Application of remote-sensing technology to the study of the spatial distribution of demersal resources and the influence of environmental factors in the central Mediterranean

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Abstract

It is herein proposed to construct, validate and demonstrate a pilot remote-sensing application for a fishery management information system to assess and monitor the fishery resources and the ecosystems in the central Mediterranean. This could be partly achieved through state-of-the-art multidisciplinary and computational capabilities. This information system will mainly contribute to understanding how the environment affects the distribution of fish and influences recruitment.

A number of commercially important fish populations respond to changes in environmental conditions on inter-annual and longer time-scales. To relate physical variability to fluctuations in marine populations, one must understand how the ocean varies in space and time, particularly the primary patterns, sources, and mechanisms of inter-annual to decadal variability. Remote sensing can assist the MedSudMed Project to investigate changes in the central Mediterranean Sea on decadal scales from historical data, so as to determine physical mechanisms that lead to these changes. It would be relevant: (1) to develop indices of environmental conditions that can be applied to problems of fishery recruitment and population dynamics; and (2) to seek straightforward algorithms for the near-real-time estimation of important physical oceanic fields (e.g. water transport, mixed-layer depth, biologically effective upwelling) from readily available variables.

It has been demonstrated that the use of environmental data (such as sea-surface temperature[1], water colour, suspended solids, currents, ocean fronts, etc.) from satellite and airborne remote sensing can assist in the detection of migratory fish. Such an approach is being currently interpreted in the USA to provide intelligent tools and services to the fishing community, such as daily “road maps” to the fish. The strategy is to combine fishery oceanography and real-time satellite remote sensing to produce tactical and strategic fishery forecasts.

Therefore, a remote-sensing component within the MedSudMed Project could implement the following research:

- Synthesis and analysis of previously unanalysed environmental data sets acquired by remote sensing, using modern statistical and image-processing techniques to characterize and evaluate the regional marine fisheries habitat.

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[1] Demersal fish follow bait and comfortable water temperatures. For various reasons bait congregates at certain "structures", such as strong temperature gradients, which may indicate different water masses that do not easily mix. By locating and correlating the potential of bait to concentrate and the comfortable water temperature range for the target species with in situ data, one can trace the bait's movement and migration.

- Integration of efforts of remote sensing and state-of-the-art predictive modelling, including physical, biological and fishery data, to assess the interaction and use of remotely sensed data to study the effects of regional climatic variations on oceanographic processes important to fish populations.

Using its ground receiving station, Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD) is able to supply near-real-time processed data from raw data supplied by NOAA polar-orbiting satellites 12, 14, 15 and 16. These data, in conjunction with calibration software, would provide 1-km sea-surface temperature resolution for the central Mediterranean area. In addition to NOAA AVHRR data, data related to ocean colour is also received and processed. One key component of such data is chlorophyll-*a*, which is a strong indicator of the presence of nutrients in the ecosystem under study. Additional instrumentation, such as airborne digital imaging and multi-spectral scanning systems, would also complement data enhancement for detailed, high-resolution information, especially for inshore coastal waters. Data acquisition, image processing and analysis could be carried out by ICoD staff.