ZOOARCHAEOLOGY

Teacher's Manual

Table of contents

Subjects:

Biology (Anatomy), Social Studies

Duration:

2-4 class periods, depending on which extension activities are used

Class size:

10 - 30

Summary

Overview:

This unit provides an introduction into the science of zooarchaeology. This includes information on skeletal anatomy of birds, fish, and mammals, as well as specific information on how zooarchaeologists identify different species of animals based only on skeletal remains. Finally, methods of quantifying identified bones will be covered.

Objectives:

- Students will be able to explain how skeletal anatomy reflects the organization of the Linnaean Hierarchy and how that knowledge can help identify species or class of animal fro bones.
- Students will learn the patterns of bone growth in mammals and will practice using this knowledge to identify age and sex of animals based on their bones.
- Students will learn some of the techniques used by zooarchaeologists when analyzing archaeological bone samples.
- Students will practice using zooarchaeological data to create hypotheses about past interaction of animals, humans, and their environments.

Material:

Introductory Slide Show
• Teacher's Edition
• Student worksheets
• Bones (82 specimens, labeled KBP Burke 092 through KBP Burke 209, in 5 sets):
  • Reference materials
  • Class ID
  • Age and Growth
  • Quantification
  • Species ID

Vocabulary

Adaptation:
An evolutionary change in a species in response to changing environmental conditions or moving into/utilizing a new habitat.

Articulate:
To intersect with another bone, either in a relatively mobile joint like a hip or shoulder, or a relatively immobile joint like ribs articulating with vertebrae.

Cancellous bone:
The inner portion of bone that is filled with a fine network, or lattice, of bony struts.

Cortical bone:
The dense outer layer of a bone.

Diaphysis:
The main shaft portion of a bone.

Distal:
The end of a longbone that is oriented away from the core of the body.

Epiphysis:
The end portion of bones; in juvenile animals the epiphysis and diaphysis are separate bones that gradually fuse together as the individual matures.

Epiphyseal plate:
A thin layer of cartilage between the epiphysis and the diaphysis; this is where most bone growth occurs.

Femur:
The thigh bone, or upper leg bone.

Humerus:
The upper arm bone.

Island biogeography:
The scientific study of the distributions of animal species living on islands.

Linnaean Hierarchy:
The system used to organize all living things in a way that reflects their evolutionary histories.

Medullary bone:
The hollow inner portion of a longbone shaft; medullary bone is variously filled with marrow, oil, or air.

Ossification:
The process of converting cartilage into bone.

Paleontology:
The scientific study of animal remains that reflect natural (i.e., non-human) patterns of animal activities or behavior.

Phytogeography:
The scientific study of the distributions of different plant species.

Proximal:

The end of a longbone that is oriented towards the core of the body.

Quadrupedal:

Uses all four limbs for walking.

Zooarchaeology:

The scientific study of animal remains that reflect patterns of human activities or behavior.

Introduction

This module introduces students to the discipline of **zooarchaeology** (pronounced either "zoh-ark-e-ol'-o-gee" or "zew-ark-e-ol'-o-gee") and highlights how zooarchaeology has been used in the Kurils Biocomplexity Project. Students will

- Examine and identify bones
- Learn how to determine age and sex of the bones, and
- Analyze zooarchaeological data from their lab work and (optional) data from the KBP Expeditions.

Zooarchaeology is an interdisciplinary field that combines zoology (the study of animals) and archaeology (the study of past human activities). Like its sister discipline, **paleontology**, zooarchaeology is focused on the study of bones, teeth, and shells. The difference between the two disciplines is that zooarchaeological samples are found in association with human activities and reflect human behavior (the "archaeology" part). Paleontological samples come from deposits that reflect natural geological processes but do not have any evidence of human activity.

How does zooarchaeology work?

The first step in any zooarchaeological analysis is to identify what animal the bone or shell sample has come from. Zooarchaeologists rely on the fact that animals that are closely related to each other tend to have similar-looking skeletons. Animals that are not closely related tend to have different-looking skeletons. The degree of difference or similarity usually scales with how closely related two species are.

