PARKE NACIONAL
ARUBA

Quick Scan Marine Environment

Ecosystem and Biodiversity Composition and Potential Negative Impacts of Increased Human Activity at Isla di Oro.

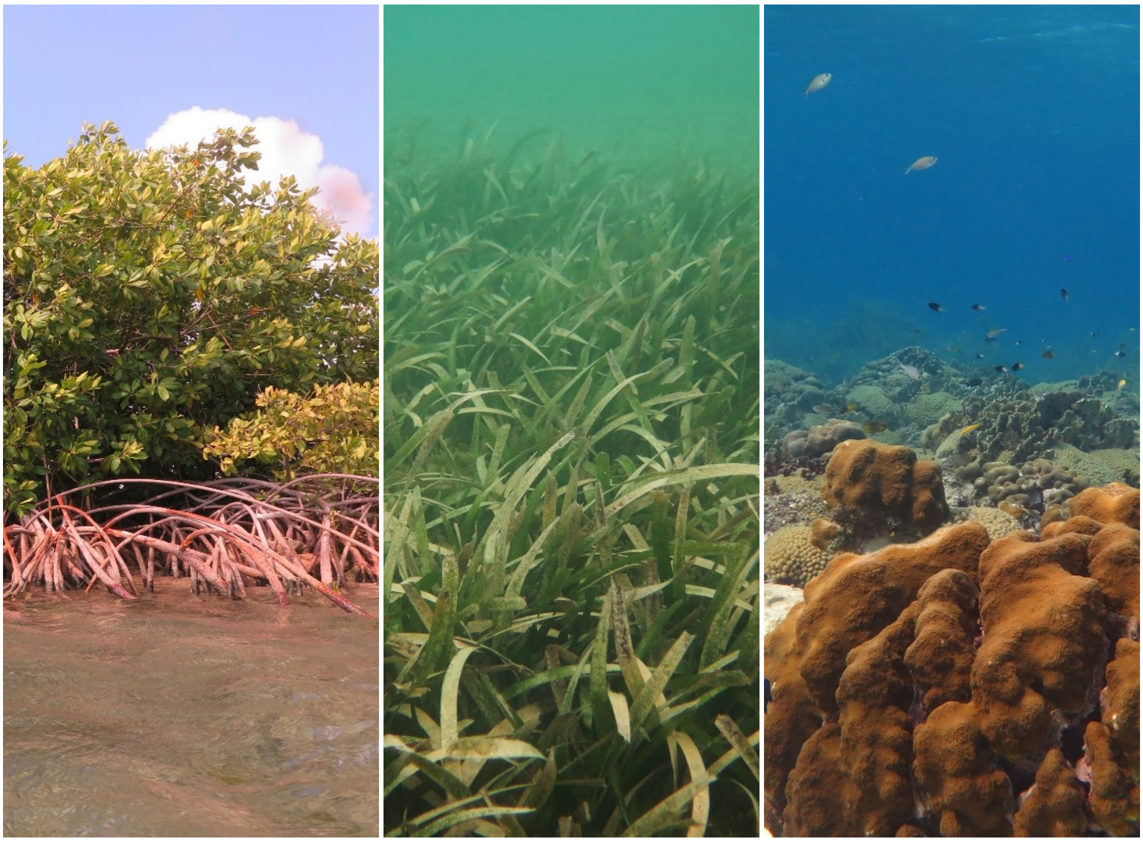

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Table of Contents

Executive summary

This Quick Scan was conducted with the main goal of investigating the current marine biodiversity and ecosystem features of the Isla di Oro site on Aruba's south coast. These results are used to gauge the potential impacts of recreational development in an area of significant natural value that has been left untarnished for over 30 years. The importance of this area has been recognized over the past decades for its key biodiversity and nursery functions.

This pristine little coastal sanctuary is the only remaining coastal area where there is an undisturbed connection between the different marine ecosystems that together form the **'Power of Three'** – mangrove forests, seagrass meadows, and coral reefs. The mangrove forest at Isla di Oro harbors 3 protected mangrove species and is the largest and thickest undisturbed and unfragmented patch of mangroves on the island of Aruba, covering a total of over 190.000 m^2. The seagrass ecosystem includes at least 2 protected native species of seagrass and on the coral reef at least 24 protected coral species were observed.

These ecosystems form a key biodiversity area with already over 225 species recorded in just a short observation. This observation included many species that are both ecologically and commercially important such as a variety of bird species, parrotfish, surgeonfish, snappers, grunts, silverfish, and crustaceans.

Observed impacts following the most recent development attempt include damage to mangroves, the bottom structure and the smothering of seagrass and corals by sedimentation of silt and other fine particles. Any further developments for human exploitation would severely increase the impacts observed and by doing so negatively affect the ecosystem function of this site and its value as a biodiversity replenishment zone. Expected negative impacts include but are not limited to: waste and chemical pollution, disturbance from noise, light and the presence of humans, trampling, crushing, increased wave action and erosion, sedimentation, introduction of invasive species, and wildlife feeding and disturbance of their natural behaviors. Such increased pressures on the sensitive marine environment and its biodiversity would ultimately lead to its demise.

Therefore, FPNA, as an independent nature conservation organization, recommends keeping this marine sanctuary as pristine as possible and to even further enhance its ecological values through strategic evidence-based conservation and restoration efforts like the 'Turning the Tide' project, and full protection as a strict marine reserve.

Through awareness raising, advocacy and educational outreach, the unique value of this area can be further highlighted. It is important to inform people to appreciate the value of this area without having to physically visit it. Due to its fragile state, people are encouraged to not impact the area at all and appreciate its value from a far distance, allowing its ecosystem functions to continue unimpeded.

Introduction

This is a Quick Scan Assessment Report by Fundacion Parke Nacional Aruba (FPNA) of Ecosystem and Biodiversity Composition and Potential Negative Impacts of Increased Human Activity at the Isla di Oro site within Parke Marino Aruba's MPA Mangel Halto and Protected Nature Reef Islands and Mangroves. The urgency of this Quick Scan was triggered by the recent clearing and beach construction activities and (potential) impacts caused by J.O.B. Holding and Management VBA.

The current marine biodiversity and ecosystem features of this specific area were assessed to gauge the potential impacts of recreational development in an area of significant natural value that has been left untarnished for decades. This pristine little coastal sanctuary is the only remaining coastal area where there is an undisturbed connection between the different marine ecosystems that together form the Power of Three – mangrove forests, seagrass meadows, and coral reefs. This connected system is crucial as many marine species depend on each of these ecosystems at different stages within their life cycles. It is for this reason as well that this area is recognized as a Key Biodiversity Area (KBA) and more recently as part of the RAMSAR site #2526 'Aruba South Coast'[1] by the Ramsar Convention on Wetlands - an intergovernmental treaty, currently endorsed by almost 90% of UN member states. The Ramsar Convention provides a framework for the conservation and wise use of wetlands and their resources.

Besides key biodiversity values the site also provides significant ecosystem services to the Aruban economy and community. The three ecosystems – mangrove forests, seagrass meadows and coral reefs – are not only considered the most biodiverse ecosystems, but they are also considered the most productive ecosystems of the marine environment (Kaiser MJ, 2020). Together these ecosystems provide regulatory, provisional, supportive, and cultural ecosystems services (Probert, 2017)such as: carbon sequestration, coastal protection, carbon and sediment filtration, sediment stabilization, nutrient sources and cycles, reproduction, nursery and feeding habitats, and support biodiversity, cultural aesthetics and our Aruban identity, authenticity, and image.

Background

Since the closure of the boat-shaped restaurant at Isla di Oro, 30 years ago, this site has been left abandoned. Due to the decreased human visitation and the natural protection of the thick mangrove forest shield, the biodiversity in this area has started to recover and flourish. The importance of this area for its key biodiversity and nursery function has been recognized over the past decades. In the Spatial Development Plan for Aruba 2009 (DIP, 2009), because of its key biodiversity value, the Isla di Oro area was proposed to become a strict marine nature reserve as part of an island round marine park model.

