

# Kids and Squids

## A Humboldt Squid Dissection Guide for Educators

*Dosidicus gigas* is commonly known as the Humboldt squid or the jumbo flying squid. Humboldt squid are large cephalopods that support the largest invertebrate fishery in the world. They live in the eastern Pacific Ocean from Chile to Baja California, Mexico, although they recently have been moving further north, into California and even Alaska.

### Humboldt Squid Dissection

#### Preparation

1. Allow the frozen squid ample time to thaw (at least 8 hours or overnight). Placing the squid in a hot water bath speeds this process.
2. Collect your tools: a sharp knife, measuring tape, disposable gloves, blank paper to write on with squid ink.
3. Figure out how you're going to deal with the mess. It can be helpful to lay down plastic and have paper towels and running water handy, if possible.

#### External Anatomy

1. Before you start your dissection, take a moment to assess the whole animal. Squids are unique creatures, and you may not be familiar with their structure and appendages. Use the visual guides to identify the following features:

- **arms and tentacles:** squid have eight arms and two retractable tentacles attached to the **head**. Humboldt squid have **suckers with teeth** along each arm, and also at the ends ("clubs") of each tentacle. Put your finger on the suckers to feel how they still work.
- **mantle:** the rest of the squid's body is called the mantle. The mantle is a hollow structure and thus the internal organs are all exposed directly to seawater.
- **funnel:** squids move by pumping seawater out of their mantle through the funnel, also called the siphon. They can alter the angle of the funnel in order to change directions rapidly.
- **fins:** squids have two fins at the end of their body opposite the head. The fins are used for both maintaining position and generating thrust. They can also be rolled up around the body to minimize drag.
- **chromatophores:** cephalopods are able to change the color of their bodies by controlling these tiny elastic sacs of pigment. Each dot on a cephalopod's skin is controlled by little muscles that can expand the sac to display more color. When these muscles relax, the sac contracts and less color is seen. Humboldt squid can turn their entire bodies from red to white to red again in less than one second!

2. Now, look more closely at the head, and find these structures.

- **beak:** at the center of the arms is the squid's beak. Squids eat their prey by taking small bites that are pulled into the esophagus by the tongue-like

**radula**, a rough structure inside the beak. Using your fingers, grab the two halves of the beak and pull them out from the buccal mass. Rinse them in tap water and they will dry to make nice keepsakes.

- **eyes:** note the large size of the eyes. Squids are visual predators and they must be able to see in poor light conditions.

