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Satellite images faster, cheaper and better

BIO project finds new way to monitor health of oceans

By **BRIAN HAYES**

Researchers at the Bedford Institute of Oceanography in Dartmouth are using satellite data to monitor the health of the marine ecosystem and its impact on fisheries and aquaculture.

"We're trying to take our work from the purely science arena and highlight the benefit to society," says Trevor Platt, a BIO scientist and director of a three-year program co-funded by the Canadian Space Agency to stimulate the application of satellite data to ecosystem-based fisheries management.

He said the focus of SAFARI, or Societal Applications in Fisheries and Aquaculture using Remotely Sensed Imagery, is to use instruments on American and European satellites to collect information on phytoplankton fields and particularly the annual biological spring algal bloom.

Mr. Platt said satellites can record surface water temperatures and the distribution and abundance of phytoplankton-microscopic organisms at the bottom of the food chain, which larval fish need to survive in the critical period after they are hatched.

Research vessels used to be the only means to collect this information, but Mr. Platt said satellite imagery has the advantage of speed, is more cost effective and provides a much larger view of the oceans.

"The area is huge and you would never get anywhere near this, even with a fleet of ships.

"We get detail down to one kilometre," said Mr. Platt of the images from space that scientists are able to record within minutes.

He said the data can also reveal the biomass of phytoplankton and how it is distributed in the oceans.

"With this data we can also estimate how fast phytoplankton is growing.

"We're interested in the global view. Ours was the first study of its kind, but there is now a world effort through the Group on Earth Observations, of which SAFARI is an element.

Venetia Stuart, executive scientist with the International Ocean Colour Co-ordinating Group, a co-sponsor of the program along with the space agency and the federal Fisheries Department, said although satellite passes are made every day, their view can be blocked on days of fog and heavy cloud, requiring researchers to combine data and produce a composite image over a period of a week or two.

Mr. Platt said a large number of observations are made and scientists can determine that "if you take any one season of the year, you can check whether the evolution in time of these images is the same in all the years, or if it is more advanced in one year or more retarded in another.

"We can look at the spatial properties and how the seasonal cycle varies from year to year.

"At the moment, our time series is about 10 years long."

Mr. Platt said all phytoplankton organisms contain the pigment chlorophyll-a, allowing them to absorb energy from the sun.

"It's conventional in our field to describe or to quantify the abundance of phytoplankton as to the concentration of chlorophyll-a. With this (satellite) methodology we can develop a time series of these properties presented as images and use that time series for research into the variability in the ecosystem and its potential repercussions for fisheries."

BIO scientist Trevor Platt, with a scientist from a program sponsor, Venetia Stuart: 'Our study is more concerned . . . with how can we translate that information into data that will be useful to fishermen or fishery managers.' *(BRIAN HAYES)*

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BIO scientist

Dr. Platt said colour-coded satellite images reveal higher and lower concentrations of chlorophyll-a, with red being higher, and blue lower and "not being very rich, biologically speaking."

Georges Bank, the productive fishing grounds off the Nova Scotia coast, is almost always biologically rich, he noted.

Scientists have long thought the survival of larval fish depended on the timing of the spring bloom of phytoplankton. But its verification had to wait for technology with sufficient spatial and temporal resolution.

They believed the abundance of fish in a given year was determined by food availability during the critical period of larval development. Researchers were of the view that variations in food supply between different years, probably determined by differences between the timing of the spring bloom of phytoplankton and the timing of fish spawning, accounted for later variations in the abundance of adult fish.

Mr. Platt said the spring bloom has to be initiated by seasonal warming conditions. Studies have shown that when the bloom starts early, the probability that the larvae will survive and be recruited into the fish population is much larger than in a year when the bloom occurs later.

Sunshine and nitrogen are dominant factors in the growth of phytoplankton, which, individually, cannot be seen by the naked eye, but collectively modify the water colour, which is picked up by satellite imagery.

"It's the only way it can be done at these very large scales," Mr. Platt said. "It's as if we had a window through which we can look at the base of the marine ecosystem.

"We have an explanation for the structure as we see it in any given season."

Mr. Platt said by examining satellite images, scientists can see the heavy concentrations of phytoplankton fields move from the south to the north as summer advances.

In the area of Baffin Island and further north, spring may actually come in August.

"When blooming happens, it's exceedingly intense. The spring bloom is usually a short season and can last from two to six weeks, depending on conditions."

He said blooms go through a natural seasonal cycle, but they are also subject to changing weather from year to year.

"I'm willing to say the phytoplankton ecosystem off the coast of Nova Scotia is healthy. Nevertheless it's a variable thing and the organisms that live in it are hostage to the invariability imposed by the weather that can change from year to year.

"We're convinced that there is enormous variability in these seasonal cycles between years."

Mr. Platt said the goal of the satellite-based program is to monitor and interpret information gathered from space.

"Our study is more concerned . . . with how can we translate that information into data that will be useful to fishermen or fishery managers."

The information will be presented at an international workshop on the use of remotely sensed data as an aid to fisheries research and management to be held at BIO from March 26 to 28.

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