

Spatial marine zoning for fisheries and conservation

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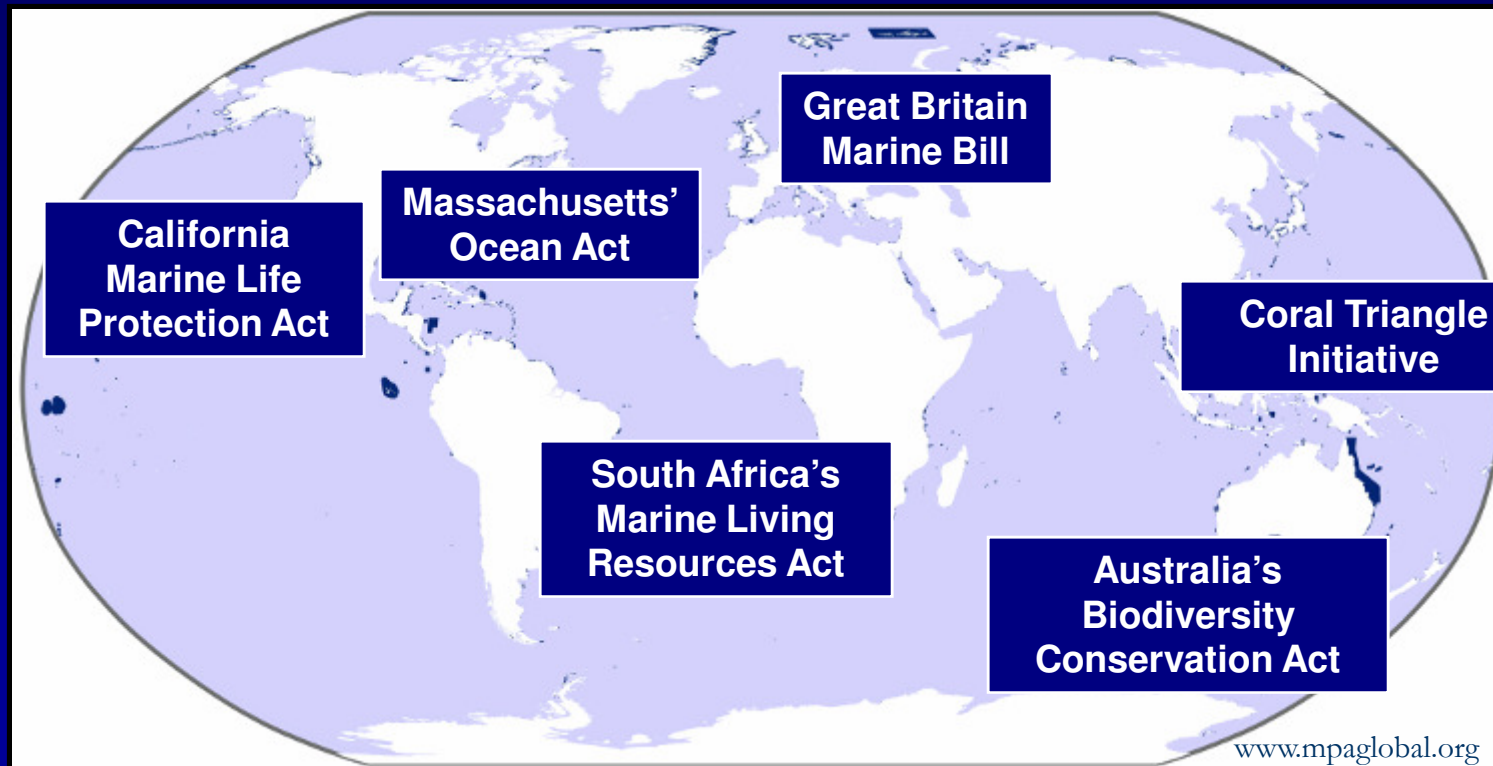
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Marine Protected Areas

