

CARP_Plan_Winter2026Async

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This is an asynchronous recording of the information presented at the online listening sessions for the California Artificial Reef Program Plan in February 2026.

0:12

Thank you for taking the time to watch a short video and we appreciate your participation in the CARP plan development process.

0:21

Today we will be going over the definition of an artificial reef.

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We will go dig into the CARP plan outline and go over some of the keys concepts that are emerging as we continue the development of the plan.

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We will dive deeper into two main sections of the CARP plan, which is Chapter 3, which covers general recommendations on materials design, citing and monitoring.

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And then we'll dive into Chapter 4, which focuses on centering biological productivity, biodiversity and ecosystem services during project development for artificial reefs.

1:05

We'll wrap up by going over where we are in the CARP Plan development timeline and next steps.

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Before we go into what is shaping up to be included in the CARP Plan, it's important we are all working with the same information on how artificial reefs are defined in California and in the CARP plan.

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In 1985, the state legislature created the California Artificial Reef program and adopted a definition of artificial reefs.

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The information on the slide is summarized language from Fish and Game Code 6421 and there are some very specific attributes mentioned in the definition about how an artificial reef is defined in California State waters currently.

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Specifically, an artificial reef in California is something that is intentionally placed by humans in the marine environment.

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It can be made of man made or natural objects.

2:01

It needs to duplicate the conditions on natural reefs and rough bottoms.

2:07

It needs to induce the production of fishes and invertebrates, stimulate growth of kelp and other mid water plant life, and create natural habitat.

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There's a long history of artificial reefs in California going back to the 1950s and building of artificial reefs has ebbed and flowed over time.

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There's been increased interest in artificial reefs over recent years that highlighted the need for a programmatic guidance document that guides regulators and project developers on best practices on how to develop an artificial reefs that has the highest likelihood of achieving its goals and objectives.

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The goal of the CARP Plan is to provide that programmatic guidance in a clear, accessible and useful way.

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The CARP Plan has four chapters building on each other to produce guidance on the main elements of the developing successful artificial reef projects.

3:02

Success for an artificial reef project is defined as achieving its goals and objectives within defined time and maintaining those benefits over time.

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The CARP plan is purposefully species, location and project agnostic.

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This means that the recommended guidance can be applied regardless of the specifics of an artificial reef project.

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The recommendations are rolled out in a way that identifies clearly not only the concept, element, or question that should be considered, but also ties those concepts and elements to specific phases in the development project.

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Chapter 1 lays the foundation for the document, including the definitions and history of artificial reefs in California.

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Chapter 2 is a scientific review of artificial reef functioning not only in California but globally and then discussing some other key factors that affect artificial reef performance like climate change and habitat conversions.

4:04

And we also discussed other types of submerged structures in this chapter.

4:09

Chapter 3 discusses the three main drivers of artificial reef performance, which are designed material and siting and lays out some recommendations for those.

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And we also discussed performance monitoring in that chapter.

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In Chapter 4 we just we dive into case studies of artificial reefs that have been deployed in California and we discuss a range of different types of projects, those on the open coast, those in bays, also mitigation reefs.

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We discussed maximizing benefits, permitting and best practices for California Native American tribal engagement.

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The CARP Plan is not a constructability or a siting plan.

5:01

It's similar to the National Artificial Reef Plan, which provides basic criterion definitions to ensure a shared understanding of the components needed for well designed, successful artificial reef projects.

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Some key concepts that are rising to the top as we continue the development of the CARP Plan are shown in the bullets.

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We've made large gains in our understanding of the functioning of marine ecosystems generally and how artificial reefs affect these systems, although there is still more to learn.

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The CARP Plan updates our approach to artificial reefs in California to align with the best science available, which will help ensure all future projects match, maximize benefits, and minimize impacts.

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Although general, the material design, citing, and monitoring guidance is a significant step forward in

California, providing a shared understanding among regulators and project developers of terminology and basic standards.

6:01

Regardless of the specific objectives of an artificial reef project, as mentioned, there are still research gaps related to artificial reefs functioning and the ecosystem services they can provide, especially with considering looking forward to the ongoing and accelerating impacts of climate change.

