

Fish Habitat Use and Insights from a Paired Sampling Strategy at Sears Point Tidal Wetland Restoration Project

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Introduction

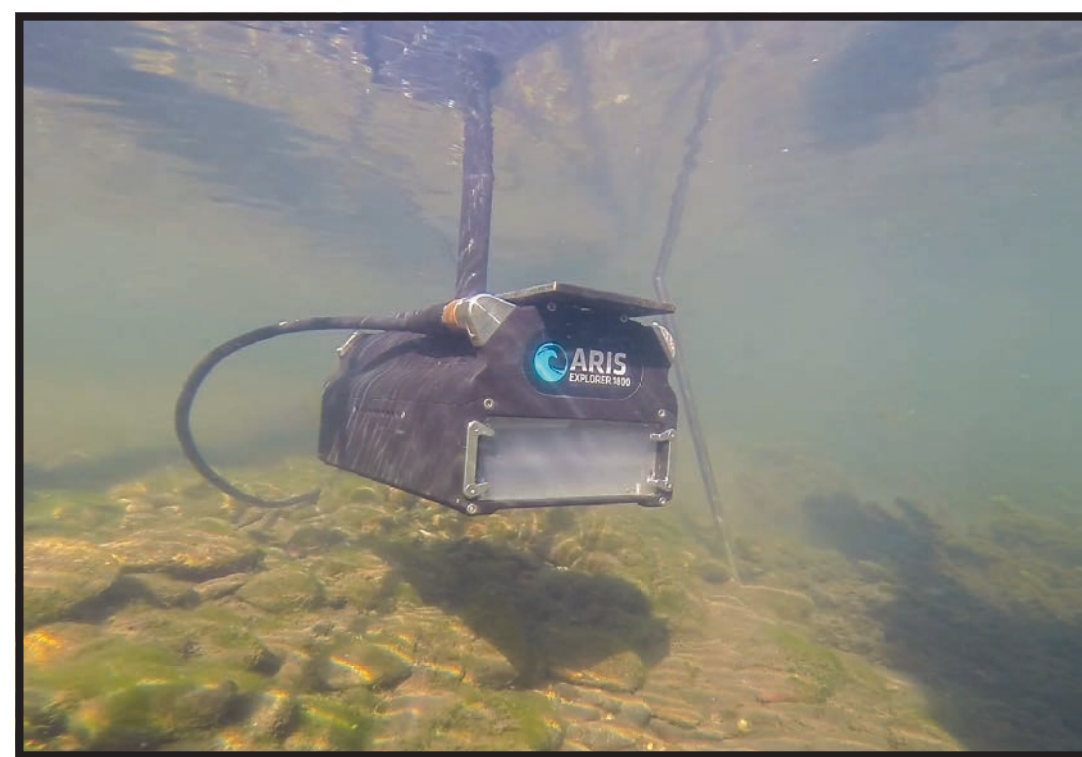


The Sears Point Wetland Restoration Project is a 1,000-acre tidal marsh basin that was breached in 2015, restoring critical habitat for endangered and native fish species. The project design incorporated several novel features (e.g., marsh mounds, root wads, submerged vegetation) in order to provide specific habitats and decrease restoration time. In an effort to improve the understanding of fish habitat use at the newly restored tidal marsh, an Adaptive Resolution Imaging Sonar (ARIS) camera was paired with traditional sampling methods to examine the fish community at the Sears Point Restoration Area.

Objectives

The project's three main objectives are to:

- 1) Use ARIS technology in combination with traditional netting techniques to perform transect surveys and determine fish use of several engineered habitat types;
- 2) Identify species using the habitats; and
- 3) Interpret fish survey data from other restored wetland habitat restoration projects in the San Francisco Estuary and compare with the current project fish survey results using bio-statistical methodology.