- **Cornerstone of most conservation strategies**

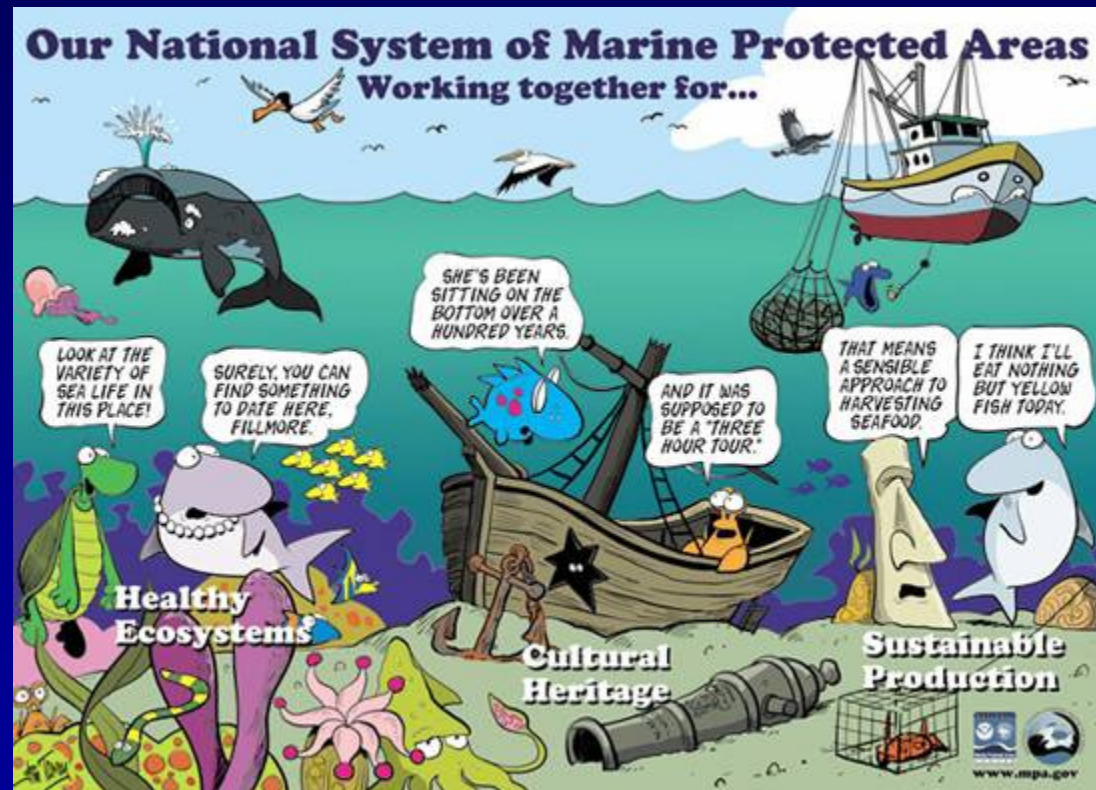
(Soule 1991, Possingham 2006)

- **Several mandates for their implementation**



Marine Protected Areas

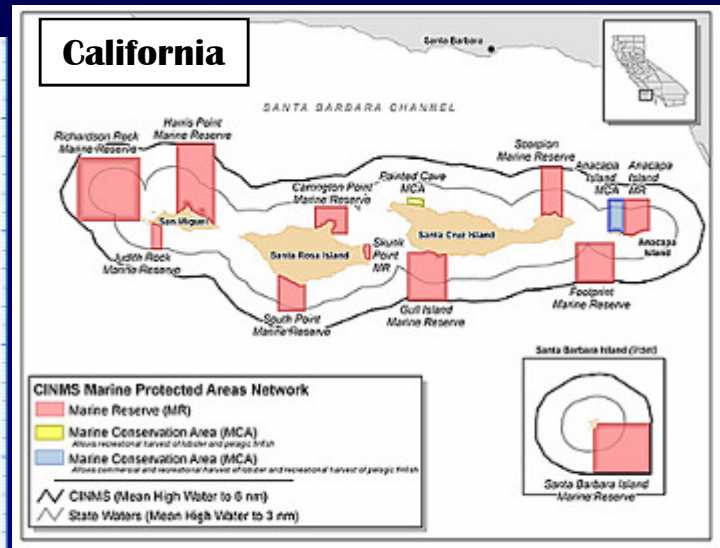
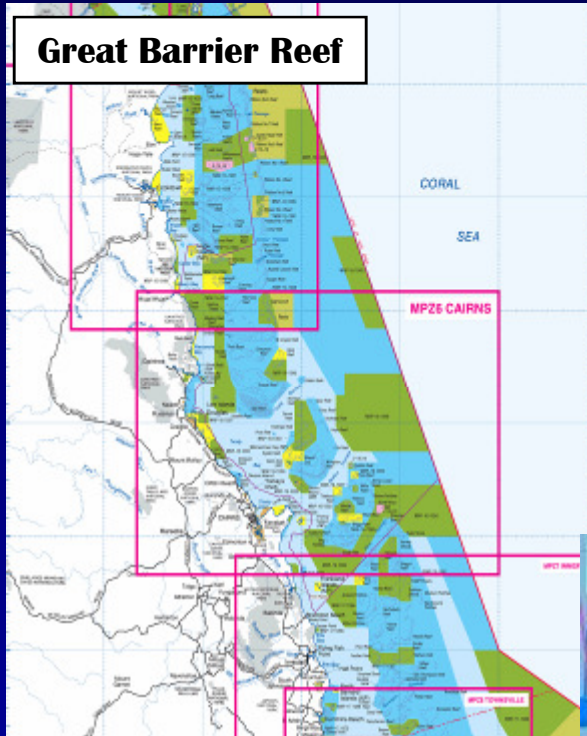
- Many different types, each with different regulations



