

3rd Grade Lesson Plan

A Day in the Life of a Larval Biologist

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1. Title

A Day in the Life of a Larval Biologist (3rd Grade)

2. Lesson Summary

Many marine invertebrates exhibit a biphasic life cycle in which they live as microscopic larvae (babies) for days to months before metamorphosing into a juvenile of their adult form. During the larval stage, some marine babies do not resemble the adults that they will grow into at all. Other larvae feature rudiments of traits they will retain into adulthood. The way these animals survive also changes throughout the life cycle as many larvae feed on microscopic plants called phytoplankton until they reach metamorphosis, and they will eat different foods once they become adults. The study of marine invertebrate larvae reveals a diverse world of animals that survive at the whim of currents and waves, following many unique life cycles until they are ready to metamorphose.

Students will use observations and math to sort larvae and collect data, as larval biologists do when studying the babies of deep-sea animals. Students will also practice describing larvae with and without the scientific vocabulary used by biologists, and compare their descriptions and hypotheses of what the larvae will metamorphose into with what larval biologists know. Students will use multiplication to estimate the number of larvae in a given volume of seawater based on the data they collect.

3. Objectives

- a. Students will observe and recognize different types of larvae
- b. Students will count the larvae and categorize the results in a data table
- c. Students will use the data collected to extrapolate and gain new estimates of larval populations
- d. Students will reflect on how environmental factors influence the concentrations of larvae
- e. Students will view, compare, and contrast different life cycles of marine larvae

4. Estimated Time

60-90 minutes

5. NGSS Standards Addressed**3-LS1-1 From Molecules to Organisms: Structures and Processes**

Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death. Performance Expectation Grade: 3-5, 3

6. Ocean Literacy Principles

OLP 5: The ocean supports a great diversity of life and ecosystems.

OLFC 5D: Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms (such as symbiosis, predator-prey dynamics, and energy transfer) that do not occur on land.

OLFC 5E: The ocean provides a vast living space with diverse and unique ecosystems from the surface through the water column and down to, and below, the seafloor. Most of the living space on Earth is in the ocean.

OLFC 5F: Ocean ecosystems are defined by environmental factors and the community of organisms living there. Ocean life is not evenly distributed through time or space due to differences in abiotic factors such as oxygen, salinity, temperature, pH, light, nutrients, pressure, substrate, and circulation. A few regions of the ocean support the most abundant life on Earth, while most of the ocean does not support much life.

7. Focus Question: What are larvae and how are they studied?

8. Materials Needed

Included:

- a. Day in the Life of a Larval Biologist Work Packet
- b. How to Make Your Own Plankton Net Instructions
- c. Born in the Abyss Life Cycle Diagrams and Larval Videos
- d. Work packet with activities and questions

Not Included:

- e. Writing utensils including colored pencils
- f. Printed work packets
- g. Optional: Plankton net construction materials

9. Preparation

- a. Review the [Larval Biology Basics page](#) on the Born in the Abyss Website
- b. Read answers to discussion questions
- c. Print out work packets (1 per student, pages 6-12)
- d. Optional: Gather supplies to make plankton nets

10. Lesson Steps

Step one: Introduce the work packet; read the introduction on page 6 aloud. Allow students to independently observe and describe the larvae on that page.

Step two: Read the introduction on page 7 aloud. Allow independent reading time or learn about the larvae and their parents as a class.

Step three: View [this video](https://youtu.be/1oAHncffsV4) that shows a sneak peek at a Day in the Life of a Larval Biologist. This video shows the process of conducting a plankton tow off a dock in Charleston, Oregon, near the Pacific Ocean, sorting larvae out of a water sample, and viewing individuals under a microscope. Link: <https://youtu.be/1oAHncffsV4>

Step four: After the video, read the introduction on page 8 and allow students time to sort/count their plankton samples and then record their data on page 10. Provide colored pencils for students to mark off larvae as they count them. Once students have completed page 8, they will sort/count a second plankton sample on page 9, and record data on page 10.

Step five: Facilitate a class discussion on data collection using the reflection questions on page 11. Answers to the reflection questions are provided on page 5 to help instructors facilitate a fruitful discussion. Optional: see extensions for more discussion material.

