



Ecological Impact on marine habitats 2019

The Palk Bay Blue Swimming Crab Fishery

A sub project of the Sri Lankan blue swimming crab fishery improvement project

Field Report

updated on 27th February 2019



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on behalf of
Seafood Exporters' Association of Sri Lanka

co-financed by
National Fisheries Institute Crab Council
Santa Monica Seafood LLC
FishWise RSVP

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Executive Summary

In order to understand the impact of the BSC fishery in Palk Bay on marine habitats, data on both fishing grounds and distribution of marine habitats were obtained. These studies were conducted throughout 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 GPS data of fishing points and community mapping efforts. Seagrass beds showed the greatest distribution in Palk Bay at 88,524 ha, followed by mangroves at 6,732 ha, then coral reefs at 7,235 ha, and limestone reefs at 16 ha.

The total extent of fishing grounds derived from GPS data amounted to ~10,000 ha. Those derived from community mapping efforts amounted to ~203,000 ha. Both community based fishing grounds and GPS based fishing grounds showed the largest overlap with seagrass beds. Around 12.72% of seagrass beds in Palk Bay overlap with fishing grounds. Both mangroves and coral reefs showed less than 1% of overlap with fishing grounds. Limestone reefs showed no overlap with fishing grounds at all.

Based on these results the BSC fishery in Palk Bay satisfies requirements set out by Seafood Watch California for sustainable fisheries recommendation. As of now, a score of 3.5 can be assigned to this fishery based on two factors: use of bottom-set gillnets and more than 50% of marine habitats being protected from coming into contact with fishing gear.

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

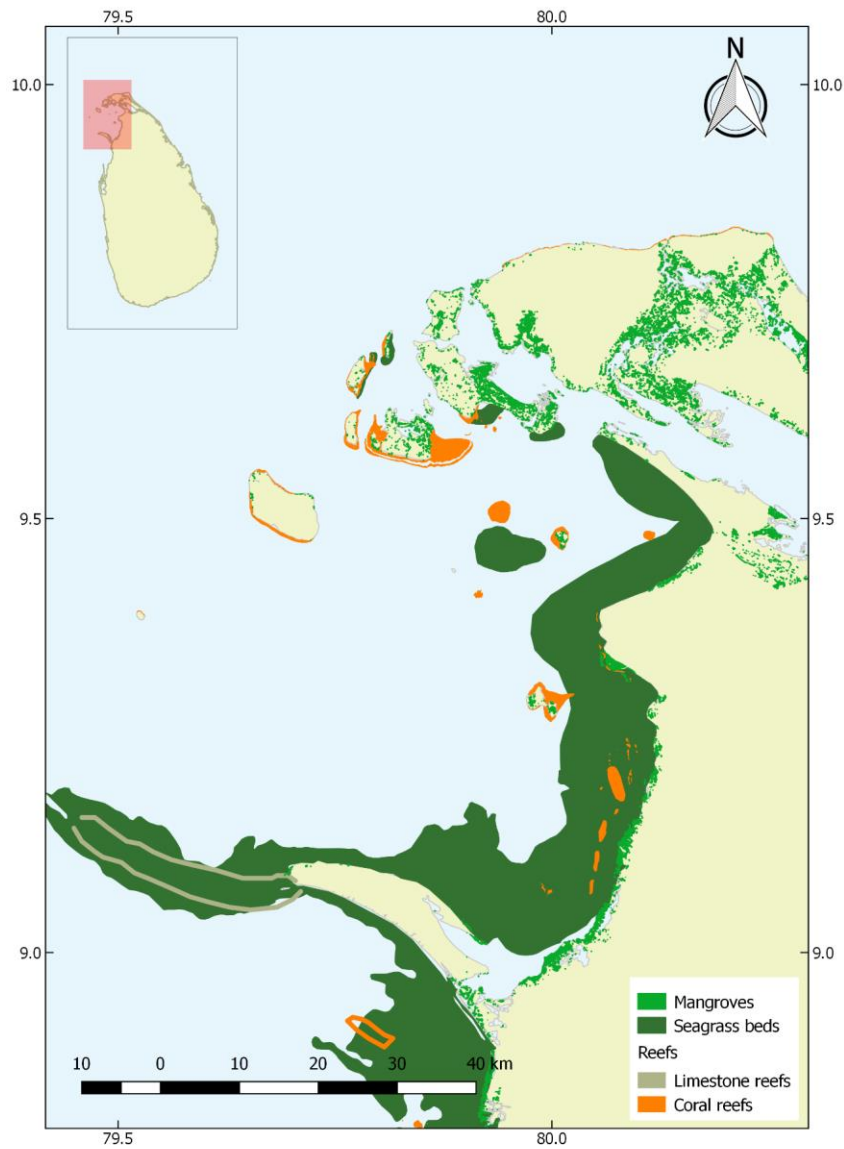
Habitat	Source	Data format	Link
Seagrass	Global distribution of seagrass (Version 5.0) by United Nations Environmental Protection program	ArcGIS Shapefile	http://data.unep-wcmc.org/datasets/7
	Bay of Bengal Large Marine Ecosystem Project, 2015	PDF/Print format	
	Marine survey report by Central Environmental 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	342,751	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%)