Jim Toomey - <http://www.noaaworld.noaa.gov>

Marine Zoning

- Most conservation planning processes involve zoning



Spatial Conservation Prioritization

- **Theory is focused on selecting one type of protected area, no-take reserves**
- **Numerical optimization tools to cost-effectively represent biodiversity**
(Kirkpatrick 1983, Possingham 2006)
- **Limited in utility when planning for multiple types of protected areas and resource uses (e.g. fishing, mining, tourism)**
- **New zoning tool – Marxan with Zones**
(Watts, Ball, Possingham. Environmental Modeling and Software. In press)



California Marine Life Protection Act

Biodiversity Conservation

- Represent habitats across depth zones

Socioeconomic Viability

- Minimize negative socioeconomic impacts

Multiple types of protected areas



Aim:

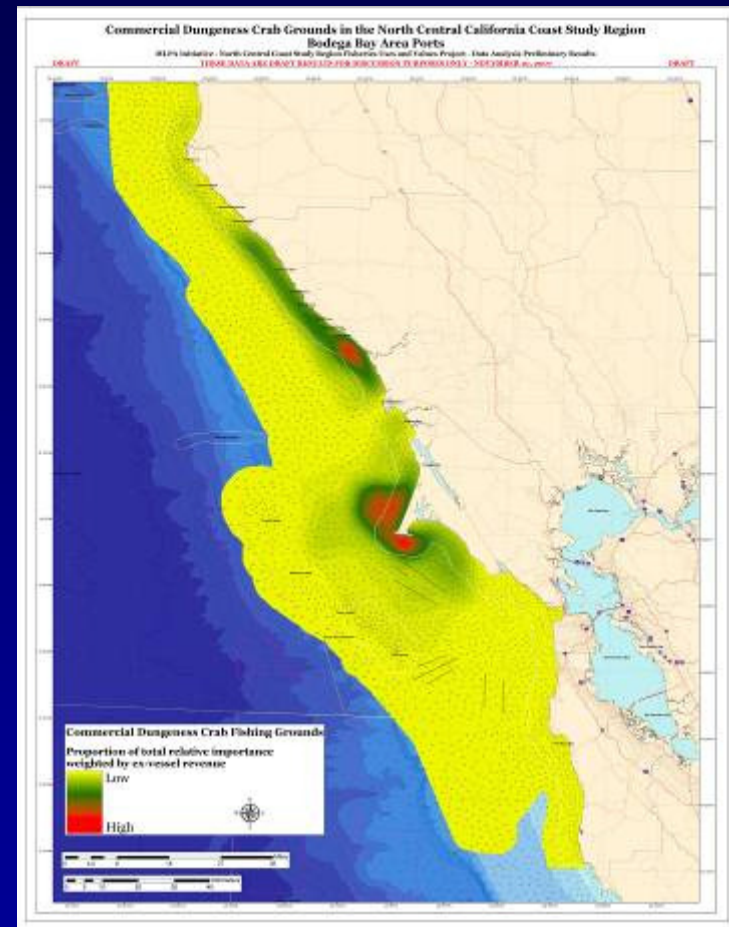
Determine what socioeconomic advantages, if any, can be delivered by a tool that allows for multiple zones versus a tool that can identify one type of protected area.

Scenarios:

- 1) Marxan**
- 2) Marxan with Zones**
- 3) Marxan with Zones, fishing targets**

Commercial fishing value

- Dungeness crab
- California halibut
- Chinook salmon
- Coastal pelagic finfish
- Deep nearshore rockfish
- Market squid
- Nearshore rockfish
- Sea urchin



Objective: Minimize lost fishing value subject to the constraint that biodiversity targets are achieved.

