

Performance Evaluation of the San Dieguito Wetlands Restoration Project

Annual Review Workshop for SONGS Wetland Mitigation



May 8, 2017

**SONGS Mitigation Monitoring Project
Marine Science Institute, University of California Santa Barbara**

This presentation focuses on:

- The results of the fifth year of performance monitoring of the San Dieguito Wetlands Restoration Project, and
- Our evaluation of the progress of the restoration project towards meeting the performance standards required for successful mitigation.

Types of Performance Standards

1. Absolute Standards: Measured only in the San Dieguito Wetlands.

(e.g., area of wetland habitats shall not vary by more than 10%)

2. Relative Standards: Measured against natural wetlands that serve as reference sites.

(e.g., the densities and number of species of birds shall be similar to that of natural wetlands in the region)

- Two types of standards are used to assess the performance of the restoration project.
- The first type, absolute standards, are measured against a fixed value and evaluated only in San Dieguito Wetlands.
- For example, the area of wetland habitats shall not vary by more than 10%.
- The second type are relative standards.
- These standards are evaluated against natural wetlands in the region that serve as reference sites.
- For example, the densities and number of species of birds in San Dieguito Wetlands shall be similar to that of natural wetlands in the region.

Absolute Performance Standards

Requirement

The San Dieguito Wetlands Restoration must meet each absolute performance standard for that year to count towards mitigation credit.

Method of Evaluation

The evaluation of each absolute performance standard is based on the value for the current year.

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Absolute Performance Standards for San Dieguito Wetlands Restoration Project



Tidal Prism



Habitat Areas



Topography

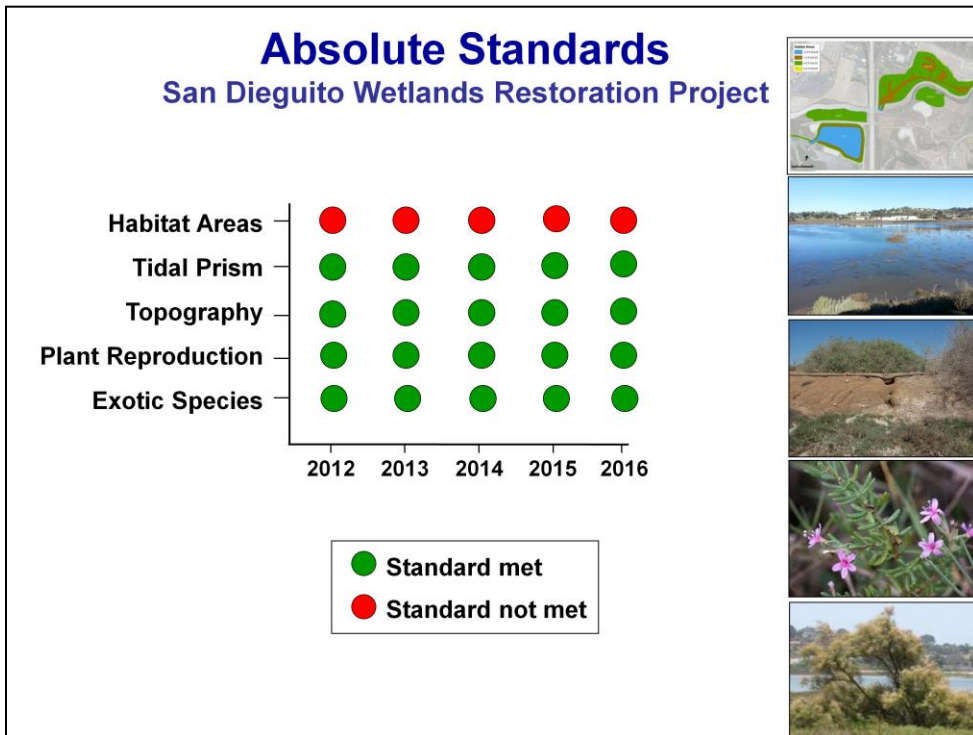


Plant Reproduction



Exotic Species

- Absolute performance standards for the San Dieguito Wetlands Restoration Project pertain to tidal prism, habitat areas, topography, plant reproduction, and exotic species.
- The tidal prism is the volume of water exchanged in an estuary between the low and high tide levels.
- It is an important metric of tidal flushing, inundation of marsh habitat, and inlet stability and the standard specifies that the tidal prism shall be maintained.
- Habitat areas standard specifies that area of wetland habitats shall not vary by more than 10% from the planned areas in the Final Restoration Plan.
- The standard for topography requires that the wetland not undergo major topographic degradation, such as excessive erosion or sedimentation.
- Plant reproductive success requires that certain plant species have demonstrated reproduction (i.e. seed set) at least once in three years.
- The last absolute performance standard pertains to exotic species.
- It requires that the important functions of the wetland shall not be impaired by exotic species.
- Exotic species can have negative impacts on wetland functioning, for example by altering food webs or the physical structure of habitats.



