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Ecological impact on marine habitats 2020
The Palk Bay Blue Swimming Crab Fishery
A sub project of the Sri Lankan blue swimming crab fishery improvement project

Report
updated on 13th July 2020

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FISH WISE

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Executive Summary

In order to understand the impact of the BSC fishery in Palk Bay on marine habitats, data on fishing grounds and distribution of marine habitats were obtained. Field studies were conducted in 2017[1] and 2018[2] in the three districts that encompass Palk Bay (Jaffna, Kilinochchi, Mannar).

Distribution data on marine habitats were gathered using existing literature, global databases, and community mapping efforts. Fishing ground information was gathered using community mapping efforts. Seagrass beds showed the greatest distribution in Palk Bay at 88,524 ha initially and it was reduced to 81036.2 ha after updating the analysis. Mangroves and coral reefs distribution in Palk Bay showed at 6,732 ha and 7,235 ha respectively and limestone reefs at 16 ha.

The total extent of fishing grounds derived from community mapping efforts amounted to 40,444 ha. Around 12.72% of seagrass beds in Palk Bay overlap with fishing grounds according to the 2019 report. Both mangroves and coral reefs showed less than 1% of overlap with fishing grounds. Limestone reefs showed no overlap with fishing grounds at all.

This is an updated report of ecological impact on marine habitats in 2019. Based on the following sources seagrass bed distribution was updated and the overlap analysis was also updated.

- **Weragodathenna, D. D. D. and Gunarathne, A. B. A. K. 2015.** *Detection of Aquatic Habitats by Geo-Eye Satellite Images at the Palk Strait, Sri Lanka*. Asian Journal of Geoinformatics 15 (4):11-18.

- **Dahanayaka D. D. G. L. and Pahalawattaarachchi, V. 2017.** *Remote-Sensed mapping of seagrass distribution in Palk Bay, Sri Lanka, using high spatial resolution WorldView-2 satellite data.* Asian Conference on Remote Sensing – 2017, New Delhi, India. 557 p.

The overlap percentage for community based mapped fishing grounds and seagrass beds has decreased from 12.72% (10,962 ha) to 10% (7,958 ha).

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[1] Bandara W. J., 2017, 'Aspects of the blue swimming crab (*Portunus pelagicus*, Linnaeus 1758) fishery in the Palk Bay Jaffna Sri Lanka: overlap with critical marine habitats, fishing practices and selected catch characteristics', Undergraduate Thesis, University of Colombo, Colombo.

[2] Ecological impacts on marine habitats in the Palk Bay fishery. Sri Lanka blue swimming crab fishery improvement project. pelagikos pvt ltd 2018

A.   Distribution of marine habitats in Palk Bay

Palk Bay has a considerable amount of different marine habitats such as coral reefs, limestone reefs, seagrass beds, and mangroves. In order to determine the distribution of marine habitats in fishing grounds of Palk Bay we employed two methods, these being

1) Analysis of existing (secondary) global and local databases and literature on the distribution of key marine habitats (i.e. mangroves, seagrass and coral / rocky reefs) in the Palk Bay (PB).

2) Collection of primary data through community mapping exercises, where local knowledge was used to identify the distribution of key marine habitats distribution in the fishing grounds of blue swimming crab (BSC) fishermen in the Palk Bay (Jaffna, Kilinochchi and Mannar districts)

1) Analysis of existing global and local databases: Existing sources/databases that were used to extract distribution data of marine habitats are listed in the table below. These sources were compiled to create a base map of marine habitat distribution in the Palk Bay.

Table 1: Data sources for marine habitats

Habitat	Source	Data format	Link
Seagrass 2020	Weragodathenna, D.D.D. and Gunarathne, A.B.A.K. (2015). Detection of Aquatic Habitats by Geo-Eye Satellite Images at the Palk Strait, Sri Lanka. Asian Journal of Geoinformatics 15 (4):11-18.	Shapefile	
	Dahanayaka D.D.G.L. and V. Pahalawattaarachchi 2017. Remote-Sensed mapping of seagrass distribution in Palk Bay, Sri Lanka, using high spatial resolution WorldView-2 satellite data, Asian Conference on Remote Sensing – 2017, New Delhi, India. 557 p.	PDF/Print format	
Seagrass 2019	Global distribution of seagrass (Version 5.0) by United Nations Environmental Protection program	ArcGIS Shapefile	http://data.unep-wcmc.org/datasets/7
	Bay of Bengal Large Marine Ecosystem Project, 2015	PDF/Print format	
	Marine survey report by Central Environmental Authority (CEA, 1994)	Print format	
Coral Reefs	Global distribution of warm-water coral reefs (Version 2.0) by United Nations Environmental Protection program	ArcGIS Shapefile	http://data.unep-wcmc.org/datasets/1
	Marine survey report by Central Environmental Authority (CEA, 1994)	Print format	
Limestone Reefs	Global distribution of warm-water coral reefs (Version 2.0) by United Nations Environmental Protection program	ArcGIS Shapefile	
	Nishan Perera (Blue Resources Trust)	Personal communication	
Mangroves	Global distribution of Mangroves by United States Geological Survey (Version 1.3)	ArcGIS Shapefile	http://data.unep-wcmc.org/datasets/4

2) Collection of primary data through community mapping: Local knowledge of marine habitats in the fishing grounds of BSC fishermen was used to add information to that existing in local and global databases for key marine habitats in the Palk Bay. Primary data was collected using community mapping exercises with fishing communities in all the Fishery Inspector Divisions (FIDs) adjacent to the fishery in Jaffna (03), Kilinochchi (02) and Mannar (04) districts. Community mapping exercises were jointly involving several BSC fishing communities in each FID.

