Photo by Mike Charest, December 20th, 2014, Tacoma Narrows [Creative Commons]

Biology-Ecology

Grade 9/10

Scott Conlan, Laura Schmidt

Sedro-Woolley High School, Sedro-Woolley School District

Anchoring phenomenon
On December 4, 2014 J32, a pregnant Southern Resident Orca washed up on shore in Courtenay, British Columbia. J32, or Rhapsody, was 18 years old and carrying a fetus near full term. At the time, her death lowered the number of resident orcas in the J, K, and L pods to 77. Her death was particularly troubling because she was a young female just entering her reproductive years and it was hoped she would contribute significantly to the recovery of the population. While the full necropsy report has yet to be released by the Canadian government, it is likely that multiple factors interacted to cause her death. These factors include noise from boat traffic, low food supply (Chinook salmon), accumulation of toxins, and her pregnancy. By understanding the factors contributing to her death we may better understand the factors affecting the recovery of the Southern Resident Orca population as a whole.

Essential question about phenomenon/unit:
Why did J32 die?

Gapless explanation:
The inability of the southern resident orca population to maintain positive growth is likely due to the combined effects of three main factors: 1) the decline of the Salish Sea Chinook salmon population, which are targeted by orcas and make up 80% of their diet, 2) exposure to high levels of fat-soluble toxicants (e.g. PCBs, DDT, and PBDEs) through bioaccumulation, which pose a variety of health risks, and 3) disturbance from private and commercial whale watching vessels, which changes orca behavior. In the case of J32, the evidence strongly suggests that her pregnancy was also a contributing factor in her death.

The abundance of Chinook salmon in the Salish Sea declined by 60% from 1984 to 2010 (epa.gov). The Chinook population decline has been primarily attributed to: 1) habitat loss, 2) harvest rates, and 3) hatchery influence. Other recognized contributing factors to the Chinook salmon decline include climate change, ocean conditions, and marine mammal interactions.

PCB production in the United States ceased in 1977, however orcas are the most PCB-contaminated animals on the planet. PCBs were used since the 1920s as lubricants and coolants in electrical devices. PCBs make the orcas more vulnerable to infectious disease, impair reproduction, and impede normal growth and development. Researchers estimate southern resident orcas' health will be at risk due to PCBs until 2063. Although agricultural use of the pesticide DDT was banned in the United States in 1972, it persists in the environment as well and has been found in high concentrations in orcas. It has been shown to cause premature births, disrupt thyroid hormone levels, and cause decreased lymphocyte response in marine mammals. Meanwhile, high concentrations of PBDEs, used as a flame retardants, also pose a risk. Animal studies have shown that PBDE exposure during pregnancy and after birth caused problems with brain development in offspring. These studies observed problems with learning, memory, and behavior in mice and rats. Animal studies also found that PBDEs can alter thyroid and other hormone levels.

As human populations increase on the shores of the Salish Sea, noise from boats has increased as well. Research indicates orcas speed up, work harder, slap their tails more and hunt less due to this human disturbance. Consequently, the orcas may burn more valuable calories. While new rules require boaters and whale-watching vessels to stay 200 yards from whales, state enforcement agencies have indicated that this space is frequently violated. Research (NOAA) also indicates that these orcas have experienced hearing loss, which may negatively affect their ability to communicate and use echolocation to identify and locate prey.

Rather than working independently, these factors likely interacted to cause J32's death. For instance, if J32 had difficulty finding enough food, her body would metabolize the fat stored in her blubber. This consequently releases the fat-soluble toxicants into the bloodstream where they can be harmful to other parts of the body. Specifically, the presence of these toxicants can disrupt the function of the reproductive systems of female orcas. The conversion of fat reserves to usable energy could be exacerbated by the behaviors displayed by orcas in the presence of boat noise. The boat noise may also make it more difficult for orcas to locate and identify their preferred prey by interfering with echolocation. J32's pregnancy also likely played a role in her death. In addition to simply increasing J32's energy requirements, pregnant mothers mobilize their fat stores to support the fetus, especially when they can't obtain enough food. Some of the contaminants are passed on to the fetus. Scientists have reported that female orcas "offload" a relatively large amount of fat-soluble toxicants to their first fetus, which has resulted in miscarriage for many of these females, but the reduction in toxicants in their bodies increases the chances of survival for future offspring. If the fetus is a female, then it is also possible these contaminants could harm the fetus' reproductive development, which could negatively impact the population's ability to recover even further.

NGSS *Performance Expectations* addressed in this unit:

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [*Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*]

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [*Assessment Boundary: Assessment is limited to provided data.*]

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

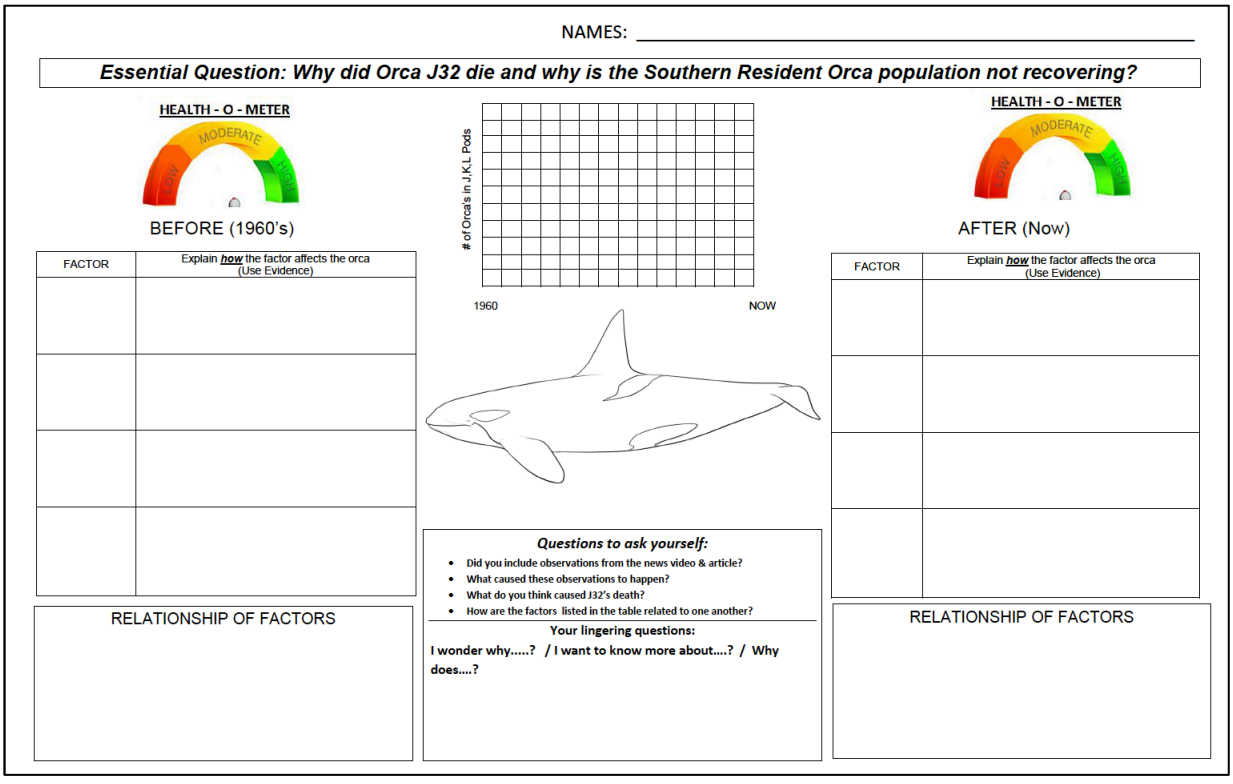
Note: We designed this unit to address only the DCIs embedded within each of these Performance Expectations (PEs), not to address each of the three dimensions integrated into each PE or to provide students with opportunities to actually meet these PEs in their entirety.

