MOBILIZING STAKEHOLDER SUPPORT FOR THE CONSERVATION OF ENDANGERED STINGRAYS AT CAPE THREE POINT, GHANA

Final Technical Report, 2022

Project Coordinator: Justina Ekuwa Annan

Coordinating Organisation: Bushmeat Crisis Foundation-Ghana (https://bcf-ghana.org/)

Funder: Mohamed bin Zayed Species Conservation Fund

SUMMARY

This project is the first conservation focused program for stingrays in Ghana. We initially investigated the patterns of stingray utilization via interviews and surveys at fish landing sites with a focus on the Daisy Whipray (*Fontitrygon margarita*) and Pearl Whipray (*Fontitrygon margaritella*). The project was undertaken at Cape Three Points and its environs in the Ahanta West District. We estimated that about 3000 stingrays were harvested annually from the study area; local people reported catch quantities have reduced drastically due to fishing pressure and activities of industrial trawlers. Seven (7) species of stingrays were reported by local people to occur in the study area: Daisy Whipray (*Fontitrygon margarita*), Pearl Whipray (*F. margaritella*), Common Stingray (*Dasyatis pastinaca*), Marbled Stingray (*Dasyatis marmorata*), Roughtail Stingray (*Bathytoshia centroura*), Bluntnose Stingray (*Hypanus say*) and Round Stingray (*Taeniura grabata*). Five (5) of the above mentioned species (Daisy, Pearl, Common, Marbled and Round) stingrays were observed during surveys in communities and fish landing sites. Three (3) of the species reported are categorized as Vulnerable on the IUCN Red List of threatened species, therefore globally threatened with extinction: Daisy Whipray, Common Stingray and Roughtail Stingray. We confirmed that the Daisy and Pearl Whiprays were the main species collected in the study area. Our opportunistic surveys at landing sites recorded 59 and 37 individuals of Daisy and Pearl Whiprays respectively, compared to a record each for the other species (Common, Marbled and Round, Stingrays). In addition to landing site monitoring and interview surveys, we organized educational campaigns at community centers, fish landing sites and schools about the plight of stingrays, sustainable fishing practices and degradation of marine resources. We periodically broadcasted our conservation message via community information centers.

INTRODUCTION

In Ghana, the utilization of stingrays is prevalent in fishing communities. However, data on utilization patterns is not readily available. Furthermore, there are no specific conservation measures in place for threatened stingrays in Ghana. In particular, the Daisy Whipray (*Fontitrygon margarita*) and its sympatric Pearl Whipray (*Fontitrygon margaritella*) are reported to be largely harvested in Ghana but have not receive any focused conservation attention. The Daisy Whipray was formally listed as Endangered by the IUCN Red List of Threatened species until recently, when it has been reassessed as Vulnerable under criteria A2d. The species is assumed to have undergone a population decline of 30-49% over the past three decades accounting for its current status (e.g. see Jabado *et al*., 2021). The species still remains at a very high risk of extinction. The Pearl Whipray has also been reassessed as Near Threatened from its previous Data Deficient category by IUCN. The species is suspected to have undergone a population decline of 20-29% over the past three decades informing its current IUCN status. The species is close to meeting the Vulnerable category A2cd due to the intense levels of unmanaged fisheries activities throughout its range (Jabado *et al*.,2021). Apart from unsustainable levels of utilization, the stingrays are faced with the potential threats from repulsive fishing practices including the use of chemicals for fishing throughout its range in Ghana.

Our project targeted fisheries activities within the Cape Three Points village and its environs. Cape Three Points is a small village in the Western Region of Ghana along the Atlantic Ocean. In addition to fishing, the village is an important locality in Ghana for tourism. It is also close to Ghana's jubilee oil field, where oil production began in 2010. The goal of our project was to strengthen conservation through collaborative research, capacity building and engagement of key stakeholders to lay strong foundation for the recovery of threatened stingrays in Ghana. Specifically, the objectives to accomplish this goal were to: (i) assess the characteristics of stingray utilization patterns with emphasis on the Daisy and Peal Whiprays; (ii) enhance the capacity of local people to conduct independent systematic surveys to monitor and document population of Daisy and Pearl Whiprays at fisheries landing sites; (iii) educate and distribute educational materials to local people about the plight of stingrays; and (iv) fortify traditional conservation governance protocols to reduce the impacts of fisheries practices on population and habitat quality of Daisy and Pearl Whiprays.

