ANNEX 13

SEMINAR: OCEANOGRAPHIC AND LOW TROPHIC-LEVEL HABITAT IN THE NORTH PACIFIC OCEAN

International Scientific Committee for
Tuna and Tuna-like Species in the North Pacific Ocean

20 July 2010
Victoria, B.C., Canada

A seminar on oceanic and low tropic-level habitat in the North Pacific Ocean was convened by Zane Zhang, Department and Fisheries Oceans, Canada on 20 July 2010. The seminar included presentations on human impacts of climate change, increased nutrient stratification in the upper ocean, expansion of subtropical gyres, and how zooplankton influence climate and physical features in the North Pacific Ocean. Four scientists, Dr. Ken Denman (senior scientist with Department of Fisheries and Oceans Canada), Mr. Frank Whitney (Fisheries and Oceans Canada, retired), Dr. Skip McKinnell (Deputy Executive Secretary of PICES), and Dr. Sonia Batten (biological oceanographer with the Sir Alister Hardy Foundation for Ocean Science) made presentations.

Climate change in the North Pacific Ocean and the responses of marine ecosystems
Dr. Ken Denman

The climate is expected to change markedly over the next century if humans do not reduce fossil fuel emissions in a timely fashion. Emissions from human activities have already increased CO_2 concentrations in the atmosphere by more than a third, and approximately 40% of these emissions since the preindustrial have ended up in the ocean. As a result the surface ocean in the North Pacific has become warmer, more stratified, fresher and more acidic. Dissolved oxygen concentrations below the surface ocean layer have been decreasing, and there is evidence that wind patterns are changing. These trends are expected to continue and accelerate with significant but largely unknown consequences for ocean ecosystems.

Nutrient dynamics in the upper ocean
Mr. Frank Whitney

Nutrient supply to the upper ocean, along with light, controls the productivity of most marine ecosystems. A variety of mixing processes can dominate nutrient supply in coastal waters, including tidal mixing, estuarine circulation, upwelling and wind. However, in the open ocean nutrients are mainly returned to the upper ocean during periods of strong winds. In the subarctic region, storms are concentrated in winter when light levels are low. This results in nutrient accumulation through several months, until ocean stratification and spring growth results in utilization that exceeds supply. In much of the subtropics, nutrients can be used throughout the year. Consequently, nutrients tend not to accumulate. Over the past several decades, increased stratification of the upper subarctic ocean has caused both a decline in oxygen levels and an increase in nutrients in the interior ocean (150 to 500 m). If nutrients are being retained in the ocean interior, an impoverishment of the upper ocean (0-100 m) must occur. At present, it is not evident which regions are experiencing nutrient losses. However, future trends in climate suggest stratification will increase which will further exacerbate the transport of oxygen and nutrients in the North Pacific.

Some physical evidence of expanding subtropical gyre
Dr. Skip McKinnell

Jeff Polovina (NOAA/Fisheries, Honolulu) made the interesting observation, based on changes in ocean color in the low-chlorophyll regions of the world, that subtropical gyres are increasing in size except in the Indian Ocean. Furthermore, he pointed out that this outcome (shoaling mixed layer, increasing water column stability) is one that is anticipated by global warming. Ocean color, however, is only a proxy for the underlying physical change so if this process is occurring, one would expect it to be evident in physical observations of the upper ocean. Project Argo provides a remarkable opportunity to examine the ocean for evidence of what has appeared in the ocean color data. This talk will provide a preliminary examination of this idea using Argo data from 2003 to present. A first assessment suggests that MLD has been shoaling and water column stability has increased but the extent to which this is occurring varies around the North Pacific.

The influence on zooplankton of variability in ocean climate and physical features of the North Pacific Ocean
Dr. Sonia Batten

The Continuous Plankton Recorder (CPR) has been deployed in the North Pacific multiple times per year on two intersecting transects since 2000. The CPR is towed behind commercial ships on their regular routes between BC and Japan, and Puget Sound and Cook Inlet. A proportion of the collected samples (about 400 per year) are processed microscopically to produce a database of taxonomically resolved abundance data. The recent dramatic fluctuations in ocean climate of the northeast Pacific Ocean, from the warmest year on record in 2005 to one of the coldest in over 50 years in 2008, provided ideal conditions to observe temperature-related interannual variability in zooplankton distribution, abundance and phenology, all of which are important to ecosystem functioning and the higher trophic levels that depend on zooplankton. This presentation provided an overview of the CPR survey and results, including increased abundance and northwards extension of warm water species in warm years, a shortening of the spring peak of a key zooplankton species and community composition changes associated with hydrography and climate.

Agenda

ISC 10 Seminar on Oceanographic and Low Trophic-LevelHabitat in the North Pacific Ocean

Center/East Vancouver Island Ballroom
Hotel Grand Pacific
20 July, 2010
Victoria, B.C., Canada

Organized by Dr. Zane Zhang, DFO, Canada

2:00 PM	Climate change in the North Pacific Ocean and the responses of marine ecosystems *Dr. Ken Denman*
2:40 PM	Nutrient dynamics in the upper ocean *Mr. Frank Whitney*
3:20 PM	Some physical evidence of expanding subtropical gyre *Dr. Skip McKinnell*
4:00 PM	Break
4:30 PM	The influence on zooplankton of variability in ocean climate and physical features of the North Pacific Ocean *Dr. Sonia Batten*