Figure 1: Distribution of marine habitats in 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

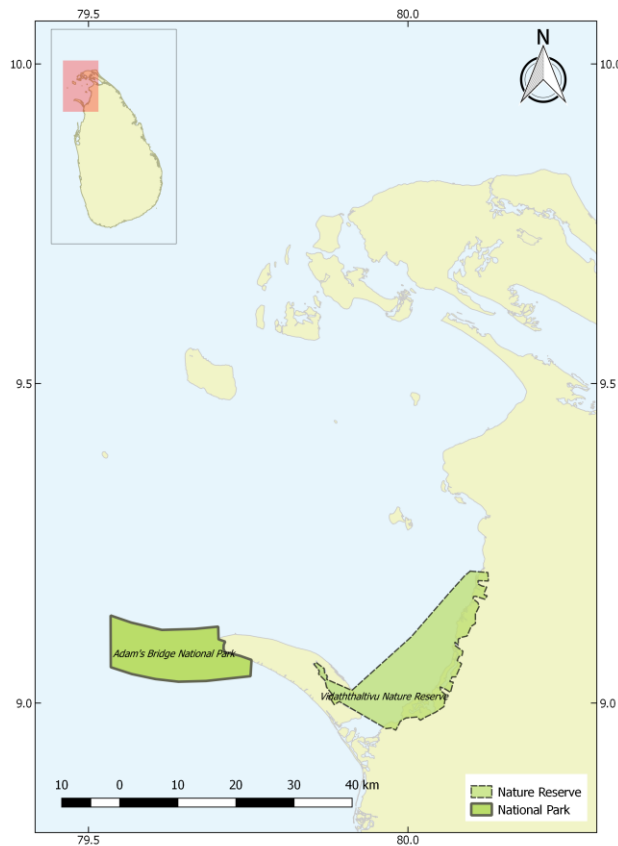
Table 3: Protected areas in Palk Bay

Protected Area	Type	Total designated area (ha)	Area that overlaps with Palk Bay (ha)
Vidatthalthivu 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 2: MPAs in Palk Bay



C. Fishing grounds of the Palk Bay BSC fishery

Methodology

Two methodologies were used to determine the fishing grounds of BSC fishermen in Palk Bay.

- 1) Global Positioning System (GPS) generated by smartphones loaded with tracking app
- 2) Community mapping of fishing grounds.

1) Global Positioning System (GPS): Smartphones loaded with GPS tracking application were given to **eight** fishing communities in the Palk Bay fishery. Four BSC fishing communities have used the app to track their fishing activities in Jaffna District (*i.e.* Melinchimunai, Mandaitivu, Thuraiyoor, Chettipulam); three BSC fishing community has used the app to track their fishing activities in Kilinochchi District (Vallaipaddu, Palakudaw and Irainamathanagar), however only one village (Vallaipaddu) generated sufficient data to demarcate the boundaries of the village fishing ground. One village in Mannar District (Illupaikadavai), have used the GPS tracking app to date. Details of the location of the fishing village is shown in Figure 7 below.

