

Performance Evaluation of the San Dieguito Wetlands Restoration Project

Annual Review Workshop for SONGS Wetland Mitigation



May 9, 2024

SONGS Mitigation Monitoring Project

Marine Science Institute, University of California Santa Barbara

- Good afternoon, I'm excited to talk to you about the performance of the San Dieguito Wetlands Restoration Project.
- This presentation reports the results of the twelfth year of performance monitoring of the San Dieguito Wetlands Restoration Project, and our evaluation of its progress 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%)

- I'm going to start by defining the performance standards that are used to evaluate the restored wetland.
- First, there are absolute standards, which are evaluated only in San Dieguito Wetlands.
- For example, the area of wetland habitats shall not vary by more than 10% from the planned areas in the Final Restoration Plan.

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 density of birds shall be similar to that of natural wetlands in the region)

- Second, there are relative standards, which are measured in San Dieguito Wetlands and evaluated against natural wetlands in the region that serve as reference sites.
- For example, the densities of birds in San Dieguito Wetlands shall be similar to that of natural wetlands in the region. We'll start by digging into the absolute standards first.

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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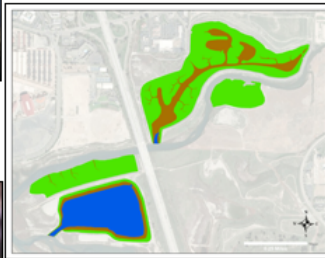
Absolute Performance Standards for San Dieguito Wetlands Restoration Project



