Vol. 55: 219–228, 2024
https://doi.org/10.3354/esr01367

ENDANGERED SPECIES RESEARCH
Endang Species Res

Published November 28

Presence of the smalltooth sawfish in the Cuban Archipelago

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ABSTRACT: The smalltooth sawfish *Pristis pectinata* is listed as Critically Endangered by the International Union for Conservation of Nature. A greater focus on the status of sawfish globally, including Cuba, is yielding much needed information on the status of this species. Interviews were conducted in 2011, 2019, and 2022 (n = 473) with coastal community members from 80 sites throughout Cuba to assess whether sawfish are still extant in Cuban waters. Traditional ecological knowledge results show sawfish encounters (n = 33) at 26 sites in Cuba since the 1960s. Northern Camagüey province was identified as the region with the highest number of sightings, with the most recent in Cárdenas Bay in 2019. The highest number of sightings occurred in relatively deep water and along the coral reef drop off. Reports, specimens, and rostra represented a wide range of sizes, from very young to mature individuals collected throughout Cuba's northern and southern shores, suggesting the persistence of a resident population, though occasional movements between Cuba and neighboring countries are possible. We recommend the following actions to better understand and protect sawfish in Cuba: (1) amending the National Plan of Action for the Conservation and Management of Chondrichthyes in the Republic of Cuba to include specific measures that address sawfishes; (2) designing and implementing sawfish awareness, outreach, and encounter recording programs that focus on raising awareness and reducing threats to sawfish, including best handling practices; and (3) conducting genetic studies to assess whether Cuba's population is resident or shared with the Bahamas and/or Florida.

KEY WORDS: Sawfish · Cuba · Critically Endangered · Traditional ecological knowledge · Shark and ray conservation

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Publisher: Inter-Research · www.int-res.com

1. INTRODUCTION

Sawfishes are arguably the world's most imperiled marine fishes (Dulvy et al. 2016). All 5 species are classified as Critically Endangered (smalltooth sawfish *Pristis pectinata*, largetooth sawfish *P. pristis*, narrow sawfish *Anoxypristis cuspidat*, dwarf sawfish *P. clavata* and green sawfish *P. zijsrona*) (Carlson et al. 2022, Espinoza et al. 2022, Grant et al. 2022, Haque et al. 2022, Harry et al. 2022). In 2007, all 5 sawfish species were listed in Appendix I of the Convention on International Trade in Endangered Species (CITES 2007), which restricts commercial trade (Vincent et al. 2014). More recently, all were included under Appendices I and II for protection under the Convention on Migratory Species (CMS 2014). The International Union for Conservation of Nature (IUCN) Shark Specialist Group selected the Caribbean as 1 of the 4 priority regions for the conservation of these species, and Cuba as 1 of the 4 priority countries in the region to focus conservation efforts (Fordham et al. 2018).

In Cuba, 1 species of sawfish has been reported: the smalltooth sawfish *P. pectinata* (Dulvy et al. 2016). Sawfishes have been protected in Cuba since 2011 under legislation focused on species of special biological significance (Ministry of Science, Technology and Environment 2011, Koubrak et al. 2022) but this is still not enforced properly. Specific management and conservation activities targeting sawfish were not included in the National Plan of Action for the Conservation and Management of Chondrichthyes in the Republic of Cuba (NPOA-Sharks 2015).

Surveys and documentation of fisher knowledge of sawfish distribution and recent catches have been undertaken in Africa and Asia, including in Guinea-Bissau (Leeney & Poncelet 2015), Bangladesh (Hossain et al. 2015), Papua New Guinea (Grant et al. 2021), Australia (Bateman et al. 2024), and in several sites in the Western Atlantic Ocean (Guttridge et al. 2022). In 2011, 91 interviews were carried out with fishers in 9 of the 15 Cuban provinces and Isla de la Juventud to gather sawfish sighting reports (Figueredo Martín et al. 2012). Interviewees reported 16 reliable sightings over 50 yr. Besides the geographical span, no material evidence (photos, body parts) was available at that time.

The aims of this study were to assess the contemporary presence of sawfishes in the Cuban archipelago by expanding on the 2011 assessment of sawfish sightings in Cuban waters (Figueredo Martín et al. 2012), explore potential connectivity with the USA and the Bahamas, locate specimens and body parts in museums and private collections as tissue sample sources for future genetic studies, and recommend further steps for research and conservation.

