Monitoring, evaluation & adaptation in Marine Spatial Planning

... lessons learned over 30 years of ecosystem-based, adaptive management

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Marine Spatial Planning
Paris, Nov 2006

Jon Day
Great Barrier Reef Marine Park Authority
Presentation Outline

• Overview of basic principles of monitoring, evaluation & adaptive management
  • Objectives, indicators, biophysical & socio-economic monitoring, reporting, etc
• Lessons learned from GBRMPA’s approach
• Principles of evaluation …vs practice
• Differing perspectives of managers & scientists
• Conclusions
• Points for discussion
Evaluating management effectiveness is not a new concept - many marine areas assess ‘effectiveness’ eg. using biophysical monitoring.

Increasing calls for more accountability and evaluation of management.

‘Management’ in marine context … rarely manage the marine components per se… primarily we manage human use of those marine components.
Main steps for evaluating management effectiveness

(adapted from Jones, 2000)

1. Identify management objectives/desired outcomes
   ↓
2. Choose indicators
   ↓
3. Undertake monitoring
   ↓
4. Periodically assess results
   ↓
5. Report findings & recommendations
   ↓
6. Adjust management as necessary (= *adaptive mgt*)
Evaluation Cycle

Context

Outcome

Planning

Output

Inputs

Mgt process

(Hocking et al, 2000)
Assessing ‘management effectiveness’ in MSP context

6 components address 3 main aspects of MSP (after Hocking et al, 2000)

- **context**
  - Planning
- **input**
  - Processes
- **outputs**
  - Outcomes
  - Design of area (e.g., size, shape, boundaries, buffers, linkages)
  - Appropriateness of management systems & processes (e.g., planning approaches, implementation, is there enough management?); and
  - Delivery of objectives (does the area achieve its stated goal/aims?)
## Elements of evaluation
*(after Hocking et al, 2000)*

<table>
<thead>
<tr>
<th>Questions?</th>
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<td><strong>Where do we want to be?</strong></td>
<td><strong>What resources do we need?</strong></td>
<td><strong>How do we go about it?</strong></td>
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**FOCUS**
- Current status
- Appropriateness of current tasks
- Resources
- Efficiency & Appropriateness
- Effective-ness
- Effectiveness & Appropriateness

However, a comprehensive system for assessing effectiveness should include evaluation of all 6 elements, as they are complementary.

For many new areas, these are the essential first steps.

For established areas, the best test of management effectiveness is an evaluation of outputs & outcomes.
Great Barrier Reef Marine Park

- > 2,300 km long
- Federal MPA up to low water mark
- complementary State Marine Park in inter-tidal waters

Only ~6% is coral reefs
A range of spatial & temporal management ‘tools’ used in GBR Marine Park

• Key legislative tools (specific Act for GBR, statutory Zoning Plan, regulations)
• Zoning maps *(seven marine zone types)*
• Permits *(linked to zones)*
• Plans of Management *(statutory)*
• Special Management Areas
• Other spatial management tools
• Temporal closures *(eg. reef spawning closures)*
• Economic instruments *(eg. Environment Management Charge)*
• Other environmental legislation *(incl. World Heritage provisions)*
• Codes of Practice/industry partnerships
1. OBJECTIVES

Clear, measurable objectives are fundamental for assessing effectiveness… articulating the desired outcome for each objective helps define a practical interpretation of that objective

- Objectives should be developed for differing management levels (eg broad goals, regional areas, specific tasks/projects)
- Need to establish objectives early in any planning/management process
## Zoning spectrum for multiple use MPA

