Marine Life Protection Act Initiative

Science Guidelines and Evaluation Methods
North Central Coast Study Region

Presentation to the
MLPA Blue Ribbon Task Force and the California Fish and Game Commission
February 13, 2008 • Pacifica, CA

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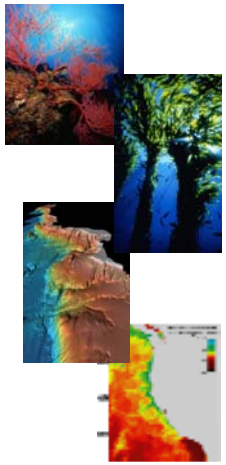
Master Plan Science Advisory Team

- MLPA goals
- Science guidelines for MPA design
- Evaluation Methods

MLPA Goals

1. To protect the natural diversity and function of **marine ecosystems**.
2. To help sustain and restore **marine life populations**.
3. To improve **recreational, educational, and study opportunities** in areas with minimal human disturbance.
4. To protect representative and unique **marine life habitats**.
5. Clear objectives, effective management, adequate enforcement, sound science.
6. To ensure that MPAs are designed and managed as **a network**.



MLPA Goals: Habitats

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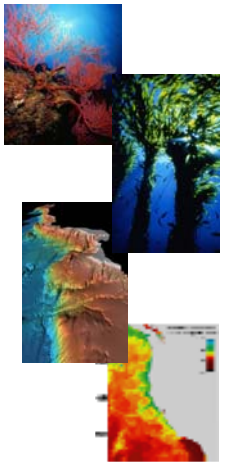


SAT Guidelines: Goals 1 and 4

MLPA Goals:
1) Protect natural diversity and function of marine ecosystems
4) Protect representative and unique marine life habitats

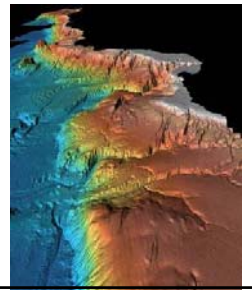
SAT Approach

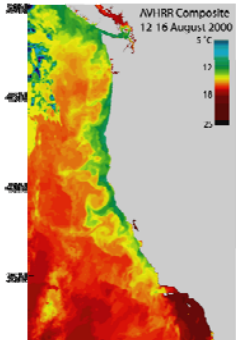
- Refined key habitats for NCCSR
- Defined biogeographic subregions
- Refined and described level of protection designations
- Evaluated habitat representation in MPAs

SAT Guidelines: Goals 1 and 4

Identified Key Habitats Using:

- Bottom Type and Depth Categories
- Biogenic Habitats
- Oceanographic Features





SAT Guidelines: Goals 1 and 4

Key Marine Habitats

Seafloor Habitats

- Rocky reefs
- Intertidal zones
- Sandy or soft ocean bottoms
- Underwater pinnacles
- Submarine canyons

Depth Zones

- Intertidal
- Intertidal to 30 m
- 30 to 100 m
- 100 to 200 m
- 200 m and deeper

Biogenic Habitats

- Kelp forests
- Seagrass beds

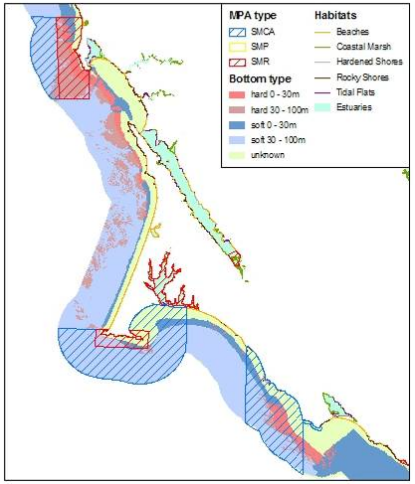
Oceanographic Habitats

- Upwelling areas
- Freshwater plumes
- Retention zones

SAT Guidelines: Goals 1 and 4

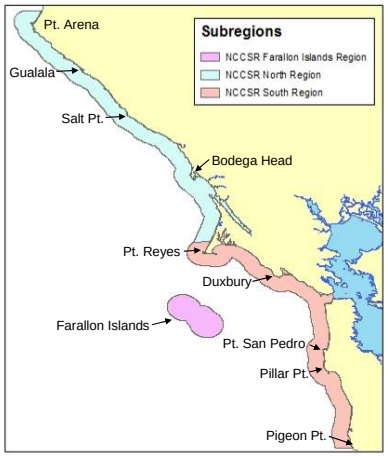
Used GIS to Locate Habitats

- Identified geographic distribution
- Estimated area of each habitat type for study area and subregions
- Estimated area or linear extent of habitat in each MPA



