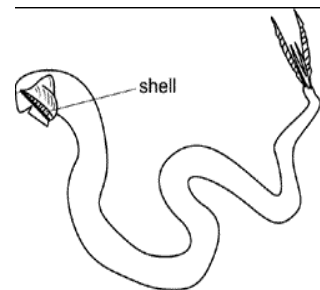


Introduction to Shipworms

k'yúu ts'udalaas aa
(ts'ujuus aa)

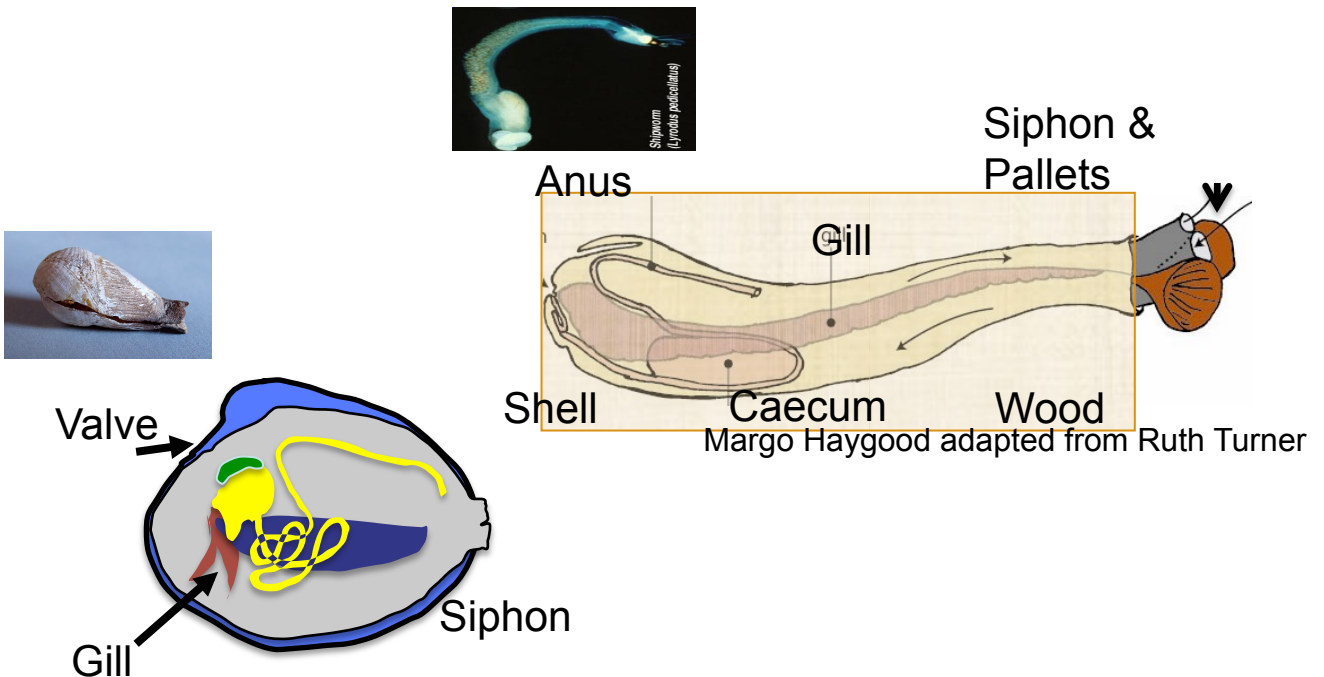


What is a shipworm?

“Termites of the Sea”

A shipworm is not really a worm at all, but is a marine bi-valve mollusk

- A valve is another word for shell. Therefore, bivalve means that this organism has 2 shells, so is more similar to a clam than a worm.
- A clam uses its shells for shelter, but the shipworm uses wood for shelter so its shells are much smaller than clam shells.



- There are over 100 different species of shipworms.
- These unique animals burrow into wood, using it for food and shelter.

