Marine Life Protection Act Initiative

Review of SAT MPA Evaluation Methods Used in the MLPA South Coast Study Region

Presentation to the MLPA Master Plan Science Advisory Team
Joint Meeting for the South Coast and North Coast Study Regions

October 30, 2009 • Eureka, California

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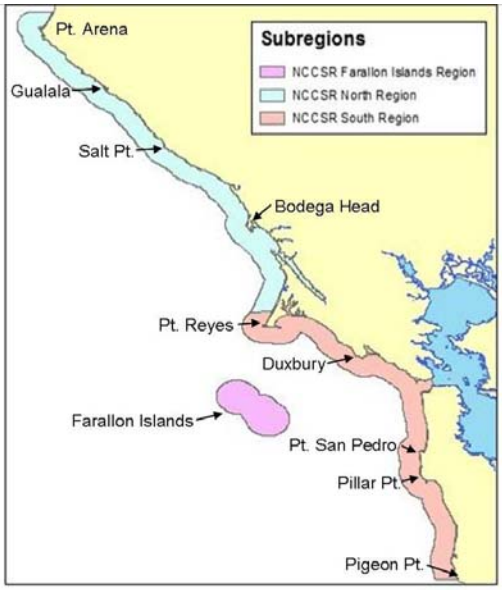
SAT Evaluation Methods

- From the ***Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA South Coast Study Region (October 26, 2009)***
  - Bioregions (Goals 1, 2 and 4)
  - Protection Levels (Goals 1, 2, 4 and 6)
  - Habitat Representation Analyses (Goals 1 and 4)
  - Habitat Replication Analyses (Goals 1, 2, 3, 4 and 6)
  - Size (Goals 2 and 6)
  - Spacing (Goals 2 and 6)
  - Bioeconomic Modeling (Goals 1 and 2)
  - Protection of Marine Birds and Mammals (Goals 1 and 2)
  - Water and Sediment Quality (Goals 1, 2 and 4)
  - Commercial and Recreational Fishery Impacts

Bioregions

- **Bioregions are areas within the study region that exhibit differences in community structure or experience reduced population connectivity.**
- **Number of bioregions:**
  - North Central Coast: 3
  - South Coast: 5
- **Bioregions are used in the evaluation of habitat replication.**



Levels of Protection

- **Levels of protection (LOPs) distinguish between MPAs that are "no take" and those that allow different types of fishing uses:**
  - **State Marine Reserves (SMRs)** are "no take" areas that have a very high level of protection
  - **State Marine Conservation Areas (SMCAs)** allow some kinds of commercial and recreational fishing
  - **State Marine Parks (SMPs)** allow some kinds of recreational fishing

*Levels of Protection

	Level of Protection	MPA Type	Activities Associated with a Protection Level for the MLPA North Central Coast Study Region (NCCSR)
	Very high	SMR	No take
	High	SMCA SMP	In water depth > 50m: pelagic finfish by hook and line (salmon by troll only); coastal pelagic finfish by seine
	Moderate-high	SMCA SMP	In water depth < 50m: pelagic finfish by hook and line (salmon by troll only); coastal pelagic finfish by seine; Dungeness crab (traps/pots), squid (pelagic seine)
	Moderate	SMCA SMP	Salmon (non-troll H&L); abalone (diving); halibut, white seabass, shore-based finfish, croaker, and flatfishes (H&L); smelt (H&L and hand/dip nets); clams (hand harvest); giant kelp (hand harvest)
	Moderate-low	SMCA SMP	Urchin (diving); lingcod, cabezon, greenling, rockfish, and other reef fish (H&L); surfperches (H&L)
	Low	SMCA SMP	Bull kelp and mussels (any method); all trawling; giant kelp (mechanical harvest); mariculture (existing methods)

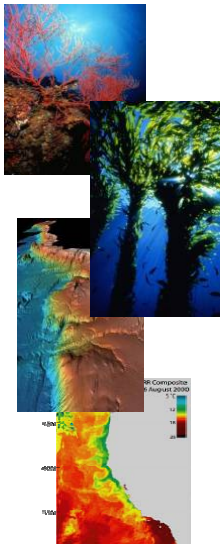
**Levels of protection from the MLPA North Central Coast Study Region*

