

Performance of the Wheeler North Reef

2020 Monitoring Results



April 12, 2021

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

Performance Standards

Used to evaluate whether the Wheeler North Reef compensates for loss of kelp forest habitat caused by SONGS

- 1. *Relative standards:* Must be similar to natural reefs in the region**
- 2. *Absolute standards:* Measured against a fixed value at Wheeler North Reef only**

The goal of the Wheeler North Reef is to compensate for the loss of kelp forest habitat caused by the operations of SONGS and a variety of physical and biological performance standards are used to determine whether this goal is met

Two types standards are used to judge the performance of the Wheeler North Reef

- 1) Relative standards are measured at Wheeler North Reef and the two reference reefs and are used to evaluate whether the Wheeler North Reef is performing similar to natural reefs
- 2) Absolute standards are measured against fixed values at Wheeler North Reef only. Absolute standards are based in part on actual measured impacts to the San Onofre kelp forest resulting from SONGS operations

Relative Performance Standards

(requires comparison to natural reference reefs)

RATIONALE: To be successful the Wheeler North Reef must sustain a kelp forest community that is *similar* to those of natural reefs in the region.

Criteria for reference reef selection:

- 1) History of sustaining giant kelp
- 2) Occur at a depth similar to that of the artificial reef
- 3) Primarily low relief, preferably consisting of cobbles & boulders
- 4) Located within the local region

The kelp forests at San Mateo and Barn best met these criteria



- Evaluating the relative performance standards requires comparing the Wheeler North Reef to natural reference reefs in the region.
- Choosing the natural reefs that are used for reference was a critical element of the mitigation project because they form the basis for determining whether the Wheeler North Reef is successful in meeting its goals
- The nearby kelp forests at San Mateo and Barn were selected as reference reefs because they had:
 1. history of sustaining giant kelp
 2. occur at a depth similar to that of the artificial reef
 3. primarily low relief, preferably consisting of cobbles and boulders
 4. located within the local region

Relative Performance Standards

(must be similar to natural reference reefs)

Definition of similar: The 4-year running average for a relative performance standard at Wheeler North Reef must *not be significantly less than* that at the reference reef having the lowest value for that performance standard.

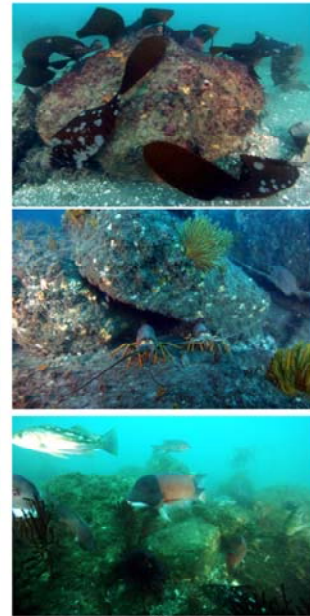
Rationale:

- For a given relative performance standard, the Wheeler North Reef should perform at least as well as the lowest performing natural reef used as a reference
- The biological characteristics of a reef (natural or artificial) fluctuate over time and a 4-year running average takes this variability into account when evaluating reef performance

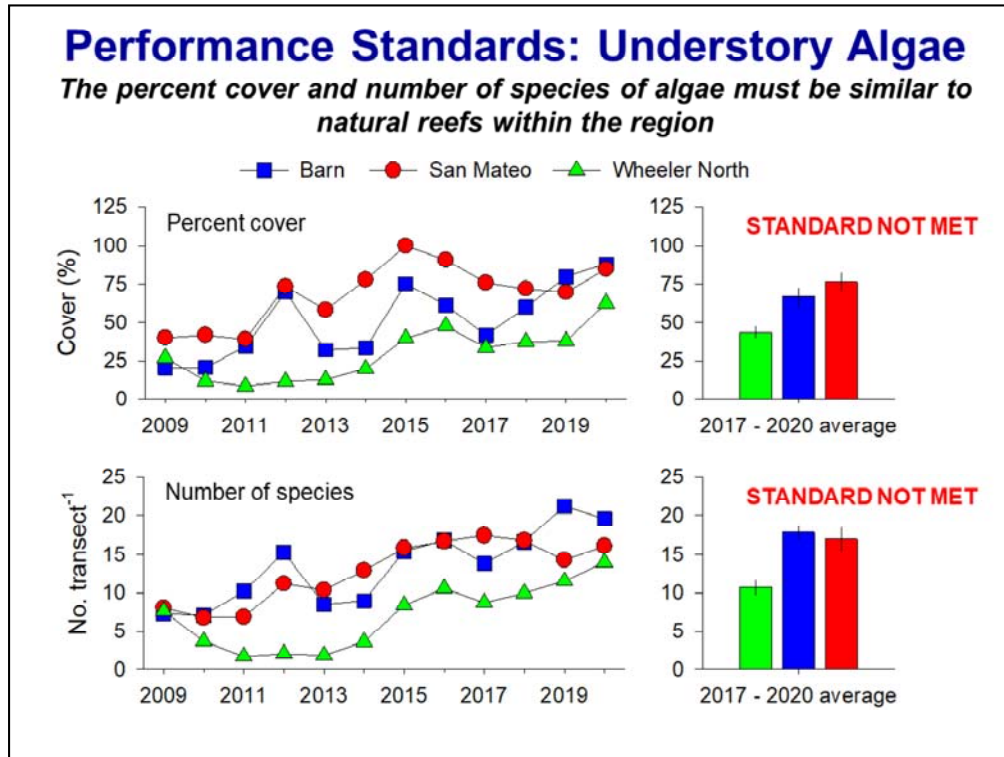
- The SONGS Coastal Development Permit envisioned a quantitative definition of “similar” for comparing the performance of the artificial reef to natural reefs, and it specified that the measure of similarity be defined in the monitoring plan for the project
- After considerable discussion the definition for the measure of similarity that was chosen is that the 4-year running average for a performance variable at Wheeler North Reef must not be significantly less than the reference reef having the lowest value for that performance variable
- This definition recognizes that no two natural reefs are identical, but that any reef chosen as a reference site should serve as an acceptable standard.
- Because the biological characteristics of reefs often vary from year to year and there is a certain amount of error associated with any type of sampling we use the 4-year running average of the performance standard to help account for this variability

Relative Standards for Wheeler North Reef

1. Algal percent cover
2. Algal species richness
3. Sessile invertebrate percent cover
4. Mobile invertebrate density
5. Invertebrate species richness
6. Resident fish density
7. Young-of-Year fish density
8. Fish species richness
9. Fish reproductive rates
10. Fish production
11. Food chain support



