



Foto: Olga Shavrina

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Teaching and research in Aquatic BioSciences, with a focus on fish biology; fish ecology and physiology, aquaculture, feeding and nutrition.

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## CURIOSITIES OF THE SEA

### NOT JUST FISHY TALES

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On Facebook you are challenged to name your favorite books and films, songs and recording artists. Fiskerikandidaten does things differently; first, you are taken on a voyage of discovery of the oceanic realm, just like the HMS Challenger expedition (1872-1876). You explore a curiosity cabinet filled to the brim with fascinating, peculiar and rare sea creatures. I joined the voyage, delved into the contents of the cabinet, and took on the challenge of making a cradle to the grave selection of the creatures that make up the weird and wonderful world of marine life.

#### LUNATIC ANTICS ON THE SPAWNING RUN

If I told you that fish leave the water to spawn on land you would probably think that old age had befuddled my brain; but no, it is not me that is the mad lunatic it is the fish. The California grunion (*Leuresthes tenuis*) is a land lubber. It is a small (15-18 cm long) New World silverside (Atheriniopsidae) that lives in shallow water along the Californian coast. The spawning season is from March to August, with the peak in late-March until early-June, and grunion do spawn on land (Figure 1). Grunion spawning runs are spectacular and they attract large audiences.

Grunion are lunatics because their spawning is governed by the lunar cycle, and the effect that this has on the tides. Spawning occurs on the nights just



FIGURE 1

Beach-spawning in the California grunion (*Leuresthes tenuis*) around the time of spring tides. (Photo credit: Cabrillo Marie Aquarium, San Pedro, California, USA)

after the full and new moons, when the tides are at their peak, and continues for four consecutive nights. As the waves break, the grunion swim as far up the beach as they can and they are left stranded on land as the water retreats. The female then digs a nest in the wet sand with her tail. She burrows into the sand and as she lays her eggs, several males curve around her body and release their milt. This spawning act is repeated several times over the next few hours.

As the eggs develop over the next 10 days or so, the tides are lower and water does not reach the grunion nests. The eggs do not dry out and die because they are kept moist by residual water in the sand at the bottom of the nest. The eggs usually hatch during the next high tides when some waves reach as high on the beach as the nests. They can remain alive for up to a month, so will still hatch even if the first cycle of high tides fails to reach the nest. The eggs hatch a few minutes after they are freed from the sand by wave action, and the newly-hatched grunion are then carried out to sea by the retreating water. The fish that survive grow rapidly and mature after about one

year; once mature they repeat the same spectacular grunion spawning runs as their parents, before dying after 2-3 years.

#### FAMILY PLANNING THE SHARK WAY

Imagine we are in a public aquarium and are looking at a female shark that has been held in solitary confinement since she was captured over 3 years ago. Suddenly she starts to lay eggs, and after some weeks these eggs hatch to give live pups. What have we witnessed? There seem to be two possible explanations, both of which are highly improbable. Have we seen a virgin birth with the pups hatching from unfertilized eggs? Or had our female mated with a male before she was caught, retained living sperm within her body for some years and then used this sperm to fertilize her eggs?

Unlikely as it may seem, both outcomes are possible and have been documented using modern genotyping and DNA fingerprinting techniques. Virgin birth, more correctly termed parthenogenesis, is known to occur in four species of sharks when females are held

in captivity for extended periods in the absence of males; white-spotted bamboo shark (*Chiloscyllium plagiosum*), bonnet-head shark (*Sphyrna tiburo*), blacktip shark (*Carcharhinus limbatus*) and zebra shark (*Stegostoma fasciatum*). In parthenogenesis, there is nothing in the DNA profile of the pup that comes from a father; everything seen in the DNA profile of the pup is also seen in the mother's profile. When the DNA profiles of mother and pup are similar the implication is that no male has been involved, and we have a case of virgin birth.

On the other hand, when pups hatch from fertilized eggs their DNA profiles have genetic contributions from both a father and a mother. When sperm fertilizes the eggs of the female, the genetic contribution of the father can be detected in the DNA profile of the pup. We know that some female sharks can store sperm for periods of 1-2 years and then use this sperm to fertilize their eggs. What is the maximum time a female shark can store sperm? Records are made to be broken; DNA profiling of pups that hatched from fertilized eggs has revealed that female brown-banded bamboo sharks (*Chiloscyllium punctatum*) can store sperm for almost 4 years. This must go down on record as an extremely good case of long-term family planning.

