Adaptation to climate change, resilience, and governance

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Structure of talk

- The notion of resilience (thanks, Beth)
- Resilience in familiar settings
  - Environmental resilience (thanks, Beth)
  - Economic resilience
  - Social resilience
- Resilience in governance
  - Why it matters
  - How can we achieve it?
  - Is it relevant to climate change / FUTURE issues?

Origins of ideas

- Informal talk at Stockholm Resilience Centre
  - Immediately after a Workshop on Governance and Ecosystem Approaches to Fisheries
  - There covered developments in international policy in biodiversity conservation relevant to fisheries management, and fisheries management relative to biodiversity conservation
  - Those dynamics play out in the Governance processes of two largely INDEPENDENT streams..
  - Will parallel, independent governance streams produce resilient outcomes? If not, WHAT WILL?

What is meant by “Resilience”

- Many critics say possibly the new abstract buzzword,
  - Following “sustainability”, “precautionary approach” and “ecosystem approach”
  - NONE were well defined technically, all criticized widely.
  - All have proved useful nonetheless
- CONCEPT of resilience is clear. Key properties include :
  - Can withstand modest perturbations without*:
    - Losing ability to return to previous states if pressure released (has capacity AND pathways not blocked)
    - Amplifying perturbations through strong linkages
  - Robust to uncertainties and plausible extreme events

* Aristotelian warning

Resilience and climate change

Withstand modest perturbations without loss of ability to recover or amplifying effects –

- Climate change accompanied by => variance in conditions, so natural perturbations increase.

Robust to uncertainties and extreme events

- Forecasts will be of conditions so far infrequently observed, not core data of parameterisation set;
- Frequency and intensity of severe storm expected to increase.
- Means that 2nd and 3rd moments of distributions as (more?) important than 1st (where is the mean going)

Resilience as a concept not novel in ecology or fisheries

Ricker 1975
With a BH Curve for the Europeans

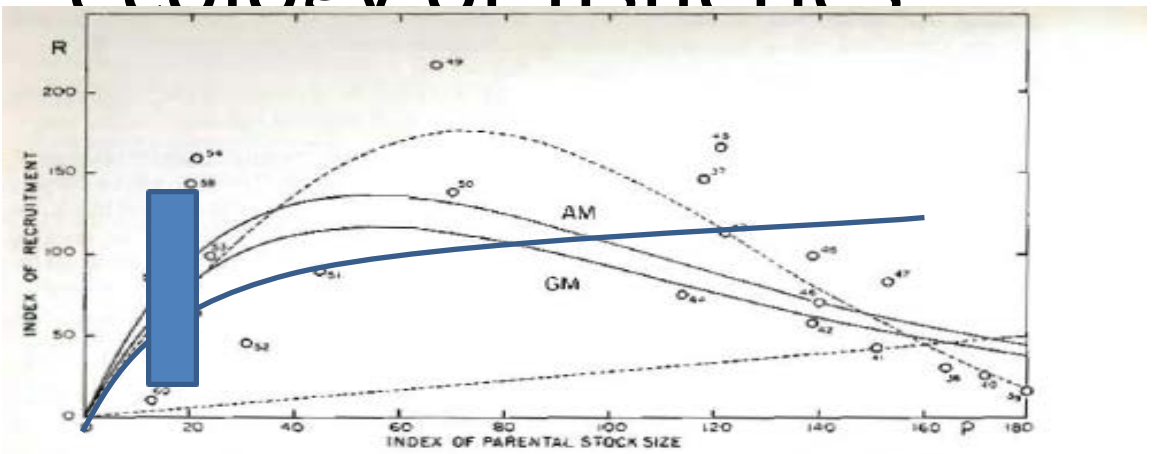


FIG. 11.3. Graph of recruitment against parental stock for Arcto-Norwegian cod. Solid curves—Ricker reproduction curves for geometric and arithmetic mean values; the broken curve is drawn freehand (see the text). (Data from Garrod 1967.)

