Ne‘epapa Ka Hana 2.0
Seventh-Grade Mathematics Resources
STEMD² Book Series

STUDENT ACTIVITIES

LET'S TAKE CARE OF THE LO‘I

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Ne‘epapa Ka Hana Seventh-Grade Mathematics Resources

Let’s Take Care of the Lo‘i

Student Activities

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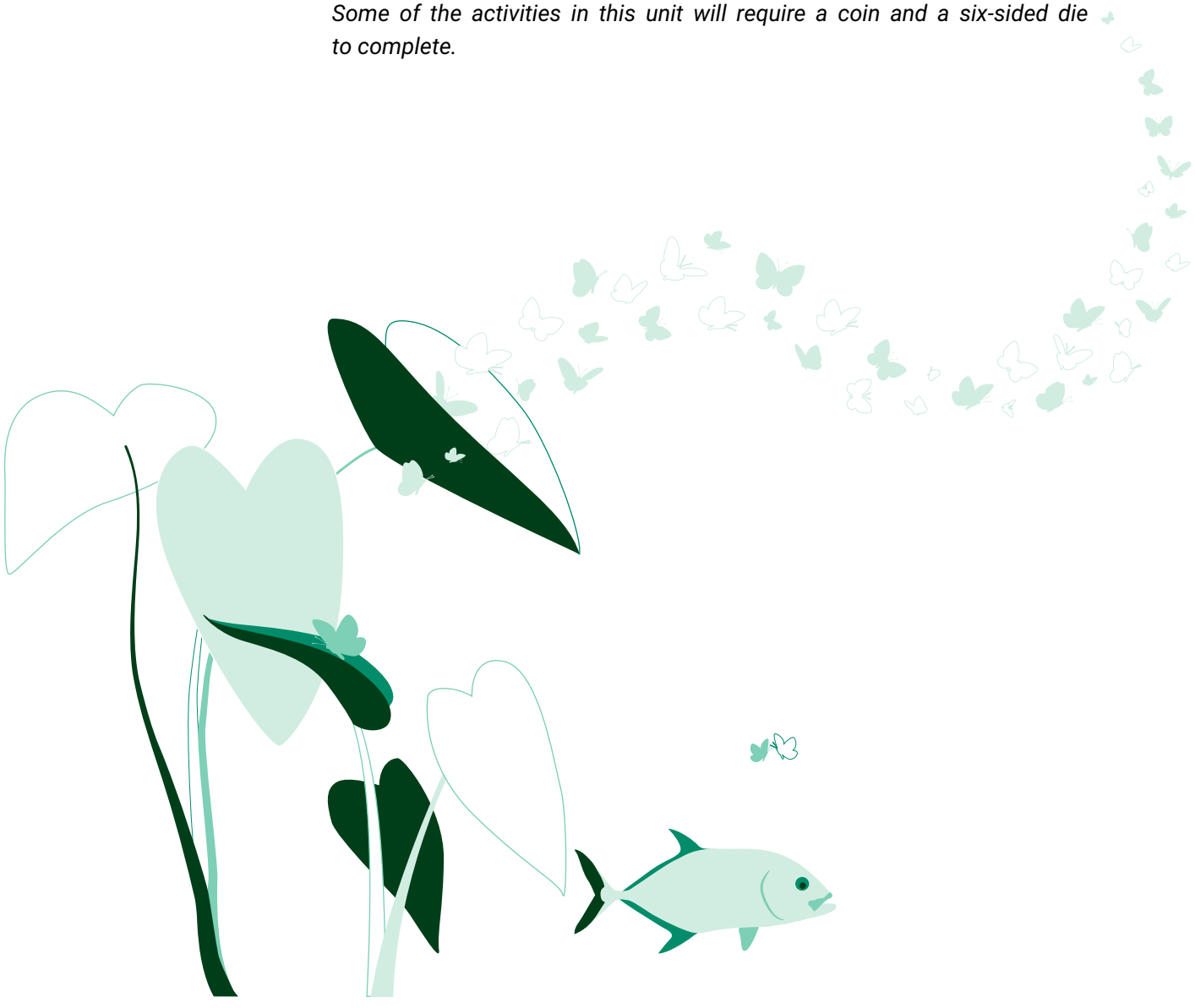
Unit 5: Statistics