2) Community mapping of fishing grounds: In response to technical issues related to digital coverage in some coastal areas; access to the server at the University of Colombo's School of Computing and insufficient funds to purchase more phones to put into the fishery, the collection of community-based maps of fishing grounds commenced at the beginning of March 2018 (during the stock assessment). Field data collection of BSC fishing grounds for all BSC landing sites in Mannar District (North) was completed in early April. Field data collection of BSC fishing grounds for all BSC landing sites in Kilinochchi District was completed in late April. Community-based mapping data for Jaffna District will be completed during the fishery management meetings convened in each FID in May 2018. The community-based fishing grounds mapping data adds another layer of spatial information about BSC fishing activities in Palk Bay. This data has been used to provide further insight into the level of interaction between BSC fishing and marine habitats in the fishery.

Results

1) GPS based fishing grounds

Table 4: Areas of GPS derived fishing grounds

District	Fishing Grounds	Community	Area (ha)	%
Jaffna	Fishing ground #1	Mandativu	1,033.5	9%
	Fishing ground #2	Mandativu	123.0	1%
	Fishing ground #3	Chettipulam and Thuraiyoor	1,957.2	18%
	Fishing ground #4	Thuraiyoor	138.4	1%
	Fishing ground #5	Melenchimunai	23.2	0%
Kilinochchi	Fishing ground #1	Palakudawa		0%
	Fishing ground #2	Valaipaddu	5,010.5	46%
	Fishing ground #3	Irainamathanagar	2,663.0	24%
Mannar	Fishing ground #1	Ilupakaddavai	--	0%
Fishery	Total		10,947.7	

The total area of fishing grounds surveyed using GPS amounted to 10,947.7 ha. Out of the seven fishing grounds identified and mapped using GPS, the Valaipaddu fishermen in Kilinochchi District fish in the largest area.

2) Community Based Fishing Grounds: 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 11 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 203,606 ha.

Table 5: 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
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	Thevanpidy	2776
	Mannar North Fishing Ground #2	Anthonyapuram	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 3: GPS based fishing grounds

