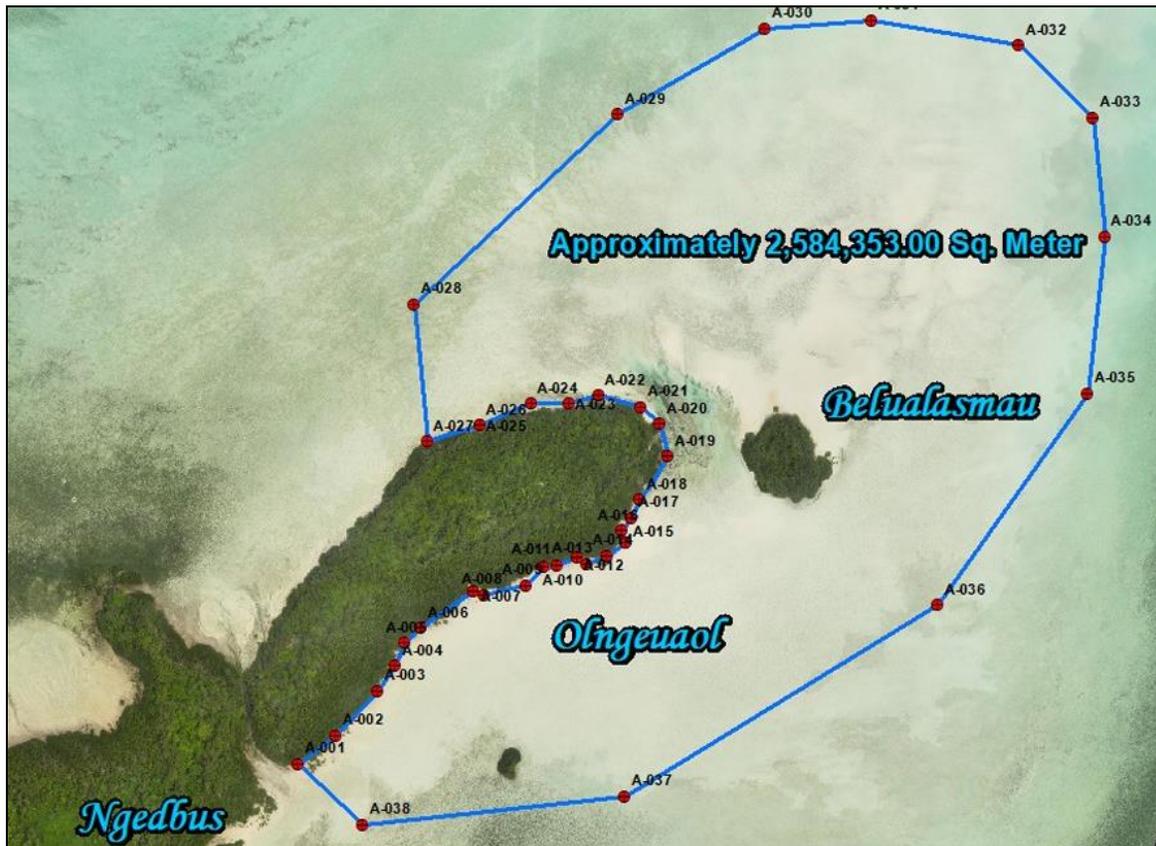


# Rapid Ecological Assessment of Lkes Marine Area, Peleliu



Shirley Koshiba, Lincy Lee Marino, Geory Mereb, Asap Bukurrou, Dawnette Olsudong, Christina Muller-Karanassos, Victor Nestor



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**Abstract**

The Lkes marine area is located in the state of Peleliu, and is mainly comprised of sand and silt flats. It is bordered by mangroves and nearby seagrass beds and has been designated as an Important Bird Area by Birdlife International. The results presented in this report are based on a rapid ecological assessment of Lkes marine area that was conducted in September and October 2019. The results of the rapid assessment show that there is an overall low marine biodiversity within Lkes. In terms of fish assemblages, there was low abundance of commercially important and edible fish species. Small schools of juvenile rabbitfish were recorded, in areas nearest to the bordering seagrass beds located outside of Lkes marine area. There were no edible or commercially valuable macro-invertebrates recorded during the assessment, which is consistent with low overall fish abundance. The benthic structure of Lkes marine area is highly dominated by sand and silt flats, which are not favorable habitats for increasing marine resources. Although seagrass beds host a variety of juvenile fish species, the benthic results show that seagrass coverage was low (5%), with sand having the highest coverage of 81%. While Lkes marine area may not be a habitat for abundance of fish and invertebrate species surveyed in this report, it might still be important as a migratory pathway for various marine species. Additionally, it could also be an essential habitat for biomass transfer amongst different organisms within different trophic levels, some of which depend on sand flats as habitats.