Tidal Prism



Plant Reproduction



Habitat Areas

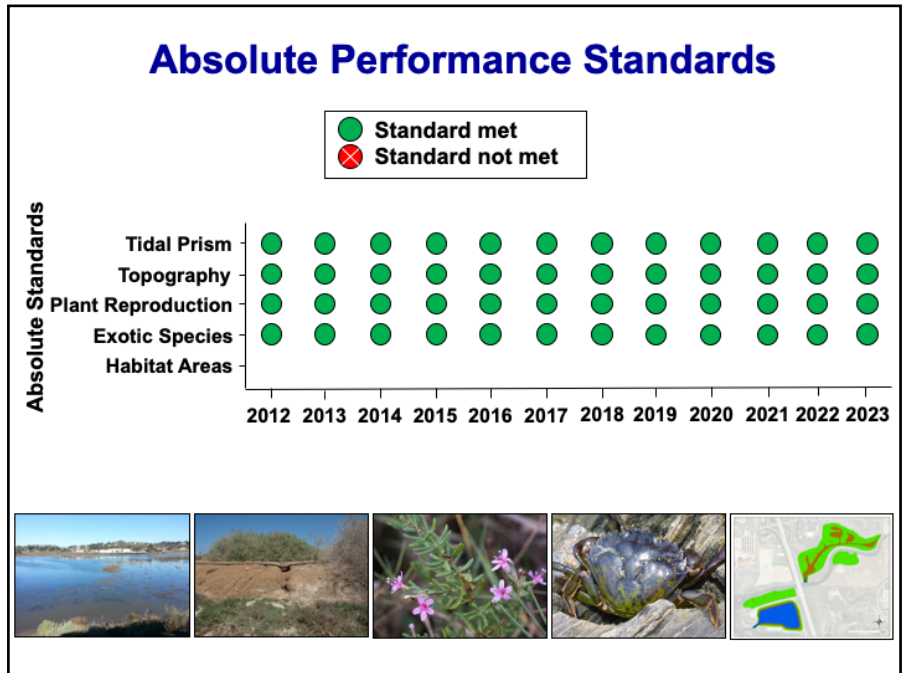


Topography

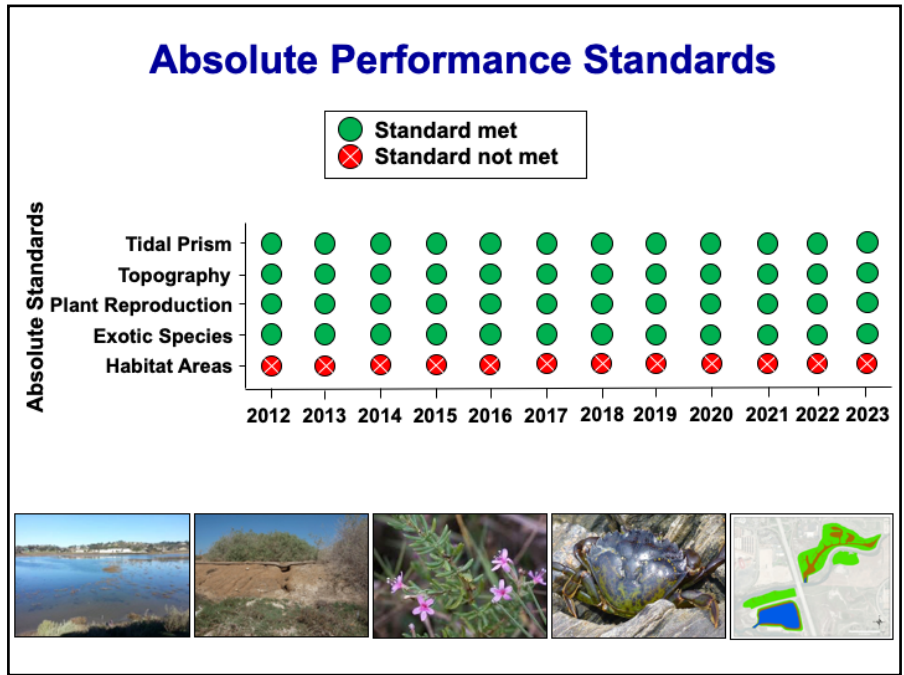


Exotic Species

- There are five absolute performance standards, which include 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, and it is a metric of tidal flushing, inundation of marsh habitat, and inlet stability. The standard specifies that the tidal prism of San Dieguito Wetland shall be maintained.
- Habitat areas standard specifies that area of wetland habitats shall not vary by more than 10% from the planned habitat areas in the Final Restoration Plan.
- The topography standard requires that the wetland not undergo major topographic degradation, such as excessive erosion or sedimentation.
- Plant reproduction requires that certain salt marsh plant species demonstrate reproduction at least once in three years.
- The exotic species standard requires that the important functions of the wetland shall not be impaired by exotic species that can have negative impacts on wetland functioning, for example by altering food webs or physical habitat structure.



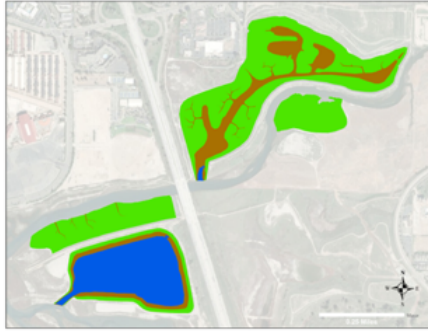
- San Dieguito Wetlands has met four of the five absolute performance standards every year since monitoring began.



- However, San Dieguito Wetland has not yet met the Habitat Areas standard, so we'd like to take a closer look at the results for this standard.

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



Vegetated salt marsh inundated at high tide at San Dieguito Wetlands

Planned acres :

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

- As described previously, the habitat areas standard specifies that the areas 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 or vice versa.
- The left side of the slide 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 associated planned acres for these habitats.

Assessment of Subtidal & Mudflat Habitat

Classified as Subtidal Habitat if:

- Continuously submerged



- Now, I'll provide a brief overview of the criteria used to classify each habitat type, starting first with subtidal and moving up in tidal elevation...
- Habitat is classified as Subtidal if it is continuously submerged, as you can see in this photo.

Assessment of Subtidal & Mudflat Habitat

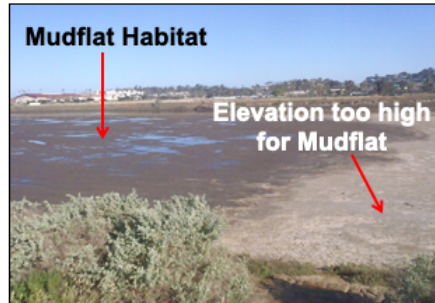
Classified as Subtidal Habitat if:

- Continuously submerged



Classified as Mudflat Habitat if:

- Intertidal and $\leq 3.5'$ NGVD
- $< 5\%$ cover of vegetation (mudflats are defined as intertidal and unvegetated)



- Habitat is classified as Mudflat if it is intertidal and $\leq 3.5'$ NGVD with $< 5\%$ cover of vegetation. So if you look at the photo on the right, this unvegetated intertidal area on the left would be classified as mudflat, but this unvegetated area on the right would not because the elevation is too high to be considered mudflat.

Assessment of Salt Marsh Habitat

Classified as Salt Marsh if:

- Intertidal and $\leq 4.5'$ NGVD
- $\geq 30\%$ cover of vegetation evaluated using aerial imagery

Vegetation cover evaluated under the Relative Standards



Salt Marsh Habitat in San Dieguito Wetlands

- Habitat is classified as Salt Marsh if the area is intertidal and $\leq 4.5'$ NGVD and also has at least 30% cover of vegetation evaluated within 10 x 10 m grids using aerial imagery.
- In addition to the habitat areas standard, which is an absolute standard, there is also a relative standard for Vegetation Cover, which is evaluated only in the habitat classified as salt marsh which we will discuss in more detail later.

Assessment of Salt Marsh Habitat

Classified as Salt Marsh if:

- Intertidal and $\leq 4.5'$ NGVD
- $\geq 30\%$ cover of vegetation evaluated using aerial imagery

Vegetation cover evaluated under the Relative Standards



Salt Marsh Habitat in San Dieguito Wetlands

Classified as "Other" if:

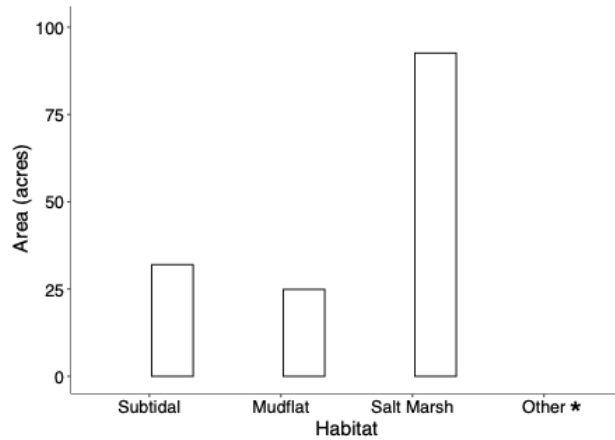
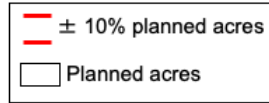
- Intertidal and $\leq 4.5'$ NGVD
- $< 30\%$ cover of vegetation evaluated using aerial imagery



