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Zoning—lessons from the Great Barrier Reef Marine Park

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Abstract

The Great Barrier Reef Marine Park (GBRMP) is bigger than the United Kingdom, Holland and Switzerland combined. Over the last 25 years a range of management 'tools', including zoning plans, permits, education, and more recently management plans, have been applied to regulate access and to control and mitigate impacts associated with human use of the GBRMP. A multiple-use zoning approach provides high levels of protection for specific areas whilst allowing reasonable uses, including certain fishing activities, to continue in other zones. Zoning has long been regarded as a cornerstone of Marine Park management, separating conflicting uses through application of the various zones and determining the appropriateness of various activities. Zoning in the GBRMP has evolved and changed considerably since the first zoning plan in 1981, along with other management approaches. This paper outlines what aspects of zoning have worked well, what has necessarily changed, and the zoning lessons learned from over two decades of 'adaptive management'.

1. Introduction

The Great Barrier Reef (GBR) Marine Park covers an area of approximately 345,000km^2; bigger than the United Kingdom, Holland and Switzerland combined and almost the size of California. Contrary to popular belief, the Great Barrier Reef is not a continuous barrier, but a broken maze of over 2900 individual reefs, and some 940 islands and coral cays. The reefs range enormously in size from <1 ha to more than 100km^2; some fringe islands or the mainland coast, while those offshore range from flat, platform reefs to elongated ribbon reefs.

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While the coral reefs initially made the area famous, the Marine Park comprises an amazing variety of other communities and habitats including mangrove estuaries, seagrass beds, algal & sponge 'gardens', sandy or muddy bottom communities, continental slopes and deep ocean troughs. This extraordinary biological diversity and the interconnectedness of the habitats and species makes the Great Barrier Reef and the surrounding areas one of the richest and most complex natural systems on earth. While coral reef, mangrove and seagrass habitats occur elsewhere, no other marine protected area or World Heritage Area contains such biodiversity. As the world's largest coral reef ecosystem, the GBR is also a critical global resource.

The GBR Marine Park extends over 14° of latitude and from the coast seaward to 100–300 km offshore, beyond the edge of the continental shelf. The inshore boundary of the Marine Park generally follows the low water mark along the coast. The GBR Marine Park does not include some relatively small nearshore areas under the jurisdiction of the State of Queensland nor the majority of the islands within its outer boundaries. Virtually all the activities on the adjacent mainland or islands are outside the direct jurisdiction of the GBR Marine Park Authority (GBRMPA) which has the responsibility for management of the GBR Marine Park. The legislation, however, does have provision to regulate activities outside the GBR that could have adverse impacts; an important issue as the well-being of the Marine Park is strongly influenced by activities on the land.

The Commonwealth (Federal) and State Governments have a cooperative and integrated approach to management of the GBRWHA built on an agreement signed in 1979. The Commonwealth Government, through GBRMPA, is responsible for both the GBR World Heritage Area and the GBR Marine Park.[1] Field-based, day-to-day management (DDM) of the Marine Park is jointly funded and conducted primarily by Queensland agencies within programs and guidelines approved by the Authority. DDM activities, undertaken mainly by officers of the Queensland Parks and Wildlife Service, include enforcement, surveillance, monitoring and education, as well as the management of adjacent Queensland Marine Parks and island National Parks.

Other Queensland and Commonwealth agencies also involved in DDM include the Queensland Boating and Fisheries Patrol, the Queensland Water Police, the Australian Customs Service (Coastwatch) and the Australian Maritime Safety Authority. Joint management has been assisted by the application of complementary legislation including complementary zoning for most adjoining State waters; this also reduces the complexities for Reef users.

The Great Barrier Reef supports a major part of Australia's economy with an estimated economic worth of more than A$1.2 billion per annum. Tourism provides about A$700 million per annum; commercial fishing around A$250 million per

[1] The GBR World Heritage Area is slightly larger than the Great Barrier Reef Marine Park as it includes internal waters of the State of Queensland, all the islands within the outer boundaries (mainly State jurisdiction) and a number of small areas along the mainland coast excluded from the GBR Marine Park. The World Heritage Area is complex jurisdictionally, with both the Federal and State Governments involved in the management of the waters and islands.

annum and the large recreational fishing and recreational boating sector is worth about A$270 million per annum.

Effective management of such a huge and complex area requires balancing reasonable human use with the maintenance of the area's natural and cultural integrity. The enormity of this task is compounded by the political and the jurisdictional complexities determined by Australia's system of Federalism; the economic importance of the area; the close proximity of rural and urban populations to the coast and their dependence upon the adjoining marine and coastal areas; the range of users and interest groups whose use patterns frequently compete and displace each other; the need for equity and fairness in access to resources; and the unique and diverse ecological values of the region.

Since the *Great Barrier Reef Marine Park Act* was passed in 1975, the GBR Marine Park has been managed in accordance with the Goal of the Marine Park Authority:

> To provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the care and development of the Great Barrier Reef Marine Park.