*primarily regulates extractive activities*

### Activities Guide

*see Zoning Plan for details*

<table>
<thead>
<tr>
<th>Activities</th>
<th>General Use Zone</th>
<th>Habitat Protection Zone</th>
<th>Conservation, Park Zone</th>
<th>Buffer Zone</th>
<th>Scientific, Research Zone</th>
<th>Marine National Park Zone</th>
<th>Presentation Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquaculture</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit 1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Bait netting</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Boating, diving, photography</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓ 2</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Crabbing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Harvest fishing for aquarium fish, coral and beachworm</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit 1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Harvest fishing for sea cucumber, trochus, tropical rock lobster</td>
<td>Permit</td>
<td>Permit</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limited collecting</td>
<td>✓ 4</td>
<td>✓ 4</td>
<td>✓ 4</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limited impact research</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓ 5</td>
<td>✓ 5</td>
<td>Permit</td>
<td>X</td>
</tr>
<tr>
<td>Limited spearfishing (snorkel only)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line fishing</td>
<td>✓ 6</td>
<td>✓ 6</td>
<td>✓ 7</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Netting (other than bait netting)</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Research (other than limited impact)</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>X</td>
</tr>
<tr>
<td>Shipping (other than in a designated shipping area)</td>
<td>✓</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>X</td>
</tr>
<tr>
<td>Tourism program</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>Permit</td>
<td>X</td>
</tr>
<tr>
<td>Traditional use of marine resources</td>
<td>✓ 8</td>
<td>✓ 8</td>
<td>✓ 8</td>
<td>✓ 8</td>
<td>✓ 8</td>
<td>✓ 8</td>
<td>X 8</td>
</tr>
<tr>
<td>Trawling</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Trolling</td>
<td>✓ 6</td>
<td>✓ 6</td>
<td>✓ 6</td>
<td>✓ 6,9</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>
GBRMPA Objectives (cont)

• Each zone type has a specific written objective
  - in all cases ‘conservation’ or ‘protection’ is specified as an overriding aspect within the objective

eg: Marine National Park Zone (= ‘no-take’ zone)
• To provide for conservation of areas of Marine Park in a natural state in perpetuity while allowing the public to appreciate and enjoy the relatively undisturbed nature of those areas; and
• Subject to (a), to provide for traditional fishing and collecting, and traditional hunting, to continue to be undertaken by traditional inhabitants

• All tasks/projects have specific objectives.
Zoning Plan provisions

- Each zone type has specific zoning provisions which list:
  a) Activities allowed ‘as of right’
  b) Activities that require a permit

There is also a provision in (b) which states a permit can be issued for ‘any other purpose’ if the proposed activity is consistent with the objective of the zone.
Example of ‘as of right’ provisions

The General Use Zone may be used or entered without a permit for any of the following purposes:
(a) recreational activities that do not involve the taking of plants, animals, or marine products;
(b) fishing involving:
   trawling;
   trolling;
   line fishing with no more than 6 hooks per line;
   spearfishing not using:
      (a) a power-head; or
      (b) a firearm; or
      (c) underwater breathing apparatus, except a snorkel;
   bait netting;
   commercial netting;
(c) collecting involving:
   limited collecting; oyster-gathering;
   crabbing; bait gathering;
(d) traditional fishing and collecting;
(e) photography, filming and/or sound recording;
Example of provisions which require a permit

The written permission of the Authority is required to use or enter the Marine National Park Zone for any of the following purposes:

(a) operating a fishing industry service vessel;
(b) conducting a tourist program;
(c) conducting research and ancillary activities, other than limited impact research (non-extractive)
(d) conducting an educational program, except a limited educational program;
(e) operating a vessel or aircraft in one vicinity:
   (i) for more than 14 consecutive days; or
   (ii) for more than 30 days in any period of 60 days;
(g) navigating a hovercraft or other craft as in Regs;
(h) navigating of a ship for tourism or research;
(i) operating a facility for a purpose that is consistent with the zone objective or discharging waste from a facility of that kind;
(j) building, assembling, fixing in position, maintaining or demolishing such a facility;
(k) constructing or operating mooring facilities for vessels;
Objectives – lessons learned (cont)

• Most marine managed areas have objectives relating to biophysical attributes
  - some have objectives relating to sustainable use
  - few have objectives relating to governance

• Some objectives may be subject to uncertainty associated with factors operating \textbf{outside} your management area or jurisdiction (\textit{eg} migratory species)
2. **INDICATORS**

*Definition* - A measure (*quantitative or qualitative*) of how close we are to achieving what we set out to achieve (*ie our objective*)

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Effectiveness indicators have been developed by IOC (2006)

- Ecological indicators
- Social–economic indicators
- Governance performance indicators
“Each generation accepts the species composition and stock sizes that they first observe as a natural baseline from which to evaluate changes. This ignores the fact that this baseline may already represent a disturbed state. The resource then continues to decline, but the next generation resets their baseline to this newly depressed state. The result is a gradual accommodation of the creeping disappearance of resource species, and inappropriate reference points ... or for identifying targets .....”

Pauly 1995
Recent increase represents small fluctuation in a population that is far fewer than existed in the 1960s.