Activity	Learning Target	Evidence Students Could Gain	Connection to Phenomena
Activity 1: Introduce the phenomenon using Local News Video & Article Video:http://www.kiro7.com/news/endangered-puget-sound-killer-whale-found-dead/82049868 Article:http://www.cbc.ca/news/canada/british-columbia/death-of-killer-whale-j-32-troubling-say-scientists-1.2861713 SEP: Asking Questions CCC:Cause and Effect	Students will be able to identify the main factors likely preventing the recovery of the southern resident orcas.	Students could gain understanding of the factors many scientists believe are preventing the recovery of the southern residents: lack of prey, noise disturbance, and toxins.	Students should make observations and identify the factors that likely contributed to the death of J32, Rhapsody.
Activity 2: WebQuest (https://www.epa.gov/salish-sea/southern-resident-killer-whales) SEP: Asking Questions CCC: Cause & Effect	Students will be able to identify the main factors likely preventing the recovery of the southern resident orcas.	Students could gain understanding of the factors many scientists believe are preventing the recovery of the southern residents: lack of prey, noise disturbance, and toxins.	Students should identify the factors that likely contributed to the death of J32, Rhapsody.
Activity 3: Salish Sea Food Web (http://marinesurvivalproject.com/research-activities/trends-modeling/) SEP: Developing & Using Models CCC: Systems & System Models, Energy & Matter	Students will be able to describe the feeding relationships in a Salish Sea food web that includes orcas. Students will also be able to justify predictions of how changes in one population in the web will affect other populations.	Students gain understanding of how matter and energy is transferred in the Salish Sea food web. This provides evidence for how low Chinook salmon populations could be preventing the recovery of the southern residents. This activity also prepares students for Activity 4: Food Chain Simulation - Bioaccumulation in the Salish Sea.	Low Chinook salmon populations could have contributed to J32's death. Chinook salmon are the preferred food source of the southern resident orcas.

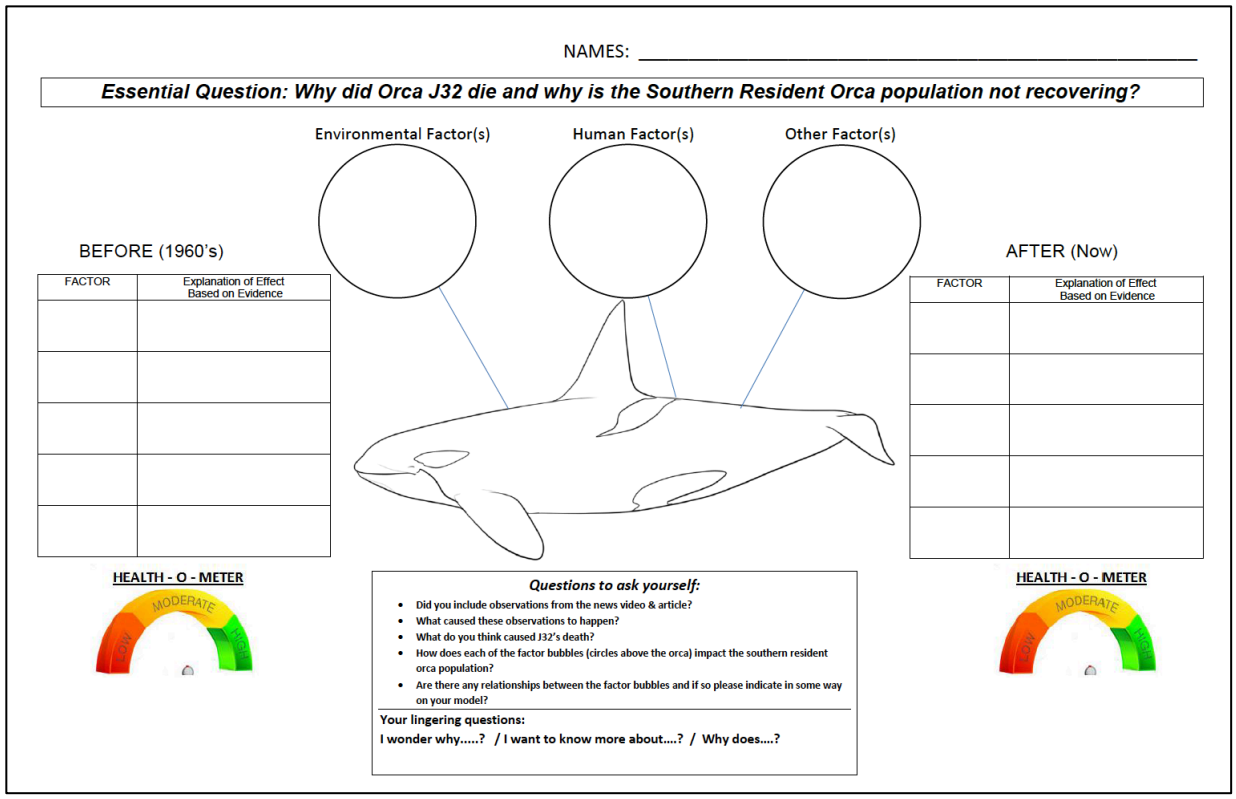
Activity 4: Food Chain Simulation - Bioaccumulation in the Salish Sea (Adapted from https://www.bigelow.org/edhab/tracing_toxins.html) SEP: Analyzing & Interpreting Data CCC: Systems & System Models, Energy & Matter	Students will be able to explain how fat-soluble toxins can be transferred up the food chain and accumulate in organisms at higher trophic levels, like orcas.	Students observe the mechanism for how toxins can be transferred from lower to higher trophic levels in the web.	J32 likely accumulated harmful levels of fat-soluble toxins, such as PCBs, during her lifetime.
Activity 5: Orcas and PCBs Article (http://www.eurocbc.org/page96.htm) SEP: Constructing Explanations CCC: Systems & System Models, Energy & Matter	Students will be able to explain why PCBs accumulate in orcas in the Salish Sea and how PCBs affect the bodies of orcas.	Students read how PCBs can be transferred from lower to higher trophic levels in a food web.	J32 undoubtedly had PCBs in her body, which may have contributed to her death.
Activity 6: Food Chain Simulation - Boat Noise & Disturbance (Adapted from https://www.bigelow.org/edhab/tracing_toxins.html) SEP: Analyzing & Interpreting Data CCC: Systems & System Models	Students will be able to explain how boat noise could interfere with an orca's ability to locate and identify prey through echolocation.	Students observe the mechanism for how boat noise could interfere with the echolocation used by orcas.	J32 may have been unable to obtain enough food to support herself and her fetus because of boat noise interference.
Activity 7: J32 Preliminary Necropsy Report (http://www.whaleresearch.com/j32-report) SEP: Engaging in Argument from Evidence CCC: Cause & Effect	Students will be able to describe the key observations of the preliminary necropsy and explain how the contributing factors (boat noise, low abundance of prey, toxins, and pregnancy) may have contributed to the condition of J32's body.	Students observe that J32's body had a extremely thin layer of fat, indicating that she did not have enough to eat. They also learn that palpation of the uterus indicated that the calf may have been dead for some time and J32 must have had difficulty expelling the calf from her body. Finally, they learn that the spleen and lymph nodes near the uterus	Given the extremely thin and dry fat tissue in J32's body it is clear that she was starving. The pregnancy must have also contributed to her death as the fetus would greatly increase the amount of food she would need to consume. While the the necropsy is only preliminary, it seems clear that J32's inability to expel the calf contributed significantly to her death.

		were swollen, indicating that her immune system was likely fighting an infection caused by the dead calf in her womb.	
Activity 8: Contributing Factors Concept Map SEP: Constructing Explanations CCC: Cause & Effect	Students will be able to explain how the contributing factors (boat noise, low abundance of prey, toxins, and pregnancy) affect each each other and how their combined effect likely caused J32's death.	While students are not presented with new evidence in this activity, we felt this was a critical element of the unit because it pushed students to reason with the evidence already presented to formulate a more robust explanation for J32's death - an explanation that clearly explains the possible connections between the factors that contributed to her death.	All of the factors are interconnected and the combined effect is much greater that any one factor by itself. (See the Gapless Explanation above for an explanation of these connections.)

