DRAFT - A Review of Bermuda's Proposed MPA Design for the Offshore Area

Purpose of this report

The purpose of this report is to ensure the Marine Protected Area (MPA) design adequately balances ecological protection with the operational practicalities of fishing and enforcement. Based on the October 2024 recommendations of the Independent Review Panel, this report reviews the existing MPA proposals for the offshore area and compares them against different ring-shaped options. The relative advantages and disadvantages of each option are discussed in the context of achieving ecological habitat targets, conservation potential, enforceability, future monitoring and stakeholder engagement.

Introduction

This report shows options and information for offshore marine protected areas based on the October 2024 Bermuda Ocean Prosperity Programme (BOPP) review panel comments on the Final Draft Marine Spatial Plan (MSP). The options considered are:

1. Ring shaped MPAs covering the outer 20%, 30%, 40% and 50% of Bermuda's waters. In the report, these options are named "Ring 20", "Ring 30", "Ring 40" and "Ring 50" respectively.
2. As above, but inset from the Exclusive Economic Zone (EEZ) boundary by 30km. In the report, these options are named "Inset 20", "Inset 30", "Inset 40" and "Inset 50" respectively.
3. MPA options with rectangle and triangle shaped cut-outs of the EEZ. The rectangle shaped cut-outs are not exact rectangles because the outer boundary of Bermuda's EEZ is not a circle. Therefore the 'rectangles' are not true rectangles, rather quadrilaterals.
4. Another option which has the proposed Muir Seamount (A13) MPA and a ring shaped MPA covering the remaining area required to reach 20% of Bermuda's waters. In addition, the proposed, lightly protected Crescent Seamount MPA is included, but does not count to the 20% protection total. This option is named "Seamounts + ring 20". Summary information for this option is shown with and without the Crescent Seamount MPA included.

For each of these options, the following summary information is provided:

a) Area of the EEZ and offshore planning area covered

b) Boundary to area ratio – the larger the ratio, the more complex the shape of the MPA. Complex shapes have less conservation potential and are harder to enforce.
c) The percentage of offshore habitats and biodiversity features covered by each option. These are the same features that were used in the prioritization modelling process that helped inform the placement of the draft offshore MPAs.

