Pathfinder Honour:

Fishes - Fascinating Facts

When we were compiling the Fishes 1 Honour, we came across so many fascinating facts on this part of God's creation that we thought it worthwhile sharing some of them.

Most fishes spend their lives in water. This wondrous world comprises a far greater part of our planet than land. We visit the water world infrequently and even today much of the oceans are still unexplored.

It is hoped that you find the fascinating facts as inspirational as we did.

Acknowledgements

Please refer to citations in the following text.

Fishes Honour: Fascinating Facts

INTRODUCTION

When we were compiling the Fishes 1 Honour, we came across so many fascinating facts on this part of God's creation that we thought it worthwhile sharing some of them.

Also, if you have a passion for fishes and have fascinating facts to share please forward to our honour website. Please read on and enjoy!

1. Number of fishes species in the world

At 31,900 species, fish exhibit greater species diversity than any other class of vertebrates. http://en.wikipedia.org/wiki/Fishes

2. Diversity in Breeding Habits

Based on '*Reproductive method'*: http://en.wikipedia.org/wiki/Fishes

The reproduction of fish species is a fascinating study. It gives a small insight into the creativity of our God.

Fish eggs that develop outside the mother's body

Fish eggs vary in shape as shown below.

Egg of Lamprey
http://en.wikipedia.org/wiki/File:Oeufs002b,57.png

Egg of Cat Shark (mermaids' purse)
http://en.wikipedia.org/wiki/File:Oeufs002b,54.png

Egg of Bullhead Shark
http://en.wikipedia.org/wiki/File:Oeufs002b,55.png

Egg of Chimaera
http://en.wikipedia.org/wiki/File:Oeufs002b,56.png

With over 97% of all known fish, the eggs develop outside the mother's body. Examples of these fish include salmon, goldfish, tuna and eels. In most species, eggs are fertilized outside the mother's body by the male fish in the surrounding water.

The newly hatched young of these fish are called larvae. They usually carry a large yolk sac for nourishment and look different to juvenile and adults. The larval period is usually only several weeks and larvae rapidly grow and change appearance and structure to become juveniles. During this transition larvae must switch from their yolk sac to feeding on zooplankton prey. Often insufficient zooplankton causes larvae to starve.

Of interest is the spawn of the anglerfish (genus *Lophius)* which consists of a thin sheet of transparent gelatinous material 0.6 to 0.9 m (2 or 3 feet) wide and 7.6 to 9 m (25–30 feet) long. The eggs in this sheet are in a single layer, each in its own cavity. The spawn is free in the sea. The larvae are free-swimming and have the pelvic fins elongated into filaments. Such an egg sheet is rare in fish.

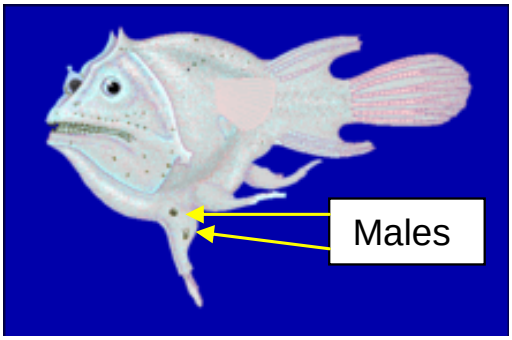
Fish that give birth to live young

In other species such as the Lemon Shark, the mother retains the eggs and nourishes the embryos with her blood supply as do mammals.

In sharks such as the Shortfin Mako and Porbeagle, developing embryos eat other eggs produced by the mother. In the Grey Nurse Shark, the largest embryos eat weaker and smaller siblings.

The wonder of Anglerfishes

Based on http://en.wikipedia.org/wiki/Anglerfish



When scientists first started capturing ceratioid anglerfish of the deep oceans, they noticed that all of the specimens were females. These individuals were a few centimetres in size and almost all of them had what appeared to be parasites attached to them. It turned out that these 'parasites' were highly reduced male ceratioids.