## **Introduction**

The Lkes marine area is located in Peleliu state in the southern end of Palau. It is situated at approximately 7° 3.95' North 134° 16.85' East of Palau and is in close proximity to the main island of Peleliu. Two small islands, Belualasmau and Ngeuall are located close to the area, which is mainly comprised of sand bars and silt flats. Lkes marine area is also bordered towards the western end, by mangroves and seagrass beds. It is a shallow intertidal sand flat area, which is also a regular site for a range of shorebird species and resident waterbirds (Belau National Museum, 2017). BirdLife International has also officially recognized Belualasmau and its sand flats as an Important Bird Area (IBA), making it the most important shorebird site in Micronesia and Oceania (Belau National Museum, 2017).

In 2019, the Palau Conservation Society (PCS) requested assistance from the Palau International Coral Reef Center (PICRC) for a rapid ecological assessment of Lkes marine area. This study was conducted to provide an initial rapid assessment and current structure and status of the marine resources in Lkes for potential inclusion in the Peleliu protected areas network. The objectives of this assessment were to 1) quantify commercially important fish assemblages within the area, 2) assess the benthic community structure of Lkes, and 3) quantify the abundance of edible and commercially important macro-invertebrates. The rapid ecological assessment was conducted over three days, during high tide in September and October 2019.

## **Methods**

### *Study site*

The Lkes marine area has an estimated size of 2,584,353 square meters and is bordered by Olngeuaol and Ngedbus islands. The monitoring protocol followed a stratified sampling design, where locations of survey sites were randomly allocated based on the total area of Lkes marine area using QGIS (QGIS Development Team 2015) (Figure 1). Areas smaller than 900,000 square meters were allocated three random points, whereas areas ranging from 1 km<sup>2</sup> to 5 km<sup>2</sup> were allocated one random point per 300,000 m<sup>2</sup>. A total of 8 sites were randomly allocated within Lkes marine area (n = 24 transects) (Figure 1). At each site, three 30 m transects were laid for the ecological surveys.

