

Plans for reduced monitoring of Wheeler North Reef



April 5, 2023

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

Provisions in the SONGS' coastal development permit for reduced monitoring of Wheeler North Reef

Condition C. Kelp Reef Mitigation

Upon completion of **ten years of independent monitoring** that demonstrate the mitigation reef is in compliance of the performance standards, the permittee shall be fully responsible for funding independent **annual site inspections**, **which will serve to identify any noncompliance** with the performance standards.

Condition D. Administrative Structure

The mitigation projects will be successful when all performance standards have been **met each year for a three-year period**. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission.

- There are provisions in the SONGS' coastal development permit to reduce the level of monitoring to annual site inspections once the Wheeler North Reef has demonstrated that it has successfully met the performance standards.
- Specifically, Condition C of the permit pertaining to kelp reef mitigation states that after 10 years of monitoring that demonstrate the artificial reef is meeting the performance standards monitoring shall be reduced to annual site inspections that serve to identify whether the performance standards are being met
- Condition D states that monitoring will be scaled down after all the performance standards have been met each year for a three-year period

Scaling back monitoring of Wheeler North Reef to site annual inspections

QUESTIONS

1. Which types of performance standards can be evaluated with annual site inspections?
2. What level of monitoring is sufficient for annual site inspections to “*identify any noncompliance with the performance standards*”?
3. When can monitoring be reduced to annual site inspections?

Reducing the performance monitoring of Wheeler North Reef in a manner that is consistent with the SONGS permit requires answers to three key questions

1. Which types performance standards can be evaluated with annual site inspections?
2. What level of monitoring is sufficient for annual site inspections to “*identify any noncompliance with the performance standards*”?
3. When can monitoring be reduced to annual site inspections?

Q1. Which performance standards are amenable to evaluation using annual site inspections?

Types of Performance Standards

1. Relative performance standards, that require Wheeler North Reef to be similar to reference sites every year
2. Absolute performance standards measured at Wheeler North Reef only that must be met every year
3. Absolute performance standards measured at Wheeler North Reef only that accumulate mitigation credit over time until a required value is met

The monitoring program will be scaled down to annual site inspections when the project is successful

- Successful is when *“performance standards have been met each year for a three-year period”*

Annual site inspections are applicable to Performance Standard types 1 and 2, but not 3

Answering the first question requires an understanding the three different types of performance standards that are used to evaluate the performance of Wheeler North Reef which are:

1. Relative performance standards, whose similarity to reference sites is evaluated every year
 2. Absolute performance standards measured at Wheeler North Reef only that must meet a fixed value every year
 3. Absolute performance standards measured at Wheeler North Reef only that accumulate mitigation credit over time until a required value is met
- The SONGS permit states that the monitoring will be scaled down to annual site inspections when the project is successful and it defines “successful” as the when the performance standards have been met each year for a 3-year period.
 - This is important because success is not measured annually for all three types of performance standards.
 - Whereas the success of Types 1 and 2 is evaluated every year, Type 3 performance standards accumulate mitigation credit over time and are deemed successful only after they have accumulated enough credit to meet the mitigation requirement.
 - Thus annual site inspections are applicable to performance standard types 1 and 2, but not 3

The performance standards are sampled in different ways

Type of Performance standard	Performance variable	Type of sampling
Absolute	1. Area of hard substrate	Transect surveys
	2. Undesirable/invasive species	Transect surveys
Relative	1. Algal % cover	Transect surveys
	2. Algal species richness	Transect surveys
	3. Sessile invertebrate % cover	Transect surveys
	4. Mobile invertebrate density	Transect surveys
	5. Invertebrate species richness	Transect surveys
	6. Resident fish density	Transect surveys
	7. Young-of-year fish density	Transect surveys
	8. Fish species richness	Transect surveys
	9. Fish production	Fish collections
	10. Fish reproductive rates	Fish collections
	11. Fish food chain support	Fish collections

Determining the best way to reduce the sampling effort for annual site inspections depends on the sampling method used to evaluate a given performance standard.

We use two different sampling methods for evaluating the performance standards.

1. Transect surveys are used to collect data to evaluate the absolute performance standards for hard substrate and undesirable and invasive species and relative standards 1 through 8.
2. Data obtained from fish collections are used to evaluate relative performance standards 9 through 11

Q2. What level of monitoring is sufficient for annual site inspections of performance standards sampled with transect surveys?