Figure 1. Project leader (far left) with some team members and a local fisherman at a fishing landing site at Cape Three Point

MATERIALS AND METHODS

Study Area

The study was conducted in Cape Three Points (4°44′38″N 2°05′20″W) and nearby Akwidaa village (4°45.410N, 002°020.118W). The main occupation of the people in these communities is fishing. Cape Three Point is part of the Ahanta West District in Ghana. Cape Three Point fringes the Gulf of Guinea and home to several species of elasmobranchs including stingrays. This locality has Ghana's only coastal rainforest reserve. Cape Three Points is popularly known for the harvest of stingrays in Ghana. Apart from commercial artisanal fishing, Cape Three Point is the locale in Ghana closest to the Jubilee Oil Field (oil field located off the coast of Ghana) and directly affected by oil and gas activities (Boohene and Peprah, 2011). The ownership of the marine environment is vested in the traditional authority of the Ahanta West Traditional Council with the Fisheries Commission of Ghana playing regulatory and advisory roles. We also explored some landing sites in Sekondi (4.9308^{o} N,1.7204^{o}W). Sekondi is a city far from our proposed study area, however we had information that industrial trawlers have been fishing inshore for stingrays so we decided to explore this area.

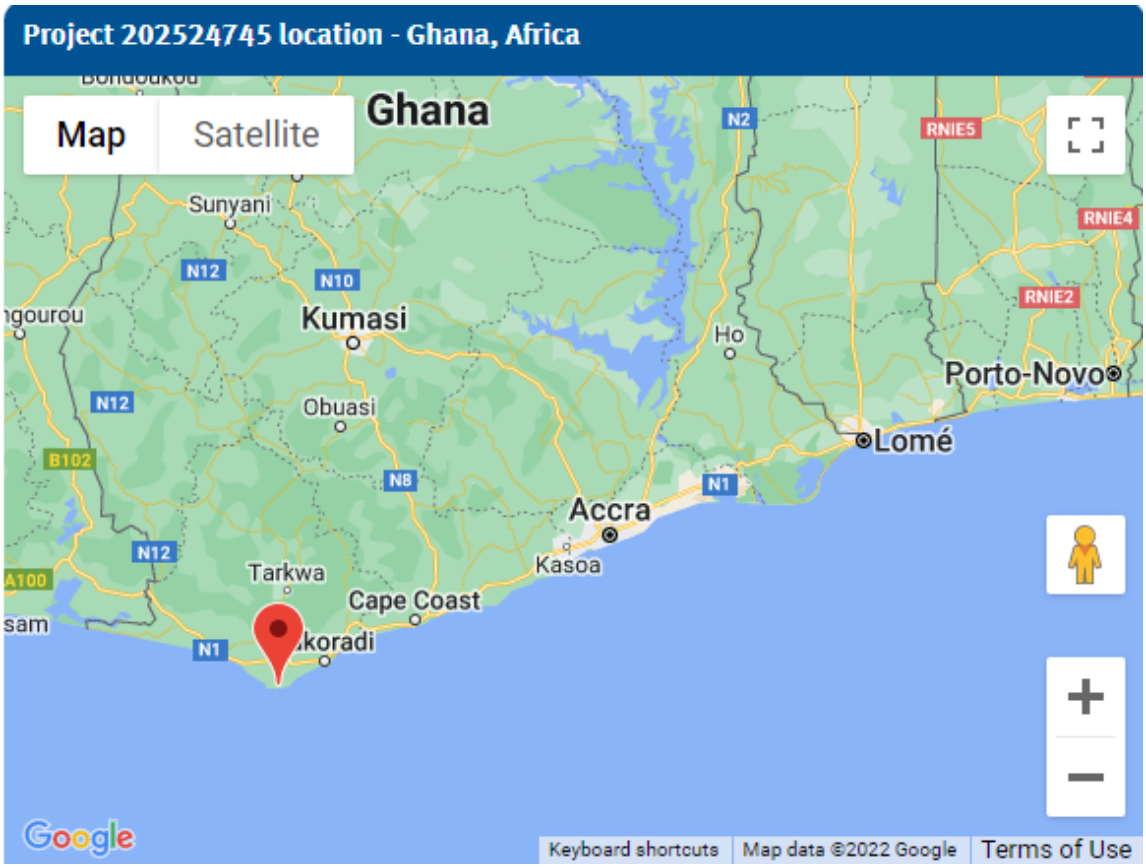

Figure 2. Map of main study location. Map was sourced from the MBZ project website (https://www.speciesconservation.org/case-studies-projects/daisy-stingray/24745)