SAT Guidelines: Goals 1 and 4

- **Three subregions**
  - North (Pt. Reyes – Pt Arena)
  - South (Pigeon Pt. to Pt. Reyes)
  - Farallon Islands
- **Based upon**
  - Species and community distributions
  - Geomorphology
  - Oceanography



SAT Guidelines: Levels of Protection

Designated levels of protection based on potential impacts of proposed activities

- direct impacts
  - habitat damage
  - incidental removal or mortality of non-target species
- indirect impacts
  - potential ecosystem effects caused by removing target or associated catch species

SAT Guidelines: Levels of Protection

The Question:

"Would there be a difference between ecosystems within an MPA that prohibits take of this species versus an area outside of the MPA where take is allowed?"

Yes if:

- habitat is damaged
- many species are removed
- removed species play an important role in the resident ecosystem (predator, prey, competitor etc.)

No if:

- no habitat damage
- little associated catch
- species removed are highly mobile so MPAs won't change local abundance

SAT Guidelines: Levels of Protection

	Level of Protection	MPA Types	Activities associated with this protection level
	Very high	SMR	No take
	High	SMCA	**salmon** (troll H&L in water greater than 50m depth), **sardine, anchovy, and herring** (pelagic seine)
	Mod-high	SMCA	**salmon** (troll H&L in water less than 50m depth)*, **Dungeness crab** (traps/pots), **squid** (pelagic seine)
	Moderate	SMCA SMP	**salmon** (non-troll H&L), **abalone** (diving), **halibut, white seabass, striped bass, shore-based finfish and flatfishes** (H&L), **clams** (hand harvest), **giant kelp** (hand harvest)
	Low-mod	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)

*** Note SAT (1/23/08) assigned this activity a "high/mod-high" LOP**

Evaluation: Habitat Representation

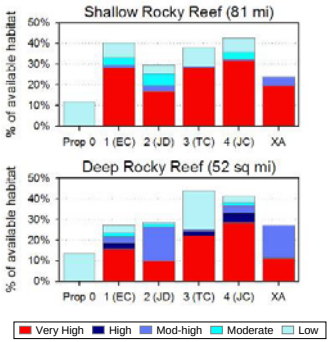
Key Questions for Each Proposed Package

1. How well are key habitat types represented in proposed MPA packages?
2. What are the proposed levels of protection for these habitat types?
3. How well are habitats and levels of protection distributed across the study region?

Evaluation: Habitat Representation

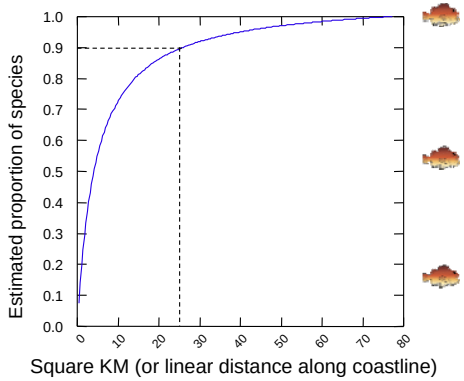
Example of how habitat representation is evaluated and presented to stakeholders

For some habitats, there are strong differences between proposals in the amount of habitat represented in MPAs and the levels of protection



How Much Habitat is Needed?

For a habitat to count in an MPA



- Should be sufficient to encompass most of the species that live in the habitat
- Survey data shows how more area captures more species
- SAT determined that area should be sufficient to capture 90% of biodiversity

How much Habitat is needed?

