

Text and illustrations  
courtesy of Ila France Porcher  
Photos by Matthew Meier  
and Andy Murch

**Blacktip reef sharks are enigmatic creatures whose complex behaviours are not widely understood. Ethologist Ila France Porcher shares her insights into the mysteries of these beautiful sharks.**

Having studied a community of blacktip reef sharks (*Carcharhinus melanopterus*) in French Polynesia for several years, many of my articles for this magazine have described the more interesting things they did. These observations have also resulted in a number of scientific papers, the latest of which is a comprehensive **ethogram**. It describes 35 distinct actions, including displays, social interactions, warnings and assaults. Since mental states are closely tied to behaviour, the sharks' actions provide clues to their inner lives.

Although remote technologies are increasingly being used to detect shark movements, there is much information about sharks that can only be learned by observing them first-hand in their natural environment—by actually

seeing what sharks do and how they respond in different circumstances.

Blacktip reef sharks were especially easy to observe in the shallow lagoons of French Polynesia, where females, juveniles and the

occasional male would range. After casual observations revealed complex behaviours unlike anything I had seen in terrestrial wildlife, I launched a long-term study of the local community to learn more about them as ani-

mals and individuals. Little had been published on the species at the time, apart from a collection of anecdotes by Randall and Helfman (1973) in an effort to prove that they are dangerous to humans.

**Behavioural observations and insights**

Once a week, at sunset, I brought some fish scraps to a site near the barrier reef in the nearby lagoon. These feeding sessions helped the blacktips

*The Hidden Lives of*

# Blacktip Reef Sharks





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get used to seeing me and allowed me to identify the individuals in the region on a weekly basis. In between feeding sessions, I roamed the lagoon without food at random times during the day. This allowed me to gather much information about the individual blacktips using the area.

They spent a large proportion of their active time following sinuous paths through their ranges in roughly oval pathways. With each new loop oriented in a different or opposite direction to the previous one, their routes formed rough figures of eight and cloverleaves when viewed from above. In this lagoon, it took about ten minutes for the shark to circle back to its starting point. The large, repeating circles were well suited to locating prey and intercepting scent flows. The pattern also brought companion sharks into close prox-

imity again and again. However, when travelling to a specific place or region, blacktips would usually take a direct route.

In the middle of the day, the blacktips would rest in deeper areas that were relatively free of coral structures. There, they would slowly cruise a few centimetres above the seafloor, usually with one or more companions. They were much less alert at such times, to the degree that they could be surprised. With many sharks resting in the same area, if there was a disturbance, the reaction of the sharks directly affected would be perceived by others through hearing and lateral line sense, even though the danger was some distance away.

Occasionally, individuals would turn onto their backs and wriggle against the sand, presumably to get rid of parasites. They would also scratch

their bellies on worn, dead coral. Their consistent choice of a suitable feature to scratch on indicates that they are surveying their surroundings and choosing the best one to use. This is an example of decision-making and cognition.

### Vigilance and curiosity

A state of vigilance characterised their actions, yet they also enjoyed investigating things in their environment. This combination generated a variety of tactics for staying hidden while scrutinising new things.

For example, if a blacktip found something of interest, such as a person underwater, and decided to investigate, it would begin by making a pass into visual range and then back out again. (The visual range is the distance at which particles that accumulate in the water obscure the view,

Blacktips follow roughly oval paths through their ranges.

so it is not dependent on the shark's eyesight). A few minutes later, the shark reappears and comes closer. It repeats this pattern, approaching more closely and directly each time, until it might make a direct, close approach, sometimes up to the person's face, whereon it turns away at an angle. This general pattern varies depending on the context and individual.