Once a bone has been identified, there is a wide range of data that are typically documented for any given bone, including age-at-death, degree of fragmentation, presence of any cultural modifications such as cut-marks or burning, and so on.

One incredibly important aspect about zooarchaeological data is that the kinds of data recorded depend entirely upon what the research question is. If a zooarchaeologist is working in a region where little or nothing is known about how prehistoric peoples made a living, simply documenting what species of animals were used for food would be a significant contribution to our understanding of that culture.

In contrast, in an area where the basic diet is well-known, as in many areas of the Pacific Northwest, more elaborate research questions can be addressed, such as "How did the occurrence of tsunamis affect the availability of shellfish?" or "How did deer populations respond to human hunting pressure?" The kinds of data needed to answer these types of questions can vary quite a bit. But it all starts with being able to identify what species any given bone (or shell) comes from.

Procedure

Lesson 1:

Warm up:

Brainstorm with the class on the question of how prehistoric people used animals and what evidence of that use would be left in archaeological sites. Introduce the concept of zooarchaeology - study of faunal remains from archaeological sites.

Procedure:

1. Use the slideshow to introduce the students to determining class, species, and age of the animals from bones. You can use the bones from the set "Class ID" as a visual prop; have students look at the bones and pass them around. The slideshow also touches briefly on how archaeologists quantify bones.

2. Divide the class into three groups and hand out the three exercises, one to each group:

A. **Species Identification** (Students learn in more detail how zooarchaeologists identify what species any particular bone has come from. Examples of mammals and birds will both be used).

B. **Age and Growth** (Students will find out how much information about age-at-death zooarchaeologists can exract from any given bone. Using the same tools that forensic scientists use, students will learn how patterns of growth can be used to determine age-at-death from their bone samples).

C. **Quantification** (Students will learn how zooarchaeologists keep track of their identifications, and how they present their data in a way that other zooarchaeologists can know what they are talking about. This section presents a few of the wide variety of quantification methods that zooarchaeologists routinely use).

After some time, have students rotate to the next "station." Repeat so that all students get a chance to work with all three sets of bones.

Wrap up:

Discuss why it may be important to determine what animals people were eating or using for their tools (prehistoric diet change could indicate that some animal was being over-hunted or that taste preferences were changing, for example).

Lesson 2:

Warm up:

Review material from the previous day (how do archaeologists study animal bones from sites?).

Procedure:

Students do an activity (part 1), which asks them to examine and analyze a table of raw data generated from a hypothetical analysis of zooarchaeological samples from three sites within the Kuril Islands. This activity can be run either in small groups or individually (either in class or as homework). Optional additions are parts 2 and 3 (accessing real zooarchaeological data from anywhere in the continental United States, as well as from the Kuril Biocomplexity Project). These can be assigned as homework.

Wrap up:

Discuss the answers with the entire class.

Step 1:

Lets start with some terminology for different parts, or landmarks, of the bones. These are the anatomical parts that help zooarchaeologists be consistent in the ways they describe bones from various species, as well as specific identification characteristics, or features, that can be used to distinguish different species from each other. (See figure) .

Assignment for students for the empty space in their packet:

Start with reference bones. Use either the set of mammal bones or the set of bird bones. Choose one bone and sketch (or trace) the outline of the bone. Now label at least four of these characters on the drawing.