Step six: Explain the concept of a life cycle using the description on page 12. Allow students time to independently view the life cycles on page 12 and write observations for each. Consider walking through one life cycle together as a class. Additional examples of life cycles of marine animals can be found here on the [Born in the Abyss Website Larval Quest](#), by clicking on the different names under “Larva to find.”

11. Extensions

- a. Optional questions with answers for extending the discussion on data collection

Question: Can you think of any reason you would find more larvae in one area than another area?

Answer: *The distribution of marine larvae throughout the ocean is not even, with higher concentrations in some areas and low densities in others. There are many factors that influence the distribution of marine larvae. Here are a few examples.*

1. *Ocean currents and hydrodynamics have great influence on where larvae are found. Seasonal changes to currents can affect the distribution of larvae significantly, such as in El Nino years when currents are transporting more water than typical.*
2. *The location of where a larva is born influences where it will travel and settle. Suitable habitat for adults is also ideal for settlement, so some larvae remain close to where they are spawned while others are transported far by currents.*
3. *Marine larvae are zooplankton that feed on phytoplankton. When phytoplankton is abundant, the productivity in an area is high, and zooplankton can congregate to take advantage of their food source. Lack of phytoplankton in an area can lead to lower densities of larvae.*
4. *While larvae cannot swim against a current, they can position themselves vertically in the water column to take advantage of outgoing or ingoing currents, allowing the movement and behavior of the larvae themselves to influence their transport and distribution.*

Question: Can you think of any reason you would find more larvae in one season than another season?

Answer: *Some seasons have more storms and less sunlight, leading to less phytoplankton to eat and fewer larvae in some areas. Seasons can also affect ocean currents which transport larvae. Adults also spawn seasonally, and a spawning event increases larval concentrations significantly.*

- b. Optional life cycle activity on page 13 of work packet: Read the introduction to "Draw your own life cycle" on page 13. Use the questions to inspire and encourage students to draw a life cycle diagram of their choice. If time and interest allow, encourage students to add labels.
- c. Click this link to visit the Born in the Abyss website to view videos of real larvae moving, feeding, and interacting with each other.
[Born in the Abyss Film Website](#)
- d. Print out [Larval Development Mandalas](#) from the Born in the Abyss website for students to color and learn more about the life cycles of marine larvae.
- e. See the build-your-own plankton net activity and have a construction day as a class. Encourage students to find a body of water and, under adult supervision, sample their own "plankton." [Build Your Own Plankton Net Instructions](#)

12. References

[Next Generation Science Standards](#)

<https://www.nextgenscience.org/>

[Ocean Literacy Principles Handbook by NMEA/NOAA](#)

<https://www.marine-ed.org/ocean-literacy/overview#ocean-literacy-overview>

[Born in the Abyss Film Website](#)

<https://www.stephenlow.com/born-in-the-abyss/#larval-biology-basics>

[Build Your Own Plankton Net Instructions](#)

<https://sealevel.jpl.nasa.gov/files/archive/activities/ts3meac3.pdf>

[A Day in the Life of a Larval Biologist Video](#)

<https://youtu.be/1oAHncffsV4>

A Day in the Life of a Larval Biologist

(Answer Key for Discussion Questions on Page 11)

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Reflection questions and answers for instructors. Use these responses to guide the final class discussion and clarify any confusion for students.

Reflect on being a Larval Biologist

1a. Did you find the same number of larvae in both of your plankton tows?

Students will find that there are more larvae in the second sample as a result of more time spent collecting plankton, leading to a greater volume of ocean water sampled in plankton tow 2.

1b. How many total larvae did you find in 1 L? In 2 L? Add the two totals together.

Students should find more larvae in plankton tow 2 because more ocean water was sampled as more time was spent sampling. Adding the totals together should illustrate to the students the importance of taking multiple samples and the idea that more time spent doing a plankton tow means a greater volume of ocean water is sampled, leading to a greater number of larvae collected. Sample size and sampling effort influence the data that is collected.

