Spatial Marine Zoning for Fisheries and Conservation

Carissa Klein, Charles Steinback, Matthew Watts,
Astrid Scholz, and Hugh Possingham

Coastal GeoTools Conference

March 3, 2009

Applied Environmental Decision Analysis
Commonwealth Environmental Research Facility

The University of Queensland
Australia

ecotrust

Marine Conservation

- Marine Protected Areas (MPAs) are a cornerstone of most conservation strategies; *Soule 1991, Possingham 2006*
- Several international, national, and regional mandates for MPAs (Massachusetts' Ocean Act, Great Britain's Marine Bill, California's Marine Life Protection Act Initiative, etc.)
- Most conservation programs involve zoning (e.g. Great Barrier Reef Marine Park)
- Many types of MPAs with different levels of protection

ecotrust

Reserve Design Approaches

- Site selection approaches only focus on no-take reserves
- Numerical optimization tools – cost-efficiently represent biodiversity; *Ball 200, Kirkpatrick 1983, Leslie 2003*
- Limited in utility as we typically face more complex problems of prioritizing for multiple types of MPAs and resource uses
- Current approaches used to zone could result in sub-optimal plans in terms of protecting biodiversity and minimizing negative socioeconomic impacts.
- Planners are desperately in need of a zoning tool to help guide decisions on what should be done, and where

ecotrust

Marxan with Zones

- Developed by Matthew Watts and Hugh Possingham (University of Queensland)
- Marxan – most widely used marine conservation planning software (used in over 100 countries)
- Objective: minimize socioeconomic costs, subject to the constraint that targets are achieved
- Marxan with Zones – new tool that allows for multiple zones, multiple costs, zone specific constraints

ecotrust

Marine Life Protection Act

- Biodiversity conservation – represent habitats across depth zones (i.e. intertidal, nearshore, shelf, slope)
- Socioeconomic viability – minimize socioeconomic impacts
- Multiple types of MPAs
  - No take Reserves
  - Marine Parks
  - Marine Conservation Areas
- North Central Coast Study Region – Pigeon Point to Alder Creek

ecotrust

Conservation Features

- We used the Initiative's goals and objectives to identify biophysical targets,
  - same habitats identified by the MLPA Science Advisory Team
- Habitats considered: rocky reefs, kelp forests, estuaries, coastal marshes, tidal flats, sandy bottom, eelgrass, and surfgrass
  - Indentified across depth zones (i.e. intertidal, intertidal to 30 m, and 30 to 100 m
  - 32 targets or features in total
- From this list, we identified reliable and quantifiable data to integrate into our approach
  - Not all habitats had spatial information available

ecotrust

Socioeconomic Data

- Socioeconomic data is based on data collected by Ecotrust staff during the summer of 2007
  - Contracted by the MLPAI to collect and compile comprehensive spatial information to characterize the spatial extent and value of the commercial and recreation fishing grounds
- For this analysis, we only considered commercial fishing ground datasets:
  - Ca. halibut, nearshore rockfish, salmon, Dungeness crab, squid, coastal pelagics, and urchin
  - Fishing grounds created and considered for each port in the study region, Point Arena, Bodega Bay, Bolinas, San Francisco, and Half Moon Bay

