

Scat Detective

OBJECTIVE

Students will examine scats, tally the data, and produce frequency histograms.

TIME REQUIREMENT

30 minutes

BACKGROUND

Fur seals eat many different types of fish and sometimes they eat birds. One of the ways scientists study fur seal food habits is by examining their scat. (Scat is also called feces or poop.) Each summer, scat is collected from the rookery, frozen, and then shipped back to the lab for further examination. After all of the organic material has been washed away the bony parts of the fur seal's prey is left behind. Many of the bony or hard parts can be traced back to a specific species of fish, squid, or octopus. The parts that survive traveling through the digestive tract of a fur seal are:

- otoliths (fish earbones)
- vertebrae (fish bones)
- eye lens
- squid or octopus beaks (mouth parts)

By using extensive reference collections located at the Alaska Fisheries Science Center, scientists are able to identify species of fish, squid, or octopus that the bones, otoliths, lenses, or beak come from. We call the scientists Scat Detectives.

MATERIALS

- Images of prey items—Appendix II
- Plastic or cloth bags, envelopes
- Otolith, bone, and fish reference keys

PROCEDURE

Preparing the scats

This should be completed at least one day before you teach the lesson.

1. Print several single sided copies of the otoliths/beaks and bones. Sixty percent of your images should be pollock bones or otoliths. If you have access to a laminating machine, laminate the images of otoliths/beaks and bones before proceeding.
2. Cut out the individual images and mix them up.

3. Obtain enough bags or envelopes for each student or pair of students to have one bag. Number each bag. If you are feeling really ambitious, label each prey item that goes into the bag with the same number. This allows you to have the same data from year to year.
4. Fill the bags with the different prey items. Remember that pollock is the most frequently consumed prey item. Almost all of the scats should have pollock otoliths or bones in them.
5. Distribute the bags around the classroom to simulate a rookery.
6. Have the students find a scat and open it up.

Analyze the data using a frequency histogram

1. Using the reference keys, ask the students to identify the bones, otoliths, and beaks in their bags.
2. Complete Worksheet 4.3.1
3. Have each student graph the result for his or her bag. The x-axis should be the species and the y-axis is the frequency or total number of items for that species.
4. Now consolidate the data for the class and make another graph.

DISCUSSION

Did all of the scats have the same species? How were the individual scats different from the class total? Why do you think the seals would eat different prey?

EXTEND AND EXPLORE

Research the species on the reference keys and answer some of the following questions. A good place to start is FishBase, www.fishbase.org.

1. Where is the species found?
2. How big does it get? How many would a fur seal have to eat to fill up?
3. Is the species commercially harvested in Alaska or off the West Coast? If yes, what time of the year is it harvested? What size fish are the fishermen targeting?

NOTE: It takes time to cut out all of the images and put them in bags. Start the preparation for this activity one or two days before you plan on teaching it. Save it for future years

Student Name: _____

Scat Bag #: _____

Place a tally mark for each item that is present in your bag.

Species Name	bones	otoliths or beaks	Total
walleye pollock			
Pacific cod			
Atka mackerel			
Pacific herring			
Pacific sand lance			
Northern smoothtongue			
coho salmon			
squid			

Class Total

Total # of scat bags: _____

Species Name	# bones	# otoliths or beaks	Total
walleye pollock			
Pacific cod			
Atka mackerel			
Pacific herring			
Pacific sand lance			
Northern smoothtongue			
coho salmon			
squid			

ACTIVITY 4.3 **TEACHER KEY 4.3.1** Scat Detective—Frequency Data*Student Name: Sample DataScat Bag #: 32

Place a tally mark for each item that is present in your bag.

Species Name	bones	otoliths or beaks	Total
walleye pollock			
Pacific cod			
Atka mackerel			
Pacific herring			
Pacific sand lance			
Northern smoothtongue			
coho salmon			
squid			

Class Total

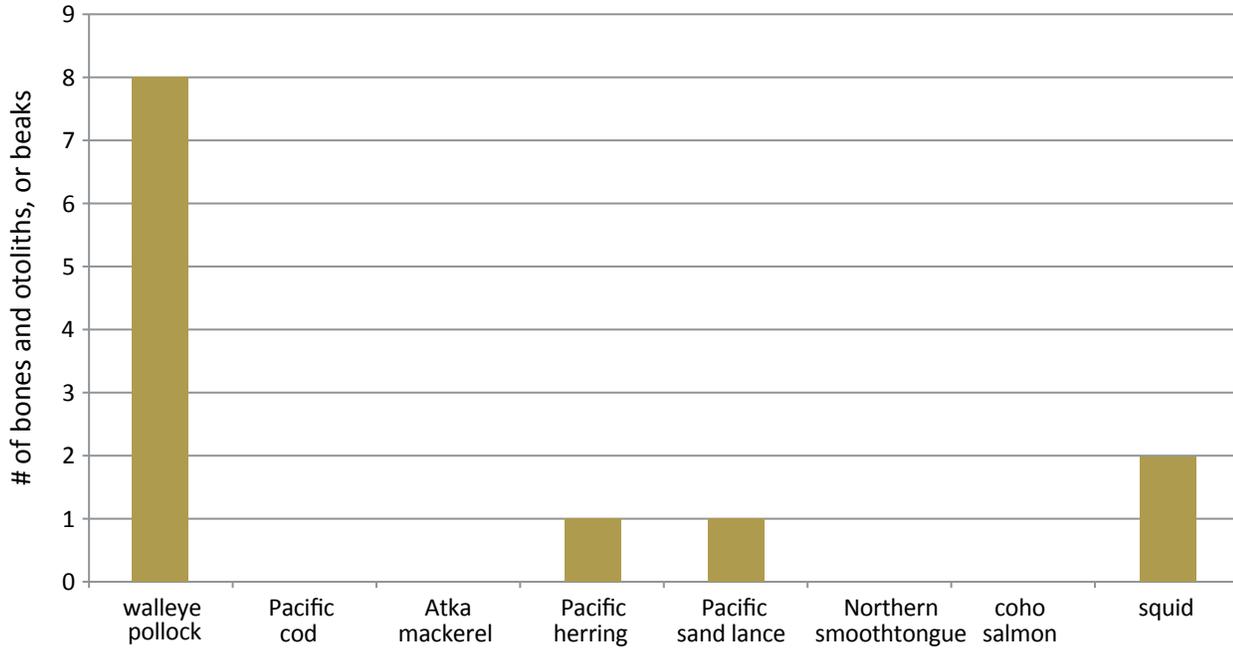
Total # of scat bags: 10

Species Name	# bones	# otoliths or beaks	Total
walleye pollock	42	28	70
Pacific cod	5	2	7
Atka mackerel	3	4	7
Pacific herring	6	2	8
Pacific sand lance	5	3	8
Northern smoothtongue	3	3	6
coho salmon	2	1	3
squid		15	15

