DISTRIBUTION OF JUVENILE SALMONIDS ON BOTH SIDES OF THE DELTAPORT CAUSEWAY

Introduction

There are no major salmonid stream south of Roberts Banks and it is likely that most juvenile salmonids found on Roberts Bank emerge in streams located in the northern portion of the area (the Fraser River estuary and its tributaries), west of the Deltaport causeway. It has been speculated that the Deltaport causeway acts as a barrier to juvenile salmonid movements. Such a scenario makes the prediction that for an equal sampling effort on either side of the causeway most juvenile salmonids will be sampled on the west side of that causeway. It also implicitly assumes that habitats of either side of the causeway provide equal rearing opportunities in terms of growth and predator avoidance.

The present memo explores the distribution of juvenile salmonids on both sides of the causeway. It is based on data collected by Triton Environmental Consultants on behalf of the Vancouver Port Authority for its application to CEAA for a container expansion on Roberts Bank.

Methods

The catch data from beam trawls, minnow traps and beach seining were examined for juvenile salmonids. No salmonids were caught in minnow traps and only 15 juvenile chum, all in the spring, were caught through beam trawls. The vast majority of salmonids were caught through beach seines, and the following results are entirely based on these catch data.

Eight beach seining sites were sampled to ensure coverage all intertidal habitats (mudflats, start of eelgrass and salt marsh). All sites were sampled at night and during the day during four seasons[1] to document seasonal and temporal variations in habitat use (two replicates per site). Day and night samplings were conducted as close in time as possible (same date whenever feasible). Each juvenile salmonid caught was measured and weighed, but these data have not been analyzed. The present discussion only concerns numbers of fish caught.

Results

There were 565 juvenile salmonids caught on both sides of the causeway during all four seasons, 204 pink (*Oncorhynchus gorbuscha*) and 361 chum (*O. keta*; **Table 1**). Overall close to 70% of all salmonids caught were caught on the west side of the causeway (390/565). Most salmonids were caught in the spring

[1] There were four consecutive seasons: summer and fall, 2003, and winter and spring, 2004.

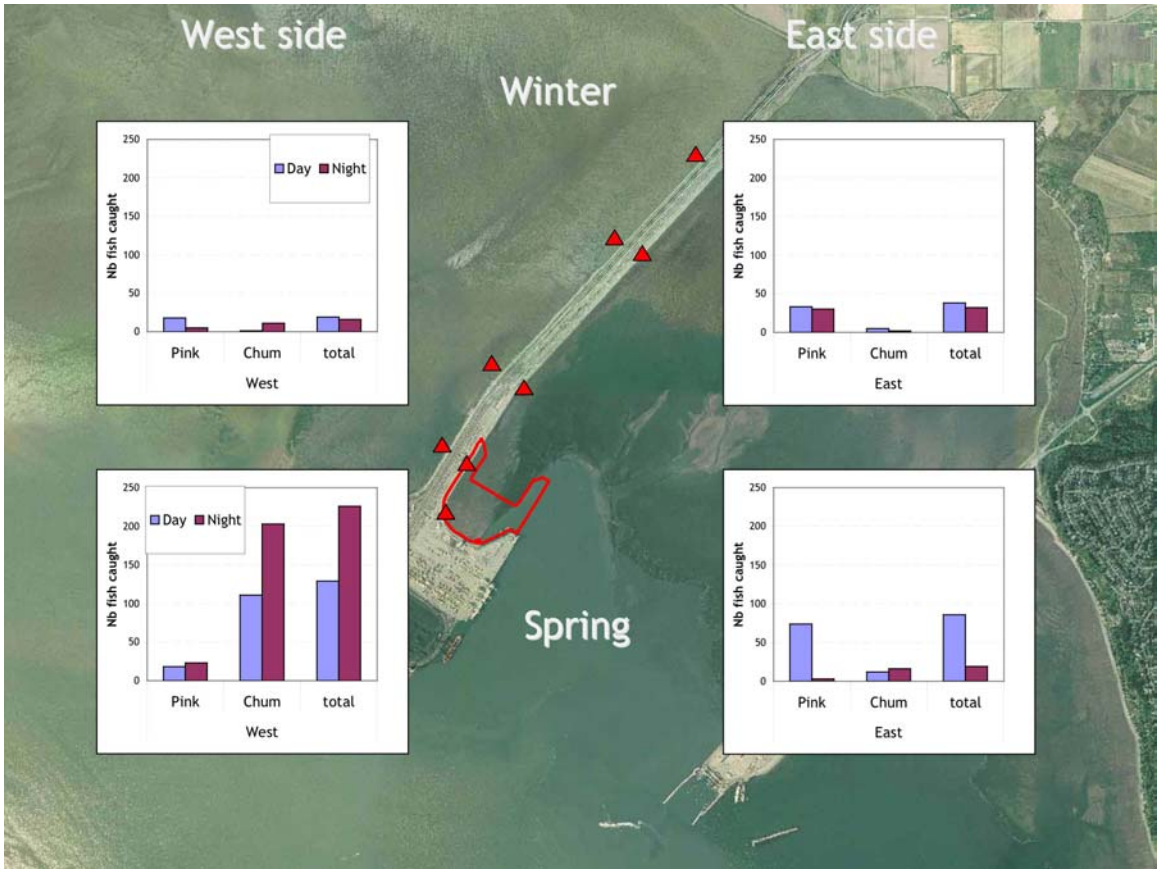
(460/565, or 81%; 95% of chum juveniles were caught in the spring) and none were caught in summer or fall.