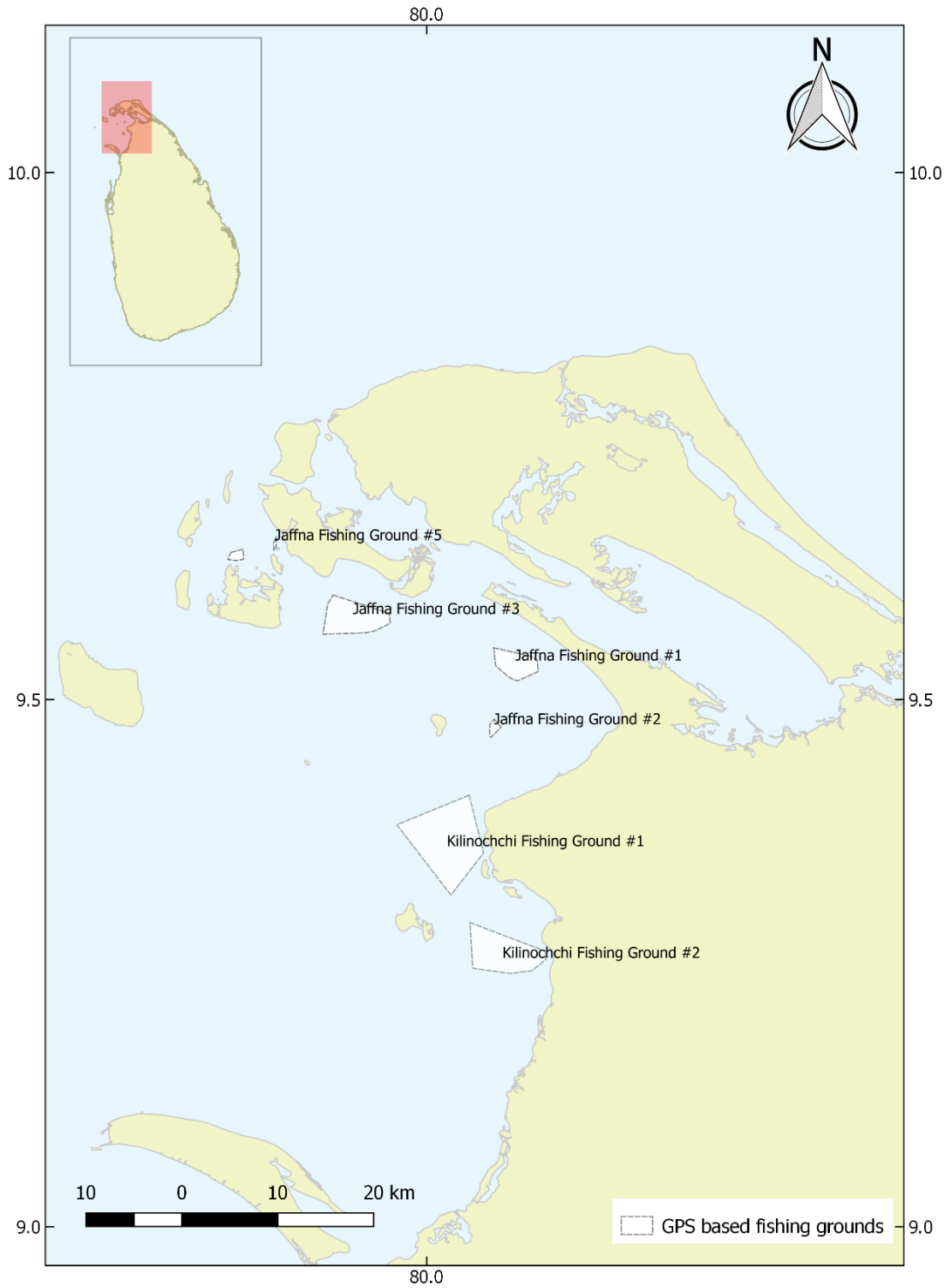