Maps of each MPA shape option

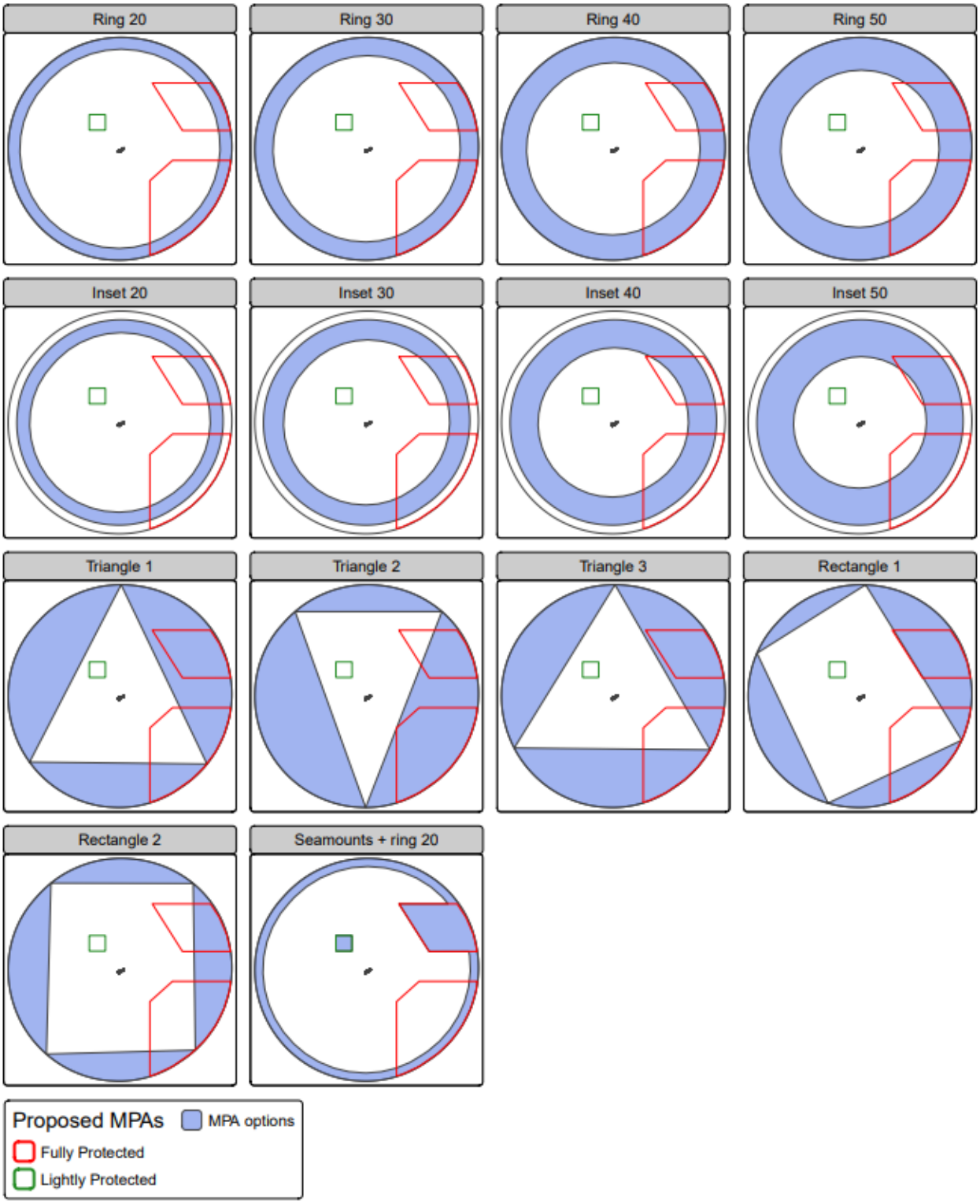

Figure 1: Map showing MPA shape options and draft proposed MPAs for reference.

MPA shape option statistics and spatial overlap

Option	Area as % of EEZ	Area as % of offshore planning area	Boundary: area ratio (x10,000)
Proposed MPAs	20.6	20.7	2.1
Ring 20	20.3	20.4	4.9
Ring 30	30.2	30.4	3.2
Ring 40	40.2	40.4	2.3
Ring 50	50.2	50.4	1.8
Inset 20	20.2	20.3	4.4
Inset 30	30.2	30.4	2.9
Inset 40	40.1	40.4	2.1
Inset 50	50.1	50.4	1.6
Triangle 1	58.9	59.2	1.6
Triangle 2	64.1	64.5	1.5
Triangle 3	58.5	58.8	1.6
Rectangle 1	38.5	38.8	2.6
Rectangle 2	37.2	37.4	2.6
Seamounts + ring 20	20.6	20.8	5.4
Seamounts + ring 20 no Crescent	20.0	20.1	5.3

Table 1: Ring MPA areas and boundary to area ratio

Option	Abyssopelagic	Bathypelagic	Cold coral	Escarpments	Knolls	Pelagic zone 1	Pelagic zone 2	Pelagic zone 3	Plains	Seamounts	No. targets met
Proposed MPAs	20	39	62	28	28	20	23	20	16	95	9
Ring 20	20	2	0	14	14	15	30	19	22	14	3
Ring 30	30	4	0	15	23	23	45	28	32	24	6
Ring 40	40	9	0	18	30	31	59	38	43	37	6
Ring 50	50	11	0	25	37	40	72	48	53	55	8
Inset 20	20	6	0	5	16	16	30	19	21	19	3
Inset 30	30	7	0	7	22	25	43	29	32	36	6
Inset 40	40	23	29	16	32	33	56	39	42	54	8
Inset 50	49	34	62	18	44	43	67	49	50	72	8
Triangle 1	58	36	62	24	45	49	70	62	62	90	9
Triangle 2	63	28	62	37	66	68	84	47	63	65	9
Triangle 3	58	36	62	25	50	41	95	55	60	90	9
Rectangle 1	38	36	62	20	30	24	54	44	39	84	9
Rectangle 2	37	9	0	17	25	34	46	34	40	41	7
Seamounts + ring 20	20	40	62	18	13	11	21	30	21	95	6
Seamounts + ring 20 no Crescent	19	36	62	16	12	10	21	29	20	86	5

