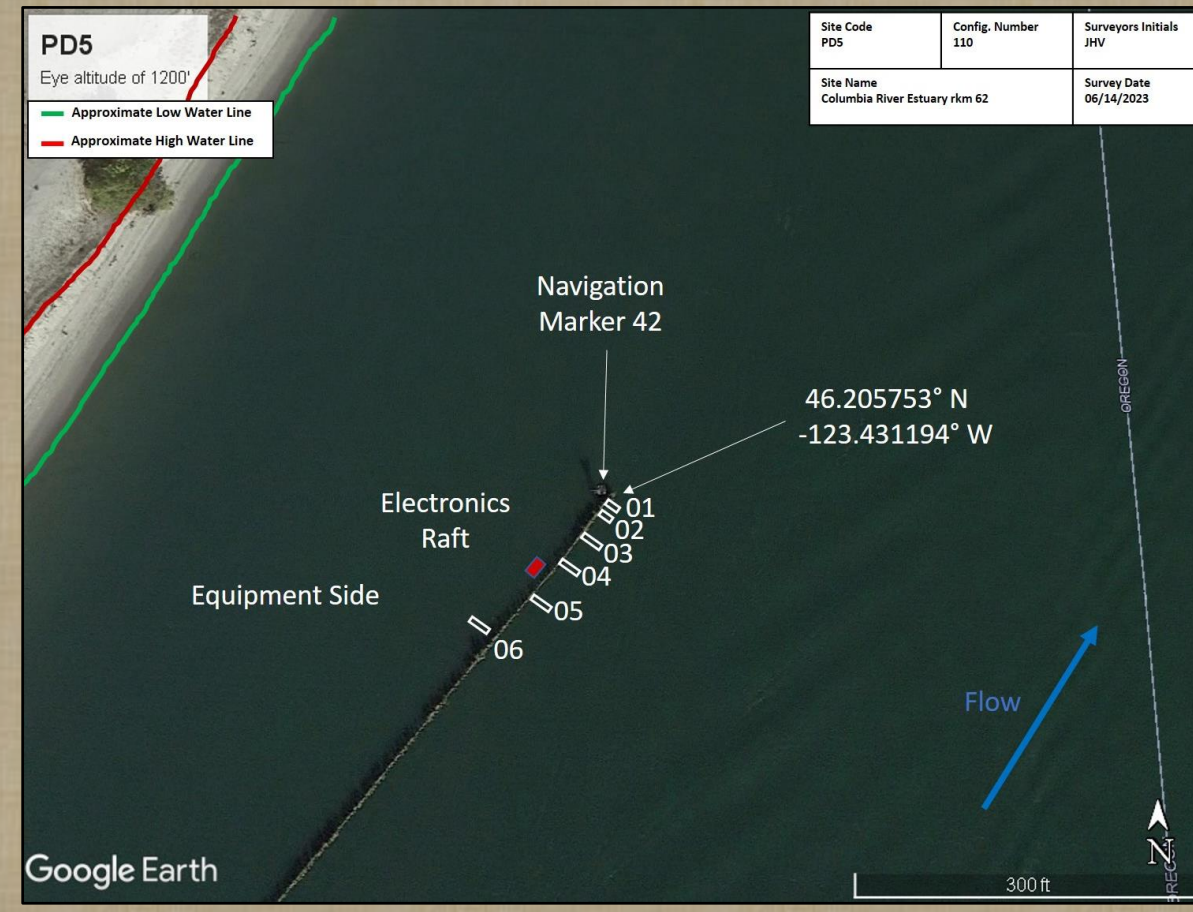


Pile Dike PIT Interrogation in the Columbia River Estuary, 2023

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PD5 (Training Dike)



Species Composition

Species (Run)	Total
Chinook (Spring)	1,729
(Summer)	812
(Fall)	1,322
(Unknown)	114
Coho	757
Cutthroat Trout	31
Sockeye (Summer)	108
(Unknown)	9
Steelhead (Summer)	2,197
(Winter)	47
(Unknown)	109
N Pikeminnow	2
Sturgeon, Green	0
Sturgeon, White	53
Unknown	172
Total:	7,462