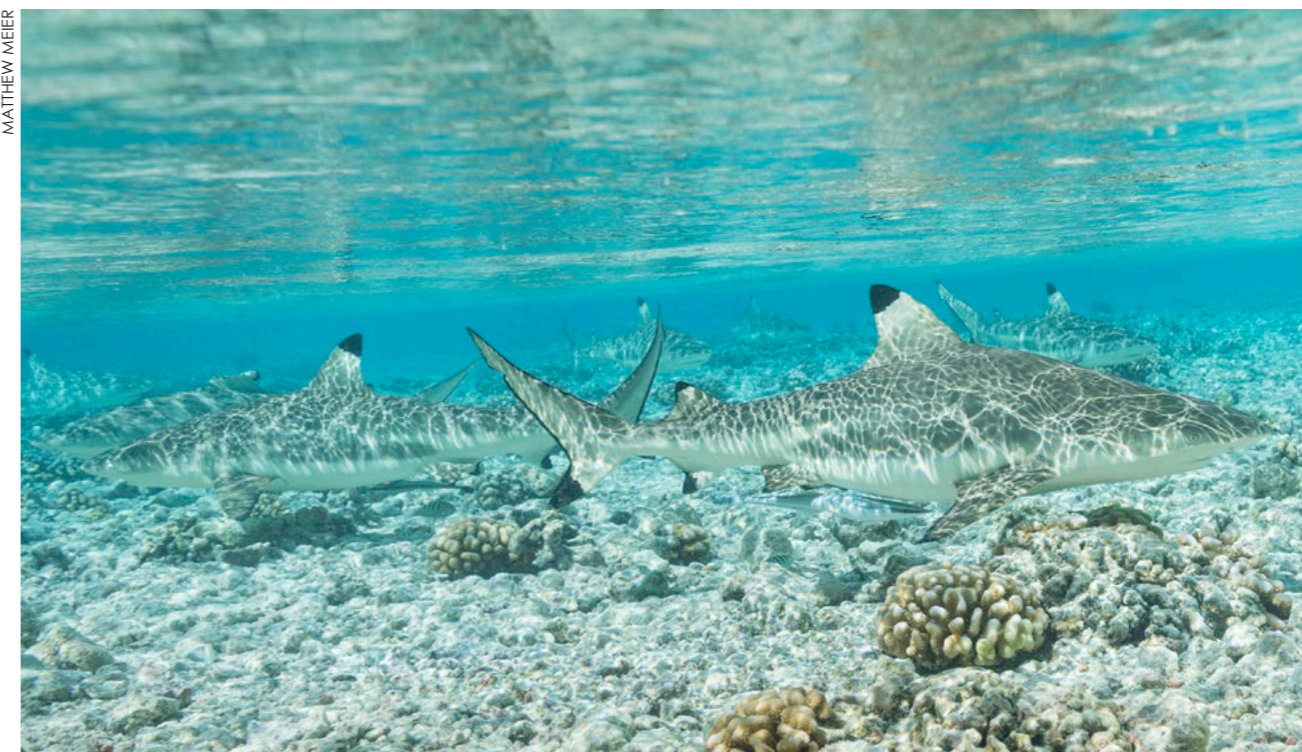
### Concealment

The approach pattern was one of several ways that blacktip reef sharks used the visual limit for concealment. Often, they would remain beyond visual range until precisely the right moment to zoom in and take a treat from another shark. They would also follow another animal, sometimes for long periods, while remaining just beyond the visual range. Apparently, they are capable of integrating infor-

mation from their other senses well enough to analyse ongoing events without seeing them. However, shark vision is acute, and the fact that the blacktips occasion-



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Blacktip reef sharks in the shallows

Whitetip reef sharks *Triaenodon obesus* (right); Tiger shark, *Galeocerdo cuvier* (lower right); Sicklefin lemon shark, *Negaprion acutiden* (below)



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ally moved into visual range shows that taking a look is also important to them. This is to be expected in animals that spend much of their lives in brightly lit shallows studded with coral obstacles.

Moving through a vibrating realm in which light travels less easily than sound, sharks hear well, while their lateral line sense perceives underwater vibrations directly. The lateral line sense responds to changes in pressure rather than sound, allowing the shark to sense the movements of other animals as well as the waves created by its own actions, bouncing off obstacles. The lateral line sense has even been found to help sharks locate scent flows.

While the ampullae of Lorenzini are extremely sensitive to electrical stimuli, heat, mechanical influences and salinity, they only work at close range.

I have also seen whitetip reef sharks (*Triaenodon obesus*) and sicklefin lemon

sharks (*Negaprion acutidens*) use the visual limit for concealment. Tiger sharks (*Galeocerdo cuvier*) and Atlantic lemon sharks (*Negaprion brevirostris*), which I observed for shorter periods of time, also did so. When approaching a group of divers and other sharks, they will pass just within visual range for a look, come closer a few minutes later, and then approach nearer again after another delay. Tiger sharks, however, tend to pass overhead when they come close for a look.