Methods

I. Interview Surveys

For a period of two months, we interviewed 82 local people using semi-structured questionnaires in Akwidaa, Cape Three Points and Sekondi. Local people interviewed included fishermen (who fish in the sea) and vendors involved processing and supply chain of fish. We trained seven (7) local volunteers to assist with interview surveys in their communities. Semi-structured questionnaires were organized in the University of Cambridge KoboToolbox software installed and administered with smartphones. KoboToolbox is an online-offline software that offers a suite of tools for field data collection for use in challenging environments. Two set of questionnaires were used to collect data from the respondents; questions about the demography of respondents and those about the status and utilization of stingrays.

II. Focus Group Meetings

We organized two (2) focus group meetings involving staff of the Fisheries Commission of Ghana (Western region directorate), leaders of fishing groups, fishers (*incl.* canoe owners, captains, crew members, fish vendors) and traditional leaders. Fishers were selected with the help of their leaders (*apofohen* literally chief fisherman and *konkohemaa* literally chief fishmonger/vendor). Only fishers with at least 5 years' experience and harvested or sold stingrays within a month to start of focus group meetings were selected. The focus group meeting gathered information on characteristics of the fishery including fishing effort, fishing methods and gear selectivity. This meeting also gathered information on threats to stingrays via fishing activities.

III. Surveys at Fish Landing Sites

We collaborated with the Ghana Fisheries Commission to train three (3) community volunteers to assist in biological data collection at fish landing sites and markets. We provided trainees with identification charts, weighing scales, measuring boards, notebooks and appropriate personal protective equipment (PPE's) to embark on data collection. Data was collected within a period of six (6) months from March – August 2021. All stingray species landed were identified, counted and their biological parameters (*incl.* sex, weight, total length and disc length) recorded.

Figure 3. Community volunteers receiving training on measurement of stingray biometric data

IV. Laboratory Analysis of Heavy Metals

We performed heavy metal analysis using samples of stingray and brine (sea water) samples we collected from the study area. Three (3) samples of stingray were picked each from Akwidaa, Cape Three Points and Sekondi. The brine was picked only from Akwidaa with a clean plastic bottle due to convenience. Samples were analyzed for nine (9) Heavy Metals at the College of Engineering Laboratory, Kwame Nkrumah University of Science and Technology: (Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Manganese (Mn), Nickel (Ni), Lead (Pb) and Zinc (Zn)). The procedure for the analysis were as follows:

Digestion of Fish and Water Samples for Heavy Metal Determination.

A 1.0g of ground sample was weighed and placed into 300ml volumetric flask (1.0 g to 50mls of the sea water sample). Ten (10) ml of HNO3 and HClO4 mixture of acid in the ratio 9:4 was added and the contents well mixed by swirling thoroughly. The flask with contents was then placed on a hot plate in the fume chamber and heated, starting at 850C and then temperature raised to 1500C. Heating continued until the production of red NO_2 fumes ceased. The contents were further heated until volume was reduced to about 3ml and became yellowish, but not dried. This was done to reduce interference by organic matter and to convert metal associated particulate to a form (the free metal) that can be determined by the Atomic Absorption Spectrophotometer (AAS). Contents were cooled and volume made up with distilled water and filtered through Whatman 1 acid-washed filter paper in 50mls conical flask. The resulting solution was preserved at 40C, ready for Atomic Absorption Spectrophotometric determination of the metal analysis (Motsara and Roy, 2008).

