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# Where and why sharks attack

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**The reasons for shark attacks and the question of when and where they might occur has always been the subject of intense scientific interest in the effort to make seaside recreation as safe as possible.**

Now, Erich K. Ritter of the Shark Research Institute, and Raid Amin, Peter Kennedy, and Laura Cossette of the University of West Florida, have approached the problem in a new way and have discovered that there are definite high and low risk zones involved. They have localized several such areas along the coastlines of Florida and California, where more than two thirds of all shark attacks

take place in the United States, examining the regions where attacks rarely happen as well as those already known to be dangerous. This has resulted in a more comprehensive understanding of shark attack patterns along these shores.

The researchers used data from the Shark Research Institutes's Global Shark Attack File and the records of attendance at beaches to determine the ratio of shark attacks to the number of people using the water. They used the modern cluster analysis software SaTScan™ to find the relative risk of being bitten by a shark, termed the "shark attack rate", which was not possible before this tool was

available.

This new method revealed regions with significantly higher or lower sharks attack rates than would have been predicted by examining just the numbers of shark bites. Though they varied over time, the clusters were clearly defined and remained in place year after year.

## Application

On the eastern coast of Florida, for example, 345 shark attacks were recorded between 1994 and 2009, and of these, 210 incidents involved surfers, and 114 involved swimming and bathing. The remainder did not fit the criteria and were excluded. No attacks on divers were mentioned. The SaTScan™ analysis revealed two high risk zones, and two that are low risk areas.

Applying the same method to the Californian coastline resulted in similar clearly defined clusters being identified. Since 90 percent of the attacks on that coastline are due to the great white shark, the shark attack clusters seemed to be linked to the nearby presence of colonies of seals and sea lions where great whites congregate to hunt for food. The coastal region between San Mateo and Del Norte is one such region. The presence of the pinniped colonies continuously attracts the great seal predators to the area, some of which likely circle closer to the shores and come into contact with humans.

On the other hand, the low risk regions occurring south of Santa Barbara and

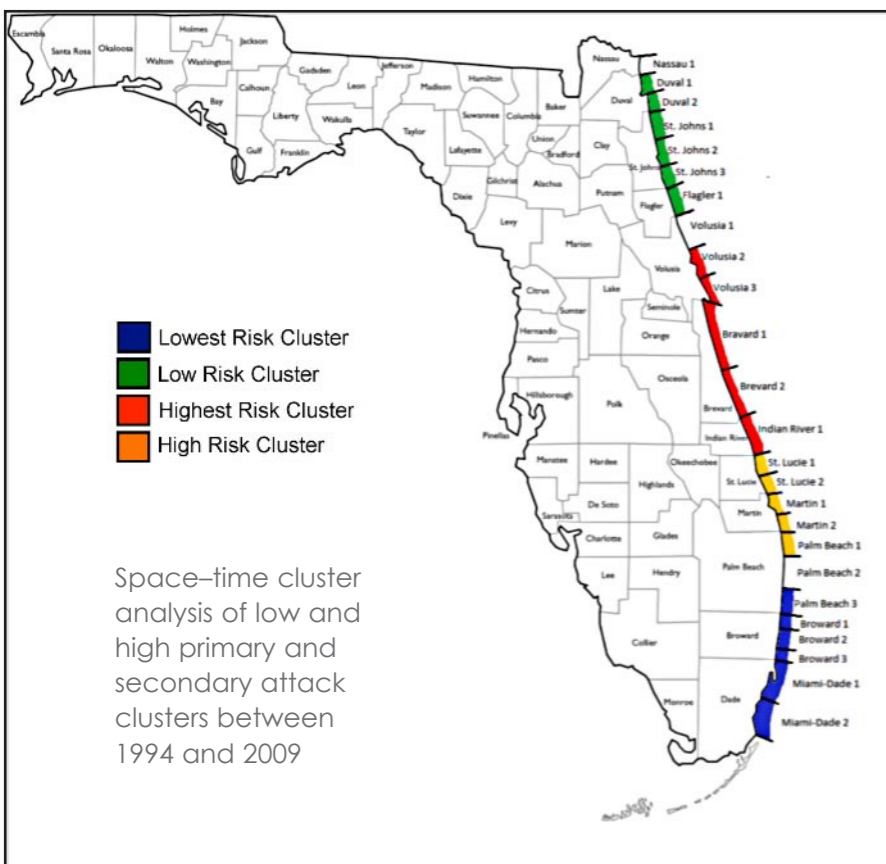
Conception Point, where the low attack rate has remained stable over many years, were associated with regions dominated by female white sharks migrating to a shark nursery in the area to give birth.

Noting that many of the attacks were by smaller sharks, the researchers postulated that they might be due to very young ones hunting fishes along the sea floor and into shallow waters where people were swimming and surfing. They could also have been driven inshore by cannibalistic adults, though such speculation is yet to be proven. Little is known about the social patterns of the species.

As Ritter explained, "It is the constellation of factors that determine the likelihood of an incident—be aware of those and the chances are greatly reduced."

## From innovation to insight

SaTScan™ was initially developed by Martin Kulldorf for the purpose of analysing



outbreaks of diseases to see whether they are random or not, and to evaluate them geographically and over time. The software can also be applied in other fields of research, but this is the first instance of it being used to generate information about the likelihood of being bitten by a shark.