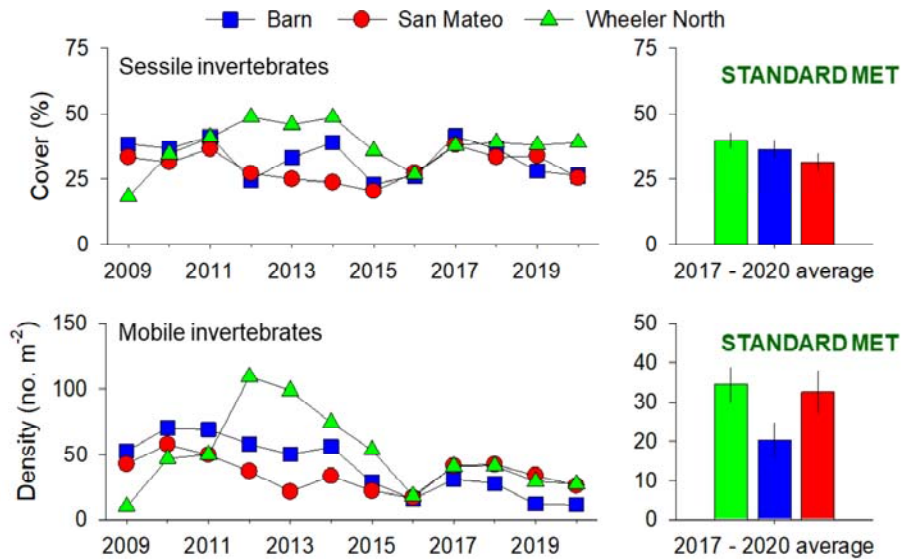
- Shown here are the 11 relative performance standards that are used to judge the performance of the Wheeler North Reef
- Standards 1-5 pertain to the benthic community of algae and invertebrates
- Standards 6-10 pertain to reef fishes
- Standard 11 integrates the benthic community of algae and invertebrates with reef fishes by focusing on the extent to which the benthic community supplies food for reef fishes
- What follows next are the results of the 2020 performance monitoring for these 11 standards



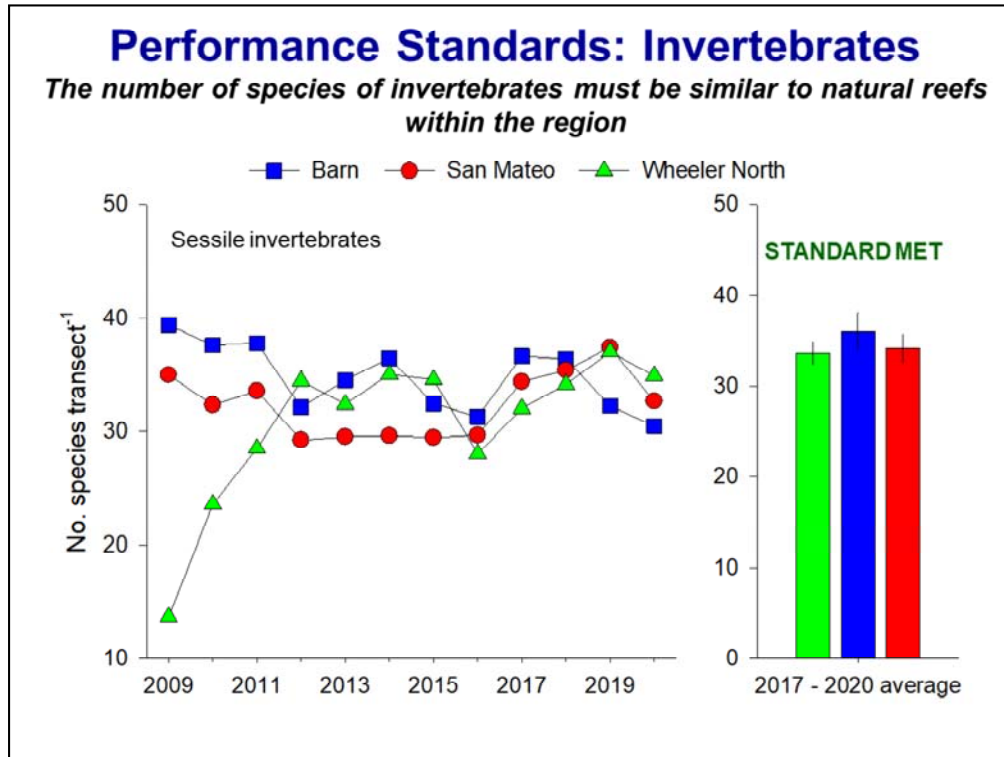
- In the slides that follow different colors are used for the different reefs; Blue and red represent the reference reefs at Barn and San Mateo respectively, and green represents the Wheeler North Reef
- In each slide the annual time series since 2009 is plotted on the left and the four-year running average for 2020 is plotted on the right.
- Plotted in this slide are data collected at the Wheeler North Reef, Barn and San Mateo on the mean (\pm SE) percent cover (top graph) and the mean number of species (bottom graph) of understory algae
- The annual time series shows that percent cover and number of species of understory algae at Wheeler North Reef has consistently been lower than that of nearby natural reefs
- As such The Wheeler North Reef did not meet either of these performance standards in 2020.

Performance Standards: Invertebrates

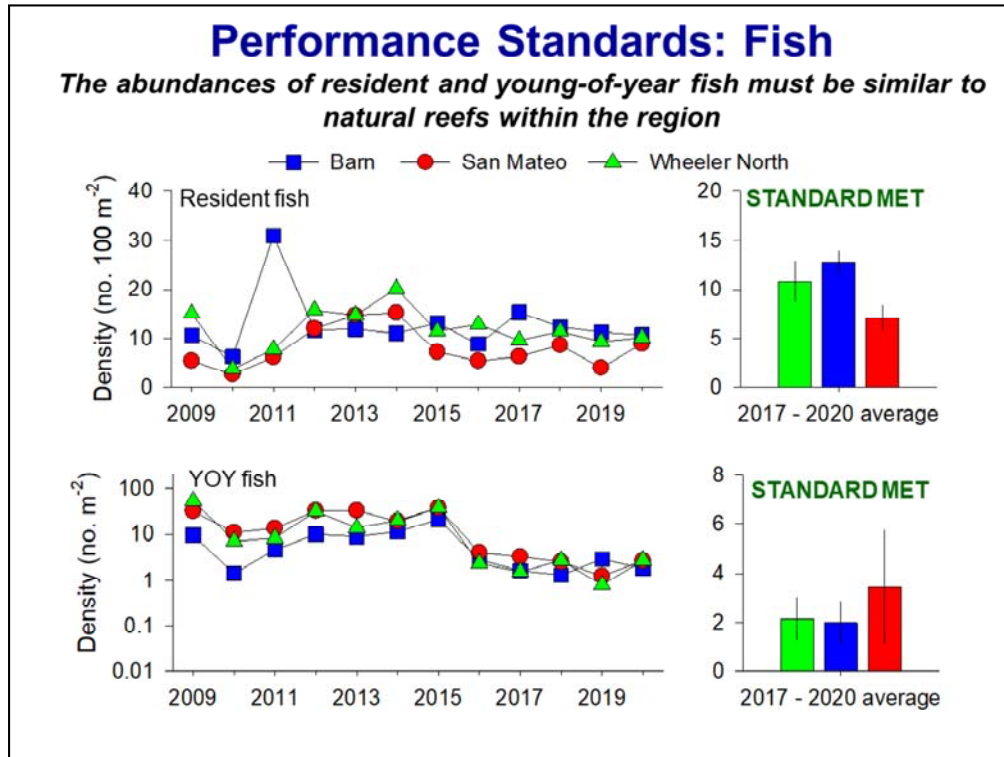
The percent cover of sessile invertebrates and the density of mobile invertebrates must be similar to natural reefs within the region