Zones: Marxan with Zones	Commercial fishing restrictions
No-take marine reserve	All 8 fisheries.
Conservation area, high	Halibut, crab, rockfish, squid, urchin, salmon <50m
Conservation area, high/medium	Halibut, rockfish, urchin
Conservation area, medium	Rockfish, urchin
Fishing zone	None



Zone-specific costs

Conservation Features

Habitats

Rocky reefs

Kelp forests

Estuaries

Coastal marshes

Tidal flats

Sandy bottom

Eelgrass

Surfgrass

Depth Zones

Intertidal

Intertidal-30 m

30-100 m



Laura Francis

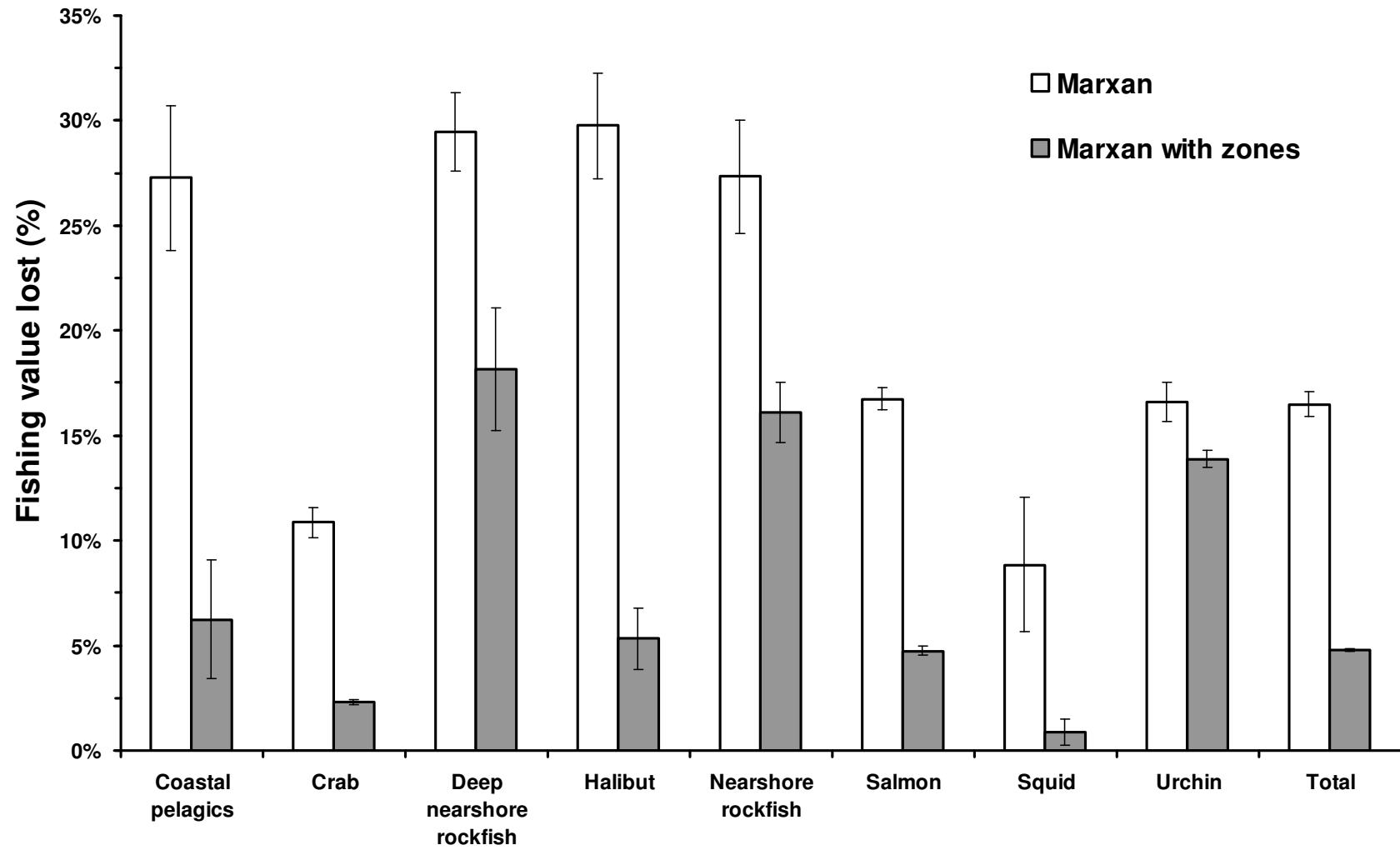
Zones	Marxan	Marxan with Zones
No-take reserve	30%	10%
Conservation area (high)		30%
Conservation area (high/medium)		
Conservation area (medium)		
Fishing zone		