Unique Detections by Antenna

	Antenna Number							Total
	01	02	03	04	05	06	07	
PD5								
Total Tags Detected	945	388	1,773	630	3,350	214	162	7,462
Tags Later Detected on Another Antenna	18	32	303	217	783	80	96	1,529
'True' Unique Tags	927	356	1,470	413	2,567	134	66	5,933
'True' Unique (%)	98.1	91.8	82.9	65.6	76.6	62.6	40.7	79.5

In 2011, we began developing methods to install PIT tag antennas on flow control structures- pile dikes- in the Columbia River estuary to target detections of adult salmonids. Acoustic camera surveys showed more adult activity on the downstream side of pile dikes, guiding our initial antenna placement.

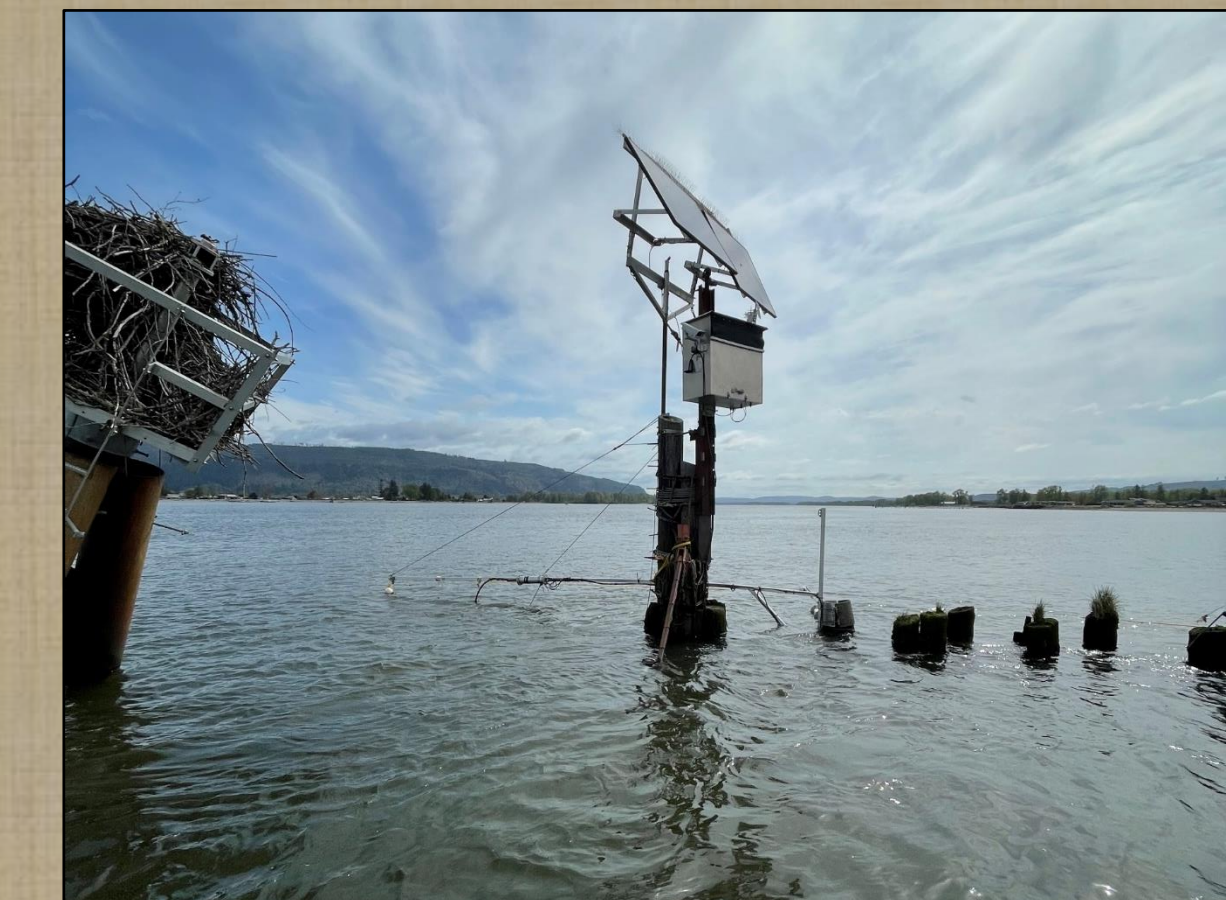
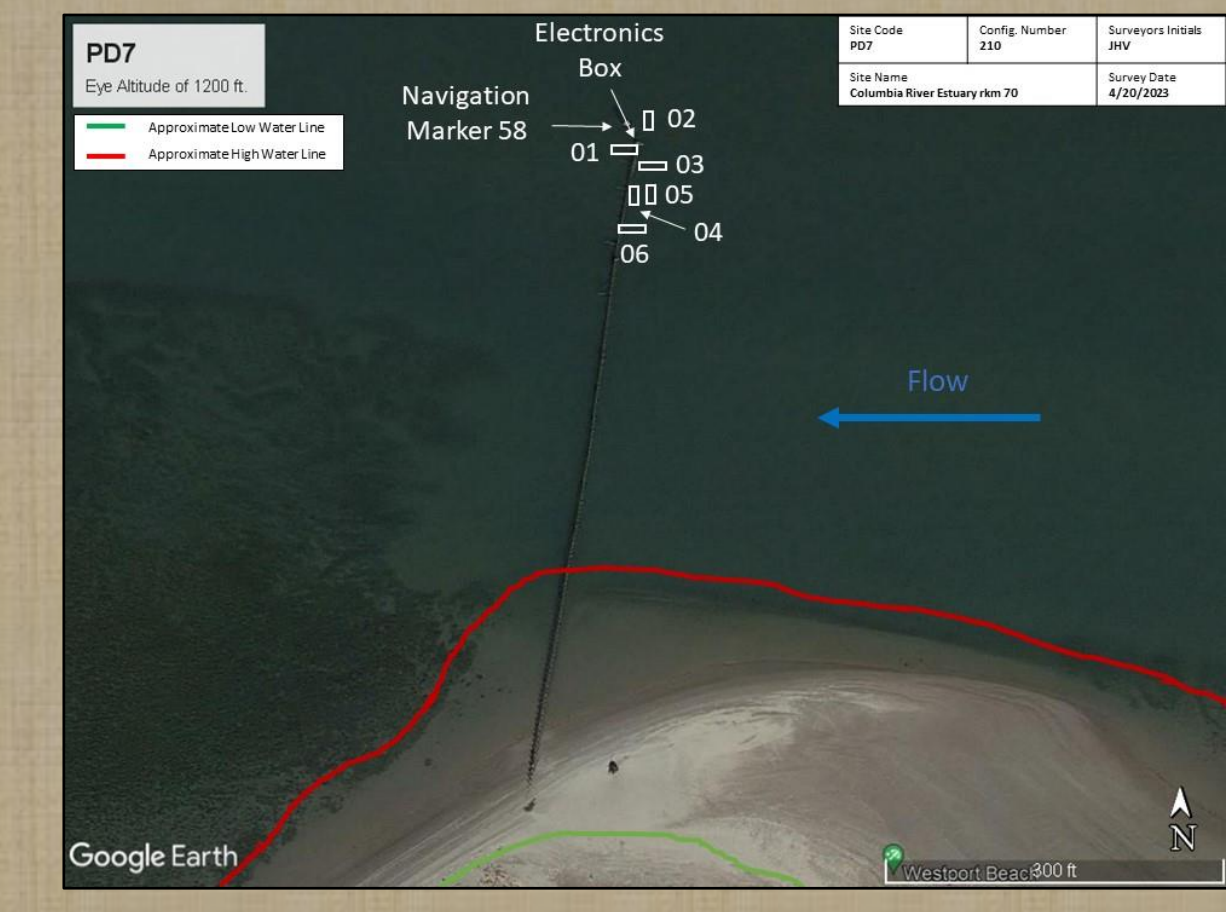
The stationary interrogation concept was first developed on a spur dike (oriented 90 degrees to flow) near RKM 70 on a site labeled "PD7" in PTAGIS. Continued development through the 2010's saw various iterations of antenna construction and placement to improve detection efficiency of PIT-tagged fishes along the dike. Since the initial phases of the project, changes in management objectives in the basin and water management of spill programs highlighted the importance of juvenile salmonid detection in the estuary to complete Federal Columbia River Power System reach survival estimates.