In 2018, when a developer by name of 'Zoetry' proposed a water bungalow project, the Directorate of Nature and Environment (DNM) as well as the Directorate of Infrastructure and Planning (DIP) advised against any development or recreational use as this would be against the spatial planning ordinance and cause detrimental damage to an invaluable biodiversity and sensitive ecosystem (DIP, 2018; DNM, 2018). The concept of complete protection as a strict marine reserve was further reinforced in 2022 by stakeholders during the extensive stakeholder engagement sessions for Parke Marino Aruba, including MPA

[1] South Coast | Ramsar Sites Information Service

Mangel Halto, where the Isla di Oro site was the only site identified by the stakeholders as the most suitable site for a strict reserve (FPNA, 2024). This in connection to its high biodiversity, unique interconnectedness of the power of three, and the naturally reduced accessibility by the thick mangrove forest.

The Power of Three - mangrove forests, seagrasses, and coral reefs - are crucial ecosystems that are naturally interconnected and provide a variety of benefits to humans and the environment:

Mangrove forests

Mangrove forests prevent coastal erosion, absorb nutrients, sequester carbon dioxide from the air, filter run-off from land, and are a nursery and feeding habitat to numerous species of fish and crustaceans. Mangrove aggregations represent one of the most valuable marine ecosystems in the world, with high productivity and high associated biodiversity. Mangroves are woody trees that flourish at the land-sea interface. These plants are highly adapted to survive in these waterlogged, anoxic sediments and salty conditions that would be fatal to most other flora. They are home to a dynamic mix of terrestrial and marine organisms such as birds, insects, crabs, and fish. Mangroves can sequester carbon, export carbon to adjacent areas, protect the coast from erosion, and provide nursery habitat for many fish species as well as crustaceans. All species of mangroves found on Aruba are protected by national decree under the Nature Ordinance (AB 1995 no2, Article 4, 1a & 2a).

Seagrass meadows

Seagrass meadows bind sediments, sequester carbon, absorb nutrients, and support a diverse range of vertebrate and invertebrate communities, including maturing commercially important fish species. Seagrasses are flowering plants that live underwater. Like land plants, seagrasses produce oxygen. Seagrass beds form in shallow coastal lagoon areas as they require high light availability. Seagrass ecosystems are amongst the most productive in the world; an average growth rate of seagrass leaves is about 5mm per day, with entire stands of seagrass being turned over every 16 weeks with 3-4 crops annually. In addition to this, the leaves of seagrasses provide a huge surface area for settlement of epiphytes (plants that live on the surface of another organism such as calcareous green algae, crustose coralline red algae, cyanobacteria, diatoms) and epifauna (animals that live on the surface of another organism such as sponges, hydroids, bryozoans, and foraminifera's). For a square meter of seabed, a dense seagrass stand may have 20m2 of leaf area for other organisms to settle on. The productivity of the epiphytes can be twice that of the seagrasses themselves. Through a succession of growth, seagrasses turn vast areas of unconsolidated sediments into a highly productive plant dominated, structured habitat with a diversity of microhabitats. All native species of seagrass are protected by national decree under the Nature Ordinance (AB 1995 no2, Article 4, 1a & 2a).

Coral reefs

Coral reefs protect the coastline from storms and erosion, are a source of livelihood and recreation, and have been called 'rainforests of the seas' for their high biodiversity. Corals are diverse groups of invertebrate animals. Coral polyps are tiny, soft-bodied organisms that are related to jellyfish and sea anemones. Different species of coral are found in different habitats and different locations around the world. Stony corals like Acroporids, star corals and brain corals are reef-building corals. Colonial stony corals, consisting of hundreds to

hundreds of thousands of individual polyps, are cemented together by the calcium carbonate “skeletons” they secrete. As colonies grow over hundreds and thousands of years, they join with other colonies and become reefs (Kaiser MJ, 2020).
Coral reefs teem with life. Although they cover less than one percent of the ocean floor, they support about 25 percent of all marine creatures. Corals are particularly vulnerable to the effects of human activities including pollution, climate change, sedimentation, trampling and fishing. Under the Endangered Species Act, more than 25 coral species are listed as threatened or endangered. All species of stony and soft corals are protected by national decree under the Nature Ordinance (AB 1995 no2, Article 4, 1b).

The health of these three ecosystems – mangrove, seagrass, and coral - are interconnected (Guannel, 2016). Therefore, when one of these ecosystems is damaged, it can have severe negative impact on the others. For example, if mangroves are destroyed, it can lead to increased erosion and flooding which in turn damages the seagrass and coral reefs. All these sub-ecosystems work together, if one is negatively affected it could induce a negative feedback loop where all sub-ecosystems and their associated biodiversity are eventually affected.

Numerous marine species depend on the combined power of three – mangrove, seagrass, and coral reef - as they progress through these ecosystems during their different life stages from birth to adulthood and reproduction. An example of such interdependencies can be illustrated with the Grey Snapper (*Lutjanus griseus*)(Image 1), a species also observed during this Quick Scan.

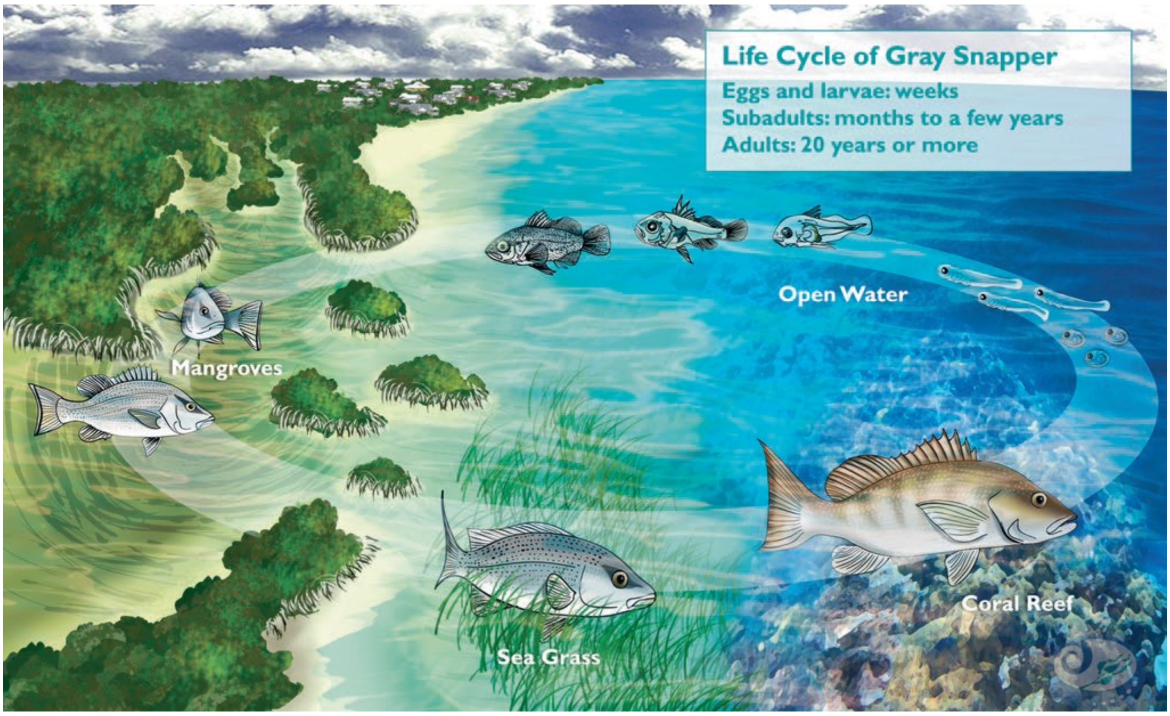

Image 1: The life cycle and interconnected ecosystem use by the Grey Snapper throughout its life phases (illustration form YOUMARES 8 Proceedings (Simon Jungblut, 2018)

In Aruba, these crucial interconnected power of three systems are under severe threat from coastal development and other associated anthropogenic impacts (Debrot, 2018; Vermeij, 2020; Cullen-Unsworth L.C., 2014). These include but are not limited to coastal development, (land-based sources of) pollution, unregulated and unsustainable recreation and extraction. Therefore, what still remains of mangroves, seagrasses and corals is already an absolute minimum of what ecosystems and biodiversity need to sustain Aruba.

