

# Range extension of the lemon shark (*Negaprion brevirostris*) within the Dutch Caribbean: First records of young individuals in the waters of Sint Eustatius.

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## Abstract

The first observations of juvenile lemon sharks (*Negaprion brevirostris*) around the island of Sint Eustatius are described. Observations were made in the summer of 2015 and spring of 2016 and only consisted of individuals estimated to be smaller than 65 cm in total length (TL). These observations represent a range extension of this species within the waters of the Dutch Caribbean.

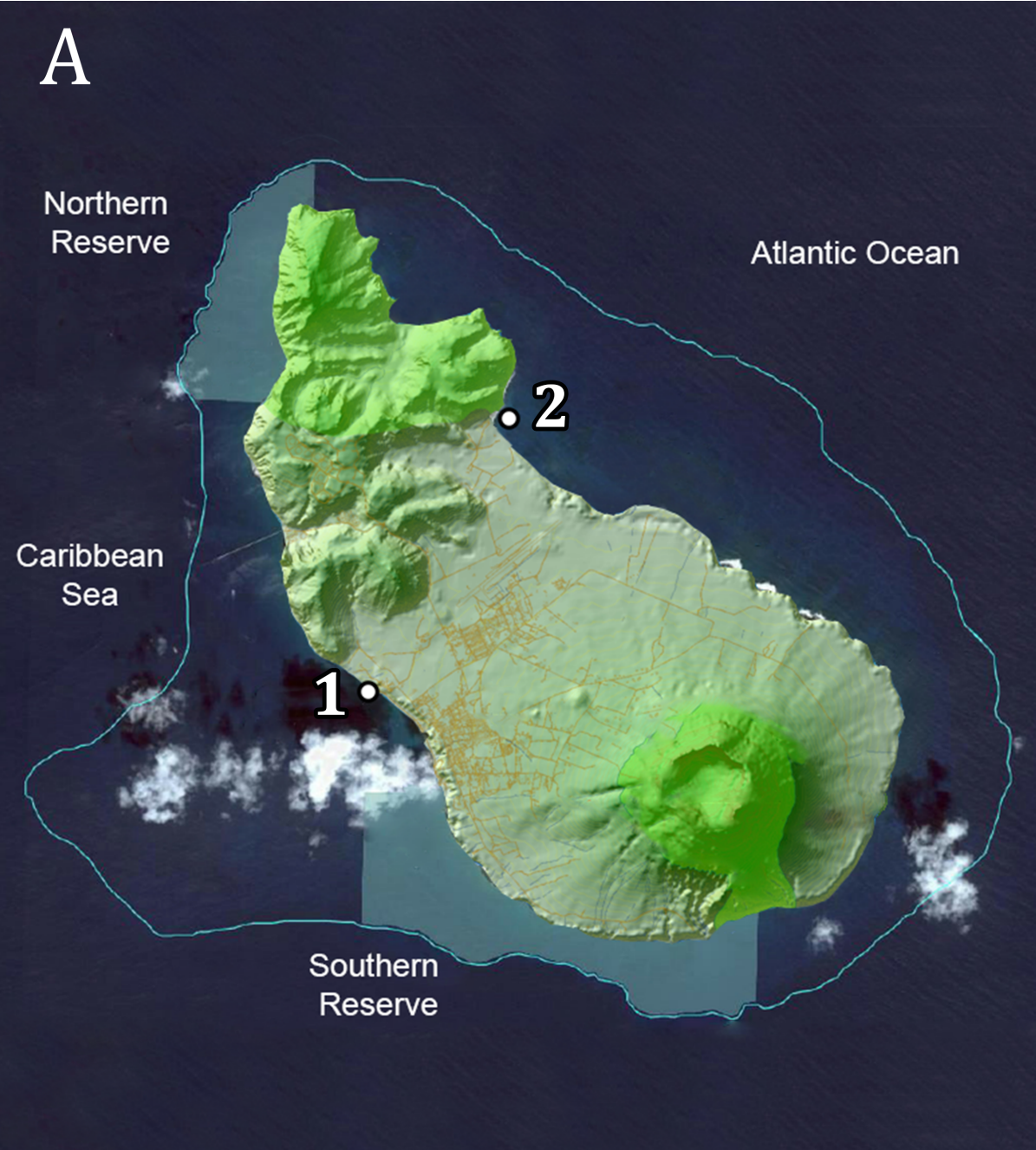
## Introduction

The lemon shark (*Negaprion brevirostris*) is a large-bodied shark with a tropical distribution throughout the Atlantic and Eastern Pacific [1]. This species is common throughout the entire Caribbean in coastal waters in, or near coral reefs, estuaries or shallow bays [1] [2]. Often targeted in both commercial and recreational fisheries, or landed as by-catch, the lemon shark is now classified as 'near threatened' both globally and for the Western Central Atlantic region by the International Union for the Conservation of Nature (IUCN) with its current population trend classified as 'unknown' [3] [4].