Insufficient cover to be assessed as Salt Marsh

- Lastly, there is "Other" habitat, which is not a planned habitat type and is not included in the Final Restoration Plan. This category was defined after monitoring began, and includes areas that are intertidal and $\leq 4.5'$ NGVD with less than 30% cover of vegetation. For example in this photo on the bottom right, this area is too sparsely vegetated to be assessed as salt marsh, but has too much vegetation and is too high in elevation to be considered mudflat.

Performance Standard: Habitat Areas



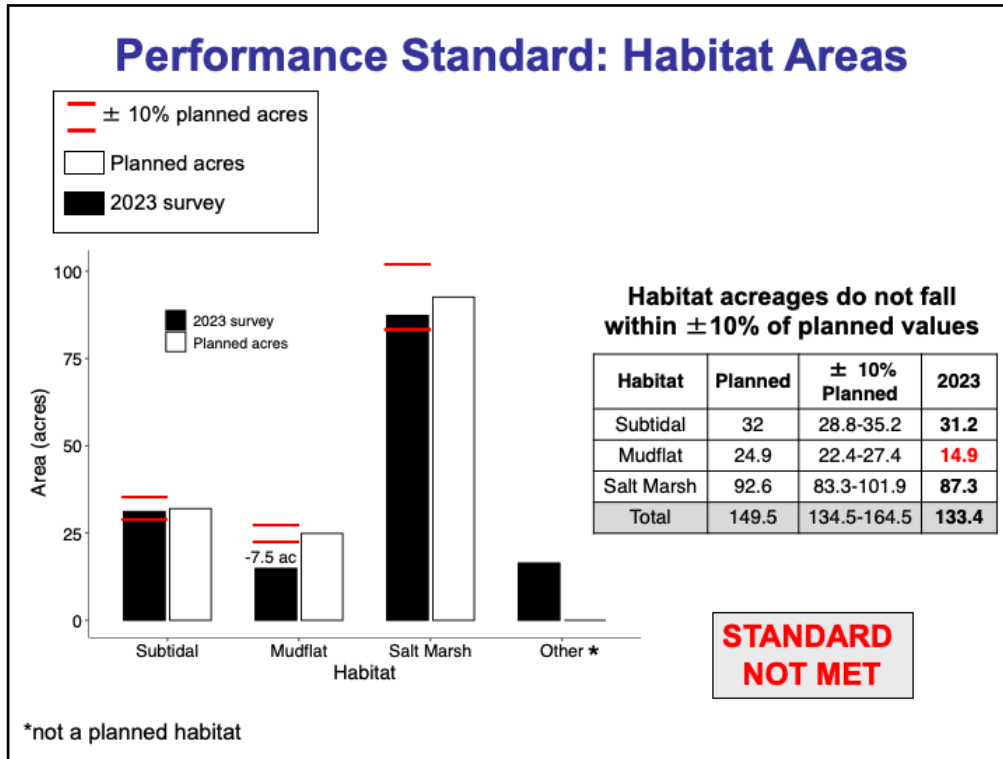
Salt Marsh Habitat at SDW



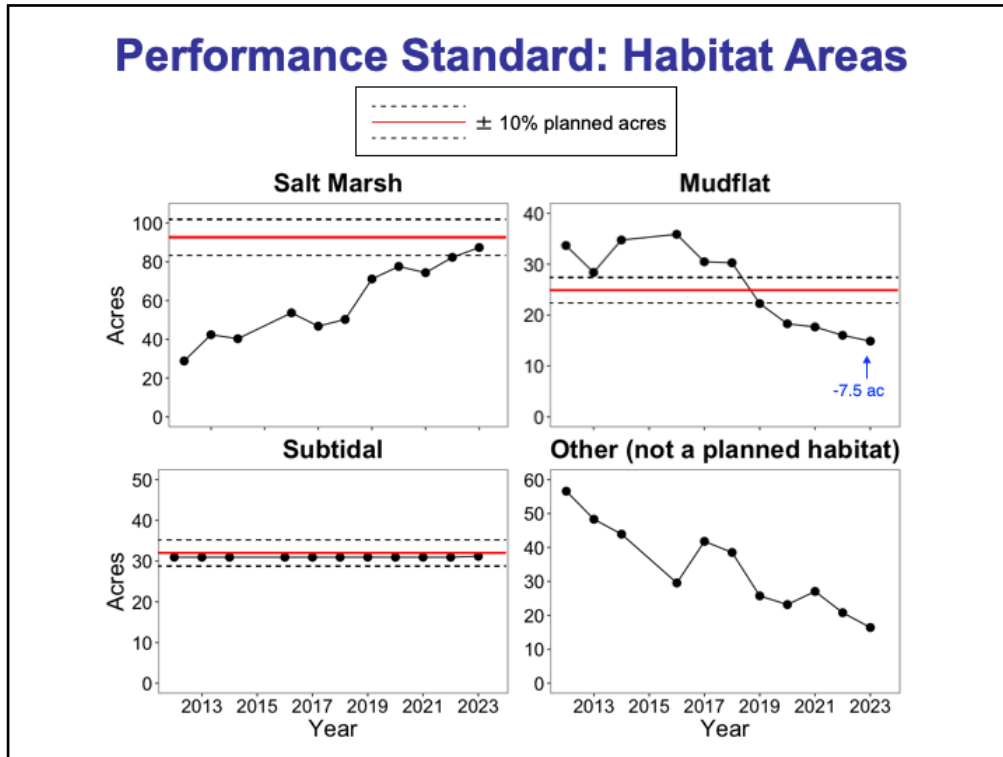
Example of "Other"