2. What other differences did you notice between plankton tow 1 and 2?

Students should find that the diversity of larvae is different between the two plankton tows with more diversity collected with the longer collection time and a larger volume of seawater sampled.

3. How many total larvae would you expect to find in 10 liters of ocean water?

Students will extrapolate using their counts of larvae from their two plankton tows.

*(# of larvae from 1 L * 10) = total # of larvae in 10 liters*

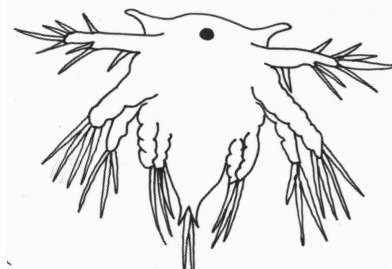
*(# of larvae from 2 L * 5) = total # of larvae in 10 liters*

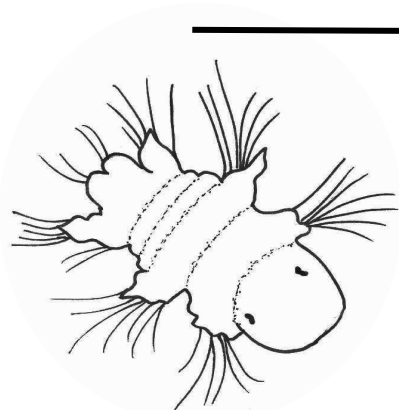
Students will find that these extrapolations result in different estimated totals. This is another opportunity to point out the limitations of estimation and the importance of collecting multiple samples to increase the accuracy of an estimate.

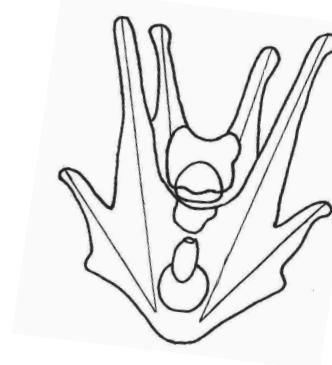
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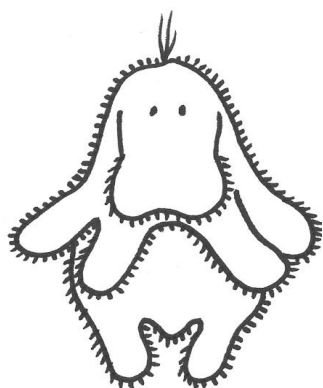
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Similar to how caterpillars change into butterflies, the babies of many marine animals go through a metamorphosis to become adults and their bodies can change a lot. When you find a new larva (baby), you don't know what it grows into, so you first need to describe it. Larval biologists write descriptions of all larvae (babies) so that they can be named, recognized, matched with their parents, and researched. Write 1-2 sentences about how the bodies of these larvae look. How would you explain these animals to someone who had never seen them before?









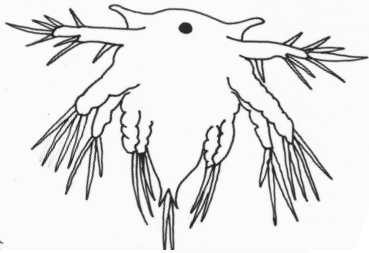


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During the larval stage, some marine babies do not look like their parents at all. Other larvae already have the beginnings of body parts they will always have even after their metamorphosis when they become adults. Would you know that a caterpillar would one day look like a butterfly just from seeing a caterpillar? Would you be able to match these larvae to their adults just by looking?

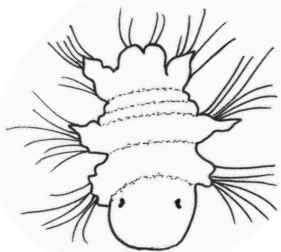
Nauplius = baby barnacle



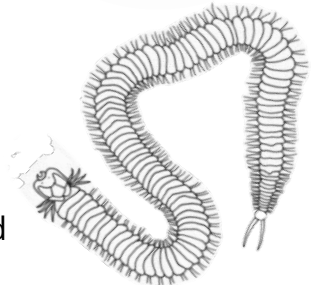
This larva is called a nauplius and it will grow into a barnacle. As babies, they have one eye that can see light and dark and special legs to help them swim. After metamorphosis, the adult barnacle will stay in one spot for the rest of its life.



