Eels 3C

Eels are long-bodied, snake-like fishes that are usually scaleless and lack pelvic fins. The saying 'as slippery as an eel' refers to the copious supply of mucus that covers the body and makes them very difficult to grasp. In most species the very long dorsal and anal fins are joined around the end of the tail to form a continuous soft-rayed vertical fin. The gill openings are small and the gas-bladder has a duct to the oesophagus. Eels have many more vertebrae and fewer bones in the face and jaw than do other fish. These structural features are associated with their habit of hiding in holes and crevices or burrowing in the sand, but some species are pelagic and swim in the open ocean. Perhaps the best known eels are the fresh - water eels (family Anguilidae) and the morays (family Muraenidae).

Feeding

Eels are generally good swimmers but most of them are rather sedentary and rely on a well-developed sense of smell, surprise tactics and large teeth to catch their prey, which consists of fishes, crustaceans and octopuses.

Reproduction

All eels, even the freshwater species, breed in the open ocean. They pass through a prolonged stage called a leptocephalus larva when they are flat, transparent and glassy, quite unlike their adults. The larval stage can last from a few weeks to a few years depending on the species and they migrate great distances in the ocean currents.

Marine eels

Although eels occur in all parts of the ocean, they are particularly common in warm waters and are abundant on coral reefs. There are over 100 species belonging to thirteen different families in the waters of southern Africa. The extended pelagic life of the larvae leads to wide dispersal of species and many of our eels are known throughout the Indo-Pacific. There are many deep-water species that are rarely seen.

Morays (family Muraenidae) The most conspicuous eels of the coral reefs are the morays, which are sharp-toothed, long-mouthed and often vicious fishes, much feared by divers. Morays often have distinctive patterning and colouring. They have a sloping forehead, no paired fins and the gill openings are reduced to pores. In KwaZulu-Natal morays and rock lobsters often share a hole. If an octopus feels along the ledges in search of a lobster meal, the moray darts out and catches the octopus instead. There are 33 species of morays in South African waters.

Congers (family Congridae) Congers are usually pale cream to black with a relatively small mouth and a flattened tapering tail. Pectoral fins are present. There are 12 bottom-dwelling species in our area. They are good eating but not common enough to be of commercial importance.

Pike congers (family Muraenesocidae) There is only one species of pike conger in southern Africa. This is 'a nasty brute to handle' with its large snapping jaws and teeth. This plain grey eel is good eating, widespread and abundant enough in India and southeast Asia to be commercially significant.

Snake eels (family Ophichthidae) Snake eels can be distinguished by the finless pointed tail that projects beyond the dorsal and anal fins. They are mostly small sand-burrowing species of no commercial significance.

Moray eel

Snipe eels (family Nemichthyidae) Snipe eels have extremely long, delicate bodies up to 120 cm. The jaws are greatly produced forwards and curving apart with rows of minute rasping teeth. They swim in the open ocean from the surface to depths of over 2 000 m.

Deep-water, bottom-dwellers There are several species of black eels that live at great depths, these include the witch eels, sawtooth eels with long jaws and small teeth and the arrow eels in which the short delicate body is truncated and arrow shaped.

Garden eels (family Heterocongridae) Colonies of garden eels are found living in mucus-lined burrows in sand. They never leave their burrows but extend their upperbodies into the water and snap up microplankton that drifts past. They are tropical creatures forming huge colonies in the Red Sea, with many thousands of eels at densities of 14 to a square metre.

Freshwater eels (*Anguilla* species)

Fresh water eels are a valuable food source and are farmed in the Far East and Europe. Four species are found in South Africa. They utilise streams, ponds and estuaries to grow and develop for 10 to 15 years, then migrate to the sea to spawn and presumably die. The leptocephalus larval stage lasts for a few weeks in South African species, before they are transformed into 'glass-eels', which enter estuaries and become olive to black. At this stage they are called elvers, which migrate upstream into rivers, even crawling up wet vertical cliffs and dam walls to reach the fresh water in which they will grow. In the middle ages in Europe, before the complex life history of eels had been unravelled, people thought that freshwater eels were spontaneously generated from mud. Before returning to the sea, eels undergo changes in physiology and structure to enable them to survive at sea.

Other eel-shaped fishes

Electric eel This is a South American freshwater fish that has an eel-shaped body, up to three metres long. It is, however, not closely related to the true eels. The fish produces an electric shock to immobilise its prey. The tail region encloses the powerful electric organ capable of delivering a shock of 1000 watts, which is strong enough to stun a man.

Author: Margo Branch September 2000

LIFE CYCLE OF FRESHWATER EEL

Flat leptocephalus larva lives in the sea

Glass-eel stage enter estuaries

Elver stage swim up rivers where they grow

Adult returns to the sea to reproduce

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
ORDER:	Anguilliformes – Eels
FAMILY:	Muraenidae – Moray eels
	Congridae – Conger eels
	Muraenesocidae – Pike congers
	Ophichthidae – Snake eels
	Nemichthyidae – Snipe eels
	Heterocongridae – Garden eels

FURTHER INFORMATION:

• South African Museum, P O Box 61, Cape Town 8000, Tel (021) 243 330
• Two Oceans Aquarium, Waterfront, Cape Town. Tel (021) 418-3823 Fax: (021) 418-3952 E-mail aquarium@twoocean.co.za
• Smith, M.M. & Heemstra P.C. 1986. *Smiths' Sea Fishes.* Macmillan South Africa, Johannesburg.

RELATED FACTSHEETS:

• Estuary Management • Sea Snakes

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

Galjoen 3C

The Galjoen, Dichistius capensis, *is South Africa's national fish and a favourite catch for many of our country's shore anglers. The name probably derives from the Dutch word for galleon, and refers to the fish's legendary fighting ability when hooked. Galjoen is one of only two species in the family Dichistidae, both of which are endemic to southern Africa. The banded galjoen,* Dichistius multifasciatus, *is smaller and prefers subtropical water.*

Galjoen have deep, plump bodies covered with small tenacious scales. The underslung mouth is small and surrounded by fleshy lips. Each of the jaws are set with a row of large, curved incisors in front and smaller teeth behind. There are no strong molars, but crushing teeth are found in the gullet. The galjoen varies in colour from silver-bronze to almost completely black, sometimes with stripes. Colours will change according to the fish's surroundings and provide a measure of camouflage. The dorsal and ventral fins, far back on the body, do not fold down and have a distinctive wedge shape.

Galjoen are found from northern Namibia to southern KwaZulu-Natal, where they frequent the turbulent surf-zone, particularly at the interfaces of rock and sand. Due to its highly energetic lifestyle, the flesh of galjoen is packed with blood vessels. These fish often use the waves to gain access to food on exposed rocks.

Feeding

Galjoen are known to feed on a wide variety of small invertebrates and seaweed that live on rocks. Small black mussels and crustaceans are among their most common prey. They feed by removing organisms from rock surfaces and their powerful incisors are admirably suited to this purpose. The teeth in the gullet are well adapted for crushing shellfish.

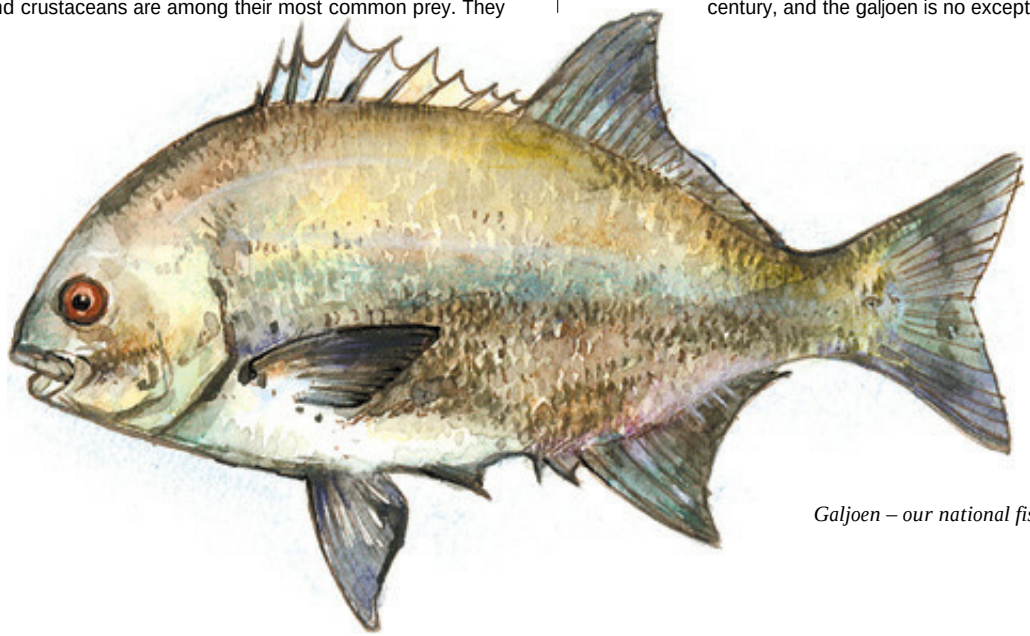
Galjoen usually remain in a small home range for long periods, maybe for several years. But some move out, and tagged fish have travelled as much as thousands of kilometres. It is not known what prompts galjoen to undertake large movements, though food availability and water conditions are likely motivations.

Breeding

Galjoen are serial spawners which means that they spawn several times in a season. Their breeding extends from October to March, peaking in December. Female galjoen grow faster than the male fish, reaching a maximum length of approximately 670 mm. Males attain 470 mm. Fish of both sexes rarely exceed 13 years of age. Sexual maturity is attained in their fifth year, at which stage females measure approximately 34 cm and males 31 cm.

Females release thousands of eggs. A rough guide is 370 eggs per gram of body mass. A large female galjoen may release 1,3 million eggs at each spawning. Fertilised eggs hatch into larvae, but these have never been located in the ocean, despite extensive sampling. Laboratory experiments have shown that the eggs float, and one can surmise that waves keep them in the surf zone where the young develop. Mortality is likely to be very high during this stage .

Galjoen once occurred in great numbers throughout its range but over the last three decades the population has been dramatically reduced. Fisheries biologists have found a marked decline in the abundance of fish commonly caught by South African shore anglers over the course of this century, and the galjoen is no exception.



Galjoen – our national fish

Galjoen is normally caught from the open beach, in the rough surf zone

Fishing regulations

The decline in the abundance of galjoen is the result of over-fishing. In the past, galjoen were caught by commercial anglers and gill netting of galjoen was only restricted after 1974. Bag limits, closed seasons and minimum sizes were introduced later. Today anglers with a recreational permit may take a maximum of five fish per day. The fishing season for galjoen is open between March 1 and October 15 annually. The minimum size that may be caught by anglers is 35 cm. There is no commercial fishery for galjoen and they may never be sold.

Marine reserves protect galjoen

New evidence has shown that marine reserves play an important role in safeguarding galjoen stocks for the future. The De Hoop Marine Reserve and the Tsitsikamma National Park provide total protection for inshore fish species like the galjoen. As a result adult fish are protected in these reserves and make an important contribution to spawning stock, although many move out of the reserve into adjacent areas where anglers catch them.

Based on tagging statistics, it was estimated that a net mass of between 10 and 20 tons of galjoen leave the De Hoop Marine Reserve every year. De Hoop is therefore supplying anglers with a steady source of galjoen which will not dry up as angling pressure increases to unrealistic proportions.

Author: Claire Attwood September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Dichistidae
GENUS :	*Dichistius*
SPECIES:	*capensis*
COMMON NAME:	Galjoen

FURTHER INFORMATION: • Van der Elst, R. 1988. *A Guide to the Common Sea Fishes of Southern Africa*. Struik, Cape Town.
• Attwood, C.G. and Bennett, B.A. 1993. *Anglers can benefit from marine reserves*. Earthyear. Issue 5.
• Ward, C. 1997. *Marine Reserves: Havens for tourists, reserve banks for fishermen*. African Wildlife. Vol 51 no 1.

RELATED FACTSHEETS: • Fishing Regulations • Fishing Industry • Geelbek • Spotted Grunter • Kobs • King Mackerel.

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

Geelbek 3C

The geelbek belongs to the kob family (Family: Sciaenidae). This elongate, robust fish is silvery-grey with a bronze-blue dorsal surface and a white ventral surface. A black spot occurs at the base of each pectoral fin. The name of the fish is derived from the fact that its mouth and the inner surface of the gill covers are bright yellow in colour. (In Afrikaans "geelbek" means yellow mouth.

Geelbek are widely distributed and are found on the east and west coast of Africa and on the east coast of Australia. In South Africa, the geelbek stock is distributed from Cape Point to southern Mozambique. It is an offshore, shoaling species commonly found over both sandy and rocky substrata in depths of 15 to 150 m. Juveniles and sub-adults occur in the south-western Cape, whilst adults undertake a seasonal spawning migration to KwaZulu-Natal. These fish are often found close to the bottom near pinnacles, steep ledges and shipwrecks.

Breeding habits

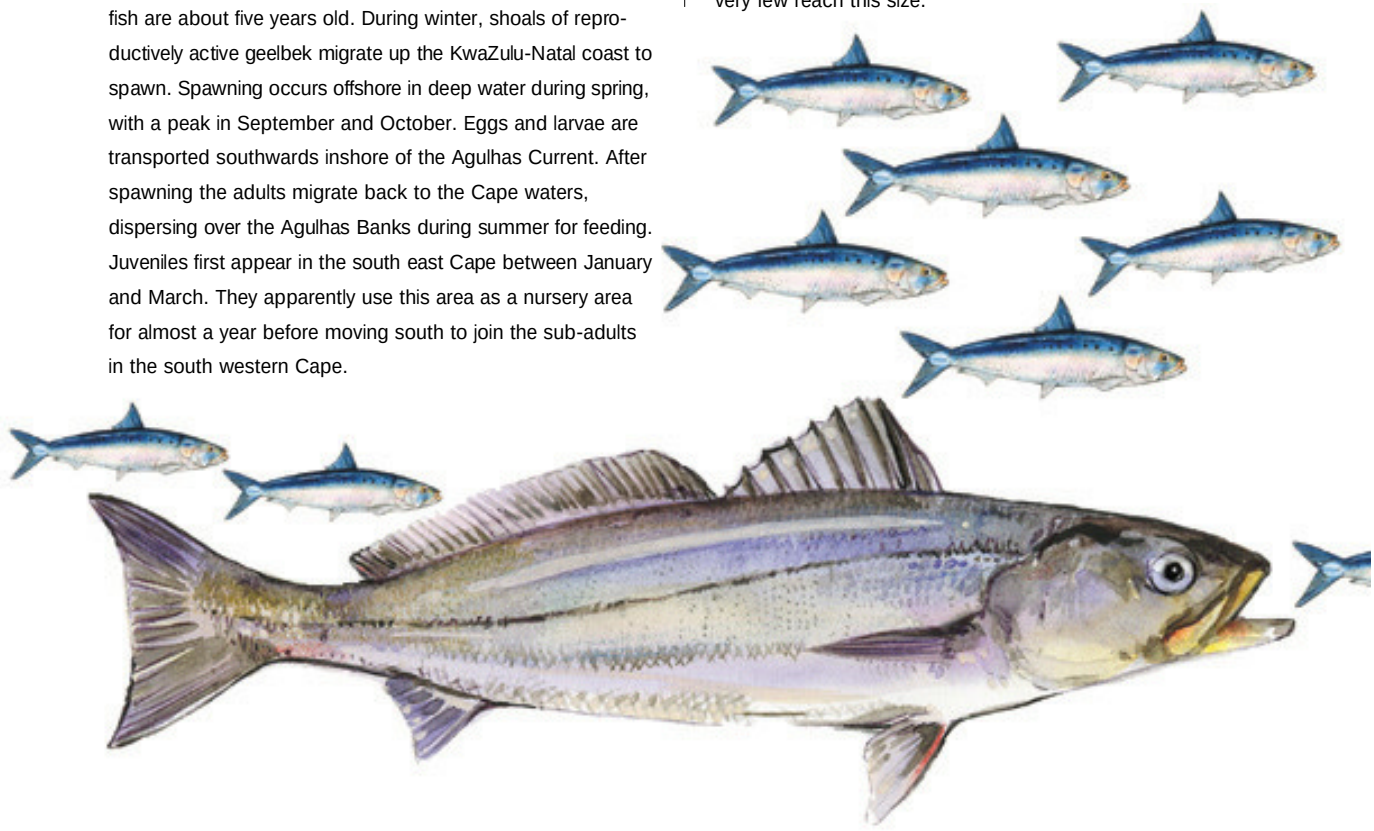
Geelbek reach full sexual maturity at about 93 cm, when the fish are about five years old. During winter, shoals of reproductively active geelbek migrate up the KwaZulu-Natal coast to spawn. Spawning occurs offshore in deep water during spring, with a peak in September and October. Eggs and larvae are transported southwards inshore of the Agulhas Current. After spawning the adults migrate back to the Cape waters, dispersing over the Agulhas Banks during summer for feeding. Juveniles first appear in the south east Cape between January and March. They apparently use this area as a nursery area for almost a year before moving south to join the sub-adults in the south western Cape.

Feeding habits

The geelbek is a highly specialised marine predator that has adapted to feed on pelagic shoaling fish in order to satisfy its energy demands. The pointed head has a large mouth with several rows of backward pointing needle sharp teeth and a projecting lower jaw. It appears that feeding occurs mainly at night, with the fish rising off the bottom to feed on their prey, which include surface fish such as pilchards, mackerel and maasbanker. Juvenile geelbek feed on tiny shrimps and anchovies.

Life cycle

The South African geelbek stock is divided into distinct age related sub-populations, each representing a particular phase in the life-cycle. The sub-adults (1–4 yrs) occur in the south-western Cape and feed predominantly on anchovies, which they follow, moving inshore in summer. The adults (5–9 yrs) undergo a seasonal inshore migration to KwaZulu-Natal where they spawn in spring. The dynamics of this migration are strongly influenced by the movement of their prey, the pilchard (sardine). The geelbek, therefore, generally arrive in KwaZulu-Natal waters in winter. Geelbek are quite fast growing and reach a maximum age of nine years at about 1.3 m and 25 kg. Although the South African record is a 22 kg specimen, very few reach this size.



