



Ministry of Environment,
Climate Change
and Technology



ENDhERI



Technical Report

Mapping Deliverables



Project: Consultancy Service for Development of Natural Capital Accounting with initiating pilot testing of the SEEA Ecosystem Accounting (SEEA EA) in Laamu Atoll

Date: 2 October 2023

Consultants:

This report was prepared by the University of New South Wales (UNSW), with support from the Rekam Nusantara Foundation (RNF) and experts from the Maldives National University (MNU) per the Terms of Reference 438-ENV/438/2022/27.

Relevant deliverables

1. Map of Laamu atoll showing all PAs, environmentally sensitive areas, known biodiversity hotspots, and key areas sustaining marine production
2. Map showing the extension of future ICZM, based on presence or absence of human activities.

Table of Contents

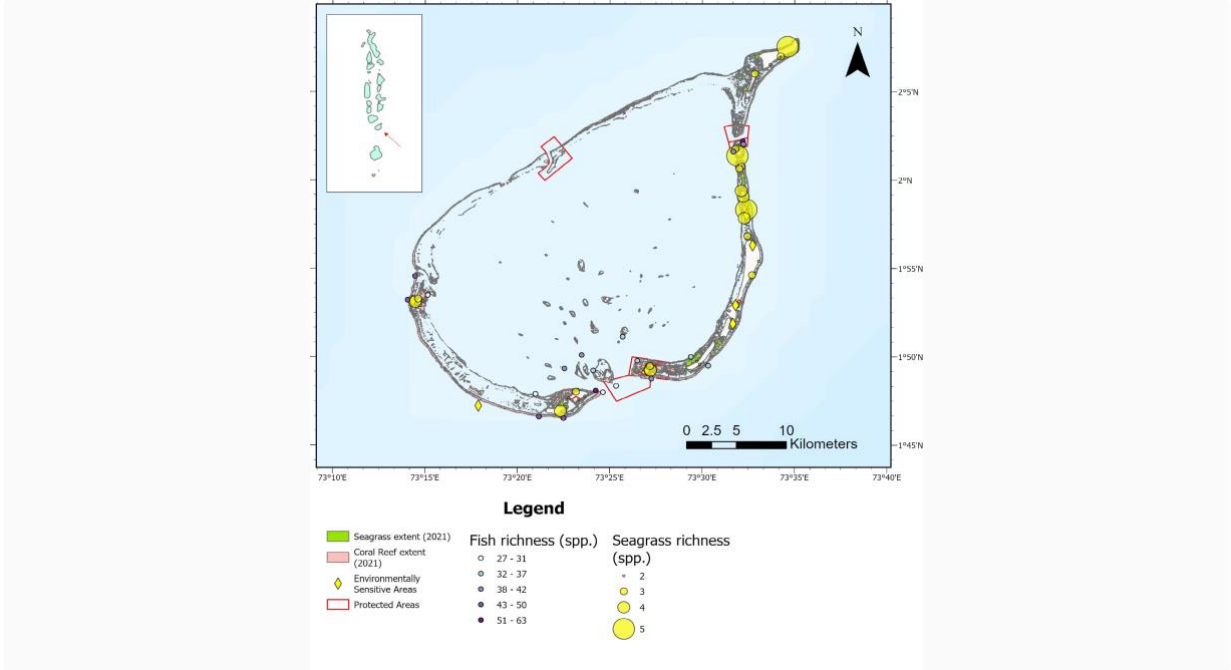
.....	1
<i>Project: Consultancy Service for Development of Natural Capital Accounting with initiating pilot testing of the SEEA Ecosystem Accounting (SEEA EA) in Laamu Atoll.....</i>	<i>2</i>
Background	4
Map Deliverable 1: Map of Laamu Atoll.....	5
<i>Components.....</i>	<i>7</i>
<i>Rationale.....</i>	<i>8</i>
Map Deliverable 2: Future Integrated Coastal Zone Management area.....	9
<i>Human activities considered</i>	<i>11</i>
<i>Modelling scenarios.....</i>	<i>12</i>
Future improvements to mapping.....	14
<i>References</i>	<i>15</i>