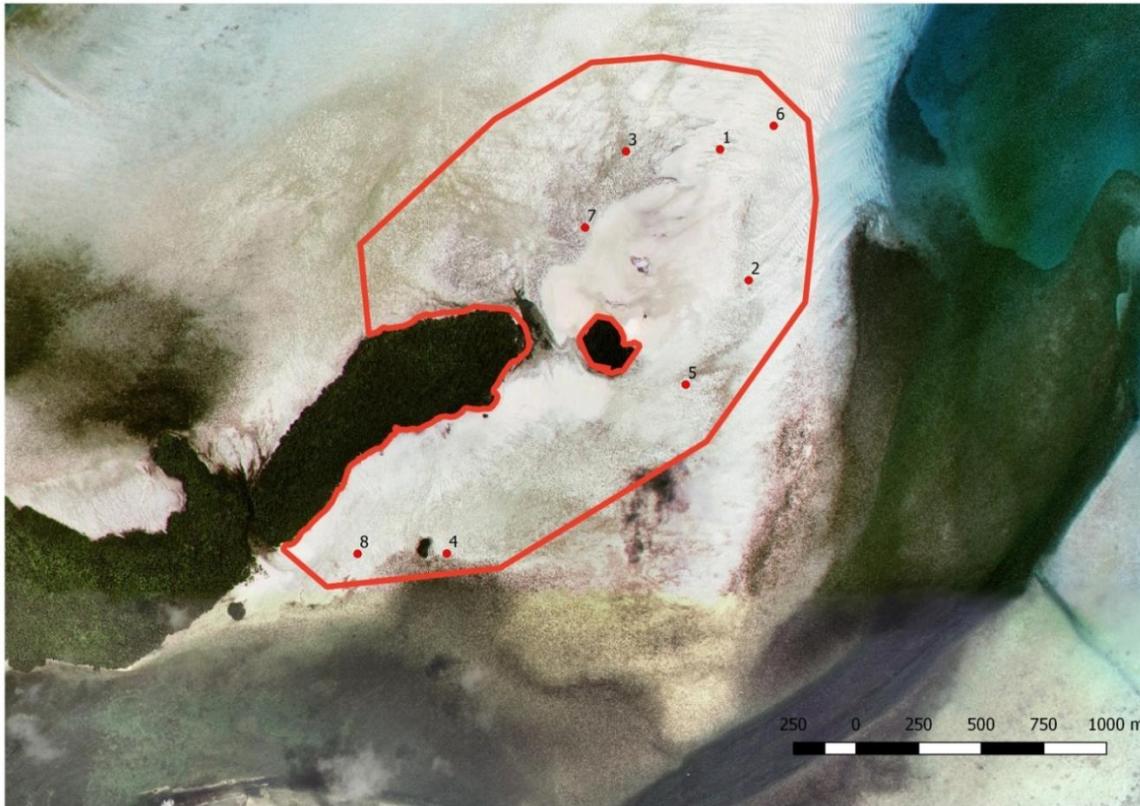


Figure 1. Map of the randomly allocated sites in Lkes marine area. Red dots indicate surveyed sites and the outer red polygon represents the boundaries of Lkes. Inner red polygon represents boundaries around Belualasmau.

#### Fish surveys

Fish data were recorded including the abundance and size estimates of the most common commercially important and protected fish species within a 5 m wide belt along each transect (see fish list in Appendix 1).

#### Edible macro-invertebrate surveys

Another surveyor recorded the abundance of commercially valuable and edible macro-invertebrates within a 2 m wide belt along each transect (see invertebrates list in Appendix 2).

### Benthic surveys

The point-intercept method was used to estimate benthic coverage. On each transect, a dedicated surveyor identified the substrata on every meter per transect for a total of 30 identified points per transect.

All data were stored and processed in Microsoft Excel and maps created for random allocation of survey sites based on GPS (Global Positioning System) coordinates provided by the Office of Palau Automated Land and Resource Information System (PALARIS) and the Palau Conservation Society (PCS).

## **Results**

### Fish surveys

All observed fish species within Lkes marine area were of juvenile status or less than 5 centimeters in total length (size). Of the total eight surveyed sites, only two sites had fish species observed, namely site 4 and site 8. Within site 8 the most observed species was a school of juvenile *Siganus fuscescens* (meyas) which had a total count of 18 individuals (Table 1). The other two species observed included juvenile *Lethrinus harak* (itotech) and *Lutjanus monostigma* (deringel) (Table 1). At site 4, small schools of juvenile *Siganus fuscescens* (meyas) and *Lethrinus obsoletus* (udech) were recorded with sizes of less than 5 centimeters. There were no other fish recorded in all other survey sites in Lkes marine area.

Table 1. List of commercially important fish species recorded in Lkes marine area.

Site	Species	Palauan name	Count	Status
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	<i>Lethrinus obsoletus</i>	Udech	3	Juvenile
	<i>Siganus fuscescens</i>	Meyas	7	Juvenile
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	<i>Siganus fuscescens</i>	Meyas	18	Juvenile
	<i>Lethrinus harak</i>	Itotech	3	Juvenile
	<i>Lutjanus monostigma</i>	Deringel	1	Juvenile

### Benthic Composition

The overall benthic composition of Lkes marine area was mainly comprised of sand with no recordings of live hard coral cover. In terms of benthic categories, sand cover was highest at 81%, followed by rubble coverage at 7% (Figure 2). There was a low cover of silt (3%), turf algae (4%), and seagrass (5%) (Figure 2). Seagrass was only recorded at sites 4 and 8.

