Analysis of Ichthyoplankton Abundance, Distribution and Species Associations in the Western Gulf of Alaska

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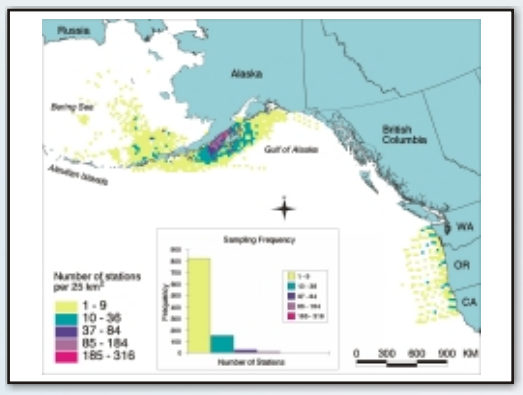
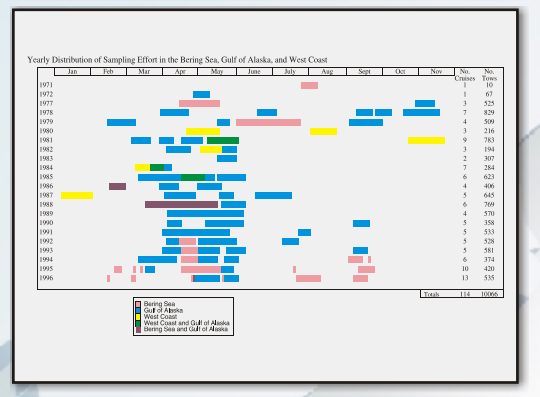
Introduction





Ichthyoplankton surveys have been carried out in many large marine ecosystems as a way of generating fishery-independent stock assessment and as a result have played a key role in understanding how marine ecosystems function. It is hypothesized that spawning strategies among marine fish populations have apparently evolved in synchrony with prevailing oceanographic conditions to give rise to persistent assemblages of fish larvae. Distinct assemblages of larvae have been recognized in diverse ecosystems and their occurrences reflect temporal and spatial patterns in the oceanographic environment.

The Fisheries Oceanography Coordinated Investigations (FOCI) research program has sought to understand processes leading to recruitment variability of commercially valuable fish and shellfish stocks of the North Pacific. To date, most of the effort has been concentrated on walleye pollock. Ancillary to the information gained on the early life history of walleye pollock, the FOCI database contains substantial information on the distribution and abundance patterns of eggs and larvae of other fish species which spawn in this region. This information can contribute significantly to an understanding of the biology and ecology of fish populations and the relationships between their life history strategies and the marine environment.

One of the goals of the Northeast Pacific GLOBEC program is to examine the effects of climate variability on plankton and fish populations and how these may respond to past and anticipated future climate change. We will use over 10,000 plankton collections spanning 22 years (1971-1996) (Figure 1) from the West Coast, Gulf of Alaska, and Bering Sea (Figure 2) to examine geographic distributions and temporal trends in the dominant egg and larval components of the ichthyoplankton and how these relate to physical and biotic conditions during this period. The results will be interpreted with a view to understanding long term fluctuations in fish populations and adaptations of their early life history strategies to the environment.

Table 1. List of ichthyoplankton taxa in AFSC plankton collections to be examined as indicators of onshore/offshore transport according to their adult habitats.

Offshore deep-water	Offshore shallow-water
Bathylagus milleri	*Icichthys lockingtoni*
Bathylagus pacificus	
Protomyctophum thompsoni	Deep-water offshore
Stenobrachius leucopsarus	*Icosteus aenigmaticus*
Chauliodus macouni	
Offshore southern deep-water	Offshore southern shallow-water
Tarletonbeania crenularis	*Sardinops sagax*
Diaphus theta	
Slope	
Hippoglossus stenolepis	*Microstomus pacificus*
Atheresthes stomias	*Embassichthys bathybius*
Anoplopoma fimbria	*Sebastolobus* spp.

Hypotheses and Research Questions

1. Spawning strategies among fish populations in the North Pacific have evolved in synchrony with the prevailing oceanographic conditions in the region to give rise to persistent ichthyoplankton associations.

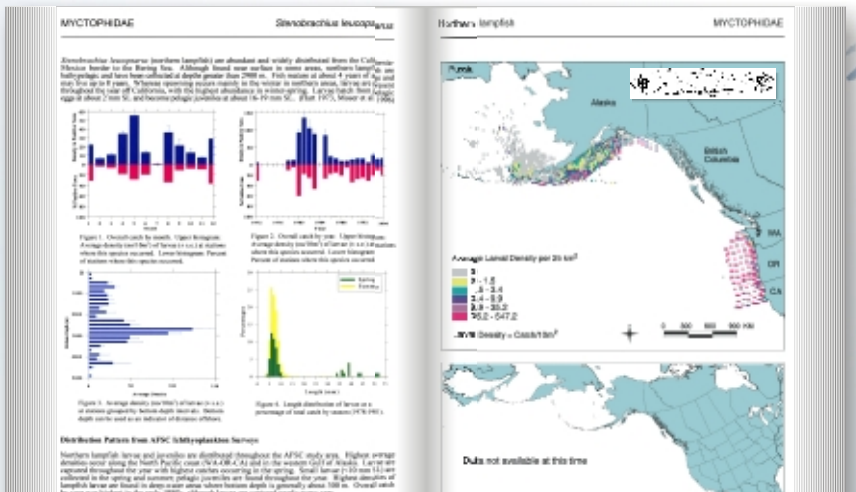
2. *Anomalous years in terms of climate and physical oceanography conditions cause major disruptions to spawning patterns and subsequent distribution and abundance of ichthyoplankton.*