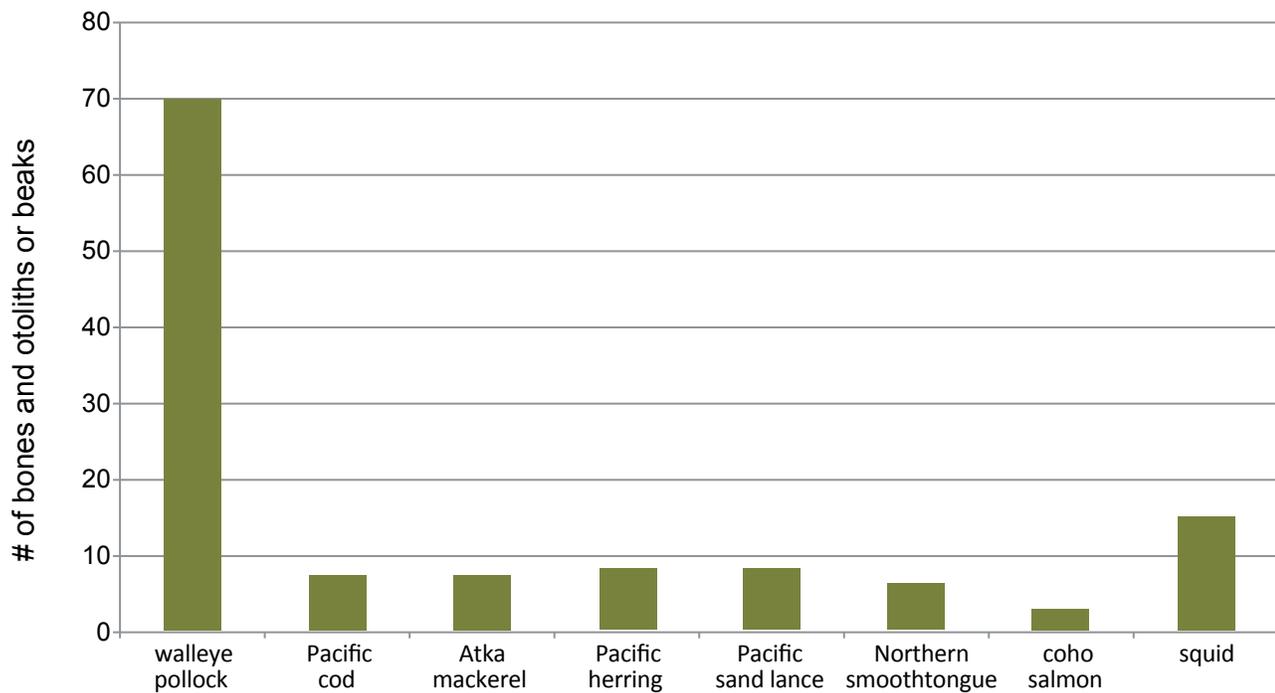
* Sample, answers will vary

Sample Data

Scat #32



Class Total



* Sample, answers will vary



squid



walleye pollock (*Theragra chalcogramma*)



Pacific cod (*Gadus macrocephalus*)



northern smoothtongue (*Leuroglossus schmidti*)



Pacific herring (*Clupea pallasii*)



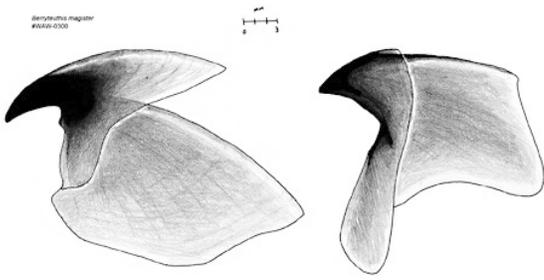
coho salmon (*Oncorhynchus kisutch*)



Pacific sand lance (*Ammodytes hexapterus*)



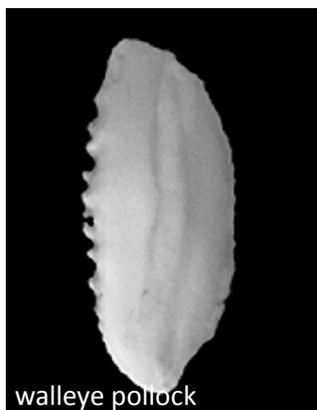
Atka mackerel (*Pleurogramma monopterygius*)