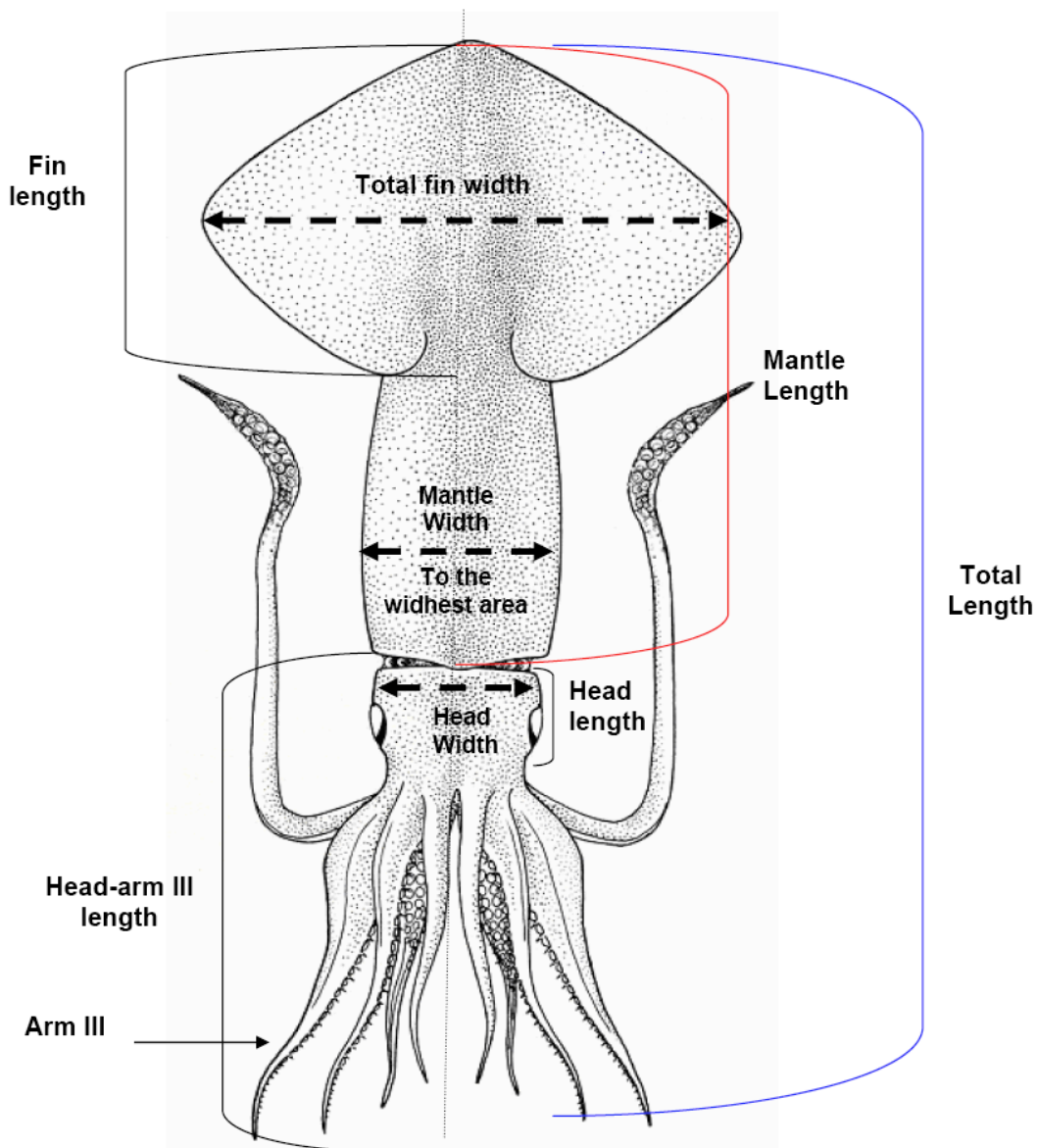
3. If you want to know how big your squid is, the most common measurement that scientists use is the mantle length (see the diagram at the end of this sheet). You can also measure total length, width, etc.

### Internal Anatomy

1. Turn the squid so that its ventral side is up: you will be able to see the siphon and the fins will be laid flat on the table/floor.
2. Reach inside the mantle to lift it away from the internal organs and use a sharp knife to slice the mantle open along the length of the body. Be sure not to cut any of the internal organs in this process. You will have sliced it from near the siphon to near the fins, and the mantle will fall open like a book.
3. At least, it should fall open like a book . . . the mantle may still be attached to the head on one or both sides with “funnel locking cartilages”—these work like snaps and you can pull them apart with your fingers without having to actually break or cut anything.
4. From here on, you will not need any tools except your fingers (until you extract the pen). The organs are all encased in thin membranes that you can pull apart to view the structures within.
5. Identify:
  - **gills:** these are 2 long organs on either side of the mantle cavity. Note the large size and bluish hue: squid have copper in their blood instead of iron and that makes the blood blue rather than red.
  - **stomach:** this is found near the base of the gills. Depending on the squid’s last meal, the stomach can be rather full and reddish with stomach acid.
  - **kidneys:** the stuff on top of the stomach that looks like cottage cheese are the squid’s “renal appendages” which remove nitrogenous wastes from the blood and excrete them as urine, just like our kidneys.
  - **reproductive organs:** is your squid a male or a female? Identify the nidamental glands and eggs (female) or spermatophoric complex (male) using the gender and sexual maturity identification key that follows.
  - **digestive gland:** this is the largest internal structure; it is fat and brownish right in the middle of the squid. Like the renal appendages, the squid liver has a fancy name: the hepatopancreas. Its function is not well understood, and it may or may not be analogous to the human liver.
  - **stellate ganglion** (pl: ganglia): this large cluster of nerves controls the muscles in the mantle. The squid uses these nerves to contract its mantle, squirting water out through the siphon to propel itself through the sea.