This clearly requires protection of the area's biodiversity whilst providing for reasonable use. Consequently over the last 25 years a range of management 'tools',[2] including zoning plans, permits, education and management plans have been applied to regulate access and to control and mitigate impacts associated with human use of the GBR Marine Park [1].

2. Background to zoning within the GBR

Zoning is basically a spatial planning tool that acts like a town planning scheme.[3] Most contemporary texts on managing marine areas refer to the concept of zoning to separate conflicting uses or to keep sensitive, ecologically valuable or recovering areas free from use, for example [2–4].

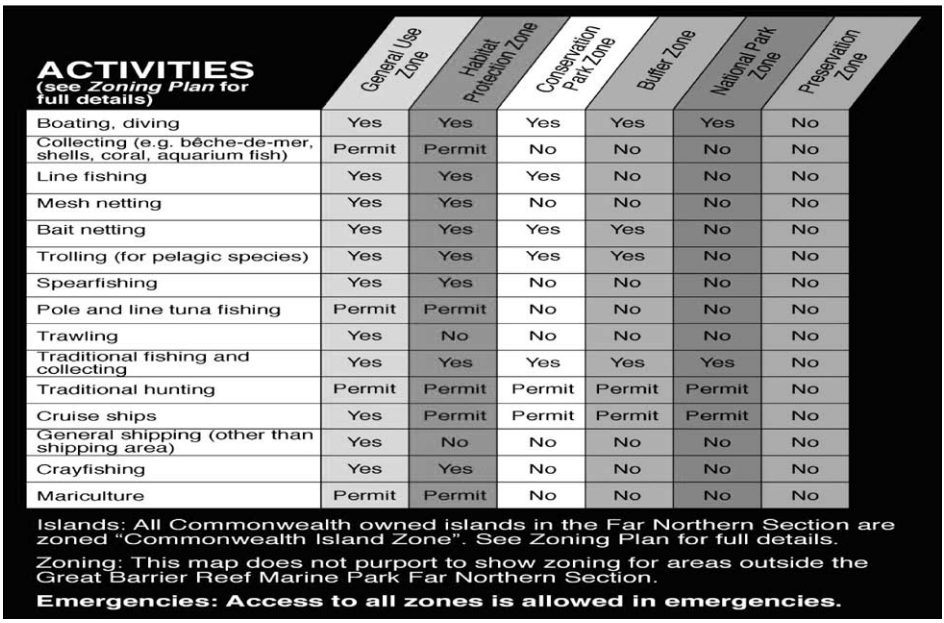
Kenchington [5] outlines the history of why and how zoning was initially applied in the GBR. Since the first GBR zoning plan (ZP) was prepared in 1981, zoning has been widely regarded as the cornerstone of GBR management.

The broad objectives of zoning in the GBR Marine Park are set out in the legislation:

- the conservation of the Great Barrier Reef;
- the regulation of the use of the Marine Park so as to protect the GBR while allowing reasonable human use of the GBR Region;

[2] A summary of the main management 'tools' is provided in Table 3.

[3] A town-planning scheme allows certain activities like residential development, to occur in specified areas, but recognizes that other incompatible activities like industry should only occur in other specially designated areas. In this way zoning provides area-based controls and separates conflicting uses.



ACTIVITIES (see *Zoning Plan* for full details)	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Buffer Zone	National Park Zone	Preservation Zone
Boating, diving	Yes	Yes	Yes	Yes	Yes	No
Collecting (e.g. bêche-de-mer, shells, coral, aquarium fish)	Permit	Permit	No	No	No	No
Line fishing	Yes	Yes	Yes	No	No	No
Mesh netting	Yes	Yes	No	No	No	No
Bait netting	Yes	Yes	Yes	Yes	No	No
Trolling (for pelagic species)	Yes	Yes	Yes	Yes	No	No
Spearfishing	Yes	Yes	No	No	No	No
Pole and line tuna fishing	Permit	Permit	No	No	No	No
Trawling	Yes	No	No	No	No	No
Traditional fishing and collecting	Yes	Yes	Yes	Yes	Yes	No
Traditional hunting	Permit	Permit	Permit	Permit	Permit	No
Cruise ships	Yes	Permit	Permit	Permit	Permit	No
General shipping (other than shipping area)	Yes	No	No	No	No	No
Crayfishing	Yes	Yes	No	No	No	No
Mariculture	Permit	Permit	No	No	No	No

Islands: All Commonwealth owned islands in the Far Northern Section are zoned "Commonwealth Island Zone". See Zoning Plan for full details.

Zoning: This map does not purport to show zoning for areas outside the Great Barrier Reef Marine Park Far Northern Section.

Emergencies: Access to all zones is allowed in emergencies.

Fig. 1. Zoning matrix for the Far Northern Section, Great Barrier Reef Marine Park.

