

# GLOBEC Research: Seasonal and Annual Patterns of Abundance and Size of Juvenile Pink Salmon on the Shelf of the Northern Gulf of Alaska

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## ABSTRACT

From 1999 - 2002 juvenile pink salmon were collected on the Seward Line in August; in 2001 the Seward line and Prince William Sound (PWS) were sampled monthly from July through October. In July 2001, catches in PWS were very high, relative to the Seward Line; however, in subsequent months the distribution shifted onto the shelf, and by October very few juvenile pink salmon remained in PWS and they were in low numbers on the shelf. In 2001, the proportion of hatchery fish decreased monthly, from a high of 66% in July to less than 15% by October. In August of 1999 - 2002, pink salmon were broadly distributed across the shelf, but were uncommon over deeper water off the shelf. Over the shelf, patterns of abundance varied annually, and August of 2002 was most anomalous with a concentration of pink salmon on the outer shelf. Juvenile chum and sockeye salmon were also common across the shelf. Mean lengths of juvenile pink salmon in August varied annually, and they were largest in 2000. There was also significant variation in length among Seward Line station in each year. In August 2000 the largest fish occurred in the middle shelf, whereas in 2001 the smallest fish were found there. Marine survival of hatchery fish varied, with highest survival (0.056) by those fish entering marine waters in 1999, and lower survival (<0.04) by those in 2000 and 2001. In GLOBEC pink salmon studies we will use bioenergetic modeling to determine if variation in growth and survival is related to habitat quality while juveniles occupy shelf waters of the NGOA.

## INTRODUCTION

Juvenile pink salmon occupy water over the continental shelf of the northern Gulf of Alaska (NGOA) for much of the summer and fall after entering nearshore marine waters in late spring (Figure 1). They return to spawn the following summer. A major objective of the GLOBEC program is to determine how variation in oceanographic conditions and plankton production affects juvenile pink salmon growth and survival while they reside in waters over NGOA continental shelf. Hatcheries in PWS release around 600 million juvenile pink salmon annually, and estimates of their marine survival are available a year after they pass through the study area. An objective of GLOBEC pink salmon studies is to document the seasonal distribution of juvenile pink salmon in the study area, especially those of hatchery origin.

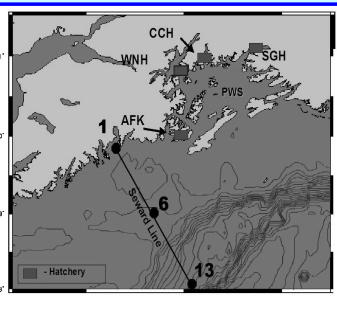


Figure 1. Map of study area with location of the Seward Line and the pink salmon hatcheries in PWS.

SGH - Solomon Gulch  
CCH - Cannery Creek  
WNH - Wally Noerenberg  
AFK - Armin F. Koernig

## METHODS

A surface trawl was used to collect small pelagic fishes on the Seward Line in August of 1999 - 2002, and monthly from July - October in 2001. The trawl was fished for 20 or 30 minutes for each sample. All fish were identified, measured and frozen for laboratory analyses. In the lab, fish were measured, weighed, and the stomach contents and otoliths were removed. Hatcheries thermally mark the otoliths of all pink salmon released in PWS with unique codes, we examined all pink salmon collected to determine if they originated in PWS hatcheries.

## RESULTS

Distribution of pink salmon juveniles in 2001 shifted seasonally from an early summer concentration in PWS to a relatively broad summer distribution over the shelf; with a rapid decline in numbers in the fall (Figure 2). In July, pink salmon were especially abundant at PWS1, located at the south end of Knight Island passage, where the mean number per haul was 431 fish

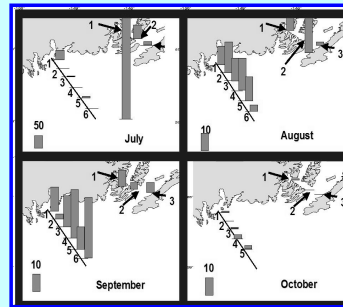


Figure 2. Distribution of juvenile pink salmon from July - Oct. 2001 at stations 1-3 in PWS and 1-6 on the Seward Line. Note the different scale in July.

From July - October 2001, pink salmon juveniles were growing rapidly; as their length approximately doubled, weights increased ten-fold (Figure 3). The fish in PWS and in shelf waters were similar in size.

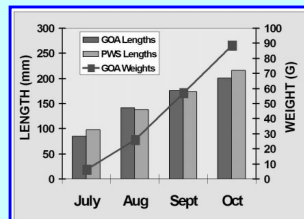
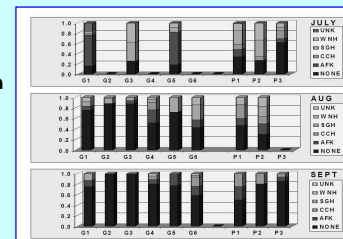


Figure 3. Mean length of pink salmon juveniles in PWS and on the Seward Line from July - October 2001, and mean weights on the Seward Line.

In 2001, the proportion of hatchery fish was high in July (66%), but dropped steadily to 15% in October (Fig. 4). In October, only 13 pink salmon were collected, so no figure was produced for that month.

Figure 4. Distributions of otolith marks in pink salmon juveniles collected in PWS and on the Seward Line in July, Aug. and Sept. 2001.



Pink salmon juveniles were an important component of the small pelagic fish community in the study area in all years 1999 - 2002; although other juvenile salmonids were also relatively abundant at Seward Line stations (Figure 5)

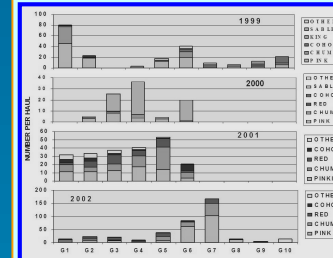


Figure 5. Abundance of small pelagic fishes on the Seward Line in August 1999 - 2002.

Mean lengths of juvenile pink salmon varied among stations, with different patterns each year (Fig. 6). In 2000 the largest fish were at Seward Line stations 3 and 4, whereas in 2001 the smallest fish occurred there. Among years, the largest fish ( $P < 0.01$ ) occurred in 2000.

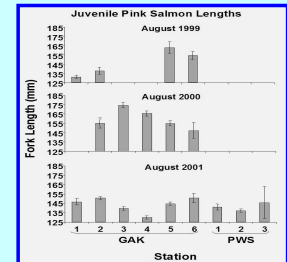


Figure 6. Mean lengths of juvenile pink salmon at Seward Line stations in Aug. 1999- 2001, and in PWS in Aug. 2001.

The combined survival of fish from CCH, WNH and AFK hatcheries was 0.056 in 1999, and just under 0.04 in both 2000 and 2001 (year of ocean entry). However, this pattern was not consistent among all hatcheries (PWS regional aquaculture corp. web site). In future analyses we will use bioenergetic models to explore the relationship of habitat quality to survival of hatchery pink salmon.

## SUMMARY

- Juvenile pink salmon are in maximum abundance on the GOA shelf in August and September.
- They grow rapidly, increasing weight ten-fold from July - Oct.
- The proportion of PWS hatchery fish declines sharply from July - Oct.
- Juvenile salmonids are the most abundant small pelagic fishes in surface waters of the GOA shelf in summer.