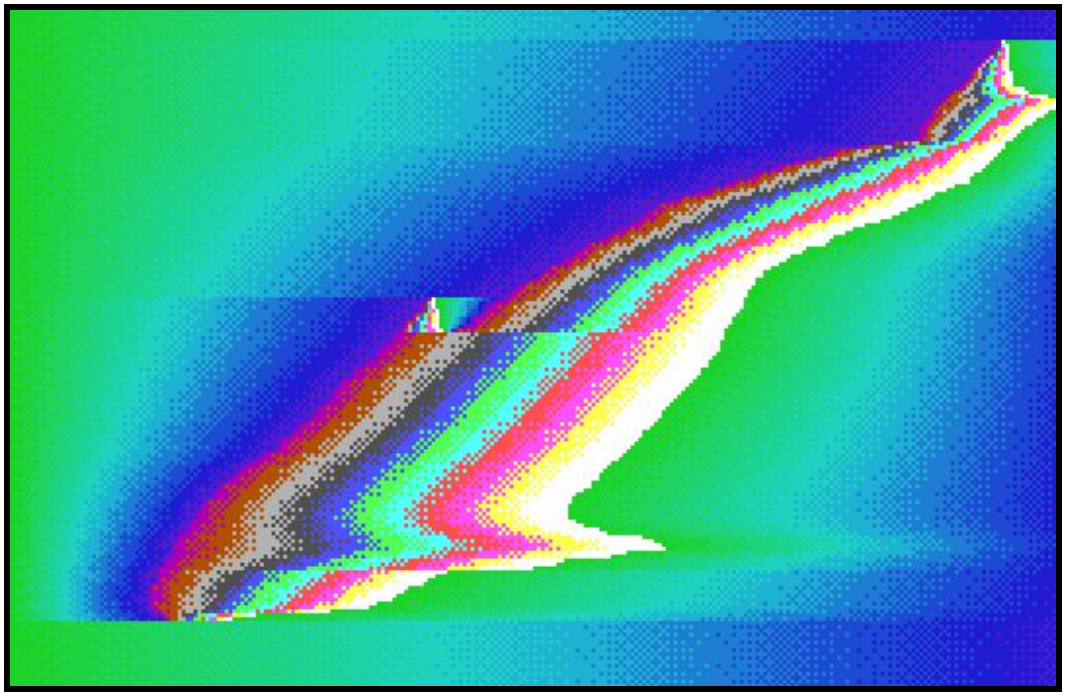


Basking Shark Has Been Through Bottleneck and Need Our Support

By Aditya Nirgun Dec 9, 2018

"O' th mighty shark,
With such grace doth he slide and measure the oceanscape.
A finned Titan!"
- *Anonymous*

A grey, cartilage-boned mass the length of a shipping container quietly glides across the surface of every temperate ocean on Earth. It averages at a weight of 5.2 tons and it is filter feeding on plankton at a relaxed pace of around 2 knots. *Cetorhinus maximus*, or the Basking Shark, is the second largest shark and has the smallest brain of any shark species. Unfortunately for the basking shark, a combination of these characteristics has made its fins some of the most valuable in international trade. Fisheries and other human interference has posed a serious threat to population numbers of the passive behemoth and, furthermore, a lack of diversity across global populations has been observed in early studies. Until recently however, evolutionary evidence to test a possible causal link between these conditions remained elusive. The researchers that took to bearing this task comprised of interdisciplinary scientists from at least

three different universities published their findings on the genetic analysis of basking shark mitochondrial DNA.

Firstly, their results presented stronger evidence from a larger scope for validating the notion that global population of basking shark suffers from low genetic diversity. Few alterations were detected in a 550bp stretch of nucleotide code resulting in just six haplotypes, or major variants, for that control region in the Cytb locus, the section of code that was examined. This coding region is found in the DNA of the maternally inherited mitochondria shared by all eukaryotes and the results revealed a low substitution rate in comparison to many other species, as is demonstrated in Figure 1.

