

2015 CHEHALIS ASRP OFF-CHANNEL EXTENSIVE SURVEYS

2nd Progress Report (November 30, 2015)

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EXECUTIVE SUMMARY

Introduction

This report summarizes results from the 2015 extensive surveys in off-channel habitat in the mainstem Chehalis floodplain. The work is part of the larger effort addressing off-channel habitats and contributes both directly and indirectly to the Chehalis Aquatic Species Restoration Plan (ASRP). The goals of the surveys are to:

- Identify late spring and summer occupancy patterns for fish and co-occurring aquatic invertebrate assemblages in off-channel habitat in the Chehalis floodplain.
- Support occupancy modeling characterizing the distribution of ASRP target species in the Chehalis floodplain.
- Support development of a Project level Environmental Impact Statement (PEIS) for reducing flood impacts on the Chehalis Basin.
- Support inundation modeling intended to evaluate potential changes in off-channel habitats as a consequence of flood control alternatives.
- Inform and prioritize restoration efforts in the basin.

This study looks at 6 of the 9 ASRP non-salmonid target species known to occur in Chehalis Basin off-channel habitats:

- American beaver (*Castor canadensis*).
- Northern red-legged frog (*Rana aurora*).
- Olympic mudminnow (*Novumbra hubbsi*)
- Oregon spotted frog (*Rana pretiosa*).
- Western pond turtle (*Actinemys marmorata*).
- Western toad (*Anaxyrus boreas*).

The work was conducted on the land of, and with the permission of, almost 50 landowners within the basin – 10 public and 37 private.

Methods

Sampling methods for the surveys included trapping (collapsible minnow traps, fyke nets and turtle traps) and dipnet surveys. Surveys were conducted between May 5 and September 25, 2015 at 61 distinct off-channel habitats distributed between the proposed dam footprint above Pe Ell down to the Highway 101 bridge in Aberdeen. Each site was surveyed using a single overnight trap set over two consecutive days.

Results and Conclusions

We recorded American beaver, seven stillwater-breeding amphibian species and selected life stages of at least 20 fish species during the 2015 during the surveys. In

addition to the beaver, 3 of the 6 ASRP non-salmonid target species were found - the northern red-legged frog, Olympic mudminnow, and western toad. However, we did not find the two remaining ASRP non-salmonid target species - the Oregon spotted frog and western pond turtle.

With the exception of not finding evidence of the western toad, the results are supported by timing of the surveys (summer) and species life history, and parallel both the species and distributions recorded during the off-channel egg mass surveys. Specific findings include a widespread off-channel presence for the northern red-legged frog, with more frequent occurrences of the American beaver and Olympic mudminnow in the lower two-thirds of the floodplain. However, it should be recognized that western toad presence was based on two post-metamorphic juveniles that may have bred at a known instream riverine location near the mouth of the Satsop rather than in the off-channel habitats adjacent to where they were found. Therefore, this dataset provides no solid evidence to contradict the western toad egg mass survey results, wherein no western toad use was documented for any off-channel habitats sampled for breeding or rearing.

Exotic (introduced) species represent fully half of the vertebrate assemblage recorded. The assemblage includes both the American bullfrog (*Lithobates catesbeiana*) and red-eared slider turtle (*Trachemys scripta*), with the bullfrog the most widespread. Bullfrog presence was recorded for 82% of all sites sampled and in all river segments except the two uppermost ones. Additional species found are as follows:

- Centrarchids – Black crappie (*Pomoxis nigromaculatus*), Bluegill (*Lepomis macrochirus*), Largemouth Bass (*Micropterus salmoides*), Pumpkinseed (*Lepomis gibbosus*), and Rock Bass (*Ambloplites rupestris*)
- Bullhead catfish species - Black Bullhead (*Ameiurus melas*) and Brown Bullhead (*Ameiurus nebulosus*).
- Yellow perch (*Perca flavescens*).
- Common carp (*Cyprinus carpio*).
- Smallmouth bass (*Micropterus dolomieu*).

The Centrarchids, bullhead and perch seem to dominate the exotic fishes assemblage, with the carp found to be localized and smallmouthed bass rare in off-channel habitat.

