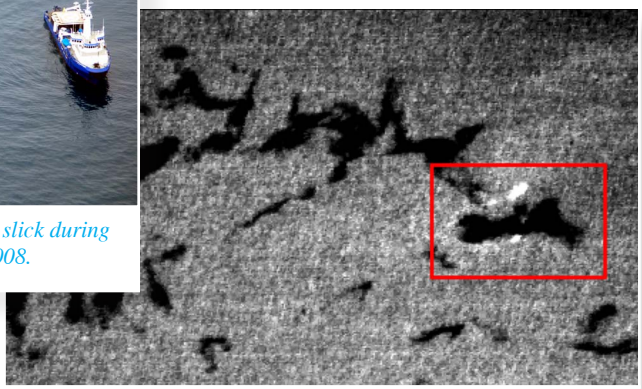
A VIEW ABOVE ALL
Ocean Imaging CORPORATION NEWS WINTER 2009

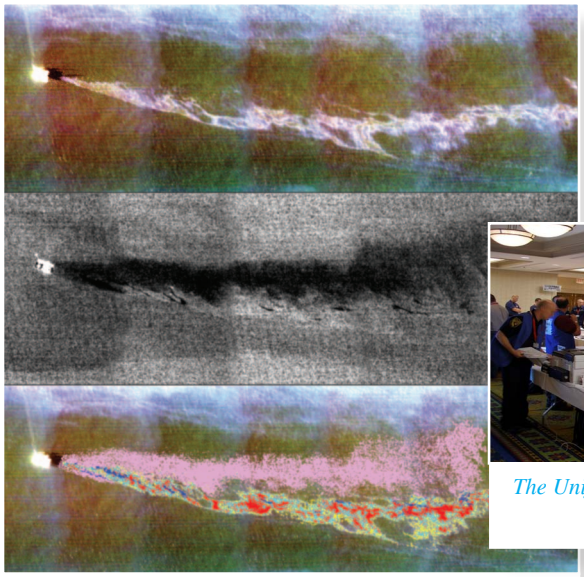
Practice Makes Perfect

Ocean Imaging continues its development of ocean oil spill mapping technologies. Our present system consists of the 4-channel UV-Visible range multispectral aerial imager integrated with a thermal IR camera unit. The imagers are also integrated with a very precise Inertial Motion sensing Unit (IMU) and DGPS, which allow accurate auto georeferencing and mosaicking of the captured images. In addition to a multitude of tests over the past few years (including during the infamous Cosco Busan spill in San Francisco Bay), the system was used operationally during oil spill response to an offshore oil platform spill in December, 2008 near Santa Barbara, California.

Fluoroscene dye simulating an oil slick during a drill off San Diego in 2008.



OI's thermal IR image highlighting the thickest oil for recovery activities during a real spill in December, 2008. (Note the 2 boats surrounding an area of thicker oil with a containment boom.)



A drill rig "spill" (actually oil from a nearby natural seep) as imaged by OI during a practice drill in 2009.

The Unified Command Center during the 2009 exercise.

The coordination of a response to an oil spill is a rather complex task, involving multiple agencies, corporations, vessels, aircraft, etc. For that reason, training for "the real thing" is important. In California (and elsewhere) large-scale oil spill drills are periodically conducted. The State of California has invited OI to participate in several of them in the past 2 years. Since no real oil can be legally released into the ocean in US waters, some of the drills utilize proxies such as fluoroscene dye released from a ship to simulate an oil slick. A drill organized by Exxon-Mobil in October, 2009 was able to get one step closer to reality: The drill involved a hypothetical spill from an offshore platform in the Santa Barbara Channel (much larger in volume that the real December spill). Since there are numerous natural oil seeps in the Channel releasing oil to the ocean surface every day, OI had a real oil target to practice on.

