Public Outreach on a GLOBEC NEP Cruise in the Gulf of Alaska: Fresh Frozen Research News

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ABSTRACT

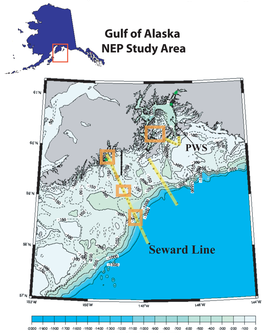
During July 21 to August 12, 2003, the U.S. GLOBEC Northeast Pacific (NEP) program conducted intensive sampling in the northern Gulf of Alaska. Using 2-3 ships at a given time, the multi-institutional, interdisciplinary team conducted process studies (rate measurements at fixed locations over a several day period), mesoscale and finescale surveys (3-D snapshots of the ocean around the process studies). On the survey vessel, R.V. WECOMA, daily activities of the scientific staff and ship crew were documented with pictures and text and posted to a public outreach web site (URL given below). This poster briefly describes the approach taken in choosing material to present on the outreach web site for a general audience. The outreach effort had two objectives: (1) to describe the background and scientific questions addressed by the scientific party; and (2) to document the scientific data collection and analysis designed to answer these questions, along with recreational and social aspects of living and working at sea. Highlights from the web page demonstrate how to meet these objectives, while appealing to a diverse audience.

http://halibut.ims.uaf.edu:8000/~salmon/mesoscale/outreach/outreach_main.htm

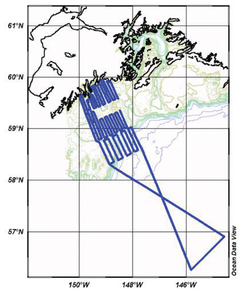
BACKGROUND

**** Outreach Goal: To describe the basic concepts of the research project to give the audience context and purpose for the study.***

U.S. GLOBEC, Global Ocean Ecosystem Dynamics, is a collaborative effort by scientists across the U.S. to better understand how global climate change may affect the abundance and production of marine organisms. The Northeast Pacific (NEP) program of GLOBEC has two components: the California Current and Coastal Gulf of Alaska. The Gulf of Alaska (GOA) has one of the most productive fisheries in the country, and historical records indicate that past changes in the GOA fisheries correspond to atmosphere and ocean adjustments. Therefore, the NEP program goals are to study the physical and biological oceanographic distributions and processes influencing marine organisms, specifically juvenile salmon.



Above: LTOP transects indicated by yellow lines; Process study areas enclosed in orange.
Below: Mesoscale Survey transects across the shelf.



LTOP

Long Term Observation Program
What? Seven 10-day cruises, March-December
Where? Seward Line, Prince William Sound (PWS)
Why? To quantify temporal and spatial variations in nutrient concentration, primary production, zooplankton species composition, abundance, and biomass, as well as the abundance of juvenile salmon

PROCESS

What? Monthly cruises between April and August
Where? Seward Line, Prince William Sound (PWS)
Why? To understand grazing and production rates of phytoplankton, microzooplankton, and zooplankton

MESOSCALE

What? Two survey cruises
- *May 1-21, 2003*: During spring phytoplankton bloom and maximum abundance of copepods
- *July 21-August 12, 2003:* During maximum zooplankton abundance

Where? Three physical regimes across the
- continental shelf
- *Inner Shelf:* low salinity
- *Middle Shelf:* intermediate salinity
- *Outer Shelf:* higher salinity

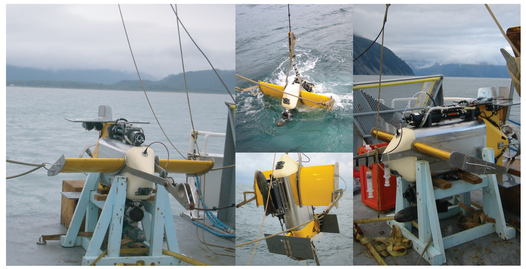
Why?
--To provide a larger spatial context for LTOP and Process studies by quantifying and understanding along-shelf variations in the Alaska Coastal Current due to seasonal variability (wind stress, freshwater discharge), topography, and eddies.