2. MATERIALS AND METHODS

We conducted semi-structured interviews in 2019 and 2022 (adding to the interviews in 2011) to determine sawfish sightings in Cuban waters. The 2011 pilot study was expanded on with in-person interviews that integrated time control, information presented, order of questions, and use of visual materials. Questions were formulated to obtain detailed information on firsthand sawfish encounters by interviewees, or encounters heard from a third person (Naz et al. 2022). Data on encounters included the date, location, type of encounter (fished or sighted), use or non-use of the animal (released or kept), and the kind of uses of captured sawfishes (consumption, sale, or trophy). Interviewees included fishermen and divers based in fishing bases or dive centers in coastal communities. We especially targeted fishers/divers $\geqslant$60 yr old and/or with $\geqslant$30 yr of experience at sea. We conducted at least 2 interviews at each of the 80 sites visited, covering all 15 provinces of the country and Isla de la Juventud (Fig. 1, Table 1).

Only the smalltooth sawfish has been reported in Cuba. However, because it is possible that the largetooth sawfish may also occur in Cuba, and it is difficult to properly identify the correct species sighted through interviews, we use the general term 'sawfishes' or 'sawfish' and only specify the species when identifiable body parts were available (Whitty et al. 2014). We focused our attention on information about Cuba, excluding reports from the Bahamas from the analysis, where Cuban fishermen commonly fished before the 1990s. When body parts were available, samples were taken following Phillips et al. (2009).

To assess the likelihood of transboundary movements of sawfish between Florida, the Bahamas, and Cuba, we measured 2 distances (to the closest km) from the southernmost reports in Florida (from Carlson et al. 2014) and the Bahamas (from Guttridge et al. 2015) to the closest island in northern Cuba as straight-line distances, deriving the proportion of that distance that encompassed the 50 m isobaths on each end (Florida–Cuba and the Bahamas–Cuba). Carlson et al. (2014) and Guttridge et al. (2015) found that sawfishes spent 96% of their time at depths <10 m and we assumed the shortest distance between shallow water in neighboring areas as having the highest likelihood of transboundary movement (Fig. 2).