The amount needed varies by habitat

Habitat	Representation needed to encompass 90% of biodiversity	Data Source
Rocky Intertidal	~0.6 linear miles	PISCO Biodiversity
Shallow Rocky Reefs/Kelp Forests (0-30 M)	~1.1 linear miles	PISCO Subtidal
Deep Rocky Reefs (30-100 M)	~0.2 square miles	Starr surveys
Sandy Habitat (30-100 M)	~10 square miles	NMFS triennial trawl surveys 1977-2007
Sandy Habitat (0-30 M)	~1.1 linear miles	Based on shallow rocky reefs
Sandy Beaches	~ 1 linear mile	

MLPA Goals: Populations

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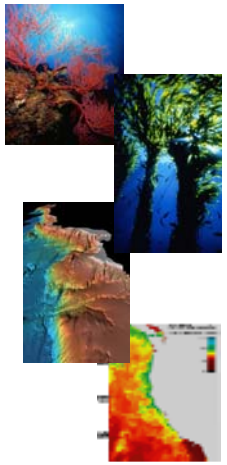


Master Plan Guidelines

Size Guideline #1: "For an objective of protecting adult populations, **based on adult neighborhood sizes** and movement patterns, MPAs should have an **alongshore span of 5-10 km** (3-6 mi) of coastline, and (6-12.5 mi). Larger MPAs would be marine birds, mammals, and migratory fish.

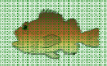
Minimum size = 9 square miles

Size Guideline #2: "For an objective of protecting the diversity of species that live at differe accommodate the movement of in shallow nursery or spawning grounds to offshore, MPAs should **extend from the intertidal zone to deep waters offshore**."

Preferable size = 18 - 38 square miles

SAT Guidelines: Goals 2 and 6

0 – 1 km	1 – 10 km	10 – 100 km	100 – 1000 km	> 1000 km
Invertebrates abalone, mussel, octopus, sea star, snail, urchin **Rockfishes** black & yellow brown, copper, gopher, grass,* kelp, quillback, starry, treefish, vermillion **Other Fishes** cabezon, eels, greenlings, giant seabass, black, striped, and pile perch, pricklebacks	**Rockfishes** black, China, greenspotted,* olive, yelloweye **Other Fishes** walleye perch*	**Invertebrates** Dung. crab** **Rockfishes** blue, bocaccio, yellowtail **Other Fishes** anchovy, Ca. halibut, herring, lingcod, sardine, starry flounder **Birds** gulls, cormorants **Mammals** harbor seal, otter	**Rockfishes** canary **Fishes** big skate Pacific halibut sablefish** salmonids** sole spp. sturgeon whiting** **Birds** gulls** **Mammals** porpoises sea lions**	**Invertebrates** jumbo squid** **Fishes** sharks** tunas** **Turtles**** **Birds** albatross** pelican** shearwater** shorebirds** terns** **Mammals** dolphins sea lions** whales**



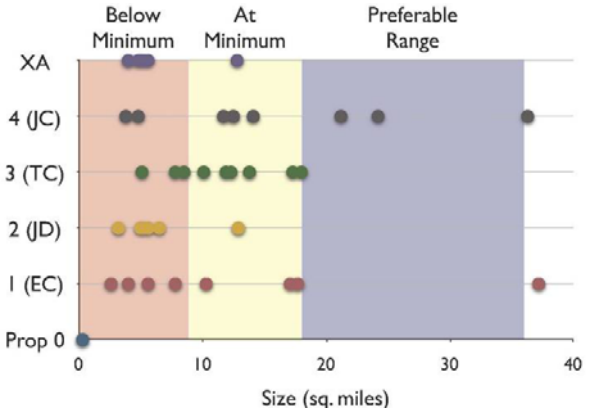
* Studies of this species included fewer than 10 individuals
** Seasonal Migration

Size Analysis Methods

- Measure individual MPA lengths and area
- Combine contiguous MPAs into single MPA complexes
- Consider level of protection
- Tabulate MPA lengths and areas relative to minimum & preferred guidelines

Evaluation: Size

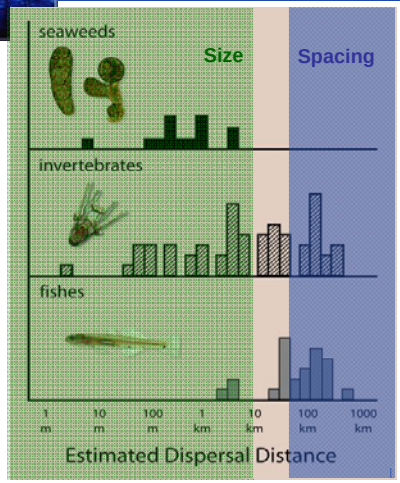
Cluster Size at High Protection



Master Plan Guidelines

Spacing Guideline: "For an objective of facilitating dispersal of important bottom-dwelling fish and invertebrate groups among MPAs, **based on currently known scales of larval dispersal**, **MPAs should be placed within 50-100 km** (31-62 m or 27-54 nm) of each other."