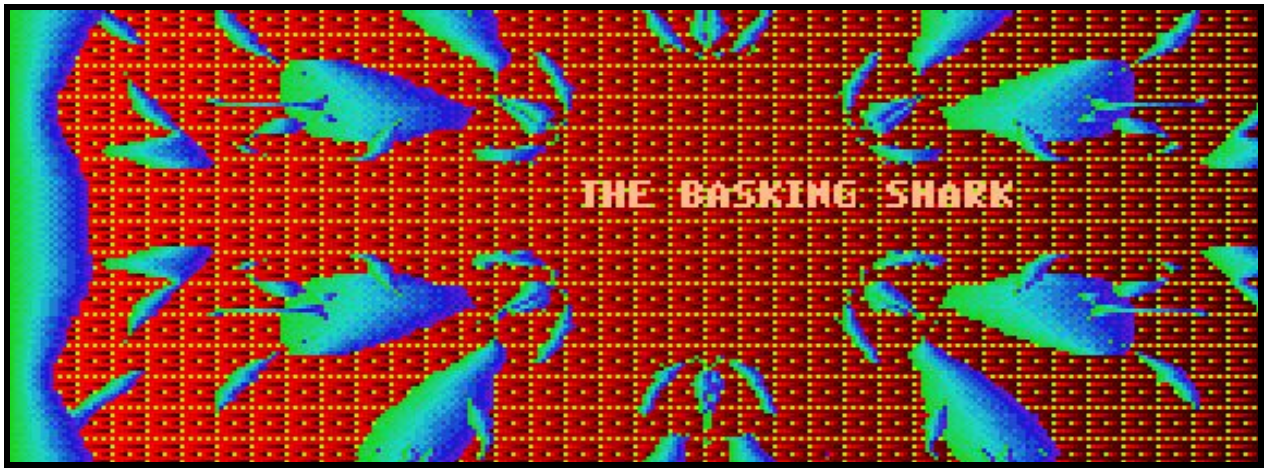
species	nucleotide diversity (π)	haplotypic diversity (h)
Basking Shark	0.0013 ± 0.0009	0.720 ± 0.028
Blacktip Shark	0.0021 ± 0.0013	0.805 ± 0.018
Sandtiger Shark	0.003 ± 0.0001	0.717 ± 0.01
Great White Shark	0.0203	—
Scalloped Hammerhead	0.013 ± 0.0068	0.80 ± 0.02
Big Eye Tuna	0.054	0.98–1.0
Swordfish	0.0148 ± 0.0005	0.997
True Tunas	0.015	0.991
Wahoo	0.053	0.999
Loggerhead Sea Turtle	0.0236 ± 0.0121	0.579 ± 0.028
Sperm Whale	0.002 ± 0.0003	0.86
Killer Whale	0.0053 ± 0.0031	0.874 ± 0.013
Common Bottlenose Dolphin	0.013–0.024	0.42–0.92
Short-Beaked Common Dolphin	0.012–0.021	0.853–1.0

Figure 1: The diversity of the basking shark's nucleotide sequence at the *Cytb* locus on a global scale comparison. Rank ordering against outgroup species shows the exceptionally low nature of the result (Heolzel 2006).

The study continues on to investigate signs of a bottleneck event in the history of the basking shark. Frequency of mismatched nucleotides was assessed by parameters of generation time and mutation rate to estimate a population expansion date. Heolzel et al. conclude that a bottleneck had occurred, though it took place 86,000 years ago, predating any possibility for significant human involvement. Possible explanations for the bottleneck could include the disruption of oceans by melting glaciers during a climate warming.

Nonetheless the bottleneck event has been considered the most likely cause of the basking shark's unprecedented global consistency in showing low diversity at the locus in question, a foreboding mark of the shark's vulnerability in present day conditions. This

discovery has become a clear signal for conservation efforts to put strong pressure on restricting human impact in the future. Lack of genetic diversity can subject a species to lack of defense against infectious disease, inability to adapt to changing conditions, and overall low fitness against new competition. Periods of long gestation and slow maturation characteristic of these sharks further aggravate these risks of dangerously low diversity to spell disaster in the wake of overfishing and habitat disruption. The regulation of shark finning in the oceanic waters of Western Europe and the Atlantic has been enforced since 2013 and was followed by restrictions in the East Pacific. However, international waters remain unregulated and no restriction are placed on shark finning in most of the Pacific and Indian Ocean. And even in regions designated as protected shark sanctuary, wildlife reporters and activists have uncovered industrial scale finning operations. It seems the struggle for survival is harder than ever for the basking shark.



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