Background

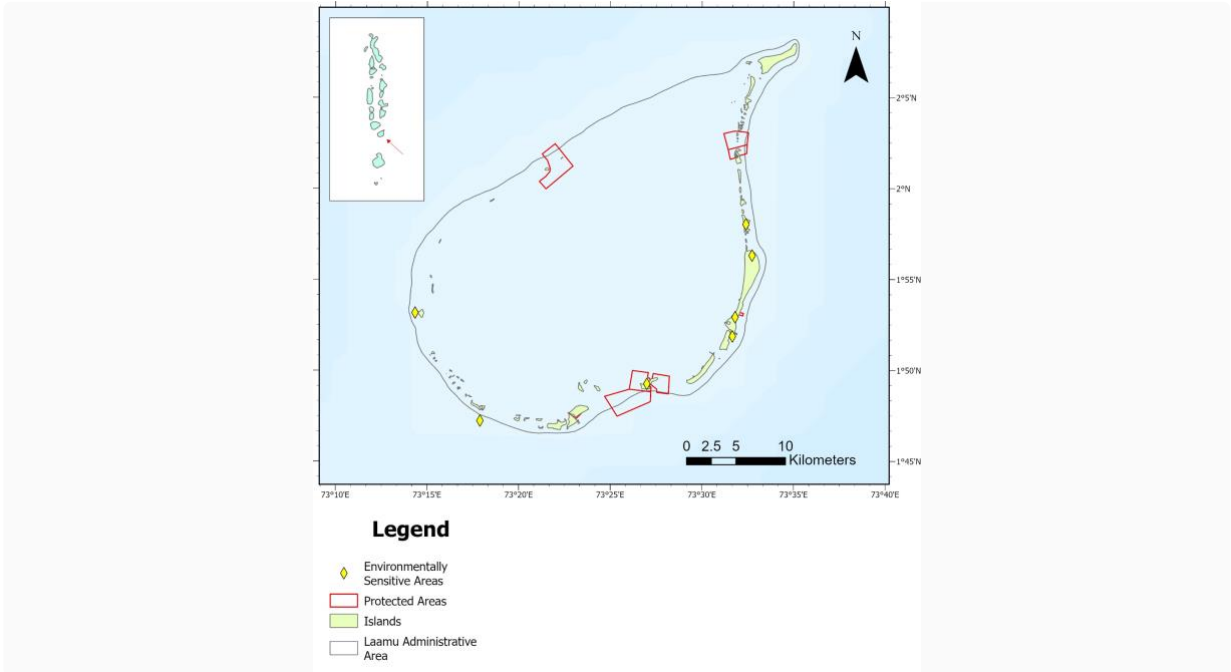
This technical report provides the appropriate context to interpret and utilize the mapping deliverables for the consultancy for policy and decision making. The context includes:

- Appropriate listing of metadata for each map (including layers),
- Methods for deriving the spatial data for each layer,
- Rationale for the representation of key layers, and
- future directions to refine the map deliverables.