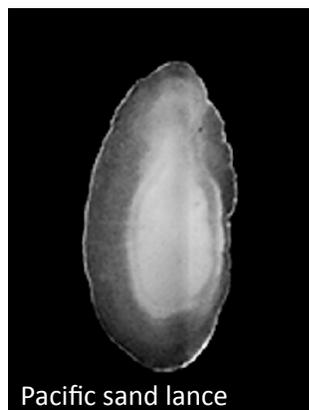
squid beak



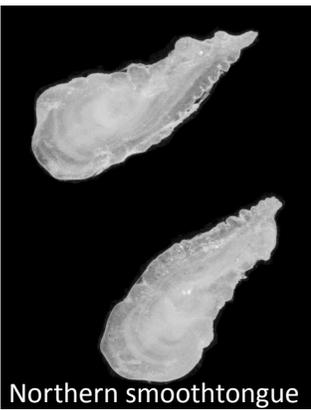
Pacific cod
Gadus macrocephalus



walleye pollock
Theragra chalcogramma



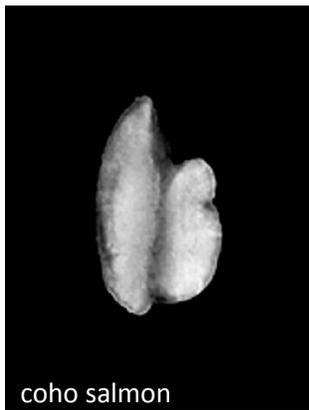
Pacific sand lance
Ammodytes hexapterus



Northern smoothtongue
Leuroglossus schmidti



Pacific herring
Clupea pallasii



coho salmon
Oncorhynchus kisutch



Atka mackerel
Pleurogramma monopterygius

ACTIVITY 4.3

REFERENCE KEY

Scat Detective



Pacific cod
Gadus macrocephalus



Pacific cod
Gadus macrocephalus



walleye pollock
Theragra chalcogramma



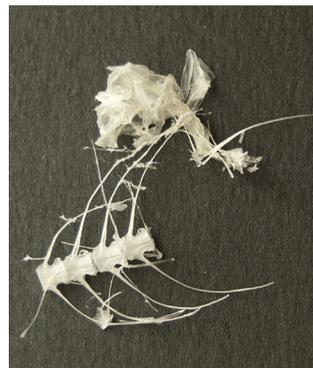
walleye pollock
Theragra chalcogramma



