Crystal Cove® CONSERVANCY | Session 3: Designing a Model

Focus: Designing & Using Models
Grade Level: 7-12
Session Length: 90-120 minutes

Driving Questions
- What might affect the fish population in the Crystal Cove SMCA?
- How can we create a model that shows how components and processes in the Crystal Cove SMCA's ecosystem interact with each other?

NGSS Links
- Designing and Using Models
- Using Mathematics and Computational Thinking
- MS-LS2-3
- HS-LS2-2
- HS-ESS3-3

Systems Thinking Characteristics
- Identifying System Components & Processes
- Identifying Simple Relationships Between System Components
- Organizing System Components & Processes within a Framework of Relationships
- Identifying Hidden Dimensions of the System

In the third session of the MPA Exploration, students work with their research teams to design a model that shows their initial ideas about how different components and processes with the Crystal Cove SMCA marine ecosystem might affect the fish population.

During the first half of the session, student research teams work together to brainstorm a list of biotic components, abiotic components, and processes that might impact the number and biodiversity of fish in the Crystal Cove SMCA. Students then work independently and draft a model in their field notebooks. During the second half of the session, research teams come back together to collaboratively design a model using an online platform.

Learning Outcomes & Assessments

By the end of this module, students will be able to...	You can assess this using...
1. *Generate* a list of biotic components, abiotic components, and processes that affect fish populations in the Crystal Cove SMCA.	Field notebook entry or shared Google Doc
2. *Create* a model that shows how biotic components, abiotic components, and processes might affect the fish populations in the Crystal Cove SMCA.	Research team models
3. *Use* computational thinking to predict environment will impact the fish populations in the Crystal Cove SMCA.	Field notebook entry or shared Google Doc
4. *Reflect* on why scientists use models to make predictions about real-world systems.	Whole class discussion

Session Overview

Section	Description	Length	Format
Launch	Students watch a video that introduces them to the idea of creating a model.	5 minutes	Whole class
Explore	Research teams generate a list of components and processes that might affect fish populations in the Crystal Cove SMCA. Students then work independently to create a draft model in their field notebook.	20 minutes	Research teams & individual
	Research teams then come back together to create a collaborative model using Padlet, SageModeler, or another online platform of the teacher's choice.	30-45 minutes	Research teams
	Optionally, research teams can also use their models to make predictions about how changes to the ecosystem will affect the fish population.	15-20 minutes	Research teams
	Finally, research teams identify what questions they still have about their model.	5 minutes	Research teams
Share	If there is time, students share their models with the whole class.	15 minutes	Whole class
Reflect	Students reflect on what they've learned from their model and what their next steps might be.	5-10 minutes	Individual

Choosing a Modeling Platform

In Session 3, student research teams work together to build a model that shows how different biotic components, abiotic components, and processes impact the fish population within the Crystal Cove SMCA.

As the lead educator, you can choose which platform you want your class to use while building their model. Unfortunately, while online modeling platforms exist, no one platform is perfect. We recommend choosing between Padlet or SageModeler , but you could also use Google Jamboard, another online whiteboard, or another platform entirely.

The pros and cons of our two recommended platforms are listed below.

Platform	Pros	Cons
Padlet Cost: Free for first three boards; requires $10/month subscription for additional boards	Modeling can be done collaboratively with multiple students using one online workspace at the same time. Teacher can see thinking in real time. Students can import videos, links, and images within the posts.	More difficult to show links and explain computational relationships. A free account can only create three Padlets (meaning students will need to sign up for their own account). Cannot import data and use it to test the assumptions in the model.
SageModeler Cost: Free	Specifically designed to support student modeling. Has a clear way to define computational relationships between components and processes. Can run simulations to see the effects of one component on another. Can import data to test the model and make graphs (which can be used to analyze data in Session 7).	One one person can manipulate the model at a time (meaning one student will need to manipulate the model and share their screen with others). Teacher can only view the contents when the link is shared, so it is hard to see thinking in real time.

Virtual Materials

- Session 3 Google Slides Presentation:
    - If you're using Padlet: **https://bit.ly/39GCpA6**
    - If you're using SageModeler: **https://bit.ly/33K1bLA**
- Session 3 Field Notebook template (optional): **https://bit.ly/33JGrnr**
- Template for your chosen modeling platform:
    - Padlet Template: **https://bit.ly/2VQrewu**
    - SageModeler Template: **https://bit.ly/3mFuHtl**

Each student will need...

- A device with internet access (a computer, smartphone, or tablet will all work!)
- Field notebook and pencil

Before You Start Teaching

- Decide which platform you want students to use when building their research team model: Padlet, SageModeler, or another platform of your choice.

- Copy over the *Session 3 Slideshow* for your chosen platform to your own Google Drive account. Test to make sure that the videos work. (If not, you may have to check the permissions on the Crystal Cove Conservancy Youtube Account.)

- Review the lesson plan and decide how you will structure the session in terms of timing. Students will likely need about two hours to complete the session, so you may want to break it over two class meetings or assign some collaborative work outside of class.

