

## Chapter 4. Nearshore Assessment: Fish use of the Twins nearshore

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### **Abstract**

The nearshore fish assemblage of the east and west Twins rivers and shoreline was assessed via beach seining of the lower river and shoreline for over a year period. The key findings include:

1. Documentation of a strong seasonal variation in fish use of the Twins nearshore that was similar to other study areas of the central and western Strait; 2. The Twins shoreline was found to have some of the highest species diversity and richness of any of the study sites, while the lower river of the Twins was found to have among the lowest; 3. Juvenile steelhead and trout were observed in high abundance in the nearshore lower river; 4. Very low numbers of coho and Chinook were observed in the nearshore lower river and shoreline of the Twins; 5.

Documentation of coho in the nearshore during winter months, and high trout numbers in the lower river during late summer and fall, and; 6. A seasonally high accumulation of macroalgae in the Twins lower river nearshore that was not observed at any of the other study sites. Based on these findings we conclude that the nearshore Twins is very important for steelhead, trout, and forage fish. While clearly important for salmon, the nearshore Twins functions differently for juvenile coho and Chinook than other areas on the nearshore Strait. Based on these findings we conclude that the Twins is a high priority for restoration, and recommend that: 1. Acquisition of nearshore private properties along the Twins shoreline should be a top nearshore restoration priority for this area; 2. Restoration of the Twins nearshore by removal of the 2.5 acre fill structure in the Twins nearshore should be completed as soon as possible; 3. Additional study to define the ecological function of the Twins nearshore for coho and Chinook, including the role lower river and shoreline alterations combined with apparently naturally occurring macroalgal blooms, may play in defining fish use in the nearshore Twins is a priority; 4. That habitat and

fish management revise provisions to better protect trout and salmon species in the nearshore during later summer, fall, and winter months, and; 5. These recommendations should be included in the revised Clallam County Shoreline Master Plan.

### **Introduction**

The nearshore of the Twin Rivers is located on the western Strait of Juan de Fuca and extends from the area of tidal influence in the east and west Twin Rivers out to 30 m MLLW. It is geologically complex and includes both tectonic and glacial influences (Parks 2005). The Twin's nearshore drift cell includes approximately four linear miles of rocky and sandy shoreline. The shoreline is highly erosional. Parks (2005) concluded that there is no long-term net apparent sediment transport direction, but rather a high degree of inter-annual variability between east/west/ and north offshore across the shore platform, and that sediment transport may be impacted by shoreline modifications. The shoreline of the Twins nearshore is a mixture of private and state ownership. A significant portion of the Twins shoreline is owned and managed by the LaFarge Corporation. Todd et al. 2006 describes the Twins nearshore as a moderately impaired stream delta complex. There are a few obvious main impactors to the Twin nearshore. The first is the 2.4 acre pier structure associated with the La Farge Twin Rivers Clay Quarry, a 214-acre quarry site located immediately west of the west Twin Rivers. Elevation of the quarry ranges from 226 feet above mean sea level to mean high water. The quarry loading facility is a filled pier structure (locally termed a 'mole') that occupies approximately 2.4 acres of intertidal area directly north of the quarry. Elevation of the mole structure ranges from 33.2 feet to -2.2 feet below mean low water (Parks 2005).

The mole begins at mean high water and extends northward 250 to 300 feet into the intertidal zone to below mean low water. It includes approximately 63,000 cy of fill, 13,000 cy of riprap and 1300 linear feet of sheet and creosote treated piles. The mole is on state tidelands that are managed by the Washington DNR, and is leased by LaFarge Corporation.

Associated with the pier, a channel measuring approximately 150 feet wide by 550 feet long has been dredged on the east side of the mole structure from the mean high water elevation in the south, extending to approximately deep to the north to allow barge access for loading purposes. Dredging records suggest that 102,000 cubic yards (77994 m<sup>3</sup>) of sediment were removed from the access channel between 1982 and 1985 (Parks 2005; WDOE, 1982).

In total the pier encompasses 2.5 acres of fill and significant dredging in nearshore Twins, including eelgrass beds. The pier is theorized to disrupt the fish migratory corridor, and displace forage fish spawning. The Twins pier has been the focus of collaborative but unsuccessful restoration proposals sponsored by the private landowner, state and tribal co-managers, and local citizens. See Shaffer et al. 2005 and Parks 2005 for a full description of the site and project.

Another potential impact to the Twins nearshore is the fill associated with the historic road grades, now the Hwy 112 road prism, and associated historic alteration of the area south of the highway and between the lower rivers of the east and west Twins. The 1926 US Coast and Geodetic Survey Map (Aslakson and Witherbee, 1926) shows the alignment of the "Pysht road" at or near the current Highway 112 alignment. The possibility of road fill being placed in low lying floodplain/wetland/back-beach areas between the two Twin river channels is very likely. Construction of the "old" Highway 9A road and the "new" Highway 112 alignment in the 1950's could have also been a factor in expanding fill material between the two river channels (Parks, pers comm.). In addition to fill, alterations in this area include lower river clearing in the 1950's (Kramer 1952). The area has also been heavily logged, and the riparian zone highly degraded (Shaffer et al 2005).