A geelbek feeding on a shoal of pilchards

Conservation status

Geelbek is an important fish in the South African linefishery and is targeted throughout its distribution range. Large quantities of geelbek are caught by lineboats fishing on the Agulhas Banks during the summer months. In KwaZulu-Natal adult geelbek are caught during their winter/spring spawning migration. Geelbek are usually caught from ski-boats, although shore anglers and spearfishers do catch them during the sardine run. It has been estimated that geelbek numbers have been decreasing and the average catch per boat has dropped dramatically to 2.5% in the southwestern Cape, 4.3% in the southern Cape and 1.5% in the south eastern Cape of historical values.

What you can do to help

Obey the fishing regulations

- Minimum size limits give fish a chance to breed at least once before they are caught and protect the fish when they are growing at their fastest.
- Bag limits restrict daily catches so that there will be enough fish for everyone. Scientists work out how many fish can be harvested safely. This information is used to set a bag limit that restricts the number of fish caught per day. This prevents more successful anglers from catching great numbers of fish, especially when the fish are 'on the bite', so leaving some behind for less successful anglers.

Where available, fill in catch cards with accurate information about your catches and co-operate with fisheries officers or scientists collecting information on your catch.

These studies provide information about the number of anglers and the number of fish being caught. Scientists can tell the age of fish by counting rings in their ear bones (otoliths) and relating this to the size of the fish. The age that the fish start breeding and their breeding season are obtained by cutting open the fish and inspecting the state of maturity of their reproductive organs. Research is also conducted on the diet of the fish. Scientists use all this information in computerised mathematical models to determine the most effective management options. The best options can be then drafted into legal regulations that are used to manage recreational species such as the geelbek.

Tag and release your fish.

Tagged fish can provide scientists with useful information about the seasonal movements of fish, their growth rates and in some cases, the size of the stock. They also give anglers an opportunity to become involved in an exciting research programme; taggers will receive information on their tagged fish, if they are recaptured. If you catch a fish with a tag in it, read the tag number or remove the tag from the fish and measure the fish (from the tip of the mouth to the fork of the tail). Send the tag number (or tag), the type of fish, where it was caught (try to give a specific location), the date caught, the length and/or weight of the fish and your name, address and telephone number to: The Tagging Officer, Oceanographic Research Institute, P.O. Box 736, Durban, 4000.

Only catch what you can eat – don't be greedy.

Geelbek is an excellent eating fish – when fresh.

Author: Judy Mann-Lang September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Sciaenidae
GENUS:	*Atractoscion*
SPECIES:	*aequidens*
COMMON NAME:	Geelbek / teraglin

FURTHER INFORMATION:

• KwaZulu-Natal Wildlife (KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
• Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik Publishers, Cape Town.

RELATED FACTSHEETS:

• Recreational Angling • Sustainable Use of Coastal Resources • Fishing Regulations • Kobs • Shad • Snoek

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

Spotted Grunter 3C

These popular table fish have long, sloping foreheads with a pointed snout. The dorsal surface of the silvery body is covered with many small brown spots that extend onto the dorsal fins but not the head. A very distinct black blotch occurs on the serrated gill cover. Spotted grunter prefer shallow coastal regions and are frequently found in the brackish water of estuaries and sheltered lagoons over soft sediments. These fish can also tolerate fresh water. Spotted grunter are widespread from Cape Point along the whole African and Madagascan coast, into Indian waters. Some species of grunter, including the spotted grunter, are able to make a grunting sound by grinding the strong jaws in their throat together, hence their common name.

Breeding habits

Spotted grunter reach sexual maturity in their third year of life when they are 30–40 cm in length. In South Africa, spawning usually occurs in the open sea adjacent to river mouths, between August and December. After spawning, the newly hatched larvae and the post-spawning adults move into estuaries to take advantage of the nutrient rich estuarine waters. The murky waters of estuaries also provide the juveniles with protection from visual predators.

Feeding habits

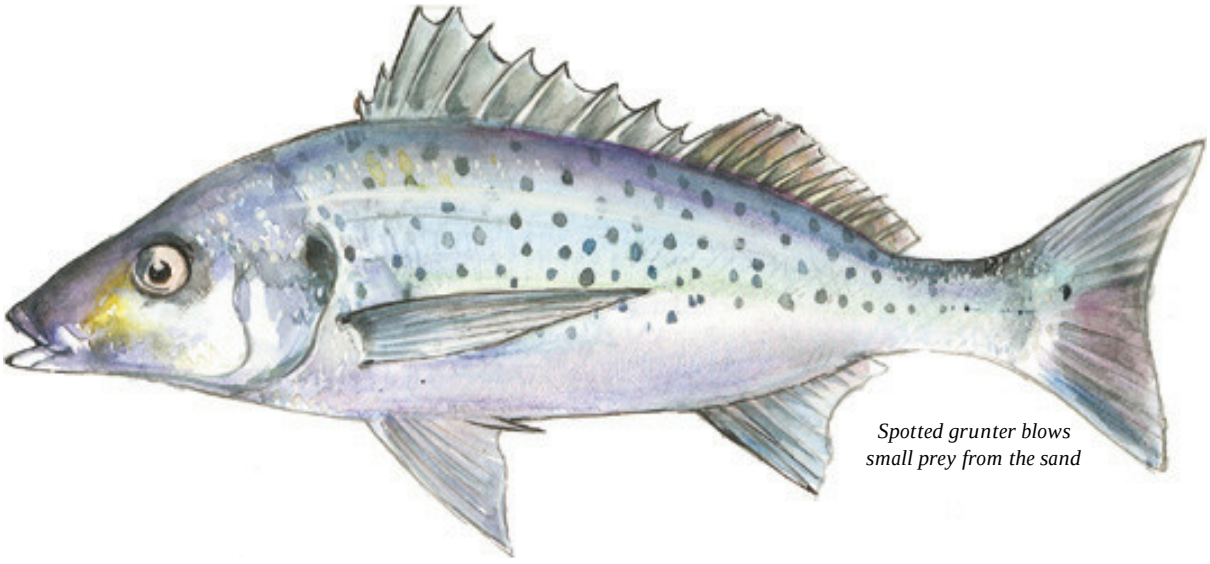
Spotted grunter have an unusual method of feeding. They use the pumping action of their large gill chambers 'in reverse' to force a jet of water through their mouths. This jet 'blows' small prey such as worms, crabs, mud- and sand-prawns out of their burrows in the sand. Grunter are often seen with their tails out of the water as they feed, head down, on shallow mud banks. It is easy to see where a shoal of spotted grunter have been feeding – the sandy bottom is covered by many tiny mounds of sand. Grunter also eat mole crabs (sealice) and small molluscs. Grunter have thick lips surrounding a small mouth bearing several rows of very fine teeth. The tough pharyngeal teeth, that are found in the throat area, assist in the crushing of their prey.

Life cycle

Spotted grunter reach a maximum length of 87 cm at an age of about 15 years, and a weight of 9.5 kg. Tag returns have shown that adult fish appear to be fairly resident in the vicinity of estuary mouths.

Conservation status

Spotted grunter depend on estuaries for the growth and protection of juveniles, as well as for adult feeding areas. This makes them particularly sensitive to estuarine degradation such as siltation or pollution. Spotted grunter are a very popular angling fish and are commonly caught in estuaries, particularly in the St Lucia estuary, which is famous for its spring grunter run. Grunter are also caught from sandy beaches



Spotted grunter blows small prey from the sand

and are sometimes trapped as a by-catch in prawn trawl nets operating off the Tugela Banks. Spearfishers frequently spear this fish and subsistence net and trap fishers in KwaZulu-Natal also catch large numbers of spotted grunter.

What you can do to help

There are a limited number of grunter in the ocean. If anglers catch more than can be replaced by their breeding, over-fishing results. This results in fewer grunter and their average size becoming smaller. To prevent this, regulations control the number of grunter that can be caught, ensuring that everyone catches their fair share and that grunter continue to be caught in the future.

Obey fishing regulations

- Minimum size limits give fish a chance to breed at least once before they are caught and protect the fish when they are growing at their fastest.
- Bag limits restrict daily catches so that there will be enough fish for everyone. Scientists work out how many fish can be harvested safely. This information is used to set a bag limit that restricts the number of fish caught per day. This prevents more successful anglers from catching large numbers of fish, especially when the fish are 'on the bite', so leaving some behind for less successful anglers.
- Closed seasons protect fish during vulnerable stages in their life cycles.

Where available, fill in catch cards with accurate information about your catches and co-operate with fisheries officers or scientists collecting information on your catch.

When fishing in an estuary in KwaZulu-Natal, please complete the pink catch cards that are available at many launch sites. These provide information about the number of anglers and the number of fish being caught. Scientists can tell the age of fish by counting rings in their ear bones (otoliths) and relating this to the size of the fish. The age that the fish start breeding as well as their breeding season, may be determined by cutting open the fish and inspecting the state of maturity of their reproductive organs. Research is also conducted on the diet of the fish. Scientists use all this information in computerised mathematical models to determine the most effective management options. The best options can then be drafted into regulations that are used to manage recreational species such as grunter.

Tag and release your fish.

Tagged fish can provide scientists with useful information about the seasonal movements of fish, their growth rates and in some cases, the size of the stock. They also give anglers an opportunity to become involved in a research programme; taggers receive information about their tagged fish, if they are recaptured. If you catch a fish with a tag in it, read the tag number or remove the tag from the fish and measure the fish (from the tip of the mouth to the fork of the tail). Send the tag number (or tag), the type of fish, where it was caught (try to give a specific location), the date caught, the length and/or weight of the fish and your name, address and telephone number to: The Tagging Officer, Oceanographic Research Institute, P.O. Box 736, Durban, 4000.

Only catch what you can eat – don't be greedy.

Author: Judy Mann-Lang September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fishes
CLASS:	Osteichthyes – Bony fish
FAMILY:	Haemulidae
GENUS:	*Pomadasys*
SPECIES:	*commersonnii*
COMMON NAME:	Spotted grunter

FURTHER INFORMATION:

• KwaZulu-Natal Wildlife (KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
• Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik Publishers, Cape Town.

RELATED FACTSHEETS:

• Recreational Angling • Sustainable Use of Coastal Resources • Fishing Regulations

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Kob 3C

There are many species of kob belonging to the scientific group of fish named the Sciaenidae. They are common throughout the world and are highly valued as table fish. About nine different species of Sciaenids are found off South Africa; the most common are the squaretail kob (Argyrosomus thorpei)*, silver kob* (A. inodorus)*, dusky kob or dagga salmon* (A. japonicus) *and the snapper kob* (Otolithes ruber)*. The geelbek and the tasselfish (baardman/ bellman) are also members of this family. Kobs are usually large, predatory fish that can tolerate marine and brackish waters. They are, therefore, frequently found in estuaries and lagoons, as well as in shallow waters close to the shore and in deeper waters. Deep river mouths are often home to large kobs.*

Kobs have a coppery sheen, are fairly robust with an elongate body and a rounded tail fin. Their lateral line is easy to see and the dorsal fin is distinctly divided into two sections. The kob family is internationally known as croakers or drums, because of the sound which most of the species produce using specialised drumming muscles. This pair of muscles, often found only in the males, rubs against the side of the swim bladder, which acts as an amplifier. It appears that this phenomenon is linked to courtship behaviour or to territorial displays; it may even be a form of underwater communication.

Various kob species are often superficially very similar, making it difficult for non-scientists to distinguish between them. In fact, scientists described the silver kob as a new species as recently as the early 1990s, where previously it was thought to be the same species as the dusky kob.

This factsheet will focus on the three most commonly caught kob species – the dusky, squaretail and silver kob. However, it should be noted that smaller kob species, such as the mini-kob and the snapper kob, are also found along the KwaZulu-Natal coast.

Breeding Habits

Dusky kob reach sexual maturity at a length of 90 cm-1 m at about 5-6 years of age. Most adults migrate from the Cape to KwaZulu-Natal to spawn between August and November. Spawning generally occurs inshore at a depth of 10-15 m of water. Juveniles enter the upper reaches of estuaries where they remain until they about 15 cm. They then move into the lower reaches of estuaries and the nearshore marine environment. Silver kob reach sexual maturity at about 30 cm in length and spawn between August and December in inshore waters. The juveniles prefer the sandy or muddy substrates in shallow embayments, while adults prefer low profile reefs in 20-120 m of water.

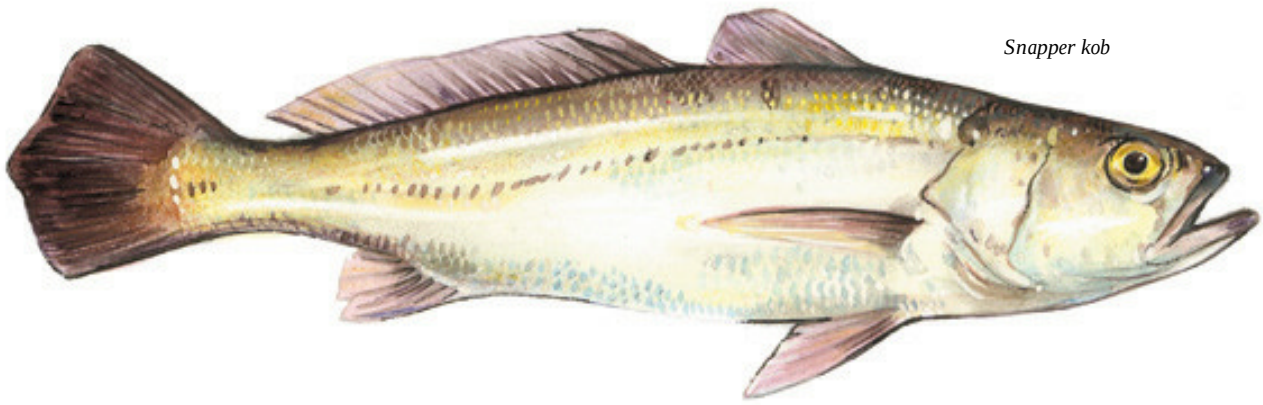
Squaretail kob reach sexual maturity at about 33 cm in length and spawn between June and September on the Tugela Banks and over other muddy substrates.

Feeding habits

Most kob species are voracious, shoaling predators and some species have become highly specialised for feeding in their muddy, murky environment. Their lateral line (a sensory system found in all fish that enables them to detect vibrations and pressure changes in the water) is very well developed and this, in conjunction with the sensory barbles on their snouts, makes the kob less reliant on sight when feeding. Small fish, crustaceans such as prawns and crabs, and molluscs such as squid and cuttlefish are all eaten by the various kob species.

Life cycle

All three kob species are slow growing and long-lived. It is relatively easy to determine the age of kobs, as their ear bones, or otoliths are large. (Scientists can tell the age of fish by counting the growth rings in their otoliths and relating that to the size of the fish).



Snapper kob

The dusky kob can reach 1.8 m in length at an age of 42 years and a weight of 75 kg. The dusky kob is widespread and is found on the eastern seaboard of southern Africa, off southern Australia, and in the northern Indian and northern Pacific Oceans.

The silver kob reaches 1.4 m in length at about 25 years of age and a weight of 36 kg. This species occurs from northern Namibia to the Eastern Cape in depths of less than 150 m.

The squaretail kob reaches 120 cm at about 13 years of age and a weight of about 13 kg. This fish has a limited distribution and is endemic to southern Africa, from Mozambique to Port Elizabeth. It is usually found north of Durban, where it appears to be fairly resident, congregating in large shoals around deep reefs and pinnacles. Unlike the dusky kob, it rarely ventures near the shore or into estuaries.

Commercial importance

All three large kob species are highly sought after by both recreational and commercial fishers as the flesh is delicious.

Dusky kob are caught by recreational estuarine and shore anglers and by recreational and commercial skiboat fishers, as well as by commercial beach seine netters.

Silver kob are an important component of the catches of shore anglers in the Western Cape and are caught by commercial and recreational skiboat fishers. They are also caught in beach-seine nets in False Bay and are an important by-catch taken by inshore trawlers.

Squaretail kob are caught by commercial and recreational skiboat fishers and are caught as by-catch by the prawn trawlers operating on the Tugela Banks

What you can do to help

There are a limited number of kob in the ocean. If anglers catch more than can be replaced by their breeding, over-fishing results. This results in fewer and fewer kob being caught and their average size becoming smaller and smaller. To prevent this, there are regulations to control the number of kob that are caught. These regulations ensure that everyone catches their fair share and that kob can continue to be caught in the future.

Obey the fishing regulations

- Minimum size limits give fish a chance to breed at least once before they are caught and protect the fish when they are growing at their fastest.
- Bag limits restrict daily catches so that there will be enough fish for everyone. Scientists work out how many fish can be harvested safely. This information is used to set a bag limit that restricts the number of fish caught per day. This prevents more successful anglers from catching great numbers of fish, so leaving some behind for less successful anglers.

Join the tagging programme and tag and release your fish.

Tagged fish can provide scientists with useful information about the seasonal movements of fish, their growth rates and in some cases, the size of the stock. They also give anglers an opportunity to become involved in an exciting research programme; taggers receive information about their tagged fish, if they are recaptured. If you catch a fish with a tag in it, read the tag number or remove the tag from the fish and measure the fish (from the tip of the mouth to the fork of the tail). Send the tag number (or tag), the type of fish, where it was caught (try to give a specific location), the date caught, the length and/or weight of the fish and your name, address and telephone number to: The Tagging Officer, Oceanographic Research Institute, P.O. Box 736, Durban, 4000.

Author: Judy Mann-Lang September 2000

Classification:

PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Sciaenidae
GENERA:	*Argyrosomus* and *Otolithes*
COMMON NAME:	Kob, salmon, kabeljou, croaker, drum

FURTHER INFORMATION:

• KwaZulu-Natal Wildlife (KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
• Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik Publishers, Cape Town.

RELATED FACTSHEETS:

• Fishing Regulations • Recreational Angling • Sustainable Use of Coastal Resources

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

King Mackerel 3C

The king mackerel (or cuda), belongs to the same family as the bonitos, tunas and other mackerel (Family: Scombridae). King mackerel have an elongated body, blue-grey above with silvery sides, irregular vertical dark bars on the flanks, a white belly and distinctive keels near the tail. The scales are minute and give the body a characteristically smooth surface. It has a deeply forked tail, indicative of its ability to swim very fast.