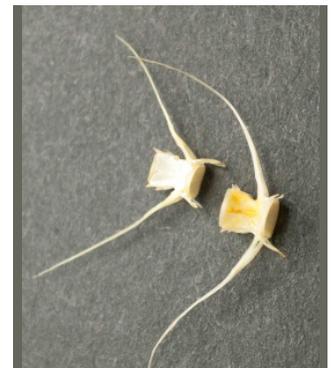
walleye pollock
Theragra chalcogramma



Northern Smoothtongue
Leuroglossus schmidti



Northern Smoothtongue
Leuroglossus schmidti



Pacific herring
Clupea pallasii



Pacific herring
Clupea pallasii



Pacific herring
Clupea pallasii



Pacific sand lance
Ammodytes hexapterus



Pacific sand lance
Ammodytes hexapterus



coho salmon
Oncorhynchus kisutch



coho salmon
Oncorhynchus kisutch

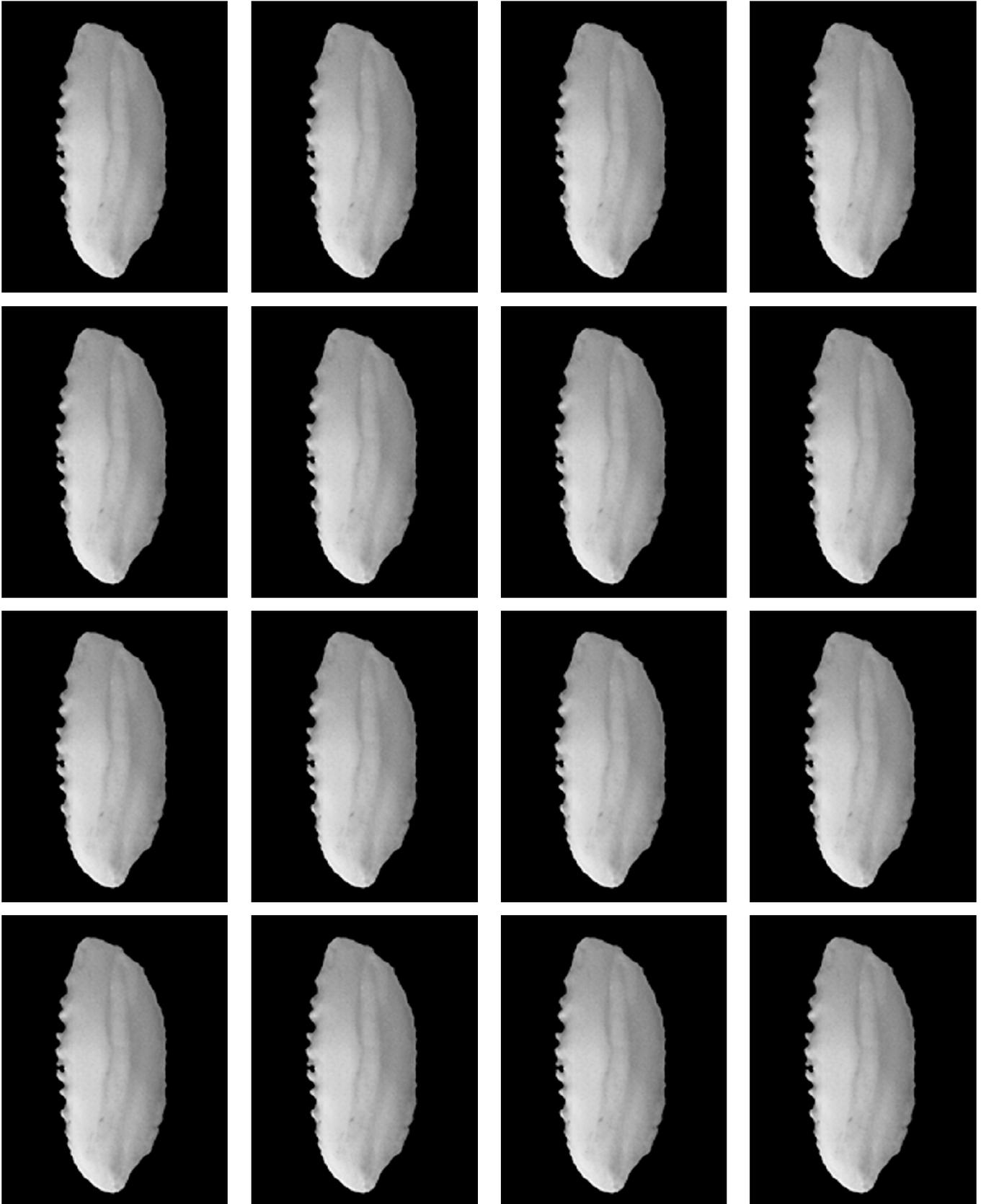


Atka mackerel
Pleurogramma monoptyerygius



Atka mackerel
Pleurogramma monoptyerygius

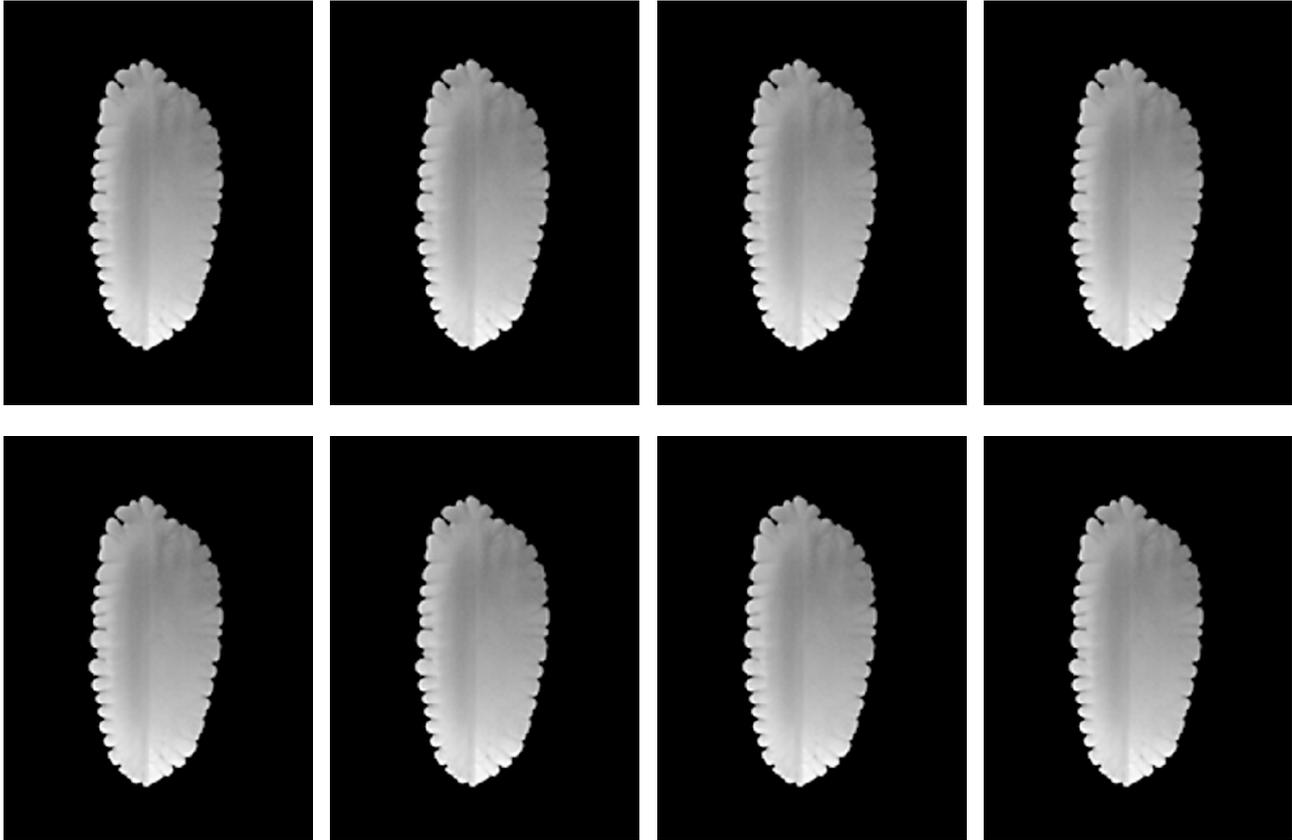
walleye pollock, *Theragra chalcogramma*