*not a planned habitat

- This figure shows the planned acres of subtidal, mudflat, and salt marsh habitat



- We now add solid bars to this figure, which represent the acreages measured in our 2023 survey and the red lines represent plus or minus 10% of those planned habitat areas.
- For the first time since monitoring began in 2012, the area of salt marsh habitat at San Dieguito was within 10% of the planned acreage at 87.3 acres in 2023.
- The area of subtidal habitat in 2023 was within 10% of the planned acreage, while the area of mudflat was less than 10% of the designed acreage at 14.9 acres, ~ 7.5 acres short of the minimum acres required.
- As a result, the performance standard for habitat areas was not met in 2023.



- When we look at the trend in habitat areas over time, we can see that the salt marsh acreage has continued to increase and is now above the minimum required acres of this habitat. Natural colonization of marsh plants, in combination with the success of SCE’s planting program to fill in sparsely vegetated and bare areas of the marsh plain have contributed to this increase in salt marsh area in recent years. The successful establishment of plants that recruited naturally as well as those that were planted is likely driven by the past few anomalous rain years we’ve had in the region.
- In contrast, the area of mudflat has been decreasing over time, particularly in the last 5 years, and is 7.5 acres lower than the minimum required area of 22.4 acres.
- The area of subtidal habitat was within 10% of the planned acreage in 2023, and this acreage has been consistent over time.

Types of Performance Standards

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

(e.g., the density of birds shall be similar to that of natural wetlands in the region)

- Moving on from the absolute standards, as a reminder, the second type of performance standards are relative standards, which evaluates San Dieguito against natural wetlands in the region that are used as a reference sites.

Types of Performance Standards

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

(e.g., the density of birds shall 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.

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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.

- In assessing the performance of the San Dieguito Wetlands Restoration project, for a given standard, we define similar performance as when the 4-year running average for a relative performance standard at San Dieguito Wetlands is *equal to or better than* that value for the lowest performing reference wetland for that standard.

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.

- Overall, to be successful, the San Dieguito Wetlands Restoration must provide resource values that are *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.

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 permit criteria.

Relative Performance Standards

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



- Shown here are the 15 relative performance standards used to evaluate the success of the San Dieguito Wetlands Restoration Project.

Relative Performance Standards

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- The first standard is the physical standard of water quality.

Relative Performance Standards

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15. Food Chain Support



- The next 10 standards are about biological communities, including the densities and species richness of birds, fish, and invertebrates.
- For fish and invertebrates, we evaluate their densities and species richness in two habitats, main channel and tidal creek habitat.

Relative Performance Standards

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3. Bird Species Richness
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15. Food Chain Support



- There are three standards about vegetation and algae.