In this unit, we'll learn how to use statistics to describe data and make conclusions through fishing with the aunties, exploring traditional Hawaiian measures, and tagging fish. There are three activities in this unit. *Module 10* involves evaluating a fish population through the use of random samples and populations. Module 11 focuses on analyzing and comparing data to help farmers with their crops. The final activity is cumulative and incorporates concepts from each of the previous activities in this unit.

Some of the activities in this unit will require a coin and a six-sided die to complete.



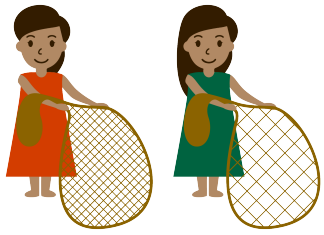
Module 10: Random Samples and Populations *Activity*

For this activity, you will need a coin and a six-sided die.

Aunty Momona and Aunty Manini are studying the fish population on the shores of Nānākuli Beach. They both decide to throw their nets into the water a few times to get a random sample of fish. A random sample will allow them to get a rough idea of the fish sizes in this area.

Halfway through the experiment, they realize something is wrong. Aunty Momona's **smallest fish** is much bigger than **almost all** of Aunty Manini's fish!

Aunty Manini suspects that Aunty Momona's sample is not random, but is a biased sample instead.



Aunty Manini Aunty Momona

1. What do you think is actually going on? (Hint: look at the picture of the two aunties fishing.)

The Aunts finally figured out what was disrupting the samples and decide to only use the data that Aunty Manini collected. Below is the data; it shows the length of every fish Aunty Manini caught (in inches).

columns

rows						
	7	8	5	1	4	6
	8	4	8	13	16	7
	15	7	10	18	12	6
	5	8	5	12	12	4
	12	3	7	6	5	5
	10	9	10	10	10	8

(heads)

columns

rows						
	10	6	17	9	11	16
	10	4	13	11	9	6
	5	7	2	7	12	9
	8	3	10	15	10	11
	1	8	3	7	5	9
	13	6	7	10	1	5

(tails)

2. Let's use the coin and die to help us choose some random numbers from the data.
   (a) First flip a coin. If it is "heads", use the table on the left. If it is "tails", use the table on the right.
   (b) Roll a die. This number will tell you which row (from the top) to look at.
   (c) Roll a die again. This number will tell you which column (from the left) to look at.
   (d) Write down your numbers. For example, if you got "tails, 3, 4" then you write down "7." This is because on the right (tails) table, 3rd row, 4th column, it shows that Aunty Manini caught a 7-inch fish.
   (e) Repeat these steps until you have collected 10 numbers. Record your data (numbers) on the tables on the following page.

Coin flip	First die	Second die	Number

Coin flip	First die	Second die	Number

3. Find the mean of the 10 numbers you collected in part 2.

4. The actual mean of all 72 numbers in the table is $8.222...$. How does the mean that you found compare to the actual mean? Is it greater than or less than the actual mean? Is it close to the real mean or way off? Why? How do you think you can get a closer answer? Feel free to discuss with a partner.

5. Let's go back to the full table of 72 numbers.

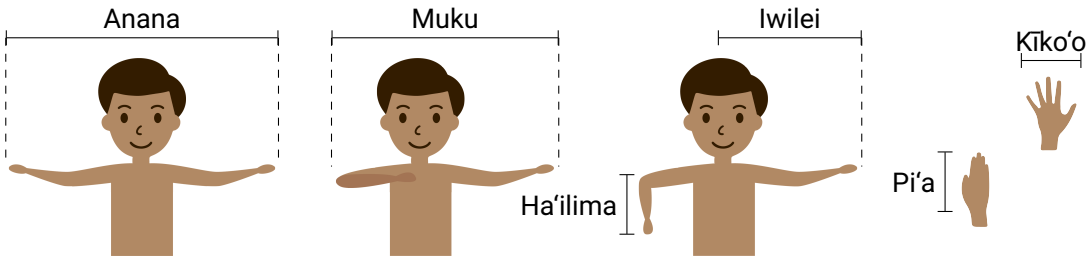
   (a) What fraction of the fish in Aunty Manini's random sample are greater than or equal to 15 inches?