For oceanic species especially, the visual limit is the only option available for concealment, which may explain why it is used by so many species.

### Fear reactions

Juvenile blacktip reef sharks, in particular, exhibited a startle reaction in which they accelerated away while arching their backs in a series of rapid jerks. The arching of the back caused the powerful



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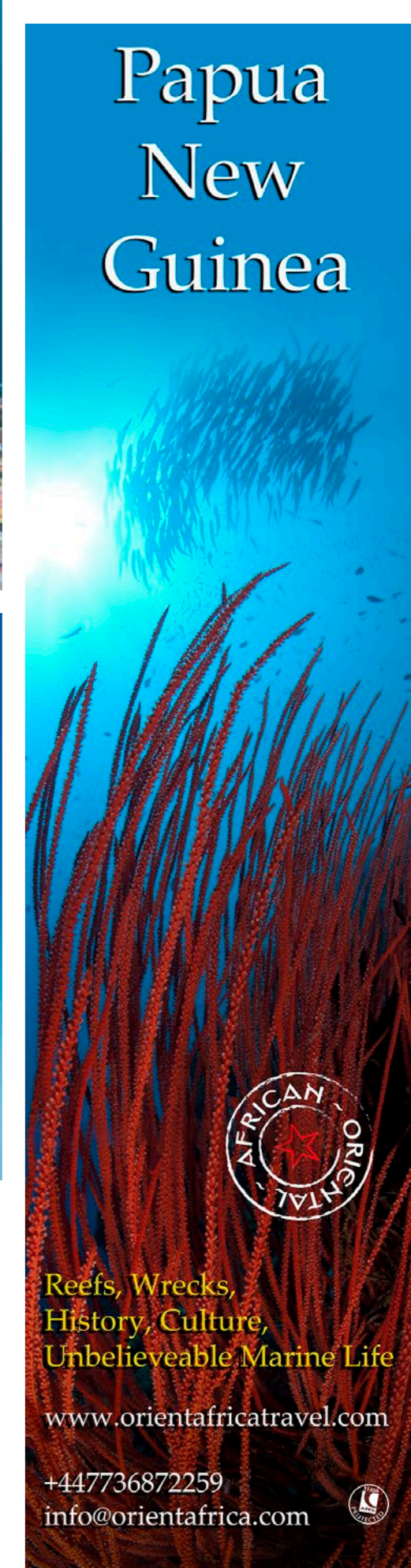
tail to point downwards, propelling the shark upwards into the open area above the coral as it fled. The pectoral fins were swiftly lowered at the moment the shark was startled, which also caused it to rise in the water column. This was most often seen as a reaction to a near collision with a larger shark, often a nurse shark. Adult blacktips would also sometimes accelerate away with a few sharp vertical undulations when startled.

This response is similar to the agonistic display of the grey reef shark, but it is nei-

ther a display nor agonistic. It appears to be a reflexive reaction that has evolved to protect the shark. The vertical jerking likely enhances predator avoidance by making it more difficult to grasp.

After being startled, the individual would often circle back in what I termed shiver mode. Shivers ran through its body, and it would twist and suddenly change direction erratically. Although this was usually seen in juveniles, shivering and unpredictable turns were also occasionally observed in

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Atlantic lemon shark, *Negaprion brevirostris* (right); Grey reef sharks, *Carcharhinus amblyrhynchos* (below)



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adults who had arrived in an aroused state for unknown reasons. Moving swiftly, while shivering and twitching at times, the animal would make sudden rushes, then whip back around in a tight circle. The restless shivering, flicking and twisting usually continued for less than a minute or two, but on one occasion, an individual remained in this state for 20 minutes, suggesting a longer-term state of disturbance.

### Threats and agonistic displays

Agonistic displays have been reported in a variety of shark species since the most well-known was described in the grey reef shark (*Carcharhinus amblyrhynchos*). However, since these dis-

plays are used flexibly, depending on the situation, and have mostly been reported incidentally, they are challenging to describe in structured terms. The close approach of the blacktips, for instance, appeared to serve as a greeting gesture when performed slowly. However, it was also done at top speed when the shark aimed to intimidate a spear fisherman into relinquishing his catch. At such times, it fell into the category of an agonistic display.