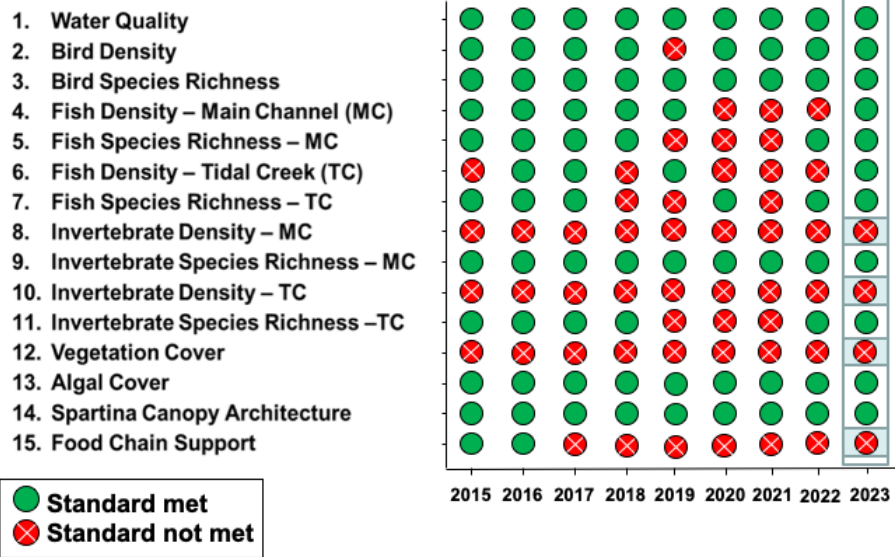
Relative Performance Standards

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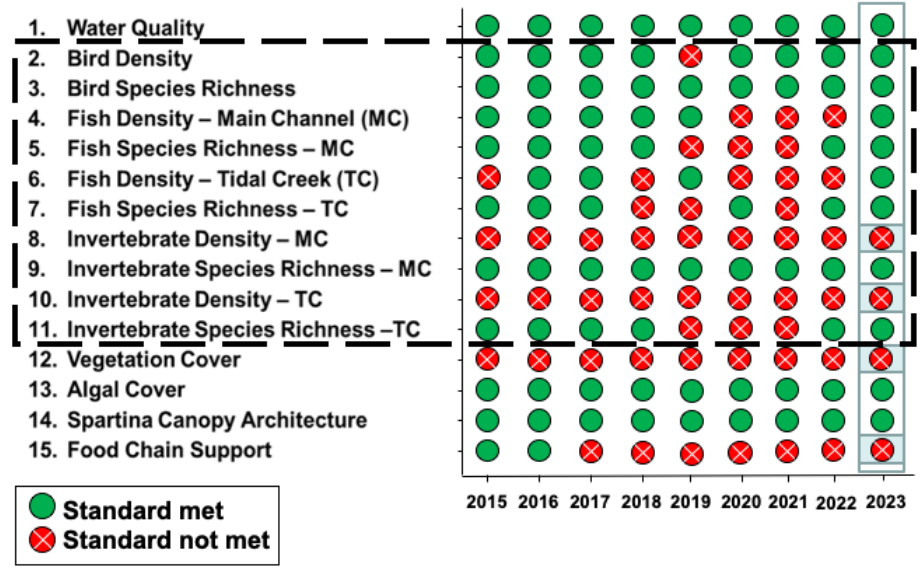
- And lastly there is a standard about food chain support, which is evaluated by the density of feeding birds.

Relative Performance Standards San Dieguito Wetlands Restoration Project



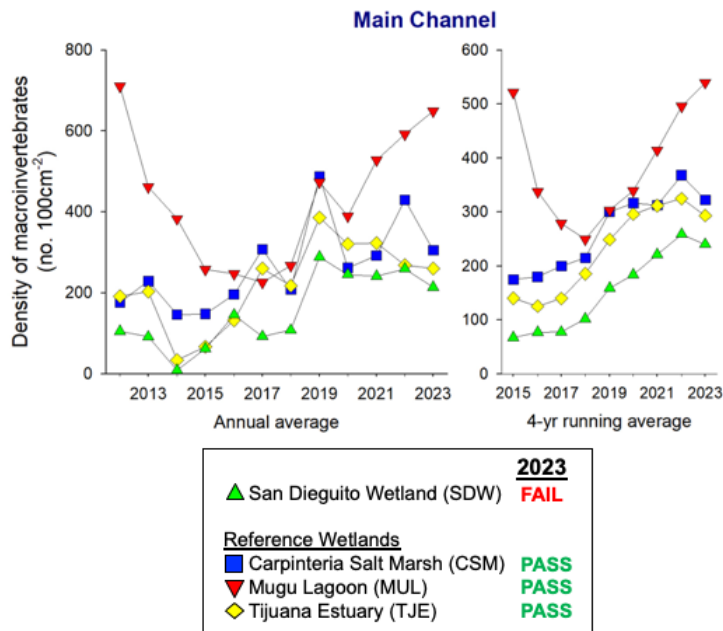
- For this talk, we will show data on the relative performance standards that San Dieguito Wetlands failed in 2023 only.