Table 2: Percentage of each feature found within each MPA shape option. This is the same information as the plot above, but in table format. Red numbers indicate target for that habitat was not met. Last column is total number of targets met (out of 10) for that option.

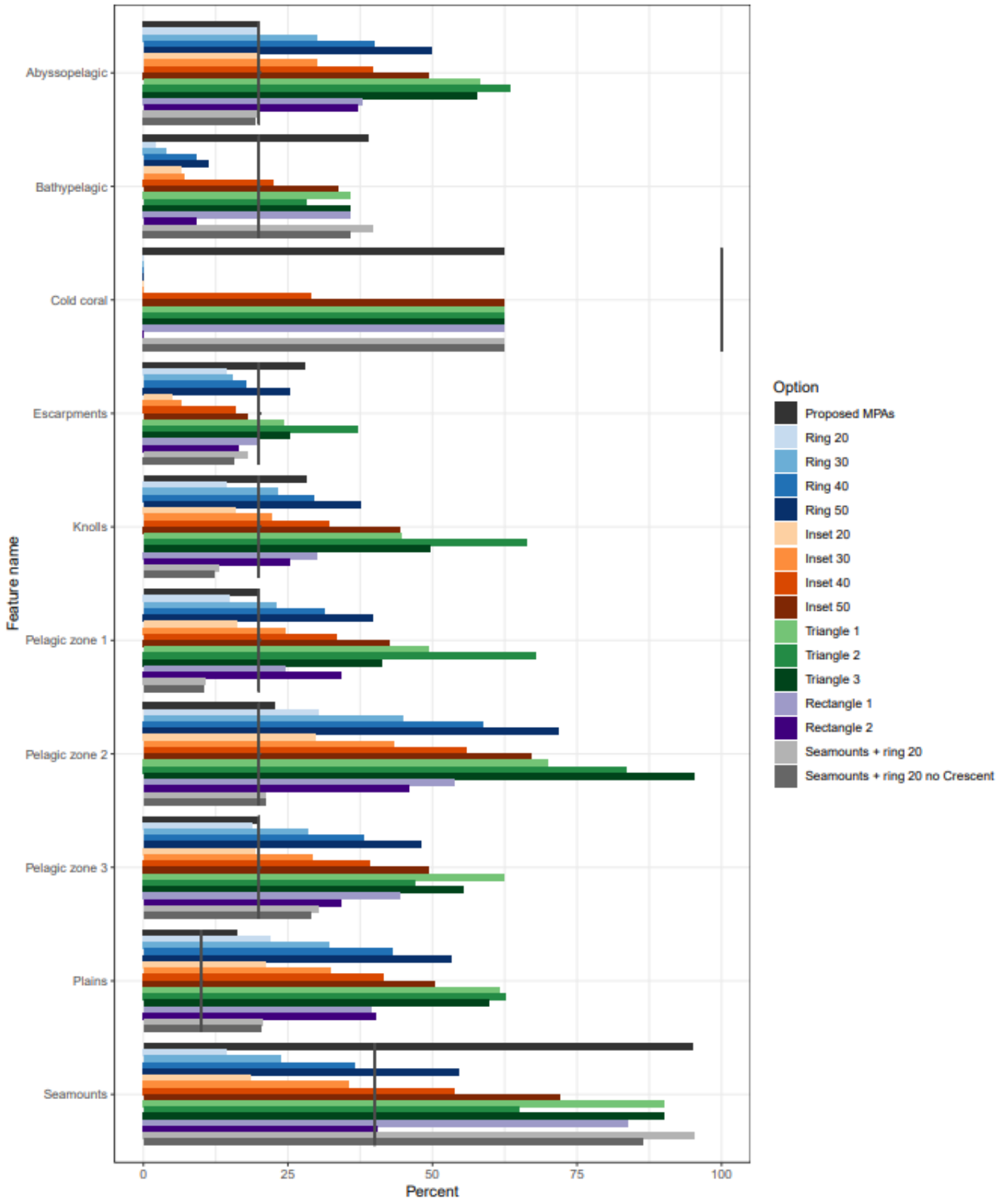

Figure 2: Percentage of each feature found within each MPA shape option. Target percentages (from the prioritization) indicated by black lines.

Review of MPA design options

Achieving habitat targets

The "Proposed MPAs" option as detailed in the Final Draft MSP achieves the highest number of habitat targets. This helps to meet the MSP's approved objective of protecting 20% of each habitat, which is recommended by scientists to ensure habitat resilience, sustained biodiversity and to promote ecosystem connectivity[1]. The only other MPA options that achieve the same habitat targets are "Triangle 1", "Triangle 2", "Triangle 3" and "Rectangle 1", which occupy between 38.5% and 64.1% of the EEZ area (compared to just 20.6% of the "Proposed MPAs" option). As the "Proposed MPAs" option achieves the same habitat targets with substantially less area protected, this would be a better option for reducing conflict with fishers (as it leaves more fishing grounds open) while still providing adequate ecological protection. The "Seamounts + ring 20" option protects the same amount of area as the "Proposed MPAs" but achieve only 6 of the 10 habitat targets. None of the "Ring" or "Inset" options meet the same number of habitat targets. The "Proposed MPAs" option also matches the areas identified by a prioritization assessment – a data driven method of identifying protected areas in a way that best meets conservation objectives while minimising user conflict.

Enforceability and conservation potential

