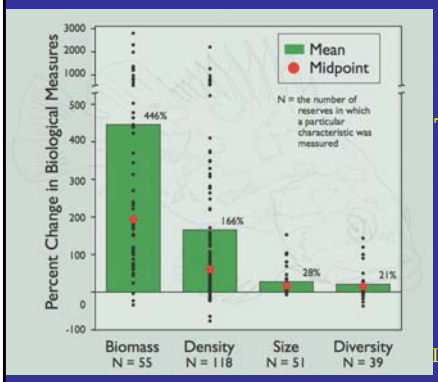
Marine Life Protection Act Initiative

Science Guidelines to Help Meet the Goals of the MLPA

Presentation to the North Central Coast Regional Stakeholder Group
August 23, 2007 • San Rafael, CA

Dr. Steve Gaines, Member, MLPA SAT 2005-2007

125 Marine Reserves with Peer Reviewed Scientific Studies



Large Effects Of Reserves Within Their Borders:

More biomass
More animals
Larger animals
More species

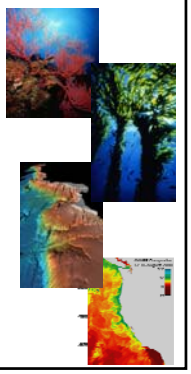
Lester *et al.* in review

Science Guidelines to Meet Goals of MLPA

- Define Habitats
- Define Levels of Protection
- Size and Spacing of a Network

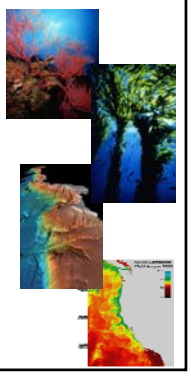
MLPA Goals

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



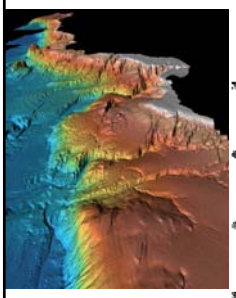
MLPA Goals - Habitats

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

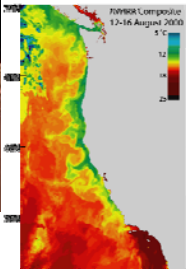


Coastal marine habitats are created by:

- **Seafloor topography and surface type**



- **Oceanographic properties** (temp., currents, nutrients)



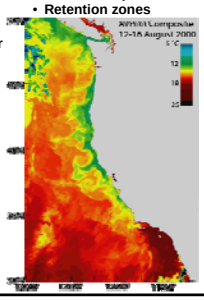
Biogenic habitats
(kelp forests, seagrass, sponges & corals)

MLPA Master Plan for MPAs
Marine Habitats

Seafloor Habitats	Depth Zones
• Rocky reefs	• Intertidal
• Intertidal zones	• Intertidal to 30 m
• Sandy or soft ocean bottoms	• 30 to 100 m
• Underwater pinnacles	• 100 to 200 m
• Submarine canyons	• 200 m and deeper
• Seamounts	

MLPA Master Plan for MPAs
Marine Habitats

Seafloor Habitats	Depth Zones	Oceanographic Habitats
• Rocky reefs	• Intertidal	• Upwelling areas
• Intertidal zones	• Intertidal to 30 m	• Freshwater plumes
• Sandy or soft ocean bottoms	• 30 to 100 m	• Retention zones
• Underwater pinnacles	• 100 to 200 m	
• Submarine canyons	• 200 m and deeper	
• Seamounts		



MLPA Master Plan for MPAs
Marine Habitats

Seafloor Habitats

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

Depth Zones

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

Oceanographic Habitats

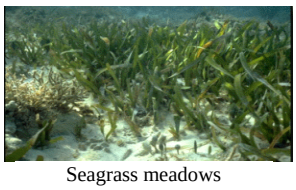
- Upwelling areas
- Freshwater plumes
- Retention zones