Evaluation of Levels of Protection

- **MLPA Blue Ribbon Task Force directed the SAT to present evaluations of MPAs at the three highest levels of protection:**
  - **Very High (SMRs)**
  - **High (SMCAs and SMPs)**
  - **Moderate-high (SMCAs and SMPs)**

	Level of Protection	MPA Type
	Very high	SMR
	High	SMCA SMP
	Moderate-high	SMCA SMP
	Moderate	SMCA SMP
	Moderate-low	SMCA SMP
	Low	SMCA SMP

Evaluation of Habitat Representation



- **Consider the availability of key habitats**
  - **within the entire study region**
  - **within each bioregion**
- **Calculate the percent of each key habitat protected at each level of protection**
  - **within the entire study region**
  - **within each bioregion**
- **Note where habitat protection is not distributed across all bioregions**

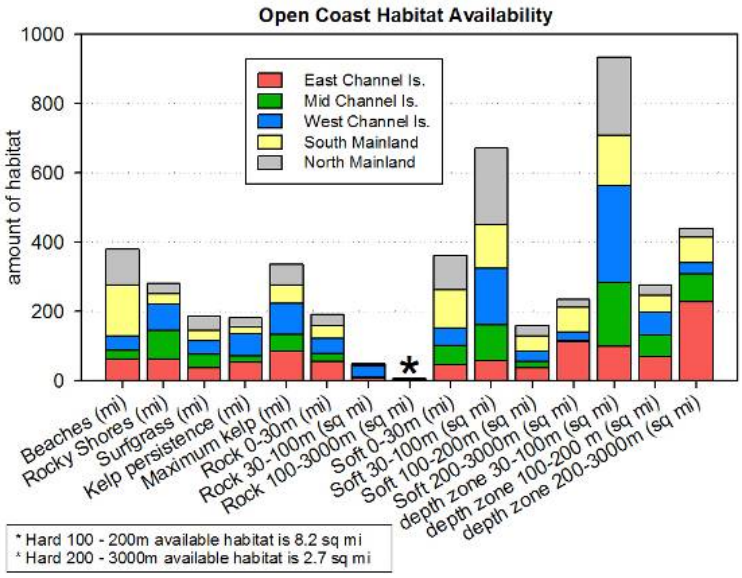
Key Habitats

Intertidal/Nearshore
- Rocky Shore
- Sandy Beach
- Coastal Marsh
- Tidal Flats
- Estuary
- Eelgrass
- Surfgrass

Oceanographic
- Upwelling centers
- Retention areas
- Freshwater plumes

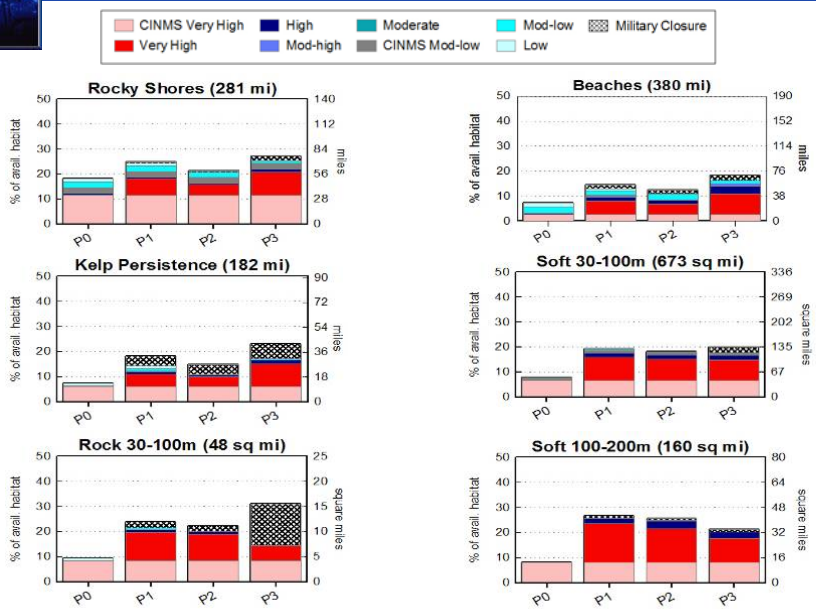
Subtidal
- Hard/Soft Bottom
  - 0-30 meter
  - 30-100 meter
  - 100-200 meter
  - >200 meter
- Kelp forest
- Canyons
- Seamounts