Conservation targets

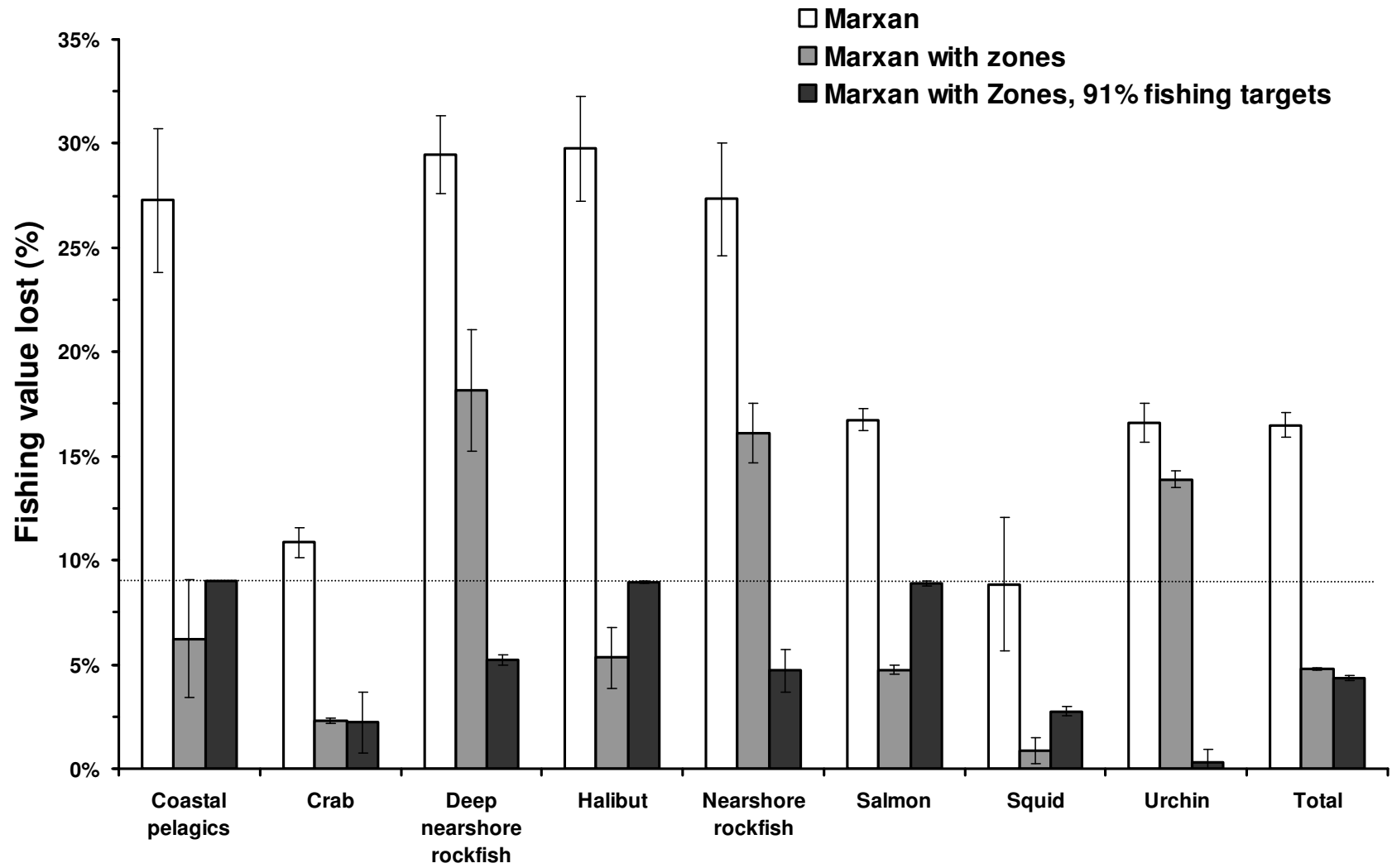
30%

10%

30%



Zones	Marxan	Marxan with Zones	
		Conservation targets	Fishing targets
No-take reserve	30%	10%	No fishing allowed
Conservation area (high)	[Grey area]	30%	[Brown area]
Conservation area (high/medium)			
Conservation area (medium)			
Fishing zone			