Within the Dutch Caribbean, the species is known to occur around the islands of Aruba, Curacao and around Sint Maarten, however, no observations have yet been published for Sint Eustatius, Bonaire and Saba [5] [6].

## Objective

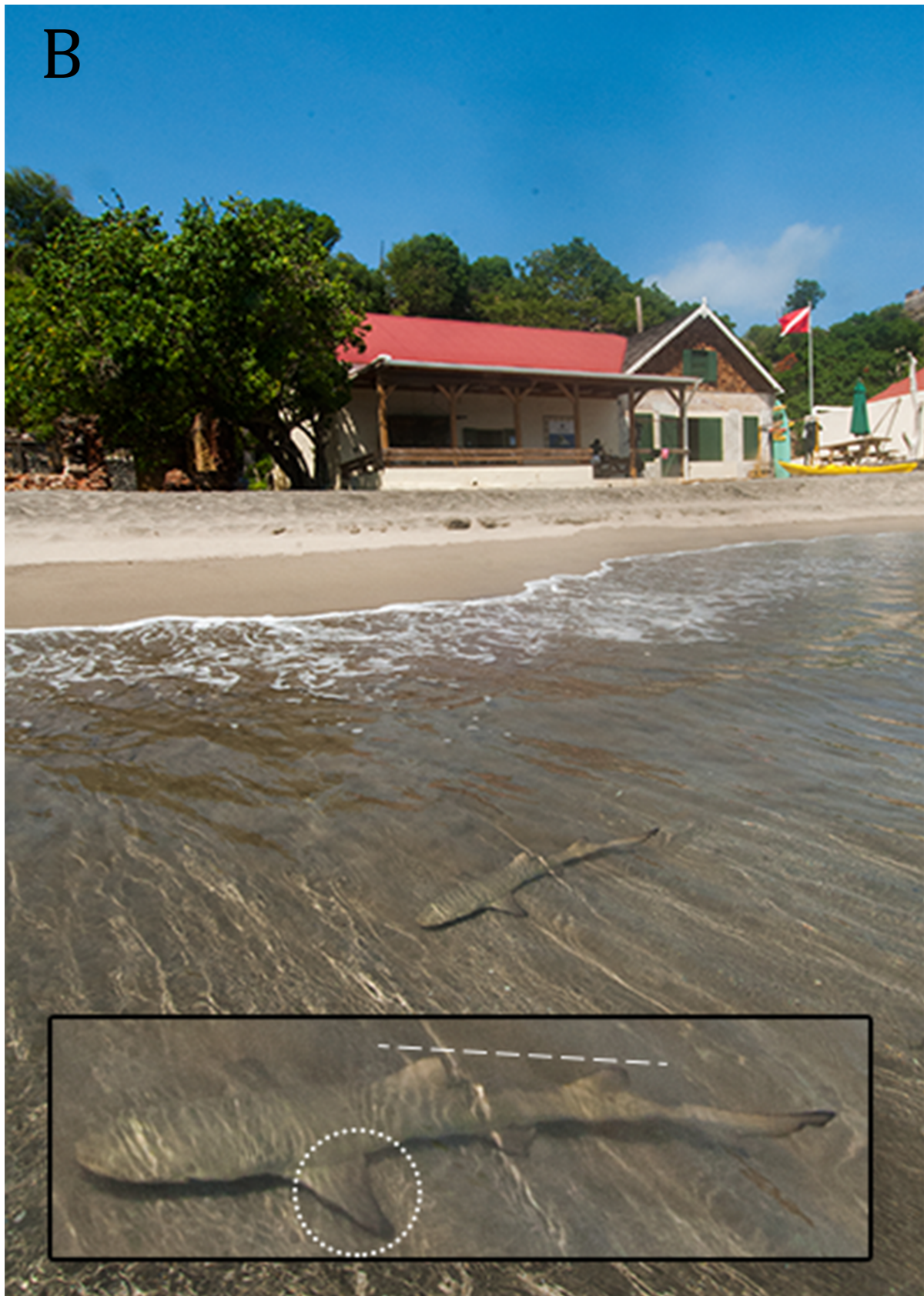
Here, visual observations and photographic evidence were used to describe the occurrence of young lemon sharks in the waters of Sint Eustatius. These data also allow for a description of a range extension of this species within the Dutch Caribbean.



Date	Location	Number of individuals	Estimated TL (cm)
14 July 2015	Oranjestad Bay (1)	2	50 – 65
27 April 2016	Zeelandia Bay (2)	1	50 – 65
13 May 2016	Zeelandia Bay (2)	1	50 – 65
26 May 2016	Zeelandia Bay (2)	1	50 – 65
9 June 2016	Oranjestad Bay (1)	2	50 - 65

a





b

### Figure Legend

Figure 1. Locations of observations of lemon sharks around Sint Eustatius.

