SPATIAL PATTERNS OF FISHING EFFORT AND RECREATIONAL FISHING PRACTICES OFF SAN DIEGO, CA (USA)

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INTRODUCTION

I. MPA DESIGN

Marine reserves are the latest solutions to manage issues of marine habitat loss, decline of major fisheries, and increasing overall pressure in the ocean (NRC 1999, Allison 1998). Most U.S. fisheries are overexploited and cannot be fished at a sustainable level (NRC 1999, Jackson 2001, Pitchford et al 2007). Due to these unfortunate details, marine protected areas (hereafter referred to as MPAs) have been pursued to thwart continued degradation of the world's oceans (Bohnsack 1998, Dayton 2000).

Historically, reserves were often created haphazardly and opportunistically with little regard to ecology or social issues (Roberts et al 2000) thus serving as "paper parks" and creating a false sense of security. Such reserves were created to please the conservationist lobby groups while also preventing political and social conflict. However, reserves randomly placed, without scientific facts and ecological rules, will be less effective than a strategically placed reserve since habitat importance, larval flow and other oceanographic properties can have a profound impact on the effectiveness of an MPA (Roberts et al 2003). Stakeholders are now calling for a legitimate reserve system, which will be chosen through the use of thorough scientific research and that will adequately protect the marine environment.

In recent years, the MPA design process has begun to shift gears by incorporating both existing and cutting edge ecological data as a basis to describe optimal reserve placement. Bohnsack et al (2000) recommends a minimum of 20% of all U.S. marine area to be designated no-take MPAs in order to establish a minimum protection based on marine fauna home range sizes and population dynamics. Other studies have suggested placing reserves around the critical habitats of exploited species such as rockfish, red sea urchin, California Spiny lobster, etc (Parnell *et al* 2004, 2006). Some assert that current flow patterns in an area should be assessed to maximize larval flow to the proposed MPA area (Leis 2002, Parnell et al 2006) and connectivity between MPA sites (Roberts 2000, Robinson et al 2005).

These reserve design methods are now being considered in California's new legislation called the Marine Life Protection Act (MLPA). In California alone, $43 billion is generated through extractive and non-extractive uses of the ocean (California Sea Grant College Program 2006) revealing the increasing pressure being placed on the marine environment. In response, California state legislature has created the MLPA, which calls for a systematic establishment of marine reserves in state waters "in order to, among other things, protect marine life and habitats, marine ecosystems, and marine natural heritage, as well as improve recreational, educational and

study opportunities provided by marine ecosystems" (http://www.dfg.ca.gov/mlpa/). The MLPA requires that multiple stakeholders be consulted during the MPA creation process. The Blue Ribbon Task Force, which heads the MLPA, requires that all proposed reserve areas be described with habitat maps, an explanation of species that will benefit from an MPA, and oceanographic features (California Marine Life Protection Act Initiative 2006). While the biology of a candidate area must be recognized, the MLPA does not require the social aspects of the area to be assessed. In fact, few studies have examined the spatial distribution of stakeholder use of marine environments (Lubchenco et al., 2003) which has aggravated the fishing community who feel that the use of an area is just as important as the biology.

II. THE FISHING COMMUNITY

The idea of a network of MPAs that could potentially close "favorite fishing spots" has outraged the fishing community. Groups including United Anglers of Southern California (UASC), American Sportfishing Association (ASA), Kayak Fishing Association of California (KFACA), and others that represent the recreational fishing community assert that they will spend considerable effort fighting any form of MPA. On their webpages and in online forums, these groups explain that they are the primary stakeholders affected by the MLPA and feel disenfranchised. Thus, while the community opposes the MLPA period, they still believe that it is important to incorporate their use of an area in the MPLA decision-making process. While a few studies on spatial distribution of recreational fishing effort have been performed in other areas (Aswani and Lauer 2006, Lynch 2006), there is a lack of such data for the San Diego region.

In 2007, ASA hired Field Research Corporation to prepare a survey to investigate the sentiments of the general public concerning marine protection. In their study, Field Research Corporation surveyed 800 California adults and 262 California anglers by telephone. A summary of the results, as they relate to this paper, is in Table 1. Their results reveal that 61% of anglers are opposed to any sort of restriction on recreational fishing. In fact, less than a half of a percent of participants believed that recreational fishing was a major threat to the world's oceans. These results align seamlessly with the sentiments recorded on the sport fishing webpages.

		% of CA adults	% CA Anglers
Californian's biggest concern about environmental threats to the oceans is pollution		59	67
Californian's biggest concern about environmental threats to the oceans is commercial fishing		26	43
Californian's biggest concern about environmental threats to the oceans is recreational fishing		9	9
Pollution is a bigger threat to the oceans than fishing		86	93
Commercial fishing is a bigger threat to the oceans that recreational fishing		85	88
Believe that traditional fisheries management practices are effective		53	67
Support BANNING commercial fishing where fish are threatened		16	64
Support LIMITING commercial fishing where fish are threatened		64	-
Not in favor of restricting commercial fishing at all		17	-
Support BANNING recreational fishing where fish are threatened		10	-
Support LIMITING recreational fishing where fish are threatened		44	-
Not in favor of restricting recreational fishing at all		44	56
Interviewees who had heard of the MLPA		32	60
	Of those aware of the MLPA: Those who thought it was a GOOD thing	25	36
	Of those aware of the MLPA: Those who thought it was a BAD thing	2	13
	Of those aware of the MLPA: Those who had MIXED feelings	5	10
Support an MPA that would not restrict fishing		83	74
Support an MPA restricting recreational fishing		57	37

Table 1. Summary of Results from Field Research Corporation. The hash marks in the CA Anglers column mean that the study did not report the anglers' responses for those questions.

Online forums, blogs, and webpages have been increasingly used to post views on issues directly related to MPAs as well as the MLPA. Many anglers fear that their "favorite" fishing locations will be targeted as a candidate MPA. Vociferous opponents of marine closures regularly post polemics on discussion boards that oppose the creation of MPAs. For example, recently on sdfishing.com and bloodydecks.com there have been posts explaining that the entire kelp forest off San Diego will be closed to fishing or that any post of a trophy fish on these message boards will be used as fuel for the "tree huggers" to implement the MLPA (Appendix A). While it is likely that both sides of the MLPA debate use the same tactics, the posts are currently being used by the angling community as a tool to add fuel to the MLPA fire.

The United Anglers of Southern California have created a tool to help fight the MLPA. UASC is actively distributing pamphlets (Appendix B) at California bait shops, charter boat operators, and other popular places for anglers to visit. Inside these pamphlets is a map that asks anglers to circle their favorite fishing locations. While this appears to be a great way to identify fishing hot spots, there may be honesty issues associated with self-identification of fishing locations and, since MPAs are generally established at a small-scale, the map is too coarse to be effective. The network of proposed MPAs will likely not cover a single large area since historically this has been difficult. Thus, this map and method is not adequate to identify heavily used fishing areas. However, the need for this kind of spatial information is still important in creating MPAs. This paper proposes a study to resolve this problem and produce fine-scale information regarding the fishing practices in San Diego, CA.

III. MOTIVATION/ GOAL

This study seeks to develop a model of fishing effort in the La Jolla and Point Loma kelp forests of San Diego. The MLPA will be moving to San Diego in the spring of 2008 and will attempt to expand the current single marine reserve with a network of MPAs. Only recently have researchers begun to georeference fishing behavior (Aswani and Lauerer 2006, Lynch 2006, Parnell 2007) making this study the only one of its kind performed in the San Diego area. This study will use surveys to describe fishing behavior in San Diego, CA as well as couple benthic modeling of the Pt Loma and La Jolla kelp forests (Parnell *et al* 2006) with findings of the distribution of fishing effort. The study addresses the following questions: 1) what are the spatial patterns of recreational and commercial fishing on the coastal shelf of San Diego? 2) How do these patterns vary seasonally? 3) How do these patterns relate to the benthic habitats modeled by Parnell et al and the current reserve off La Jolla and Pt Loma? Perhaps these three questions can shed some light on the following issues: 1) Are differences of fish abundances in and between kelp forests due to fishing or non-anthropogenic factors? 2) Can we reach a politically neutral conclusion on where to set up MPAs?