ecotrust

Zone Specific Costs

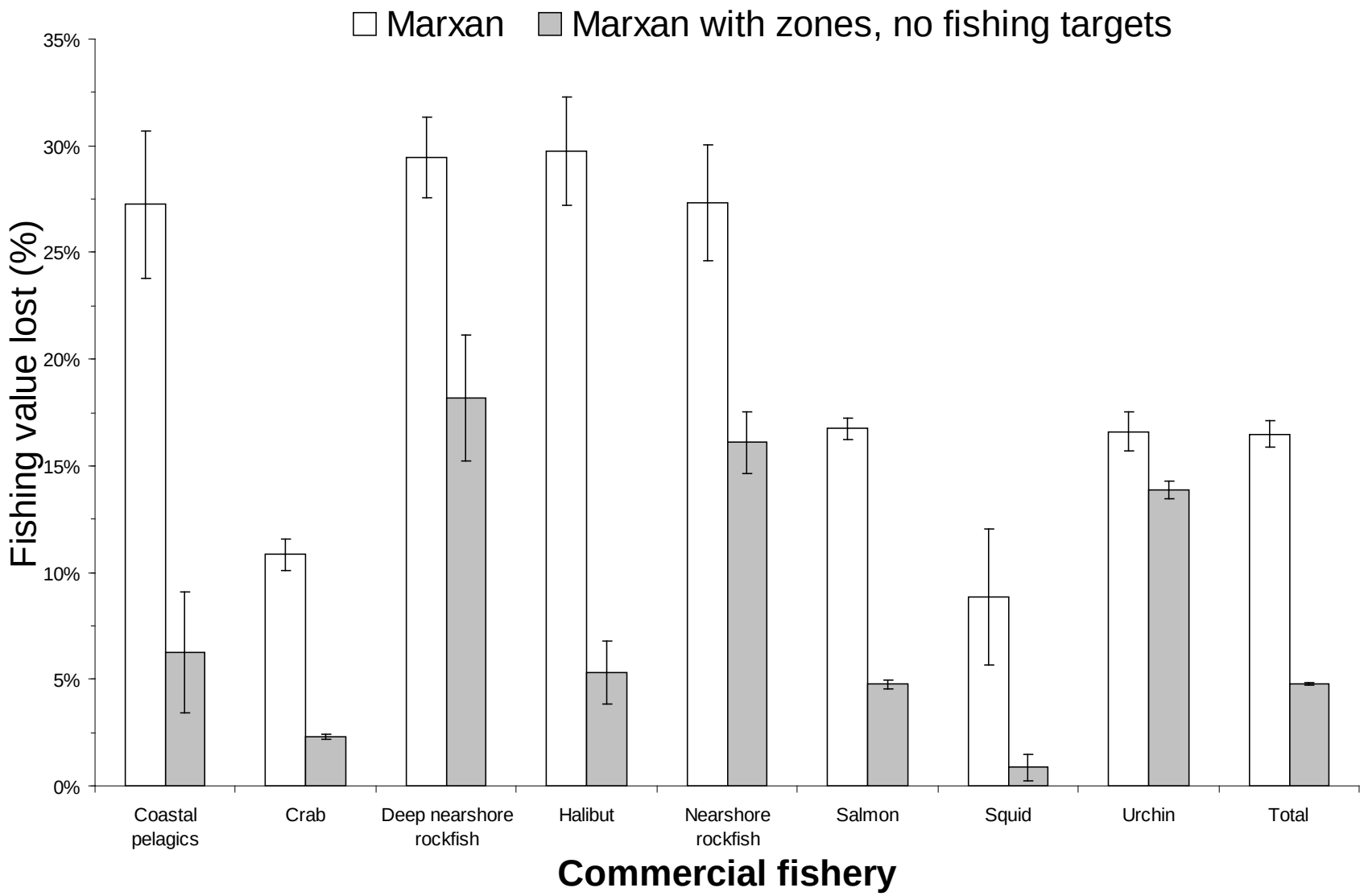
Zones	Commercial Fishing Restrictions
No-take Marine Reserves	All fishing is restricted
Conservation Area High	Ca. halibut, Dungeness crab, nearshore rockfish, squid, urchin, and salmon <50m
Conservation Area High/Medium	Ca. halibut, nearshore rockfish, and urchin
Conservation Area Medium	Nearshore rockfish and urchin
Fishing Zone (Open)	None

ecotrust

Zone Specific Targets or Constraints

Zones	Conservation Targets	
	Marxan	Marxan w/Zones
No-take Marine Reserves	30%	10%
Conservation Area High		
Conservation Area High/Medium		30%
Conservation Area Medium		
Fishing Zone (Open)		