South Coast Habitat Availability



From Round 3 Evaluations for South Coast Study Region

Percent of Each Habitat Protected



From Round 3 Evaluations for South Coast Study Region

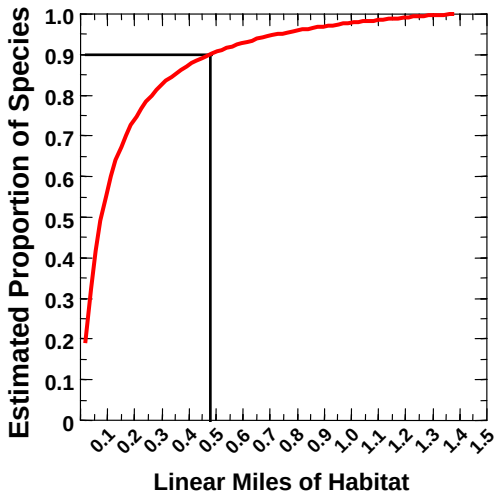
Evaluation of Habitat Replication

- Most MPAs contain multiple habitats – ***How much of each habitat is enough?***
- Part of the goal of replication is to protect "the diversity of species" in each key habitat.
- To count as a replicate, an MPA must contain sufficient habitat to encompass most of the species that live in that habitat

Evaluation of Habitat Replication

- SAT sums the number of replicates for each key habitat within each biogeographic region and bioregion
- Replicates must contain enough habitat to encompass 90% of associated biodiversity
- MPA or cluster must meet the minimum size guidelines (9 square miles)
  - Estuarine MPAs must contain at least 0.12 square miles of estuarine habitat

Habitat Size and Biodiversity



More habitat includes more species – up to a point

SAT determined that, to count as a replicate, the habitat size must be large enough to encompass 90% of biodiversity

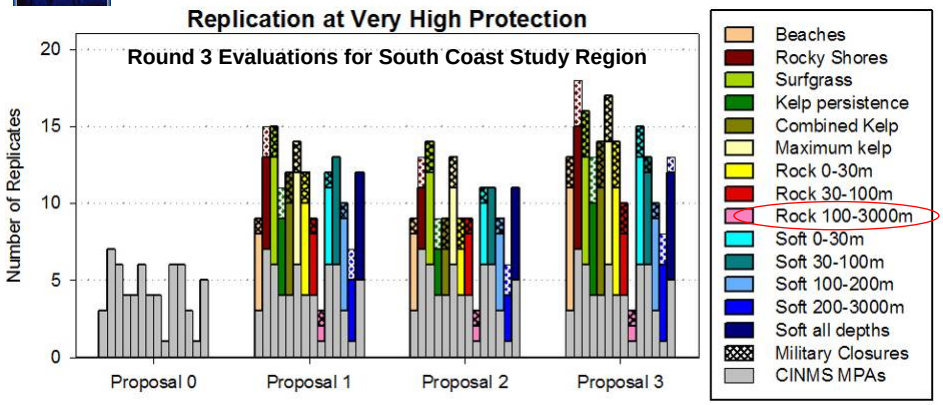
Habitat Replication

*90% threshold for different habitats

Habitat	Area or Length of a Replicate	Data Source
Rocky Intertidal	**~0.5 linear miles**	PISCO Biodiversity
Shallow Rocky Reefs/Kelp Forests (0-30 m)	**~1 linear miles**	PISCO Subtidal Surveys
Deep Rocky Reefs (30-100 m)	**~0.1 square miles**	Starr Surveys
Sandy Beaches *	**~1 linear miles**	
Soft-Bottom Habitat (0-30 m)	**~1 linear miles**	Based on shallow rocky reefs
Soft-Bottom Habitat (30-100 m)	**~10 square miles**	NMFS Triennial Trawl Surveys (1977-2007)
Estuary	**0.12 square miles (77 acres)**	

**Estimates for the MLPA North Central Coast Study Region*

South Coast Habitat Replication



- All open coast habitats meet replication guidelines
- Deep rock (100-3000 meters) is sparse and replication is difficult

CINMS MPAs are state MPAs within the Channel Islands National Marine Sanctuary, not including federal MPAs