Model Templates – version 1:



Model Templates – version 2:



NAMES: _____

Essential Question: Why did Orca J32 die and why is the Southern Resident Orca population not recovering?

Environmental Factor(s) | Human Factor(s) | Other Factor(s)

BEFORE (1960's)

FACTOR	Explanation of Effect Based on Evidence

AFTER (Now)

FACTOR	Explanation of Effect Based on Evidence

HEALTH - O - METER (LOW / MODERATE / HIGH)

Questions to ask yourself:

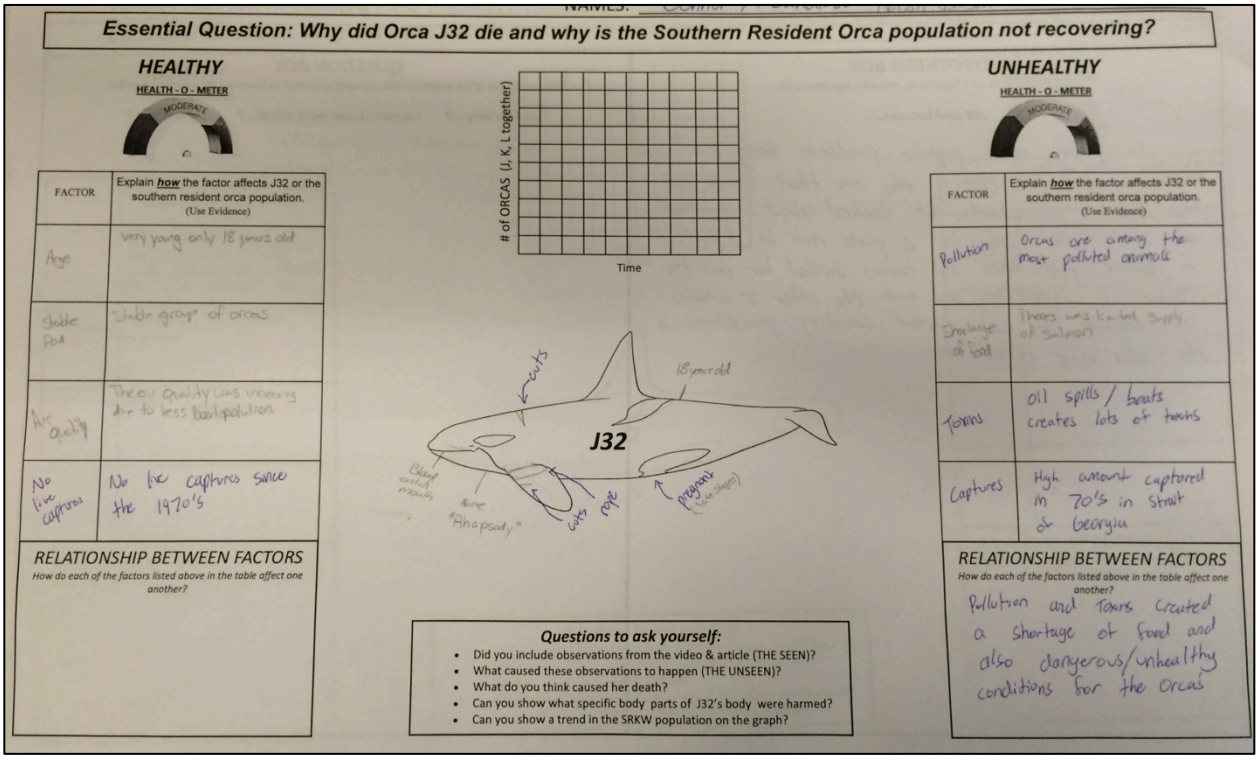
- Did you include observations from the news video & article?
- What caused these observations to happen?
- What do you think caused J32's death?
- How does each of the factor bubbles (circles above the orca) impact the southern resident orca population?
- Are there any relationships between the factor bubbles and if so please indicate in some way on your model?

Your lingering questions:

I wonder why.....? / I want to know more about....? / Why does....?

HEALTH - O - METER (LOW / MODERATE / HIGH)

Students' initial models (version 1)



Essential Question: Why did Orca J32 die and why is the Southern Resident Orca population not recovering?

HEALTHY

HEALTH - O - METER (MODERATE)

FACTOR	Explain ***how*** the factor affects J32 or the southern resident orca population. (Use Evidence)
Age	very young only 18 years old
Stable Pod	Stable group of orcas
Air quality	The air quality was improving due to less boat pollution
No live captures	No live captures since the 1970's

RELATIONSHIP BETWEEN FACTORS

How do each of the factors listed above in the table affect one another?

# of ORCAS (J, K, L together)

Time

Questions to ask yourself:

- Did you include observations from the video & article (THE SEEN)?
- What caused these observations to happen (THE UNSEEN)?
- What do you think caused her death?
- Can you show what specific body parts of J32's body were harmed?
- Can you show a trend in the SRKW population on the graph?

UNHEALTHY

HEALTH - O - METER (MODERATE)

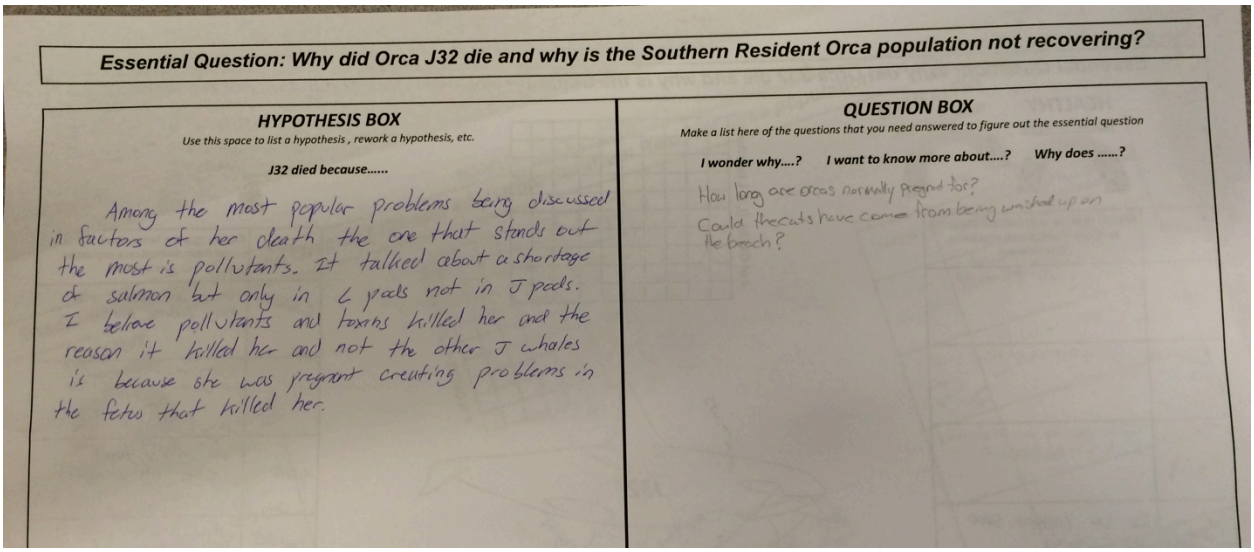
FACTOR	Explain ***how*** the factor affects J32 or the southern resident orca population. (Use Evidence)
Pollution	Orcas are among the most polluted animals
Shortage of food	There was limited supply of salmon
Toxins	Oil spills / boats creates lots of toxins
Captures	High amount captured in 70's in Strait of Georgia

RELATIONSHIP BETWEEN FACTORS

How do each of the factors listed above in the table affect one another?

Pollution and Toxins created a shortage of food and also dangerous/unhealthy conditions for the Orcas

Back:



Essential Question: Why did Orca J32 die and why is the Southern Resident Orca population not recovering?

HYPOTHESIS BOX

Use this space to list a hypothesis , rework a hypothesis, etc.

J32 died because.....

