Making Marine Spatial Planning Real:
bridging the gap from planning to implementation

Ian Dutton, Kerrie Wilson & Hedley Grantham

PICES 2009 Jeju, S. Korea

Overview

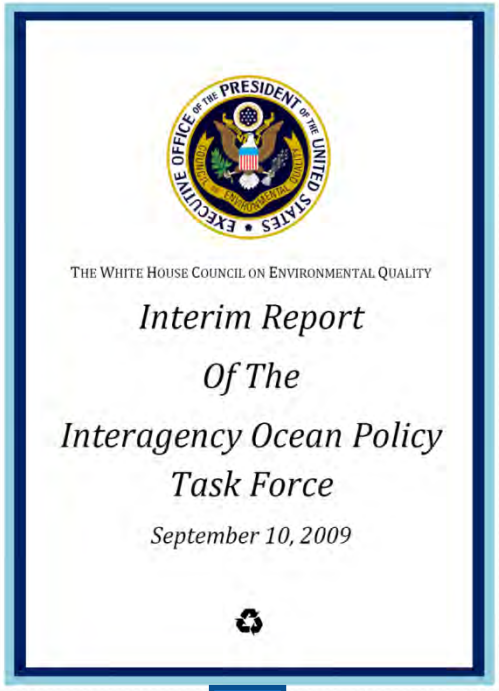
- **Marine Spatial Planning**
  - pedigree + current status

- **Case studies**
  - 30 years of MSP in the Great Barrier Reef Marine Park
  - Marxan Decision Support Tool Contributions to MSP
    - Marxan & Marzone use for MSP
    - South Africa Bycatch application
    - Solomon Islands MPA network design
  - Hierarchical Approaches – linking Big Goals, MSP and **Action**
    - Defining Priorities - Ecoregional Assessments + Gap Analysis
    - Developing Strategy and Taking Action – Miradi

- **From MSP to Impact/Results**



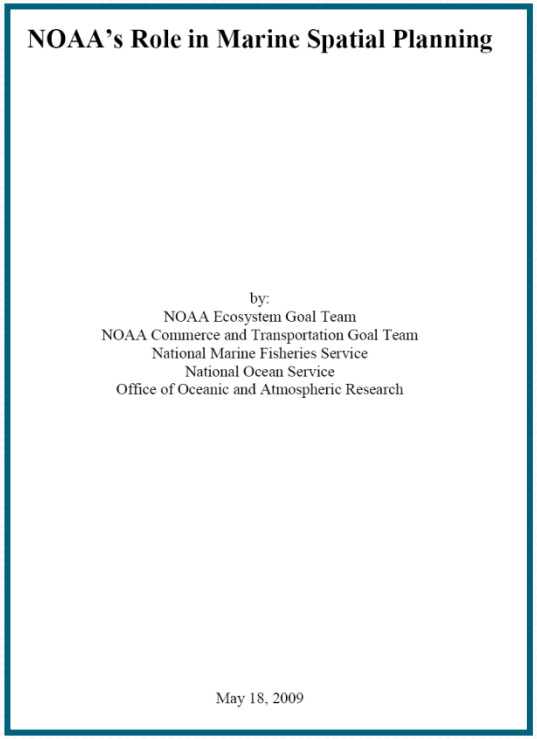

- ***Many of the serious challenges we face in maintaining the health of ocean, coastal, and Great Lakes ecosystems and economies stem from a fundamental mismatch between the way natural systems work and the way we manage the activities that affect them…***



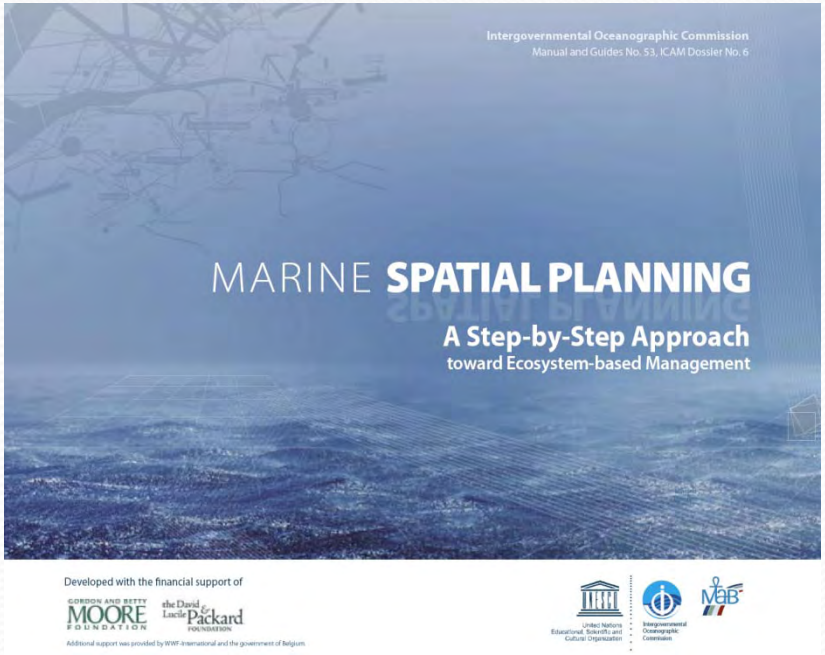
MSP

Changing Oceans, Changing World: Ocean Priorities for the Obama Administration and Congress, p. iii

LOTS of emerging guidance…



State of the art…



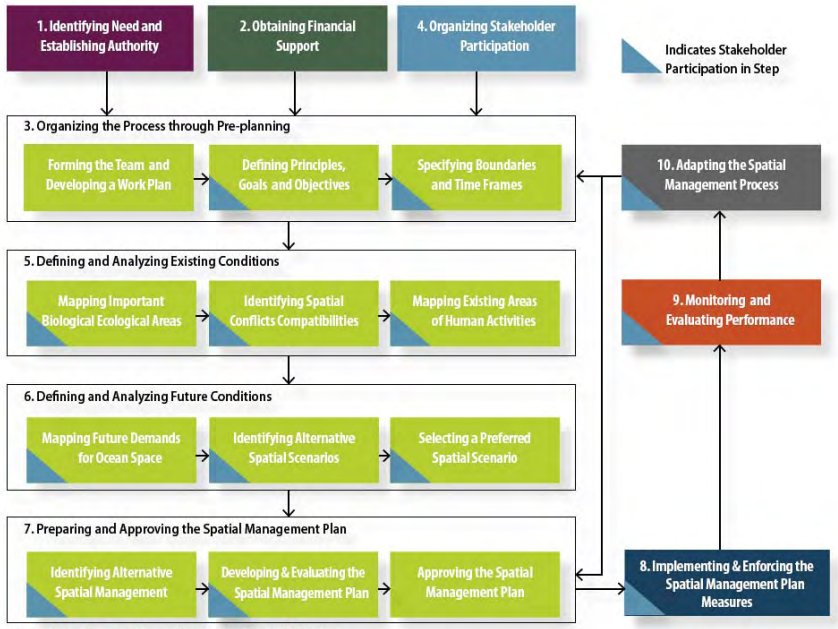


Fig. 1. A Step-by-Step Approach to Marine Spatial Planning

MSP Cycle – latest version

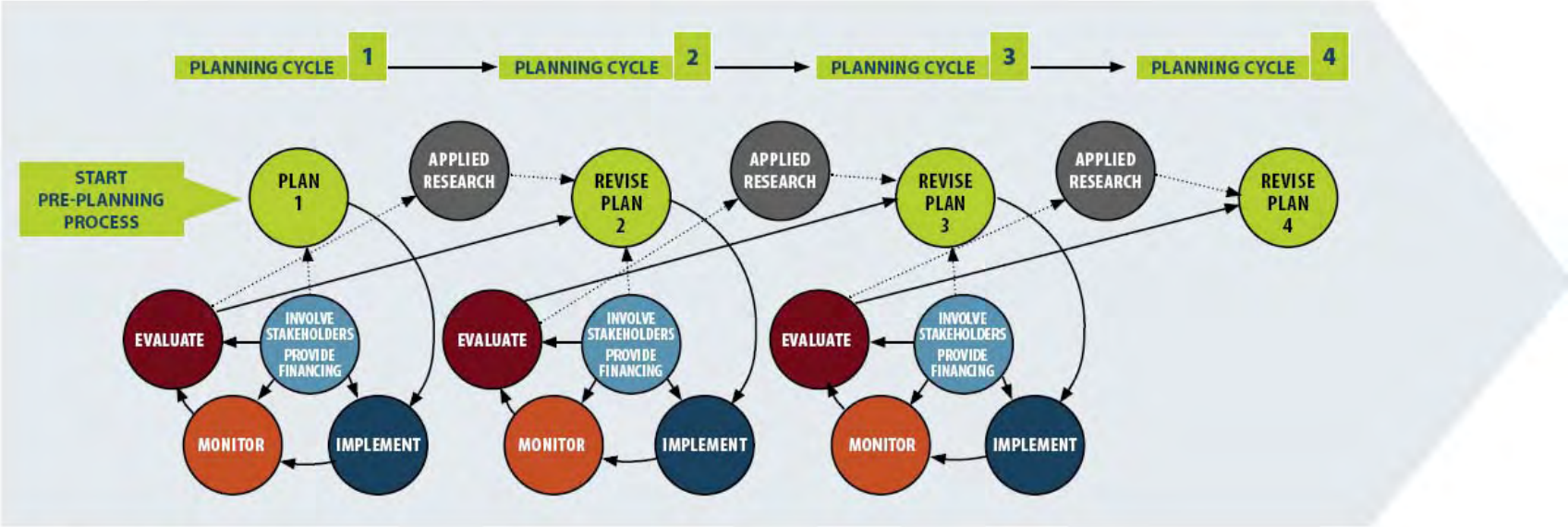
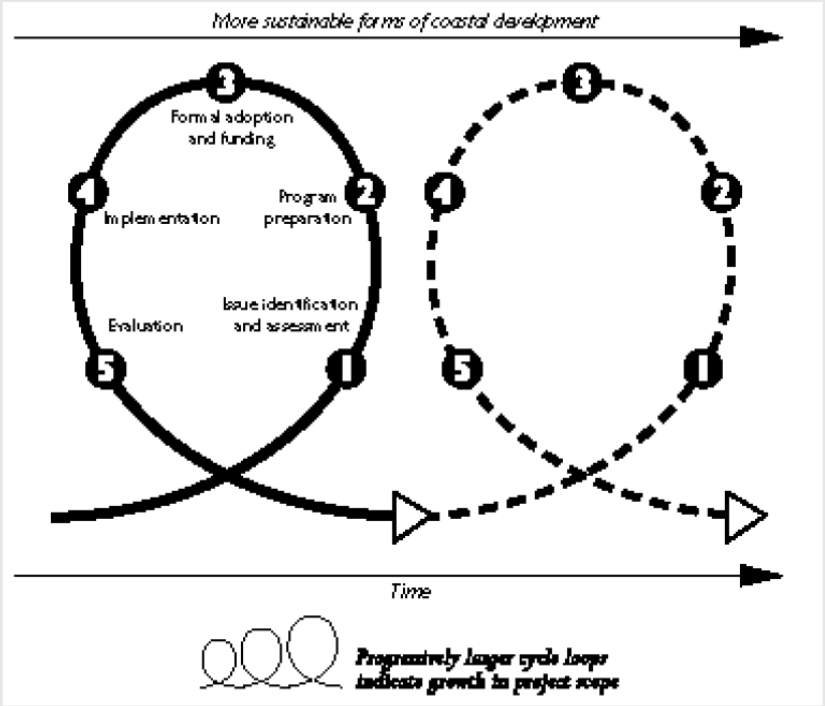


Fig. 2. The continuing MSP planning cycle

An earlier interpretation

The steps of the coastal management cycle.