The most rich exotic assemblage was found in the lower central floodplain (Porter Creek to Black River), where all 10 exotic fishes and the American bullfrog were documented. The frequent lack of detection of exotics in off-channel habitats in the upper and lower ends of the Chehalis floodplain was a unifying pattern that parallels the findings of the egg mass surveys.

Besides Olympic mudminnow, the most widespread members of the native fish assemblage were the three-spined stickleback (*Gasterosteus aculeatus*), sculpin (*Cottus* spp.), and northern pikeminnow (*Ptychocheilus oregonensis*). Four native species, the large-scale sucker (*Catostomus macrocheilus*), redbelt shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), and lamprey (*Lampetra* sp.) did not appear widespread. At this juncture, whether this pattern reflects the influence of exotics, seasonal use of off-channel habitats, or sampling issues is not

clear. As expected, salmonids were almost never detected in off-channel habitats under the summer sampling regime, however their absence may have been influenced by the extremely dry conditions of the past year. Native non-salmonid fishes were also detected less frequently in the upper and lower ends of the floodplain, but the pattern seemed less pronounced than that noted for the exotics.

Next Steps

The extensive survey effort presented here represents the first half of the work planned for the 2015 to 2017 biennium. The remaining effort will determine whether or not the patterns observed to date are generally consistent across sampling years. We anticipate that the planned progress reports and the June of 2016 biennial report will better explain some of the observed patterns for non-salmonid fishes and other target species.

The work discussed here is a summer effort and cannot capture the seasonal (fall-winter-early spring) use of off-channel habitat by juvenile salmonids. In addition, faster-swimming fish species like coho may not be as effectively sampled by the combination of visual encounter and dipnet methods used. As a result, we propose to add electroshock sampling to the combination of egg mass, extensive, and intensive survey effort to ensure that the entire fish assemblage is effectively detected in 2016 and 2017. We will also determine whether abundance information from the extensive surveys, especially between the exotic and native species assemblages, provides discernable patterns. Incorporation of the extensive survey data into preliminary modeling will occur over the fall and winter of 2016, with the data available to preliminarily inform restoration priorities.

PROGRESS REPORT

Introduction

This report summarizes results of the portion of the Chehalis ASRP off-channel habitat study efforts based on 2015 off-channel extensive surveys in the mainstem Chehalis floodplain. The extensive surveys, one part of the larger off-channel Habitat survey effort, is an effort intended to capture primarily the composition of fish assemblage and their associated aquatic species that occupies off-channel habitats during the summer season. Besides the aquatic species assemblage, special effort was made to detect six of the nine ASRP non-salmonid target species known to occur in the Chehalis Basin had some potential of being found Chehalis floodplain off-channel habitats. These are American beaver, Northern red-legged frog, Olympic mudminnow, Oregon spotted frog, Western pond turtle and Western toad.

Site Selection

We chose sites beginning with the 332-site pool of off-channel habitats spanning the entire floodplain of Chehalis mainstem from the proposed dam location (just above Pe Ell) to the 101 bridge in Aberdeen; this is the same pool used for egg mass surveys. This pool was developed in GIS from the 2011 NAIP aerial photograph taken in late summer. As with the egg mass survey effort, we defined the mainstem floodplain footprint as the FEMA-specified 100-year flood line plus an additional 100 meters drawn

perpendicular to that line. We then screened available sites by size (those >0.4 hectares), seasonality (those with permanent water), eliminated sites considered waste lagoons and also eliminated sites where access was not granted based on refusal for access during the egg mass survey effort. The only exception to the screening rule for size was in the two segments closest to the dam where the number of off-channel sites is low, we included all available sites. After screening, we had 164 sites in this selection pool.