Table 2: Distribution of marine habitats in different areas

Habitat type	Area of distribution in different areas (ha)				
	Sri Lanka	**Palk Bay**	**Kilinochchi**	**Jaffna**	**Mannar**
Seagrass beds 2020	**342,832[3]**	81,036 (23.6%)	20,036 (5.8%)	47,191 (13.8%)	13,808 (4%)
Seagrass beds 2019	**342,832**	88,524 (25%)	32,236 (9.4%)	1,795 (0.5%)	53,645 (15%)
Coral reefs	11,704	7,235 (61%)	1,963 (16.7%)	3,948 (33.7%)	1,317 (11.2%)
Limestone reefs	6,076	16 (0.2%)	3 (0.05%)	0 (0%)	13 (0.15%)
Mangroves	21,426	6,732 (31%)	1,507 (7%)	3,644 (17%)	1,587 (7%)

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[3] *Sri Lanka whole seagrass bed distribution is taken from the different sources and does not contain updated Palk Bay distribution.*
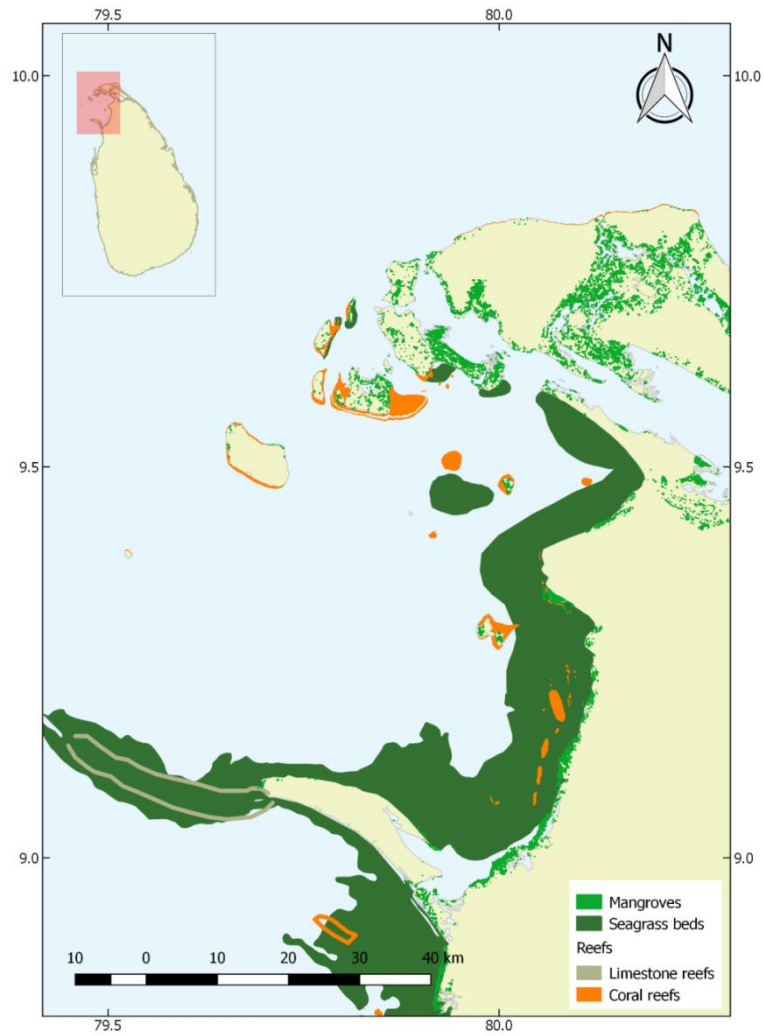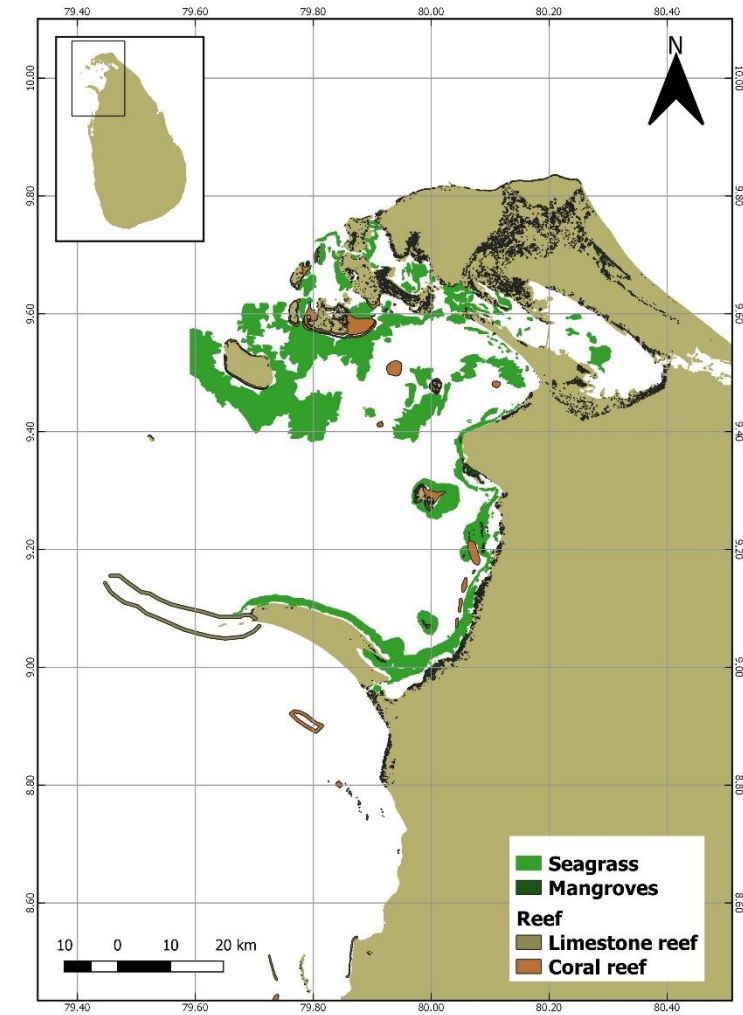
Figure 1: Distribution of marine habitats in Palk Bay