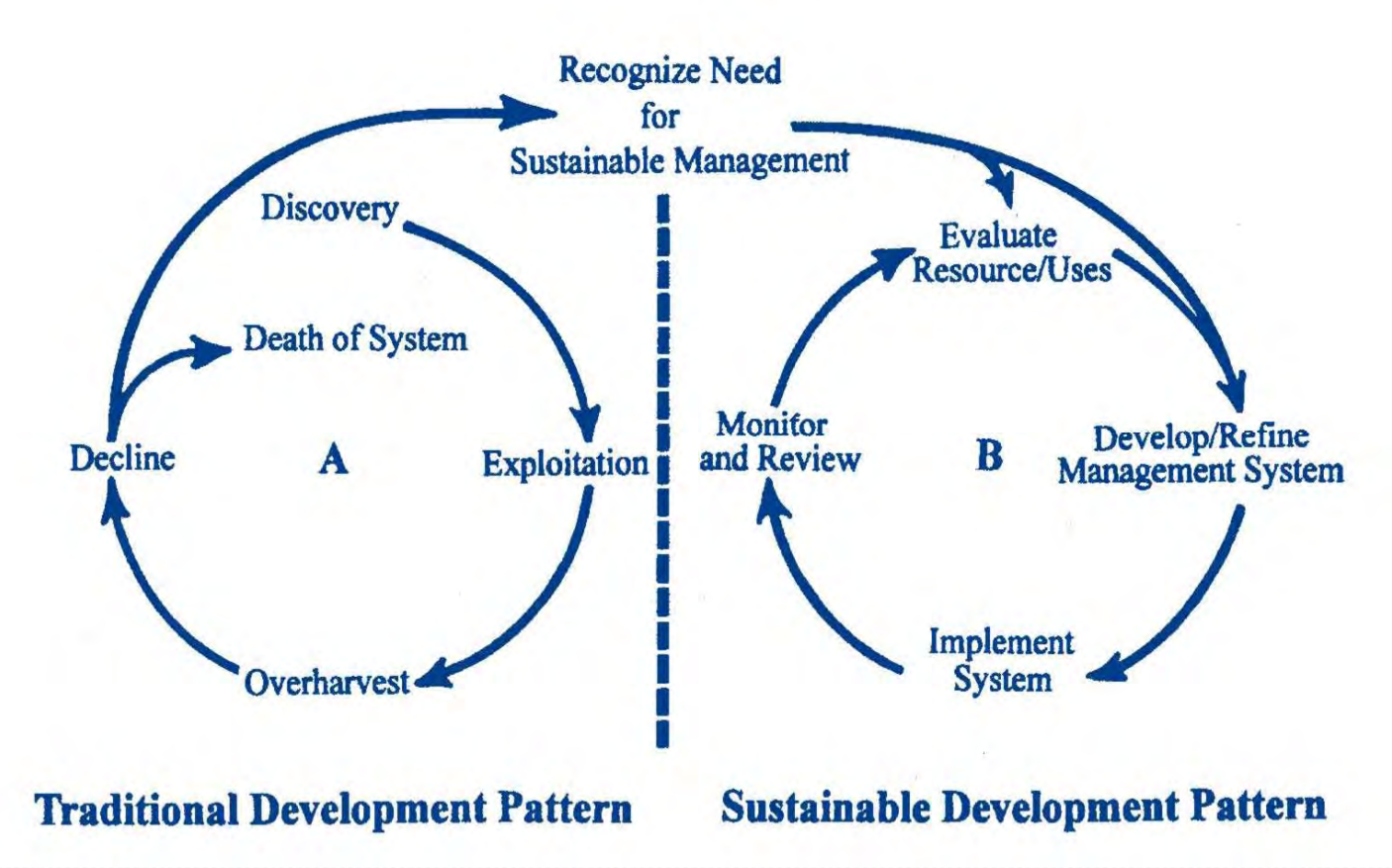
The dynamic nature of coastal management requires feedback among the steps and may alter the sequence, or require repetition of some steps (adopted from GESAMP 1996).



Source: Adapted from GESAMP, 1996, as found in Olsen et al. 1998

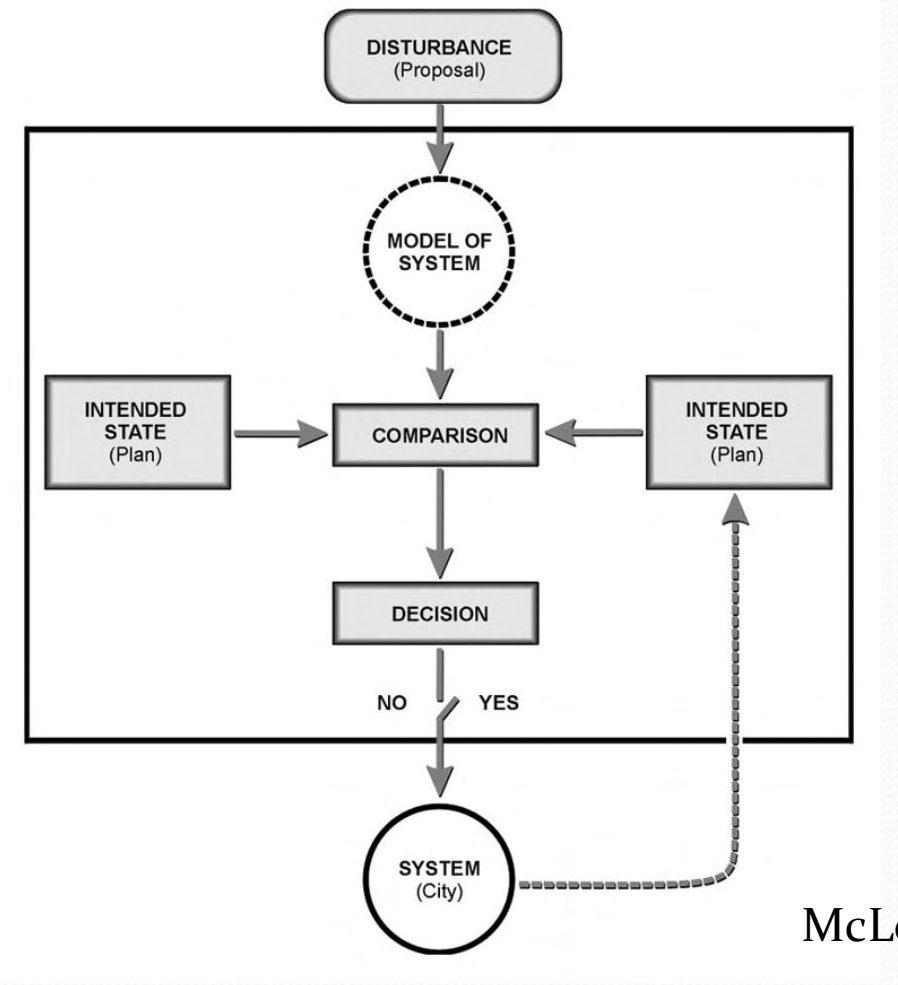
Olsen, 1996

And a little earlier…



Dutton & Hotta 1990

… right back to fundamentals of modern systems planning theory



McLoughlin, 1969

MSP Pedigree – key planning epochs

Sectoral

- Town and Country Planning – land use plans, etc.
  - 1860-1950
- Separation of conflict by zoning – **control emphasis**

Systems

- Systems Planning – genesis of sea use planning, etc
  - 1950s-1980s
- Optimization for multiple resource uses; **process emphasis**

Sustain

- Ecosystem based planning – systematic conservation etc
  - 1980s – current
- Integration of social, economic and ecological goals via effective stakeholder engagement – **governance emphasis**

So – what is new about MSP v2009?

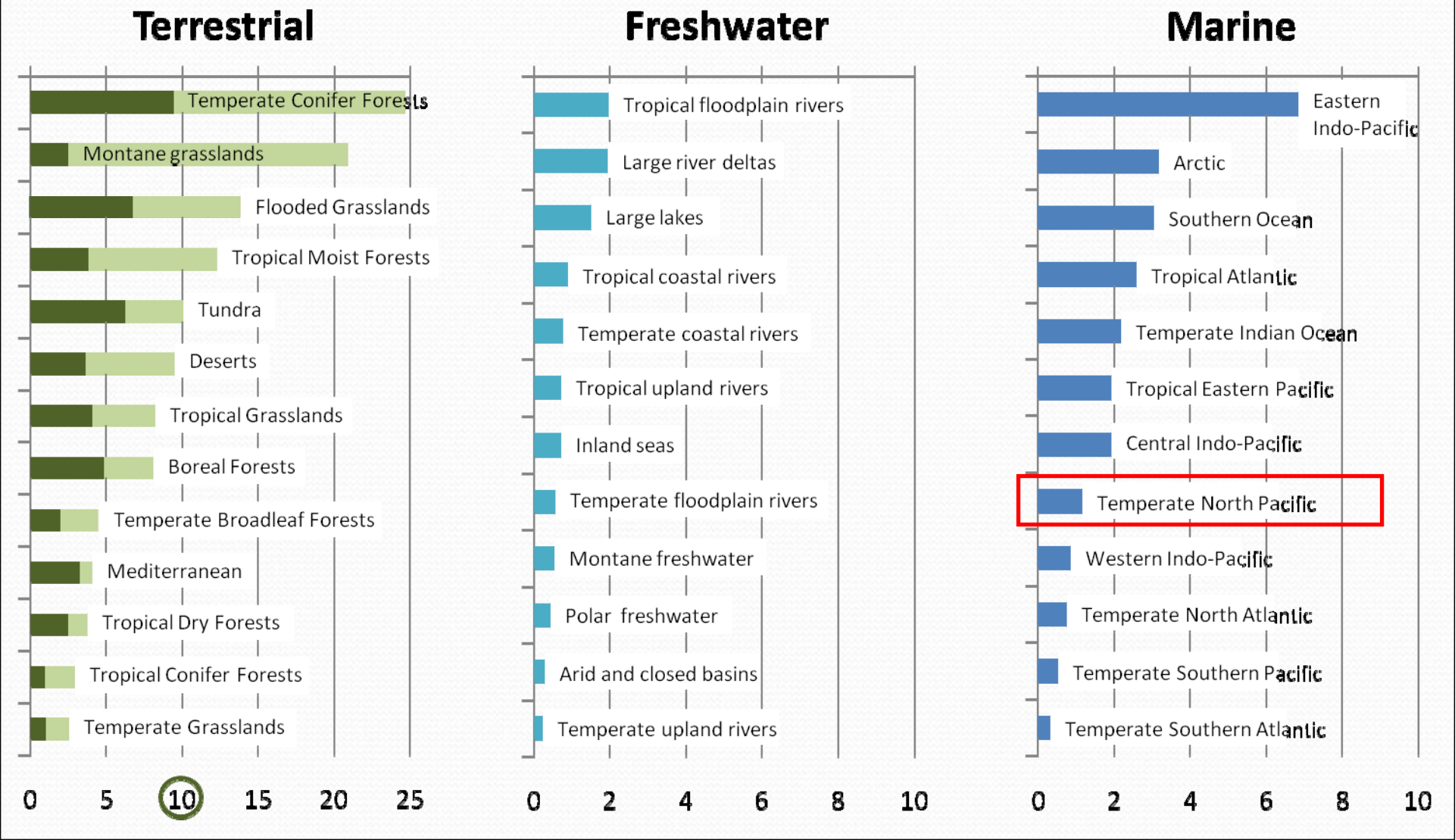
- Not a lot if you are a planner, a natural resources (incl. fisheries) manager, a local government official, etc.
  - Scale of application new (large area of EEZ for many countries)
  - Technical and turf issues – methods, vertical and horizontal integration with other instruments/policies, etc
  - Governance requirements still to be worked out in many cases esp. across jurisdictions (local-State-Federal-international).

- Lots if you have never had to make spatial allocation decisions:
  - what should be allowed to go where?
  - how can it be best undertaken?
  - what are the goals/outcomes + how will we know if it is working?
  - who decides? etc.

So… why didn't MSP catch on before?

- Variable **intensity of sea uses** around the world
- We have traditionally planned from the **land outwards** – hence emphasis on ICM since 1970s
- Lack of compelling "**drivers**" – e.g. offshore mining, crises
- **Fisheries,** as the most extensive global sea use, has its own lexicon of management practices which are spatial, temporal and rule-based and has unique governance arrangements
- Marine protected areas and other sea use restrictions had **limited political appeal** in many countries
- Lack of broader ocean **governance** frameworks
- Lack of **champions** – who speaks for the oceans and who listens?
- Lack of **data** and lack of **spatial data processing** ability to compile and analyze data in ways comparable to terrestrial systems

Conservation management imbalance



Conservation management imbalance

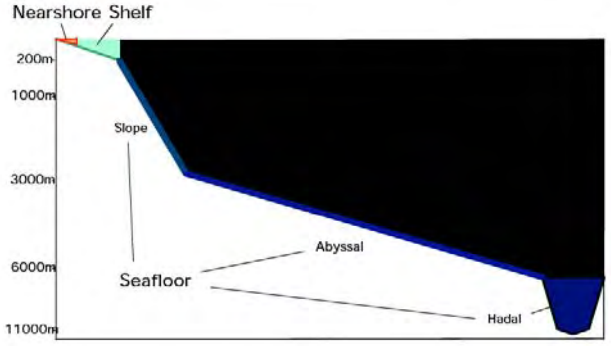


Figure 1: Separation of zones in the marine environment. Given the close connection between benthic, demersal and pelagic species in shelf areas the near-shore and shelf MHTs include both the sea floor and their overlying waters. Hence the water column and sea floor biomes only refer to deeper water areas.