- This slide shows the annual results for the Absolute Standards over the past 5 years.
- The San Dieguito Wetlands has met 4 of 5 of these standards during this period.
- So far, the SDW has yet to meet the standard for Habitat Areas.

Performance Standard: Habitat Areas

The area of different habitats shall not vary by more than 10% from the areas indicated in the final restoration plan



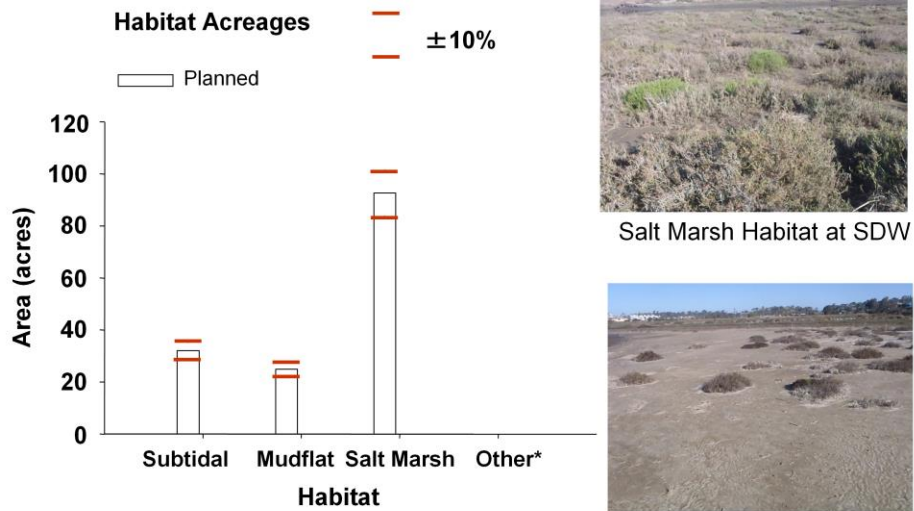
Planned acres :

Salt marsh:	green	92.6 acres
Mudflat:	brown	24.9 acres
Subtidal:	blue	32.0 acres

Vegetated salt marsh inundated at high tide at San Dieguito Wetlands

- Taking a look at the Habitat Areas standard in more detail, this standard specifies that the areas (as acres) of the different habitats shall not vary by more than 10% from the areas indicated in the final restoration plan.
- This performance standard is designed to preserve the mix of habitats provided in the Final Restoration Plan and guard against large scale conversions of one habitat type to another, for example of vegetated marsh to mudflat.
- Panel on the left shows the planned locations of salt marsh (green), mudflat (brown), and subtidal (blue) habitats as provided in the Final Plan for the restoration project as well as the planned acres for the different habitats.

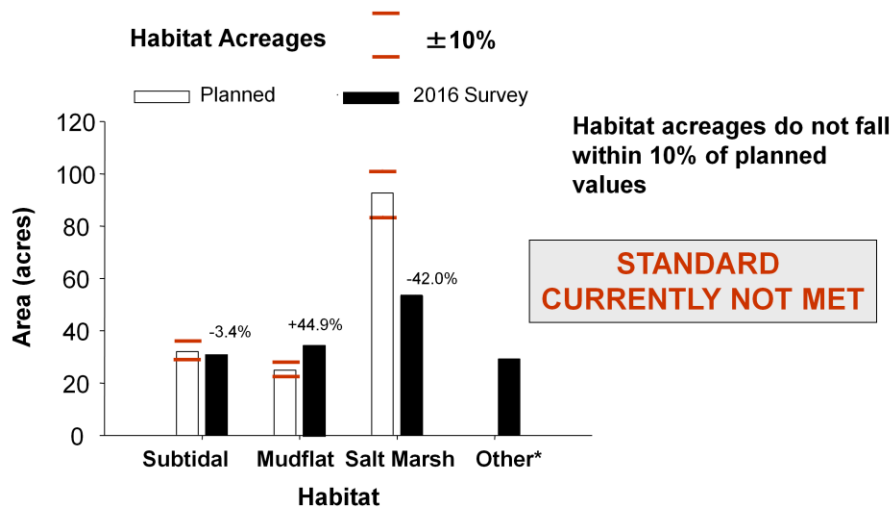
Performance Standard: Habitat Areas



*not a planned salt marsh habitat

- The open bars on this slide show the planned acreages of subtidal, mudflat, and salt marsh habitat, plus or minus 10% of these values, as well as an example of salt marsh habitat in the restored wetland with a high cover of vegetation.
- Also shown is a category that we term "other", which is not a planned habitat.
- These are areas with insufficient cover of vegetation to be assessed salt marsh and too much vegetation and/or too high intertidally to be assessed as "mudflat".