Biogenic Habitats

- Kelp forests
- Seagrass beds

Biogenic Habitats

Kelp forests

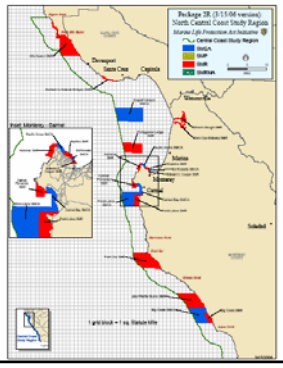


Seagrass meadows

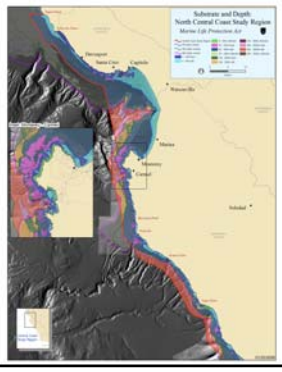
Deep-water sponges & corals

Habitat Representation

MPA Distributions



Habitat Distributions



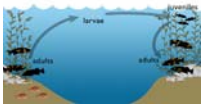
Levels of Protection

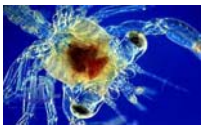
Identified Levels of Protection

- **High Protection**
  - **State marine reserve (SMR):** No take
  - **State marine conservation area (SMCA):** no take except salmon and coastal pelagics in water depth >50m
- **Moderate Protection**
  - **SMCA -** no take except salmon and pelagic fishes (>50m deep), squid, crab, spot prawn, and giant kelp (by hand)
- **Low Protection**
  - **SMCA:** allows various forms of commercial and recreational fishing and mechanical kelp harvesting
  - **State marine park (SMP):** allows various forms of recreational fishing

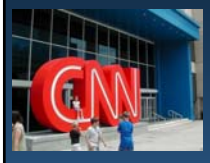
MLPA Goals - Populations

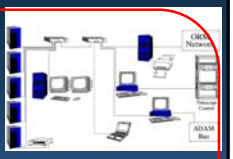
- To protect the natural diversity and function of **marine ecosystems**.
- To help sustain and restore **marine life populations**.
- To improve **recreational, educational, and study opportunities** in areas with minimal human disturbance.
- To protect representative and unique **marine life habitats**.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

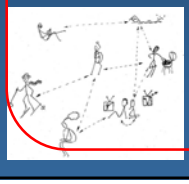


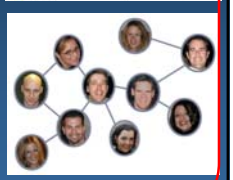


What is a Network?

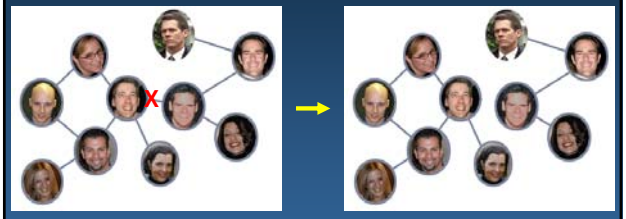








Networks Rely on Connections



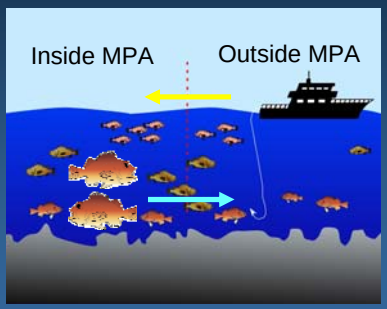
Network

Broken Network

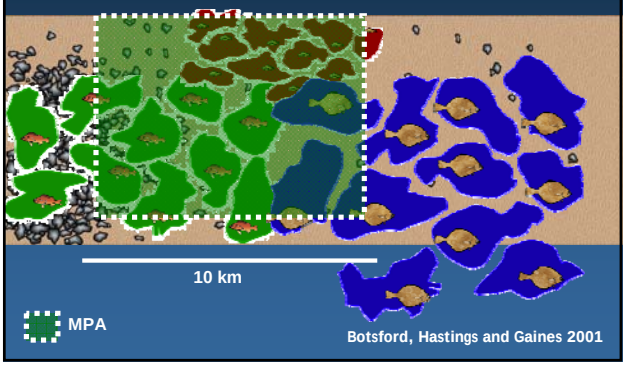
Connections through movement

Adults vs. Young

Adults at Risk When They Leave Reserve



To achieve sustainable populations: MPA size > movement of adults.



