

crash-test dummies

Foraging ecology of Cape Gannets

TEXT **PETER RYAN**



JOHN GRAHAM

above Cape Gannets adopt a streamlined, dart-like posture just before they hit the water. Shallow dives, such as diving to retrieve fish from a trawl net, are less steep than deep dives.

previous spread Hundreds of Cape Gannets turn the water milky as they dive on a school of fish in Algoa Bay, home to the world's largest gannet colony.

GANNETS ARE THE largest plunge-diving birds, using the momentum of flight to carry them to their underwater prey. Witnessing a large feeding flock is an unforgettable experience – hundreds of birds gather over a school of pelagic fish, climbing up to 30 metres above the sea before plunging out of the sky. As they approach the water, they fold back their wings, assuming a dart-like shape to enter the water with the aplomb of an Olympic high-diver. Subcutaneous air sacs help to absorb the impact of hitting the water at speeds of up to 100 kilometres per hour.

Over the past decade or so, the foraging ecology of gannets has been extremely well studied. The birds' large size and the relative ease with which they can be captured at their breeding colonies make them ideal for carrying a suite of devices. GPS loggers tell us where they go, depth recorders how deep they dive and accelerometers and heart rate recorders how hard they work; stomach temperature loggers estimate the size of each fish caught; and miniature video cameras show how the birds react to their surroundings. **Peter Ryan** explores how gannets behave at sea and what this means for their conservation.



LLOYD EDWARDS

ONE OF THE first studies, led by Yan Ropert-Coudert, showed just how well streamlined gannets are. They experience very little resistance as they enter the water, which enables them to descend at three to four metres per second to surprise their prey. Most dives are less than five metres deep and are stopped when the gannets brake to grab their prey. Momentum alone carries the birds to about 10 metres deep, but they can use their wings and feet to pursue prey to greater depths, occasionally reaching more than 20 metres.

Gannets routinely feed in large flocks, which can prove hazardous when hundreds of birds dive onto a school of fish at the same time. Video footage of gannets gathering at the sardine run off the Eastern Cape and KwaZulu-Natal coasts reveals that nearly one per cent of dives results in a collision with another gannet or

other predator. Such collisions can prove fatal; gannets have been found with deep puncture wounds in their heads and necks, consistent with being hit by another of their species.

Yan coupled his accelerometer recordings with a heart-rate monitor to assess how flight action affects the birds' heart rate. Gannets typically fly low over the water to take advantage of the ground effect, alternating bouts of flapping and gliding. They save energy by flying in lines to slipstream the lead bird, each bird flapping and gliding in the same place, but with the lead bird flapping slightly more often than its followers. Commuting birds spend about 60 per cent of their time flapping, but this increases to 76 per cent when foraging, when they have to climb prior to a dive. Yan found that heart rate is only 20 per cent higher when flapping than when gliding – less



than expected – and he surmised that the volume of blood pumped per stroke might also increase during flapping flight. Interestingly, heart rate is greater when commuting than when foraging, probably because commuting birds travel faster, averaging 44 to 50 kilometres per hour.

Yan also recorded how gannets structure their foraging trips. They are visual foragers >

top Small prey are swallowed underwater, but large prey, such as this elf, are swallowed after surfacing, increasing the risk of having it stolen.





PETER RYAN

above *The striking black and white plumage of adult gannets makes feeding flocks visible from up to 40 kilometres away.*

previous spread *Gannets use momentum to dive to 10 metres, but can also use their wings and feet to pursue prey.*

and feed almost exclusively by day. When feeding small chicks, adults usually spend one day at sea, although they may remain away overnight if they have to travel long distances to find food. Birds making one-day trips typically have two foraging bouts, separated by a period sitting on the water. Yan concluded that the adult meets its own needs during the initial feeding bout, digesting its meal while resting on the

water, then forages for its chick during the second bout before heading back to the colony. Gannets feeding small chicks are the easiest to study because the parents make short foraging trips and alternate guarding the chick, thus facilitating the recovery of devices. However, we have learned a lot about the behaviour of gannets at other times of the year from two different technologies. David Grémillet fitted

adult gannets with light-logging geolocators and implanted some individuals with loggers that record heart rate and diving activity year-round. He found that gannets from Malgas Island remain off the West Coast all year, with some birds heading north to Namibia but none joining the sardine run up the east coast. In winter, non-breeding gannets spend less time flying and make fewer, shallower dives than birds

like those feeding small chicks, make short, one- to two-day foraging trips, but trip duration increases as chicks get bigger. Males make more trips than females when feeding large chicks, balancing the investment females make in forming eggs. Outside the breeding season most adults return to the colony regularly, but the duration of both their visits and their trips away are influenced by local weather conditions (wind strength and rainfall).

Perhaps the most interesting research has revealed how gannets locate their patchily distributed prey. Andrea Thibault, working with Yann Tremblay and Pierre Pistorius, used bird-borne cameras and GPS loggers to show that breeding adults leaving their colony on Bird Island use other gannets to help locate feeding areas. Birds departing on foraging trips gather in small rafts immediately offshore, where they bathe and preen. In addition to enabling birds to wash off the dirt and grime of the colony, these rafts offer them the chance to assess the direction from which any returning birds are coming. Most of the gannets then head in that direction on leaving the raft.