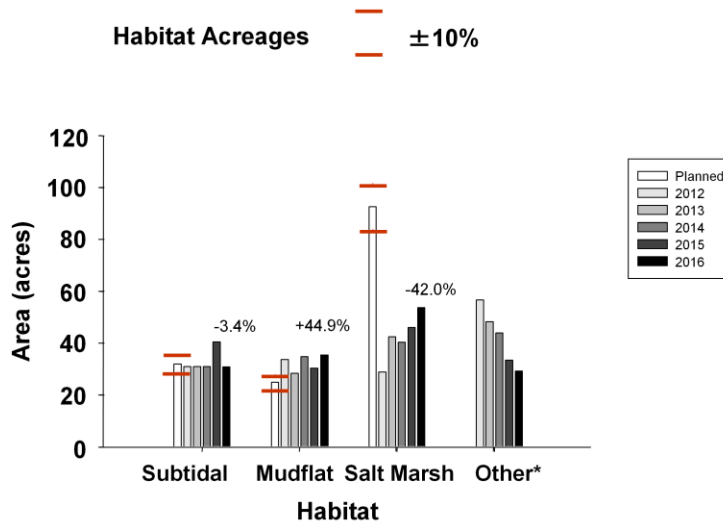
Performance Standard: Habitat Areas



*not a planned salt marsh habitat

- The solid bars indicate the acreages determined in our 2016 survey.
- While the area of subtidal habitat was within 10% of the planned acreage in 2016, the area of mudflat was greater than 10%, and there was a deficit of salt marsh habitat (of ~40 acres), which was also not within $\pm 10\%$ of the planned acreages.
- About 29 acres were assessed as “Other” not assessed as one of the planned habitats provided in the Final Restoration Plan.
- As a result, the performance standard for habitat areas is currently not met.

Performance Standard: Habitat Areas



*not a planned salt marsh habitat

- Although not yet meeting the standard for habitat areas, the monitoring results for 2016 are encouraging in that there has been an increase of about 8 acres classified as Salt Marsh habitat from 2015 and continuous decrease in the acreage of Other (now ~29 acres).

Types of Performance Standards

2. *Relative Standards*: Must be similar to natural wetlands that serve as reference sites.

(e.g., the density and number of species of birds must be similar to that of natural wetlands in the region.)

Method of Evaluation

The evaluation of each relative standard in any given year is based on an average calculated from data collected at San Dieguito Wetlands and the reference wetlands for that year and for the previous three years.

- The second type of performance standards are relative standards, evaluated against natural wetlands in the region that are used as a reference sites.
- The evaluation of each relative standard in any given year is based on an average calculated from data collected at San Dieguito Wetlands and the reference wetlands for that year and for the previous three years.

What counts as similar in the context of assessing the performance of the San Dieguito Wetlands Restoration Project?

Definition: The 4-year running average for a relative performance standard at San Dieguito Wetlands must be *equal to or better than* that value for the lowest performing reference wetland for that standard.

Rationale:

- To be successful, the San Dieguito Wetlands Restoration must provide resource values *similar* to those of natural wetlands in the region.
- A running average rather than the value for the current year better accounts for natural fluctuations over time.

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Reference Wetlands

46 sites evaluated

Criteria for inclusion of a wetland as a reference site are provided in the SONGS Permit.

Reference wetlands shall be:

- Relatively undisturbed
- Tidal
- Located in Southern California Bight



- The criteria for inclusion of a wetland as a reference site is provided in the SONGS permit.
- These criteria are that the reference wetland be relatively undisturbed, tidal, and located in the Southern California Bight.
- 46 wetlands in the region were evaluated as possible reference sites, and Carpinteria Salt Marsh, Mugu Lagoon, and Tijuana Estuary were selected as best meeting the criteria provided in the SONGS permit.