Habitat Replication by Bioregion

Round 3 Evaluation for South Coast Study Region: Rocky Habitats

Table indicates number of bioregions with at least 1 habitat replicate

	Rocky Shores (5)			Surfgrass (5)			Kelp persist. (5)			Maximum kelp (5)			Rock 0-30m (5)			Rock 30-100m (5)			Rock 100-3000m (4)		
	VH	H	MH	VH	H	MH	VH	H	MH	VH	H	MH	VH	H	MH	VH	H	MH	VH	H	MH
Proposal 0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Proposal 1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	4	4
Proposal 2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	4	4
Proposal 3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3

There are 5 bioregions in the MLPA South Coast Study Region.
Only 4 bioregions contain Rock 100-3000 meters in the south coast.

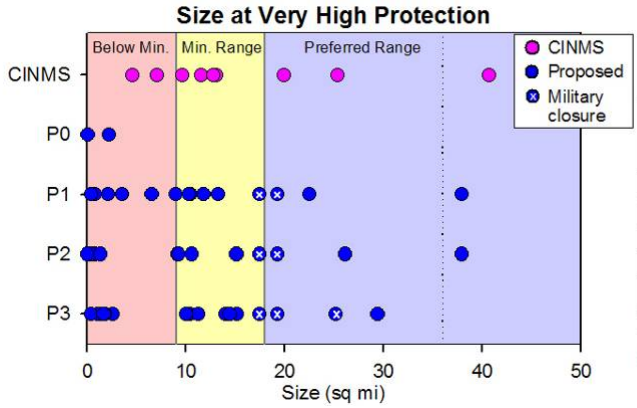
Evaluation of MPA Size

- Alongshore and offshore size guidelines are combined and simplified to yield an area guideline for evaluation:
  - **Minimum size range – 9-18 sq mi**
  - **Preferred size range – 18-36 sq mi**
- Contiguous MPAs with different allowed uses are clustered together based on level of protection.
- Clusters consist of MPAs at the three highest levels of protection: moderate-high, high, and very high.
- The area of each MPA cluster is compared to the size guidelines.

Cluster Sizes: Very High Protection

Round 3 Evaluation for South Coast Study Region

Size at Very High Protection



Number of MPA Clusters* at Very High Protection

Proposal	Below Min. Size	Min. Size Range	Pref. Size Range	Total # Clusters
CINMS MPAs	3	5	3	11
Proposal 0	3	0	0	3
Proposal 1	5	6(1)	2(1)	13(2)
Proposal 2	4	5(1)	2(1)	11(2)
Proposal 3	5	7(1)	1(2)	13(3)

* Clusters tabulated above do not include CINMS MPAs in proposals, () indicates military closures

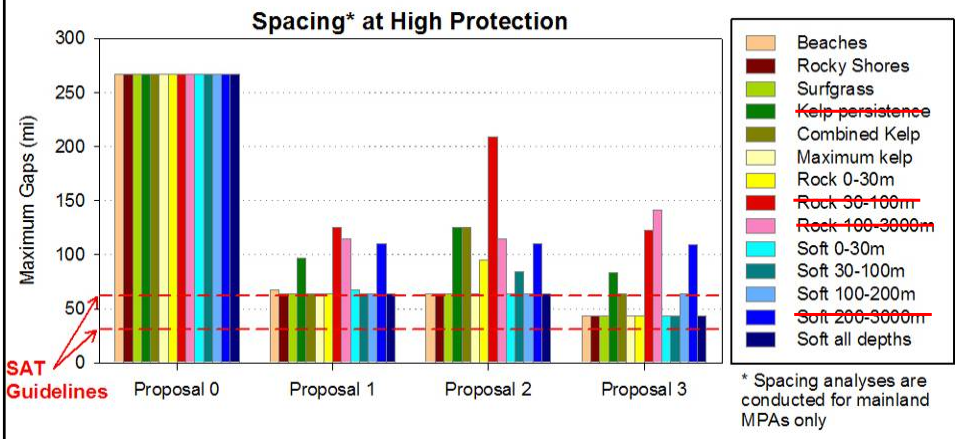
Proposals 1 & 3 have the same number of SMRs
All proposals have 3 no-take clusters in the preferred size range
Most SMRs are above the minimum size for all proposals