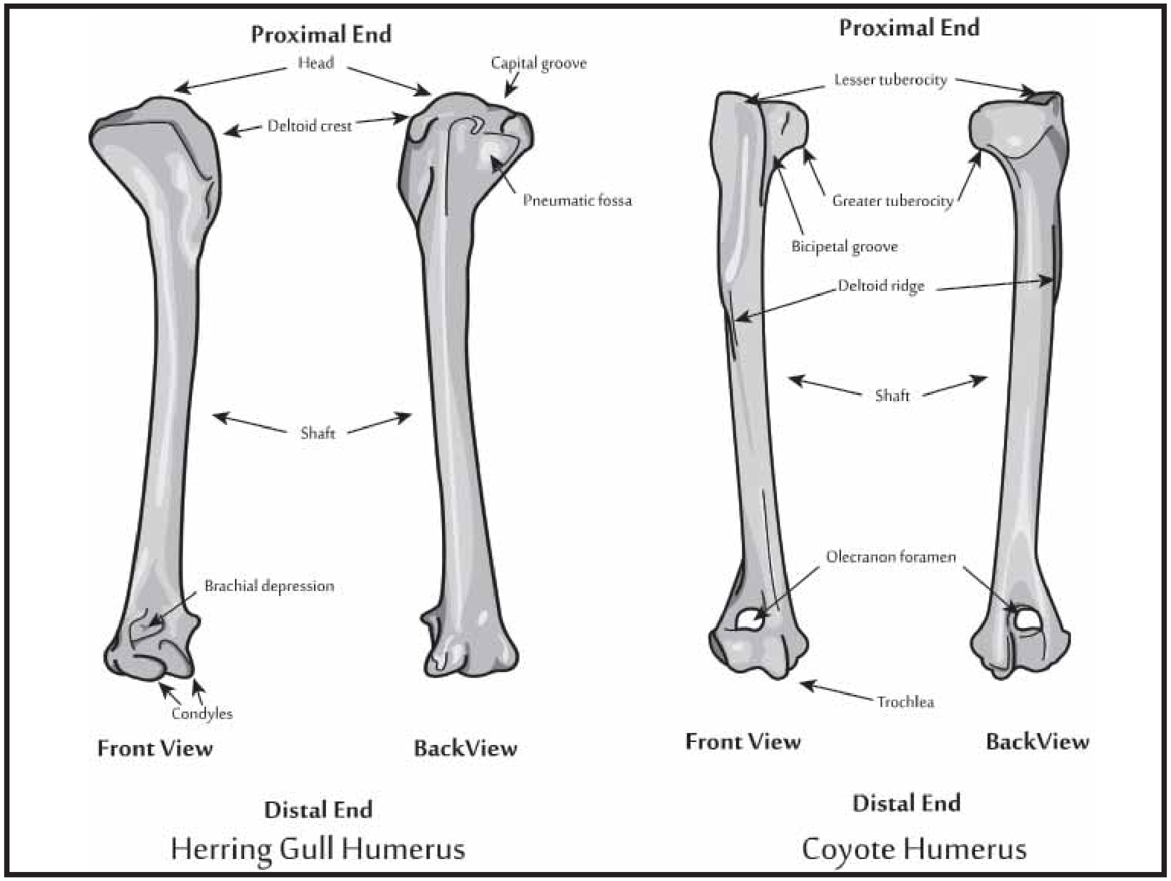


Illustration of the humerus from one bird and one mammal species showing key landmarks, or features, used to describe the anatomy of the bone.

Step 2:

Using the landmarks identified in the drawings, describe how each of the four reference bones in the set you have selected (either mammals or birds) is different from each other. Some important aspects of the landmarks may be their size or shape.

Answer: Answers will vary. Some characters the students might notice include:

1. harbor seal: the presence of a foramen, or hole, that passes through the bone on the distal end
2. fur seal: lacks the foramen seen in harbor seal
3. gull: proximal end has thin, angular projections; distal end has a spur of bone projecting out

Step 3:

Now, identify the fragmentary bones in the "Unknowns" bag from the appropriate set of bones (birds vs. mammals). Remember that size and shape are the two characters that are most helpful in identifying a species. All of the species illustrated here (4 bird species, 4 mammal species) are represented. But there are also bones from at least one species not represented here.

Record the appropriate species for each specimen in the table (see next page). Each species will be represented by one or more fragments of bone. If you think a bone specimen is not a good match to any of the species in your list, mark it as "unknown."

Examine the "unknown" bone/s closely. Which of the four reference species does it (or do they) most resemble? (Hint: Remember that closely-related species typically have bones that look similar to one another.) (Answer: Coyote bone resembles the fox, but is larger).

Step 4 (Additional Explorations):

All of the bone sketches in this module were developed from three-dimensional digital images created by the Virtual Zooarchaeology of the Arctic Project (VZAP). These images are stored as portable document files, otherwise known as PDFs, and can be viewed on most computers. Each of the illustration files is included on the DVD in the Burke Box. Once the files are opened and activated, you can view the illustrated bone from any angle by simply dragging the mouse/cursor.