- the regulation of activities that exploit the resources of the GBR Region so as to minimise the effect of those activities on the GBR;
- the reservation of some areas of the GBR for their appreciation and enjoyment by the public; and
- the preservation of some areas of the GBR in its natural state undisturbed by man except for the purposes of scientific research.

(s. 32(7), *Great Barrier Reef Marine Park Act 1975* [6])

The GBR zoning plans are required by the Act to define the purposes for which areas of the Marine Park may be used or entered. They allow reasonable activities, such as tourism, fishing, boating, diving and research to occur in specific areas, but also separate conflicting uses by the various zones and determined the appropriateness of various extractive activities (refer to the zoning matrix in Fig. 1).

A multiple-use zoning approach provides high levels of protection for specific areas whilst allowing a range of reasonable uses, including certain extractive activities, to continue in other zones. Table 1 outlines the multiple-use zoning spectrum in the GBR.

Since the first zoning plan in the Marine Park, zoning has evolved and changed, along with other management approaches. Considerable experience has now been gained with zoning as to what has worked well, and not so well, both within the

Table 1
Outline of zoning provisions in the Great Barrier Reef

General Use Zone/*General Use 'A' Zone*—least restrictive of all the zones; it provides for all reasonable uses, including shipping and trawling. Prohibited activities include mining, oil drilling, commercial spear fishing and spear fishing with SCUBA.

Habitat Protection Zone/*General Use 'B' Zone*—provides for all reasonable uses, including most commercial and recreational activities. Shipping and trawling are prohibited as well as those activities not allowed in General Use 'A' Zone.

Conservation Park Zone/*Marine National Park 'A' Zone*—provides for appreciation and recreational use, including limited line fishing (one line/hook per person). Spear fishing and collecting are prohibited as well as those activities not allowed in General Use 'B' Zone.

Buffer Zone/*Marine National Park 'Buffer' Zone*—similar to and adjacent to MNP 'B' zones, but allows pelagic trolling. All those activities not allowed in Marine National Park 'A' Zone are also prohibited.

National Park Zone/*Marine National Park 'B' Zone*—provides for appreciation and enjoyment of areas in their relatively undisturbed state. It is a 'look but don't take' zone, in which all forms of extraction (including fishing) are prohibited.

Scientific Research Zone—set aside exclusively for scientific research; entry and use for other reasons is prohibited.

Preservation Zone—provides for preservation in an undisturbed state. All entry is prohibited, except in an emergency, with the exception of permitted scientific research which cannot be conducted elsewhere.

Most recent zone names shown bold; older zone names in italics.

GBR and in other Australian marine protected areas. Many aspects, such as allowing but separating conflicting uses, have proven very successful. Experience, however, has also shown that some features of zoning have needed to be refined; furthermore, what works in the GBR may not necessarily work elsewhere and may also need to be modified in other marine situations.

3. What aspects of zoning have worked well in the GBR?

1. The *multiple use approach* means the entire GBR is managed as an integrated whole, not just a series of isolated protected areas surrounded by 'a sea' of unmanaged activities. Pressey and McNeill [7] consider such broad-area integrated management with zoning more effective than a series of small, isolated highly protected areas because:
   - *ecologically*—it recognises temporal/spatial scales at which ecological systems operate and ensures the entire GBR remains viable as a functioning ecosystem;
   - *practically*—it is easier to manage; it buffers and dilutes the impacts of activities in areas adjacent to highly protected 'core' areas; and
   - *socially*—helps to resolve and manage conflicts in the use of natural resources and ensures all reasonable uses can occur with minimal conflict.
2. Each zone has a *specific written objective* that clarifies the purpose of that zone (refer to either the Cairns Section Zoning Plan [8] or the Far Northern Section Zoning Plan [9] for details). In all cases, the objective for each zone has

'conservation' or 'protection' specified as an overriding aspect within the objective, and all zones contribute to conservation to varying degrees.

3. *Complementarity*—given the differing jurisdictions involved, the fact that a State zoning plan which includes tidal waters has virtually the same zoning provisions as the adjoining Commonwealth zoning plan means there is no need to determine exactly where the low water mark boundary lies. This ensures that it is easier for the public to understand and there is far less onus upon enforcement officers to prove the exact location of a jurisdictional boundary. Staff of both Federal and State agencies work closely together and, as far as practicable, zoning plans prepared under Federal and State marine legislation complement each other.
4. *Clear zoning provisions* provide unambiguous advice for each zone as to what is allowed to occur (if an activity is not specified, it is not allowed unless deemed appropriate as '*any other purpose*'—see below). As required by the Act, there is a list of 'use and entry' provisions for each zone that clearly stipulate what activities may be undertaken, either:

   (a) *without a permit* (i.e. 'as of right' activities that may occur within that zone); or
   (b) *only with a permit* (i.e. written permission is required;[4] therefore conducting that activity in that zone without a valid and appropriate permit is an offence).