Picture: http://en.wikipedia.org/wiki/File:Hamol_u0.gif

At birth, a male ceratioid is equipped with an extremely well developed sense of smell. He uses this to find a female anglerfish, otherwise he would probably starve to death. When he finds a female, he bites into her skin, and releases an enzyme that digests the skin of his mouth and her body, fusing the pair down to the blood-vessel level. The male then slowly loses his digestive organs, then his brain, heart, and eyes, and ends up with little more than his reproductive organs. This ensures that, when the female is ready to spawn, she has a mate immediately available. Multiple males can be incorporated into a single female.

3. Deepest Fish – the Hadal Snailfish *Pseudoliparis amblystomopsis*

Source of picture and text based on:
http://www.extremescience.com/zoom/index.php/life-in-the-deep-ocean/44-deepest-fish

In 2008, researchers of the Hadeep project were exploring the Japan Trench with a remotely operated vehicle. They filmed the deepest-known species of fish. The fish, known as Snailfish, had never been seen alive before.

They expected to find fish living at these extreme depths 7700 m (25,272 ft) to be very slow and sluggish to conserve energy in this extremely low-energy environment, but the video shows a large group of them very actively moving and feeding.

Because these fish live in complete darkness, they use vibration receptors on their snouts to navigate the ocean depths and to locate food. Their eyes appear to be virtually nonexistent. Eyes in most organisms are designed for gathering light in the creature's visual field and transmitting it to the brain. In a world where no sunlight ever penetrates, there's probably little use for eyes. The researchers on this project expect to find fish living even deeper than these!

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4. Hottest Fish - The Mariana Arc Tonguefish genus *Symphurus*

Based on '*Fish dance on sulphur cauldrons'* by Jonathan Amos, Science reporter, BBC News, San Francisco. Thursday, 14 December 2006.
http://news.bbc.co.uk/2/hi/science/nature/6212716.stm

The Mariana Arc is a 1,200km chain of volcanic seamounts and islands between Guam and Japan.

Coming from these active under-water volcanoes is a toxic mix of scalding hot acids. Also, there are molten ponds of sulphur where the measured temperature is more than 180C (355F).

This hostile environment is where the Mariana Arc Tonguefish thrives. It is a type of flatfish, the largest being about 110mm.

Picture: Mariana Arc Tonguefish feeding
http://news.bbc.co.uk/2/shared/spl/hi/pop_ups/06/sci_nat_enl_1165422439/html/1.stm

Using a remote-controlled submersible, scientists observed these fish living right up against the edge of molten sulphur ponds. They videoed fish sitting on the molten sulphur and then moving off after a few minutes, apparently unharmed. That's COOL!

5. Coldest Fish: Antarctic Icefishes

Based on '*The bloodless icefishes'* by Peter Rejcek, Antarctic Sun Editor, Sept 2008
http://antarcticsun.usap.gov/science/contenthandler.cfm?id=1540
Picture: Bill Detrich. Blackfin Icefish. *(Chaenocephalus aceratus)*
javascript:newWindow('images/fishing_icefish.jpg',%20'sunImages',%20700,%20500,%20'yes');

Antarctic Icefish are a family of fish endemic to the Southern Ocean and live in a freezer-like environment where the salty surface water is about minus 1.8 degrees centigrade.

To survive, Icefish have a number of anti-freeze 'solutions'.

They have a lightweight, brittle skeleton of low mineral density. This is a disease in humans (osteopenia) which may be a precursor to the more serious disease osteoporosis. As such, it is the topic of research.

Icefish are the only group of vertebrates in the world - 16 species of Icefish out of 50,000 vertebrate species worldwide - that don't make haemoglobin, the component of red blood cells which transports oxygen to cells. Their blood is transparent. Understanding this process may be the key to understanding human diseases such as anaemia.

As if these adaptations were not enough, these fish also have circulating antifreeze proteins that help prevent them from freezing in the chilly waters they call home. Scientists have actually created synthetic versions of these proteins in an effort to help protect frozen food and transplant organs from forming ice crystals.

Now, that's REAL COOL!