The area where this Quick Scan was conducted is surrounding the Isla di Oro reef island on the south coast of Aruba, in the middle of MPA Mangel Halto and Protected Nature Reef Island and Mangroves. This unique site is naturally sheltered from most human impacts (noise-, light-, waste pollution, human activity and exploitation) by the dense mangrove forest. The shallow lagoon area between the mangroves and the reef island is a natural seagrass system with an associated high biodiversity. Just outside the reef island is the coral reef ecosystem, connected to the lagoon and mangroves on both sides of the island. Since the abandonment of the former restaurant on the reef island three decades ago, this area has started to recover and flourish back to its original state of a pristine interconnected and functional power of three due to the reduced human activity.
To further encourage the restoration of this area, FPNA has included this specific area in the EU RESEMBID program funded 'Turning the Tide' project (launched in February 2023) – to maintain economic resilience in Aruba through hands-on restoration and conservation of its marine biodiversity[2][3]. Restoration interventions were already put in place in 2023, including a silt trap at Rooi Lamunchi to prevent further siltation of the mangrove forest at Isla di Oro and the installation of artificial reef structures – MARRS Reefstars with Staghorn coral fragments (*Acropora cervicornis*) – just outside the reef island to restore the historic presence of Acroporids that had suffered a mass die-off in the 1970s (Cramer, 2020).

[2] Turning the Tide - WUR
[3] Co-Funded by the EU'S RESEMBID PROGRAM and Wageningen University & Research, PILOT PROJECT 'TURNING THE TIDE' launches in Aruba | Aruba National Park Foundation

Survey methods

The Isla di Oro site was assessed using several methods to get a broad impression of the area within a limited timeframe due to the urgency of the matter at hand.

Roving surveys

The Isla di Oro site was surveyed by conducting visual assessments of the present flora and fauna. This survey was conducted twice; in the afternoon of 11 March 2024 (15:00-18:00h) and morning of 12 March 2024 (8:00-11:00h), to account for diurnal variations.
Surveys in water were performed by conducting visual assessments (including photo analysis) and a roving survey while snorkeling above present bottom cover. The roving survey covered a lagoon area (yellow) of approximately 14.060 m^2, as well as the shallow coral reefs on the seaside of the reef island (red) of approximately 16.702 m^2. While accessing the area through the dense mangrove forest the observed species were also recorded (blue)(Image 2). All observed species were recorded and identified.

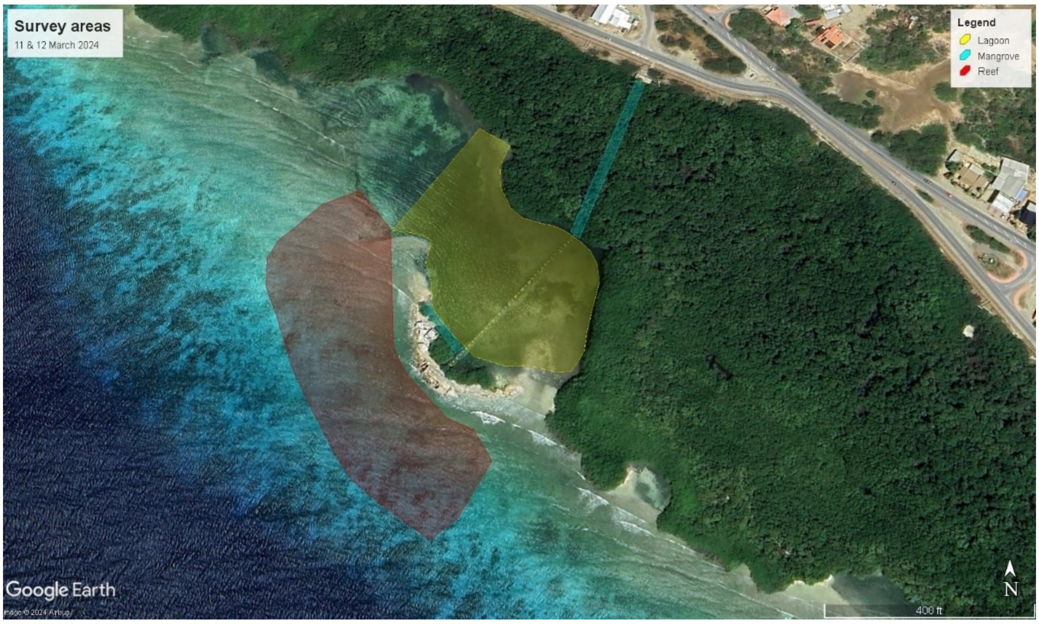

Image 2: Aerial view of Isla di Oro site with areas covered by roving surveys on 11 & 12 March 2024.

Additional observation data

As some species, especially birds, are susceptible to seasonal variations, observation data recorded in eBird[4] by local bird expert Michiel Oversteegen since 2016 were used. This area is part of MPA Mangel Halto and the reef area is currently frequently monitored as part of the coral restoration efforts of the 'Turning the Tide' project. This includes research and monitoring. Therefore, other documented species observations for this site since the start of this multi-partner project in February 2023 are also included in the species list.

Transects

In both the lagoon and coral reef areas, transects were laid out for an evenly dispersed subset of photo quadrats for bottom cover analysis. In both the lagoon and the coral reef area a total of 150 meters (5x30m) of transect line was laid out in 5 parallel lines, 10 meters apart from each other. Photo quadrats were taken every other meter, totaling 75 photos per area. See Image 3 for an impression of the location of the transect lines (yellow).

[4] eBird - Discover a new world of birding...

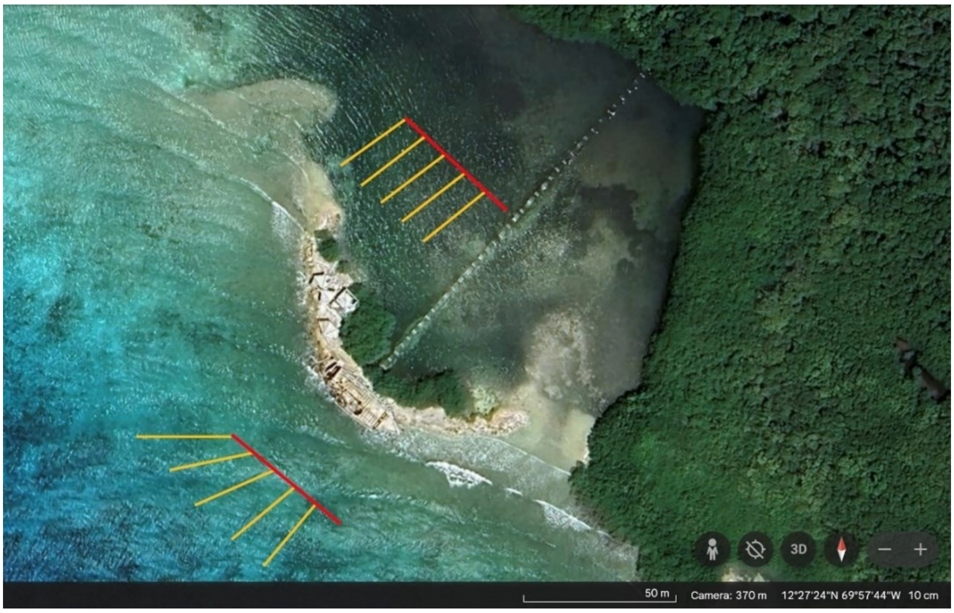

Image 3: Aerial view of Isla di Oro site with the locations of the transect lines (yellow), laid parallel with 10 meters distance indicated by the perpendicular transect line (red).