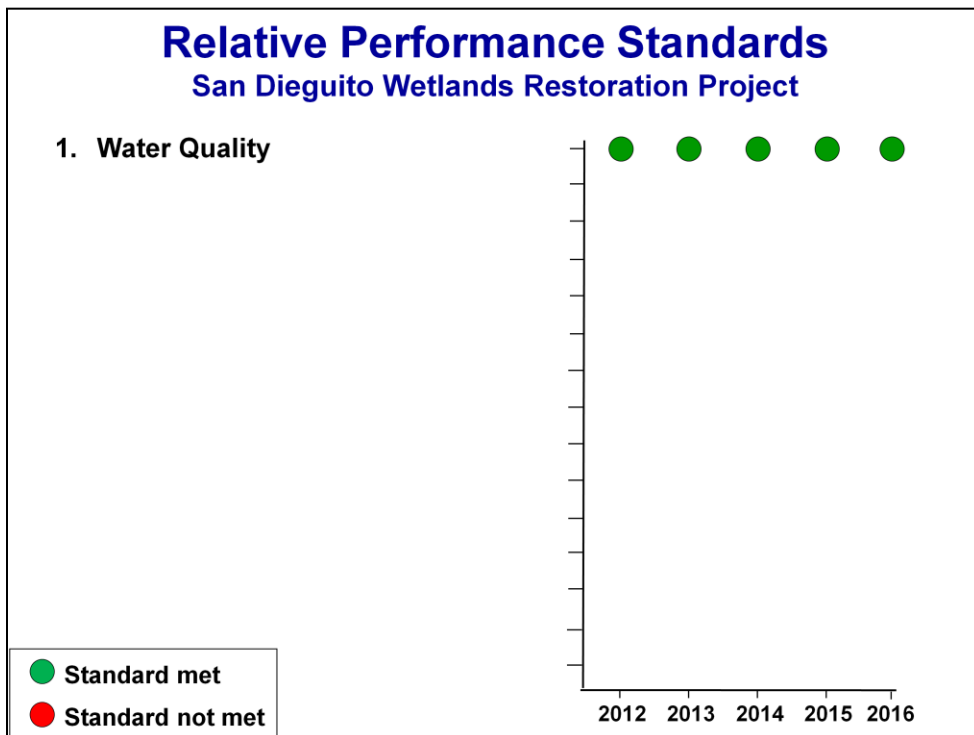
Relative Performance Standards Dieguito Wetlands Restoration Project

1. Water Quality
2. Bird Density
3. Bird Species Richness
4. Fish Density–Main Channel
5. Fish Species Richness–Main Channel
6. Fish Density–Tidal Creek
7. Fish Species Richness–Tidal Creek
8. Invertebrate Density–Main Channel
9. Invertebrate Density–Tidal Creek
10. Invertebrate Species Richness–Main Channel
11. Invertebrate Species Richness–Tidal Creek
12. Vegetation Cover
13. Algal Cover
14. *Spartina* Canopy Architecture*
15. Food Chain Support

* Evaluated relative to Tijuana Estuary only



- Shown here are the relative performance standards used to evaluate the success of the San Dieguito Wetlands Restoration Project.
- One of the relative standards, *Spartina* canopy architecture, has been evaluated only in comparison to Tijuana Estuary because *Spartina* is not present in Carpinteria Salt Marsh and until recently rare in Mugu Lagoon.



- The following slides will summarize whether a particular relative standard was met during each of the last 5 years.
- A green dot indicates that the standard was met for a particular year, and a red dot will indicate that the standard was not met.
- This slide summarizes the results for water quality.
- As a result of its importance to estuarine health, dissolved oxygen concentration is the water quality variable used to evaluate this standard.
- We assess DO by comparing the mean number of hours of continuous hypoxia, DO values $<3\text{mg/l}$, between San Dieguito Wetlands and the reference wetlands.
- If mean number of consecutive hours of continuous hypoxia is significantly higher in the San Dieguito Wetlands than in the reference wetland with the highest value, then San Dieguito Wetlands fails to meet the standard.
- The values for sequential hours of hypoxia at San Dieguito has been similar to the reference wetlands for the past 5 years.

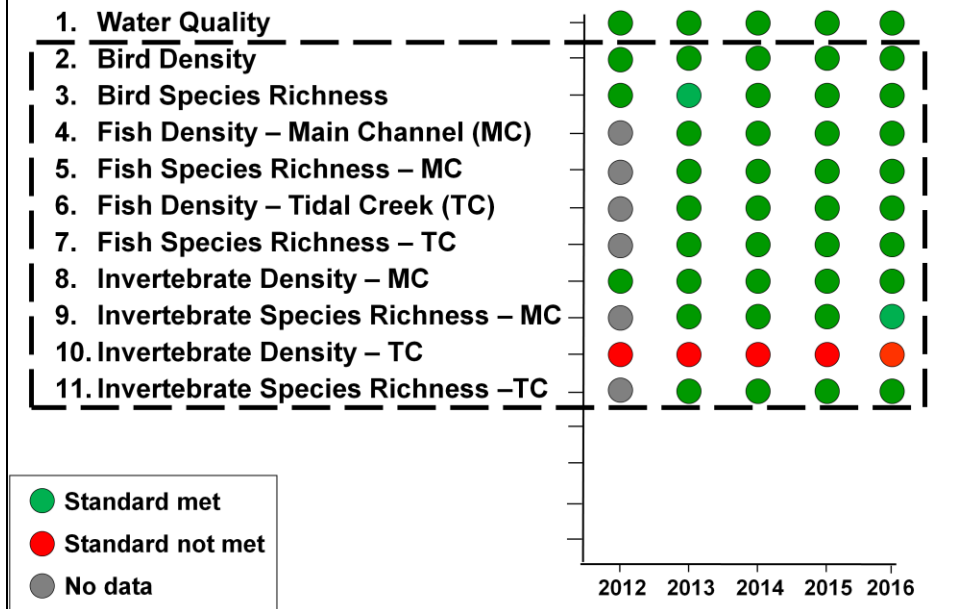
Performance Standard: Biological Communities