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6. Fastest Fish

Based on: http://en.wikipedia.org/wiki/Sailfish

Picture: Indo-Pacific Sailfish *(Istiophorus platypterus).*
http://upload.wikimedia.org/wikipedia/commons/thumb/3/3e/Istiophorus_platypterus_.jpg/800px-Istiophorus_platypterus_.jpg

Most experts nominate the Sailfish as the fastest fish. Speeds up to 110km/h (68 mph) have been recorded – enough to qualify you for a hefty speeding fine in many places in land. Sailfish are also known for their incredible jumps.

Sailfish live in warmer parts of all the oceans of the world.

They are predominately blue to gray in colour, but can change their colouring vibrant purples and even silver when excited or chasing prey. They have an erectile dorsal fin known as a sail which often stretches the entire length of the back. Another notable characteristic is the elongated bill, resembling that of the swordfish and other marlins.

Sailfish grow quickly, reaching 1.2-1.5 m (4-5 ft) in length in a single year, and feed on the surface or at mid-depths on smaller pelagic forage fish and squid. Generally, sailfish do not grow to more than 3 m (10 ft) in length and rarely weigh over 90 kg (200 lb).

7. A Shocking Fish

Based on: http://en.wikipedia.org/wiki/Electric_eel

Picture: Electric Eel (*Electrophorus electricus)*
http://upload.wikimedia.org/wikipedia/commons/8/8f/Electric-eel.jpg

The Electric Eel is a real shocker. Mature Electric Eels can produce an electric shock of 500 volts and 1 ampere of current (500 watts). Such a shock could be deadly for an adult human as electrocution death is due to current flow; the level of current that is fatal in humans is roughly 0.75A.

Electric eels are capable of varying the intensity of the electrical discharge, using lower discharges for "hunting" and higher intensities for stunning prey, or defending themselves. When agitated, they can produce intermittent electrical shocks over a period of at least an hour without signs of tiring.

Electric Eels live in the fresh waters of the Amazon and Orinoco River systems in South America and grow to about 2m (6.5ft) and weigh about 20kg (44lbs)

Strictly speaking, the Electric Eel is not an eel but a member of the Knifefish family and is more closely related to catfishes.

The biological mechanisms used by Electric Eels to generate electricity are being researched by scientists as a possible power source for medical implants and other tiny devices.

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8. Sharks – Who's Afraid?

Based on: http://en.wikipedia.org/wiki/Shark

Well-known species such as the Great White Shark, Tiger Shark, Blue Shark, Mako Shark, and the Hammerhead are apex predators, at the top of the underwater food chain. Their extraordinary skills as predators fascinate and frighten humans even as their survival is under serious threat from fishing and other human activities.

There are about 440 species of shark, ranging in size from the small Dwarf Lanternshark (*Etmopterus perryi*), a deep sea species only 170 mm (6.7 in) in length to the Whale Shark (*Rhincodon typus*) the largest fish, which reaches approximately 12 metres (39.3 ft)

Sharks are found in all seas and are common down to depths of 2,000 metres (6,600 ft). They generally do not live in freshwater, with a few exceptions such as the Bull Shark and the River Shark which can live both in seawater and freshwater.

What's in a name?
Until the 16th century, sharks were known to mariners as 'sea dogs'. According to the Oxford English Dictionary, the name 'shark' first came into use after Sir John Hawkins' sailors exhibited one in London in 1569 and used the word to refer to the large sharks of the Caribbean Sea, and later as a general term for all sharks. It has also been suggested to be derived from the Yucatec Maya word for shark, xok, pronounced 'shok'.

Shark skin
Based on: http://en.wikipedia.org/wiki/Dermal_denticle#Placoid_scales

Sharks have neither skin nor scales like other fishes. They have Placoid scales also called 'dermal denticles' ('denticle' translates to 'small tooth') which cover the shark's body. This covering is in several layers. The outermost layer is composed of vitrodentine, a largely inorganic enamel-like substance. Placoid scales cannot grow in size, but rather more scales are added as the fish increases in size.

Studies have found that the placoid scales create tiny vortices that reduce drag which makes swimming more efficient as well as quieter compared to bony fishes.