The conservation potential and enforceability of an MPA is linked to the complexity of the MPA shape, for example, a simple square would be easier to enforce than a shape with many edges such as a star or hexagon, as the boundaries are easier to mark and navigate. Complex shapes also have proportionately more boundary and will therefore increase the likelihood of fish crossing over into areas where they become vulnerable to exploitation, making them less effective at preserving ecological value[2]. Enforceability is also affected by the sea state, prevailing winds, and the distance and direction from shoreline access points.

The complexity of an MPA network design is represented in this report via the 'boundary-to-area ratio', where lower ratios indicate simpler shapes, and therefore more conservation potential and greater ease of enforcement of the network. The "Proposed MPAs" option detailed in the Final Draft MSP is composed of relatively simple shapes and has a total boundary-to-area ratio of 2.1. The "Ring 50", "Inset 50", "Triangle 1", "Triangle 2" and "Triangle 3" options have lower boundary-to-area ratios and so theoretically have greater enforceability and conservation potential, while the "Inset 40" option achieves the same ratio as the "Proposed MPAs". However, these other options occupy between 40.1% and 64.1% of the EEZ area (compared to just 20.6% of the

[1] McLeod, Elizabeth, et al. "Designing marine protected area networks to address the impacts of climate change." *Frontiers in Ecology and the Environment* 7.7 (2009): 362-370

[2] Roberts, C. M., J. A. Bohnsack, F. Gell, J. P. Hawkins and R. Goodridge (2001). Effects of Marine Reserves on Adjacent Fisheries. Science 294.

"Proposed MPAs" option), which is considered too large an area to restrict fishing and would result in high user conflict. The other options (particularly the options containing the thinner rings) have substantially higher boundary-to-area ratios. These designs would reduce the likelihood of habitats and associated communities receiving adequate benefit from protection. The added complexity of these shapes also makes them more difficult to enforce and would require enforcement around the entire perimeter of the EEZ, whereas the "Proposed MPAs" option only borders the EEZ outer edge in two areas to the east and south-east.

