



BIOPHYSICAL DESIGN PRINCIPLES FOR OFFSHORE NETWORKS OF NO-TAKE MARINE PROTECTED AREAS

TECHNICAL SUMMARY



Marine and Coastal Biodiversity Management
in Pacific Island Countries



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Marine Spatial Planning is an integrated and participatory planning process and tool that seeks to balance ecological, economic, and social objectives, aiming for sustainable marine resource use and prosperous blue economies.

The MACBIO project supports partner countries in collecting and analyzing spatial data on different forms of current and future marine resource use, establishing a baseline for national sustainable development planning.

Aiming for integrated ocean management, marine spatial planning facilitates the sustainable use and conservation of marine and coastal ecosystems and habitats.

This technical summary describes biophysical principles to design offshore networks of no-take Marine Protected Areas. It is part of MACBIO's support to its partner countries' marine spatial planning processes. These processes aim to balance uses with the need to effectively manage and protect the rich natural capital upon which those uses rely.

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On behalf of:
Federal Ministry
for the Environment, Nature Conservation,
Building and Nuclear Safety
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No-take marine protected areas (MPAs) that prohibit extractive uses are one of the most effective tools for protecting marine ecosystems from destructive and extractive human activities. They have been used in coastal seas all over the world, often according to widely accepted design principles or guidelines that enhance the likelihood of their success. Increasingly, they are also being implemented in the open ocean. Using knowledge about offshore ecosystems and existing MPA design principles, we developed ten comprehensive biophysical design principles for offshore, no-take MPA networks.



PRINCIPLE 1: REPRESENT ALL BIOREGIONS¹

1a. Represent at least 20–30% of marine bioregions in no-take MPAs

Protection of all habitats, flora and fauna, ecosystem function, integrity and resilience requires that adequate examples of every bioregion are included in no-take areas.

1b. Represent at least 20-30% of marine bioregional transition boundaries in no-take MPAs

Boundaries and transition zones between bioregions in the open ocean tend to aggregate a high diversity and density of open ocean species.



PRINCIPLE 2: REPRESENT ALL HABITATS

Represent at least 10–30% of each known habitat or feature² in no-take MPAs, with special considerations where bioregions are unknown.

To ensure future sustainability of offshore marine environments, examples of the full range of known and mapped biophysical habitats must be included in no-take MPAs.



PRINCIPLE 3: REPRESENT WHOLE FEATURES / HABITATS, WHENEVER POSSIBLE

Mappable features of the open ocean include known areas of high productivity, diversity or significant ecological processes, and need to be protected in their entirety.



PRINCIPLE 4: HAVE AT LEAST THREE REPLICATE NO-TAKE MPAS WITHIN BIOREGIONS AND INCLUDE AT LEAST ONE EXAMPLE OF EACH HABITAT OR FEATURE

4a. Have at least three replicates: within bioregions; of very large features; of known habitats and of ecological processes

Replication of protection minimizes the risk of losing all examples of a habitat, population or assemblage in the case of disturbance. Replication also enhances representation of biological heterogeneity within poorly known habitats.

4b. Include at least three areas along the migration path of migratory species or within ranges of highly mobile species

Where it is not possible to protect an entire migration pathway or species range, placing several replicate no-take MPAs at critical points along the migration route or within the range can disproportionately benefit the whole population.

¹ Where marine bioregions have been defined at a scale useful for management.

² Shelf valleys, slope terraces, slope, abyssal and hadal escarpments, shelf-incising canyons connected to river systems, other shelf incising river systems, blind canyons, basins, ridges, troughs, bridges, fans 10% each; trenches and plateaus 15% each; shelf, abyssal and hadal sills, each type of seamounts 20% each; coral reefs and oceanic islands that emerge from >80m 25%; epipelagic, mesopelagic, bathypelagic, abyssopelagic, hadopelagic and any other habitats 20-30%.



PRINCIPLE 5: INCLUDE SPECIAL, UNIQUE OR RARE FEATURES AND/OR SPECIES

This may include, for example, unique geomorphologic or hydrodynamic features, areas important for aggregation, nurseries, spawning, foraging, offshore nesting sites, migratory staging points, mammal calving areas, areas with high biodiversity, endemism, productivity or with threatened, isolated or rare species or habitats.



PRINCIPLE 6: MAKE MPAS LARGER RATHER THAN SMALLER

6a. Inshore (coast to edge of shallowest adjacent habitats): Make no-take MPAs 400m–2km in diameter

This guideline is for inshore areas and matches the range, distribution and dispersal patterns associated with many inshore habitats and species.

6b. Nearshore (outer edge of coastal habitat e.g. outer edge of reef to 80m contour): Make no-take MPAs 2–10km in diameter

Further offshore, habitat features, species ranges and dispersal patterns tend to be larger.

6c. Offshore (beyond 80m contour): Make no-take MPAs 50–200km in diameter

Offshore ecosystems host migratory and wide-ranging species, and habitats and special, unique features tend to be larger than in inshore or nearshore environments. However, even these species and habitats are now known to benefit from protection of part of their range, migration route or spatial occupation.



PRINCIPLE 7: MAKE MPAS SIMPLE SHAPES AND MAXIMISE THE AREA TO BOUNDARY RATIO

Simple shapes, such as squares, maximize the area in the centre of an MPA, reduce the complexity of boundaries and reduces boundary length, thus facilitating compliance.



PRINCIPLE 8: SPACE MPAS TO MAXIMISE CONNECTIVITY BETWEEN THEM

8a. Inshore (coast to edge of shallowest habitats): Distance between no-take MPAs should be between 500m and 5km

This guideline is for inshore areas and matches the range, distribution and dispersal patterns associated with many inshore habitats and species.

8b. Nearshore (edge of slope to 80m contour): Distance between no-take MPAs should be between 5 and 20km

Connectivity beyond the edge of shallow habitats tends to be naturally lower, and can occur over larger distances.

8c. Offshore (beyond 80m contour): Distance between no-take MPAs should be between 20 and 200 km

Because of the wide-ranging or widely distributed nature of offshore populations, genetic connectivity is possible across very large areas.



PRINCIPLE 9: CHOOSE PERMANENT PROTECTION OVER TEMPORARY PROTECTION

Permanent protection enhances the likelihood of recovery of populations and habitats, even if they are very long-lived, slow-growing or heavily damaged.



PRINCIPLE 10: APPLY OTHER MPA CATEGORIES, WHICH ALLOW FOR EXTRACTIVE ACTIVITIES, ONCE 20-30% OF BIOREGION/HABITATS IS ADEQUATELY PROTECTED IN NO-TAKE MPAS

Reducing threats to other categories of MPAs and to surrounding areas will enhance the effectiveness of no-take MPAs and the area as a whole.

SOURCE: Ceccarelli DM, Matoto V, Raubani J, Jones GP, Fernandes L (2018) Biophysical design principles for offshore networks of notake Marine Protected Areas. MACBIO (GIZ/IUCN/ SPREP): Suva, Fiji. 56 pp.



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