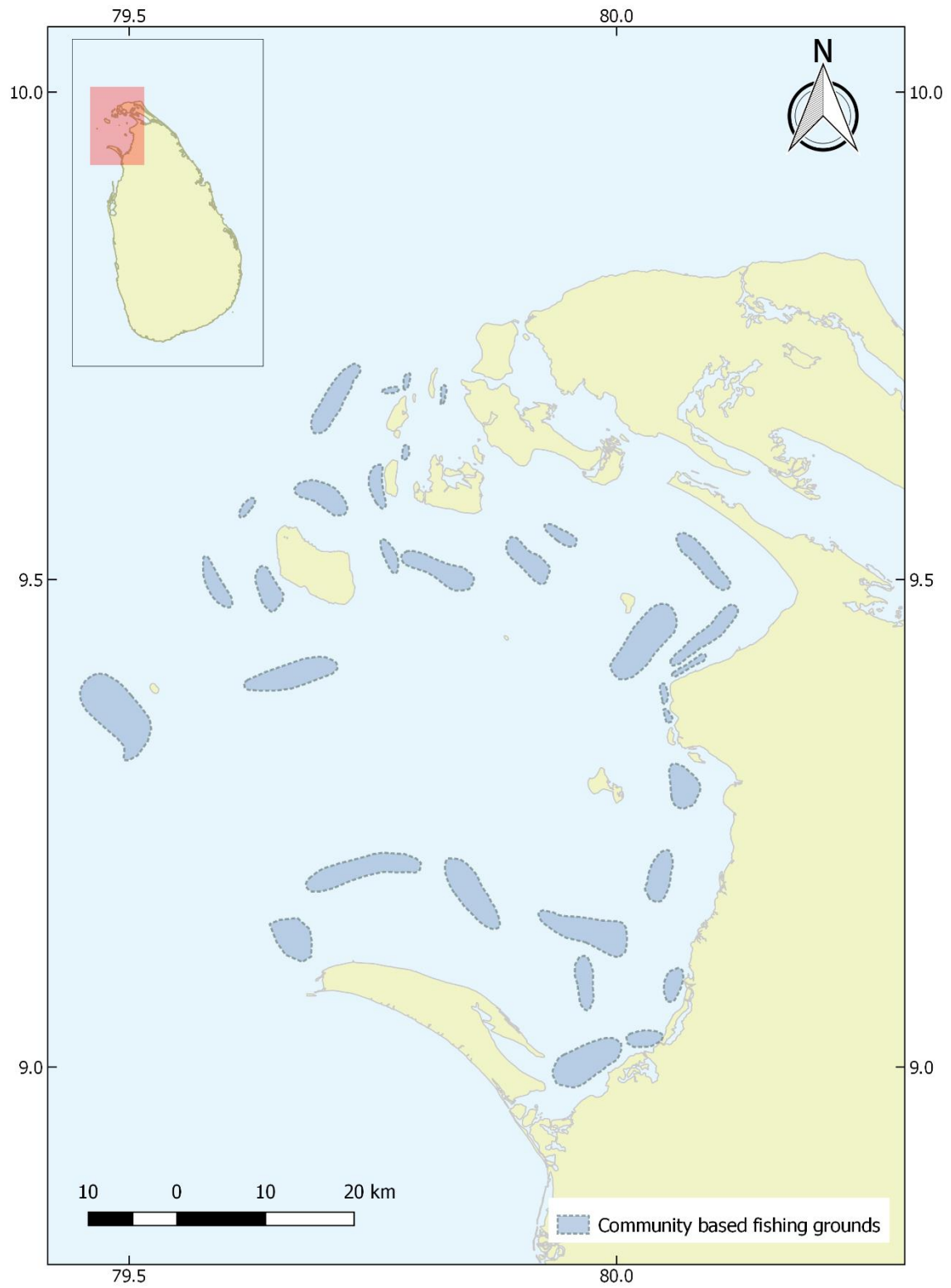


