wcape.gov.za
Land-based whale-watching

Southern right whales can be seen close inshore between June and November each year from Lambert’s Bay on the west coast to Algoa Bay on the south coast, although the majority occur west of Mossel Bay. Most are females, which take up residence in sheltered bays to give birth and nurse their calves until they are ready to embark on the long migration back to the Southern Ocean feeding grounds. Annual surveys conducted in October, after the calves have been born, suggest that the main nursery area is in the vicinity of De Hoop Nature Reserve and San Sebastian Bay, at Witsand. Large numbers of whales can also be seen in Walker Bay, particularly from the cliffs of Hermanus, which attracts tourists and day visitors with a Whale Festival held each September. In 1995, indirect expenditure by visitors during the “whale season” in Hermanus was estimated to be R5 million.

Humpback whales can be seen migrating up the west and east coasts of southern Africa in June-July each year to their breeding grounds off the coast of Gabon and Mozambique. They return to their Southern Ocean feeding grounds along the same route in about September. These whales tend to occur further offshore than southern rights, but are sometimes seen between Yzerfontein and Lambert’s Bay on the west coast, and east of Plettenberg Bay on the south coast. However, they are best observed from the headland at Cape Vidal in Zululand, where they pass quite close inshore.

Bryde’s whales occur off the southern African coast all year round, but are seen less often because they usually remain offshore. Schools of dolphins are also frequently seen, particularly Heaviside’s, common, bottlenose and dusky dolphins.

The MTN Whale Route was established to boost tourism and thus promote economic development through whale-watching. As part of this initiative, numerous interpretive signs have been erected at popular whale-watching spots, and a tourist map and information brochure distributed.

Boat-based whale-watching

In order to protect whales from being disturbed or harassed while in our waters, the Marine Living Resources Act prohibits people from approaching or remaining closer than 300 metres to a whale in any craft, unless they have a permit to do so. Until recently this legislation rendered boat-based whale-watching illegal, but it proved difficult to enforce and some infractions occurred. It was therefore decided to allow the development of a small-scale experimental boat-based whale watching sector, and in 1998 permits were issued for the first time to 13 operators. The sector is regulated through strict permit conditions.
and a Code of Conduct, with operators risking the withdrawal of their permits if infringements are reported.

Development of the boat-based whale-watching sector faced opposition from some quarters on the grounds that it might interfere with land-based viewing and cause disturbance to the whales, possibly even driving them from our coastal waters and thus inhibiting their recovery from past over-exploitation through whaling. However, internationally there is little documented evidence to suggest a long-term impact on whales through boat-based whale-watching. In South Africa, a study on the short-term effects of boat approaches found no significant impact on whale behaviour. While some whales changed direction if a boat approached, there was no observable change in swimming speed, and in almost half the trials the whale approached the idling boat, apparently out of curiosity. The study therefore concluded that whales could be approached by boats with little stress to the animals.

The boat-based whale-watching sector would, however, be halted should scientific evidence reveal that it is detrimental to the whales. In addition, permits have not been issued for the main nursery areas (e.g. San Sebastian Bay) to avoid disturbance of cow-calf pairs, or in areas where land-based viewing would be compromised (e.g. parts of Walker Bay).

What you can do

If you observe a whale from a vessel at sea, ensure that you keep a distance of 300 metres from the whale, unless you are on a commercial boat-based whale-watching tour with a licensed operator. Report any irresponsible behaviour by the operator, such as steering the boat after a fleeing whale or allowing clients to attempt to touch or attract the attention of the whale, to Marine & Coastal Management or a nature conservation official.

While watching from the shore, do not make excessive noise or throw objects at the whales, and avoid trampling vegetation or trespassing on private property.

FURTHER INFORMATION:
• MTN Whale Hotline: 0800 228 222

RELATED FACTSHEETS:
• Southern Right Whale • Humpback Whale • History of Whaling • Dolphins • Baleen and Toothed Whales • Baleen Whales seen around South Africa

Author: Sue Matthews September 2000

Whale behaviour
Behaviours commonly observed while whale-watching are:

Breaching - The function of this behaviour, in which the whale leaps almost clear of the water and falls back with a large splash, is not known. It may be a means of communication with other whales, a way of dislodging dead skin and whale lice, or even just a form of play behaviour.