Shipworm: k'yúu ts'udalaas aa
Wood: cháan is ii



Where do shipworms live?

- Shipworms have been found in every ocean of the world.
 - They are tolerant to changes in temperature, salinity and oxygen availability and therefore can survive in many different climates.
 - Salinity 9-35 ppt
 - Temperature 10° - 30°C
- ★ Salinity can be measured in a variety of ways. One such way is with a salinity refractometer, a second way is through using water chemistry test kit. Make several measurements using both methods and compare. How do the results compare and contrast?
- They exist over a wide range of depths, and have been found as deep as 7000m below sea level as well as in the inter-tidal zone.
 - Most importantly, there must be an abundance of wood in an area in order for shipworms to be present.

Shipworm: k'yúu ts'udalaas aa

Wood: cháan is ii

Yellow cedar: sgahláan

Red cedar: ts' úu

Alder: káang

Spruce: kíid

Ocean: Siisgwii, síisgaay

Temperature: sangáay

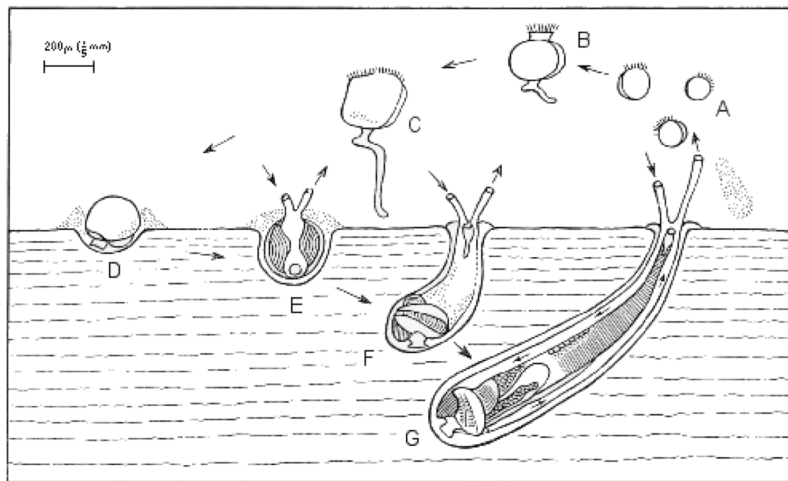
Saltwater: cháan tángaa

Shipworm Life Cycle

Shipworms are related to boring clams that prefer wood over muddy bottoms to burrow through. They have two small shells that grow only to a length of about one-third of an inch, and has a long, wormlike body, which the surrounding tunnel of wood supports and feeds.

In some species larvae (young shipworms) are released into the water. These larvae attach to wood in the environment and begin to create a home within the wood.

Shipworms do not depend solely on wood for food, but also feed on plankton that they suck in through their siphons.