Among the most popular problems being discussed in factors of her death the one that stands out the most is pollutants. It talked about a shortage of salmon but only in 2 pods not in 3 pods. I believe pollutants and toxins killed her and the reason it killed her and not the other 3 whales is because she was pregnant creating problems in the fetus that killed her.

QUESTION BOX

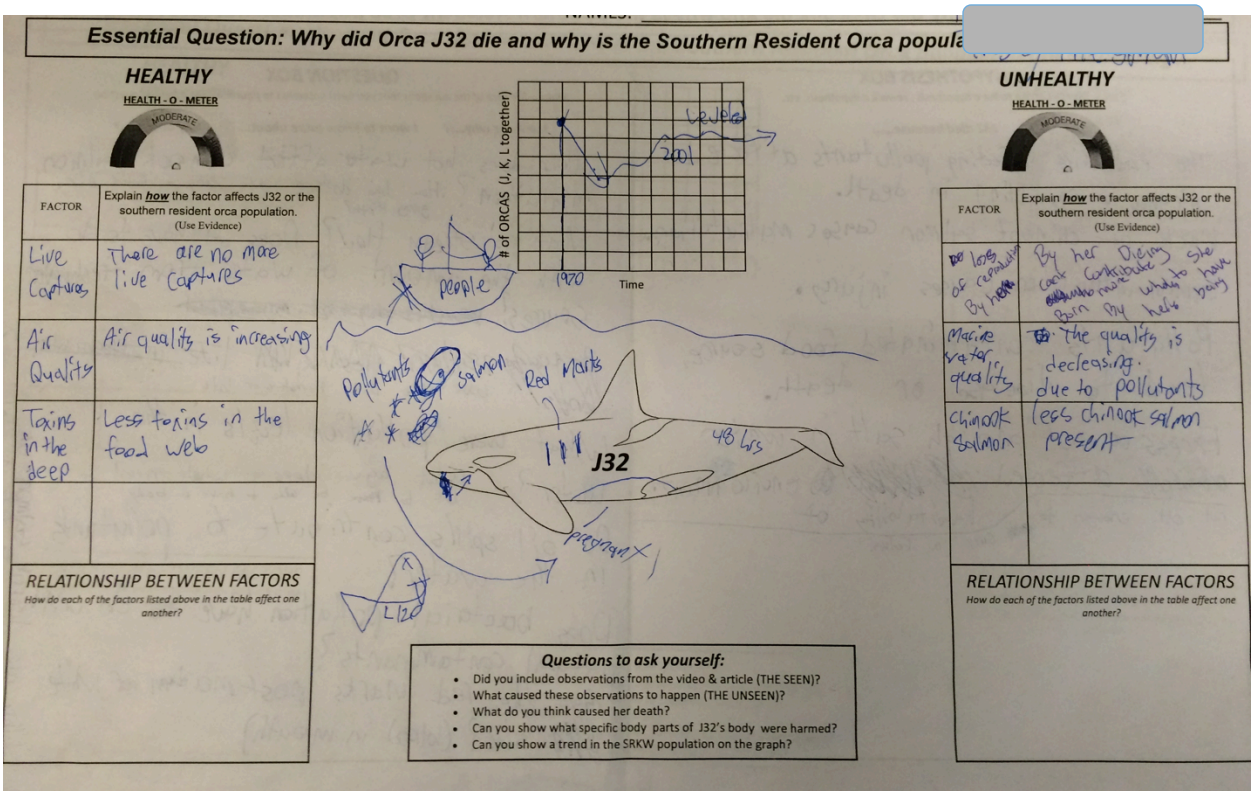
Make a list here of the questions that you need answered to figure out the essential question

I wonder why....? ***I want to know more about....?*** ***Why does .....?***

How long are orcas normally pregnant for?

Could the cats have come from being washed up on the beach?

Front:



Essential Question: Why did Orca J32 die and why is the Southern Resident Orca popula

HEALTHY

HEALTH - O - METER

MODERATE

FACTOR	Explain ***how*** the factor affects J32 or the southern resident orca population. (Use Evidence)
Live Captures	There are no more live captures
Air Quality	Air quality is increasing
Toxins in the deep	Less toxins in the food web

RELATIONSHIP BETWEEN FACTORS

How do each of the factors listed above in the table affect one another?

Questions to ask yourself:

- Did you include observations from the video & article (THE SEEN)?
- What caused these observations to happen (THE UNSEEN)?
- What do you think caused her death?
- Can you show what specific body parts of J32's body were harmed?
- Can you show a trend in the SRKW population on the graph?

UNHEALTHY

HEALTH - O - METER

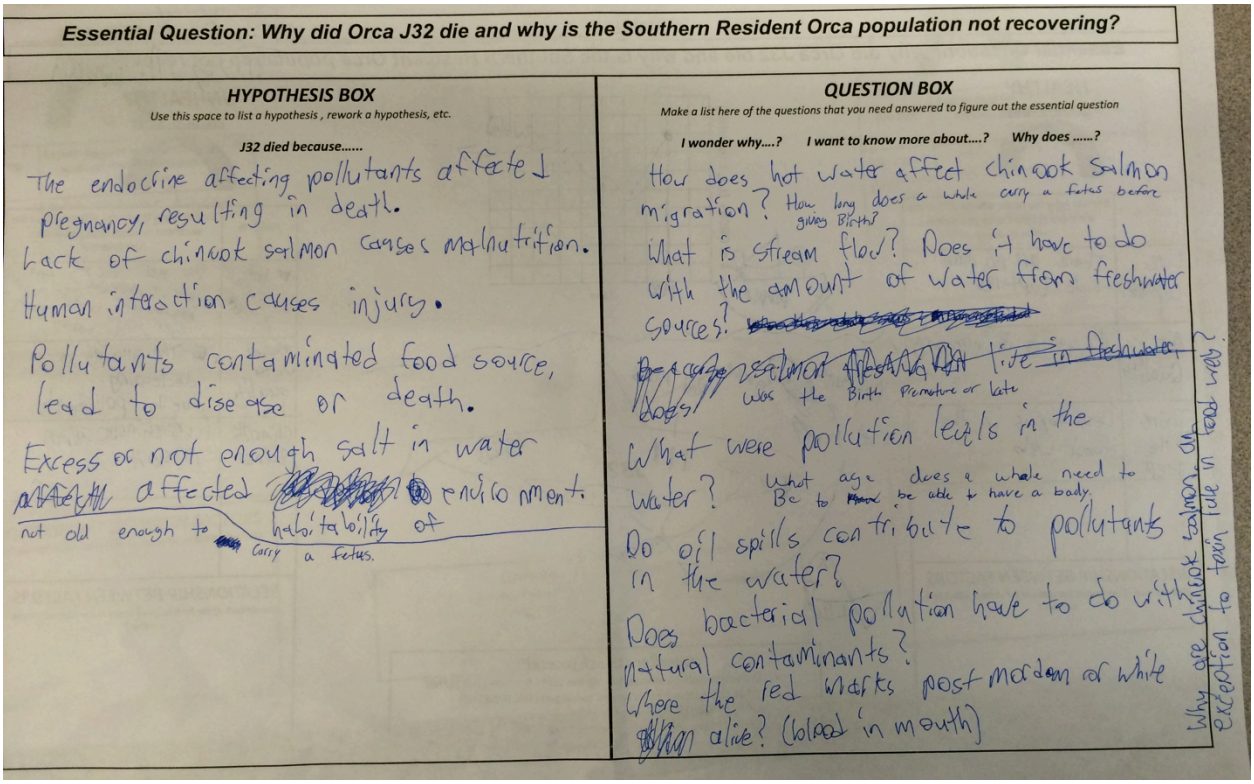
MODERATE

FACTOR	Explain ***how*** the factor affects J32 or the southern resident orca population. (Use Evidence)
loss of reproductive By her	By her Dieing she could contribute to more whales to have born by help
Marine water quality	the quality is decreasing. due to pollutants
Chinook Salmon	less chinook salmon present

RELATIONSHIP BETWEEN FACTORS

How do each of the factors listed above in the table affect one another?

