**Research Review 4:**

**Summary**

    This research looks at upwelling in the eastern boundary current systems. Upwelling is a process by which the wind causes cold nutrient rich waters to rise to the surface. This research is unique in that it looks at seasonal upwelling’s effects on top ecosystem predators. The hypothesis they investigated is that Spring and Summer working through indirect trophic interactions have an effect on top predators. The study took place in the California Current where bottom-up processes are considered to dominant the food web. One of the main reasons research similar to this is difficult to conduct is that it is hard to measure the many complex pieces of the system on appropriate temporal and spatial scales.

    The researchers developed a number of regression models that utilized the predictor and response variables shown in Table 1. Path analysis was run separately for Spring/Summer upwelling and Winter upwelling. Statistical significance was determined through path analysis and regression analysis.

**Table 1: Predictor and Response Variables**

|  |  |
| --- | --- |
| **Predictor Variables** | **Response Variables** |
| Upwelling | Splitnose Rockfish growth |
| Chlorophyll | Seabird Reproductive Success and Timing of Breeding |
| Zooplankton | Chinook Salmon Abundance |
| Forage Fish | Humpback Whale Abundance |

   The researchers found support for their hypothesis. A number of other key findings include the following:

* Seabird phenology has ties to both winter and summer upwelling through zooplankton
* Seabird breeding success was related to summer upwelling through zooplankton
* Humpback whale and salmon abundance were related to summer upwelling
* Most predator responses are indirect and vary with known predator food behaviors.

    Another important part of this research was the path analysis and modeling framework that could be further utilized in similar research. One area that the study suggests is using it to model predator response to climate variability.

**Discussion**

    Some areas that could be further explored are those discussed by the researchers themselves in analyzing how climate change influences the seasonality of upwelling and how this would affect the complex food webs that depend on these processes. Something else that stood out in this research was the use of multiple data sources and how the researchers combined them in order to look at a complex issue. One area that stood out to me if I were to rewrite this study is to possibly expand upon regression utilized but with more complex computational modeling. The use of this might allow for more data from a number of ecosystems to help strengthen the conclusions that the researchers have drawn.

**Citations:**

S.A. Thompson, W.J. Sydeman, J.A. Santora, B.A. Black, R.M. Suryan, J. Calambokidis, W.T.

Peterson, S.J. Bograd. *Linking predators to seasonality of upwelling: using food web indicators and path analysis to infer trophic connections* Progress in Oceanography. (2012)