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This requires a thoughtful approach to future development as well as creates opportunities to design pilot projects to specifically address gaps in our knowledge understanding related to artificial reefs and marine ecosystems.

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The CARP Plan lays out both the challenges and opportunities.

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Permitting for artificial reefs has been a strong area of interest for both regulators and project developers that we heard through our scoping and was an important element to include in the CARP Plan.

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We're not going to discuss this component in detail today, but I want to assure everyone in listening we have heard you and are working with our regulatory partners to provide some practical and useful guidance on the permitting in the CARP plan.

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The CARP plan will provide systematic guidance that permitting agencies which can see some of those listed at the bottom of the slide may consider an evaluating artificial reef proposals.

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We believe creating a uniform understanding for both project developers and state and federal regulators of the components of well designed artificial reefs will significantly improve the ability of projects to meet their goals and improve the permitting process to get projects in the water when appropriate.

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I want to emphasize that the CARP plan is not constructability guidelines and is not a road map that identifies locations for artificial reefs.

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It is a programmatic guidance document for artificial reef developers and regulators that will create a shared understanding around best practices for materials design, siting, and performance monitoring for artificial reefs.

8:05

Spend our remaining time today digging into a little more detail on Chapter 3, which contains the general recommendations, and the sections of Chapter 4, which contains the key innovation of the

CARP Plan, which is elevating the role of improving biological productivity and biodiversity as the foundational element of project planning and how that relates to maximizing the benefit artificial reefs can provide through ecosystem services.

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We'll get into that in a second, but first I want to provide some additional detail on the general recommendation and why these are such an important step in laying the groundwork for future artificial reef projects in California.

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An expert panel of 11 scientists was convened to review the best available science to provide discrete general recommendation about the key drivers of artificial reef performance.

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These recommendations are universally applicable regardless of the particular focus of an artificial reef project.

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These recommendations provide updated and clear guidance based on the latest scientific understanding of best practices related to materials design, deciding and monitoring.

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If we look at the materials recommendations, you're likely familiar with materials of convenience that have been used in the past like tires or construction debris.

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Data has shown that those types of materials don't produce high quality habitat.

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There are several existing guidance that is out there and that is well vetted.

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You can see on the right of the slide there's the National Artificial Reef Plan, there's the London Convention on Artificial Reefs, and then there's a more recent document from March of 2020 specifically discussing the types of materials and the need for them to be inert and non-toxic and durable.

10:04

So the materials guidance aligns with all of the existing guidance we have.

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Moving down to the design, single species or a single focus on a habitat element as done in the past is not the state-of-the-art.

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Projects around the world, including those in California, have demonstrated that designing to mimic

the entire structure of a productive rocky reef ecosystem can lead to the greatest benefits versus just focusing on enhancing a single species or habitat element.

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So the plan discusses that and provides specific recommendations.

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Siding is also a key driver of artificial reef performance and environmental conditions currently and in the future are the are part of those primary drivers of biological productivity.

11:00

So, using all the data available to understand current conditions and predict future ones in the face of climate change is a required element of artificial reef design to achieve the goals and objectives of the project.

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Another major part of citing relates to socioeconomic impacts, both positive and negative.

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Considerations that should be included in citing conversations include, but are not limited to, environmental justice, economic impacts to existing uses, cultural and traditional uses, and accessibility.

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Appropriate conditions include the full suite of conditions of biological, physical, chemical, and socioeconomic needed to achieve the goals and objectives.

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And then when we think about monitoring, the monitoring period of a project should align with the variability in the system and be tied to an estimate of when the goal and objectives of a project would be achieved.

12:03

Monitoring includes multiple categories, physical, chemical, biological, and socio economic that require selected metrics to allow for the evaluation of the project in relation to the goals and objectives.

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This necessitates creating quantitative objectives when feasible.

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This can be challenging in the dynamic marine environment, but there are established approaches that utilize ratios or trajectories when compared to natural control sites that allow for the required evaluations.

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The recommendations of the CAR plan are organized in a highly accessible what, where, when arrangement for each of the broad categories of monitoring.

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The recommended monitoring approach outlined in the CARP Sports Adaptive Management Planning prior to the installation of a project which aligns with the current regulatory framework.