Protection statistics

REALM	Percentage of Realm or Province protected	Percentage of entire MHT protected	Percentage of global shelf area protected	Percentage of Realm or Province protected	Percentage of entire MHT protected	Percentage of global shelf area protected
	All protected areas			IUCN management categories I-IV		
(TEMPERATE) NORTHERN ATLANTIC	3.70	1.50	0.54	0.80	0.33	0.12
(TEMPERATE) NORTHERN PACIFIC	3.15	0.91	0.33	1.17	0.34	0.12
TEMPERATE (SOUTHERN) ATLANTIC	1.48	0.11	0.04	0.32	0.02	0.01
TEMPERATE INDIAN OCEAN	6.62	0.36	0.13	2.22	0.12	0.04

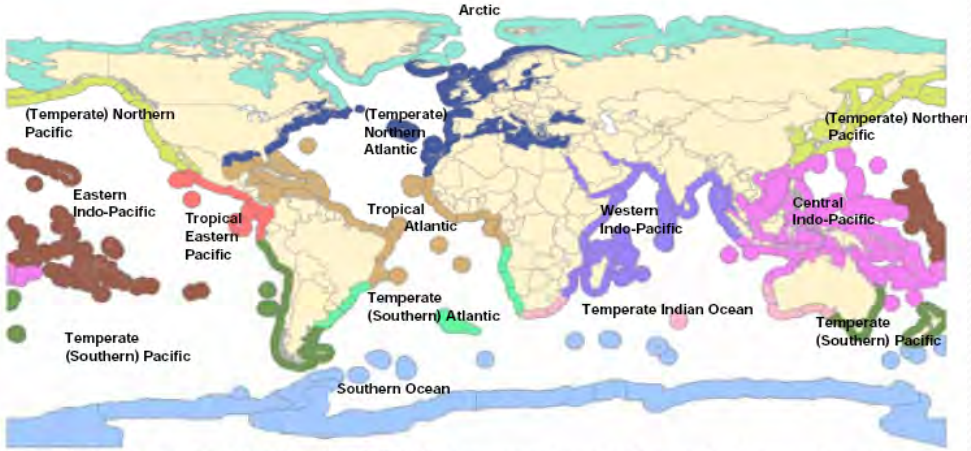
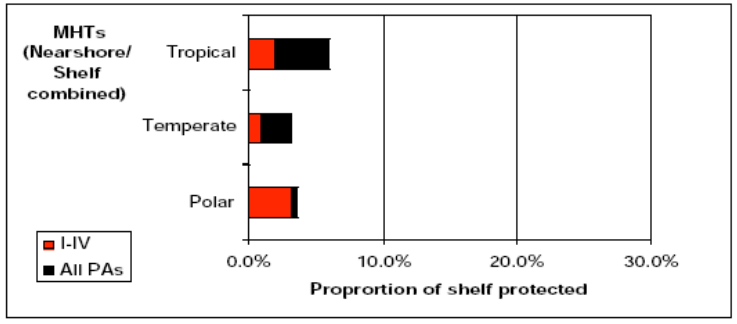


Figure 2: The realms as defined by the MHT. Words in parentheses have been added from earlier versions of the system to introduce a more consistent nomenclature.



Spalding et al., 2008

Great Barrier Reef Case Study

http://www.gbrmpa.gov.au/

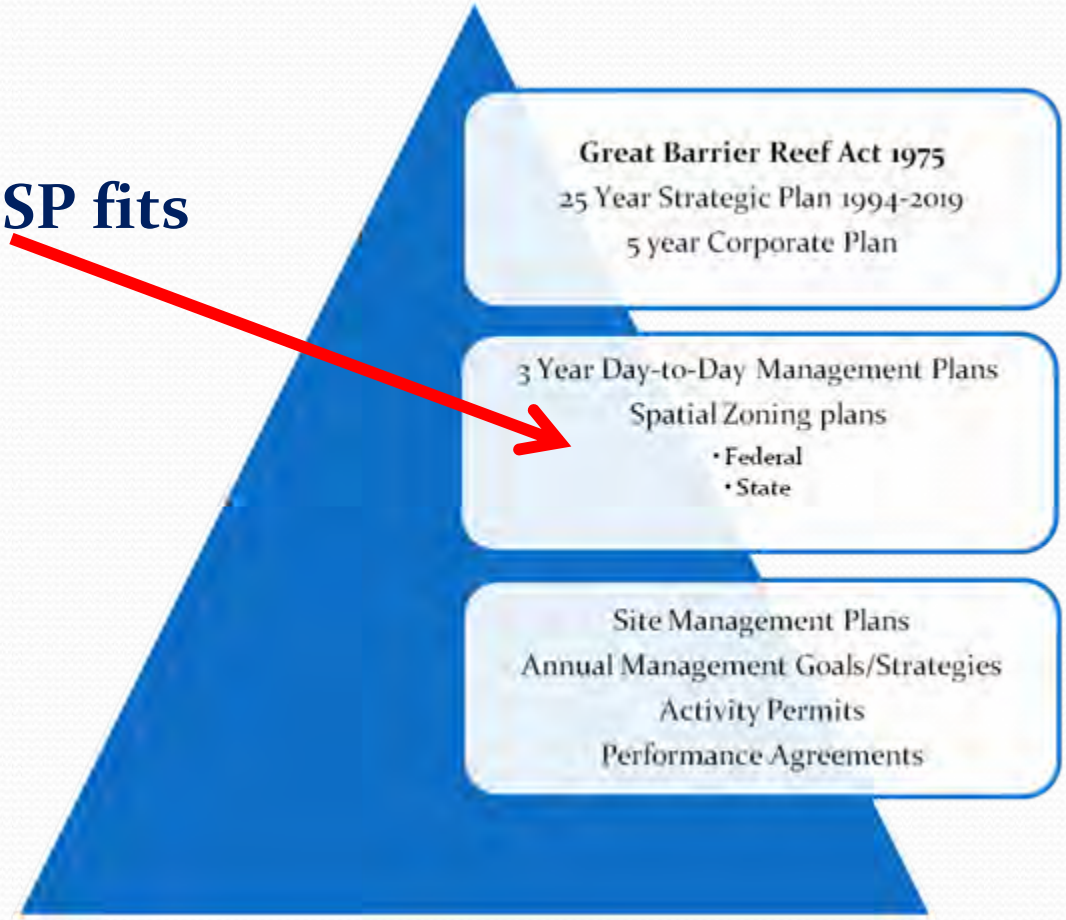
Great Barrier Reef Marine Park

- Established 1975
- 350,000 km2
- National and State management coordinated
- Mining and oil drilling banned
- <5% strictly protected 1979-2004 to @33% no take zoning in 2004
- Tourism vs fisheries vs conservation dynamic changing

GBR Governance Framework

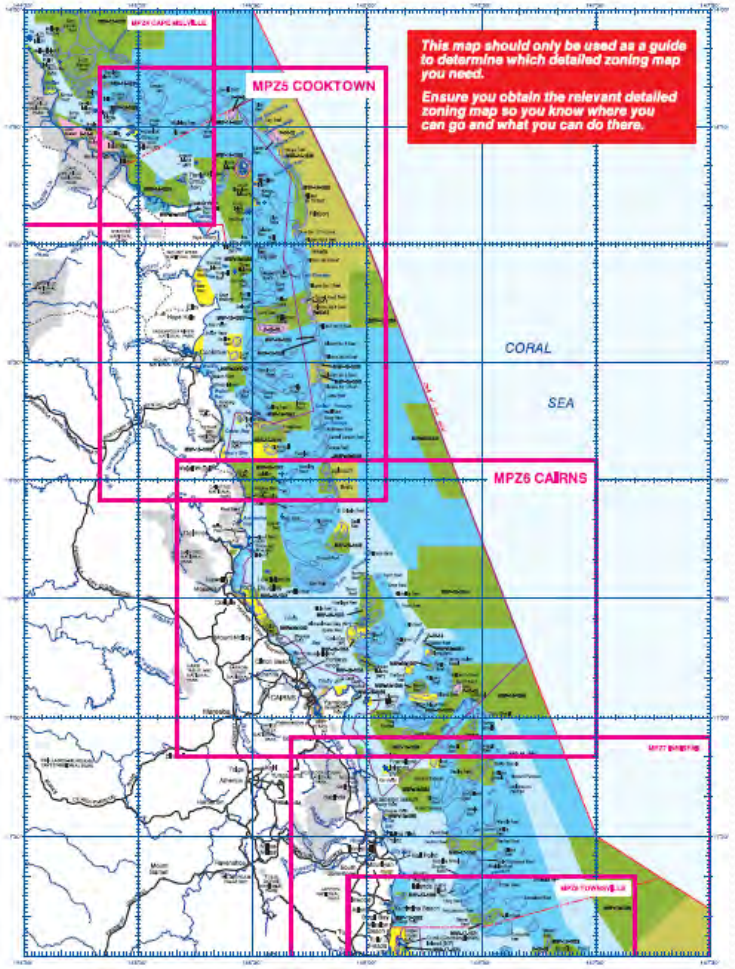
- integration of space/scale/time/players

Where MSP fits



GBR Zoning Scheme Organization

- zoning separates conflicts, provides basis for regulation of industry and recreation uses, targets biodiversity goals, defines management authority, etc.



ACTIVITIES GUIDE
(see relevant Zoning Plans and Regulations for details)

	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Buffer Zone	Scientific Research Zone	Marine National Park Zone	Preservation Zone
Aquaculture	Permit	Permit	Permit[1]	✗	✗	✗	✗
Bait netting	✓	✓	✓	✗	✗	✗	✗
Boating, diving, photography	✓	✓	✓	✓	✓[2]	✓	✗
Crabbing (trapping)	✓	✓	✓[3]	✗	✗	✗	✗
Harvest fishing for aquarium fish, coral and beachworm	Permit	Permit	Permit[1]	✗	✗	✗	✗
Harvest fishing for sea cucumber, trochus, tropical rock lobster	Permit	Permit	✗	✗	✗	✗	✗
Limited collecting	✓[4]	✓[4]	✓[4]	✗	✗	✗	✗
Limited spearfishing (snorkel only)	✓	✓	✓[1]	✗	✗	✗	✗
Line fishing	✓[5]	✓[5]	✓[6]	✗	✗	✗	✗
Netting (other than bait netting)	✓	✓	✗	✗	✗	✗	✗
Research (other than limited impact research)	Permit	Permit	Permit	Permit	Permit	Permit	Permit
Shipping (other than in a designated shipping area)	✓	Permit	Permit	Permit	Permit	Permit	✗
Tourism programme	Permit	Permit	Permit	Permit	Permit	Permit	✗
Traditional use of marine resources	✓[7]	✓[7]	✓[7]	✓[7]	✓[7]	✓[7]	✗
Trawling	✓	✗	✗	✗	✗	✗	✗
Trolling	✓[5]	✓[5]	✓[5]	✓[5,8]	✗	✗	✗

PLEASE NOTE: This guide provides an introduction to Zoning in the Great Barrier Reef Marine Park. Relevant Queensland Marine Park Zoning Plans or the Queensland Environmental Protection Agency should be consulted for confirmation of use or entry requirements.

1. Restrictions apply to aquaculture, spearfishing and harvest fishing for aquarium fish, beachworm and coral in the Conservation Park Zone.
2. Except for One Tree Island Reef (SR-23-2010) and Australian Institute of Marine Science (SR-19-2006) which are closed to public access and shown as orange, all other Scientific Research Zones are shown as green with an orange outline.
3. Limited to 4 catch devices (eg. crab pots, dillies and inverted dillies) per person.
4. By hand or hand-held implement and generally no more than 5 of a species.
5. Maximum of 3 lines/rods per person with a combined total of 6 hooks per person.
6. Limited to 1 line/rod per person and 1 hook per line. Only 1 dory detached from a commercial fishing vessel.
7. Apart from traditional use of marine resources in accordance with s.211 of the *Native Title Act 1993*, an accredited Traditional Use of Marine Resources Agreement or permit is required.
8. Pelagic species only. Seasonal Closures apply to some Buffer Zones.

Detailed information is contained in the Great Barrier Reef Marine Park Zoning Plan and Regulations.

- Permits are required for most other activities not listed above.
- Commonwealth owned islands in the Great Barrier Reef Marine Park are zoned "Commonwealth Islands Zone" - shown as cream.
- All Commonwealth Islands may not be shown.
- Special Management Areas may provide additional restrictions at some locations.
- The Zoning Plan does not affect the operation of s.211 of the *Native Title Act 1993*.