Approach used to determine sampling effort for full monitoring

- Determine the sample size needed to detect a 20% difference between the mean values for the lowest and second lowest performing reefs with relatively high confidence

N = 82 transects/reef; use *probability values to detect differences among reefs*

Approach used to determine sampling effort for annual site inspections

- Set sample size at a much reduced level that is capable of identifying noncompliance with the performance standards, understanding that there will be ***less assurance*** of correctly identifying noncompliance than that obtained from full monitoring

N = 15 transects/reef; use *rank values to detect differences among reefs*

- Understanding the rationale and approach for the current monitoring program provides important context for determining the level of monitoring for annual site inspections.
- The approach used to determine the sampling effort for full monitoring of the performance standards sampled with transect surveys was based on the desire to detect a 20% difference between the mean values for the lowest and second lowest performing reefs with relatively high confidence.
- This resulted in a sample size of 82 transects per reef and the use of probability values to detect differences among reefs.
- The approach used to determine the sampling effort for annual site inspections was based on the desire to substantially reduce the sample size but still retain the ability to identify non-compliance with the performance standards, albeit with less assurance than that obtained with full monitoring
- The method proposed for annual site inspections uses a sample size of 15 transects per reef and simply compares rank values to detect differences among reefs

Q2. What level of monitoring is sufficient for annual site inspections of performance standards sampled by collecting fish?

Performance Standard	Current Method	Annual Inspection*
Fish production	Measure growth and gonadal production of 5 indicator species <i>(n = 75-100 individuals collected per species per reef)</i>	Use transect data on fish biomass density of the 5 indicator species as a proxy for fish production <i>(no fish collections)</i>
Fish reproductive rates	Measure annual fecundity of 4 indicator species <i>(n = 75-100 individuals collected per species per reef)</i>	Measure annual fecundity of 2 indicator species <i>(n = 40-50 individuals collected per species per reef)</i>
Fish food chain support	Measure gut fullness of 2 indicator species <i>(n = 75-100 individuals collected per species per reef)</i>	Measure gut fullness of 2 indicator species <i>(n = 40-50 individuals collected per species per reef)</i>

* proposed

Comparison of reef performance using current method of full monitoring vs. proposed annual site inspections

Number of relative performance standards met out of 11

Meets requirement for relative & absolute standards

		Wheeler North		San Mateo		Barn				Wheeler North	
		Current method	Annual site inspections	Current method	Annual site inspections	Current method	Annual site inspections			Current method	Annual site inspections
2012		8	8	6	6	10	9	2012		Yes	Yes
2013		7	8	6	5	10	10	2013		Yes	Yes
2014		8	8	5	5	10	10	2014		Yes	Yes
2015		9	8	6	5	9	10	2015		Yes	Yes
2016		9	9	6	5	9	9	2016		Yes	Yes
2017		9	7	5	5	10	10	2017		Yes	Yes
2018		8	8	8	6	9	9	2018		Yes	Yes
2019		8	7	8	7	10	9	2019		Yes	Yes
2020		9	8	7	7	10	9	2020		Yes	Yes
2021		9	9	7	4	10	9	2021		Yes	Yes

Conclusion:

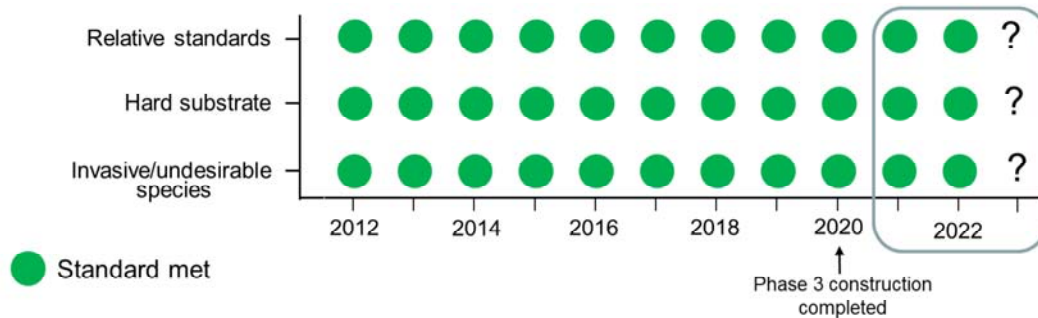
- The number of relative performance standards met by each reef was similar for the current method of full monitoring and the method proposed for annual site inspections
- Reducing the monitoring to annual site inspections would not have affected whether Wheeler North Reef met the requirement for the relative performance standards and the absolute standards for hard substrate and undesirable/invasive species