Aerial views
Supplementary work included satellite and drone imagery analysis. These areal views were used to calculate surface area cover as well as comparisons due to the recent changes caused by the initial work done by the excavator on the island before this J.O.B. Holding & Management VBA project was halted.

Water quality
Water quality describes the condition of the water, including chemical, physical, and biological characteristics, usually with respect to its suitability for a particular purpose such as drinking, swimming, or ecological regulation.
Water samples were collected on 12 March 2024. The six samples were taken in the lagoon area, on the barrier reef and on the shallow outside reef (Image 4). These samples were analyzed for several indicative factors, including the concentration of dissolved oxygen (DO), alkalinity, salinity, phosphate (PO4), nitrite (NO2), nitrate (NO3), ammonia (NH3), and ammonium (NH4).

Image 4: Water quality sample sites at Isla di Oro on 12 March 2024.

Results

Mangroves

The mangrove forest at Isla di Oro is the largest and thickest undisturbed and unfragmented patch of mangroves on the island of Aruba covering a total of over 190.000 m^2, which is larger than the biggest unfragmented mangrove forest patch at Spaans Lagoen that covers only 134.000 m^2 without interruption. The large majority of this mangrove area, including the reef island, comprises of the Red mangrove (*Rhizophora mangle*). The other two mangrove species follow the natural succession of mangroves with Black mangroves (*Avicennia germinans*) in the intertidal zone and White mangroves (*Laguncularia racemosa*) in the dryer areas including one specimen on the reef island.

Image 5: Drywood termite (C. cylindroceps) nest within the mangrove forest that is used by protected Brown-throated parakeet (E. pertinax arubensis) for nesting.

The dense mangrove forest shelters the marine environment of this area from the road, erosion, noise, artificial light, and other anthropogenic stressors. It also harbors many different bird and invertebrate species. A total of 86 bird species have been observed in this area since 2016. This includes for example the locally endemic and protected sub-species of the 'Prikichi' or Brown-throated parakeet (*Eupsittula pertinax arubensis*), Aruba's national bird. This special bird has a symbiotic relationship with the Drywood termite (*Cryptotermes cylindroceps*). Where the Prikichi uses the termite nest to make its own nest inside. This coexistence is only observed in dense mangrove forests (Image 5) where there is minimal human disturbance. The Prikichi is therefore dependent on this specifically dense mangrove area for its reproduction. The mangroves are also home to many invertebrate species such as crabs, spiders, and butterflies.

Seagrasses

Characteristic of the area, the main species of seagrass found during the surveys conducted was Turtle grass (*Thalassia testudinum*), followed by the invasive seagrass *Halophila stipulacea* (Image 6). There were also some areas with Manatee grass (*Syringodium filiforme*).

The photo quadrats of the transect lines for the lagoon area show an average seagrass cover of 86.1%, with 3.3% macro algae and 10.6% sand/sediment bottom (Table 1). The transect lines (3, 4 and 5) where most likely disturbance has taken place over the past decades, (wading, fishing, and test drilling for the previous development plan of Zoetry in 2018) the invasive seagrass seems to dominate, while the most undisturbed side is dominated by the native Turtle grass (transects 1 & 2).

Table 1: Average seagrass cover in subsection of lagoon per transect and overall.

Transect	% Total seagrass cover	% Thalassia testudinum	% Halophila stipulacea (invasive)	Macro Algae	Sand/Sediment
1	92.7	76.0	24.0	7.3	2.0
2	91.7	65.0	35.0	2.0	4.7
3	96.0	8.0	92.0	0.7	3.0
4	94.0	12.3	87.7	1.7	4.3
5	57.3	13.1	79.2	3.8	38.8
Average cover	*86.1*	*35.0*	*63.6*	*3.3*	*10.6*

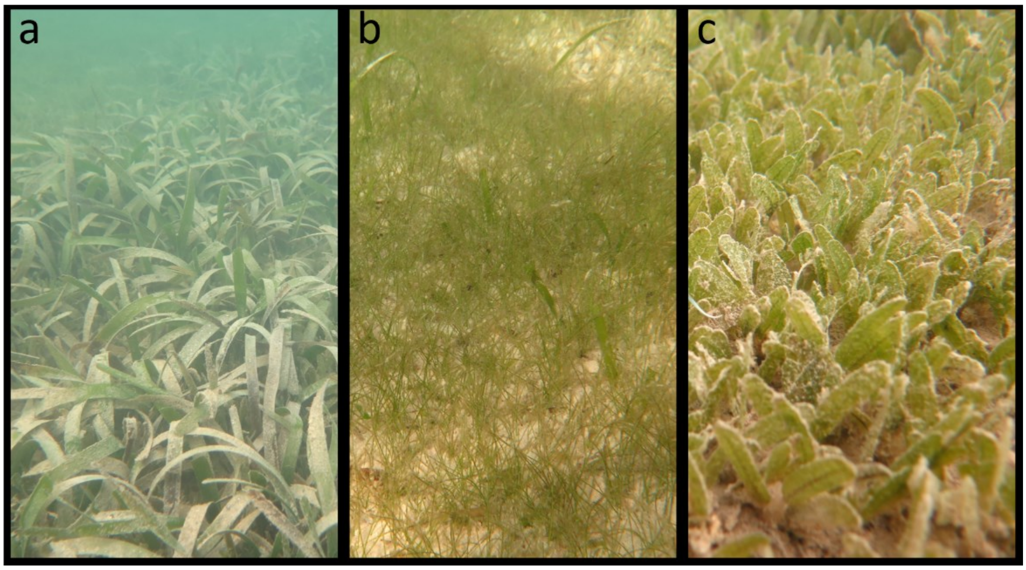

Image 6:Observed seagrass species at Isla di Oro lagoon, a=T. testudinum, b=S. filiforme, c=H. stipulacea

Close to the mangroves in the lagoon the macro algae cover becomes denser, which is typical for such an area. This tranquil lagoon area is also teeming with Upside-down jellyfish (*Cassiopea xamachana*), a characteristic species of such undisturbed lagoon areas.

In the shallow zone towards the open sea, Thin finger coral (*Porites divaricata*) was observed between the Turtle grass and coral rubble, together forming a unique habitat only observed in two other areas around Aruba. Additionally, several Turtle grass (*T. testudinum*) areas displayed signs of active grazing by large herbivore grazers such as Green turtles (*Chelonia mydas*).

Image 7: P. divaricata between T. testudinum and coral rubble.

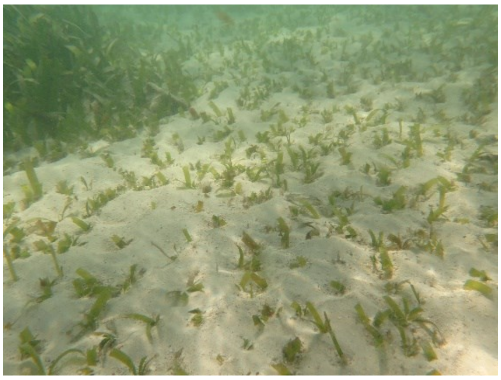

Image 8: Grazed patch of T. testudinum

Corals

Within the surveyed area, 14 species of stony coral, 3 species of hydrocorals and 7 species of gorgonians were observed. All these coral species are protected by national decree (AB 1995 no2, Article 4, 1b & 2b) and over half of these coral species are classified as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) on the IUCN Red List of Threatened Species[5] (Table 2). Noteworthy was the relatively high presence of Staghorn coral (*Acropora cervicornis),* Elkhorn coral (*Acropora palmata*), Fire corals (*Millepora spp.*), and Gorgonians, which are often described as pioneer species in the succession of a coral reef. This indicates the start of natural restoration of coral reef ecosystem in the area. This restoration is further strengthened by the 4 artificial reef installations with Staghorn coral (*A. cervicornis*) fragments of the 'Turning the Tide' project.

Of all the 75 photo quadrats of the transect lines, 62.7% of the photos contained live healthy coral specimens. All photos also included patches of coral rubble, indicative of historic high presence of corals, especially Acroporids. Historic presence of these corals in high abundance also illustrates the restorative potential of this area.