ACCESS TO ALL ZONES IS PERMITTED IN AN EMERGENCY.

our great barrier reef
let's keep it great

Zoning Approach Change

1979-1999

- Pioneer resource surveys
- Extensive user consultation
- Separation of competing space demands by **negotiation** – fisheries and tourism rights reinforced

1999-2004+

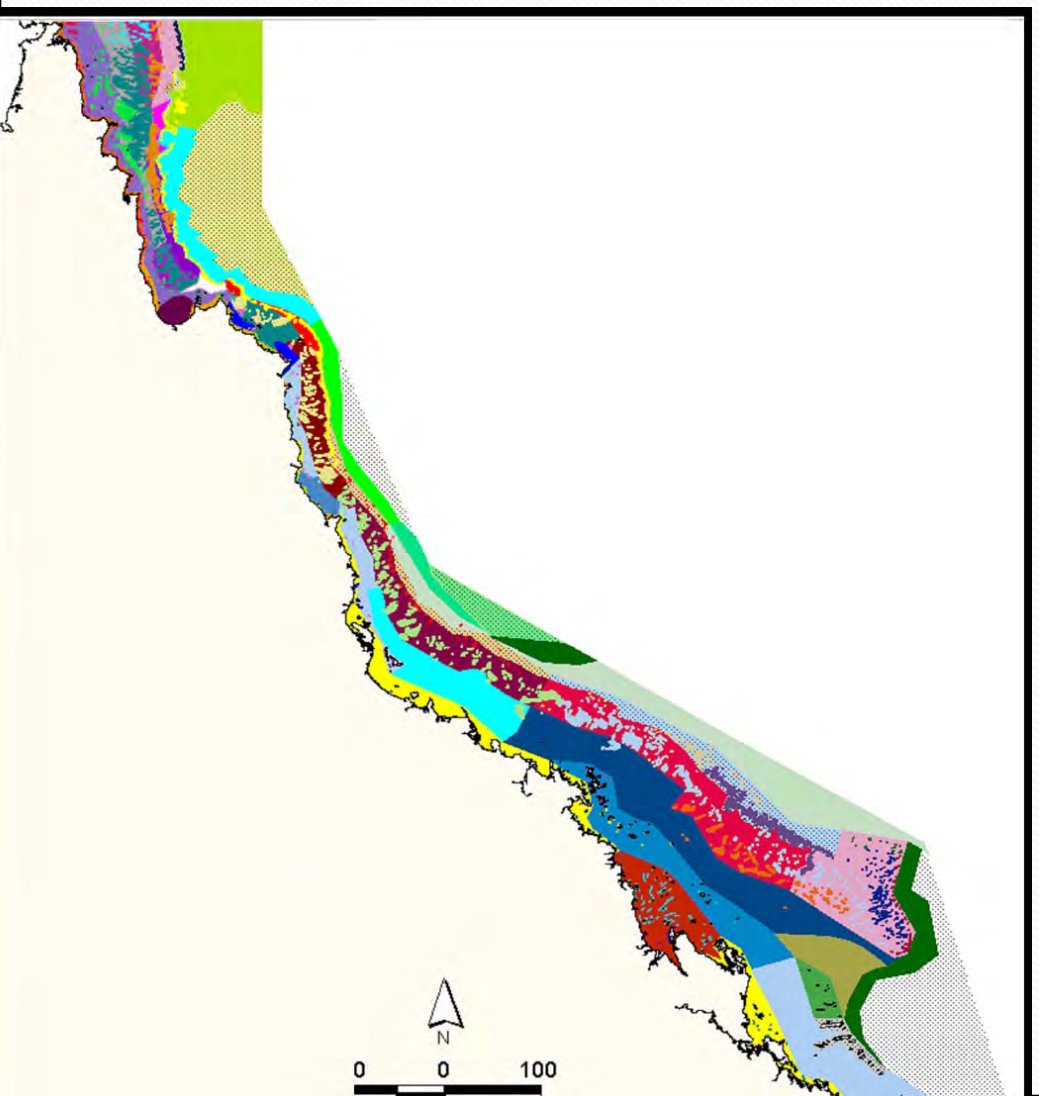
- Bioregional analysis with **systematic conservation planning** tool (Marxan)
- Extensive public input
- Deliberate priority to conservation

Marxan use to inform rezoning

- 13,000 planning units
- Aim to expand green zones from 4.7%
- 31,000 stakeholder submissions!
- Minimize the "cost" of the system where costs are a combination of:
  - Commercial fishing values
  - Recreational fishing values
  - Perimeter length
  - Negative cost (benefit) – places where people actually want reserves

Fernandes et al. 2005 Conservation Biology 19, 1733–1744.

GBR Habitat Stratification



30 different Reef habitats

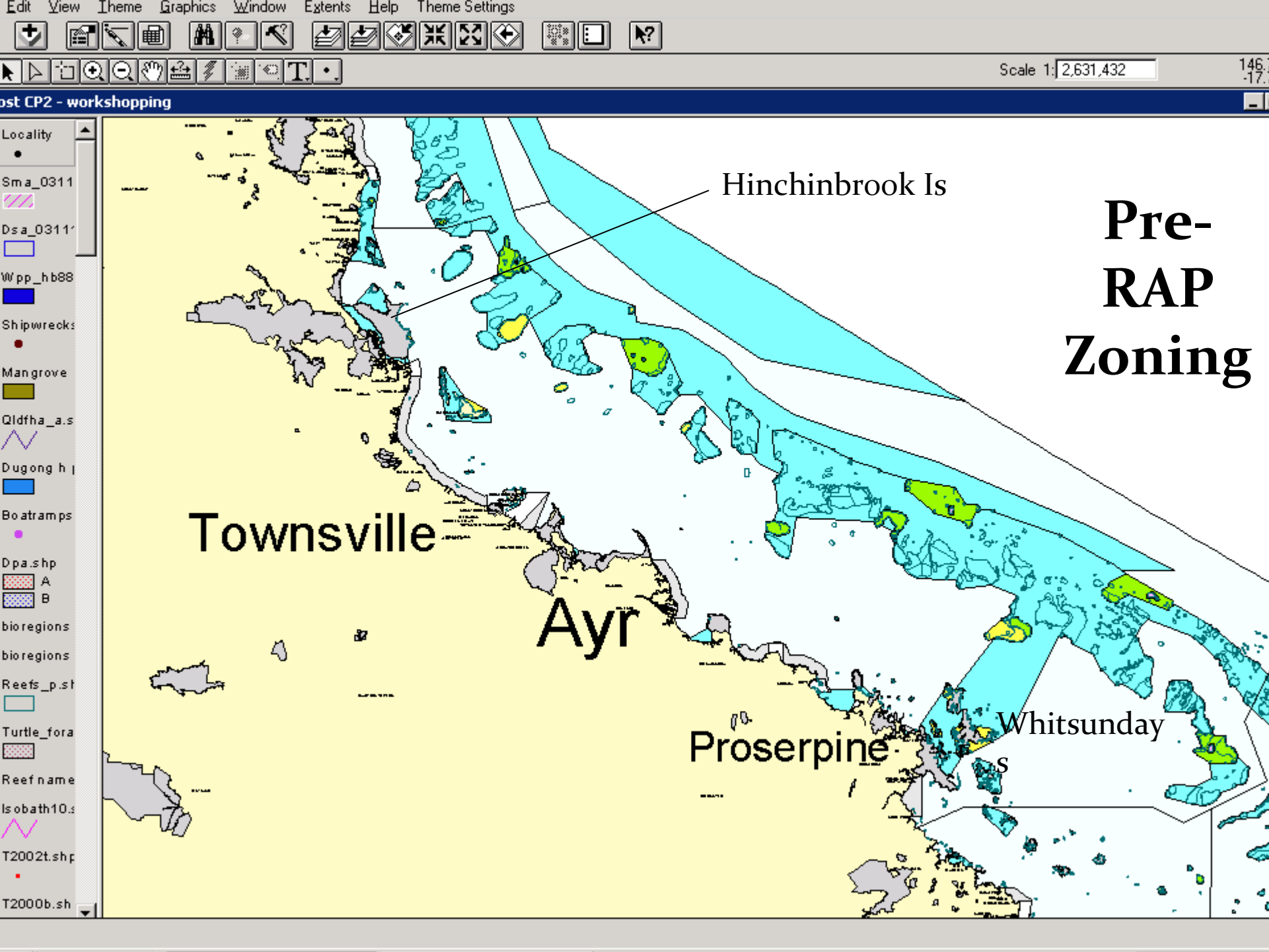
40 different non-Reef habitats

A total of 70 different habitat types

GBR Rezoning Principles

11 biophysical principles such as:

- Minimum of 20% per habitat type within no-take areas
- Represent diversity of plants and animals across:
  - northern to southern reef
  - inshore to offshore
- Protect biophysically special or unique places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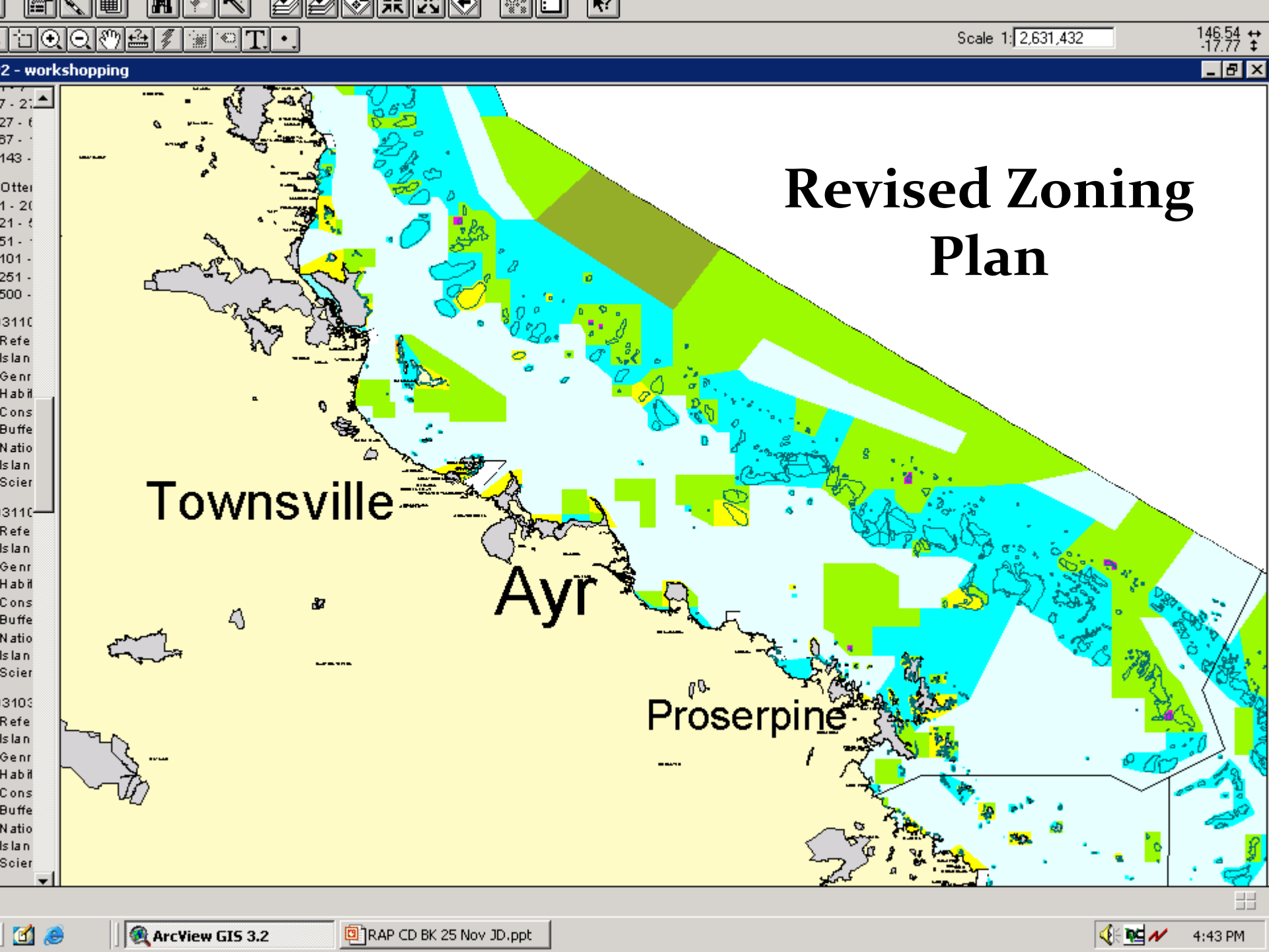
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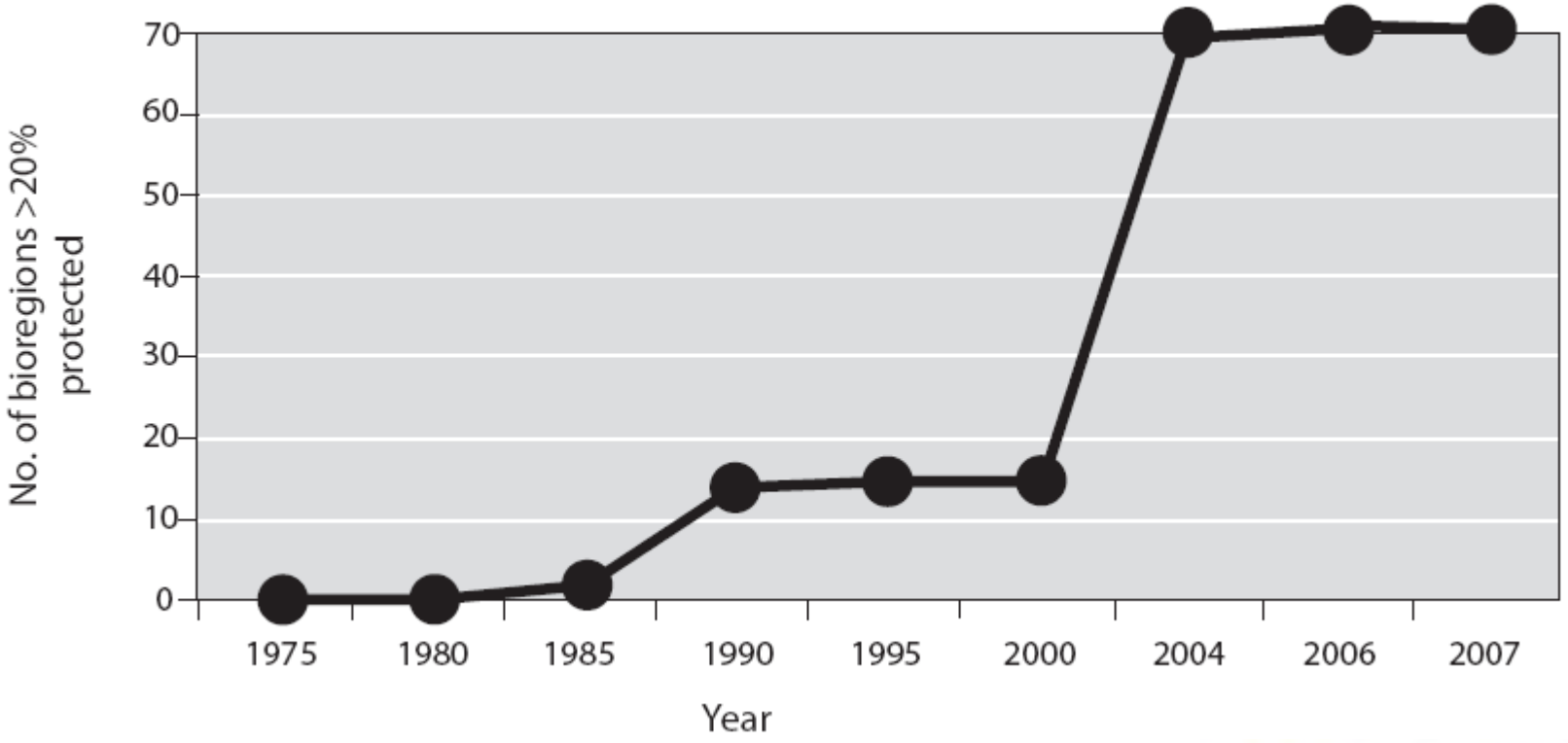
Resultant Representativeness



our great barrier reef
let's keep it great

Initial monitoring indicates reef diversity has been better protected, but clearly zoning alone is not enough…

1890

Same Reef 1994

our great barrier reef
let's keep it great

Marxan Overview

http://www.uq.edu.au/marxan/

- Decision support system that addresses core systematic conservation principles
  - representation,
  - cost efficiency,
  - spatial constraints,
  - zonal complementarity, etc.