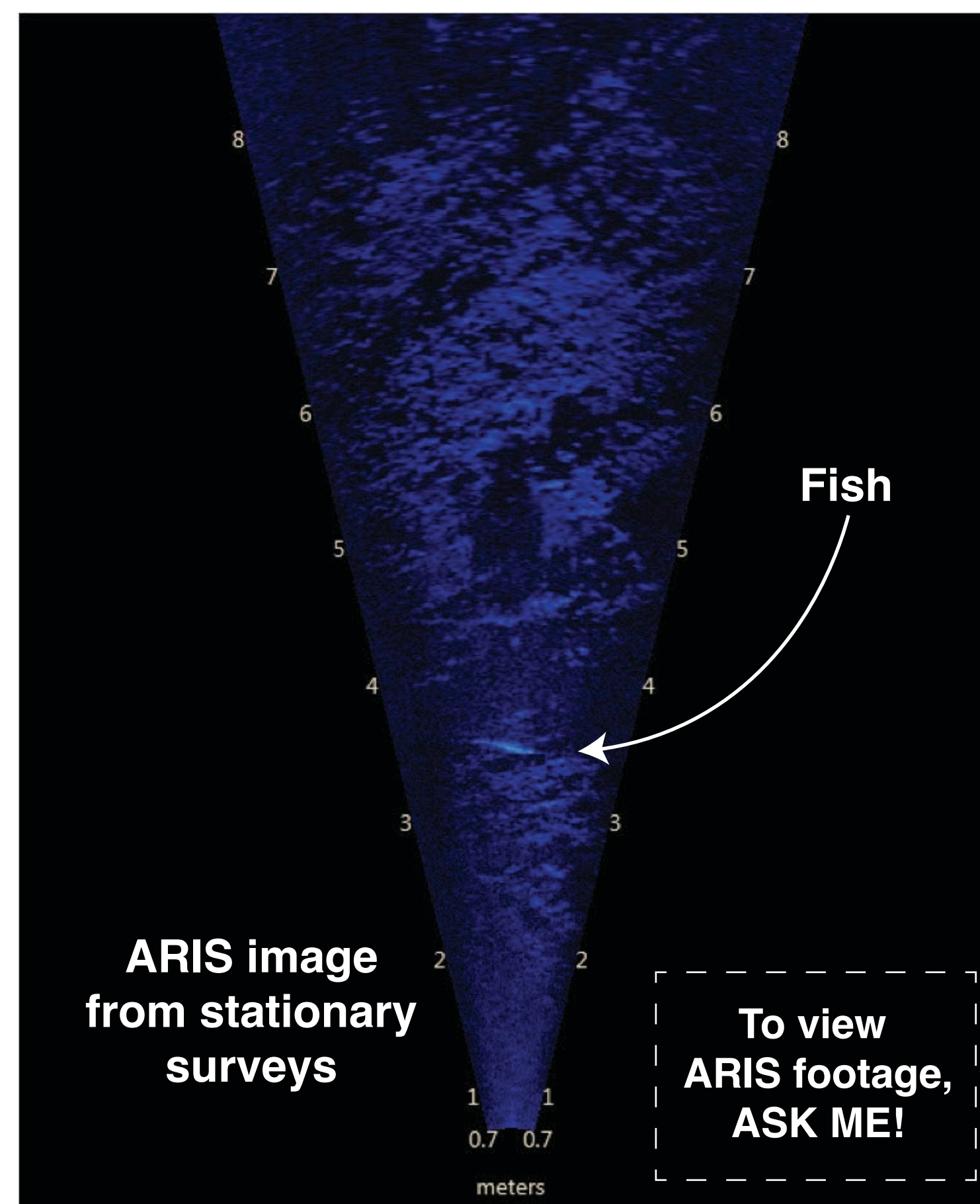
Methods

- Spring sampling was conducted in May 2017, and consisted of both stationary (n=18) and transect (n=24) surveys.
- During stationary surveys, the ARIS was deployed for a set amount of time at each survey location and focused to capture any important habitat features.
 - Immediately following the ARIS survey, the area was sampled with a beach seine (75 ft x 8 ft; ¼ inch Delta Weave) that was hauled to shore.
 - The ARIS continued to operate throughout the duration of fish sampling to characterize capture efficiency and avoidance behavior around the net.
- During transect surveys, the ARIS was deployed for a set amount of time along a fixed transect.
 - Immediately following the ARIS survey, the same transect was sampled with an otter trawl (12 ft wide at the mouth, equipped with side doors, and ¼ inch stretch mesh Delta Weave).
 - During the trawl, the ARIS was focused on the opening of the net to characterize capture efficiency and avoidance behavior around the net.
- All fish captured during surveys were identified to species and measured.