King mackerel are widely distributed and are found in warm waters throughout the Indo-Pacific. On the east coast of South Africa it ranges southwards from Mozambique to KwaZulu-Natal (KZN) and the eastern Cape, occasionally extending as far south as Mossel Bay. This pelagic fish commonly occurs in coastal, inshore waters.

Breeding habits

King mackerel have a protracted spawning season extending over the spring and summer months. The major spawning area off the east coast is probably in Mozambique waters, as it appears that little or no spawning occurs off the KZN coast. In fact, 60% of mature females captured off the KZN coast are in a post spawning condition, leading to speculation that the migration of large king mackerel into our waters is a post spawning migration. Males mature at 2.5 kg, which is much smaller than the 10 kg at which females mature.

Feeding habits

This coastal migrant is a fierce predator that, as a juvenile, hunts in large shoals. The fast swimming adults hunt either alone or in small groups. The mouth is large and armed with razor-sharp, triangular teeth. King mackerel feed primarily on fish such as anchovies, mackerel, sardines and, as juveniles, on a variety of small crustaceans.

Life cycle

Although king mackerel weighing more that 40 kg are occasionally caught, these are exceptional and most king mackerel caught off our coast are young fish, between one and three years of age (5 – 10 kg). King mackerel grow very fast and reach 80 cm in their first six months. Adults can attain 2.2 m (44.9 kg) at an age of about five years.

Conservation status

King mackerel is one of the most important recreational game fish species caught on the KZN coastline. In 1998, a catch of 36 t of king mackerel was reported by commercial fishers, while about 43 t was reported by recreational ski-boat fishers and spearfishers. Although many fishers do not report their catches, these figures give some idea of the large amount of king mackerel caught. The quantity of king mackerel caught each year is, however, very variable and depends on the survival and growth of young fish during the previous year. The average weight of the fish taken in the fishery is 5.5 kg for males and 6 kg for females. This is rather alarming as the average size of the females captured is far below 10 kg – the

King Mackerel

size at which they reach sexual maturity. However, if a minimum size limit of 10 kg was introduced, this would exclude 90% of the current catch and result in both short – and long-term economic and social problems.

What you can do to help

Where available, fill in catch cards with accurate information about your catches and co-operate with fisheries officers or scientists collecting information on your catch.

These studies provide information about the number of anglers and the number of fish being caught. Scientists can tell the age of fish by counting rings in their ear bones (otoliths) and relating this to the size of the fish. The age that the fish start breeding and their breeding season are obtained by cutting open the fish and inspecting the state of maturity of their reproductive organs. Research is also conducted on the diet of the fish. Scientists use all this information in computerised mathematical models to determine the most effective management options. The best options can be then drafted into legal regulations that are used to manage recreational species such as the king mackerel.

Tag and release your fish.

Tagged fish can provide scientists with useful information about the seasonal movements of fish, their growth rates and in some cases, the size of the stock. They also give anglers an opportunity to become involved in an exciting research programme, taggers receive information about their tagged fish, if they are recaptured. This is particularly important for migratory fish such as the king mackerel. At present, scientists know very little about the migration patterns of king mackerel, their growth and death rates or the amount of mixing between Mozambique and KwaZulu-Natal stocks. More tagged fish will help scientists to improve their understanding of king mackerel and ultimately contribute to the sound management of this valuable resource. If you catch a fish with a tag in it, read the tag number or remove the tag from the fish and measure the fish (from the tip of the mouth to the fork of the tail). Send the tag number (or tag), the type of fish, where it was caught (try to give a specific location), the date caught, the length and/ or weight of the fish and your name, address and telephone number to: The Tagging Officer, Oceanographic Research Institute, P.O. Box 736, Durban, 4000.

Only catch what you can eat – don't be greedy.

King mackerel are delicious when eaten fresh.

Author: Judy Mann-Lang September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Scombridae
GENUS:	*Scomberomorus*
SPECIES:	*commerson*
COMMON NAME:	King mackerel, cuda, couta, katonkel

FURTHER INFORMATION:

• KwaZulu-Natal Wildlife (KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
• Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik Publishers, Cape Town.

RELATED FACTSHEETS:

• Recreational Angling • Sustainable Use of Coastal Resources • Fishing Regulations

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

Mudskippers / Mudhoppers 3C

A FISH OUT OF WATER

Some 350 million years ago in a fresh-water swamp, fish began to haul themselves out of water and became the first back-boned creatures to invade the land. To cross this frontier they, like the first terrestrial invertebrates, had to solve two problems: first, how to move out of water, and second, how to obtain oxygen from the air. There is one fish alive today that manages to do both these things – the mudskipper or mudhopper. This fish is not closely related to those early land pioneers but even so, it can give us a hint as to how land was colonised by vertebrates. This fish stores water in its gill chambers and can absorb oxygen from the air through its moist skin. It also has leg-like fins used for walking.

Habitat

You can find mudskippers in mangrove swamps and muddy estuaries in many parts of the tropics. They lie on the glistening mud or cling to the aerial roots of mangroves above the water level and skitter back to the safety of the water if disturbed. While not very common in South Africa, there are two species which can be found in mangrove swamps on the east coast. These are the bigfin mudhopper, *Periophthalmus sobrinus*, and the African mudhopper, *Periophthalmus koelreuteri africanus,* which are very similar except for the front dorsal fin, which is taller in the bigfin mudhopper.

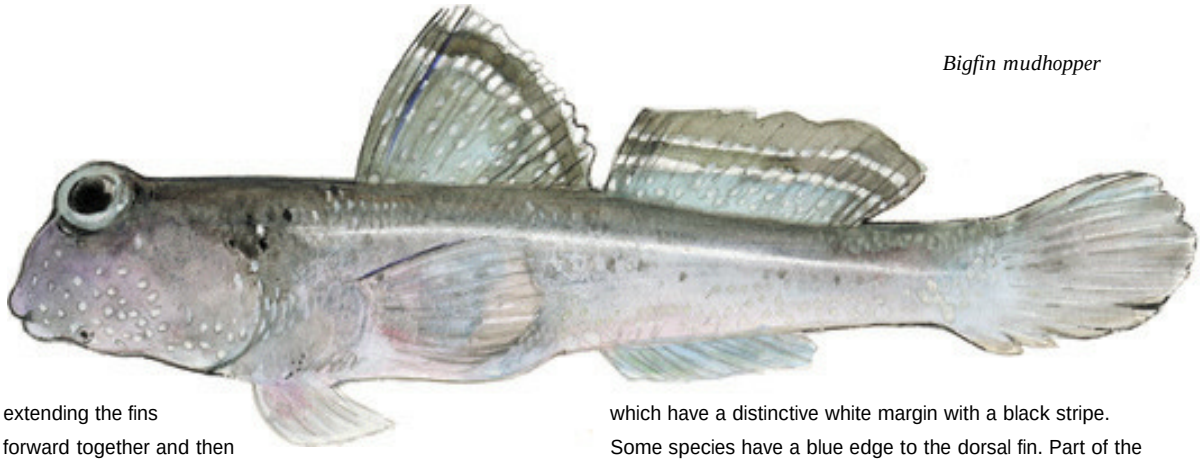
Biology

Mudskippers are small, only a few centimetres long. They are inconspicuous speckled greyish-brown fish, related to gobies. They have a steep forehead and protruding pop-out eyes reminiscent of frog's eyes and an advantage for spying flying prey. They come out of water to feed on insects and other invertebrates that swarm on the soft oozy surface of the mud.

Movement on land and water

Periophthalmus moves in a fascinating variety of ways using its specially adapted paired fins. The pectoral fins resemble the forelimbs of terrestrial animals but with fin-rayed extremities. The fleshy base of these fins has an elbow-like bend, supported internally by bones. The pelvic fins – on the underside of the fish are connected and spread out like semicircular fans, which are very flexible. Submerged in water the mudskipper swims like other fishes but fairly slowly. However, it can also skim quickly across the surface of the water in a series of bounds. It swims with its body just submerged and its eyes protruding above the water level, then shoots into the air by a flick of its tail and spreads the pectoral fins as stabilising 'wings'. On land, the mudskipper uses the pectoral fins as crutches,

The African mudhopper clings to mangrove roots



Bigfin mudhopper

extending the fins forward together and then swinging the body forward between them. 'Crutching' is fairly slow and not much use for catching food or escape. For these needs, the fish uses a skipping motion to hop across the mud. It bends the tail forward to one side and pushes off with its tail and pelvic fins and then uses the pectoral fins for gliding and landing.

Breathing

Mudskippers breathe by means of gills both in water and on land. When submerged – in typical fish fashion – the water flows in through the mouth, over the gills and out through the gill slits. Out of water they use special methods to keep the gills wet and supplied with oxygen. On first leaving the water the fish takes a gulp of air and then closes the gill slits forming a sealed chamber with some water and a lot of air to supply the oxygen. But they must live within reach of water to keep the gills wet. When the fish returns to the water it lies first with one side of the head in the water and then the other, to replenish the water in the storage chamber above the gills. They often sit with the tail end in the water and the skin may absorb some oxygen, but the gills are the main respiratory surfaces.

Reproduction and breeding

Mudskippers seem to be more at home out of water than in it. They even court and mate out of water. The male constructs and protects a mud nest in the estuary. The nest has a chamber about 30 cm below ground level, permanently filled with water, and twin openings surrounded by turrets. The male displays to the female by erecting his dorsal fins, which have a distinctive white margin with a black stripe. Some species have a blue edge to the dorsal fin. Part of the eye is specifically modified for intense colour vision, and as a result the fin displays are powerful signals of warning or attraction. After mating the female lays the eggs on the walls of the nest, which is then protected by the territorial male. The young eventually hatch and remain in the nest chamber for a period before swimming away. They are totally aquatic and only become amphibious, living on land and sea, after metamorphoses into the adult form.

Importance to humans

Mudskippers have no real economic value and are too small to provide a food source for humans. In some countries, such as Malaysia, they occur in vast numbers and must help to keep down the populations of swamp insects including mosquitoes. Their strange behaviour and adaptations to living out of water are of interest to scientists, aquarists and other naturalists.

Author: Margo Branch September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Gobiidae
GENUS & SPECIES:	*Periophthalmus koelreuteri africanus* – African mudhopper *Periophthalmus sobrinus* – Bigfin mudhopper

FURTHER INFORMATION: • Attenborough, D. *Life on Earth*. Readers Digest, William Collins and the British Broadcasting Corporation. (Video and book) • Berjak, P. Campbell, G. K., Huckett, B. I. & Pammenter, N. M. 1977. *In the mangroves of Southern Africa* . Wildlife society of Southern Africa. Natal Branch. • Smith, M.M. & Heemstra P.C. 1986. *Smiths' Sea Fishes*. Macmillan South Africa, Johannesburg.

RELATED FACTSHEETS: • Mangrove Swamps

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

Potato Bass 3C

This large, robust member of the rockcod family (Family: Serranidae) is grey to brown in colour and covered in dark oval spots. The tail is rounded and the eyes are quite large. Potato bass can attain 2 m in length and may weigh up to 100 kg. Their name is a reference to the potato-shaped spots on the body. Interestingly, the potato bass is related to the tiny sea goldies commonly found on reefs in KwaZulu-Natal. The rockcod family is, therefore, very diverse in both size and shape.

The potato bass frequents rocky and coral reefs down to depths of 150 m. It is often found sheltering in caves, but is usually territorial over large areas of a reef. Potato bass occur along the whole east coast of Africa, into the Indo-West Pacific, to Japan and Australia.

Breeding habits

Although few studies have investigated the breeding behaviour of the potato bass, it appears that spawning occurs in spring and summer. Sexual maturity is reached at about 90 cm and pairing during the breeding season appears to involve elaborate courtship displays, complete with colour changes. During courtship, both the male and female fish become much lighter in colour and engage in a ritualised mating 'dance' that includes rubbing their bodies together and swimming in tight circles a few metres above the reef. After this sensuous display, eggs and sperm are released and fertilisation occurs.

Feeding habits

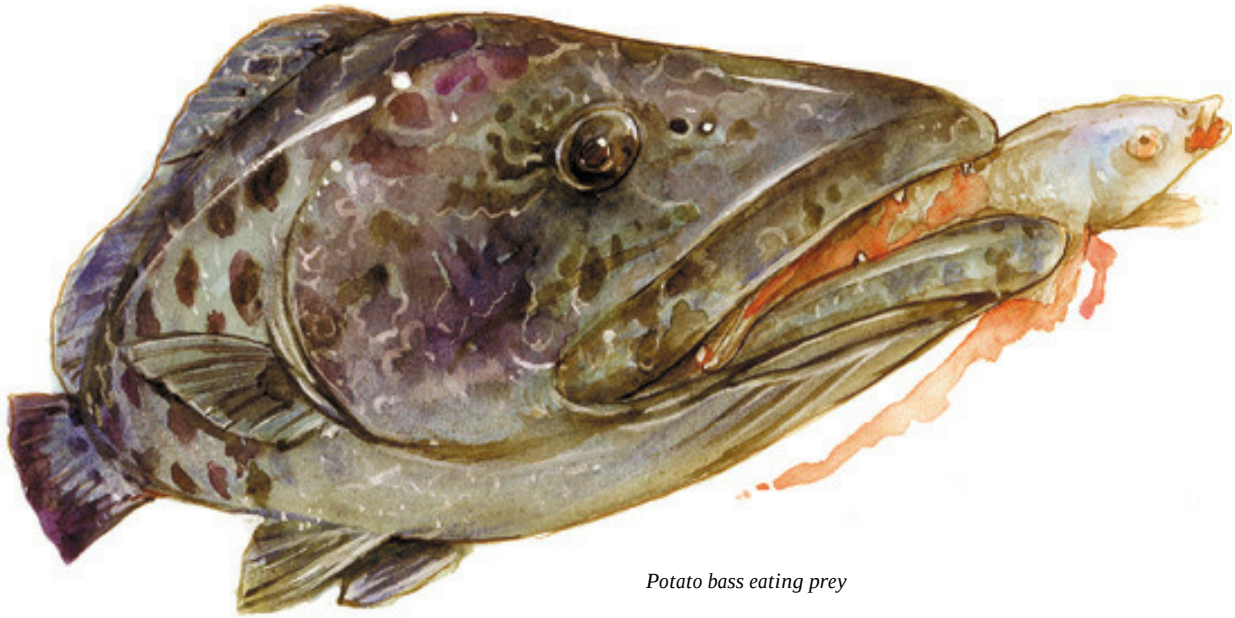
This solitary predator feeds on a variety of fish, crabs and rock lobster using its huge mouth to engulf prey. Prey are usually ambushed and snatched after a short chase. The jaws of the potato bass bear several rows of backward-facing teeth as well as a number of small, sharp canines.

Life cycle

This highly territorial species is one of the most dominant predators on a reef. Potato bass probably grow very slowly, a factor that makes them extremely vulnerable to over-exploitation. Since few studies have been undertaken on this species, little is known about its life cycle.

Conservation status

This slow growing, long-lived fish is vulnerable to over-exploitation because it is commonly found in shallow waters



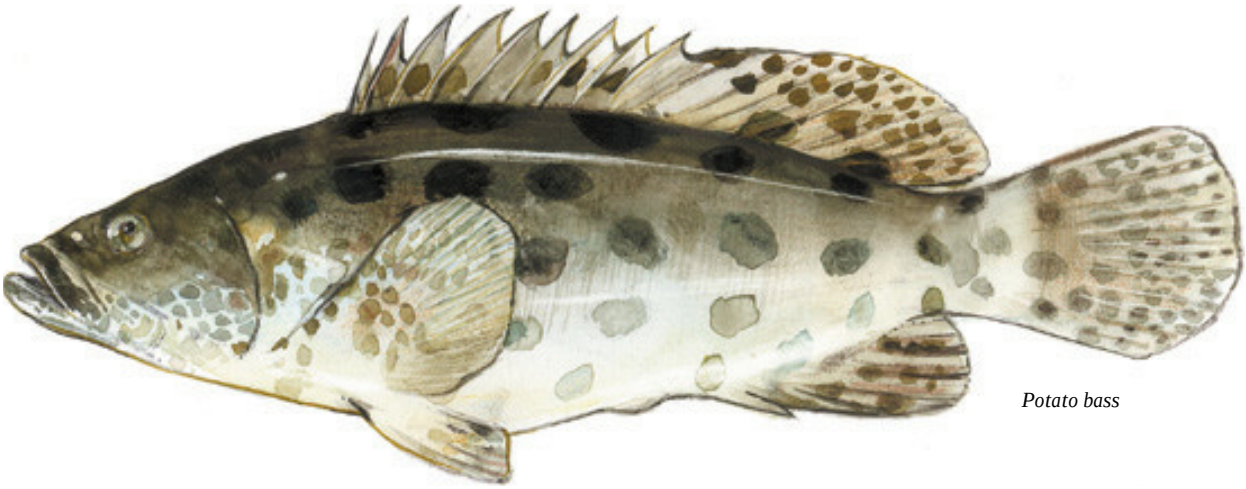
Potato bass eating prey

and has an inquisitive nature. As top predators, potato bass are often the first to take a bait and as a result, they are easily caught. In fact, the absence of these fish on a reef is an indication of intense fishing pressure. Spearfishers in particular find the potato bass an easy target as the fish will venture out of its hole to investigate a diver in its territory. As this fish does not move very great distances, marine reserves are an effective tool in their protection. In fact, the abundance of these large predators on the protected reefs of the Maputaland and St Lucia marine reserves in KwaZulu-Natal has increased significantly since the establishment of the reserves.

What you can do to help

- Although normally placid, this fish often appears to be inquisitive, swimming close to divers. If provoked, potato bass may behave aggressively. When diving, make sure that you do not harass the potato bass.
- Potato bass are considered to be a vulnerable species and are specially protected in South African waters. Fishers may not catch potato bass.
- Report anyone seen harassing or catching potato bass to your nearest fisheries officer.