Evaluation of MPA Spacing

- The MPA spacing guideline is designed to connect populations, therefore:
  - **MPA must contain enough appropriate habitat**
  - **MPA must be large enough to protect a population**
- Only MPAs or MPA clusters that contain a replicate of a habitat are used in spacing analysis
  - **MPA or cluster above minimum size (9 square miles)**
  - **Habitat protected sufficient to include 90% of biodiversity**
- Maximum gaps between each 'key' habitat are calculated for the three highest levels of protection
  - **Adjacent MPAs should be placed within 31-62 miles**

Maximum Gaps: High Protection

Round 3 Evaluation for South Coast Study Region



Maximum distance between patches of persistent kelp, rock 30-100m, rock 100-300m and soft 200-3000m exceed spacing guidelines in some locations of the MLPA South Coast Study Region.

Bioeconomic Modeling Evaluation

Spatially-explicit models predict:

- **Biomass of different species across space**
  - "Sustainability" of stock
- **Fishery Yield, Effort and Profit across space**
  - Change from status quo

Model Inputs

- Habitat maps
- Proposed MPA boundaries and regulations
- Species life history characteristics
- Adult movement
- Larval dispersal from ocean circulation model
- Fishing fleet model, based on Ecotrust data, considers:
  - spatial abundance of fish
  - distance from port
  - congestion
  - weather

Model Species for South Coast

- Ocean Whitefish
- Black Surfperch
- Opaleye
- Kelp Bass
- Kelp Rockfish
- Sheephead
- Red Sea Urchin
- California Halibut

Model Outputs

- **Conservation Value**
  - Spatial distribution of larval settlement and biomass
  - Total settlement and biomass (summed over study region, weighted sum across species)
- **Economic Value**
  - Spatial distribution of yield
  - Total yield and profit (summed over study region, weighted sum across species)

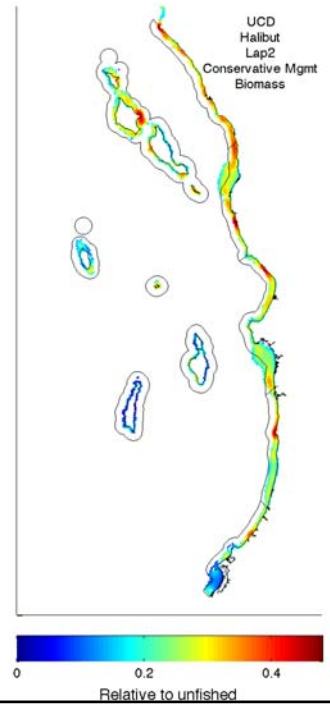
Example Results

Spatial Distribution of Biomass

(Maps also available for recruitment, fishery yield and fishing effort)

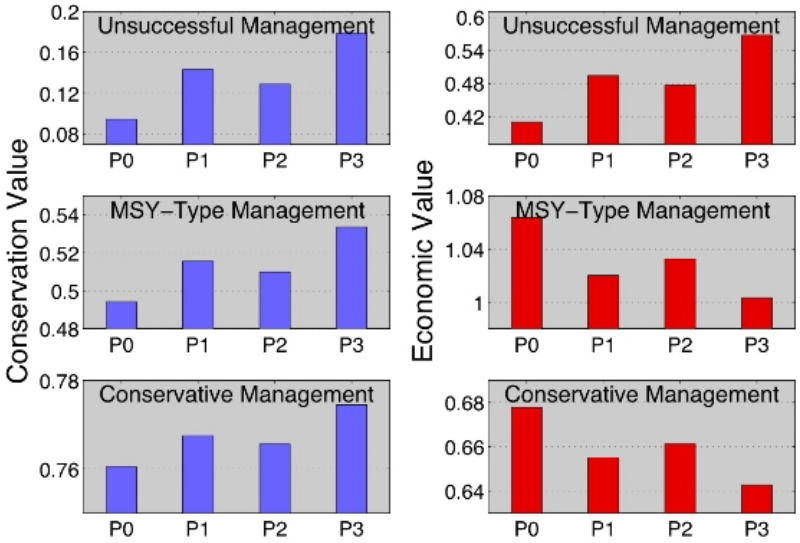
- **Example species**: Halibut
- **Example proposal**: Lapis 2
- **Management assumption***: Conservative management outside MPAs