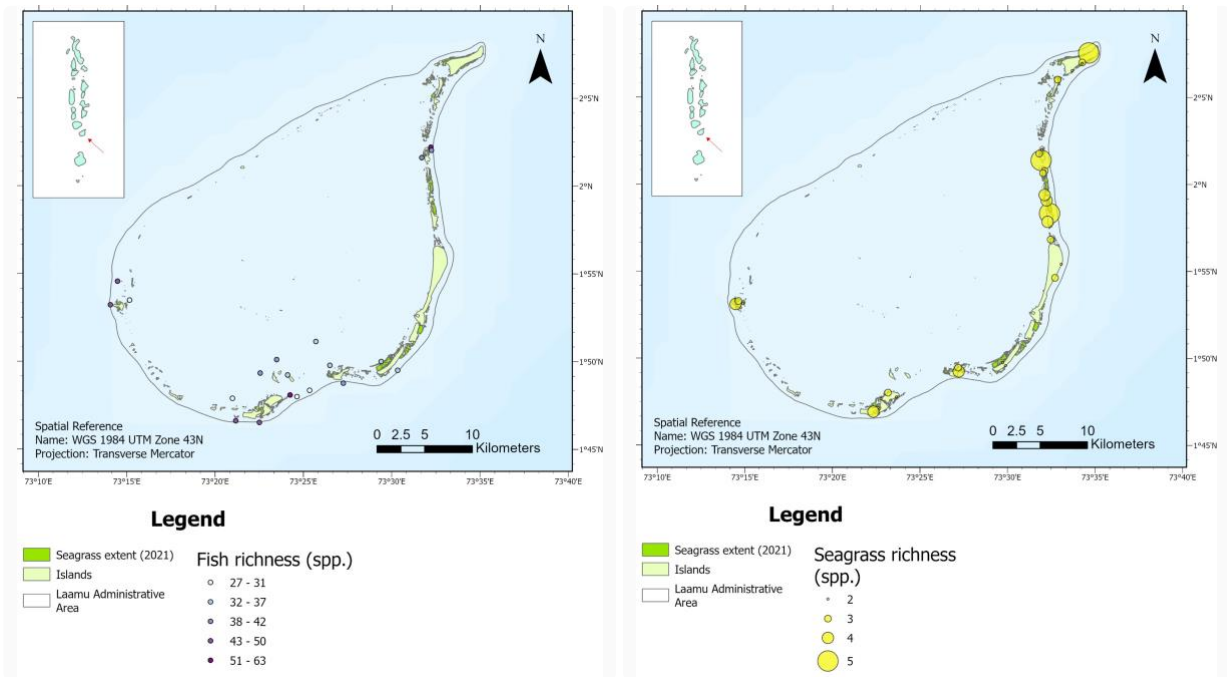
Map Deliverable 1: Map of Laamu Atoll



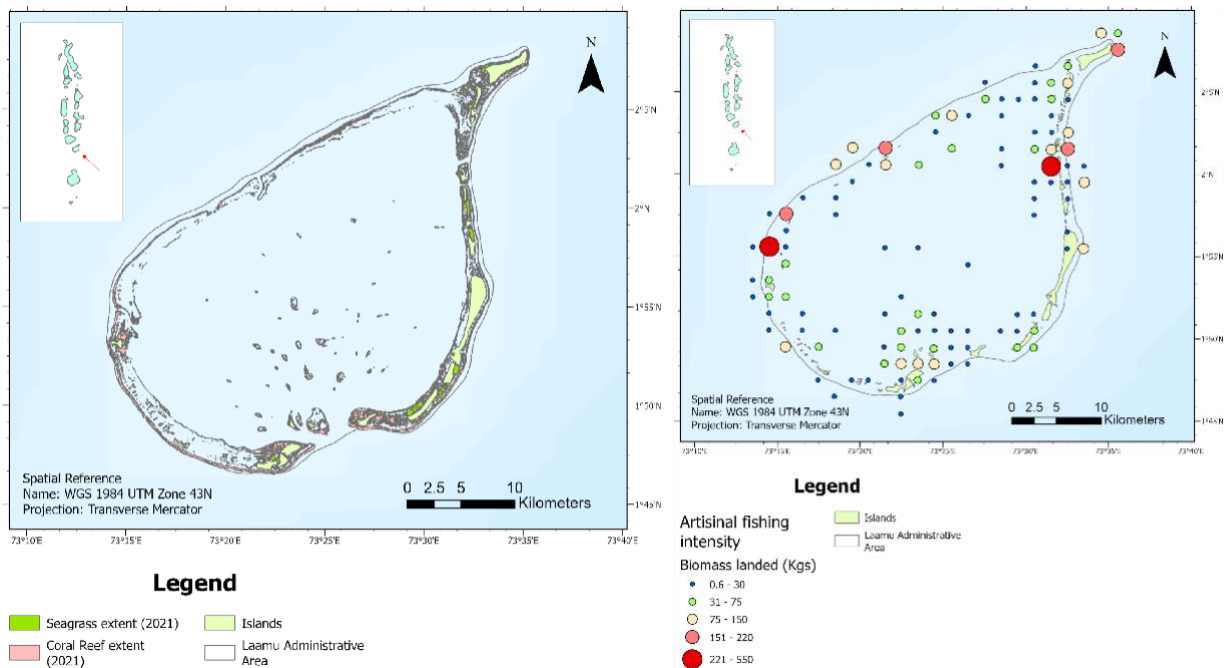
Map 1.1 Map of Laamu Atoll showing all Protected Areas, environmentally sensitive areas, known biodiversity hotspots, and key areas sustaining marine production.