Relative Performance Standards San Dieguito Wetlands Restoration Project

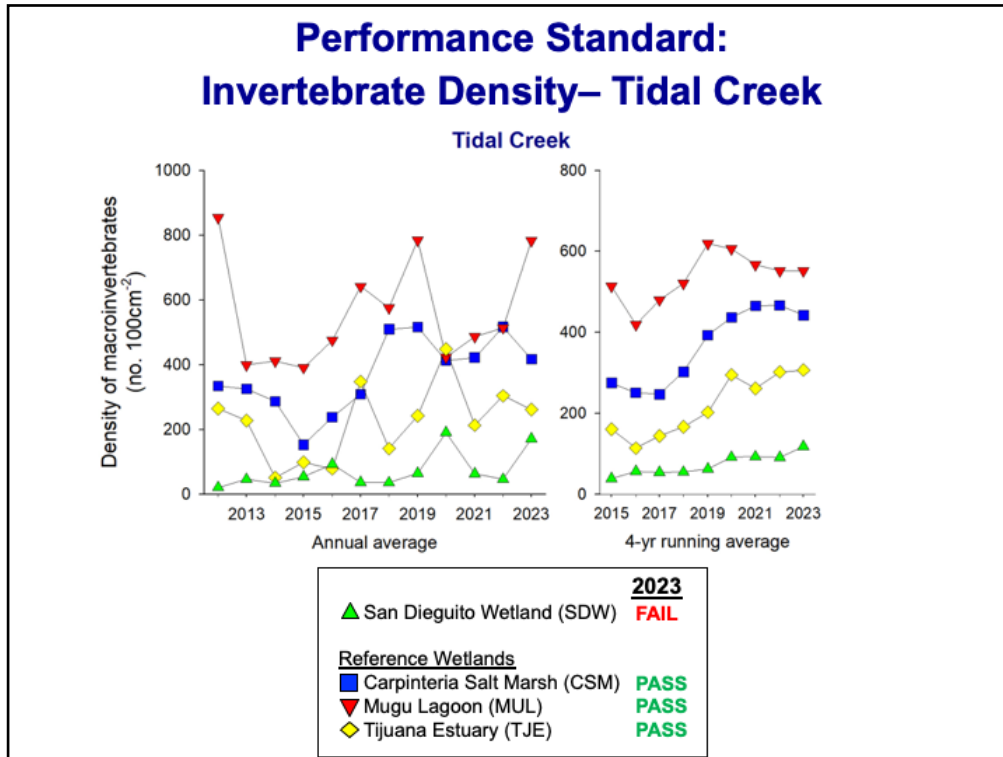


- The relative performance standards that pertain to the biological community at San Dieguito Wetlands that were not met in 2023 include invertebrate density in main channel and tidal creek habitats.

Performance Standard: Invertebrate Density– Main Channel

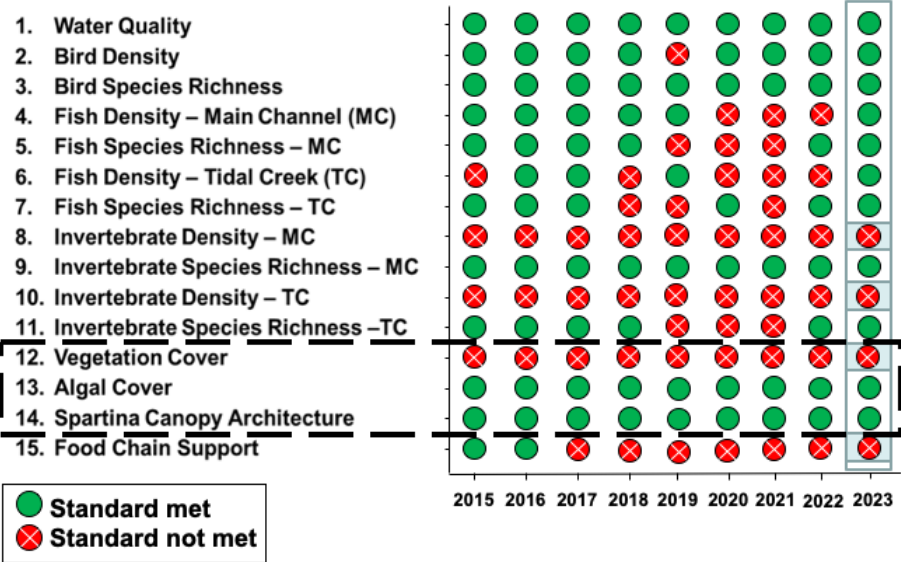


- First, we show the results for invertebrate density in main channel habitats.
- The annual value in San Diego Wetlands has generally been lower than the value in the lowest performing reference wetland throughout the time series. Contrary to the modest increase in main channel invertebrate densities at San Diego Wtland in the past few years, 2023 saw a decrease in density.
- This is reflected in the running average for San Diego Wtlands, which, despite being the consistent lowest performer, has been on an upward trajectory since 2015, with the exception of this past year where the running average declined for the first time. A similar decline in the running average was also observed at Carpinteria Salt Marsh and Tijuana Estuary.
- The running average at San Diego Wtlands has continued to be well below the lowest performing reference site and therefore, this standard was not met in 2023.



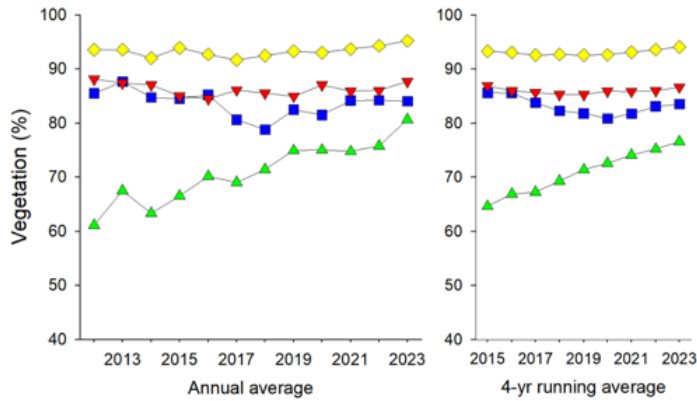
- This slide shows the results for macro-invertebrate density in tidal creek habitat.
- Looking at the annual average on the left, we see that the annual value for tidal creek invertebrate density in 2023 rose to its second highest value since monitoring began, but continues to be well below the reference sites.
- The consistently low densities at San Dieguito is reflected in the running average which continued to remain well below the lowest performing reference site, Tijuana Estuary, in 2023. Therefore this standard was not met in 2023. Rachel will speak in more detail about potential reasons for underperformance of fish and invertebrate densities in the talk that follows.

Relative Performance Standards San Dieguito Wetlands Restoration Project



- Moving now to another relative performance standard that has yet to be met—vegetation cover.

