



Adaptive Management in the GBR

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Outline

1. Great Barrier Reef context
2. Why Adaptive Management?
3. Effects of Line Fishing Experiment
4. Management decisions
5. Observations and lessons
6. Acknowledgements

The Great Barrier Reef

1. Big
2. Complex
3. National and International Icon
4. World Heritage Area
5. Multiple-Use Marine Park
 - Tourism
 - Shipping
 - Fishing
 - Recreation
 - Coastal Development
 - Agriculture



Great Barrier Reef – Institutional arrangements

1. Great Barrier Reef Marine Park Authority

- Federal
- Reef and offshore waters
- Conservation and wise use of the GBR Marine Park
- Impacts of fishing on conservation values
- **NOT** fisheries management
- Spatial planning and “zoning” primary tool

2. Queensland Fisheries Management Agency

- State primary industry department
- Queensland waters under Federal-State fisheries agreement
- Limited recognition of broader effects of fishing on biodiversity
- Input controls (effort, size regulations) primary tool (at time of ELF Expt)

Why an Active Adaptive Management Experiment?

1989

1. Potential effects of fishing on the world heritage values of the GBR.
 - Very limited understanding of the biology and population and community dynamics of the reef fish communities and their linkage with inter-reef habitats
2. Expansion and increasing effort in Queensland's major commercial fisheries in the GBRWHA (prawn, scallop, tropical reef fish) and growth in recreational fishing on the reef.
 - Very limited knowledge of biology and sustainable yields of major target species
 - Historical catch and effort data of limited value for “traditional” assessments
 - Very limited knowledge of linkages between target species of reef fisheries and inter-reef habitats impacted by trawl fisheries

Why an Active Adaptive Management Experiment?

1989

1. GBRMPA responsible for conservation value and managing impacts of fishing on GBR
2. High uncertainty about impact of fishing on target species and broader biological communities (in particular, at the time, Crown of Thorns starfish)
3. Strong community, industry (tourism) and political concern
4. Spatial complexity of GBR and limited ability to generalize from one area/region to another
5. The “rise” of Active Adaptive Management (e.g. Walters 1986, Sainsbury 1988) and champions in the GBRMPA
6. Strong community of experimental ecologists and few “traditional “ stock assessment scientists

Design I - Walters and Sainsbury

1990

1. Examined comprehensive design:

- Impacts of trawling
- Impacts of line fishing
- Interaction between trawl and line fishing through habitat modification and juvenile mortality
- Impact of line fishing on Crown of thorns through predator mortality

2. Provide alternative designs

3. Considered institutional arrangements and oversight

4. Recommended necessary pilot studies to address major assumptions of design

Design II - Mapstone et al 1994, Poiner et al 1998 1992-94

1. Priorities, logistic and funding realities result in decision to pursue separate trawl and line fishing experiments
2. Priority pilot work completed to test underlying assumptions for line fishing
 - Movement of adults among reefs (Davies 1995, 2001)
 - Biology (Ferreira et al, 1994, Ferreira and Russ 1995, Russ et al 1996)
 - Survey methods (Mapstone et al 2000 Brown et al 1994)
3. Original design study revisited:
 - Effect of Line Fishing only (Mapstone et al 1996; Campbell et al 2001)
 - Updated with results from pilot studies
 - Alternate design recommendations focus on scale, levels of replication, “stair-case” (or not) design.

Effects of Line Fishing Experiment (ELF) – Design

1994

1. Objectives

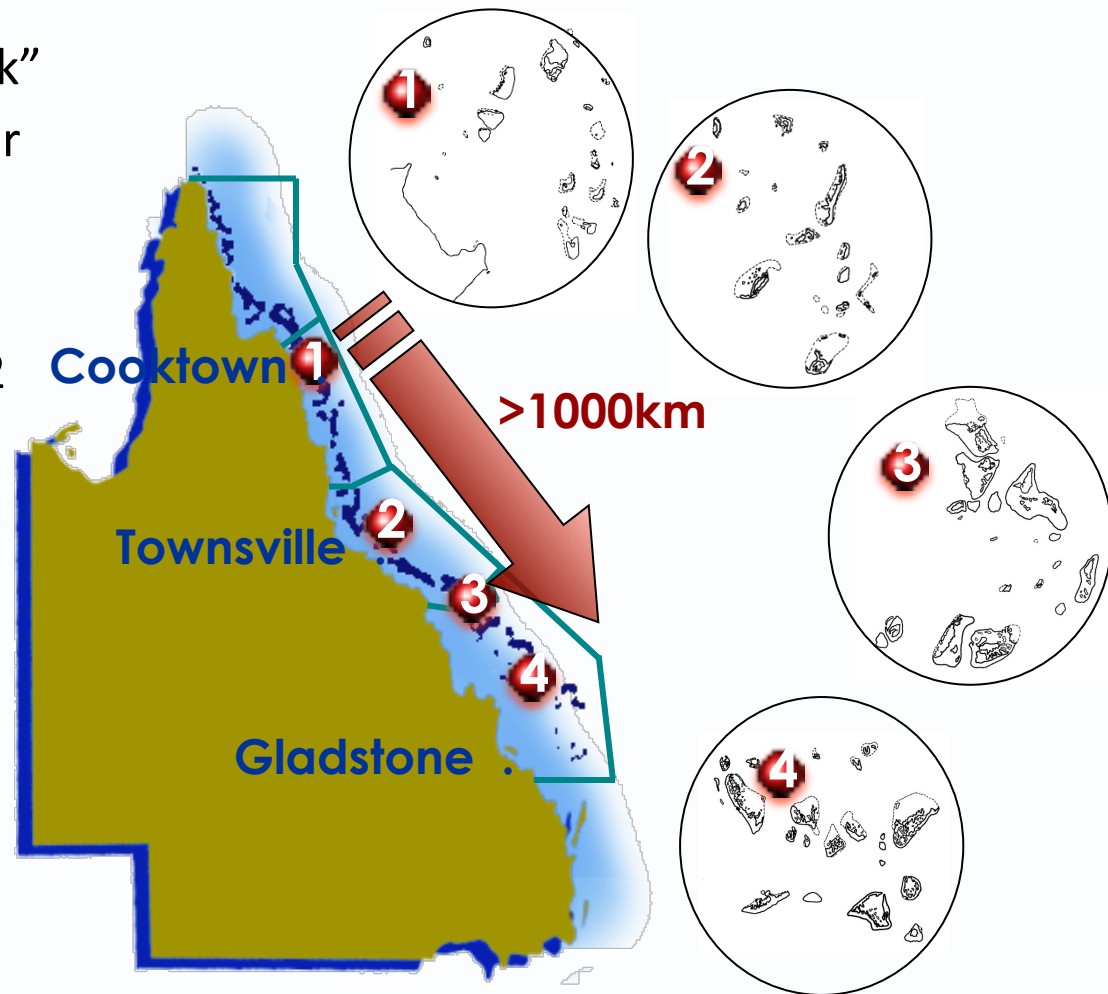
- Test Zoning: “do MPAs work”
- Estimate key parameters for assessment and MSE