The reaction of the blacktips to a diver who once accompanied me provides another example. They were moving expectantly around me when he first arrived underwater, whereon they instantaneously vanished

beyond visual range. Ten minutes passed, in which one could believe that the lagoon was absolutely devoid of sharks. Then suddenly, the 36 blacktips reappeared. Led by two individuals noted for their leadership tendencies, they zoomed towards us through the coral canyons in two lines, single file, straight up to the face of the diver. There was no doubt of their intent to intimidate. The diver was enveloped in a swirl of swiftly moving sharks, and he fell over backwards. Despite being an experienced dive club owner and shark diver, he was intimidated.

This behaviour suggests social buffering, wherein the blacktips prefer to approach possibly challenging situations together rather than alone.

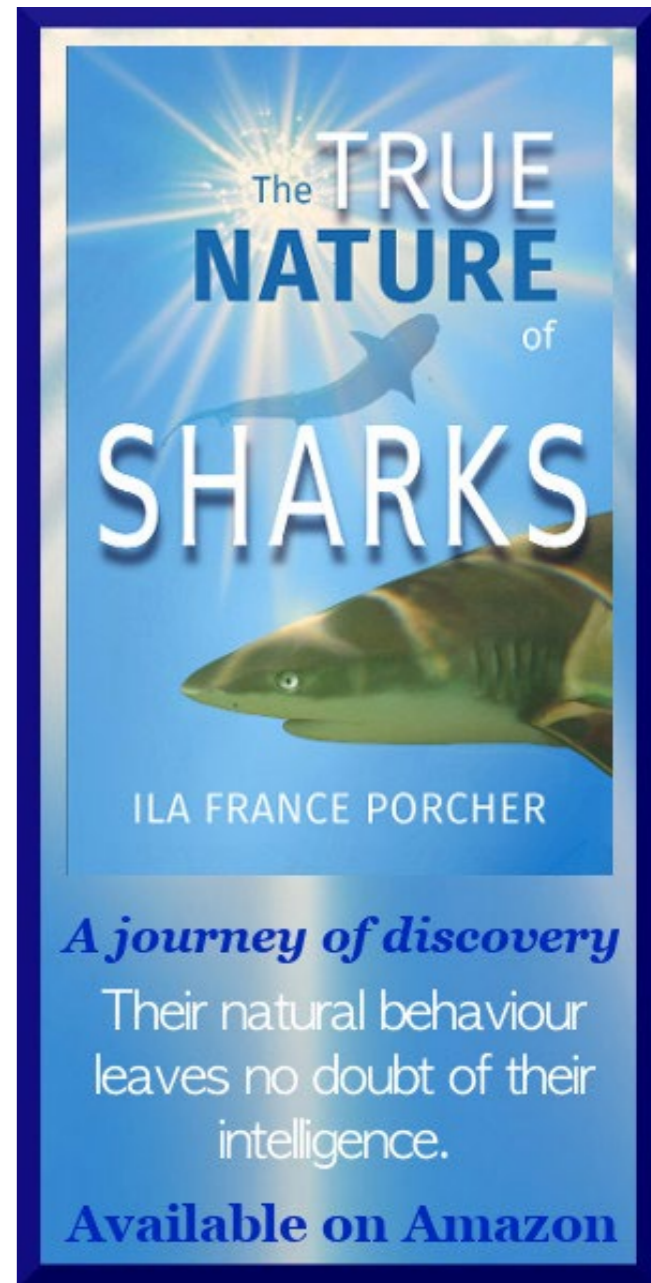
In rare circumstances, the close approach could accelerate into a physical attack, which I termed slamming. One or more blacktips would accelerate towards a target and slam into it. Initially, the animal would make contact with the shoulder, but as its level of arousal grew, it would spiral upwards from below with its back arched to slam with its back—the area in front of the dorsal fin. Just before impact, it lowered its pectoral

fins. Slamming could be done with great force, and once one individual slammed, the entire company was likely to do so.