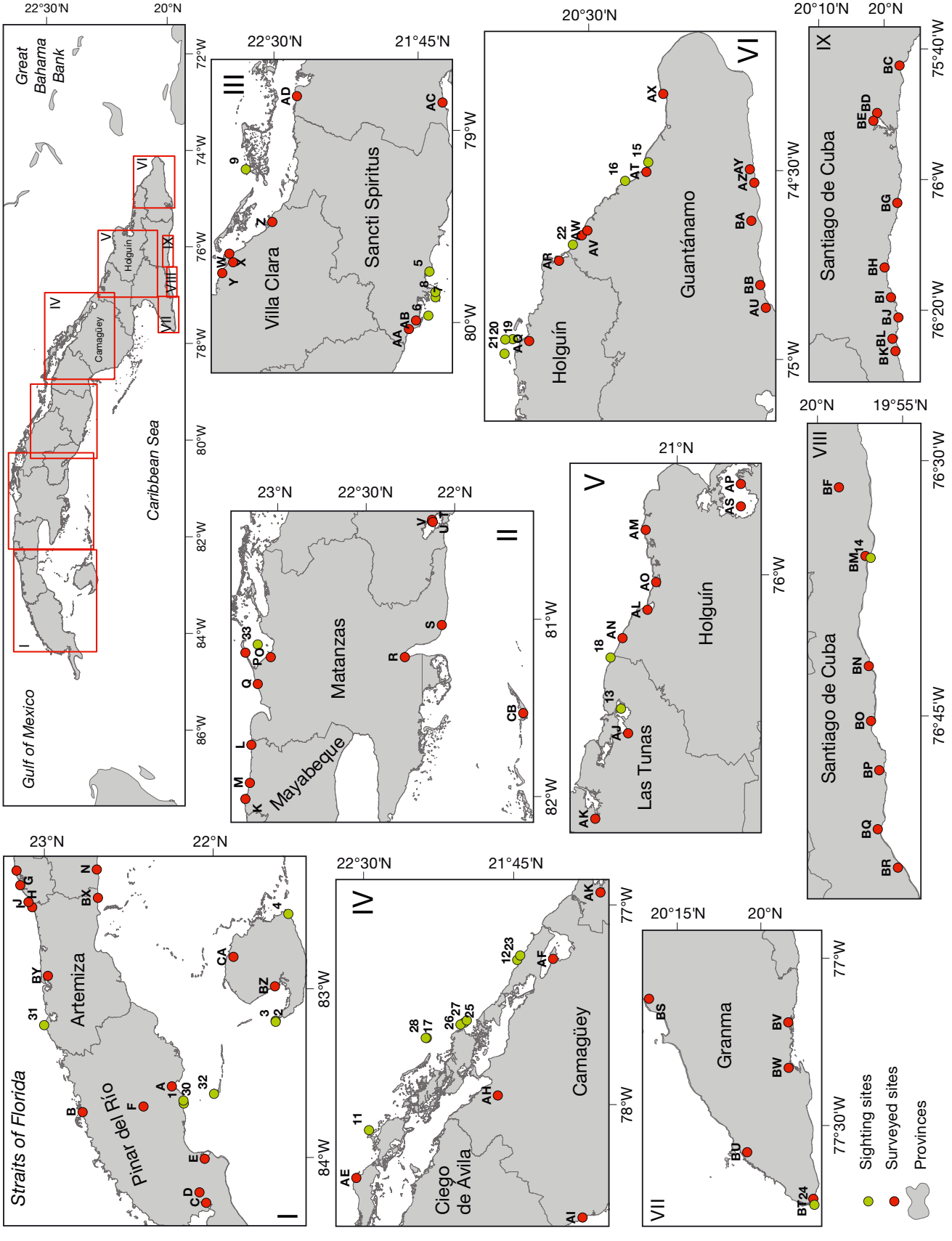

Fig. 1. Study sites (n = 80) visited in Cuba across 15 provinces between 2011 and 2022

Table 1. Study sites (n = 80) visited in Cuba across 15 provinces in 2011, 2019, and 2022. Total of number of interviews was 452

Province	Site	Site ID	Study year 2011	2019	2022
Pinar del Río	Coloma	A			X
	Puerto Esperanza	B	X		X
	La Fé	C	X		X
	Sandino	D	X		X
	Cortez	E	X		X
	Pinar	F	X		X
Habana	Cojímar	G			X
	Almendares (Vedado)	H			X
	Santa Fé	I			X
	Jaimanitas	J			X
Mayabeque	Boca Jaruco	K			X
	Puerto Escondido	L			X
	Santa Cruz del N.	M			X
	Batabano	N			X
Matanzas	Cárdenas	O			X
	Varadero Vento	P			X
	Boca Camarioca	Q			X
	Ciénaga, Caletón	R			X
	Ciénaga, Girón	S		X	X
Cienfuegos	Laguna del Cura 1	T			X
	Base Laguna del Cura	U			X
	Base Jagua	V			X
Villa Clara	El Santo	W		X	X
	Juan Francisco	X			X
	Nazabal	Y			X
	Caibarién	Z		X	
Sancti Spíritus	Trinidad, Base Boca	AA	X	X	X
	Trinidad, Casilda	AB	X	X	X
Ciego de Ávila	Júcaro	AC	X	X	X
	Punta Alegre	AD	X		X
Ciego de Ávila	Cayo Coco-Guillermo-Paredón	AE	X		X
Camagüey	Nuevitas	AF	X	X	X
	Santa Cruz del Sur	AG	X		X
	Brasil	AH		X	
	Playa Florida	AI	X		
Las Tunas	Puerto Padre	AJ	X	X	X
	Manatí	AK	X	X	
Holguín	Gibara	AL		X	X
	Guardalavaca	AM		X	X
	Caletones	AN		X	
	Bariay	AO		X	
	Guatemala	AP		X	
	Moa	AQ		X	
	Yamaniguey	AR		X	
	Nipe	AS	X		
Guantánamo	Baracoa	AT	X	X	X
	Baitiquirí	AU		X	X
	Taco Taco	AV		X	
	Nibujon	AW		X	
	Yumuri	AX	X	X	
	Cajobabo	AY		X	
	Tacre	AZ		X	
	Playa Imias	BA	X	X	
	Sabanalamar	BB		X	
Santiago	Siboney	BC		X	X
	Santiago	BD	X		X
	Bahía Santiago	BE			X
	Guamá, Aserradero	BF		X	X
	Caleton Blanco	BG		X	
	El Francés	BH		X	
	Bahía Larga	BI		X	
	Playa Blanca	BJ		X	
	Guama	BK		X	
	Chivirico	BL		X	

3. RESULTS

We visited 80 sites across the 15 Cuban provinces and Isla de la Juventud (Fig. 1) and interviewed 452 people (Table 1). We also contacted 21 fisheries technicians from state fisheries companies by phone to ask for recent fishing reports of sawfish. In-person interviewees were on average 56 yr old (39% were older than 60 yr old) with an average of 36 yr of experience at sea (66% with more than 30 yr). From the 473 interviewees, 18% had either heard about sawfishes or observed them firsthand through captures or sightings in Cuban waters.