We stratified selection of sites across 10 segments of the Chehalis mainstem partitioned primarily on the entry of major tributaries (Figure 1). Our sampling effort in this biennium is distributed over two years, so Table 1 shows the number of sites originally available after screening contrasted to the number targeted for random selection over the two-year interval,

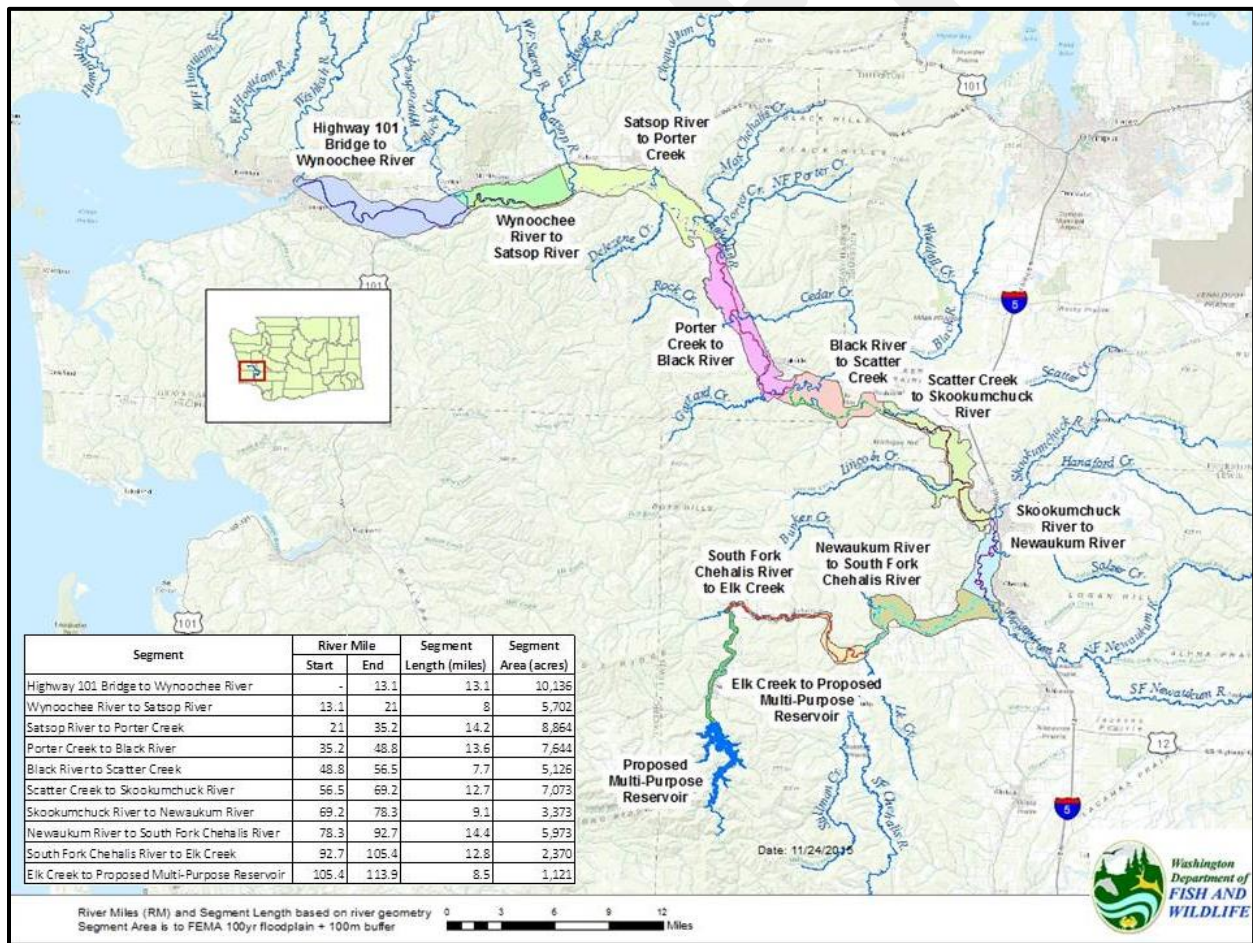


Figure 1. Chehalis River mainstem segments used to stratify sampling of off-channel habitats. The inset describes the start and end points (by river mile (RM), length (in miles based on measurement along the mainstem) and area (in acres) for the 10 segments (each with a unique color on the map).