- We wanted to compare the performance of each reef using the current method of full monitoring vs. the performance that would have resulted from the method proposed for annual site inspections
- Shown for each year is the number of relative performance standards out of 11 met by each reef for the current method of full monitoring
- We see that for any given year Wheeler North typically met more standards than San Mateo and fewer standards than Barn
- The annual site inspection column shows the number of standards that were met when we retroactively subset the data to include only those transects and fish sample sizes that are planned for annual site inspections
- As you can see the number of relative performance standards met by each reef was similar for the two methods
- This suggests that the method proposed for annual site inspections should be sufficient for identifying noncompliance with the performance standards
- We also want to know the extent to which reducing monitoring to annual site inspections might influence Wheeler North Reef's ability to earn mitigation credit
- To do this we Wheeler North Reef's ability to meet the annual mitigation requirement for the collective group of relative performance standards and the two annual absolute standards using the current method of full monitoring and the reduced method proposed for annual site inspections
- A yes in the table on the right indicates that the Wheeler North Reef met the annual mitigation requirement for both types of performance standards.
- The results show that Wheeler North Reef. would have met the annual mitigation requirement for the relative and absolute performance standards in every year using either sampling method suggesting that reducing the monitoring to annual site inspections will likely not significantly affect Wheeler North Reef's ability to earn mitigation credit

Q3. When can monitoring be reduced to annual site inspections?

After at least 10 years of monitoring and three consecutive years of Wheeler North Reef successfully meeting the performance standards

- Full monitoring using the 4-y average to evaluate the performance standards began in 2012
- Three successive years in meeting the performance standards begins in 2021 following completion of construction of Phase 3



Annual site inspections can begin in 2024 if Wheeler North Reef passes the relative standards and the absolute standards for hard substrate and undesirable/invasive species in 2023

- According to the SONGS permit at least 10 years of monitoring and three consecutive years of Wheeler North Reef successfully meeting the performance standards is needed before monitoring can be reduced to annual site inspections
- Full monitoring using the 4-y average to evaluate the performance standards began in 2012. Thus the 10-year requirement has been met
- Three successive years in meeting the performance standards begins in 2021 following the construction of Phase 3
- Therefore the soonest annual site inspections can begin is in 2024
- In order for this to happen Wheeler North Reef must pass the relative standards and the absolute standards for hard substrate and undesirable/invasive species in 2023
- We are hopeful that this will be the case as it has passed these performance standards every year since 2012

Summary of proposed annual site inspections

Comparison of sampling effort between current full monitoring and proposed reduced monitoring

Performance standard type	Sample size (Full Monitoring)	Sample size (Reduced Monitoring)	Percent Reduction in sampling effort
Relative (transect sampling)	246 transects (82 per reef)	45 transects (15 per reef)	82%
Relative (fish collections)	5 species (100 fish/species/reef)	3 species (50 fish/species/reef)	70%
Absolute annual evaluation (Wheeler North Phases 1+2)	82 transects (Wheeler North only)	15 transects (Wheeler North only)	82%

- The sample sizes for the current level of full monitoring and the proposed reduced monitoring are summarized in this table for the different types of performance standards
- The percent reduction in sampling effort for each performance standard type is shown in the far right column

Q1. Which performance standards are amenable to evaluation using annual site inspections?

Types of Performance Standards

1. Relative performance standards, that require Wheeler North Reef to be similar to reference sites every year
2. Absolute performance standards measured at Wheeler North Reef only that must be met every year
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Annual site inspections are not applicable to 3, but implementing annual site inspections for 1 and 2 may provide opportunities to reduce sampling for 3

- Returning to the types of performance standards that are amenable to assessment with annual site inspections, as we discussed previously, annual site inspections are not applicable to the third type of standard, those absolute standards measured at Wheeler North Reef only that accumulate mitigation credit over time until a required value is met.
- However, implementing annual site inspections for the first two standards may also provide opportunities to potentially reduce sampling effort for this third type of standard.

Can the monitoring effort for the absolute performance standards that accumulate credit over time be reduced?

- Data collected from the 82 transects at Wheeler North Reef to evaluate the relative and the annual absolute performance standards are also used to evaluate the cumulative absolute standards for fish standing stock and giant kelp area
- Do we need all 82 transects to evaluate fish standing stock and giant kelp area when most of them (i.e., 67) will no longer be sampled in annual site inspections?



Locations of the 82 transects used to evaluate the relative standards and the annual absolute performance standards

- Phase 1: 12 transects
- Phase 2 primary polygons: 70 transects (35 pairs)

**Phase 2 contingency polygons used for fish standing stock and kelp area: 10 transects (5 pairs)*

- Thus, we explored whether the monitoring effort for absolute performance standards that accumulate credit can be reduced, given the approach for annual site inspections.
- These cumulative standards include fish standing stock and giant kelp area. In our current sampling scheme, data collected from the 82 transects at Wheeler North Reef that are used to evaluate the relative and annual performance standards are also used to evaluate these cumulative standards.
- Scaling back the number of transects from 82 to 15 for the relative standards and the annual absolute standards that must be met every year for annual site inspections led us to question whether we need all 82 transects to evaluate fish standing stock and giant kelp area over time when 67 of them will no longer be sampled in the annual site inspection.
- This map shows the location of the 82 transects shown as the black diagonal lines
- 12 of the transects are located on the phase 1 modules shown in purple and 70 transects arranged in 35 pairs are located in the primary polygons of phase 2 shown in green
- An additional 10 transects arranged in 5 pairs are sampled for fish and kelp in the phase 2 contingency polygons shown in yellow

Can the monitoring effort for the absolute performance standards that accumulate credit over time be reduced?