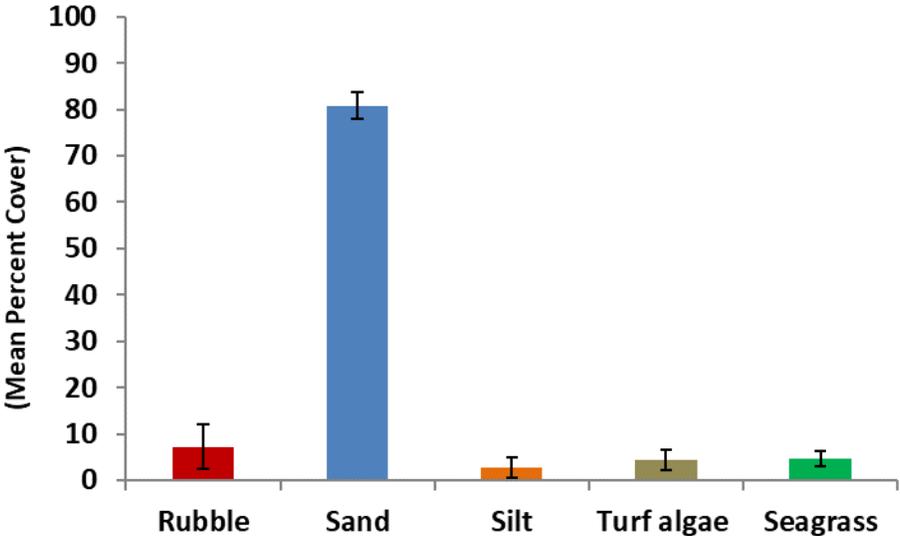


Figure 2. Benthic composition of Lkes marine area.

Macro-invertebrates

There were no commercially valuable macro-invertebrates observed in Lkes marine area. Refer to Appendix 2 for complete list of macro-invertebrates that are surveyed by PICRC.

Discussion

The results of this rapid assessment demonstrate overall low fish and benthic diversity within the Lkes marine area. In terms of fish assemblages, there was little to no abundance of food fish, including commercially valuable fish species. The only fish that were recorded included small schools of juvenile *Lethrinus obsoletus* (udech), *Siganus fuscescens* (meyas), and *Lethrinus harak* (itotech). All juvenile fish species were recorded within only two survey sites (sites 4 and 8) that border a seagrass bed located outside of Lkes (Figure 1). This might explain the observations of juvenile fish, since seagrass beds are the main habitat for juvenile rabbitfish. This low abundance of fish species, could be attributed to the natural habitat structure of Lkes marine area, which is highly dominated by sand flats. Lkes marine area lacks other habitats such

as seagrass beds, or reef flats that include reef building corals, which are home to a variety of juvenile and adult fish species.

The benthic community structure of Lkes shows very low diversity since the area is made up primarily of sand flats (81%), followed by rubble (7%), turf algae (4%) and seagrass coverage (5%). The attributes of this benthic structure may also help to explain the lack of macro-invertebrate abundance as there were no invertebrates recorded during the survey period.

Due to its natural environmental conditions such as high percentages of sand cover, it may prove useful to include other habitats, such as nearby seagrass beds, within the marine area in order to increase marine resources. Seagrass habitats are commonly known as nurseries, and provide support for high juvenile density and growth for both fish and invertebrates (McDevitt et al, 2016). In addition, the size of an area deemed appropriate for increasing marine resources is an important criteria, since a variety of fish species have differing home ranges and life cycles. The area for Lkes if in consideration to become an MPA may be quite small with an area of 2.58 km<sup>2</sup>, and could only be effective at protecting a smaller percentage of fish (Krueck et al, 2018). In order to increase the marine resources within Lkes area, habitat structure, total area, coupled with continuous biological monitoring is needed for effective management of Lkes.

### **Acknowledgements**

The Palau International Coral Reef Center would like to thank the Palau Conservation Society, the Office of the Palau Land and Resource Information System and the Peleliu State Government staff and rangers for their assistance throughout this study.