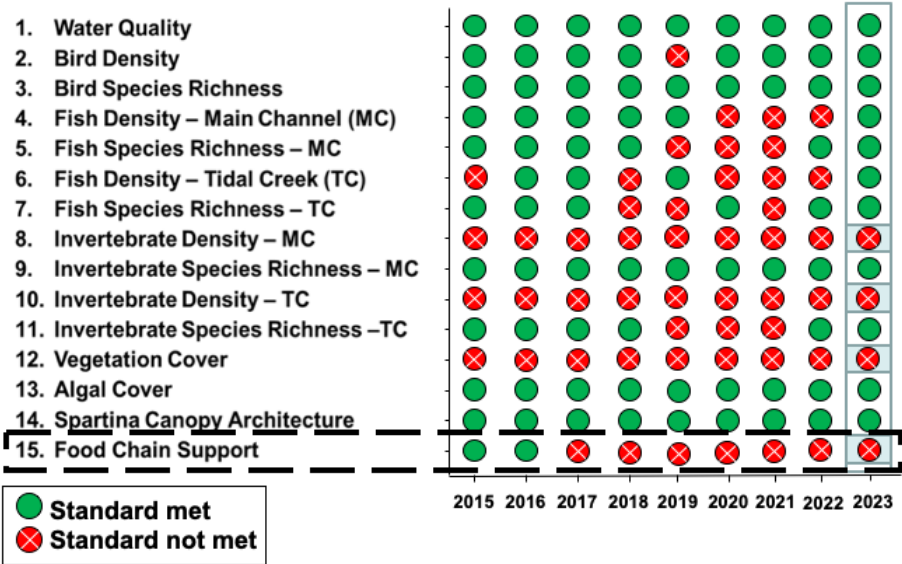
Performance Standard: Vegetation



▲ San Diego Wetland (SDW)	2023 FAIL
<u>Reference Wetlands</u>	
■ Carpinteria Salt Marsh (CSM)	PASS
▼ Mugu Lagoon (MUL)	PASS
◆ Tijuana Estuary (TJE)	PASS

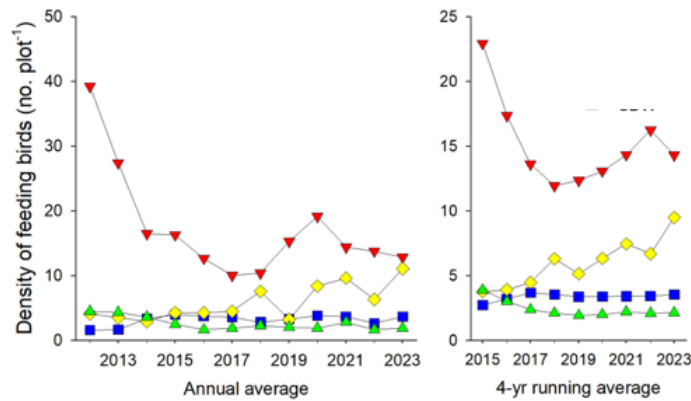
- The vegetation cover standard only includes salt marsh vegetation cover greater than 30%. Vegetation cover has generally increased over time, but stagnated from 2019-2022. In 2023, we saw a substantial increase in vegetation cover at San Diego Wetland, now just below the annual value for Carpinteria Salt Marsh.
- The running average is on a promising trajectory but still below the reference sites.
- This increasing trend for SDW has been consistent over time and will likely intercept the values for the reference wetlands soon.

Relative Performance Standards San Dieguito Wetlands Restoration Project



- Finally, we will review the results from food chain support, measured as the density of feeding birds. This is another standard at the wetland that has been chronically underperforming.

Performance Standard Food Chain Support – Bird Feeding



▲ San Dieguito Wetland (SDW)	2023 FAIL
<u>Reference Wetlands</u>	
■ Carpinteria Salt Marsh (CSM)	PASS
▼ Mugu Lagoon (MUL)	PASS
◆ Tijuana Estuary (TJE)	PASS

- Across all years, food chain support has been consistently highest at Mugu lagoon.
- At San Dieguito the running average in density of feeding birds declined from 2016 to 2018 relative to the lowest performing wetland, Carpinteria Salt Marsh. Since then, density of feeding birds has remained lower than the references.
- Since food chain support in San Dieguito was lower than in Carpinteria Salt Marsh, the lowest performing reference wetland in 2023, this standard was not met.

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.

- To review the requirements for the Relative Standards-
- 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.

Relative Performance Standards

Requirement

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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.

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Relative Performance Standards