Habitat function of the Twins shoreline is complex, and intriguing. The shoreline of the Twin Rivers is documented to support a diverse fish and invertebrate community (Miller et al 1980). It is an important surf smelt spawning area (Shaffer et al. 2005; WDFW Salmonscape 2008) and is heavily used for recreational smelting and crabbing. Collectively the Twin Rivers are important for a number of salmon stocks including coho, cutthroat, and steelhead (Roni et al 2008;

Haggerty in prep). Chinook use is cited for the Twins (Kramer 1952) and juvenile Chinook are theorized to use the nearshore. Little other information is available about fish use of the Twins nearshore. The purpose of this study is therefore to define Twins nearshore habitat function for juvenile fish, with an emphasis on salmonids, and the role restoration actions within the Twins nearshore may play in the larger Strait of Juan de Fuca ecosystem.

### **Methods and Materials**

The east shoreline of the main channel of the west Twin River and marine shoreline between the mouths of the east and west Twin rivers were seined weekly from April-December 2007 and then monthly from December 2007 -March 2008. The main channel was sampled using a 24.4 meter PSAT design seine and protocol. The shoreline was sampled using the standard 37 meter PSAT design seine and protocol. One to two seines were conducted per nearshore habitat type per sampling date (Figure 1).

Basic water quality of the lower river and shoreline was recorded for each sampling date. In addition the Twins main channel was sampled once a month during daylight hours on a falling neap tide between +6 and +3 MLLW. Point data on turbidity, dissolved oxygen (DO), temperature, salinity, and conductivity were sampled using a YSI meter. The monthly water quality results are summarized in the companion report entitled 'Nearshore water quality of WRIA 19' see chapter 9.

Master files with weekly/monthly fish densities and lengths and water quality data will be provided in appendix in final report.

### **Results**

The Twins nearshore comprised approximately 1-10% of all fish collected in this study (Table 1). As observed in other geographic areas of this study, the Twins nearshore showed very high seasonal abundance, diversity, and richness in fish use. Twins shoreline had some of the highest species richness and diversity of any of the sites sampled. The lower river in contrast, had some

of the lowest (Figure 2-4). Fish use of the Twin's nearshore varied between the lower river and shoreline, and was also different than other sites in this study. In particular the lower river use was dominated by trout and salmon: steelhead, cutthroat, unidentified trout, and chum were dominant. Surprisingly, Chinook and coho were not observed in the Twins lower river, and only a very few coho were collected from the nearshore throughout the duration of the study (Figure 5-6; Appendix A-H).

Size of trout and salmon collected in the Twins nearshore are provided in Figure 7-8.

Another important observation of the Twins nearshore is the seasonal accumulation of drift algae in the main channel of the river, which began at the end of July and persisted through November 2007. The mat was recorded to be at a minimum 0.33 meter thick, and made up of brown and red macro algae (primarily Laminarians and fleshy reds). The mat was observed as anoxic beginning the month of August, and fish stress observed on one sampling day in August when the mat was entrained in the sampling. This stress revealed that care had to be taken not to stir up the mat during August-October sampling. The mat persisted until the middle of November when rain events flushed it out. Species composition of the mat indicated that the mat was shoreline algae pushed into the lower river by tidal energy during periods of low flow and high tides (not a macro algae bloom associated with nutrient loading)..

Smelt were the dominant fish in for the Twins shoreline (Table 1).

