



Human–crocodile interactions in the western Solomon Islands: the importance of local data for reducing attacks on people

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Abstract Interactions between people and the saltwater crocodile *Crocodylus porosus* frequently occur on islands and in coastal regions. Saltwater crocodiles impact people's lives and livelihoods by attacking them, resulting in minor or serious injuries, and by interfering in people's foraging activities. Retaliation may include killing the crocodiles involved. To reduce such human–crocodile interactions, data about the occurrence of incidents are required. We present data on encounters with crocodiles and attacks on people in the Roviana Lagoon, Solomon Islands. Data includes time of incident, gender, age and activity of the victim, water conditions and what happened to the crocodile after the incident. We used a questionnaire to capture the details of incidents that occurred during 2000–2020 in the villages of Dundee, Baraulu, Nusa Hope and Kozou. Most incidents were in the evening, mostly involving women, and most victims were aged 20–39 years or ≥ 60 years. In all cases people were attacked while gleaning for shellfish in the mangroves. Attacks occurred irrespective of whether the water was clear or murky, and in all cases the crocodiles were not killed. Such site-specific data will facilitate the formulation of strategies for reducing negative interactions between people and crocodiles in this particular location. Although the saltwater crocodile is categorized as Least Concern on the IUCN Red List, research such as this provides data that can be used for promoting coexistence with and conservation of this species.

Keywords Conflict, conservation, crocodile attack, *Crocodylus porosus*, livelihoods, negative interactions, saltwater crocodile, Solomon Islands

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Negative interactions between the saltwater crocodile *Crocodylus porosus* and people are common in coastal areas of the Asia-Pacific region, and the lives and livelihoods of people are affected by these interactions (van der Ploeg et al., 2019). Here we present data on negative interactions

between people and saltwater crocodiles in four villages in the Roviana Lagoon, Solomon Islands. We compare these local data with an earlier national survey of interactions between people and crocodiles in the wider Solomon Islands (van der Ploeg et al., 2019). The national survey was conducted during April–August 2018 and covered incidents during 1998–2017. A total of 225 crocodile attacks on people were recorded in 234 villages, of which 83 were fatal, including 31 on children (van der Ploeg et al., 2019). Our more recent data for attacks in the Roviana Lagoon can potentially inform site-specific policies and strategies to reduce attacks and promote co-existence between crocodiles and people in this particular location. Local data based on site-specific research are crucial because they reveal details and experiences that larger scale studies may obscure. Examples of such local studies include Das & Jana (2018) and Matanzima et al. (2023) for the Indian Sundarban and Lake Kariba, Zimbabwe, respectively.

Male saltwater crocodiles grow to > 6 m in length and weigh $> 1,000$ kg (Britton et al., 2012), and females grow to > 3 m in length and weigh up to 150 kg (Cogger, 1996). The species ranges from the Bay of Bengal, throughout Southeast Asia and New Guinea, to northern Australia. The easternmost breeding population of the species is in the Solomon Islands, with an estimated population of 1,400–2,300 non-hatchling individuals (van der Ploeg et al., 2019). *Crocodylus porosus* is categorized as Least Concern on the IUCN Red List, and the assessment states that 'There are increasing *C. porosus* populations in the Solomon Islands, Sarawak and Sabah due to effective protection measures, although management may require incentives derived from sustainable use in order to counter negative public attitudes towards them' (Webb et al., 2021, p. 1). Detailed research about negative interactions of this species with people is important because it generates data that can be used in promoting coexistence with and conservation of the species.

Saltwater crocodiles inhabit tidal rivers and creeks, freshwater lakes and mangrove forests but forage occasionally on coral reefs. They frequently use the sea to move between river systems. Their movements seem related primarily to changes in social status: males are highly territorial and chase away subordinate rivals, who then search for suitable habitat and unguarded females. In the Solomon Islands the species interacts with people in various ways, including negative encounters and positive relationships in which

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FIG. 1 Locations of the four villages (Dunde, Baraulu, Nusa Hope and Kozou) in which we interviewed residents regarding incidents with the saltwater crocodile *Crocodylus porosus* in the Roviana Lagoon, New Georgia Group, western Solomon Islands, during 2000–2020.

members of local clans (*butubutu*) regard crocodiles as their totemic ancestors, and may speak to them or use their presence as omens of human affairs (Aswani & Vaccaro, 2008). Negative interactions between crocodiles and people can pose a challenge to crocodile conservation (Pooley, 2015, 2016; Matanzima et al., 2023).

