Strait of Georgia Ecosystem Research Initiative Project

Annual Report for 2008-2009

Project Title: Large and Small Pelagics Hotspots in the Strait of Georgia

Proponents names and Affiliations: John Holmes, Tom Therriault, Ken Cooke, George Cronkite, Jake Schweigert - PBS/MEAD, Applied Technology and Pelagics

Objectives:

1. Multi-frequency acoustic scan of the Strait of Georgia to locate biological hotspots based on acoustic backscatter at 38- and 120-kHz and diversity of acoustic sign at these frequencies;
2. Intensively sample the biology of biological hotspots identified during the acoustic scan with echosounders, trawl, Bioness and bongo nets and sample environmental factors with CTD;
3. Provide proof-of-concept for the utility of new technologies (Simrad EK-60 multi-frequency echosounders) and gears (Bioness, bongo nets) as tools for ecosystem sampling and monitoring; and
4. To retrospectively identify biological hotspots for small and large pelagic species and assess the significance of these areas over time.

Pelagic species are an important linkage between lower and upper trophic levels in the Strait of Georgia (SoG). At present, some of the small (Pacific herring, *Clupea pallasi*) and large (hake, *Merluccius productus*; pollock, *Theragra chalcogramma*) commercially-valued pelagics are among the most abundant species in the SoG. There are more than 50 years of catch-age and biological data for the Strait of Georgia herring stock and stock survey data for hake and pollock date to the mid-1970s and perhaps earlier. The overall goal of this project is to identify biological hotspots that may be key drivers of the productivity of pelagic fish stocks in the Strait of Georgia.

Research activities in 2008-09 focused on the development of acoustic methodology to monitor the distribution of juvenile and adult pelagic species in association with productivity levels and hotspots on a research survey from Jan 29-Feb 24, 2009. We see this survey as the first of a series of surveys during different seasons to identify biological hotspots and the most appropriate time to monitor these areas.

The winter 2008-09 survey used multi-frequency acoustic methodology (38- and 120-kHz) to monitor the distribution of juvenile and adult pelagic fish and plankton in the Strait of Georgia from Cape Mudge to Boundary Bay (not including the Gulf Islands). This large scale survey was used to map the distributions of fish and plankton and identify hotspots using backscatter and diversity of acoustic signals at 38- and 120-kHz from Jan 31 to Feb 6. Hotspots identified by this process were assessed with more detailed acoustic surveys using a 1 km grid in order to map distribution patterns of productivity during the day and night and sampled intensively with trawls (fish) and Bioness (plankton) to confirm acoustic signatures. A total of 17 midwater trawl tows, 5 bottom trawl tows and 6 Bioness tows were completed. Water properties were also monitored using a grid of standard CTD stations established for the SoG.

Approximately 546 nautical miles of track between Boundary Bay and Cape Mudge were surveyed acoustically with two frequencies during the day and 40 CTD profiles were collected at night during the first leg of the cruise from Jan 31 to Feb 7. No biological sampling was conducted during this phase of the cruise since the goal was to identify hotspots based on high acoustic backscatter (which is proportional to biomass) and acoustic sign diversity. Four potential hotspots were identified: Malaspina Strait (including the sill of Jervis Inlet), the west side of Texada Island, north of Sabine Channel out to Achilles Bank and Exeter Shoal, the east slope of Vancouver Island from Gabriola Island to Ballenas Island, the basin between Savary and Hernando Islands and Desolation Sound, and the eastern slopes of Galiano, Mayne and Saturna Islands at the south end of the Strait of Georgia.

The second leg of the cruise (Feb 8-14) focused on intensive day and nighttime surveys of Malaspina Strait and the West Texada Island sites using a 1 km trackline grid at each location and verification of acoustic fish sign with midwater (Polish rope trawl) and bottom (Yankee 36) trawl gear. A total of 136.8 nautical miles of track was surveyed over two days in Malaspina Strait and again over two nights and 113.6 nautical miles of track were surveyed over two days and nights at the West Texada Island site. Trawls were made to confirm acoustic sign and to obtain samples of targets for species and size composition analysis rather than to provide quantitative data for biomass estimation. Five midwater trawl tows were made in Malaspina Strait and four midwater and three bottom trawl tows were made off west Texada Island.

The third leg of the cruise (Feb 15-20) focused on plankton sampling in Malaspina Strait and the west Texada Island sites with the Bioness sampler followed by intensive survey operations combined with trawling and Bioness sampling at a third site located along the eastern shore of Vancouver Island from Gabriola to Ballenas Island. Three Bioness tows and a further three midwater and one bottom trawl tows were made in Malaspina Strait. Two midwater tows and one extended Bioness tow on several layers were made at the West Texada site. Attempts to survey and sample the east Vancouver Island site were abandoned for operational reasons and the ship moved to the southern end of the Strait of Georgia to sample near Saturna Island where one bottom trawl and one Bioness tow were made.

Analysis of our data is ongoing, but certain patterns have emerged. (1) Three biological layers were detected throughout the SoG: a layer from the surface to the bottom at 125 m consisting primarily of juvenile and adult herring, a layer between 150 and 200 m consisting plankton (probably euphausiids, chaetognaths), invertebrates (jellyfish) and small fishes (myctophids), and a layer below 200 m consisting of hake, dogfish, brown catfish sharks and pollock. (2) Acoustic backscatter (proportional to biomass) categorized as fish (38-kHz) and identified as hake, herring, dogfish and pollock by trawling and plankton (38- and 120-kHz) identified as euphausiids, chateognaths, and myctophids by Bioness sampling were greatest in Malaspina Strait and the west side of Texada Island. (3) The identification of Malaspina Strait as a hotspot is consistent with previous acoustic surveys in the SoG, which begin in 1975 and usually reported that highest biomass of large pelagics (hake, pollock, dogfish) were observed in Malaspina Strait during the winter (Dec – Feb) followed by a reduction in abundance as hake moved into deep basins in the main part of the SoG for spawning in the late Feb-March period. We believe we captured this movement of hake between the first leg and subsequent legs of our cruise. (4) Adult and juvenile herring were detected acoustically and identified by trawling along the slopes in many areas, including Malaspina Strait and west Texada Island. Modifications to our survey methodology are needed to fully map herring distribution. Data analysis and reporting of our results will continue into 2009-2010 period.