METHODS

I. STUDY SITE

The San Diego coastal shelf consists of two major kelp forests: La Jolla and Point Loma. The spatial extent of the Pt Loma kelp forest is approximately 8 to 10 km long and 1 km wide

(Tegner 1997). The south end of the kelp forest is directly aligned with the mouth of the bustling San Diego Bay. The La Jolla kelp forest is approximately 7 km north of the Pt Loma kelp forest. La Jolla is quite patchy and measures over 8 km long and 1.5 km wide and is the smaller of the two kelp forests (Parnell et al 2006). The northern end of the kelp forest is easily accessible by kayaks and surfboards entering from La Jolla cove. The San Diego-La Jolla Ecological Reserve (SDLJER), located inside La Jolla cove, is a no-take reserve that protects the extreme northern end of the La Jolla kelp forest.

A considerable amount of ecological and oceanographic research has been performed not only on the SDLJER (Parnell et al 2005), but also on the Pt Loma and La Jolla kelp forests (Dayton 1999, Tegner 1997). The Parnell et al 2006 study, along with unpublished data, directly relates to the future development of MPAs in San Diego. This study evaluated the relative species affinities of both fish and invertebrates, to habitats in the La Jolla and Point Loma kelp forests. To place a reserve in an "optimal" region, Parnell et al indicate that it is important to balance species' requirements for a habitat with other biological and physical requirements of fish communities. Combining the findings of this study along with this idea of optimization, Parnell et al suggest that the southern portion of the La Jolla kelp forest would serve as an optimal reserve on the coastal shelf of San Diego. The paper reveals that there are differences in fish abundances in and between the two kelp forests within the same habitat types. The southern end of La Jolla has a greater abundance of fish than the northern end of the kelp forest while La Jolla, as a whole, had greater fish abundances than all of Pt Loma. Could these differences in fish abundances be caused by fishing effort or are there natural events occurring that cause these differences?

II. SURVEY DESIGN AND METHODS

Surveys were performed at launching ramps in Dana Landing (Mission Bay) and Shelter Island (San Diego Bay) from September 2007 through April 2008. While I went to the launch ramps approximately 27 times, surveys were only recorded for 15 total days, 7 business days and 8 non-business days, with 1 to 20 interviews performed per visit. This high variability in the number of interviews performed per day is due to a few limitations. First, the California Recreational Fisheries Survey (CRFS) were often present at the launch ramps performing their own surveys examining recreational fishing catch. CRFS is an organization run by the California Department of Fish and Game (CDFG) that compiles recreational catch data by visiting boat launch ramps throughout California. On one occasion, a CRFS personnel, Brian, requested that

my presence be restricted to times when CRFS was not present so that I would not impact their results. After speaking with his supervisor, (Toby Carpenter), it was decided that my study resume when CRFS was not present in order to prevent further conflict. As a result, when a CRFS personnel was spotted at one of the launch ramps, I would simply relocate to a different launch ramp or return on another date. Second, there were often few to no boaters at the launch ramps on the days I was present. Lastly, surveys were not performed on regular days not only due to the factors previously mentioned, but also so that boaters would not become accustomed to or annoyed by my presence. All surveys were performed for approximately 4 to 5 hours either in the late morning or late afternoon and alternated between the two sites.

During the survey process, I approached every boater that stopped to care for his boat immediately after retrieving it from the water. I wore regular street clothes (generally jeans, a t-shirt, and flip flops) and spoke quite casually. Upon contact, the potential participant was informed that I was a student at the University of California San Diego and the use of their responses in my Master's project. No boater was forced to participate in the survey and all were given the option before the survey commenced. Approximately 12% of fishermen refused to participate while 100% of the non-fishing boaters participated. While many of the boaters were very friendly, sometimes a few of the fishermen would get offensive. On one occasion I approached two men who said they would take the survey. However, they were very uncooperative. When asked where they were fishing they said "the Pacific ocean." They remarked that they fish to get away from "people like you." I volunteered to terminate the survey, but they claimed they wanted to participate. After more than 5 minutes of similar conversation, I once again volunteered to leave and they said "Yes. Leave. And put THAT in your report." There were approximately 5 aggressive encounters such as these with more occurring toward the end of this study, possibly reflecting the growing tension as the MLPA nears. Still, on the whole, people were generally friendly and willing to speak with me. Each survey was approximately three minutes in length and consisted of approximately ten open-ended, structured questions (Appendix C). By the end of the study, 118 participants' responses had been recorded. The data was coded in Microsoft Excel by the following parameters: whether or not respondents were fishing (0= no; 1= yes), fishing location (SDB= San Diego Bay; PL= Pt Loma; MB= Mission Bay; LJ= La Jolla; NC= North County), fishing depth (1= shallow(0-20ft); 2= kelp forest depth (21-100ft); 3= bottom fish fishing depth regulation (101-120ft); 4= deep (121+ft)), and target catch (1= anything/not specific; 2= surface/migratory fish; 3= demersal fish; 4= invertebrates; 5= declined to state). While landed catch information was also obtained in the surveys, it was not used in the analysis due to fears that landings would not be honestly reported.

I did not request to see their landings to confirm their assertions since it was important to increase participation. After being coded, the data was put into R and a multiple correspondence analysis was performed.

III. TIME LAPSE PICTURE OBSERVATIONS AND METHODS

Spatial analysis of boaters was determined using time-lapse photography. Five Nikon Coolpix 8 megapixel cameras encased in weatherproof housings were mounted on roofs and hilltops throughout San Diego that overlooked La Jolla and Pt Loma kelp forests. Digisnap controllers controlled the cameras to take pictures every fifteen minutes. The memory cards were collected semi-monthly and the data was stored on the lab computer for spatial analysis.

All five cameras were operational and taking pictures by May 2007 and continue to produce data at present. Due to the staggering quantity of data (roughly 25,000 day-light photographs and growing), only a subset of these pictures was chosen for analysis. Photographs were chosen at random from days in which all five cameras were functional and all pictures were clear of rain and fog. Fourteen business days and fourteen non-business days, 28 days total, between June 2007 and January 2008 were selected for analysis. Pictures were not selected to correspond with the surveys for a number of reasons. First, the time in which the interviewer had to perform the surveys consisted of a very narrow window due to the time-scale of the project. Thus, surveys could only be performed between September 2007 and April 2008. Second, analyses were limited to days in which all cameras were operating properly and conditions were clear. Finally, in order to examine seasonal variability, it was important to select photographs taken throughout most of the year. The time frame was selected to allow the examination of major fishing seasons such as lobster (*Panulirus interruptus*) as well as seasonal movement of migratory species such as yellowtail (*Seriola lalandi*). In all 7,285 photographs were analyzed with 30,392 boat observations being accounted for. All analyses were performed using MATLAB script files. Camera were placed at strategic locations of opportunity thus, some cameras were placed at lower elevations and, therefore, captured a smaller area (Table 2). In MATLAB each photograph was assessed for atmospheric condition, sea state, vessel location, and vessel type, which were assigned to categories. Vessel type was assigned to the following categories: recreational boat, urchin fishing vessel, lobster fishing vessel, fish trapping vessel, kayak, transitioning vessel, cargo or large boat, sailboat, CPFV (fishing charter), or unidentified. Each determination was made using both visual and behavioral identifications. For example, if a transiting boat could be identified by the white-wash behind the boat that was visible in the

photograph. However, a lobster boat would be identified by examining a sequence of pictures in which it could be seen moving, stopping to pick up a trap, and then moving to another location.