ecotrust



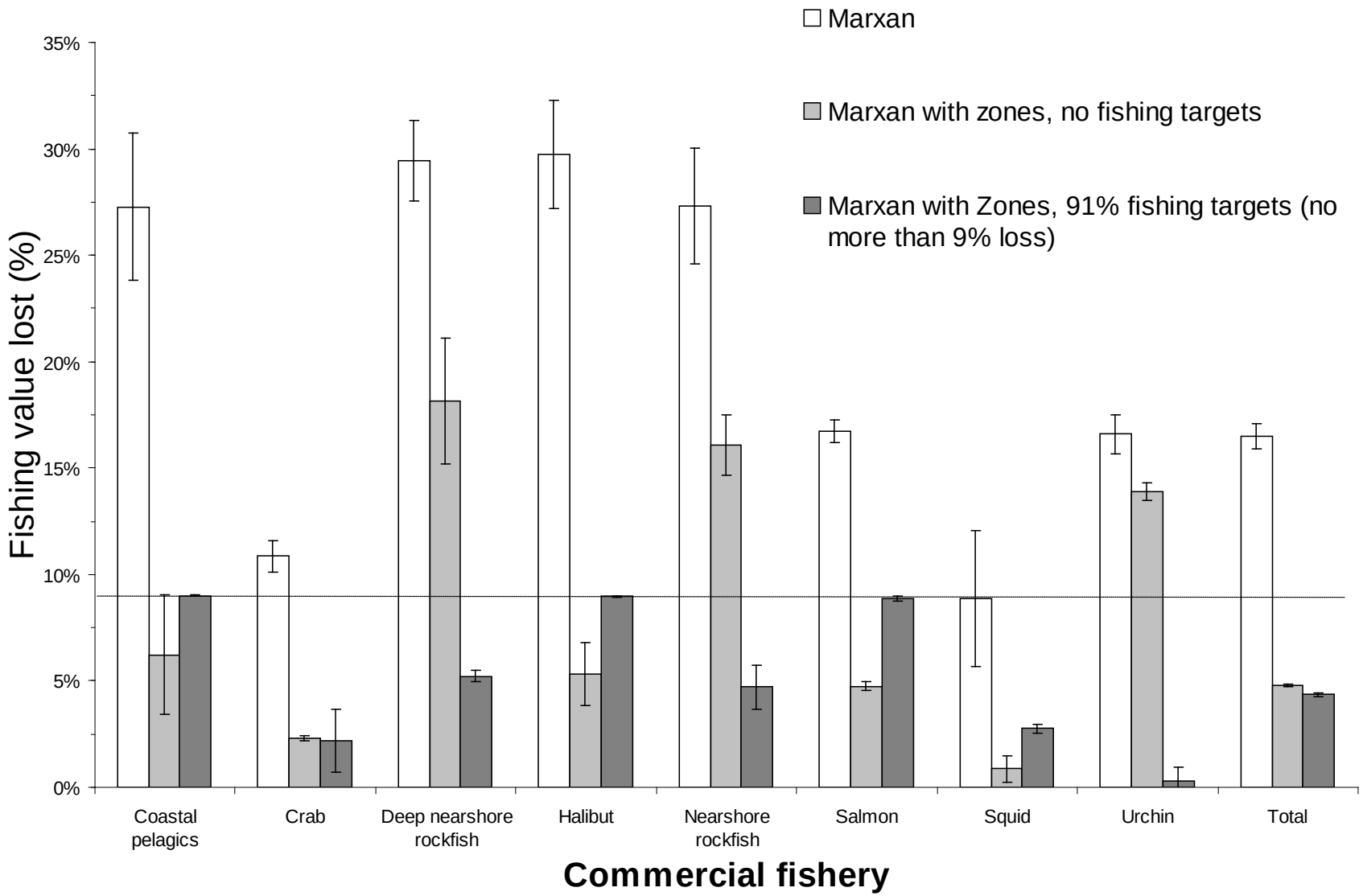
Solutions have a smaller overall impact on each fishery when Marxan with Zones is used