Figure 2: Updated distribution of marine habitats in the Palk Bay

B. Marine protected areas in Palk Bay

There are 2 protected areas located in the Palk Bay which can be classified as marine protected areas (MPAs). These are

1. Adam's Bridge National Park
2. Vidatthalthivu Nature Reserve

Table 3: Protected areas in Palk Bay

Protected Area	Type	Total designated area (ha)	Area that overlaps with Palk Bay (ha)
Vidaththaltivu Nature Reserve	Nature Reserve	28,923	25,914 (90%)
Adams Bridge National Park	National Park	19,024	1,205 (6.4%)

Regarding the level of protection granted for these protected areas, National Parks have been granted the highest level of protection. Traditional human activities such as fishing and agriculture cannot be carried out inside a national park and the general public cannot enter their boundaries without a permit issued by the Department of Wildlife Conservation.

Nature Reserves are areas conserved for their biodiversity importance but there are no restrictions regarding the continuation of traditional human activities such as fishing and agriculture.

Figure 3: MPAs in Palk Bay
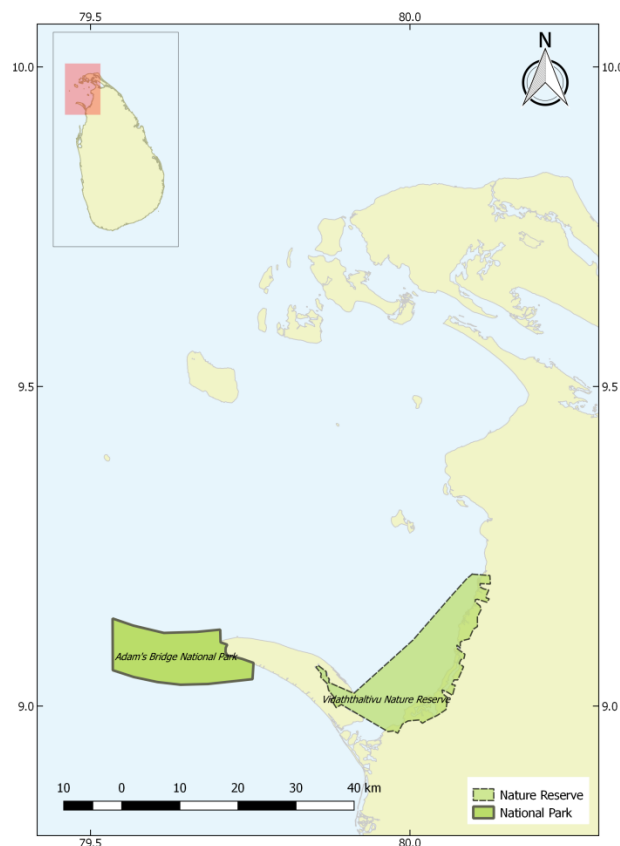
C. Fishing grounds of the Palk Bay BSC fishery

Methodology

Community mapping was used to determine the fishing grounds of BSC fishermen in Palk Bay. The collection of community-based maps of fishing grounds commenced at the beginning of March 2018 (during the 2018 stock assessment). Field data collection of BSC fishing grounds for all BSC landing sites in Mannar District (North) was completed in early April in 2018. Field data collection of BSC fishing grounds for all BSC landing sites in Kilinochchi District was completed in late April in 2018. Community-based mapping data for Jaffna District was completed during the fishery management meetings convened in each FID in May 2018.