Decision-support, not a decision-maker!

- Identifying multiple good solutions, even to very large problems
- Systematic, repeatable and transparent area selection
- Easy to use – aids transparency!

Using Marzone to Select Strategy

Zoning framework.

Zone name	Recreational fishing	Non-extractive recreation
High protection	Not allowed	Not allowed
Partial protection	Not allowed	Allowed
Multiple use	Allowed	Allowed

Table 2
Definition of multiple objectives.

Activity	Objective
Conservation	Protect minimum of 30% of defined marine biodiversity features
Non-extractive recreation	Maintain defined recreation activities at minimum of 80% o current
Fishing	Maintain defined fishing activities at minimum 80% of current

Table 3
Level of contribution towards meeting objectives for each zone.

Activity objective	High protection zone	Partial protection zone	Multiple-use zone
Conservation	100%	20%	0%
Recreation	0%	100%	20%
Fishing	0%	0%	100%

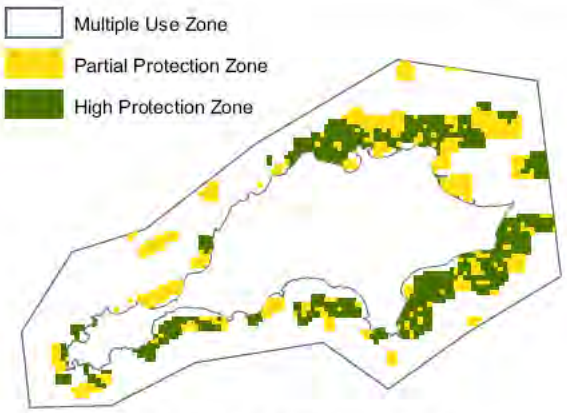
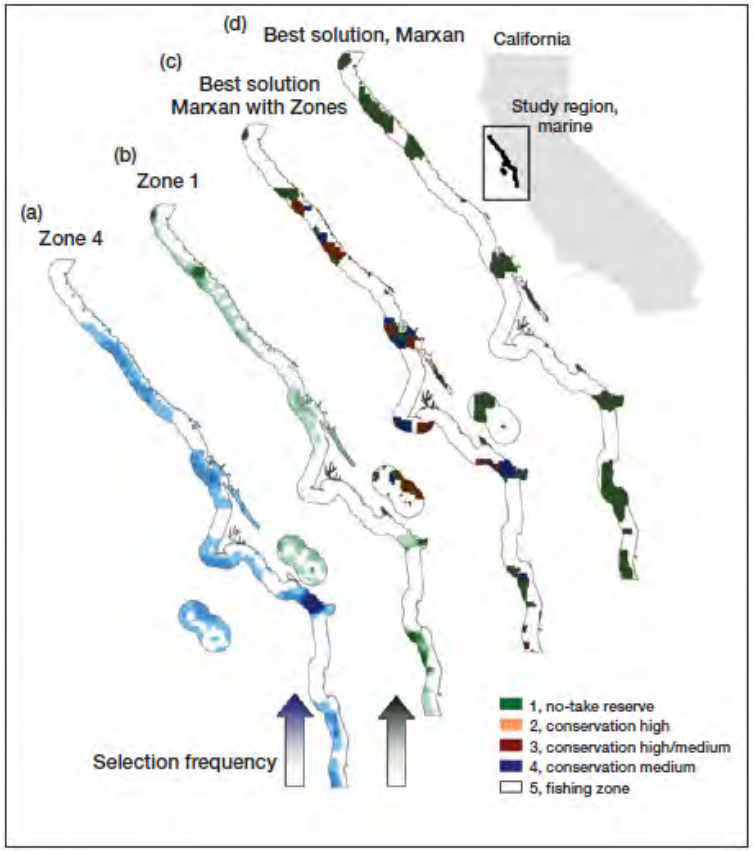
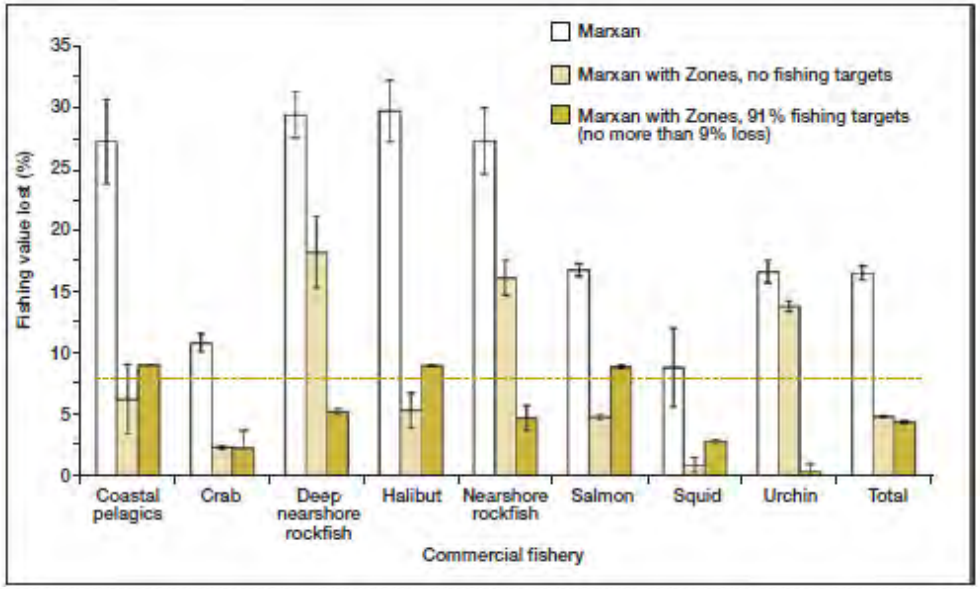


Fig. 1. Example solution for Rottnest Island Case Study.

Please cite this article in press as: Watts, M.E., et al., Marxan with Zones: Software for optimal conservation based land- and sea-use zoning, Environ. Model. Softw. (2009), doi:10.1016/j.envsoft.2009.06.005

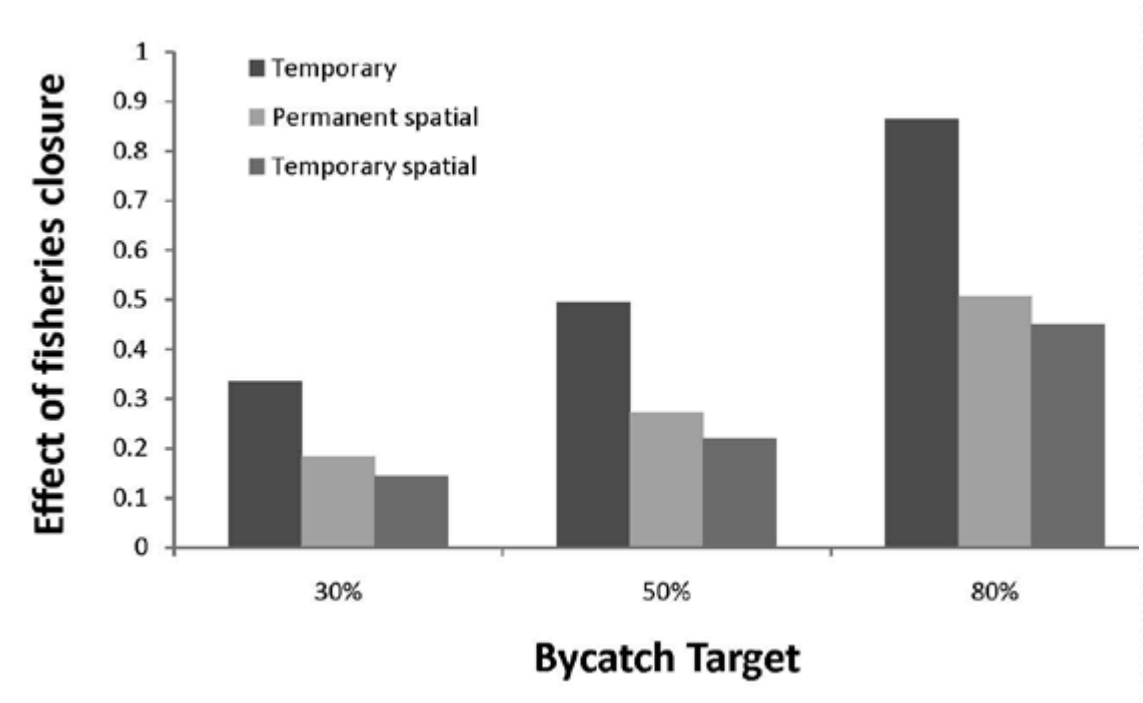
CA Output examples





Klein et al. (In Press) Frontiers in Ecology and Environment

Using MPAs to Reduce Bycatch in SAfr.*

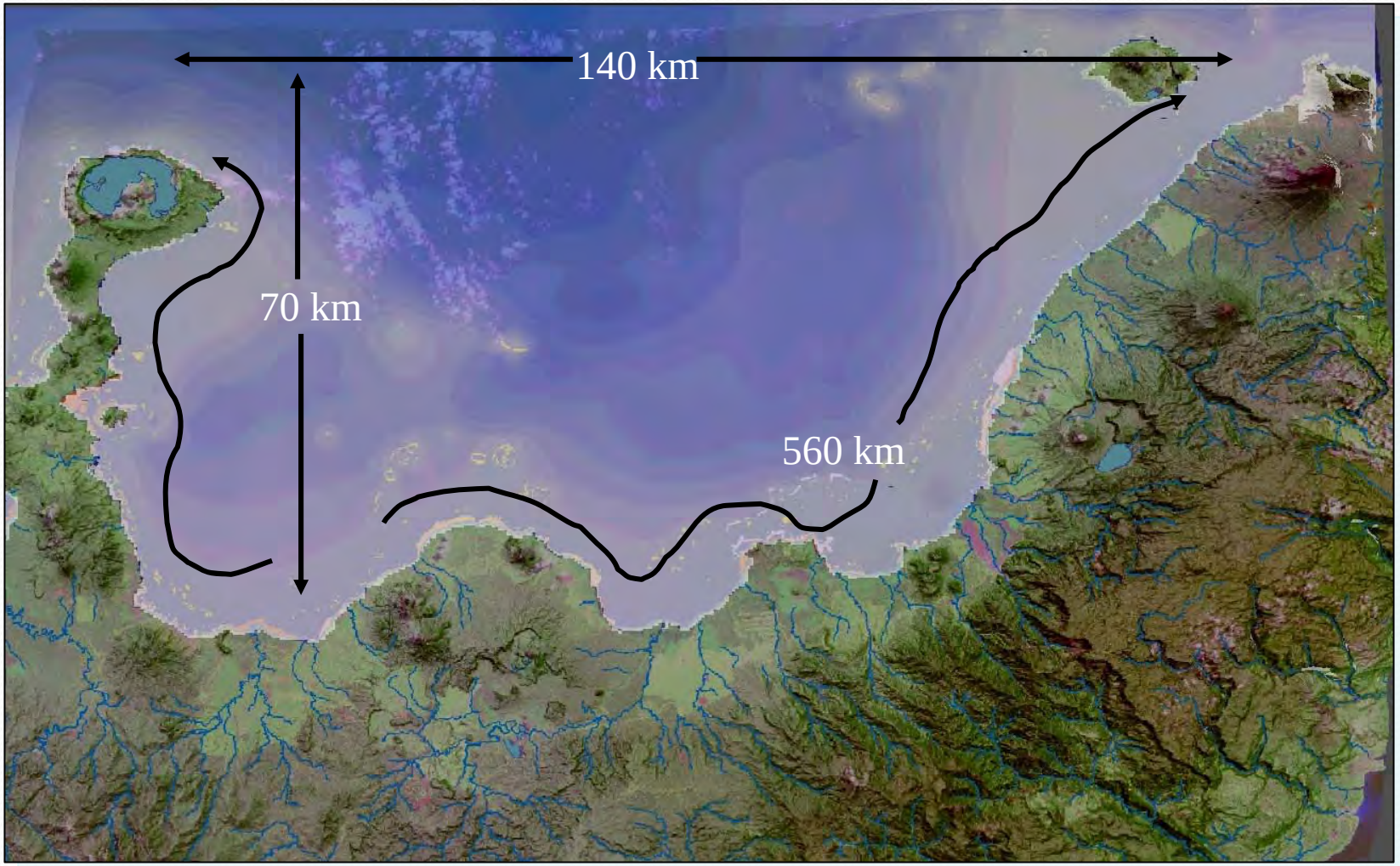


- Seven bycatch species associated with longlining industry (3 birds, 2 turtles and 2 shark species) in South Africa
- Objective is to find least cost (foregone fishing effort) to achieve bycatch reduction
- Temporary spatial closures provide more options