the number of sites targeted for sampling in 2015, and the number of sites sampled in 2015. One focus of this effort was informing proposed dam alternatives. As effects of these alternatives are expected to be most evident in the mainstem floodplain nearest the dam, and off-channel habitats in the mainstem river segments nearest the proposed dam were few, we intentionally sampled more sites in the segments more proximate to the proposed dam. In particular, we selected all sites with permanent water in the two mainstem river segments nearest the proposed dam and about 50% of the sites available in the mainstem segment that was the third nearest the dam to be surveyed each year. In the remaining seven segments further downstream, we selected 20% of sites in proportion to the numbers available for survey each year. We originally projected that 45% of available sites would be sampled over the two years of study. Beyond the emphasis on more sampling nearer the dam, we randomized site selection within each segment. We did this with the realization that it was unrealistic to expect to obtain permission for access from every landowner; the randomization allowed us to be able to select the next site(s) in the randomized sequence within any particular segment if selected permissions for access were refused. This enabled us to reach our target numbers.

Table 1. Site Numbers Summary by Chehalis Mainstem River Segment for Sites Sampled During the Off-Channel Extensive Sampling. The “Available” column is the numbers of sites obtained from the original GIS exercise after screening; the “2-year Target” column is the number of sites that should be sampled over two study years; the “2015 Target” column is the number of sites that should be sampled in 2015; and the “Completed in 2015” column is the number of sites sampled in 2015.

River Segment		Available	Targets		Completed in 2015
			2015-17	2015	
1	Hwy 101 Bridge to Wynoochee River	10	4	2	3
2	Wynoochee River to Satsop River	19	8	4	4
3	Satsop River to Porter Creek	46	18	9	12
4	Porter Creek to Black River	37	14	7	13
5	Black River to Scatter Creek	8	4	2	3
6	Scatter Creek to Skookumchuck River	21	8	4	10
7	Skookumchuck River to Newaukum River	14	6	3	9
8	Newaukum River to South Fork Chehalis River	7	7	4	3
9	South Fork Chehalis to Elk Creek	3	3	3	2
10	Elk Creek to Proposed Dam	2	2	2	2
Totals		164	74	40	61

Sampling

We conducted all surveys with at least four people over a two-day interval at each site. Surveys involve up to 10 evenly spaced vegetation transects (spacing was a minimum of least 5 m apart), at which vegetation composition, percent cover, water temperatures, deepest depth, visibility, wetted widths and distance between transects were recorded. At smaller sites where the minimum 5 m spacing criterion between transects could not be met, we placed a variable number of transects down to a minimum of five. Biotic surveys involve dipnet surveys (25 dipnet samples per site), minnow traps (3 traps placed per transect) and up to 4 fyke nets (2 fish and 2 turtle) per site (we always placed a minimum of 1 fish and 1 turtle net). All traps were placed on a first sampling day, left in an overnight set, and retrieved the next day and captured animals processed and released. Up to 10 animals of any one species caught in any particular trap were identified, photographed and/or measured, and their location and capture method recorded. If over 10 animals of a species were caught in one trap or dip, a representative species photo and count was obtained. Other relevant data, such as sign of American beaver or predatory bird or mammal activity were recorded.

Results

We surveyed 61 distinct off-channel habitats over the length of the floodplain for their aquatic-associated vertebrate species over the interval 5 May to 25 September 2015. That effort resulted our surveying two to 13 different sites in each of the 10 river segments (see Completed column in **Table 1**). We equaled or exceeded our 2015 target numbers for all river segments during the 2015 season.

We recorded four of the nine ASRP non-salmonid target species across the 61 off-channel habitats sampled: American beaver, Northern red-legged frog, Olympic mudminnow, and Western toad. At least one of these four ASRP non-salmonid target species was detected at 62% (38 of 61) these off-channel habitats (**Table 2**). The two other ASRP non-salmonid target species that could potentially be found in floodplain off-channel habitats, Oregon spotted frog and Western pond turtle, were not detected.

None of the four ASRP non-salmonid target species were recorded at more than half of the extensive survey sites. Northern red-legged frogs were the most frequently detected ASRP target species (**Table 2**). They were found in every floodplain segment, and recorded at 41% of sites (25 of 61). On average, Northern red-legged frogs were detected at 49% of sites per segment (range: 22-100%), and were found at fewer than 40% of sites in floodplain segments below the Black River and at 100% of sites within a segment in the two upstream-most river segments in the floodplain (**b**).