   (b) If you swam by $2,400$ random fish at this beach. How many of them would you expect to be greater than or equal to 15 inches?

Module 11: Analyzing and Comparing Data *Activity*

In a loʻi, the spacing between the kalo is very important. There are many issues that can occur if they are grown too far apart or too close together. If the kalo are too far apart, you would be wasting land that could be used to grow more plants. If the kalo are grown too close together, it may be hard for the farmer to come into the loʻi and take care of the plants. It would also be easy for bugs and weeds to grow quickly, destroying the kalo.

Traditionally, Hawaiians used their body parts to measure things. In particular, the rows of a loʻi are often spaced one muku apart.



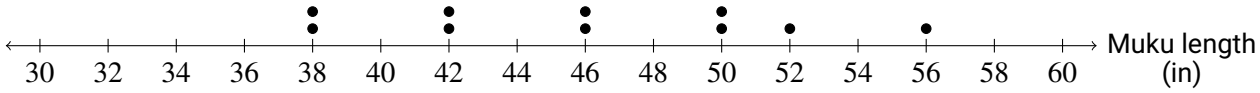
Nā Anakahi Hawaiʻi: The Hawaiian Units of Measurement

Measuring with our body parts is more convenient than carrying around a large ruler. However, it might cause problems if the farmers have very different body sizes.

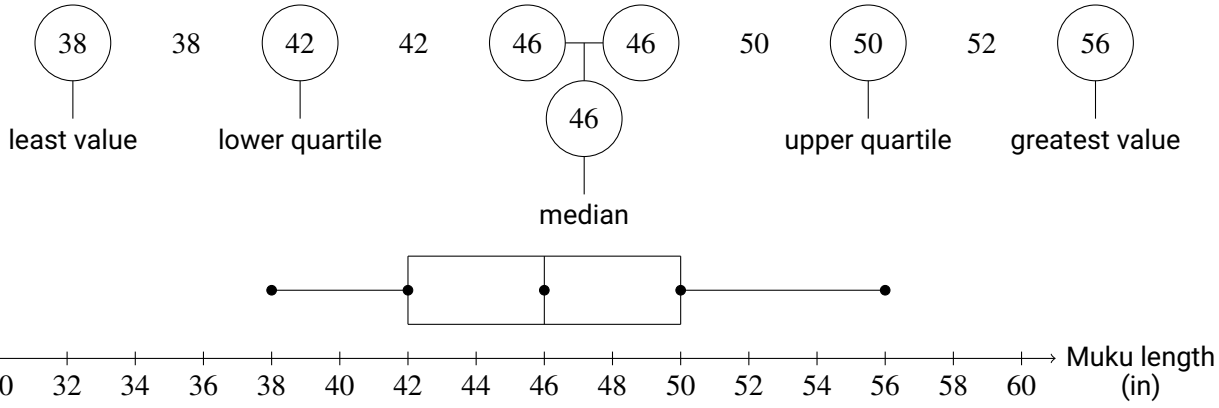
Let's take a look at a group of farmers from **Waiʻanae** and the lengths of their muku in inches (in).

$$50\ , 56, 46, 42, 52, 38, 38, 46, 42, 50$$

We will first put the numbers on the dot plot.



Next, we can find the least value, or minimum, and greatest value, or maximum. Then we find the median, and the lower and upper quartiles to make a box plot.



Finally, we can see that the mean is 46:

$50 + 56 + 46 + 42 + 52 + 38 + 38 + 46 + 42 + 50 = 460$

$460 \div 10 = 46$

and the mean absolute deviation (MAD) is 4.8.