To view the three-dimensional illustrations, double-click on the PDF file you are interested in.

Single-click on the image to "activate" the 3D capabilities.

Click and hold the mouse, and then rotate the bone by "dragging" it in any direction.

Student Worksheet guide
Identifying Species
Step 3 table

Specimen number	Species	Answer		Specimen number	Species	Answer
KBP Burke 0134		Cormorant		KBP Burke 0154		Fur seal (adult female)
KBP Burke 0135		Gull		KBP Burke 0155		**Coyote**
KBP Burke 0136		Murre		KBP Burke 0156		Fur seal
KBP Burke 0137		Cormorant		KBP Burke 0157		Fox
KBP Burke 0138		Cormorant		KBP Burke 0158		Harbor seal
KBP Burke 0139		Gull		KBP Burke 0159		Fur seal (pup)
KBP Burke 0140		Goose		KBP Burke 0160		Deer
KBP Burke 0141		Teal		KBP Burke 0161		Harbor seal
KBP Burke 0142		Mallard		KBP Burke 0162		Harbor seal
KBP Burke 0143		Gull		KBP Burke 0163		Fox
KBP Burke 0144		Murre		KBP Burke 0164		Fur seal (adult female)
KBP Burke 0145		Cormorant		KBP Burke 0165		Harbor seal (pup)
KBP Burke 0146		Goose		KBP Burke 0166		Deer
KBP Burke 0147		Gull		KBP Burke 0167		Harbor seal
KBP Burke 0148		Murre		KBP Burke 0168		Fox
KBP Burke 0149		Mallard		KBP Burke 0169		Fur seal (adult male)
KBP Burke 0150		Murre		KBP Burke 0170		Harbor seal
KBP Burke 0151		Gull		KBP Burke 0171		Harbor seal
KBP Burke 0152		Cormorant		KBP Burke 0172		Fox
KBP Burke 0153		Mallard		KBP Burke 0173		Fur seal

Possible species: Cormorant, Gull, Mallard, Murre, Deer, Fox, Fur seal, Harbor seal, Unknown.
The unknown "challenging" bone should be the coyote (in bold).

Step 1:

Using reference bones included in this section and the illustrations as a guide, separate the diaphysis (long bone shafts) into two piles, one for humeri and one for femora.

Step 2:

Using the illustrations AND the sorted bones, determine which of the loose end caps (unfused epiphyses) belong with the humeri and which belong with the femora.

Step 3:

Using the broad categories in the table below, how many bones of each age are in your sample of humeri? How many bones of each age are in your sample of femora? You do not need to count the reference bones in your totals. You can ignore the fact that the bones may be from different species. However, if an unfused epiphysis definitely fits onto a diaphysis, count the matched pair as ONE bone.

	Humerus	Femur
Juvenile (no fused epiphyses)	4	6
sub-adult (only one epiphysis fused)	1	0
adult (all epiphyses fully fused)	1	1

Step 4:

Using the information about the age when different epiphyses fuse in different species of animals, determine as precisely as possible the age-at-death for the samples listed below. (D = distal; P = proximal):

species	bone	state of fusion	Age Estimate
dog	humerus	D unfused; P unfused	answer: < 5 months
red fox	femur	D unfused; P fused	answer: < 26 weeks, >28 weeks
deer	femur	D fused; P fused	answer: > 26 months
harbor seal	femur	D unfused; P unfused	answer: < 3 years
male fur seal	humerus	D fused: P unfused	answer: 7-9 years
female fur seal	humerus	D fused; P unfused	answer: 5 years
fur seal, sex unknown	humerus	D unfused; P unfused	answer: < 4 years

(these specimens are not included in the box)

Advanced:

Coyotes are intermediate in size between dogs and red foxes. Assuming that their growth patterns are also intermediate between dogs and red foxes, fill in the following table with your predictions of the age of fusion for the humerus and femur.

species	Proximal Humerus	Distal Humerus	Proximal Femur	Distal Femur
dog	10 months	5-8 months	6-9 months	6-8 months
coyote	ans: 6-8 months	ans: 6 months	ans: 7-8 months	ans: 7-8 months
red fox	17 weeks	16 weeks	26 weeks	28 weeks

Question 1:

Keeping in mind that this exercise includes only two skeletal elements (humerus and femur), outline the steps you would take to determine what the MNI (minimum number of individuals) is for the sample. Then follow these steps to answer the questions that follow.