Results

BSC fishing communities operating from landing centres along the southern coast line of Jaffna, Kilinochchi and Mannar districts identified thirty-two (32) fishing grounds in the Palk Bay, as shown in Table 4 below and Figure 4 overleaf. The data from the community-based mapping of BSC fishing grounds Kilinochchi and Mannar districts suggests that the full extent of fishing grounds is more than 40,444 ha.

Table 4: Areas of community based fishing grounds

District	Fishing Ground	Community	Area (ha)
Jaffna	Jaffna Fishing Ground #1	Melinchimunai	449
	Jaffna Fishing Ground #2	Chettipulam	1353
	Jaffna Fishing Ground #3	Melinchimunai	216
	Jaffna Fishing Ground #4	Delft	900
	Jaffna Fishing Ground #5	Delft	2362
	Jaffna Fishing Ground #6	Melinchimunai	4281
	Jaffna Fishing Ground #7	Melinchimunai	1003
	Jaffna Fishing Ground #8	Analativu	1723
	Jaffna Fishing Ground #9	Analativu	631
	Jaffna Fishing Ground #10	Nainativu	110
	Jaffna Fishing Ground #11	Nainativu	1748
	Jaffna Fishing Ground #12	Chettipulam	105
	Jaffna Fishing Ground #13	Delft	106
	Jaffna Fishing Ground #14	Thuraiyoor & Chettipulam	109
	Jaffna Fishing Ground #15	Thuraiyoor	3253
	Jaffna Fishing Ground #16	Mandaitivu	478
	Jaffna Fishing Ground #17	Mandaitivu	1256

District	Fishing Ground	Community	Area (ha)
Kilinochchi	Kilinochchi Fishing Ground #1	Palakudawa	1314
	Kilinochchi Fishing Ground #2	Palakudawa	99
	Kilinochchi Fishing Ground #3	Valaipaddu	153
	Kilinochchi Fishing Ground #4	Valaipaddu	261
	Kilinochchi Fishing Ground #5	Valaipaddu	1420
	Kilinochchi Fishing Ground #6	Irainamathangar	1441

Mannar	Mannar North Fishing Ground #1	Thevanpiddy	2776
	Mannar North Fishing Ground #2	Anthoniyapuram	2385
	Mannar North Fishing Ground #3	Illupaikadawaia	2757
	Mannar North Fishing Ground #4	Illupaikadawaia	982
	Mannar North Fishing Ground #5	Vidaththalthivu	617
	Mannar North Fishing Ground #6	Vidaththalthivu	2650
	Mannar North Fishing Ground #7	Palakamunia	612
	Mannar North Fishing Ground #8	Erukulampiddy	1255
	Mannar North Fishing Ground #9	Pesalai	1639

Figure 4: Community based fishing grounds
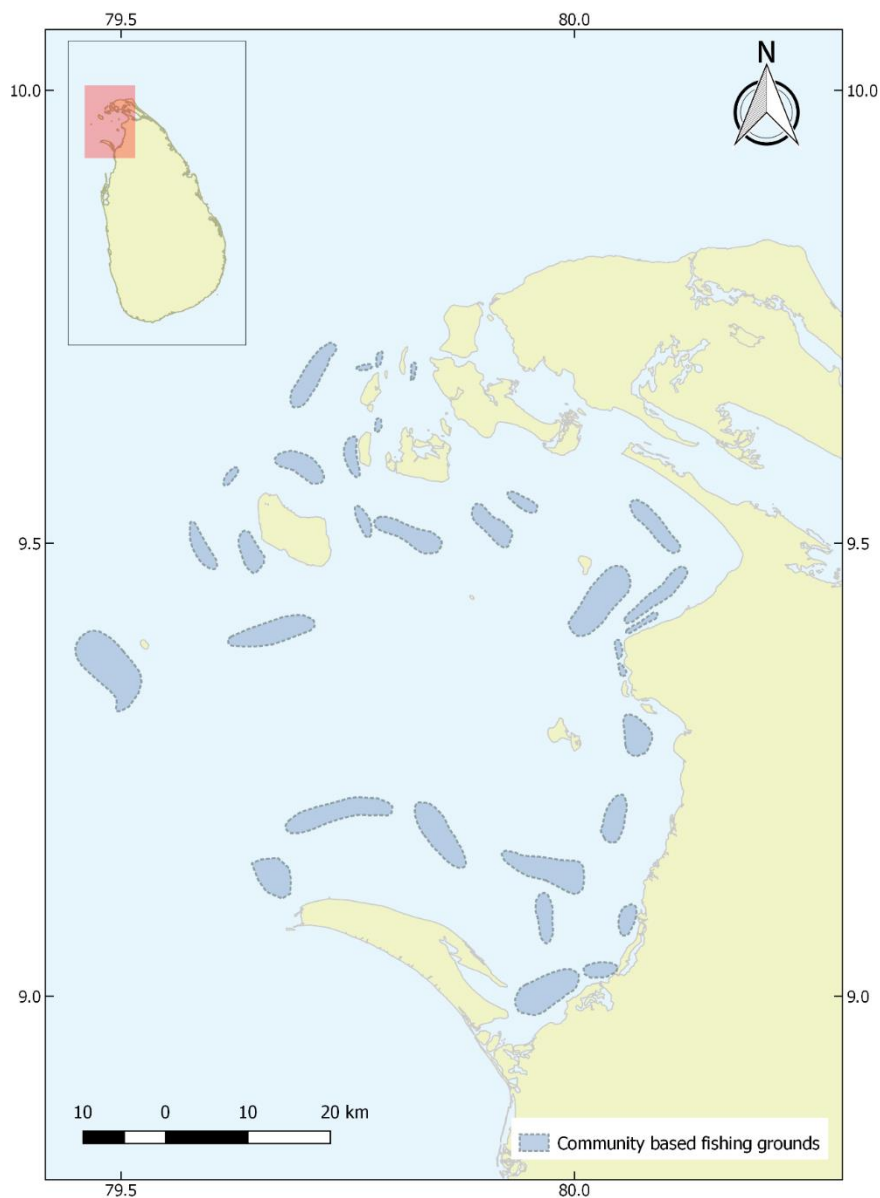
D.   Overlap between fishing grounds and marine habitats