Beginning in 2022, we expanded this concept to a site across the river from PD7 on a training dike (~45 degrees to flow) to take advantage of the streamlined flow created by the structure. We placed antennas along the upstream side at the lower terminal end of the dike to target detections of juvenile salmonids. This site, PD6, detected 3,076 fish in its first year of operation, with juvenile salmonids comprising 96% of detections. In contrast, the estuary PIT trawl, which is the primary source of juvenile detections in the estuary, detected 9,662 juvenile fish during the same period.

Based on 2022 results, we further expanded pile dike detection in the estuary to encompass two new training dikes in 2023. PD5 was 8 km downstream of PD7 and adjacent to the thalweg. PD8 was 12 km upstream of PD7 and constructed on a training dike where the thalweg was closer to the opposing shore. All four sites were autonomous and included a solar array, charge controller, and batteries, cellular communication, a PIT transceiver, and at least four antennas placed on the upstream side of the dike. Since each location presented unique challenges based on river location, flow, debris loading, and distance from vessel moorage, individual sites were uniquely constructed based on the needs of each location.

In 2023, PD5 detected 7,462 fish of varying species, runs, and life stages, PD6 6,735, PD7 820, and PD8 725. After accounting for duplicate detections between pile dike sites, this interrogation method detected 15,549 unique fish. During the juvenile salmonid outmigration season (1 April to 15 June), it detected 12,228 fish compared to the PIT Trawl's 9,485 fish. We will continue our expansion in 2024, taking lessons learned from each site to further increase estuary detection and contribute to hydrosystem survival estimates and other studies that include the species and life stages detected by the pile dike arrays.

PD7 (Spur Dike)