A total of 33 encounters with sawfish from 26 sites between 1955 and 2019 were reported from Cuban waters (Fig. 1, Table 2), including 2 relatively recent sightings with detailed geographical and biological information and evidence (pictures, film, and rostra) (Table 2, Fig. 3). Most of these reports were from fisheries encounters (76%). A total of 36% of those reports were from the last 2 decades, 30% from the 1980s to 1990s, and 33% from the 1960s to 1970s. Northern Camagüey province was the region with the highest frequency of occurrence (21% of all sightings, Fig. 1, Table 2). Almost half of the sawfish reports were recorded in the eastern half of the northern coast (from Ciego de Ávila to Guantánamo provinces). Reports made from the 1960s to 1990s were equally distributed between the northern and southern coasts, with increasing records noted along the northern coast between 2000 and 2022. Most reports were made of sightings in less than 15 m, but deeper reports were common. Sizes were reported from very young (around 100 cm total length, TL) to mature individuals (>350 cm TL), noting that males mature at around 340 cm TL and females around 370 cm TL (Brame et al. 2019). Using 350 cm TL as a reference for maturity, 56% of the specimens were assumed to be immature and 44% were assumed to be mature. Information about sex was poorly

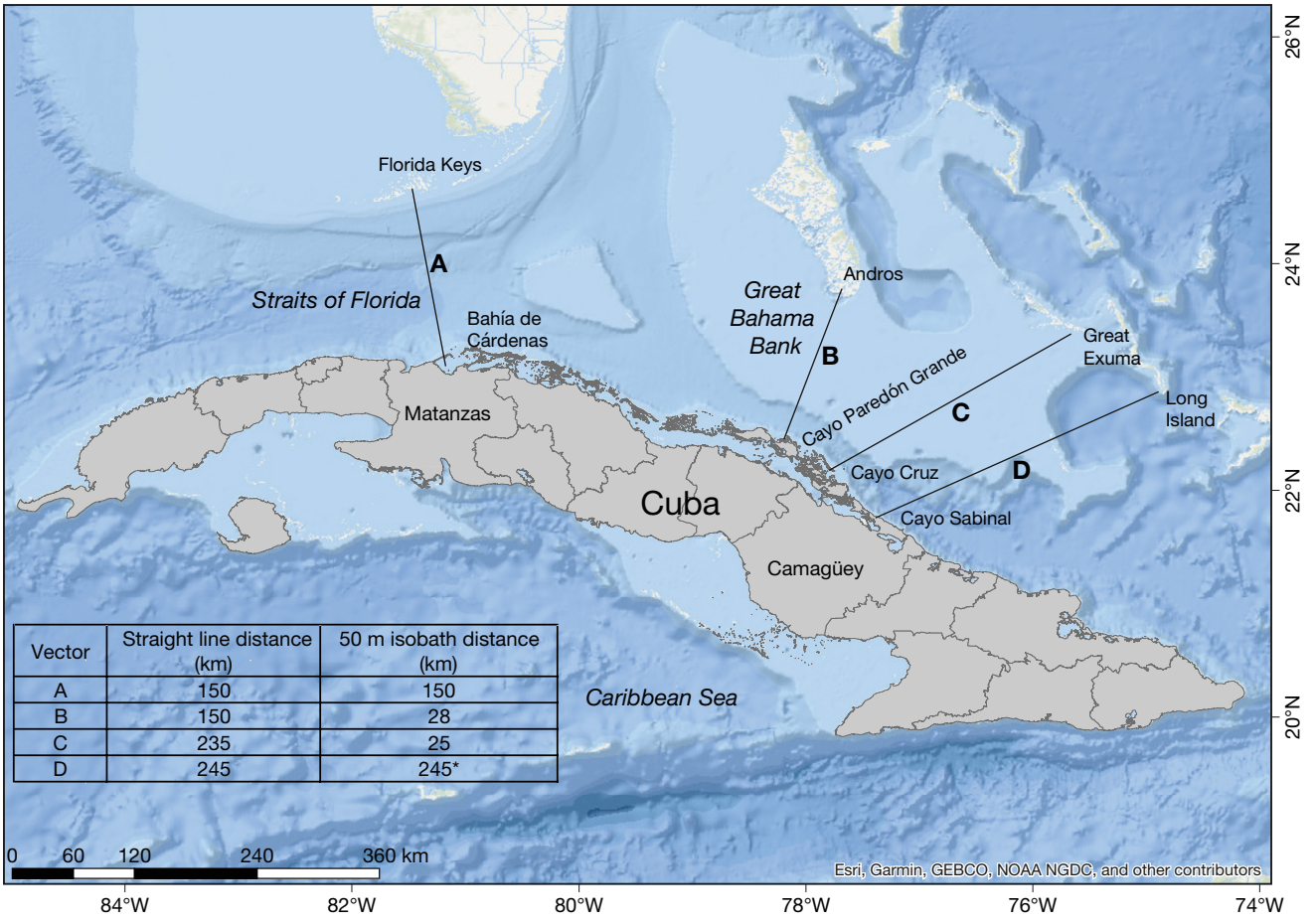

Fig. 2. Straight-line distance from the southernmost reports in Florida (Florida Keys) and the Bahamas (southern Andros, Great Exuma, Long Island) to the closest islands in northern Cuba (Bahía de Cárdenas, Cayo Paredón Grande, Cayo Cruz, Cayo Sabinal, respectively). The 50 m isobath is the distance from the first instance of 50 m depth off the coasts of Cuba and Bahamas. As smalltooth sawfish prefer to spend as little time over deep water channels as possible (Guttridge et al. 2015), this is the relative distance between Bahamian and Cuban continental shelves and hence where sawfish are most likely to use as migration jumping points. *Great Exuma, while geographically far from Cuba, is closer in terms of habitat preference due to the large expanse of shallow water between the countries