Sharks travel widely under the influence of a variety of factors that include food sources,

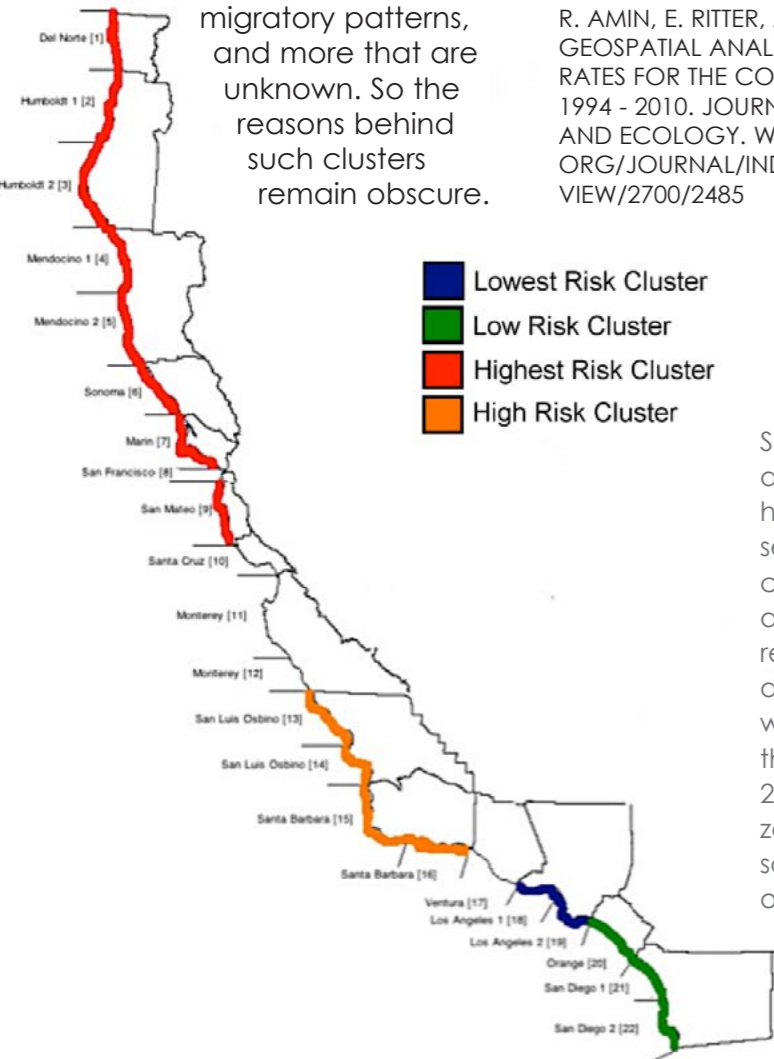
reproductive cycle, migratory patterns, and more that are unknown. So the reasons behind such clusters remain obscure.

But now that the shark attack rates for these coastlines have been established, beach goers looking for the safest places to swim and surf have definite information on which to base their decision at last. ■

**SOURCES:**

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Space-time cluster analysis of low and high primary and secondary attack clusters between 1994 and 2010. The highest region of risk was along the north coast with higher risk during the years 2003 to 2010, while a lesser risk zone occurred farther south, as shown in orange



## Great white sharks as scavengers

Great white sharks love whale blubber more than seals and gorge on it whenever they can, a new study finds.

University of Miami scientists Dr Neil Hammerschlag and Austin Gallagher, in collaboration with Chris Fallows of Apex Expeditions, South Africa, observed the feeding activity around four dead whales that appeared in the False Bay region during a period of ten years. They concluded that such bountiful sources of energy-rich blubber may be a significant food source for the great sharks.

A whale carcass trails a rich scent flow for miles, which continuously attracts sharks to the feast. The sounds made by feeding sharks carry a long distance too, and will rouse the curiosity of any other sharks within range. The resulting gathering presents an opportunity for researchers to document the behaviour of white sharks feeding together over long

periods of time. The researchers were able to watch up to forty sharks scavenging on one whale over the course of one day.

### No aggression

Yet though these apex predators are usually solitary creatures, and large individuals were often attracted to eat, no wild feeding frenzy ever occurred. There were no signs of aggression, and the great white sharks left no inter-animal space between them.

However, a size hierarchy was identified in which the largest sharks took charge of the parts of the carcass where the blubber was richest, so that the smaller ones had to feed on the less fatty parts. Those who could not gain a place among those devouring the carcass, such as the juveniles,

were left snapping up the crumbs which, it seems were sizeable.

The sharks tore into the carcass as only great white sharks can do, taking huge bites, tasting them, spitting them out, and biting again, displaying unexpected fussiness as they picked over their meal, searching for the best titbits. One was filmed tearing a fetus from the huge cadaver.

The researchers observed that the sharks often fed on the flukes first but could offer no explanation since the flukes contain comparatively little fat.

*By attracting many large white sharks together to scavenge, we suspect that the appearance of a whale carcass can play a role in shaping the behaviors, movements, and the ecosystem impacts of white sharks.*

While the sharks were occupied with the whale blubber, pressure was taken off their usual prey, the local seals, who were freer to roam in search of their own food. Thus, the feeding event affected the ecology of the rest of the food chain.

### No waste

Carcasses in nature are never wasted, and scavengers are well known among terrestrial animals. But it is uncommon for marine researchers to come across the spectacle of marine life feeding on large carcasses.

The researchers found that at least in this region off South Africa, great white sharks are the dominant feeders on dead baleen whales and suggest that in spite of the rarity of coming across a whale carcass, shark populations may actually rely on such finds to supplement their usual diet of seals.

Hammerschlag said, "By attracting many large white sharks together to scavenge, we suspect that the appearance of a whale

carcass can play a role in shaping the behaviors, movements, and the ecosystem impacts of white sharks. These patterns may shed some light into the ecology of this often studied—yet still highly enigmatic—marine predator."

Their study entitled, *White sharks (Carcharodon carcharias) scavenging on whales and its potential role in*

*further shaping the ecology of an apex predator*, was published in *Plos One*. ■