SAT Guidelines – Goals 2 and 6



- **Size:**
  - **5-10 km, minimum**
  - **10-20 km, preferred**
  - **Intertidal to deep waters**
- **Spacing:**
  - **50 – 100 km apart**

Size and spacing are interrelated

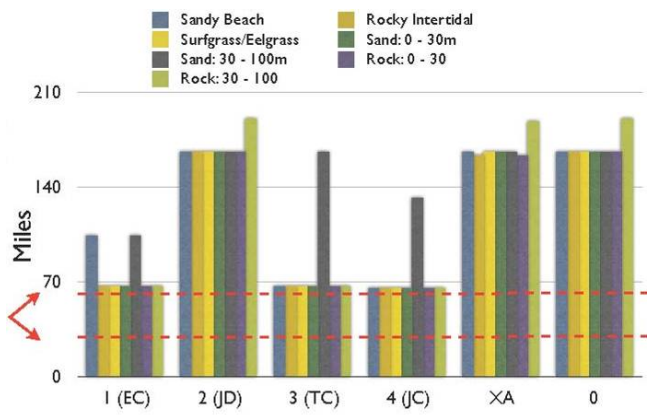
Data from Kinlan and Gaines 2003, PISCO 2007

Spacing Analysis Methods

- Characterize each MPA by the habitats included
- For each habitat, measure the gaps between adjacent, high protection MPAs

Evaluation: Spacing

Maximum Gaps at High Protection



MPA Replication Guidelines

Replication Guidelines:

- "'Key' marine habitats should be replicated in multiple MPAs across large environmental and geographic gradients to protect the greater diversity of species and communities that occur across such gradients, and to protect species from local year-to-year fluctuations in larval production and recruitment."

- "For an objective of providing analytical power for management comparisons and to buffer against catastrophic loss of an MPA, at least **three to five replicate MPAs** should be designed for each habitat type within a biogeographical region."

Evaluation: Habitat Replication

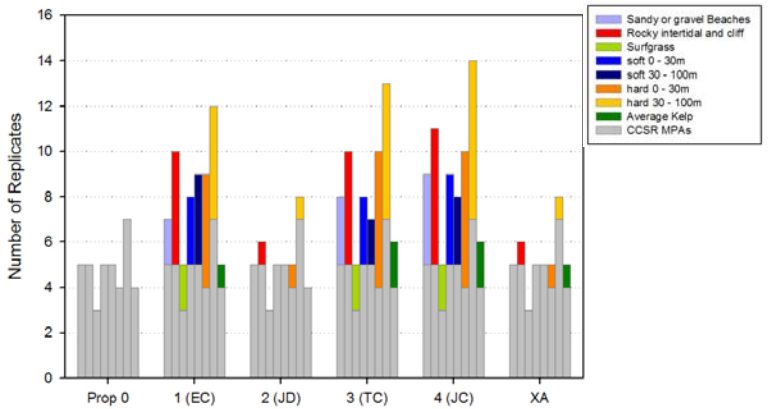
To count as a replicate, the MPA must

1. Meet the desired level of protection
2. Meet size guidelines (9 sq mi) – estuarine MPAs are the exception to this rule
3. Contain enough of the habitat to encompass 90% of biodiversity

Note: The biogeographic region is Oregon to Point Conception

Evaluation: Habitat Replication

Replication at High Protection



Evaluation: Replication

Replication can inform adaptive management

- Comparing a marine reserve (no take) to an MPA that allows one activity can provide insights about the impact of that activity on marine ecosystems
- For study purposes, the MPAs should be located in similar habitats and in the same subregion
- Multiple points of comparison (replicates) increases analytical power