reported. A female caught in the 1980s in Cayo Paredón Grande was gravid and had 4 embryos when gutted. Only 3 other individuals were reliably sexed, 1 female (Cayo Confites, November 2017) and 2 males (Cayo Confites, 1980 and Versailles, 1988).

Two whole specimens and 3 rostra of smalltooth sawfish and 2 rostra from largetooth sawfish were inspected in museums in Cuba, and an additional 4 smalltooth sawfish rostra and 1 largetooth sawfish rostrum were found in private collections in Cuba (Fig. 3). These 12 individuals are the only ones that we know for sure the species. Fewer than a third of all samples had identifying information such as origin, date collected, size, sex, and TL. Two rostra were confirmed from Cuban waters, based on fisher interviews and photographs (Cayo Confites, November 2017 and Cárdenas Bay, 2019, Table 2). Two other rostra were confirmed from Bahamian waters, since the collector acquired them directly from the fishers that caught these 2 specimens and confirmed it was in Cayo Anguila in the Bahamas. It was impossible to establish the origin of the 3 largetooth sawfish rostra. Three of the rostra were incomplete. The rostrum from the most recent smalltooth sawfish individual reported to be accidentally caught in Cárdenas Bay in 2019 was donated by the fisher to authors of this study (T. Figueredo Martín & F. Pina Amargós), and then deposited in the collection of the Marine Research Center of the University of Havana (Fig. 3).

While assessing putative connectivity of sawfish between the Florida Keys, the Bahamas, and Cuba, straight-line distances from the southernmost reports in Florida (Florida Keys) and the Bahamas (southern Andros, Great Exuma, Long Island) to the closest

Table 2. Reports of sawfish sightings (n = 33) per site and per province. Est. size: estimated size (TL) of the animal; NA: no answer