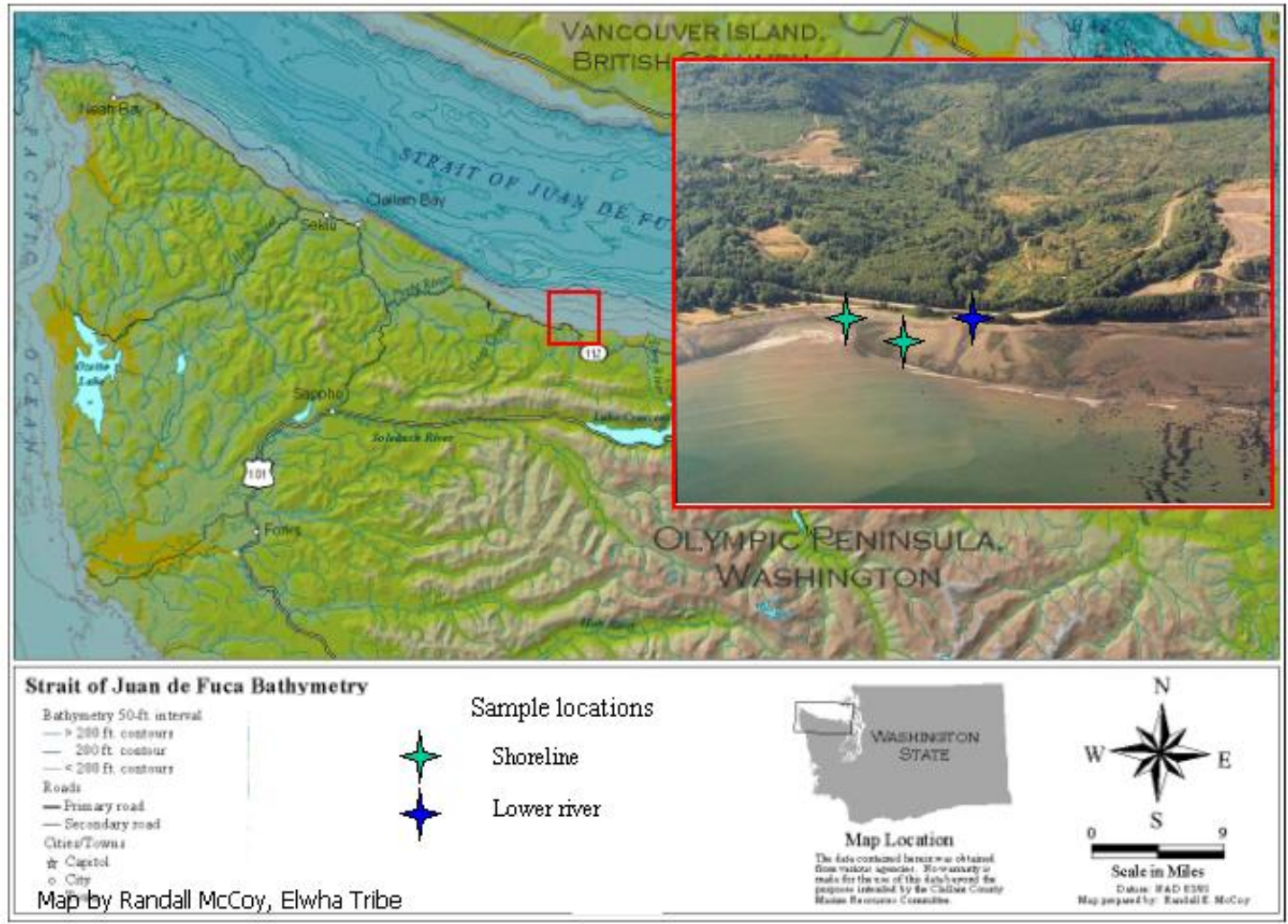


Figure 1. Sampling sites, Twins Nearshore

Table 1. Dominant species (percent) by sample site nearshore central Strait of Juan de Fuca, March 07- April 08

Site	Total # seines	Total Fish	Total fish /net	% of all fish	Chinook	Coho	Chum	Smelt (adult)	Smelt (juv)	Smelt (pl)	Herring (juv)	Sand lance (juv)	3- Spine stickle back	Shiner perch	Staghorn sculpin	Cottids <30mm	Cut throat	Prickly Sculpin	Northern Anchovy (Adult)	Cumulative %
Crescent Bay	41	11563	282	6	2	2	2	<b>42</b>	<b>14</b>	0	4	<b>21</b>	1	1	3	0	0	0	0	92
Freshwater Bay	28	12259	437.8	6	4	0	1	<b>14</b>	6	9	<b>56</b>	7	0	1	0	0	0	0	1	98
Pysht Shoreline	30	31720	1057	17	0	0	0	<b>11</b>	<b>79</b>	0	2	0	0	0	3	0	0	0	0	95
W. Twins Shoreline	32	19810	619.1	10	0	0	0	<b>10</b>	<b>17</b>	4	<b>19</b>	0	0	0	0	0	0	0	<b>39</b>	89
Elwha Bluffs	13	5518	424.5	3	10	1	9	1	<b>43</b>	<b>15</b>	<b>20</b>	1	0	0	0	0	0	0	0	99
Dungeness Bluffs	16	24960	1560	13	0	0	0	1	6	<b>90</b>	2	0	0	0	0	0	0	0	0	98
Dungeness Spit	12	5049	420.8	3	0	0	6	4	<b>54</b>	<b>14</b>	<b>11</b>	8	0	0	0	0	0	0	0	98
Ediz Hook	9	3101	344.6	2	6	0	3	5	<b>20</b>	1	<b>51</b>	<b>12</b>	0	0	0	0	0	0	0	99
Salt Creek Side Channel	52	13947	268.2	7	0	1	2	0	0	0	0	0	<b>12</b>	<b>54</b>	<b>22</b>	7	0	0	0	99
Elwha Side Channel	52	16258	312.7	9	<b>12</b>	2	1	0	0	0	0	0	<b>70</b>	0	4	5	0	1	0	96
Pysht Side Channels	36	15586	432.9	8	0	0	0	0	0	0	0	0	<b>49</b>	<b>26</b>	<b>19</b>	3	0	0	0	99
Pysht Main Channel	44	9553	217.1	5	0	1	1	0	7	0	0	0	1	0	7	79	0	0	0	96
Salt Creek Main Channel	66	18731	283.8	10	0	2	3	0	0	0	0	0	5	<b>68</b>	<b>14</b>	6	0	0	0	99
W.Twins Main channel	28	1477	52.75	1	0	0	1	0	0	0	0	0	0	0	5	<b>48</b>	6	<b>33</b>	0	93
Total	459	189532																		