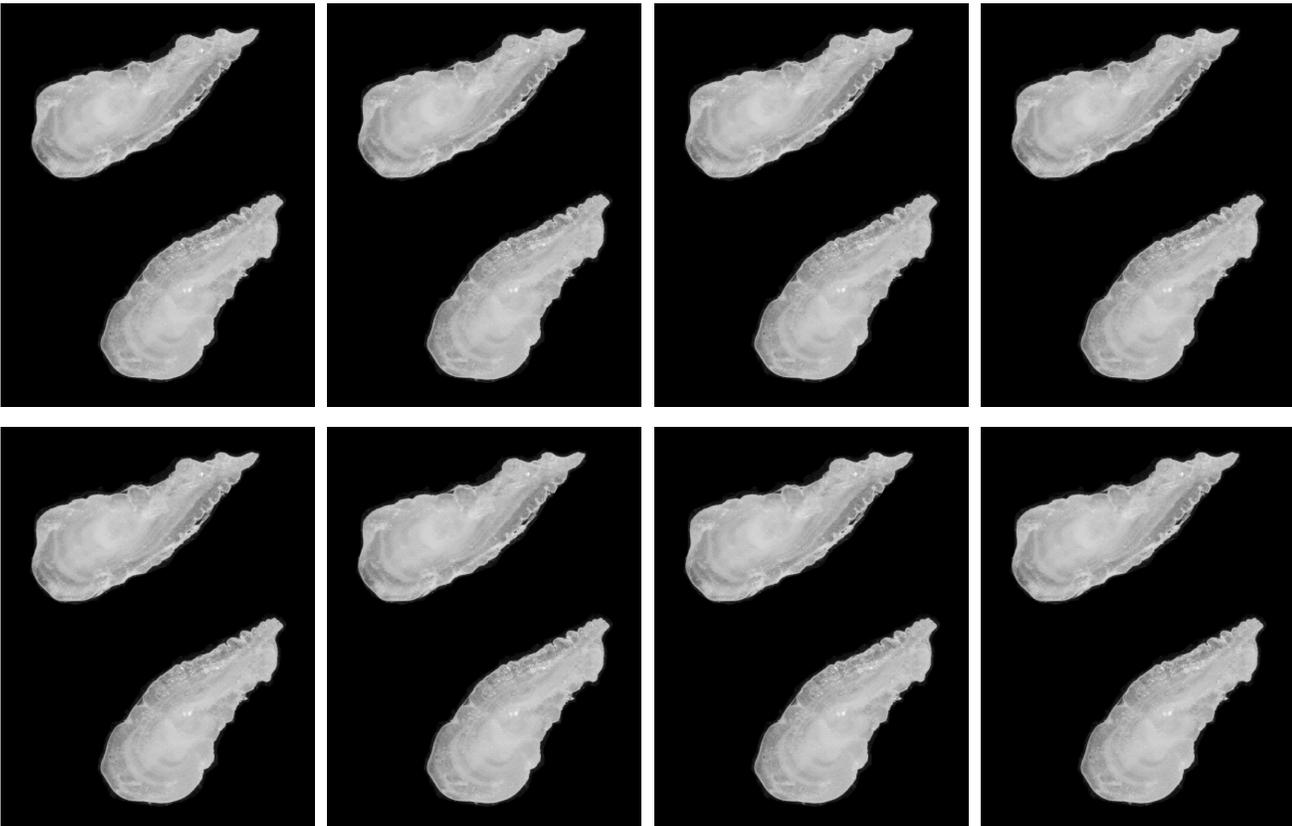
APPENDIX II

SCAT DETECTIVE IMAGES

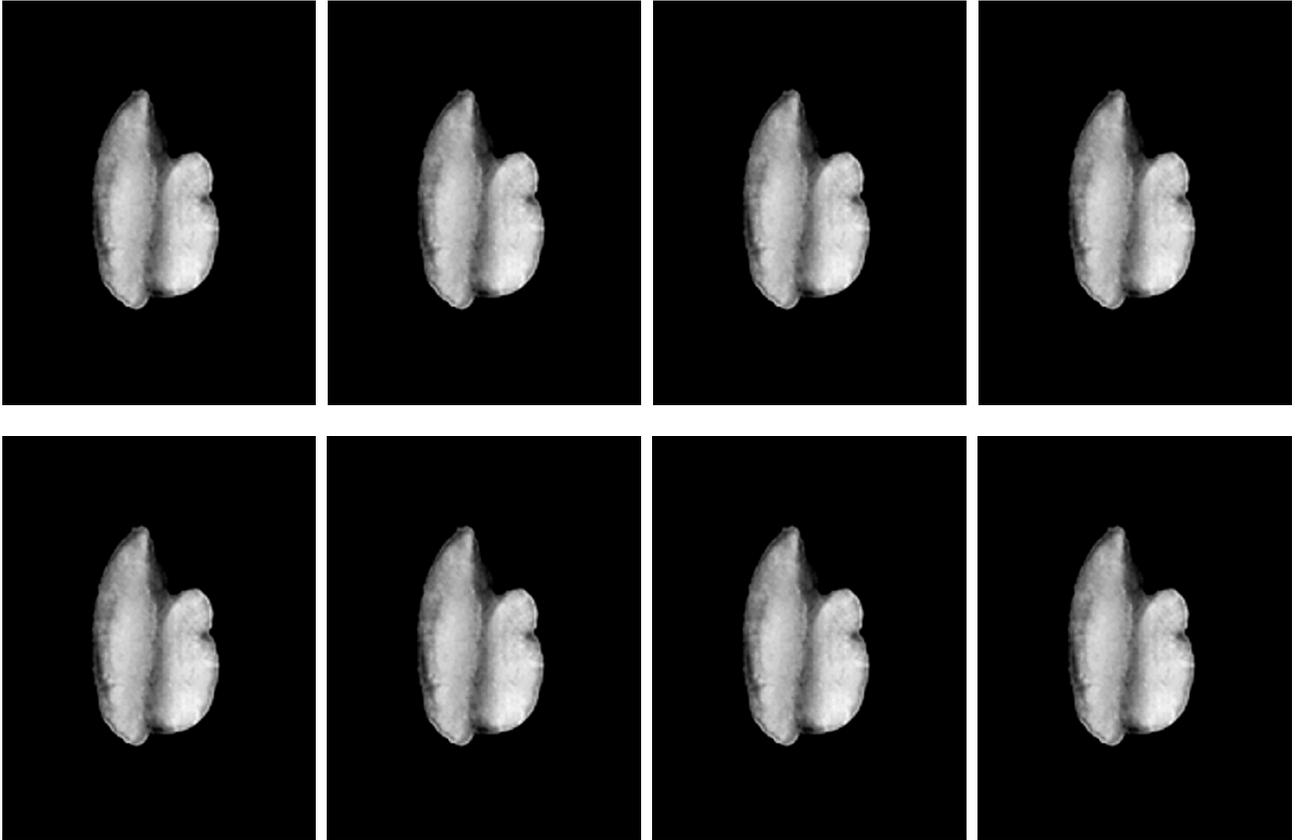
Pacific cod, *Gadus macrocephalus*



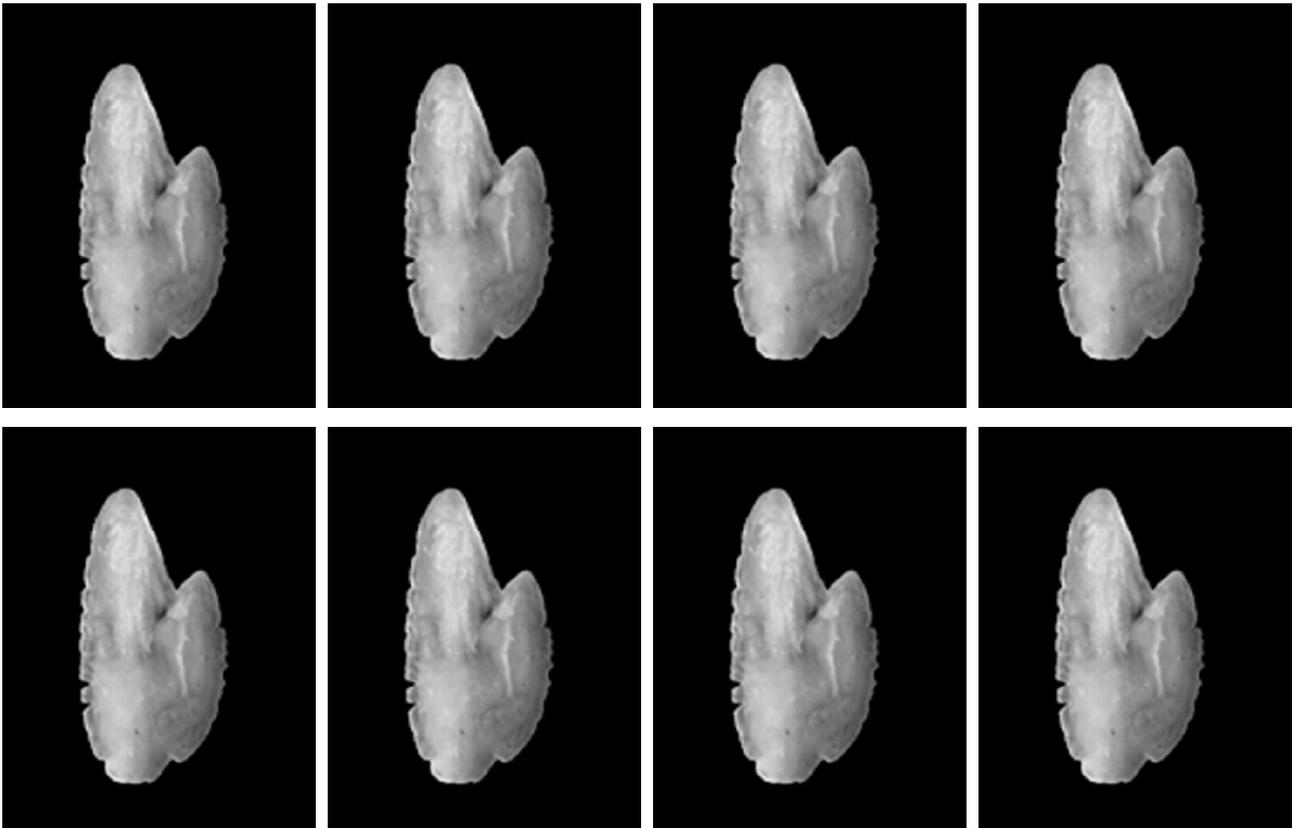
Northern smoothtongue, *Leuroglossus schmidti*