Methodology
The identified fishing grounds from the community-based mapping data were then overlapped with marine habitats using the Shapely library for the Python programming language. The potential overlaps of fishing grounds with each key marine habitat was calculated automatically by the programme for the Palk Bay fishery as well by district for the spatial data described above. In the updated analysis the identified fishing grounds derived from community-based mapping were intersected with the seagrass bed distribution layer using Q – GIS 3.4 and the potential overlap was calculated using field calculator tool in Q-GIS 3.4 for the Palk bay and also by district.

Results
The results of the potential overlap of BSC fishing grounds estimated from community-based surveys in the Palk Bay are presented by marine habitat below.

Mangroves: The community-based fishing ground survey data suggests a very small potential interaction, of under two hectares (1.23 ha) (see Table 5). The overlap happens with a small patch of mangroves in the Mannar district with one fishing ground. This potential interaction represents 0.02% of mangroves found in the Palk Bay and 0.01% of mangrove coverage in Sri Lanka.

Table 5: Overlap of BSC fishing grounds with mangroves in the Palk Bay

	Mangroves		
	ha	**Palk Bay**	**National**
Palk Bay	*1.23*	*0.02%*	*0.01%*
Jaffna District	0.0		
Kilinochchi District	0.0		
Mannar District	1.23	0.02%	0.01%

Seagrass:
2019 - The community-based data suggests that the BSC fishing crab fishery may interact with as much as 10,962 hectares of seagrass in the Palk Bay fishery (see Table 6). This is equivalent to 12.72% of seagrass coverage at the fishery level and 3.21% at the national level.

2020 (Updated) - Fishing ground information derived from the community – based mapping showed that BSc fishery may interact with 7,958 ha of seagrass in the Palk Bay which is a less area than previous (see Table6). This is equivalent to 10% of seagrass coverage at the fishery level and 2.32% at the national level.

Table 6: Overlap of BSC fishing grounds with seagrass in the Palk Bay

	Seagrass 2019			**Seagrass 2020**		
	ha	**Palk Bay**	**National**	**ha**	**Palk Bay**	**National[4]**
Palk Bay	*10,962*	*12.72%*	*3.21%*	*7,958*	10%	2.32%
Jaffna District	1,135	1.28%	0.33%	3,712	5%	1.08%
Kilinochchi District	3,449	**4%**	**1%**	946	1%	0.28%
Mannar District	6,378	**7.44%**	**1.88%**	3,300	4%	0.96%

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[4] Sri Lanka whole seagrass bed distribution is taken from the different sources and does not contain updated Palk Bay distribution.

Coral Reefs: The community based fishing grounds overlapped with a total of 68.8 ha (see Table 7) of coral reefs. This accounted for 0.94% of coral reef coverage in Palk Bay and 0.57% nationally.

Table 7: Overlap of BSC fishing grounds with coral reefs in the Palk Bay

	Coral Reefs		
	ha	Palk Bay	National
Palk Bay	**68.84**	**0.94%**	**0.57%**
Jaffna District	60	0.82%	0.52%
Kilinochchi District	8.77	0.11%	0.04%
Mannar District	0.07	0.01%	0.01%

Limestone Reefs: Community-based fishing grounds didn't show any overlap with limestone reefs in Palk Bay (Table 8). The major reason for this is the relative rarity of limestone reefs in the Palk Bay.