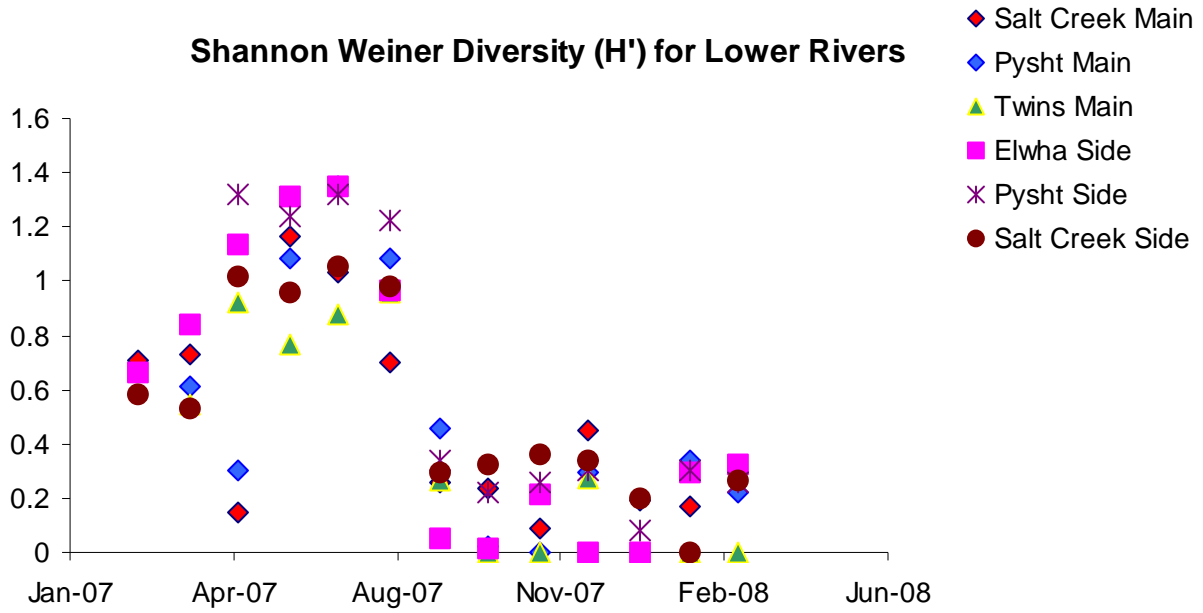


Figure 2. Diversity, central and western Strait of Juan de Fuca nearshore.