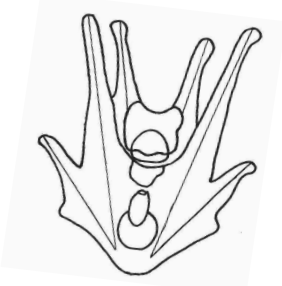
Nectochaete = baby bristle worm



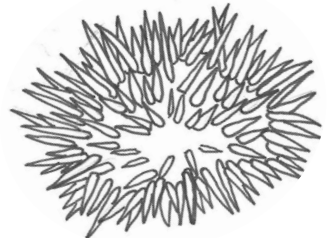
This larva is called a nectochaete and it will grow into a bristle worm. As babies, nectochaetes have the same bristles or spines they have as adults. These bristles can help these worms move and protect themselves from predators. As the nectochaete grows, it will grow more and more bristles.



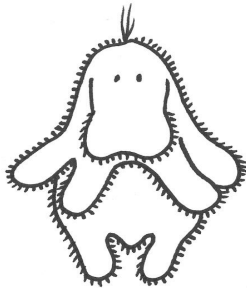
Pluteus = baby sea urchin



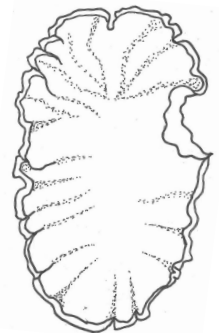
This larva is called a pluteus and it will grow into a sea urchin. The straight lines you see inside the baby are the start of the adult sea urchin skeleton which is called a "test".



Müller's larva = baby flatworm



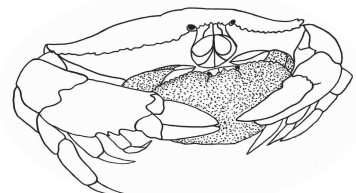
This larva is called a Müller's larva and it will grow into a flatworm. The "hairs" you see all over this larva are called cilia. Cilia allow many of the microscopic babies in the ocean to feel their environment, move around, and find food. The long cilia on the top are important for sensing their environment.



Zoea = baby crab



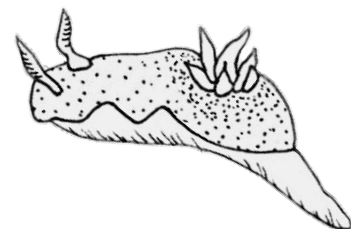
This larva is called a zoea and it will grow into a crab. Unlike the eyes of most other microscopic babies, the eyes of a zoea can see images, not just light and dark. Their great eyesight makes them successful predators of other tiny animals. Zoea can swim very well, but after metamorphosis, most crabs spend their lives crawling on the ocean floor.



Gastropod veliger = baby sea slug



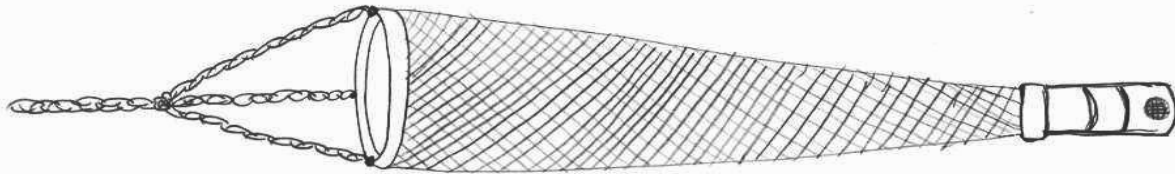
This larva is called a gastropod veliger and it will grow into a sea slug. You can see that as larvae, gastropod veligers have shells like snails, but drop their shells during metamorphosis into a sea slug.



