

## Sample in-class activity: Investigating primary production with OOI data

*Learning objectives:* At the end of this activity, students should be able to...

- Describe geographic and seasonal variation in primary production
- Identify patterns in realistic chlorophyll data that relate to primary production cycles
- Apply knowledge of limiting factors (nutrients, light, stratification) and evidence from data to develop hypotheses about primary production in different regions of the ocean

*Before class:*

- Homework questions with static graph of chlorophyll data from the *Chlorophyll Across the Year* exploration activity

*Beginning of class:*

- Concept check question: limiting factors & chlorophyll at equator
- Students log into Blackboard and open Chlorophyll Across the Year “Exploration” page
  - Discuss homework answers as a class (and review the graph axes)
- Where did these data come from? (show OOI maps, mooring array diagrams)
  - chlorophyll fluorometer instrument

*Interactive data exploration:* Guided by Worksheet A

- Students work in pairs to examine assigned graphs
- Stop between each exploration to regroup, discuss and summarize conclusions

*End of class debrief:* Relationships? Connection to prior knowledge? Remaining questions?

Links to Data Explorations used in this lesson

Chlorophyll Across the Year:

<https://datalab.marine.rutgers.edu/explorations/productivity/activity2.php?level=exploration>

Chlorophyll in Temperate Zones:

[https://datalab.marine.rutgers.edu/explorations/productivity/activity4.php?level=concept\\_intention](https://datalab.marine.rutgers.edu/explorations/productivity/activity4.php?level=concept_intention)

Chlorophyll near Polar Zones:

[https://datalab.marine.rutgers.edu/explorations/productivity/activity5.php?level=concept\\_intention](https://datalab.marine.rutgers.edu/explorations/productivity/activity5.php?level=concept_intention)

Chlorophyll Inshore vs. Offshore:

<https://datalab.marine.rutgers.edu/explorations/productivity/activity6.php?level=application>

## Worksheet A: Investigating primary production with OOI data

1. Open the web link for *Chlorophyll in Temperate Zones* or *Chlorophyll Near Polar Zones*. Record your answers to these questions (circle the zone that you viewed):
  - a. How did the chlorophyll concentration vary over time in the [temperate/polar] zone?
  - b. What is your *evidence* for the pattern that you observed in the data over time?
  - c. What questions do you have about patterns in chlorophyll concentration over time in the [temperate/polar] zones of the ocean?
2. Open the web link for *Chlorophyll Inshore vs. Offshore*. Record your answers to the questions below.
  - a. Is there a relationship in primary production among the inshore and offshore locations?
    - If so, what kind of relationship is it? Why do you think that relationship exists for chlorophyll concentration among the inshore and offshore locations?
    - If not, why do you think there is no relationship for chlorophyll-a concentration among the inshore and offshore locations?
  - b. How does this relationship (or lack of relationship) support or challenge what you previously knew about primary production?
  - c. What questions do you still have about primary production?
3. If you have time, use the Excel data files supplied on Blackboard to plot your own graph of chlorophyll vs. time

## Homework exercise (due prior to in-class activity)

### Part I

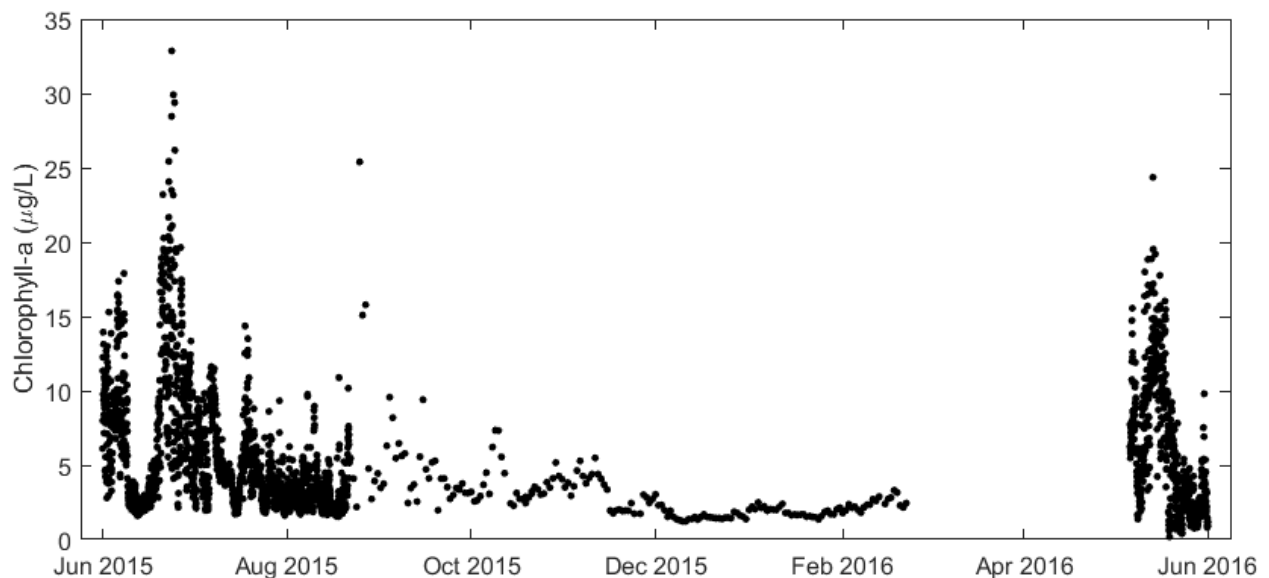
[questions from the textbook chapter on primary production]

### Part II

View Figure 1 (on the next page) of chlorophyll concentration, an indicator of the abundance of phytoplankton in the water. These chlorophyll data were collected above the continental shelf of Washington state by the Ocean Observatories Initiative (<http://oceanobservatories.org/>).

Answer the following questions about these data:

1. Do you observe any patterns in the chlorophyll data? If so, what are the patterns?
2. Over the year shown in Figure 1, what time of year had
  - a. the lowest phytoplankton abundance (as indicated by chlorophyll concentration)?
  - b. the highest phytoplankton abundance?
3. What factors might be responsible for the low vs. high abundance in your answer to #1? (Check your answer to Part I, question 2)
4. What questions do you have about chlorophyll concentrations over a year? (“none” does not count as an answer!)



**Figure 1.** Chlorophyll concentration in micrograms per liter at 7 meters below the surface. These data came from the Ocean Observatories Initiative Endurance array (mooring on Washington continental shelf in a water depth of 30 meters). Data were collected between June 1, 2015 and May 31, 2016 with a gap in data collection in March-April, 2016.