   A further invaluable clause under (b) is '*any other purpose* consistent with the objective of the zone', which means that unforseen activities may be permitted[5] (i.e. a permit granted), but only if the activity is not an 'as-of-right' activity under (a) and it is consistent with the objective of the zone.

   These 'use and entry' provisions enable users and managers to know clearly what can occur in each zone,[6] what is 'as of right' and what will require a permit. All other activities are prohibited unless deemed appropriate under 'any other purpose'.
5. *Zoning maps*—there are many successful features of the current zoning maps including:

   (a) The spatial accuracy of the maps showing the actual location of zones. While these maps are not deemed to be formal Hydrographic Charts for navigation purposes, they are in many instances more accurate than charts (particularly for the locations of coral reefs) having been mapped from rectified satellite imagery. They are therefore popular with commercial and recreational users alike.

[4] Permits are assessed systematically against a range of specific criteria set out in the legislation (*Regulation* 18 [10]).

[5] This approach assists legislators and managers who cannot expect to forecast all possible future uses of the marine park.

[6] Some detrimental impacts, like oil drilling, mining or spear fishing on SCUBA, are specifically prohibited throughout the Marine Park under the legislation; hence zoning provisions specify which reasonable activities may occur and where.

(b) The more recent zoning maps show zoning information for both Federal and State Marine Parks without any distinction as to respective or overlapping boundaries.
(c) Zoning information is now available in electronic formats which may be interfaced directly with modern navigational aids found on many vessels.
(d) Zoning maps were originally considered to be indicative only, with reliance on the zone descriptions for specific zone locations; however, some components of the zoning maps are now considered to be part of the statutory zoning plan.

6. The process for the *development of zoning plans* is stipulated in the legislation[7] and includes a minimum of two statutory phases of public participation. GBRMPA has been commended over the years for its public involvement in planning and zoning processes. This has included a variety of brochures, booklets and other media to involve the public effectively and as far as practicable in the planning process.
7. Zoning information to *assist public understanding* once new zoning provisions have been promulgated—in addition to the formal zoning plan and zoning maps, a variety of other materials are published including:
   - A '*Basis for Zoning*' document (explains the reasons behind the zoning decisions, often on a site-by-site basis)
   - An *Introductory brochure* explains the complex zoning information in simple terms; usually includes a zoning matrix (see Fig. 1).
   - *Sector-specific or site-specific information*—explains relevant zoning and management information for a specific user group (eg spear fishers) or for a specific location.
8. *Additional zoning provisions*—as well as the zoning spectrum outlined in Table 1, zoning plans also have provision for other special management measures for other designated areas, such as:
   - *Special Management Areas* (allow special management areas to be declared if required outside the statutory zoning process, e.g. for the conservation of natural resources, public safety, undisturbed scientific research, etc.);
   - *Shipping Areas* (allow the navigation of ships in excess of 1500 tonnes);
   - *Seasonal Closure Areas* (allow closures not exceeding 6 months in a year if essential for such aspects as breeding or spawning sites);
   - *Fisheries Experimental Areas* (allows research into the effects of fishing through the temporary opening of areas 'closed' to fishing or the closure of 'open' areas); and
   - *Defence Areas* (enables the conduct of Defence training or operations without conflicts with other users).
9. *Pragmatic provisions*—while some small areas are closed to public access (Preservation Zones and Scientific Zones) and all zone restrictions are enforceable by law, all zoning plans have a specific clause which means any zone may be entered to save human life or to avoid injury, or to secure vessel safety, etc.

[7] See s. 32 & s. 33 in the *Great Barrier Reef Marine Park Act 1975* [6]

4. What aspects of zoning have been changed or are being changed in the GBR?

1. Most *zones names* have been changed over the years. As shown in Table 1, the more recent names (in bold) provide a better indication of the overall objective of the zone. It is also interesting to note that many of the original zone names became colloquially known by their colour as depicted on the zoning map, e.g. the Marine National Park 'B' Zone became readily known as a 'Green' zone—and a 'Green' zone remains widely recognised as a 'no-fishing' zone.
2. The *zone boundaries* have always been described in detailed 'zone descriptions' in a Schedule to the statutory zoning plan (generally in terms of specified distances from a definable point). Presently, most zone boundaries are described using distances from identifiable points or natural features, such as 500 or 1000 m from the reef edge. However, the legal definition of 'reef edge' is confusing and in many cases the reef edge was not easily recognised in the field—causing problems for public understanding, compliance and/or enforcement.