The first time I witnessed slamming, I had just arrived for one of my weekly feeding sessions. Coincidentally, a seabird I was rehabilitating had accompanied me, which was unprecedented, and as I prepared, she alighted on the kayak behind me. There she perched, gasping with her mouth open. However, she closed it as she looked down at the water, solid with sharks, just centimetres below her.

When I was ready, I turned to undo the straps holding the sharks' food. The bird flew low across the site, just centimetres above the surface, and the water actually shivered as the thousands of waiting fish were startled. I was watching the surreal quivering of the sea with her passing, so later I was not sure how it happened, or whether it could have been a coincidence, that right at that moment, the sharks attacked the boat.

The heavy weight of the loaded kayak, with me on it, was bashed first one way and then the other with shocking force as the sharks slammed it from multiple directions. The surface



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disappeared—all I could see were sharks emerging at high speed, twisting, bashing into the boat and flowing together as more replaced those shooting away. Then they came out of the water to snap at the food in the well of the kayak behind me. I could hear their jaws snapping shut, and one got a good bite out of the remains of a saumon des dieux or opah, (*Lampris guttatus*) that overhung the water a little bit.

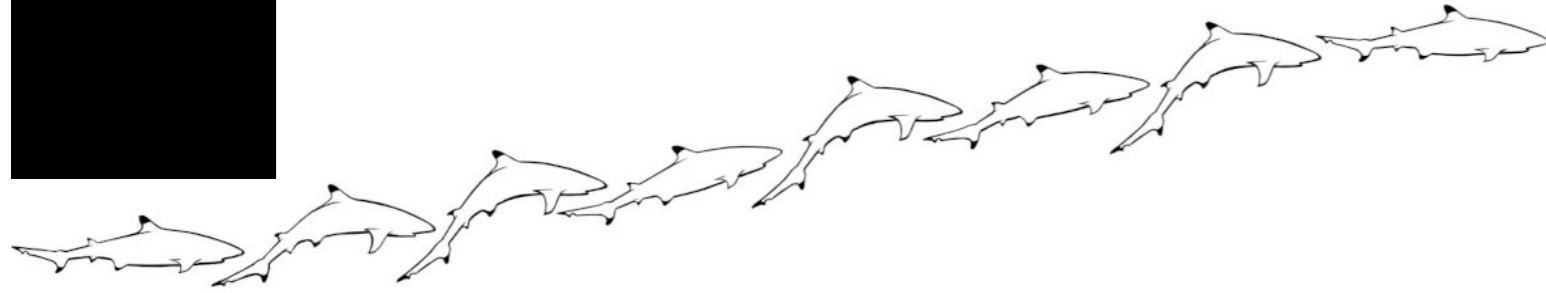
Obviously, the sharks could see through the surface and were aware that there were things above. They knew, although they had never seen it from above the water, that the food was in the boat, and they knew where



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Startled reaction of a blacktip reef shark (below). Disturbed blacktip reef shark (right). Illustrations courtesy of Ila France Porcher.



in the boat it was! Those that started breaching to access the food were instantly copied by the rest of them, exemplifying social learning and providing another example of cognition.

The sharks were moving so fast that it was not possible to identify each one. The heavy blows came mostly from below, and I had to turn around (with difficulty) to see the back of the kayak where they were speeding through the surface, trying

to grab the food.

I was on the verge of jumping in but instead started throwing the food in, hoping that the sharks would leave the kayak and start eating. But one of the leaders continued to dash to the surface and slam it, even when all the food had been thrown in! Eventually, they all descended to look over the food lying on the sand, and I slid underwater.

This behaviour, involving not

only the resident blacktips but also their visitors, was seen in a variety of circumstances, especially during a four-month period when they showed every sign of being dissatisfied with something I was doing. But I never learned the reason. It seemed to me that the moment I arrived with their food should have been when they were happiest with me.

Their behaviour was influenced by certain key indi-



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Juvenile blacktip reef sharks in the shallows

viduals. Once one began slamming, the rest of the 36 blacktips joined in. This pattern suggests emotional contagion, in which emotions are communicated among them. Initially, they only slammed my kayak, but there were times when they slammed me personally.

Slamming behaviour has not been reported elsewhere, and how it is normally expressed is unknown, but during my study, it was only used as a method of attack, usually by a group of sharks. Once, however, a lone female blacktip started slamming me. Needless to say, after the third slam, I leapt into my kayak.