Table 8: Overlap of BSC fishing grounds with limestone reefs in the Palk Bay

	Limestone Reefs		
	Ha	Palk Bay	National
Palk Bay	*0*	-	-
Jaffna District	0	-	-
Kilinochchi District	0	-	-
Mannar District	0	-	-

Figure 5: Overlap between marine habitats and fishing grounds (2019)

Legend:
- Community based fishing grounds
- Seagrass beds
- Mangroves
- Limestone reefs
- Coral reefs
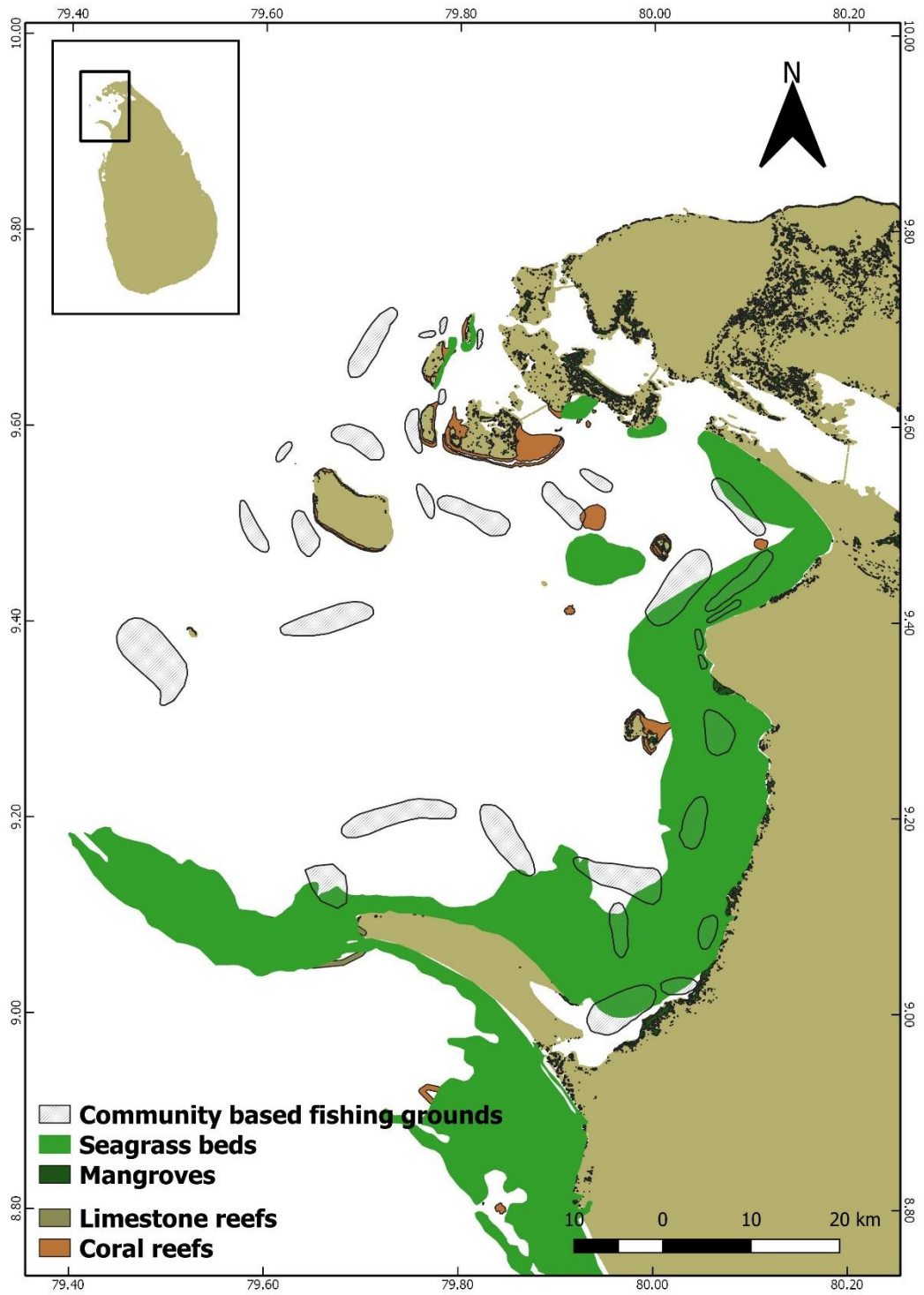
Figure 6: Overlap between marine habitats and fishing grounds (Updated)