The rough, sandpaper-like texture of shark skin, coupled with its toughness, has led it to be valued as a source of leather. Called 'shagreen', one of its many applications was in the historical manufacture of hand-grips for swords.

Shark's skeleton
Shark skeletons are very different from those of bony fish and terrestrial vertebrates. Sharks have skeletons made of cartilage and connective tissue. Cartilage is flexible and durable, yet has about half the density of bone. This reduces the skeleton's weight, saving energy. Sharks have no rib cage and therefore on land a shark's own weight can crush it.

Shark buoyancy
Unlike bony fish, sharks do not have controllable gas-filled swim bladders for buoyancy. Equivalent sized sharks are much lighter because their cartilage skeletons are about half as dense as bone and their livers (up to 30% of body mass) contain a low density fluid.

This helps, but to maintain a desired depth, sharks need to swim positioning their pectoral fins an angle to create lift, just like an aeroplane wing. Sharks sink when they stop swimming. Most sharks need to swim constantly in order to breathe and cannot sleep very long, if at all, without sinking.

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Shark digestion
Digestion can take a long time. The food moves from the mouth to a 'J' shaped stomach, where it is stored and initial digestion occurs. Unwanted items may never get past the stomach, and instead the shark either vomits or turns its stomachs inside out and ejects unwanted items from its mouth.

Shark senses
Sharks have keen sense of smell with some species able to detect as little as one part per million of blood in seawater. They can often determine the direction of a scent based on the timing of scent detection in each nostril. This is similar to the method mammals use to determine direction of sound. They are often attracted to the chemicals found in the guts of many species. As a result often linger near or in sewage outfalls. Some species, such as Nurse Sharks, have external barbels that greatly increase their ability to sense prey.

Shark eyes are similar to the eyes of other vertebrates with similar lenses, corneas and retinas. Their eyesight is well adapted to the marine environment. They can contract and dilate their pupils, like humans. Sharks have eyelids, but they do not blink because the surrounding water cleans their eyes. To protect their eyes some species have membranes which cover the eyes while hunting and when the shark is being attacked. However, some species, including the great white shark (*Carcharodon carcharias*), do not have this membrane, but instead roll their eyes backwards to protect them when striking prey.

Sharks have electroreceptor organs which may number in the hundreds to the thousands. They use these to detect the electromagnetic fields that all living things produce. This helps sharks (particularly the Hammerhead Shark) find prey. Sharks have the greatest electrical sensitivity of any animal. They find prey hidden in sand by detecting the electric fields they produce. Ocean currents moving in the magnetic field of the Earth generate electric fields that sharks can use for orientation and possibly for navigation.

Shark's speed
In general, sharks cruise at an average speed of 8kmph (5mph) – fast enough to beat the world record for men's 100m freestyle. When feeding or attacking, the average shark can reach speeds upwards of 19kmph (12 mph). The Shortfin Mako shark, the fastest shark and one of the fastest fish, can burst at speeds up to 50 kilometres per hour (31 mph).

Shark feeding methods
Whale, Basking and Megamouth Sharks filter feed. Whale sharks use suction to take in plankton and small fishes. Basking Sharks are ram-feeders, swimming through plankton blooms with their mouth wide open. Megamouth Sharks make suction feeding more efficient, using luminescent tissue inside the mouth to attract prey in the deep ocean. This type of feeding requires gill rakers, long slender filaments that form a very efficient sieve, analogous to the baleen plates of the great whales. The shark traps the plankton in these filaments and swallows from time to time in huge mouthfuls.

Cookiecutter Sharks feed by biting flesh out of other larger fish and marine mammals. Angel Sharks and Wobbegongs use camouflage to lie in wait for their prey. Many bottom dwelling sharks feed solely on crustaceans which they crush with their flat molar-like teeth. The Great White Shark and other large predators either swallow small prey whole or take huge bites out of large animals. Thresher Sharks use their long tails to stun shoaling fishes, and Sawsharks either stir prey from the seabed or slash at swimming prey with their long blade-like snouts which are edged with teeth.