Water quality

The processing of the 6 water samples for the water quality parameters gave the following results. The slight differences between the samples are not considered significant and therefore the results are averaged.

Sample	**DO (mg/L)**	**pH**	**Salinity (ppt)**	**Alkalinity (mg/L)**	**PO4 (mg/L)**	**NO2 (ug/L)**	**NO3 (mg/L)**	**NH3 (mg/l)**	**NH4 (mg/l)**
Lagoon 1	3.6	7.8	41.4	150.0	0.0	0.0	4.0	2.5	2.7
Lagoon 2	5.8	8.0	41.0	151.0	0.0	0.0	6.2	4.1	4.5
Barrier reef 1	4.6	8.1	41.1	143.0	0.0	0.0	7.6	3.0	3.2
Barrier reef 2	5.3	8.1	40.7	143.0	0.0	0.0	5.7	4.9	5.3
Reef 1	5.3	8.1	41.0	144.0	0.0	0.0	5.2	2.7	2.9
Reef 2	5.3	8.1	40.7	142.0	0.0	0.0	4.2	3.9	4.2
Average	*5.0*	*8.1*	*41.0*	*145.5*	*0.0*	*0.0*	*5.5*	*3.5*	*3.8*

[5] IUCN Red List of Threatened Species (https://www.iucnredlist.org/en)

DO, pH, salinity and alkalinity showed normal values for marine coastal systems. Phosphate was not detected. Nitrate is an intermediate product of the nitrogen cycle and is very toxic to aquatic life. Organic waste is rich in nitrogen, usually in the form of ammonia ($NH3$). This substance is transformed by bacteria to nitrite ($NO2$), which quickly needs to be transformed by other bacteria to nitrate ($NO3$). The nitrate can be used again by plants and algae for growth and thus is taken up from the water column again. An overload of waste could disrupt this process, resulting in bacteria not being able to transform all the intermediate products quickly enough causing a build-up of nitrite ($NO2$) or a surplus of nitrate ($NO3$) in quantities which cannot be taken up anymore by the plants/algae present. The absence of nitrite is an indication of a healthy balanced system.
The slightly higher than desirable values (Nordin, 2009) for nitrate ($NO3$), ammonia ($NH3$) and ammonium ($NH4$) could be attributed to the organic matter that is generally present in Aruban water due to many sources of run-off.

Observed biodiversity

While considering a limited observation time, the research team documented over 140 different species during the quick scan (Table 2). With the addition of the observed birds as well as commonly associated species (Table 3), this comes to a total of over 225 different species.

In addition to the highly valuable, endangered and protected mangroves, seagrass and corals, other ecologically and commercially relevant species were also observed. Essential grazers for coral and ecosystem health were also observed, such as Parrotfish and Surgeonfish. These include juvenile (initial) stages and terminal phases of 8 species of Parrotfish (Scaridae), all protected by national decree under the Nature Ordinance (AB 1995 no2, Article 4, 2b). Parrotfish and Surgeonfish are essential grazers on coral reefs that keep the corals healthy by eating the competing algae of the structures. Important to note is that the Parrotfish produce the white sand that make Aruba's beaches so famous.
Commercially relevant species were also observed in multiple live stages characteristic of their life cycles being dependent on the interconnectedness of the mangrove, seagrass, and coral habitats. These include 7 species of Snapper (Lutjanidae), 4 species of Grunts (Haemulidae), 2 Goatfish (Mullidae) and the Great barracuda (*Sphyraena barracuda*). This area is also home to many different Silversides (*Atherinidae spp.*), with spillover to adjacent areas for fisheries, mainly cast net ('taray') fishing.

Coralline algae (Corallinaceae), another protected species (AB 1995 no2, Article 4, 1a) was also observed on many structures. Coralline algae and Reef cement (Rhodopyta) are not only a valuable food source for grazers. These fundamental algae also function as the cement foundation for coral recruitment, settlement and reef building, emphasizing the restorative potential of this site.

Table 2: Documented species during Quickscan of 11 & 12 March 2024.

Common name	Scientific name	Article 4	SPAW Annex	CITES	IUCN Status
Mangroves					
Red mangrove	*Rhizophora mangle*	2a	III		LC
White mangrove	*Laguncularia racemosa*	2a	III		LC
Black mangrove	*Avicennia germinans*	2a	III		LC
Seagrass					
Manatee grass	*Syringodium filiforme*	1a	III		LC
Turtle grass	*Thalassia testudinum*	2a	III		LC
Broadleaf seagrass	*Halophila stipulacea*				LC
Stony corals					
Elkhorn coral	*Acropora palmata*	1b	II	II	CR
Staghorn coral	*Acropora cervicornis*	1b	II	II	CR
Blue crust coral	*Porites cf. branneri*	1b	III	II	CR
Massive starlet coral	*Siderastrea siderea*	1b	III	II	CR
Maze coral	*Meandrina meandrites*	1b	III	II	CR
Pillar coral	*Dendrogyra cylindrus*	1b	III	II	CR
Symmetrical brain coral	*Pseudodiploria strigosa*	1b	III	II	CR
Lobed star coral	*Orbicella annularis*	1b	III	II	EN
Boulder brain coral	*Colpophyllia natans*	1b	III	II	VU
Golfball coral	*Favia fragum*	1b	III	II	LC
Lesser starlet coral	*Siderastrea radians*	1b	III	II	LC
Mustard hill coral	*Porites astreoides*	1b	III	II	LC
Thin finger coral	*Porites divaricata*	1b	III	II	LC
Yellow pencil coral	*Madracis auretenra*	1b	III	II	LC
Hydrocorals					
Blade fire coral	*Millepora complanata*	1b	III	II	CR
Branching fire coral	*Millepora alcicornis*	1b	III	II	VU
Ridged fire coral	*Millepora striata*	1b	III	II	VU
Gorgonians					
Common sea fan	*Gorgonia ventalina*	1b	III		
Knobby sea rods	*Eucinea spp.*	1b	III		
Orange spiny sea rod	*Muricea elongata*	1b	III		
Sea plumes	*Antillogorgonia spp.*	1b	III		
Slit-pore sea rods	*Plexaurella pss.*	1b	III		
Encrusting gorgonian	*Erythropodium caribaeorum*	1b	III		
Yellow sea whip	*Pterogorgia citrina*	1b	III		
Encrusting zoanthid	Palythoa caribaeorum				
Sponges					
Stinker sponge	*Ircinia felix*				
Scattered pore rope sponge	*Aplysina fulva*				
Red boring sponge	*Cliona delitrix*				

Corallinaceae					
Crustose coralline algae	*Rhodopyta*	1a			
Reef cement	*Rhodopyta*	1a			
Macroalgae					
Bristle ball brush	*Penicillus dumetosus*				
Cactus tree alga	*Caulerpa cupressoides*				
Encrusting fan-leaf alga	*Lobophora variegata*				
Flat green feather alga	*Caulerpa mexicana*				
Green grape alga	*Caulerpa racemosa*				
Green net algae	*Microdictyon boergesenii*				
Leafy flat-blade alga	*Stypopodium zonale*				
Mermaid's fans	*Udotea spp.*				
Saucer blade alga	*Avtainvillea asarifolia*				
Serrated strap alga	*Dictyota ciliolata*				
Three finger leaf alga	*Halimeda incrassata*				
White scroll alga	*Padina sanctae-crucis*				
Y-branched alga	*Dictyota spp.*				
Y-twig alga	*Amphiroa rigida*				
Marine invertebrates					
Queen conch	*Lobatus (Strombus) gigas*	1b	III	II	
Caribbean spiny lobster	*Panulirus argus*	1b	III		DD
Knobby anemone	*Ragactis lucida*				
Upside-down jellyfish	*Cassiopea xamachana*				
Atlantic yellow crowrie	*Erosaria acicularis*				
Bearded fireworm	*Hermodice carunculata*				
Blue crab	*Callinectus sapidus*				
Brown fanworm	*Notaulax nudicollis*				
Christmas tree hydroid	*Pennaria disticha*				
Christmas tree worm	*Spirobranchus giganteus*				
Fringeback dondice	*Dondice occidentalis*				
Lettuce slug	*Elysia crispata*				
Rock-boring urchin	*Echinometra lucunter*				
Stocky cerith	*Cerithium litteratum*				
West indian sea egg	*Tripneustes ventricosus*				
Hermit crab	*Paguroidea spp.*				
Flamingo tongue	*Cyphoma gibbosum*				
Four-tooth nerite	*Nerita versicolor*				
Yellowline arrow crab	*Stenorhynchus seticornis*				
Sally lightfoot	*Grapsus grapsus*				
Amber penshell	*Pinna carnea*				
West Indian fuzzy chiton	*Acanthopleura granulata*				
Terrestrial invertebrates					
Monarch butterfly	*Danaus plexippus*				LC
Golden silk orb weaver	*Nephila clavipes*				LC
Lyside sulphur butterfly	*Kricogonia lyside*				