$|50-46|=4$ $|56-46|=10$ $|46-46|=0$ $|42-46|=4$ $|52-46|=6$

$|38-46|=8$ $|38-46|=8$ $|46-46|=0$ $|42-46|=4$ $|50-46|=4$

$4+10+0+4+6+8+8+0+4+4=48$

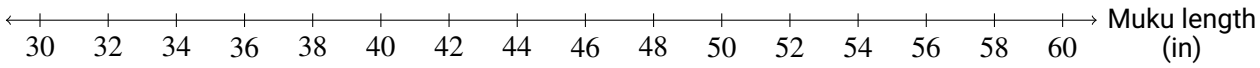
$48\div 10=4.8$

A group of volunteers from **Kahuku** measured their muku as well, and below is their data.

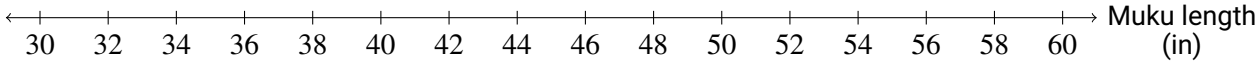
$$42\text{ , }50,38,38,40,32,36,38,36,40$$

1. Create a dot plot and box plot of the Kahuku data.

   (a) Dot plot



   (b) Box plot



2. Use the plots to compare the Waiʻanae farmers with the Kahuku volunteers.

   (a) Compare the shapes of the dot plots.

   (b) Compare the centers of the box plots.

   (c) Compare the spread, or variance, of the plots.

3. Find the mean muku length of the Kahuku volunteers.

4. How many inches longer is the mean muku length of the Wai‘anae farmers compared to the mean muku length of the Kahuku volunteers.

5. Find out how many mean absolute deviations (MADs) Kahuku’s mean is from Wai‘anae’s mean based on Wai‘anae’s MAD. To find this, divide your answer in part 4 by the MAD of the Wai‘anae farmers. Round to one decimal place.

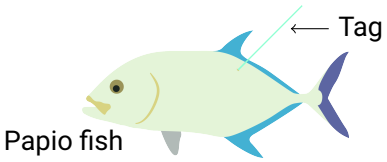
6. Find the MAD of the Kahuku volunteers.

7. Find out how many mean absolute deviations (MADs) Wai‘anae’s mean is from Kahuku’s mean based on Wai‘anae’s MAD. To find this, divide your answer in part 4 by the MAD of the Kahuku volunteers in part 6. Round to one decimal place.

Unit 5: *Cumulative Activity*

The ancient Hawaiians were experts in building highly advanced loko i'a, or fish ponds, which made significant contributions to their sustainable way of life. The loko i'a were designed to keep fish in, keep their predators out, and allow fresh water to flow through. Unfortunately, most of these fish ponds have disappeared with time, and fish populations are not as they used to be.

In the 2000's, the Hawai'i Department of Land and Natural Resources set out to monitor and learn more about the papio fish and the 'ulua (papio over 10 lbs). Fishermen were recruited to help the project by catching, tagging, and releasing these fish. The initial fish length, type, location, and date tagged was recorded by the fishermen and sent to the state. If a tagged fish was caught again, the new length, date, and location was recorded again and sent to the state. With all this data, the state was able to gather a tremendous amount of information about the ulua and papio, giving us an insight into the health of the fish population.