Stationary Surveys

- A total of 574 fish were observed with the ARIS camera during stationary surveys, with an average of nearly 32 fish observed at each sampling location.
- A total of 441 fish were collected by beach seine, nearly half of which consisted of Bay Goby (47.8%), followed by Topsmelt (15.4%) and Starry Flounder (14.3%). The total catch consisted of over 89% native fish species.
- All fish observed with the ARIS camera were between 8 and 60 cm (avg. 25.0 cm).
- Fork lengths of fish captured by beach seine ranged from 2 to 21 cm; the larger fishes that were observed by the ARIS camera were likely Striped Bass, Splittail, and California Halibut. Smaller fish species (<6.3 cm) included Shiner Surfperch, Starry Flounder, Chameleon Goby, and Threespine Stickleback.
- A single juvenile Splittail was also collected and was 6.4 cm in length.
- Fish habitat use appeared similar among sidecast ridge, marsh mounds, and natural beach habitat types, and about half as abundant in submerged vegetation.
- From review of the ARIS footage, fish were most commonly observed in the natural beach habitat as well as the submerged vegetation and near the breach. Abundance was very similar at the remaining habitat types.



Results

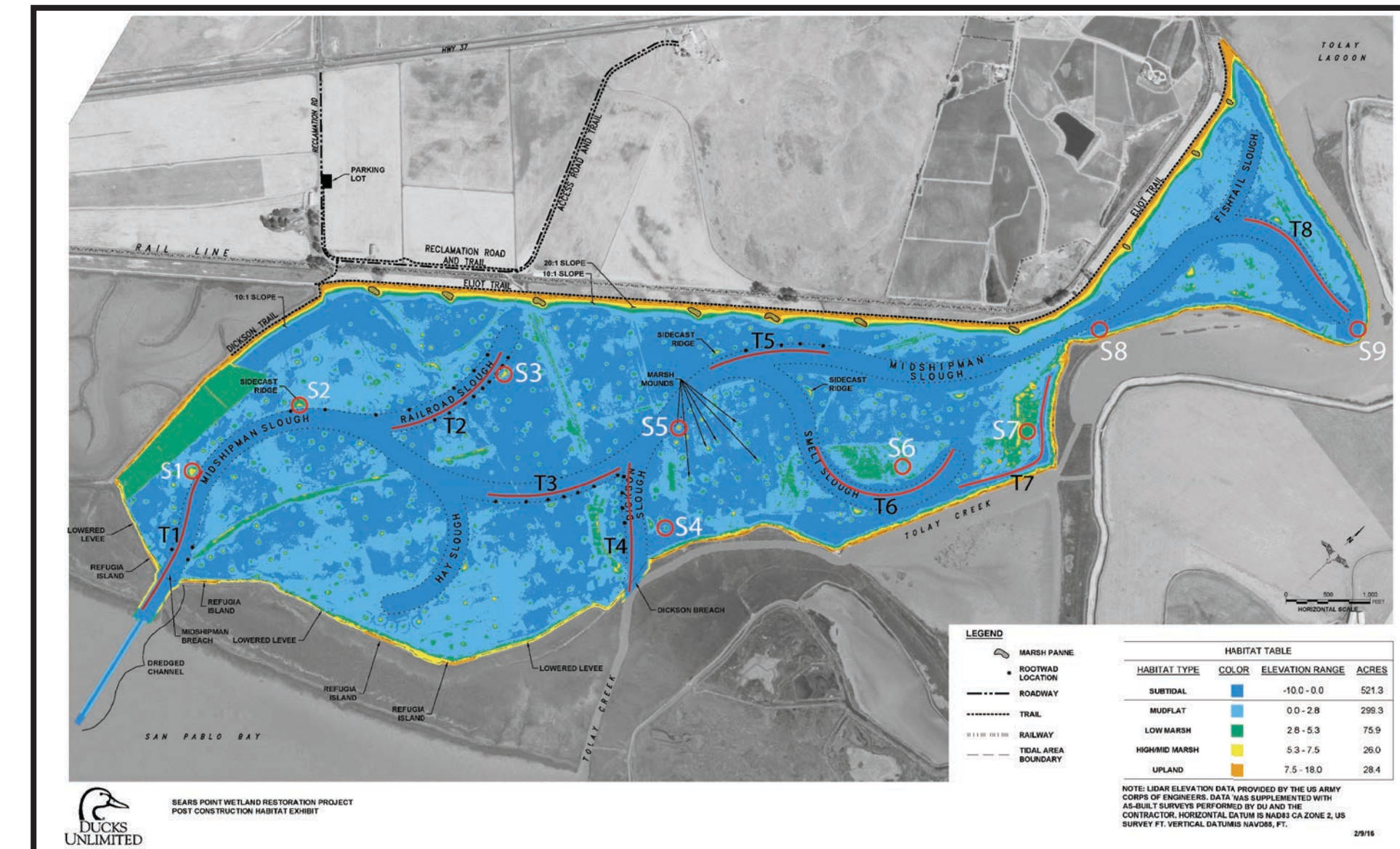


Figure 1. Survey locations at the Sears Point Restoration Area in May 2017.