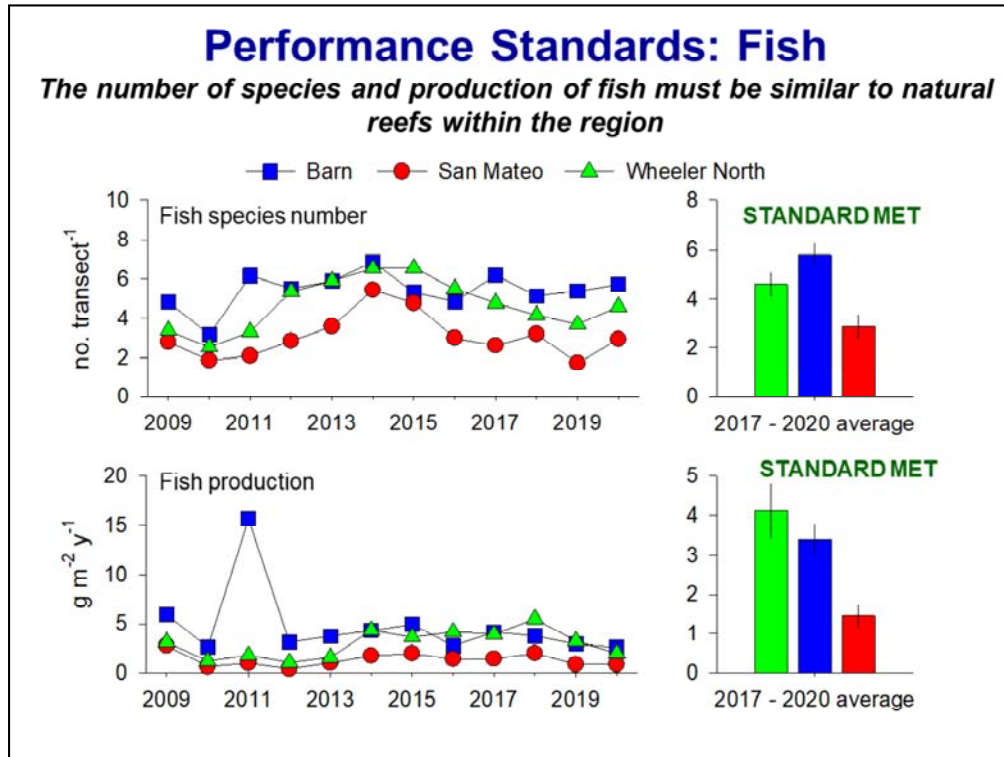
- Plotted here are data collected at the Wheeler North Reef, Barn and San Mateo on the percent cover of sessile invertebrates (top graph) and the abundance of mobile invertebrates (bottom graph)
- The time series data show that except for the first year or two following reef construction, the abundance of sessile and mobile invertebrates at Wheeler North Reef have consistently been within or above the range of nearby natural reefs
- The Wheeler North Reef met both of these performance standards in 2020.



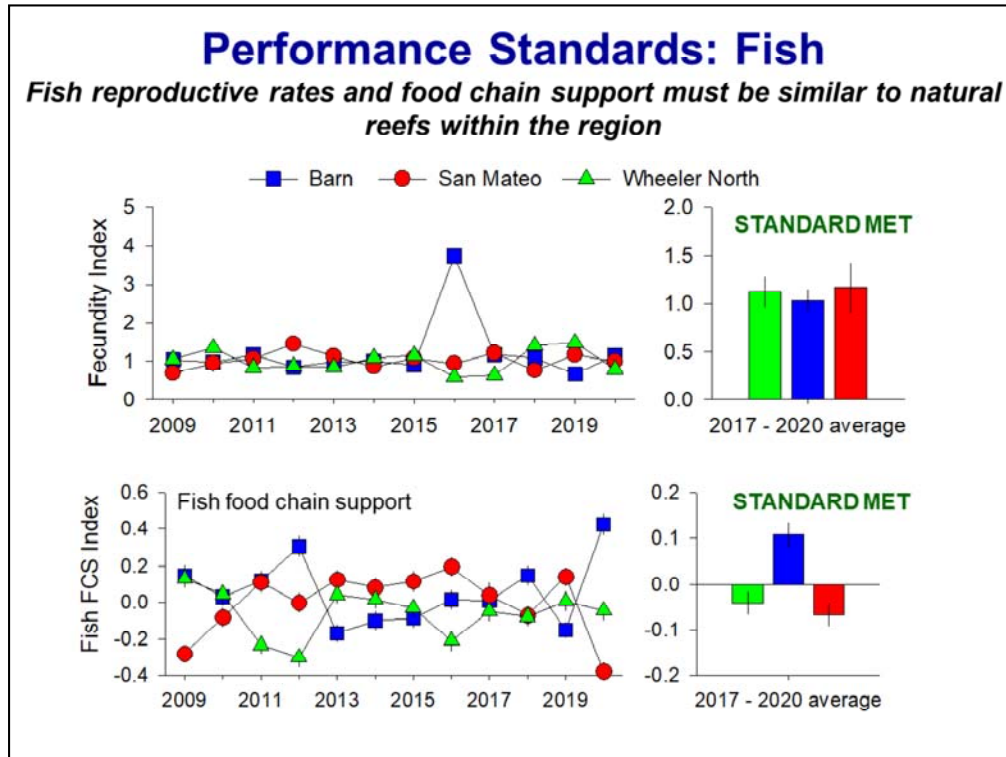
- Plotted here is the mean (+/- SE) number of species of sessile and mobile invertebrates per transect at the Wheeler North Reef, Barn and San Mateo
- Relatively few species of invertebrates inhabited the Wheeler North Reef during the first couple of years of its existence
- Since 2012 the number of species of reef invertebrates at Wheeler North Reef has been much more similar to that of nearby natural reefs
- The Wheeler North Reef met this performance standard in 2020



- Plotted here are data collected at the Wheeler North Reef, Barn and San Mateo on the mean (\pm SE) density of older resident fish (top graph) and newly recruited Young-of-year reef fish (bottom graph)
- The densities of resident and YOY fish at Wheeler North Reef have consistently been within or above the range of nearby natural reefs
- The Wheeler North Reef met both of these performance standards in 2020.