Lobtailing - Whales are often seen lifting the tail out of the water and repeatedly slapping it down on the surface. This may be some type of social communication, expressing alarm, annoyance or threat.

Sailing - Sometimes the whales spend long periods doing vertical “head stands” with the tail held out of the water. One theory is that the whale is using its tail as a sail, while another is that the tail is being used either to absorb heat through solar radiation or lose heat through evaporative cooling.

Spyhopping - This behaviour, in which the head is lifted vertically out of the water, may simply allow the whale to have a look at its surroundings.

Playing with kelp - Whales can sometimes be seen at the edge of a kelp bed, rubbing themselves against the fronds. Perhaps this allows them to scratch off irritating dead skin and whale lice.

For more information, please contact The Coastal Management Office, Marine and Coastal Management, Department of Environmental Affairs and Tourism, Private Bag X2, Roggebaai 8012, Cape Town, South Africa. Tel: +27 (0)21 402-3208 Fax: +27 (0)21 418-2582 e-mail: czm@mcm.wcape.gov.za Website: http://sacoast.wcape.gov.za

breaching
lobtailing
sailing
skyhopping
Intangible benefits

There is something about the views, the smell and the rumbling motion of the ocean together with healthy activity that makes the coast a place for renewal, peace, relaxation and spiritual upliftment. These values are difficult to measure but result in improved health and greater productivity when holiday-makers return to work.

Tourism, recreation and leisure

There are over forty different recreational activities that take place at the coast.

Water sports: Swimming and bathing are regular activities at the shore especially where the water is warm along the east and south coasts. Shark nets, at selected popular beaches, protect bathers from the danger of sharks. In the Cape and on the west coast where sea temperatures range between 3°C and 13°C folk enter the water wearing wet suits or settle for sunbathing instead. Wherever swimming is popular life-saving clubs are active and lifesavers provide an essential safety service at busy beaches.

Surfing is a very popular sport and the annual surfing competition/Ocean Action event in Durban attracts over 800 000 visitors and generates over R220 million for local Durban businesses in only 10 days. Jeffrey’s Bay was acclaimed by a group of surfers that travelled the world in search of the ‘perfect wave’.

Over 100 000 SCUBA divers generate R36 million annually by their activities around the coast. They are attracted to sites of sunken wrecks, the coral splendour of Sodwana, views of ragged-tooth sharks at Aliwal Shoals and the beauty of kelp beds in the Cape. Many of them are sport fishermen but a new breed of underwater photographers is emerging.

Sailing has a huge international and local following and important ocean races stop at South African ports where they attract spectators, repair boats and stock up on supplies. Boat-building and sail-making are thriving industries.

The windy Cape also provides high-energy thrills for wind surfers and kite fliers, while the calmer waters of estuaries and bays are used for motor boating, jet skis, water skiing and canoeing.

Beach activities: Many people unwind by walking or running along the fine sandy beaches that cover about 1 700 km of the coast, or exercise and play with their dogs in the refreshing atmosphere. Beach volleyball is becoming a popular sport and many competitions are held in summer. There is a network of hiking trails, with huts, along the coast where hikers can spend several days and enjoy some of the wilderness areas. The Otter Trail in Tsitsikamma is world famous for its rugged beauty.

Fishing: Rock fishing is popular and successful along the east and south coasts. Ski-boaters launching from harbours and beaches skilfully ride the pounding breakers as they set forth to fish. There are over 600 000 recreational fishing enthusiasts, employing over 131 000 people and generating R1.3 billion in revenue. There are so many anglers that their activities have resulted in several endemic reef fishes becoming endangered. Recreational fishers must have a permit, observe fishing restrictions and limits and may not sell their catch.

Site-seeing tours: Many tour companies arrange site-seeing tours along the coast.

The garden route between Port Elizabeth and Mossel Bay is scenically stunning and takes in some lovely beaches and rocky headlands and includes Knysna Lagoon, Plettenberg Bay and the Tsitsikamma National Park. This route passes through indigenous forest with giant yellowwood trees, the Cango Caves and the Addo Elephant Park.