South of Cooktown, GBR dugong population “…is a fraction of what it was decades ago”
Indicators – lessons learned

• Indicators must reflect changes at spatial and temporal scales of relevance to management and what needs to be measured

• Differing indicators for site level and system level

• As well as more obvious environmental indicators, need also to develop social and governance indicators

• Ecological goals and socio-economic goals are not mutually exclusive; but they do need different evaluation criteria/indicators.

• Problems of ‘dangerous targets’
3. MONITORING

**Definition** - process of repeated observation for specified purposes, according to prearranged schedules in space and time and using comparable data collection methods

*(after Meijers, 1986)*

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Monitoring can serve differing management needs:

- assess the ecological state of ecosystems
- assess whether regulated performance criteria have been exceeded
- detect and assess impacts of human-generated disturbance(s)
- assess responses to restoration efforts

*(Downes et al, 2001)*
Monitoring in the GBR

• **Huge variety of monitoring**
  - long-term *(site specific & regional scales)*;
  - reactive/ impact assessment *(generally site-specific)*;
  - compliance *(issue-specific)*

• **Some 50+ monitoring projects currently underway (biophysical, biological, social)**
  - Formal monitoring programs
  - Day-to-day management monitoring
  - Volunteer monitoring eg.
    - Seagrass Watch
    - ‘Eye on the Reef‘
    - CAP Reef
  - Other external monitoring programs
Monitoring - lessons learned

- Monitor wisely .... at ecologically- and socially-relevant temporal and spatial scales
- Many monitoring programs ‘do the thing right’ (*ie precise local measurements*) rather than ‘doing the **right** thing’!
- If possible, get managers and users who are on the water daily to assist with monitoring
- Value of quick, easily accessible results
- Development of affordable/acceptable monitoring programs for some areas may typically involve innovation in scientific methods and approaches.
- May need to monitor outside your particular area or jurisdiction to ascertain the context upon which your results may be assessed.
### Reporting

- Reporting is a key part of communicating the monitoring or evaluation results.

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- Wide range of interested parties:
  - *the managers, espec those in the field*
  - *other managers/ other agencies*
  - *Decision makers/Governments*
  - *interest groups (funding bodies, NGOs, international community/programs)*

- May take many different forms:
  - *written (reports, papers)*
  - *mass media*
  - *internet/web*
  - *oral presentation*
• A 3-fold difference in coral trout biomass

• A 2-fold difference in density of prey fish of coral trout between zones

• Suggests a trophic effect of fishing and zoning

Reporting - lessons learned

• Assessments should be open, transparent and accessible to community

• ‘A picture paints a thousand words’ (importance of visuals, graphs to show trends etc)

• Important to think about reporting means at the outset of project, and to tailor the report style and level of detail to the target audience.

• Timing/release of a report can be critical, espec if using media

• Reporting research results can sometimes take years/decades (outside management & political timeframes)
5. **ADAPTIVE MANAGEMENT**

*Essential to meet changing circumstances:*

- changing patterns of use
- technological change
- social change
- political change
- dynamic systems → natural changes
Adaptive management is necessary to manage tourism in GBR

eg. new technology
Initial zone boundaries (1980s-1990s) – 500 metres from reef edge
Current coordinate based zoning - using Latitude/longitude points
## Examples of adaptive management in GBR

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>Fishing</strong></td>
<td>Trawl Mgt Plan; TEDS/BRDs; changes to enforcement approach; inshore trawl closures</td>
</tr>
<tr>
<td><strong>Water quality</strong></td>
<td>End-of-river targets for 2011; coordinated monitoring programs; efforts including monitoring, being directed towards industry, all levels of government and the adjoining catchment areas</td>
</tr>
<tr>
<td><strong>Tourism</strong></td>
<td>‘Best Environ. Practices’; development of partnership approach; criteria for pontoon reviewed</td>
</tr>
<tr>
<td><strong>Zoning</strong></td>
<td>Representative Areas approach (RAP)- new system of representative, comprehensive system of zones incl highly protected areas</td>
</tr>
<tr>
<td><strong>Threatened species</strong></td>
<td>Dugong Protection Areas declared; communities ban hunting dugong in Sthn GBR; new whale &amp; dolphin policy</td>
</tr>
<tr>
<td><strong>Shipping</strong></td>
<td>Compulsory pilotage; mandatory position reporting; cruise ship anchorages reviewed</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td>Shift in mgt focus - recognition of key critical issues, and a restructure of agency to effectively address these issues; greater use of various advisory committees; new focus on compliance/enforcement; increased emphasis on co-operative management with Indigenous people</td>
</tr>
<tr>
<td><strong>Legislation</strong></td>
<td>New Regs (eg. aquaculture, EMC); new ZP; new complementary legislation (Qld); better linkages to EPBC; GBRMPAAct review</td>
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The Great Barrier Reef Representative Areas Program
an ecosystem approach to protecting biodiversity