coho salmon, *Oncorhynchus kisutch*



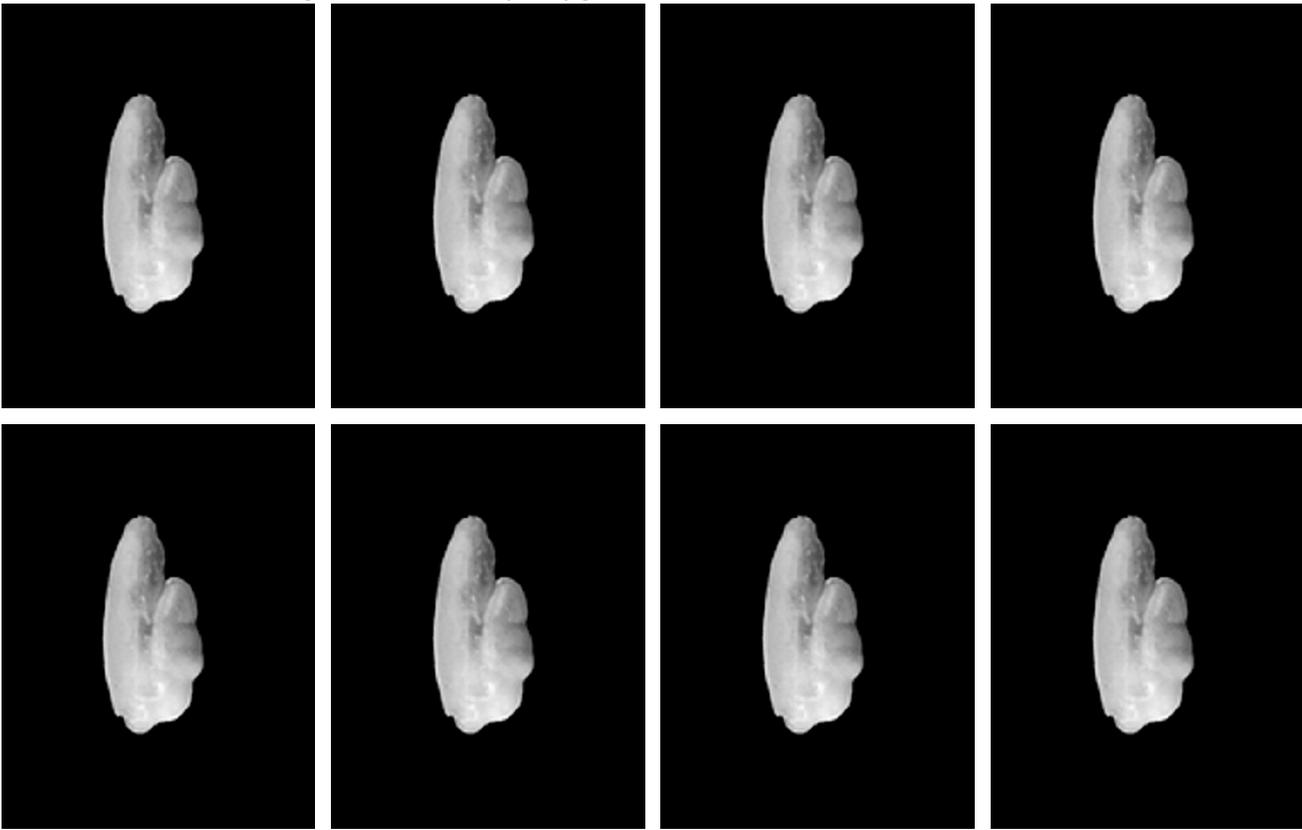
Pacific herring, *Clupea pallasii*



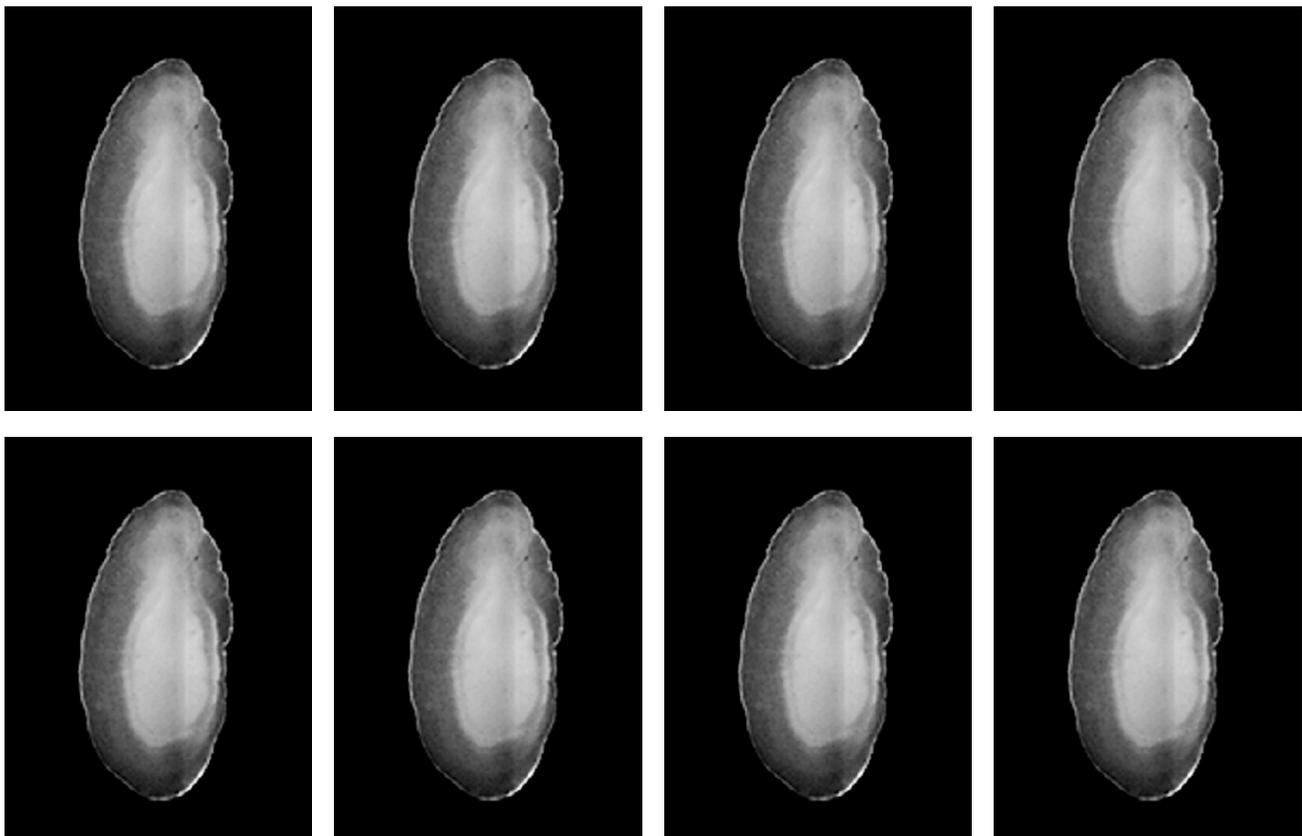
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SCAT DETECTIVE IMAGES

