

Creature Feature – Nautilus

A Living Fossil

Very little is known about the nautilus despite the fact that its fossil record indicates that it has remained virtually unchanged for the last 500 million years. There was a time in history where nautilus species were the key predators in all the oceans, but then sharks and other fish evolved and nautilus moved into areas where these new visual predators were less of a threat: the dark depths. Today, they are far more restricted in the number of species and in their distribution, found only in the Indo-Pacific region. The species found in the Coral Sea is called *Nautilus pompilius* and here are some facts you may or may not have known about these mysterious creatures:

Fast facts:

- **Taxonomy:** Nautilus species belong to the family Nautilidae within the class Cephalopoda (which includes octopus, squid and cuttlefish as well). Cephalopods are in the phylum Mollusca, which includes snails, slugs, bivalves like mussels and clams, and chitons.
- **Average size:** depends on species, but *N. pompilius*, found in the Australian waters of the Coral Sea, ranges between 130mm and 170mm depending on which reef it is from.
- **Lifespan:** ~20 years
- **Food:** They scavenge/predate on shrimp, small fish, and crustaceans. Nautilus have parrot-like jaws powered by very strong musculature. Their raspy tongue, much like a chainsaw, is well adapted for chomping on crustacean shells.
- **Habitat:** Deep slopes of coral reefs, between 150 and 800m, but usually at 300m.
- **Predators:** Anything with a strong jaw, and deep sea octopus that drill into the adductor muscle and inject poison so they can eat the animal.
- **Growth:** As the nautilus grows, it moves forward in its shell and seals the chamber (camerae) behind it with a new septum (divider). A nautilus will have approximately 7 camerae when it hatches to more than 30 when it is mature.
- **Life history:** Females lay eggs once a year in shallow waters. The eggs may take 8-12 months to develop until the young hatch looking like miniature adults.

Nautilus: A different kind of cephalopod

Though nautilus have tentacles, a prominent head and share many other characteristics with their close relatives the octopus, squid and cuttlefish, there are a number of features that truly set these creatures apart:

- They are the only cephalopod that has an external body structure in the form of a shell
- They are much longer lived than other cephalopods
- Females will lay eggs many times throughout their lives, rather than just once
- They don't have a lens in their eye, they use a pinhole system for focusing – the same system as old pinhole cameras
- They don't have the same colourful displays that other cephalopods exhibit

Interview with an expert:

Andy Dunstan, a PhD candidate at the University of Queensland, has spent 12 years researching nautilus. He has spent countless hours both in and on the water using innovative techniques that have already provided insight into the behaviours of these creatures of the deep. We asked him a thing or two about the nautilus...

Q: Andy, you are placing tracking devices on nautilus on a number of reefs in the Coral Sea, including Osprey Reef and Bougainville Reef, what are you learning from this research?

Yes, we are fitting nautilus that we capture with an acoustic transmitter, which we take measures to ensure doesn't affect the buoyancy of the animal. Using a hydrophone and receiver, we can then track the animals in real time and gather location information, depth, and the temperature of the surrounding water. As well as zooming around in boats on the surface with our receiver equipment, there are a number of receiver stations around Osprey Reef that gather data from animals that come within 500m of the receiver. We are then able to download those data from the stations. This research is providing information which may well turn upside down the theories of nautilus daily vertical migrations from the deep daytime locations, to shallower waters at night to feed.

We are also doing catch-and-release studies. We have tagged 2,500 animals and recaptured 250 and so from this information we are able to estimate population sizes and growth rates.

Q: Do nautilus migrate very far during their lifetime? For example, how far might an adult be found from where it hatched?

This isn't really well documented, and is something my research will hopefully provide more insight on. The nautilus is able to live in depths between 150m and 800m, beyond 800m the shell will implode due to the pressure. They are caught on the deep slopes of reefs rather than in midwater, suggesting that they don't generally move between reefs separated by deep trenches. So, in an area like the Coral Sea, where the reefs are quite distant from one another and divided by trenches, there is likely little to no movement between reefs. This means that the populations associated with each reef are probably genetically distinct from one another. In comparison, somewhere like the Great Barrier Reef likely allows much more movement of individuals as there is much more connectivity between reefs producing more of a genetic gradient than distinct populations.

Q: Are nautilus populations healthy?

In some areas of the world they are heavily fished for their shells. There is great demand for them and so as many as can be supplied are going to be bought. In the Australian waters of the Coral Sea, there are no pressures on nautilus and so these populations can be used as baseline data for monitoring in other areas.

Q: What else should people know about nautilus?

There is a common misconception that nautilus control their buoyancy with the same ease that a diver controls buoyancy using a Buoyancy Control Device. This isn't true, it is quite a slow process of equilibrating. Nautilus control buoyancy by osmotically pumping gas and fluid into or from the camerae (which are connected through siphuncles). However, they can't operate under extreme hydrostatic pressures. If they spend too long in deep waters (~400m) their shell will gradually fill with water due to the external pressure and they can't counter this so they have to actively swim up to become neutrally buoyant again.

Also, these creatures are iconic. The nautilus shell features prominently in art and architecture and is a model in structure and design. Nautilus have been around for nearly 500 million years, through five massive animal extinctions, we could stand to learn a great deal from them particularly in the face of a rapidly changing global climate.