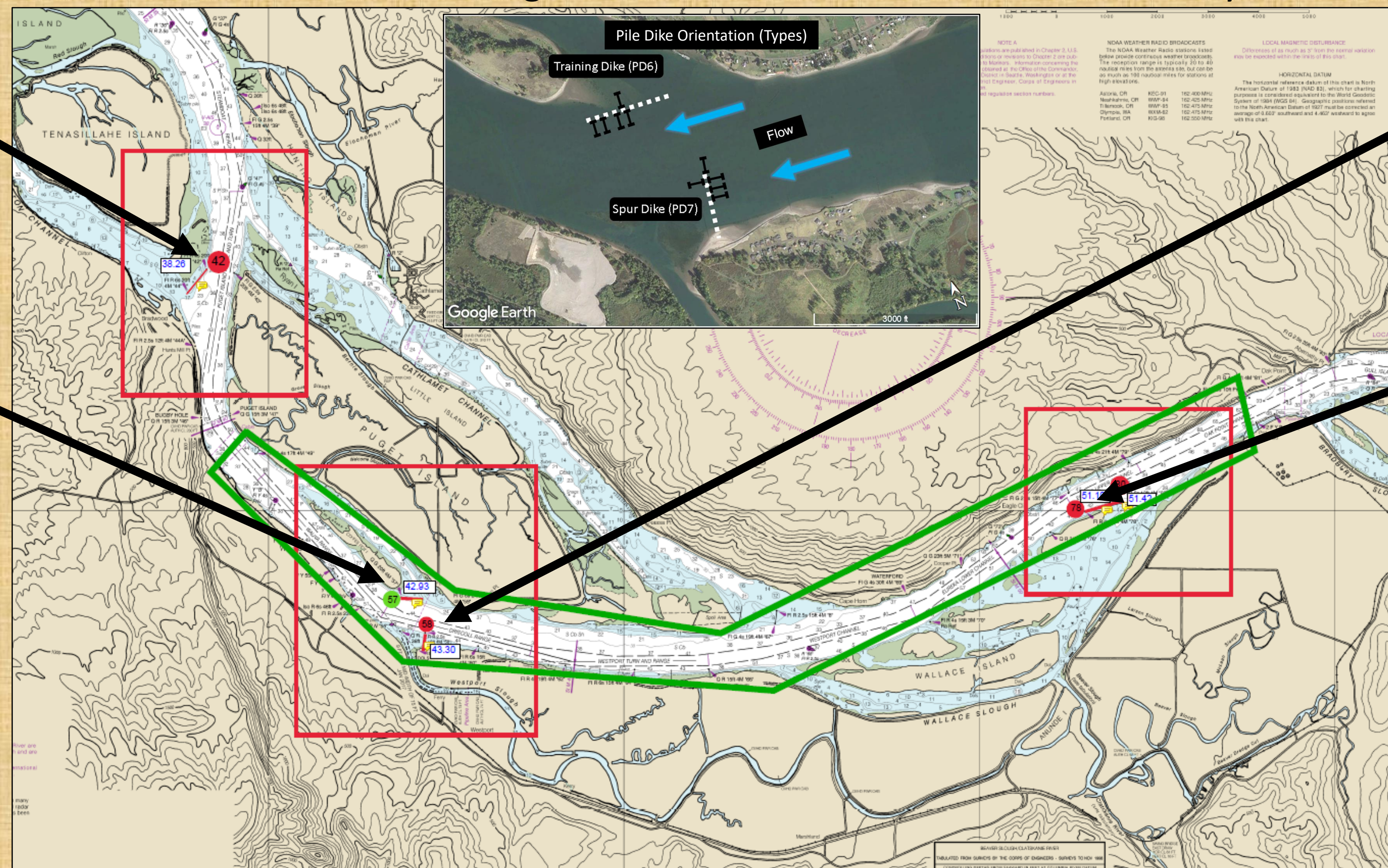
Species Composition

Species (Run)	Total
Chinook (Spring)	222
(Summer)	103
(Fall)	221
(Unknown)	10
Coho	70
Cutthroat Trout	3
Sockeye (Summer)	12
(Unknown)	6
Steelhead (Summer)	86
(Winter)	5
(Unknown)	5
N Pikeminnow	0
Sturgeon, Green	0
Sturgeon, White	45
Unknown	32
Total:	820