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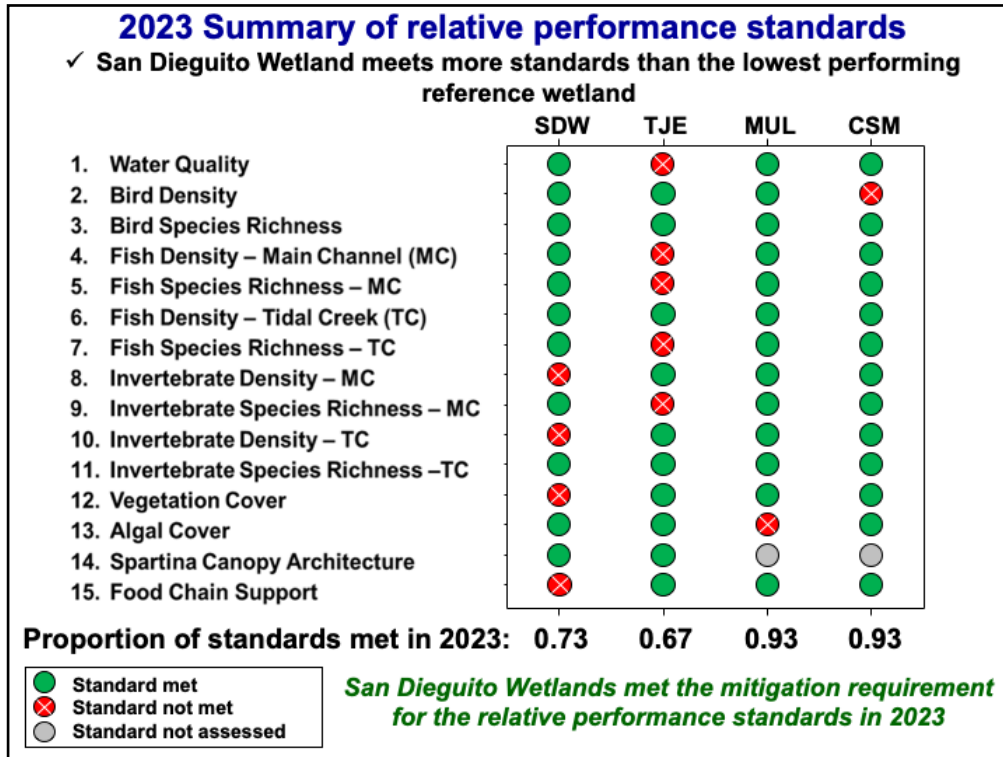
Method of Evaluation

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.

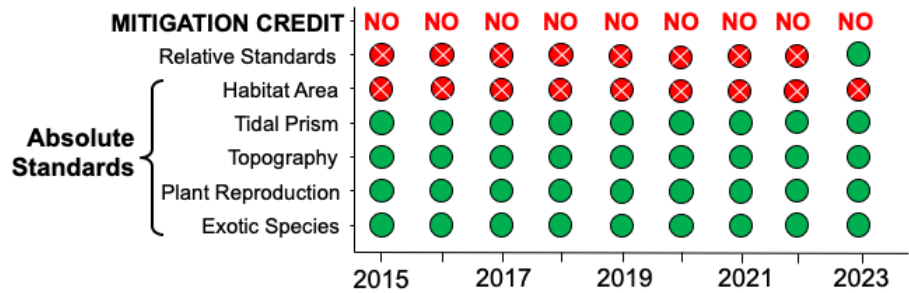
- This requirement that the San Dieguito Wetlands Restoration meet at least the same proportion of relative standards as the lowest performing reference wetland achieves the desired mitigation goal of being similar to natural wetlands without requiring the restoration to outperform the reference wetlands.



- This table summarizes the outcomes for each relative performance standard for each wetland for 2023. A green dot indicates that the performance variable at a wetland is similar to the other wetlands. A red dot indicates that the performance variable at a wetland was not similar to the other wetlands. Gray dot indicates that the performance variable is not measured in a particular wetland.
- Carpinteria Salt Marsh and Mugu Lagoon both failed one performance standard, bird density in Carpinteria and algal cover in Mugu Lagoon. Overall, these wetlands met 93% of the standards.
- Tijuana Estuary failed five standards, including water quality, fish density and species richness in main channel, fish species richness in tidal creek, and invertebrate species richness in main channel. Therefore, Tijuana met 67% of the standards, a drop from the year prior.
- As previously described, San Dieguito Wetlands failed 4 standards, which means that the restored wetland met 73% of the standards.
- Since the proportion of standards met by San Dieguito Wetlands was higher than that of the lowest performing reference wetland, San Dieguito Wetlands met the relative standards requirement in 2023, for the first time since monitoring began.
- The relatively poor performance at TJE may be linked to the recent sewage

inputs into the estuary. This has led to internal discussions within the SONGS MMP regarding whether or not TJE is an appropriate reference site. In 2023, known sewage inputs at TJE may have affected wetland performance but we will continue to monitor the situation in upcoming years. For example, this year we evaluated the performance of SDW with 2023 TJE data included versus omitted and in both scenarios, SDW met the relative standards requirement in 2023.

Mitigation Credit San Dieguito Wetlands Restoration Project



● Standard met
✗ Standard not met

Number of years of credit needed = 32
Number of years of credit earned = 0

- Now to examine how these outcomes translate to mitigation credit, 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.
- 2023 is the first year the project has met the Relative Standard requirement.
- In terms of absolute standards, the San Dieguito Wetlands has yet to meet the Habitat Areas Absolute Standard due to the loss of mudflat.
- Therefore, the project has not yet satisfied the performance success criteria in the SONGS permit and has not yet received mitigation credit.

Agenda

Annual Public Workshop San Onofre Nuclear Generating Station Wetland Mitigation Project May 9, 2024

- 1:30 – 1:40 Introduction and Overview – Mark Page, UCSB
- 1:40 – 2:30 Performance of the San Dieguito Wetlands Restoration Project – Kat Beheshti, UCSB
- 2:30 – 3:00 Causes and consequences of habitat conversion at San Dieguito Wetlands– Rachel Smith, UCSB
- 3:00 – ? General Discussion

For more information go to: <http://marinemitigation.msi.ucsb.edu/>

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