Within 4 years of construction, the total densities and number of species of birds, fish, and macroinvertebrates shall be similar to the densities and number of species in similar habitats in the reference wetlands



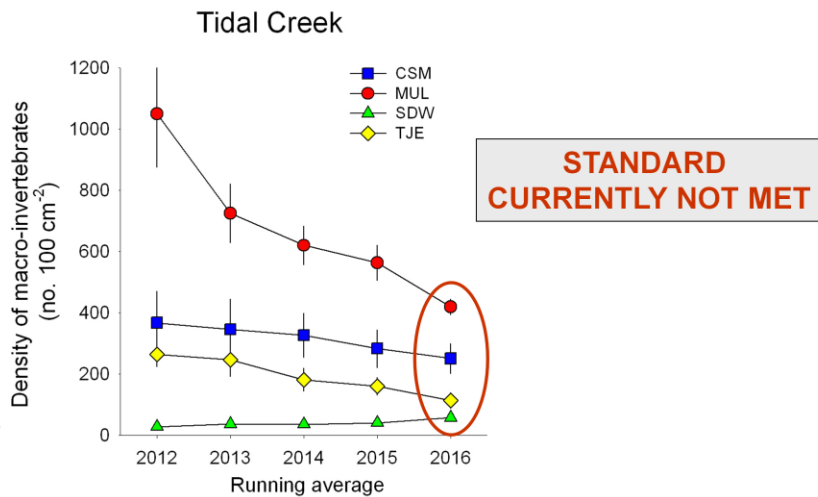
- We are now moving onto the performance standards for biological communities, which includes standards for birds, fish, and macroinvertebrates.
- These are relative standards that pertain both the densities and numbers of species of these groups.
- The performance standard for biological communities requires that within 4 years of construction, the total densities and number of species of birds, fish, and macroinvertebrates shall be similar to the densities and number of species in similar habitats in the reference wetlands.

Relative Performance Standards San Dieguito Wetlands Restoration Project



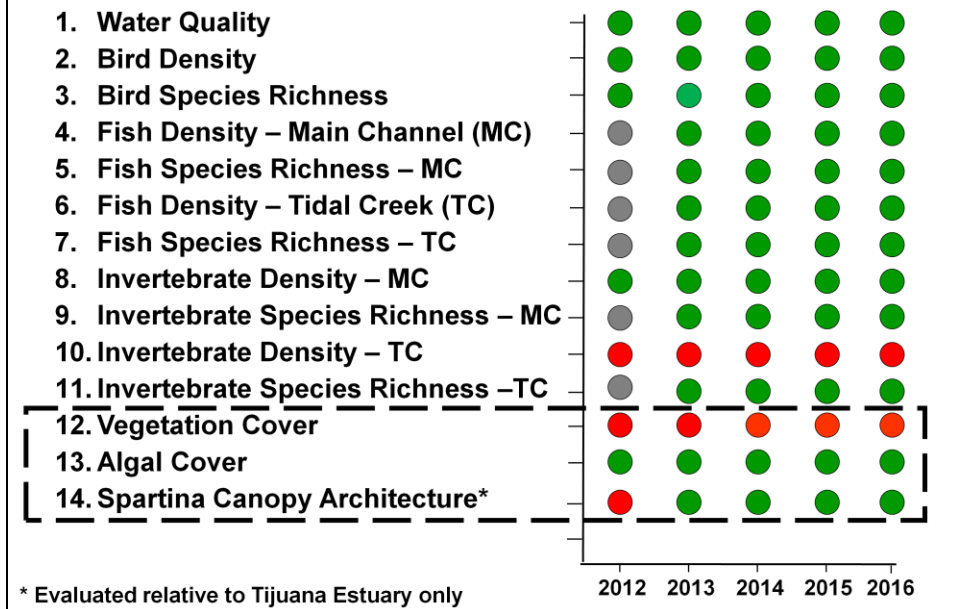
- This slide summarizes the monitoring results for Biological Communities for the past 5 years.
- Again, a green dot indicates that the standard was met for a particular year, a red dot indicates that it was not met.
- Clapper rail nesting prevented the collection of data for some standards from the Tijuana Estuary reference site in 2012.
- The densities and species richness of birds and fish in SDW has been similar to in the reference wetlands for the past 5 years.
- However, the densities of macroinvertebrates in the tidal creeks of SDW have underperformed relative to the reference wetlands during the past 5 years.