Map 1.2 Map of Laamu Atoll showing all protected areas, environmentally sensitive areas.



Map 1.3 Map of Laamu Atoll showing biodiversity hotspots for (A) fish and (B) seagrass species.



Map 1.4 Map of Laamu Atoll showing key areas sustaining marine production through (A) nursery services for important species (seagrass and coral reefs) and (B) estimated biomass landed per km².

Components

Layer name	Contents	Source
Protected Areas	Terrestrial and marine protected areas, as declared under Protected Areas Regulation (No. 2018/R-78).	EPA, MECCT
Environmentally Sensitive Areas	As identified by the Environmental Protection Agency (EPA) of the Maldives.	EPA
Biodiversity Hotspots	Layers containing potential biodiversity hotspots for fish and seagrass species.	Consultants, drawn from open access data and field surveys
Key areas sustaining marine production	Key ecosystems providing nursery services for important species (seagrass and coral reefs) and potential small scale fishing areas.	Consultants, drawn from remote sensing (coral and seagrass) and Thomas (2022)

Rationale

Protected Areas

The Environmental Protection Agency and MECCT maintain the spatial data that designates terrestrial and marine protected areas. Several government departments are responsible for ensuring the conservation and sustainable use of marine and coastal biodiversity in the Maldives, including the Ministry of Environment, Climate Change and Technology, Ministry of Economic Development, Ministry of Tourism, the Ministry of Fisheries Marine Resources and Agriculture, and Atoll and island Councils.

Environmentally Sensitive Areas

The Environmentally Sensitive Areas (ESA) are areas such as islands, individual channels, ecosystems and reefs that have unique features and are vital for maintaining biological diversity and natural resources. These areas include reef systems, mangroves, wetlands, sea grass beds, and other important habitats for flora and fauna. The compilation of the ESA list began in 2009 with the help of local Island Offices and other stakeholders. The purpose of the list is to identify environmentally and economically significant areas to protect and enhance the country's biodiversity.

The ESA designation helps in monitoring and mitigating the environmental impacts of development projects in these areas. The ESA list does not make these areas protected areas, but rather highlights their importance when considering development. It should be noted that being identified as an ESA does not mean sustainable development cannot occur, and it cannot be used as a reason to refuse development applications.