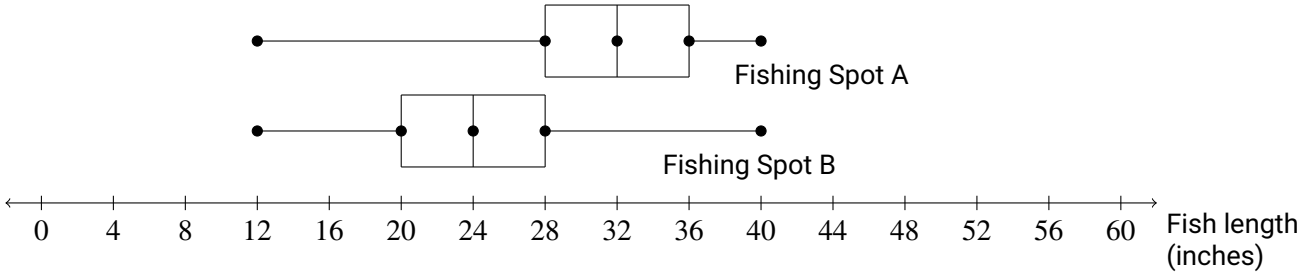
One method of surveying fish populations involves tagging a species of fish, releasing them, and fishing the same area again at a later date. Scientists can then use proportions to make estimates of fish populations based on how many of the caught fish were tagged.

1. Initially 500 papio were tagged in a fish pond. At a later date, fishermen caught and released 100 papio and only 10 of them had tags. Using this information, estimate how many total papio are in the pond. Please explain your reasoning, and show your work.

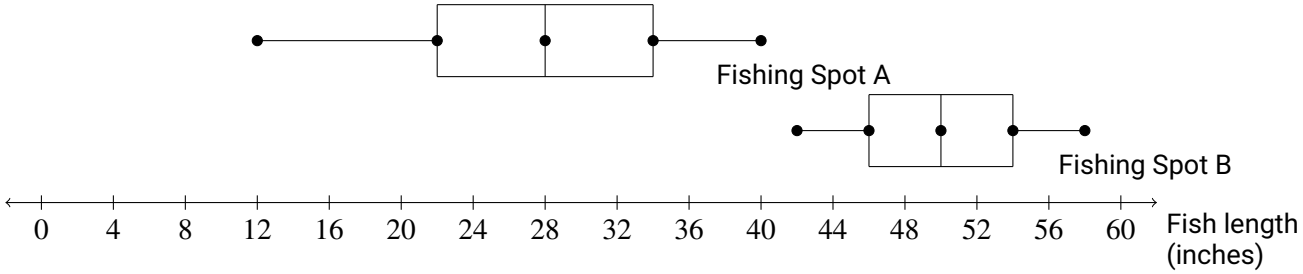
2. If you know that 25% of mullet's in the fish pond are tagged, and you catch 20 mullet's, how many of those 20 would you expect to have tags? Please explain your reasoning.

We mentioned that fishermen take measurements when they tag fish. Let's compare some 'ulua/papio data that were collected from different fishing spots around O'ahu.

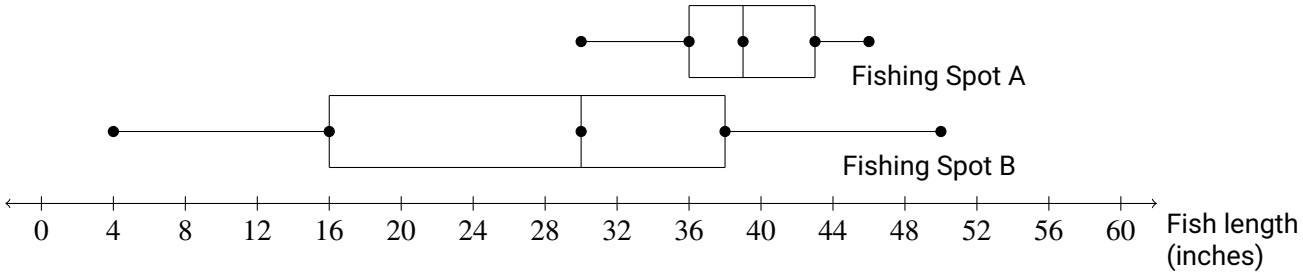
3. Which of these two fishing spots have more large fish? Explain.



4. Based on the box plots below, which of the two fishing spots would you expect to have more variation in fish sizes? Explain.



5. Which of these two fishing spots would you rather fish in? Explain what the size of fish you expect to catch and why you chose that fishing spot.



6. With a partner or in the online comment section, explain why you think it is important to do experiments like these. What can we learn from them and how can it help make our world a better place?