Marine Protected Areas: An Analysis of Management Strategies and Effectiveness in Puget Sound

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Marine Protected Area (MPA) is a general classification for a variety of zones designated for the long-term protection of part, or all of the natural resources found in marine or estuarine locations. The establishment of MPAs are set around a goal of conserving a specific species, improving biodiversity, abundance of fisheries, or protecting culturally important sites. In addition, MPAs can fulfill a dual purpose of habitat protection as well as providing recreational, educational and research opportunities to the public, special interest groups and managing entities. As there are various regulating agencies that employ a broad spectrum of management strategies one must first understand the ways in which each strategy affects the level of protection these areas receive. Additionally, a few factors such as the size and age of each MPA need to be considered when attempting to quantify the efficacy of these areas designed to protect marine resources.

In Washington, there are 127 MPAs which fall under Federal, State, Tribal, or local government regulation. This patchwork of varying protections covers 644,000 acres and encompasses six million feet of shoreline (Van Cleve *et al.*, 2009). Puget Sound is home to a majority of the state's MPAs, where 110 protected areas are regulated by eleven separate entities, all of whom have differing and overlapping management strategies (Christie *et al.*, 2018). Most of these individual MPAs can be grouped into several categories based on their intended purpose, protocols, and protection levels.

The strategy most associated with MPAs is the traditional no-take protection area in which no fishing or resource harvesting is allowed. In the spectrum of protection offered by MPAs, the no-take strategy is considered the highest level of protection. No-take MPAs frequently focus on improving and

protecting biodiversity as seen with the nine Washington Department of Fish and Wildlife (WDFW) Conservation Areas. However, the no-take strategy is also employed in areas where recreation opportunities are the primary goal. For example, the Edmonds Underwater Park is managed by the city of Edmonds as a recreational diving destination.

The second most protective form of MPAs behind no-take areas are marine preserves that prohibit the harvesting of some marine resources or add stipulations to the way in which harvesting is allowed. The most common example of this in Puget Sound are the 17 WDFW Marine Preserves. One of the strategies employed to increase the level of protection is modifying the means of legal harvest in these areas in addition to the statewide fishing rules. For example, Z's Reef Marine Preserve allows for salmon harvest only by fly-fishing methods. Another management protocol used is restricting the type of fish that can be harvested in an area. This method is implemented at False Bay Marine Preserve where fishing is only permitted for herring. Each Marine Preserves utilizes a different strategy specific to the needs and goals of that specific area, making comparison between them difficult. Further complicating this marine preserve category of MPA, Saltwater State Park Marine Preserve is an outlier where no-take is allowed across any species. However, despite its similarities, Saltwater State Park is not qualified as a no-take Conservation Area (WAC 220-302-090).

The next grouping of MPAs in order of decreasing protection are the Aquatic Reserves managed by the Washington State Department of Natural Resources (WA-DNR). These reserves represent seven marine areas in Puget Sound without any additional fishing restrictions. Instead, the management strategy of Aquatic Reserves focusses on regulating bottomland leasing to protect critical habitat (Christie *et al.*, 2018) or the restriction of non-harvest activities including vessel mooring or public access (Van Cleve *et al*. 2009).

Species specific MPAs offer increased protection, but only to a narrow ecological group. These areas focus specifically on the safeguarding of vulnerable species. WDFW manages several species specific MPAs including the Cucumber and Urchin Exclusion Zones that, with agreement from treaty tribes, offer protection of the species from both commercial and recreational fishing in response to overharvesting in the late the late 20th century (The Washington Department of Fish and Wildlife, 2022). Similarly, the seven WDFW Octopus Protection Areas prohibit the recreational harvest of any octopus species. However, Octopus Protection Areas were developed with the interest in supporting recreational dive tourism revolving around the local giant Pacific octopus (*Enteroctopus dofleini)* (WAC 220-330-090).

Many other MPAs exist outside of the designation and managing agencies of these categories. For example, all state parks with marine shoreline are also classified as MPAs and are managed by the Washington Parks and Recreation Commission. State parks therefore account for the largest managing agency with 67 MPAs. However, state park protections are mostly limited to intertidal shoreline and are not associated with species of concern. The remainder of the marine protected areas in Washington State are regulated by the Department of Ecology, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, local counties, cities, and educational institutions. These areas are then labeled under different terminology depending on the managing agency and can fall under terms such as refuge, recreation areas, sanctuaries, or research reserves, some of which appropriately describe the level of protection they offer while others do not. Although the number of MPAs attributed to each entity varies, the level of protection provided to marine resources ranges from a no-take Conservation Area to the less restrictive Aquatic Reserve.

With an understanding of the strategies used in MPAs, we can now address the remaining question: are MPAs effective? As previously described, the term ‘MPA’ encompasses several levels of protection. Therefore, when assessing their effectiveness, it is crucial to specify the management

strategy being analyzed. One study that sought to evaluate the success of MPAs on rocky reef fish in Puget Sound narrowed their focus to comparing no-take areas with unprotected control locations (Palsson and Pacunski, 1995). This study compared fish size and density of two rockfish species and lingcod (*Ophiodon* elongatus) between these fished and unfished sites. Their findings showed that fish density of the focus species was double in protected zones when compared to fished locations. Additionally, there was three times greater density of lingcod over 70 cm in the no-take areas than at the control sites. No rockfish over 40 cm or lingcod greater than 90 cm were observed at the fished sites, while in protected areas the average sizes seen were above these lengths. The difference in the average length observed between unprotected and protected locations was 20 cm for lingcod and more than 40 cm for rockfish. Finally, calculated egg production of each studied species was greater in protected areas than the control sites (Palsson and Pacunski, 1995).