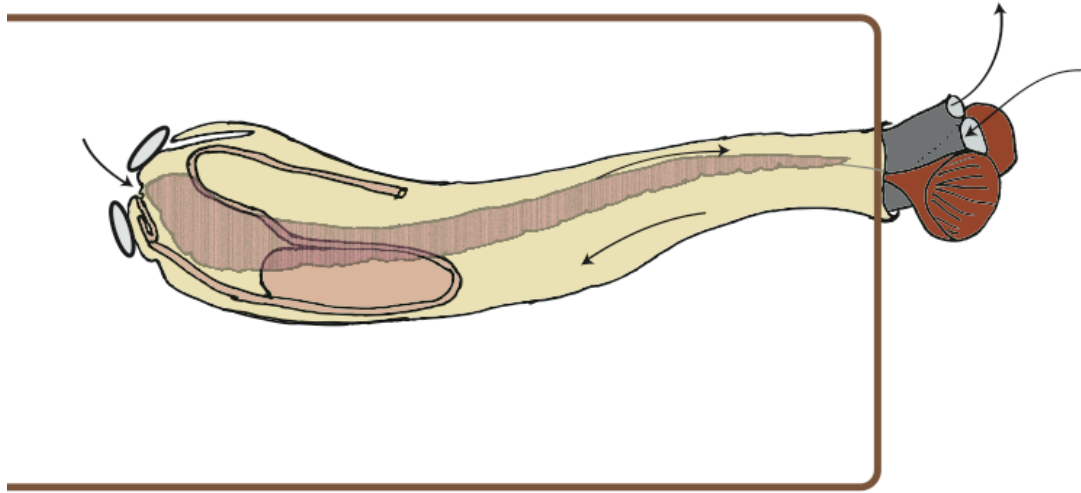


research.ttlchiltern.co.uk

Shipworm **valves** are used to break up the wood in order to create its burrow and to provide the worm with small pieces of wood for food.

As the shipworm burrows it lines its tunnel with a calcareous lining.

Shipworm Anatomy



Shell

Siphon

Pallet

Gill

Caecum



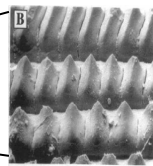
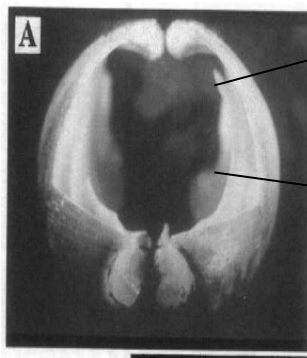
Label each animal and their shell and body.

Siphons extend outside of the wood into the surrounding water. Water enters the worm through the siphons, travels through the **gills** and then exits through the siphons. This is how the worm breathes.

- When a piece of wood is under water the siphons are visible outside of the wood and are therefore an indicator that a worm is present.



Pallets are used to close off its burrow if the wood it is living in is no longer under water. They can survive many hours this way and can therefore survive tidal changes.



- When the wood is out of water, the siphons are retracted.

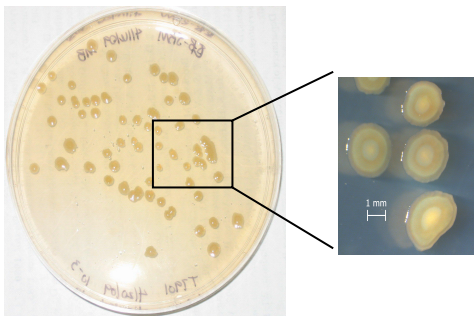
Shells have toothed ridges, that shave away bits of wood as the worm grows and moves. The shipworms' calcified tunnels never intersect.

Shipworm shell used for breaking up wood. Scale bar in A 0.5cm, B 5um (Distel 2007 American Chemical Society)

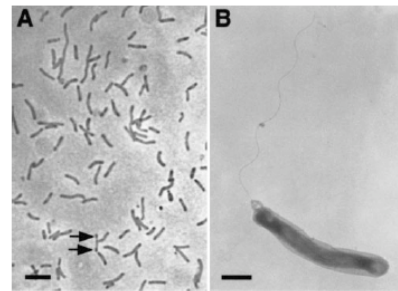
Shipworm-Bacterial Symbiosis

Symbiosis-a close ecological relationship in which organisms from more than 1 species live together in close proximity.

- Shipworms play host to a community of bacteria that live in bacteriocytes within the gill.
- What do these symbionts do?
 - Produce chemicals which allow the shipworm to: digest wood
 - provide the shipworm with nutrients (nitrogen fixation)
 - Antimicrobial.



Teredinibacter turnerae from a shipworm growing on a plate in a laboratory culture.



Teredinibacter turnerae- A bacterium cultured from a shipworm. D. Distel

Importance of Shipworms

Throughout history shipworms have caused large amounts of damage to wooden ships and piers.