Back:



Essential Question: Why did Orca J32 die and why is the Southern Resident Orca population not recovering?

HYPOTHESIS BOX

Use this space to list a hypothesis , rework a hypothesis, etc.

J32 died because.....

The endocrine affecting pollutants affected pregnancy, resulting in death.

Lack of chinook salmon causes malnutrition.

Human interaction causes injury.

Pollutants contaminated food source, lead to disease or death.

Excess or not enough salt in water affected environment. not old enough to habitability of carry a fetus.

QUESTION BOX

Make a list here of the questions that you need answered to figure out the essential question

I wonder why....? **I want to know more about....?** **Why does .....?**

How does hot water affect chinook salmon migration? How long does a whale carry a fetus before giving birth?

What is stream flow? Does it have to do with the amount of water from freshwater sources?

~~Because salmon affected life in freshwater,~~ does? was the birth premature or late

What were pollution levels in the water? What age does a whale need to be to be able to have a baby.

Do oil spills contribute to pollutants in the water?

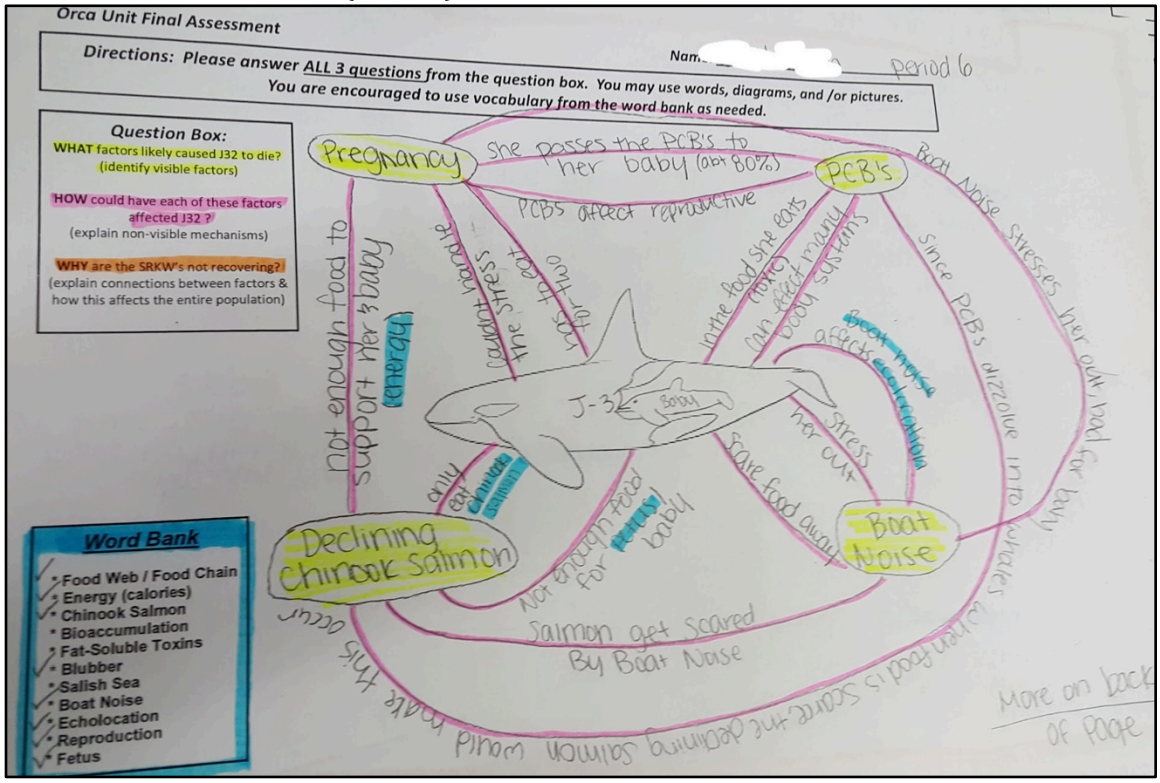
Does bacterial pollution have to do with natural contaminants?

Where the red marks post mordem or while alive? (blood in mouth)

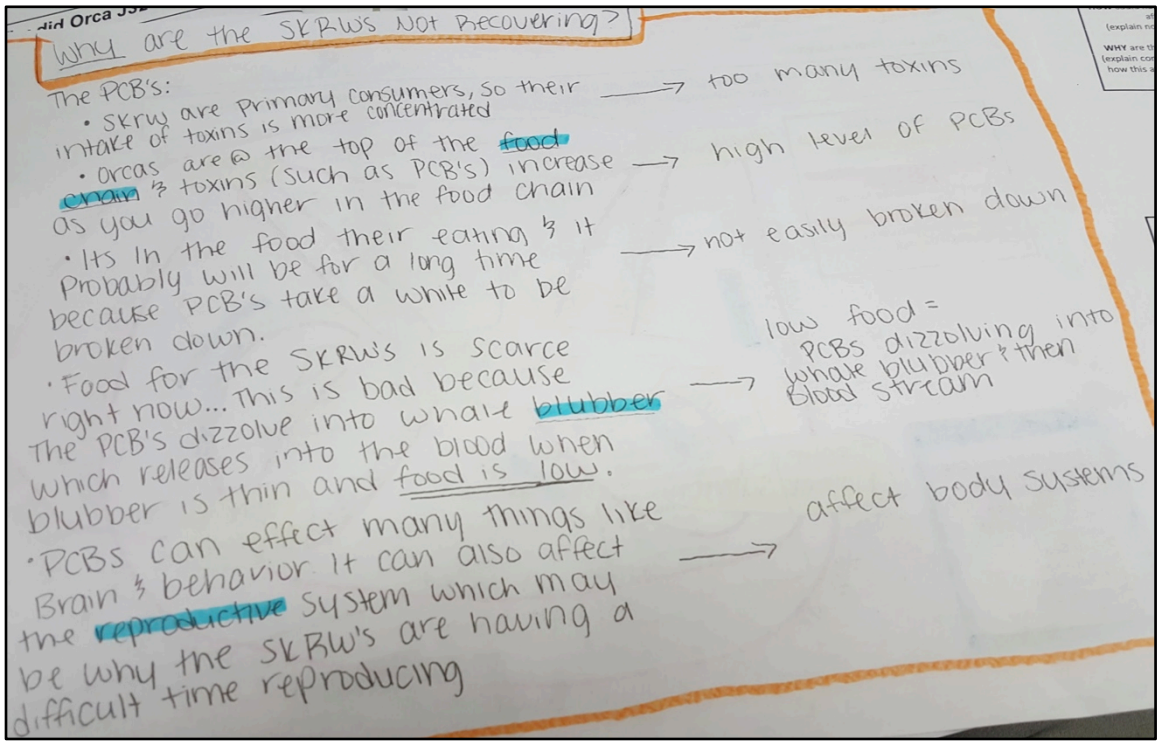
Why are chinook salmon an exception to fact in food web?