These findings indicate that when evaluating MPAs on their effectiveness in conservation of rocky reef fish, no-take MPAs result in greater fish density, size, and reproduction. If efficacy is based on the criteria of protecting the targeted species, no-take MPAs in Puget Sound are effective. Though this study was conclusive, it analyzed only one of the multiple variables associated with MPAs. This begs the question, besides management strategy, what other factors impact the success of MPAs?

One major difference that can be seen in Washington marine waters is in the size of the individual protected areas. While the average area of an MPA in the state covers 23 acres, the size range varies from smaller than one acre to over 300,000 acres (Van Cleve *et al.*, 2009). However, the largest protected areas within the Puget Sound are the WA-DNR's Aquatic Reserves which offer the least amount of protection. This variability in protections levels within the umbrella term 'MPA' means that MPAs cannot be judged solely by their size, nor that larger MPAs necessarily provide greater benefits.

In a literature review conducted of global MPA data, Halpern (2003) questioned if the size of a protected area has an impact on its effectiveness. In this review only no-take MPAs were considered to simplify the primary variable of protection type. The four vertices Halpern (2003) considered when analyzing MPA success were organism size, density, species richness, and overall biomass of the area. Despite the review examining data from areas ranging from half an acre to 200,000 acres, there was no statistically significant difference in the efficacy of MPAs. Organism size, density, and species richness were comparable between all reserves and were higher than non-reserve areas. Overall biomass within the MPAs was analyzed on a proportional basis to area covered, which also supported the findings that MPA size does not have an impact on MPA success (Halpern 2003).

Other research has focused on the impact that the age of an MPA might have on its effectiveness. A study conducted in the San Juan Islands compared the density of small, medium, and large individual red sea urchins (*Strongylocentrotus franciscanus*) in three categories of sites (Tuya *et al*., 2000). The first set of sites surveyed, which we will refer to as the 'Old MPAs', had been closed to urchin harvest since the 1970's. The next group, the 'New MPAs' had been established three years prior to the study. The last category was the unprotected survey locations where urchin harvesting was only restricted by the WDFW statewide fishing regulations. This research found that each of the three site categories shared a similar density of small sized red urchin. Conversely, the density of medium and large urchin was significantly higher in the Old MPA's than in the unprotected areas or the New MPAs. There was no statistically significant difference in the abundance of medium and large urchin between the New MPAs and the unprotected areas. The results of this study suggest that the age of a protected area is the most crucial factor that contributes to the success of a no-take MPA, specifically regarding a slow growing species like the red sea urchin (Tuya *et al.* 2000).

In summary, the level of protection is likely the most important factor when evaluating the effectiveness of marine protected areas. Research of no-take protected areas within Puget Sound suggests that when target species such as rocky reef fish are allowed refuge from recreational and commercial fishing population density, length, and reproduction increases (Palsson and Pacunski, 1995). However, it is not the only element that determines efficacy. Further studies find that the age of protected areas is also a key variable in successful MPAs, and long-term protection may be required to see the results especially for slow growing species like the red sea urchin (Tuya *et al*., 2000). Surprisingly, when it comes to MPA's, Halpern (2003) found that size does not matter, and any area of refuge is better than none.

Though MPA's are commonly referred to as one singular conservation tool, their variability in stewardship results in unequal and often incomparable levels of protection to the habitats they encompass. The additional intricacies of regulating agencies, terminology, and classifications complicates discussing protected areas in Puget Sound. As a result, it is difficult to answer the question 'are MPAs effective?', when perhaps we should be asking 'which MPAs are effective?'. Moving forward with this new perspective, MPA management could be simplified and adjusted to more successfully protect the natural resources of Puget Sound.

References

Christie, P. et al. (2018) 'Policy pivot in Puget Sound: Lessons learned from marine protected areas and tribally-led estuarine restoration,' Ocean & Coastal Management, 163, pp. 72–81. https://doi.org/10.1016/j.ocecoaman.2018.05.020.

Halpern, B.S. (2003) 'THE IMPACT OF MARINE RESERVES: DO RESERVES WORK AND DOES RESERVE SIZE MATTER?,' Ecological Applications, 13(sp1), pp. 117–137. https://doi.org/10.1890/1051-0761(2003)013.

Octopus protection areas in Puget sound (no date). https://wdfw.wa.gov/fishing/management/mpa/octopus-preserve.

Palsson, W.A. and Pacunski, R.E., 1995, January. The response of rocky reef fishes to harvest refugia in Puget Sound. In Proceedings (Vol. 1, pp. 224-234).

The Washington Department of Fish and Wildlife (2022) 'A deep dive into sea cucumber conservation and consumption,' Medium, 5 January. https://wdfw.medium.com/a-deep-dive-into-sea-cucumber-conservation-and-consumption-f1d956d3aeca.

Tuya, F.C., Soboil, M.L. and Kido, J., 2000. An assessment of the effectiveness of marine protected areas in the San Juan Islands, Washington, USA. ICES Journal of Marine Science, 57(4), pp.1218-1226.

Van Cleve, F.B. et al. (2009) Marine Protected areas in Washington: Recommendations of the Marine Protected Areas Work Group to the Washington State Legislature. report. https://wdfw.wa.gov/sites/default/files/publications/00038/wdfw00038.pdf.

WAC 220-302-090: (no date). https://apps.leg.wa.gov/WAC/default.aspx?cite=220-302-090.

WAC 220-330-090: (no date). https://apps.leg.wa.gov/WAC/default.aspx?cite=220-330-090.