*Also run for "unsuccessful management" and "Maximum Sustainable Yield" (MSY-type) management



Example: Modeling Evaluation Results

Round 3 Evaluation for South Coast Study Region

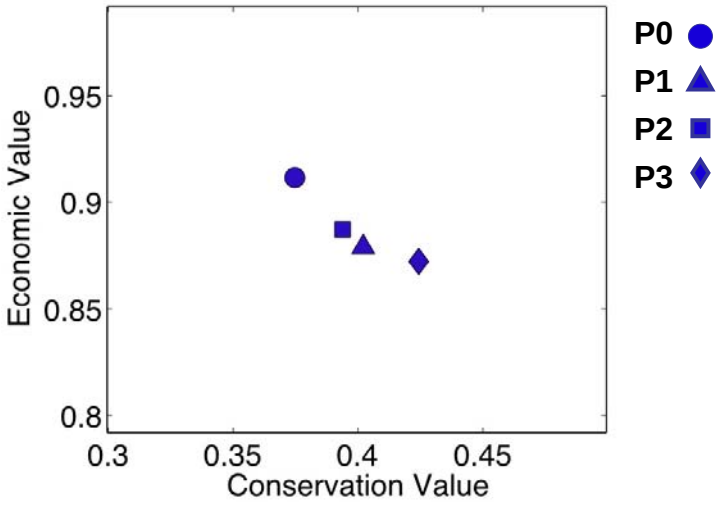


From Revised Fleet Model: UC Davis

Example: Modeling Evaluation Results

Round 3 Evaluation for South Coast Study Region

Scenario: MSY-type Management



From Revised Fleet Model: UC Davis

Birds and Mammals Evaluation

Direct Benefits of MPAs

1. Decreased disturbance at breeding and resting sites
2. Decreased human interactions at foraging sites

Indirect Benefits of MPAs

1. Reduced competition with humans for food resources
   a) Prey availability is an important factor regulating annual breeding population and reproductive success

Photo: Jeffrey Slovin

Photo: Rick Heiser

Birds and Mammals Evaluation

Five Analyses Quantify Percentages of Populations Likely to Benefit from MPAs for Three Use Categories:

- Breeding
- Resting
- Foraging

Notes:

- Marine mammal analyses considered only proposed state marine reserves (SMRs)
- Marine bird analyses included SMRs and proposed state marine conservation areas (SMCAs) if allowed uses were considered likely to benefit birds

Birds and Mammals Evaluation

Potential Benefits Categories	P 1	P 2	P 3
Seabird & Pinniped Breeding Colonies	=	=	=
Seabird Roost Sites (Brown Pelicans)	+		
East CI Harbor Seal Haulouts			+
Sea Otter Habitat Protection			+
Foraging:			
Least Tern North Mainland		+	+
Least Tern South Mainland	+		+
Bald Eagle			+
Harbor Seal			+
Neritic "Hot Spots"			+
Bird Habitats: Beach/Marsh/Tidal Flats			+
Estuary Habitat	+		+

Round 3 Evaluation for South Coast Study Region

Water Quality Evaluation

- No guidance provided by Marine Life Protection Act on how to consider water quality in design of MPAs
- The master plan states **"Placement of MPAs should take into account the adjacent terrestrial environment and associated human activities."**
- Water quality is a secondary consideration in MPA design

SAT Guidance on Water Quality

- **Areas of water quality concern should be avoided in design of MPAs:**
  - power-plant intakes and discharges
  - storm water discharges
  - waste water discharges
- **Areas of water quality opportunity should be included in design of MPAs:**
  - Areas of Special Biological Significance

Water Quality Evaluation

Summary of water quality evaluation of **coastal** MPAs in Round 3 proposals for the MLPA South Coast Study Region

Proposal	Number of MPAs	Storm Water	Waste Water	Power Plant	ASBS	Weighted Scores
1	52	5	2	0	22	0.85
2	40	4	1	0	20	0.86
3	43	2	2	0	23	0.82