- Plotted here are data collected at the Wheeler North Reef, Barn and San Mateo on the mean (+/- SE) number of species of reef fish per transect (top graph) and annual production of new reef fish biomass (bottom graph) which are used to evaluate the performance standards pertaining to the number of species of fish and their production.
- The number of species of fish at Wheeler North Reef has consistently been within or above the range of nearby natural reefs and this performance standard was met in 2020
- Fish production is the amount of fish biomass produced per year and it takes into account somatic and gonadal growth.
- Fish production is measured in five indicator species: blacksmith, señorita, black perch, sheephead and kelp bass
- These species were chosen because they are among the most common species of fish in the kelp forest and they represent different feeding guilds that use the reef in different ways.
- Blacksmith eat plankton during the day and seek shelter on the reef at night, señorita eat plankton and small invertebrates on the reef, black perch feed on small invertebrates that live on or near the bottom, sheephead feed on larger invertebrates on the bottom, and kelp bass primarily feed on other species of fish.
- Fish production at the Wheeler North Reef has consistently been within the range or above the two reference reefs and in 2020 its four-year average was greater than San Mateo and Barn, hence it met this performance standard.



- Plotted here are indices of female fecundity as a measure of reef fish reproduction (top graph for the Wheeler North Reef, Barn and San Mateo).
- The mean fecundity index at Wheeler North Reef has been consistently similar to that nearby natural reefs and the Wheeler North Reef met this standard in 2020
- There is also a performance standard that requires the benthic community of the Wheeler North reef to provide food for the fishes that feed on the reef in an amount that is similar to that provided by natural reefs
- We evaluate this performance standard by measuring the weight of the food in the guts of two common species of fish that feed on the bottom: black perch and the California sheephead
- We use this information to calculate an index of food chain support that is scaled to the weight of the fish
- The food chain support (FCS) index at Wheeler North Reef has fluctuated inconsistently over time
- This was especially true in 2020 when Barn showed a dramatic increase and San Mateo showed a dramatic decrease
- These large fluctuations in 2020 resulted from the fact that FCS values for both species were highest at Barn and lowest at San Mateo
- The annual value and the four year average of the FCS index at Wheeler North Reef in 2020 was within the range of that of the two reference reefs
- Consequently, the Wheeler North Reef met the FCS standard in 2020.

Relative Performance Standards

(must be similar to natural reference reefs)

Evaluation Criteria

Wheeler North Reef (WNR) must meet as many relative standards as the lowest performing reference reef in a given year for that year to count towards mitigation credit.

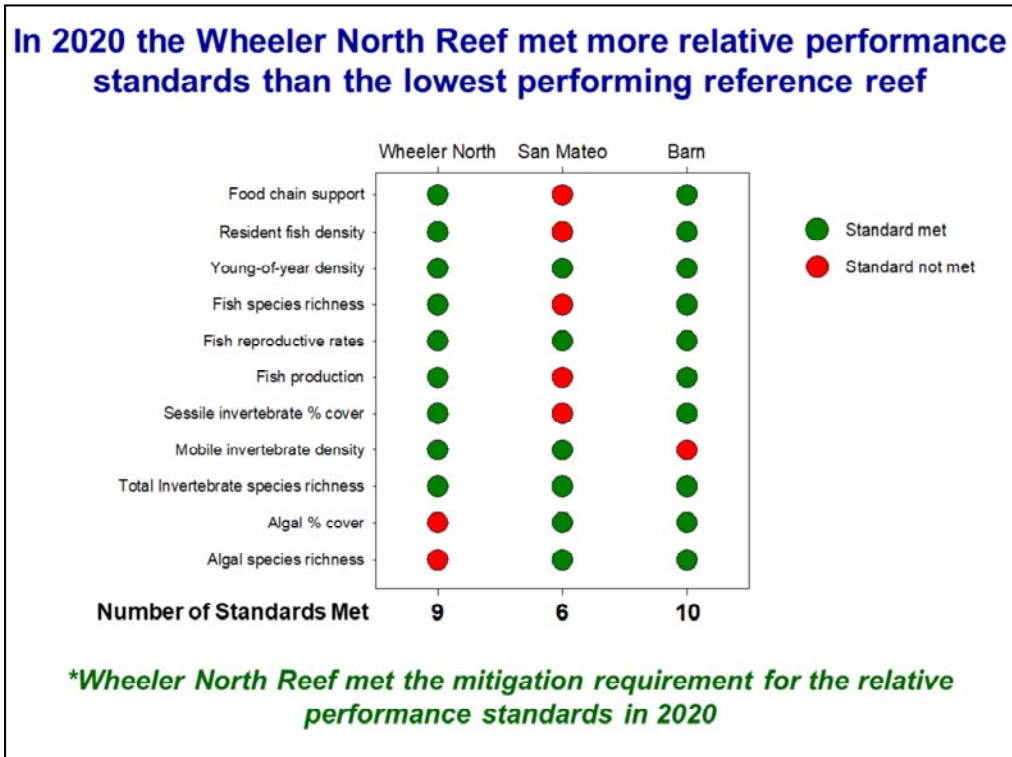
Rationale

Requiring WNR to meet at least as many relative standards as the reference reefs achieves the desired goal of WNR being similar to natural reefs without requiring it to consistently outperform them.

Method of Evaluation

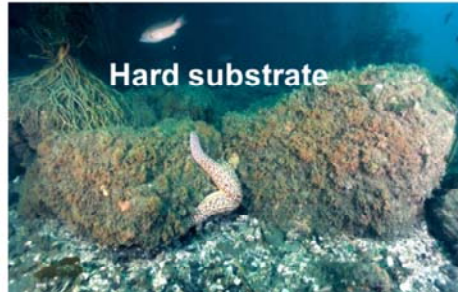
WNR and the reference reefs are evaluated with respect to each other to determine whether they meet each relative standard and the total number of relative standards met by each reef is tallied and compared.

- Because natural kelp forests also vary greatly over time in their species composition and abundance it is likely, that they too would not consistently meet all the relative standards in a given year
- Therefore, to avoid requiring the Wheeler North Reef to perform better than the reference reefs, the Wheeler North Reef is required to meet only as many of the relative standards as the lowest performing reference reef in a given year for that year to count towards mitigation credit
- This achieves the desired goal of Wheeler North Reef being similar to natural reefs without requiring it to consistently outperform them
- The method involves evaluating the performance of the three reefs relative to each other to determine whether they meet each relative standard
- The total number of relative standards met by each reef is then tallied and compared



- This slide summarizes the number of relative standards met at Wheeler North Reef and the two reference reefs, San Mateo and Barn in 2020
- The monitoring results show that Wheeler North Reef met 9 of the 11 relative standards in 2020, which was 3 more than San Mateo, the lower performing of the two reference reefs.
- Based on these results we conclude that the ecological resources and functions provided by the Wheeler North Reef in 2020 were *similar* to those provided by nearby natural reefs.
- Therefore, the Wheeler North Reef met the collective mitigation requirement for the relative performance standards in 2020.