Author: Judy Mann-Lang September 2000



Potato bass

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Serranidae
GENUS:	*Epinephelus*
SPECIES:	*tukula*
COMMON NAME:	Potato bass

FURTHER INFORMATION:

• KwaZulu-Natal Wildlife (KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
• JLB Smith Institute of Ichthyology Private Bag 1015, Grahamstown, 6140
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik Publishers, Cape Town.

RELATED FACTSHEETS:

• Reef Fish • Marine Protected Areas

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

Seahorses 3C

With their long snouts, curly tails and upright posture, it is difficult to imagine that seahorses are fish. But like all fish, seahorses hatch from eggs, draw oxygen from water passing over their gills and use fins to propel themselves through water. The body of the seahorse is covered with stiff, ring-like plates.

Seahorses have long captured the imagination of human beings. In classical mythology, giant seahorses with long golden manes, drew the chariot of Poseidon, god of the sea. Today, seahorses have become such a popular marine icon that we are far more likely to see their stylised images in posters, fabrics or ceramics, than we are to see them in their natural habitat.

Seahorses are thought to have evolved at least 40 million years ago. Today, 30 to 40 species of seahorse occur in coastal and estuarine waters around the world. They range in size from the largest, *Hippocampus abdominalis,* which measures 35 cm from head to tail, to the smallest, *Hippocampus barbiganti*, which is only 3 cm.

In South Africa, so little is known about the seahorses that occur around our coast that even their names and distributions have not been confirmed. Five different species are believed to inhabit our waters. The best known, and the only seahorse in the world that is believed to be endangered, is the Knysna seahorse, *Hippocampus capensis*. This species is known to occur in the Knysna, Keurbooms and Swartvlei estuaries on the south coast.

The yellow seahorse, *Hippocampus kuda* is the largest of South African seahorses and may grow up to 30 cm in length. It is found in nearshore habitats between Mossel Bay and Mozambique. The thorny seahorse, *Hippocampus histrix*, and the longnose seahorse, *Hippocampus trimaculatus*, are both very rare. The former has been recorded near Durban and the latter has only been sighted at Morgan's Bay in the Eastern Cape. The crowned seahorse, *Hippocampus whitei*, has been recorded in KwaZulu-Natal, but there is some dispute over it's specific name.

Feeding

Seahorses feed on small, soft planktonic organisms that are sucked into the small mouth. In aquariums they are fed on brine shrimps, hatched from special soft shells. If eggs with hard shells are used they seem to clog the tubular mouth of the seahorse, resulting in death.

Breeding

Perhaps the most fascinating aspect of seahorse behaviour is that the male plays a more prominent role in pregnancy and birth than the female does. Although other fish species are known to tend their eggs, there is no other male fish that is better adapted to care for its young than the tiny seahorse.

Seahorses mate for life and are highly territorial, with the male seahorse occupying a tiny patch of turf within the female's much larger area. They inhabit shallow seagrass beds in estuaries and warm coastal waters, coiling their tails around submerged objects to prevent themselves from being washed away by tidal currents.

In early spring, when water temperatures start to rise, seahorse couples engage in an extraordinary mating dance. Moving vertically in the water column, the male tries to present his brood pouch to his partner so that she may deposit her eggs into the pouch. The eggs are fertilised in the male's pouch, the soft tissues of which provide the eggs with the oxygen and nutrients that are vital for their development.

As the embryos develop and the male's pouch begins to swell, the seahorse pair remain in daily contact. The pregnancy lasts between two and four weeks and during this period the female seahorse develops a new batch of eggs. As soon as the male

Male seahorse giving birth

Seahorses cling to eelgrass

seahorse has expelled his brood, the female will deposit another batch of eggs into his pouch. In this way, several batches of offspring will be born to a breeding pair of seahorses in a single season. Young seahorses are expelled from the male's brood pouch by abdominal contractions that may last for several hours. They are fully developed when they pop out and drift out of their parents' territory on currents. At this stage young seahorses are black in colour and easy prey for crabs and fish. As they grow they develop the subtle camouflage that will enable them to blend into their environment.

The Knysna seahorse under threat

Like many animals that depend on a specific habitat for their survival, seahorses around the world are becoming victims of burgeoning human populations and the associated habitat destruction. The Knysna seahorse is no exception.

This mottled green or brown seahorse occurs singly or in small groups, usually in association with submerged aquatic plants such as the eelgrass, *Zostera capensis*. No published information is available on the abundance of the Knysna seahorse, but collection records suggest that this species is most frequently encountered in the Knysna estuary. The seahorse reaches a maximum length of 120 mm and sexual maturity is attained within one year, at a length of approximately 65 mm. This species is well adapted to estuaries and can survive a wide range of salinities. It cannot, however, survive in fresh water.

Because of its limited distribution, the Knysna seahorse is protected by law in the Knysna estuary. But human settlements and associated industrial, domestic and recreational activities are increasing around all four estuaries where the seahorse has been recorded. Researchers and National Parks managers cite Knysna's rapid growth as a threat to the seahorse populations. Whereas previously the thickly forested lagoon catchment provided a buffer zone and filter for pollutants entering the system, developments right to the water's edge allow polluted water to flow directly into the lagoon. Anything which affects the submerged plant beds of the estuaries will impact on seahorse populations.

The Knysna seahorse is not only threatened by pollution, however. A growing trade in seahorses also poses a threat to the fish's survival. Live seahorses are highly prized by the international aquarium trade and it is estimated that more than one million of these creatures are sold to aquaria annually. A second problem is the trade in dried seahorses which are sold as curios or for use in traditional Chinese medicines. These delicate and little-known animals are thought to cure a range of complaints, from asthma and incontinence to baldness and impotence. Because of their hard outer armour their quaint shape is perfectly preserved when dried.

Related species

The pipe fish is a related species which also has a prehensile tail and broods its young.

Author: Claire Attwood September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthys – Bony fish
FAMILY:	Sygnathidae – Seahorses and pipefishes
GENUS:	*Hippocampus*
SPECIES:	*capensis*
COMMON NAME:	Knysna seahorse

FURTHER INFORMATION: • Day, E. 1997. *Seahorses - Drifting into Danger*. African Environment and Wildlife. Vol 5 no 7.

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

Shad / Elf 3C

Shad are one of South Africa's most popular angling fish and they are pursued by over 300 000 anglers every year. Their streamlined bodies are perfectly shaped for speed through the water and their silvery coloration, light beneath and darker above, helps them to blend in with the ocean.

Shad are widely distributed in the warm coastal waters of the Indian, Atlantic and Pacific Oceans. The South African stock is, however, distinct which means that we have the responsibility to look after the shad along our coast. Shad are found in sandy and rocky areas from the shore down to depths of 100 m.

Breeding habits

Tagging studies have shown that shad migrate from the cool waters of the western and eastern Cape to KwaZulu-Natal each winter. This migration is associated with one of their primary prey – the sardines, which migrate to KwaZulu-Natal during the annual "sardine run". Shad breed in the warmer waters of KwaZulu-Natal from spring to mid-summer. They reach sexual maturity at one to two years of age, when they are about 25 – 30 cm in length. Large female shad may produce up to two million eggs in one season, although most females produce about one million eggs each season. The eggs hatch after a few days and the pelagic larvae drift passively inshore of the Agulhas Current back to the south-eastern Cape, where they spend their first year living in large marine bays. During their drift southwards the young fish have very little chance of survival as the sea teems with filter feeders and carnivorous zooplankton that thrive on gulping down small fish larvae.

Feeding habits

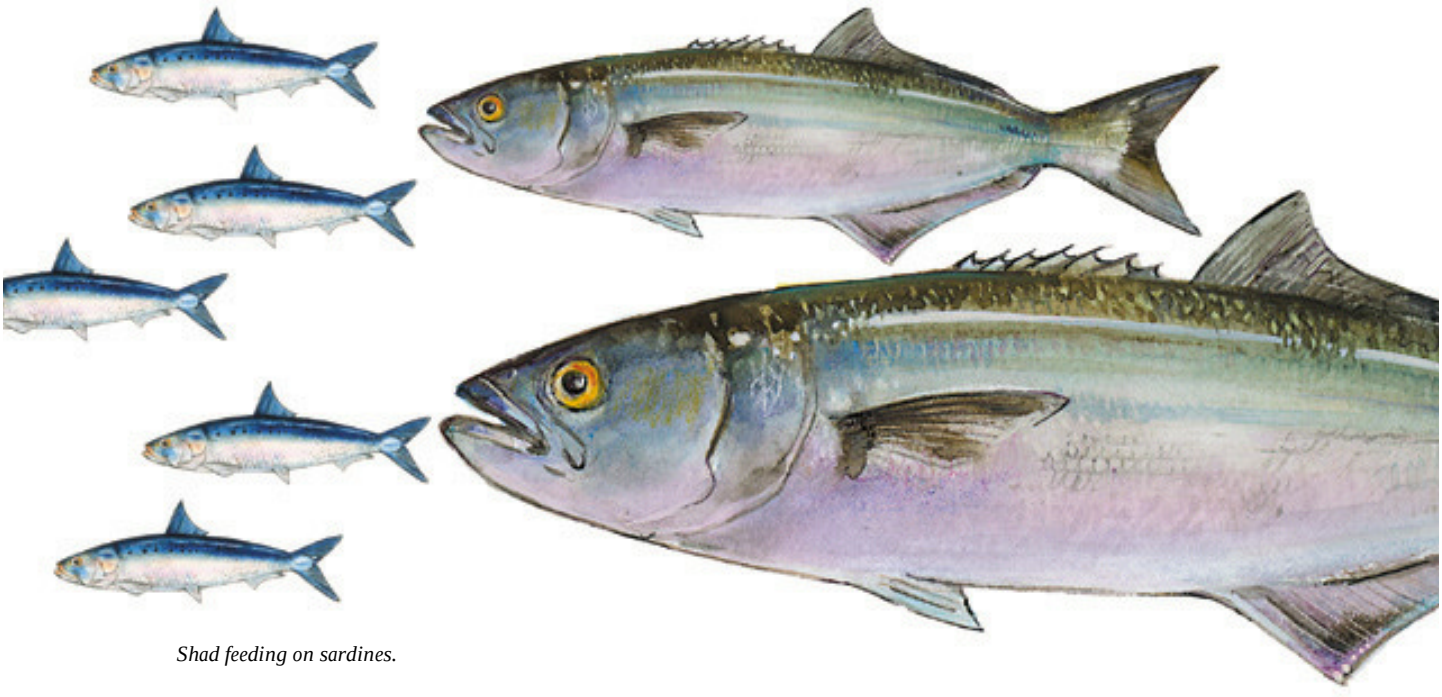
As larvae, shad feed on small marine creatures drifting in the open ocean. Adult shad are voracious predators (piscivores), preying on small fish such as sardines, pinkies and strepies (karanteen). Their razor sharp teeth are able to tear quite large prey into shreds. Shoals of shad hunt by sight in clear water, during the day. They favour sandy sea-beds along the edge of reefs. Shad, in turn, are hunted by other predators such as large gamefish, sharks and dolphins.

Life cycle

Shad can grow to one metre in length and a weight of 10 kg. A large fish of this size would be about 10 years old but given the high fishing pressure along our coast, few reach this size.

Conservation status

Shad have been caught since the early 1900s and there are records of huge shoals of shad being netted off Durban. Shad catches declined severely during the 1960s and 1970s, primarily because of overfishing. A detailed study undertaken by scientists at the Oceanographic Research Institute in Durban showed that a dramatic decrease in fishing effort was



Shad feeding on sardines.

required to rebuild the stocks. To achieve this, a daily bag limit, a closed season and a minimum size limit were introduced. These limitations have been successful in rebuilding the shad stocks to their present levels. Bag and size limits, and closed seasons can be adjusted as scientists learn more about the biology of these fish and the status of the stocks. Shad are the most important fish caught by the recreational shore fishery along the entire eastern seaboard. They are also caught off skiboats, particularly in the south western Cape, and in treknets in False Bay.

What you can do to help

There are a limited number of shad in the ocean. If anglers catch more than can be replaced by their breeding, over-fishing results. This results in fewer shad being caught and their average size becoming smaller. To prevent this, there are regulations to control the number of shad that are caught. These regulations ensure that everyone catches their fair share and that shad can continue to be caught in the future.

Obey the fishing regulations

- Minimum size limits give fish a chance to breed at least once before they are caught and protect the fish when they are growing at their fastest.
- Bag limits restrict daily catches so that there will be enough fish for everyone. Scientists work out how many fish can be harvested safely. This information is used to set a bag limit that restricts the number of fish caught per day. This prevents more successful anglers from catching great numbers of fish, especially when the fish are 'on the bite', so leaving some behind for less successful anglers.
- Closed seasons protect fish during vulnerable stages in their life cycles. The shad closed season protects the fish at the peak of their breeding season.

Where available, fill in catch cards with accurate information about your catches and co-operate with fisheries officers or scientists collecting information on your catch.

These studies provide information about the number of anglers and the number of fish being caught. Scientists can tell the age of fish by counting rings in their ear bones (otoliths) and relating this to the size of the fish. The age that the fish start breeding and their breeding season are obtained by cutting open the fish and inspecting the state of maturity of their reproductive organs. Research is also conducted on the diet of the fish. Scientists use all this information in computerised mathematical models to determine the most effective management options. The best options can then be drafted into regulations that are used to manage recreational species such as shad.

Tag and release your fish.

Tagged fish can provide scientists with useful information about the seasonal movements of fish, their growth rates and in some cases, the size of the stock. They also give anglers an opportunity to become involved in an exciting research programme; taggers receive information about their tagged fish, if they are recaptured. If you catch a fish with a tag in it, read the tag number or remove the tag from the fish and measure the fish (from the tip of the mouth to the fork of the tail). Send the tag number (or tag), the type of fish, where it was caught (try to give a specific location), the date caught, the length and/or weight of the fish and your name, address and telephone number to: The Tagging Officer, Oceanographic Research Institute, P.O. Box 736, Durban, 4000.

Only catch what you can eat – don't be greedy.

Shad lose quality, texture and flavour when frozen but are delicious when eaten fresh.

Author: Judy Mann-Lang September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Pomatomidae
GENUS:	*Pomatomus*
SPECIES:	*saltatrix*
COMMON NAME:	Shad, elf, bluefish, tailor

FURTHER INFORMATION:

• KwaZulu-Natal Wildlife (KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
• Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik Publishers, Cape Town.

RELATED FACTSHEETS: • Sardine Run • Recreational Angling • Fishing Regulations

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

Sharks 3C

Sharks, rays, skates and chimeras are cartilaginous fish belonging to the class Chondrichthyes. A number of characteristics distinguish cartilaginous fishes from bony fish: most importantly, their skeletons are not composed of rigid bone, but of gristle-like cartilage; they have a number of gill slits rather than a single gill opening and their fins are composed of fibrous supporting filaments rather than rays or spines. Instead of scales, most cartilaginous fish have rough skin, embedded with sharp, toothlike projections known as dermal denticles.

There are approximately 350 species of sharks in the world, ranging in size from the 16 cm-long dwarf dogshark to the whale shark at about 12 m. At least 98 species of sharks inhabit the waters off South Africa.

Feeding

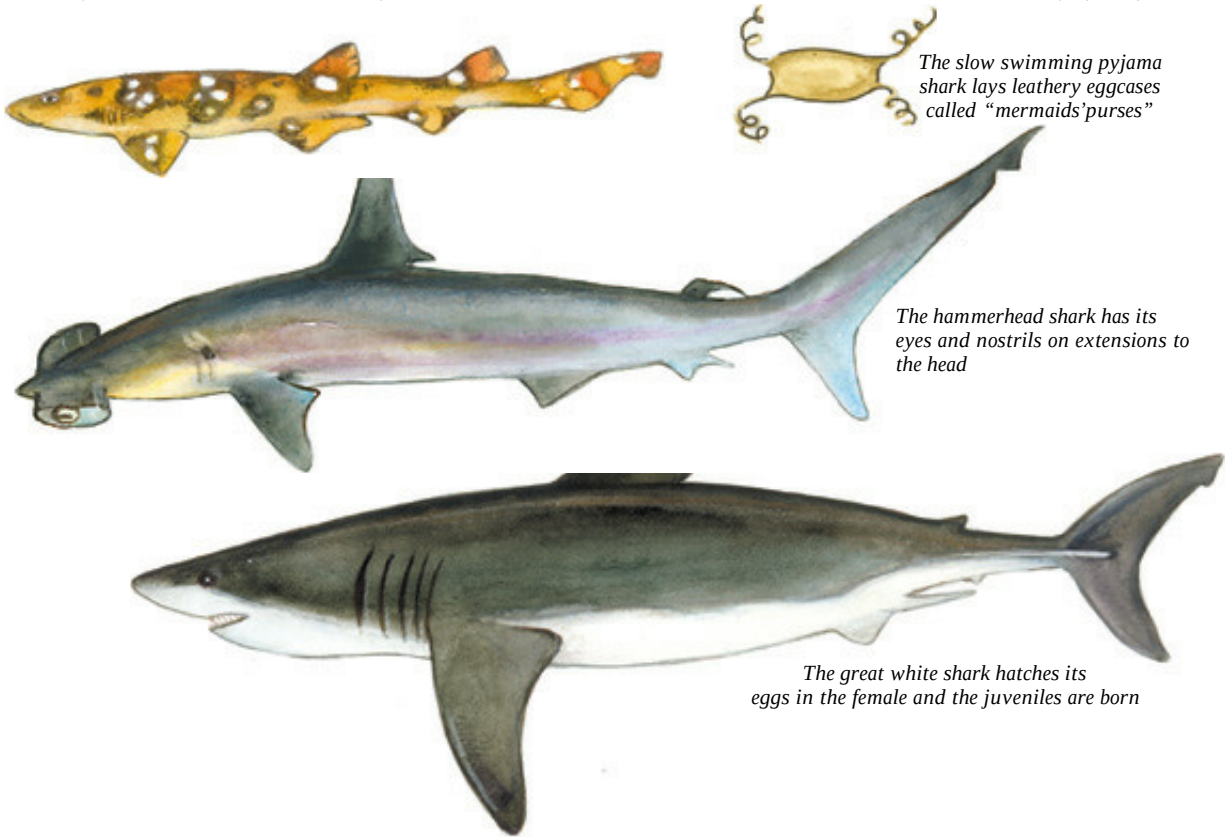
Most sharks are carnivorous yet their feeding strategies vary widely. The very large sharks, such as basking sharks and whale sharks, are filter-feeders that sieve shrimps, small fish, squid and plankton out of the water as it flows through their mouths and out of their gill slits. Bottom-feeding sharks, such as shysharks, feed on shellfish and other burrowing animals that they extract from the substrate. Pelagic sharks, like the tiger shark, eat all kinds of food, from large fish to marine mammals and tough-shelled turtles. Human beings do not form part of a shark's diet and, although vast numbers of people use the sea, less than 100 shark attacks are recorded annually around the world. Humans are far more likely to be bitten by a poisonous snake or struck by lightening than they are to be bitten by a shark.