#	Study Year	Site	Province	Date of encounter	Encounter type	Depth (m)	Habitat	Est. size (cm)	Comments
1	2011	Guama River	Southern Pinar del Río province	1993	Caught in net	1	Mangrove	100	
2	2011	Punta Frances	Isla de la Juventud	1970	NA	Deep	NA	150	
3	2011	Punta Frances,	Isla de la Juventud	Jun 2010	Diving sighting	15	Sand near coral reef	100	
4	2011	Punta del Este	Isla de la Juventud	1985	Caught in trap	3	Seagrass	150	
5	2011	Higuanojo River	Southern Sancti Spiritus province	1960	NA	2	NA	200	Multiple reports
6	2011	Banco Iguano	Southern Sancti Spiritus province	1961	NA	NA	Coral reef	250	
7	2011	Cayo Blanco de Casilda	Southern Sancti Spiritus province	Sep 2006	Caught	NA	Channel	300	Multiple reports
8	2011	Cayo Blanco de Casilda	Southern Sancti Spiritus province	Sep 2006	Caught	NA	Channel	350	Multiple reports
9	2011	Cayo Frances	Villa Clara	1991	NA	40	NA	NA	
10	2011	Cayo Sevilla	Southern Camagüey province	1961	Caught in net	NA	Drop off	NA	
11	2011	Cayo Paredón Grande	Northern Ciego de Ávila province	1983	Caught in net	60	Drop off	350	Multiple reports (2019). Pregnant with 4 pups
12	2011	Cayo Sabinal	Northern Camagüey province	1980	NA	NA	NA	NA	
13	2011	Puerto Padre	Northern Las Tunas province	1960	NA	NA	NA	NA	
14	2011	Uvero	Santiago de Cuba	1960	Caught in net	NA	NA	250	
15	2011	Miel River	Northern Guantánamo province	Jul 2009	Caught	NA	Drop off	300	
16	2011	Banco Nelson	Northern Guantánamo province	2001	NA	NA	Channel	350	
17	2019	Cayo Confites	Northern Camagüey province	29 Nov 2017	Caught in net	80	Drop off	381	Confirmed, pictures, rostrum
18	2019	Mangle	Holguín	2008	Snorkeling sighting	30	Drop off	300	
19	2019	Cayo Bueno de Moa	Holguín	1955	Caught in net	2	Seagrass	350	
20	2019	Cayo Bueno de Moa	Holguín	1987	Caught in net	25	Drop off	400	Multiple reports
21	2019	Cayo Moa	Holguín	1978	Caught in longline	50	Offshore	400	Multiple reports
22	2019	Bahía de Taco	Holguín	Apr 2009	Snorkeling sighting	15	Coral head on sand	300	
23	2019	Cayo Sabinal	Northern Camagüey province	Jun 2013	Snorkeling sighting	6	Coral head on sand	350	
24	2019	Cabo Cruz	Granma	1986	Caught in net	15	Sand	300	Multiple reports
25	2019	Versailles	Northern Camagüey province	1988	Caught in net	20	Drop off	300	Multiple reports
26	2019	Versailles	Northern Camagüey province	1970	Caught in net	20	Drop off	400	Multiple reports
27	2019	Versailles	Northern Camagüey province	1960	Glass bucket sighting	20	Drop off	400	Multiple reports
28	2019	Cayo Confites	Northern Camagüey province	1980	Caught in net	50	Drop off	350	Multiple reports
29	2022	Cauto River	Granma	1980	NA	2	NA	NA	
30	2022	Guama River	Southern Pinar del Río province	1960	NA	1	NA	NA	
31	2022	Punta Gobernadora	Northern Pinar del Río province	2002	NA	NA	NA	NA	
32	2022	Cayo Juan Garcia	Southern Pinar del Río province	2000	NA	NA	NA	NA	
33	2022	Cárdenas Bay	Northern Matanzas province	2019	NA	1	Seagrass	210	Confirmed, pictures, rostrum

Fig. 3. Field study. (A) Donation of a smalltooth sawfish rostrum to authors (F. Pina Amargós on the left, fisher on the right). (B) The same sawfish specimen at the time of landing after being entangled in a net in Cárdenas Bay in 2019. The rostrum was donated to the authors and then deposited in the collection of the Marine Research Center of the University of Havana

point in northern Cuba (Bahía de Cárdenas, Cayo Paredon Grande, Cayo Cruz, Cayo Sabinal, respectively) ranged from 150 to 245 km and the distance from 50 m isobaths each side range from 25 to 245 km (Fig. 2). Straight-line distances coincided with northern Cuba sightings records.

4. DISCUSSION

Insights into the historical and contemporary distribution of sawfishes throughout the Cuban shelf were gleaned through the interviews with experienced fishers and divers in Cuba. Our results reveal that although encounters are rare, surveys and dozens of reports confirm that sawfishes persist in Cuban waters, at least through 2019. Taking into account that the only 3 largetooth sawfish rostra inspected in Cuba have an unknown source, and it is possible that they were obtained through the tourist curio trade, smalltooth sawfish are more likely the only sawfish in Cuban waters.