**Absolute Performance Standards that must be met every year
in order for the Wheeler North Reef to receive mitigation
credit**



Hard substrate

*At least 90 percent of the exposed hard
substrate must remain available for
attachment by reef biota*



**Undesirable & Invasive
species**

*The important functions of the reef shall
not be impaired by undesirable or
invasive benthic species*

Method of evaluating compliance

**The evaluation of each standard is based on the value measured for the
current year, or the 4-year running average (calculated from the current
year and the previous three years), *which ever is higher.***

There are two absolute performance standards that the Wheeler North Reef must meet each year in order to receive mitigation credit:

1. The performance standard for hard substrate requires at least 90% of the exposed rock initially present at Wheeler North Reef remain available for the attachment by reef biota
2. The performance standard for invasive species requires that the Wheeler North Reef shall not be impaired by undesirable or invasive benthic species

The evaluation of each of these standards is based on the value measured for the current year, or the 4-year running average (calculated from the current year and the previous three years), which ever is higher.

Evaluating the Performance of Hard Substrate

1. Measure footprint area (A) of Wheeler North Reef (Phases I + 2) in sonar surveys
2. Measure percent cover of exposed rock (P)
3. Calculate area of exposed rock as $A \times P$
4. Compare area of exposed rock to that measured immediately after reef construction to determine whether 90% or more is still available for reef biota



9 Substrate categories:

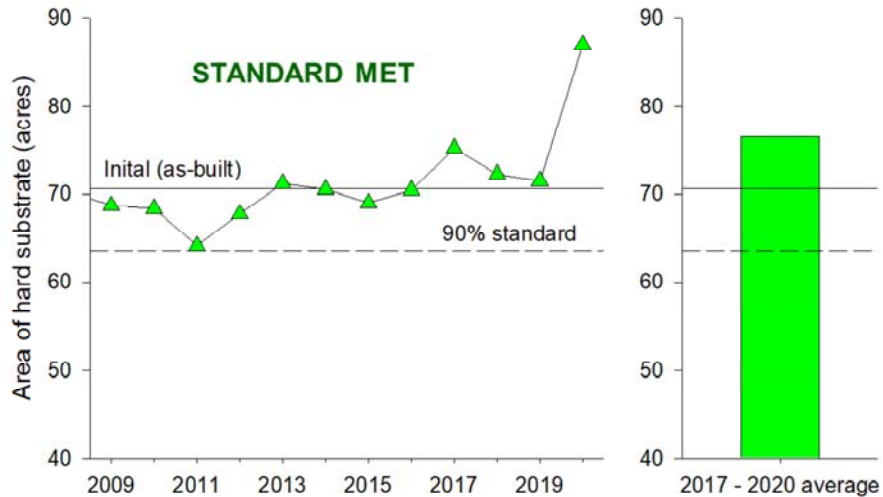
Bedrock
Large boulder (≥ 100 cm)
Medium boulder (≥ 50 cm & < 100 cm)
Small boulder (≥ 26 cm and < 50 cm)
Cobble (≥ 7 cm and ≤ 25 cm)
Pebble (≥ 2 mm and < 7 cm)
Sand (< 2 mm)
Shell hash
Mudstone

The performance standard for hard substrate is evaluated in the following way:

- Measure the footprint area (A) of Wheeler North Reef using multi-beam sonar once every 5 years.
- Divers estimate the percent cover of exposed rock (P) in five 1 m² quadrats on the 82 transects distributed across Phase 1 and 2 of the Wheeler North Reef.
- The product $A \times P$ is the estimate of the area of exposed hard substrate.
- We compare this estimate to that obtained immediately following construction of Wheeler North Reef.
- The SONGS coastal development permit requires that this amount not fall below 90% of what was available immediately after the reef was constructed.
- Divers collect percent cover data for nine different types of bottom substrate.
- The five categories of bottom substrates outlined in the green box are those that counted as hard substrate in our analyses.

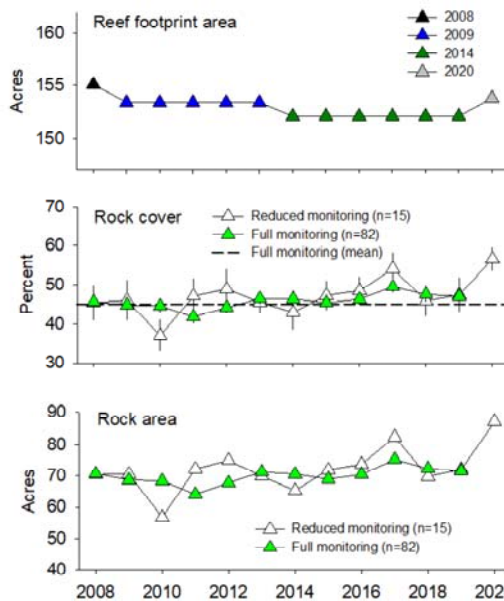
Performance Standard: Hard Substrate

At least 90 percent of the exposed hard substrate must remain available for attachment by reef biota



- Plotted here is an annual time series of the total area of exposed hard substrate at Wheeler North Reef (left) and the 4-year running average (right).
- The annual time series shows that at least 90% of the initial area of exposed hard substrate on Wheeler North Reef has remained available every year since the reef was constructed
- Annual values greater than the initial as-built in some years likely reflect scouring and/or redistribution of reef material that resulted in an increase in the total area of exposed hard substrate
- The Wheeler North Reef met this performance standard in 2020 as both the annual value and the 4-yr running average were greater than the as-built condition and thus exceeded the 90% threshold.

Performance Standard: Hard Substrate



Sonar surveys show little change in the footprint area of Phase 1 and 2 reefs

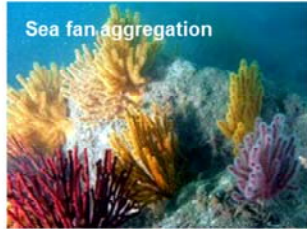
Smaller sample size leads to greater variability (i.e., less certainty) in the estimate of the percent cover of rock

Reduced sampling of the cover of rock in 2020 likely led to an overestimate of the total area of rock in 2020

- Recall that the area of hard substrate is the product of reef footprint area of Phase 1 and Phase 2 as determined by sonar surveys and rock cover determined by diver surveys
- Data from sonar surveys in the top graph show little change in the footprint area of Phase 1 and 2 reefs since 2008
- Data from diver surveys in the middle graph show that smaller sample size associated with reduced monitoring leads to greater variability and less certainty in the percent cover of rock
- This greater variability and uncertainty in rock cover in 2020 is what led to the large apparent increase in the area of rock in 2020
- We expect that this estimate will be lower in 2021 when full monitoring of hard substrate is performed.