Camera	Elevation (ft)
Birch	242
Wind&Sea	75
Bird Rock	25
Cabrillo North	399
Cabrillo South	378

Table 2. Elevations of each camera.

All map projections were performed on MATLAB. X- and y-coordinates were created by MATLAB when each picture was initially assessed for the factors mentioned above. Coordinates of boats in the oblique camera views were then transformed into geographic coordinates (WGS84) using an affine transformation.

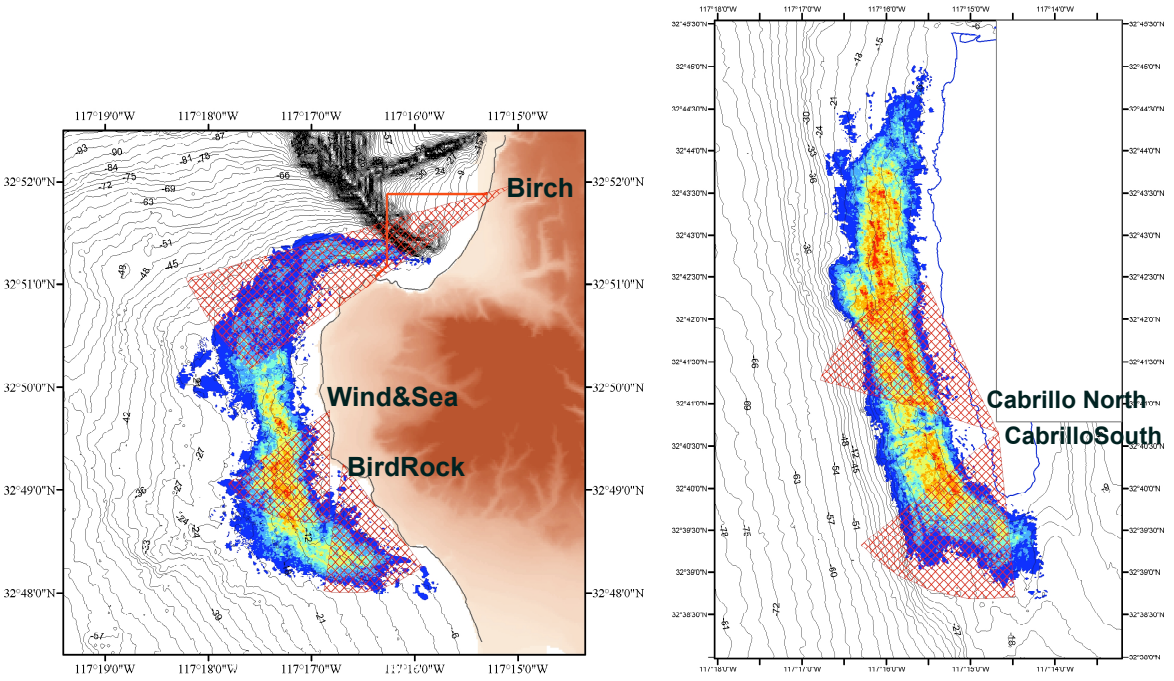


Figure 1. The red grid represents the line of sight of each of the five cameras. The map on the left is the La Jolla kelp forest listed with its three cameras and the areas of their views. The map on the right is representative of the Pt Loma kelp forest and shows the areas of the two cameras overlooking it. The color patterns in the two images represent the persistence of kelp over 25 years within the two kelp forests. The redder the color, the more persistent the kelp. The dark blue areas represent areas that have only been document once.

RESULTS

I. SPATIAL PATTERNS OF FISHING EFFORT

i. Time-Lapse Picture Analysis

The analysis of both the boaters' surveys and time-lapse photography shows a clear variation between the abundances of recreational anglers at both La Jolla and Pt Loma. There are significantly more recreational boat observations at the Birch (northern La Jolla) camera and the Cabrillo North (middle of Pt Loma) camera than any of the other three cameras (Figures 2a-b). The survey results were used to help determine the breakdown of the boats in the recreational boats category of the time-lapse analysis. Of the 118 boater surveyed, nearly ninety percent (105/118) of the recreational boaters were fishing. Additionally, recreational boats that were fishing remained in one place for sometime whereas other recreation boats were tubing or participating in activities that would cause the boat to be categorized as "transiting" during the analysis. Therefore, it is likely that ninety percent or more of the recreational boats in the time-lapse images were recreational fishing boats. Hereafter, all recreational boats will be referred to a recreational angling vessels. That said, there is an obvious "hotspot" of recreational angling vessels on the north end of La Jolla just out from the Children's Pool (Figure 2a) and the middle of Point Loma just out from New Hope rock (Figure 2b).

The time-lapse photographs were graphed by category (Figure 3a). Recreational angling vessels were an order of magnitude more common than any other boat observation. Additionally, recreational angling vessels were observed more often at the Birch (4,221 observations) and Cabrillo South (4,412 4,221 observations) cameras than any other locations (Wind &Sea= 2,126 4,221 observations; Bird Rock= 1,045 4,221 observations; Cabrillo North= 2,185 4,221 observations) (Figure 3b). Commercial fishing vessels such as lobster boats, fish trappers, and urchin boats, are most commonly observed at Birch (334 observations) and Cabrillo South (548 observations) and not at Wind&Sea (108 observations), Bird Rock (75 observations), and Cabrillo North (223 observations). While fish trapping vessels were seen solely in the Wind&Sea and Bird Rock cameras, lobster and urchin boats were observed in every location. Although further analysis is necessary, it is interesting to note that lobster boats tended to fish the edges of the SDLJER while the fish trappers were observed in very shallow waters close to shore.

