

Ecological Consequences of Habitat Variability: Examining the influence of different disturbance agents to the kelp forest canopy (*Macrocystis pyrifera*) on local diversity.

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Introduction

In our local kelp forests, the habitat generated by *Macrocystis* plants has a significant influence on the abundance and diversity of species inhabiting the canopy and settling to the benthic environment. Kelp forests habitats are patchy and subject to frequent disturbances, both anthropogenic and natural. Despite the ecological importance of kelp ecosystems, there has been little research on how kelp forest fauna respond to a spatial and temporal variability in the canopy habitat.

Along with the Nature Conservancy, we are measuring the relationship between different disturbance agents and their effects on kelp forest fish and fauna. Sites are monitored to assess the biodiversity supported by the kelp canopy, and the effects of canopy variability on the diversity. It is our hope that the study of the kelp canopy habitat for these species may illuminate some of the key factors that control the diversity of the nearshore and suggest best management practices for these essential nursery habitats.

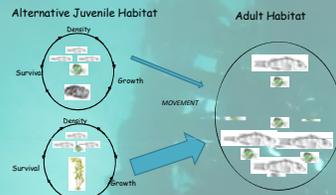


Nursery Role of Kelps Forests

A habitat is a nursery for juveniles of a particular fish or invertebrate species if it contributes disproportionately to the size and numbers of adults relative to other juvenile habitats.

- Density
- Growth
- Survival
- Movement to adult habitats

➢ Beck et al. (2001)¹

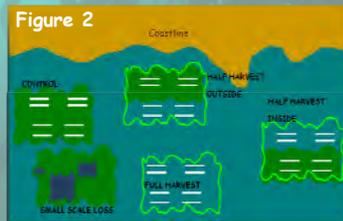


Methods

Along the central coast (Figure 1), kelp beds are experimentally manipulated to measure the influence of canopy variability on local nearshore community composition. Experimental manipulations replicate loss of habitat by kelp harvesting, extraction of canopy by hand harvesters, and natural loss of canopy habitat (Figure 2).

Experiments

- In manipulated and control areas we compared rockfish & invertebrate abundance, diversity within the experimental manipulations:
Macrocystis present & absent



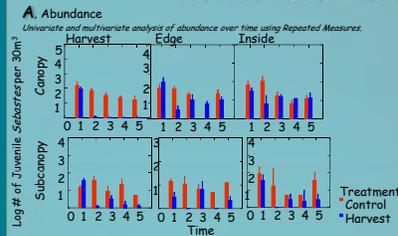
Divers collect data on the size and abundance of all juvenile rockfish and invertebrates. At each site, 8 transects (30 m long by 2 m wide) are surveyed by diver pairs at each of two levels (sub-canopy and canopy) for a total of 48 transects treatment/ site. Surveys are conducted at four time periods: pre and post canopy loss and then at 2 and 4 weeks after canopy loss.

Field Support: Patrick Berk, Kathi Gilles (6 monster), Brian Zavisza, Chris Reeves, Selena Mc Millian, Paul Tompkins (PT), Andy (Lunchbox) Reynaga, Aurora Alifano, Pete DalFerro (PbF), Steve Claubausch, Jamie Grover, Kurt Merg, Reed Vander Schaaf, Kate Schroneck (Ganster Kate), Don Canestro, Lexi Howard, Angela Johnson, James Willis, James White, Natalie Bollinger, Scott Gabara, Marie (Tenny) Oliver, Nina Schkinsberger, the Landell-Hill Big Creek Reserve, Kenneth Norris Marino Rancho Reserve and the UCSC Fall 2005 & 2006 Scientific Diving Class.

Lab Support: Armand Barolitti, Jessica Couture, Joy Feather, Reed Vander Schaaf, Justine Grajski, Lexi Howard, James Willis, Andrew Gray, Angela Johnson, Jenna Javar, Clint Collins, Patrick Berk, Kathy Gilles, Chris Reeves, Scott Garbana

1. Beck MW, Heck KL, Able KW, Childers DL and 9 others (2001) The identification, conservation and management of estuarine and marine nurseries for fish and invertebrates. *Bioscience* 51:633-641.

Results for Juvenile Rockfish

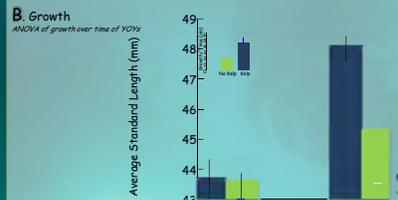


Do juvenile rockfish move down in the water column after loss of the canopy habitat? **NO**

Do rockfish move from the outer edge of disturbance to an undisturbed area? **YES**

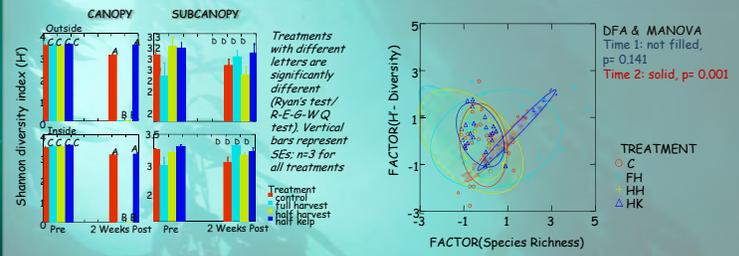
Does the timing (early season vs. late season) of harvesting influence abundance of fish? **YES**

Early Season Univariate	p	Early Season Multivariate	6-6	Late Season Univariate	p	Late Season Multivariate	6-6
Treatment	0.008	Time	0.930	Treatment	0.088	Time	0.088
Depth	0.436	Time* Treatment	0.835	Depth	0.002	Time* Treatment	0.008
Area	0.184	Time* Area	0.101	Area	0.518	Time* Area	0.027
		Time* Depth	0.633			Time* Depth	0.750



Does the presence of kelp canopy drive the growth of juvenile rockfish? **YES**

Results for Invertebrates



	Outside Canopy	Inside Canopy	Outside Subcanopy	Inside Subcanopy
Treatment	P< 0.000	P< 0.000	P = 0.021	P = 0.002
Time	P< 0.000	P< 0.000	NS	NS
Treatment x Time	P< 0.000	P< 0.000	NS	P= 0.001

Does the invertebrates community composition in the canopy respond to habitat variability? **YES**

Does the invertebrates community composition in the subcanopy respond to habitat variability? **YES**

Does diversity & abundance change in absence of the canopy habitat? **YES**

Conclusions

• In California, we are using kelp leasing (Big Sur & San Simeon) as a tool to examine effects of canopy loss on rockfish and invertebrate biodiversity

Experiments on large scale loss in kelp canopy habitat demonstrate that canopy presence drives local juvenile rockfish & invertebrate communities.

Small scale, hand harvesting experiments will begin during the 2009 season

It is our goal to provide informative suggestions for best management practices of the kelp canopy habitat within the Monterey Bay National Marine Sanctuary

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