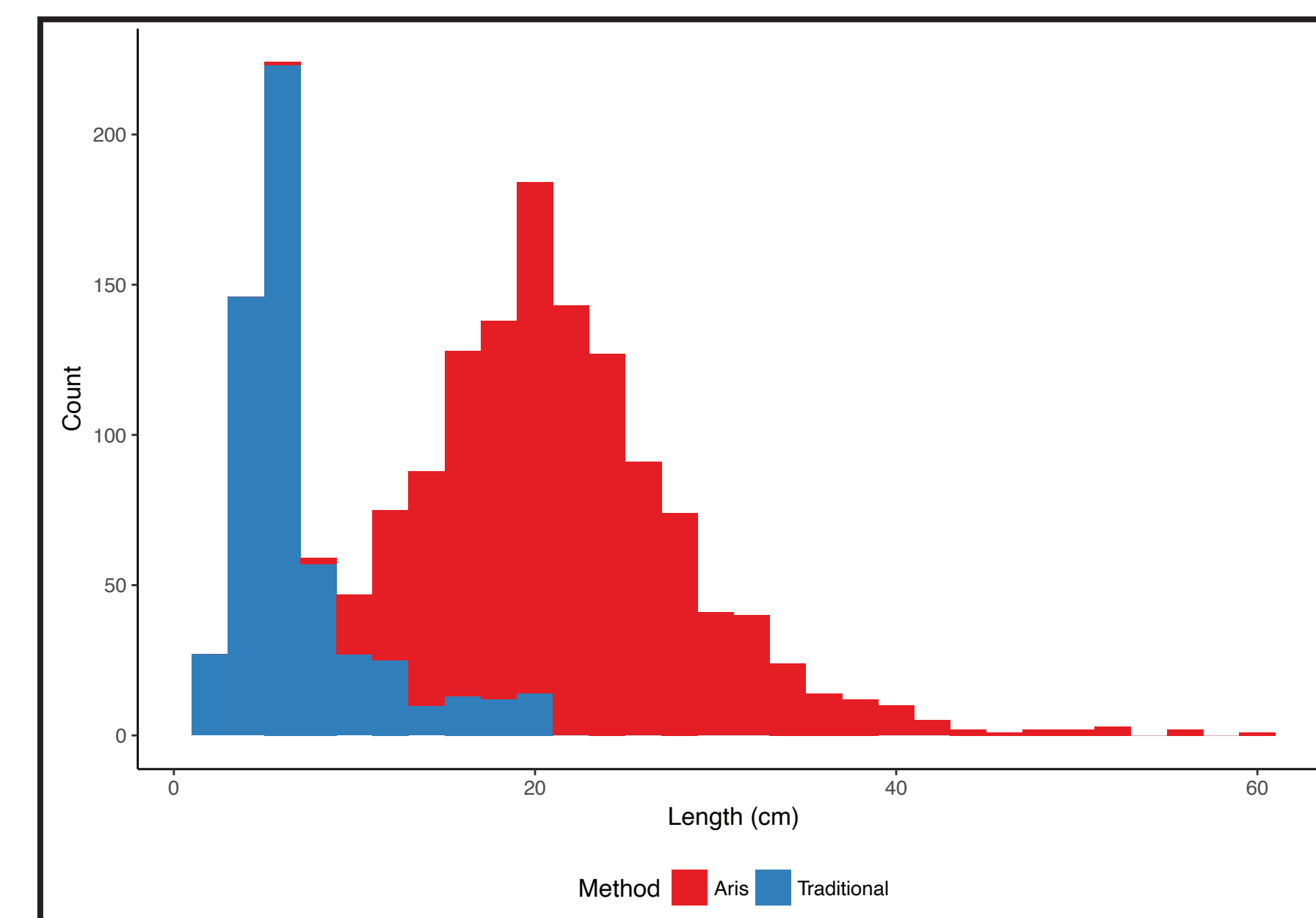


Figure 2. Lengths of fish observed at the Sears Point Restoration Area in May 2017.