Examples of Student Work – Final Assessment:

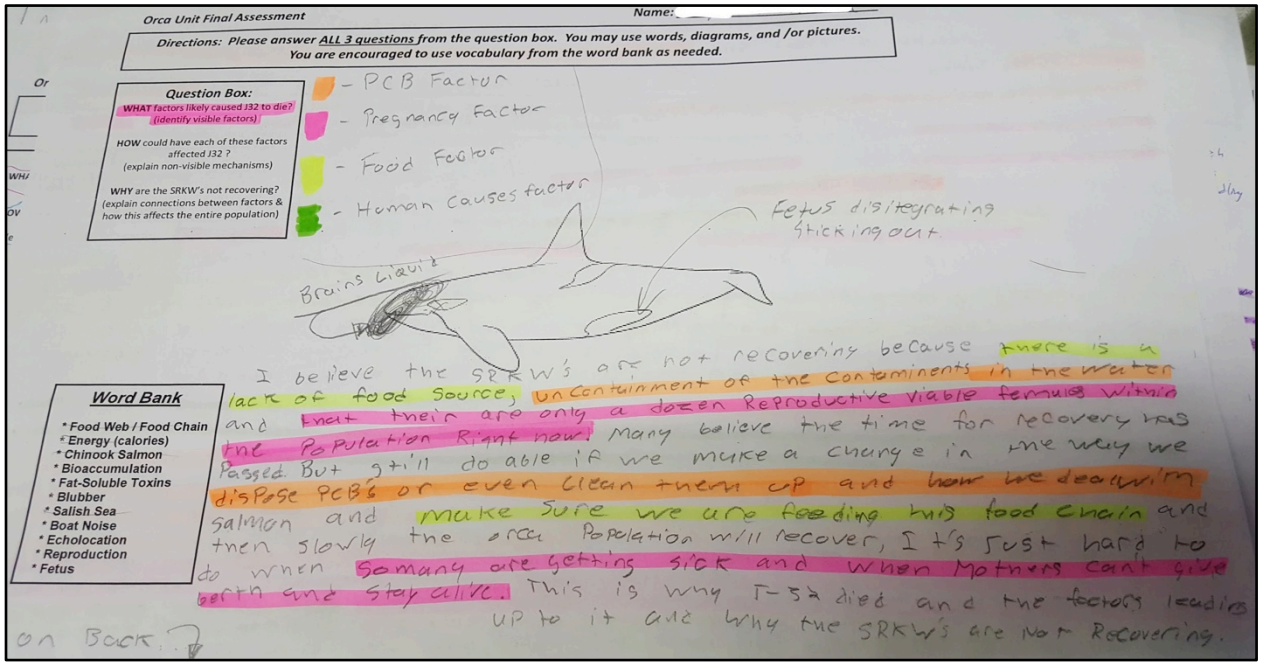
Student A final assessment (FRONT)



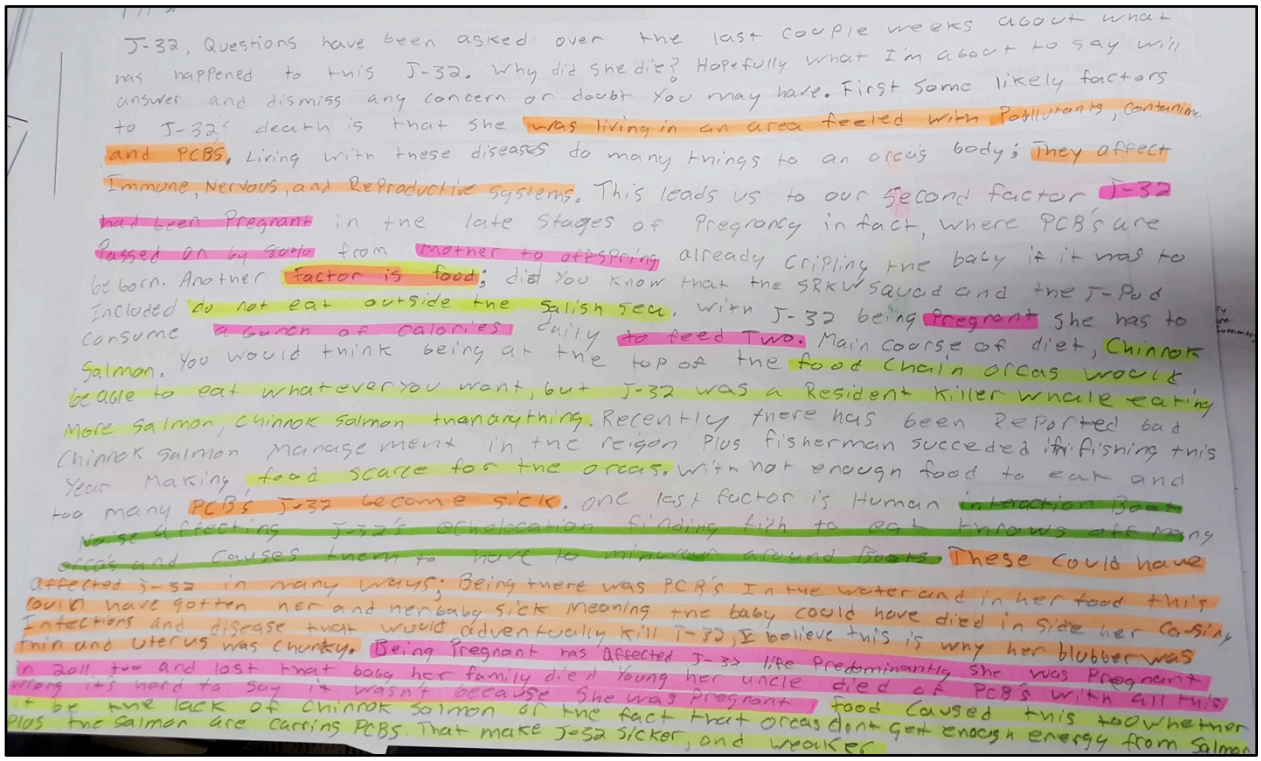
Student A final assessment (BACK)



Student B final assessment (FRONT)

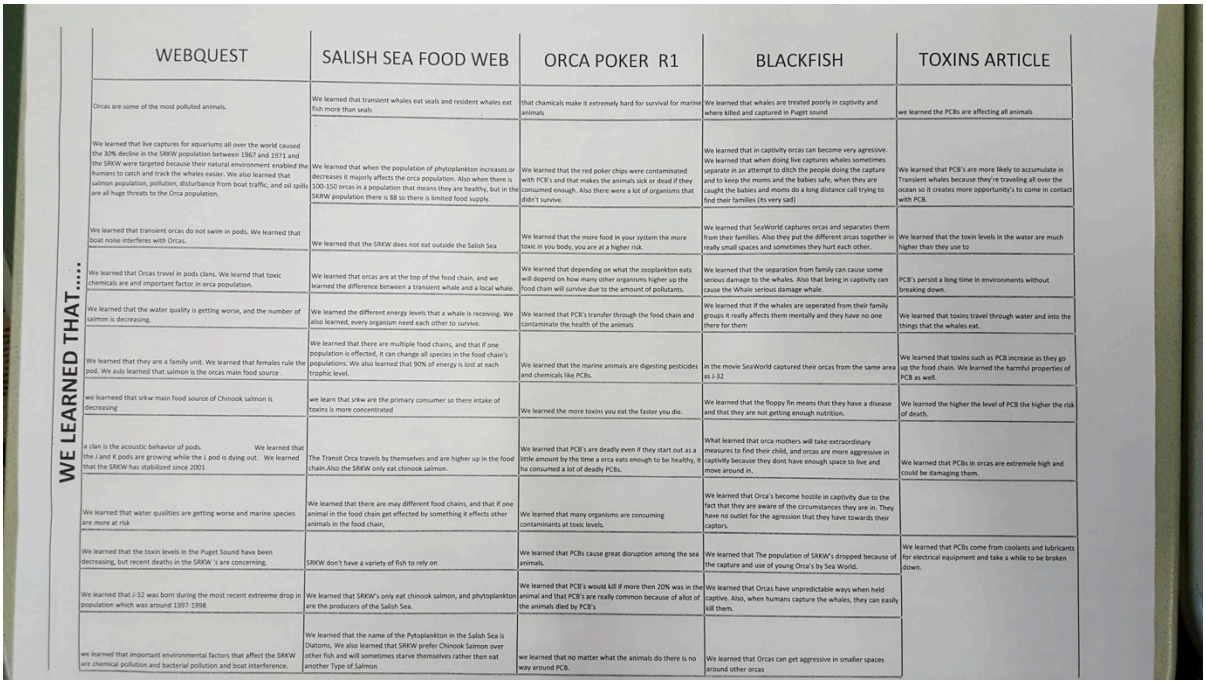


Student B final assessment (BACK)