Grantham 2008 Endangered Sp. Research

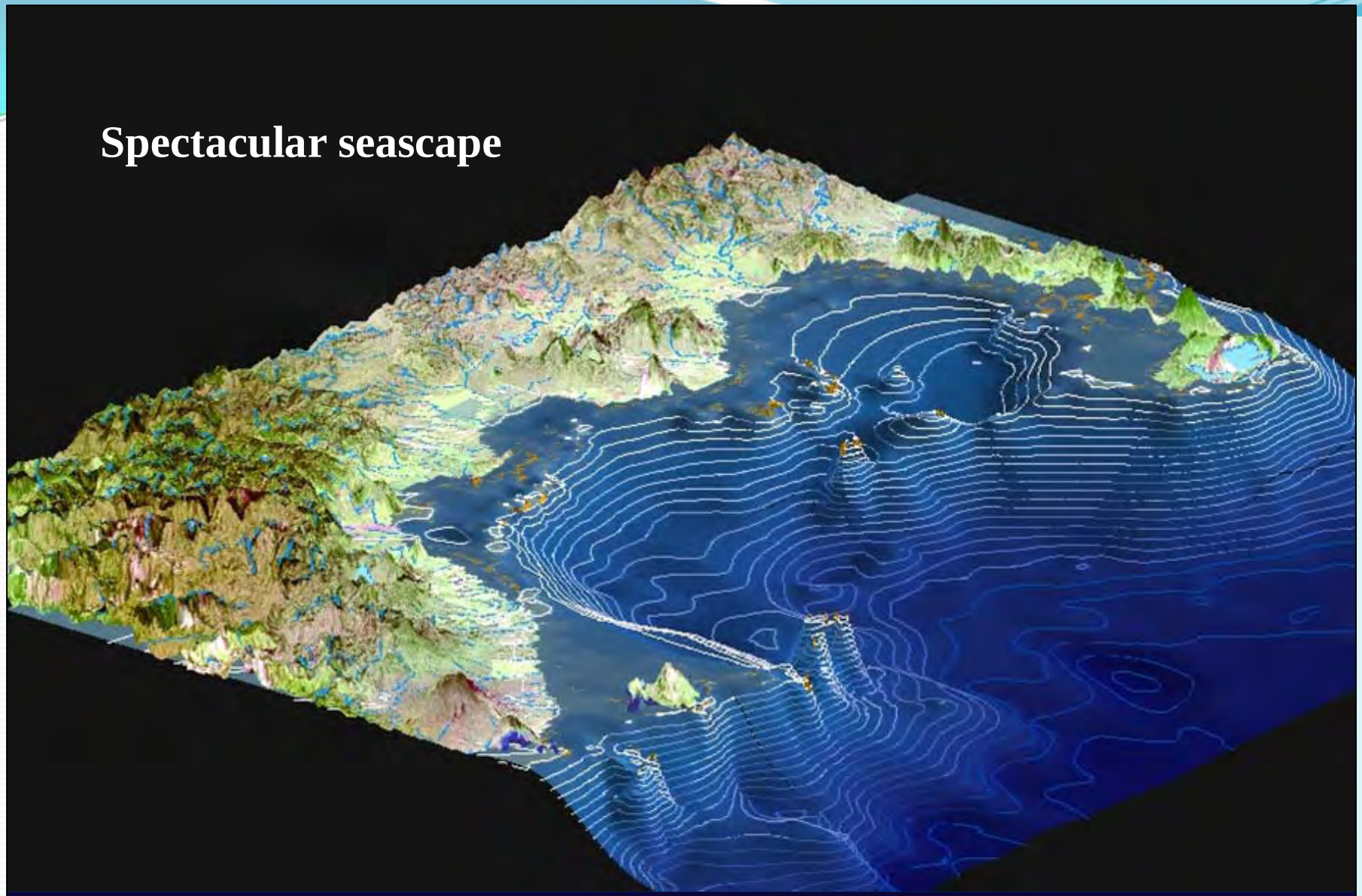
Solomon Islands MPA Network Design

Kimbe Bay MPA Network - Marxan Analysis



Green et al, 2009, Oryx

Spectacular seascape

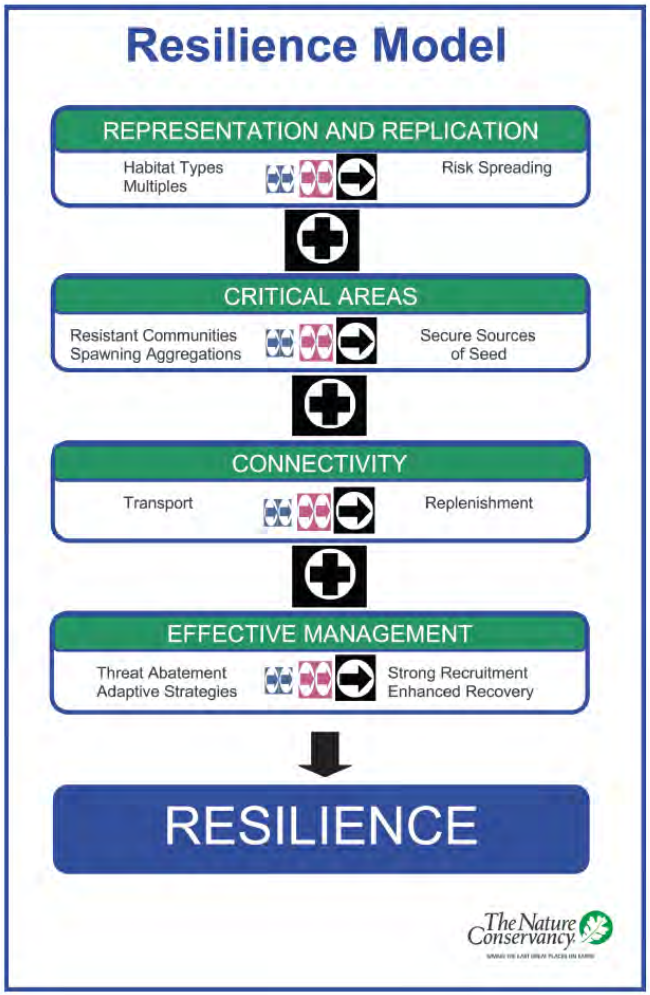


Coastal shelf (200m max), most >500m deep, narrow
Drops off dramatically to deep ocean depths (>2000m) close to shore

Building in Climate Change Considerations

- Salm et al 2009. Coral Reefs and Climate Change: Science and Management, Coastal and Estuarine Studies 61: 207-222.

- Green, Alison. 2007. *Scientific design of a resilient network of marine protected areas: Kimbe Bay, West New Britain, Papua New Guinea*. TNC Pacific Island countries report, No. 2/07. South Brisbane, QLD, Australia: Nature Conservancy, Indo-Pacific Resource Center.



Used Marine Reserve Software (MARXAN)

The Design Process

Process

10 ha planning units
32,834 units

Process
Stage1
- Several scenarios tested
  - Different locking schedules
  - Different boundary modifiers (BLM)

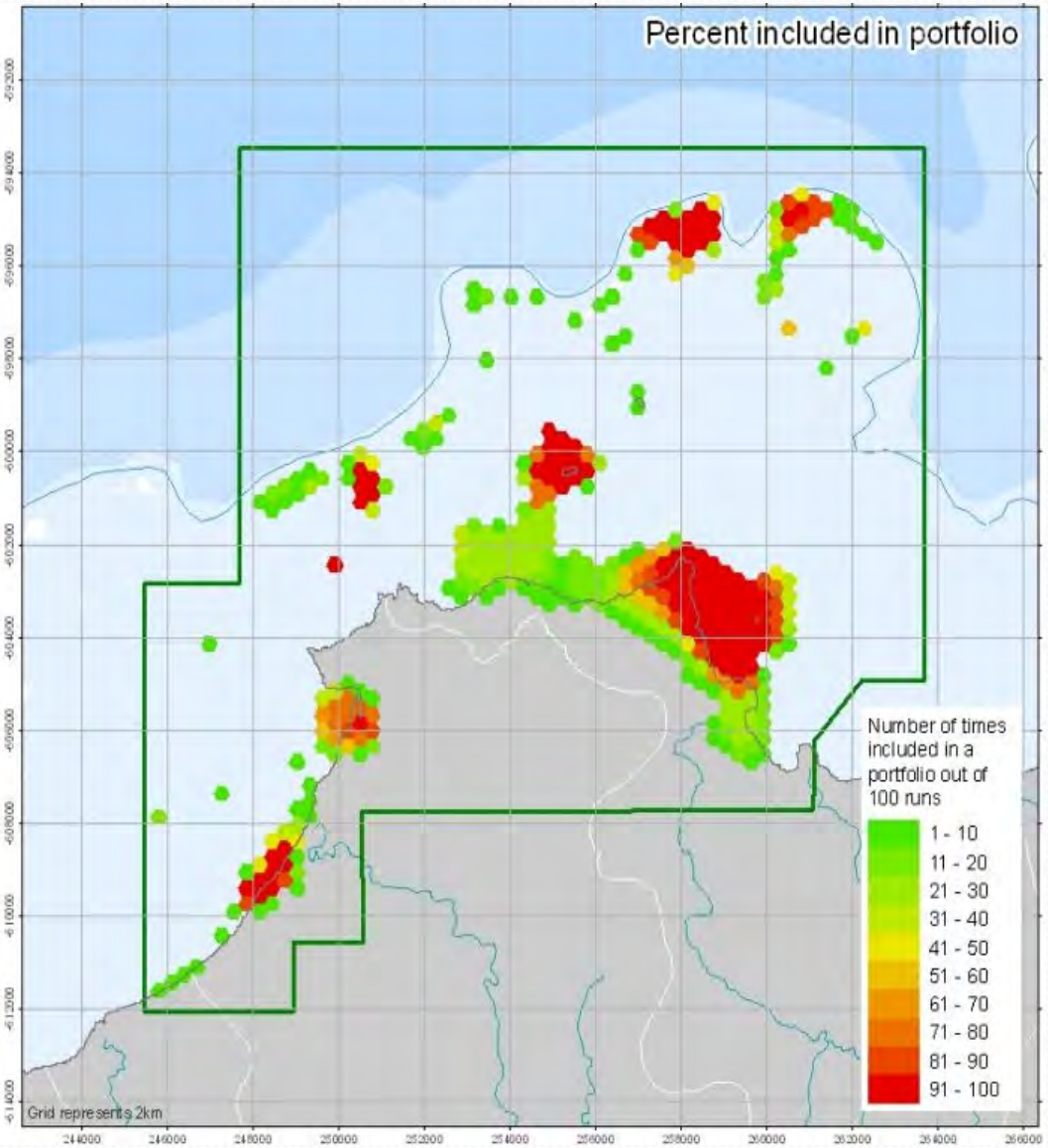
- We only used 1
  - Special & unique sites locked in

Stage2
- Clustered results around "Community AOI's"

- Manual accounting for checking that AOI's capture design criteria

- Rerun Marxan. Outside of AOI Locked out (inside open)

- Clustered Results into "focus areas" to be zoned.