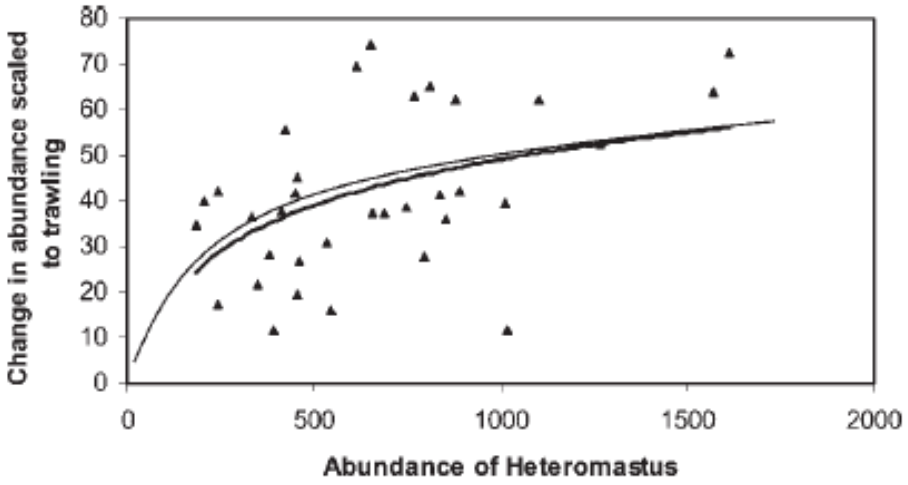
Regardless of details of the line there are both a

- Shallow Domain – unit loss in B produces << unit loss in R
- Steep Domain – Unit loss in B produces >> unit loss in R

Stock is RESILIENT in the shallow domain

Limit Reference Point near the transition between domains

Concept is generalizable well beyond fisheries S – R relationships



SAME properties of SHALLOW and STEEP Domains
Same region of transition between domains that is robust to what model is fit

Transition = = Ecological **TIPPING POINT**

Beyond the Tipping Point recovery slow and insecure

Tipping Points and Economics

- Curvilinearities in fisheries economics back to Clark in 1980s. Expressed many places
  - Price elasticity and supply to markets
  - Labour markets and wages
  - Fishing capacity, effort and profits
- Concept now part of the economic vernacular

  "Budget Deal Is a Tipping Point for the US Economic Recovery" Time Magazine Cover - Dec 2013
- Message the same as in population dynamics
  - **Good economic decisions stay in the shallow zone.**
  - **Beyond TP recovery possible but slow & fragile**

Social “Tipping Points”

- Term less established
  - Perverted as “going viral” from social media
- Has more serious manifestations; e.g.
  - Loss of income of fishery dependent communities
  - Emigration of the young and educated etc
- All have tipping points that affect viability of communities and cultures
- Communities and cultures may NOT have potential for recovery when Tipping Point passed

So in the familiar contexts

- Curvilinearities are the rule not the exception
- Tipping points are inherent in curvilinear relationships (max 2nd derivative)
- Exact location of tipping points moderately robust to formulation of functional relationship (robustness increases with curvature [?])
- GOOD MANAGEMENT KEEPS US AWAY FROM TIPPING POINTS, (Beth's "other goal")
  - Minimize risk of approaching any of the three TPs
  - Not maximizing a property like yield or profit.
- If two dimensions trade off strongly, maximization algorithms will push to joint cliffs [?]

Going beyond the “familiar” uses of resilience to Governance:

- About *properties and functions* (policy **outcomes**)
  - Recruitment size, abundance of benthos
  - Profit, employment, retention of residents
  - Outcomes are all measurable directly
- All might be linked to climate drivers in analyses and models (possibly not direct but pathways of effects).

RESILIENCE IN GOVERANCE IS DIFFERENT!

- Governance is a PROCESS.
- How do we get to PRODUCTS (outcomes) that are resilient (to climate change etc.) from governance PROCESSES?
- What PROPERTIES are needed by the PROCESS?

How do our resilient properties map onto governance outcomes”?