   A new system of boundary descriptions based on co-ordinates of latitude and longitude is currently proposed to simplify boundary descriptions, and will enable zone boundaries to be more easily interfaced with modern navigation devices (e.g. GPS and navigation plotters).
3. '*Split*' *zoning* (i.e. partial zoning**,** particularly around a single feature such as an island or an individual reef, resulting in part of the area as one type of zone while the remainder of the area is another type of zone)—in many cases split zoning has caused problems for public understanding, compliance and enforcement and is no longer a recommended approach. Furthermore, split zones are of questionable ecological value, particularly some of the smaller areas developed in earlier zoning plans. As far as practicable, single zonings or regulatory provisions should surround areas with a discrete geographical description (i.e. single islands or reefs should avoid having multiple zonings or split zonings).
4. Zone *boundary markers*—considerable difficulty has been encountered trying to physically mark some zone boundaries in the field (particularly when split zones were used). Recently, there has been considerable success with markers for other management reasons (e.g. the 'no-anchoring' markers have been very successful and self-educating and enforcing), but zoning plans continue to rely upon other means for boundary identification.
5. The original GBRMP zoning spectrum indicated primarily the *level of extractive activities* which were allowed, principally as area-based controls. Experience has shown that neither the existing zoning spectrum or the existing zone provisions have been effective tools for managing or controlling levels of tourism or recreation in high use or localised areas. Consequently, other management actions (e.g. statutory Plans of Management [11,12]) have necessarily been introduced to ensure an appropriate 'use opportunity spectrum' is maintained in high-use tourism and recreation areas. Other management approaches such as temporal controls are now also being increasingly applied. Certain activities may only be permitted a specified times and this may involve either short-term or long-term closures.

6. When a new type of sub-zone (the 'No-Structures' sub-zone which basically prohibited all marine structures other than navigation aids and approved moorings) was introduced in the review of the Cairns Section Zoning Plan in 1992 [8], it was depicted on the zoning maps as a cross-hatching irrespective of the colour of the underlying zone; this effectively allowed various combinations of the zones with, or without, the sub-zone.

5. Other lessons learnt about zoning

1. As far as practicable, the pattern of zones within a multiple-use marine protected area should *avoid sudden transitions* from highly protected areas to areas of relatively little protection. The concept of 'buffering' (i.e. a gradation in zone types) should be applied wherever possible.
2. As far as practicable, *significant breeding or nursery sites* should be included either within 'no-take' zones, some other form of protective zoning (e.g. a 'no public access' zone) or within an appropriate seasonal closure (that is, given a high degree of protection on either a permanent or seasonal basis).
3. As far as practicable, *representative examples* of all marine communities in any marine protected area should be included within two or more 'no-take' zones. These highly protected areas should be permanent features of MPAs, and their conservation and fishery benefits are greatly diminished if protection is only temporary [4].
4. Management needs to be addressed at *various scales*; while zoning is very effective in addressing the generic large area (i.e. small scale) issues, it is not the most appropriate tool for addressing many specific small area or localised issues. Statutory Plans of Management (which may themselves have a spectrum of uses) have been found to be preferable rather than trying to squeeze all activities into the existing zoning spectrum. The requirements for Plans of Management are set down in the legislation [6], including ensuring that activities are ecologically sustainable, and the plans must consider the protection of World Heritage values and the precautionary principle.
5. The original GBRMP zoning scheme was developed before the appropriateness of applying zoning provisions or other constraints to the activities of Indigenous people became a matter of public debate. To address this issue, Queensland Marine Parks have introduced a *Traditional Use Zone.* Other zone types like Estuarine Conservation Zones and Commonwealth Island Zones have also been introduced to address specific requirements not covered by the original zone types.
6. In contrast to the last point, experience has shown that *too many zone types* with only minor differences can confuse the users as well as complicate enforcement. For example, fishing by trolling for pelagic fish (i.e. behind a moving boat) is allowed in a Buffer Zone, while other types of line fishing are prohibited. However, demersal fish can be caught while trolling; furthermore, as much of the offshore patrolling is undertaken by aerial surveillance, it is extremely difficult to

determine from a surveillance aircraft whether a vessel is trolling for pelagics or line fishing for other species.

7. It is clear that any *zoning will not be perfect* in perpetuity; only time and experience will determine what was right and what needs to be fine-tuned. Neither natural systems nor protected areas nor values and attitudes to reasonable use are ever static,[8] and a wide variety of changes can, and do, occur and hence zoning needs to be periodically reviewed. The most obvious changes which can affect zone locations and/or provisions include:
   - increasing levels and types of use;
   - new scientific understanding of sustainability of use and conservation requirements; and
   - other changing circumstances, whether they are technological, social, cultural, environmental or natural changes.

   Two of the GBR Marine Park's four main sections have now been formally reviewed and updated. In addition, detailed plans of Management prepared for three other intensively used areas and for one threatened species (dugong). In all instances there have been increases in the zoning restrictions or other controls as use has increased or as more information has become available. Zoning plans today differ from those developed decades ago, and in some instances the level of zoning applied in specific areas has changed markedly. Zoning provisions associated with each zone type have also been updated as zoning plans have been reviewed.