J-32, Questions have been asked over the last couple weeks about what has happened to this J-32. Why did she die? Hopefully what I'm about to say will answer and dismiss any concern or doubt you may have. First some likely factors to J-32's death is that she was living in an area flooded with Pollutants, Contaminants and PCBS. Living with these diseases do many things to an orcas body; they affect Immune, Nervous, and Reproductive systems. This leads us to our second factor J-32 had been Pregnant in the late Stages of Pregnancy in fact, where PCB's are Passed on by Sorta from mother to offspring already crippling the baby if it was to be born. Another factor is food; did you know that the SRKW squad and the J-Pod Included do not eat outside the Salish Sea. with J-32 being Pregnant she has to consume a bunch of calories daily to feed Two. Main course of diet, Chinook Salmon. You would think being at the top of the food chain orcas would be able to eat whatever you want, but J-32 was a Resident killer whale eating More salmon, chinook salmon than anything. Recently there has been Reported bad Chinook salmon Manage ment in the reigon Plus fisherman succeded in fishing this year Making food scarce for the orcas. with not enough food to eat and too many PCB's J-32 become sick. one last factor is Human interaction Boats noise affecting J-32's echolocation finding fish to eat knowns as many orcas and causes them to have to maneuver around boats. These could have affected J-32 in many ways; Being there was PCB's In the water and in her food this could have gotten her and her baby sick meaning the baby could have died in side her Causing Infections and disease that would adventually kill J-32, I believe this is why her blubber was thin and uterus was chunky. Being Pregnant has affected J-32 life Predominantly she was Pregnant in 2011 too and lost that baby her family died young her uncle died of PCB's with all this wrong it's hard to say it wasn't because she was pregnant food caused this too whether it be the lack of Chinook salmon or the fact that orcas don't get enough energy from salmon plus the salmon are carring PCBS. That make J-32 sicker, and weaker

Additional Documents

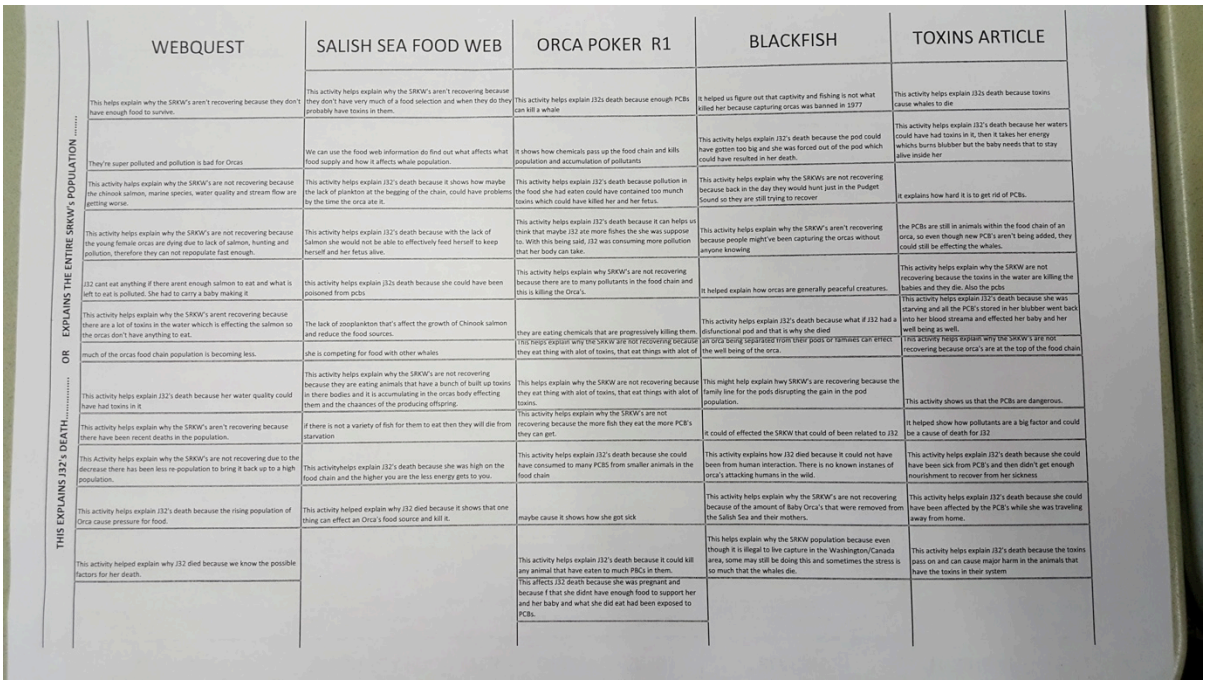
SUMMARY CHART from unit created with students -- PAGE 1 of 2
LEARNING FROM EACH ACTIVITY



WE LEARNED THAT.....

WEBQUEST	SALISH SEA FOOD WEB	ORCA POKER R1	BLACKFISH	TOXINS ARTICLE
Orcas are some of the most polluted animals.	We learned that transient whales eat seals and resident whales eat fish more than seals	that chamicals make it extremely hard for survival for marine animals	We learned that whales are treated poorly in captivity and where killed and captured in Puget sound	we learned the PCBs are affecting all animals
We learned that live captures for aquariums all over the world caused the 30% decline in the SRKW population between 1967 and 1971 and the SRKW were targeted because their natural environment enabled the humans to catch and track the whales easier. We also learned that salmon population, pollution, disturbance from boat traffic, and oil spills are all huge threats to the Orca population.	We learned that when the population of phytoplankton increases or decreases it majorly affects the orca population. Also when there is 100-150 orcas in a population that means they are healthy, but in the SKRW population there is 88 so there is limited food supply.	We learned that the red poker chips were contaminated with PCB's and that makes the animals sick or dead if they consumed enough. Also there were a lot of organisms that didn't survive.	We learned that in captivity orcas can become very agressive. We learned that when doing live captures whales sometimes separate in an attempt to ditch the people doing the capture and to keep the moms and the babies safe, when they are caught the babies and moms do a long distance call trying to find their families (its very sad)	We learned that PCB's are more likely to accumulate in Transient whales because they're traveling all over the ocean so it creates more opportunity's to come in contact with PCB.
We learned that transient orcas do not swim in pods. We learned that boat noise interferes with Orcas.	We learned that the SRKW does not eat outside the Salish Sea	We learned that the more food in your system the more toxic in you body, you are at a higher risk.	We learned that SeaWorld captures orcas and separates them from their families. Also they put the different orcas together in really small spaces and sometimes they hurt each other.	We learned that the toxin levels in the water are much higher than they use to
We learned that Orcas travel in pods clans. We learnd that toxic chemicals are and important factor in orca population.	We learned that orcas are at the top of the food chain, and we learned the difference between a transient whale and a local whale.	We learned that depending on what the zooplankton eats will depend on how many other organisms higher up the food chain will survive due to the amount of pollutants.	We learned that the separation from family can cause some serious damage to the whales. Also that being in captivity can cause the Whale serious damage whale.	PCB's persist a long time in environments without breaking down.
We learned that the water quality is getting worse, and the number of salmon is decreasing.	We learned the different energy levels that a whale is receiving. We also learned, every organism need each other to survive.	We learned that PCB's transfer through the food chain and contaminate the health of the animals	We learned that if the whales are seperated from their family groups it really affects them mentally and they have no one there for them	We learned that toxins travel through water and into the things that the whales eat.
We learned that they are a family unit. We learned that females rule the pod. We aslo learned that salmon is the orcas main food source .	We learned that there are multiple food chains, and that if one population is effected, it can change all species in the food chain's populations. We also learned that 90% of energy is lost at each trophic level.	We learned that the marine animals are digesting pesticides and chemicals like PCBs.	in the movie SeaWorld captured their orcas from the same area as J-32	We learned that toxins such as PCB increase as they go up the food chain. We learned the harmful properties of PCB as well.
we learneed that srkw main food source of Chinook salmon is decreasing	we learn that srkw are the primary consumer so there intake of toxins is more concentrated	We learned the more toxins you eat the faster you die.	We learned that the floppy fin means that they have a disease and that they are not getting enough nutrition.	We learned the higher the level of PCB the higher the risk of death.
a clan is the acoustic behavior of pods. We learned that the J and K pods are growing while the L pod is dying out. We learned that the SRKW has stabilized since 2001	The Transit Orca travels by themselves and are higher up in the food chain.Also the SRKW only eat chinook salmon.	We learned that PCB's are deadly even if they start out as a little amount by the time a orca eats enough to be healthy, it ha consumed a lot of deadly PCBs.	What learned that orca mothers will take extraordinary measures to find their child, and orcas are more aggressive in captivity because they dont have enough space to live and move around in.	We learned that PCBs in orcas are extremele high and could be damaging them.
We learned that water qualities are getting worse and marine species are more at risk	We learned that there are may different food chains, and that if one animal in the food chain get effected by something it effects other animals in the food chain,	We learned that many organisms are consuming contaminants at toxic levels.	We learned that Orca's become hostile in captivity due to the fact that they are aware of the circumstances they are in. They have no outlet for the agression that they have towards their captors.	
We learned that the toxin levels in the Puget Sound have been decreasing, but recent deaths in the SRKW 's are concerning.	SRKW don't have a variety of fish to rely on	We learned that PCBs cause great disruption among the sea animals.	We learned that The population of SRKW's dropped because of the capture and use of young Orca's by Sea World.	We learned that PCBs come from coolants and lubricants for electrical equipment and take a while to be broken down.
We learned that J-32 was born during the most recent extreeme drop in population which was around 1997-1998	We learned that SRKW's only eat chinook salmon, and phytoplankton are the producers of the Salish Sea.	We learned that PCB's would kill if more then 20% was in the animal and that PCB's are really common because of allot of the animals died by PCB's	We learned that Orcas have unpredictable ways when held captive. Also, when humans capture the whales, they can easily kill them.	
we learned that important environmental factors that affect the SRKW are chemical pollution and bacterial pollution and boat interference.	We learned that the name of the Pytoplankton in the Salish Sea is Diatoms, We also learned that SRKW prefer Chinook Salmon over other fish and will sometimes starve themselves rather then eat another Type of Salmon	we learned that no matter what the animals do there is no way around PCB.	We learned that Orcas can get aggressive in smaller spaces around other orcas	