American beaver was the second most frequently detected ASRP target species (**Table 2**). We recorded American beaver or their sign in off-channel habitats in river segments between the Wynoochee and Newaukum Rivers, and found them at 36% of sites (22 of 61). On average, American beaver or their sign were detected at 43% of sites in the segments between those two rivers (range: 33-50%).

Olympic mudminnow was the third most frequently detected ASRP target species (**Table 2**). We recorded Olympic mudminnow in off-channel habitats in river segments below the Skookumchuck River (**Table 2**), and found them at 23% of sites (14 of 61).

On average, Olympic mudminnow were detected at 34% of sites in the segments where it was found (range: 33-50%).

Western toad was the least frequently detected ASRP target species (**Table 2**). The sole records of Western toad were two post-metamorphic juveniles each found adjacent to two off-channel habitats near the Satsop River's entry to the Chehalis River floodplain.

Besides the four ASRP non-salmonid target species found, we recorded five other stillwater-breeding amphibian species (**Table 2**) and at least 19 other fish species (**Tables 3 and 4**) during the extensive surveys in floodplain off-channels habitats.

Of the entire assemblage of remaining aquatic species, the exotic species, American bullfrog (*Lithobates catesbeianus*) appeared to be by far the most widespread. American bullfrogs were recorded at 82% (50 of 61) of sites sampled during extensive sampling. Despite this high frequency, American bullfrogs were not recorded at any of the four off-channel habitats in river segments located above the South Fork Chehalis River and at fewer than 50% of the seven off-channels habitats sampled below the Satsop River (**Table 2**). However, in the floodplain between the Satsop and the South Fork Chehalis River, American bullfrogs occurred on average at 94% of off-channels habitats (range: 83-100%).

The remaining four amphibian species were all recorded at <35% of off-channel habitats during the extensive surveys (**Table 2**). The Northwestern salamander (*Ambystoma gracile*) was the most frequently recorded (34%: 21 of 61), followed by the Rough-skinned Newt (*Taricha granulosa*: 31%: 19 of 61), the Pacific Treefrog (*Pseudacris regilla*: 25%: 15 of 61), and the Long-toed Salamander (*Ambystoma macrodactylum*: 2%: 1 of 61).

Table 2. Species Detection of ASRP Target Species and Non-ASRP Target Amphibians based on Numbers of Sites per Segment during Extensive Off-Channel Surveys, May-September 2015. River segments are displayed in an upstream sequence. Detection data on fishes other than Olympic mudminnow are in Tables 3 and 4. The totals in the columns labeled “Totals Sites with ASRP Targets” and “Total Sites with Amphibians” do not equal the sums of their dependent columns because more than one species often occurred at different sites.

River Segment		Sites	ASRP Target Species					Non-ASRP Target Amphibians					Total Sites with Amphibians
			American beaver	Northern red-legged frog	Olympic mudminnow	Western Toad	Total Sites	Northwestern salamander	Long-toed salamander	Pacific treefrog	Rough-skinned newt	American Bullfrog	
1	Hyw 101 Bridge to Wynoochee River	3	0	1	1	0	1	2	0	2	2	2	2
2	Wynoochee River to Satsop River	4	2	1	1	0	3	1	0	2	2	1	4
3	Satsop River to Porter Creek	1 2	6	4	4	2 *	8	2	0	3	5	10	1 0
4	Porter Creek to Black River	1 3	5	5	3	0	4	4	1	4	2	13	1 3
5	Black River to Scatter Creek	3	1	2	2	0	3	1	0	1	2	3	3
6	Scatter Creek to Skookumchuck River	1 0	4	5	3	0	8	7	0	3	4	10	1 0
7	Skookumchuck River to Newaukum River	9	4	2	0	0	6	5	0	2	0	8	9
8	Newaukum River to South Fork Chehalis River	3	0	1	0	0	1	2	0	2	0	3	3
9	South Fork Chehalis to Elk Creek	2	0	2	0	0	2	2	0	1	2	0	2
10	Elk Creek to Proposed Dam	2	0	2	0	0	2	2	0	1	2	0	2
Totals		6 1	2 2	2 5	1 4	2	3 8	21	1	15	19	50	5 9

*One juvenile each was found near the margin of two adjacent sites on the Satsop River entry to the Chehalis floodplain; both individuals are likely to have originated from a known breeding site on the instream Satsop River that appears when the hydrograph drops.