Many sharks, including the Whitetip Reef Shark are cooperative feeders and hunt in packs to herd and capture elusive prey. These social sharks are often migratory, traveling huge distances around ocean basins in large schools.

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Shark's Teeth
Based on: http://en.wikipedia.org/wiki/Shark_teeth

Picture: Tiger Shark teeth - oblique and serrated for sawing through flesh.
http://upload.wikimedia.org/wikipedia/commons/3/3f/Tiger_shark_teeth.jpg

Tooth shape depends on diet.

Sharks that feed on molluscs and crustaceans have dense flattened teeth for crushing; those that feed on fish have needle-like teeth for gripping and those that feed on larger prey such as mammals have pointed lower teeth for gripping and triangular upper teeth with serrated edges for cutting. The teeth of plankton-feeders such as the basking shark are smaller and non-functional.

The teeth of sharks are not attached to the jaw, but embedded in the flesh and are constantly replaced throughout the shark's life. When they lose a working tooth it will be replaced by the next tooth behind it. All sharks have multiple rows of teeth along the edges of their upper and lower jaws. New teeth grow continuously in a groove just inside the mouth and move forward from inside the mouth on a 'conveyor belt' formed by the skin in which they are anchored.

Typically a shark has two to three working rows of teeth with 20 to 30 teeth in each row, although a whale shark has about 300 teeth in each row. Most sharks shed individual teeth, but the Cookiecutter Shark sheds an entire series of lower jaw teeth at once.

Shark Attacks
Based on: http://en.wikipedia.org/wiki/Shark_attack

Few things generate as much fear as a shark attack. The media often seizes on each shark attack resulting in gruesome headlines and gory details. Although shark attacks are often horrific, the incidence of shark attacks is relatively rare. An international organisation, the International Shark Attack File, records shark attacks around the world. A snapshot is as follows. See - http://www.flmnh.ufl.edu/fish/sharks/isaf/isafabout.htm

- The United States has had more reported shark attacks than any other country, with a total of 1,049 attacks (49 fatal) during the 339 years from 1670–2009.
- Outside the United States, Australia and South Africa have had the most recorded attacks.
- In 2000, the year with the most recorded shark attacks, there were 79 shark attacks reported worldwide, 11 of them fatal.
- In 2005 and 2006 this number decreased to 61 and 62 respectively, while the number of fatalities dropped to only four per year. Of these attacks, the majority occurred in the United States (53 in 2000, 40 in 2005, and 39 in 2006)

A difficulty with this data is that the most third world coastal nations have yet to embed procedures for reporting shark attacks and any subsequent injuries or fatalities. As a result there are gaps in the data. Even so, shark attacks are relative rare. By comparison over a 20 year period, an average of 20 people lost their lives each year due to horse-related accidents in Australia. http://www.nisu.flinders.edu.au/pubs/bulletin24/bulletin24-Mortalit.html

The Florida Museum of Natural History compares shark attack statistics with the much higher rate of deaths from other, less feared causes. For example, in the US, an average of more than 38 people die annually from lightning strikes in coastal states, while less than 1 person per year is killed by a shark. Also, In the United States, the annual number of people who drown is 3,306, whereas the annual number of shark fatalities is 1.

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Contrary to popular belief, only a few sharks are dangerous to humans. Out of some 440 shark species, only four have been involved in a significant number of fatal unprovoked attacks on humans: the Great White, Tiger, Bull and the Oceanic Whitetip, which is considered to be the most dangerous. These sharks, being large, powerful predators, may sometimes attack and kill people. Being top of the food chain, they have little fear of other creatures.

Lacking any limbs with sensitive digits such as hands or feet, the only way sharks can explore an object or organism is to bite it; these bites are known as exploratory bites. Generally, shark bites are exploratory and the animal will swim away after one bite. For example, exploratory bites on surfers are thought to be caused by the shark mistaking the surfer for the shape of prey. Nonetheless, a single bite can grievously injure a human if the animal involved is a powerful predator like a Great White or Tiger Shark.

Sharks normally make one swift attack and then retreat to wait for the victim to die or exhaust itself before returning to feed. This protects the shark from injury from a wounded and aggressive target; however, it also allows humans time to get out of the water and survive.