As they progress offshore, they further refine their route by reacting to other birds heading back to the colony. Gannets also join others leaving the colony, forming small flocks that fly for longer than individual birds, which often rest on the water, seemingly waiting for direction. Andrea found that these strategies reduce the time taken to reach the first foraging area by roughly half compared to the time taken by birds that don't encounter returning gannets. It seems that gannets spend more time looking at what other gannets are doing than they do actively searching for prey. They also cue in on fishing boats and schools of dolphins.

Adult gannets are highly conspicuous at sea as a result of their mostly white plumage, and feeding aggregations are visible from afar because the birds climb so high above the sea. The GPS tracks show that birds change direction and increase their flight speed to join foraging groups from impressive distances. Small foraging groups of fewer than 50 gannets seldom attract birds from more than 10 kilometres away, whereas flocks of more than 100 gannets >

At the end of the 1980s the Cape Gannet colony on Malgas Island in the West Coast National Park was the largest in the world, but its numbers have decreased by two-thirds over the past few decades, leaving large unoccupied areas within the colony.

during the breeding season, consistent with their scavenging at trawlers at this time. Pierre Pistorius, senior lecturer at Nelson Mandela Metropolitan University, and his student Gavin Rishworth equipped pairs of gannets breeding at Bird Island, Algoa Bay, with tiny radio transmitters. A receiver on the island logs the comings and goings of each bird throughout the year. The researchers found that incubating birds,

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PETER CHADWICK

A Kelp Gull carries off a Cape Gannet egg. Losses of eggs and chicks to gulls are largely restricted to the edges of colonies. Their impacts on the gannet population are relatively unimportant in large, healthy colonies, but become increasingly serious as colonies dwindle and expose proportionally more gannets to predation by gulls.

attract birds from 20 to 40 kilometres away. Andrea found that birds joining larger flocks make more dives, suggesting that it is worth travelling farther to join larger feeding groups.

The success of the gannets' network to locate and efficiently exploit fish schools depends in part on the number of birds in a colony – which is a problem for some West Coast colonies. Early GPS tracking work led by David Grémillet showed that the foraging ranges of gannets breeding at different colonies barely overlap. As a result, each colony operates as an independent network to locate prey.

There are only six Cape Gannet colonies, three in Namibia and three in South Africa. In the 1950s, 70 per cent of the population (115 000 pairs) bred in Namibia, but numbers there crashed following the collapse of sardine stocks in the early 1970s. Currently the three Namibian colonies support only 13 000 breeding pairs, with the tiny colony on Possession (380 pairs) on the brink of extinction. The species was recently listed as Critically Endangered in Namibia.

Increases in the three South African colonies, from 50 000 pairs in the 1950s to some 120 000 pairs currently, partly offset the decreases in Namibia. However, about two-thirds of the global Cape Gannet population breeds at Bird Island, Algoa Bay, making this the largest gannetry in the world. The two West Coast colonies have both decreased over the past two decades, the one at Malgas Island falling from 56 000 pairs in 1996 to 19 000 pairs in 2015. The decrease at Lambert's Bay has been more modest, from 12 000 to 8000 pairs, but this colony only persists thanks to the decisive intervention of CapeNature when it was deserted following repeated attacks on adult gannets by Cape fur seals in 2005.

Annual tracking of the foraging ranges of gannets from Malgas Island since 2002 has shown how the shift in their pelagic fish prey from the West Coast to the Agulhas Bank has forced the birds to travel farther in search of their preferred food. Similarly, westward contraction of pelagic fish across the eastern Agulhas Bank in recent years has seen gannets from Bird Island having to travel farther in search of food. In some years, West Coast

birds are forced to switch to sub-optimal fishery discards, which results in slower chick growth rates and lower breeding success. A study by David Grémillet estimated that adults breeding at Malgas Island in 2012 and 2014 spent more energy searching for food than they gained from each foraging trip, compromising their body condition.

Dwindling gannet colonies face additional problems on land. As colonies shrink, an increasing proportion of pairs are forced to breed on the edge of the colony, where breeding success is compromised. David Green and Pierre Pistorius found that edge nests at Bird Island are almost twice as likely to fail than nests even just two to three metres into the colony. Kelp Gulls are the main culprits, stealing eggs and small chicks from nests along the edge of the colony. The automated monitoring system at Bird Island confirms that breeding success is strongly influenced by the amount of time adults spend brooding and guarding their chicks. This in turn is influenced by the availability of food at sea, which determines foraging trip durations. Pierre and his PhD student Rabi'a Rijkclief have recently established a similar monitoring system at Malgas Island that will further elucidate the factors driving the contrasting population trends between the colonies on the West Coast and at Bird Island, Algoa Bay.

Gannets are versatile predators that exploit a wide range of prey over a large area around their colonies, but they face a daunting array of threats. In addition to nest predation and competition with fisheries for food, they are prone to heat stress during extremely hot weather, outbreaks of avian cholera and predation of fledglings by Cape fur seals. Active management is needed if the species is to survive. ♦