

## **Tabling or classroom activity: Mapping out Southern Resident Killer Whales!**

**Purpose:** to educate participants as to the scale of a local orca species, the Southern Resident Killer Whales (SRKW), the amount of PCBs they contain, and what harms come from that amount of contamination.

**Introduction:** The local Southern Resident Killer Whale population in Puget Sound is endangered, and a major cause is pollution and lack of food. These organisms are some of the most heavily contaminated on the planet with respect to PCBs. In fact, the prediction is for all first-born calves to not survive more than a few weeks after being born because they have such a high PCB load that they cannot survive. This activity will show that a seemingly 'small' amount of PCBs in a SRKW is enough to alter their reproduction potential.

### **Supplies needed:**

- String
- Tape
- Tape measure
- Scale
- Small objects to weigh to represent contaminants (Beads, marbles, sand, etc)
- Calculator
- Laminated sheet with:
  - o dimensions of a male SRKW (including length, height, dorsal fin length, pectoral fin length)
  - o dimensions of a female SRKW (including length, height, dorsal fin length, pectoral fin length)
  - o amount of PCBs in a male SRKW
  - o amount of PCBs in a female SRKW
  - o conversion chart (pounds to kilos; kilos to grams; the definitions of micro-, nano-, pico-, etc. for grams)

**Skills learned:** conversions, concentrations, using a scale

### **Terms/ Definitions:**

- Southern Resident Killer Whales
  - o These are the iconic symbol of Puget Sound. These organisms have three Pods that they travel in: the J, K, and L Pods. They occasionally interact or are found in the same area, but Pods are typically found discretely. This species of orca is on the endangered species list, with only 78 individuals remaining (as of December 2016). These orcas eat only fish, and have a preference for Chinook salmon (also an endangered species). They tend to be in the Puget Sound area from ~May until ~late October each year. In the other months, they are found offshore of WA and Vancouver Island.



- Transient orca
  - o These orcas are the other species that is found in Puget Sound. They can be found from southern California to Alaska and they feed on marine mammals. Because their food preference is more diverse and their range is larger, they are not as vulnerable to fluxes in prey populations. They are also higher in population number, though there is no exact count. They are also larger than the SRKWs.
- Polychlorinated Biphenyl
  - o A legacy contaminant found in many industrial waterways, including those of Puget Sound. They are a legacy contaminant because they have been a pollutant for a number of decades, their manufacturing was stopped in the late 1970s, and they do not degrade easily. Therefore, their legacy of contamination lasts for decades and spans generations. They were originally manufactured as an industrial lubricant because they can withstand high temperatures and do not break down easily. Great for industry, but not for the environment! Legal and illegal discharges have allowed their accumulation in aquatic environments. They stick to sediments and do not like being in water so accumulate in sediments and in animals. Animals also cannot readily break these compounds down, so they accumulate in the fatty tissues of animals and can easily increase in concentration as larger organisms eat smaller ones. Thus, since orcas are at the top of the food web, they accumulate some of the highest levels of PCBs of any organism. PCBs cause cancer and reproductive effects in organisms, including humans.
- Sexual Dimorphism
  - o This term applies to organisms where the males look different from the females. One of the classic examples is in ducks where males have bright plumage and females are more camouflaged. Humans are another good example. In orcas, the males have much larger fins and are generally heavier than females.

### **Step 1:**

- Using the info on the dimensions of the male SRKW, map out the length and width of the orca. Also map out the dorsal fin and pectoral fin.
- Have participants lay down in the whale outline to see how big it is; lay down in the pectoral fin and dorsal fins as well
- Map out a female to see the size difference
- Talk about the scale of these organisms, how many there are, the different pods, endangered species status
- This is also a good time to talk about sexual dimorphism

### **Step 2:**

- Talk about diet differences between transients and residents
- Using the conversion chart, determine the weight of PCBs in the males and females
- Weigh out the “PCBs”



- Place them inside the outline of the orcas
- Talk about the size of those contaminants vs. size of the orcas
  - o A really small amount can have a really large effect!!

**Step 3:**

- Lead discussions on reactions of participants
  - o Did they think the whales are this big?
  - o How big do you think they are in comparison to other whales?
  - o Were you surprised at the size of the orcas vs. the amount of PCBs it takes to harm them?
  - o Talk about the difference between males and females with respect to pollutant loading
    - Females can unload a lot of their contaminants into the babies, so have a lower amount in them once they mature enough to start having calves
    - Males have no way to get rid of contaminants

**Resources:**

**From the EPA:**

**Five things you can do to help!**

1. Orcas are sensitive to noise and disturbance from boats. Instead of approaching them in your own vessel, spend a day watching them from a responsibly-managed whale watching vessel. Or watch for them from land with help from the [Whale Trail](#).
2. Engage in citizen science by alerting researchers at the [Orca Network](#) or the [Salish Sea Hydrophone Network](#) when you spot orcas so scientists can track their travel.
3. Get involved in efforts to protect and restore salmon habitat in your community. Chinook salmon are especially important to orca populations in the Salish Sea.
4. Choose to eat sustainably-harvested salmon and other seafood to help protect wild fish populations.
5. Do your part to dispose of unused medicine and chemicals properly. Never dump into household toilets and sinks or outside where they can get into ditches or storm drains. See if your community has a household hazardous waste collection facility that will take your old or unused chemicals.