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A range of potential interventions can be planned for to allow for adjustments to be made to help a project achieve its goals and objectives if the estimated performance milestones are not being reached.

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The comprehensive monitoring approach recommended in the CARP plan will also help identify unidentified consequences and when a project has not met established goals and objectives, which may require removal of a project.

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How we apply the general recommendations we just went over and operationalize them does come down to the goal and objectives of the project.

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As I mentioned, the key innovation of the CARP plan is clearly establishing that all future artificial reef projects in California need to center biological productivity and biodiversity as the goal of the project.

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It is well established that biological productivity and biodiversity are required foundational elements for most benefits to humans or ecosystem services we get from artificial reefs.

14:02

If we take a look at the diagram on the left, which is an example from Nostra ET al.

14:06

2023 based on placing an artificial reef in the tropical system off Kenya, it illustrates nicely how centering biological productivity and biodiversity leads to a host of positive outcomes for people in nature.

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The arrows represent the the many biological processes associated with biological productivity leading to in this case improvements in fishing and diving.

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These relationships hold true for our temperate ecosystem in California and we're in the process of making a similar diagram to be included in the CARP plan.

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Ecosystem services include a much broader array of benefits than just improving recreational opportunities like fishing and diving.

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We look at the right hand side of the slide.

14:55

This wheel diagram shows the myriad of ecosystem services the marine environment provides to humans.

15:01

It's broken down into 4 categories, Provisioning, Supporting, maintaining and cultural.

15:08

The graphic strongly illustrates why having biological productivity and biodiversity as the goal for all all future projects ensures we can maximize the benefits if we comply a conservative interpretation to a hypothetical future artificial reef project and start checking off the potential benefits that we could achieve with the project by having the goal of improving biological productivity and biodiversity.

15:37

We can see that many benefits are checked off right out of the gate just by centering the material design and citing decisions made about the project on improving biological productivity and biodiversity.

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In addition to these services indicated on the slide by checkmarks, which we could be provided simply by looking to improve biological productivity and biodiversity, we can also think about how we can make decisions about materials, designs and siding that result in improvements that layer on additional ecosystem service benefits like shoreline protection, carbon sequestration, recreational opportunities, research and education, and cultural uses, which you can see indicated by the circles on the slide.

16:29

To better visualize this idea of center centering biological productivity and biodiversity and then layering on additional ecosystem services, I wanted to show a quick example of a project that is called the Giant Marsh Project and is in San Francisco Bay.

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You can see a picture in the upper right there.

16:51

This project posted focused on recreating native oyster ecosystem, including enhancing the surrounding eelgrass habitat and attenuating surge and flow to provide shoreline protection and also enhance eelgrass populations.

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Additionally, the project investigated how carbon sequestration was affected.

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This project also had strong and planned research and education components with students actively engaging in performance monitoring as well.

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So you can see in the diagram there that by centering biological productivity and biodiversity, the project was then able to show layer on additional benefits like the shoreline protection, like the carbon sequestration, and like the research and education component.

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The real key component to this is the idea that by centering biological productivity and biodiversity and then making intentional decisions about the site, the materials and design, you can maximize benefits and layer on additional ecosystem services.

18:03

Want to wrap up today by going over the plan timeline and look at where we've been and where we're going to take us to a final CARP plan.

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So we began in the winter of 202425 where we had pre project listening sessions which we held held in January and February of last year.

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That led us into kicking off the project and convening our panel of 11 scientific and technical experts, and they began their work in the spring of last year.

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Springing forward to where we are now in the winter of 202526, we are having additional listening sessions which are going to help us get to a draft in the spring of this year.

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We expect to deliver a early draft to Tribes in the late June of this year and the public draft will be released at the end of July.

19:12

That will kick off a 45 day public comment period, which will wrap up in the fall.

19:19

During the review and public comment period, we'll be going through a concurrent scientific peer review.

19:27

We'll receive all of that feedback and respond and integrate that in the fall of this year, leading to a final cart plan by the end of this year or early next year.

19:41

Want to thank everybody for taking the time to watch this video and please visit our website or reach out to us via e-mail or phone if you have any questions or comments.