--Variability in water masses influence the location of nutrients, phytoplankton, and zooplankton, which are essential factors in understanding the distribution and abundance of juvenile salmon within the GOA.

SCIENTIFIC ACTIVITIES

****Outreach Goal: To describe the scientific data collection and analysis to explain how and why particular information is collected.***

SeaSoar



To study these physical regimes of the shelf, we used the SeaSoar--a towed, undulating platform outfitted with various physical, biological and chemical sensors. These sensors collect data about nitrate, fluorescences, chlorophyll, conductivity, temperature, and pressure. The SeaSoar samples 24 data points per second as it moves through the water column, providing (after averaging) one meter vertical resolution while covering two kilometers per cycle horizontally.

Salinity

Salinity is calculated using measurements from a Conductivity, Temperature, and Depth profiler (CTD) attached to the SeaSoar. A CTD samples water at various depths in the water column, and measures the electrical conductivity of the sea water to calculate the salinity. This data is useful for mapping the variation in salinity from onshore to offshore, which indicates areas influenced by freshwater from land. Combining salinity with temperature data helps determine density, which provides information on water masses, water column stability, and locations of gradients such as fronts. (Figure 1)

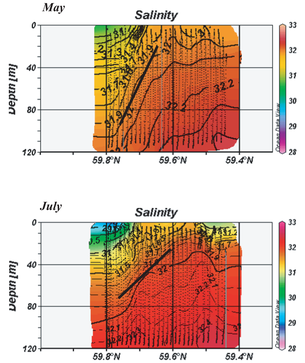


Figure 1

These cross-section salinity plots from May and July show a salinity profile from onshore to offshore (left to right), from the sea surface to 120 meters depth (top to bottom), with the colorbar on the right side indicating high salinity in red, low salinity in blue.

Temporal variations: May shows higher salinity overall and steep isohalines (lines of constant salinity) compared to July. For example, the black line parallels the 32 isohaline for both months, showing the flatter slope in July, indicating a less intense Alaska Coastal Current later in the summer due to freshwater discharge from land.

Nitrate

Nitrate is the form of nitrogen used by phytoplankton (small plants in the ocean) for new production and growth. An In Situ Ultraviolet Spectrometer (ISUS) attached to the SeaSoar absorbs UV radiation in the water to calculate the nitrate concentrations in the water column. These nitrate measurements provide information on spatial availability for phytoplankton production and potential pathways of nutrient supply for the shelf. (Figure 2)

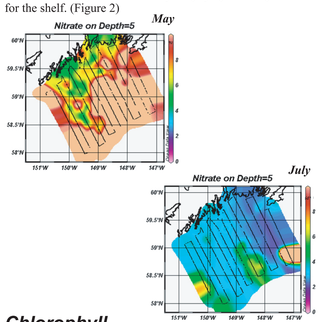


Figure 2

These plan-view plots give a bird's-eye view of the water at a depth of 5 meters below the surface.

Temporal variations: The May plot shows higher nitrate concentrations offshore (red) than inshore (green), and the inshore flow curls offshore at Chiswell Ridge, indicating a topographical control of the Alaska Coastal Current.
In July, the nitrate concentrations are much lower than earlier in the summer, corresponding to phytoplankton consumption of nutrients for production.

Chlorophyll

Chlorophyll A (Chla) is a pigment used in capturing light and photosynthesis. A fluorometer attached to the SeaSoar uses light at a specific wavelength that stimulates a fluorescence emission of a different wavelength from phytoplankton. This difference in wavelength provides an estimate of the chlorophyll concentration in the water. Information about Chla is useful, because it helps describe the phytoplankton abundance and distribution. (Figure 3)

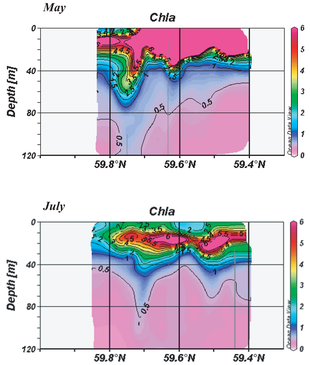


Figure 3

These cross-section plots show data from onshore to offshore (left to right), from the surface to 120 meters depth (top to bottom), with the colorbar at the right side indicating high Chlorophyll A in bright pink, and low concentrations in blue.