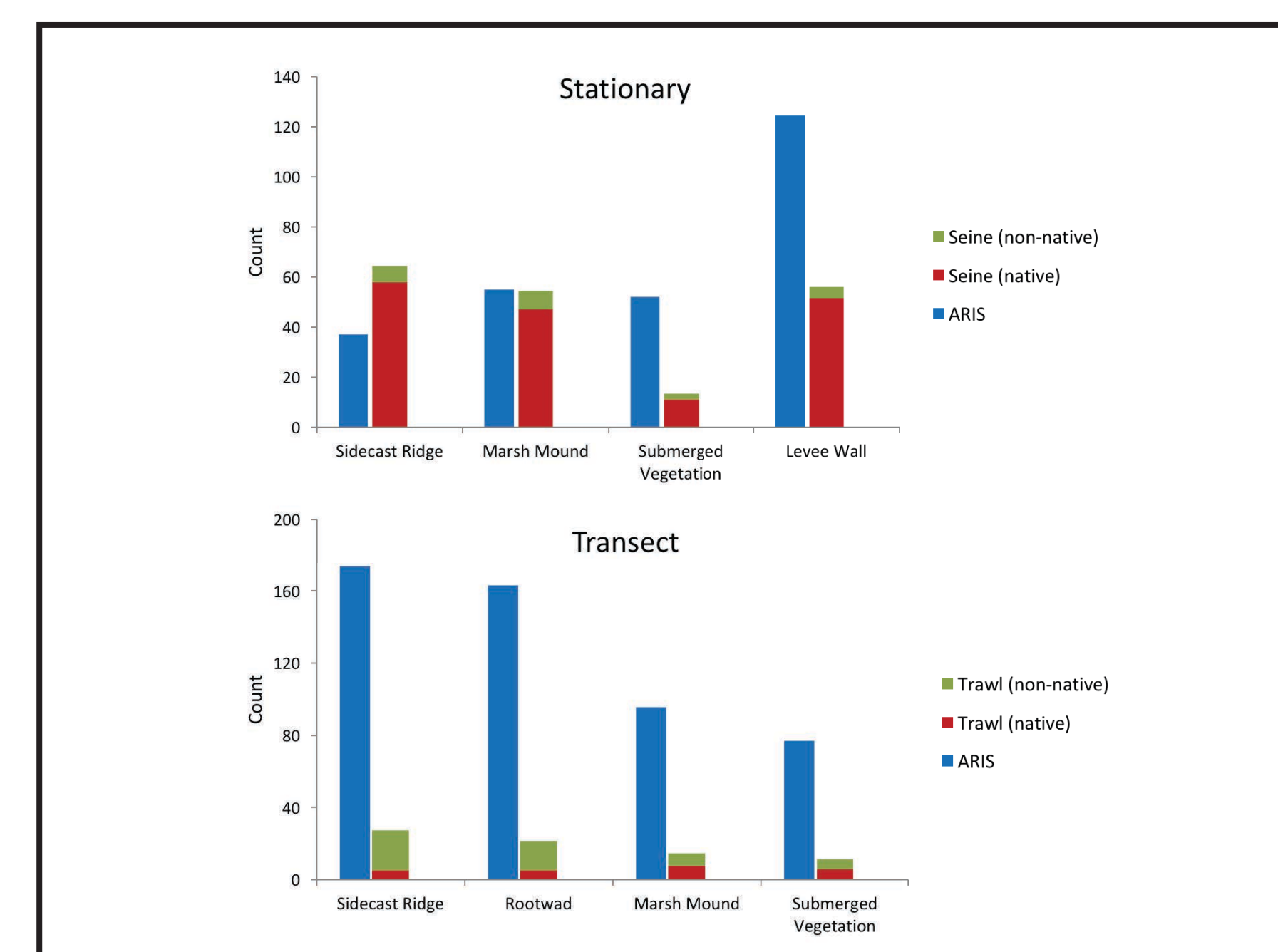