- In fact, it is thought that Christopher Columbus' ships were destroyed by shipworms.
- The microbial community and the chemicals they produce can prove useful in biofuels production and anti-microbial drugs.



sfbay.wr.usgs.gov/

Shipworms have caused vast amounts of damage to wooden structures in coastal areas.



www.wikipedia.com



Collecting shipworms

- **Traps**
 - Traps consist of pieces of wood attached to a rope which is hung into the water for a long period of time and collected once worms have colonized the wood.
- **Collection of inhabited wood**
 - Pieces of wood that already contain living worms can be collected by diving or from the beach at low tide.
- **Signs of shipworm inhabitation:**
 - Bore holes, calcareous (white, chalk-like) lining

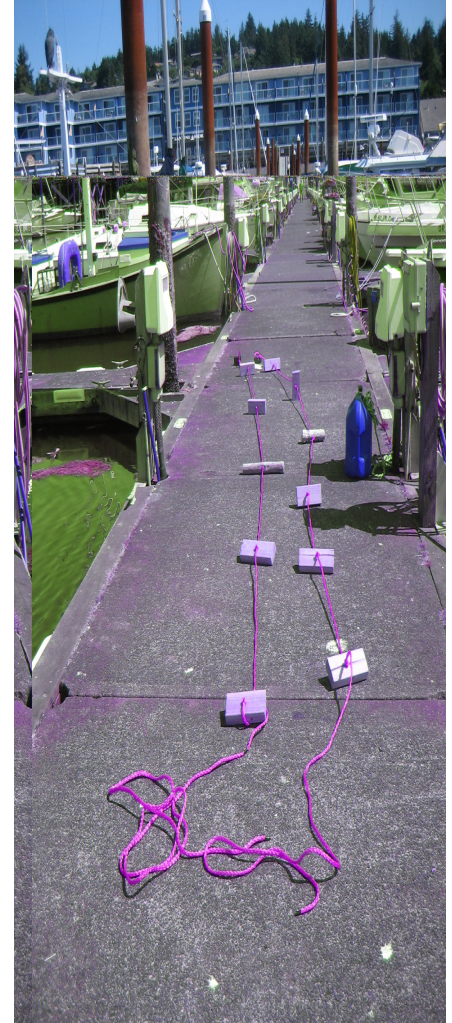
Variable:

Type of wood

Depth of water

Temperature & salinity of water

Distance between wood traps



Shipworm: k'yúu ts'udalaas aa

Wood: cháan is ii

Yellow cedar: sgahláan

Red cedar: ts' úu

Alder: káng

Spruce: kíid

Ocean: Siisgwii, síisgaay

Temperature: sangáay

Saltwater: cháan tángaa

Traps: skám

Burrow: k'wiiyáay, kugáay, kíidang

Variables

Scientists use an experiment to search for cause and effect relationships in nature. In other words, they design an experiment so that changes to one item cause something else to vary in a predictable way. These changing quantities are called variables.

A **variable** is any factor, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: **independent**, **dependent**, and **controlled**.

An **independent** variable is the one that can be changed by you. A good experiment will have only one independent variable. As you change your independent variable, observe what happens **dependent variable**. A **controlled variable** is one that never changes, allowing you to observe how your independent variable affected your study.



Question	Independent variable (What I changed)	Dependent variable (What I observed)	Controlled variable (What stayed the same)

Shipworms



Label the body parts:

Head

Body

Pallets

Siphon: stast' áangaa

Shell

Calcareous lining



Haida terms for shipworm study

Shipworm: k'yúu ts'udalaas aa
Wood: cháan is ii
Yellow cedar: sgahláan
Red cedar: ts' úu
Alder: káang
Spruce: kíid
Ocean: Siisgwii, síisgaay
Temperature: sangáay
Saltwater: cháan tángaa
Nitrogen: k'wii' láa aa uu íinas ' láagang
Siphon: stast' áangaa
Symbiosis: gud tl' áng káatsgiidang
Traps: skám