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...

Changing Oceans, Changing World: Ocean Priorities for the Obama Administration and Congress, p. iii
LOTS of emerging guidance...
State of the art...

**MARINE SPATIAL PLANNING**
A Step-by-Step Approach toward Ecosystem-based Management
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 (adapted from GESAMP 1996).

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

**Terrestrial**
- Temperate Conifer Forests
- Montane grasslands
- Flooded Grasslands
- Tropical Moist Forests
- Tundra
- Deserts
- Tropical Grasslands
- Boreal Forests
- Temperate Broadleaf Forests
- Mediterranean
- Tropical Dry Forests
- Tropical Conifer Forests
- Temperate Grasslands

**Freshwater**
- Tropical floodplain rivers
- Large river deltas
- Large lakes
- Tropical coastal rivers
- Temperate coastal rivers
- Tropical upland rivers
- Inland seas
- Temperate floodplain rivers
- Montane freshwater
- Polar freshwater
- Arid and closed basins
- Temperate upland rivers

**Marine**
- Eastern Indo-Pacific
- Arctic
- Southern Ocean
- Tropical Atlantic
- Temperate Indian Ocean
- Tropical Eastern Pacific
- Central Indo-Pacific
- Temperate North Pacific
- Western Indo-Pacific
- Temperate Southern Pacific
- Temperate Southern Atlantic
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 and near shore and shelf MPA's include both the sea floor and their overlying waters. Here is the water column and sea floor biomes only refer to deeper water areas.

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.

Protection statistics

<table>
<thead>
<tr>
<th>REALM</th>
<th>Percentage of Realm or Province protected</th>
<th>Percentage of entire MHT protected</th>
<th>Percentage of global shelf area protected</th>
<th>Percentage of Realm or Province protected</th>
<th>Percentage of entire MHT protected</th>
<th>Percentage of global shelf area protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>(TEMPERATE) NORTHERN ATLANTIC</td>
<td>3.70</td>
<td>1.50</td>
<td>0.54</td>
<td>0.80</td>
<td>0.33</td>
<td>0.12</td>
</tr>
<tr>
<td>(TEMPERATE) NORTHERN PACIFIC</td>
<td>3.15</td>
<td>0.91</td>
<td>0.33</td>
<td>1.17</td>
<td>0.34</td>
<td>0.12</td>
</tr>
<tr>
<td>TEMPERATE (SOUTHERN) ATLANTIC</td>
<td>1.48</td>
<td>0.11</td>
<td>0.04</td>
<td>0.32</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>TEMPERATE INDIAN OCEAN</td>
<td>6.62</td>
<td>0.38</td>
<td>0.13</td>
<td>2.22</td>
<td>0.12</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Spalding et al., 2008
Great Barrier Reef Case Study

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

Great Barrier Reef Act 1975
25 Year Strategic Plan 1994-2019
5 year Corporate Plan

3 Year Day-to-Day Management Plans
Spatial Zoning plans
- Federal
- State

Site Management Plans
Annual Management Goals/Strategies
Activity Permits
Performance Agreements
GBR Zoning Scheme Organization

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

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
Revised Zoning Plan
Resultant Representativeness
Initial monitoring indicates reef diversity has been better protected, but clearly zoning alone is not enough...

1890

Same Reef 1994
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.
- 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

<table>
<thead>
<tr>
<th>Zone name</th>
<th>Recreational fishing</th>
<th>Non-extractive recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High protection</td>
<td>Not allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Partial protection</td>
<td>Not allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td>Multiple use</td>
<td>Allowed</td>
<td>Allowed</td>
</tr>
</tbody>
</table>

### Table 2
Definition of multiple objectives.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation</td>
<td>Protect minimum of 30% of defined marine biodiversity features</td>
</tr>
<tr>
<td>Non-extractive recreation</td>
<td>Maintain defined recreation activities at minimum of 80% coverage current</td>
</tr>
<tr>
<td>Fishing</td>
<td>Maintain defined fishing activities at minimum 80% of current</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Activity objective: High protection zone. Partial protection zone. Multiple use zone</th>
<th>Conservation</th>
<th>Recreation</th>
<th>Fishing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>100%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

