

Name: \_\_\_\_\_

Period: \_\_\_\_ Date: \_\_\_\_\_

### Lab Activity: Dogfish Shark Dissection

(Adapted from Bohensky, 2002)

#### Background:

Biologically, sharks are fish belonging to the Phylum Chordata and the subphylum Vertebrata. However, sharks and their relatives, the rays and skates, are unique because their skeletons are made entirely of cartilage, not bone. This places them in the Class Chondrichthyes. They are divided into nineteen families, with five families, making up 75 per cent of the known species.

Shark **fertilization is internal**, and most shark "pups" hatch internally, to continue their development within the uterus of the mother. After a period of gestation (up to two years in the spiny dogfish, *Squalus acanthias*, the longest of any vertebrate) they are born alive as a smaller version of the adult. This method of reproduction called **ovoviviparous**. The number of pups in a litter varies from two in some species to sixty in others. Some sharks are **oviparous**, laying large eggs enclosed in shells, or egg-cases, consisting of a horn-like material. They are usually flat and quadrangular shaped with long tendrils which serve to anchor the eggs to seaweed or other objects (ex. Mermaid's purse).

While there are close to 20,000 living species of fish, there are approximately 250 to 350 species of sharks worldwide and only 12 species have been known to attack man. Their size ranges from the 6-inch dwarf shark all the way up to the 60 foot plankton feeding whale shark weighing over ten tons. Contrary to popular belief, the two largest of sharks are quite inoffensive beasts, deriving most of their nourishment from planktonic animals.

#### **DOGFISH SHARK**

The dogfish, scientific name *Squalus acanthias*, of the family **Squalidae**, is our dissection specimen. The species name "*acanthias*" refers to the animal's mildly poisonous spines, one in front of each dorsal fin (*both should have already been removed from your shark*). It is a relatively small shark, growing to about 3 feet in length and weighing about 15 pounds. The **absence of an anal fin** is characteristic of the entire family.

This shark is found worldwide, from the temperate to the subpolar regions, from the shallow waters of the sea shore to depths of 100 fathoms (600 feet). Dogfish sharks are voracious eaters, feeding on fish, crustaceans, squid, gastropods, jelly fish, and even red and brown algae. The spiny dogfish, as most other sharks, is **omnivorous**, eating both plants and animals.

The dogfish shark is an abundant species. On this side of the Atlantic it is infamous for its disruptive activities to fishing operations. It destroys fishing gear; hook and line nets are bitten and their catch devoured and freed. This results in a high animal loss to the fishing industry. Up until the early 1990's, except as laboratory specimens, no economic use had been found for them and, as a result, they were very inexpensive. As humans have looked to the ocean for more food sources, dogfish shark meat has become a sought after catch to supply European fish and chips. As a result, dogfish are now a regulated fishery and easily obtained for scientific purposes.

#### **CLASSIFICATION**

Kingdom: Animalia

Phylum: Chordata

Class: Chondrichthyes

Order: Elasmobranchii

Family: Squalidae

Genus: *Squalus*

Species: *acanthias*

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Pre-Lab Questions (10 points)

1. What is the scientific name of the dogfish shark?
2. What type of fertilization occurs with the shark?
3. What is the difference between ovoviviparous and oviparous? Which of these terms applies to the dogfish shark?
4. What does the species name *acanthias* refer to with this shark?
5. What common feature is absent in this species of shark?

Materials:

- Preserved Dogfish shark
- Plastic bag and newspaper
- Scalpel or Scissors
- Probe
- Dissection guide

Procedure: *dissection is to be completed in small groups of 4-5 students.*

**External Dissection**

1. Prepare a place for your shark by making a 'shark nest'. Flatten a large blue disposable sheet on your work area using masking tape and then place additional sheets on top of this to absorb any fluid from the shark or the container.
2. Place the shark in the middle of your lab table, away from all edges.
3. Examine the skin of the shark by running your fingers over it lightly, from the **posterior to the anterior** end. The roughness you feel is the **placoid scales**, also called the **dermal denticles**. Because of its abrasive quality, shark skin was once known as "shagreen" and was used to polish wood. Describe how the scales feel. (1 point)

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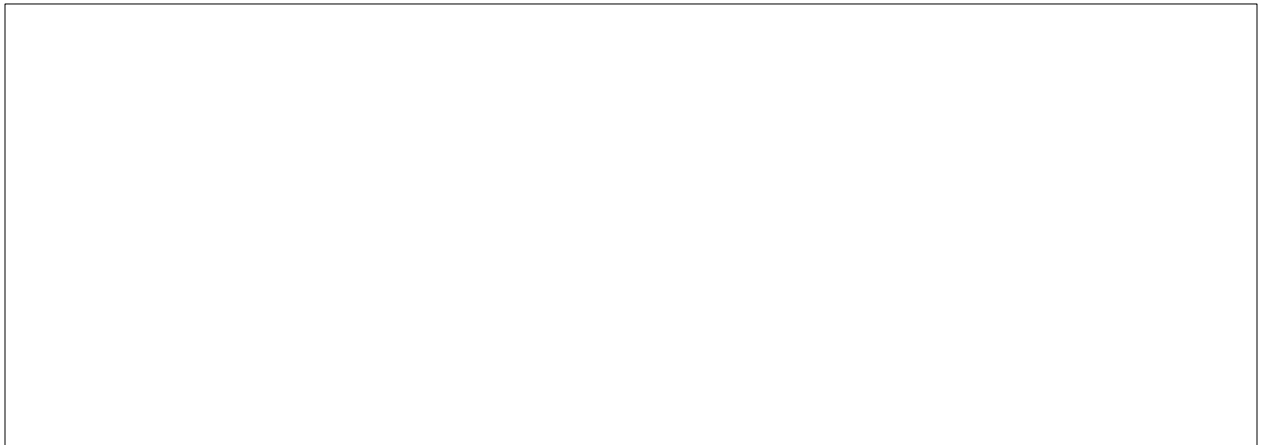
4. Locate the **mouth**, **eyes**, **nostrils** (external nares), **snout**, and **olfactory sacs** (inside each spiracle). The spiracles are actually reduced, modified gills. Most fish respire by taking in water through the mouth and sending it through the pharynx to the gills. However, when a **spiracle** is present, water enters through it also. Relatives of the shark, such as rays and skates, which live on the bottom of the ocean, use the spiracle for water intake almost exclusively. Why might this be true? (2 points)