The most recent report of an encounter in north Cárdenas Bay (150 km east from Havana) was an individual caught by a net in 2019 (Table 2, Fig. 3). Cárdenas Bay (Fig. 2) is a highly populated and heavily fished area. The coastline is dominated by mangroves and muddy benthos, important habitats for sawfish (Simpfendorfer et al. 2008, Guttridge et al. 2015, Hollensead et al. 2018). The recently captured individual was immature with an estimated TL of 210 cm. Since juveniles show higher site fidelity than adults (Simpfendorfer et al. 2010, Norton et al. 2012, Poulakis et al. 2016, Hollensead et al. 2018, Brame et al. 2019, Graham et al. 2021), this individual was likely a resident rather than a transient from Florida or the Bahamas.

Northern Camagüey province was identified as the region with the highest number of sightings. However, we must be aware of the extremely low likelihood of an encounter there, as elsewhere in Cuba.

Versailles is a site that, from the 1960s to 2008, was fished year round with 1 km long fixed net fishing, mostly for snappers. That could account for almost 15 000 d of continuous fishing over a large area that yielded only 2 caught and 1 sighted sawfish.

The majority of sawfish sightings took place in the deeper water and coral reef drop offs along Cuba's northern coast. These are somewhat different findings to those in the USA and the Bahamas, where most sightings are recorded in shallow water (USA, 96% of their time at depths <10 m, Carlson et al. 2014; Bahamas, 77% of encounters in <2 m, Guttridge et al. 2015) and in mangrove-seagrass-muddy habitats (Wiley & Simpfendorfer 2010, Carlson et al. 2014, Guttridge et al. 2015). However, no sawfish research effort or fisheries occur in deeper waters in the Bahamas, so the lack of data there is not surprising. In addition, more than 30% of non-research-based sawfish encounters reported in Florida waters occur in deeper shelf edge habitats up to 70 m deep (Poulakis & Seitz 2004), and Graham et al. (2021, 2022) suggested deeper shelf edge habitats may be critical habitats and potential areas of elevated bycatch risk.

We do not consider that the few sawfish caught in Cuba are an artifact of low fishing effort. First, Cuban waters are heavily fished (20% of fishery resources are fully exploited, 74% are overexploited, and 5% are collapsed) (Baisre 2018) by around 40 000 fishers and almost 10 000 boats from more than 200 fishing bases around Cuba (NPOA-Sharks 2015) with the current fishing effort above 55 000 d yr^{-1} (with a maximum in the 1980s of 180 000 d yr^{-1}) (Puga et al. 2018). Second, species typically caught in the habitats where sawfish are more often encountered abroad, such as mullet, sardine, herring, and mojarra, account for more than 40% of Cuban landings (Baisre 2018). Thus, since habitats are suitable, fishing pressure is likely to limit sawfish maintenance (Yan et al. 2021).

Reports, specimens, and rostra represented a wide range of sizes, from very young (around 100 cm TL) to mature individuals (>350 cm TL), collected throughout Cuba's northern and southern shores, suggesting the persistence of a resident population, though occasional movements between Cuba and neighboring countries are possible. In the Bahamas and the USA, sawfish are sighted or captured as young-of-year to mature-sized fish (range: 80 to 450 cm stretch total length [STL]; mean: 332 cm STL) (Carlson et al. 2014, Guttridge et al. 2015). The recent capture of a juvenile smalltooth sawfish (210 cm TL) in Cárdenas Bay along with several reports of captures, supports the possibility of a resident population in Cuba. Limited movement of sawfishes is supported by scientific research. Sawfishes tagged in the Bahamas and the lower Florida Keys showed no evidence of movement between the 2 countries. While the distance between Andros Island in the Bahamas and the Florida Keys is only about 240 km, *Pristis pectinata* tended to remain inside the 150 m bathymetric contour and did not venture to the deep intervening waters of the Gulf Stream (Carlson et al. 2014, Guttridge et al. 2015).

