

Killer Whale Recovery

High school: Population Comparison and demographics

Lesson 2: Trading Cards Part 2

	Subject Area(s): Look at factors or threats impacting population size and health of a population of whales	Duration: one 50 minute period
	Key words: longevity, mortality, reproductive age, post reproductive age, age classes	
Materials:	Worksheet Computers with internet access	
State Standards: WA, OR, and ID	WA: EALR 2, 9-12 INQA (generate questions and evaluate a question) EALR 3, 9-12 APPA (scientific ideas influenced society) EALR 3, 9-12 APPB (technological design, defining problem in terms of criteria) OR: H.2L.2 (explain how ecosystems change in response to disturbances) H.3S.5 (explain how technology problems and advances create a demand) ID: 9-10.B.1.6.1 (Identify questions and concepts that guide scientific investigations) 9-10.B.5.2.1 (explain how science advances technology) 9-10.B.5.2.2 (explain how technology advances science)	
Focus Questions:	Are population sizes changing? What factors influence increases, decreases or stable populations? How might one go about studying these changes?	
Learning Objectives:	At the end of this lesson students will be able to: <ul style="list-style-type: none"> • Explain how age classes and sex ratios are used to inform population dynamics. • Compare the Southern Resident killer whale population with the Northern Residents. • Formulate the current population status on the Southern Resident killer whales. 	
Engage and Encounter	Review graphs from the Recovery Plan to interpret the issues facing the Southern Resident killer whales.	
Explore and Investigate	Trading card activity: Have students look at some of the population parameters such as abundance and demographics (age and sex ratios and distribution of individuals among different subpopulations).	
Reflect and Explain	Explore some of the issues impacting their decline, why are they important to recovery? What else do we still need to know to better understand these animals? Any data gaps?	
Apply and Extend	Connect with a math/statistics/computer teacher to continue to analyze graphs/statistics from worksheet in lesson 1.	
Background for teacher	<p>Longevity At birth, the average life expectancy of southern and northern resident killer whales is about 29 years for females and 17 years for males (Olesiuk et al. 1990a). However, for animals that survive their first six months, mean life expectancy increases to about 50-60 years for females and 29 years for males. Life expectancy at sexual maturity (about 15 years of age in both sexes) averages about 63 years for females and 36 years for males. Maximum life span is estimated to be 80-90 years for females and 50-60 years for males (Olesiuk et al. 1990a). Reasons for the shorter longevity of males are unknown, but are probably linked to sexual selection (Baird 2000). Among southern Alaska residents, females reaching 6 months of age have a shorter life expectancy of 39 years and a maximum life span of 60-70 years (Matkin et al. 2003). Mortality curves are U-shaped for both sexes, although the curve is narrower for males (Olesiuk et al. 1990a). Mortality is extremely high during the first six months of life, when 37-50% of all calves die (Bain 1990, Olesiuk et al. 1990a). Annual death rates for juveniles decline steadily thereafter, falling to 0.5% for both sexes from 10.5 to 14.5 years of age, and an estimated 77% of viable calves reach maturity. Death rates remain low among females of reproductive age, averaging just 0-1.7% per year between 15.5 and 44.5 years (Olesiuk et al. 1990a). Mortality increases dramatically among older females, especially those beyond 65 years of age. After reaching sexual maturity, death rates for males increase throughout life, reaching 7.1% annually among individuals older than 30 years. Life history tables for both of these resident populations are presented in Olesiuk et al. (1990a).</p>	
Contact NOAA	For a guest speaker in lesson 5 email: nwr.education@noaa.gov	

Lesson 2 Procedures

Population comparison and demographics

I. Anticipatory Set: (15 minutes)

- A. What defines a healthy population or a long-term sustainable population? In the case of the Southern Resident killer whales in order to be delisted there must be a positive population growth (i.e., more individuals entering the population than being removed) over a certain time frame and an adequate number of individuals of both sex classes and mixed ages, distributed among the three pods, to make it unlikely the population will fall below a threshold at which it is in danger of extinction.
- B. To gauge whether the above biological parameters were realistic, NOAA Fisheries used Northern Resident population data to help guide their delisting criteria. Ask students to pull out their homework regarding graphing and go over together.

II. Direct Instruction: (35 minutes)

- A. **Comparing Populations using Graphs:** Have the students share what they learned from the graphing activity for homework last night. What trends did they see? What might have caused some of those changes? How are their habitats different? NRKW population is over 200 whales and appears to be increasing, SRKW population is about 87 whales and has fluctuated and less than half the size. Live captures in the '60-'70s, urban watersheds, and increased vessel impacts.
- B. **Trading Cards Part 2:** Hand out the trading cards again, same groups would be easiest (by matriline) or to have the students learn about a new matriline would be fine too.
 1. **Part 1:** Have students answer the questions on their worksheets just about their matriline. This would be a great time to verify that all students know what matrilineal means and have them explore the number of generations, oldest female and male, etc.
 2. **Part 2:** When matrilineal are done, have pods get together and tally information.
 3. **Part 3:** Do as a whole class. Have students share their pod data and look at the whole population. Address the last question, what does this information tell us about recovery? Are we there yet? Does it look promising? Have them look at what the color of the cards mean. Ask them what color or decade of whales is the oldest and the average life span for a female is about 50-60 years and males about 29 years.

III. Assessment:

- A. Class participation in activity.
- B. Homework: Finish worksheet and have students ask their loved ones about what they know about the status of this population. Have them be thinking of what advocacy or stewardship action they could participate in to help protect this population.

IV. Apply and extend:

- A. Look at other graphs from the recovery plan. Connect with a math/statistics/computer teacher and go in more depth on the tables, graphs, statistics, or techniques how to graph from the Recovery Plan.
- B. Learn more about what scientists are studying
http://www.nwfsc.noaa.gov/publications/documents/srkw_newsletter.pdf



Killer Whale Trading Card Activity Part 2

Population demographics

Part 3: Southern resident population data (whole class)

Quantitative measures for population parameters include:

Do you have representation from at least three pods?	Yes	No	Why is this critical?				
Are there more than two reproductive age males in each pod or information that fewer males are sufficient?	Yes	No	Why is this critical?				
Find the current population size of the Southern Resident killer whales (you will use this below)	J	K	L	Total population:			
A ratio of the following in comparison to Northern Resident population:	Total Number currently	Total population	% Currently	Target	Are we close to the target?		Too high Too low
					Yes	No	
Number of juveniles (3-14 years old)				47%			
# of reproductive females (15-45 years old):				24%			
# of post-reproductive females (46 years and older)				11%			
# of adult males (15 years old and older)				18%			

What does this information tell us about recovery?