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M.S. PLAN B

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**OPTIMIZATION of MULTI-purpose ARTIFICIAL
SURFING REEF GEOMETRY**

ABSTRACT

Multi-purpose artificial surfing reefs (MPARs) are structures designed to have various functions such as improvement of surf quality, protection of the shore against erosion related to waves and creation of marine habitats. There are eight MPARs around the world. A brief literature review of four representative designs shows none of them is performing to expectation regarding surf quality improvement. The design guidelines for artificial surfing reefs are still uncertain.

This paper develops a methodology for surfing reef configuration optimization. As a parametric study, the structures are placed on a flat bottom and numerical modeling is used to propagate prevailing swells over the reefs. The wave model used is a non-linear version of REF/DIF that solves the mild-slope equation with a dispersion relation which allows smooth transition between the Hedges form in shallow water and the Stokes relationship in deep water. The model results and reef geometry define the input parameters for assessment of the breaking conditions. The surfability parameters that measure the quality of a surf break include the wave height amplification, breaker type, peel angle. As a case study, the optimized reef is placed on a real bathymetry and its effect on adjacent coastlines or structures is tested for realistic wave conditions. The selected site is near the entrance to Kahului

Harbor, Maui, Hawai'i. A phase-resolving model BOUSS-2D is used to better describe the effects of the reef on the surrounding wave pattern.

The results showed that the slope of the reef has great influence on the breaker type and on the amplification of the wave height. The hardest design requirement to achieve is the peel angle, especially for large values catered to intermediate surfing level, since the wave crest tend to align with the reef isolines. On the real environmental conditions, the optimized reef is proved to be capable of focusing the wave energy to create suitable surfing environments. There is significant energy dissipation on the lee side of the reef, although the energy inside Kahului Harbor remains the same