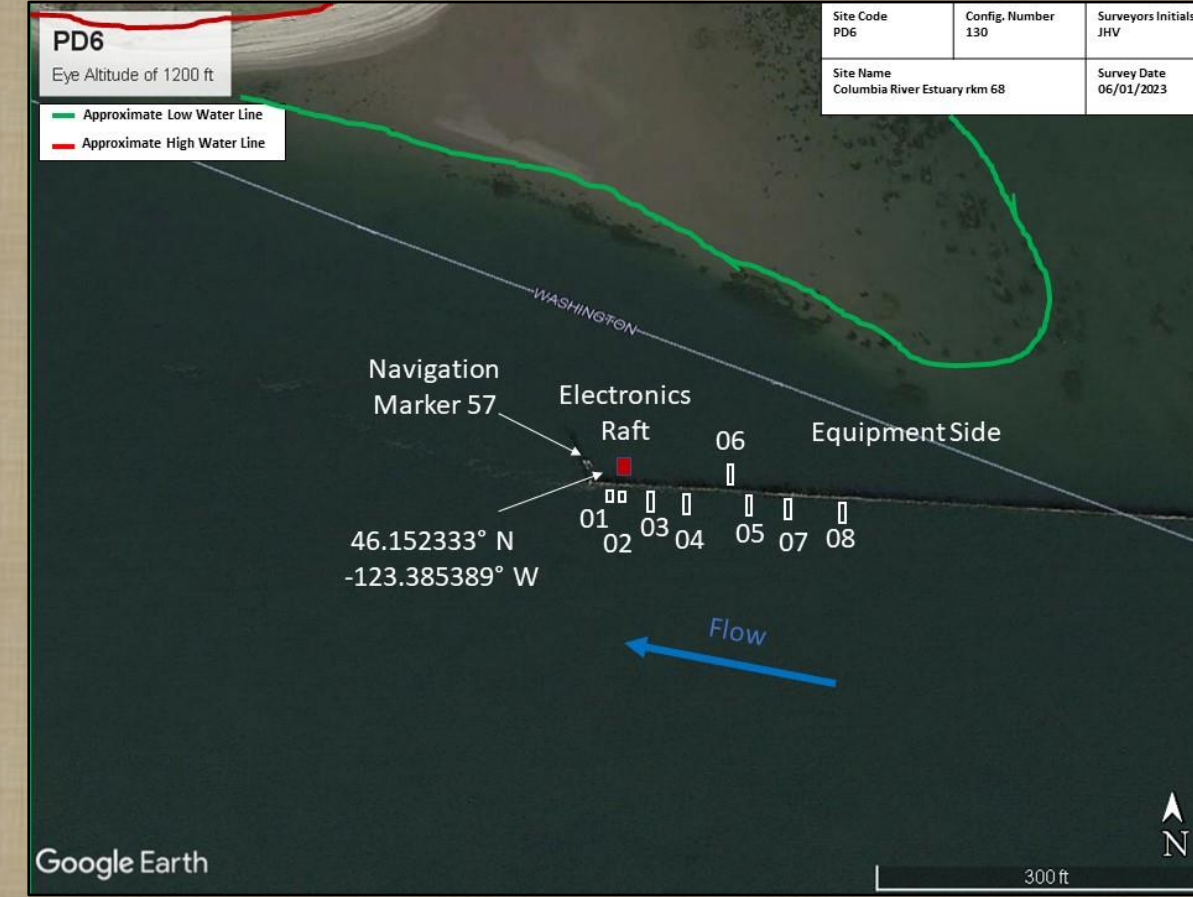
Unique Detections by Antenna

	Antenna Number							Total
	01	02	03	04	05	06	07	
PD7								
Total Tags Detected	103	125	208	93	134	154	3	820
Tags Later Detected on Another Antenna	33	10	70	53	59	78	1	304
'True' Unique Tags	70	115	138	40	75	76	2	516
'True' Unique (%)	68.0	92.0	66.3	43.0	56.0	49.4	66.7	62.9

Pile Dike PIT Interrogation Sites in the Columbia River Estuary



PD6 (Training Dike)



Species Composition

Species (Run)	Total
Chinook (Spring)	2,738
(Summer)	709
(Fall)	879
(Unknown)	151
Coho	294
Cutthroat Trout	8
Sockeye (Summer)	93
(Unknown)	12
Steelhead (Summer)	1,618
(Winter)	23
(Unknown)	42
N Pikeminnow	0
Sturgeon, Green	1
Sturgeon, White	9
Unknown	158
Total:	6,735