Evaluation requires spatially distributed sampling that accurately estimates the area of kelp and the standing stock of fish across *all three phases* of Wheeler North Reef



Current sampling effort = 151 transects

- Phase 1: 12 transects
- Phase 2: 80 transects (40 pairs)
- Phase 3: 59 transects

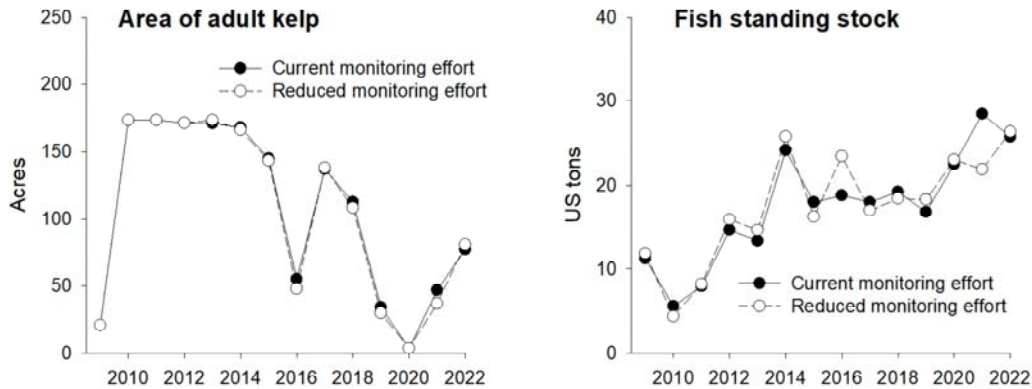
Proposed sampling effort = 111 transects

- Phase 1: 12 transects
- Phase 2: 40 transects (no pairs)
- Phase 3: 59 transects

Eliminate one of the transects in each of the 40 pairs on Phase 2

- Evaluation of the two cumulative absolute performance standards requires spatially distributed sampling that accurately estimates the area of giant kelp and the standing stock of fish across all 373 acres of Wheeler North Reef
- The current sampling effort for kelp area and fish standing stock consists of 151 transects distributed across all three phases of Wheeler North Reef, which are shown as black diagonal lines in this map
- 12 of these transects are located on the Phase 1 modules, 80 are arranged in 40 pairs on the primary and contingency polygons of Phase 2, and 59 are on the polygons of Phase 3
- One method for reducing the sampling effort but maintaining broad spatial coverage is to eliminate one of the transects in each of the 40 pairs on the Phase 2 polygons
- Doing so would reduce the number of transects sampled for fish standing stock and giant kelp area from 151 to 111

Comparison of kelp area and fish standing stock using current vs. reduced monitoring



Proposed reduction in sampling effort from 151 to 111 transects will likely have little effect on estimates of kelp area and fish standing stock

***Reduced monitoring could begin in 2024 pending the 2023 monitoring results
STAY TUNED!***

Shown here are time series graphs of the area of adult kelp on Wheeler North Reef on the left and the standing stock of fish for:

- The current level of monitoring based on 40 paired transects in Phase 2 (shown as solid black circles and solid lines), vs.
- the proposed reduced monitoring in which had one of the transects in each pair was eliminated (open circles and dashed lines)
- These graphs indicate that the proposed reduction in sampling effort from 151 transects to 111 transects will likely have little effect on estimates of kelp area and fish standing stock at Wheeler North Reef
- Reduced monitoring for fish standing stock and giant kelp area will begin in 2024 provided that the results of full monitoring in 2023 show that Wheeler North Reef met the annual requirements for the relative and annual absolute performance standards, which it has consistently done the past 10 years

Annual Public Workshop

**San Onofre Nuclear Generating Station Artificial Reef Mitigation Project
Wednesday, April 5, 2023**

Agenda

- 1:30 – 1:45** Introduction to SONGS reef mitigation – *Dan Reed, UCSB*
- 1:45 – 2:30** Results from the 2022 performance monitoring of the Wheeler North Reef – *Kat Beheshti, UCSB*
- 2:30 - 2:45** Questions and comments on performance monitoring results
- 2:45 – 3:00** Plans for reduced monitoring of Wheeler North Reef – *Rachel Smith, UCSB*
- 3:00 - ??** Questions, comments and general discussion