**Shannon Weiner Diversity (H') for Shoreline Sites**

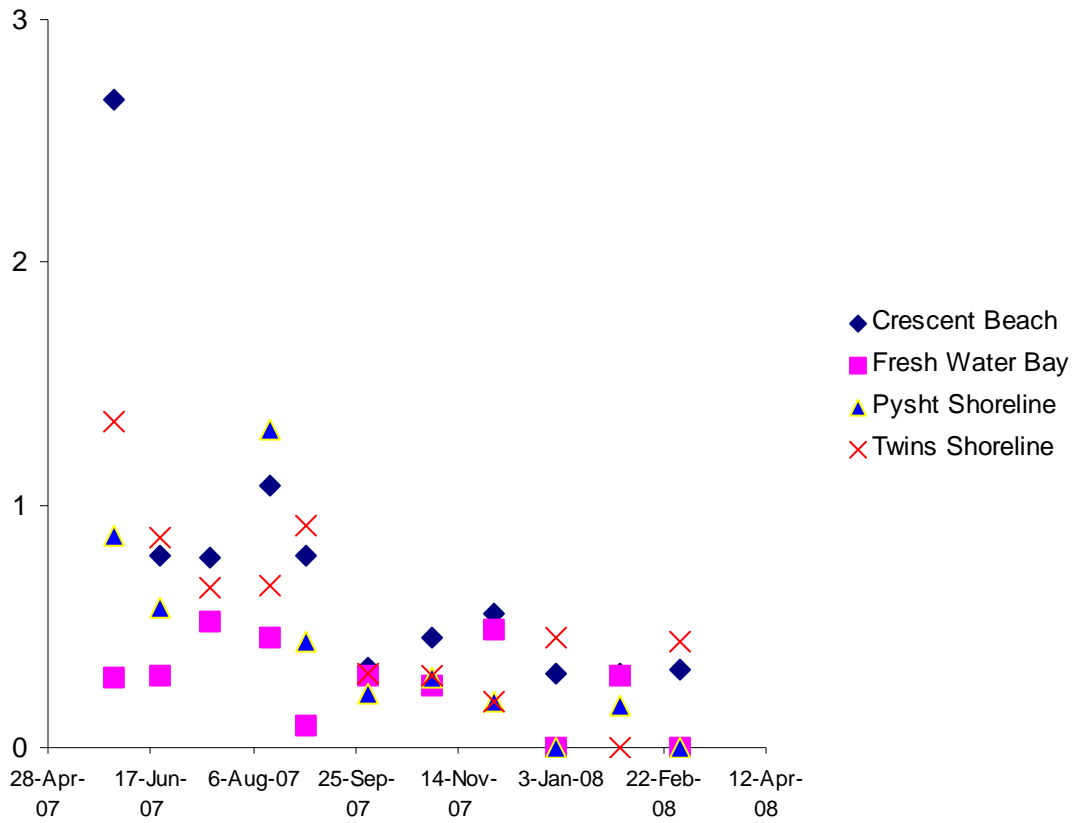


Figure 3. Diversity, central and western Strait of Juan de Fuca shoreline sites

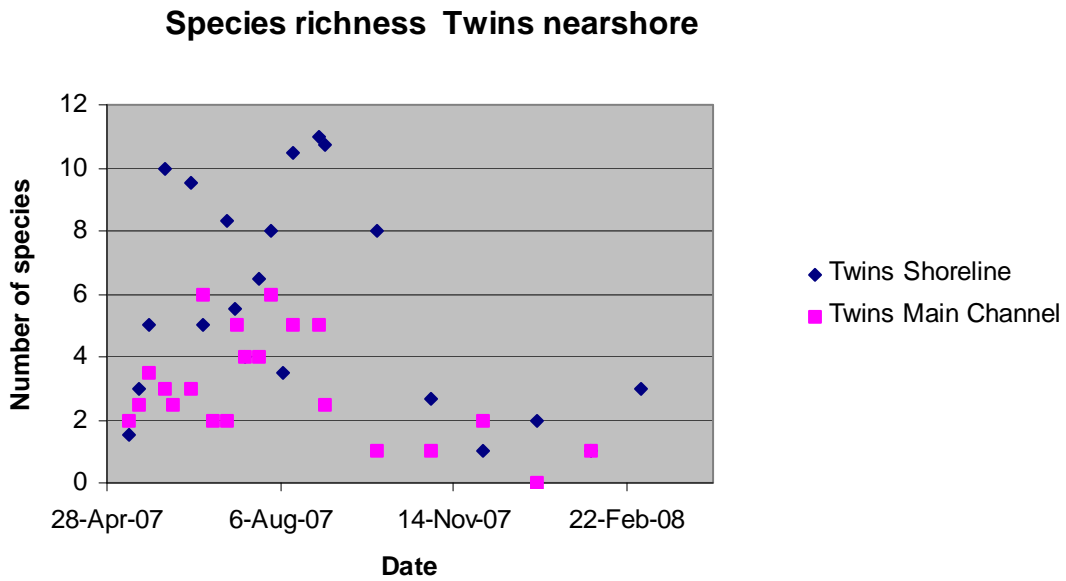


Figure 4. Species richness, Twins nearshore

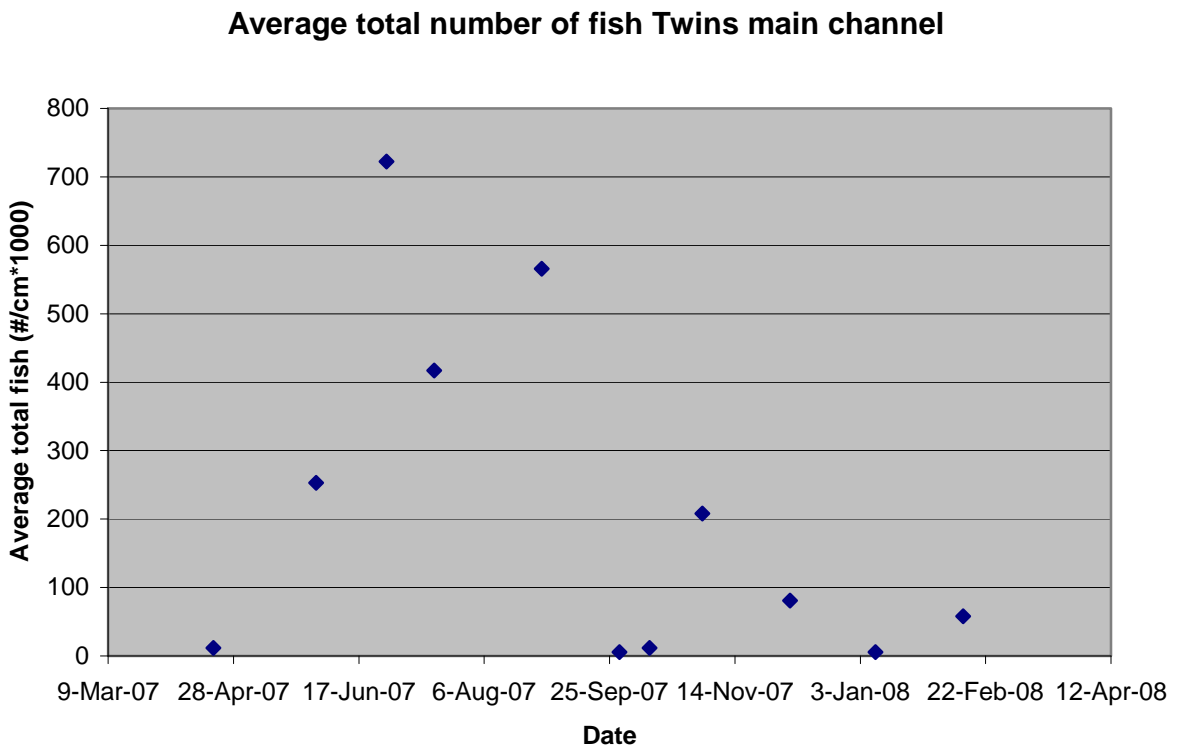


Figure 5. Average total fish, Twins nearshore main channel.