Bermuda's Marine Resources Enforcement Strategy (MRES) provides comprehensive information on enforcement capacity and planning for the offshore area, and refined details can be found in the associated action plan for enforcement[3]. The MRES aims to align with the wider Caribbean Community (CARICOM) Implementation Agency for Crime and Security (IMPACS) Caribbean Maritime Security Strategy (CMSS), to build on existing partnerships, close legislative loopholes, and engage the public about current regulations and practices to ensure that MPAs are adequately enforced.

The proposed network of protected areas has been carefully designed with direct input from enforcement stakeholders, including the Royal Bermuda Regiment Coast Guard. The design and layout have been reviewed and endorsed as "enforceable" by experts from the Government of Bermuda, the Waitt Institute, and Auxilium Worldwide. The MPA boundaries follow straight lines of latitude and longitude where possible, making them easy to monitor using basic GPS equipment, and will be integrated into nautical charts and navigation software upon implementation.

To bolster enforcement capacity, Bermuda has established key external partnerships, including collaborations with the US Coast Guard and the UK Blue Belt Ocean Shield program. These partnerships provide access to advanced offshore surveillance, which has confirmed that illegal fishing by foreign commercial vessels poses a low threat, though authorities receive alerts when risks arise. Additionally, a ship rider agreement in development will empower Bermuda's enforcement officers to join US Coast Guard patrols, expanding their operational reach.

Bermuda's Marine Resources Enforcement Strategy (MRES) serves as a guiding framework for offshore enforcement capacity and planning. Aligned with the CARICOM IMPACS Maritime Security efforts, the MRES aims to strengthen interagency coordination, close legislative gaps, and promote public awareness to ensure effective MPA enforcement. Key elements of the strategy include:

[3] Government of Bermuda (2025) Enforcement Action Plan for Bermuda's MSP. https://www.dropbox.com/scl/fi/6bj5dbqhfmog2zllctomk/Enforcement-Action-Plan-V6.pdf?rlkey=9nn9n6xn8lnb0vok5kaa0s2ya&e=1&dl=0

- **Expanding Enforcement Capacity Through Partnerships**: Increased collaboration with agencies such as the US Coast Guard, UK Blue Belt Ocean Shield, and Bermuda's Maritime Operations Centre enhances Bermuda's ability to patrol and interdict in offshore areas.
- **Optimizing Existing Resources**: The Royal Bermuda Regiment and other local agencies have the capability to enforce regulations, but resource mobilization and strategic coordination will be necessary to achieve high compliance rates.
- **Addressing Compliance Challenges**: Similar to traffic laws and posted speed limits, some degree of non-compliance is inevitable. The enforcement strategy will continuously assess and mitigate emerging compliance issues with the best available technology and applied enforcement tactics.
- **Adaptive Management**: The MRES emphasizes a collaborative, adaptive approach to enforcement, allowing authorities to respond effectively to evolving threats and compliance challenges.
- **Building Long-Term Compliance Through Outreach**: Public engagement and education efforts will foster greater stewardship of marine resources, ultimately reducing the need for enforcement interventions.

By integrating robust enforcement measures with proactive compliance strategies, Bermuda's approach ensures that its MPAs remain effectively protected, safeguarding marine biodiversity while promoting sustainable ocean management. However, strong enforcement and public adherence to regulations are essential to prevent undermining the integrity of the network's design and the valuable input contributed by stakeholders across government, enforcement agencies, and conservation organizations. Without consistent enforcement, illegal activities could threaten marine ecosystems, weaken public trust in the management framework, and diminish the effectiveness of collaborative efforts. Ensuring compliance through regular patrols, surveillance, and legal accountability will reinforce the credibility of the MPA network and uphold the commitments made by those involved in its creation. Moreover, fostering a culture of stewardship through education and outreach will encourage voluntary compliance, reducing the burden on enforcement agencies over time. Only through this balanced approach—where enforcement is strong, compliance is high, and public engagement remains ongoing—can Bermuda fully realize the long-term conservation and economic benefits of its protected marine areas.