Answer:

[Younger students may need some guidance with this]. Separate the bones into two separate piles, one for femora and one for humeri. Then separate those piles into "rights" and "lefts." Determine which pile has the largest number of bones. (It is not terribly important that the students be able to tell which side these bones come from, just that one side is the mirror image of the other). MNI is the number of bones in the larger pile.

Question 2:

What is the MNI for this sample, and what was it based on?

Answer:

There are four left humeri, so many students will answer that the MNI of humeri is 4. However, some students may notice that one of the right humeri is much larger than any of the other left humeri. They would be correct if they argued that the right humerus is likely to have come from a different individual than any of the other left humeri, with an MNI of 5.

Both answers could be considered to be correct! One of the limitations to the use of MNI is that different researchers use different criteria to quantify the minimum number of individuals likely to be represented in a collection.

Question 3:

Suppose that all of the skeletal elements in your sample came from different individuals. What is the maximum number of individuals that could be represented in your sample?

Answer: MNI = 11.

Question 4:

What is the NISP (total number of specimens identified for each species) of the sample, and how does that relate to your answer to Question 3?

Answer:

If all of the skeletal elements in your sample came from different individuals, the NISP and the maximum number of individuals will be the same. In this case, NISP = 11.

Question 5:

What is the MNI for femora. Is it the same as for humeri? Why or why not? Which MNI would you use to represent the number of animals at the site?

Answer:

There are five femora, but the MNI is 3, as there are three left femora. It is different from the humerus MNI because the division between left and right elements is different. The larger MNI of 4 (or 5) that is obtained from humeri is the better representation of animals found at the site.

Lesson 2: Analyzing Data

This portion of the Zooarchaeology Module deals with analyzing zooarchaeological data. If you have not already explored the "QUANTIFICATION" portion of Lesson Activity 2, please take a few minutes to review the different ways zooarchaeologists tally their identification data.

The non-human bones that are recovered in archaeological sites[1] most typically derive from three main sources: accumulated trash or refuse from human foraging activities; tool-making and construction debris; and intrusive remains of burrowing species like mice. The job of the zooarchaeologist is to try to determine which of those three categories any particular bone fits into, identify what species the bone came from, and then tally the identification data to answer a variety of research questions.

[1]The Kuril Biocomplexity Project did not excavate any human burials, as they would not have provided data relevant to the research questions our team was interested in pursuing.

Those research questions range from purely descriptive (For instance, "What species were being use for food, and in what proportions?") to socioeconomic in nature ("Did Household A have access to higher-quality resources than Household B?"). Other research questions may be only indirectly related to human activity at the site, such as "What evidence of climate change do we see in the zooarchaeological samples?"

Analyzing Data, Part 1:

The following set of exercises is based on realistic data for three archaeological sites in the Kuril Islands.

Step 1 (optional). Using the spreadsheet of raw data, tally the total number of specimens identified for each species (NISP), from each stratum, for each of the three archaeological sites. Put your totals in the appropriate boxes on the table "Bone ID NISP blank table" (data for Simushir, Stratum 1, are already provided).

PAY CAREFUL ATTENTION TO INFORMATION PROVIDED IN THE "COMMENTS" COLUMN OF THE DATA TABLE.

Step 2. Using either your results from Step 1, or the provided data table ("Bone ID NISP data"), answer the following questions:

1. Are there significant changes through time in the number of albatross that were harvested at Rasshua? (Answer: Yes, there seems to be a significant drop in the number of albatross bones. The sample size in Stratum 1 is large enough so

that if there had been more albatross bones, they probably would have shown up in the sample.

2. Do you think the changes in albatross use at Simushir are significant? (Answer: While it is true that there are three times as many albatross bones in Stratum 1 as in Stratum 3, the overall sample size of albatross bones is quite small. With a sample size this small, it is difficult to tell if there is any patterning or not).