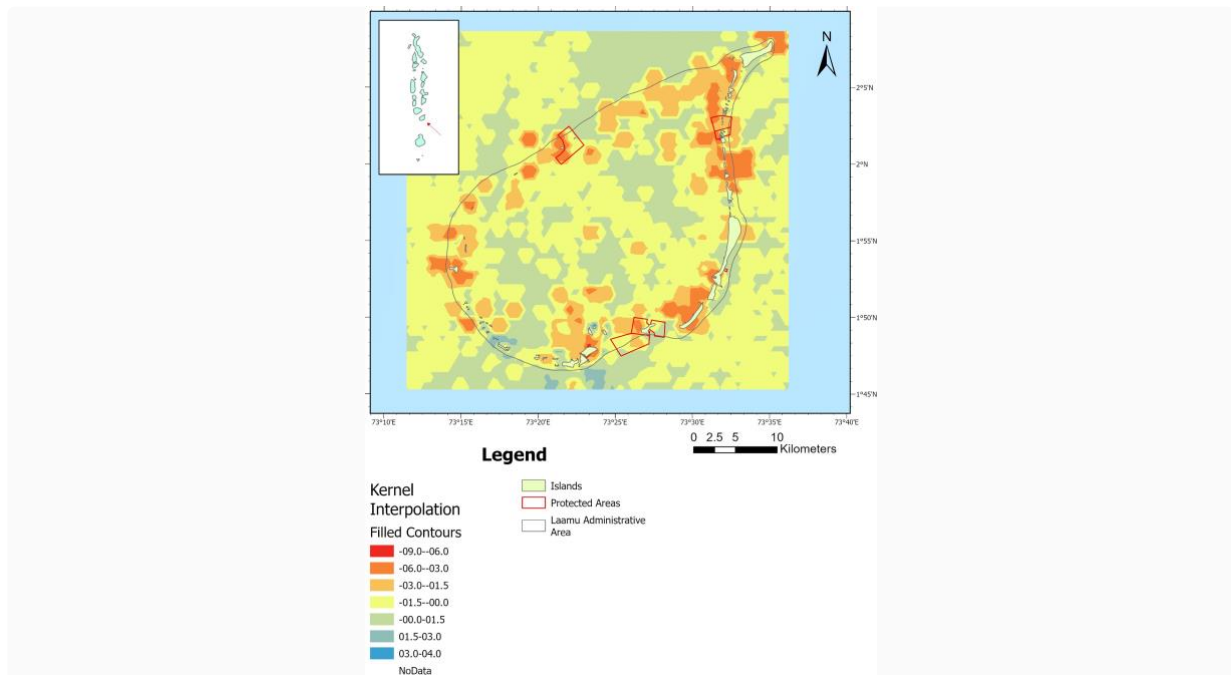
Biodiversity Hotspots

While Maldives is known as a global hotspot for marine biodiversity, there is a lack of data to identify trends in biodiversity at the atoll scale. Here, we attempt to use two datasets to identify potential hotspots of biodiversity by (i) fish species and (ii) seagrass species. The datasets are based on open access data and surveys conducted by the consultancy team. The data presents represent one of the most complete assessments of seagrass at an Atoll scale within the Maldives.

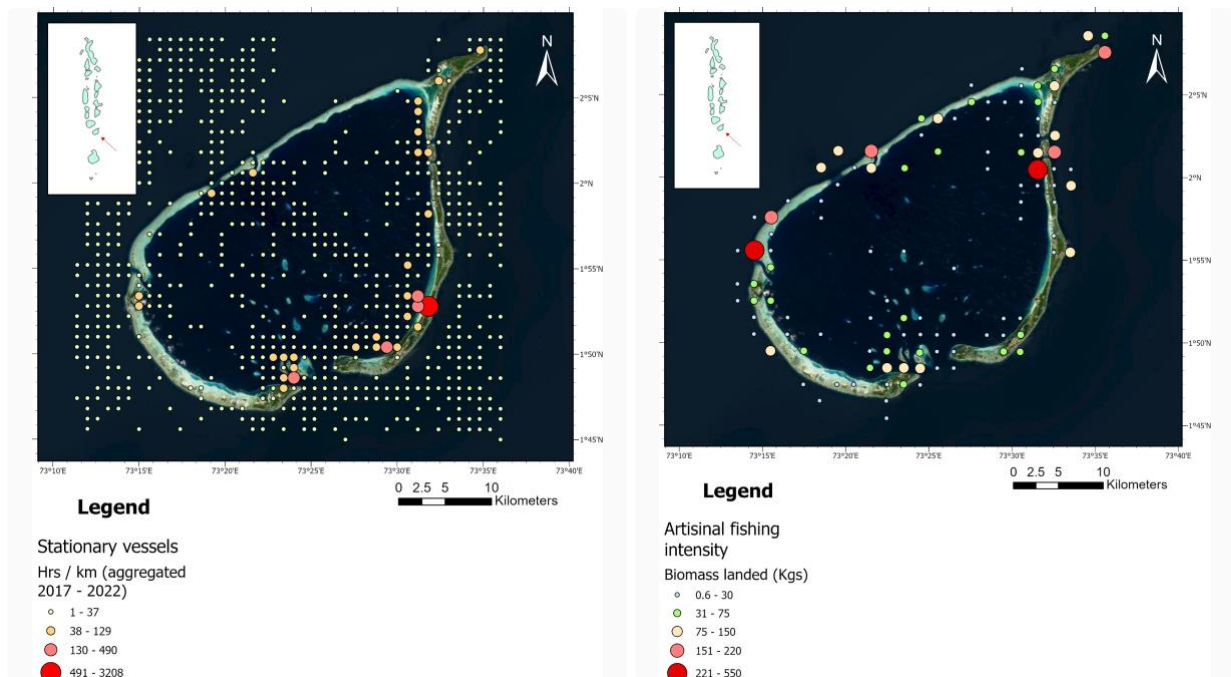
Key areas sustaining marine production.