Atomic Absorption Spectrophotometry (AAS) Analysis

AAS 220 model was used in determining the total As, Cd, Cr, Cu, Hg, Mn, Ni, Pb and Zn concentration in the previously digested samples. The acetylene gas and compressor were fixed and compressor turned on and the liquid trap blown to rid of any liquid trapped. The Extractor was turned on and the AAS 220 power turned on (AOAC, 2006). The capillary tube and nebulizer block were cleaned with cleansing wire and opening of the burner cleaned with an alignment card. The worksheet of the AAS software on the attached computer was opened and the hollow cathode lamp inserted in the lamp holder. The lamp was turned on; ray from cathode aligned to hit target area of the alignment card for optimal light throughout, then the machine was ignited. The capillary was placed in a 10 ml graduated cylinder containing deionized water and aspiration rate measured, and set to 6 ml per minute. The analytical blank was prepared,

and a series of calibration solutions of known amounts of analyte element (standards) were made. The blank and standards were atomized in turn and their responses measured. A calibration graph was plotted for each of the solutions, after which the sample solutions were atomized and measured. Metal concentrations from the sample solution was determined from the calibration, based on the absorbance obtained for the unknown (AOAC, 2006).

RESULTS AND DISCUSSION

I. Interviews at Fish Landing Sites and Markets

Respondents demography

Out of the 82 local people interviewed, 30 were fish vendors and processors, and 52 were fishermen. All vendors were females except one person; their ages were between 24-56years. Vendors processed their own fish (with the support of their families) for the market. Less than 10% of these women had up to a secondary education. About 40% of vendors (processors) had a secondary occupation such as farming, fuelwood trading and petty trading (selling either provisions, vegetables or other food items).

Fishermen interviewed were all males. Majority of the fishermen (about 90%) were within the age group of 24-56 years. Around 10% fishermen had secondary school education whiles 34% of them had no education. Sixty percent (60%) of the fishermen had a secondary occupation which was mostly crop farming. Fishermen interviewed either played the role of crew members, outboard motor operators or canoe captains engaged in the direct capturing of fish. Others were canoe owners, canoe watchmen and head potters; occasionally, these people were also part of fishing crew.

Status of stingrays in the study area

Stingrays were locally referred to as *Tantra* (Fante), *Tandala* (Ahanta) or *Kudike* (Nzema) within the study area. Seven (7) species of stingrays were reported by local people to occur in the study area: Daisy Whipray (*Fontitrygon margarita*), Pearl Whipray (*F. margaritella*), Common Stingray (*Dasyatis pastinaca*), Marbled Stingray (*Dasyatis marmorata*), Roughtail Stingray (*Bathytoshia centroura*), Bluntnose Stingray (*Hypanus say*) and Round Stingray (*Taeniura grabata*). Five (5) of these species (Daisy, Pearl, Common, Marbled and Round) were positively confirmed in communities and fish landing sites during surveys.

According to the IUCN Red List of Threatened Species, three (3) of the reported species are globally threatened with extinction; Daisy Whipray (Vulnerable), Common Stingray (Vulnerable) and Roughtail Stingray (Vulnerable).

Other elasmobranchs observed included 15 preserved (salted and sun-dried) carcasses of guitarfishes, the Brown/Peacock Skate (*Raja miraletus*) and the Spotted Skate (*Raja montagui*) were common during the study.

For both fishermen and vendors (processors), majority (73% and 63% respectively) indicated that the species composition, quantities and sizes of stingray landed have reduced drastically over the past five (5) years. Roughtail, Marbled and Bluntnose stingrays were mentioned to be rare over the past decade. This (according to fishermen) was as a result of excessive fishing pressure worsened by chemical usage (*incl*. dynamites and detergents), activities of industrial trawlers in the species habitat. Other reasons given for the declining population of these species were: poor enforcement of fisheries laws and fallen local norms governing sustainable fishing practices; domestic and plastic pollution; the activities of oil and gas in the Jubilee oil field; and the recent upsurge in Sargassum sea weeds.

The months of May, March and August were mentioned as the peak season for stingray harvest although stingrays are also harvested all year round. Fishermen believed that the catch levels are influenced by the availability of small pelagic fishes (*incl*. herrings, anchovies, sardinellas and mackerel) during a fishing season.

The Daisy and Pearl Whiprays were mentioned as the dominant species harvested in the study area followed by the Common Stingray. Typically, nine (9) individuals of stingrays are harvested per canoe in a day. This could go as high as 10-15 individuals. Stingrays are both targeted (esp. by fishers using Beach Seine, Hook and Line and Set Net gears) and incidentally caught (by purse Seine fishers). Annually, about 192 fishing trips are made by each canoe. Therefore, on the average we can estimate that 1,728-2,880 stingrays were captured in a year by a single canoe.