The Roviana and Vonavona Lagoons lie in the New Georgia Group, western Solomon Islands, and extend contiguously over a large area of south-western New Georgia Island (Fig. 1). The Roviana Lagoon covers an area of c. 700 km² (Aswani, 1999). Data were collected in May 2023 in four villages: Dunde, Baraulu, Nusa Hope and Kozou. The population of each village is 50–300 people. The four villages were selected because of their proximity to the lagoon. We used a questionnaire designed by Simon Pooley of the IUCN Species Survival Commission Crocodile Specialist Group to gather information on human–crocodile incidents (Supplementary Material 1). Three research assistants from the local villages, who speak the local Roviana language and were familiar with the villages, were recruited to assist author SA with interviews. Adults in 60 households across the four villages were asked to recall any incidents with crocodiles during 2000–2020. The interviews, with 23 men and 37 women, lasted 40–60 minutes. Interviewees in 20 households reported that a member of the household had been a victim of a negative encounter with or attack by a saltwater crocodile (one reported attack in each affected household): four in Dunde, seven in Baraulu, five in Nusa Hope and four in Kozou. For all reported incidents we recorded the time of the incident, gender and age of victim, activity when attacked, water conditions at time of incident and what happened to the crocodile after the incident, if known.

Ten of the 20 incidents occurred in the evening (50%), eight in the afternoon (40%) and two in the morning (10%). Sixteen victims (80%) were female and four were male (20%), of which two (10%) were < 20 years old, eight (40%) were 20–39 years old, two (10%) were 40–59 years old, and eight (40%) were ≥ 60 years old. The victims were attacked whilst searching for shellfish (clams and cockles) along the intertidal shore, mostly in mangrove areas. Ten of the incidents (50%) occurred when water conditions were clear and 10 when water conditions were murky. In none of the 20 cases were the crocodiles killed or captured. Two of the attacks were fatal (10%), one on a male and one on a female, and 18 (90%) were non-fatal.

These data potentially illustrate the gendered aspects of human–crocodile conflict in Roviana, similar to incidents elsewhere in which more women than men have been attacked (e.g. in the Indian Sundarban; Das & Jana, 2018). However, at a national scale in the Solomon Islands more men have been attacked. Of 225 attacks documented by van der Ploeg et al. (2019), 140 were on men, 40 on women, and 45 on children. Such variations between local and national surveys underscore the importance of local surveys for designing strategies to reduce attacks and promote coexistence. Strategies tailored to minimize attacks on men could potentially be ineffective in contexts where most of the victims are women, as in the Roviana Lagoon.

All the women attacked were searching for shellfish, an activity typically undertaken by women in the Roviana Lagoon, whereas the four men were fishing. This contrasts with the national level data, which indicated that women were mostly attacked while washing clothes (van der Ploeg et al., 2019). Women have a significant role in gathering

marine shellfish in the Roviana Lagoon, for both subsistence and sale (Chapman, 1987; Aswani & Weiant, 2004). Recommendations for alternative livelihoods, to reduce vulnerability to crocodile attacks, could be tailored towards local women, but would need to consider regional variations in activities known to increase vulnerability to attacks. Nationally, most incidents occurred when people were fishing or diving (van der Ploeg et al., 2019).

Most victims were 20–39 or ≥ 60 years old, similar to the age profile of victims in Mexico (Garcia-Grajales & Buenrostro-Silva, 2019) and Zimbabwe (Marowa et al., 2021). Searching for shellfish is mostly carried out by adult women, although children of both sexes are often involved. Most attacks in the Roviana Lagoon occurred in the late afternoon or evening, whereas at a national scale most attacks occurred at night, a common time for men to fish (van der Ploeg et al., 2019). These temporal details are useful for recommending strategies to reduce crocodile attacks. Strategies that limit people's activities at night would be inappropriate in locations where incidents occur mainly in the afternoon or evening.

Water clarity did not appear to influence the likelihood of incidents. Conventional understanding is that people are attacked when the water is muddy, when it is difficult to see crocodiles hidden in the water. However, people are at risk from attacks whether water is clear or not, and the reflection of the sun on clear water can make it difficult to discern the movements of crocodiles.

None of the crocodiles involved in incidents were captured or killed, and none were monitored to see how they behaved after an incident or to establish whether they were injured. It is difficult to monitor these crocodiles because of the expanse of the mangrove and riverine system in the region. Retaliatory killings have, however, been documented elsewhere in the Solomon Islands (van der Ploeg et al., 2019). Retaliatory killing generates challenges for conservation, but our findings suggest that retaliation is not necessarily a problem in all regions of the Solomon Islands.

Based on our findings, we recommend that (1) shellfish collectors avoid this activity in the late afternoon and evenings, and (2) if they have to collect shellfish at this time, they remain particularly alert and work in groups (the latter may both improve surveillance for crocodiles and the chance of rescue in the case of any attack), and (3) future research focuses on the details of local incidents (as such data complements those of broader studies and can inform locally relevant strategies to promote coexistence and reduce crocodile attacks). Aspects of universal strategies to reduce crocodile attacks may not be applicable in all contexts because of variation in the type and distribution of local activities and in the type of interactions between people and crocodiles.

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Conflicts of interest None.

Ethical standards This research abided by the *Oryx* guidelines on ethical standards, and is part of a larger project on marine fisheries and human ecology that has received ethical clearance from Rhodes University, South Africa (ethics approval number 2023-5096-8105). Author SA has worked with Indigenous communities in the Solomon Islands since 1994.

Data availability Not available to the public.

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