3. Is it safe to conclude that the people living on Ushishir did not own dogs? Why or why not? (Answer: No, this is not a safe conclusion—people could have easily had dogs as pets on Ushishir. Dog remains wouldn't necessarily show up in the midden samples. Also, one of the fur seal ribs (KBP 0345.08) is listed as having carnivore gnaw marks on it, which could have come from either a dog or a fox. While this still doesn't answer the question about whether or not the inhabitants of Ushishir had dogs, it is a piece of evidence to consider).

4. List at least two hypotheses that could explain the increase in sea otters at Rasshua. Be sure to examine the dates of occupation (see "Stratigraphic dates" table) (Answer: Answers will vary, but could include (a) the people living at Rasshua may have become involved in the commercial sea otter trade and/or (b) there may have been a shift in climate that made sea otters more locally abundant).

Step 3 (optional). Using the spreadsheet of raw data, tally the minimum number of individuals (MNI) represented by the sample of bones for each species FOR ONE STRATUM from only ONE SITE (data for Simushir, Stratum 1, are already provided). Use information about the skeletal element that is represented, any age or sex information that is recorded, as well as information in the "Comments" column of the spreadsheet. Enter your MNI data in the appropriate boxes in the table "Bone ID MNI blank table," including what you based your calculations on (for instance, in Stratum 1 at Simushir, the MNI of salmon is 1 based on the presence of either bone, while the MNI of albatross is based on the presence of a single humerus).

Step 4. Using either your results from Steps 1 & 3, or the provided data tables ("Bone ID NISP data" and "Bone ID MNI data"), answer the following questions:

1. When the data are quantified using MNI instead of NISP, do you come to a differenct conclusion about the trend in albatross use at Rasshua? Why or why not? (Answer: The differences are much less pronounced when the minimum number of individuals is considered. Although the overall samples sizes of Stratum 1 (NISP = 16) and Stratum 3 (NISP = 13) are similar, a reduction from 4 individuals to 1 individual could simply reflect (a) where on the site the bones were discarded and (b) where the excavation units were placed).

2. When the data are quantified using MNI instead of NISP, do you come to a differenct conclusion about the trend in albatross use at Simushir? Why or why not? (Answer: When the MNIs for albatross from Simushir are considered, there appear to be no differences at all between strata).

Step 5. Imagine that you have lost the stratigraphic information from the deepest part of your excavations at Rasshua (Stratum 3 and Stratum 5). You still have the data table of identifications, but now you must recalculate the NISPs and the MNIs with these two strata combined.

Fill out the table "Combined Strata Blank" and answer these questions:

1. How do the NISPs change relative to the original, un-combined strata? (Answer: The NISPs for the combined strata are simply the sum of the NISPs from the strata considered separately).

2. Do the MNIs change in the same way? Why or why not? (Answer: No. Because the MNIs are calculated based on the most commonly encountered skeletal element in that stratum, you cannot simply combine strata and add the MNIs together. The raw data must be examined to determine what the most commonly encountered skeletal element is for the combined strata to recalculate the new MNI).

Analyzing Data, Part 2:

Now you'll have the opportunity to explore real data from your own state! (requires internet access). You'll have an opportunity to explore the actual Kurils data in "Analyzing Data, Part 3".

Archaeological and paleontological data are typically available to the public, especially if the project is funded through a federal agency like the National Science Foundation. Although the standard approach scientists use to make their data available is to publish their results in scientific and popular journals, the internet is an increasingly popular outlet for making data broadly available.

One of the most comprehensive on-line databases is called the "Neotoma Paleoecological Database." The database is named after a curious rodent called a pack rat (scientific name *Neotoma*), which has a habit of collecting scraps of vegetation and storing them in large piles in caves. These piles accumulate and in the right conditions can preserve for tens of thousands of years. Paleoecologists study the vegetation in these pack rat "middens" to understand how climate has changed through time.

The Neotoma database is an on-line archive of a wide range of paleoecological data, including pollen studies, and mollusk studies, as well as paleontological and archaeological bone data.