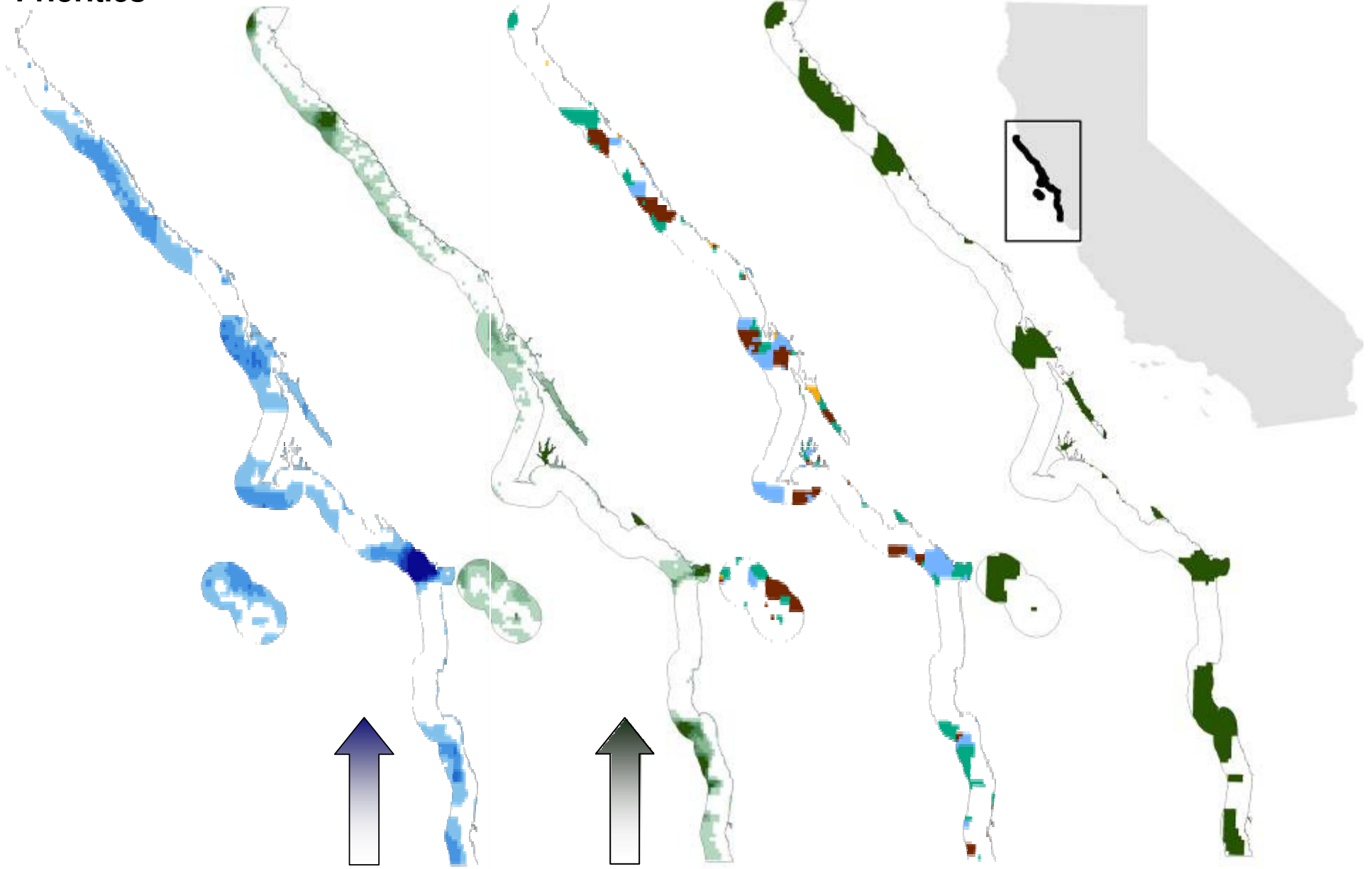


**CA, Med
Priorities**

**Reserve
Priorities**

Marxan with Zones

Marxan





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Conclusions



- A Zoning tool outperformed a non-zoning in two ways:
 - 1) The overall impact on the fishing industry was reduced
 - 2) There was a more equitable impact on different fisheries
- Marxan with Zones - free to download www.uq.edu.au/marxan
- Tools should support, **NOT** replace, stakeholders in design processes

Acknowledgements

University of Queensland



Ecotrust



Centre for Applied Environmental Decision Analysis



RESEARCH COMMUNICATIONS RESEARCH COMMUNICATIONS

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