Original Zoning Plan
- 1983 - 1988

Realisation that existing Zoning Plans inadequate for the protection of biodiversity
- 1988 - 1999

40 Datasets

Maps of Bioregions
- New Coastal Areas added to the GBRMP

Develop operating principles

Community Participation Phase 1
- 10,000 public submissions
- 2002

Community Participation Phase 2
- 21,000 public submissions
- June - Aug. 2003

Draft Zoning Plan

Revised Zoning Plan
- December 2003
- Regulatory Impact Statement

Revised Zoning Plan submitted to Parliament
- November 2003

New Zoning Plan in effect mid 2004

The objective of the RAP was to increase the protection of biodiversity within the GBRMP through:

- maintain biological diversity of the ecosystem, habitat, species, population and species;
- allow species to evolve and function undisturbed;
- provide an ecological safety margin against human-induced disasters;
- provide a solid ecological base from which threatened species or habitats can recover or repair themselves; and
- maintain ecological processes and systems.

Final Draft
Role of public participation in reviewing zoning

- Written public submissions over two formal phases:
  - 10,000 submissions prior to preparing draft map
  - 21,500 submissions commenting on Draft Zoning Plan
- One of the most comprehensive processes of community involvement & participatory planning for any environmental issue in Australia’s history
- > 1,000 formal & informal meetings
Federal zoning came into effect on 1 July 2004…

…..State of Queensland then ‘mirrored’ the zoning in all adjoining State waters in Nov 2004

i.e. LWM to HWM, plus ‘internal waters’
Revised Zoning Plan
1 July 2004

Revised ZP  Old ZP

Preservation Zone  0.2%  (0.1%)

Marine Nat’l Park  33.3%  (4.6%)

Scient. Research  0.05%  (0.01%)

Buffer Zone  2.9%  (0.1%)

Conservat’n Park  1.5%  (0.6%)

Habitat Protect’n  28.2%  (15.2%)

General Use  33.8%  (77.9%)
Applying Marxan, a purpose-built decision support tool

Preliminary map of ‘candidate areas’—biophysical info only
Preliminary map of ‘candidate areas’ - adding socio-econ info
Planning team’s early pragmatic iteration
Many important spatial ‘activities’ are NOT managed primarily by the zoning spectrum, including:

- Defence
- Shipping
- High use tourism areas
- Research
- Indigenous use
- Special Management Areas
- Spawning closures
- World Heritage Area

These are better addressed by other spatial/temporal planning approaches
Shipping lanes

Shipping only allowed with a specific permit

Shipping ‘as-of-right’
A Plan of Management includes various spatial ‘management units’ allowing differing levels of tourism use:

- high levels of use around resort areas
- lower levels of use in more remote areas
Area of Indigenous Sea Country agreement
Combing most spatial layers – *too complex for zoning alone*
Other spatial management layers include:

- **Mandatory pilotage areas for ships**
- **Historic shipwrecks**
- **Remote Natural area overlay (far north only)**
- **Australian Whale Sanctuary**
- **Native Title claims**
Temporal closures – entire area closed during reef fish spawning
Spatial management of activities outside Marine Park has major downstream implications for the Marine Park - flood plumes.
Other key strategies to increase the resilience of the GBR

• Improving water quality  
  *(Reef Water Quality Protection Plan)*

• Promoting sustainable fisheries  
  *(Queensland Fisheries Management Plans)*

• Developing sound policy re effects of climate change on reefs  
  *(Climate Change Action Plan)*
Adaptive management - lessons learned

• Most, if not all, management approaches need to be periodically reviewed and updated.
• No successful management regime can be inflexible to new information.
• Often need to consider a much wider context than just your marine managed area
• Aim to get monitoring & evaluation as part of the management/planning cycle ..... - not just an add-on or once-off
Key dates – GBR Marine Park

1975 - Act passed; Marine Park boundary only
1983 - first Zoning Plan completed for part only
1988 - entire MP zoned (four major sections zoned sequentially)
1998 - two sections rezoned, but recognition of need for GBR-wide representative approach; RAP commenced
2003 - new ZP to Parliament; and approved
2004 - new ZP came into effect on 1 July

\[ \begin{align*}
13 \text{ yrs} & \quad (<5\% \text{ no-take}) \\
5 \text{ yrs} & 
\end{align*} \]
**Differing perspectives....**

