

Title: **Marine Protected Areas as a Risk Management Tool**

Author(s): Jason Murray, Sturla Kvamsdal, Theodore Groves

Abstract: There is considerable debate in the literature about the usefulness of Marine Protected Areas as fishery management tools. While most economists have found that it is unlikely that marine reserves will improve steady-state yields, some biologists have shown that protected areas have the potential to reduce uncertainty. Most of the work on uncertainty has focused on exogenous environmental variability; the probability of collapse can be reduced with protected areas, but this comes at the cost of lower yields. Here we consider single-owner management with spatial closures under growth and production-function parameter uncertainty. There are many reasons to suspect that estimates of fishery growth parameters are highly uncertain: intrinsic variability, lack of data, weak identification, and technological change to name a few. If a single owner does not know growth parameters very well then it is difficult to determine optimal extraction paths. Traditional optimal management utilizes a single control variable, catch. When growth and production parameters are uncertain we consider the expected benefits of utilizing a second control variable: fraction of area harvested. We show that even in a deterministic dynamical system, if parameters are unknown, expected harvests can be improved with protected areas. Under some parameterizations, unique optimal reserve and fleet sizes exist.