Average density of fish Twins shoreline

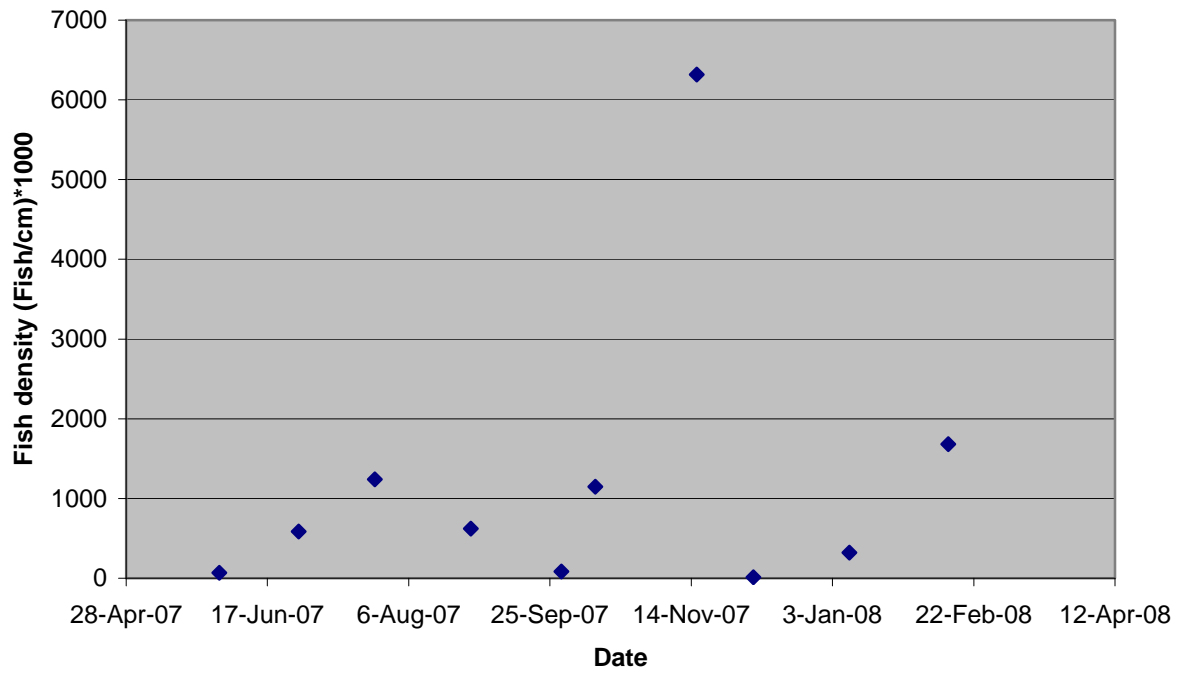


Figure 6. Average total fish, Twins nearshore shoreline.