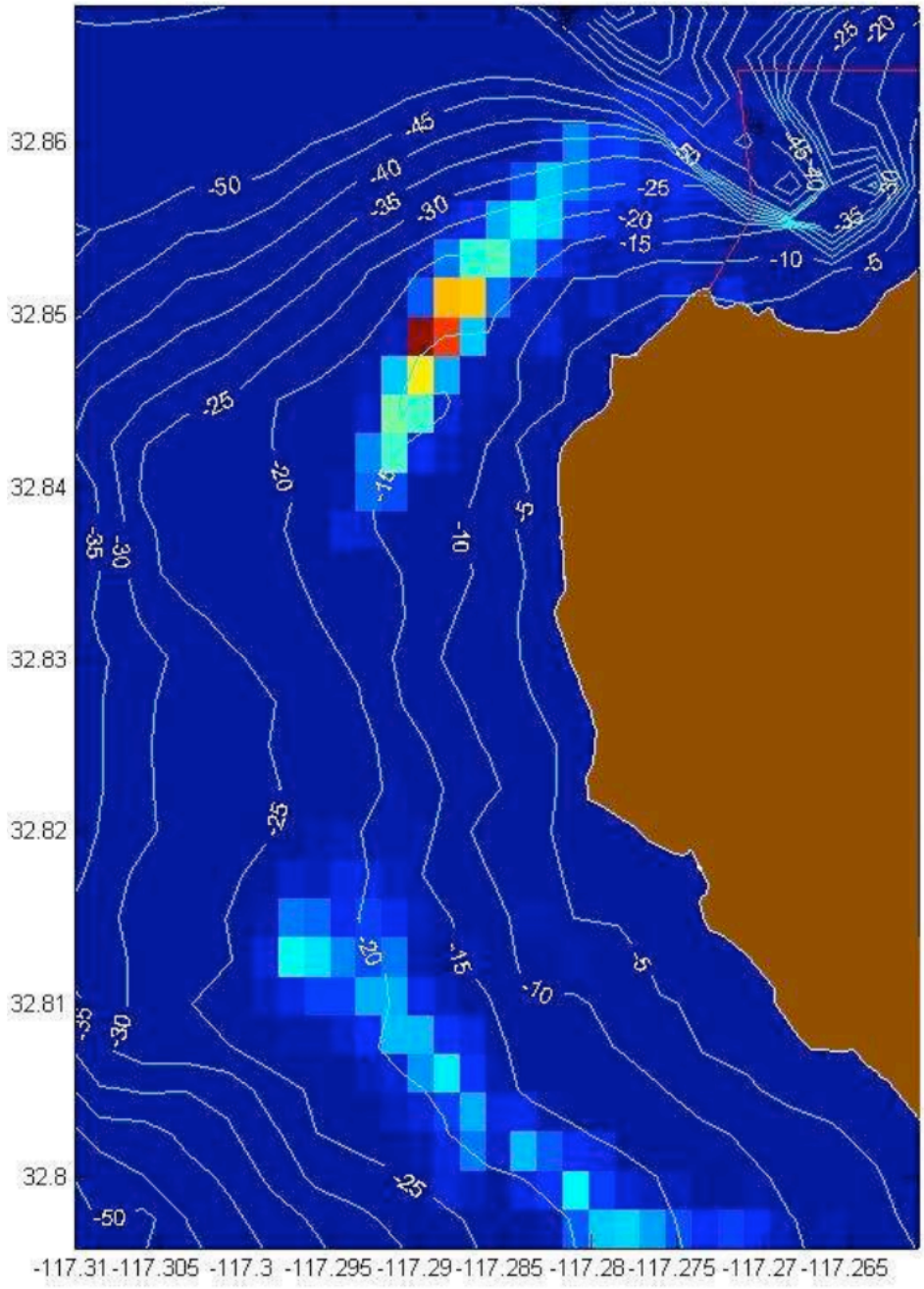


Figure 2a. Spatial distribution of recreational fishing effort in La Jolla. The coverage of each square is approximately 250m on each side. Please note that areas outside of the camera coverage do not indicate lack of use.

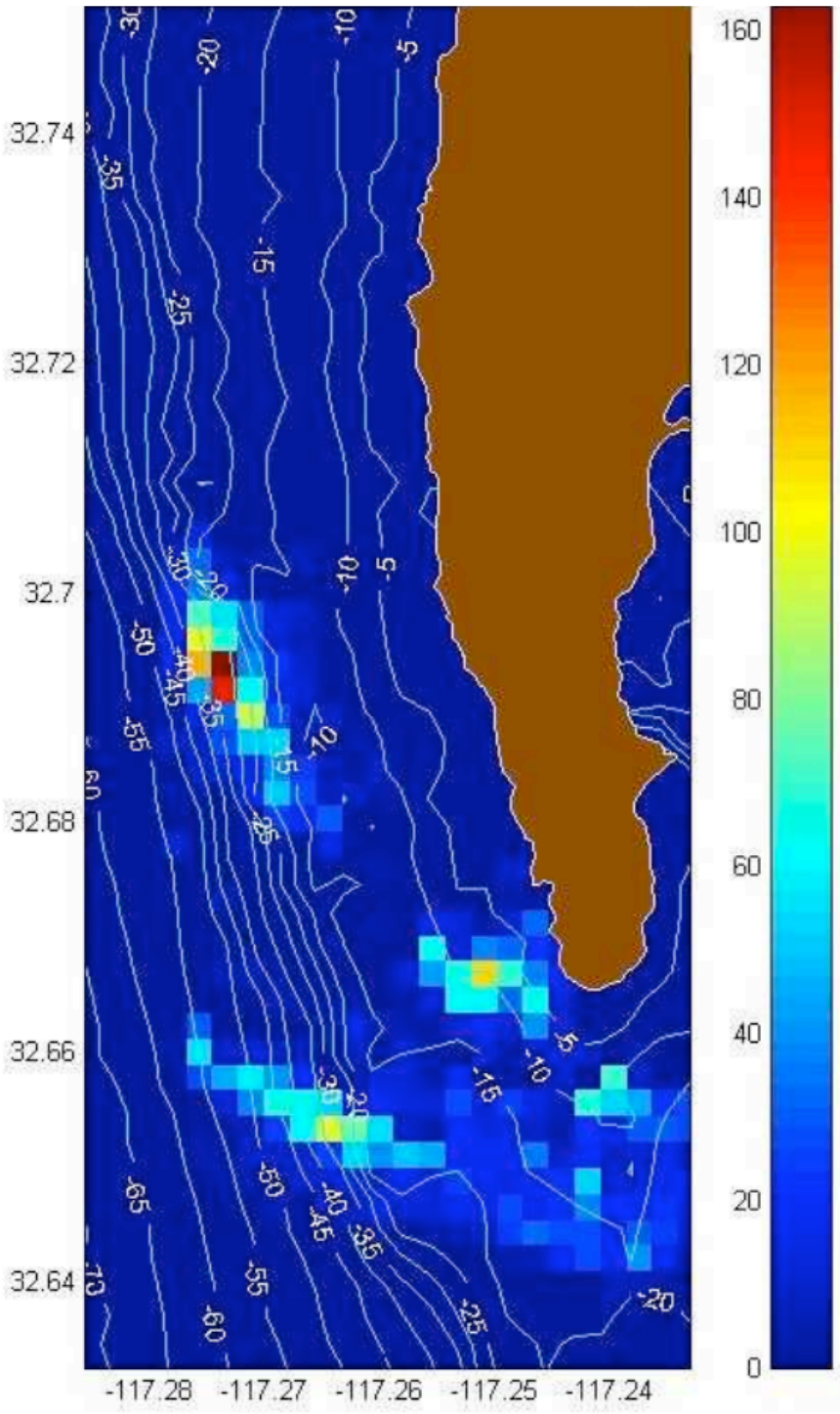


Figure 2b. Spatial distribution of recreational fishing effort in Pt Loma. The coverage of each square is approximately 250m on each side. Please note that areas outside of the camera coverage do not indicate lack of use.