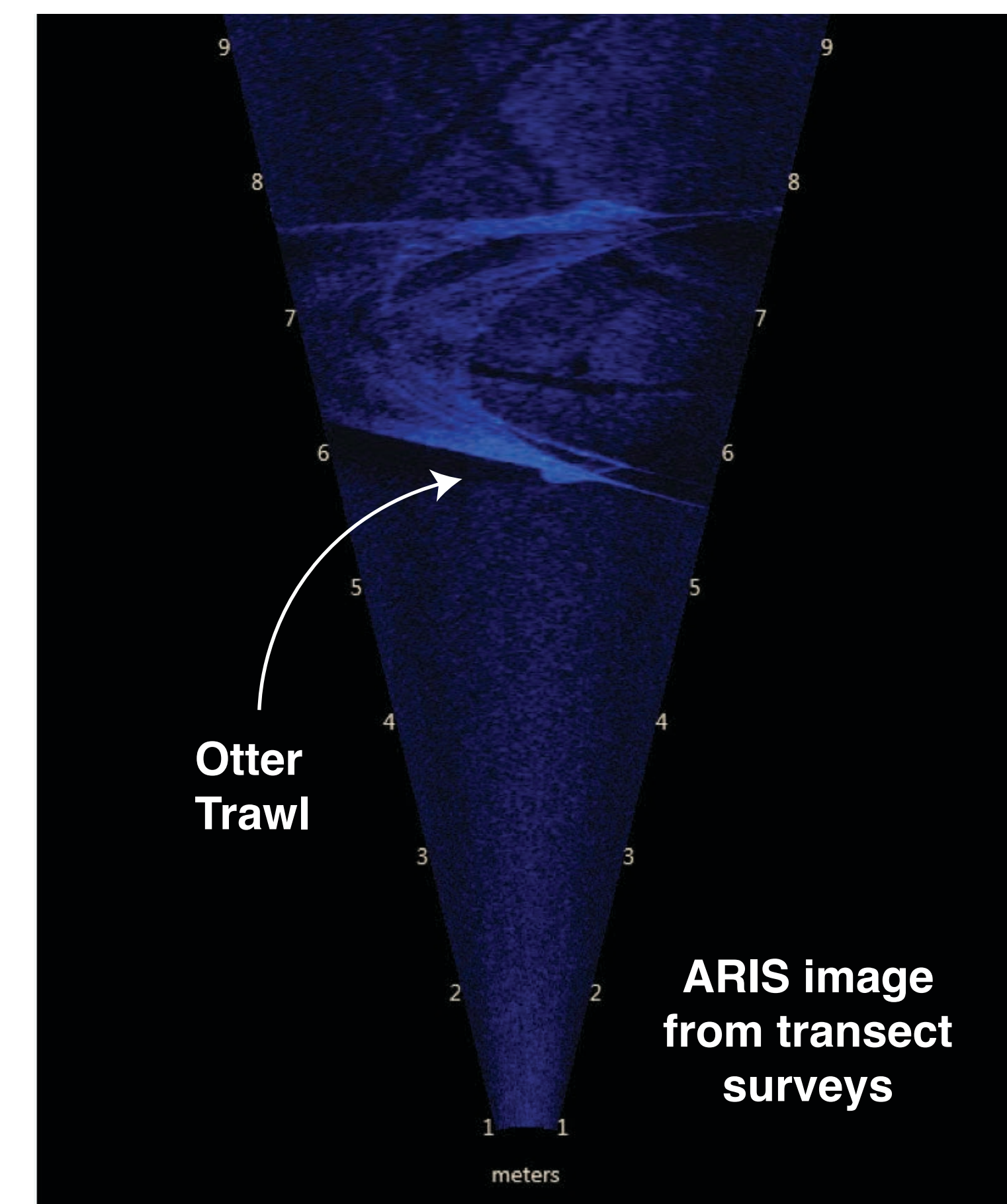