Performance Standard: Undesirable & Invasive Species

The important functions of the reef shall not be impaired by undesirable or invasive benthic species



Sea fan aggregation



Sea urchin barrens



Caulerpa taxifolia



Sargassum horneri

Undesirable and invasive species that are of potential concern include:

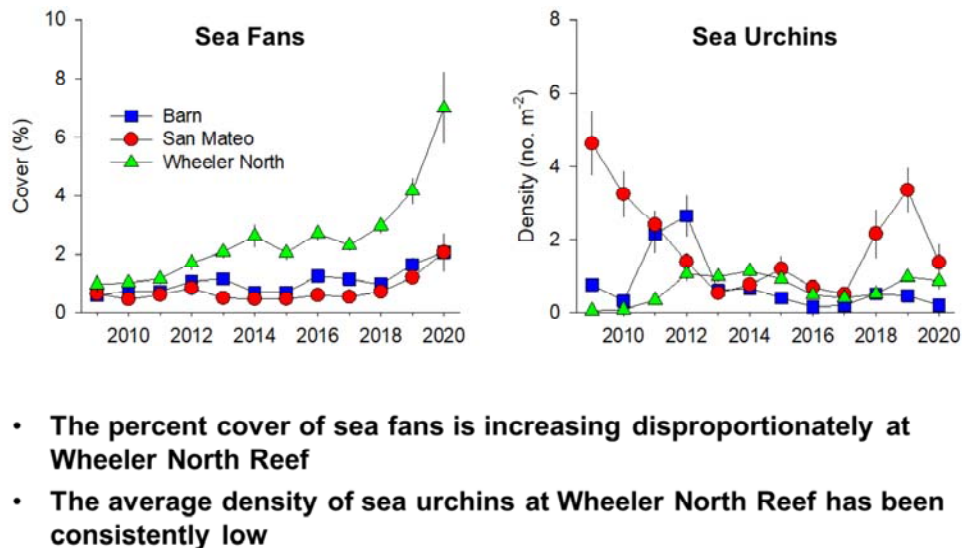
- High density sea fans
- High density sea urchins
- Non-native algae (e.g., *Caulerpa*, and *Sargassum*)

Primary production by giant kelp and nursery habitat for young-of-year reef fishes are used as indicators of important reef functions

- The other absolute performance standard that must be met every year for the Wheeler North Reef to receive mitigation credit requires that its important ecological functions not be impaired by undesirable or invasive benthic species.
- Native species can become “undesirable” if they become so abundant that they impair important functions of the reef.
- Two examples of this are dense aggregations of sea fans that can monopolize space and exclude other species including giant kelp, and high densities of sea urchins that can over graze the bottom and create large deforested areas commonly called sea urchin barrens.
- Invasive species are non-native species that become abundant and displace native species.
- Two non-native species that are know to be invasive in southern CA are the green alga *Caulerpa taxifolia* and the brown alga *Sargassum horneri*
- Primary production by macroalgae and nursery habitat for fishes are two important functions of reefs
- We are using data on the density of young-of-year fish as an indicator of nursery habitat for fishes and net primary production (NPP) of giant kelp as derived from the density of giant kelp fronds

Performance Standard: Undesirable Species

Sea Fans and Sea urchins

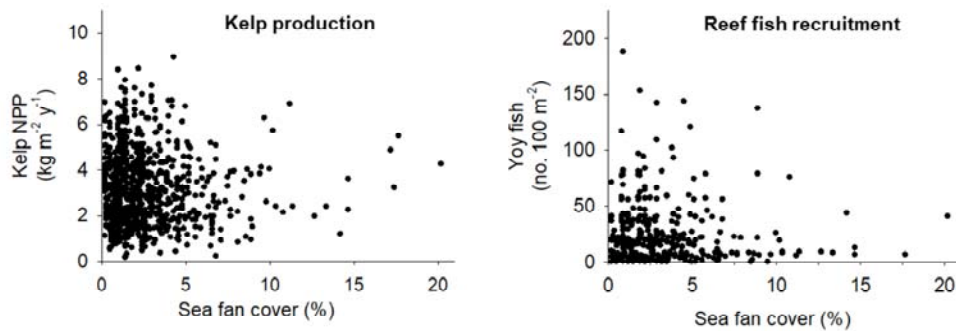


- The percent cover of sea fans is increasing on all three reefs, but disproportionately so at Wheeler North Reef.
- In contrast the average density of sea urchins at Wheeler North Reef has remained relative stable at ~ 1 per m² for the past 9 years.
- By comparison, sea urchin densities typically have been higher and more variable at the two reference reefs

Performance Standard: Undesirable Species

Sea Fans

No relationship between sea fan cover and kelp primary production or fish recruitment at Wheeler North Reef when data are de-trended for time



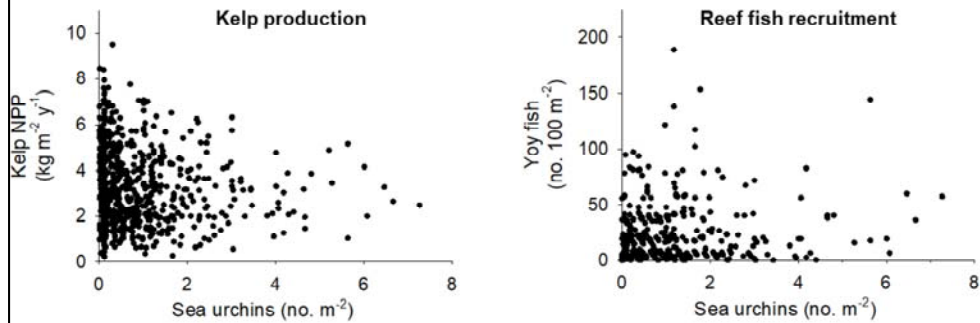
Sea fans do not seem to be impairing kelp primary production or nursery habitat for young-of-year reef fish

- We evaluated whether sea fans (*Muricea* spp.) were impairing the important functions of the reef by examining the relationship between its percent cover and the net primary production of giant kelp shown in the graph on the left, and the density of newly recruited young-of-year reef fish (which is an indicator of fish nursery habitat) shown in the graph on the right
- The points in the graphs represent values collected from the 82 transects from 2010-2020.
- The data have been adjusted to remove variation resulting from annual trends in kelp NPP, YOY fish density and the percent cover of sea fans in order to highlight variation in kelp NPP and YOY density explained solely by the percent cover of sea fans.
- The data show that while the percent cover of sea fans has been increasing over time at Wheeler North Reef we found no significant relationship between it and kelp primary production or fish recruitment at Wheeler North Reef
- These results indicate that sea fans are not impairing either of these important reef functions of the Wheeler North Reef

Performance Standard: Undesirable Species

Sea Urchins

No relationship between sea urchin density and kelp primary production or fish recruitment at Wheeler North Reef when data are de-trended for time



Sea urchins do not seem to be impairing kelp primary production or nursery habitat for young-of-year reef fish

- We did a similar analysis to explore the extent to which sea urchins might be impairing kelp primary production and reef fish recruitment and found similar results
- The relatively low density of sea urchins at Wheeler North Reef do not appear to be having any effect on kelp primary production or fish recruitment at Wheeler North Reef
- Thus we conclude that sea urchins are not impairing these important ecological functions of Wheeler North Reef.

Performance Standard: Invasive Species

Non-native macroalgae



No non-native benthic macroalgae were observed at Wheeler North Reef in 2020

Invasive, non-native benthic species are not impairing important ecological functions of Wheeler North Reef

- We did not record any non-native benthic macroalgae at Wheeler North Reef in our 82 transects in 2020.
- Hence there is no evidence that invasive non-native species have impaired important ecological functions at Wheeler North Reef

Performance Standard: Undesirable & Invasive Species

The important functions of the reef shall not be impaired by undesirable or invasive benthic species

Conclusion: No evidence that undesirable or invasive species are adversely affecting the important functions of Wheeler North Reef

STANDARD MET

- Based on correlative analyses involving sea fans and sea urchins and the lack of observations of non-native invasive macroalgae at Wheeler North Reef we conclude that there is no evidence that undesirable and invasive species adversely affected the important ecological functions of Wheeler North Reef in 2020.