Legend:
- Community based fishing grounds
- Seagrass
- Mangroves
- Reef
  - Limestone reef
  - Coral reef
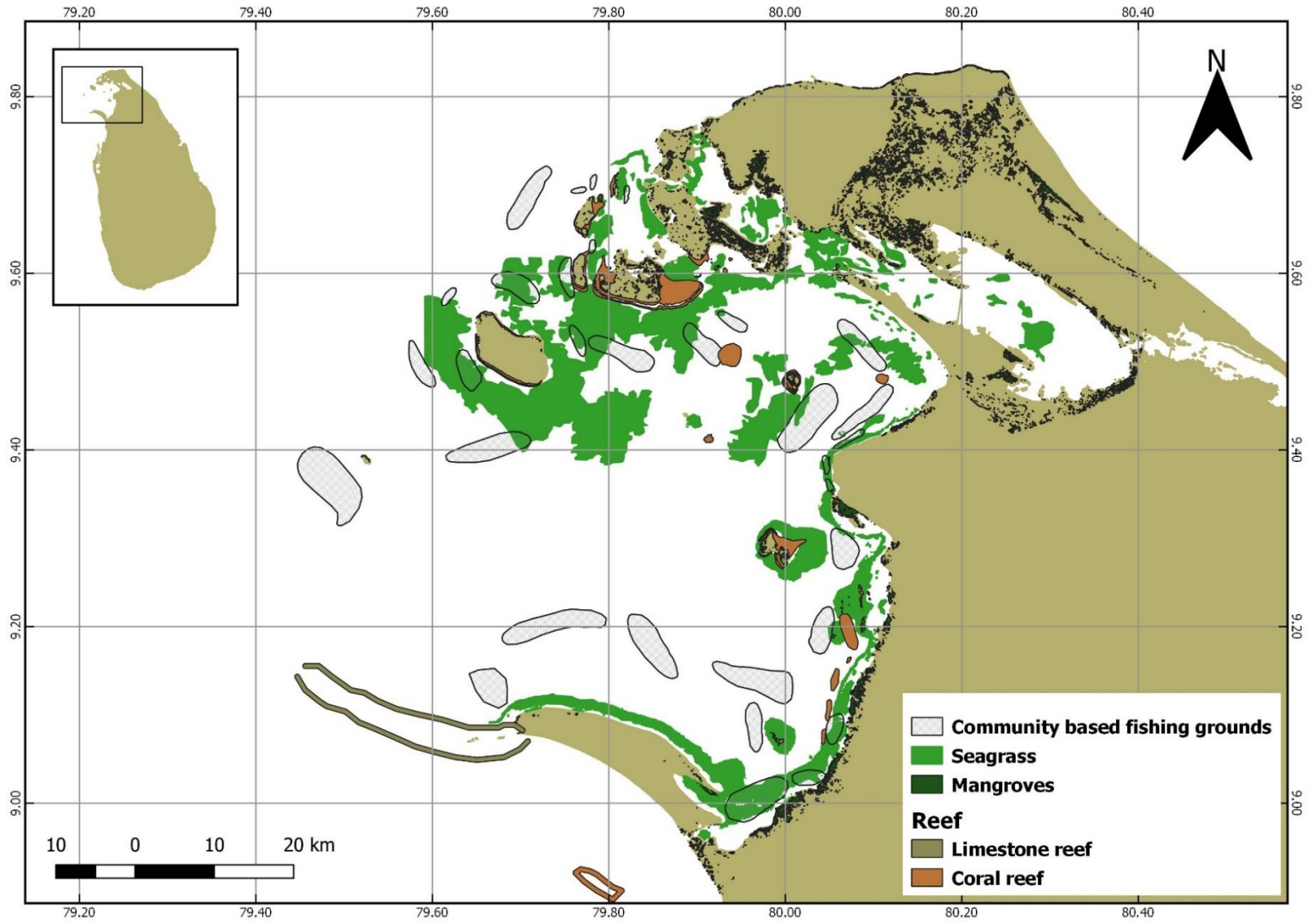
## E.   Overlap between fishing grounds and MPAs

Marine Protected Areas: Marine Protected Areas (MPA) in Palk Bay include the newly declared Vidaththalthivu Nature Reserve and the Adam's Bridge National Park. Nature reserves are distinguished from Strict Nature Reserves and National Parks by the fact that they do allow traditional human activities such as farming, fishing and foraging to continue. Community based mapping of BSC fishing grounds indicated some interactions with marine protected areas (MPAs) in Palk Bay.

The data suggested an overlap of 183 ha (23.49% of the MPA's total area) between fishing grounds and the Adam's Bridge National Park. This can be explained by the significant number of fishing communities present near the North Western end of the Mannar peninsular. It would be advisable to inform fishermen on the presence of the National Park and to avoid fishing within its boundaries as much as possible.

Table 9: Overlap of Community based fishing grounds with Protected Areas

	Vidaththalthivu Nature Reserve			Adam's Bridge National Park	
	ha	%		ha	%
Palk Bay	3,693	14.55%	-	183	23.49%
Jaffna District	0	0%	-	0	0%
Kilinochchi District	0	0%	-	0	0%
Mannar District	3,693	14.55%	-	183	23.49%