- Robust to uncertainties and extreme events
  - These encountered on ALL THREE axes (s-e-e)
  - Decisions manage risks at all potential failure points
- Potentially Amplifying Linkages –
  - Do we have coherence in policy across issues?
- Recoverability – Does social contract exist to implement decisions;
  - Outcomes perceived as arrived at justly and pathways to them are understood same way by all
    - Costs honestly described (no phony “win-win”)
    - Distribution of costs and benefits transparent

PROPERTIES of a GOVERNANCE PROCESS to produce resilient outcomes: support.

- Strong science base that ideally describes:
  - Uncertainties and likelihoods of events (higher moments of distributions!),
  - Locations of tipping points (curvilinearities)
  - Magnitude and distributions of costs and benefits
  - These are needed for all three dimensions of sustainable development: Social, Economic, Ecological
- Explicit Integration in assessments and decisions across the sustainable development dimensions.
  - Important trade-offs are *across* dimensions;
  - NOT of different variables within one dimension.

Properties of resilient governance systems: Decision-making

Resilient governance decisions strive to:

- Avoid tipping points,
  - Requires knowledge of tails of key distributions and curvature),
  - NOT optimize trade-offs, which are usually estimated from central moments
  - Robustness of tipping point neighborhood to details of formulation of relationships is important positive.
- Seek inclusive consensus on specifics (pathways) not platitudes (outcomes): “hard objectives” –
  - the HOW, not just the WHAT

So how well do our governance systems display these properties?

- Use the interplay between fisheries management and biodiversity conservation as the model.
  - These can each be subdivided, of course, especially large-scale and small-scale fisheries.

Points of Contact –
Policy for biodiversity conservation and fisheries management

- **Objectives:** WHERE do policy makers (and society) want to end up? (Robust end points)
- **Subject Matter:** WHAT do they want to deal with in the end and during the journey to get there? (What are each comfortable with – and not)
- **Tools and Tactics** – HOW do they want to get to their desired outcome? (Pathways and values of items to trade).

What is the nature of the interfaces?

- Strategic and Tactical (operational) **Objectives** (outcomes)
  - Both matter, but for different reasons
  - Strategic ones are about the goals
  - Tactical ones are about the decisions made “today”
- **Subject matter** (what are the costs and benefits)
  - For biodiversity the subject matter is everything, and fisheries are a pressure to deviate from ideal state
  - For fisheries the subject matter is people and the ecosystem to the extent it feeds or employs them
- **Tools and tactics** (pathways to follow or avoid)
  - Each has a history and preferences, and slow to take up tools and tactics of the other

Strategic and Tactical Objectives

- In the end, the goal is the same – healthy and productive ecosystems, with happy and secure human communities / society.
- Today fisheries policy acknowledges:
  - the importance of managing the ecosystem footprint of fisheries
  - That damaged ecosystems can't support healthy fisheries
- And biodiversity policy acknowledges:
  - the legitimacy of sustainable use
  - Cannot expect societal / community support and compliance if users are excluded too extensively

Promising Situation -
but how much devil is in the details?

- All perspectives agree to some high level Strategic Objectives, but:
  - Can we go from platitudes to specifics (Operational Obj)
  - Do we agree on ALL objectives, or just have some overlap in two separate sets of objectives
- Concrete example from workshop on MPAs and Fisheries Management (FAO & UNEP) at Bergen in 2011
  - Nearly 100 participants, nearly 50:50 by “root” agency
  - One subgroup (~30 people) looked specifically at “objectives” that would be supported by each community.

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Review

The role of MPAs in reconciling fisheries management with conservation of biological diversity

Jake Rice [a,*], Erlend Moksness [b], Colin Attwood [c], Stephen K. Brown [d], Geir Dahle [e], Kristina M. Gjerde [f], Ellen Sofie Grefsrud [e], Richard Kenchington [g], Alf Ring Kleiven [b], Patrick McConney [h], Magnus A.K. Ngoile [i], Tor F. Næsje [j], Erik Olsen [e], Esben Moland Olsen [b], Jessica Sanders [k], Chandrika Sharma [l], Ole Vestergaard [m], Lena Westlund [n]

Conclusions from study

- Nearly 2/3 of 67 plausible objectives were shared among fisheries and biodiversity perspectives
- Most fishery conflicts were differential acceptance of social & economic objectives:
- Most biodiversity conflicts were over full exclusion objectives

Substantial common grounds on which to build.