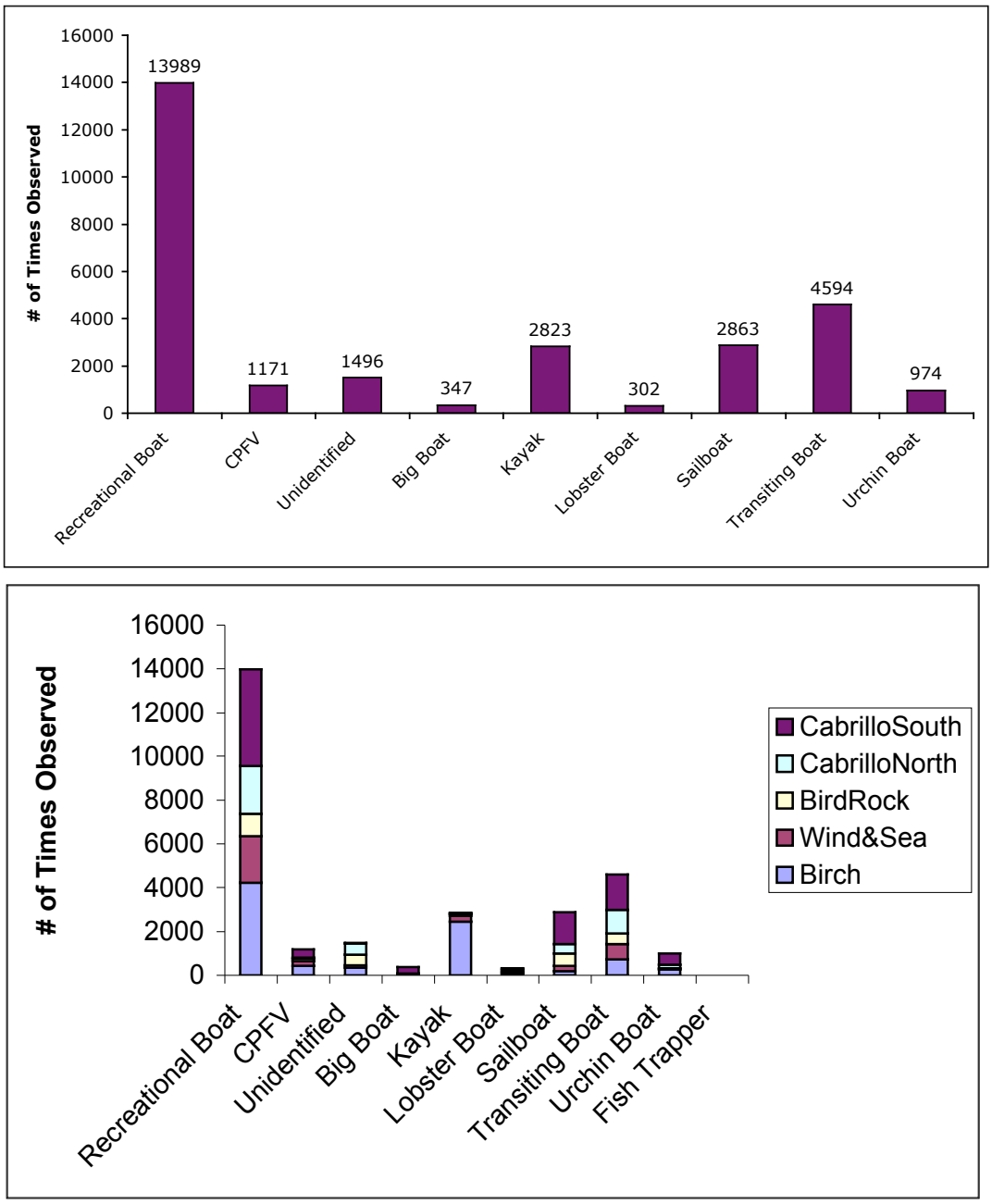


Figure 3 (a-b). Figure 2a (top) shows the total number of boat observations for each boat type. Figure 2b (bottom) shows the total number of observations of each boat type at each camera.

ii. Survey Analysis

The survey results illustrate a strong correlation between fishing location, target fish, and fishing depth and a difference in behavior between locations (Figure 4). The multiple correspondence analysis from the survey responses, which accounts for 84% of variance, shows

that the respondents who fished in San Diego Bay and Point Loma claimed to fish for demersal fish such as rockfish and halibut. At these locations, boaters regularly fished between 20-100ft, which corresponds with the persistent depths of the Pt Loma kelp forest. Conversely, respondents that fished in La Jolla or north of La Jolla asserted that they regularly fish beyond kelp forests depths from 100ft to great than 120ft. These same respondents claimed to fish for migratory, surface fish such as white sea bass (*Atractoscion nobilis*) and yellowtail (*S. lalandi)*. Respondents fishing in Mission Bay consistently fished no deeper than 20ft.

II. TEMPORAL PATTERNS OF RECREATIONAL AND COMMERCIAL FISHING EFFORT

The analysis of the time-lapse photographs reveals changes in boat observations between

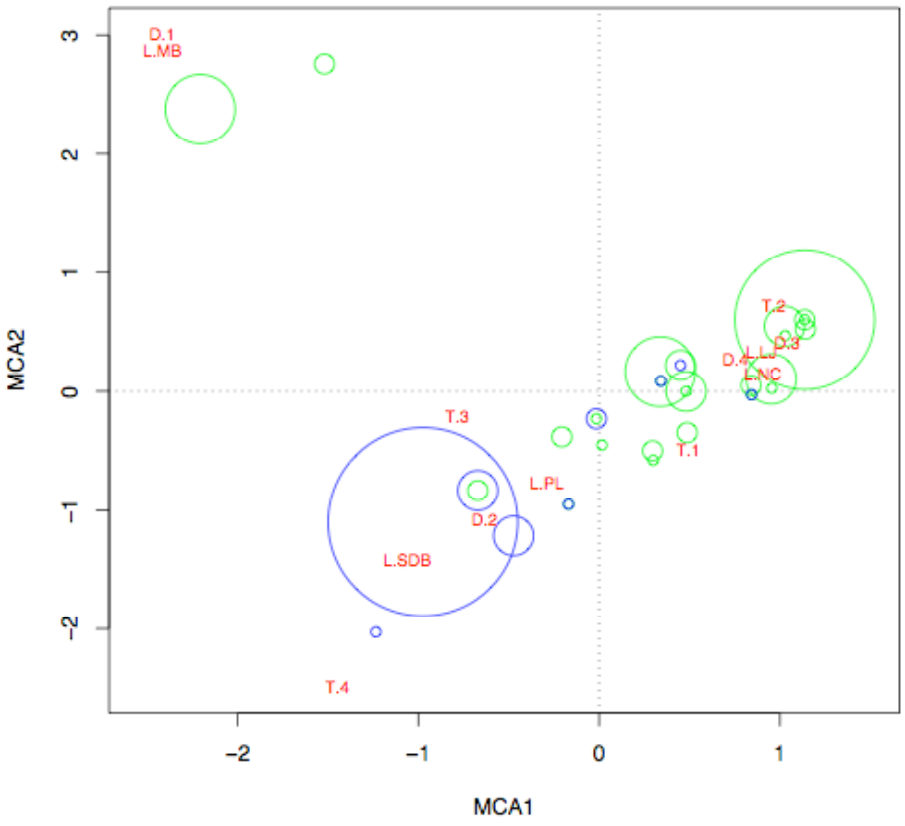


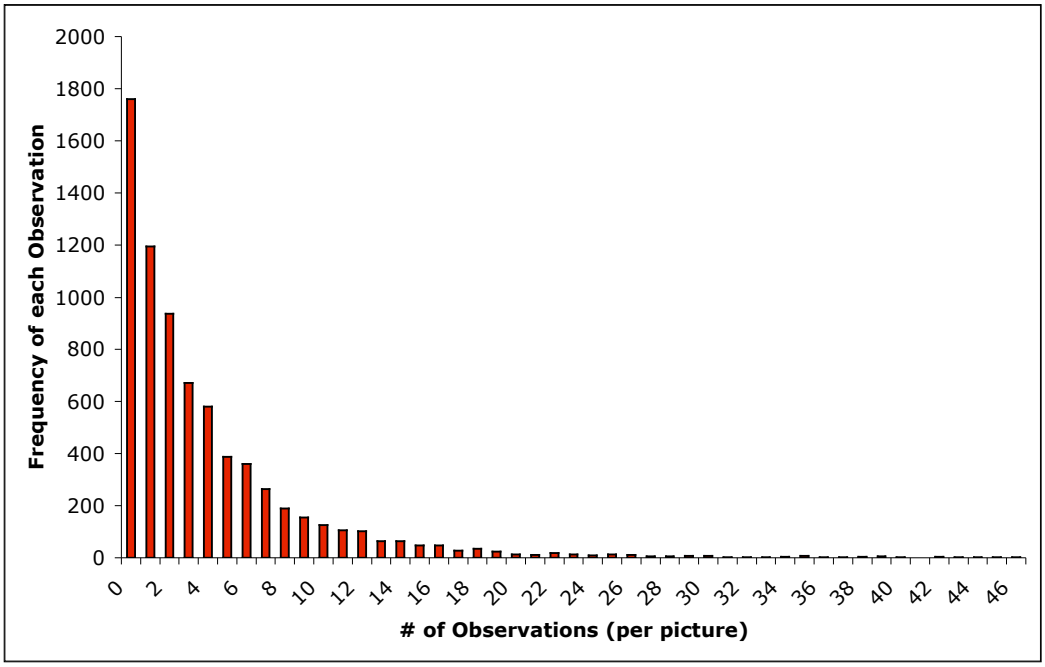
Figure 4. The multiple correspondence analysis shows a strong correlation between the location of fishing, target catch, and fishing depth. All blue circles represent the respondents surveyed at San Diego Bay while the green circles represent all the respondents surveyed at Mission Bay. Each red character represents a different variable in the analysis. (Locations: L.MB= Mission Bay; LLJ=La Jolla; LNC= North County; LSDB=San Diego Bay; LPL=Pt Loma) (Depths: D1=0-20ft; D2= 21-100ft; D3= 101-120ft; D4= 121+ ft) (Target catch: T1= "Anything"; T2= Surface fish; T3= Demersal fish; T4= Declined to state)