In spring Namaqualand, a semi-desert along the west coast, blossoms into a magnificent wild flower garden with an infinite variety of fascinating plants. Tours are arranged from Cape Town to nearby Posberg at Langebaan Lagoon and as far afield as Springbok, 800 km north. The flowers open on sunny days and turn to face the sun. The best views are seen when driving with the sun behind one.
Robben Island, a World Heritage Site near Cape Town, Cape Point and Hermanus are spectacular destinations for sightseeing and whale watching. At Boulders Beach visitors have an opportunity to see penguins. There are many shorter tours from the main coastal towns and cities.

Accommodation

A wide variety of accommodation is available along the coast. This includes camping, bed-and-breakfast rooms, self-catering apartments, hotels, resorts and guesthouses of various grades. The greatest concentration of accommodation is along the east and south coasts, particularly north and south of Durban and along the garden route. The Transkei and Northern KwaZulu-Natal have several popular resorts but some roads are very rugged. The west coast has few hotels and resorts and these are in great demand during the spring flower season (July to September) and should be booked in advance. Some of the hiking trails are also very popular and need to be booked up to a year in advance.

Impacts of development and tourism

Without effective management the coast can be over-used, degraded and developed to a point where the very features that attract tourists are lost. It is important to keep a balance between concentrated nodes of development and unspoilt wilderness areas with limited access. It is also important that the benefits of tourism are realised by local communities and tour companies from foreign regions should use local tour guides, amenities and produce.

Blue Flag Campaign

The international Blue Flag Campaign is an incentive scheme that encourages local authorities along the coast to manage their beaches in an environmentally friendly manner. Beaches that meet specific criteria on safety, cleanliness, services, water quality, amenities, environmental education and monitoring of beach profiles are annually awarded a blue flag which can be flown as part of the local authorities’ tourism marketing strategy. In Europe, Blue Flag beaches have been shown to attract greater numbers of tourists. Fourteen South African beaches, situated between Sodwana and Cape Town, were selected to take part in a pilot project to test the criteria as part of the South African effort to achieve formal Blue Flag status.

Welcome Campaign

The South African Welcome campaign aims to encourage South Africans to be sensitive to the needs of international travellers, and to promote local tourism, national pride and caring for the environment.

FURTHER INFORMATION:

• South African Tourist Board, SATOUR, Pretoria Tel (012) 4826200, E mail dalet@icon.cp.za
• South African National Parks, Cape Town, P O Box 7400, Roggebaai 8021. Tel (021) 222810/6 Fax (021) 246211. E mail: reservations@parks-sa.co.za

RELATED FACTSHEETS:

• Aquariums in South Africa • Whale Watching • Penguins • Our Coast: A National Heritage • Marine Protected Areas • Garden Route • West Coast • St Lucia • Islands around South Africa.

For more information, please contact: The Coastal Management Office, Marine and Coastal Management, Department of Environmental Affairs and Tourism, Private Bag X2, Roggebaai 8012, Cape Town, South Africa. Tel: +27 (0)21 402-3208 Fax: +27 (0)21 418-2582 e-mail: czm@mcm.wcape.gov.za Website: http://sacoast.wcape.gov.za
Shark cage-diving has become a popular tourist attraction in recent years, particularly among foreign visitors to South Africa. All existing cage-diving operations focus on the Great White Shark Carcharodon carcharias, which is widely distributed throughout the world’s temperate and sub-tropical oceans. Large numbers of the sharks can be seen in the vicinity of seal colonies, which are an important prey item of “great whites”. The cage-diving industry is therefore based in Mossel Bay (1 operator), Gansbaai (5 operators) and False Bay (2 operators) along the southern Cape coast. Here seal colonies are found on small rocky islands lying in sheltered, temperate waters suitable for boat-viewing and diving.

**Means of operation**
Most cage-diving operators take small groups of 3-10 tourists out to sea in skiboats (typically 8-10 m catamarans). Upon arrival at the site, the operators start attracting sharks by chumming with a bloody mixture of minced fish. If a patrolling shark detects the chum slick, it may swim up the scent path to investigate the potential source of food. Once the shark reaches the chumming site, it is lured closer to the boat with bait, which is attached to the boat with ropes. The most commonly used bait is a piece of shark meat, but some operators use sardines enclosed in tough nylon bags. The shark may mouth or attack the bait, providing an exciting spectacle for the tourists on board.