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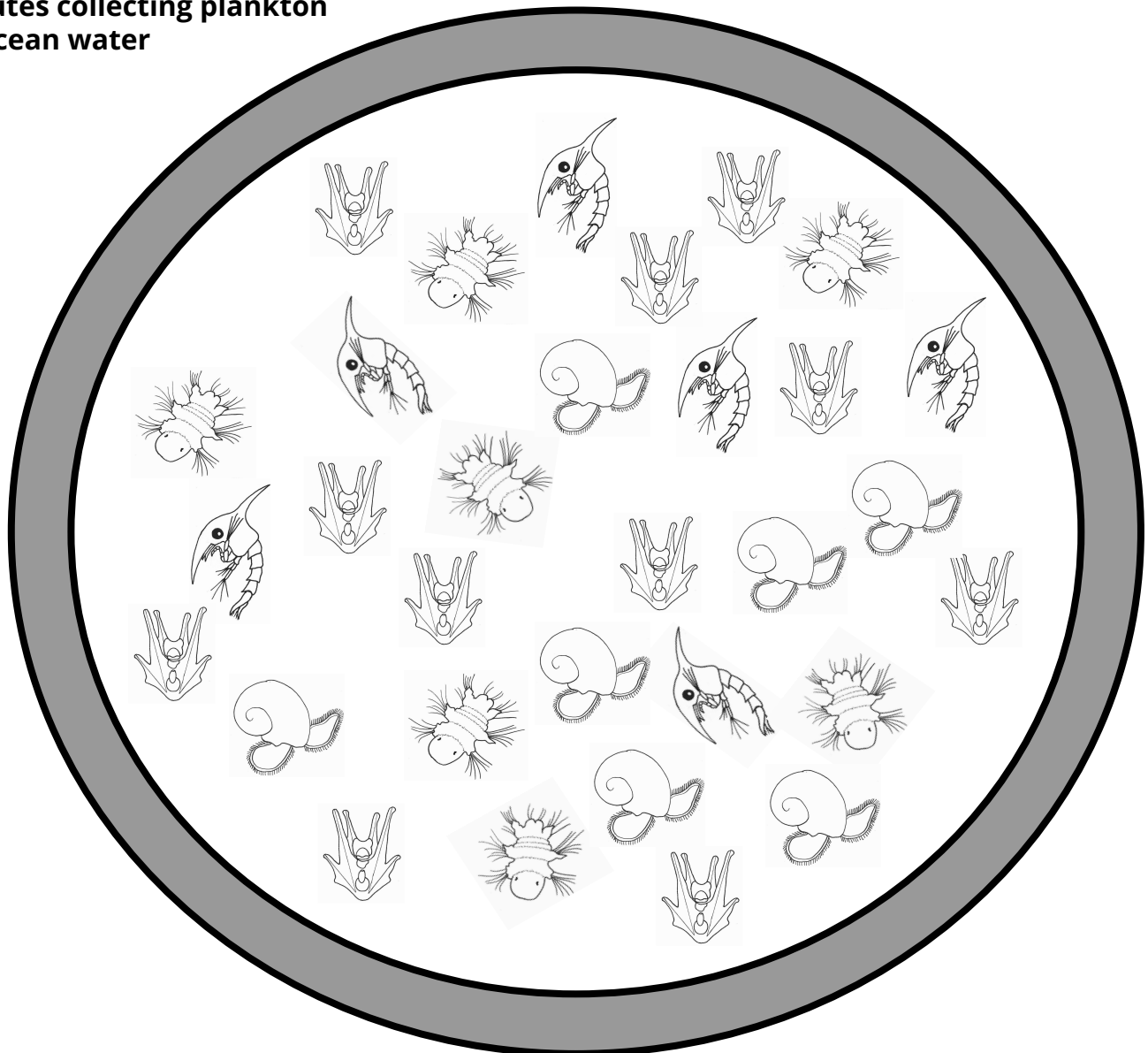
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The babies of marine animals or larvae you met on pages 1 and 2 are a type of zooplankton. Zooplankton are any animals that cannot swim against a current. Most zooplankton are microscopic and their small size makes it impossible to control their movement against currents and waves. Instead of swimming, zooplankton drift and float throughout the ocean. In fact, the word "plankton" is Greek for "drifter." Larval biologists use a plankton net to collect these drifters and study them.