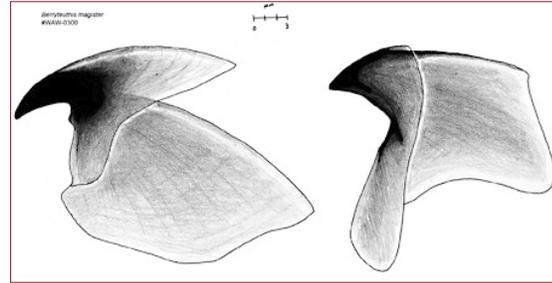
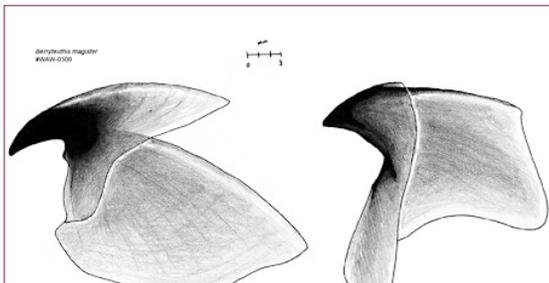
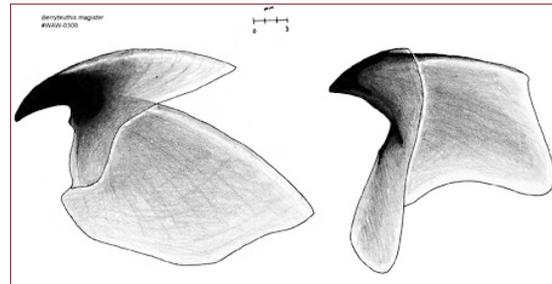
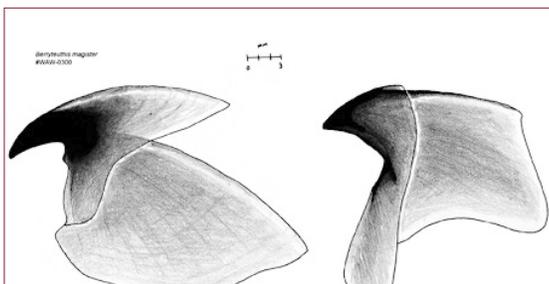
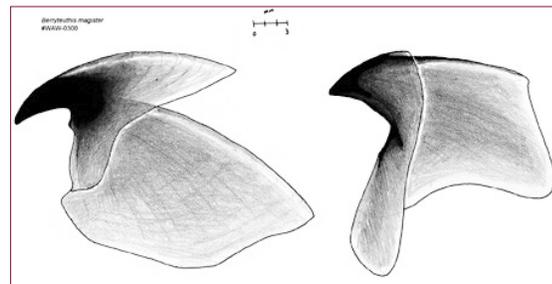
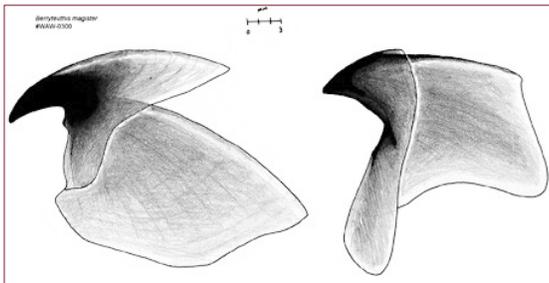
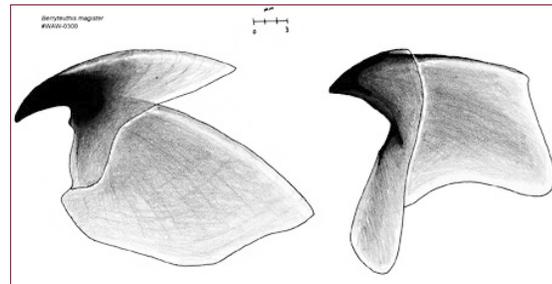
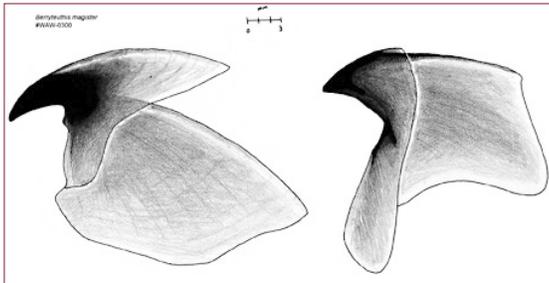
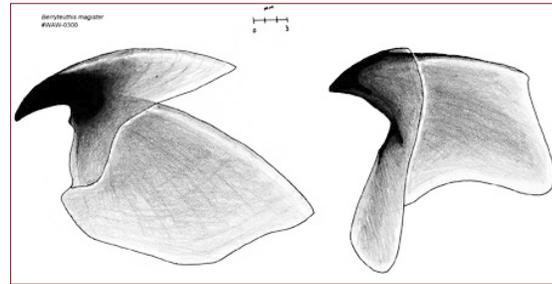
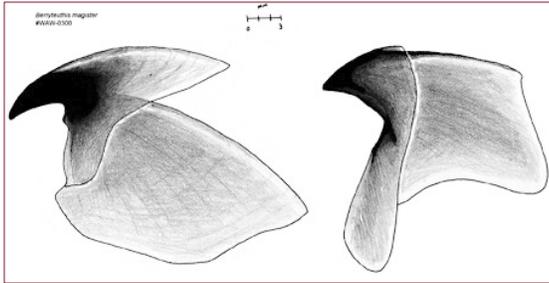
Atka mackerel, *Pleurogramma monopterygius*



