**APES- *Fish as Fertilizer: The Impacts of Salmon on Coastal Ecosystems***

**Directions:** READ each part carefully- you make take notes and draw the graphs but **DO NOT** write on the packet- **to be re-used**. Answer the following questions for each part. You will be doing a scientific write-up for each part. Please type up answers in complete sentences/paragraphs.

***General Background:*** *Discuss the following:*

* What are the important nutrients in ecosystems?
* What drives the nutrients through ecosystems?
* Describe the idea of a *“nutrient conveyor belt”* carrying marine nutrients to freshwater and terrestrial ecosystems *(Be able to define marine, freshwater, terrestrial and riparian ecosystems)*

***Pacific Salmon Life Cycle:***

**Explain and DIAGRAM (label)** the general life cycle of the Pacific Salmon that spawn in northwestern North America.

***Explain*** how after spawning, the adult salmon die- depositing **biomass** into the river and how this contributes to huge ocean-derived organic material being transported upstream into freshwater and the surrounding riparian ecosystems.

***Stable Isotope Analysis:***

***Explain*** how scientists can find out how much **MDN**’s actually get deposited by using stable isotopes. ***Define isotopes.***

Student Assessment

Below are several suggestions for assessing students’ overall understanding of the case study. The diagram quiz essentially asks students to construct a concept map of the whole case. For more information about concept mapping, see the Resources section.

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 Short essay quiz: Many salmon stocks in the Pacific Northwest have declined greatly since the mid-1800s. What effects might this decline have on both stream and riparian ecosystems? Try to incorporate as many of the ecosystem components and effects that you learned about from the figures in the case as you can.

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 Short essay quiz: Some researchers call Pacific salmon “keystone species” in coastal ecosystems. A keystone species is one that has a disproportionate and widespread impact within its ecosystem or community. Based on what you learned in this case study, do you think salmon are keystone species? Support your answer with evidence from the research studies you examined.

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 Diagram quiz: Make as complete a diagram as you can of the movement of nutrients from the ocean into components of the stream and riparian ecosystem. Label each component in your diagram. Between components, write a phrase or sentence that clearly describes the relationship or connection between the components.