Performance Standard: Invertebrate Density – Running Averages



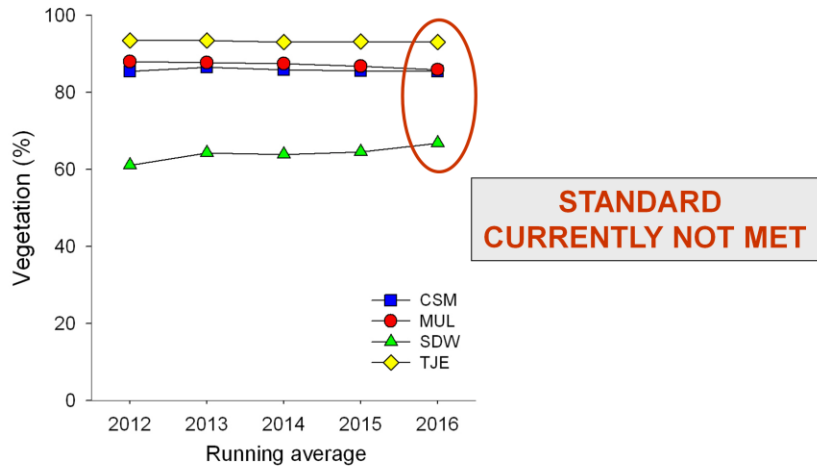
- Looking at invertebrate densities in tidal creeks in more detail, this slide shows the running averages used to evaluate macroinvertebrate density, as mean number per 100 cm², in tidal creek habitat.
- You can see that the running average for invertebrate densities in tidal creeks has increased slowly over time, which is promising, but is not yet similar to the lowest performing reference site in 2016.
- Therefore, the performance standard for macroinvertebrate density in the tidal creeks of San Dieguito Wetlands is currently not met.

Relative Performance Standards San Dieguito Wetlands Restoration Project



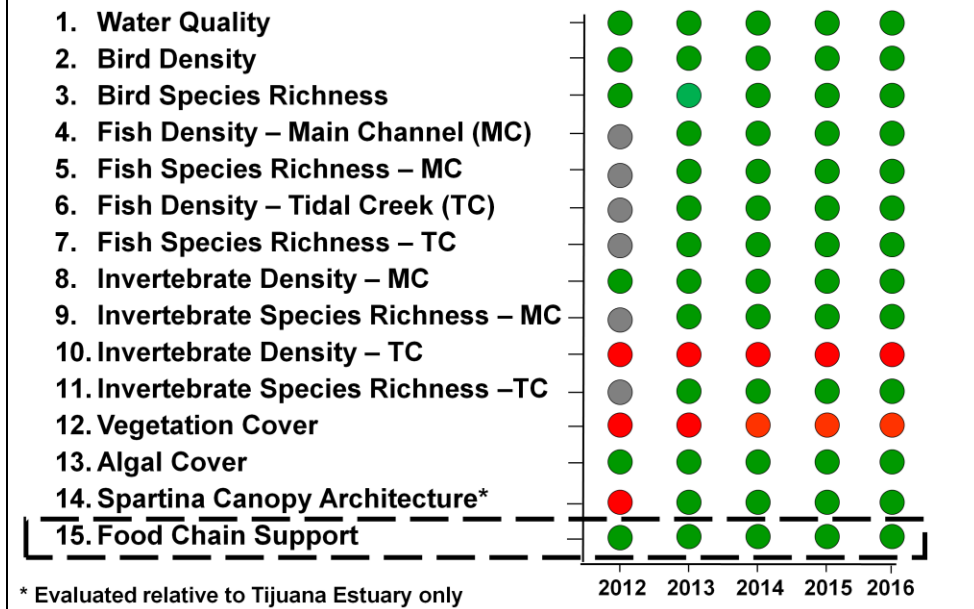
- Reviewing the relative standards that pertain to Vegetation Cover, Algal Cover, and Spartina Canopy Architecture, we see that the standard for Vegetation Cover has not yet been met.
- A high cover of macroalgae can indicate eutrophic conditions or poor tidal circulation and can be detrimental to estuarine health.
- For this standard, we evaluate algal cover relative to the reference wetlands with the highest of cover of macroalgae, since excessive cover may be detrimental.
- Macroalgal cover in San Dieguito Wetlands has been lower than the value in the reference wetland with the highest cover for the past 5 years.
- Therefore, the relative standard for Algae is currently met.
- Spartina was planted throughout the restoration site to provide habitat for the light foot clapper rail, now Ridge’s Rail and other species.
- The performance standard for Spartina specifies that the restored wetland shall have a canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall.
- This standard is only evaluated relative to Tijuana Estuary because as mentioned earlier Spartina is absent in Carpinteria Salt Marsh and was rare in Mugu Lagoon.
- Spartina canopy architecture has been similar to Tijuana Estuary 4 of the past 5 years.

Performance Standard: Vegetation – Running Averages



- Taking a look at the data for vegetation cover in more detail, this slide compares the running average of cover of vegetation in the San Dieguito Wetlands to the reference wetlands.
- Although vegetation is colonizing the restored wetland and is more widely distributed than previous years, it has not yet filled in to the point where we see an appreciable increase in cover in the running average for 2016 and thus SDW is not yet similar to the reference wetlands.
- Mark will speak more about the status of vegetation development in the next talk.