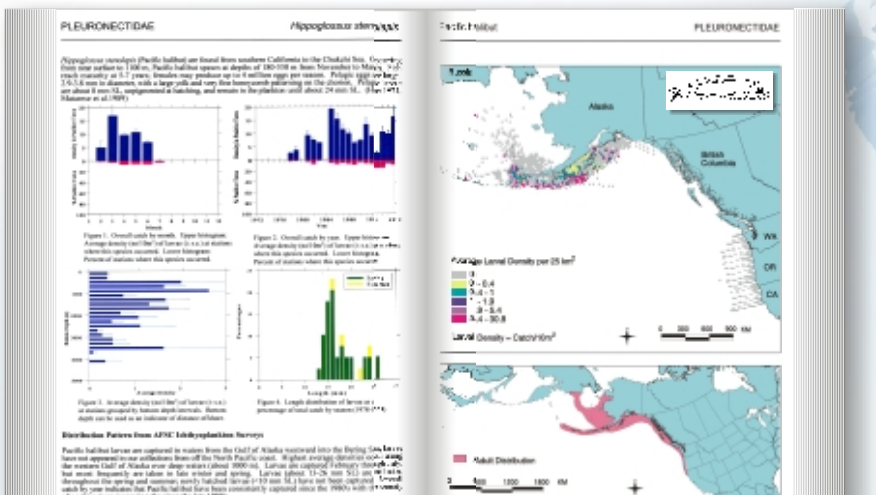
3. *Oceanographic regime shifts in the Northeast Pacific cause changes in spawning patterns among fish species and affect the occurrence and distribution of ichthyoplankton assemblages.*

4. *The unusual occurrence or abundance of certain ichthyoplankton species in some years are manifestations of anomalous oceanographic conditions such as those that prevail during ENSO events.*

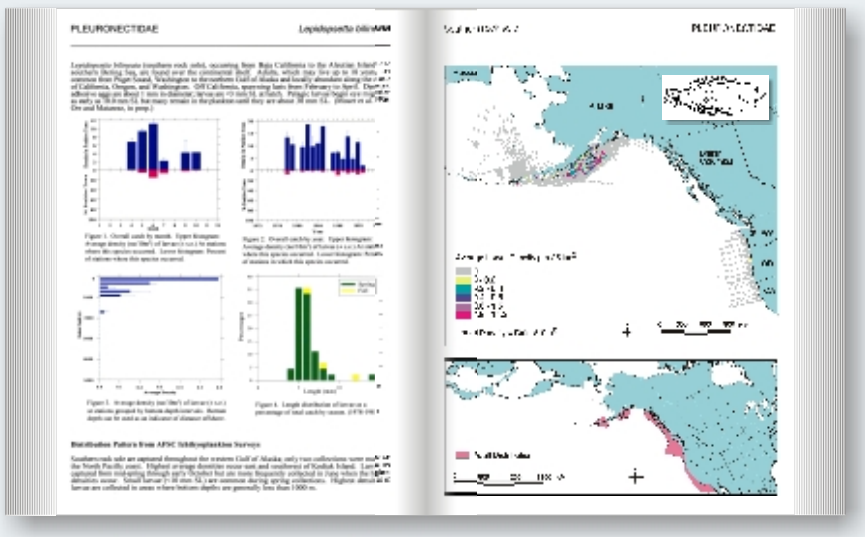
Work in Progress

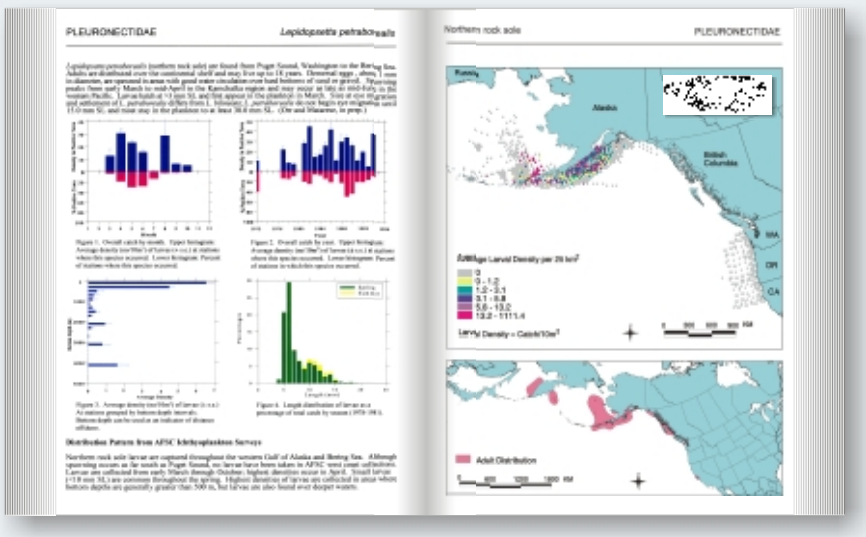
The objective for the first year is to error-check and clean the database and begin to produce a comprehensive atlas of the distribution patterns of approximately 100 species that are important contributors to the ichthyoplankton assemblage. Examples of the layout for four species are shown in the figures below. We are also analyzing the distributions of select taxa (Table 1) as indicators of ENSO-induced onshore transport.





ATLAS





Planned Work

1) Identify dominant species and assemblages in the ichthyoplankton, describe their horizontal distribution patterns, and relate these to the oceanography of the study areas.
2) Examine temporal (intra- and interannual) variability in species composition, relative abundance, assemblage structure, and distribution patterns of spring ichthyoplankton.
3) Describe processes associated with onshore transport of fish eggs and larvae and develop cross-shelf exchange tracers composed of offshore ichthyoplankton assemblages.
4) Examine long-term trends in larval abundance and compare to available population trends of each species for each study area.