BUT Issues needing resolution are:

- Tolerance for varying degrees of perturbation,
- Priority given to human benefits.

Is this a basis on which to expect to built resilient outcomes

- Each perspective does NOT concede legitimacy of some priority outcomes of the other
  - Conservation: Social & Economic uses of biodiversity
  - Fish Management: Full protection of biodiversity
- So social licence for ANY outcomes unsure, and concepts of “Integration” must differ
- Shared outcomes were desired states – not dealing with tolerance of undesired states
  - How much will each perspective pay to avoid the other’s tipping points?

How do we build and/ find resolution? SUBJECT MATTER of each perspective.

- Might "meet in the middle" but coming to the middle via different historical pathways.
- Fisheries Policy
  - By 800s: who gets a share of fisheries yields
  - By 1800s: how to maintain recorded yields
  - 1900s: how to maintain stocks producing yields
  - 2000s how to maintain ecosystems to provide yields (biodiv.)
- Conservation policy
  - By 800s: protect places and species for nobility
  - By 1800s: protect places and species for landowners
  - First half 1900s: protect places and species for all
  - 2nd half 1990s: manage the threats to the "fortresses"
  - 2000s: manage threats to the ecosystems (fisheries)

Why do the historical pathways matter?

- Fisheries policy started with USE
  - Reduce use only as needed to keep sustainable
  - Biodiversity is accommodated as "collateral" issue
  - Tolerate as much perturbation as needed to accommodate use demands unless harm shown
- Biodiversity policy started with PROTECTION
  - Perturbations tolerated only when lack of harm shown
  - Manage uses on basis of threat posed not benefit taken
- Both precautionary approach and ecosystem approach made the dialogue more sophisticated, but participants in the dialogue still have different root vocabularies

How do these stack up to our resilience properties

	Science Foundation	**Avoid Tipping Points**
Ecol	About Equal	DIFFERENT risk tolerances
Econ	Stronger in fisheries	Stronger in fisheries
Social	Divisive (history)	Unsystematic in both

- Full integration: both fall far short
- Inclusive Consensus: no universal social license for either preferred pathway

Can’t choose pathways for climate change adaptation without social license to act.

Resilience and tools and tactics:

Tool	**Resilience**
Fisheries	
• Input Controls	• Neutral (precautionary)
• Output Controls	• Neutral (precautionary)
• Gear / technology	• Neutral
• Spatial/Temporal closures	• Scale dependent
Biodiversity	
• Protected species	• Deterministic (VERY PA)
• Protected areas	• Deterministic (VERY PA)
• Spatial planning	• Potential if “hard” not “soft”, but hard to be hard.

Social License: each tends to challenge other's tools & tactics

- Fisheries use of gear mitigation for bycatch and habitat impacts
  - Distrust of commitment to implement
- Fisheries use of VMEs (and EBSAs)
  - Distrust of Knowledge basis for detection
  - Encounter protocols *post hoc* not preventative
- Biodiversity use of Protected Species or Area listings:
  - Distrust import of terrestrial tools for marine ecosystems
  - Distrust claimed magnitudes of benefits and risk
- Different risk tolerances for management errors
  - Misses vs False Alarms in exercise of regulatory powers