Now, you are a larval biologist looking at an ocean water sample you collected with your plankton net! The circle below is your microscope. Look through the circle lens to see a zoomed in view of the microscopic babies your net captured today! As you count the different types of larvae, remember to log your data on **page 5**.

Plankton tow 1:
30 minutes collecting plankton
1 L of ocean water

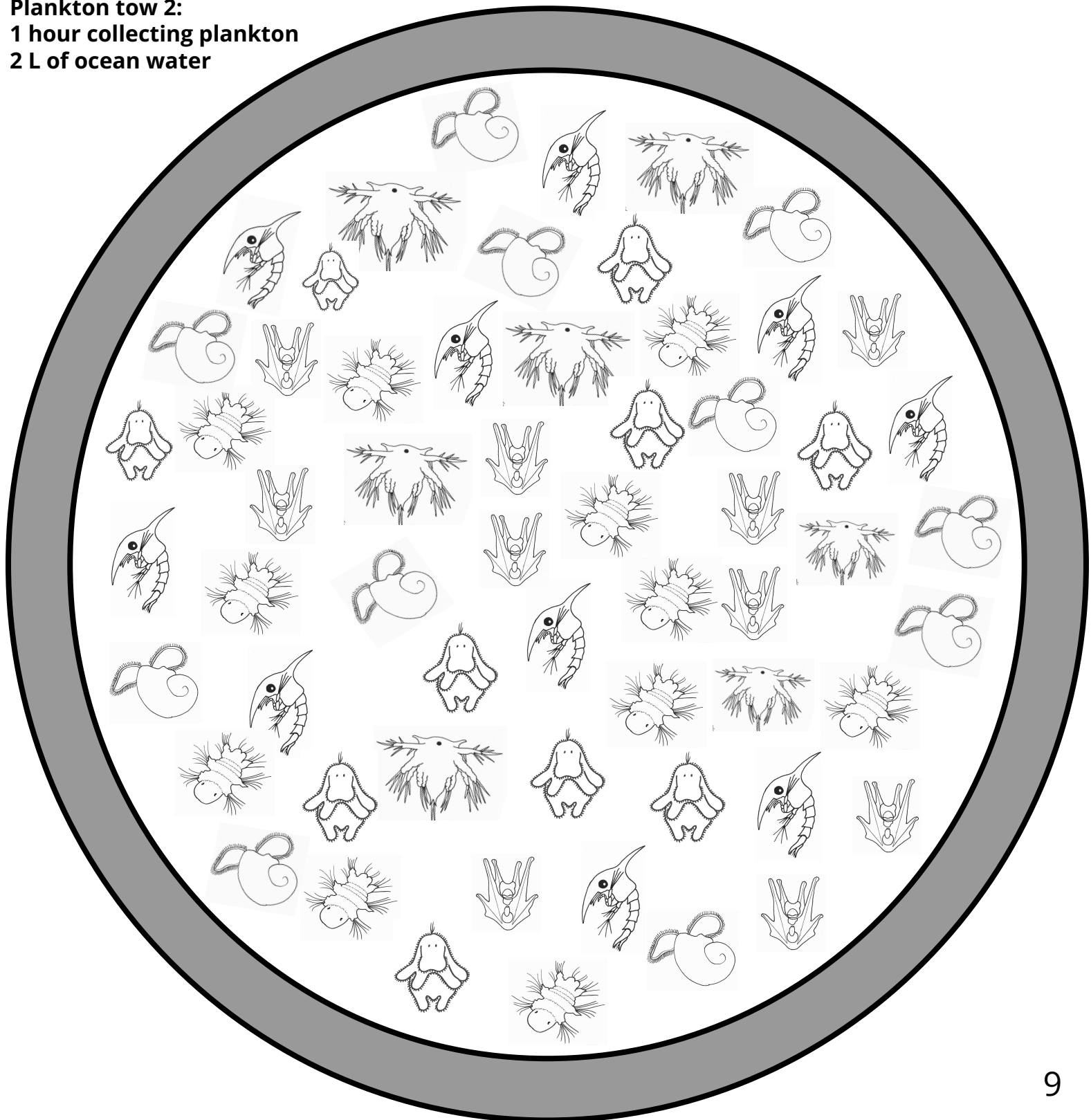


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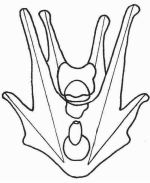
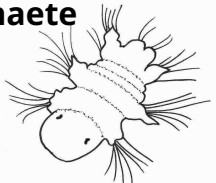
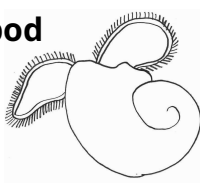
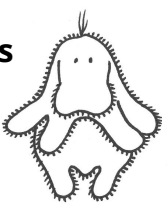
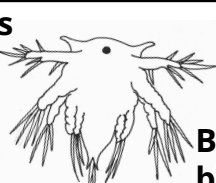
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As a larval biologist, you decide to collect more larvae by taking another plankton tow and spending more time pulling the net through the ocean water. Can you