**MING AND METHUSELAH: BATTLE OF THE ANCIENTS**

Methuselah is reported to have lived to the ripe old age of 969 years (Genesis 5: 21-27). Can any marine animal match this? The glass sponges (*Hexactinellida*) probably beat Methuselah by several thousand years; it is thought that some glass sponges can reach an age of 15,000 years or more. The glass sponges are, however, colonial animals and this gives them an unfair advantage. So what about non-colonial, marine animals? The Greenland shark (*Somniosus microcephalus*), with a suspected maximum age of about 400 years, is probably the longest-lived marine vertebrate, but it is not the longest-lived, non-colonial marine animal. At present, this honour goes to Ming, a bivalve mollusc.

Ming was a large (shell length 85+ mm; height 70+ mm), and very old Ocean quahog (*Arctica islandica*) (Figure 2). The Ocean quahog is widely distributed in the North Atlantic, where it lives in muddy sand at depths between about 5 and 300 m. Before Ming was discovered, it was already known that Ocean quahogs were long-lived; specimens with ages between 100



**FIGURE 2.** Ming, the longest-lived (500+ years) Ocean quahog (*Arctica islandica*) on record. Ming was caught in Icelandic waters in 2006. (Photo credit: Bangor University, UK)

and 200 years were quite common, and some from Icelandic waters had ages over 300 years. The shell hinges of Ocean quahogs have growth rings that can be used to estimate age. When Ming's growth rings were counted an age of 507 years was found. Confirmation of Ming's age was obtained using an alternative aging technique based on C-14 radiocarbon dating.

**We know that some female sharks can store sperm for periods of 1-2 years and then use this sperm to fertilize their eggs.**

Genus: *Arctica islandica*  
 Ref #: 061294  
 Locality: Iceland  
 Station: B05 AD03  
 Dredge/Tow #:  
 Ave. Latitude: 66° 31,59N  
 Ave. Longitude: 18° 11,74W  
 Water depth: 83-81 m  
 Collector: Scourse  
 Cruise: Bjarni Saemundsson, Iceland B05  
 Collection Date:  
 Method: Arctica dredge  
 Live(Y) or dead(A/R/L): YA  
 Length: 86.9 mm  
 Height: 72.5 mm  
 Max Height: 82.1 mm  
 Width: 48 mm  
 Weight of shell valve: 52.08g  
 Periostracum: 1  
 Ligament: 4 Shell margin: 4  
 Bioerosion: 4  
 Nacre: 1  
 Sex: Spent?  
 Flesh wet weight: 40.28 g  
 Notes:

This means that Ming was over 60 years old when William Shakespeare was born, and was 300+ at the time of the birth of Charles Darwin. Could Ming have outlived Methuselah? That we will never know because Ming's life was brought to an abrupt and premature end. The life of this Methuselah amongst molluscs was terminated in 2006; dredged up from an Icelandic seabed home during a research cruise. Maybe Ming has some older siblings, a Yuan or even a Jin, that are still carrying on the family tradition and are defying the march of time.

**FOOD FOR THOUGHT**

I have delved into the marine curiosity cabinet and have described some of the creatures I found there; there are many, many more I could have chosen. What about the gruesome; the cannibalistic shark pups who eat their siblings whilst developing within their mother's uteri. Or the dwarf males of the deep-sea anglerfish; parasitic males who are little more than testes that feed on the tissues of their much larger wives. Alternatively, I could have explored the deep-sea to try to find the legendary Kraken. Or I could have plunged to the very depths of the hadal trenches to examine the smokers that release methane and provide life-support to a unique and varied assortment of peculiar creatures.

Although we know far more about oceanic life today than we did at the time of the *HMS Challenger* expedition, it is still a case of the more we look, the more we find. We are continually surprised and fascinated by the variety of life that abounds in the seas and oceans, and we know that there is still much more to be discovered in the unfathomed depths of *mare incognitum*.

**ADDITIONAL READING**

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