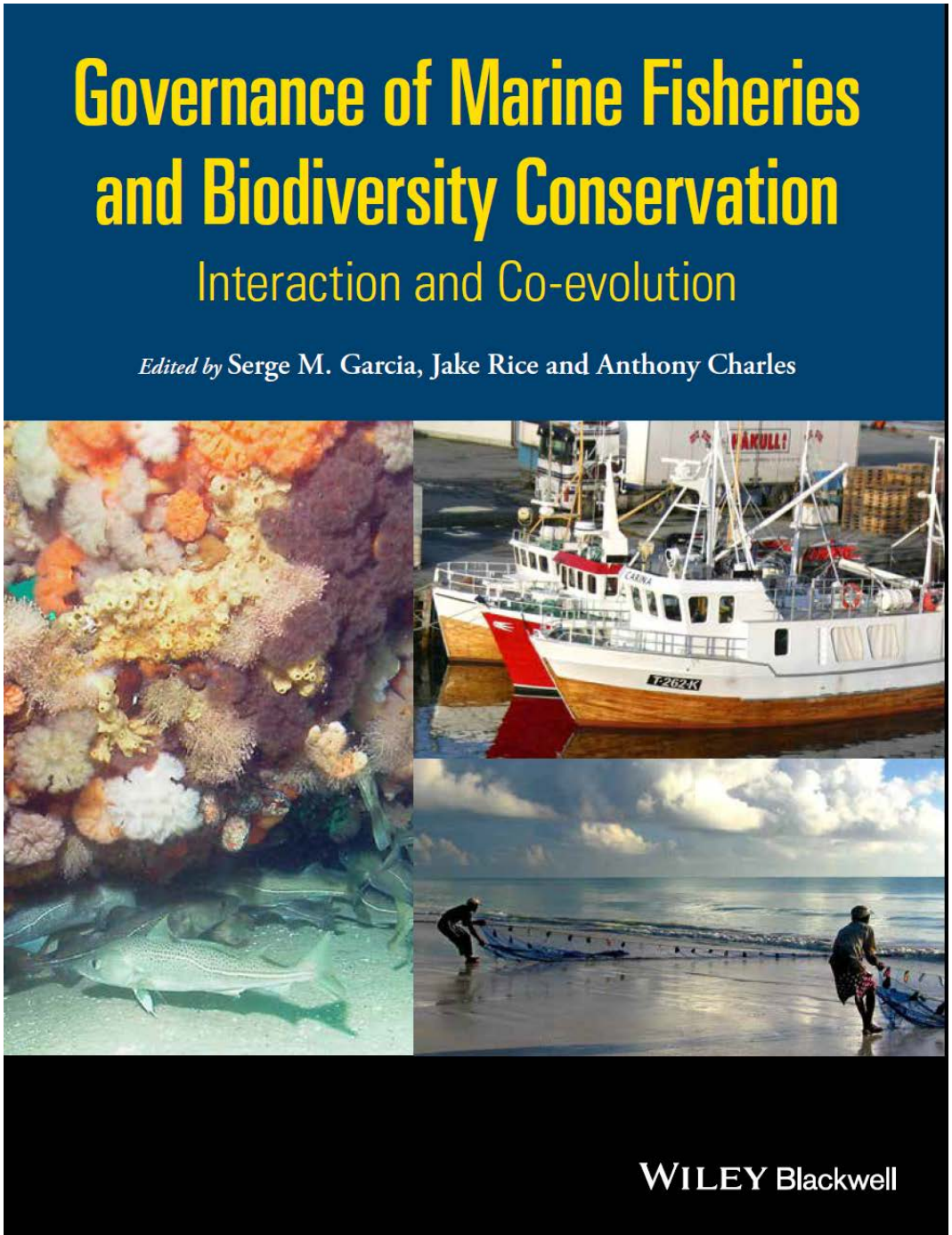
Resilience and Governance: Conclusions

- ** Robust to uncertainties :
  - Weak. Reliance on “precaution” but must accept large foregone benefits. Challenge to profit & food security needs.
- ** Robust to plausible extreme events
  - Weaker. Science support focuses on typical outcome, not avoiding plausible extreme ones
- Not being countered by other decisions on other (directly or indirectly) linked issued. (Integrated Management)
  - “Integration” is cross-sectoral, and NOT social, economic and ecological dimensions of outcomes.
- ** Social contract to implement decisions
  - Valuation for phony win-win is new “great hope”
  - Not dealing with real differences in risk tolerances for errors

Governance, Resilience and FUTURE?

To inform resilient decisions :

- Where are the tipping points?
  - Take advantage of robustness of max curvature
- What plausible extreme events could move us to them quickly?
- How can we avoid tipping points on ALL THREE factors, not just the ecological one(s).
- More attention to status – use – benefits integration, even if at expense of end-to-end ecology
  - Social consensus to get to the right neighborhood (away from tipping points), and react swiftly to potential shocks



THANK YOU

And for more on roots (and branches) of these ideas, coming in August from Wiley…