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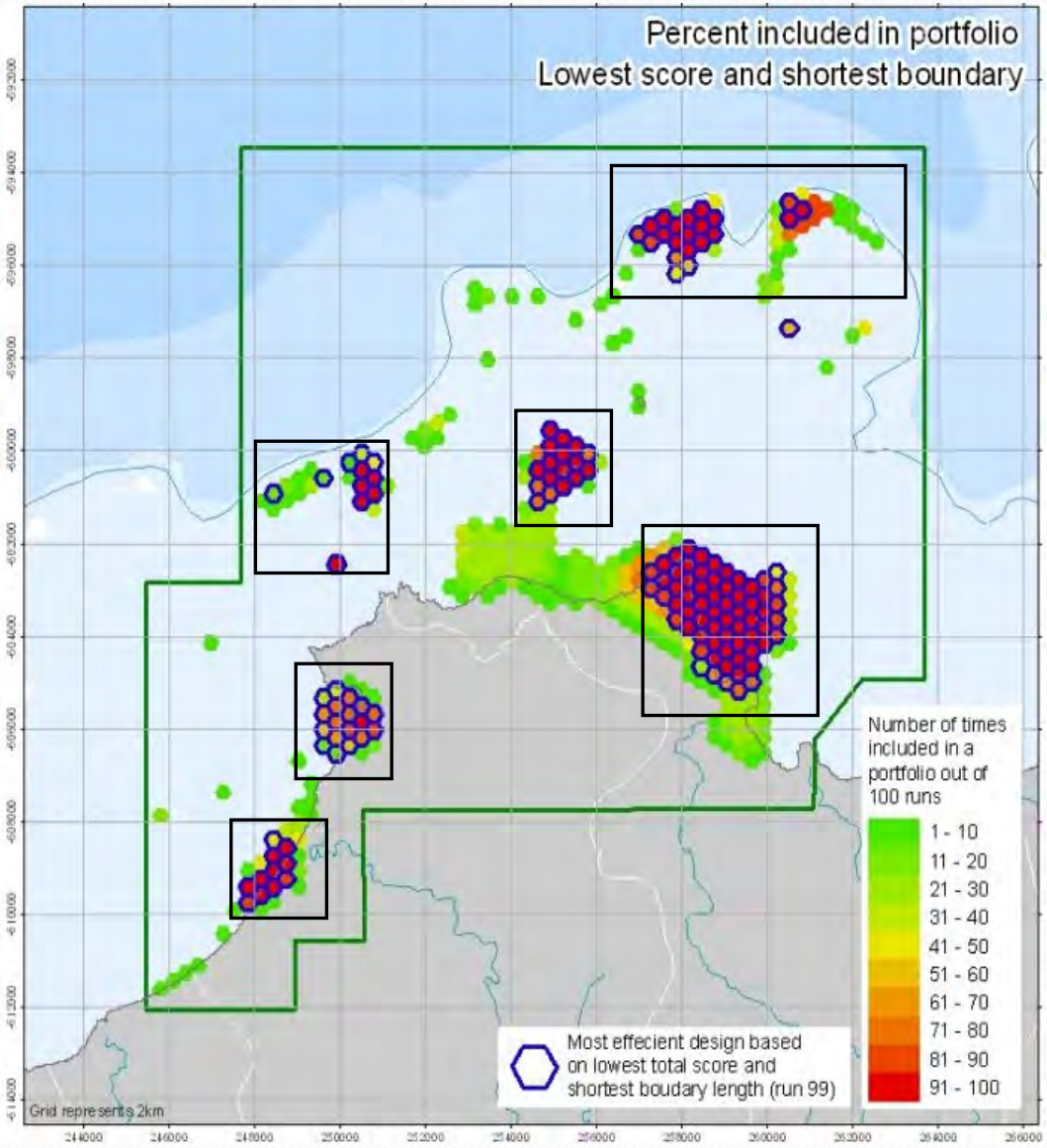
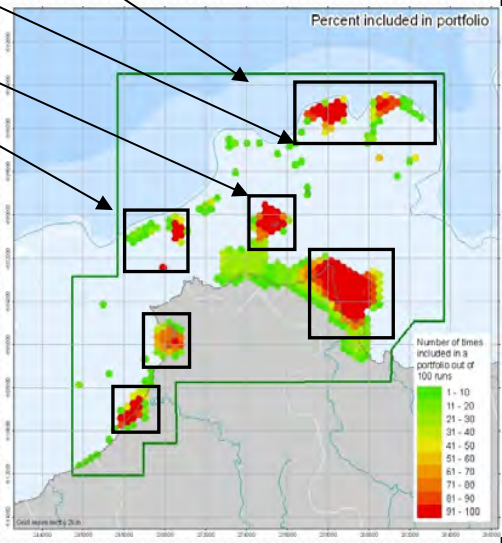
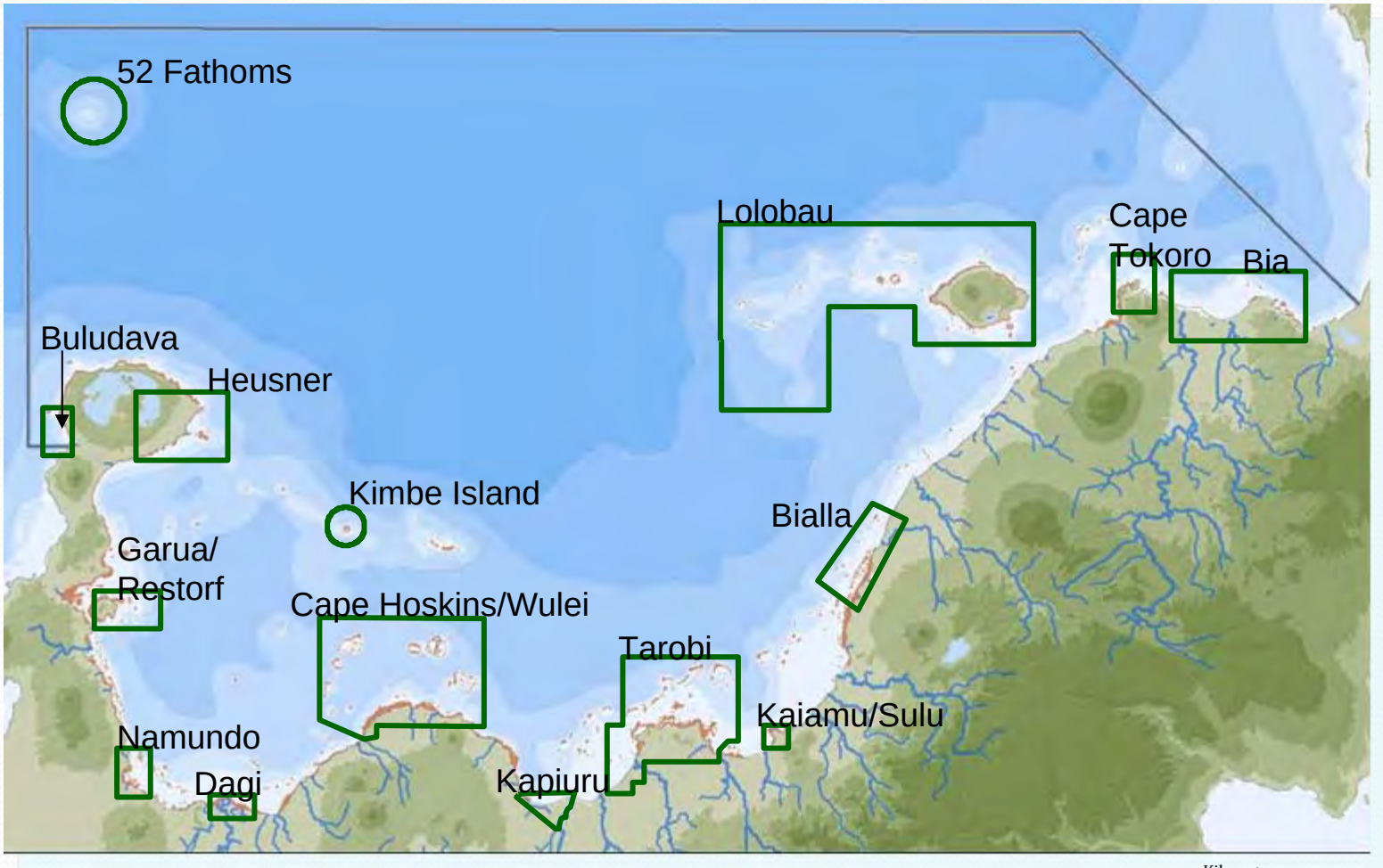


		Permitted (v) Not Permitted (X) Activities					
ZONE	Preservation	Marine Reserve	Buffer	Research	Habitat Protection	Conservation Zone	General Use
	NO GO	NO TAKE	LIMITED TAKE Pelagics Only	NO TAKE (EXCEPT WITH PERMIT)	PROTECTION OF HABITAT SOME TAKE	PROTECTION OF KEY FEATURES SOME TAKE	TAKE
Poison Rope Fishing	X	X	X	X	X	X	X
Spear Gun Fishing	X	X	X	X	X	X	v
Net fishing	X	X	X	X	X	X	v
Hook & Line Fishing	X	X	X	X	v	v	v
Night Fishing Using torch/lamp	X	X	X	X	X	X	v
Harvesting of Sea Cucumber & Trochus	X	X	X	X	X(C)	X	v Species restriction
Harvesting of Wild Fowl Birds & Eggs	X	X (A)	X (A)	X (A)	-	X	v
Harvesting of Turtle and Eggs	X	X (A)	X (A)	X (A)	X	X	v species restriction
Tourism (Diving & Photography)	X	X	X	X	v Permit	v Permit	v Permit
Recreational Picnic & Snorkeling	X	X	X	X	v Permit	v Permit	v
Boating	X	v (B)	v (B)	v (B)	v	v	v
Research (Diving Using Scuba)	X	v Permit	v Permit	v Permit	v Permit	v Permit	v Permit
Shipping	X	X	X	X	X	X	X
Commercial Fishing (Trochus, Sea Cucumber)	X	X	X	X	X	X	X
Cutting of Shoreline Trees	X	X	X	X	X	X	X



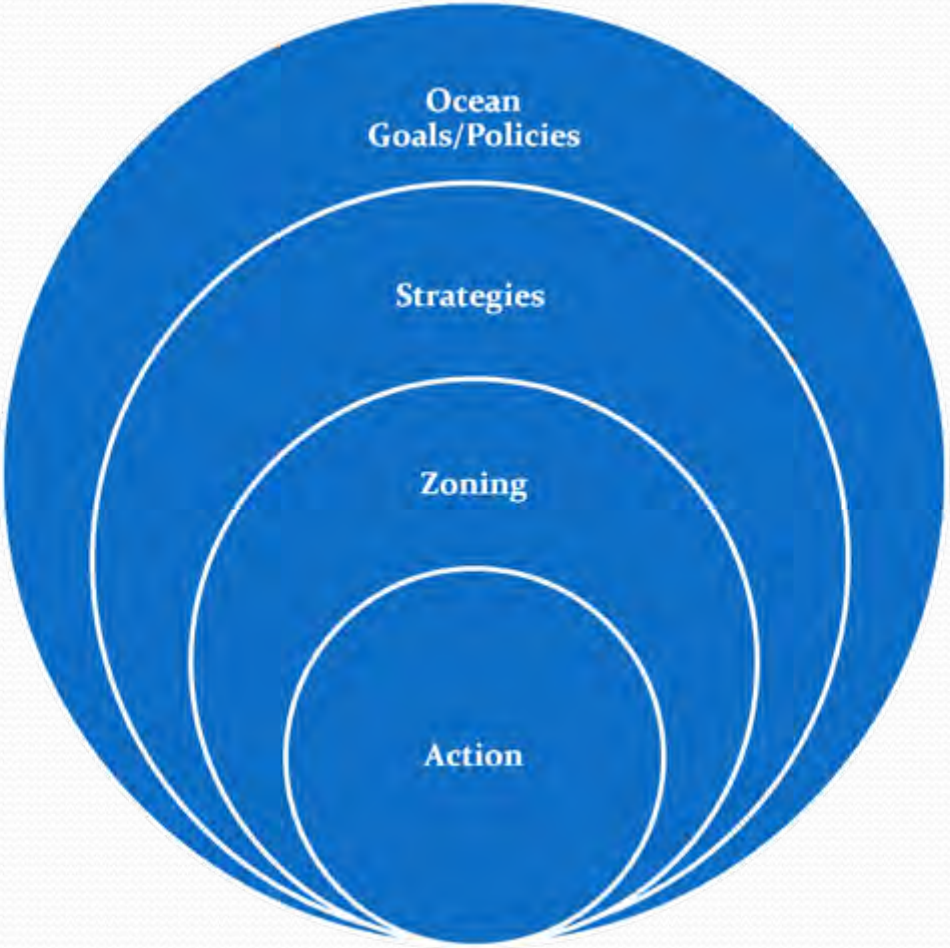
(A) Harvesting of turtle eggs and megapode eggs is restricted to Banban Island (This should be further restricted to a contrained collection time)
A is problematic as it is supposed to be a "No Take" area??
(B) Permit required for boating with the exception of Bulubulu to Tamabolo and Tagi reef
(C) Hook and line fishing NOT permitted with the exception of Tivogo and Veavea Bay
Species restrictions - What species?? Can the communities identify these??

Proposed Kimbe Resilient MPA Network



How best can communities "conserve" these Areas of Interest?

