MARINE RECREATION AT THE MOLOKINI SHOAL MLCD

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EXECUTIVE SUMMARY

Hawai‘i hosts approximately seven million visitors each year who spend more than $11 billion during their visit. More than 80% of these visitors engage in coastal or marine recreation activities such as snorkeling or scuba diving. Given this level of recreational use, Hawaii’s Department of Land and Natural Resources (DLNR) faces a set of management challenges in areas under their jurisdiction including: mitigating reef environments from degradation, protecting public access, determining recreational use thresholds and managing use levels to ensure that these thresholds are not violated, and ensuring that user experiences are not compromised. This study presents a comprehensive assessment of social impacts related to marine recreation activities at the Molokini Shoal Marine Life Conservation District (MLCD). It presents a rigorous scientific approach capable of assessing social impacts related to marine recreation use, and applies this approach at the Molokini Shoal MLCD to test its performance and potential transferability to other high priority marine recreation sites across the state.

ADMINISTRATIVE CONTEXT

Marine recreation planning and management in Hawai‘i takes place within an administrative context that includes several state agencies and a broad range of relevant regulations. Management of MLCD is the responsibility of the Division of Aquatic Resources (DAR) which is an administrative unit of the DLNR whose mission is to “manage, conserve, and restore” Hawaii’s aquatic resources and ecosystems for present and future generations. The Division of Boating and Ocean Recreation (DOBOR) is responsible for the management and administration of recreation and coastal areas programs in all waters out to three nautical miles, and the Division of Conservation and Resources Enforcement (DOCARE) is responsible for enforcement activities at state marine recreation sites.

Marine Life Conservation Districts (MLCD) in the State of Hawai‘i are regulated under the Marine Life Conservation Program as defined by Hawai‘i Revised Statutes Chapter 190, Sections 1-5. Fishing and other consumptive uses are usually prohibited in MLCD, but these areas commonly support non-consumptive commercial activities such as dive operations and snorkeling tours. DLNR regulation of commercial activities that affect MLCD is guided by a set of policies which includes a hierarchy of priorities. The highest priority is to conserve natural and cultural resources, and commercial activities should only occur on state owned or managed lands or waters if these do not unduly damage the resource. The second priority is public access which should only be maintained as long as natural and cultural resources are preserved. Commercial activities are third in this hierarchy and should only be permitted if impacts do not impinge on the resource or
use by the general public. The commercial use policy also states that Limits of Acceptable Change (LAC) principles should be used to manage commercial use of state controlled resources. The Molokini MLCD was created in 1977 through HAR 13-4-31 which outlines boundaries, prohibited and allowed activities, exceptions, permits, and penalties. The DLNR has issued 41 commercial use permits at the Molokini MLCD under the authority of HAR 13-31-5 to engage in commercial scuba diving, snorkeling, snuba, swimming, and sightseeing tours. Day use moorings were also installed at the site under the authority of HAR 13-4-257 which was enacted in 1994.

ENVIRONMENTAL CONTEXT
Molokini islet is the southern rim of an extinct volcanic crater and the shallow inner cove is the crater’s submerged floor. The islet is owned by the U.S. Fish and Wildlife Service and managed as a bird sanctuary, and the Hawaiian Islands Humpback Whale National Marine Sanctuary surrounds the MLCD. The crater offers protection for fragile benthic species and the site is well removed from offshore sediment inflows that frequently disrupt nearshore reef habitats. The most common substrates are turf algae, sand, and approximately 38 species of hard corals. The environmental status of Molokini MLCD is regularly evaluated by DAR as part of a broader marine environmental monitoring program in the State of Hawai‘i. Coral reefs at Molokini are considered to be “relatively healthy” in spite of substantial marine recreation use and impacts associated with these activities are mitigated by the site’s isolation and depth.

Fish surveys at Molokini MLCD have identified high species diversity, richness, and biomass that varies spatially due to factors such as food availability and habitat structure. Tropic structure among habitats was 42% herbivores, 41% predators, and 17% secondary consumers with dominant species such as surgeon fish, trigger fish, sharks, jacks, and parrot fishes. The most common fish are orangespine and unicornfish, but bluefin trevally, giant trevally, and the bigeye emperor fish are also widespread. Juvenile white tip reef sharks are frequently seen at Molokini, and abundant plankton along the outer crater wall can attract whale sharks and manta rays. Fish surveys at Molokini found more apex predators, herbivores, and larger fish of heavily-targeted species than in other comparable open access areas of Maui County.