Adult Movement for Species of Interest

0 – 1 km	1 – 10 km	10 – 100 km	100 – 1000 km	> 1000 km
Invertebrates Abalone Mussel Octopus Sea Star Snail Urchin Rockfishes Blk. & Yellow China Gopher Kelp Other Fishes Gobie Sculpin	Rockfishes Black Brown Copper Greenspotted Olive Vermilion Other Fishes Cabezon Ca. Halibut Lingcod	Invertebrates Dung. Crab* Rockfishes Bocaccio Canary Yellowtail Widow Other Fishes Anchovy Herring Sardine Birds Gulls Cormorants Mammals Harbor Seal Otter	Fishes Big Skate Pacific Halibut Sablefish* Salmonids* 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*

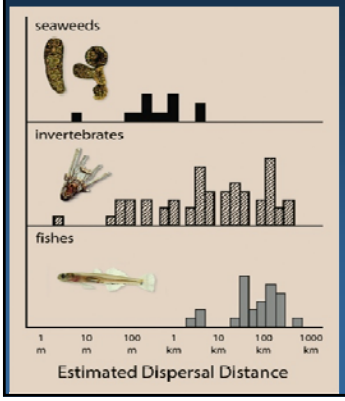
* Seasonal Migration

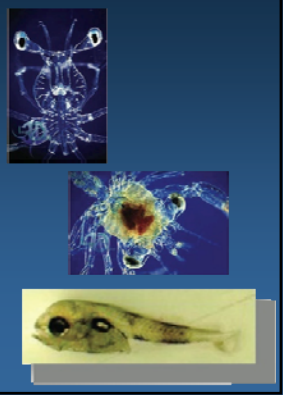
Larger Reserves Benefit More Species

0 – 1 km	1 – 10 km	10 – 100 km	100 – 1000 km	> 1000 km
Invertebrates Abalone Mussel Octopus Sea Star Snail Urchin Rockfishes Blk. & Yellow China Gopher Kelp Other Fishes Gobie Sculpin	Rockfishes Black Brown Copper Greenspotted Olive Vermilion Other Fishes Cabezon Ca. Halibut Lingcod	Invertebrates Dung. Crab* Rockfishes Bocaccio Canary Yellowtail Widow Other Fishes Anchovy Herring Sardine Birds Gulls Cormorants Mammals Harbor Seal Otter	Fishes Big Skate Pacific Halibut Sablefish* Salmonids* 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*

* Seasonal Migration

Same Rule for Movement of Young

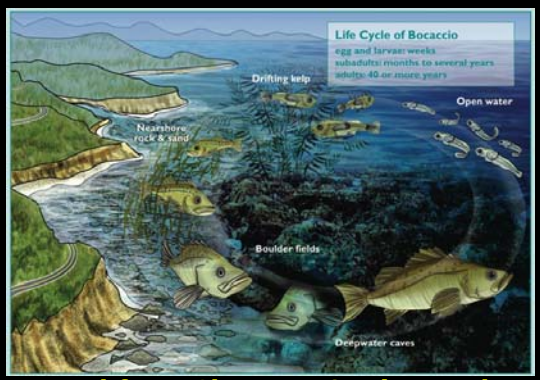




Minimum Size Guidelines:
Min: 5 - 10 km Preferred: 10 - 20 km

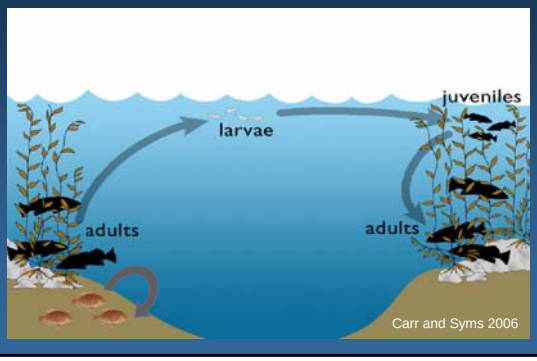
0 – 1 km	1 – 10 km	10 – 100 km	100 – 1000 km	> 1000 km
Invertebrates Abalone Mussel Octopus Sea Star Snail Urchin Rockfishes Blk. & Yellow China Gopher Kelp Other Fishes Gobie Sculpin	Rockfishes Black Brown Copper Greenspotted Olive Vermilion Other Fishes Cabezon Ca. Halibut Lingcod	Invertebrates Dung. Crab* Rockfishes Bocaccio Canary Yellowtail Widow Other Fishes Anchovy Herring Sardine Birds Gulls Cormorants Mammals Harbor Seal	Fishes Big Skate Pacific Halibut Sablefish* Salmonids* 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*