   The review of zoning plans and performance should be conducted at intervals short enough for managers to respond to problems but not so frequent that it becomes prohibitively expensive [3].
8. Many aspects of management continue to evolve in the GBR Marine Park. Concerns now exist that the current zoning (most of it done decades ago) focussed to a major extent on the coral reef habitats and does not adequately protect the range of biodiversity that is now known to exist within the area. In response, the Representative Areas Program (RAP) is essentially *a review of the zoning system* across the entire area to ensure that it meets the requirements of s. 32(7) (a) [6] of the legislation. The RAP will update the protection of reef environments in the light of substantial improvements in knowledge and aims to enhance the protection of the full range of biodiversity within the GBR by developing a comprehensive and adequate network of no-take areas representing examples of all habitats and communities [13].
9. *Consider aspects of connectivity* when determining marine zoning—given the high levels of connectivity within marine systems, the application of all available information on aspects of connectivity is important when developing zoning maps. For example, reefs or areas that have high levels of spawning ('source' reefs) need to be considered differently from reefs that may be well replenished (or 'sink' reefs) given the prevailing currents. Clearly an effective 'source' reef is

[8] Public attitudes as to what activities are acceptable or reasonable have changed over the years, for example, shell collecting.

better zoned as a 'no-take' area as it is likely to replenish a number of other reefs; conversely an identified 'sink' reef may be zoned for fishing if it is known that it is being replenished from adjacent source areas. Explaining concepts such as of connectivity to users can be assisted by the use of diagrams; for example [14].

10. While *colours* can be useful to *distinguish different zones* on zoning maps, some pitfalls have also been encountered:
    - some printing/ production methods will vary the tone of zone colours which can lead to confusion;
    - too many zones can be hard to distinguish if the colours are not distinct;
    - some people are colour blind;
    - the cost of colour productions (e.g. for brochures) is much higher than single colour or black and white publications (if necessary, consider the use of hatching or other means to distinguish zones); and
    - displaying zones on other navigation devices may be limited due to colour restrictions.
11. Differing zoning scheme or spectrums may be more appropriate considering the differing management implications occurring in coastal, estuarine, near shore and offshore situations. Coastal, estuarine and nearshore areas should, as far as practicable, retain the use of recognisable features to define zone boundaries whereas in offshore situations, the use of latitude/longitude points is a preferable method of defining an area provided any such zones fully encompass the underlying ecological habitats/communities.
12. The existing spectrum of zones in the GBR does not correlate directly with the various IUCN categories for protected areas. The most compatible grouping of GBR zones against the various IUCN Protected Area categories is shown in Table 2

    The park was initially set up with minimal broad-scale ecological information and under controversial circumstances and focussed particularly on the coral reef habitats; consequently the levels of 'no-take' zones were considered the best compromise at the time. About 16,000 km^2 of the GBRMP is currently zoned as

Table 2
Comparison of GBRMP zones with IUCN categories

GBR zones	Equivalent IUCN categories[a]	% of GBRMP
General Use 'A' and General Use 'B' Zones	Categories V and VI	95.3
MNP 'A', MNP 'Buffer' and MNP 'B' Zones	Category II	4.5
Scientific Research and Preservation Zones	Category Ia	0.2

[a] The IUCN (CNPPA/WCMC 1994) has classified protected areas into six categories:

Strict Nature Reserve/Wilderness Area	IUCN Category I
National Park	IUCN Category II
National Monument	IUCN Category III
Habitat/Species Management Area	IUCN Category IV
Protected Landscape/Seascape	IUCN Category V

'no take' and 'no go' zones. This equates to only 4.7% of the Marine Park, but ~21% of the coral reef system reflecting the historical focus on coral reefs. There is also a higher concentration of protected areas in more remote areas. It must be stressed that the figures in Table 2 must NOT be interpreted as implying that because only 4.7% of the GBR Marine Park currently is 'no-take', that a model MPA should have some 95% of its area as allowing extraction in some form. These issues are currently being addressed as part of the RAP program (see 8 above) with the result the area of 'no-take' will almost certainly increase.

13. *Zoning in a vertical dimension*—by proclamation, the GBR Marine Park and the relevant zones extend into the airspace (915 m above the sea surface) and 1000 m below the seabed. For effective marine management, these areas are often as important as the water column.

    In southern Australia, the waters and seabed in the Tasmanian Seamounts Marine Reserve has been divided into two vertically stratified zones: a Highly Protected Zone from a depth of 500 m below sea level to 100 m below the seabed, assigned to IUCN category Ia; and a Managed Resource Zone, from the sea surface to a depth of 500 m, assigned to IUCN category VI. The suitability of this arrangement for enforcement, however, has yet to be tested. Also the linkages between benthic and pelagic species are not fully known, so careful monitoring will be necessary to ensure that the exploitation of the surface or midwater fisheries does not affect the underlying benthic communities [4].