Absolute Performance Standards that accumulate mitigation credit on an annual basis



The artificial reef(s) shall sustain 150 acres of medium-to-high density giant kelp



The standing stock of fish at the mitigation reef shall be at least 28 tons

Method of evaluating compliance

The annual standing stock of fish and acreage of giant kelp at Wheeler North Reef are measured each year and summed over time until they reach a cumulative total equivalent to the annual target x the number of years of SONGS operations

Unlike the absolute performance standards for hard substrate and invasive species that must be met each year, the absolute standards pertaining to giant kelp area and fish standing stock are evaluated on a cumulative basis and the Wheeler North Reef receives partial credit for these standards each year

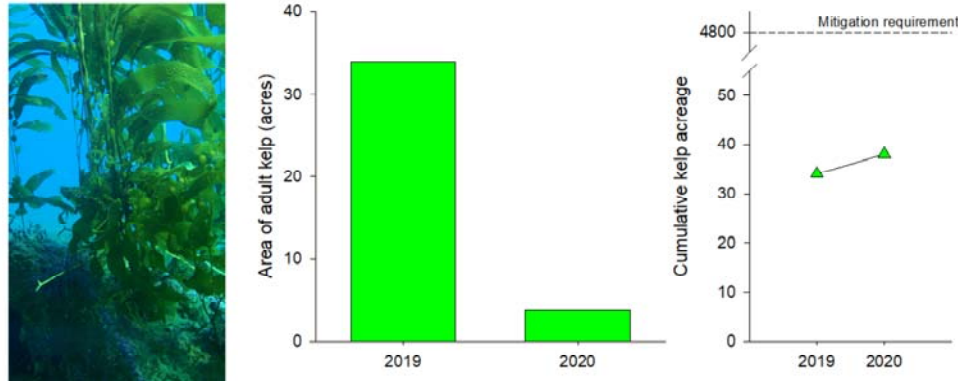
1. The performance standard for giant kelp is based on the intent that the Wheeler North Reef sustain 150 acres of medium-to-high density giant kelp for a period of time equivalent to the operating life of SONGS
2. Similarly, the performance standard for fish standing stock is based on the intent that the Wheeler North Reef sustain a fish standing stock of at least 28 tons for a period of time equivalent to the operating life of SONGS

Mitigation credit for these two performance standards is summed over time until the accumulated credit for each performance standard reaches a total value equivalent to the annual target (which is 150 acres for kelp and 28 tons for fish) x the number of years of SONGS operations

Mitigation credit is accumulated beginning in 2019.

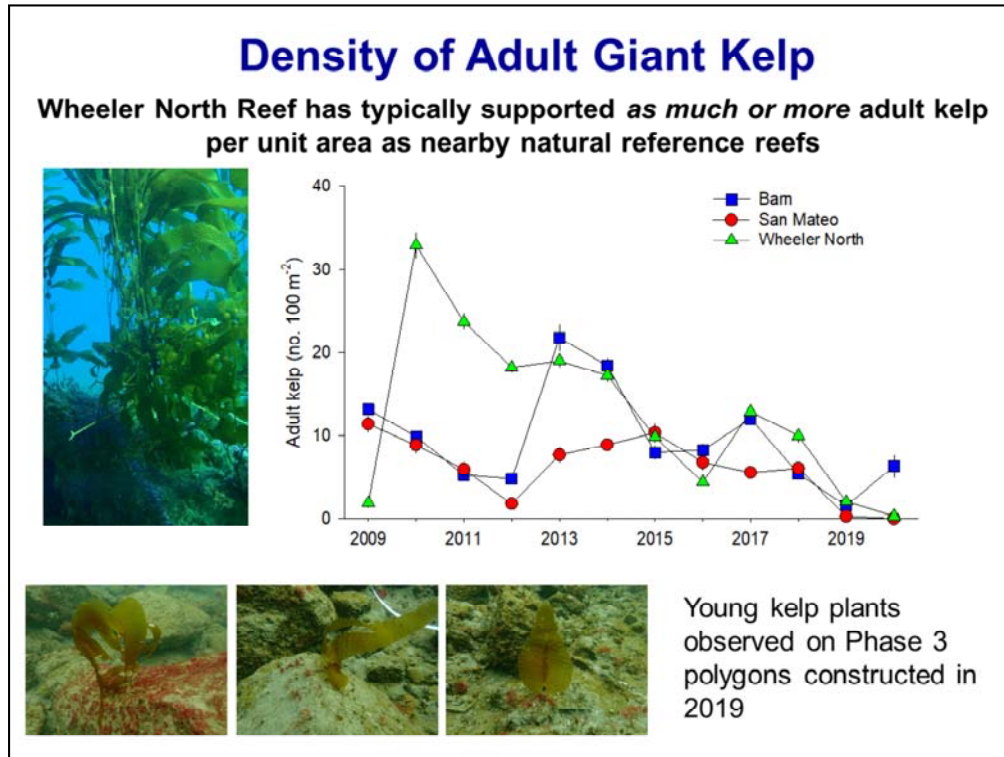
Performance Standard: Giant Kelp

Reef design: sustain 150 acres of medium-to-high density (> 4 plants / 100 m^2) giant kelp in any give year



Wheeler North Reef earned mitigation credit for 4 acres of medium-to-high density giant kelp in 2020 resulting in a cumulative total of 38 acres of adult giant kelp

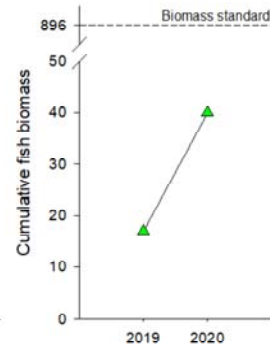
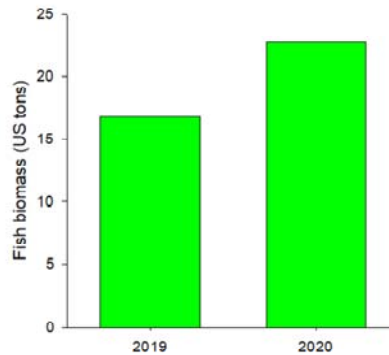
- This graph shows the area of medium-to-high density adult giant kelp supported by the Wheeler North Reef in 2019 and 2020.
- 2019 was the first year that mitigation credit for kelp was assigned on a cumulative basis.
- In 2019 the Wheeler North Reef earned 34 acres of credit for sustaining medium-to-high density giant kelp in 2019 and 4 acres in 2020 for a cumulative total of 38 acres
- The area of kelp on Wheeler North Reef in recent years has been far below that of prior years when every acre of the reef supported > 4 adult plants / 100 m^2



- Comparison of temporal changes in kelp area at nearby natural reefs provides insight into whether the recent decline in kelp area is specific to Wheeler North Reef or more characteristic of the region.
- The data plotted in this graph show that since 2010 the Wheeler North Reef has typically supported as much or more adult kelp per unit area as nearby natural reference reefs.
- Moreover the general decline in giant kelp observed at Wheeler North Reef since 2017 were also observed at the natural reference reefs.
- Our observations last summer of young kelp plants on the Phase 3 polygons constructed in 2019 give rise for optimism that the area of adult kelp on Wheeler North Reef will increase in 2021.