The Other Dimension

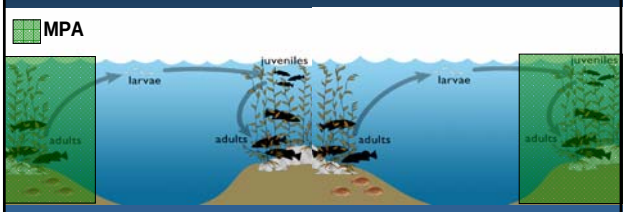


Extend from Shore to 3 mi Boundary

For Larvae, Multiple MPAs Change the Rules

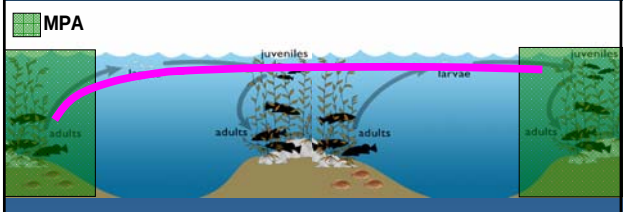


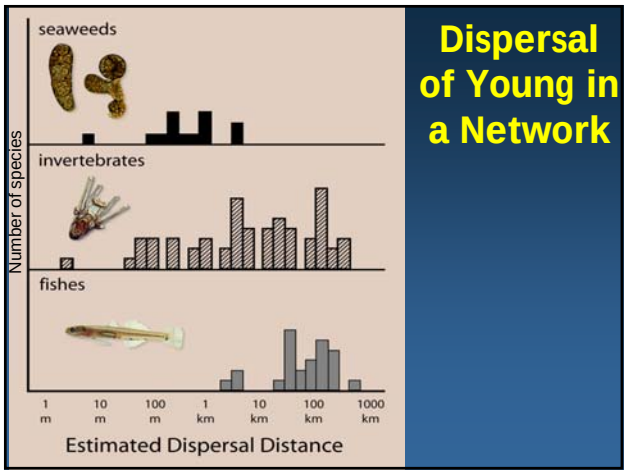
Dispersal Between MPAs is Just as Beneficial as Retention Within MPAs



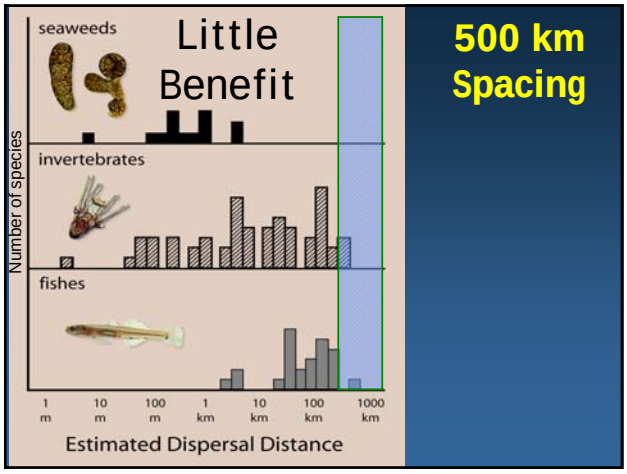
Key Criterion:

Spacing of MPAs < Larval Dispersal

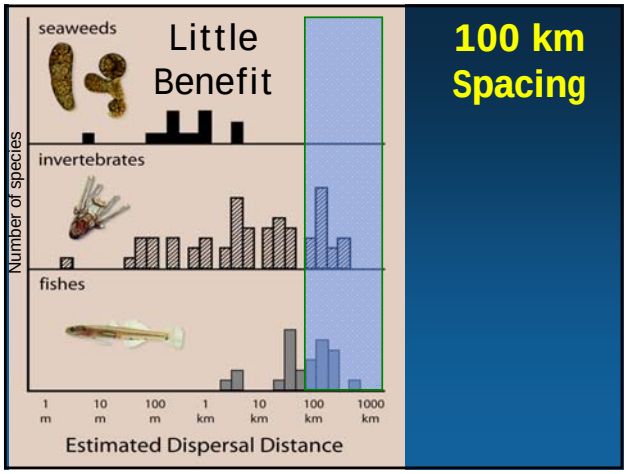




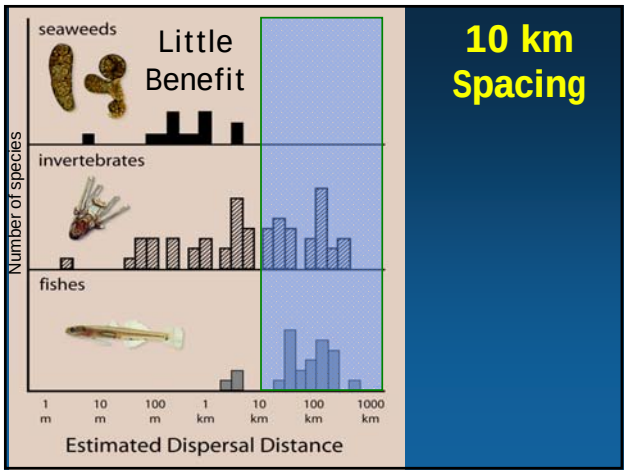
Dispersal of Young in a Network



500 km Spacing

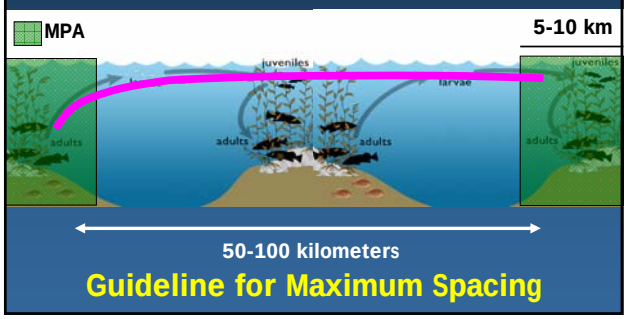


100 km Spacing

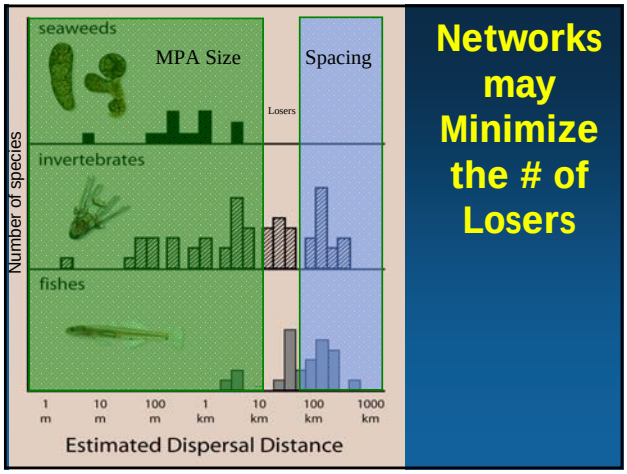


10 km Spacing

To contribute to an ecological network, MPAs should be placed at distances that allow substantial exchange of larvae between MPAs.



Guideline for Maximum Spacing

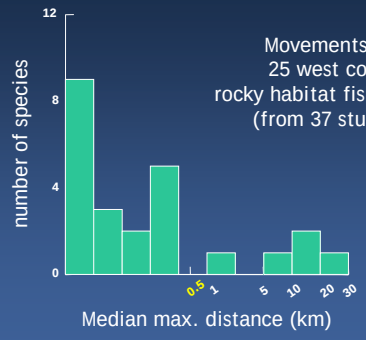


Networks may Minimize the # of Losers

Why do Guidelines Have Ranges?

- Size: 5 to 10 km minimum, 10 to 20 km preferred
- Max Spacing: 50 to 100 km

Minimum Size Guidelines:
Min: 5 - 10 km Preferred: 10 - 20 km



Freiwald, unpublished

Minimum Size Guidelines:
Min: 5 - 10 km Preferred: 10 - 20 km

0 – 1 km	1 – 10 km	10 – 100 km	100 – 1000 km	> 1000 km
Invertebrates Abalone Mussel Octopus Sea Star Snail Urchin Rockfishes Blk. & Yellow China Gopher Kelp Other Fishes Gobie Sculpin	Rockfishes Black Brown Copper Greenspotted Olive Vermilion Other Fishes Cabezon Ca. Halibut Lingcod	Invertebrates Dung. Crab* Rockfishes Bocaccio Canary Yellowtail Widow Other Fishes Anchovy Herring Sardine Birds Gulls Cormorants Mammals Harbor Seal Otter	Fishes Big Skate Pacific Halibut Sablefish* Salmonids* 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*