- Decide how you want students to collaborate and share their ideas as they are brainstorming a list of components and processes and reflecting on their models. If you want them to use a shared Google Doc (instead of using their field notebooks), copy over the Research Team Brainstorming template and set up a document for each research team.

    If you want students to use a shared Google Doc, update *Slide 5* with links to the Research Team Brainstorming documents for each team.

Learning Sequence

Launch

Getting Started with Modeling (5 minutes)

1. Open the *Session 3 Slideshow* and play the video on *Slide 2* for your class. In this video, Erick will briefly introduce Session 3 and the fact that students will work in their research teams to build a model of the Crystal Cove SMCA marine ecosystem.

2. After watching the video, move on to *Slide 3*, which gives an overview of what students will do and learn during Session 3.

Explore

Explore Part 1: Brainstorming Components & Processes (20-25 minutes)

1. Advance to *Slide 4* and play the video. Erick will introduce students to the first task in creating their model: they will need to work in their research team to brainstorm a list of abiotic components, biotic components, and processes that could affect the fish population in the Crystal Cove SMCA.

2. Once the video is done, move on to *Slide 5* and reiterate the task for students: They will work in their research teams to brainstorm abiotic components, biotic components, and processes that could affect the fish population in the Crystal Cove SMCA.

Let students know how you want them to record their list (in a shared Google doc, in their field notebook, etc.).

Some tips to share with students:
- What was your question?
- What sources did you look at to help answer your question?
- Were the sources reliable, or was there anything you needed to keep in mind while reading and interpreting them?
- What new information did you learn?

3. Break students into their research teams and give them 10-15 minutes to brainstorm their list. If possible, give them a two-minute reminder before the end of the brainstorming time.

4. When the research teams are done brainstorming, play the video on *Slide 6*. In this video, Erick will challenge students to pick the 10-12 items from their list that have the biggest effect on fish populations.

5. Move on to *Slide 7* and ask students to break back into their research teams. Give them two minutes to choose the 10-12 items on their shared list that they think will be most important to include in their team model.

If there is time, ask the research teams to share some of the final components and processes on their list with the whole class.

Explore Part 2: Drafting a Model Individually (15-20 minutes)

6. Move on to *Slide 8* and play the video for students, which will challenge them to now work independently to begin building a model. There are written directions on *Slide 9* , which you can use to review the task again.

Give students time to begin drafting their models individually in their field notebooks. You can have them do this individually in class or assign it as individual work outside of class.

Explore Part 3: Building a Team Model (30-45 minutes)

7. Once students have finished drafting their individual models, move on to *Slide 10* and play the video for the whole class. This will introduce them to the modeling platform that they will be using to build their team models.
- If you are using Padlet, the model-building instructions are broken in two. There is one video on how to register for an account and set up a Padlet for their research team (*Slide 10*), written instructions on how to set up the Padlet (*Slide 11*), and a second video and written instructions on how to use Padlet to build a model (*Slide 12-13*).

   Note that as students set up their model, they are asked to use conditional statements to describe the relationship between different components of the model. They will use these conditional statements to construct logical proofs later on so that they can use their model to make predictions about how changes to the ecosystem may impact the fish population.

- If you are using SageModeler, there is one video on how to use SageModeler (*Slide 10*) and a second with written instructions (*Slide 11*).

8. Give students research teams to build their models. If it is possible, visit each group (whether virtually and in person) to check in on their progress. As you do so, encourage them to think about parts of the ecosystem and processes that they can't see, as well as those that are visible.

Explore Part 4: Using the Model to Simulate Change (Optional) (20 minutes)

9. Once there is time, you can also ask student research teams to use their model to think about how changes to the ecosystem will impact the fish population.
- If you are using Padlet, the video on *Slide 14* introduced the idea of how to use student models to think about change.
- If you are using SageModeler, students can use the slider bars within SageModeler to simulate change within their model. The screencast video on *Slide 12* will introduce how to do this.

10. After introducing the task, give students ten minutes to explore their model and determine how changes to the ecosystem will impact the fish population.

Explore Part 5: Identifying Questions (5 minutes)

11. Finally, move on to *Slide 16* (in the Padlet slideshow) or *Slide 14* (in the SageModeler slideshow), which will ask students to identify any remaining questions that they have about their models.

Move on to the next slide, which has written instructions, and give research teams a few minutes to finalize their questions.

Sharing Our Models (Optional) (10-15 minutes)

Share

1. If there is time, gather the entire class for a group discussion. Invite the research teams to share their models and their predictions about how changes to the ecosystem will impact the fish population.

Reflect

Reflecting on Session 3 (5 minutes)

1. Tell students that they have one last task. In the slideshow, advance to Padlet *Slide 19* or SageModeler *Slide 17* and play the video, where Erick will invite them to spend a few minutes reflecting.

2. Move on to the final slide, which will share reflection questions. Ask students to spend five minutes reflecting on their experiences today in their field notebook.

3. Finally ,if you are able, thank the class for their time today. Tell them that when you gather again, they will dive deeper into their models to refine them and start thinking about how we can use our ideas about the Crystal Cove SMCA's marine ecosystem to monitor how it is changing.