Round 3 Evaluation for South Coast Study Region

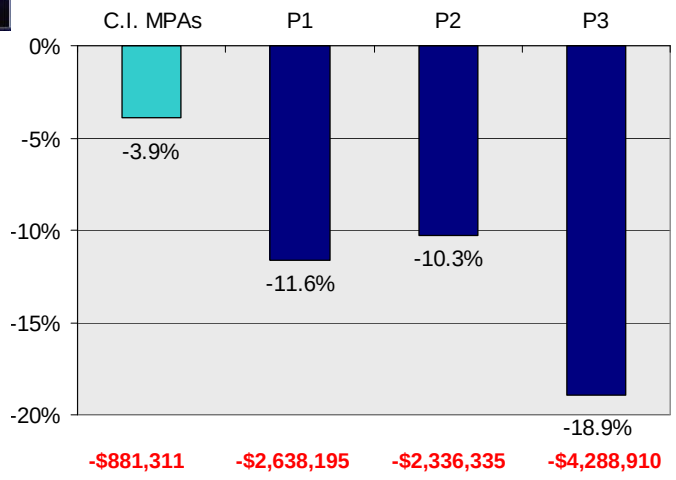
Evaluation of Potential Economic Impacts

- Ecotrust is contracted to:
  - Supplement existing data
  - Collect data on commercial and recreational fishing (use and values) to characterize the spatial extent and relative importance
  - Evaluate the maximum potential economic impact (gross and net) of MPA proposals
  - <u>Focus on the fisheries, not on regional multipliers of economic impact</u>

Potential Economic Impact Analyses

- **Commercial Fisheries**
  - Maximum potential impacts on fishing grounds (area and value)
  - Consideration of existing closures
  - Maximum potential impacts on individual fishermen
  - Maximum potential socioeconomic impacts
- **Recreational Fisheries**
  - Maximum potential impacts on fishing grounds (area and value)

Net Economic Impacts (Commercial)



Maximum Potential Net Economic Impact (% Reduction in Profit)

Note: Potential net and gross economic impacts reported for commercial and recreational fisheries.

Round 3 Evaluation for South Coast Study Region

Net Economic Impacts (Commercial)

Round 3 Evaluation for South Coast Study Region

*Lowest potential impact in each row is highlighted in blue font

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	C.I. MPAs	P1	P2	P3
				% Reduction in Profit	% Reduction in Profit		
Ca. Halibut (flatty) (Hook & Line)	100%	52%	48%	9.3%	19.9%	**17.9%**	27.6%
Ca. Halibut (flatty) (Trawl)	—	—	—	—	—	—	—
Coastal Pelagics	100%	56%	44%	0.8%	6.3%	**4.1%**	11.7%
Ca. Spiny Lobster	100%	46%	54%	1.6%	16.6%	**12.9%**	21.2%
N. Fishery (Hook & Line)	100%	52%	48%	11.1%	23.1%	**23.0%**	27.1%
N. Fishery (Trap)	100%	51%	49%	0.7%	15.8%	**8.9%**	21.4%
Rock Crabs	100%	47%	53%	4.0%	11.7%	**10.3%**	12.7%
Sablefish (blackcod)	100%	56%	44%	0.0%	44.9%	61.8%	**41.5%**
Sea Cucumbers (Diving)	100%	50%	50%	13.0%	22.3%	**21.3%**	30.3%
Sea Cucumbers (Trawl)	—	—	—	—	—	—	—
Spot Prawn	100%	49%	51%	9.9%	18.7%	**17.1%**	19.3%
Market Squid	100%	57%	43%	3.7%	7.3%	**6.7%**	19.5%
Swordfish	100%	66%	34%	2.1%	17.9%	**9.7%**	19.1%
Thornyhead	100%	52%	48%	0.0%	62.7%	67.0%	**55.9%**
Red Sea Urchin	100%	45%	55%	6.6%	13.2%	**12.0%**	16.9%
All Fisheries	**—**	**—**	**—**	**3.9%**	**11.6%**	**10.3%**	**18.9%**

Note: The Coastal Pelagics fishery includes both Northern Anchovy and Pacific Sardine.
The N. Fishery includes Cabezon, Greenlings, and some Rockfishes.

Summary

- **For the north coast, the SAT is starting with the evaluation methods developed in previous study regions**
- **Recognizing differences between the MLPA North Coast Study Region and other regions, SAT will review the evaluation methods and consider modifications for proposal evaluation**

For More Information

For more information about MPA evaluation methods:

- Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA South Coast Study Region
  www.dfg.ca.gov/mlpa/pdfs/agenda_102009b1.pdf