OI located a suitable target slick in the lee of Platform Holly and imaged it with the oil mapping system both mornings of the 2-day exercise. The data were pre-processed while still in-flight and a completed oil slick distribution and thickness map was disseminated shortly after landing. The image data were uploaded on a specialized web-based interactive server developed by OI for the California Dept. of Fish & Game's Office of Spill Prevention and Response (OSPR). Within 45 minutes of data acquisition, a GIS map of the "spill's" location, extents and thickness distributions was thus available to all agencies within the "Unified Command Post," as well as response groups in the field. For all involved, the drill was quite a success!

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DMSC multispectral image of the sand replenishment experiment.

Got SAND?

Beach sand replenishment is a fact of life along virtually every part of the US coast and other world regions. Trying to reverse the loss of sand due, in many instances, to man's alteration of coastal stream inputs, shoreline construction and rising sea level is always a costly undertaking ($1+ million per mile). What adds to the cost in many cases is the expense of mining and transporting the needed sand from a suitable source to its intended deposition site. This is because strict regulations govern the suitability of the material to be used. One of the most important is sand particle size composition – suitable sand must not have too many fine particles in its mix.

The existing rules were determined decades ago and, arguably, are not supported by research relevant to different shoreline regimes along the US coasts. In order to shed more light on the sand suitability question, the US Geological Service partnered with the US Army Corp. of Engineers, OI and several other groups to conduct an experiment near the US/Mexico border. Over the course of 2 weeks in September, 2009 the USACE deposited 35,000 cubic yards of sand on the beach from a nearby canyon that has to be cleared annually after the rainy season, but up to now its sand's composition did not meet standards for beach replenishment use. In the meantime, scientific instruments were used to measure the transport and fate of the deposited material.

OI utilized its multispectral DMSC and IR aerial imagers to conduct daily mapping of the existing currents and wave-fields affecting the deposited sand, and directly image its transport as suspended sediment.

The imagery should help interpolate the field instrument measurements in time and space. Having customized the DMSC's channels with specific wavelengths to maximize the detection of color differences between the existing sand and the new deposited material, we will also attempt to isolate the spectral signature of the "new" sand from the background and trace it through time. Ideally, the studies will show that the inland sand does not adversely impact water quality and ecosystems around the area and can be safely utilized for local beach enhancement.

Do you have a research or other project that could benefit from Ocean Imaging's capabilities?
Call 858-792-8529 to discuss your project!

- ***UV-Vis-NearIR-Thermal IR aerial imaging***
- ***Satellite data processing & analysis***
- ***Field validation***
- ***Customized imaging applications***

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CSI:OI

Crime Scene Investigation: Ocean Imaging

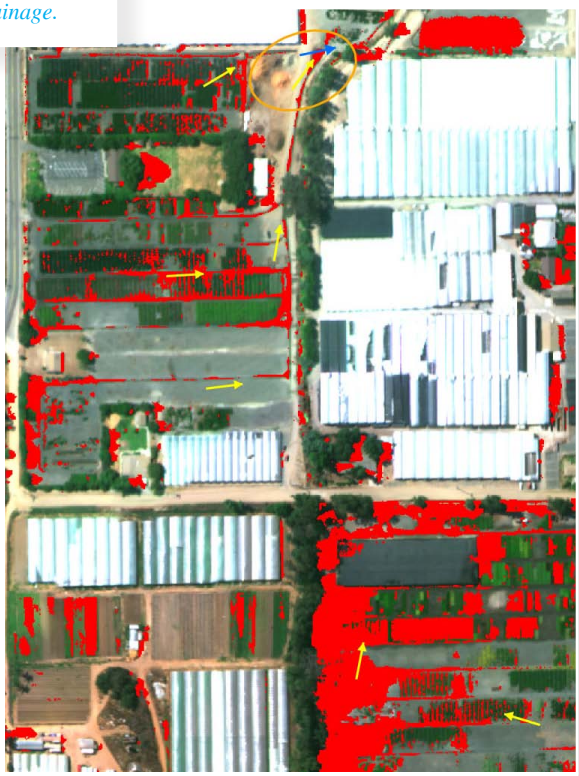
Every once in a while we get a project that requires true "outside the box" thinking, and usually those are the most fun. In one such case we were approached about the possibility of using aerial remote sensing to uncover surface and sub surface drainage patterns that may be polluting a Southern California creek. The region around the creek is covered by a mix of agricultural and residential properties. Fertilizer-laden runoff from the agro areas could be responsible for increased phosphate loads while leaking septic systems could be the source of measured increased nitrates.