Drywood termite	*Cryptotermes cylindroceps*				
Fish					
Rainbow parrotfish	*Scarus gaucamaia*	2b	II		NT
Stoplight parrotfish	*Sparisoma viride*	2b	II		LC
Bucktooth parrotfish	*Sparisoma radians*	2b	II		LC
Princess parrotfish	*Scarus taeniopterus*	2b	II		LC
Queen parrotfish	*Scarus vetula*	2b	II		LC
Redband parrotfish	*Sparisoma aurofrenatum*	2b	II		LC
Redtail parrotfish	*Sparisoma chrysopterum*	2b	II		LC
Striped parrotfish	*Scarus iserti*	2b	II		LC
Peppermint goby	*Coryphopterus lipernes*				VU
Atlantic tarpon	*Megalops atlanticus*				VU
Cubera snapper	*Lutjanus cyanopterus*				VU
Lane snapper	*Lutjanus synagris*				NT
Mutton snapper	*Lutjanus analis*				NT
Black margate	*Anisotremus surinamensis*				DD
Yellowtail snapper	*Ocyurus chrysurus*				DD
Blue tang	*Acanthurus coeruleus*				LC
Bluehead	*Thalassoma bifasciatum*				LC
Rock beauty	*Halocanthus tricolor*				LC
Sergeant major	*Abudefduf saxatilis*				LC
Silversides	*Atherinidae spp.*				LC
Spotted goatfish	*Pseudupeneus maculatus*				LC
Orangespotted filefish	*Cantherhines pullus*				LC
Peacock flounder	*Bothus lunatus*				LC
Chain moray	*Echidna catenata*				LC
Roughhead blenny	*Acanthemblemaria aspera*				LC
Redlip blenny	*Ophioblennius atlanticus*				LC
Dusky damselfish	*Stegastes adustus*				LC
Yellowfin mojarra	*Gerres cinereus*				
Mahogony snapper	*Lutjanus mahogani*				
Cleaning goby	*Gobiosoma genie*				
Palehead blenny	*Labrisomus gobio*				
Banded butterflyfish	*Chaetodon striatus*				LC
Bandtail puffer	*Sphoeroides spengleri*				LC
Beaugregory	*Stegastes leucostictus*				LC
Bicolor damselfish	*Stegastes partitus*				LC
Blue chromis	*Chromis cyanea*				LC
Bluestriped grunt	*Haemulon sciurus*				LC
Brown chromis	*Chromis multilineata*				LC
Cocoa damselfish	*Stegastes variabilis*				LC
Coney	*Cephalopholis fulva*				LC
Doctorfish	*Acanthurus chirurgus*				LC

Foureye butterflyfish	*Chaetodon capistratus*				LC
French angelfish	*Pomacanthus paru*				LC
French grunt	*Haemulon flavolineatum*				LC
Goldentail moray	*Gymnothorax miliaris*				LC
Green moray	*Gymnothorax funebris*				LC
Goldspotted eel	*Myrichtys ocellatus*				LC
Great barracuda	*Sphyraena barracuda*				LC
Gray snapper	*Lutjanus griseus*				LC
Harlequin bass	*Seranus tigrinus*				LC
Lionfish	*Pterois volitans*				LC
Ocean surgeonfish	*Acanthurus tractus*				LC
Puddingwife	*Halichoeres radiatus*				LC
Schoolmaster	*Lutjanus apodus*				LC
Sharpnose puffer	*Canthigaster rostrata*				LC
Spotted scorpionfish	*Scorpaena plumieri*				LC
Slippery dick	*Halichoeres bivittatus*				LC
Smallmouth grunt	*Haemulon chrysergyreum*				LC
Smooth trunkfish	*Lactophrys triqueter*				LC
Spanish hogfish	*Bodianus rufus*				LC
Spotfin butterflyfish	*Chaeton ocellatus*				LC
Squirrelfish	*Holocentrus adscensionis*				LC
Threespot damselfish	*Stegastes planifrons*				LC
Trumpetfish	*Aulostomus maculatus*				LC
Yellowtail damselfish	*Microspathodon chrysurus*				LC
Yellow goatfish	*Mulloidichthys martinicus*				LC
Birds					
Peregrine Falcon	*Falco peregrinus*	1b	II	I	LC
Crested Caracara	*Caracara plancus*	1b	II		LC
Roseate Tern	*Sterna dougallii*	1b	II		LC
American Flamingo	*Phoenicopterus ruber*	1b	III		LC
Brown Pelican	*Pelecanus occidentalis*	1b			LC
Burrowing Owl	*Athene cunicularia*	1b			LC
Brown-throated Parakeet	*Eupsittula pertinax arubensis*	1b			LC
Blue-tailed Emerald	*Chlorostilbon mellisugus*	2b			LC
Ruby-topaz Hummingbird	*Chrysolampis mosquitus*	2b			LC
Least Tern	*Sternula antillarum*		II		LC
Scarlet Ibis	*Eudocimus ruber*		III	II	LC
Rose-ringed Parakeet	*Psittacula krameri*			II	LC
Blackpoll Warbler	*Setophaga striata*				NT
Reddish Egret	*Egretta rufescens*				NT
Semipalmated Sandpiper	*Calidris pusilla*				NT
American Golden-Plover	*Pluvialis dominica*				LC

American Kestrel	*Falco sparverius*				LC
American Redstart	*Setophaga ruticilla*				LC
Bananaquit	*Coereba flaveola*				LC
Bank Swallow	*Riparia riparia*				LC
Bare-eyed Pigeon	*Patagioenas corensis*				LC
Barn Swallow	*Hirundo rustica*				LC
Belted Kingfisher	*Megaceryle alcyon*				LC
Black-bellied Plover	*Pluvialis squatarola*				LC
Black-crowned Night Heron	*Nycticorax nycticorax*				LC
Black-faced Grassquit	*Melanospiza bicolor*				LC
Black-necked Stilt	*Himantopus mexicanus*				LC
Blue-winged Teal	*Spatula discors*				LC
Bobolink	*Dolichonyx oryzivorus*				LC
Brown Booby	*Sula leucogaster*				LC
Carib Grackle	*Quiscalus lugubris*				LC
Cliff Swallow	*Petrochelidon pyrrhonota*				LC
Common Gallinule	*Gallinula galeata*				LC
Common Ground Dove	*Columbina passerina*				LC
Common Tern	*Sterna hirundo*				LC
Eared Dove	*Zenaida auriculata*				LC
Fork-tailed Flycatcher	*Tyrannus savana*				LC
Gray Kingbird	*Tyrannus dominicensis*				LC
Great Blue Heron	*Ardea herodias*				LC
Great Egret	*Ardea alba*				LC
Greater Yellowlegs	*Tringa melanoleuca*				LC
Green Heron	*Butorides virescens*				LC
Groove-billed Ani	*Crotophaga sulcirostris*				LC
House Sparrow	*Passer domesticus*				LC
Killdeer	*Charadrius vociferus*				LC
Laughing Gull	*Leucophaeus atricilla*				LC
Least Sandpiper	*Calidris minutilla*				LC
Lesser Yellowlegs	*Tringa flavipes*				LC
Little Blue Heron	*Egretta caerulea*				LC
Magnificent Frigatebird	*Fregata magnificens*				LC
Neotropic Cormorant	*Nannopterum brasilianum*				LC
Northern Scrub-Flycatcher	*Sublegatus arenarum*				LC
Northern Waterthrush	*Parkesia noveboracensis*				LC
Osprey	*Pandion haliaetus*				LC
Pectoral Sandpiper	*Calidris melanotos*				LC
Pied-billed Grebe	*Podilymbus podiceps*				LC
Rock Pigeon	*Columba livia*				LC
Roseate Spoonbill	*Platalea ajaja*				LC
Royal Tern	*Thalasseus maximus*				LC
Ruddy Turnstone	*Arenaria interpres*				LC