14. '*Zoning outside the square*'—while zoning within the Marine Park has always provided a major tool for conservation, the GBRMP Act has provision for regulations allowing controls on certain activities that occur *outside* the Marine Park. The most recent application has been Regulations that control discharge from aquaculture regulations up to 5 km inland. A new Federal Act [15] also has provisions to control activities that may occur outside, but may adversely impact, World Heritage areas. Both these provisions can be viewed as effectively a managerial extension of a zoning approach.

6. Conclusions

Zoning has been, and will remain, one of the cornerstones of management for the GBR. However, other management tools are also important and should be used in conjunction with zoning (Table 3 indicates what various management tools aim to do, and to whom and where they apply).

The spectrum of zones[9] set within the framework of a multiple use area allows a range of reasonable uses to occur in a coordinated way, and provides for broad-area integrated management with many of the benefits highlighted above.

[9] Zones ranging from General Use through to Preservation Zones as applied in the Great Barrier Reef, along with their differing zoning provisions, may not be appropriate in many other marine areas. However if possible, a clear spectrum of two or more zones should be applied in all MPAs, with at least some areas defined as 'no-take' zones, set within a broader multiple use framework

Table 3
Summary of the main management tools for the GBR Marine Park (adapted from [1])

Management tool	What the tool aims to do	Primary area of operation	Who the tool applies to	Prime responsibility	Legislative Head of Power
GBRMP Act and regulations	Provides the legislative basis for the Marine Park and the managing Authority	Entire Marine Park	All Marine Park users and GBRMPA (the managing Authority)	GBRMPA	Administrative Arrangements Orders (thro' Executive Council)
Zoning plans	Indicates where users can go and what is allowed and what requires a permit	Each of the Sections of the Marine Park	All Marine Park users	GBRMPA	*Great Barrier Reef Marine Park Act 1975* (the GBRMP Act 1975)
Plans of Management	Indicates what users can do in specifically designated areas	◦ Cairns/Port Douglas ◦ Whitsundays ◦ Hinchinbrook ◦ Dugong (Shoalwater Bay)	All users of the designated planning areas (additional to zoning provisions)	GBRMPA	GBRMP Act 1975
Site plans	Detailed plans for designated areas	Designated local areas	All users of the designated sites	QPWS (State)	State legislation
Designated areas	Set additional requirements/ restrictions in specific areas	Designated local areas	All users of the designated areas/sites	GBRMPA	GBRMP Act 1975
Permits	Regulate activities and locations of permittees by specifying conditions	The zones and locations specified in the permit	The permittee (e.g. a tourist operator)	GBRMPA/QPWS	GBRMP Act 1975

(*continued on next page*)

Table 3 (*continued*)

Management tool	What the tool aims to do	Primary area of operation	Who the tool applies to	Prime responsibility	Legislative Head of Power
Best Environmental Practices/Codes of practice	Guidelines advising environmentally responsible ways to conduct activities	Entire Marine Park	All Marine Park and island NP visitors	Industry	N/a (Self-regulatory)
Economic instruments (e.g. Environment Management Charge)	Regulate use	Entire Marine Park	Most commercial operations	GBRMPA	GBRMP Act 1975
Impact assessment	Determining and minimising any impacts	Designated sites/ locations	Applicants for permission	GBRMPA/EPA	GBRMP Act 1975; State legislation
Surveillance/ patrolling	Systematic observation to determine extent, nature and purpose of activities in the Marine Park	All areas of MP (effort concentrated in high use areas and enforcement 'hotspots')	All Marine Park and island NP visitors	GBRMPA and QPWS (i.e. Day-to-day management)	GBRMP Act 1975; State legislation
Enforcement	Apprehension of deliberate, blatant and persistent offenders	Whenever and wherever required	Any deliberate, blatant and persistent offenders	GBRMPA and QPWS (i.e. Day-to-day management)	GBRMP Act 1975; State legislation
Research and monitoring	Provide a good basis for effective management	Specified research and monitoring sites	Depends whether it is long-term or site-specific	CRC for the GBRWHA	GBRMP Act 1975
Education, interpretation and extension	Provide users with information to assist them and managers	Primary areas for visitor contact	Targeted Marine Park and island NP visitors	GBRMPA/QPWS/ DDM	GBRMP Act 1975

Use patterns and technology are constantly changing and the marine environment itself is dynamic; subject to both human use and natural changes. Management of any marine protected area therefore cannot remain static and hence zoning must similarly change. Some of the management tools and zone locations which were appropriate when the GBR Marine Park was first declared are less relevant now; consequently management must also adapt (Table 4).

One aspect that has contributed to the success of the Great Barrier Reef Marine Park has been the level of public involvement throughout the zoning process, usually well beyond the level required in the legislation. While such levels of public participation cost a lot in terms of resources and time, the outcome has been considered worthwhile and cost-effective in the long term. However, it is also generally true that the final zoning product in a large multiple use Marine Park like the GBR is the result of compromise, accommodating a range of needs and political requirements.[10] Zoning is generally not a simple task.