imagine trying to sort and count these larvae while they are zooming around the circle? Larval biologists work with live larvae that are constantly moving. Lucky for you, these larvae are staying still. As you count, you can use colored pencils to mark larvae and keep track of which ones you've counted. Remember to log your data on **page 5**.

Plankton tow 2:
1 hour collecting plankton
2 L of ocean water



Data Collection Log

Type of Larva (baby)	How many were in the first plankton tow? (100 mL)	How many were in the second tow? (1 L)
Pluteus  Baby sea urchin		
Nectochaete  Baby bristle worm		
Zoea  Baby crab		
Gastropod veliger  Baby sea slug		
Müller's larva  Baby flatworm		
Nauplius  Baby barnacle		
TOTAL:		

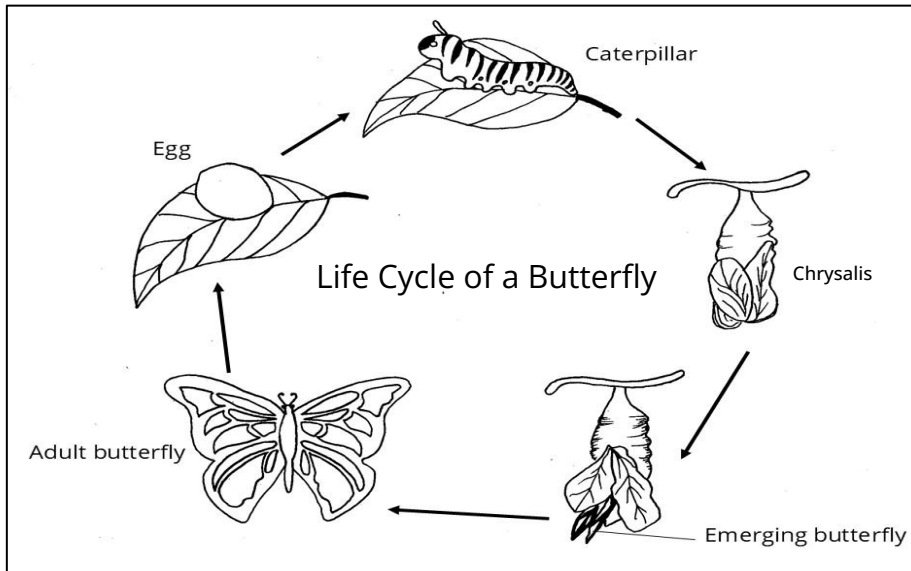
1. Did you find the same number of larvae in both of your plankton tows? How many total larvae did you find in 1 L? In 2 L? In both together?