It is possible there is movement between the Bahamas and Cuba. The 381 cm TL smalltooth sawfish caught at Cayo Confites in 2017 was presumably mature and caught along the Cuban side of the narrowest portion of the Old Bahama Channel, and reports suggested that large specimens are more commonly encountered in northeastern Cuba. The distance from the Cuban shelf to the Great Bahama Bank in this region is only about 25 km, so it is possible larger individuals could have migrated to Cuba from the Bahamas. Furthermore, Faria et al. (2013) found only 1 haplotype common to the western Atlantic Ocean *P. pectinata*, suggesting mixing among populations. Sawfish fitted with satellite tags in the USA and the Bahamas traveled relatively long distances (i.e. 279.1 km, Carlson et al. 2014); however, none moved out of the national waters of insular or continental shelves or over deeper waters (over 800 m). Graham et al. (2021) analyzed movements of 43 large smalltooth sawfish tagged with acoustic transmitters in Florida. Individuals were detected on nearly 500 receivers as far as 700 km away from their tagging site, but only in US waters. Graham et al. (2022) combined those acoustically tracked sawfish with an additional 17 satellite-tagged sawfish, and again, there was no evidence that any left US waters. Despite the proximity of the Bahamas (<100 km) and the existence of extensive acoustic receiver arrays on Andros and Bimini, the 2 islands where Guttridge et al. (2015) reported 85% of the known sawfish records in that country, no US-tagged sawfish were detected in the Bahamas. To determine whether individuals reported in Cuban waters are residents of a Cuban population, transients from neighbor populations, or both, will require further research including conventional and telemetry tagging and genetic analyses.

Since 2011, Cuba has protected species of special biodiversity significance (Ministry of Science, Technology and Environment 2011). This resolution highlights that species listed in its Appendix I, including sawfishes, are only available for research and conservation activities (Article 21). The recently passed Law 150 that replaced Law 81 of the Environment (Cuban National Popular Assembly 2023) provides a comprehensive framework covering a range of subjects including the preservation of biodiversity. It is now

mandatory to identify Cuba's threatened species such as sawfish and implement recovery measures. Enforcement will continue to be key in the implementation of this new legislation. This study provides an opportunity to update the National Plan of Action for the Conservation and Management of Chondrichthyes in the Republic of Cuba (NPOA-Sharks 2015), that, to date, only briefly mentions sawfish and requires actionable points.

5. CONCLUSION AND RECOMMENDATIONS

Our study, highlighting traditional ecological knowledge, reveals that sawfish have been encountered at 26 sites throughout Cuba since the 1960s, and that all recent encounters (since 2017) were solely of the smalltooth sawfish. Records of smalltooth sawfish suggest they are found all around the island; however, the degree of individual movement around the island is unknown without a tagging program. Northern Camagüey province was identified as the region with the highest number of sightings, and the most recent one was in 2019 in Cárdenas Bay, Northern Matanzas province. Interviews indicated that sawfish are still occasionally caught in Cuban waters as bycatch, and that relatively poor knowledge exists of the species and safe release techniques. Any incidental capture could be detrimental to the viability of the local population and will reduce the likelihood of recovery. Fishers interviewed were also unaware that sawfish are protected in Cuba and that there are penalties for unauthorized take. Considering the lack of connectivity for smalltooth sawfish between the Bahamas and the USA, it is likely that Cuba hosts a resident population; however, research using population genetics is needed to test this hypothesis.

Taking into account all the above, we considered several future actions. We recommend amending the National Plan of Action for the Conservation and Management of Chondrichthyes in the Republic of Cuba (NPOA-Sharks) to include specific actions regarding sawfishes, such as designing and implementing encounter reporting, awareness, and outreach programs in Cuba, focused on raising awareness of the presence and vulnerability of sawfishes and best practices for safe handling and release. These programs have been suggested in other countries such as the Bahamas to support conservation (Guttridge et al. 2015). We recommend conducting genetic studies to assess whether Cuba has a resident or shared population, which will further inform how threats to sawfish are managed (Faria et al. 2013).

Acknowledgements. Thank you to the Wildlife Conservation Society for funding the publication of this research. The authors appreciate support from New England Aquarium's Marine Conservation Action Fund, The Ocean Foundation, Wildlife Conservation Society, The Code Blue Foundation, National Geographic Society, Centro de Investigaciones Marinas of the University of Havana, and Centro de Investigaciones de Ecosistemas Costeros. We thank the following for their support in the research: Yoendry A. Paz Rodríguez, Alexis Medina Valmaseda, Roberto Fajardo Veloso, Sandra Chapman Stable, Yusniel Nuñez Acosta, and Alexander Pupo Sánchez. We also thank the editors and anonymous reviewers for their critical comments that helped improve the manuscript.

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Editorial responsibility: Robert Harcourt, Sydney, New South Wales, Australia
Reviewed by: B. Hueter, D. Morgan and 1 anonymous referee

Submitted: February 22, 2024
Accepted: October 2, 2024
Proofs received from author(s): November 12, 2024