Evaluating the Connectivity Potential Between Marine Protected Areas Using CODAR High-Frequency Radar

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To investigate the connectivity potential between Central California marine protected areas (MPAs), backwards and forward projections were calculated using the network of high-frequency (HF) radar ocean surface current mapping (SCM) stations operated along the California coast by the member institutions of the Coastal Ocean Currents Monitoring Program with funding provided by California voters through Propositions 40 & 50 and administered by the State Coastal Conservancy. With forcing from linear interpolation of the 2 km and 6 km resolution SCM measurements, trajectories of 1 km resolution grids of water particles were forward and back-projected from ten MPAs each hour, out through 40 days in the past, from each day in 2008. These trajectories produced maps of where surface waters travel over a 40-day period from and into the MPAs - and visualizations of the length of time the waters travel along these paths.

By comparing the travel times of those track-points that crossed between MPA regions, the connection time between MPAs along the State's central coast was assessed. Repeating these calculations resulted in a connectivity matrix between the MPAs in the region. Life history information for ecologically important resident invertebrate and fish species was then merged with the physical trajectories to generate an ecological connectivity matrix for the MPA network in Central California. Results are used to evaluate the use of HF-radar in this application, the connectivity of organisms restricted to the surface ocean during a fraction of their lifecycle, and to comment on the potential effectiveness of the MPA network design.

http://www.cocmp.org/

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Table 1. Mean number of days connecting trajectories took to intersect the MPA regions given by the row headers when back-projected from the MPAs per the column headers.

		Back-projected from:									
To:	*Sorted north-to-south*	Año Nuevo	Soquel Canyon	Portuguese Ledge	Point Lobos	Point Sur	Big Creek	Piedras Blancas	Cambria	Point Buchon	Vandenberg
	Año Nuevo	-	16.7	13.2	14.1	19.6	22.4	23.8	24.3	24.0	
	Soquel Canyon	20.6	-	6.1	11.0	15.1	18.3	21.9	23.3	34.5	
	Portuguese Ledge	24.7	19.2	-	10.2	13.8	16.6	21.0	23.5	34.3	
	Point Lobos	23.8	22.2	18.2	-	8.0	11.5	17.7	20.9	30.7	
	Point Sur	25.3	25.2	22	14.3	-	7.5	15.3	16.6	23.2	
	Big Creek	30.0	22.9	26.0	23.5	18.4	-	12.5	20.8	22.6	36.2
	Piedras Blancas	29.4	28.3	28.8	23.7	20.0	16.2	-	10.0	22.0	37.7
	Cambria	24.6	23.2	25.0	30.1	27.2	25.8	13.2	-	16.3	25.2
	Point Buchon	35.8	35.9	36.4	35.1	30.4	26.6	21.2	23.9	-	20.7
	Vandenberg					37.3	35.6	26.5	27.1	25.8	-