The distribution of the two species along the two sides of the causeway was uneven: most pink juveniles were caught on the east side of the causeway (= intercauseway area; 140/204 or 69%) whereas most chum juveniles were caught on the west side (326/361, or 90%) (**Table 1**; **Figure 1**).

Table 1. Total number of juvenile salmonids caught through beach seining along both sides of the Deltaport causeway in 2003 and 2004.

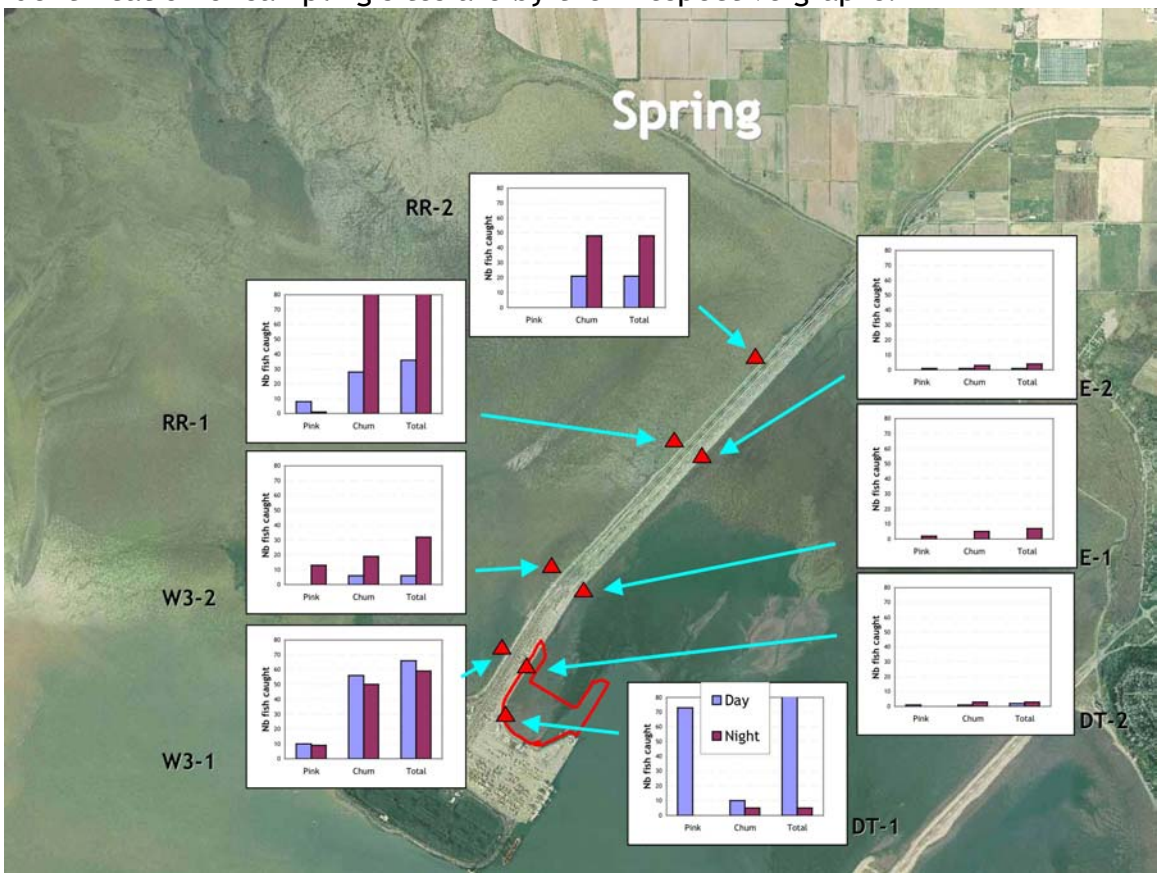
	West		**East**	
	Day	Night	Day	Night
Pink				
Summer	0	0	0	0
Fall	0	0	0	0
Winter	18	5	33	30
Spring	18	23	74	3
total	***36***	***28***	***107***	***33***
Chum				
Summer	0	0	0	0
Fall	0	0	0	0
Winter	1	11	5	2
Spring	111	203	12	16
total	***112***	***214***	***17***	***18***
Grand total	***148***	***242***	***124***	***51***

Figure 1. Distribution of juvenile pink and chum salmon caught by beach seining along the Deltaport causeway in winter and spring, 2004. All catches totalled per side per season. Red triangles are sites sampled. Red outline is footprint of proposed Deltaport Third Berth expansion.