Figure 4: Community based fishing grounds



D. Overlap between fishing grounds and marine habitats

Methodology

The identified fishing grounds from the GPS data and 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 two types of spatial data (i.e. GPS and community-based) described above.

Results

The results of the potential overlap of BSC fishing grounds estimated by using GPS tracking of fishing boat activities and from community-based surveys in the Palk Bay are presented by marine habitat below.

Mangroves: The GPS data locating fishing grounds in the Palk Bay collected to date indicates that there is no potential for interaction between BSC fishing and mangroves in the Palk Bay (see Table 5). 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 6: Overlap of BSC fishing grounds with mangroves in the Palk Bay

	GPS Data			Community-based Data		
	ha	Palk Bay	National	ha	Palk Bay	National
Palk Bay	0.0	-	-	1.23	0.02%	0.01%
<i>Jaffna District</i>	0.0	-	-	0.0		
<i>Kilinochchi District</i>	0.0	-	-	0.0		
<i>Mannar District</i>	<i>Data by July</i>	-	-	1.23	0.02%	0.01%

Seagrass: The GPS tracking data suggests that the BSC fishing crab fishery may interact with as much as 8,462 hectares of mangroves in the Palk Bay fishery (see Table 6). This represents 9.56% of seagrass found in the Palk Bay (see Table 1) and 2.47% of seagrass found in Sri Lanka (342,751 see Table 1). 90% of this potential interaction is a result of BSC fishing activities tracking in Kilinochchi District (7,645 ha).

The community-based mapping data collected from Kilinochchi and Mannar districts suggest the overlap to be a little higher than the data collected to date by the GPS survey, yet consistent with the GPS findings. The community-based data suggests that the BSC fishing crab fishery may interact with as much as 9,998 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.