### A different reaction to my arrival

Two years later, the sharks were being finned, and their

community was in upheaval. Due to personal troubles, I was unable to visit them for two months. When I finally returned to the lagoon, I paused for a drink of water, and suddenly, there was a blacktip drifting past, with more coming from beyond. The well-known resident sharks drifted alongside, undulating against the kayak. One slid against the paddle. For many minutes, they glided placidly around me, dorsal fins above the surface, pushing the curves of their bodies against the kayak, going underneath and pressing against it, again and again. I reached down and stroked them for the first time as they passed, instinctively responding to what could only be interpreted as an affectionate gesture. They seemed to understand that

much more time than usual had passed since my last visit.

The sharks did this each time they met me after that. The one that ranged along the border of the lagoon was always the first and would swim slowly under my hand as I sat in the low craft so I could stroke her. She would drift while being caressed, then undulate against the kayak and disappear below.

One calm evening, through the flawless clarity of the water, I saw them come straight up from just above the sand (2m below), undulate against the boat and go straight down again, their tails flashing above the surface, droplets flying. There were several of them on each side of the kayak, and their tails flicked through the surface at the same moment.





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This was, therefore, a different action to the undulating against the craft at the surface, and once again, they acted in unison, with no sign of communication nor reason to do so. Then they returned to sliding against the boat and the paddle and undulating from one to the other.

From then on, these individuals greeted me in this way each time I arrived in the lagoon. They had feelings, and their feelings had changed.

Although I did not add it to my ethogram, as time passed, these sharks began to come directly to me in the kayak when I arrived, raising their heads above the water to be stroked. Sometimes, when con-

ditions were rough and I was being washed over by waves, I thought I was going to have a shark on my lap, but they never made a mistake. I wrote their full story in my first book, **The Shark Sessions**, if you are interested.

### Social formations and collective behaviour

Socialising was important to the blacktips. Groups, pairs and solitary individuals from other regions regularly appeared and merged with the residents. They would all accelerate and soar through the vicinity. Follow-formations formed and dissolved fluidly as they moved swiftly and flexibly together. A high level of coordination was apparent but

without visible communication.

At these times, the fish scraps were often ignored, suggesting that socialising took precedence over eating. Since the species is known to take long excursions, and these exuberant gatherings often involved the rarest of visitors, I speculated that the residents might be acquainted with blacktips living far away on other islands, whom they rarely encountered but easily recognised when they did. They were so excited together; it was awesome to watch.

Certain annual visitors arrived year after year with the same companions, while others always appeared alone.

A better understanding of sharks and their behaviour can lead to a greater appreciation of their role in the marine ecosystem.

### The tendency to bite

As a wildlife artist and rehabilitator, I have been in long-term, intimate contact with a wide range of species of birds, mammals, reptiles and fish, and the blacktip reef sharks are the only species that have never bitten me, either accidentally or in a fit of pique. Instead, they slammed. After all the years I spent with them, it seemed reasonable to conclude that sharks and their relatives do not share the strong tendency to bite that is typical of our own evolutionary lineage. The lack of any documented incidents of sharks fighting supports this conjecture. Sharks are truly peaceful, much more so than we are.

### A new perspective on shark behaviour

The complex actions of blacktips in many circumstances help to challenge the traditional view of sharks as mindless predators. The study provides valuable new information about their natural behaviour. Further research in natural environments will undoubtedly provide deeper insights into their lives. A better understanding of sharks can help dispel myths and fears about them, foster a greater appreciation of their role in marine ecosystems and generate more concern for their conservation. ■

*Ethologist Ila France Porcher, author of The Shark Sessions and The True Nature of Sharks, conducted a seven-*

*year study of a four-species reef shark community in Tahiti and has studied sharks in Florida with shark-encounter pioneer Jim Abernethy. Her observations, which are the first of their kind, have yielded*

*valuable details about sharks' reproductive cycles, social biology, population structure, daily behaviour patterns, roaming tendencies and cognitive abilities. Visit: [ilafranceporcher.wixsite.com/author](http://ilafranceporcher.wixsite.com/author).*



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Socialising is important to blacktip reef sharks.