Future monitoring

Monitoring offshore waters is challenging but feasible. Bermuda Institute of Ocean Science (BIOS) already conduct oceanographic measurements of the Sargasso Sea within offshore areas of Bermuda's EEZ and have been active partners in the development and design of the "Proposed MPA" option. The BOPP Science Committee (comprised of more than 15 local marine scientists) has discussed practical methods

for monitoring offshore waters, including the use of hydrophones and eDNA sampling to assess community composition in valuable habitats such as seamounts. These ideas will be considered in the MSP Monitoring and Evaluation Plan, which is currently being prepared.

Stakeholder Engagement

The BOPP Science Committee helped to draft the first set of area objectives to serve as an 'instruction manual' to aid the design of Bermuda's new MPA network based on global and local science. The draft objectives were released to the public in October 2020, following which further refinements were made[4].

The Ocean Use Survey[5][6] (OUS) was conducted from September 2020 to February 2021 to statistically assess how the Bermuda public uses and values the ocean. This data was used alongside science-derived ecological data in a prioritization assessment. This is a data-driven assessment where a computer algorithm identifies priority areas for protection based on local ecological data, while at the same time minimising impact to fishers, as measured by the values assigned to areas by fishermen during the OUS.

This information was used by the Steering Committee to design several MPA network options for consideration[7][8]. Taking account of the scientific evidence and overall stakeholder input, an early version of the "Proposed MPA" option was voted favourable since it adopted a balanced approach between environmental and stakeholder needs. At the same time, the Steering Committee also considered a modified outer ring option after receiving feedback from commercial fishing representatives. This was voted out due to its poor design and failure to meet the ecological objectives of the MSP. As demonstrated in this report, the ring designs do not meet required habitat targets and have lower enforceability and conservation potential.

The "Proposed MPAs" option is the result of science-driven processes and has acquired support from various stakeholders, including some commercial fishermen. Survey data suggests that there is little commercial fishing activity taking place in the proposed fully protected MPAs in the offshore. Feedback from those businesses potentially affected has been incorporated into MPA design to minimise impact. Additionally, 80% of Bermuda's EEZ will remain open to fishing, providing ample opportunities for the

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[4] BOPP Steering Committee, (2021) BOPP | Principles, Goals, Objectives for Bermuda's Marine Spatial Plan | 47d1fd_265059d33fc64e80a1b4b11ad31a0bce.pdf (bermudaoceanprosperity.org)
[5] BOPP (2021) | Bermuda Ocean Use Survey Results | 47d1fd_a9abc9b46947449697fa3094bbf215b3.pdf (bermudaoceanprosperity.org)
[6] BOPP & SeaSketch (2023) Bermuda Ocean Use Survey Results, Appendix 3: Additional Commercial Fishing Data | a5608098-1e68-4545-8d8f-3792e27f704a.filesusr.com/ugd/418ca0_e1ad7c3f12144f018a4190ff6464d233.pdf
[7] BOPP Steering Committee (2022) | Drafting of Marine Protected Area (MPA) Scenarios in Bermuda's Waters | 47d1fd_dc360deb47bb418c94c9d31323bcce9d.pdf (filesusr.com)
[8] BOPP Steering Committee (2022) | MPA Network Proposals: Supplemental Materials | 47d1fd_a7a81557b8b544849eee7972e7cffee7.pdf (filesusr.com)

Island's pelagic fishing industry to expand while facilitating sustainable fish stocks into the future. MPAs are just one tool that will be implemented alongside other priority measures identified by stakeholder (including commercial fishers), such as improved enforcement, monitoring and licencing.

Conclusion

The "Proposed MPAs" option offers the best balance between environmental protection and reducing user conflict compared to other options. The design has been guided by sound scientific concepts and has been refined over several years to account for feedback from different user groups, including those whose livelihoods depend on the ocean. Through partnerships, Bermuda has the capacity to effectively enforce and monitor this MPA network design in the offshore, and improvements continue to be made in these areas. MPAs are just one tool that will be implemented alongside other measures such as improved enforcement, monitoring, and licensing, to bring lasting benefits to Bermuda's ocean and those who rely on it.