We didn't sleuth around with UV flashlights like in the CSI TV show… but almost. OI flew its combination of thermal IR and visible-nearIR sensors at dawn in order to: 1) maximize the thermal emissivity difference between standing water/wet soil and dry ground; 2) image during a time when many of the agro operations are irrigating their fields and residents are taking morning showers. The area is naturally very dry and heats-up quickly during the day.

Anomalous pattern of vigorous growth suggesting persistent near-surface water drainage.

The strategy seemed to work. In the agro areas the IR imagery clearly revealed areas of excessive irrigation in the form of runoff ditches containing standing water (some of them emptying directly into the creek) or permanent pools of saturated soil where contaminants are likely to seep into the underlying water table.

No, we did not find any direct septic streams from early morning bathers, but we used the multispectral imagery to reveal anomalous patterns of plant (i.e. chlorphyll) vigor that could be due to long-term underlying seepage. Our data are providing ground investigators with some initial guidelines of which areas to take a look at first.



Multispectral image overlayed with irrigation overflow patterns extracted from thermal IR data.

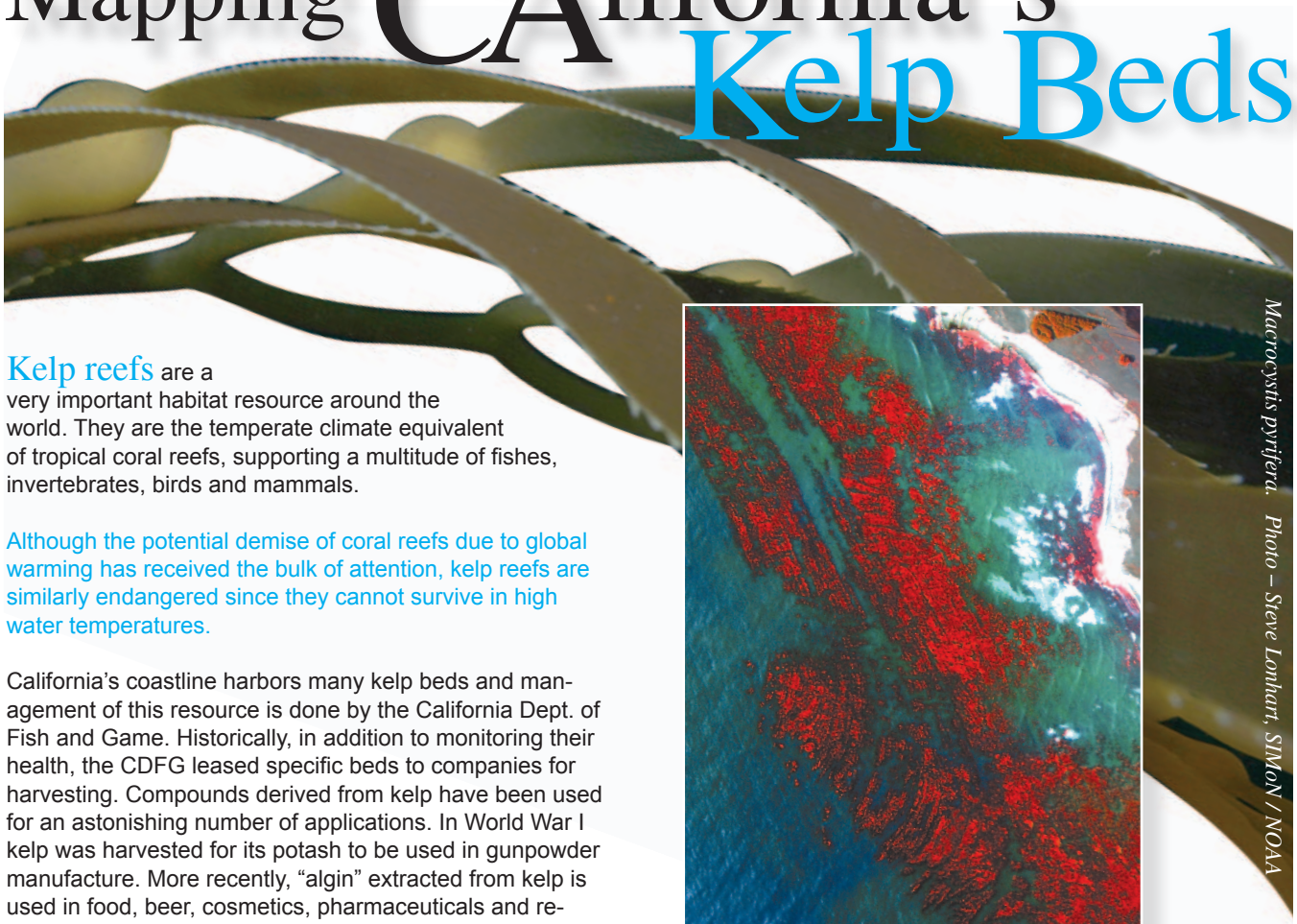
WHERE IN THE WORLD ARE WE??

