Marine Parasites of Juvenile Salmon in the Northern California Current System: Differences in Regional Trophic Interactions?

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ABSTRACT

Parasites obtained through trophic interactions are being examined in juvenile coho salmon (*Oncorhynchus kisutch*) and chinook salmon (*O. tshawytscha*) to determine if habitat influences salmon diet and health, and if habitat differences are reflected in parasite communities. Juvenile salmon were collected between Crescent City, California and Newport, Oregon during the 2000 U.S. GLOBEC cruise. Juvenile salmon were also collected between Newport, Oregon and La Push, Washington in 1998 and 1999 as part of a project funded by the Bonneville Power Administration (BPA) to examine to potential effect of the Columbia River on salmon survival in the ocean. Both studies were carried out in early and late summer using a 30 m X 20 m rope trawl fished near the surface. Chi-square analyses were used to determine differences in prevalences, and intensities were tested using an ANOVA.

The common parasite species (three trematodes and one nematode) found in the stomach were used in these analyses. The trematode, *Genolinea* sp. was most abundant south of Newport. *Hemiurus* sp. was consistently found throughout the nearshore. *Brachyphallus* sp. and the nematode *Anisakis simplex* had low prevalences in salmon caught directly off of the Columbia River, but *Brachyphallus* sp. was not recovered south of Newport. We found no difference in prevalences and intensities between juvenile chinook and coho salmon. Low prevalences of some marine parasites in the juvenile salmon caught in the Columbia River region could reflect an influence of the Columbia River plume. These observations could be a result of habitat (salinity or turbidity) effects on salmon trophic interactions, or a result of the timing of their ocean entry. Too few fish were collected south of Cape Blanco to determine any potential effects this feature had on salmon trophic interactions.

OBJECTIVES

Parasite communities obtained through trophic interactions are being examined in juvenile coho salmon (*O. kisutch*) and chinook salmon (*O. tshawytscha*) to determine if habitat differences (measured spatially and temporally) that might affect the biology of the salmon is reflected by these parasite communities.

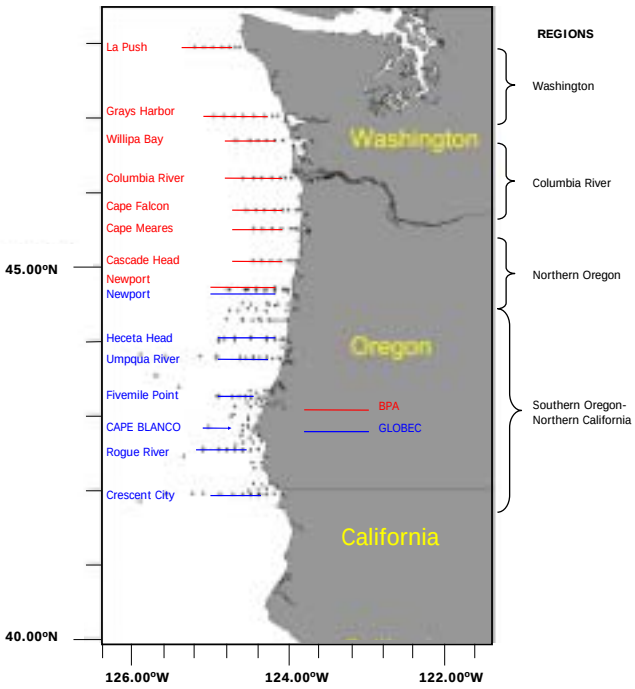

Figure 1. Map of study areas showing locations of BPA (red lines) and GLOBEC (blue lines) transects. The study areas are divided into four regions indicated on the right.

FISH COLLECTION

Juvenile salmon were collected offshore between June and September 1998-2000 (BPA) (Figure 1). Seven transects were sampled between La Push, Washington and Newport, Oregon. Another 6 transects located between Newport and Crescent City, California were sampled in June and August 2000 (GLOBEC). Fish were collected using a 30 m X 20 m rope trawl. All juvenile salmon were frozen whole. The stomach and body cavity were examined for parasites.