**Other resources:**

- The Orca Network: <http://www.orcanetwork.org/Main/>
- Center for Whale Research: <https://www.whaleresearch.com/>
- The Whale Museum: <https://whalemuseum.org/>

**Conversions:**



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### Weight:

- 1 kilogram = 1,000 grams = 100,000 milligrams
- Alternatively, 1 milligram = 0.001 grams = 0.000001 kilograms
- 1 pound = 0.45 kilograms
- 1 metric ton = 1,000 kilograms
- 1 metric ton = 2,204 pounds
- 1 gram = 0.0022 pounds

### Length:

- 1 meter = 3.3 feet

### Orca stats:

- Male Southern Resident Killer Whales
  - o Average weight: 5 metric tons
  - o Average length: 7.2 meters
  - o Average pectoral fin dimensions: 2m long x 1.2m wide
  - o Average dorsal fin length: 1.8m
  - o Average PCB loading: 146.3 mg/kg
- Female Southern Resident Killer Whales
  - o Average weight: 3.5 metric tons
  - o Average length: 6 meters
  - o Average dorsal fin length: 1m
  - o Average PCB loading: 55.4 mg/kg
- Consume 2 – 10% of their body weight every day!
  - o Males: 100 – 500kg/day → 220 – 1102 pounds
    - This equals a max of ~36 Chinook per day!
  - o Females: 70 – 350 kg/day → 154 – 771 pounds per day
    - This equals ~25 max Chinook per day!



## Female Southern Resident Killer Whales: how polluted are they?

To figure this out, we are going to have to use some math!

Each female weighs approximately 3.5 metric tons

Past reports reveal they can have 55.4 mg/kg of PCBs

Cross-multiply:

$$\frac{55.4 \text{ mg}}{1 \text{ kg}} = \frac{x \text{ mg}}{3500 \text{ kg}}$$

X = \_\_\_\_\_ mg

Convert this to grams by dividing by 1000: \_\_\_\_\_ g

Converting to pounds:

$$\frac{1 \text{ g}}{0.0022 \text{ pounds}} = \frac{(\text{your answer from above question})\text{g}}{x \text{ pounds of PCBs}}$$

Cross multiply for x = \_\_\_\_\_ pounds of PCBs



## Male Southern Resident Killer Whales: how polluted are they?

To figure this out, we are going to have to use some math!

Each male weighs approximately 5 metric tons

Past reports reveal they can have 146.3 mg/kg of PCBs

Cross-multiply:

$$\frac{146.3 \text{ mg}}{1 \text{ kg}} = \frac{x \text{ mg}}{5000 \text{ kg}}$$

X = \_\_\_\_\_ mg

Convert this to grams by dividing by 1000: \_\_\_\_\_ g

Converting to pounds:

$$\frac{1 \text{ g}}{0.0022 \text{ pounds}} = \frac{(\text{your answer from above question})\text{g}}{x \text{ pounds of PCBs}}$$

Cross multiply for x = \_\_\_\_\_ pounds of PCBs



## How big is a male Southern Resident Killer Whale?

Total length: 7.2 meters

Converting to feet:

$$\frac{1 \text{ meter}}{3.3 \text{ feet}} = \frac{7.2 \text{ meters}}{x \text{ feet}}$$

X = \_\_\_\_\_ feet long!

Pectoral fins: 2 meters long by 1.2 meters wide

Converting to feet =  $2 \times 3.3 =$  \_\_\_\_\_ feet long

=  $1.2 \times 3.3 =$  \_\_\_\_\_ feet wide

Dorsal fins: 2 meters tall

Converting to feet: =  $2 \times 3.3 =$  \_\_\_\_\_ feet tall



## How big is a female Southern Resident Killer Whale?

They are typically 6 meters long!

Converting to feet:

$$\frac{1 \text{ meter}}{3.3 \text{ feet}} = \frac{6 \text{ meters}}{x \text{ feet}}$$

X = \_\_\_\_\_ feet long

Dorsal fins: 1 meter tall

Converting to feet: = 1 x 3.3 = \_\_\_\_\_ feet tall