seasons as well as between days. The number of boat observations showed a clear Poisson distribution curve (Figure 5a). However, when the observations are broken down to business versus non-business days, the non-business day curve shifts and begins to flatten (Figure 5b). It makes perfect sense that there are fewer images without boats on the non-business days than on the business days. Additionally, boat observations were plotted onto a scatter chart to determine

boat traffic not only within the week but also between seasons (Figure 6). The graph shows that non-business days and the month of August (summertime) are when the most observations were recorded. On average, 1,330 observations were made during the summer images compared to 840 on non-summer days. Additionally, an average of 1502 observations were made on non-business days compared to 669 on business days. The data was further explored to determine the make-up of boats on business versus non-business days (Figure 7). Recreational boat observations show a considerable increase on non-business than non-business days. Conversely, commercial boats which include fish trappers, lobster boats, and urchin boats, were observed fairly evenly throughout business and non-business days with 638 commercial boats on non-business days and 650 commercial boats observed on business days. In summary, there is a temporal variation within the week and between seasons. Boats are observed more often on non-business days and during summer.

III. COMPARING MAPPED BENTHIC HABITATS WITH SPATIAL DISTRIBUTION OF FISHING

Comparison of figures 2a and 2b with figure 1 explain the spatial distribution of recreational fishing effort in relation to benthic habitats. In La Jolla, the kelp forest runs between the 16m to 20m isoclines depending on the bottom substrate. Therefore, it is apparent that the fishing in La Jolla is mostly occurring on the outside edge of the kelp forest in both southern cameras and in the northern camera. In Pt Loma the kelp forest lies between the 5m and 15m isoclines. Once again, when comparing figure 2b with figure 1, in the Cabrillo North camera, the recreational fishing boats are located on the outside edge of the kelp forest. However, in the Cabrillo South camera, recreational fishing boats are situated inside and around the kelp forest.



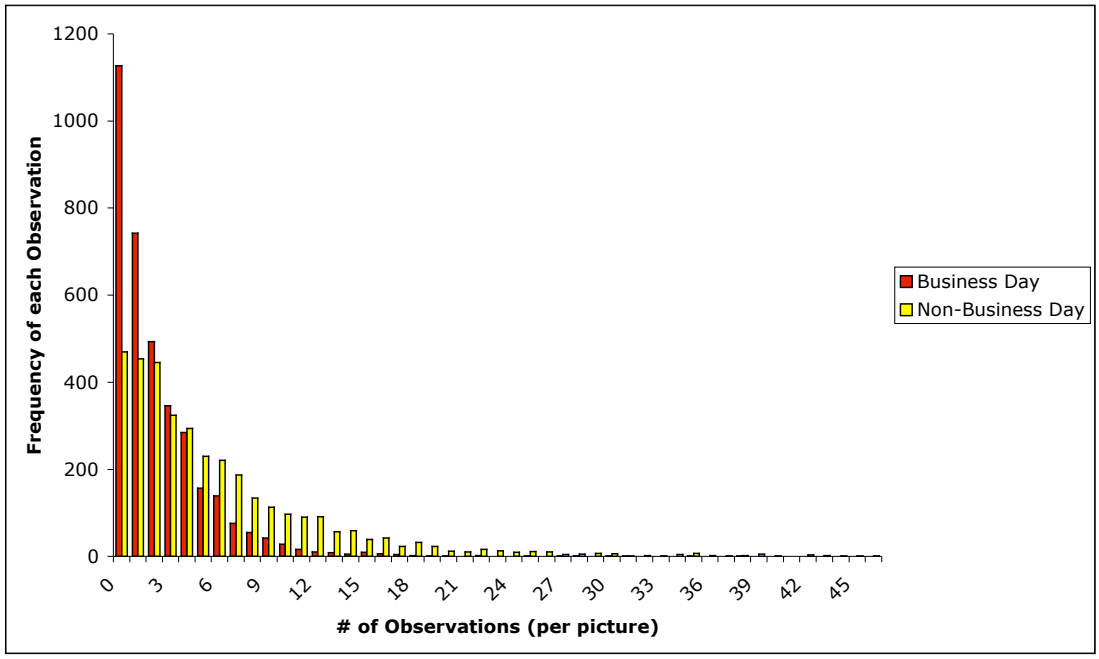


Figure 5 (a-b). Figure 5a (top) frequency distribution of the total number of boat observations for all boat types combined. Figure 5b (bottom) compares the frequency distribution of business day observations (red) with the frequency distribution of non-business day observations (yellow).

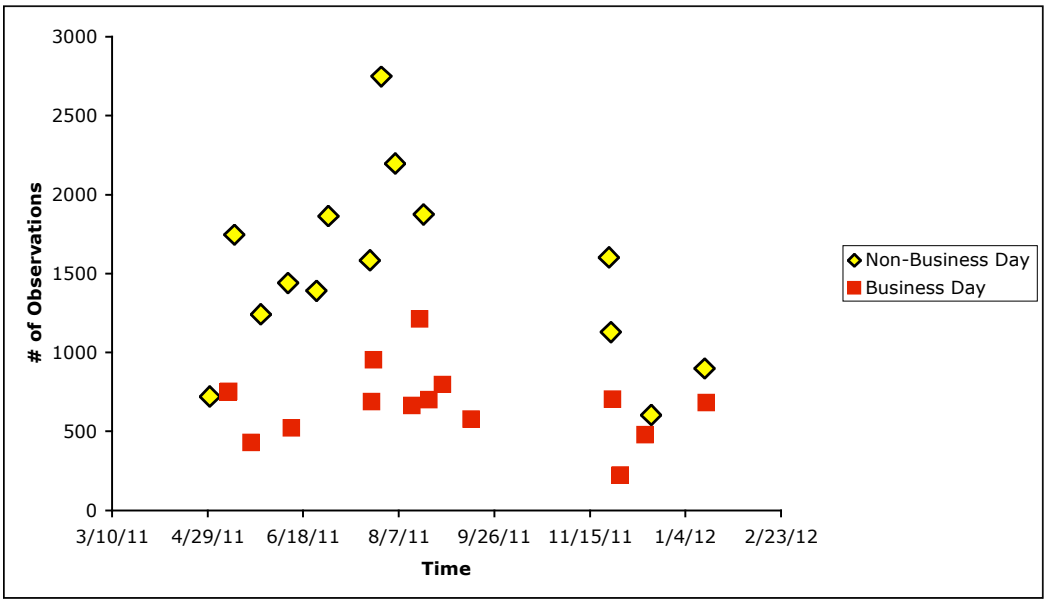


Figure 6. Scatter plot diagram of the number of observations on business (yellow) versus non-business (red) days. Note the peak of boats in August.