FOCUS GROUP SUMMARY
Results of focus groups with commercial operators, government agencies, native Hawaiians, and recreation and environmental interest groups showed both similarities and differences among stakeholders with interests in Molokini. With respect to similarities, the focus groups demonstrated a lack of communication among agencies and stakeholders, and all groups desired improved collaboration. Stakeholders identified a lack of agency leadership, management, and enforcement, no clear
objectives or goals for the site, and a lack of rigorous human use data. Also, there was a lack of dedicated funds for management, planning, operations, maintenance, data collection, communication outreach and inreach, monitoring, and enforcement. Confusion over agency jurisdiction and responsibility, and lack of information from agencies were also identified as issues. There were significant concerns voiced over management of moorings. A desire for all types of sustainability, site enhancement, and effective education of users was present, but no one suggested making the area an "off limits" sanctuary or preserve. All participants agreed in principal on objectives for Molokini (sustainable environment, sustainable businesses, quality user experiences, respect Hawaiian culture) with a few minor differences in priorities.

Differences between commercial operators and community groups were also evident. Commercial operators were more concerned about business operations and client safety, and believe that the existing situation works well (except agency – operator relations). Community groups, on the other hand, believed that changes need to occur. Disagreements were identified over the number and size of boats that should be allowed in the MLCD, and the appropriate amount of human use that should be allowed at the site. Ideas varied regarding the appropriate type and number of non-commercial moorings. Perceptions about the degree of non-commercial versus commercial conflict at Molokini were also identified. Different perspectives on educating visitors at Molokini were evident, with community groups believing that the Hawaiian cultural aspect is largely absent in interpretation provided on tour boats.

MARINE RECREATION USE AND SOCIAL CARRYING CAPACITY

Onsite Observations

Researchers traveled on 28 commercial trips to Molokini and documented that most trips departed harbors or boat ramps by 7:30 AM, returned by 12:30 PM, and visited a secondary site before or after visiting Molokini. All boats had onboard toilets and most trips offered meals and played music on the boats. Barbequing occurred on most large boats, but not on smaller boats. Guides handling or showing marine life to clients was observed on some trips, introductory diving was observed on some smaller boats, and fishing was observed on a few larger boats. Dumping waste overboard and feeding fish was not observed on any trips. Information about safety, equipment, nature, underwater species, coral reefs, proper etiquette, fish feeding, and touching marine life was provided on almost all trips. Most trips on large boats provided information about history and impacts on the environment, but smaller boats did not discuss these issues. Few trips provided information about native Hawaiian culture.
Personal and Trip Expectations
Pre-trip \((n = 712)\) and post-trip \((n = 439)\) onsite surveys were administered to people visiting Molokini on tour boats in both high and lower use periods. Results showed that 85% of visitors to Molokini were snorkeling and 15% were scuba diving. Almost all people on large boats were snorkeling and all but a few on smaller boats were scuba diving. Approximately 30% of visitors were using their Molokini trip to try this activity for the first time with 32% snorkeling and only 12% diving for the first time. Most visitors were minimally or moderately experienced and involved in these activities. Only a few were highly specialized with snorkelers less specialized than scuba divers. In total, 81% of respondents were first-time visitors who had not previously been to Molokini, but visitors on smaller dive boats were more likely to have been to Molokini before. Most respondents visited Molokini in groups of two or four people, but group size was much smaller on dive boats with the largest proportion traveling on their own in these boats.

Almost all Molokini visitors had biocentric (nature oriented) values toward the environment, and there were no groups with mixed or anthropocentric (human focused) value orientations. Almost all visitors also had protectionist (nature oriented) specific values toward coral reefs, and there were no groups with mixed or use-related value orientations toward reefs. Visitors on smaller dive boats were more likely to hold stronger protectionist orientations toward reefs. Pre-trip and post-trip responses showed that trips to Molokini had no immediate change on visitor value orientations toward coral reefs (i.e., visitors were not more environmentally oriented or appreciative of coral reefs immediately after their trip). In total, 52% of survey respondents were female, but more males (61%) were present on the smaller dive boats and more females (55%) were present on larger snorkel boats. The largest proportion of visitors was between 40 and 49 years old, and average age of respondents was 41 years old. Almost all respondents did not live on Maui (97%) with only 4% residing in the state of Hawai'i. Over 79% of visitors resided in the United States and 15% were from Canada. Most visitors from the United States lived in the western states of California, Washington, and Oregon.

Satisfaction
Results showed that the overall satisfaction of Molokini visitors was extremely high, with 95% of respondents satisfied with their trip and almost no respondents dissatisfied. The majority of passengers also considered Molokini to be the best attraction in Maui. Over 60% of visitors considered their trip to be exactly what they expected and one-third believed that it was better than they expected. High overall satisfaction, however, is typical in recreation and tourism settings, and does not mean that visitors were satisfied with all aspects of their visit to Molokini. Visitors were most satisfied with customer service from tour staff and the equipment and boats used on these tours. A large
proportion of visitors, however, were dissatisfied with the inability to escape crowds of people, and that they did not learn about history of the area or native Hawaiian culture.