A further critical aspect of any new zoning system is to ensure that the practicalities of field recognition and enforcement are carefully considered. A zoning scheme that looks good on paper is not worth much if it is difficult to recognise zone boundaries in the field from the perspective of users or enforcement officers.

It is also important to recognise that zoning is not the answer to all aspects of marine conservation. Issues such as decreasing water quality, unsustainable fishing and other activities or uncontrolled coastal development can collectively cause significant impacts, and the best zoning scheme in the world will alone not necessarily result in effective marine conservation.

There are also clearly other marine protected areas around the world with differing management models and strategies. The Great Barrier Reef Marine Park Authority is continually looking outwards and is willing to work with others to develop the best outcomes for marine area management, both in the GBR but also in other parts of the world.

There are many lessons to be learnt from the successes and mistakes made in the GBR Marine Park. For example, while zoning has worked well in separating many conflicting uses, experience has shown that:

- Management must be addressed at various scales and, while zoning is effective in addressing the generic small scale/large area issues, it is not adequate for addressing many specific localised small area issues. As the existing zones primarily concerned only 'purposes of use and entry', with a particular focus on extractive use, it has been necessary to introduce other management actions to regulate uses within the broad zones and to ensure an appropriate 'use opportunity spectrum' in high-use tourism and recreation areas.
- Many zone boundaries have been described in ways that have not helped public understanding, compliance or enforcement.

[10] The importance of social, economic and cultural considerations, which are largely outside the manager's jurisdiction but which are critical in influencing the final political outcomes, must also be addressed throughout any zoning process.

Table 4
The areas and proportions of each zone type within each section of the Great Barrier Reef Marine Park (as at April 2002) [17]

Zone	Section				TOTAL in GBRMP (% of entire MP)
	Far Northern Section	Cairns Section	Central Section	Mackay/ Capricorn Section	
General Use Zone/*General Use 'A' Zone*	62 525 (73%)	25 900 (73%)	58 200 (77%)	121 500 (85%)	268 125 (78%)
Habitat Protection Zone/*General Use 'B' Zone*	9660 (11%)	8340 (24%)	15 000 (20%)	19 380 (13%)	52 380 (15%)
Conservation Park Zone/*Marine National Park 'A' Zone*	1140 (1%)	153 (<1%)	665 (<1%)	95 (<1%)	2053 (<1%)
Buffer Zone/*Marine National Park Buffer Zone*	152 (<1%)	355 (1%)	—	—	507 (<1%)
National Park Zone/*Marine National Park 'B' Zone*	11 422 (13%)	630 (2%)	1755 (2%)	1965 (1%)	15 772 (5%)
Scientific Research Zone	— (0%)	— 0%	3 (<1%)	25 (<1%)	28 (<1%)
Preservation Zone	220 (<1%)	106 (<1%)	47 (<1%)	80 (<1%)	453 (<1%)
Islands (State and Commonwealth)	81 (<1%)	16 (<1%)	430 (<1%)	355 (<1%)	882 (<1%)
Total	85 200	35 500	76 100	143 400	345 400 (incl 5200 km^2 unzoned)

Areas in km^2.

- Too many zone types with only minor differences have been shown to confuse some users and complicate enforcement.
- The original GBRMP zoning scheme was developed before the appropriateness of applying zoning provisions or other constraints to the activities of Indigenous people became a matter of public debate.
- The differing management implications when applying a similar zoning scheme in coastal, estuarine, near shore and offshore situations, and across jurisdictions.
- The existing zoning network needs to be periodically reviewed to ensure adequate protection of biodiversity.

It is also important to remember that when the GBR Marine Park was first declared in the mid 1970s, there were:

- major differences of opinion between the State and Federal governments on both the need for the park and the park boundaries (in fact 28 coastal areas were initially precluded from the GBR Marine Park, and only recently have these been incorporated into the GBR Marine Park);
- little ecological information initially and no precedent in managing large marine protected areas;
- interdepartmental conflicts when it came to resource management, especially over fisheries matters; and
- a number of user sectors who completely opposed the Marine Park concept or the idea of 'no-take' zones e.g. commercial fishermen.

It is certainly not necessary to wait until everything is known about an area or that all uncertainties are resolved before declaring and zoning a marine protected area; to slightly adapt the conclusion of Kelleher and Kenchington [16]:

> …it is better to create, *zone* and manage successfully a marine protected area (MPA) which may not be ideal in ecological terms but which nevertheless achieves the purpose for which it is established than it is to labour futilely and vainly to create the theoretically "ideal" MPA.

Many positive aspects of zoning are outlined in this paper, along with the experience gained and lessons learned within the GBR. Zoning will continue to evolve and improve, but will remain a key management tool for marine areas around the world.

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