Managers, researchers, local communities and politicians all have very different perspectives/priorities/agendas. For example… (after Lawrence, Woodley & Kenchington, 2002)

<table>
<thead>
<tr>
<th>Factor</th>
<th>SCIENTISTS</th>
<th>MANAGERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>status</strong></td>
<td>values higher education and peer opinion</td>
<td>values practical experience, and public &amp; political opinion</td>
</tr>
<tr>
<td><strong>valued actions</strong></td>
<td>research, sound experimental design, valid statistics</td>
<td>finding solutions, satisfying stakeholders/decision-makers</td>
</tr>
<tr>
<td><strong>time frames</strong></td>
<td>often long-term or whatever necessary to ensure confidence</td>
<td>usually short-term/immediate</td>
</tr>
<tr>
<td><strong>language</strong></td>
<td>cautious, scientific concepts, reluctance to simplify</td>
<td>often bureaucratic, frequent use of acronyms</td>
</tr>
<tr>
<td><strong>basis for decision-making</strong></td>
<td>require data and analysis, ‘concrete’ scientific evidence</td>
<td>draws upon info extracted from science, but reinterpreted within own operational bounds</td>
</tr>
<tr>
<td><strong>focus</strong></td>
<td>focus on details, usually single discipline</td>
<td>broad problems/context; multidisciplinary</td>
</tr>
<tr>
<td><strong>viewpoint</strong></td>
<td>rational/logical; primacy of their discipline</td>
<td>mixture of subjective &amp; objective; primacy = political, social &amp; practical</td>
</tr>
</tbody>
</table>
Principles of mgt evaluation .... and practice?

• Many theoretical calls for comprehensive evaluation of management effectiveness of marine areas...
  .... the reality is few resource management agencies have implemented such systems.

• Most efforts to date have concentrated on the bio-physical aspects/condition in a few selected areas ...
  .... few are comprehensive assessments of management effectiveness, or included social or economic aspects.

• Many evaluations have relied upon staff from academic or research institutions to do the work ....
  ..... very few have been conducted by, or effectively involved, management staff.

• Most management plans today refer to adaptive management and the need to monitor performance ....
  ..... few really have, with the main excuses seem to be high costs, institutional barriers & lack of political support.
Conclusions

• Widespread recognition that monitoring, evaluation, effective reporting & adaptive management are all fundamental components for effective marine management.

• MSP is a continuous process involving all the above elements

• Ecosystem-based adaptive management can ensure healthy, productive and resilient marine areas that provide the goods and services that people want and need.

• Monitoring/evaluations need to concentrate on the most important issues affecting or potentially affecting a marine managed area.
Conclusions (cont)

• As managers, we have developed a comprehensive prioritized list of research and monitoring required to address the key management needs.

• Precautionary principle – *don’t wait for ‘perfect’ science before taking management action.*

• Zoning is only one of a wide range of management tools used in the GBR

• Complementary approach across jurisdictions (State/Federal) also fundamental
Conclusions (cont)

• Adaptive management can:
  • demonstrate the extent to which objectives have been achieved;
  • identify gaps that may be rectified;
  • provide feedback as to what’s working and what’s not, enabling more informed decision-making;
  • promote accountability and demonstrate resources have effectively used; and
  • enable effective review of management direction, priorities, resourcing requirements, etc

• Adaptive planning approach – don’t wait for perfect info; be prepared to take on new info
Possible discussion questions

1. Given often differing views (eg. managers/scientists/ politicians/wider public?) when it comes to MSP, how might you determine the most appropriate outcome(s) when it comes to addressing the following things:
   a) objectives?
   b) monitoring priorities?
   c) indicators?
   d) reporting formats?
   e) resourcing priorities to meet (a)-(d)

2. Can you effectively undertake any sort of evaluation or prioritization in the wider marine environment without clear objectives?

3. Integrating a range of MSP tools is difficult without one clear mandate or a coordinated management approach – what are some of the ways to ensure a consistent viewpoint across sectors and between various managing agencies?

4. What might be some effective ways to get a range of stakeholders involved in management evaluation in your marine areas?

5. How frequently should we review our management and planning approaches? Perhaps more importantly, how often can we afford to do so?
THANK YOU

Particular thanks to the UNESCO MSP workshop organisers

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