Relative Performance Standards San Dieguito Wetlands Restoration Project



- Food chain support is one of the more important functions of coastal wetlands.
- This standard specifies that the food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds.
- The relative standard for Food Chain Support has been met the past 5 years.

Relative Performance Standards

Requirement

The San Dieguito Wetlands Restoration must meet at least the same proportion of relative standards as the lowest performing reference wetland in a given year for that year to count towards mitigation credit.

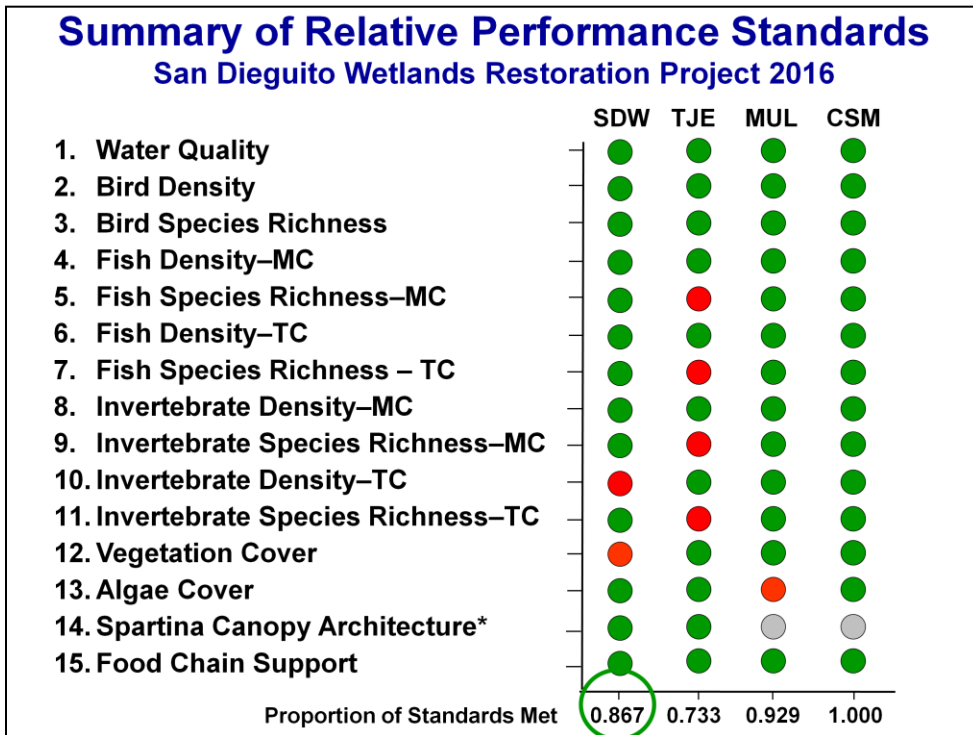
Method of Evaluation

San Dieguito Wetlands and the reference wetlands are evaluated with respect to whether or not they meet each relative standard and the proportion of relative standards met by each wetland is computed and compared.

Rationale

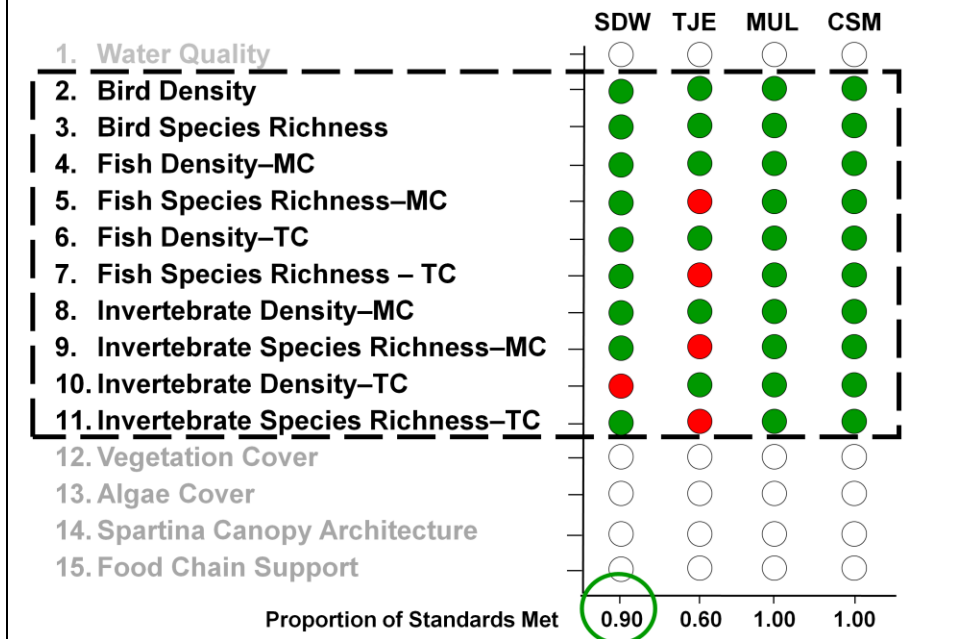
Requiring the San Dieguito Wetlands Restoration to meet at least the same proportion of relative standards as the lowest performing reference wetland achieves the desired mitigation goal of being similar to natural wetlands without requiring the restoration to outperform the reference wetlands.