Temporal variations: In July, the chlorophyll concentrations are depleted at the surface showing a subsurface maximum, because the Chla was used earlier in the summer by phytoplankton.

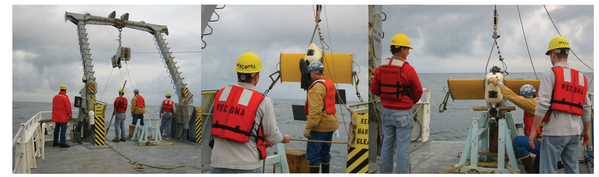
Also, the downward dips in both plots show downwelling (transport of oceanic water inshore that causes water along the coast to sink), which is detected by the high resolution of the SeaSoar.

LIFE AT SEA

****Outreach Goal: To describe living and working at sea to give the audience an idea of what ocean research is really like.***

Scientific Party

Chief Scientist: plans all scientific activities on board; chooses the course, survey parameters, and what data is sent to other ships working in the area
Watch Captains: oversee SeaSoar activities and nutrient sampling during the watch
Daywatch (noon-midnight), Nightwatch (midnight-noon): monitor and operate SeaSoar; organize data; recover and deploy scientific instruments as necessary (SeaSoar recovery below)



Daily Logs

July 24
At about 3:30 this morning, the SeaSoar was not collecting nitrate data, so the ISUS was either broken or "slimed" by a jellyfish. In order to collect nitrate data again, we had to bring the SeaSoar onboard and clean the ISUS (In Situ Ultraviolet Spectrometer). SeaSoar recovery takes almost thirty minutes to bring in the 400 meters of cable, but cleaning the ISUS with a small cue-tip only took a few minutes. Once the ISUS was cleaned, we launched the SeaSoar again and headed back to our transect line. We have started the Mesoscale Survey, which takes seven full days to complete, compared to the Finescale Survey we just completed in less than three days.
July 28
Once we reached the end of one of the transect lines this evening, we took the opportunity to complete some general checks on the SeaSoar. While the SeaSoar was cleaned and inspected, the crew performed a man-overboard drill. "Oscar," a life-jacket attached to a wooden cross and chain (named after the flag flown when a man goes overboard), was thrown into the water. We notified the bridge, and the ship maneuvered towards Oscar until we could save him. After completing the SeaSoar maintenance and the safety drill, we continued our surveying.
August 6
The SeaSoar was successfully deployed around 2 pm, and we started our "eddy hunting." An eddy is essentially an underwater hurricane, created by the transfer of momentum from a meandering current that breaks off from a main current. An eddy can form when wind disturbs a major current, creating a break in the flow's momentum. This disturbance meanders from the initial current until it is separated and creates a swirling vortex of water that travels slowly along the path of the major current. We are surveying for an eddy in order to gain a better understanding of this potential mechanism for cross shelf exchange--water movement from the deep sea to the shallow Alaskan shelf.

Recreational Activities

When not working, you can pass the time by watching movies, relaxing in the sun, or playing computer games.

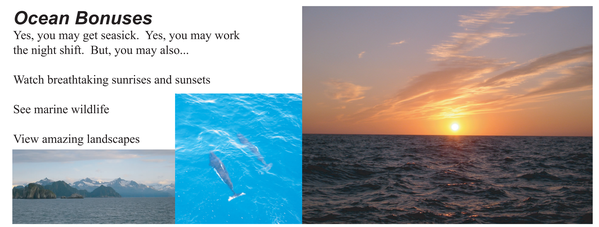
Ocean Bonuses

Yes, you may get seasick. Yes, you may work the night shift. But, you may also...

Watch breathtaking sunrises and sunsets

See marine wildlife

View amazing landscapes



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