- **ink sac:** this is lying on top of the liver, underneath the **esophagus**. You can carefully pull the ink sac out (making sure not to pop it!) This will give you plenty of ink so you can write something with the pen (see next:)
- **gladius (pen):** when you are all done investigating the internal organs, you can extract the pen. This is the internal shell of the squid (they are molluscs, after all!) Pull the other organs out of the way and press your fingers along the length of the body. You will feel something rigid. Using the knife, gently slice the flesh of the mantle along the pen, and use your fingers to pull it out. The base of the pen, by the fins, is much wider and harder: you may have to cut in several places before you are able to bring the pen out.

You can use the pen to write a message in squid ink!

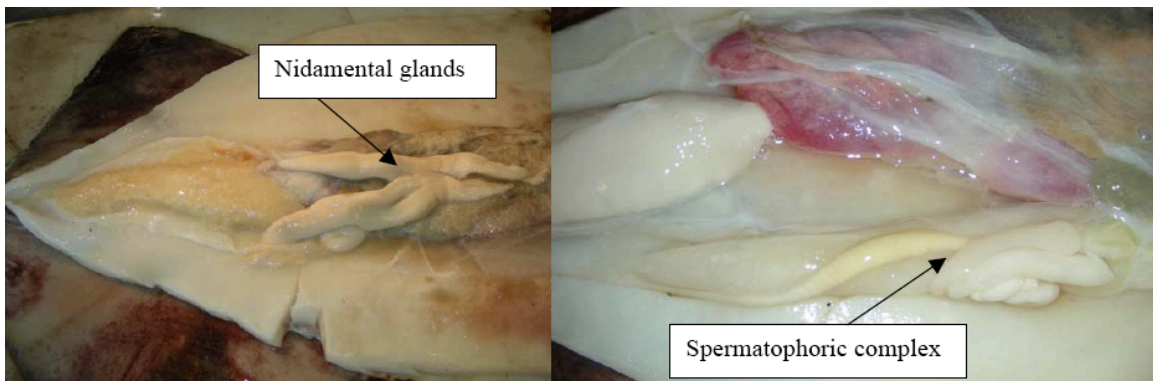


Dorsal view of *D. gigas* (modified from Roper *et al.* 1984)

## Gender and sexual maturity identification key

(L. Zeidberg, adapted from Lipinski and Sauer for *Dosidicus gigas*)

<u>Stage</u>	<u>Gender</u>	<u>Characteristics</u>
I	Juveniles:	cannot tell male or female nidamental glands hard or impossible to see can tell testes (compact) from ovary (sack of grapes)
II	Females:	nidamental glands, translucent or white oviduct is not distended
	Males:	spermatophoric sack is small
III	Females:	nidamental gland white and broad oviducal gland is tiny oviducts have no eggs ovary is transparent -> getting yellow
	Males:	no spermatophores in spermatophoric complex, but can differentiate all parts
IV	Females:	few eggs in oviducts of yellow-brown ovary orange ripe eggs in oviducts
	Males:	few sperm in spermatophoric complex
V	Females:	oviduct is full of orange eggs ovary is yellow
	Males:	spermatophoric complex full of spermatophores
VI	Spent:	this has not been observed



*Left:* dissected female squid with nidamental glands displayed. *Right:* dissected male squid with spermatophoric complex