Visitors on smaller dive boats were much less likely to learn about nature, reefs, history, and Hawaiian culture. These visitors were also less likely to experience calm ocean conditions, try new activities, rest and relax, photograph marine life underwater, and spend time with friends or family. They were, however, more likely to meet new people and see a lot of fish, a variety of fish species, and different types of coral. Over 80% of visitors learned that feeding fish and touching marine life is harmful on their trip. A majority of visitors also increased their awareness of the marine environment, learned that their daily actions affect these areas, and that humans impact the marine environment and their own behaviors cause problems in these areas. Visitors also learned that they can help the marine environment by donating or volunteering. Only a few visitors learned information that increased their awareness of native Hawaiian culture. Visitors on large snorkel boats were much more likely than those on smaller dive boats to experience these learning opportunities during their trip.

Visitors on large snorkel boats rated almost all experiential attributes of their trip to be important and were satisfied that they experienced these attributes, indicating that they felt managers and operators on these boats are doing a good job. Managers and operators should, however, monitor attributes such as seeing a large number and variety of fish, viewing larger marine life and colorful coral, and learning about nature, reefs, and marine species. Visitors strongly expected to encounter these attributes on their trip, but only slightly agreed that they actually experienced these on their trip. Visitors on smaller dive boats rated many attributes of their trip to be important and were satisfied that they experienced these on the trip. Many passengers on these smaller boats, however, expected to photograph marine life underwater and learn about history of the area and native Hawaiian culture, but most were dissatisfied that they did not experience these on their trip. Managers and operators should also address issues such as seeing large marine life and colorful coral, and learning about nature, reefs, and marine species because visitors on these smaller boats strongly expected to encounter these on the trip, but only slightly agreed that they actually experienced these features.

Attributes that met or exceeded visitor pre-trip expectations included those related to boat staff and equipment, trip organization and food, safety, spending time with friends or family and meeting people, time in the water, water cleanliness and visibility, scenery, coral conditions, having fun, and value for money. However, attributes that did not meet visitor pre-trip expectations involved educational information and opportunities for learning (e.g., marine life, coral, nature, Hawaiian culture), trying new activities, taking risks, being adventurous, and seeing many fish and other marine species.
Social Carrying Capacity

Respondents encountered an average of 62 people on their boat, but not surprisingly, this differed by boat size with respondents encountering an average of 78 people on large boats and 17 people on smaller boats. Encounters reported by visitors were similar to use levels counted by trained researchers (average or mean of \( M = 64 \) people per boat: 96 on large boats, 14 on smaller boats). Respondents also saw an average of 84 people in the water on their trip to Molokini, with visitors on large boats seeing more people in the water (\( M = 98 \) people) than what visitors on smaller boats encountered (\( M = 42 \) people). These encounters are likely related to boat size. Passengers remained close to their boats and only likely counted people they saw or encountered in the water surrounding the boat on which they were traveling (i.e., they did not count users on other boats moored in other areas of Molokini). Trained researchers recorded that the average number of people in the water was almost double (\( M = 162 \)) the number reported by visitors. Respondents saw an average of 153 people in total at Molokini with visitors on large boats reporting more encounters (\( M = 177 \) people) than those on smaller boats (\( M = 82 \) people). Visitors likely only counted the number of people they saw on their boat, in the water surrounding their boat, and on and near boats moored immediately next to the boat on which they were traveling. Researchers recorded the average number of users at Molokini any one time was 326 people, which is double the number reported by visitors.

Most visitors (63%) reported seeing 6 or fewer boats on their trip at Molokini, but it can be challenging for visitors to accurately count since line of sight can easily be blocked by other boats at Molokini. Trained researchers counted an average of 12 boats at any one time at Molokini. Researcher counts of the average number of boats (12) and occupancy of boats (96 on large boats, 14 on small boats) can be used to estimate current visitation at the site. Assuming 6 large boats and 6 smaller boats, the number of people at Molokini at any one time is approximately 660 people (240,000 people visiting Molokini per year). This estimate should be treated with caution because it does not account for boats that make two or more trips to Molokini each day, differences in proportion of large and small boats, economic factors affecting tourism, and weather preventing boats from visiting. For example, if 75% of boats at Molokini were large and one of these boats was making a second trip each day, the estimate would be 1,002 people per day (365,000 people per year).

Visitors to Molokini would accept encountering a maximum of approximately 63 people on their boat, 102 people in the water, and 160 people in total at one time. Respondents on large boats would accept encountering substantially more people than what those on smaller boats would accept encountering. Using the maximum acceptable number of people as a standard for management at Molokini may be inappropriate, however,
because the ability to distinguish or count people is constrained when visitors are underwater or when line of sight is impeded by waves and boats. Use levels at Molokini are also directly linked to the number and size of boats carrying passengers to the site, and these factors are likely more appropriate for determining standards of quality.