Figure 7: Overlap between fishing grounds and MPAs

Community based fishing grounds
Vidaththaltivu nature reserve
Adam's bridge national park
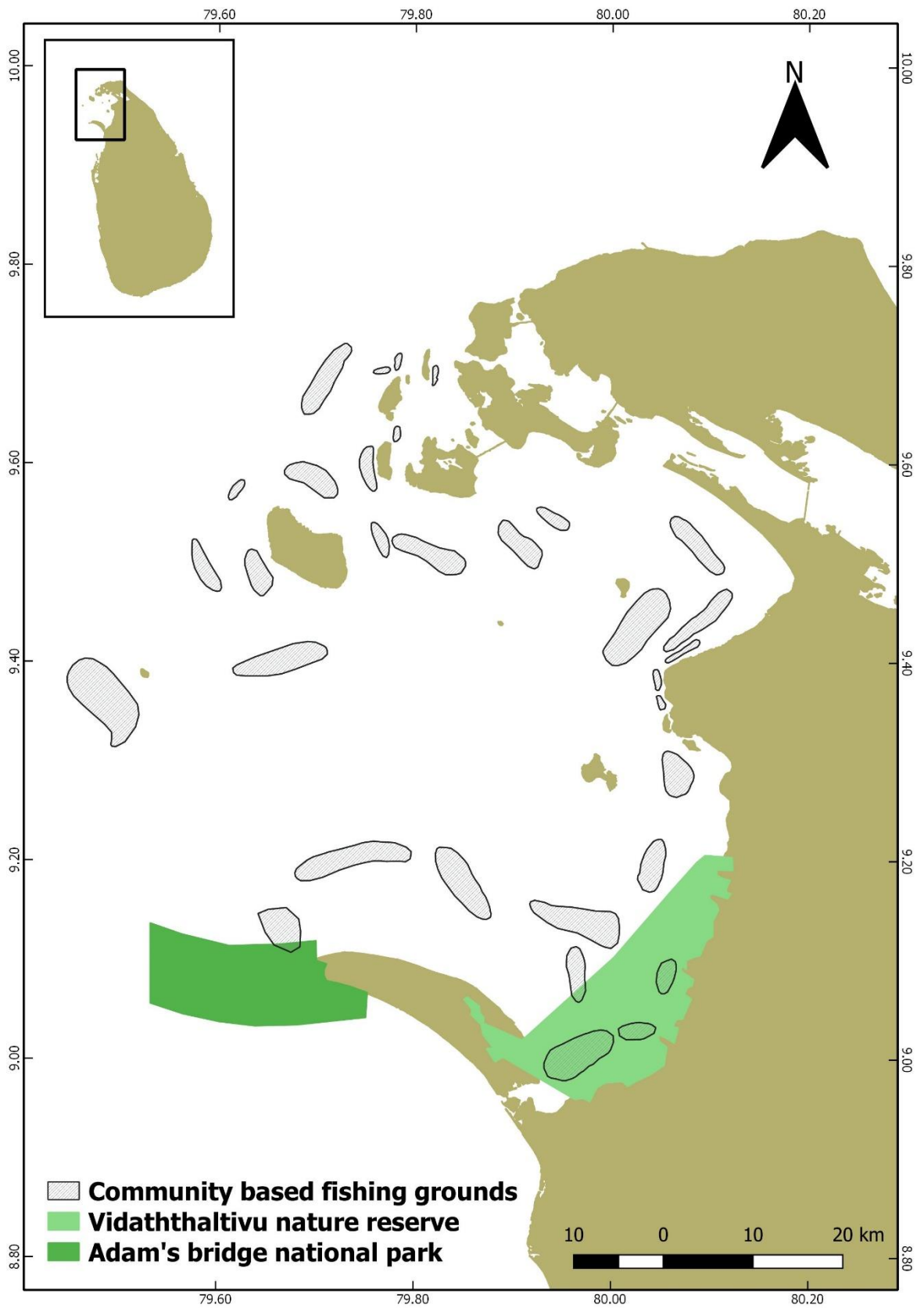
Conclusion

The observations made on the blue swimming crab fishery in 2019 suggested a low level of potential overlap with the marine habitats of the area for coral reefs (0.94% / 68.84 ha) and mangroves (0.2% / 1.2 ha) in the Palk Bay. The highest level of potential overlap in the Palk Bay was shown between fishing grounds and seagrass beds of 12.72% (10,962 ha) for data gathered using community-based field surveys. In the updated analysis for seagrass beds using new secondary sources of GIS data the highest level of interaction between the fishery and marine habitats is still with seagrass beds, but the overall interaction has decreased to 10% (7,958 ha) for fishing grounds derived from community-based mapping.

The marine protected areas within Palk Bay include the Adam's Bridge National Park and Vidaththalthivu Nature Reserve. The community mapped data suggested an overlap between BSC fishing grounds in Mannar with the Adam's Bridge National Park (23.49% / 183 ha) and the Vidaththalthivu Nature Reserve (14.55% / 3,693 ha).

The updated ecological impact assessment of the impact of BSC fishing on marine habitats using community based spatial data for fishing grounds indicates that there is low level of interaction between BSC fisheries and marine habitats. This is consistent with fishermen's claims that they do not deliberately set their nets on coral / rocky reefs or in seagrass beds, as coral reefs destroy their nets and are not habitats for blue swimming crabs and seagrass beds entangle in their nets and reduce the catching efficiency.

Colombo
17th July 2020