Besides Olympic mudminnow, the native fish assemblage included at least nine native (**Table 3**). Of the native species, sculpins (number of species represented unclear) and Three-spined sticklebacks (*Gasterosteus aculeatus*) were the only species recorded at more than 50% of the sites and in all floodplain river segments except the uppermost one (**Table 4**). Northern Pikeminnow (*Ptychocheilus oregonensis*) was the only other native species recorded over at least a quarter of off-channel habitats sampled (26%: 16 of 61). The remaining five native species were all recorded at $\leq 11\%$ (7 or fewer) sites with the two salmonids, Coho salmon (*Oncorhynchus kisutch*) and Steelhead (*Oncorhynchus mykiss*) being each recorded at only one site.

The non-native fish assemblage approximated the native assemblage in richness, with at no fewer than 10 species represented (**Table 4**). None of the non-native fishes were recorded at as many sites as American bullfrogs, but Largemouth Bass (*Micropterus salmoides*) and sunfishes (number of species represented unclear) were both recorded close to 50% of the sites sampled. Seven additional non-native fishes, namely Black bullhead (*Ameiurus melas*), Brown bullhead (*Ameiurus nebulosus*), Black Crappie (*Pomoxis nigromaculatus*), Bluegill (*Lepomis macrochirus*),

Table 3. Detection of Native Fish Species based on Numbers of Sites per Segment during Extensive Off-Channel Surveys, February-May 2015. River segments are displayed in an upstream sequence. Olympic Mudminnow data are provided in **Table 2** and Non-native fish species detection data are provided in **Table 4**. Unidentified lamprey and sculpin detections may represent more than one species; fin clips from unidentified sculpin detections are currently being processed to determine species identities. The “Total Sites with Native Fishes” column includes Olympic mudminnow (data from **Table 2**) and the totals do not equal the sum of their dependent columns because more than one species often occurred at different sites.

River Segment		Sites	Coho Salmon	Largescale Sucker	Northern Pikeminnow	Redside Shiner	Speckled Dace	Steelhead	Three-spined Stickleback	Unidentified Lamprey	Unidentified Sculpin	Total Sites with Native Fishes
1	Hyw 101 Bridge to Wynoochee River	3	0	0	0	0	0	0	2	1	1	3
2	Wynoochee River to Satsop River	4	0	2	1	0	3	0	4	1	3	4
3	Satsop River to Porter Creek	12	0	0	5	0	1	1	6	0	9	9
4	Porter Creek to Black River	13	1*	2	5	1	2	0	6	1	10	11
5	Black River to Scatter Creek	3	0	0	1	1	0	0	2	0	2	3
6	Scatter Creek to Skookumchuck River	10	0	2	3	1	0	0	8	1	3	10
7	Skookumchuck River to Newaukum River	9	0	0	0	0	1	0	1	0	3	5

River Segment		Sites	Coho Salmon	Largescale Sucker	Northern Pikeminnow	Redside Shiner	Speckled Dace	Steelhead	Three-spined Stickleback	Unidentified Lamprey	Unidentified Sculpin	Total Sites with Native Fishes
8	Newaukum River to South Fork Chehalis River	3	0	0	1	1	0	0	1	0	1	3
9	South Fork Chehalis to Elk Creek	2	0	1	0	1	0	0	1	0	2	2
10	Elk Creek to Proposed Dam	2	0	0	0	0	0	0	0	0	0	0
Totals		61	1	7	16	5	7	1	31	3	34	50

*Based on the single record of a dead juvenile.