To access this on-line database, open the URL for the "Neotoma Paleoecological Database" (using the web browser of your choice):

http://www.neotomadb.org

You should see a screen that looks something like this (it changes occasionally, so don't be alarmed if it doesn't look exactly like this):

Use your mouse to move the cursor over the word "DATA" at the top left of the screen. When the line of words appears that reads

"Overview Contribute Data Tilia FAQ Explore Data etc..."

move the cursor to the word "Explore Data" and click on that to open the link.

Finally, click on the map or the "Go to the Neotoma Explorer" link at the bottom of the page to launch the "EXPLORER" function of Neotoma.

[You can by-pass all of this by simply loading the following URL. However, this also by-passes interesting and potentially important back-ground information about the Neotoma database].

http://www.neotomadb.org/data/category/explorer

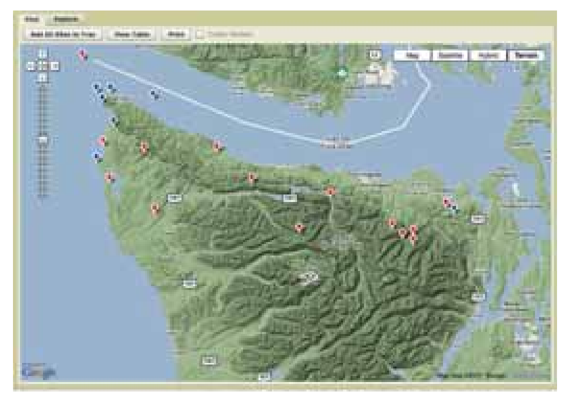
VERY IMPORTANT NOTE ABOUT NEOTOMA MAPPING FUNCTION: You must specify if you want Neotoma to search only within the area of the map visible on your screen, or if you want to search globally [see "Geographic Coordinates" at bottom left of screen]. Either approach works fine, just be aware that the area visible on your screen might determine how complete your search is.

The first search you will perform will be to find all the paleontological and archaeological data that have been recorded for Clallam County, which lies at the extreme northwest corner of Washington State.

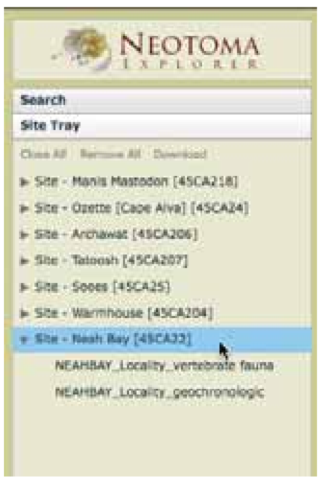
To do that, start typing "United States" in the "Place Name" section of the Search window on the left-hand side of the screen. A drop-down list will appear. You can either scroll down through the list, or you can continue typing "United States_Washington_Cl...." until the following appears:

Once you have "United States_Washington_Clallam" showing in the "Place Name "section, click the "SEARCH" button at the bottom left corner of the screen.

There are several ways to view the search results. Most immediately, you should see a map with several pin-flags showing the locations of sites with paleontological and archaeological data. Adjust the zoom level either by using the slider on the left, or by double-clicking on the map (to re-center and zoom in). Blue pin flags represent archaeological/paleontological sites (there are 7 on the map), and red pin flags represent pollen sites (14 total, with some modern and some ancient).



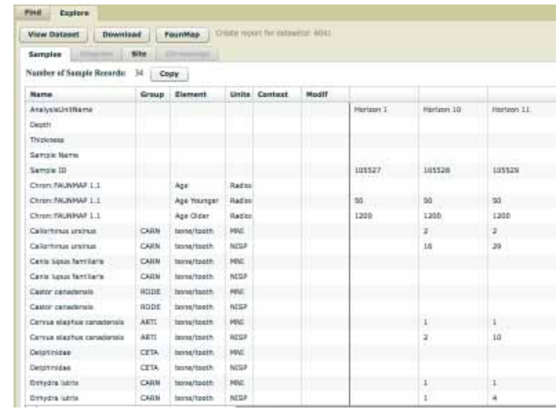
You can also view the search results in table format by toggling the "View Map/View Table" button. To find data for a specific site, you need to load the site on the "Site Tray." To do this, either double-click on a pin-flag, or in the map view, click on the "Add All Sites To Tray" button.