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5. The body is divided into three sections, the **head**, **trunk**, and the **tail**. Make a sketch of the shark and label these 3 body parts. (5 points)



**Figure 1 – External anatomy of the Dogfish Shark (*Squalus acanthias*)**

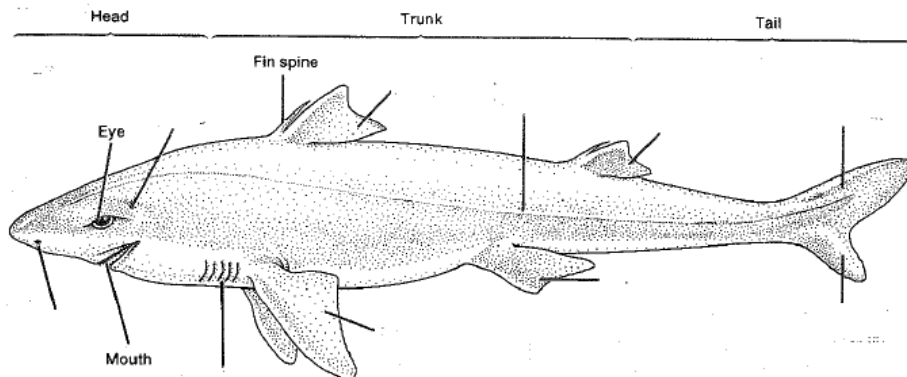
6. Locate the **lateral line** and notice that the body is darker above the lateral line than below. This special type of shading (**countershading**) works to camouflage the shark as the natural light from above highlights its dorsal side and makes shadows on the ventral side. Draw the lateral line on your drawing above. What is the function of the lateral line? (2 points)

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7. Locate the **seven fins** on your shark: **anterior dorsal**, **pectoral (2)**, **pelvic (2)**, **caudal**, and **posterior dorsal**. Using the diagram below, **label these fins accordingly**. Notice that the caudal fin is **asymmetrical**. This improves the shark's stability, allowing it to ride evenly through the water. In fish more advanced than the shark that have lungs or a swim bladder, this extra stability is unnecessary. Therefore, such fish have a symmetrical caudal fin. (10 points)



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8. Open the **mouth** and describe the teeth. (2 points)

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9. Identify the **gills** and describe them. What is the function of the gills? (2 points)

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Determine the **sex of your shark** by checking the pelvic fins for **claspers**. Only males have these strong, grooved structures. Make sure you observe a shark of each sex. Locate the **urinary ducts** and in the male, the **genital ducts** that open at the tip of the urinary papilla. This can be found just inside the **cloaca**, on the ventral side of the shark, **between the two pelvic fins**. The cloaca serves as an exterior opening for the digestive, excretory, and reproductive systems.

10. What is the gender of your shark? \_\_\_\_\_ (1 point)

11. What is the function of the claspers in the male? (1 point)

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### Internal Dissection

1. Place the shark on the prepared surface, **ventral side up**.
2. Using the diagram as a guide, **take a scalpel and begin cutting just anterior to the pelvic fins**, making the cut on the **right side of the mid-ventral line**. **Continue cutting anteriorly until you reach the pectoral fins**.
3. Make **two transverse cuts**, across the body, one just **posterior to the pectoral fins** and another just **anterior to the pelvic fins**. The cuts should extend from one lateral line of the shark to the other.

### Digestive System:

4. At the most **anterior** part of the cavity rests the **liver**. Count the lobes of the liver and record:  
\_\_\_\_\_ (1 point)

5. What is the function of **liver**? (1 point)

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6. The long thin **gall bladder** is implanted in the **median lobe of the liver**. To observe it better, scrape away the liver tissue with a dissecting probe. Once the gall bladder is exposed, locate the attached **bile duct**. What is the function of the gall bladder? (2 points)

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Spread the lobes of the liver to locate the **esophagus** and the **stomach**. Both have approximately the same diameter so it is difficult to tell where the esophagus stops and the stomach begins. The posterior end of the stomach curves anteriorly, giving the stomach a "**J**" shape. The rest of the digestive system turns posteriorly to form a **straight intestine** that continues to the outside body opening, the **cloaca**.

7. Although associated with the digestive system, the **spleen** is actually part of the circulatory system. It is found at the **posterior end of the stomach**. Describe the spleen. What is its function? (2 points)

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8. Locate the **pancreas**. It has two-lobes, the dorsal lobe coming from the right side of the spleen on the dorsal side of the intestine, and the ventral lobe, which is oval-shaped, and sitting on top of the beginning of the intestine. What is the function of the pancreas? (1 point)

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#### Urogenital System:

On either side of the anterior end of the esophagus and stomach are the **gonads (testes and ovaries)**. Locate them. The **kidneys** can be observed lying on the dorsal wall of the cavity, one on either side of the mid-dorsal line. They are **long bands of dark tissue and often run almost the entire length of the cavity**.