RESULTS

- The nematode, *Anisakis simplex* and the trematodes, *Brachyphallus* sp., *Hemiurus* sp. and *Genolinea* sp. were the common parasites in both juvenile coho and chinook salmon stomachs (Figure 2)
- Prevalences were similar in coho and chinook salmon and in both studies

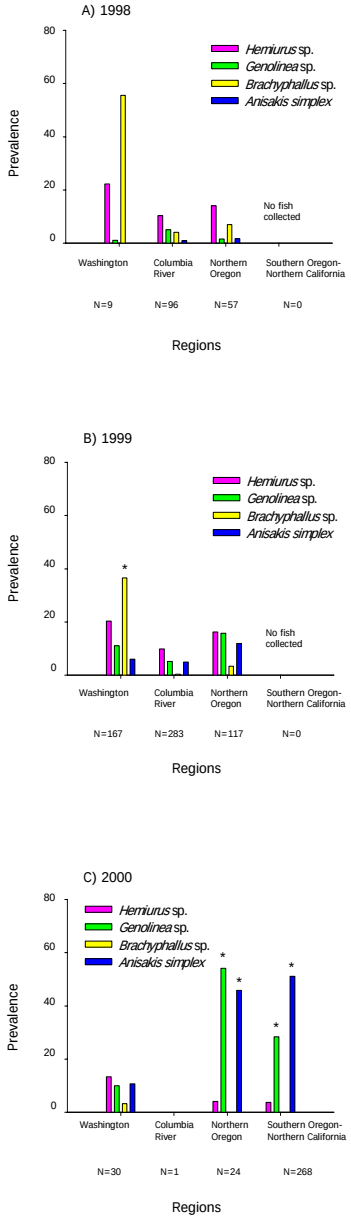

Figure 2. Prevalences of three trematodes in juvenile coho and chinook salmon from four regions over three years A) 1998, B) 1999 and C) 2000 (* = parasite prevalence was significantly different between regions using a Chi-square Test).

RESULTS CONTINUED

- *Hemiurus* sp. (Figures 2A-C) was found in all regions
- The distribution of *Genolinea* sp. (Figure 2C) was most abundant south of Newport
- *Brachyphallus* sp. was not recovered south of Newport (Figures 2A-C)
- *Anisakis simplex* (Figures 2A-C) was found in all regions, with an increase in prevalence south of the Columbia River in 2000
- Parasite intensities of infected fish were not different between regions (Table 1)

Table 1. Parasite Intensities for the four regions in 1998, 1999 and 2000.

	Parasite Intensity (N)			
	Hemiurus sp.	*Genolinea* sp.	*Brachyphallus* sp.	*Anisakis simplex*
1998				
Washington	5.6±3.5 (2)	1.0±0.0 (1)	7.4±7.3 (5)	0
Columbia River	2.5±2.9 (10)	2.2±2.2 (5)	1.8±1.5 (4)	2.0±0.0 (1)
Northern Oregon	1.9±0.6 (8)	2.1±1.8 (9)	1.0±0.0 (4)	1.0±0.0 (1)
Southern Oregon - Northern California	0 (0)	0 (0)	0 (0)	0 (0)
1999				
Washington	4.6±5.6 (34)	4.5±3.3 (6)	6.4±8.8 (61)	0.1±0.3 (61)
Columbia River	3.9±6.7 (28)	5.7±7.8 (13)	4.0±0.0 (1)	1.0±0.0 (1)
Northern Oregon	2.6±1.7 (9)	4.0±6.0 (4)	2.3±1.5 (4)	0.0±0.0 (4)
Southern Oregon - Northern California	0 (0)	0 (0)	0 (0)	0 (0)
2000				
Washington	1.3±0.5 (4)	5.0±2.6 (3)	2.0±0.0 (1)	1.3±0.6 (3)
Columbia River	0	0	0	0
Northern Oregon	1.0±0.0 (1)	13.5±25.2 (13)	0	2.3±1.3 (11)
Southern Oregon - Northern California	1.6±1.0 (10)	6.7±17.3 (76)	0	2.7±2.2 (138)

WHY ARE PREVALENCES DIFFERENT BETWEEN REGIONS?