To see what has been loaded onto the "Site Tray," click on the white bar at the bottom left corner of the screen (the white bar that says "Site Tray").

Now double-click on the site you are interested in. If it is a modern sample, the table entry will expand to show only one additional line of text, which will lead you to the data for that site (by double-clicking on the text). If the data are from an ancient site, the table entry will expand to show two additional lines: one for the data, and one for the geochronological information (i.e., the dating for that site).

As an example, navigate to the data table for the archaeological site called "Neah Bay." It is represented by the blue pin flag out near the middle of the Strait of Juan de Fuca [this is not actually the true location of the site; the true location has been intentionally "blurred" to limit the amount of illegal and destructive looting of this sensitive archaeological site]. Double-click on the text that reads "NEAHBAY_Locality-vertebrate fauna" and you should see this table:



Adjust the column widths if you need to by dragging-and-dropping the edges of the column, or by double-clicking on a column boundary. Here are some of the key components of the data table for Neah Bay:

Date of deposits:

Ranges from 2,000 radiocarbon years BP to 50 radiocarbon years BP.

Species represented:

Callorhinus ursinus (northern fur seal), *Canis lupus familiaris* (domestic dog, entered here as a sub-species of wolf, *Canis lupus*), and so on.

Student Worksheet guide

Analyzing Data

Part 2 - continued

Quantification Units used:

Both MNI (minimum number of individuals) and NISP (number of identified specimens) were recorded for this particular collection of bones [see the "QUANTIFICATION" lesson if you need to review quantification methods]. Occasionally species are recorded in Neotoma only as present/absent, with a "1" indicating that at least one bone was identified from that stratum.

Using the Neah Bay data table answer these questions:

1. How many horizons, or strata, are represented by the data? (answer: 10)

2. What is the total NISP for raccoons (*Procyon lotor*) for all horizons combined? (answer: 3)

3. What is the total NISP for northern fur seals (*Callorhinus ursinus*) for all horizons combined? (answer: 55)

4. What is the total MNI for northern fur seals (*Callorhinus ursinus*) for all horizons combined? (answer: 12)

OTHER SEARCHES

You can also narrow your search by other search terms.

Start by first clearing the previous search results (unless you want to combine two or more searches). To do this, click on the "Remove All" button at the top of the Search Tray. Then click on the white bar at the top left corner of the screen (the white bar that says "Search").

To search for data for different species, use the "Taxon Name" section of the Search window. To see a map of all the sites that have a particular species (black-tailed deer (*Odocoileus hemionus*) in this example) recorded in them, start typing "Odocoile..." and use the drop-down list to select black-tailed deer.

Using the same approach as you did for extracting data for the Neah Bay site, answer these questions [Remember that the "Geographic Coordinates" setting may affect your search results]:

1. How many total sites are recorded in North

Analyzing Data, Part 3:

America that contain black-tailed deer bones? (Answer: 194. One of the site records is mapped in northern Canada, but it should really be located in Kansas).

2. Describe the geographic distribution of the sites that contain black-tailed deer bones. (Answer: With two exceptions (Frankstown Cave, in Pennsylvania, and Squaw Creek, in northern Canada), all of the records for black-tailed deer are in the western United States. If you look more closely at the two outliers, Frankstown Cave dates to 13,000 years ago, so it may be accurate. The Squaw Creek site is actually located in Kansas, but there is an error in how the coordinates for the site have been entered.

3. How many sites in Washington State contain black-tailed deer bones? (Answer: 11 (for some reason only 10 flags appear, so that answer should be considered correct).

All of the zooarchaeological data for the Kuril Islands sites have also been entered into the Neotoma database.

In order to see the map distribution of all the sites with faunal remains, enter "Russia_Sakhalin [Sakhalinskaya]" into the "Place Name" section of the Search window.

1. How many sites in the Kuril Islands are reported to have faunal remains?
Answer: 51 sites.

2. Based on information presented in the Settlement modules of the Kurils Burke Box, what is the total number of archaeological sites recorded?
Answer: Approximately 70 sites.

3. Are the answers to Question 1 and Question 2 the same? Why do you think this is the case?
Answers will vary, but there will typically be more sites documented than there are sites with faunal remains because faunal remains do not always preserve).