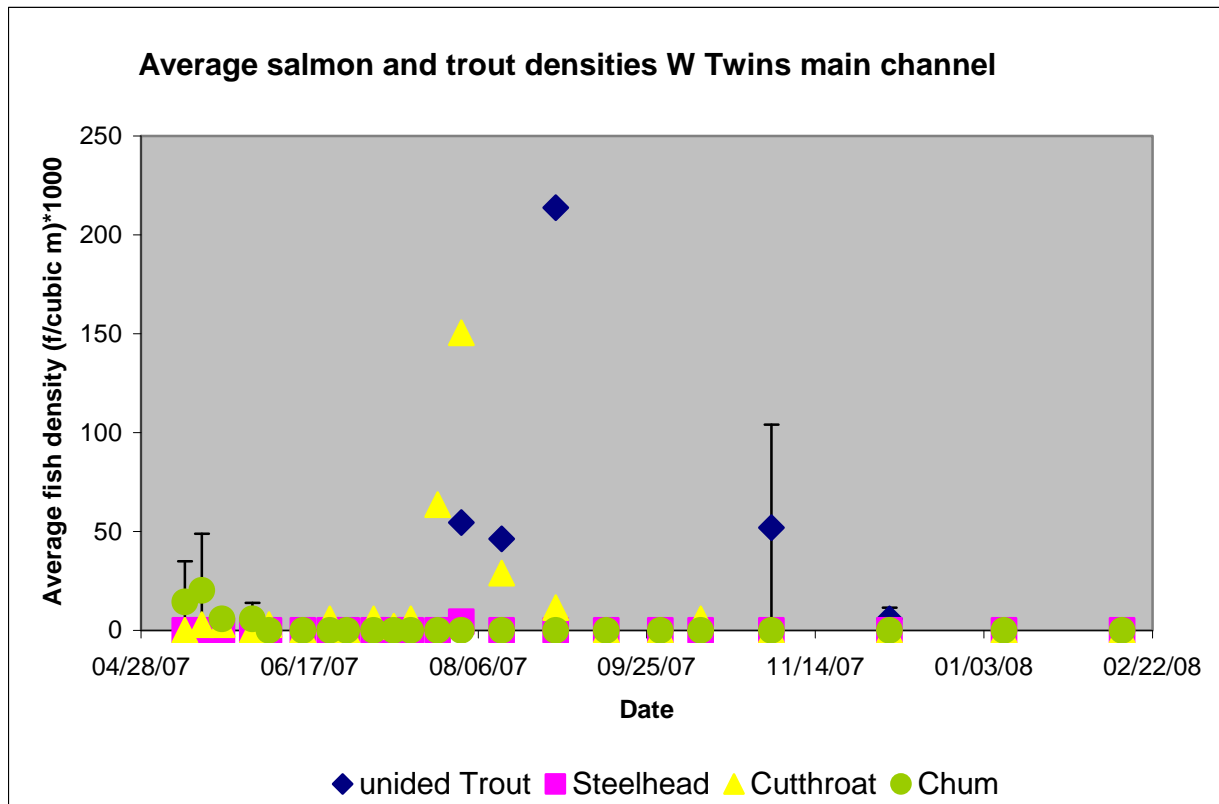


Figure 7. Salmon and trout densities, West Twins nearshore main channel

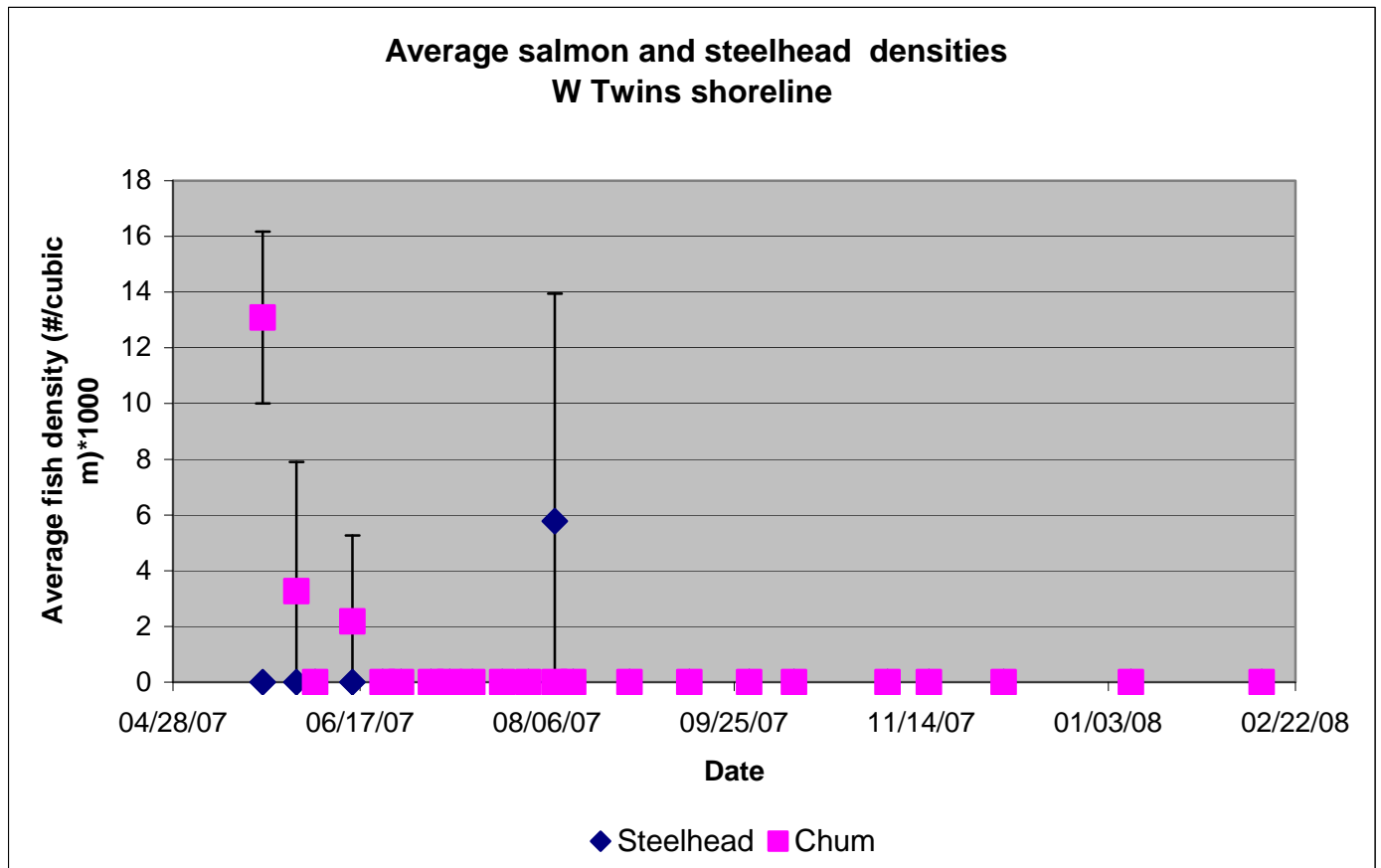


Figure 8. Salmon and trout densities, Twins nearshore shoreline site.



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**Discussion and Recommendations**

The Twins nearshore is a unique feature of the central and western Strait and provides important habitat to a complex mix of freshwater, anadromous, and marine type fishes. The high diversity of fish use observed along the west Twins shoreline in this study is consistent with previous work (Miller et al 1980) and is further validation that the Twins shoreline is extremely diverse and should be managed to preserve, and where appropriate, restore ecosystem function.

The high density of smelt observed along the Twins nearshore is consistent with the documented surf smelt spawning for this area (WDFW Salmonscape 2008). The area is very popular for launching of boats for crabbing and smelting, and is adjacent to private recreational property. Management care should be taken to preserve this high quality and function beach. Vehicle driving on the beach should be prohibited and shoreline alterations along the Twins should be avoided. The Twins nearshore should be a priority for acquisition, and restoration.

Results of this study indicate that salmon and trout use of the Twins nearshore is complex. While we know they use the Twins, coho were in very low numbers in Twins nearshore samplings and Chinook smolts were not collected at all. Both results are perplexing. Chinook were collected in the Pysht and Salt Creek nearshore (Shaffer et al in prep; see chapters x and xx), which are respectively west and east of the Twins nearshore, indicating the Chinook are migrating through the Twins nearshore. It is possible that fish are migrating along the shoreline, but offshore of our sampling area. The large pier and fill structure and associated dredging of adjacent eelgrass beds to the west of the west Twins may be related to this offshore migration if it is in fact occurring, and may possibly be disrupting salmonid migration along the Twins shoreline.