Stingray Commodity Chain

Stingrays are mostly sold fresh (at the landing site) to fish vendors (processors) who either sun-dry, salt or smoke them for market sales in some neighboring towns and cities including Agona Nkwanta, Tarkwa, Takoradi and as far as Kumasi (about 300Km from the study area). Depending on the size, freshness of catch, season (lean or bumper which influences the availability of fish in the market) and relationship with the fishing company or the sales clerk one stingray may cost between 4-6ghc ($0.5-$0.8). Persons with long standing relationship, financiers of fishing trips and buyers who offer a good price normally stand

the chance of getting a stingray to buy. Whiles some fishermen (about 30% made a monthly income of less than 500ghc ($62.6) from fishing, others (56%) made between 500ghc-2,000ghc ($250.6) in a month. The rest (15%) made more than 2,000ghc. Income generated from stingray fishing was 5%-20% (100-400ghc; $12.5-$50.1) of the overall fishing proceeds for majority (73%) of respondents. The trade in stingrays seem not to be a very lucrative venture, however this may change in the future since fishers are currently focusing on them. Stingray catches are also generally shared among the fishing crew for their own consumption or are given as gifts to friends and family for consumption.

II. Focus Group Meetings

Fishing effort

For fishers, fishing is an everyday activity except for these reasons: the sea is rough; premix fuel is in shortage; and there is a taboo day (mostly on Tuesdays); the fishing close season is being observed; and a fishing crew is sick or the canoe, net or outboard motor is faulty.

Fishers used bigger canoes including beach seine canoes (7-12meters long) or purse seine (*Alli Polli Watsa*-A.P. W; 15-20meters long); where about 12 crew members were involved in fishing expeditions and spent an average six (6) and 12 hours respectively. Smaller canoes namely *One-Man Canoe* (about 2meters) were also observed in Akwidaa and Cape Three Points. These were often occupied by one person or two who engage in hook and line fishing.

Apart from fishing nets and outboard motors (48Hoarsepower mostly), fishermen also carried with them food and water during their expeditions. Live jacket and modern tools like compass and GPS were not used. Some A.P.W fishers revealed that they sometimes used light fishing materials including generator, dynamite, light bulbs and electric wires were sometimes used to boost fish catch. Fishers seem to be familiar with national fisheries regulations, however they hardly observed them. Traditional regulations like Tuesday fishing holidays were sometimes flouted especially when fishers experience bad catch in a season. We observed some of these flouts during community and landing site surveys.

III. Surveys at Landing Sites

A total of 99 individual stingrays were recorded during our opportunistic monitoring at fish landing sites. There was no fishing activity in the month of July as it was observed as a national fishing close season. Five species were recorded: Daisy Whipray (*Fontitrygon margarita*), Pearl Whipray (*F. margaritella*), Common Stingray (*Dasyatis pastinaca*), Marbled Stingray (*Dasyatis marmorata*) and Round Stingray (*Taeniura grabata*) (Table 1).

Table 1. Abundance of stingray species recorded during landing site monitoring in the study communities

Species	**Number of individuals by sex**		**Total**
	Male	**Female**	
Fontitrygon margaritella	19	18	37
Fontitrygon margarita	26	33	59
Taeniura grabata	0	1	1
Dasyatis marmorata	1	0	1
Dasyatis pastinaca	1	0	1
Total	**47**	**52**	**99**

Figure 4. Daisy stingray recorded at Akwidaa fishing community during landing site surveys

IV. Heavy Metals

Heavy metals analyzed were detected in all samples except for Arsenic and Mercury which were absent in the sea water sample. Heavy metals detected in all samples were far below the Maximum Allowable Limits (MAL) set by the Food and Agricultural Organisation (FAO) signaling no disadvantageous levels to marine life and humans (Bosch *et al.,* 2015).