Sharks' teeth provide a good indication of the kind of food they eat: small, spikey teeth are used for gripping small prey, while flat, blunt teeth are suitable for crushing hard-shelled prey. Long, pointed teeth are used for seizing prey that is swallowed whole. Sharks with triangular, serrated teeth are able to cut their prey into sections by shaking their heads from side to side. These sharks such as the great white, are able to attack prey that is larger than a single mouthful.

During its life a shark will replace thousands of teeth. When the front ones become worn or break, they are replaced by new ones in the row behind. Some sharks shed one or two teeth at a time while others replace a whole row at a time. Sharks' teeth are embedded in their gums and are not directly attached to their jaws, like those of bony fishes.

Breeding

In contrast to bony fishes, which usually fertilize their eggs in the water, sharks' eggs are internally fertilized. Male sharks possess a pair of claspers that are formed from the inner edge of their pelvic fins. During mating one of the claspers is rotated forward and inserted into the female's body opening



The slow swimming pyjama shark lays leathery eggcases called "mermaids'purses"

The hammerhead shark has its eyes and nostrils on extensions to the head

The great white shark hatches its eggs in the female and the juveniles are born

or cloaca. Sperm is then pumped into the female and the fertilization of her eggs takes place.

While bony fishes tend to lay vast quantities of eggs, sharks produce only small numbers of young. However, newly-hatched bony fishes are undeveloped at birth and vulnerable to predation, while shark pups are large and well developed at birth and have a much better chance of survival.

Sharks have three distinct modes of reproduction.

Oviparous development is the most primitive form. Here the embryo, with its adequate yolk supply, is encased in a 'mermaid's purse' which is laid by the female and attached to a suitable underwater object by coiled tendrils. Development takes place inside this egg case from which the young shark hatches. Catsharks and shy sharks are oviparous sharks.

Ovoviviparous development is the most common mode of reproduction among sharks. In this mode the embryo hatches from the egg while it is still in the mother's uterus. Here development continues and the embryo is nourished by its own yolk sac before being born in an advanced state. Dogfish are ovoviviparous sharks. Ragged-tooth sharks practise a bizarre form of intra-uterine cannibalism where the first formed juveniles feed off the other eggs and embryos and only two pups are born.

Viviparous development is the most advanced. Here the embryo not only develops within the uterus, it is also nourished by it, either through a placental connection or by a form of uterine milk that bathes the embryos. Hammerhead sharks are viviparous sharks.

The senses of sharks

Sharks have the same five senses as people – they can see, hear, taste, touch and smell. They also have a sixth sense that allows them to detect weak electrical signals generated by their prey. This electro-sense may also help them to navigate on their journeys in the sea.

Individual shark species have variously developed senses, depending on their habitat and behaviour. Most sharks have large eyes that are similar in structure to those of other vertebrates. A well-developed tapetum lucidum – the reflective layer that enhances low-light vision – allows sharks to see well in deep or murky water. On bright, sunny days a shark can shield its tapetum with a layer of pigment. Some sharks have a transparent third eyelid known as the nicitating (or blinking) eyelid which protects the eye when the shark attacks its prey or swims up to unfamiliar objects.

The nostrils of sharks are used exclusively as olfactory organs. Many sharks that live on the seabed have feelers or barbels on their noses which they use to probe the sand for food.

Small sensory pores, called ampullae of Lorenzini, occur on the heads of most sharks. These deep pores are full of jelly and connected to nerves. They are used to detect weak electrical signals produced by their prey's muscles and bodily processes. Sometimes sharks are confused by electrical signals given off by metal, so they will bite shark cages.

A favourite catch

Sharks and rays have long been a favourite catch of sport fishers who value them for their fierce fighting strength. The largest shark ever caught on hook and line in South Africa was a great white shark that weighed 742 kg. Shore anglers still target sharks and rays. Some of their favourite catches are bronze whalers, smooth hammerheads, giant guitarfish and honeycomb rays. A conservation ethic has been introduced to fishing competitions and anglers weigh their shark catches and then tag and release them.

In South Africa soupfin and smooth hound sharks are caught by longline fishing boats. The meat is exported to Europe and Australia and the fins are traded in the Far East where they are highly prized as an ingredient for soup.

Hake trawlers catch many sharks, although they do not target sharks and rays. Trawling is such an unselective means of catching fish that large numbers of soupfin sharks, dogfish, catfish, smoothhound sharks, skates and rays are regularly caught in trawl nets. Most of these fishes are discarded.

Author: Claire Attwood September 2000

FURTHER INFORMATION:

• Payne, A.I.L. and Crawford, R.J. (Eds). 1989. *Oceans of Life off South Africa*. Vlaeberg Publishers, Cape Town.
• Smith, M.M. and Heemstra, P.C. 1986. *Smith's Sea Fishes*. Macmillan. South Africa.
• Van der Elst, R. 1986. *Sharks and Stingrays*. C. Struik Publishers, Cape Town
• Compagno, L.J.V., Ebert, D.A. & Smale, M.J. 1989. *Guide to the sharks and rays of Southern Africa*. Struik Publishers, Cape Town.
• Natal Sharks Board Private Bag 2, Umhlanga Rocks 4320. Tel: 031 566 0400
• South African Museum Shark Research Unit PO Box 61, Cape Town 8000. Tel: (021) 424 3330

RELATED FACTSHEETS:

• Great White Shark • Whale Sharks • Skates and Rays • Ragged-tooth Shark • Shark Diving • Aquariums in 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

Great White Shark 3C

There are over 350 species of sharks in the world. Members of this group of animals range from the huge, plankton-eating whale sharks to the somewhat comical shyshark which, when captured, will curl its body and cover its eyes with its tail. Yet, despite this great diversity, humans usually think of sharks as conforming to a single image; that of the great white shark, Carcharodon carcharias. *Sensationalised films and media coverage have been largely responsible for portraying the great white shark as a blood thirsty man-eater; since the 1970s the "great white" has enjoyed an undeserved notoriety.*

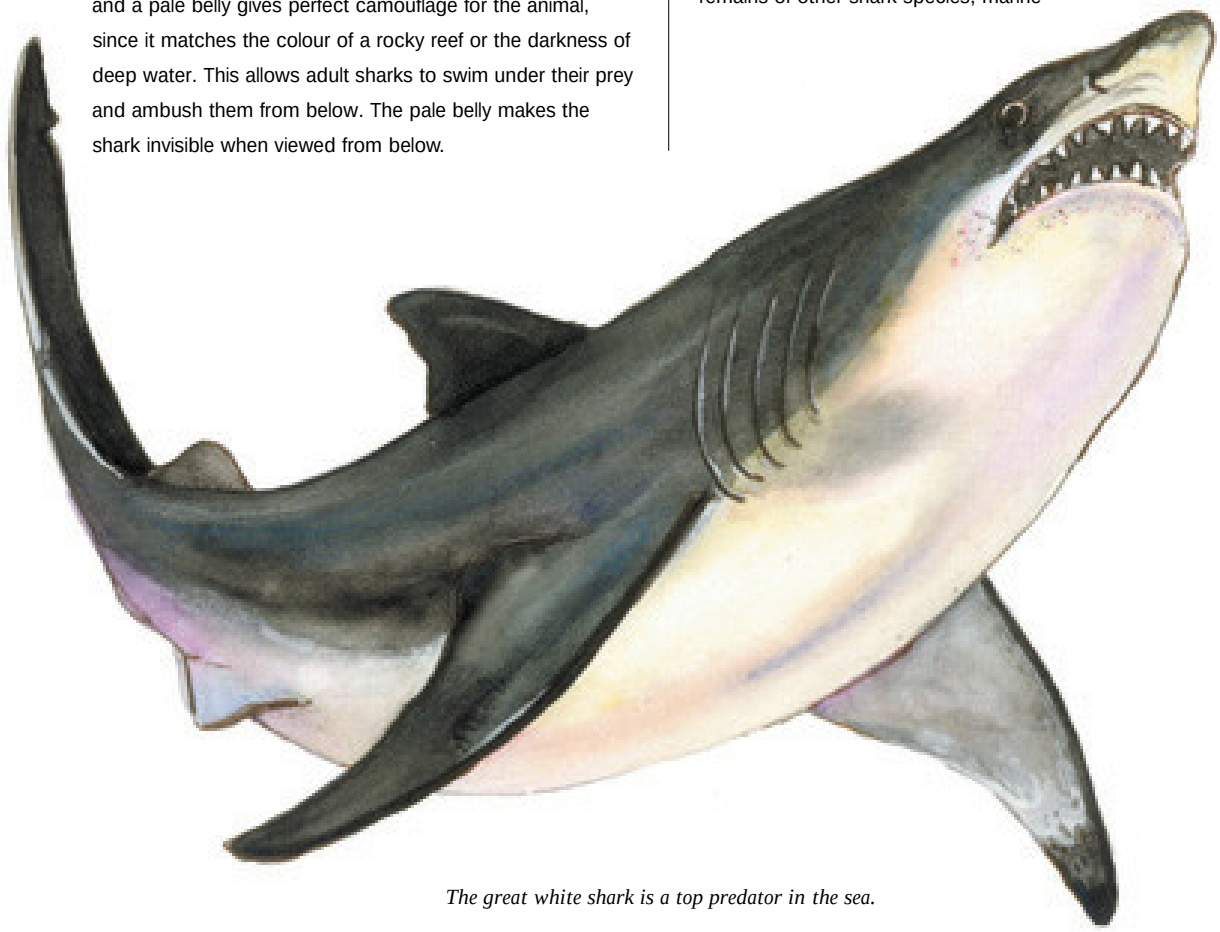
The public's misunderstanding of the great white shark is evident in the use of its name. This robust, torpedo-shaped, blue-grey species of shark was named for the colour of its belly, probably because the first of this species were seen dead, lying on their backs on the deck of a boat. Its other name, "blue pointer" is perhaps more appropriate. From an ecological perspective, the counter-shading of a dark back and a pale belly gives perfect camouflage for the animal, since it matches the colour of a rocky reef or the darkness of deep water. This allows adult sharks to swim under their prey and ambush them from below. The pale belly makes the shark invisible when viewed from below.

The great white shark is one of the largest and most powerful predators on earth. Records show that female white sharks grow larger than males. Males reach up to 5.5 m in length, whereas females may exceed 7 m. In South Africa, the largest great white shark to be landed by hook and line weighed a massive 742 kg.

Surprisingly, very little is known about these animals, which occur in temperate waters around the world and along the entire South African coastline. Adult great white sharks are so large and relatively uncommon that they are not captured frequently. When they are taken, carcasses are so unmanageable and, except for the jaws and fins, of such low commercial value, that they are usually disposed of at sea. These factors, coupled with the shark's notoriety have hampered scientific research on the species. Yet, in the last decade or two, interest in the biology of the great white shark has increased, and observations of sharks in the United States, Japan, Australia, New Zealand and South Africa have started to reveal some of the secrets of their fascinating lifecycles.

Feeding

Food preference varies according to the shark's size. The stomach contents of landed specimens have contained the remains of other shark species, marine



The great white shark is a top predator in the sea.

mammals – mostly seals – bony fish and large rays such as mantas. Since seals are thought to be a favourite prey item of great white sharks, it is not surprising that in South Africa, the centre of the sharks' range is the south western Cape, often in close proximity to large seal colonies.

Reproduction

It is thought that most female great white sharks mature at a length of between 4.5 and 5 m. Research conducted in the United States found that males with a body length greater than 4.6 m have fully developed reproductive organs. As with other elasmobranchs, sperm are transferred to the female through paired claspers – rod-like, grooved processes attached to the pelvic fins of male sharks. An anecdotal report of sharks mating off the coast of New Zealand follows:

"I had thought at the beginning they were fighting as one animal appeared to be attempting to grasp the other with its great mouth, making great gouges in its side. However, they had eventually become motionless, one under the other, turning over from time to time belly to belly. This obvious copulation lasted some forty minutes before the animals finally parted and glided off in opposite directions."

Fresh and healed bite marks found on mature females would seem to reinforce the idea that some biting takes place during mating.

Although the gestation period of great white sharks is unknown, juvenile sharks are known to be born alive, probably in temperate locations around the world, during spring or summer. Maximum litter size is at least 10 and perhaps as high as 14. At birth, juvenile great white sharks are estimated to be between 120 cm and 150 cm long.

Great white shark attacks on humans are rare. In South Africa, between 1922 and 1994 only 63 unprovoked attacks by white sharks on humans were recorded. The majority of attacks were on surfers or spearfishers and many (29) inflicted only minor injuries. Fifteen of the recorded attacks proved fatal.

Author: Claire Attwood September 2000

Protected but vulnerable

The increasing monetary value of white shark jaws and teeth is a cause for concern because this creates a market for the capture of white sharks.

In South Africa, government protection was granted to the great white shark in 1991, making it illegal to catch, kill or harass a great white shark in South African waters. The reasons for wanting to protect this species are the same as those applied to the protection of top terrestrial carnivores: in addition to being increasingly rare, they are at the apex of a complicated food web which is only partially understood. There is, however, an urgent need to investigate the populations of great white sharks in South Africa, and assess the validity and effectiveness of protective legislation.

The tagging of great white sharks under the auspices of a national marine linefish tagging program, initiated by the Oceanographic Research Institute (ORI) in 1984 has provided an opportunity for studying the growth and movements of great white sharks. In 1990 the Shark Research Centre of the South African Museum, initiated research into the movements, habitat use, behaviour, abundance and population structure of the species.

The 40 km of shark nets that are maintained by the Natal Sharks Board in KwaZulu-Natal, catch an average of 1 354 sharks per year, including 39 great white sharks. Since 1988, most sharks found alive in the nets, including the dangerous ones, have been released and, whenever possible, tagged.

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Chondrichthyes – Cartilaginous fish
SUBCLASS:	Elasmobranchii
FAMILY:	Lamnidae
GENUS:	*Charcharodon*
SPECIES:	*carcharias*
COMMON NAMES:	Great white shark, blue pointer

FURTHER INFORMATION: • Natal Sharks Board, Private Bag 2, Umhlanga Rocks 4320. Tel: (031) 566 0400.
• South African Museum, Shark Research Unit, PO Box 61, Cape Town 8000. Tel: (021) 424 3330.
• Klimley, A.P. and Ainley, D.G. (Eds) *Great White Sharks. The Biology of Carcharodon carcharias*. 1996. Academic Press, USA.
• Wallet, T. 1978. *Shark Attack and treatment of victims in Southern African waters*. Purnell, Cape Town.
• Compagno, L.J.V., Ebert, D.A. & Smale, M.J. 1989. *Guide to the sharks and rays of Southern Africa*. Struik Publishers, Cape Town.

RELATED FACTSHEETS • Sharks • Whale Sharks • Shark Diving • Ragged-tooth Shark • Ichthyology – the Study of Fishes

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

Ragged Tooth Shark 3C

Spotted ragged-tooth sharks, or 'raggies' as they are popularly known, are one of about 100 species of shark that occur off southern Africa. They are popular aquarium animals because they look more fearsome than they are! Their jagged teeth project ominously from their spectacular jaws and yet they are really quite docile. Ragged-tooth sharks are also unusual among sharks in that they have the ability to actively pump water over their gills so that they can remain stationary for long periods and still breathe – a distinct advantage to aquarium staff if they need to be transported. In sharp contrast, some of the most dangerous sharks, like the great white or the Zambezi shark, are aggressive and yet their teeth are concealed by their lips so that they don't appear so ferocious. They also differ in that they have to swim to draw water over their gills to aerate them.

Identifying features

The ragged-tooth shark *Charcharius taurus*, is a plump, light-brown to grey shark with a paler belly and large brown spots, which fade with age. They grow up to 3.2 m and 295 kg. The fins are thick and rounded and the first dorsal fin is well behind the line of the pectorals. The dorsal and anal fins are much the same size. Being a slow-swimming shark the lower lobe of the tail is small. The small eyes are situated well forward on the pointed snout and the jaws carry rows of long, pointed, smooth teeth, most of which have three cusps.

Distribution

Ragged-tooth sharks are widespread throughout the warmer

Biology

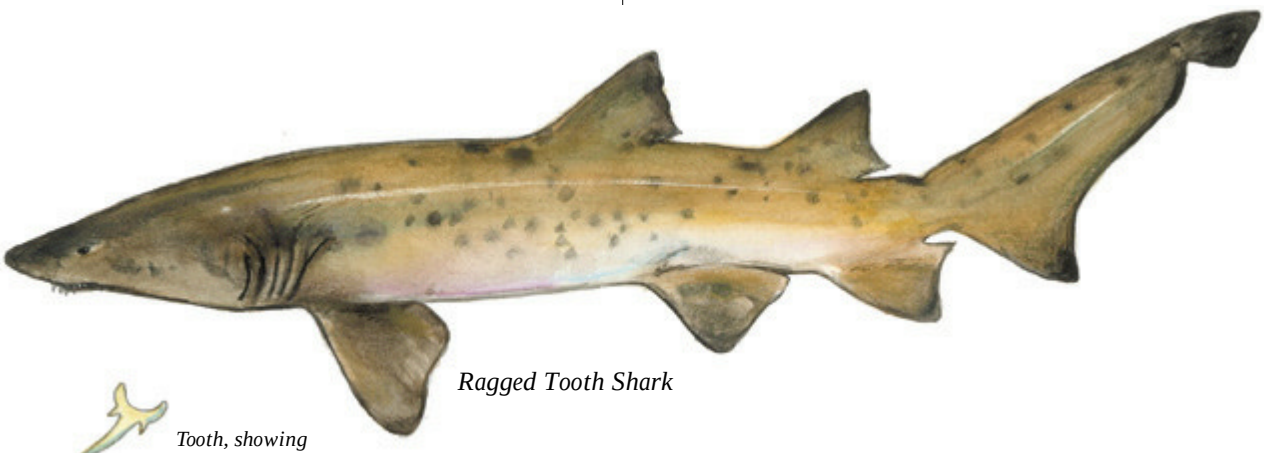
Raggies frequent shallow reefs where they ambush bony fish and the juveniles of other sharks. Their smooth, tricuspid teeth are used for gripping food, which is swallowed whole. (Predatory sharks belonging to a different family, Carcharhinidae, have serrated, cutting teeth.) Both jaws bear rows of teeth which are continually moving forward to replace outer teeth that break and are lost while feeding. The shark produces more than 1000 teeth during its lifetime of approximately 15 years.