Pacific sand lance, *Ammodytes hexapterus*



squid, *Berryteuthis magister*



APPENDIX II

SCAT DETECTIVE IMAGES

walleye pollock *Theragra chalcogramma*



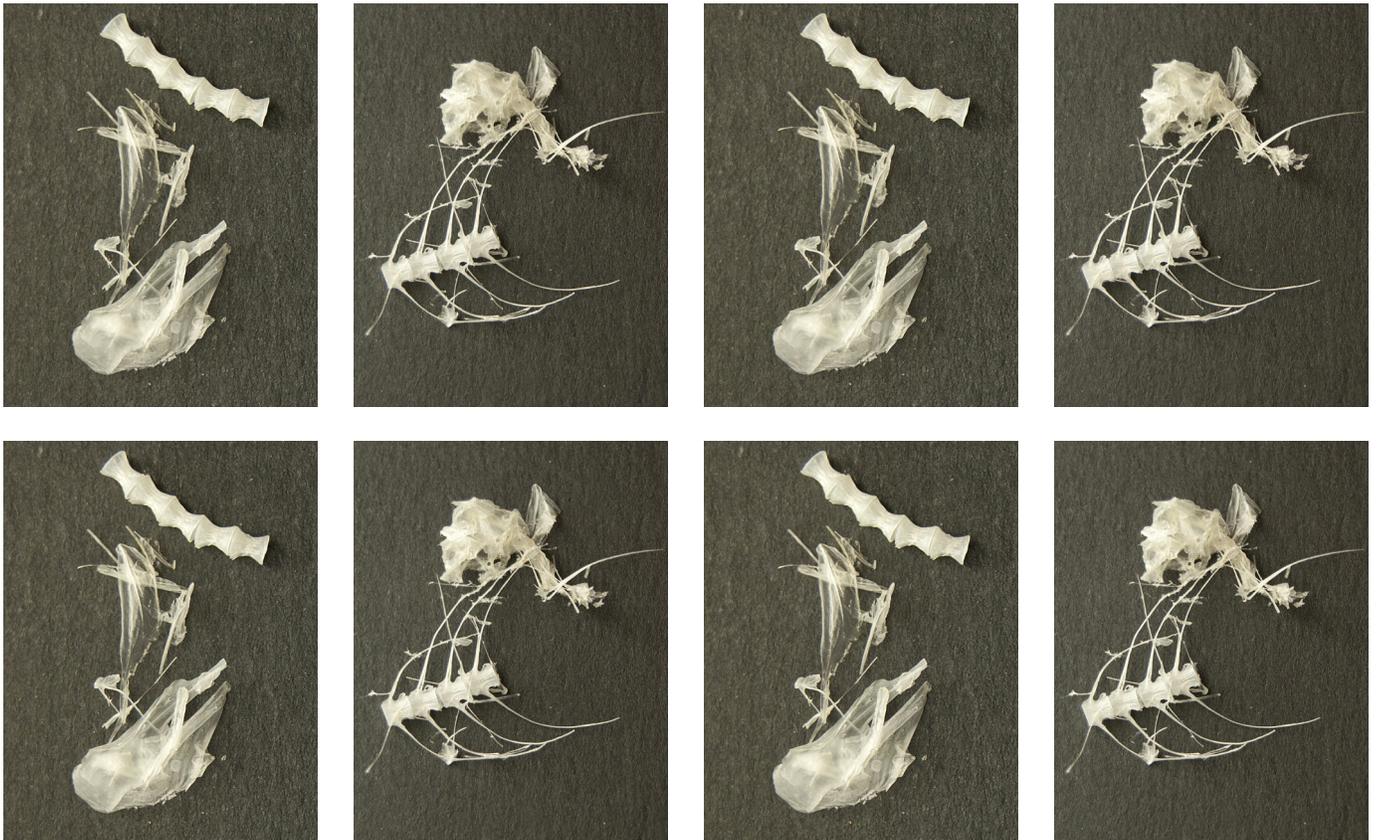
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Pacific cod, *Gadus macrocephalus*



Northern Smoothtongue, *Leuroglossus schmidtii*



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SCAT DETECTIVE IMAGES

Pacific herring, *Clupea pallasii*



Pacific sand lance, *Ammodytes hexapterus*



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SCAT DETECTIVE IMAGES

coho salmon *Oncorhynchus kisutch*



Atka mackerel, *Pleurogramma monopterygius*



Lesson 4 Activity 4.3: Scat detective

Bag-stomach game

Fish Image Sources

squid beak (*Berryteuthis magister*)

NOAA/NMFS/AFSC/NMML

<http://www.afsc.noaa.gov/Quarterly/amj2011/divrptsNMML1.htm>

squid (*Berryteuthis magister*)

NOAA/Alaska Fisheries Science Center/Multimedia Gallery

<http://access.afsc.noaa.gov/MultimediaGallery/details.php>

walleye pollock (*Theragra chalcogramma*)

NOAA/Alaska Fisheries Science Center/Age and Growth

http://www.afsc.noaa.gov/refm/age/age_pollock.htm

Pacific cod (*Gadus macrocephalus*)

NOAA/Alaska Fisheries Science Center image database

http://www.afsc.noaa.gov/race/media/photo_gallery/fish_files/Pacific_cod.htm

Pacific sand fish (*Trichodon trichodon*)

NOAA/Alaska Fisheries Science Center image database

http://www.afsc.noaa.gov/race/media/photo_gallery/fish_files/Pacific_sandfish.htm

Pacific herring (*Clupea pallasii*)

USGS/Alaska Science Center

Field Guide to Identifying Kittlitz's Murrelet Forage Fish

Mayumi Arimitsu and John Piatt

USGS-ASC, 3100 National Park Rd, Juneau, Alaska 99801

marimitsu@usgs.gov

Pacific sand lance (*Ammodytes hexapterus*)

NOAA/Alaska Fisheries Science Center/Auke Bay Lab

http://alaska.usgs.gov/science/biology/seabirds_foragefish/foragefish/Aleutian/images.php

coho salmon (*Oncorhynchus kisutch*)

NOAA/Northeast Fisheries Science Center

<http://www.nefsc.noaa.gov/faq/fishfaq2c.html>

Atka mackerel (*Pleurogramma monopterygius*)

NOAA/Alaska Fisheries Science Center image database

http://www.afsc.noaa.gov/RACE/media/photo_gallery/fish_files/Atka_mackerel.htm

Otolith Image Source

Harvey, James T., Thomas R. Loughlin, Michael A. Perez, and Dion S. Oxman. 2000. Relationship between fish size and otolith length for 63 species of fishes from the eastern north Pacific Ocean. NOAA Tech Report 150.

Bone Image Source

Pam Goddard, Thalassa Education