SUMMARY CHART from unit created with students -- PAGE 2 of 2
CONNECTION TO EXPLAIN J32 PHENOMENON



THIS EXPLAINS J32's DEATH..... OR EXPLAINS THE ENTIRE SRKW's POPULATION .....

WEBQUEST	SALISH SEA FOOD WEB	ORCA POKER R1	BLACKFISH	TOXINS ARTICLE
This helps explain why the SRKW's aren't recovering because they don't have enough food to survive.	This activity helps explain why the SRKW's aren't recovering because they don't have very much of a food selection and when they do they probably have toxins in them.	This activity helps explain J32s death because enough PCBs can kill a whale	it helped us figure out that captivity and fishing is not what killed her because capturing orcas was banned in 1977	This activity helps explain J32s death because toxins cause whales to die
They're super polluted and pollution is bad for Orcas	We can use the food web information do find out what affects what food supply and how it affects whale population.	It shows how chemicals pass up the food chain and kills population and accumulation of pollutants	This activity helps explain J32's death because the pod could have gotten too big and she was forced out of the pod which could have resulted in her death.	This activity helps explain J32's death because her waters could have had toxins in it, then it takes her energy whichs burns blubber but the baby needs that to stay alive inside her
This activity halps explain why the SRKW's are not recovering because the chinook salmon, marine species, water quality and stream flow are getting worse.	This activity helps explain J32's death because it shows how maybe the lack of plankton at the begging of the chain, could have problems by the time the orca ate it.	This activity helps explain J32's death because pollution in the food she had eaten could have contained too munch toxins which could have killed her and her fetus.	This activity helps explain why the SRKW's are not recovering because back in the day they would hunt just in the Pudget Sound so they are still trying to recover	it explains how hard it is to get rid of PCBs.
This activity helps explain why the SRKW's are not recovering because the young female orcas are dying due to lack of salmon, hunting and pollution, therefore they can not repopulate fast enough.	This activity helps explain J32's death because with the lack of Salmon she would not be able to effectively feed herself to keep herself and her fetus alive.	This activity helps explain J32's death because it can helps us think that maybe J32 ate more fishes the she was suppose to. With this being said, J32 was consuming more pollution that her body can take.	This activity helps explain why the SRKW's aren't recovering because people might've been capturing the orcas without anyone knowing	the PCBs are still in animals within the food chain of an orca, so even though new PCB's aren't being added, they could still be effecting the whales.
J32 cant eat anything if there arent enough salmon to eat and what is left to eat is polluted. She had to carry a baby making it	this activity helps explain J32s death because she could have been poisoned from pcbs	This activity helps explain why SRKW's are not recovering because there are to many pollutants in the food chain and this is killing the Orca's.	It helped explain how orcas are generally peaceful creatures.	This activity helps explain why the SRKW are not recovering because the toxins in the water are killing the babies and they die. Also the pcbs
This activity helps explain why the SRKW's arent recovering because there are a lot of toxins in the water which is effecting the salmon so the orcas don't have anything to eat.	The lack of zooplankton that's affect the growth of Chinook salmon and reduce the food sources.	they are eating chemicals that are progressively killing them.	This activity helps explain J32's death because what if J32 had a disfunctional pod and that is why she died	This activity helps explain J32's death because she was starving and all the PCB's stored in her blubber went back into her blood streama and effected her baby and her well being as well.
much of the orcas food chain population is becoming less.	she is competing for food with other whales	This helps explain why the SRKW are not recovering because they eat thing with alot of toxins, that eat things with alot of	an orca being separated from their pods or famiees can effect the well being of the orca.	This activity helps explain why the SRKW's are not recovering because orca's are at the top of the food chain
This activity helps explain J32's death because her water quality could have had toxins in it	This activity helps explain why the SRKW's are not recovering because they are eating animals that have a bunch of built up toxins in there bodies and it is accumulating in the orcas body effecting them and the chaances of the producing offspring.	This helps explain why the SRKW are not recovering because they eat thing with alot of toxins, that eat things with alot of toxins.	This might help explain hwy SRKW's are recovering because the family line for the pods disrupting the gain in the pod population.	This activity shows us that the PCBs are dangerous.
This activity helps explain why the SRKW's aren't recovering because there have been recent deaths in the population.	if there is not a variety of fish for them to eat then they will die from starvation	This activity helps explain why the SRKW's are not recovering because the more fish they eat the more PCB's they can get.	It could of effected the SRKW that could of been related to J32	It helped show how pollutants are a big factor and could be a cause of death for J32
This Activity helps explain why the SRKW's are not recovering due to the decrease there has been less re-population to bring it back up to a high population.	This activityhelps explain J32's death because she was high on the food chain and the higher you are the less energy gets to you.	This activity helps explain J32's death because she could have consumed to many PCBS from smaller animals in the food chain	This activity explains how J32 died because it could not have been from human interaction. There is no known instanes of orca's attacking humans in the wild.	This activity helps explain J32's death because she could have been sick from PCB's and then didn't get enough nourishment to recover from her sickness
This activity helps explain J32's death because the rising population of Orca cause pressure for food.	This activity helped explain why J32 died because it shows that one thing can effect an Orca's food source and kill it.	maybe cause it shows how she got sick	This activity helps explain why the SRKW's are not recovering because of the amount of Baby Orca's that were removed from the Salish Sea and their mothers.	This activity helps explain J32's death because she could have been affected by the PCB's while she was traveling away from home.
This activity helped explain why J32 died because we know the possible factors for her death.		This activity helps explain J32's death because it could kill any animal that have eaten to much PBCs in them.	This helps explain why the SRKW population because even though it is illegal to live capture in the Washington/Canada area, some may still be doing this and sometimes the stress is so much that the whales die.	This activity helps explain J32's death because the toxins pass on and can cause major harm in the animals that have the toxins in their system
		This affects J32 death because she was pregnant and because t that she didnt have enough food to support her and her baby and what she did eat had been exposed to PCBs.		