Shark attacks may also occur due to territorial reasons or as dominance over another shark species. An example is the prevalence of Bull Sharks in coastal canals and streams of South Queensland – even in fresh / brackish water or flood waters. These unpredictable sharks are aggressive and territorial.

<u>Shark safety strategies</u>

If one wants to be totally safe from shark attacks, water activities should be confined to the bathtub. While there is no way to completely eliminate the possibility of a shark attack in the sharks' natural environment, a few simple precautions can be taken to reduce the risk of a shark attack:

- Swim between the flags at lifesaver-patrolled beaches and obey any instructions given by them. If this is not possible:
    - Avoid the water at dawn, dusk, or night, when sharks tend to feed.
    - Avoid areas where sharks generally locate themselves, such as murky waters and steep drop-offs.
    - Avoid swimming alone, always being near a group of people, and if possible, avoid being at the edge of the group.
    - Refrain from excess splashing or movement.
    - Prevent pets from entering the water.
    - Avoid shiny jewellery, tan lines and bright clothing, all of which can attract sharks.
    - Avoid entering water if bleeding from an open wound or if menstruating.
    - Avoid areas where the remains of fish have been discarded into the water, such as near fishermen cleaning their catch.

Apparent death of a shark

We have only touched the surface of the wonderful world of sharks. After touching on the gruesome topic of shark attacks on humans, it's time to look at what we term 'the apparent death of a shark.'

Based on: http://en.wikipedia.org/wiki/Tonic_immobility#Tonic_immobility

Many animals such as sharks, beetles, snakes, striped hyenas and the Virginia Opossum, are capable of appearing to be dead to an observer, while otherwise alive.

This could either be a reflex action or a defence mechanism for avoiding predators such as in the case of the Virginia Opossum which is well known for 'playin' possum' when under threat. Many people have been totally fooled and surprised when the dead Opossum suddenly comes to life.

With some sharks, this 'apparent death' is considered to be a reflex action; perhaps associated with mating. Here the shark remains in this state of paralysis for an average of fifteen minutes before it recovers. Scientists call this 'tonic immobility'.

There are a number of ways that tonic immobility can be induced. Lemon Sharks and Reef Sharks are be turned upside down. With 3–4 metres (10 to 15 feet) Tiger Sharks tonic immobility may be achieved by placing hands lightly on the sides of ts snout near the general area surrounding its eyes. During tonic immobility, the dorsal fin(s) straighten and both breathing and muscle contractions become more steady and relaxed.

In an eye-witness case in 1997 off the coast of California, a female Killer Whale was seen purposely inducing tonic immobility in a Great White Shark. The Killer Whale held the shark upside down to induce the tonic immobility, and kept the shark still for fifteen minutes, causing it to suffocate to death. This was the first recorded eye witness case of predation on a Great White Shark in the wild by a species other than humans.

Scientists have exploited this phenomenon to study shark behaviour. The effects of chemical shark repellent have been studied to test effectiveness and to narrow down dose sizes, concentrations, and time to awaken.

9. The Legend of the Clumsy Slave

Based on: http://en.wikipedia.org/wiki/Lamprey

Picture: Illustration from an edition of *Tacuinum Sanitatis*, 15th century.
http://en.wikipedia.org/wiki/File:Tacuinum_Sanitatis-fishing_lamprey.jpg

This old legend has a moral!

Vedius Pollio was punished by Augustus, the Roman Emperor for tryingto feed a clumsy slave to the lampreys in his fishpond.

...one of his slaves had broken a crystal cup. Vedius ordered him to be seized and then put to death, but in an unusual way. He ordered him to be thrown to the huge lampreys which he had in his fish pond. Who would not think he did this for display? Yet it was out of cruelty. The boy slipped from the captor's hands and fled to Caesar's feet asking nothing else other than a different way to die — he did not want to be eaten. Caesar was moved by the novelty of the cruelty and ordered him to be released, all the crystal cups to be broken before his eyes, and the fish pond to be filled in... – Seneca, On Anger, III, 40