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- San Dieguito Wetlands and the reference wetlands are evaluated with respect to whether or not they meet each relative standard and the proportion of relative standards met by each wetland is computed and compared.
- Requiring the San Dieguito Wetlands Restoration to meet at least the same proportion of relative standards as the lowest performing reference wetland achieves the desired mitigation goal of being similar to natural wetlands without requiring the restoration to outperform the reference wetlands.



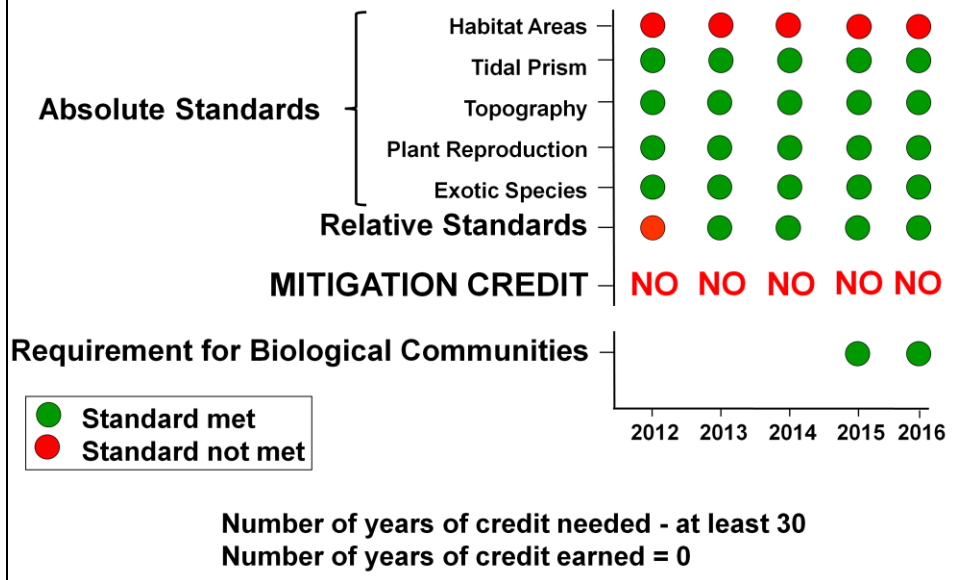
- This table provides a summary assessment of the relative performance standards for 2016 using the 4 year running average.
- A green dot indicates that the performance variable at a particular wetland is similar to the other wetlands.
- A red dot indicates that the performance variable at a particular wetland was not similar to the other wetlands
- Comparing the running averages, Mugu Lagoon and Carpinteria Salt Marsh were the best performing wetlands with a higher proportion of standards met than the other wetlands.
- San Dieguito Wetlands met a higher proportion of the standards than Tijuana Estuary, the reference site with the lowest proportion of standards met.
- Therefore, San Dieguito Wetlands met the relative standards for 2016.
- The SONGS permit also has special requirements for the Biological Communities standards, those standards that pertain to birds, fish, and macroinvertebrates.

Summary of Biological Communities Standards San Dieguito Wetlands Restoration Project 2016



- This table provides a summary assessment of the relative performance standards that pertain just to Biological Communities for 2016.
- Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds shall be similar to the densities and number of species in similar habitats in the reference wetlands.
- These standards are evaluated as a subset of the relative performance standards.
- Again, a green dot indicates that performance variable at a particular wetland is similar to the other wetlands.
- San Dieguito Wetlands had a higher proportion of biological standards met than Tijuana Estuary.
- Therefore, San Dieguito Wetlands met the special requirement for Biological Communities.

Project Compliance San Dieguito Wetlands Restoration Project



- Taking a look at project compliance, in order to receive mitigation credit for a given year, the wetland restoration project must meet all of the Absolute Standards and as many of the Relative Standards as the worst performing reference wetland.
- So far, the SDW has yet to meet the Habitat Areas Absolute Standard, primarily due to slow vegetation development.
- However, the project met the Relative Standard requirement for 2016, and the Biological Communities requirement has been satisfied.
- Since the Absolute Standard for Habitat Areas has not yet been met, largely due to slow vegetation development, the project has not yet satisfied the performance success criteria in the SONGS permit and has not yet received mitigation credit.