Table 2. Results for Fish and Water (Brine) Quality Analysis

	PARAMETERS	SPEC A Mg/kg	SPEC C Mg/kg	SPEC S Mg/kg	SEA WATER Mg/l
1	Arsenic (As)	0.0128	0.0182	0.0134	ND
2	Cadmium (Cd)	0.0001	0.0001	0.0002	0.00002
3	Chromium (Cr)	0.0187	0.0199	0.0171	0.00018
4	Copper (Cu)	0.0098	0.0049	0.005	0.00001
5	Mercury (Hg)	0.0001	0.0008	0.0002	ND
6	Manganese (Mn)	0.0022	0.0023	0.0015	0.00002
7	Nickel (Ni) ppb	0.0009	0.0008	0.0006	0.00003
8	Lead (Pb) ppb	0.0001	0.0014	0.0018	0.00001
9	Zinc (Zn) ppb	0.0251	0.016	0.0167	0.00008

NOTE: ND= NOT DETECTED

SPEC A= Stingray sample from Akwidaa
SPEC C= Stingray sample from Cape Three Points
SPEC S = Stingray sample from Sekondi

THREATS TO STINGRAYS

Apart from unregulated harvesting of stingrays, we observed plastic waste pollution, open defecation and upsurge in Sargassum seaweed as threats to marine life in the study area. Waste management was a major issue in the study communities with few suitable toilets and no proper household waste disposal sites. The Sargassum seaweed was widespread on beaches and was also reported by fishermen to be a problematic weed impeding their fishing business. In addition, the deliberate flout of fishing regulations such as light fishing was reported by fishermen as widespread. It was also reported that the use of chemicals such as detergents for fishing was also common in the study area.

Stingray catch quantities were reported to have reduced drastically recently. Local people attributed this to excessive fishing pressure worsened by the use of chemicals (incl. dynamites and detergents), activities of industrial trawlers in the species habitat. They also blamed poor

enforcement of national fisheries laws and fallen local norms governing sustainable fishing practices.

CONSERVATION EDUCATION

We organized educational campaigns at community centers, fish landing sites and schools about the plight of stingrays, sustainable fishing practices and degradation of marine resources. We broadcast conservation messages in local dialect (Fante and Nzema) via community information centers in the mornings (4:00-6:00am and evenings (7pm) as these were the best times to get community folks back to their homes from their daily activities. We observed that community members were very keen about information center sessions as they came around to ask questions about our talks. We conducted one-on-one beach campaigns with our volunteers to educate fishermen and other landing site users including fish mongers, head potters, canoe watchmen etc. This face to face campaign offered the opportunity for fishers to ask questions and make suggestions for conservation of stingrays.

We visited four (4) community schools to educate school children and their teachers about stingrays. At schools we first tested the knowledge of pupils about stingrays after which we gave 20 minutes' talks on the biology and conservation needs of stingrays. We distributed 500 fact sheets to school children and their teachers. We distributed MBZ and stingray branded T-shirts (200) to fishers, teachers, school children and community members. In addition to engaging the general community populace, we visited the chiefs and his elders to educate them and fortify our conservation initiatives in their communities.

Figure 5. Project leader (left in project branded T-shirt) at a conservation education session with community members at Akwidaa community center

Figure 6. Project team members with community chief and his elders at Akwidaa: we went to educate them and seek their support to sustain our conservation actions in their communities.

CONCLUSION AND RECOMMENDATION

Our surveys within important fishing communities (especially Akwidaa and Cape Three Points) along the west coast of Ghana have provided essential information to make a fair account of the status of stingrays in Ghana. The harvesting of stingrays is substantial than we expected as thousands (approx. 3,000) of stingrays are harvested annually for food. The current levels of harvesting of stingrays threatens the survival of especially the Daisy and Pearl stingrays that were reported to be predominantly harvested by local people. These species are now targeted by both artisanal and industrial fishers than previously believed to be caught as by-catch. Although, we counted 59 and 37 Daisy and Pearl Whiprays respectively during a short period monitoring at landing sites, the actual catch for these species are likely higher (hundreds), given that these species were reported to dominate stingray catches and also, we may have missed a lot of canoes landing at different times of the day.