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### **APPENDIX 1. List of commercially valuable and edible fish species**

<b>Species</b>	<b>Palauan name</b>	<b>Note</b>
<i>Caranx ignobilis</i>	Erobk	—
<i>Caranx melampygus</i>	Oruidel	—
<i>Cetosacarus bicolor</i>	Beadel, Ngesngis	—
<i>Cetoscarus/Scarus spp.</i>	Melemau	—
<i>Choerodon anchorago</i>	Budech	—
<i>Hipposcarus harid</i>	Bekism	—
<i>Hipposcarus longiceps</i>	Ngiaoch	—
<i>Kyphosus spp. (vaigiensis)</i>	Komud, Teboteb	—
<i>Lethrinus obsoletus</i>	Udech	—
<i>Lethrinus olivaceus</i>	Melangmud	—
<i>Lethrinus rubrioperculatus</i>	Rekrük	—
<i>Lethrinus xanthochilis</i>	Mechur	—
<i>Liza vaigiensis</i>	Uluu	—
<i>Lutjanus argentimaculatus</i>	Kedesau'l iengel	—
<i>Lutjanus bohar</i>	Kedesau	—
<i>Lutjanus gibbus</i>	Keremlal	—
<i>Naso lituratus</i>	Cherangel	—
<i>Naso unicornis</i>	Chum	—
<i>Plectorhinchus albobittatus</i>	Melim ralm, Kosond, Bikl	—
<i>Plectorhinchus crysotaenia</i>	Merar	—
<i>Scarus microrhinos</i>	Otord	—
<i>Siganus argenteus</i>	Beduut	—
<i>Siganus lineatus</i>	Kelsebuul	—
<i>Siganus puellus</i>	Reked	—

<i>Siganus punctatus</i>	Bebael	—
<i>Valamugil seheli</i>	Kelat	—
<i>Bolbometopon muricatum</i>	Kamedukl	Protected Fish (seasonal harvest and species closed for harvest)
<i>Cheilinus undulatus</i>	Maml	
<i>Epinephelus fuscoguttatus</i>	Meteungerel'temekai	
<i>Epinephelus polyphekadion</i>	Ksau'temekai	
<i>Plectropomus areolatus</i>	Tiau	
<i>Plectropomus laevis</i>	Tiau, Katuu'tiau, Mokas	
<i>Plectropomus leopardus</i>	Tiau	
<i>Siganus fuscescens</i>	Meyas	

## APPENDIX 2. List of commercially valuable and edible macro-invertebrates

Species	Palauan name
<i>Actinopyga echinites</i>	Eremrum
<i>Actinopyga lecanora</i>	Ngelau
<i>Actinopyga mauritiana</i>	Badelchelid
<i>Actinopyga miliaris</i>	Eremrum, cheremrum edelekelk
<i>Actinopyga palauensis</i>	Eremrum
<i>Actinopyga sp.</i>	Eremrum
<i>Bohadschia argus</i>	Mermarech, esobel
<i>Bohadschia similis</i>	Mermarech
<i>Bohadschia vitiensis</i>	Mermarech
<i>Holothuria impatiens</i>	Sekesaker
<i>Holothuria atra</i>	Cheuas
<i>Holothuria coluber</i>	Cheuas
<i>Holothuria edulis</i>	Cheuas
<i>Holothuria fuscogilva</i>	Bakelungal-cherou
<i>Holothuria fuscopunctata</i>	Delal a molech
<i>Holothuria lessoni</i>	Delal a molech
<i>Holothuria leucospilota</i>	Cheuas
<i>Holothuria nobilis</i>	Bakelungal-chedelkelek
<i>Holothuria scabra</i>	Molech
<i>Holothuris falvomaculata</i>	Cheuas
<i>Pearsonothuria graeffei</i>	Meremarech
<i>Stichopus chloronotus</i>	Cheuas
<i>Stichopus hermanni</i>	Delal a ngimes, ngimes ra tmolech
<i>Stichopus horrens</i>	Irimd
<i>Stichopus vastus</i>	Ngimes
<i>Thelenota ananas</i>	Temetamel

<i>Thelenota anax</i>	Belaol
<i>Tripneustes gratilla</i>	Ibuchel
<i>Trochus maculatus</i>	Semum

### APPENDIX 3. Coordinates of the study sites

Site	Latitude	Longitude
1	7.072655 N	134.286614 E
2	7.067926 N	134.287644 E
3	7.072577 N	134.283209 E
4	7.058050 N	134.276731 E
5	7.064150 N	134.285368 E
6	7.073508 N	134.288550 E
7	7.069834 N	134.281729 E
8	7.058035 N	134.273507 E