Sharks have a skeleton of cartilage and, unlike bony fishes, they do not possess gas-filled swim-bladders. As a result most sharks must swim constantly to avoid sinking. The raggy, however, gulps air from the surface into its stomach so that it will not sink below a certain level. The large oil-rich liver of sharks also helps them to maintain buoyancy.

The skin of sharks is imbedded with dermal denticles, known as teeth-scales, making it rough and abrasive. In fact the dried skin, known as shagreen, has been used as sandpaper.

Senses

Sharks have well-developed sense organs which put them in touch with their surroundings. They have two types of photo-receptor cells in their eyes; rods detect light intensity and cones perceive colour. The ratio of these cells differs according to the light conditions in which the shark lives. So, sharks living in shallow water have good colour vision while those that inhabit murky waters may have better light-intensity perception. They use their nostrils, taste buds and pit organs in their skin, to detect minute quantities of chemicals in the water, especially those associated with food. Sharks have a Lorenzini detection system which is sensitive to small electric fields. This enables them to locate prey which produce electric fields around them. Sharks can also navigate using electro-magnetic cues from the earth and salt water currents. Finally the lateral line sense organ detects mechanical forms of energy which are

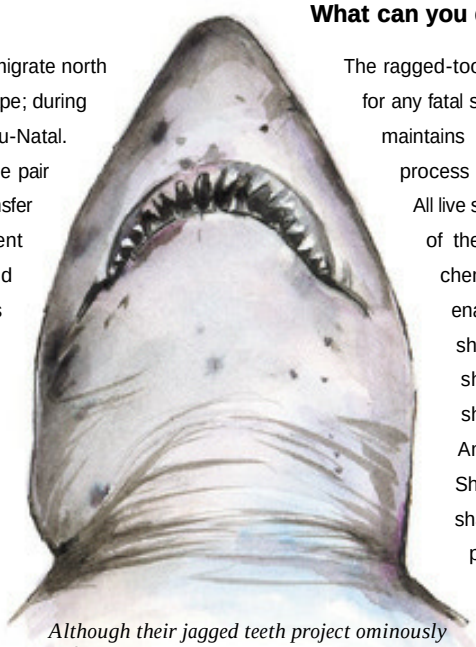


Ragged Tooth Shark

Tooth, showing the three cusps

Reproduction

In spring, mature ragged-tooth sharks migrate north from the colder waters of the eastern Cape; during summer they mate off northern KwaZulu-Natal. Males are easily distinguished by a large pair of ventral claspers which they use to transfer sperm to the female. Mating is a violent affair often leaving the female gashed and scarred. Each female produces masses of eggs, as many as 20 000, which are packaged in capsules of about ten and retained in the uterus. During the nine-month gestation period, the females move south in the Agulhas current. Inside the uterus, embryos that develop first use the egg parcels as their food supply, consuming both the unfertilized eggs and the small embryos. Eventually only two sharks are born, one from each branch of the uterus. This process of intra-uterine cannibalism represents natural selection with a vengeance. Even after birth the juveniles are in danger of being eaten by adult sharks and the mother shows no parental care. The juveniles enter estuaries to escape predation.



Although their jagged teeth project ominously from their spectacular jaws, ragged-tooth sharks are really quite docile.

Humans and sharks

Shark fishing began in the 1930's and products such as meat, fins, skin (shagreen), fertiliser and oils were produced. At one time South Africa extracted 6 million international units of vitamin A oil annually from shark livers, but vitamin A is now produced synthetically. Raggies seem to tolerate divers who regularly observe juveniles at Aliwal Shoal or pregnant females at Sodwana Bay's Quarter-Mile Reef. Raggies are of no commercial fishing importance but are a favourite of many shore anglers and the majority of catches are made from rocky ledges using live bait. Captive raggies are a great draw-card in aquaria and help to generate income and educate the public about these magnificent top predators of the ocean.

What can you do to help

The ragged-tooth shark has never been responsible for any fatal shark attacks. The Natal Sharks Board maintains nets to protect bathers and in the process catches over 1000 sharks annually. All live sharks are tagged and released; some of them are injected with tetra-cycline, a chemical that stains the backbone and enables an assessment of ageing if the shark is recaptured. Many anglers catch sharks purely for sport and these should also be tagged and released. Anglers should contact the Natal Sharks Board if they recapture tagged sharks. If the tag has a number with a prefix 'BT' the shark (especially the backbone) should be kept frozen. Valuable information can be gained about growth rates, age and migration from tagged sharks. In 1994, 1 600 raggies were tagged, of which 79 were recaptured. These had travelled an average distance of 219 km and a maximum distance of 1 416 km.

Author: Margo Branch September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Chondrichthyes – Cartilaginous fish
SUBCLASS:	Elasmobranchii
FAMILY:	Odontaspididae
GENUS:	*Charcharius*
SPECIES:	*taurus*
COMMON NAME:	Ragged-tooth shark

FURTHER INFORMATION:

• Natal Sharks Board, P. Bag 2, Umhlanga Rocks 4320, Tel. (031) 566 0400
• Shark Protection and Preservation Association, South African Museum, PO Box 61, Cape Town 8000. Tel. (021) 243330
• Tagging News, Oceanographic Research Institute, P.O. Box 10712, Durban 4056. Tel. (031) 337 3536
• Campagno, L.J.V., Ebert, D. A. & Smale, M. J. 1989. *Guide to the sharks and rays of Southern Africa*. Struik Publishers, Cape Town
• Van der Elst, R. 1988. *A Guide to the Common Sea Fishes of Southern Africa*. Struik Publishers, Cape Town

RELATED FACTSHEETS:

• Sharks • Great White Shark • Skates and Rays • Aquariums in 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

Whale Shark 3C

Whale sharks are the world's largest living fish, growing up to a length of 13 m and weighing up to 13 tons, although there have been unsubstantiated records of whale sharks reaching 18 m in length. They are distinctive with a striking checkerboard pattern of black and white on the dorsal surface. Typical of most fish that swim in the well-lit zone near the surface, the whale shark is darker above than beneath, countershading that makes it blend into its surroundings when viewed from any angle. As in other shark species, their skeleton is made of cartilage, albeit highly strengthened cartilage.

Whale sharks are cosmopolitan in distribution, occurring in all tropical and warm temperate waters, preferring temperatures of 21 – 25ºC. They are believed to be highly migratory, their movements corresponding with plankton blooms and changing temperatures of water masses. Whale sharks are most abundant off KwaZulu-Natal during the summer and autumn months. They are often found in association with schools of pelagic fish that are probably feeding on the same prey. These giant fish can cruise at 3 km per hour, often near the surface.

Breeding habits

Although information about the reproduction of the whale shark is limited, it appears that they have internal fertilisation and are ovoviviparous, meaning that the female produces live offspring from eggs hatched in the uterus. A ripe female caught off Taiwan measuring 10.6 m in length, contained 300 embryos, from 42 to 63 cm in length. This is thought to be the highest level of fecundity among all sharks, skates and rays. The survival rate of these offspring is not known.

Feeding habits

Despite being the largest fish in the sea, whale sharks are filter feeders, like baleen whales, feeding on a wide variety of minute zooplankton, small fish and squid. They use their large mouths like enormous vacuum cleaners to suck up huge volumes of water which are then filtered through sieve-like structures occurring inside five pairs of large gill slits on either side of the head. Whale sharks have been observed feeding passively by cruising with their mouths agape or hanging vertically in the water and feeding actively by opening their mouths and sucking in prey-rich surface water. Although they have about 3000 teeth in each jaw, these are minute, covered by a skin flap and do not appear to be used in feeding.

Life cycle

Very little is known about the growth rates of whale sharks. It has been suggested that they only reach maturity at 30 years of age, at about 9 m. They may, therefore, have a life span of over 100 years, but this is based on speculation and has not yet been confirmed by scientific study.

Water enters the large mouth and food is sieved from the water as it flows out of the gill slits

Conservation status

Whale sharks are currently listed as 'indeterminate' on the World Conservation Union's *Red List of Threatened Animals*, as scientists are not sure of their exact status. The increase in the popularity of whale shark meat in the Far East has led to the establishment of a small, but extremely lucrative, fishery for these huge animals off the Taiwanese coast. In 1997, whale shark meat was selling for about R35 per kg in Taiwan. In this fishery, whale sharks are caught by means of harpoons or set nets. There is no fishery for whale sharks in South Africa and their seasonal migration along our coast is regarded as an important tourist attraction.

Whale shark-based ecotourism is increasing in popularity in many parts of the world, including South Africa. A research project, contributing to the international pool of knowledge about this species, is currently being undertaken along the KwaZulu-Natal and southern Mozambique coasts. Aerial surveys, boat-based studies and a tagging programme are well underway, although data collected to date are insufficient to make any accurate estimates of population size or draw any conclusions about migratory routes.

The checkerboard patterns appear to be unique to each individual and are useful for identification using aerial photographs. In 1994 an aerial survey of the KwaZulu-Natal coast leathery skin, 15 cm thick around the dorsal fin, that special tags and a modified speargun have been designed to insert the tags with minimum discomfort and stress to the animals.

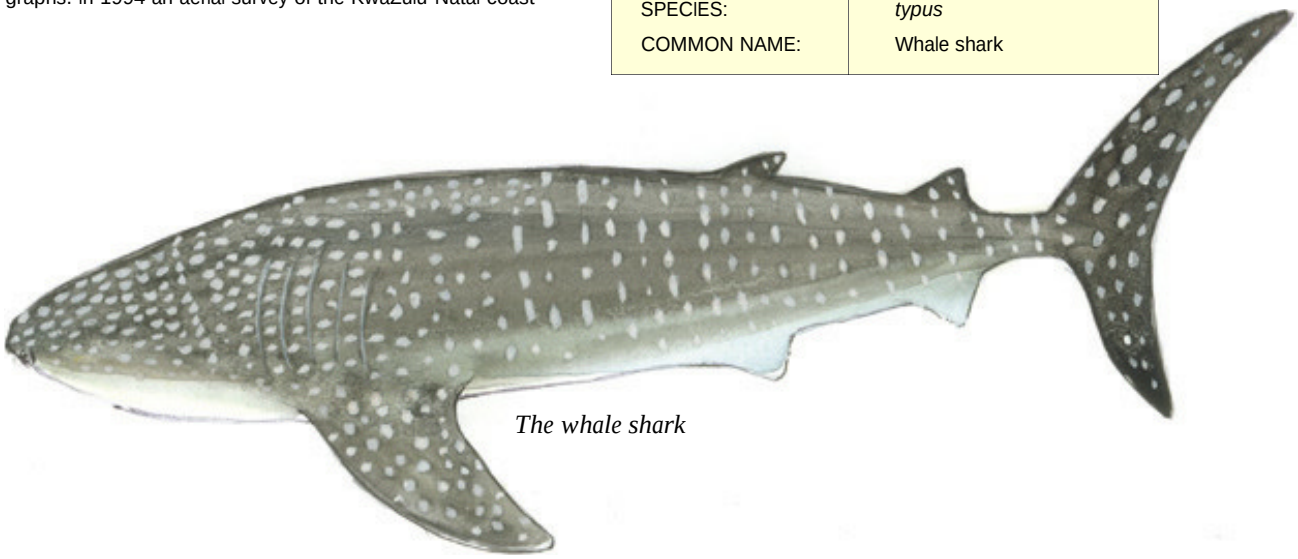
What you can do to help

If you encounter a tagged whale shark while diving or find a whale shark stranded along the coast, please make a note of the following information: date, tag number, location, and any other information that may be of use to researchers. Please report the information to the:

- Natal Sharks Board (031) 5611001
- KZN Wildlife (031) 2051271
- The Whale Shark Research Group (031) 764 0349.

Author: Judy Mann-Lang September 2000

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Chondrichthyes
SUBCLASS:	Elasmobranchii
ORDER:	Orectolobiformes
FAMILY:	Rhincodontidae
GENUS:	*Rhincodon*
SPECIES:	*typus*
COMMON NAME:	Whale shark



The whale shark

FURTHER INFORMATION:

- KwaZulu-Natal Wildlife (formerly KwaZulu-Natal Nature Conservation Service), P.O. Box 13053, Cascades, Pietermaritzburg 3200. Tel: (0331) 8451999
- Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
- Natal Sharks Board Private Bag X2, Umhlanga Rocks 4320. Tel: (031) 566 1001
- Compagno, L.J.V., Ebert, D.A. & Smale, M.J. 1989. *Guide to the Sharks and Rays of Southern Africa*. Struik Publishers, Cape Town.
- von Etzdorf, B. 1996. *Mightymouth Whale Sharks – the world's largest fish.* Africa Environment and Wildlife. Vol.4(1):59 – 65.

RELATED FACTSHEETS:

• Baleen and Toothed Whales • Sharks • Whale Watching • Plankton

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

Skates and Rays 3C

Skates and rays are flattened fishes that use their expanded pectoral fins like wings to 'fly' leisurely through the water like great marine bats. It is no wonder that they are known as batoids and belong to the superorder Batoidea which also includes guitarfish and sawfish. Batoids are cartilaginous fishes with a skeleton of cartilage like the sharks and chimaeras (elephant fish). Unlike sharks their five or six gill slits are positioned below the expanded pectoral fins on the ventral surface of the body. Behind the eyes on the dorsal surface are a pair of openings, called spiracles, through which water enters to be pumped over the gills. This arrangement is a great advantage for bottom dwellers as it avoids the need to take in water through the ventral mouth, which might suck in sand and clog the gills.

Comparing different batoids

Skates and rays superficially look alike with the pectoral fins expanded and fused to the head and trunk to form a disc while the sandsharks and sawfishes have more elongate bodies with flattened front regions.

Skates can usually be distinguished by the presence of two small dorsal fins and a pair of slender electric organs near the tip of the narrow tail, which lacks a stinging spine. Skates lay eggs in leathery quadrangular cases with a horn at each corner.

wide.

Rays There are four different types of rays, distinguished below, which retain the eggs in the uterus and give birth to live young (ovoviviparous). Over 170 species occur world-wide.

Stingrays have whip-like tails with one or no dorsal fins and a venomous spine near the base of the tail. Sixty species occur off southern Africa.

Eaglerays have larger heads with lateral eyes and triangular pectoral fins. At the base of the slender tail is a dorsal fin and a venomous spine. Four species occur around southern Africa.

Manta rays are moderate to gigantic fishes reaching 6.7 metres across. They have horn-like fins on the head that herd plankton and small fish into their large terminal mouths. The internal gill openings are guarded by unique filter plates that trap the small organisms as the water flows out through the gills. Mantas have a slender tail without a sting. Two species occur off southern African shores.

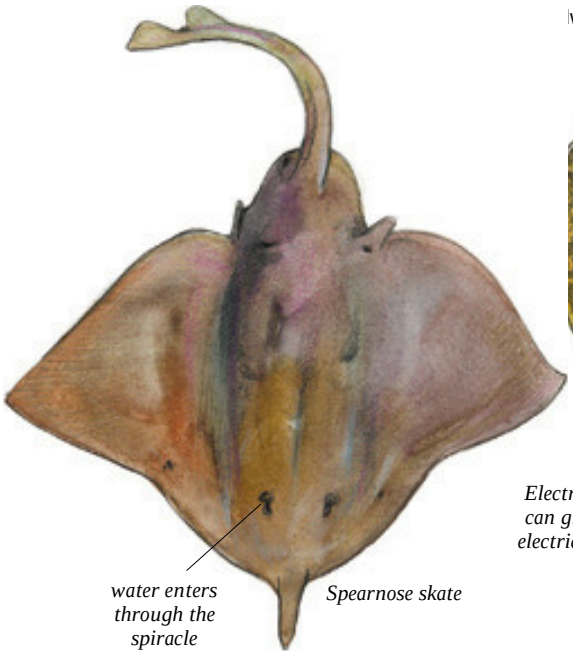
Electric rays are large oval batoids with a pair of kidney-shaped electric organs on the front half of the disc, which are modified swimming muscles that can generate short, powerful bursts of electricity measuring several hundred volts and used to stun prey and deter enemies. They have two dorsal fins and a stout tail with a tail fin used for swimming. Three species occur off southern African shores.

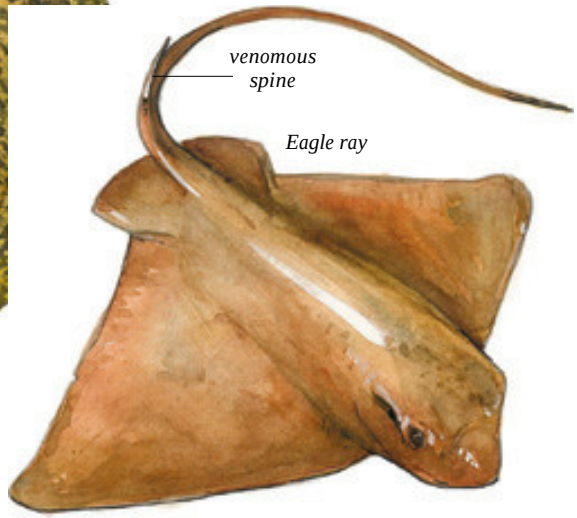
Guitar fishes (sandsharks) have a thick elongate body with a thick trunk and tail region with two large dorsal fins and a caudal fin. The head and pectoral fins are expanded and flattened. They are ovoviviparous giving birth to live young. Seven of the 52 species occur off southern African shores.