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

	GPS Data			Community-based Data		
	ha	Palk Bay	National	ha	Palk Bay	National
Palk Bay	8,462	9.56%	2.47%	9,998	12.72%	3.21%
<i>Jaffna District</i>	816	0.92%	0.24%	1135	1.28%	0.33%
<i>Kilinochchi District</i>	7,645	8.64%	2.23%	3449	4%	1%
<i>Mannar District</i>	<i>Data by July</i>	-	-	6378	7.44%	1.88%

Coral Reefs: The GPS tracking data suggests that the BSC fishery may interact with as little as 44 hectares of coral reefs in the Palk Bay (see Table 7). This represents less than 1% of coral reefs found in the Palk Bay (see Table 1) and less than 0.5% of coral reefs found in Sri Lanka (17,780 see Table 1). The preliminary results of the community-based mapping data collected from Kilinochchi and Mannar district are considerably higher than the GPS generated data (see Table 7).

The community based fishing grounds overlapped with a total of 68.8 ha of coral reefs. This accounted for 0.94% of coral reef coverage in Palk Bay and 0.57% nationally.

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

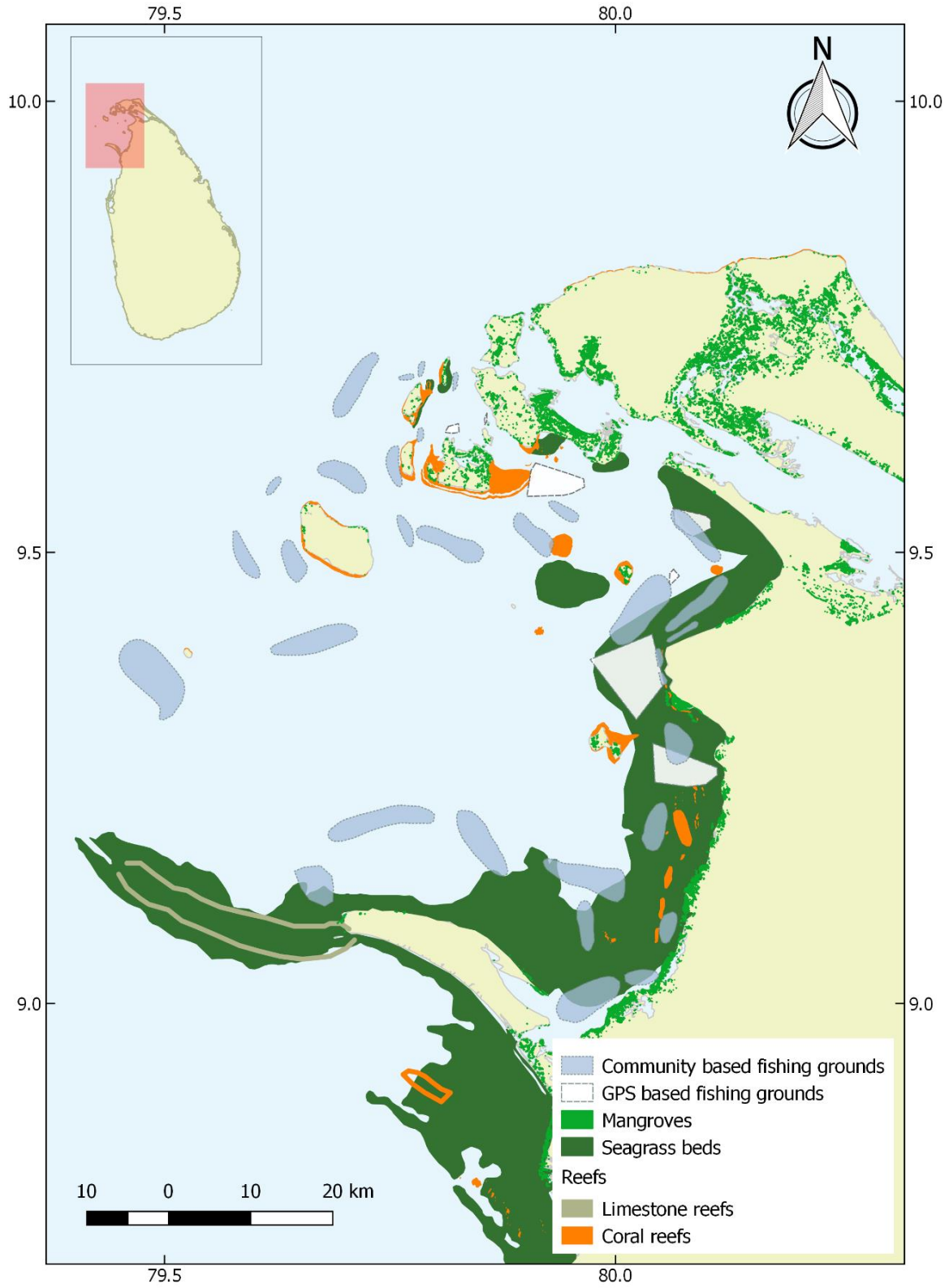
	GPS Data			Community-based Data		
	ha	Palk Bay	National	ha	Palk Bay	National
Palk Bay	44	0.61%	0.25%	68.84	0.94%	0.57%
<i>Jaffna District</i>	32	0.44%	0.18%	60	0.82%	0.52%
<i>Kilinochchi District</i>	12	0.17%	0.07%	8.77	0.11%	0.04%
<i>Mannar District</i>	<i>Data by July</i>	-	-	0.07	0.01%	0.01%