The distribution of juvenile salmonids along the two sides of the causeway was more uneven in the spring: 65% of pink juveniles were caught on the intercauseway side whereas 92% of chum juveniles were caught on the west side (**Figures 1** & **2**). The pink juveniles distribution bias can largely be accounted for by juveniles caught in the Deltaport footprint, which totalled 62% (73/118 fish) of the total pink catch on both sides.

Figure 2. Distribution of juvenile salmonid beach seining catches during the spring of 2004 (May 3-5, 2004) among eight sites along the Deltaport causeway. Identification of sampling sites are by their respective graphs.



The beach seining sweeps extended approximately 35 m from the shoreline. They thus sampled shoreline habitats, and each site was dominated by different habitats (**Table 2**).

Table 2. Main habitats sampled by beach seining during 2003/2004. Refer to Figure 2 for location of sites.

Beach seining site	Main habitat
RR-1	salt marsh
RR-2	salt marsh
W3-1	cobble/mudflat
W3-2	*Z. japonica* /mudflat
DT-1	mudflat
DT-2	*Z. japonica* /mudflat
E-1	*Z. japonica*/*Z. marina*
E-2	*Z.japonica*/*Z. marina*

When catches are divided among habitats, it appears that 52% of the total spring catch of juvenile chum salmon was from salt marsh habitat whereas 63% of that of pink juveniles was from mudflat habitat (**Table 3**).

Table 3. Number of juvenile salmonids caught through beach seining in May, 2004, in different habitats. Some catches were counted twice for overlapping habitats (mudflats and *Z. japonica*)

Habitat	Chum juveniles	Pink juveniles
Salt marsh	183	9
Z. japonica	144	36
Mudflat	28	77

Discussion

The results presented above are based on a limited number of samples (eight stations sampled during four seasons) and caution must be exercised when making inferences about juvenile salmonid distribution around the Deltaport causeway. There are no major salmonid stream south of Roberts Banks and it is safe to assume that most juvenile salmonids sampled along both sides of the causeway came from the northern portion of the area (the Fraser River estuary and its tributaries). Juvenile pink and chum salmon often school together during their early marine phase and spend much time in shallow water near shorelines (Heard 1991, and references within). This was observed near the Deltaport causeway, as pink and chum juveniles were usually caught in the same sets over cobble/*Z. japonica* habitat (sites W3-1 & W3-2, **Figure 2**).

Juvenile chum salmon were caught in greater numbers on the west side of the causeway area than whereas juvenile pink showed the opposite trend. Chum juveniles were caught in abundance over salt marsh habitat (sites RR) and over cobbles (site W3-1). The salt marsh habitat was only sampled on the west side of the causeway. Presence of chum in this habitat is expected, as juvenile chum salmon have been reported to use sloughs near the Fraser River in their early marine phase (Healey 1982) where they feed on copepods, chironomid larvae and amphipods (Salo 1991, and references within). Chum salmon may be present in the intercauseway salt marsh but this habitat could not be sampled.

Pink salmon nursery areas usually exhibit shelter from waves and tidal currents, and they feed primarily on copepods and other zooplankton when near cobbles and sand substrates (Heard 1991). Such substrates were primarily found in sites DT, W3 and E (**Figure 2**), and pink juveniles were most abundant in catches

from sites W3-1 and DT-1. Magnhagen (1988), working with both species, surmised that pink juveniles responded more to open areas than chum, which may partly explain why pink juveniles were caught in greatest numbers in DT-1, the site most devoid of vegetation. Juvenile salmon are primarily diurnal feeders (Sagar and Glova 1988, and references within) and their presence in DT-1 during daytime may have been related to foraging opportunities.

Pink and chum juveniles were sampled in greatest numbers in habitats which they are reported to use in their early marine phase (Heard 1991; Salo 1991). Although there were less salmonids caught in the intercauseway area than on the west side of the causeway, the data collected cannot conclusively show that the Deltaport causeway restrains juvenile salmonids use of a favourite habitat. A better test of this hypothesis might be to sample a habitat such as a salt marsh, which appears to provide good rearing opportunities for chum salmon, on both sides of the causeway. Salt marsh conditions and species composition are however different between the two sides – the intercauseway salt marsh experiences more saline conditions and is patchy whereas the salt marsh on the west side is brackish and homogeneous (Gary Willliams, pers. comm.). Other such habitat could be mudflats which appear to be favoured by pink juveniles – shoreline mudflats are present on both sides of the causeway (SW of W3-1 and in DT-1).

Literature Cited

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