Whale attack simulations reveal prey escape strategies

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Humpback whales feed from a range of species that have adapted to escape their fate in a variety of ways. As much as humans track their prey according to the species they are stalking, so whales lunge open-mouthed in different ways depending on the target they are hunting.

Research by Dr Nicholas Carey from the Goldbogen lab at Stanford University's Hopkins Marine Station, United States and collaborators from IAMC-CNR, Italy uses data from real whale lunges along with lab simulations to examine if whales alter their lunging strategy to catch different dinners.

"Our results illustrate the complex balance between whale attacks and fish escape responses, and how the lunge characteristics of the whales may be related to the escape abilities of targeted prey," says Dr. Paolo Domenici, who spent several weeks at Hopkins Marine Station and helped lead the study.

Dr. Jeremy Goldbogen believes that this research can tell us how whales may be changing their attack strategy depending on the prey they are targeting in order to maximise their hunting success. "Whale lunges are very energetically costly, so any aspect which increases the potential success of these lunges is beneficial."

Humpback whales hunt a range of different species including krill, herring, sardines and anchovies. These prey species move in different ways, meaning that the whales can't just use one hunting strategy for all

their targets.

"Anchovies are likely to swim faster and cover greater distances compared to krill, and so may have better ability to escape an oncoming whale," explains Dr. Carey. "We think that these different characteristics may require varying attack strategies by the whales."

Humpback whales commonly feed on large prey shoals by accelerating to high speeds and "lunging" at their prey, engulfing a large volume of water and filtering out the prey through their filter feeders. Dr. Carey's colleagues in the Goldbogen Lab led by Dave Cade collected lunging data from live humpback whales during feeding, which informed the creation of a predatory 'looming stimulus' model which they used to analyse the escape responses of anchovies in the lab.

Lunging data was collected by placing electronic tags on the whales to measure speed, acceleration and timing of the mouth opening in order to create different lunging profiles for each target prey species. "Humpback whales feeding on fish showed more variability in their lunge strategies, and, despite prey being much faster, actually lunge more slowly," says Dr Goldbogen.

"Anchovies are among the most abundant fish in the oceans, forming vast schools of millions of individuals and are targeted by a multitude of predators," says Dr Carey, "because of this, they have evolved to be speedy, vigilant and highly responsive to approaching threats."

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