Performance Standard: Fish Standing Stock

Reef design: standing stock of fish at least 28 tons

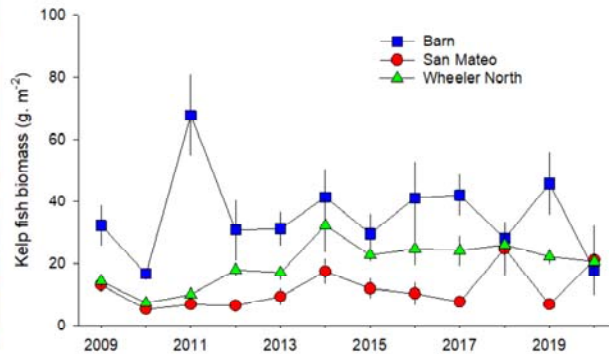


Wheeler North Reef earned mitigation credit for 22 tons of fish standing stock in 2020 resulting in a cumulative total of 40 tons of fish standing stock

- Shown here is annual standing stock of reef fish on Wheeler North Reef in 2019 and 2020
- The Wheeler North Reef earned 18 tons of credit for its fish standing stock in 2019 and 22 tons in 2020 for a cumulative total of 40 tons

Fish Biomass Density

(Wheeler North Phase I and II Reef)

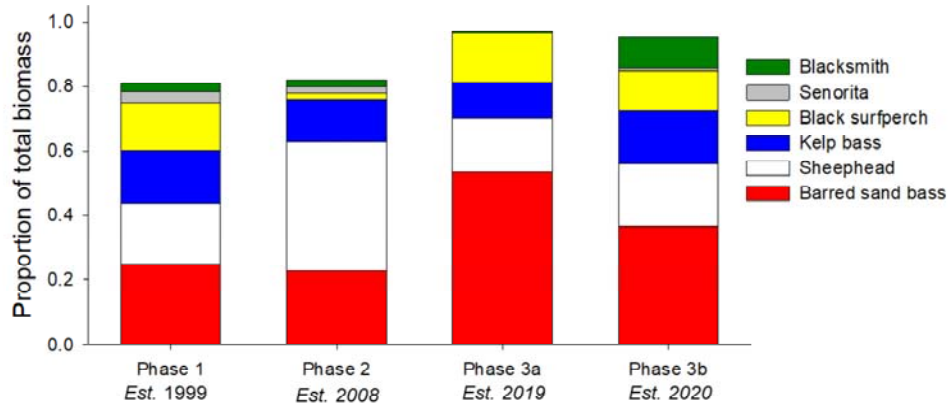


The biomass density of fish at Wheeler North Reef has been consistently *within the range* of nearby natural reefs

- Its worth noting that the biomass density of fish at Wheeler North Reef has been consistently *within the range* of nearby natural reefs, lower than Barn but higher than San Mateo.
- This suggests that the standing stock of fish at Wheeler North Reef would be within the range of a natural reef of comparable size.

Fish Standing Stock – species composition

Six species comprise 80% or more of the fish standing stock on Wheeler North Reef



The species composition of the fish standing stock was similar on all three phases of Wheeler North Reef in 2020

- Shown here is the biomass of six species of fish in 2020 as a proportion of the total standing stock for the Phase 1 and Phase 2 reefs and for the portions of the Phase 3 reef that were built in 2019 and 2020.
- These six species comprise 80% or more of the fish standing stock on all three phases of the Wheeler North Reef
- The data from 2020 suggest that the species composition of the fish standing stock on the different phases is largely the same despite the differences in their ages.

SONGS Reef Mitigation Compliance

Relative performance standards & Absolute performance standards for hard substrate and invasive & undesirable species

- One year of mitigation credit is given for each year that Wheeler North Reef meets all of these performance standards
- Fulfillment of the mitigation requirement occurs when the number of years of mitigation credit accrued by the Wheeler North Reef equals the total years of operation of SONGS Units 2 & 3 (= 32 years)

Absolute performance standards for giant kelp area and fish standing stock

- Each performance standard is evaluated independently.
- Fulfillment of these mitigation requirements occur when the total accrued acres of kelp or tons of fish equal the targeted annual value (= 150 acres of kelp or 28 tons of fish) x the total years of operation of SONGS Units 2 & 3 (= 32 years)

- The goal of the SONGS reef mitigation project is to replace the kelp forest resources that were lost due to the 32 years of operations of SONGS Units 2 & 3 for a period of time that is equivalent to the operating life of SONGS Units 2 and 3.
- One year of mitigation credit is given for each year that Wheeler North Reef meets the relative performance standards and the absolute standards pertaining to hard substrate and invasive species.
- Fulfillment of the mitigation requirement for these performance standards occurs when the number of years of mitigation credit accrued by the Wheeler North Reef equals the total years of operation of SONGS Units 2 & 3 (= 32 years)
- Unlike the other performance standards the absolute performance standards for giant kelp area and fish standing stock are assigned mitigation credit independently of other performance standards
- Fulfillment of the mitigation requirements for these performance standards occurs when the total accrued credit accrued equals the targeted annual value (= 150 acres in the case of giant kelp and 28 tons in the case of fish standing stock) x the total years of operation of SONGS Units 2 & 3 (= 32 years) .

Wheeler North Reef Summary of earned mitigation credit

	<u>2020 status</u>
All relative standards	pass
Hard substrate	pass
Undesirable and Invasive species	pass
Number of years of credit earned	2
Number of years of credit required	32
Number of years of credit still needed	30

	2020 credit	Cumulative credit	Credit required	Credit needed
Giant kelp area	4 acres	38 acres	4800 acres	4762 acres
Fish standing stock	22 tons	40 tons	896 tons	856 tons

- Shown here is a summary of project compliance for the SONGS reef mitigation project.
- In 2020 the Wheeler North Reef earned 1 year of credit for meeting the relative standards and the absolute standards for hard substrate and invasive species.
- It has earned a total of 2 years of mitigation credit for these performance standards and needs another 30 years of credit for this mitigation requirement to be met.
- In 2020 the Wheeler North Reef earned credit for 4 acres of giant kelp for a cumulative credit of 38 of the 4800 acres of giant kelp required for the giant kelp performance standard.
- An addition 4762 kelp acres is needed before the mitigation requirement for the giant kelp performance standard is met.
- In 2020 the Wheeler North Reef earned credit for 22 tons of fish standing stock for a cumulative credit of 40 tons.
- It needs to earn an addition 856 fish tons of mitigation credit before the mitigation requirement for the fish standing stock performance standard is met.