Sanderling	*Calidris alba*				LC
Sandwich Tern	*Thalasseus sandvicensis*				LC
Semipalmated Plover	*Charadrius semipalmatus*				LC
Shiny Cowbird	*Molothrus bonariensis*				LC
Short-billed Dowitcher	*Limnodromus griseus*				LC
Snowy Egret	*Egretta thula*				LC
Solitary Sandpiper	*Tringa solitaria*				LC
Sora	*Porzana carolina*				LC
Southern Lapwing	*Vanellus chilensis*				LC
Spotted Sandpiper	*Actitis macularius*				LC
Stilt Sandpiper	*Calidris himantopus*				LC
Tricolored Heron	*Egretta tricolor*				LC
Tropical Mockingbird	*Mimus gilvus*				LC
Venezuelan Troupial	*Icterus icterus*				LC
Western Cattle Egret	*Bubulcus ibis*				LC
Whimbrel	*Numenius phaeopus*				LC
White-cheeked Pintail	*Anas bahamensis*				LC
White-tipped Dove	*Leptotila verreauxi*				LC
Willet	*Tringa semipalmata*				LC
Wilson's Snipe	*Gallinago delicata*				LC
Yellow Oriole	*Icterus nigrogularis*				LC
Yellow Warbler	*Setophaga petechia*				LC
Yellow-billed Cuckoo	*Coccyzus americanus*				LC
Yellow-crowned Night Heron	*Nyctanassa violacea*				LC
Lesser Black-backed Gull	*Larus fuscus*				LC
Collared Plover	*Charadrius collaris*				LC

In the described ecosystems and in addition to the observed species, there are a number of species that were not observed during the Quick Scan. However, they have a strong association with the observed biodiversity and ecosystems (Table 2). These include three species of sea turtles, the critically endangered Hawksbill (*Eretmochelys imbricata*) for which the observed sea sponges are a food source, the endangered Green sea turtle (*Chelonia mydas*) that mainly consumes Turtle grass (*Thalassia testudinum*) (Bjorndal, 1985), and the vulnerable Loggerhead (*Caretta caretta*) that eats many seagrass and coral associated invertebrates, such as urchins, conch and shellfish. At least 6 species of dolphin (*Tursiops truncatus, Steno bredanensis, Stenella longirostris, Stenella frontalis, Stenella attenuata and Stenella coeruleaoalba*) have been recorded to use the shallow waters surrounding the Isla di Oro site as refuge for birthing, nursing, resting and recovery. Other endangered species that are associated with such connected ecosystems and have been observed in habitats nearby are the Whitespotted eagle ray (*Aetobatus narinari*), Southern stingray (*Dasyatis americana*) and Lemon sharks (*Negaprion brevirostris*).
Additionally, the protected Long-spined urchin (*Diadema antillarum*) and Longsnout seahorses (*Hippocampus reidi*) are likely to be found in this ecosystem and may have been observed were a more extensive survey carried out.

Table 3: Species directly or indirectly associated with the observed ecosystems & biodiversity.

Common name	**Scientific name**	**Article 4**	**SPAW Annex**	**CITES**	**IUCN Status**
Hawksbill	*Eretmochelys imbricata*	1b	II	I	CR
Loggerhead	*Caretta caretta*	1b	II	I	VU
Green sea turtle	*Chelonia mydas*	1b	II	I	EN
Longsnout seahorse	*Hippocampus reidi*			II	NT
Long-spined urchin	*Diadema antillarum*	2b			NE
Whitespotted eagle ray	*Aetobatus narinari*				EN
Southern stingray	*Dasyatis americana*				NT
Lemon shark	*Negaprion brevirostris*				VU
Common bottlenose dolphin	*Tursiops truncatus*	1b	II	II	LC
Rough-toothed dolphin	*Steno bredanensis*	1b	II	II	LC
Spinner dolphin	*Stenella longirostris*	1b	II	II	LC
Atlantic spotted dolphin	*Stenella frontalis*	1b	II	II	LC
Pantropical spotted dolphin	*Stenella attenuata*	1b	II	II	LC
Striped dolphin	*Stenella coeruleaoalba*	1b	II	II	LC

Observed impacts

When FPNA was alerted to the presence of an excavator on the Isla di Oro reef island, part of Marine Protected Area (MPA) Mangel Halto and a reef island of the new protected nature areas (AB 2020 no. 67), FPNA immediately took drone images of the situation. The aerial footage below was taken on 9 March 2024 (Image 9). Besides the excavator on the island there is a platform visible with bags of sand.

Image 9: Aerial view of Isla di Oro on 9 March 2024. Visible are excavator, pile of demolition waste and platform with 8 cubic meter bags filled with white sand.

This platform is inside the protected area leaning on the protected Red mangroves (outside of the property borders of J.O.B. Holding and Management VBA). Upon further inspection on 11 and 12 March 2024, damage done by this platform on the mangrove roots was visible (Image 10).

Image 10: Red mangrove (R. mangle) with damaged mangrove roots.

The pile of demolition waste had been placed against this same mangrove patch on the island side (Image 9), covering some of the branches and impeding the natural space of these mangroves (Image 11).

During the site inspection and survey of 11 and 12 March 2024, the FPNA research team also observed that the sand from the bags previously seen by drone on March 9 (Image 9) had been spread out over some of the concrete paved section of the island (Image 12), as to create a beach like appearance.
As this reef island consisting mainly of coral rubble is not naturally a sandy beach, introducing sand from elsewhere can have serious impacts on the surrounding environment and is not sustainable. This artificially introduced sand will be eroded by waves, wind and rain and subsequently cover and suffocate the adjacent fragile seagrass and corals. Seagrass and coral both need sunlight to survive, being covered by sand prevents sunlight from reaching these organisms, which can ultimately be fatal.

Image 11: Red mangrove (R. mangle) branches covered and impeded by demolition waste.

Image 12: Area where white sand was spread out, covering a section along the edge of the paved island from the waste pile to the tip of the excavator.

During later observations via drone (15 March 2024) as well as in person when the excavator was removed (22 March 2024), several newly excavated holes were observed (Image 14). A total of 6 holes were counted including one in the water (Image 13) far outside of the 'erfpacht' property, officially in the protected area.

Image 14: Aerial view of Isla di Oro site on 15 March 2024 with holes visible, indicated with red arrows.

Image 13: Hole in submerged area (MPA Mangel Halto)

On 22 March 2024, while observing the removal of the excavator from the island, it was clear that any mechanical development on the island also has severe impacts in the surrounding waters. The excavator crossed through protected area outside of the 'erfpacht' property and onto the barge. While this barge is holding place in the shallow waters it causes sedimentation with its propellor thrusts and crushing of the bottom (Image 16, Image 15).

Image 16: Excavator in position to move onto barge

Image 15: Sedimentation and upwelling caused by barge in shallow water

Potential future impacts

Because of its high biodiversity and ecological significance as a key biodiversity area, it is the intention for this area to function as an ecological replenishment zone by designating it as a strict marine reserve ('no-go-zone') in the near future, as part of the sustainable and ecosystem-based management approach of Parke Marino Aruba. The necessity for replenishment zones as part of marine conservation management is well documented. The fact that the Isla di Oro site is the most suitable location for such a strict reserve has been indicated multiple times over the past decades (DIP, 2009; DNM, 2018; DIP, 2018; FPNA, 2024).
The Isla the Oro site is currently visited occasionally by some snorkelers, kayak recreation, fly fishing, and cast net fishing. No nighttime visitation is known. Allowing other increased human activity to take place in this site now would set back the recovery of this replenishment zone and hinder the possibilities of excluding such activities in the future.