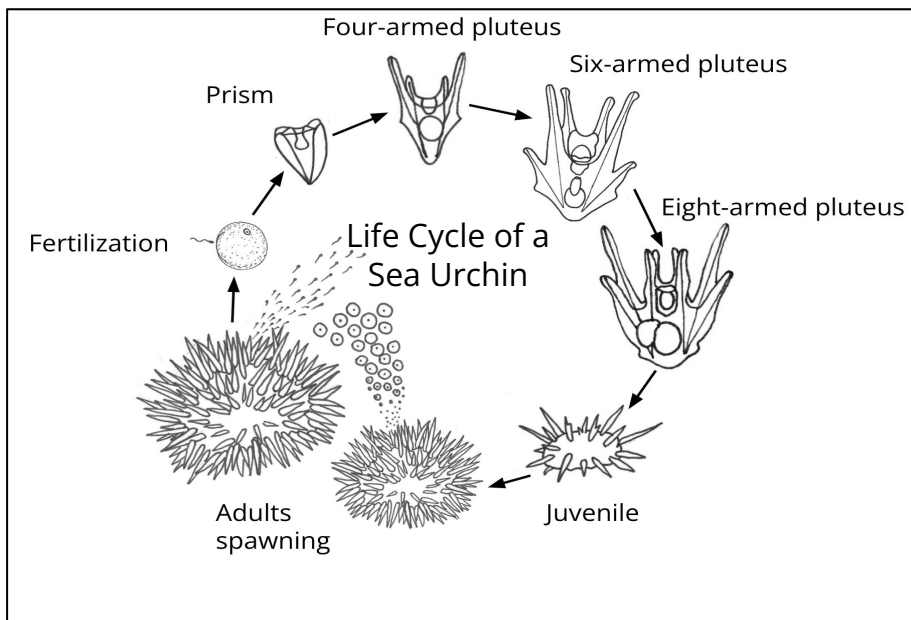
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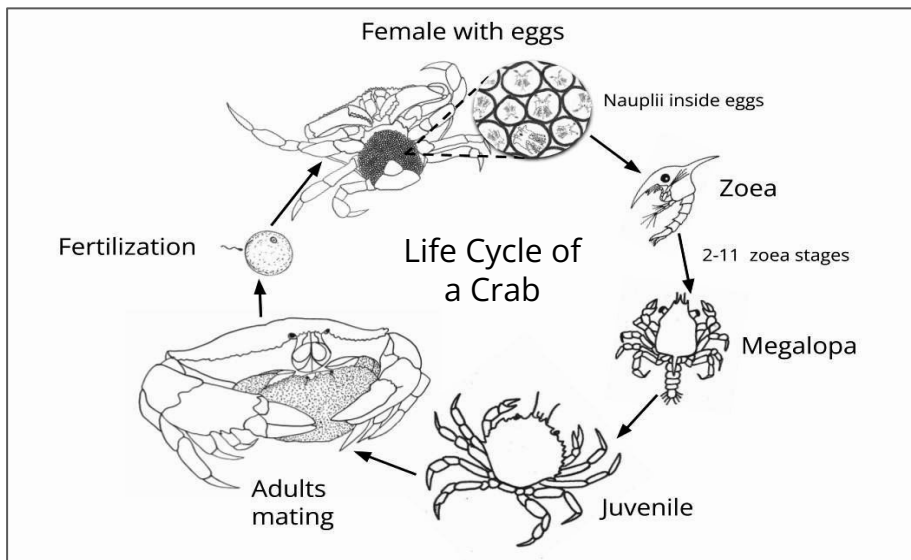
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A life cycle diagram is a picture that shows all the steps an animal grows through from birth to adulthood. The cycle starts over when a new generation of babies is born. Write 1-2 sentences on what you notice about each life cycle. Focus on similarities, differences, and anything that surprises you.







Draw your own life cycle

Using the space below, draw the life cycle of an animal of your choice. You can draw an animal you know of, or you can design your own microscopic animal. If you're stumped, you can also practice drawing one of the life cycles from the Born in the Abyss website. Your life cycle must be continuous, meaning the point where it ends is also where the cycle starts over.

Questions to get you started:

Does the mother of your animal give birth or lay eggs? How many babies or eggs?

How many stages does your animal grow through before it becomes an adult? Does your animal go through a big change or metamorphosis?

Does your animal eat or act differently after its big change (metamorphosis)?

How many days, weeks, or months does it take your animal to reach metamorphosis?

How many days, weeks, or months does it take your animal to grow into an adult?

The Life Cycle of