(A) Locations of the observations of juvenile lemon sharks around Sint Eustatius in 2015 and 2016. The two marine reserves on the northern and southern sides of the island are indicated in grey.

(B) One of the lemon sharks observed and photographed in the shallow waters of Oranjestad Bay in July 2015. The near equal size of the second dorsal fin compared to the first dorsal fin, in combination with the broad base of the pectoral fins are characteristics for this species. Photo: Mike Harterink (Scubaqua Dive Center, Sint Eustatius).

## Results & Discussion

Photographs and video footage taken in Oranjestad Bay by a local dive shop in July 2015 showed 2 small sharks (estimated to be <65 cm TL), which were later identified as juvenile lemon sharks. More juvenile lemon sharks were observed throughout the spring of 2016 on the northeastern side of the island in the shallow waters of Zeelandia Bay ( $n = 3$ , one individual on 3 separate occasions). Here, only one individual estimated to be smaller than 65 cm in total length was observed on each occasion. In addition, 2 young lemon sharks (estimated to be <65 cm TL) also in the shallow waters of Oranjestad Bay were filmed in June 2016 (Fig. 1A). All observations described here occurred in shallow water (<2 m depth) and on sandy substrate.

Clear photographic evidence was available for 3 out of 5 observations, which enabled identification and estimations of the sharks' total length (TL) (Fig. 1B). Key morphological characteristics were used to identify the species: (1) a second dorsal fin approximately equal in size compared to the first dorsal fin; (2) broad pectoral fins at their base; and (3) size of the observed sharks, all of which were estimated to be smaller than 65 cm TL, which is the upper limit of the reported size-at-birth for the lemon shark [1]. Although all of the observed sharks were in the range of the reported size-at-birth for this species, estimation bias for observations from the surface should always be taken into account [7]. Based on the growth curve for this species, it is likely that all observed lemon sharks are younger than 2 years of age [8]. According to Morrissey and Gruber, the home range of lemon sharks of this age is approximately 0.68 km<sup>2</sup> [9]. Sint Eustatius is located on the same bank as Saint Kitts (approx. 12.2 km) and Nevis (approx. 46.6 km), for which the presence of lemon sharks is unknown. The closest island with known presence of lemon sharks is Sint Maarten located at a distance of approximately 55.8 km to the northwest [5]. Sint Maarten and Sint Eustatius are located on different banks separated by deep water, which juvenile lemon sharks are known to avoid [10]. The limited home range of young lemon sharks combined with the distances to nearby islands and observations from the same bay for 2 consecutive years (Fig. 1A) indicate that the waters of Sint Eustatius are possibly an important site for juveniles of this species. Considering the limited home range of the juveniles, it is likely that the adult females were also present.

Although the species is not considered to be endangered on the IUCN Red List, threats like overfishing and habitat degradation remain undefined [11] [12]. There is currently no local management in place for this species, however, a network of protected areas across the species' range, covering different life-stages of the species, could greatly improve conservation of shark species [13] [14]. Moreover, protection of nearshore habitats has been shown to be crucial to juvenile lemon sharks [15].

3 of the islands of the Dutch Caribbean, Saba (including the Saba Bank), Bonaire and Sint Maarten, have been designated as shark sanctuaries. In the waters of St. Maarten and Bonaire the capture of sharks is restricted. In the waters of Saba and Bonaire, further measures are planned to improve the protection of all sharks [16]. Sint Eustatius, however, has not implemented protective management for sharks in its waters. The island currently has 2 marine reserves (Fig. 1A), but these do not cover the bays in which the lemon sharks were observed for 2 consecutive years. Young lemon sharks exhibit high natal site fidelity (i.e. remain in the same area for multiple years), which indicates that local management efforts could have great potential to effectively conserve juveniles of the species in the waters of Sint Eustatius [17].

## Conclusions



The current observations included in this study describe a range extension of lemon sharks in the waters of the Dutch Caribbean and the use of the waters of Sint Eustatius by young individuals of this species. Furthermore, these observations also highlight the importance of documenting local observations and their potential value for local nature conservation.

### Limitations

The described observations were only made on 2 specific locations on the island, leaving the rest of the coastal waters of the island unstudied, causing a possible underestimation of the number of juvenile sharks utilizing its coastal waters.

Future research should focus on elucidating which life stages of this species are utilizing the waters of Sint Eustatius. Additionally, future studies should determine if the waters of Sint Eustatius serve as a nursery for this species according to the criteria for shark nurseries described by Heupel *et al.* 2007 [18].

### Additional Information

#### Methods and Supplementary Material

Please see <https://sciencematters.io/articles/201803000002>.

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#### Ethics Statement

Not Applicable.

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