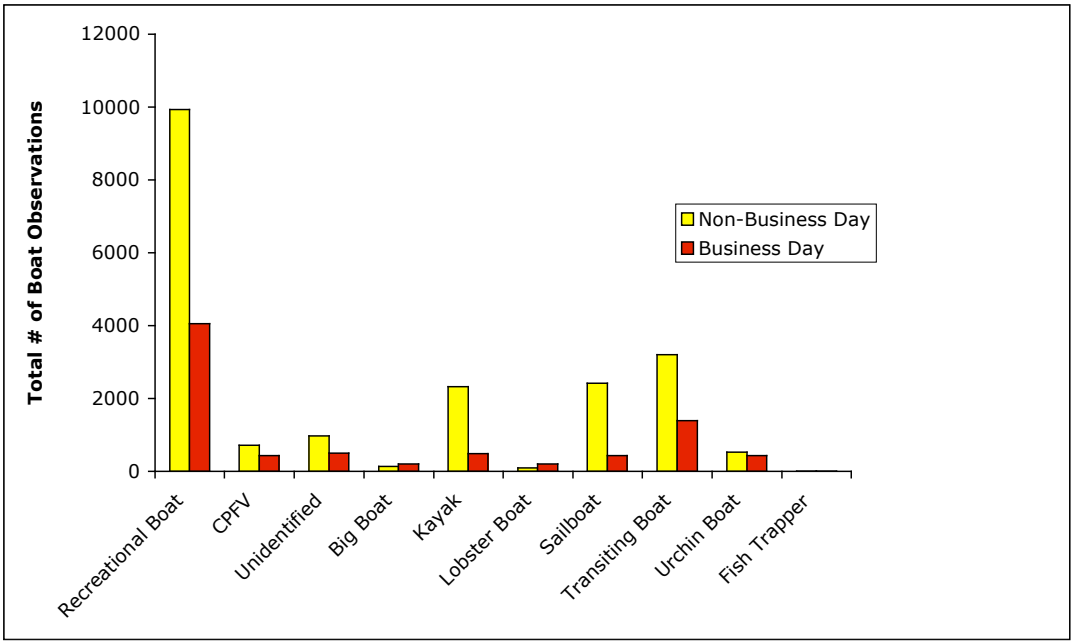


Figure 7. Total number of observations for each boat type. Yellow bars represent non-business days. Red bars represent business days.

DISCUSSION OF RESULTS

I. FISHING EFFORT AND ECOLOGICAL PATTERNS

Parnell et al 2006 determined that there was a difference in species' affinities for the same habitats in and between the La Jolla and Pt Loma kelp forests. Is fishing effort the cause

of this difference or are there other mechanisms involved? In the case of lobster (*P. interruptus*), Parnell et al 2007 determined fishing effort was not likely a large impact on the lobsters' affinity to their preferred habitat. Fishing efficiency (CPUE) was high in northern La Jolla even though there was increased fishing pressure in that area. Thus, a high fishing effort was not necessarily hindering the lobster fishery since CPUE was still very high. Our study shows similar results for recreational fishing effort in the La Jolla kelp forest.

By comparing the survey results with the maps of fishing effort created from the time-lapse photo analysis, it appears unlikely that high fishing effort is impacting species affinities in La Jolla, but the opposite is true in Pt Loma. Figure 2a shows that recreational fishing boats are focusing their effort outside the La Jolla kelp forest. In addition, the multiple correspondence analysis shows that anglers in La Jolla fished for migratory and surface fish. When comparing these results, it is unlikely that recreational anglers are causing a profound impact on the fish abundances in the kelp forest as described by Parnell et al 2006 since they are not landing resident species. Conversely, in Pt Loma, the results show that fishing effort could be causing a decrease of fish abundances in the kelp forest habitats. Spatial patterns in Pt Loma illustrate that recreational fishing boats are fishing inside the kelp forest while the multiple correspondence analysis shows that anglers are fishing for demersal fish. Since anglers are catching non-migratory, resident kelp forest species it is plausible that fishing effort has impacted Pt Loma's overall fish abundances. However, to bolster these assertions, it is necessary to compare recreational catch numbers to these fishing locations as well as extrapolate the data from this study to determine total fishing effort at each location over a year. If these differences are still apparent after these factors have been examined, the results indicate that management efforts between the two kelp forests should take different approaches.

The contrasting results between the Pt Loma and La Jolla kelp forests begs the question: Is it important to put a reserve in an area with high fishing effort or an area with the optimal ecology? Lynch 2006 asserts that it is necessary to position an MPA in an area of heavy fishing to decrease anthropogenic impacts on the marine environment. However, our study results in La Jolla confirm that higher fishing effort does not necessarily overwhelm a habitat since they were targeting migratory fish that do not depend on the kelp forest for habitat. The southern extreme of the La Jolla kelp forest has been toted as an optimal reserve site due to its ecology (Parnell et al 2006). Implementing a reserve in southern La Jolla would also elicit less criticism than the middle of Pt Loma or northern La Jolla where fishing hot spots are occurring. However, if high fishing effort in Pt Loma is indeed the cause of reduced fish abundances, a reserve inside Pt Loma may be practical to aid the species impacted by high fishing pressure. On the other hand, since Pt

Loma is heavily used, placing a reserve inside the kelp forest may elicit a negative response from the recreational fishing community. When selecting candidate areas for an MPA, looking at fishing pressure or ecology alone is not enough. Both the biological, physical, and social aspects of an area must be considered to develop an effective reserve.

II. STAKEHOLDER GROUPS AND IMPLICATIONS FOR RESERVE PLACEMENT

MPAs affect a heterogeneous group of stakeholders with often conflicting perspectives about marine environments (Himes 2007). Fishing groups, environmental groups, state and government agencies, and academia all have different perspectives and agendas in the MLPA process. Such diverse perceptions can hinder MPA effectiveness because without stakeholder buy-in, it is impossible to implement an effective MPA. Himes 2007 concluded that in some areas, these conflicting views may hinder the potential of designating an MPA at all. Even after an MPA is implemented, cooperation of the stakeholder groups is important. Due to high poaching rates and historically poor enforcement, the effectiveness of MPAs requires a great deal of cooperation among these groups (Faasen 2007).

It is the hope of this study to contribute to a better, science-based dialog between stakeholders and decision-makers with regard to potential reserve sites. I determined that recreational angling vessels as well as commercial fishing vessels are heavy users of the northern extreme edge of the La Jolla and the middle of the Pt Loma kelp forests. When coupling this stakeholder usage with Parnell's two studies (Parnell et al 2004 and Parnell 2006) it is apparent that the area in the southern end of La Jolla, proposed by Parnell et al, would be an optimal area to set up an MPA. Not only would it minimize stakeholder conflict, but ecologically, it would serve as an effective reserve.

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Appendix A: Posts from Online fishing forums

Post from sdfishing.com forum
(http://www.sdfish.com/forums/dcboard.php?az=show_topic&forum=124&topic_id=33935&msg_id=33935&page=)

Fri Jan-18-08 11:34 AM by fomen
I'm not going to fingerpoint, or muckrake, because I've been guilty of it myself, but posting pictures of boatdecks covered in fish, or livewells filled with fish isn't helping our cause. The MLPA is reading these forums. They're downloading the pictures of MASSIVE catches of fish, and placing them in portfolios. They're using them as ammunition against the recreational fishermen. It needs to stop! If you have a good day on he water, then post up a few picks of yourself or deckmates holding fish, type up some comments of your day (i.e. highlights, lowlights, ect....), and leave it at that!

I'm not saying don't eat what you catch, because I ride the fence with C-N-R. I normally retun to the drink what comes over the rails of my boat, but I'll keep a good haul of rockfish, yellowtail, or the occasional legal halibut. But regardless of where you stand, these people are hell bent on shutting down the fisheries for EVERYONE! When they compile page upon page of pictures of huge hauls of fish, it's detremental to our beloved pastime. Please, no one take this personally. I'm as guilty as the next guy, but every journey starts with a single step. If you're gonna keep fish, fine. It's not only your perogative, it's your legal right. Just be wise about the content of your post, and the pictures you attach. Believe me, the enemy is watching, waiting, and chomping at the bit to destroy the fishing industry.

Thanks for your time!

~Scott Allen~
aka FOMEN

P.S. If you're with the MLPA, PETA, Greenpeace, or any other cookey "animal rights, tree hugger" organization, and your reading this..... You drink your own pee!