Number of boats had a stronger influence than size of boats on acceptable use levels. The majority of people visiting Molokini did not accept the presence of more than a relatively even mixture of 15 small and large boats at one time, and this could represent a possible standard of quality for management purposes. The acceptable use level would rise to 17 boats if all boats present were “small” and fall to only 12 boats if all boats present were “large”. These minimum acceptable boat numbers can also be combined with researcher counts of average boat occupancy to estimate social carrying capacities at Molokini. For example, if half of the boats are small and half are large, estimated site capacity would be 915 people at one time. If all boats are large, the maximum acceptable site capacity would be approximately 1,105 people at one time.

The majority of visitors expected to escape crowds at Molokini, but over two-thirds of respondents felt crowded at this site with 67% feeling crowded by the number of boats and number of people on their boat, 70% feeling crowded by the number of people in the water, and 73% feeling crowded by the total number of people at Molokini.Crowding levels this high suggest that Molokini is "overcapacity" and immediate management action is necessary to improve and preserve visitor experiences. Without immediate action, the site is likely destined to become a "sacrifice area" of high-density use where the quality of the environment and visitor experiences are compromised. A majority of respondents reported encountering more people on their boat, in the water, and in total at Molokini than they would tolerate. This suggests that human use levels (i.e., number of people) are a problem at Molokini and the site is operating over its capacity. A majority of respondents reported encountering fewer boats at Molokini than they would tolerate, suggesting that although the number of people visiting Molokini is problematic, the number of boats may be less of a concern. However, over 65% of visitors still felt crowded by the number of boats at Molokini, and this suggests that managers should consider actions that control both the number of people and number of boats at this site.

**Conflict**

Over 70% of snorkelers observed other snorkelers being too close, not looking where they were going, and bumping into people. Fewer than 26% of divers observed these snorkeler behaviors. The majority (56%) of snorkelers and 30% of scuba divers experienced conflict with other snorkelers, with almost all of this being interpersonal or face-to-face conflict. Approximately 30% of scuba divers observed other divers being too close, not looking where they were going, and bumping into people. Fewer than 5% of snorkelers observed these scuba diver behaviors. Over 75% of scuba divers did not
experience conflict with other divers and almost 90% of snorkelers did not experience conflict with scuba divers at Molokini. These results suggest that there was relatively little conflict with scuba divers, but quite a high amount of conflict with snorkelers, and most of this conflict was in-group interpersonal conflict with other snorkelers.

Only 18% of respondents saw snorkelers chase or harass marine life at Molokini. Fewer than 10% of visitors saw snorkelers or scuba divers feeding fish or bumping, handling, or standing on coral at this site. More people on larger boats saw snorkelers chase or harass marine life (21%) and more users on smaller dive boats saw scuba divers bump, handle, or stand on corals (23%). Only 13% of respondents saw tour boat staff handle or touch marine life at secondary sites (e.g., Turtle Arches / Turtle Town) and 8% witnessed staff handling marine life at Molokini. Approximately one-third of people on both the large snorkel boats (31%) and smaller dive boats (36%) believed that it would be acceptable for tour boat staff to handle or touch marine life during the tours.

**Support for Management**

Over 83% of respondents supported prohibiting fish feeding at Molokini. Over two-thirds of visitors supported restricting use levels at Molokini by limiting the number of boats allowed per day (79%), limiting the number of people allowed per day (73%), and restricting the size of boats allowed (66%). These high levels of support for such direct and restrictive actions on use levels and visitation are rare in recreation and tourism. Over two-thirds of respondents also supported doing more to inform passengers about the marine environment (75%), appropriate behavior (67%), and native Hawaiian culture (64%). Approximately 50% of visitors supported improving maintenance and upkeep of harbor and boat ramp facilities, 41% supported designating some boat moorings solely for non-commercial use, and 36% supported spatially zoning activities at Molokini. Fewer than 30% of visitors supported prohibiting music, barbequing, and introductory dive training on boats, but users on smaller dive boats were more supportive of these restrictions. Few visitors (9%) supported closing Molokini to all recreation and tourism use. Approximately 66% of respondents believed that there are currently too many moorings at Molokini and that there should be fewer moorings. Most respondents (74%) were aware that Molokini was a marine life conservation district, 26% were unsure, and only 1% believed that it was not a conservation district.

**Future Visitation**

Almost all visitors (82%) said that they would return to Molokini. Approximately 44% would come back with different expectations about the site; 16% would not come back because they felt that they do not need to visit twice; and 11% would not come back because they believed that they can have better experiences elsewhere on Maui.
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