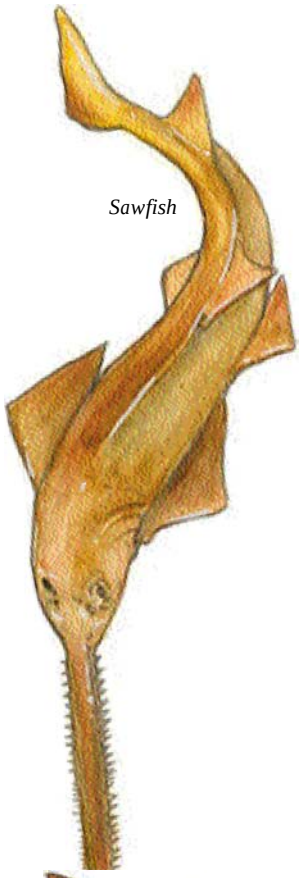
Sawfishes are very distinctive with flattened shark-shaped bodies and conspicuous saw-like snout that have large teeth embedded in sockets on either side. They are

om-dwellers that dig up and stun their

rey with rapid sideways movements of the head and saw.





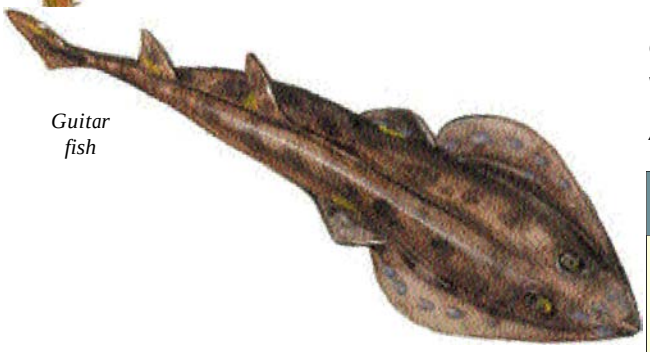


Sawfish

y

shes are torpedo shaped to slip easi-
rough the water with minimum fric-
on. All skates and rays are flat fish,
however, and use their expanded fins
to glide. They inhabit all the niches
in the ocean, and even enter into
very shallow estuaries, lagoons
and rivers. Pelagic species like
eaglerays, devilrays and mantas
the surface waters and glide down-
ls and then turn to soar upwards into
urrent making maximum use of the
e sea water in which they live. They
n leap out of the water. The eyes of
laced on the side of the head, which
and above the flat body, thus
ee prey in the water around them.

ays are superbly adapted for bot-
e they can glide over sand and mud
es of movement along the pectoral
n. They never see the food they eat
es are on the top of the head and the



Guitar fish

itself over the prey to claim it. The food is sucked into its mouth and crushed between powerful grinding plates of pavement teeth. Most skates and rays feed on molluscs, crustaceans, worms and small fishes that hide in the sand. Some hover over reefs and engulf their prey. Bottom-dwelling skates and rays are usually well camouflaged and can even wriggle beneath the sand to lie in wait of prey and to avoid detection from birds and other predators. Their flat shape makes them awkward to swallow and they can protect themselves with venomous spines or electric shocks.

Beware of danger cloaked in sand

To avoid treading on sting rays, when paddling in shallow lagoons, it is advisable to shuffle along to disturb them so that they swim off. Cloaked in sand a sting ray is not easy to see. It will defend itself by whipping its tail around and jabbing the serrated razor-sharp spine into the foot or ankle of the victim. The venomous spine causes tissue damage, swelling and extreme pain and, on rare occasions, even death. Soaking the wound in very hot water for 30 minutes usually brings relief as the heat denatures the powerful protein toxins. The spine can introduce infection and 'Betadine' can be used to treat the wound. If the spine breaks off in the wound a doctor should be consulted.

Fisheries By-catch

Skate wings are good to eat and are harvested as a by-catch by bottom trawlers for hake and are marketed locally and in the Far East.

Skate City

'Skate City' where divers feed and frolic with large numbers of giant stingrays, is a great tourist attraction in clear shallow water of the Caribbean Sea.

Author: Margo Branch September 2000

Classification:	
PHYLUM:	Chordata
SUB PHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Chondrichthyes – Cartilaginous fish
SUBCLASS:	Elasmobranchii
SUPERORDER:	Batoidea – Flattened fish with 5-6 gill slits
ORDER:	Torpediniformes – Electric rays
	Rajiformes – Skates and guitar fishes
	Myliobatiformes – Stingrays, eagle rays and mantas
	Pristiformes – Sawfishes

FURTHER INFORMATION: • Campagno, L.J.V., Ebert, D. A. & Smale, M. J. 1989. *Guide to the sharks and rays of Southern Africa.* Struik Publishers, Cape Town
• Smith, M.M. & Heemstra P.C. 1986. *Smiths' Sea Fishes*. Macmillan South Africa, Johannesburg
• Two Oceans Aquarium, Waterfront, Cape Town. Tel (021) 418-3823 Fax: (021) 418-3952
• Van der Elst, R. 1988. *A Guide to the Common Sea Fishes of Southern Africa.* Struik Publishers, Cape Town

RELATED FACTSHEETS: • Sharks

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

Sunfish 3C

The sunfish is the largest and most unusual of bony fishes. It has no tail, no scales, no pelvic fins, no lateral line sense organ and no swim bladder. Even its skeleton is mainly cartilaginous with a small percentage of bone. Yet it is considered to be one of the most advanced of the bony fishes that can weigh as much as two tons and reach lengths of 3 metres.

Ocean sunfish *Mola mola*

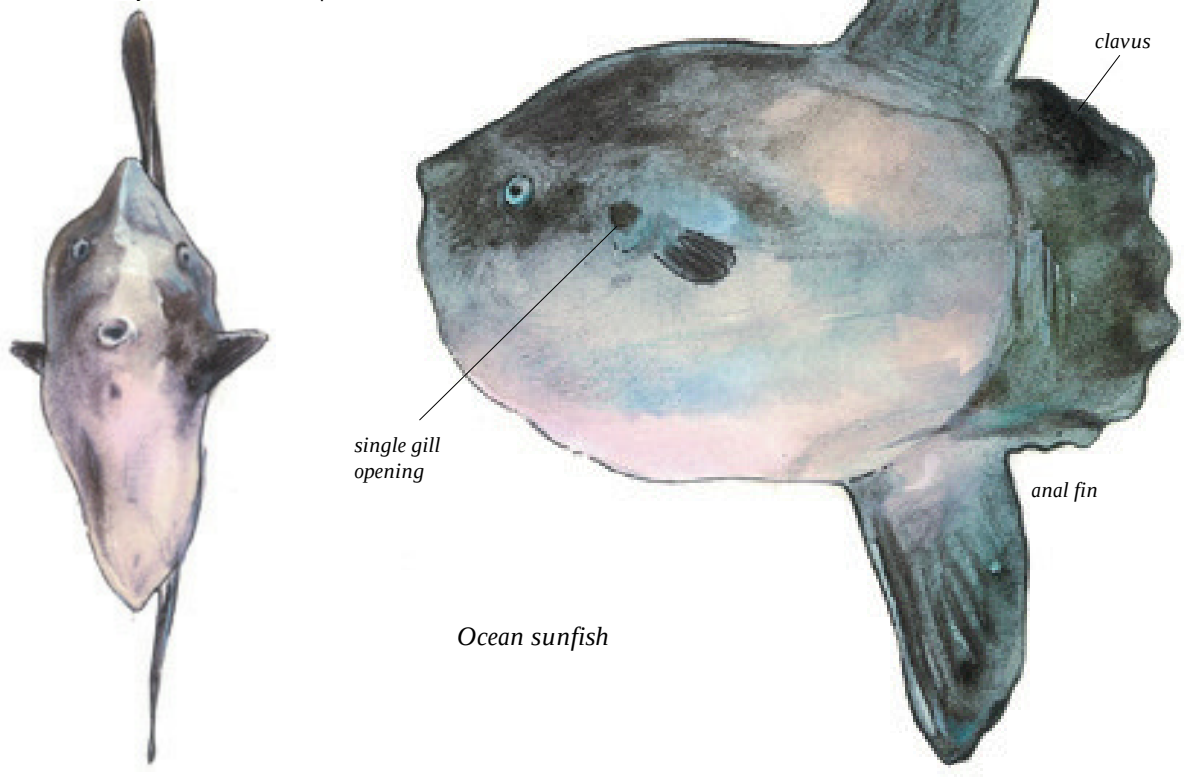
These enormous laterally-compressed, oval fishes look as if the tail end has been chopped off, resulting in an almost circular shape and hence their common name of 'sunfish' (or in Japan – 'moonfish'). Instead of the tail there is a flap with bony plates along the edge, called the clavus, which acts as a rudder and is used for steering. The fish paddles itself through the water by flapping its long narrow dorsal and anal fins sideways. Small pectoral fins provide balance. Unlike most bony fish they have no pelvic fins. The skin is thick and tough with small rough denticles, similar to a shark's skin. Although sunfishes lack a swim bladder, the fat stored in their tissues make them light and buoyant and they are normally found in open oceans lying on their sides near the surface, as if sunbathing. The are found in all, except the polar, oceans. They have four gill arches and a single round gill opening on the side of the body, at the base of the pectoral fins.

Senses

The sunfishes have large mammal-like eyes and seem to rely on their eyesight for finding food and avoiding objects. It is quite horrifying to see a sunfish that has just been placed in an aquarium exhibit, swim head-on into the transparent acrylic windows. It soon learns to avoid the windows. Other fish can sense waves bouncing off the obstacle of the window with their lateral-line sense organ and, in addition, sharks use electric impulses to sense objects. The sunfish has no lateral-line sense organ or sensory canals in the skull bones to detect vibrations in the water, but they can hear and respond to sounds.

Feeding

The reason for the sunfish's peculiar shape is something of a mystery as it is not very streamlined or fast moving. Its flat shape may help the fish to bask near the surface in search of the jellyfish, salps and comb jellies on which it feeds. In shallow water it will also feed on small creatures and fish found on the bottom. The sunfish sucks the food into its small round mouth and then crushes it, using a parrot-like beak comprised of the fused teeth.



Ocean sunfish

Reproduction

The sunfish is the most fecund of all fishes, producing up to 300 million tiny eggs. These are shed into the sea during spawning. The juvenile fish at first has a normal tail fin. When it is less than 5 mm long it is covered with spines, to help it float, and was originally described as a distinct species not related to the adults. The tail is gradually absorbed during development and the fish becomes more and more circular in outline, until only a fleshy flap (the clavus) remains in the adult.

Related species

Southern sunfish *Mola ramsayi*
This giant sunfish, known only from South Africa, New Zealand and Australia, has more rays to the clavus (12) with broader bony ossicles than does *Mola mola*.

Sharptail sunfish *Masturus lanceolatus*
This sunfish has a distinctly pointed clavus without bony ossicles. It attains a length of 3 m and weight of about 2 000 kg. It is rare but has been recorded in all the temperate oceans.

Trunkfish *Razania laevis*
This is a small elongate-oval species, up to 80 cm, with a thin smooth skin composed of hard fused hexagonal plates.

Sunfish in captivity

Sunfish are popular for aquarium displays because of their weird appearance and habits. But they have not been easy to keep in captivity because they tend to rub themselves on the sides of the tanks and damage their skin. The greatest success has been achieved in Japan, where the tanks are lined with a soft plastic inner-shell to overcome this problem. The Two Oceans Aquarium in Cape Town has a facility in the harbour where injured sunfish can be rehabilitated.

Author: Margo Branch September 2000

Development of the sunfish

Fish-like larva (2 mm)

Spiny juvenile (3 mm)

Juvenile Sunfish – tail being absorbed (25 mm)

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
ORDER:	Tetraodontiformes
FAMILY:	Molidae – Ocean sunfishes
GENUS:	*Mola*
SPECIES:	*Mola*
COMMON NAME:	Ocean sunfish

FURTHER INFORMATION: • South African Museum, P O Box 61, Cape Town 8000, Tel (021) 243 330
• Two Oceans Aquarium, Waterfront, Cape Town. Tel (021) 418-3823 Fax: (021) 418-3952 E-mail aquarium@twoocean.co.za
• Smith, M.M. & Heemstra P.C. 1986. *Smiths' Sea Fishes.* Macmillan South Africa, Johannesburg.

RELATED FACTSHEETS: • Ichthyology– Study of Fishes • Aquariums in 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

Coelacanth 3C

The coelacanth is the only surviving member of the ancient super-order of lobe-finned fish, the Crossopterygii. It first appeared in the fossil record in the Devonian Period 375 million years ago. The earliest coelacanths lived in shallow fresh waters, but during the Mesozoic era these and many other fish invaded the sea. Although fossils have been found on every continent except Antarctica, none date from the time after the Cretaceous Period, 65 million years ago. For this reason the coelacanth was long presumed extinct, until it was rediscovered in South Africa in December 1938.

Discovery

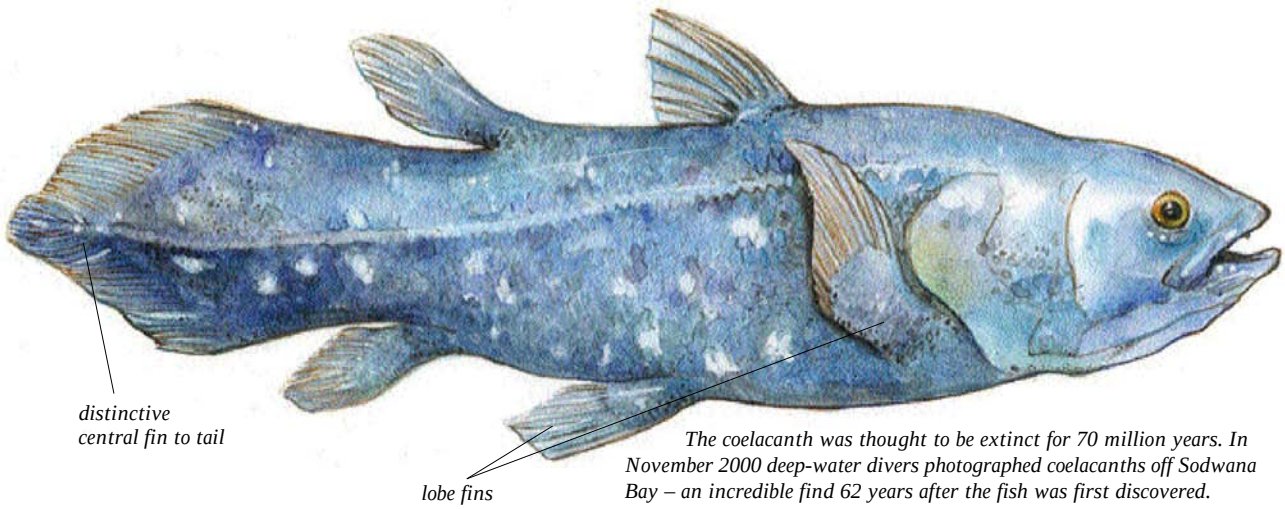
On 22 December 1938, Ms Marjorie Courtenay-Latimer, the curator of the East London Museum, was summoned to the harbour by Captain Goosen to examine his catch of trawled fish. Ms Courtenay-Latimer recognised one of the fish as unusual, and transported it back to the laboratory. She sent a letter describing the fish, enclosing a sketch of it, to Dr J. L. B. Smith of Rhodes University, asking for his assistance in its identification. Dr Smith was on holiday in Knysna and only received the letter two weeks later. He immediately recognised it as a crossopterygian and sent an urgent message that the fish be preserved, but by this time it had decomposed and only the skin had been saved. Nevertheless, Dr Smith was able to identify the fish as a coelacanth when he returned to Grahamstown.

News of the discovery of the "living fossil" made headlines around the world. Dr Smith described the species in an article in the journal Nature, naming it *Latimeria chalumnae* in honour of Ms Courtenay-Latimer and the area where the fish had been caught – off the Chalumna River (now Tyolomnqa). He dubbed it "Old Four Legs" because of its limb-like pelvic and pectoral fins.

Dr Smith embarked on a public awareness campaign in his search for more coelacanth specimens, and distributed a "Wanted" poster along the East African coast and adjacent islands. Twelve years after the initial discovery, in December 1952, he was informed that a second coelacanth had been caught in the Comoran islands. As there was at that time no air service from South Africa to the islands, he appealed to Prime Minister D.F. Malan, who ordered the air force to transport Dr Smith to the Comores to collect the fish.

Since then, a few coelacanths have been caught every year in the Comores by fishermen targeting other edible deep-sea fish, such as the oilfish. At least two coelacanths have been caught off the coast of Madagascar, but these were believed to be stray individuals, like the first and only South African specimen, swept southward by strong currents. The Comoran islands were thought to be home to the last remaining population of the species.

However, in 1997 a dead coelacanth was photographed in a fish market in Indonesia by the wife of an American fish biologist named Mark Erdmann. Dr Erdmann immediately launched an intensive information campaign among local fishermen and 10 months later, on 30 July 1998, he was alerted that a coelacanth had been caught in a deep-set shark gill-net off a small volcanic island in Sulawesi, Indonesia. Although most coelacanths do not survive being brought to the surface from depth because of the rapid change in pressure, this specimen survived for a few hours, and Dr Erdmann was able to obtain film footage of the fish swimming in a tank.



The coelacanth was thought to be extinct for 70 million years. In November 2000 deep-water divers photographed coelacanths off Sodwana Bay – an incredible find 62 years after the fish was first discovered.

Recent discovery

On Monday 27 November 2000, a group of recreational divers discovered and photographed three living coelacanths at 108 m depth in the St Lucia Marine Protected Area, South Africa. They were 5 km north of Sodwana Bay and 800 m from the shore. This is the shallowest find of coelacanths so far and the only site that can be accessed by divers. Diving in excess of 60 m requires specialist training and the use of TRIMIX (a mixture of oxygen, nitrogen and helium.) Unfortunately this stunning discovery was marred by the death of diver Dennis Harding.

There are plans to use a submersible to find out more about this South African population of coelacanths.

This factsheet is dedicated to the memory of Dennis Harding.