Figure 3. Fish observations by habitat type at the Sears Point Restoration Area in May 2017.

Transect Surveys

- A total of 1,018 fish were observed with the ARIS camera during transect surveys, with an average of over 42 fish observed at each sampling location.
- A total of 150 fish were collected by otter trawl. Shimofuri Goby was the most abundant fish in the otter trawl catch (39.3%), followed by Bay Goby (16.7%) and Striped Bass (13.3%). The total catch consisted of only 31% native fish species.
- All fish observed with the ARIS camera were between 7 and 56 cm (avg. 22.3 cm).
- Lengths (fork length) of fish captured by otter trawl ranged from 2 to 21 cm; the larger fishes that were observed by the ARIS camera were likely Striped Bass, Splittail, Yellowfin Goby, and California Halibut.
- Surfperch, Pacific Herring, Starry Flounder, Threespine Stickleback were all less than 3.9 cm in length and likely not detected by the ARIS camera. Other species included Pacific Staghorn Sculpin, Bay Goby, Chameleon Goby, Shimofuri Goby, and Shokihaze Goby (3.3-9.3 cm).
- The highest abundance of fish was observed at marsh mounds and root wads, with lower abundance observed in submerged vegetation and in the fish tail.
- From review of the ARIS footage, fish were most commonly observed in the channel near root wads and similar at the remaining habitat types.



Discussion

Fish sampling resulted in high totals for both observed catch and species diversity, indicating extensive use of the newly restored habitat by a variety of fish species. Differences in fish abundance between various habitat types were relatively minimal, potentially due to the proximity and uniformity of many of the sampling sites as well as fluctuations in tidal conditions. Traditional sampling gears showed higher differences in abundance between habitat types, likely reflecting the difficulty of sampling in certain areas (i.e., submerged vegetation).

Much of the species abundance observed during beach seining and trawling could be attributed to just a handful of species. No endangered fish species (e.g. Delta Smelt, Longfin Smelt, salmonids) were observed during sampling, however, Splittail, was present in both the beach seine and otter trawl catches. Species composition was generally consistent with the documented catch from other tidal marsh and wetland habitats in San Francisco and San Pablo Bays.

Utilizing dual sampling methods allowed for a more in-depth examination of the fish community in a variety of habitats. Additionally, the ARIS was able to detect species in habitats that were difficult to sample with traditional sampling gear. More broadly, pairing an ARIS camera with conventional sampling gear that is used extensively throughout the estuary and Delta may yield important information about detection rates of larger, more mobile fishes.

Additional sampling during the fall and further data analysis should help to elucidate any differences between fish habitat use in the restored area, particularly among species.