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

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

The Coral Triangle

[Map showing the Coral Triangle and surrounding countries]
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


The Design Process

10 ha planning units
32,834 units

Process

Stage 1
- Several scenarios tested
  - Different locking schedules
  - Different boundary modifiers (BLM)

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

Stage 2
- 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.
Used Marine Reserve Software (MARXAN)

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  – Different boundary modifiers (BLM)
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• Manual accounting for checking that AOI’s capture design criteria
• Rerun Marxan. Outside of AOI Locked out (inside open)
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<table>
<thead>
<tr>
<th>ZONE</th>
<th>Preservation</th>
<th>Marine Reserve</th>
<th>Buffer</th>
<th>Research</th>
<th>Habitat Protection</th>
<th>Conservation Zone</th>
<th>General Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO GO**</td>
<td>NO GO**</td>
<td>NO TAKE</td>
<td>LIMITED TAKE Pelagies Only</td>
<td>NO TAKE (EXCEPT WITH PERMIT)</td>
<td>PROTECTION OF HABITAT SOME TAKE</td>
<td>PROTECTION OF KEY FEATURES SOME TAKE</td>
<td>TAKE</td>
</tr>
<tr>
<td>Poison Rope Fishing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Spear Gun Fishing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v</td>
</tr>
<tr>
<td>Net fishing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v</td>
</tr>
<tr>
<td>Hook &amp; Line Fishing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Night Fishing Using torch/lamp</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v</td>
</tr>
<tr>
<td>Harvesting of Sea Cucumber &amp; Trochus</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X(C)</td>
<td>X</td>
<td>v</td>
</tr>
<tr>
<td>Harvesting of Wild Fowl Birds &amp; Eggs</td>
<td>X</td>
<td>X(A)</td>
<td>X(A)</td>
<td>X(A)</td>
<td>-</td>
<td>X</td>
<td>v</td>
</tr>
<tr>
<td>Harvesting of Turtle and Eggs</td>
<td>X</td>
<td>X(A)</td>
<td>X(A)</td>
<td>X(A)</td>
<td>X</td>
<td>X</td>
<td>v species restriction</td>
</tr>
<tr>
<td>Tourism (Diving &amp; Photography)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v Permit</td>
<td>v Permit</td>
<td>v Permit</td>
</tr>
<tr>
<td>Recreational Picnic &amp; Snorkeling</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v Permit</td>
<td>v Permit</td>
<td>v</td>
</tr>
<tr>
<td>Boating</td>
<td>X</td>
<td>v(B)</td>
<td>v(B)</td>
<td>v(B)</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Research (Diving Using Scuba)</td>
<td>X</td>
<td>v Permit</td>
<td>v Permit</td>
<td>v Permit</td>
<td>v Permit</td>
<td>v Permit</td>
<td>v Permit</td>
</tr>
<tr>
<td>Shipping</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Commercial Fishing (Trochus, Sea Cucumber)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cutting of Shoreline Trees</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

(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 Veaeva 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


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

www.miradi.org

www.conservationmeasures.org
Kimbe Strategy Example

- Design & implement Local Marine Protected Areas
  - Maritime Zones Bill is passed by Parliament
  - Legal framework established
  - Governor, Provincial Assembly support MPA network design

- Appropriate legal and policy framework for the MPA network is in place
- Four Local area Mgmt Plans finalized
- Community based monitoring is initiated and supported

- Spawning Aggregation areas closed or restricted access
- Mgmt Actions Implemented on schedule

- MPAs in Kimbe Bay under effective mgmt
- Threat Abatement
  - Reduction in destructive fishing
  - Reduced overharvesting of marine resources

- Project Scope:
  - Nearshore Platform Reefs
  - Inshore Reef Systems
  - 2 Goals
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.)