Tourists who wish to view the sharks underwater enter a galvanized metal cage, which floats on the surface of the sea. This means that divers are able to participate in cage-diving. The cage is fastened to the boat and can accommodate two people at a time.

**Code of Conduct**
The great white shark is listed as ‘vulnerable’ on the 1996 IUCN World Conservation Union Red List of Threatened Species and is a protected species in South Africa. However, the chumming and baiting involved in cage-diving could potentially constitute harassment of the sharks and disturbance of natural feeding regimes. The Department of Environmental Affairs and Tourism therefore manages the cage-diving industry through regulations, permit conditions and a Code of Conduct.
The Code of Conduct prohibits the use of mammalian products as bait or chum, or any foodstuffs that are foreign to the shark's diet. Cage-diving operations are also limited to existing sites near seal colonies to minimise the impact of chumming. In addition, the number of operators at the cage diving-sites is restricted to protect the penguins, other seabirds and seals breeding on the islands. The Code of Conduct includes safety considerations such as a certificate of sea-worthiness for vessels, a cage safety certificate issued by an engineer, and the need for a qualified skipper and divemaster on board. Swimming outside the cage during or after chumming is prohibited.

Research

Various research projects have been initiated to investigate the effects that the cage-diving industry has on the great white shark and its interactions with other marine species and humans. These involve satellite- and sonic-tracking of tagged sharks, as well as behavioural studies. Some of the specific aims of the research are:

- To establish a baseline against which to determine changes in the frequency of great white sightings should the cage-diving industry at Dyer Island expand
- To determine the nature of interactions between great whites, seals and penguins
- To describe the behaviour of seals when great whites are present and ascertain if cage-diving is influencing this behaviour
- To make scientific observations on the effect of cage-diving on great whites
- To monitor the impacts and benefits of cage-diving
- To investigate if the sharks become conditioned to approach boats by offering “free” meals
- To provide information on sharks movement patterns and residence times in a core area
- To advise on the management of the non-consumptive use of this protected species.

In 1998, 13 shark attacks occurred in South African waters, against the background of a worldwide increase in the number of shark attacks. Although this resulted in speculation in the media that the increased incidence of local shark attacks is linked to the growth of the cage-dive industry, no scientific evidence exists to support this claim. Instead it is likely that the main reason for the increased number of shark attacks is human population growth, ever-increasing recreational use of the sea, environmental influences and the recovery of the seal population following over-exploitation in the early part of the previous century.

Free-diving with sharks

Diving with sharks, without the need for protective cages, is a popular activity amongst recreational divers. A number of commercial dive operations run specific shark-diving trips to Protea Banks and Aliwal Shoal on the south coast of KwaZulu-Natal. Here a variety of species can be observed, including ragged-tooth, Zambezi, hammerhead, tiger and copper sharks. In an effort to reduce shark disturbance at Aliwal Shoal, tourist divers are educated in shark behaviour and encouraged to take photographs that can be used to identify individual sharks, track their movements and become part of a research database. In the tropical waters of northern KwaZulu-Natal and Mozambique, some dive operations advertise dive excursions to view the whale shark, a large filter-feeding species.

Aquariums offer a ‘diving-with-sharks’ experience

Two Oceans Aquarium, Cape Town and Sea World, Durban offer an opportunity to dive with the sharks in their predator exhibits. Volunteer divers at the Two Oceans also enter the exhibit to clean the inside of the enormous windows.

Author: Sue Matthews September 2000

FURTHER INFORMATION:
- Herman Oosthuizen, Marine & Coastal Management, Private Bag X2, Roggebaai 8012, tel. (021) 402-3189.
- Shark Protection and Preservation Association, South African Museum, PO Box 61, Cape Town 8000. Tel. 021 243330 www.divethebig5.co.za

RELATED FACTSHEETS:
- Aquariums in South Africa • Great White Shark • Sharks • Ragged Tooth Shark • Whale-watching
Aquariums, as with all facilities that maintain animals in captivity, have an enormous responsibility – both to the animals in their care and the people who visit them. The animals must be maintained under conditions that promote their good health and well-being. Every attempt should be made to ensure that all animals are kept in as natural an environment as possible. Attractive exhibits showing the beauty and diversity of marine life can be used to focus attention on scientific discoveries and the need for marine conservation. Although controversy surrounds the keeping of animals, particularly mammals, in captivity, it remains a fact that without places such as aquariums most people would be unaware of the fragility of the sea and would not understand the need to protect our oceans. Aquariums, therefore, have a responsibility to ensure that their displays create an awareness of man’s links with the environment and challenge people to take action and make a difference in ensuring the conservation and wise, sustainable use of our ocean and freshwater systems.