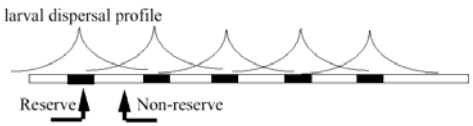
Evaluation: Birds and Mammals

Consider:

- **Breeding Colonies/Rookeries**
  Abundance and percentage of subregional populations within proposed MPAs
- **Haul-outs/Roosts**
  Number of major roosts/haul outs within proposed MPAs
- **Foraging areas**
  Focus on species with limited foraging ranges.
  Considered overlap of draft proposal with foraging areas near colonies (near = 3 mi alongshore x 1 mi offshore)
  Weighted analysis based on colony size and foraging area of overlap within proposed MPAs.

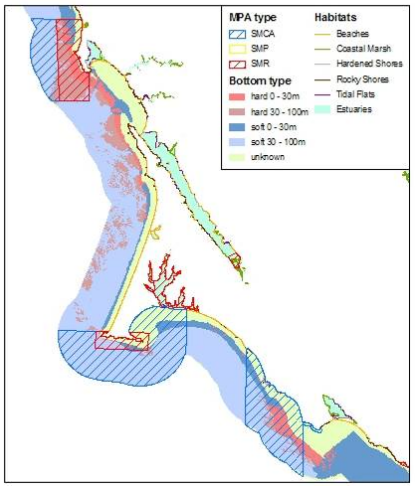
SAT Parallel Approaches Group

- Size and spacing guidelines come from simple models informed by data

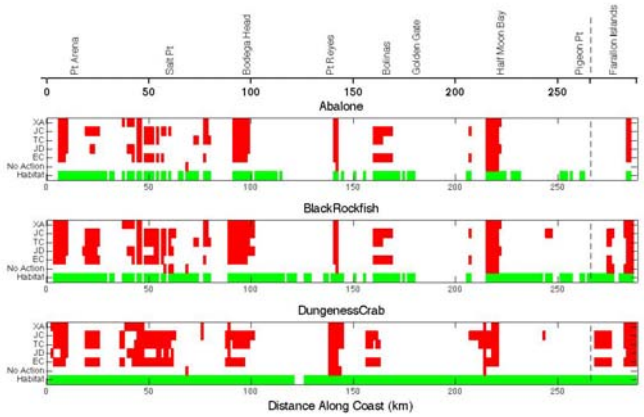


SAT Parallel Approaches Group

- Habitats are patchy
- Packages do not have MPAs of uniform size and spacing
- Costs depend on how marine species and humans respond

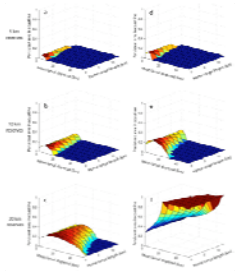


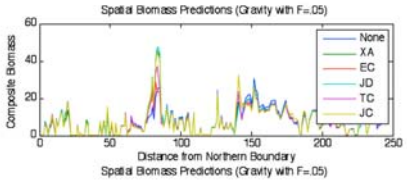
Different Species, Different Views



SAT Parallel Approaches Group

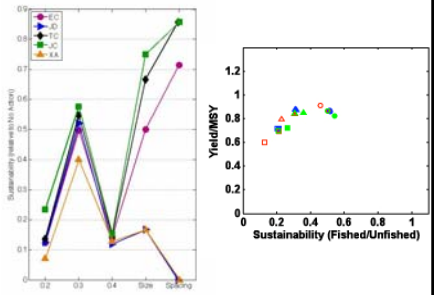
- Two new complementary modeling efforts
  - UC Davis
  - EDOM
- Model package impacts on abundance/ sustainability and yiel
- Multiple species





New Model Insights

- Estimate costs and benefits of packages
- Combine impacts of size and spacing
- Evaluate consequences of different human actions outside MPAs



Conclusions

- MLPA goals and MPF guidelines remain the same across study regions
- Evaluations are tailored to the specific study region
  (eg. some habitats not present, presence of offshore islands)
- The NCC SAT has refined evaluation methods with additional science
  - levels of protection
  - minimum habitat to count
  - evaluation of birds and mammals
  - new ways to present evaluations
  - new insights from models