Possible causes include:

- The timing of ocean entry by the juvenile salmon
- Intermediate hosts, both zooplankton (amphipods, copepods and euphausiids) and forage fish may have varying population densities
- Low salinity in the freshwater plume of the Columbia River may limit marine parasites both in the estuary and nearshore
- Shorter estuarine residence by Columbia River juvenile salmon

FUTURE RESEARCH

- Compare parasite communities from fish collected from both the BPA and GLOBEC studies in 2002
- Compare the parasite communities of the non-salmonids collected in 2000 and 2002 to the salmonid parasite community

Table 1. Parasite Intensities for BPA (1999) and GLOBEC (2000) juvenile salmon by major

	Month	Parasite Intensity		
		Hemiurus sp.	*Genolinea* sp.	*Brachyphallus* sp.
A) BPA				
Juvenile Coho	May	1.0±0.0	0	0
	June	1.8±1.6	5.6±4.0	0
	September	6.0±8.0	7.0±8.5	5.5±8.2
Subyearling Chinook	May			
	June			
	September	4.8±6.6	5.2±8.9	4.8±4.2
Yearling Chinook	May	1.3±0.8	3.7±3.8	0
	June	4.0±5.2	4.5±3.5	1.0±0.0
	September	4.3±4.2	3.0±0.0	8.8±12.7
B) GLOBEC				
Juvenile Coho	June	1.5±0.7	18.5±31.9	0
	August	0	15.6±22.2	0
Subyearling Chinook	June			
	August	1.5±0.7	2.7±2.9	0
Yearling Chinook	June	1.0±0.0	3.3±2.7	0
	August	1.8±1.3	1.7±0.6	0

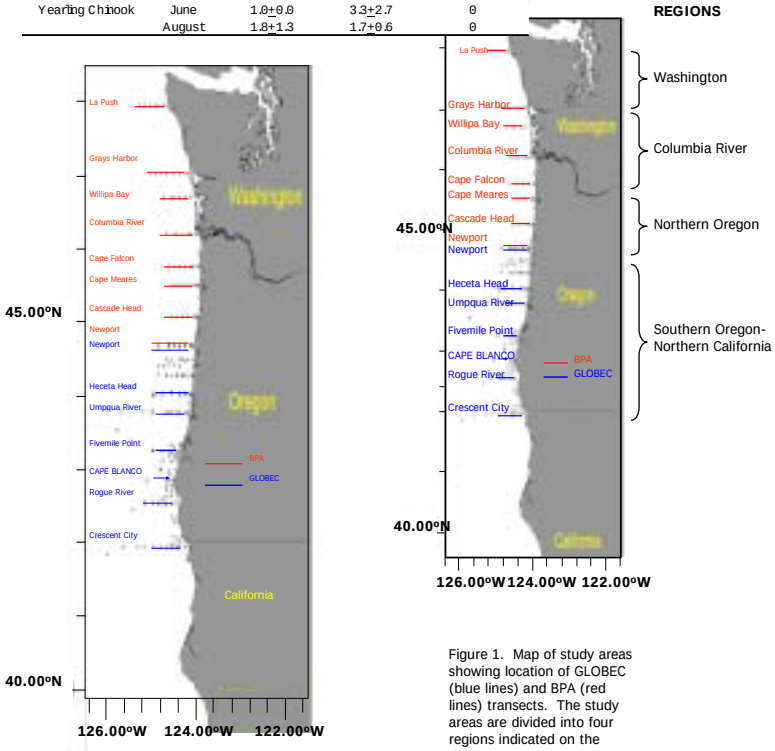

Figure 1. Map of study areas showing location of GLOBEC (blue lines) and BPA (red lines) transects. The study areas are divided into four regions indicated on the right.