Responses to the post above:

- *Nicely put. Changes are definitely in the wind. And yes, the opposition is watching these sites and collecting ammo to support their nafarious agendas.__"Artists use many mediums to express themselves. Be they oils, stone, wood, even food. Creasy's medium is death. And he's about to create his masterpiece."*- SGTAJ

- *I have hinted at this before..__Great post, folks should take notice_and consider your phto actions as I'm_sure that more than one photo has likely_made it to "poster photo of the week".__We are under attack and have been for many_years.*- relhak

- *good post Fomen. As much as like to see the successful hauls of my fellow fishermen and women, these pictures can easily be taken out of context and misconstrued with another agenda in mind. It's a shame we have to "censor" ourselves, but what you're saying is a reality and it applies to us hunters also._By the way, I am a member of PETA- People Eat Tasty Animals...great P.S. at the end!!*-Feesh on

- *If the MLPA is already here, then there's nothing we can do about it. Trying to negotiate with them is indicative of Palestine trying to negotiate with Israel. We all know they DESPISE each other, and it's NEVER going to happen. Those people want to shut us down (commercial and recreational alike). So if they're already here, and we know their agenda is to try and shut us down, and there's no negotiating with them, what do we do? We have 2 choices. We bow a knee and listen to Lawman, and C-N-R EVERYTHING that comes over the rail of our boats (knowing that it's already too late to change their minds), or we say, "SCREW IT!", and fill our freezers with mass quantities of fish, knowing that our time is short?*

  I'm willing to bet that the Volvo driving, NPR listeners trying to pass the MLPA take a a dimmer view of the "sport" of fishing ie. "fish have feelings too, etc." than of those who might fish for the pleasure of eating their bounty.

  To fishingband: Likely true. However, if we had banded together to make fishing a sport rather than a meat hunt, it would have given us some arguments to have defeated the democrats when they originally enacted the bill that became the MLPA. The debate on the floor of the legislature could have been won at that time with proof anglers were not killing fish. Bingo, no preserves needed. Its a sport, not a method to feed your family. If you are hungry, go to Vons. Stop voting for democrats.

  M = Money (Special Interest)__L = Lies (Poor science from Students and Professors starved for funding)__P = Politics (Liberal loonies and their bogus agendas)__A = Angler beware! (Ding ding!!, it's going to be an ugly fight. -Lawman

Post from bloodydecks.com forum
http://www.bloodydecks.com/forums/california-fishing-politics/89463-socal-s-mlpa-process-just-got-huge-bump-up-schedule-not-good-thing.html

Dec-07-07 1:02 PM by duanediego
SoCal's MLPA process just got a HUGE bump up in schedule... THIS IS NOT A GOOD THING
i know this topic has probaly been touched on a few times already, but its important enough to bring it up again....
this isnt a joke.... we are VERY close to losing a lot of our valuble inshore fisheries here in SoCal. they already got central cal and now we're next...
SignOnSanDiego.com > News > Metro -- Timetable moved up on marine preserves
we need to all act now. you can start by going to UASC's webpage (United Anglers of Southern California: News) and downloading the UASC Survey on the right hand side of the page ("UASC Survey - Recreational Anglers we need you help..") fill that out and mail or fax it back to the addresses provided.
you can also help by writing or emailing a letter to the California Fish and Game Commission, attending MLPA/ Local California Fish & Game Commision meetings, etc...
keep in mind, when youre sending these letters/emails and/or speaking at these meetings that you represent all of us "recreational anglers" as a whole. please be polite and respectful when giving your input.
hopefully most of you are aware of all of this and have made some sort of contribution towards stopping it. if not, its not too late... but soon it will be.

Responses to the post above:
- *Just a note to all SoCal fishermen it is very important that you become involved in this MLPA process. It is coming your way and there is no stoping it. I was on the North Central Coast Stakeholder group as an alternate and helped to develope the proposals that are being presented to the Fish and game Commision. Believe me You need to attend*

the meetings, become a stakeholder as a primary or alternate, communicate with fishing groups in your area and get the dive community involved as well. If you want to keep your honey holes get involved and work within the process. Otherwise you will not like the final outcome. We had a lot of give and take in our region and lost some of best fishing areas but would have lost much more if the fishing and diving interest were not represented. Anyway good luck your going to need it.- h2ospero

- *Last chance for a say fellas*.-Kurt

Appendix B: UASC Pamphlet

IF WE DON'T DEFINE THE AREA, OTHERS WILL DO IT FOR US !

Here's how providing this information will help:

- You'll help us learn where Southern California anglers fish most often
- You'll tell us what areas are most important to you
- You'll show us where recreational access most needs to be protected
- You'll give us the tools to make informed decisions and work with policy makers from a position of strength and knowledge

Please fill in your name, address, and email address, and then mail this brochure to UASC headquarters or return to your favorite tackle store. You can also fax a copy of both sides to (949) 863-9482. **Providing your personal information is critical; it will help us keep you informed about important upcoming events, activities, and decisions.** The information below is private; it will not be sold or transferred to third parties.

How Do You Fish?

___ Pier/Shore ___ Private Boat
___ Kayak ___ Party Boat/Charter

Name: _____

Address: _____

_____

_____

Phone: _____

E-Mail: _____

UA Member # (optional): _____

Contact me for more information about UASC ☐

Place Stamp Here

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17391 Murphy Ave., Suite A
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of Southern California
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www.unitedanglers.com

RECREATIONAL ANGLERS!
We Need Your Help !
DON'T GET LOCKED OUT!

The Marine Life Protection Act (MLPA) is coming to Southern California and we need your help. In order to make sure Recreational Anglers have the best fishing Opportunity and best Access to our favorite fishing grounds, take a few minutes and let us know which fishing areas are important to you.

Your Fishing Depends On It!

Angler's For Conservation and Great Fishing!

Here's what we want you to do:

Using the provided map of coastal and island waters, please draw rough boundary lines around the top three areas you fish most often and number them (1 = most important)

You don't need to give away any secret spots or be too specific (*West end of Catalina*, *Horseshoe Kelp* or *Orange County Coastline* will do)

UNITED ANGLERS
of Southern California
For more information please go to
www.unitedanglers.com

Appendix C: Boaters' Survey

Investigator: Rachelle Fisher

1) What was the purpose of your trip today?
   1- Fishing
   2- Commercial Fishing
   3- Tubing/Rafting/Water Skiing
   4- Just spending time on the water (no particular purpose)
   5- Other Recreational Uses
   6- Other Commercial Uses

2) Where did you go?
   1- La Jolla Kelp Forest
   2- Mission Bay
   3- Pt Loma
   4- Pt Loma Kelp Forest
   5- San Diego Bay
   6- Coronado Islands
   7-Other- specify

2.a) Did you visit more than one location? If yes, specify.

2.b) At what depth did you spend most of your time at?
   1- 0-20ft
   2- 20-40ft
   3- 40-60ft
   4- 60-80ft
   5- 80-100ft
   6- 100-120ft
   7- 120-140ft
   8- 140ft-160ft
   9- more than 160ft

2.c) How do you decide where you do?
   1- Experience
   2- Friends
   3- Talk to bait shops
   4- Online forums
   5- Other- specify

3) How often do you go out?
   1- everyday
   2- more than once a week
   3- once a week
   4- more than once a month
   5- once a month
   6- couple of times a year
   7- once a year or less

3.a) What sorts of factors affect how often you use the boat? (ie gas prices, family, etc)

4) What size is the boat you used today?

5) How many people were on the trip today?

6) What is the primary use of the boat?
   1- Fishing
   2- Commercial Fishing
   3- Tubing/Rafting/Water Skiing
   4- Just spending time on the water (no particular purpose)
   5- Other Recreational Uses
   6- Other Commercial Uses

7) How long were you out on the boat today?
   1- Less than an hour
   2- 1-2 hours
   3- 2-3 hours
   4- 3-4 hours
   5- 4-5 hours
   6- 5-6 hours
   7- 6-7 hours
   8- 7-8 hours
   9- More than 8 hours
   10- Other

8) If you went fishing today, what were you looking to catch?

8.a) What did you land?

Thank you for your participation. Have a wonderful day!

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