Unique Detections by Antenna

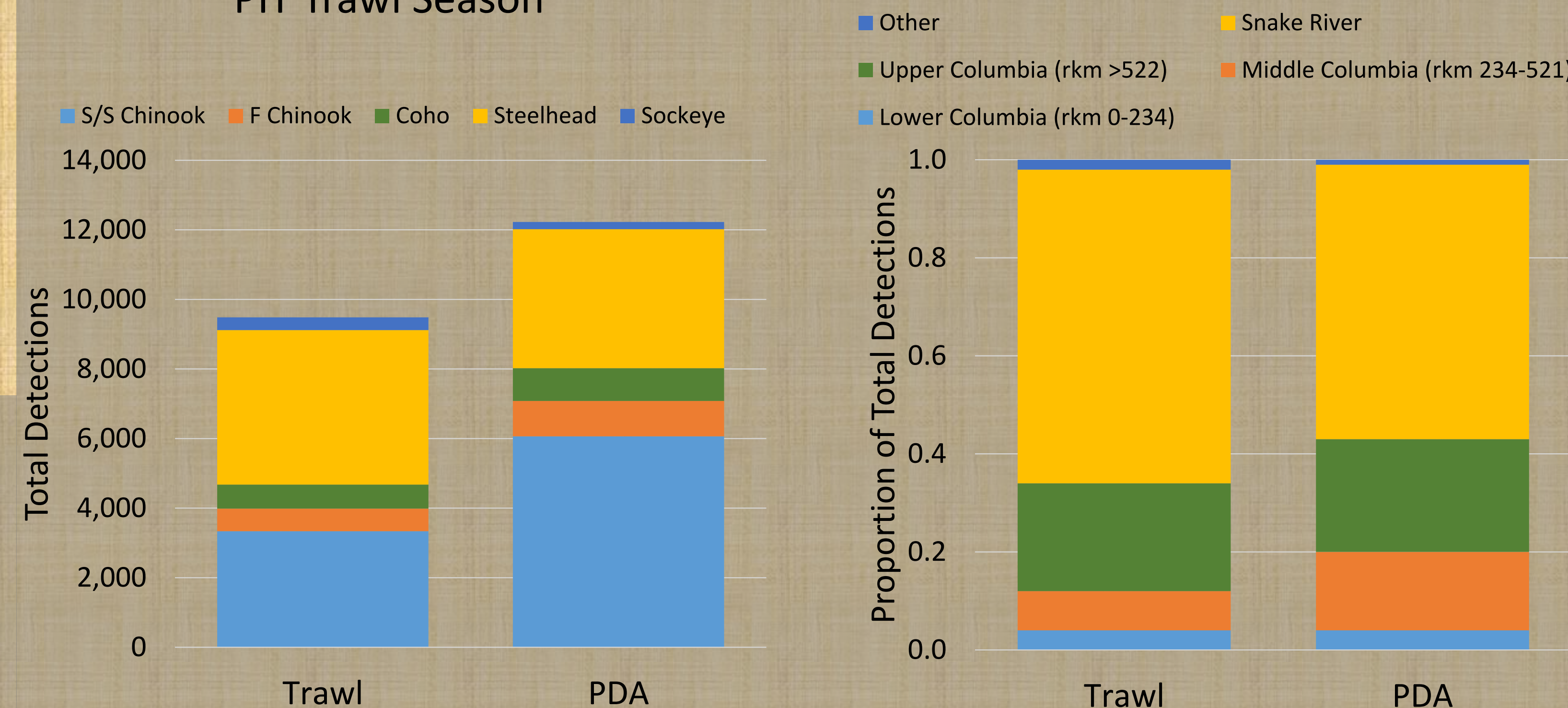
	Antenna Number								Total
	01	02	03	04	05	06	07	08	
PD6									
Total Tags Detected	904	897	363	2,040	2,279	115	37	100	6,735
Tags Later Detected on Another Antenna	3	53	86	658	980	16	17	40	1,853
'True' Unique Tags	901	844	277	1,382	1,299	99	20	60	4,882
'True' Unique (%)	99.7	94.1	76.3	67.7	57.0	86.1	54.1	60.0	72.5