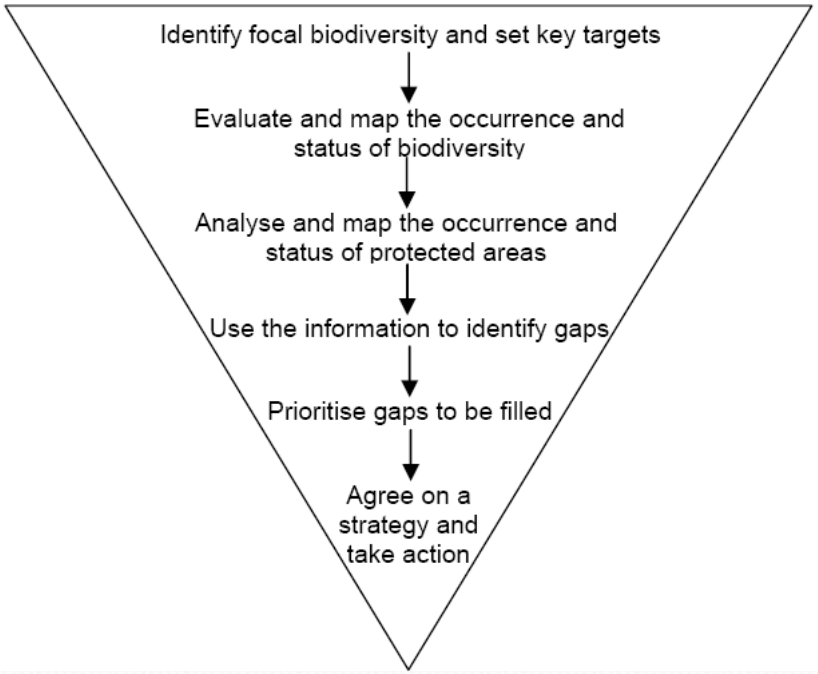
MSP – bridging the big picture and action



Ecoregional Assessment/Conservation Priority Setting/Gap Analysis

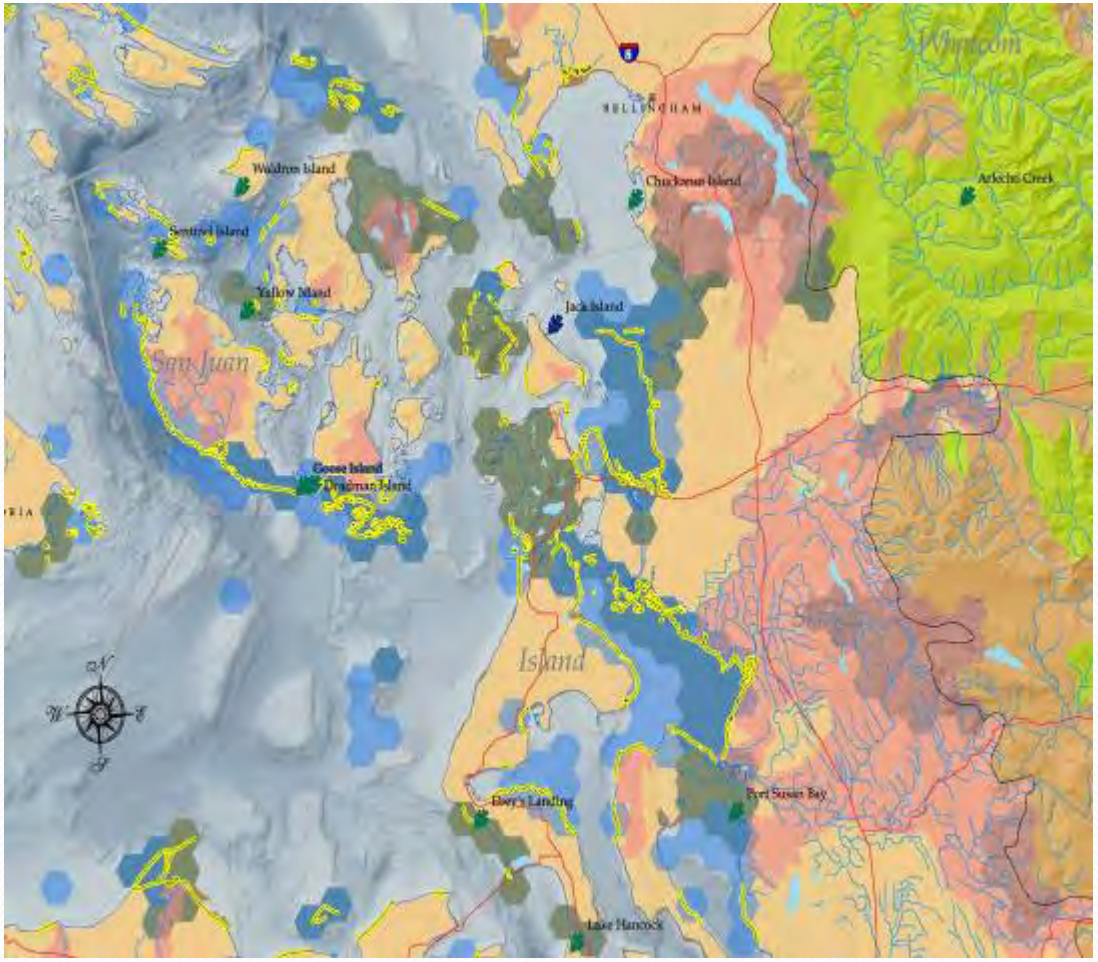
http://conserveonline.org/workspaces/cbdgateway/

http://www.cbd.int/protected/gap.shtml



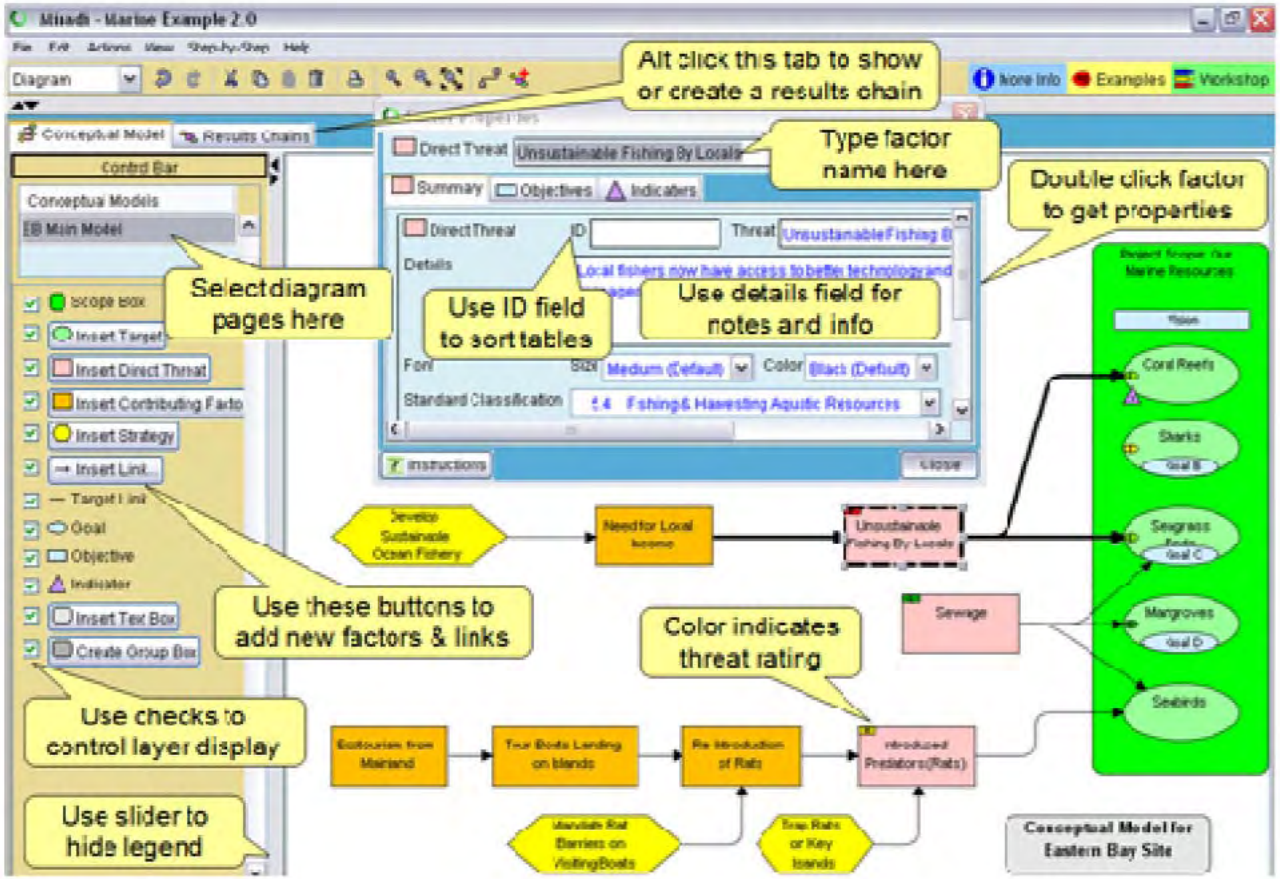
Lays out the big picture – e.g. where do we need to focus?

But what should we do after we have a spatial plan?



Integrated Project Planning System

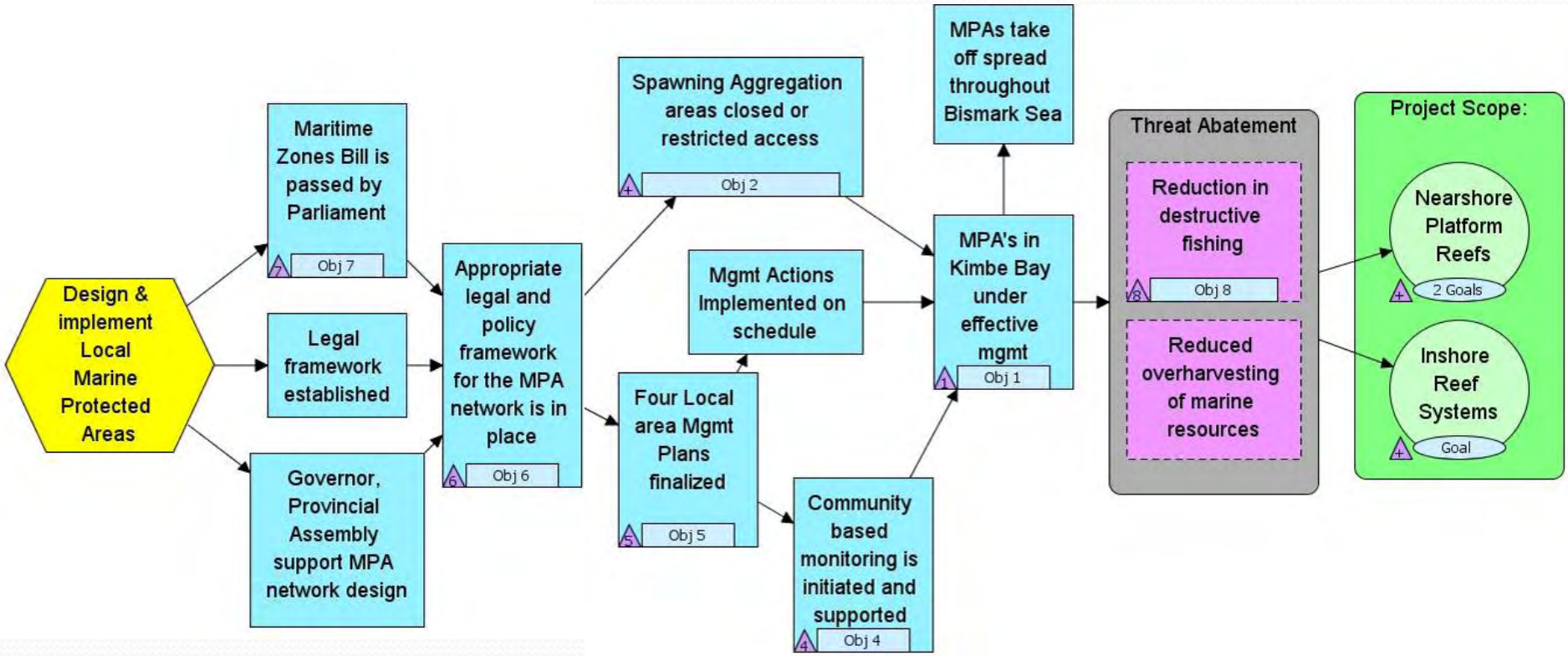
MIRADI™ Adaptive Management Software for Conservation Projects



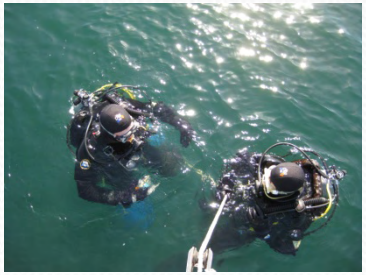
www.miradi.org

www.conservationmeasures.org

Kimbe Strategy Example



Summing Up: MSP checklist



- What are you trying to achieve? (*Begin with the end in mind…)*

- Is marine spatial planning the best tool to help you "get there"
  - Appropriate scale?
  - Vertical and horizontal integration
  - Compatibility with governance systems
- What needs to be in place to enable MSP? – science, stakeholder engagement, related sectoral and place-based strategies

- How will MSP planning link with action/implementation? (at all relevant scales)
- How will you know MSP has been effective and when & how plans need to be changed? (indicators, reviews, etc.)