Marxan with Zones, with Fishing Targets

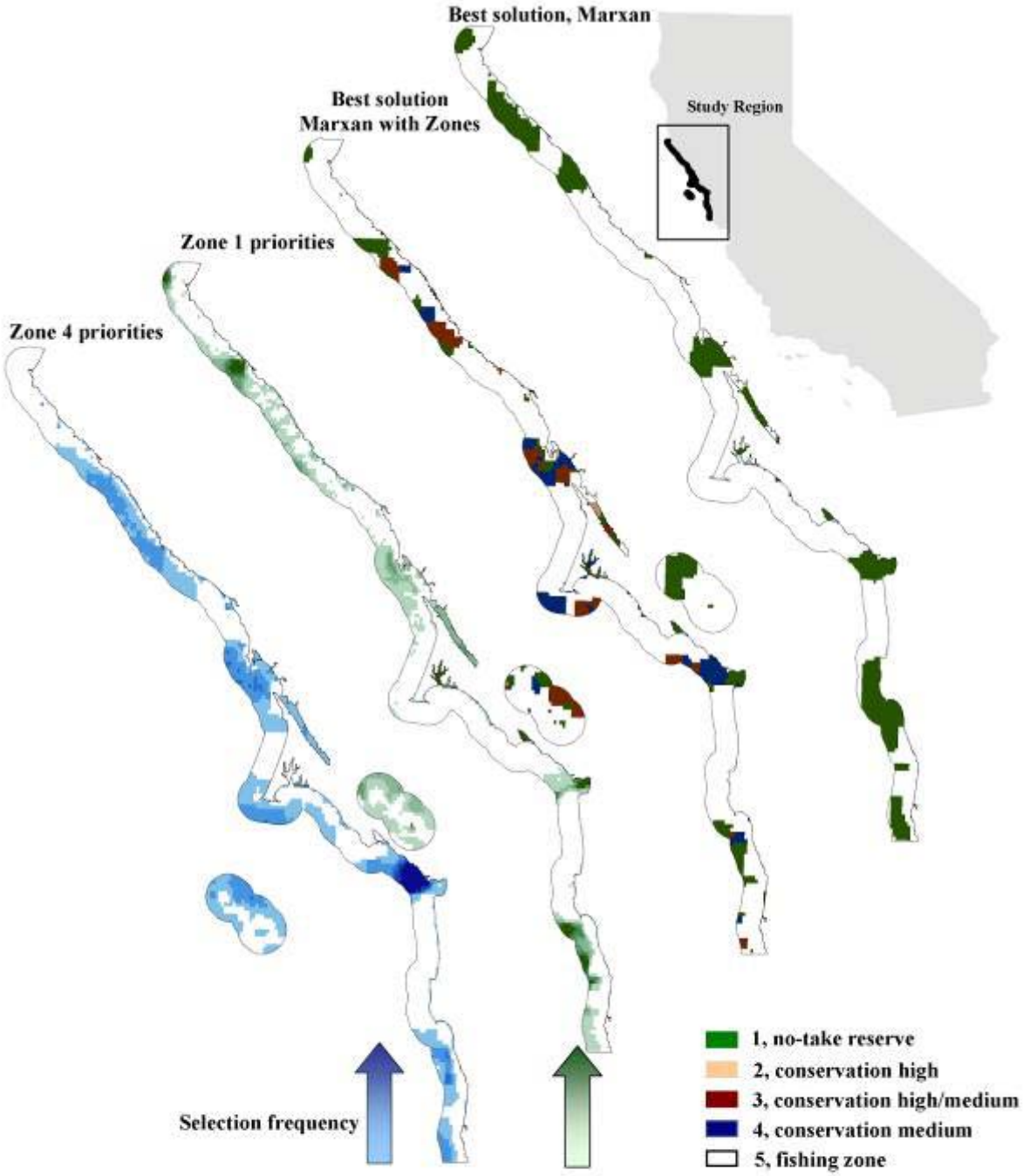
Zones	Marxan with Zones	
	Conservation Targets	Conservation & Fishing Targets
No-take Marine Reserves	10%	No fishing targets
Conservation Area High	30%	Targets for 2 fisheries
Conservation Area High/Medium		Targets for 4 fisheries
Conservation Area Medium		Targets for 5 fisheries
Fishing Zone (Open)		Targets for all 8 fisheries

In addition to conservation targets, we targeted a percentage of each fisheries total value, where the fishing targets could only be achieved in zones where the given fishery was not restricted.

ecotrust



Without compromising conservation goals, we produced a zoning configuration that entailed value losses of less than 9% for any fishery.


Best solution, Marxan
Study Region
Best solution
Marxan with Zones
Zone 1 priorities
Zone 4 priorities
Selection frequency
1, no-take reserve
2, conservation high
3, conservation high/medium
4, conservation medium
5, fishing zone

Key Messages

- A spatial optimization tool that allows for multiple zones versus a tool that can only indentify marine reserves delivers potential solutions that:
  - Have a smaller overall impact on fishing communities
  - Have a more equitably affect across individual fishing sectors

- Tools should support, NOT replace stakeholders in a MPA design process

ecotrust

Thank You

- Charles Steinback – charles@ecotrust.org
- Carissa Klein – c.klein@uq.edu.au
- Matthew Watts – m.watts@uq.edu.au

ecotrust