Unique Detections by Site

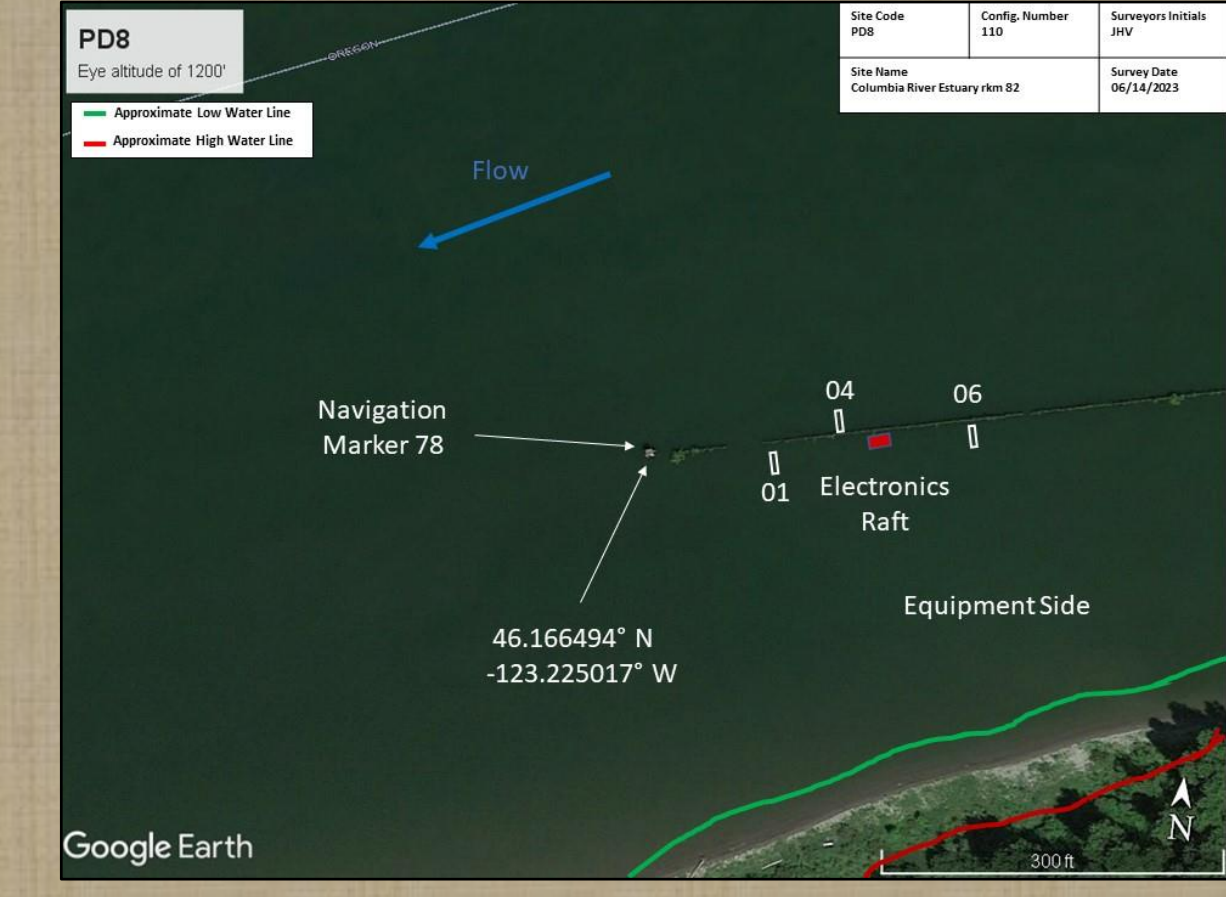
	PD5	PD6	PD7	PD8	Total
All Sites					
Total Tags Detected	7,462	6,735	820	725	15,742
Tags Later Detected on Another Site	135	19	31	8	193
'True' Unique Tags	7,327	6,716	789	717	15,549
'True' Unique (%)	98.2	99.7	96.2	98.9	98.8

All Sites Combined

Juveniles Detected During PIT Trawl Season



PD8 (Training Dike)



Species Composition

Species (Run)	Total
Chinook (Spring)	328
(Summer)	55
(Fall)	108
(Unknown)	12
Coho	43
Cutthroat Trout	2
Sockeye (Summer)	2
(Unknown)	2
Steelhead (Summer)	112
(Winter)	8
(Unknown)	6
N Pikeminnow	5
Sturgeon, Green	0
Sturgeon, White	14
Unknown	28
Total:	725

Unique Detections by Antenna

	Antenna Number					Total
	01	03	04	05	06	
PD8						
Total Tags Detected	51	134	241	154	145	725
Tags Later Detected on Another Antenna	10	0	42	38	15	105
'True' Unique Tags	41	134	199	116	130	620
'True' Unique (%)	80.4	100.0	82.6	75.3	89.7	85.5

Conclusions from 2023:

- More estuary detections from pile dike sites than the PIT Trawl for Chinook and coho, steelhead comparable.
- Pile Dike sites detect fish from around the Columbia River Basin.
- Each antenna and site detects unique fish.
- Expanding these systems to further increase estuary detection is feasible and planned for 2024.