In fact, as human population continues to grow and existing economic hardship of households within coastal communities continue to worsen especially due to the impacts of the novel COVID-19 in Ghana, artisanal fishers are using obnoxious methods (incl. dynamites, chemicals etc) to boost fish catch to help their families survive. Therefore, we need to step up efforts for stingrays which are already threatened due to the lack of monitoring and conservation support. This project is an eye-opener and a stepping stone to scaling up conservation efforts for especially the Daisy and Pearl's stingrays in Ghana. Moving forward we recommend the following research and conservation actions:

a. There should be a conscious effort to expand and extend monitoring at landing sites to collect data on the actual volumes of species of stingray captures in a year. This can be achieved through citizen science networks and marine stewardship monitoring programs.
b. Introduce and sustain marine literacy programs among fishing communities through the development of conservation education and capacity building toolkits to target different people (school children, opinion leaders, fish vendors and processors, fishermen etc) in communities.
c. DNA surveys should be conducted across landing sites and markets to confirm the identify and volumes of the Daisy and Pearl Whiprays; and also confirm the occurrence of the Bluntnose and Roughtail stingrays that were reported to occur in the study area but were missed during landing site surveys. In fact, Bluntnose and Roughtail stingrays occur outside Ghana according to the IUCN Red List of Threatened species (e.g. see Carlson *et al*. 2020a & Carlson *et al*. 2020b).
d. Research is needed on fishing efforts, uses of stingrays and socio-economic profiles of fishermen who target stingrays.

ACKNOWLEDGEMENTS

We thank the Mohamed bin Zayed Species Conservation Fund (MBZ) for providing the financial support for this project. We also express our heartfelt gratitude to Professor John Blay (University of Cape Coast, Ghana) and Dr. Samuel Addo (University of Legon, Ghana) who assisted in the identification of species. We are grateful to Mr. Patrick Tawiah, Ms. Emmanuella Neizer, Mr. Jerry Assilidjoe, Mr. Egya Ndah Assilidjoe, Jonathan Badwin, Community Volunteers and Fisheries Commission staff who assisted in various ways to see the success of this project. We are grateful to leaders of fishermen, fishmongers and traders. We are very grateful to the chief and opinion leaders of Akwidaa and Cape Three Point communities. It is also worth mentioning that, this project support by MBZ has made it possible

to receive other funding (£2,000) from the British Ecological Society Outreach grant program to sustain conservation education campaigns in communities.

REFERENCES

AOAC (2006) Official Methods of Analysis. 18th Edition, Association of Official Analytical Chemists, Gaithersburgs, MD *also in* Journal of AOAC INTERNATIONAL, Volume 89, Issue 5, 1 September 2006, Pages 1229–1242, https://doi.org/10.1093/jaoac/89.5.1229.

Boohene R., Peprah J., 2011 Women, Livelihood and Oil and Gas Discovery in Ghana: An exploratory Study of Cape Three Points and Surrounding Communities. Journal of Sustainable Development, Volume 4. DOI:10.5539/JSD.V4N3P185 Corpus ID: 55143085.

Bosch, A.C., O'Neill, B., Sigge G.O., Kerwath S.E., Hoffman L.C. 2015 Heavy metals in marine fish meat and consumer health: a review. Society of Chemical Industry J Sci Food Agric 2016; 96: 32–48. (wileyonlinelibrary.com) DOI 10.1002/jsfa.7360.

Carlson, J., Charvet, P., Blanco-Parra, MP, Briones Bell-lloch, A., Cardenosa, D., Derrick, D., Espinoza, E., Herman, K., Morales-Saldaña, J.M., Naranjo-Elizondo, B., Pacoureau, N., Schneider, E.V.C. & Simpson, N.J. 2020. Hypanus say. The IUCN Red List of Threatened Species 2020: e.T60159A3090316. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T60159A3090316.en. Accessed on 19 June 2022.

Carlson, J., Charvet, P., Avalos, C., Briones Bell-lloch, A., Cardenosa, D., Espinoza, E., Herman, K., Morales-Saldaña, J.M., Naranjo-Elizondo, B., Pacoureau, N., Pilar Blasco, M., Pérez Jiménez, J.C., Schneider, E.V.C., Simpson, N.J. & Talwar, B.S. 2020. Bathytoshia centroura. The IUCN Red List of Threatened Species 2020: e.T104065040A3122808. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T104065040A3122808.en. Accessed on 19 June 2022.

Jabado, R.W., Badji, L., Chartrain, E., De Bruyne, G., Derrick, D., Dia, M., Diop, M., Doherty, P., Keith Diagne, L., Leurs, G.H.L., Metcalfe, K., Seidu, I., Soares, A.-L., Tamo, A., Vander Wright, W.J. & Williams, A.B. 2021. Fontitrygon margarita. The IUCN Red List of Threatened Species 2021: e.T161495A104172843. https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T161495A104172843.en