Aquariums also assist in the rehabilitation of stranded or injured animals. Penguins, dolphins, seals, turtles, sunfish and other animals that would probably have died, are cared for at these facilities and, either released into the wild or, if this is not possible, accommodated for life.

**Sea World - Durban**

Situated on the Durban beachfront in KwaZulu-Natal, Sea World is part of the South African Association for Marine Biological Research (SAAMBR). SAAMBR is a non-government, not-for-gain organisation, whose mission is to stimulate community awareness of the marine environment and its resources.
through education and promote the wise, sustainable use of marine resources through research. This unique organisation, founded in 1951, combines the scientific expertise of a professional research institute with a public aquarium, dolphinarium and education centre.

The aquarium and dolphinarium provide a window into the West Indian Ocean and are home to a wide range of marine life, representative of local seas. Features include jellyfish, corals, sharks, fish, dolphins, seals and penguins. The large main exhibit houses species such as Eastern Little tuna, graceful spotted eagle rays, triggerfish, honeycomb rays, colourful tropical reef fish such as butterfly fish and angelfish and large sandsharks, eels and turtles.

The Oceanographic Research Institute (ORI) carries out applied research that serves as decision support to managers and users of marine resources. The Sea World Education Centre uses the facilities of the aquarium and dolphinarium, the natural environment, and the expertise of the ORI to provide a wide range of relevant and effective programmes for learners, teachers and marine-resource users.

Two Oceans Aquarium – Cape Town

The Two Oceans Aquarium is the most modern in South Africa and was opened in 1995. Situated in the heart of Cape Town’s popular Victoria and Alfred Waterfront, this aquarium compares marine life of the cold Atlantic Ocean with that of the warmer Indian Ocean.

The huge predator exhibit, the size of a tennis court, displays ragged-tooth sharks, turtles and rays swimming amongst shoals of large pelagic fish. The two-storey deep kelp exhibit provides an insight into the gently moving world of a kelp forest while the diversity hall shows the variety of life in our oceans, including the miniature world as seen through a microscope. The river ecosystem exhibit takes visitors on a journey along the course of a river, from its source to the mouth.

The Two Oceans Education Centre offers new experiences to learners of all ages. Its mission is “to stimulate interest in and promote custodianship of the oceans and coastline of South Africa through innovative educational programmes designed to meet the needs of all communities”. The Aquarium runs an intensive training course for volunteer guides and aquarists, with opportunities for hands-on experience. Teacher enrichment courses and public lectures are a popular service.

Bay World - Port Elizabeth

Incorporating the Oceanarium, Snake Park and Museum, Bay World is situated on the beachfront in Port Elizabeth. The institute forms part of the Directorate of Museums and Heritage Resources of the Province of the Eastern Cape, administered within the Department of Education, Culture and Sport.

Daily presentations at the dolphinarium give visitors a memorable introduction to dolphins, Cape fur seals and African Penguins. Bay World also plays an important role in the rehabilitation of stranded marine mammals and birds. The aquarium displays tropical and temperate marine fish and invertebrates common on the Eastern Cape coast. The museum has an excellent display on marine life including interesting marine fossils from the region.

Research is undertaken by a small group of specialised scientists, who work on many subjects including sharks, dugongs and dolphins. An active education department teaches thousands of local scholars at Bay World and also visits schools in outlying areas with interactive natural displays.

Other Aquariums

The East London Aquarium although small, has interesting marine and riverine displays as well as seals, penguins and a deck for whale watching. The charm of Mossel Bay Aquarium is that it provides interesting information on a variety of marine animals found in gulleys on its doorstep and in deeper water.

In Pretoria, the National Zoological Gardens of South Africa has a small Aquarium and Reptile Park with representatives of both marine and fresh water biota.

Related Factsheets: Marine and Coastal Educators’ Network • Ichthyology – The study of Fishes