Due to their extensive area within Laamu Atoll, seagrass and coral reefs contain significant potential to support marine production. Fishing areas, as identified by stationary vessels, was also considered when identifying key areas for marine production within the Atoll.

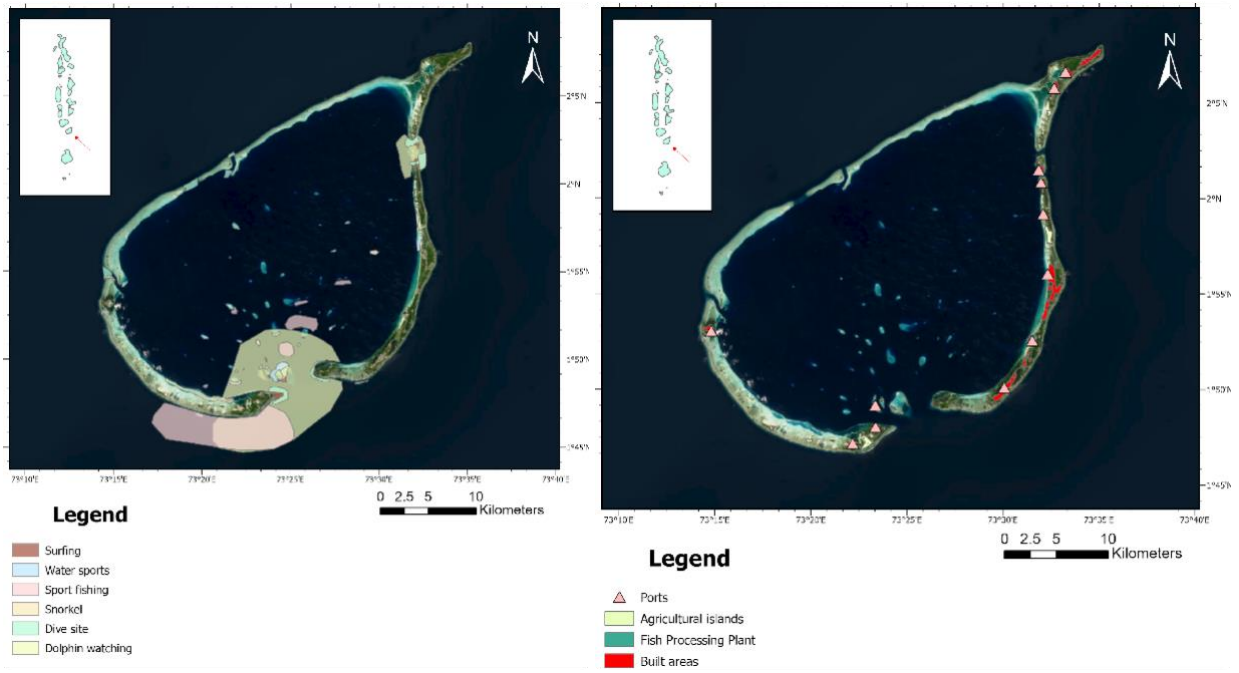
Map Deliverable 2: Future Integrated Coastal Zone Management area



Map 2.1 Map of Laamu Atoll showing potential extensions of the Integrated Coastal Zone Management (ICZM), focusing on protected areas by suitability. Red areas are lower feasibility, while blue are higher areas of feasibility for protected and/or activity exclusion areas.



Map 2.3 Map of Laamu Atoll showing stationary vessel hours as a proxy for vessel traffic (aggregated between 2017 and 2022) and Artisanal Fishing Intensity (Kg per km area).



Map 2.3 Map of Laamu Atoll showing spatial distribution of tourism activity and built environment.

Human activities considered

Layer name	Contents	Source
Fishing	Fishing intensity identified via survey.	Thomas (2022)
Vessel traffic and ports	Aggregated stationary vessel hours (both moored and unmoored, during the day)	Global Fishing Watch (AIS data), Google Maps
Fish processing plant	Horizon Tuna Fish Factory	Google Maps
Tourism	Water-based activities (snorkeling, diving, water sports, sport fishing, surfing, dolphin watching)	Laamu Resource Use report - Blue Marine Foundation and Maldives Resilient Reefs
Uninhabited agriculture islands	Islands designated for agriculture.	Consultants, drawn from remote sensing
Built settlements	Urban areas	Consultants, drawn from remote sensing

Modelling scenarios

Per the deliverable, scenarios were only based on the presence or absence of human activities. To identify potential areas for future expansion, the following ruleset was used for modelling.