Table 4. Detection of Non-Native Fish Species based on Numbers of Sites per Segment during Extensive Off-Channel Surveys, May-September 2015. River segments are displayed in an upstream sequence. Olympic Mudminnow data are provided in **Table 2** and Native fish species data are provided in **Table 3**. Unidentified sunfish detections may represent more than one species; fin clips from unidentified sunfish detections are currently being processed to determine species identities.

River Segment		Sites	Black Bullhead	Black Crappie	Bluegill	Brown Bullhead	Common Carp	Large-mouthed Bass	Pumpkinseed	Rock Bass	Small-mouth Bass	Yellow Perch	Unidentified Bullhead	Unidentified Sunfish	Total Sites with Non-native Fishes
1	Hyw 101 Bridge to Wynoochee River	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Wynoochee River to Satsop River	4	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Satsop River to Porter Creek	12	2	1	5	2	0	7	3	5	0	1	1	9	11
4	Porter Creek to Black River	13	2	6	5	9	3	9	4	3	1	4	0	10	12
5	Black River to Scatter Creek	3	0	1	1	0	0	2	1	2	0	0	1	1	2

River Segment		Sites	Black Bullhead	Black Crappie	Bluegill	Brown Bullhead	Common Carp	Large-mouthed Bass	Pumpkinseed	Rock Bass	Small-mouth Bass	Yellow Perch	Unidentified Bullhead	Unidentified Sunfish	Total Sites with Non-native Fishes
6	Scatter Creek to Skookumchuck River	10	2	2	1	2	0	3	2	2	0	1	2	4	7
7	Skookumchuck River to Newaukum River	9	3	1	4	6	0	4	3	0	0	1	1	7	7
8	Newaukum River to South Fork Chehalis River	3	0	0	1	1	0	2	2	1	0	1	2	1	3
9	South Fork Chehalis to Elk Creek	2	0	0	1	0	0	0	0	1	0	0	0	0	2
10	Elk Creek to Proposed Dam	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		61	9	11	18	20	3	27	15	14	1	7	7	32	44

Pumpkinseed (*Lepomis gibbosus*), Rock Bass (*Ambloplites rupestris*) and Yellow Perch (*Perca flavescens*) were recorded over at least 10% (≥ 7) of sites. Two species, Common Carp (*Cyprinus carpio*) and Smallmouth Bass (*Micropterus dolomieu*), were both recorded at few (≤ 3) sites. Notably, we recorded no non-native fishes in both the seven off-channel sites sampled in the lowermost two segments of the floodplain, and in the two sites sampled in the uppermost river segment of the floodplain (**Table 4**). Additionally, we recorded the greatest non-native fish species richness in the floodplain river segment between Porter Creek and the Black River (segment 4), where we found all 10 non-native fishes recorded in the floodplain. Overall, we recorded at least one non-native fish species in off-channel habitats at 72% (44 of 61) of sites. In contrast, we recorded at least one native fish species at 82% (50 of 61) of sites.

Discussion

The 2015 egg mass surveys represent about half of the planned effort for this particular study in the Chehalis floodplain, so patterns we describe from these surveys must be viewed as preliminary. Assessment to date is based on naïve occupancy patterns, the dataset is not quite large enough to integrate into modeling efforts, and selected statistical analysis await the larger dataset. Nonetheless, patterns that appear to be emerging are:

- 1) Off-channel habitats in the Chehalis floodplain are relatively species rich in amphibians and fishes. A large part of that species richness is contributed by the entire suite of native stillwater-breeding amphibians and fishes (e.g., Olympic mudminnow) that do not use (or actually avoid) flowing-water habitats for breeding and rearing.
- 2) Many off-channel habitats in the Chehalis floodplain are also rich in exotic aquatic vertebrates, namely the American bullfrog and a large suite of warmwater fishes. A suite of centrarchid fishes (namely Black Crappie, Bluegill, Largemouth Bass, and Pumpkinseed), bullhead catfishes (Black and Brown Bullheads), and Yellow Perch dominate the exotic fish assemblage. The American bullfrog seems much more widespread than the exotic fishes. Despite the widespread nature of the exotic assemblage, that assemblage seems less frequent or absent at the tails of the floodplain.
- 3) The extensive survey effort emphasizes the importance of a trapping effort to highlight the fish species assemblage. Most fishes recorded in both the egg mass surveys and the extensive surveys at the 11 sites at which both types of surveys were applied reveals that the assemblage of fast-swimming fish species, which includes the exotic centrarchids, were sampled three to six times as effectively by trapping versus the dipnetting applied during egg mass surveys. Conversely, this comparison highlights the effectiveness of the egg mass surveys for sampling amphibians. The exceptions to this pattern are Olympic mudminnow and Three-spined stickleback, which seemed effectively sampled by both methods, though dipnet sampling may have been somewhat more effective.
- 4) Our inability to detect Western Toad in Chehalis mainstem floodplain off-channel habitats during the extensive surveys reinforced the same unexpected result we obtained in the egg mass surveys. Western toads are well known to favor stillwater habitats for breeding (Jones et al. 2005), so this pattern suggests that in their current state, floodplain off-channel habitats are somehow unsuitable for Western Toad. Unsuitability could be related to lack of breeding habitat (western toads deposit eggs in unvegetated shallow water), exotics that potentially disfavoring toad presence (difficult to understand since toad larvae [tadpoles] have skin toxins from which they derive protection from most aquatic predators), or another unidentified factor or combination of factors. The remaining years of both extensive and egg mass survey efforts in off-channel habitats will enable identifying whether lack of Western toads in off-channel habitats is a real pattern, and if it is, analysis of off-channel habitat co-variables may suggest the basis of unsuitability. Lastly, given our frequent encounters of breeding Western Toad in the Chehalis mainstem after the water levels dropped seasonally in both 2014 and 2015 using VES/dipnet sampling, our finding of the lack of Western toads in floodplain off-channel habitats is unlikely to result from a sampling issue.
- 5) The extensive surveys generally reinforced the pattern obtained in the egg mass surveys of Olympic mudminnow and American beaver being recorded more frequently in the lower Chehalis River below Scatter Creek. This may reflect the greater extent of off-channel habitat in the lower river. We caution, however, that

both the fish-focused trapping effort for the extensive surveys and our diurnal VES/dipnet sampling system was not designed to detect typically nocturnal beaver and we expect to integrate several other datasets to develop a more complete picture of beaver distribution in the floodplain.

- 6) The extensive trapping effort may indeed be less effective for the native amphibian species assemblage, but this is confounded with the fact the most of the native amphibian species we recorded exit their stillwater breeding habitat for adjacent uplands during the non-breeding active season.
- 7) The Rough-skinned newt was the only native amphibian species seemingly recorded in roughly similar frequencies by both the egg mass and extensive surveys.
- 8) No living juvenile salmonids were recorded during the late spring-summer extensive effort in off-channel habitat. This was expected because juvenile salmonids typically egress from off-channel habitats before the late spring-summer interval, probably because of the thermal risk associated with those habitats. We found one dead juvenile Coho in an off-channel habitat that likely remains linked to the mainstem longer in years less droughty than 2015. Temperatures in that habitat at the time of the find were $\geq 22^{\circ}\text{C}$, which would be potentially lethal. A handful of live juvenile Coho and Chinook salmon were recorded during dipnet sampling during the egg mass surveys, which occurred over the time interval when one would expect juvenile salmonids in off-channel habitat. We did not capture many juvenile salmonids during the dipnet sampling perhaps because in contrast to Olympic mudminnow and Three-spined stickleback, they are faster-swimming species. Though this notion may be confounded with the fact that there may have been few juvenile salmonids because of drought year conditions, we intend to address some of this potential bias by adding backpack electroshocking sampling to the egg mass survey effort in 2016 and 2017.
- 9) Our failure to record both the Oregon spotted frog and Western pond turtle during the extensive survey effort reinforced the same pattern obtained during the egg mass surveys. However, we did observe two Red-eared sliders (*Trachemys scripta*), an exotic species, at one off-channel location, Bowers Lake, located within the Satsop River to Porter Creek segment.

We should also note that genetic verification of species identities for the sculpins and sunfishes will likely change the picture of the fish species assemblage as well as selected analyses. Genetic verification is currently underway.

Literature Cited

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