Introduction of sandy beach

As the currently observed impacts are likely only the start of the planned development, it can be presumed that the developer would add more sand to cover the concrete and rubble to create the illusion of a pristine beach. However, introducing sand from elsewhere to this area would be the start of an unsustainable and vicious cycle where the sand will be added on a regular basis to maintain a sandy appearance as the waves, wind and rain keep eroding this sand into the sea – an unsustainable cycle already observed frequently along Aruba's coastline, especially in the touristic zone. This activity will cause more and more smothering and suffocation of seagrass and corals by introduced sand.

Increased human traffic

If the Isla di Oro site is to be developed, or the ruins repurposed for human activity, this will automatically cause an increase of traffic to and from the island, through MPA Mangel Halto marine reserve. Whether the visitors would come through the mangroves or from sea, both will introduce added pressure to this marine environment. These pressures can include but are not limited to:

- the widening of the trail or the creation of a new trail through the mangrove forest causing fragmentation of Aruba's largest mangrove patch;
- seagrass and coral destruction by wading through the shallow waters to and from the island;
- noise pollution from boat motors, humans conversing or shouting from excitement as they move to and from the island causing disturbance of wildlife;
- increased risks of damage or crushing by propeller, propeller thrust forces or wave action to the fragile habitats surrounding the island.

Increased human pressures

Once the visitors are on the Isla di Oro reef island, any facilities or activities will increase the pressure and anthropogenic impacts on the surrounding environment through:

- pollution by using consumables (sunscreens, food & beverage, sewage waste, etc.);
- noise pollution by human voices or music;
- light pollution for nighttime activities and or as part of a false sense of security overnight;
- wildlife disturbance, 'chasing' and wildlife feeding as many human visitors may share their food with nature. This is not only a detrimental and often fatal diet for the

animals consuming the human food, but it also takes these animals away from their ecological roles;
- trampling of fragile seagrass and corals as it is logical that visitors to such an island will want to enter the water as part of their recreational activity;
- invasive species, like the *Halophila stipulacea* seagrass, that are better adapted to human pressures can outcompete native species, having both direct and indirect impacts on the entire ecosystem and reducing biodiversity.

Noise- and light pollution
Many species, and especially the endangered migratory species such as birds, marine mammals and turtles, are very sensitive to noise- and light pollution (Probert, 2017; Crowe, 2015). Both these forms of pollution can have impacts much further than the eye can see. Noise travels much faster and further underwater. Any increased anthropogenic activity in this sensitive habitat will unavoidably include noise and light pollution and its detrimental impacts to the habitat and sensitive species.

Eutrophication
At the nature reserve directly adjacent to the Aruba Ocean Villas - another development by J.O.B. Holdings and Management VBA - it has become very clear that this developer takes no precautions to reduce their impacts on this sensitive area. So far, the developer has shown no compliance with rules or promises. Continuous wastewater influx has led to severe eutrophication (Probert, 2017; Crowe, 2015; Valiela, 1995),of this comparable system further along the coastline leading to an unnatural disbalance and unwanted changes in the environment in a relatively short time frame (FPNA, 2024). Building on this evidence, if development on Isla di Oro would commence, there is no guarantee against wastewater seepage and dumping. Many anthropologically sensitive species can still be found here in this fairly intact sanctuary that will experience significant stress, a regime shift such as witnessed at nature reserve adjacent to the Aruba Ocean Villas, and eventually ecosystem collapse should this area be anthropogenically developed.

Discussion

It is important to note that this Quick Scan conducted by the research team of FPNA does not comprise an extensive assessment of this area. Even in such a short time span and without covering the entire area nor full consideration for seasonal or diurnal variation, a very high variety of species was documented. It is evident that the Isla di Oro site is of significant importance to preserve for its high biodiversity and essential ecosystem functions. A complete environmental assessment of the area would undoubtedly result in the documentation of even more species and natural values.

At the moment of producing this Quick Scan report the exact intentions of the developer are yet unknown. Information that FPNA has received sketch a recreational attraction with a restaurant where visitors can spend the day in leisure. The potential future impacts described in this report are based on the presumption of a small-scale recreational development with occasional visitations. Even considering a small-scale development the impacts are already expected to be at an unacceptable in such an essential sanctuary site. Impacts would become even more severe if there are more intense human recreation or even lodging intentions for this site.

Conclusions

The marine sanctuary at Isla di Oro is the last remaining (relatively) undisturbed section in Aruba where the power of three – mangroves, seagrass, and corals – is still present in restorative condition and functionally interconnected as it should be. It comprises unique ecosystems and biodiversity and is of insurmountable value to the marine environment. It is also the only remaining area that has the potential to be a marine replenishment zone as a strict marine reserve.

Due to the vulnerability of these habitats for biodiversity, increased human activities in these shallow waters will have a high impact on the marine life through disturbance, trampling, crushing, dragging, increased wave action, and pollutants, ultimately leading to its demise. These human induced added pressures will however, through increased human activity in this area, not only result in biodiversity loss of this area itself. The expected impacts on the replenishment zone and tranquility of the surroundings would eventually also impact the values for biodiversity, fisheries, and ecotourism in Aruba's South Coast as a whole.

Recommendations

Based on the presented findings FPNA recommends keeping this marine sanctuary as pristine as possible and even further developing the natural values through evidence-based restoration like the 'Turning the Tide' project and full protection as a strict marine reserve. Any anthropogenic development would impede the natural replenishment potential of this site.

Through awareness raising, advocacy and educational outreach, the unique value of this area can be further highlighted. It is important to inform people to appreciate the value of this area without having to physically visit it. Due to its fragile state, people are encouraged to not impact the area at all and appreciate its value from a far distance, allowing its ecosystem functions to continue unimpeded.

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Fundacion Parke Nacional Aruba (FPNA) is an independent conservation management organization, encharged with the conservation of nature, and the management of protected areas in Aruba which as of today encompass just over 24.3% of Aruba's natural terrain and 0.02% of Aruba's territorial waters in the form of 4 Marine Protected Areas (MPAs) at Oranjestad, Mangel Halto, Sero Colorado and Arikok.

PARKE NACIONAL ARUBA

FPNA's conservation management philosophy is characterized by an integrated and inclusive approach to nature conservation with a focus on heterogeneity and island wide connectivity of nature to maintain long term ecological sustainability, integrity of our biosphere, and related ecological processes. At FPNA, by our 8 guiding conservation principles, we apply strategic, evidence-based, precautionary, adaptive, and integrated conservation management to address conservation issues, deliver conservation objectives and critically evaluate all our conservation endeavors. We work according to the principles of Ecosystem-Based Management (EBM) and Biodiversity Conservation, using the Conservation Standards (Theory of Change) to deliver high conservation performance.

Ecosystem-Based Management (EBM) is an integrated management approach applied by FPNA in all conservation efforts. EBM aims to manage in an integrated and precautionary manner human uses and their cumulative impacts on terrestrial, marine and coastal ecosystems functioning on an ecological scale, rather than confined to jurisdictional boundaries or considering single issues, species or ecosystem services in isolation.

Biodiversity Conservation goes hand in hand with habitat and ecosystem conservation. FPNA prioritizes in-situ biodiversity conservation with a strong focus on the conservation of endemic species, keystone species, threatened/endangered species and the mitigation of invasive/alien species.

Whenever and wherever necessary, FPNA will apply the *precautionary principle* as a strategy to cope with possible risks where scientific understanding is yet incomplete, as is often the case for Aruba. Where serious or irreversible damage is imminent, the lack of full scientific certainty should not be used as a reason to continue activities and to not postpone measures to prevent degradation of nature and the environment.