Draft suitability index

A preliminary index was developed, although must be updated to conform with the aims and goals of integrated coastal zone management.

1. All cells within a 100m x 100m grid were assigned a score of 0.
2. Human activities lowering suitability adjusted the score by -1 to -3,
3. Human activities with medium to high suitability adjusted the score by +1 to +3.

An alternative approach could be the use of Bayesian Belief Networks to identify the conditions under which existing protected areas are designated and find similar conditions across the Atoll, in conjunction with other considerations.

Scores

- Areas with existing fishing activity were considered low suitability, with high intensity areas given a value of -3 and low intensity areas -1,
- Areas with high boat traffic were considered low suitability (value = -3), Areas within 200 m of ports were considered low suitability (value = -3),
- Areas within 500 m of urban areas were considered low suitability (value = -1).
- Areas within 500 m of the fish processing plant were considered low suitability (value = -3), Areas within 500 m of un-inhabited agriculture islands were considered medium suitability (value = +1).
- Areas adjacent to resorts, buffered by 200 m, were considered high suitability (i.e., low < 200 m, 200 < high < 1000 m), value = +2,
- A tourism index was developed based by intersecting the number of tourist activities in an area and assigning a value of either low (1 activity, value = 1), medium (>2 activities, value = 2), or high (3 - 4 activities, value = 3).

Rationale for suitability scores

Avoiding existing incompatible uses:

- Fishing: Existing fishing areas could be retained, given that most boats are small in scale, fishing intensity is low (relative to the pelagic fishery), and reef fish are targeted either for direct consumption, sale at market or tourism.
- Boat traffic and ports: While transiting through areas may not directly impact ecosystems, protected areas may consider limiting access into the future. These areas should avoid existing high traffic areas.
- Fish processing area: Receive large amounts of boat traffic and are an industrial area.

Maximizing synergistic uses:

- Tourism establishments (including resorts) within the Maldives benefit from a pristine ecosystem. Other activities, such as traditional fishing are incompatible within the boundary of areas leased for tourism operations. They areas could be considered for allocating protected areas and Other Effective Area-based Conservation Measure (OECM).
- Areas surrounding agriculture islands may be impacted by fertilizer run-off. Coastal plans could be created to reduce such impacts. The lack of inhabitants reduces boat traffic and other incompatible human activities.

Future improvements to mapping

1. Iterate plans with updated data

Updating maps and spatial plans is crucial as further local data becomes available. As seen in the case of the Laamu Atoll, the mapping deliverables provide valuable information on protected areas, environmentally sensitive areas, biodiversity hotspots, key areas sustaining marine production, and future integrated coastal zone management. However, these maps should not be seen as static representations but rather as dynamic tools that need to be regularly updated.

2. Refine policy and management aims of the Integrated Coastal Zone Management of the atoll

Before commencing any mapping exercise for plan development, it is important to define clear policy and management aims. This ensures that the objectives and goals of the protected area are clearly identified and can guide decision-making and management actions. It also ensures that stakeholders and local communities are engaged, and their needs and concerns are considered. The presented maps could be updated depending on the aims and considerations. The buffer areas could also be refined by referencing policy and legislation.

3. Conduct community engagement with the developed maps

Including community engagement in developing Integrated Coastal Zone Management plans is essential to ensure compliance. Coastal communities are directly impacted by the management decisions and policies implemented in their areas. By involving them in the planning process, their local knowledge and perspectives can be incorporated, resulting in more effective and sustainable management strategies. Community engagement fosters a sense of ownership and responsibility among community members, leading to increased compliance and participation in conservation efforts. This can enhance the success and long-term viability of integrated coastal zone management plans.

References

Thomas, K. (2022) Quantifying the artisanal fisheries of Laamu Atoll. Masters Thesis. Accessed via Blue Marine Foundation.