Natural history

The first to observe and film live coelacanths in their natural habitat was Dr Hans Fricke from the Max Planck Institute for Behavioural Physiology. In 1987, using a small submersible vessel, Dr Fricke discovered that coelacanths in the Comores spend the daylight hours in groups of up to 14 in caves in the steep barren lava slopes of the volcanic islands. These caves lie at about 200 m depth and are below the 18°C isotherm. At night the coelacanths leave the cave individually and descend to a depth of 250-300 m to feed on benthic fish.

In 1991 Dr Mike Bruton, then director of the J.L.B. Smith Institute at Rhodes University, persuaded Dr Fricke to bring the submersible to South Africa to search for a local population of coelacanths. The study focussed on the Tsitsikamma National Park, but the habitat was found to be unsuitable for coelacanths, and none were found.

Examination of specimens in the Comores over the years has revealed that females are larger than males and ovoviviparous, i.e. the eggs, the size of an orange, are retained in the female's uterus, where they hatch and the female gives birth to multiple live young. The largest specimens have been 1.8 m long and weigh 85 kg. Coelacanths are the only living animal to have a functional intacranial joint, a feature of many Devonian fishes and primitive tetrapods. This is a complete division running through the braincase and separating the nasal organs and eye from the ear and brain; its function is not known.

The coelacanth's paired fins move in a way unlike the co-ordination seen in most fishes, but in the same way that we move our arms and legs. In addition, the ear seems to have sensory areas that are precursors of structures responsible for hearing in air. Owing to these features, coelacanths were once thought to be the ancestors of the first land-living vertebrates, but modern evolutionary analysis suggests that they are more distantly related to land vertebrates than at first thought.

Conservation

In 1989 an aid project funded by the European Community replaced the canoes of the Comoros fishermen with motor-boats, allowing them to increase their catch. Since then, many of the fishermen's boats have fallen into disrepair, and the fishermen are trying to maintain their catch by rowing out to the edge of the island's shelf to fish, taking many coelacanths as a by-catch. Coelacanths are also deliberately targeted because of the high reward paid by museums for specimens.

In 1994, the population at Grand Comore was estimated at only 200-230 fish. The species is on the International Red Data List, as well as CITES Appendix 2 in an effort to control its trade. However, the discovery of Indonesian and South African populations of coelacanths, far from the Comores, suggests that the species may not be as rare as previously thought, and that other populations may exist in suitable habitat throughout the Indo-Pacific. Its true status is therefore unknown.

Author: Sue Matthews January 2001

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
SUPER ORDER:	Chrossopterygii
ORDER:	Coelacanthiformes
FAMILY:	Latimeridae
GENUS:	*Latimeria*
SPECIES:	*chalumnae*
COMMON NAME:	Coelacanth

FURTHER INFORMATION: • Comrie-Greig, J. 1991. The Search for "Old Fourlegs". *African Wildlife* Vol. 45 No. 5.
• Fricke, H. 1988. Coelacanths: the fish that time forgot. *National Geographic* Vol. 173 No. 6.
• J.L.B. Smith Institute of Ichthyology. Rhodes University, Grahamstown.
• Two Oceans Aquarium , Dock Road, Victoria & Alfred Waterfront, Cape Town. Tel (021) 418 3823 • www.dinofish.com

RELATED FACTSHEETS: • Ocean Currents • Ichthyology – The Study of Fishes

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

Sex Change in Fishes 3C

WHAT IS SEX CHANGE IN FISH?

*Many different species of fish have the remarkable ability to change their sex. All sea goldies (*Anthias *spp.), are born female with the largest, most dominant female changing sex to become male. They live in small groups with the male controlling a harem of smaller females. The difference between the sexes is clearly visible as the male has a long dorsal spine and is larger and redder than the golden-orange females. If the male of the harem dies, or is removed, the most dominant female will change sex and become the male – complete with colour change, an increase in size and a more dominant attitude! The anemone fish or clown fish do it the other way around – they are all born as males and as they move up the social hierarchy, sex change occurs and the large, dominant female takes charge!*

How do fish change sex?

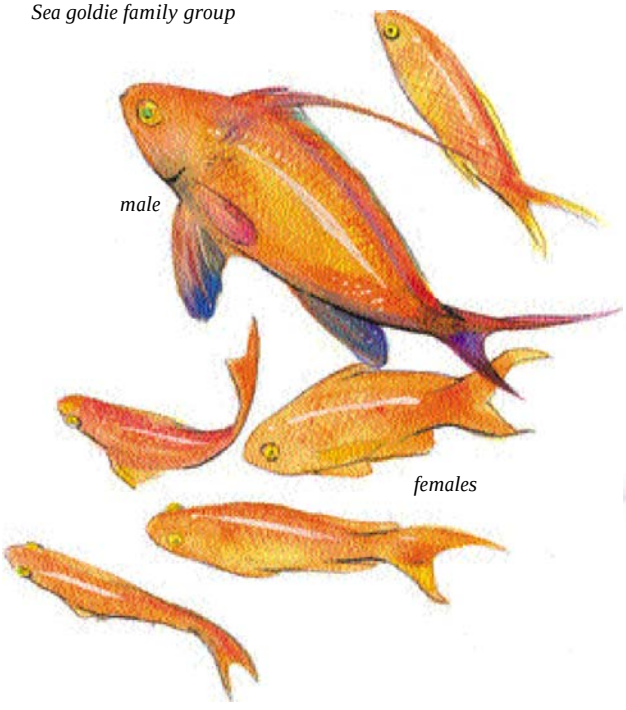
Why has this amazing ability to change sex evolved in some fishes? There are a number of theories but first we need to understand that, in most fish, changing sex is not a very complicated task. In these fish there are no external reproductive appendages and the immature gonads themselves are relatively simple structures containing both male and female tissue. The secretion of certain hormones, induced by social or environmental cues, will result in either the male or female portion of the gonad maturing. Similarly, if the hormone balance is altered during the life of a mature fish, this can induce the latent sex to develop, resulting in sex change. Most sex changing fish, however, only change sex once during their lifetime.

Why do fish change sex?

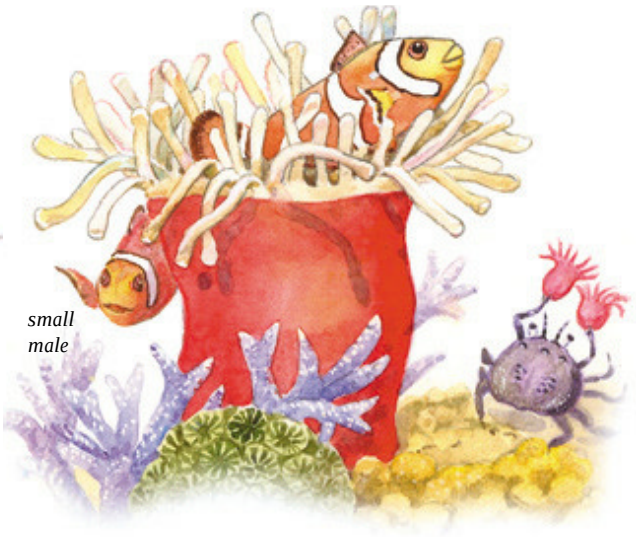
Now let's look at some of the theories as to why fish change sex. In the first instance let us consider a fish which changes sex from male to female (protandrous). Production of sperm is not as energy consuming as the production of eggs and therefore, in fish that are all born male, more emphasis is placed on growth during the early life stages. However, once the fish is large and has changed sex to female, the fish spends less energy on growing and more on the production of eggs. Large females are able to produce more eggs than small females. As it is usually the number of eggs which limit the reproductive potential of a species, more eggs mean more young (sperm is usually produced in such huge quantities that under natural conditions it is not a limiting factor). Each individual fish, therefore, maximises its own reproductive output.

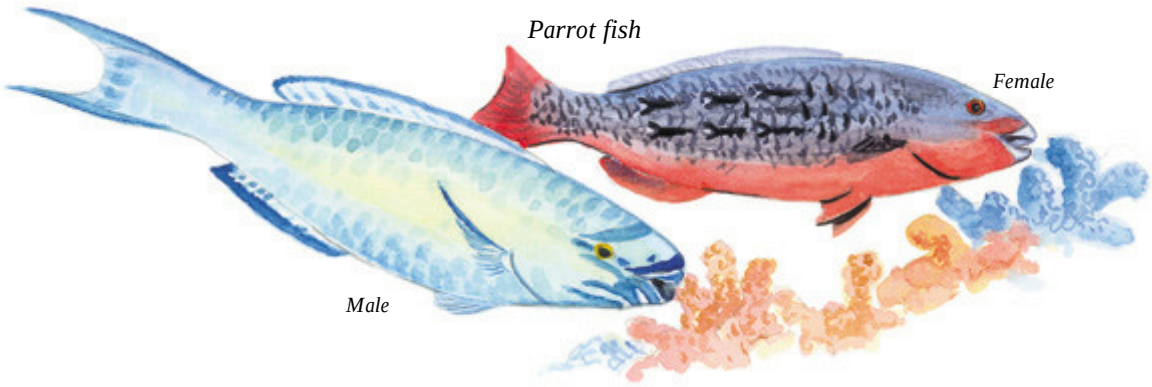
But why do some fish change sex from female to male (protogynous)? Again it appears to be largely related to growth and maximising individual reproductive output, but in this case there is also competition for preferred spawning sites. Fish that change sex from female to male, have usually evolved a fairly complex mating system. A large, dominant male sets up a territory that he defends against all other males. The bigger his territory the more females he can encourage or entice to spawn with him. In this situation it is

Sea goldie family group



Large female clown fish hides in anemone





clearly an advantage to be female when small – a small female can spawn with any territorial male whereas, a small male would not be able to compete with larger males in establishing a territory. Overall, sex change appears to be a trade off between having a few large females producing a lot of eggs (protandrous) or lots of small females collectively producing a lot of eggs (protogynous).

Which fish change sex?

The ability to change sex is found in a surprising number of marine fish off the South African coast. These include some of the wrasses (Labridae), parrotfish (Scaridae), damselfish (Pomacentridae) and many of our important angling species such as the sea breams (Sparidae) and rockcods (Serranidae). Common species such as the slinger, roman and yellowbelly rockcod, which make up a large percentage of our present commercial linefish catches, are known to change sex from female to male (protogynous). Similarly, some common shore angling species such as blacktail, strepie and Natal stumpnose (all Sparidae) change sex from male to female (protandrous).

Implications for fisheries management

Although the ability to change sex has enabled many fish species to ensure maximum reproductive output, the management of these fish stocks is greatly complicated by sex change. What are the implications of sex change on fisheries management? When fishing for protogynous reef fish it is normally the large, dominant fish that take the bait first. In time, many of the males are removed from the population and the sex ratio of males to females is skewed. Scientists have shown that this is exactly what has happened to slinger on the Kwa-Zulu-Natal coast. Heavy fishing on the south coast has resulted in a sex ratio of one male to twenty females, whereas in the St Lucia Marine Reserve, where no bottom fishing is allowed, the sex ratio of slinger is one male to three females! This skewing of the sex ratio probably results in a lowering of the reproductive potential of the population because there are not enough males to spawn with all the females. It appears likely that our present slinger populations are only being sustained by healthier stocks in the St Lucia and Maputaland Marine Reserves and in southern Mozambique (which up until fairly recently has received relatively little fishing pressure).

Most of our important linefish are protected by minimum size limits, normally set at a length when 50% of the population has reached sexual maturity. If the species in question changes sex above the minimum size limit, then only one sex of that species is receiving protection. This is just one of the many complications that arise when trying to manage sex changing species. It is becoming increasingly apparent that one of the best management options available for ensuring the sustainability of resident reef fish which change sex is to set aside large protected areas such as the De Hoop, Tsitsikamma, St Lucia and Maputaland Marine Reserves.

Many of the interesting questions concerning sex change are currently under investigation by marine scientists in South Africa. Hopefully, they will help us to understand the fascinating biology of these animals, so that we are able to conserve them for the enjoyment of present and future generations.

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FURTHER INFORMATION:

• Oceanographic Research Institute, Sea World, Sea World Education Centre P.O. Box 10712, Marine Parade 4056. Tel: (031) 3373536, Fax: (031) 3372132
• JLB Smith Institute of Ichthyology Private Bag 1015, Grahamstown 6140
• van der Elst, R.P. 1988. *A Guide to the Common Sea Fishes of Southern Africa* (2nd ed). Struik, Cape Town.
• Payne, A.I.L., Crawford, R.J.M. & van Dalsen, A.P. 1989. *Oceans of Life off Southern Africa*. Vlaeberg, Cape Town.

RELATED FACTSHEETS:

• Ichthyology • Marine Reserves • Reef fisheries in KwaZulu-Natal • Fishing Regulations • Recreational Angling

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

Snoek 3C

The snoek, Thyrsites atun, *is an elongated, silvery fish that is widely distributed in the temperate coastal waters of the southern hemi - sphere, occurring off southern Africa, southern Australia and New Zealand, the southern parts of South America, and oceanic islands. In southern Africa the species has been recorded from northern Angola to Algoa Bay, Port Elizabeth, but most fish are found between the Cunene River and Cape Agulhas. Recent research has indicated that there are two sub-populations – one off Namibia and the other off South Africa.*

Biology and behaviour

The snoek is a medium-sized fish that reaches a maximum length of 2 m, corresponding to a mass of 9 kg. It is a shoaling predator with strong jaws and large, sharp teeth. In South African waters the adult fish prey mainly on sardine, anchovy and mantis shrimps.

Sexual maturity is reached at the age of three years, when the fish are about 73 cm long. Spawning occurs during winter and spring along the edge of the shelf (150-400 m depth) of the western Agulhas Bank and the west coast as far north as Hondeklip Bay. The eggs and larvae are transported by currents to the main nursery ground north of Cape Columbine, or to a secondary nursery area near Hermanus, to the east of Danger Point. These shallow waters (< 150 m depth) are extremely productive, providing a ready source of food for the developing young. For the first few days after the eggs hatch – about two days after fertilisation – the larvae feed on phytoplankton, but then prey largely on the larvae of other fish species. Juveniles remain on the nursery grounds until maturity, attaining a length of 33-44 cm at the age of one year. In autumn, the juveniles move inshore to feed on young pelagic fish in the St Helena Bay area.

After reaching sexual maturity, the snoek move offshore to spawn. Here hake, sardine, round herring and horse mackerel make up the diet. Males spend more time on the spawning ground than females, which are thought to move inshore between spawning events. This is probably in search of a more nutritious diet between energetically expensive spawning bouts, as the pelagic fish found inshore are higher in energy content than the offshore hake.

Based on the recovery of tagged fish and an analysis of catch statistics, southern African snoek were previously believed to comprise a single stock undergoing a seasonal longshore migration between Namibia and the south coast. It was postulated that the fish remained in Namibia from September to March, but started moving southwards in April and May to spawn. Between May and August the fish were believed to have reached St Helena Bay and the Cape Peninsula, and by June and July many were found in Gansbaai, with some as far east as Algoa Bay. They were thought to begin their return journey to Namibia in August-October.

A recent study indicates that the seasonal trends in trawl catches result from the offshore spawning migration rather than longshore migration from Namibian waters. The existence of two separate sub-populations of snoek in southern Africa is supported by the distribution of eggs and larvae in two distinct bands, separated by a cold upwelling cell off southern Namibia. Snoek catches are low in the area of the upwelling cell, which represents an environmental barrier to many species, including sardine and round herring. However, catch statistics suggest that some exchange occurs between the Namibian and South African sub-populations about every five years, probably in response to prey availability and environmental events such as intrusion of warm equatorial water as a result of climatic fluctuations.

Snoek is the most important commercial line fish species

The snoek fishery

As early as the 1600s, snoek were recorded as being caught in Saldanha Bay by Jan van Riebeeck. By 1830, some 40 boats and 200 men were exclusively engaged in fishing with handlines off the Western Cape, and salted snoek was being exported, mainly to Mauritius. By 1889 the Cape fleet consisted of 374 boats and more than 2 200 people, and the annual handline catch was between 3 000 and 4 500 tons.

During the Second World War, the canning industry became more important, although fresh or cured snoek later resumed dominance of the market.

A trawl fishery for snoek was developed in the 1960s. The total annual catch peaked at about 81 000 tons in 1978, but dropped substantially after foreign trawlers were excluded from Namibian waters in 1991. In the 1980s the number of skiboats involved in the handline fishery proliferated.

Today snoek is still the most important linefish species in both the commercial fishery, comprising 39% of the 1986-1997 catch, as well as the recreational boat fishery. The current annual commercial catch ranges between 14 437 and 22 920 tons (1991-1995). Around 60% of this is made by trawlers and 40% by commercial handline fishers, although catches by the latter may be under-reported by as much as 75%.

Regulations

The minimum legal size limit for the linefishery is 60 cm total length, or 54 cm fork length. A closed season was imposed on the sector from the 1960s, but was abolished in 1981. This was because the trawl fishery could not avoid catching snoek as by-catch, and it was considered unfair to impose regulations that could not be applied to all sectors.

There are currently about 3 000 boats in the commercial handline sector, but fishing rights have not yet been allocated in terms of the Marine Living Resources Act. More than 4 000 boats and about 12 800 anglers participate in the recreational lineboat sector, which is subject to a bag limit of 10 snoek per person per day.

Author: Sue Matthews October 2000

PHOTO: G.BRANCH

Classification:	
PHYLUM:	Chordata
SUBPHYLUM:	Vertebrata
SUPERCLASS:	Pisces – Fish
CLASS:	Osteichthyes – Bony fish
FAMILY:	Gempylidae
GENUS:	*Thyrsites*
SPECIES:	*atun*
COMMON NAME:	Snoek, barracouta

FURTHER INFORMATION:

• Dr Mark Griffiths, Marine & Coastal Management, Private Bag X2, Roggebaai 8012, tel. (021) 402-3911.
• Payne, A. I. L., Crawford, R. J. M. & Van Dalsen, A. 1989. *Oceans of Life off Southern Africa*. Vlaeberg Publishers, Cape Town.
• Van der Elst, R 1990 *A guide to the common sea fishes of southern Africa*. Struik Publishers, Cape Town.

RELATED FACTSHEETS:

• Fishing Industry • Recreational Angling • Demersal Fishing

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