2. Design

- 4 clusters, 6 reefs/cluster, 2 replicates/treatment
- Treatments:
 - closed-open-closed
 - Open-increased-closed

3. Monitoring

- Underwater VS
- Research catch surveys
- Biological sampling



Effects of Line Fishing Experiment (ELF) – Stakeholders

1994-96

1. Cooperative Research Centre (CRC) for GBR
 - Formal non-incorporated body
 - Major stakeholders are formal partners & board members
 - Long-term funding (7yrs + 5 yr renewal)
 - “honest broker” key research staff appointed to CRC
 - “learning environment”: post-grad and post-doctoral researchers
 - Data, IP, media, political management
2. Strong imprimatur for “Industry” engagement
 - Commercial, recreational, charter fishers
 - Environmental NGOs
 - GBRMPA
 - Queensland Fisheries and Queensland National Parks
3. Active engagement of stakeholders in final design of experiment, implementation and monitoring

Effects of Line Fishing Experiment (ELF) – interventions 1996-1999

1. Implementation required amending Federal legislation

- GBRMP zoning plans are a legislative instrument (similar to a FMP)
- Implementation of experimental “treatments” required federal parliamentary approval and full public consultation.
- Extremely controversial then; practically impossible now.
- Extensive (multi-level) stakeholder engagement central to final approval
- Approval for 2nd intervention contingent on independent review of 1st.

SURPRISE!!

2. Cyclone Justin

- Largest cyclone on the GBR to that time
- Size of “cyclone effect” swamped treatment effect of opening closed reefs and “pulsing” open reefs.

Effects of Line Fishing Experiment (ELF) – Evaluate 1998

1. Independent Review recommended second round of experiment proceed
 - Essential to improve estimation of key parameters, given impact of confounded effects in first round;
 - Important to increase accuracy of catch monitoring on treatment reefs
2. Second round of treatments completed
 - Strong response on closed reefs opened to fishing
 - Weak “pulse response” on reefs open to fishing

Effects of Line Fishing Experiment (ELF) – Evaluate 2004

1. Effectiveness of zoning on GBR
 - MPAs have greater abundance of coral trout and red throat emperor
 - Coral trout and red throat emperor in MPAs larger
2. Strong Regional differences
 - Strong increasing trend in abundance of major target species to south
 - Northern region quite “different” to Southern three regions
 - Monitoring across geographic range important
3. Experimental treatments
 - improve estimates of abundance for modelling
 - Estimates of natural and fishing mortality should improve over “recovery” period.
4. Age-based biological parameters for >20 target and byproduct sp.

Influence on Conservation and Fisheries Management decisions

1. Revision of size limits for target and by-product species based on new biology
2. Zoning comparison provides strong basis for effectiveness of closed areas for protecting populations from effects of fishing
3. MSE modelling indicates that these benefits stabilise around ~30% closure for coral trout on the GBR.
4. MSE modelling indicates that increased fisheries benefits (yield and CPUE) likely to be increased by reduction in effort

SURPRISE!!

5. Queensland fisheries management move to quota (output) controls

Some observations

1. As a general rule, our management systems remain inherently risk averse. Not without good reason.
2. This continues to be a barrier to wider application of Adaptive Management as it requires, at least, the admission that “what we are currently doing” may not be right.
3. Institutional and individual champions are central to success.
4. Improvements in speed and complexity of simulation modelling approaches provide the ability to examine alternative realities and management approaches without the risk and expense of real world implementation, *alla* Management Strategy Evaluation.
5. This is not, however, a substitute for good monitoring data based on sound experimental designs at the scale appropriate to the management issue at hand.

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