Disruption of shoreline migration however would not be expected to directly impact river outmigration by juvenile coho, or explain the lack of coho observed in the lower river of the

west Twins. Roni et al 2008 documented significant numbers of coho emigrating from both the east and west Twins from 2004-2008. Outmigrating numbers for juvenile coho were approximately 33% lower in 2007/8 than previous years while outmigrating trout were at peak levels. The high numbers of trout we observed in the lower river nearshore of the west Twins are therefore consistent with Roni's observations, but the lack of coho in our lower river samples is perplexing. Possibly the lack of coho observed in the lower river and shoreline of this study could be due to fish avoidance of our sampling gear. The main channel of the Twins is a bit more constrained than other lower river nearshore areas we sampled. Fish may have been able to see the net when sampling, and avoid it. While we did not see evidence of avoidance in other similar size areas, possibly there may be specific unique elements to the Twins that allow higher avoidance. Gear avoidance, however, does not explain why only a very few coho, and no Chinook, were observed in our shoreline seining at Twins relative to all other study sites of the study.

Albeit both studies observed salmon in low numbers, our observation of coho in the shoreline areas of the Twins nearshore in December is consistent with PIT results by Roni et al (2008), who observed that, in low numbers, coho are migrating between the two Twin rivers during winter months. Coho movement is primarily from east to west Twins (Roni et al 2008). This repeated observation of juvenile coho in the nearshore during winter months is an important consideration for habitat management.

The recent listing of steelhead makes the high numbers of unidentified trout observed in August and September very important. We are currently having genetic testing done to identify these fish. Regardless of identity, the high numbers of trout and cutthroat during late summer and fall suggest that extra consideration is warranted when making habitat management decisions, including project timing for the Twins nearshore and lower river, to accommodate these later coho and high numbers of trout.

From a broader perspective, the Twins nearshore appears unique from nearshore areas of the central Strait and may in fact be representative of nearshore western Strait of Juan de Fuca, just as the Twins watershed is in many respects characteristic of other smaller order western Strait streams. It is therefore important to understand how this western nearshore system functions if we are to manage these western Strait systems wisely.

Our work leads to a number of restoration recommendations. Todd et al. 2006 describes the Twins shoreline as moderately impaired, and notes shoreline alterations and the Highway 112 as possible impactors, and states: “While not necessarily blocking fish passage, Highway 112, and associated fill prism, is built within the Twins nearshore and may have a significant effect on the Twins nearshore by disrupting the lateral channel connectivity, as well as the integrity and function of the delta south of the road prism and between the two rivers, and the connectivity between the stream delta south of the highway and the current shoreline”. Field observations indicate that sediment at the toe of the current road prism is comprised of silt, indicating the presence of wetlands prior to fill (Parks, pers obs.) A detailed analysis of the Twins nearshore, including estuarine changes, hydrologic relationship between the Twins mole and estuarine alterations, and detailed assessment of fish use, is therefore warranted, and recommended.

The observation of natural macroalgae mats in the lower river is also important. The fish stress observed when the seaweed mat was entrained in the seine during one of our August samplings may have been due to fish exposure to decreased water quality associated with the sea weed mat. Decreased water quality may include increased temperature, decreased oxygen, and high flocculant/turbidity. While we were unable to detect any pre- and post change in water quality, the fish response is strong evidence that more detailed information is needed on the relationship between seaweed mats and fish use in the nearshore, and that extreme care is critical when working with macroalgae in the nearshore.

It's important to note that the observation of large accumulation of macroalgae in the lower river of the Twins was also unique in this study, and may play a role in fish use of the lower river Twins nearshore. Shan et al. 2008 documented significant diurnal changes in nearshore DO levels of a small creek. DO levels ranged from supersaturated to hypoxic and were specifically associated with macroalgae blooms. Our observations of fish stress during lower river sampling indicates that macro algae are an important feature to the Twins nearshore, and may play a role in fish use of the nearshore by limiting migration times due to low DO levels. Macroalgae mats have been documented to occur in areas of shoreline alteration as well as to result in forcing ecosystem shifts (Shaffer 2002). The macroalgae mats observed in the lower Twins may therefore be further indication of alteration of a historic estuary along the Twins lower rivers.

The absence of both coho and Chinook in the Twins nearshore relative to all other sites in this study and the high accumulation of macroalgae observed only in the Twins lower river, lead us to conclude that the Twins nearshore is in fact functioning differently than other nearshore areas in this study. One hypothesis is that coho and Chinook outmigrating to the nearshore Twins do so at night. Night migration at the Twins may be selected for due to predator avoidance, and may be a response to the very limited estuary of the lower Twins. DO levels may also play a role in outmigration timing. Historic alterations of what was once Twins estuary and shoreline may also play a role in nearshore function. Additional assessment work is recommended to further clarify juvenile salmonid use, in particular juvenile Chinook and coho use of the Twins nearshore. A detailed analysis of historic alteration of the lower rivers, and the impact alterations of the lower river including the highway road prism, historic fill and alteration of the road prism area, and Twins shoreline should be a focal point of this work.

The Twins shoreline is clearly significantly altered due to the 2.5 acre pier structure and associated dredging, which has displaced eelgrass and surf smelt spawning, disrupted longshore transport, and may be disrupting fish migration as evidenced by the lack of

Chinook along the Twins shoreline. Given the high species diversity and richness of the Twins shoreline, well documented smelt spawning in the area, and high numbers of trout and salmon documented in the Twins system by this study and other authors, we recommend the Twins pier be a priority for restoration for the western Strait nearshore.

Finally, it should be noted that Clallam County will soon embark on its update of the Shoreline Master Program. These recommendations should be included in the revised SMP if not already there.

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