In the past year OI's Ocean Eye fish-finding service has become a staple for a fishing fleet based on this far-away island with an interesting history. Columbus was the first European to land there on his 3rd voyage in 1498 (and very gratefully too, since he was down to his last barrel of water and practically no food). A typical sugar economy in the 19th century gave way to an oil-based economy in the 20th.

The first 5 readers with the right answer will receive a SeaView Fishing ball cap! E-mail your answers to paula@oceani.com.

C O N T E S T

Mapping CAlifornia's Kelp Beds



Macrocystis pyrifera. Photo – Steve Lonhart, SIMoN / NOAA

Kelp reefs are a very important habitat resource around the world. They are the temperate climate equivalent of tropical coral reefs, supporting a multitude of fishes, invertebrates, birds and mammals.

Although the potential demise of coral reefs due to global warming has received the bulk of attention, kelp reefs are similarly endangered since they cannot survive in high water temperatures.

California's coastline harbors many kelp beds and management of this resource is done by the California Dept. of Fish and Game. Historically, in addition to monitoring their health, the CDFG leased specific beds to companies for harvesting. Compounds derived from kelp have been used for an astonishing number of applications. In World War I kelp was harvested for its potash to be used in gunpowder manufacture. More recently, "algin" extracted from kelp is used in food, beer, cosmetics, pharmaceuticals and research. Harvesting was originally done by hand, but since the 70s specially designed ships, akin to giant lawnmowers, would slice tracks through the beds. Price competition from overseas has put a stop to California's commercial harvesting, but the CDFG needs to continue monitoring the beds since they are directly linked to the abundance of many marine animals.

Central California kelp beds highlighted in a September, 2009 aerial image classification

The CDFG maps all of the coastal kelp in an annual photographic survey. OI has been contracted to do the mapping since 2008. We have extensive past experience in satellite and aerial imaging of kelp, including development of kelp biomass estimations from aerial imagery in Alaska and creating the first-ever worldwide kelp map from high resolution satellite data. California's financial woes caused the kelp mapping contract to be suspended for 2009, but due to the need for the information, non-state sources have stepped forward to finance specific portions of the State's coast. Our 2009 aerial survey work began in late September.