Limestone Reefs: Both community based fishing grounds and GPS tracked fishing grounds didn't show any overlap with limestone reefs in Palk Bay. The major reason for this is the relative rarity of limestone reefs in the Palk Bay ecosystem compared with Gulf of Mannar.

Table 9: Overlap of BSC fishing grounds with limestone reefs in the Palk Bay

	GPS Data			Community-based Data		
	ha	Palk Bay	National	Ha	Palk Bay	National
Palk Bay	0	-	-	0	-	-
<i>Jaffna District</i>	0	-	-	0	-	-
<i>Kilinochchi District</i>	0	-	-	0	-	-
<i>Mannar District</i>	<i>Data by July</i>	-	-	0	-	-

Figure 5: Overlap between marine habitats and fishing grounds



E. Overlap between fishing grounds and MPAs

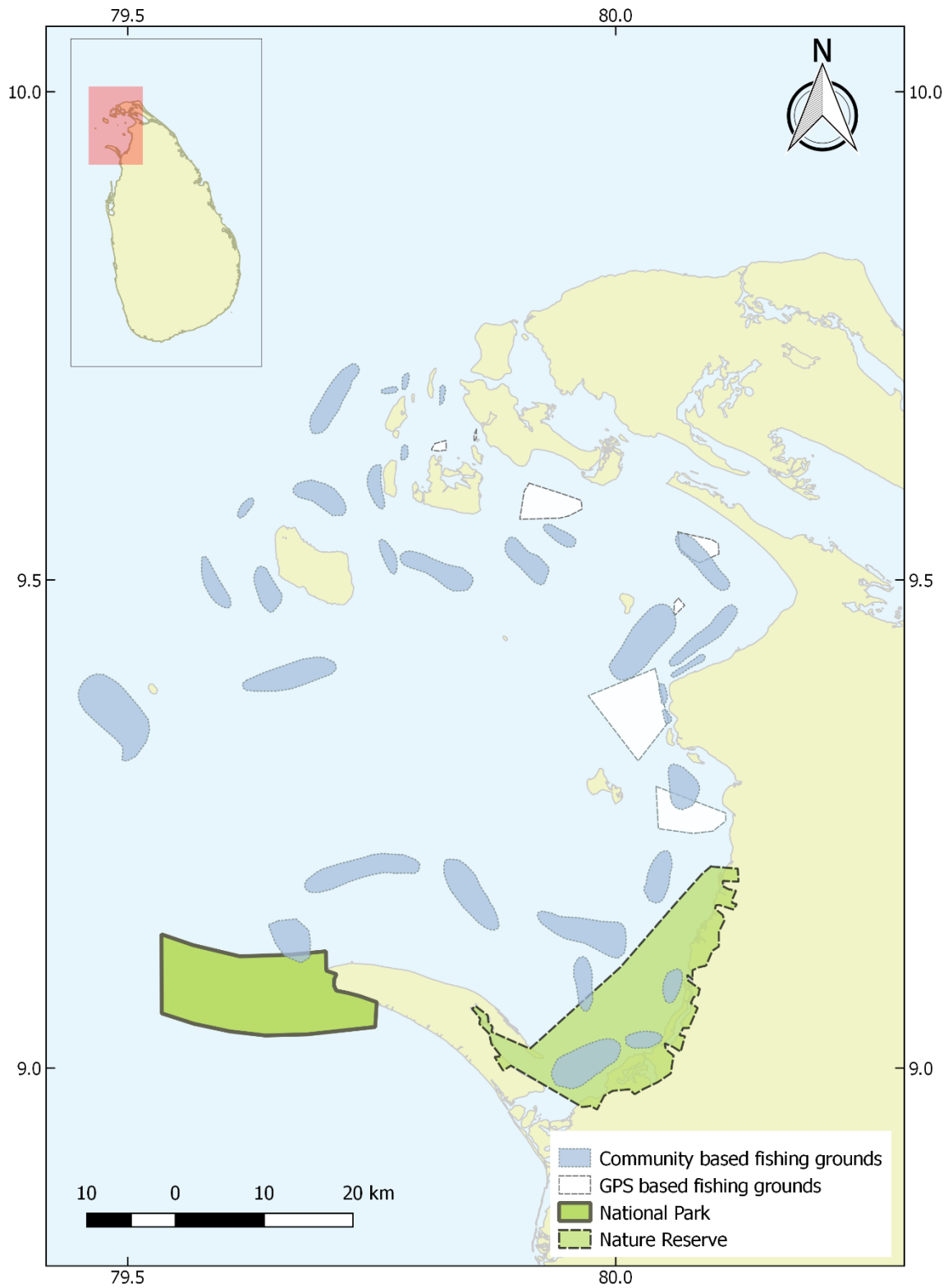
Marine Protected Areas: The GPS tracking data suggests that the BSC fishery does not interact with marine protected areas (MPAs) in Palk Bay. Marine Protected Areas in Palk Bay include the newly declared Vidattalthivu Nature Reserve and the Adam’s Bridge National Park. Nature reserves are distinguished 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.

However we detected some overlap of community based fishing grounds with the two MPAs. We detected 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 10: Overlap of Community based fishing grounds with Protected Areas

Protected Area Type	Name	Overlap with Jaffna Fishing Grounds (ha)	Overlap with Kilinochchi Fishing Grounds (ha)	Overlap with North Mannar Fishing Grounds (ha)
Nature Reserve	Vidattalthivu Nature Reserve	0 (0%)	0 (0%)	3693 (14.55%)
National Park	Adam’s Bridge National Park	0 (0%)	0 (0%)	183 (23.49%)

Figure 6: Overlap between fishing grounds and MPAs



Conclusion

The observations made on the blue swimming crab fishery suggests a low level of potential overlap with the marine habitats of the area for coral reefs / seagrass beds and mangroves in the Palk Bay. The highest level of potential overlap in the Palk Bay was shown between fishing grounds and seagrass beds, ranging from 9.58% to 12.72% for data gathered using GPS and smartphones and community-based field surveys.

The marine protected areas within Palk Bay include the Adam's Bridge National Park and Vidattalthivu Nature Reserve. We observed no overlap between GPS based fishing grounds and these areas, however there was some overlap between community based fishing grounds and them.

Both GPS based and community based spatial data for fishing grounds agrees that there is minimal overlap between them and marine habitats. Fishermen have repeated said that they do not deliberately set their nets on coral / rocky reefs (as these destroy their nets and are not a habitat for blue swimming crabs), or in seagrass beds.

Based on these results, the BSC fishery in Palk Bay qualifies for a score in excess of 3.2 on the Seafood Watch assessment criteria. Since the fishery operates using bottom-set gillnets, that automatically gives it a score of +3. And based on these results, less than 50% of all marine habitats are affected by fishing gear. This gives it a score of +1 which amounts to a total of 4.

This is the highest level of sustainability attainable on the Seafood Watch recommendation program.