

Differences in Diet of Adult Pelagic Sharks and Adult Skates/Rays

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In the Pacific Ocean bordering western California, there are two groups in the subclass of fish known as elasmobranchs that we will be focusing on; one being the west coast adult pelagic shark, the other being west coast adult skates/rays. According to the Florida Museum of Natural History, what differentiates skates/rays from other fish are their dorso-ventrally flattened bodies. What makes pelagic sharks stand out from the overall grouping of sharks is that they are open sea swimmers and hunters.

I find this topic fascinating because despite being in the same subclass, the way these animals hunt, swim, and utilize survival tactics are unique to each species. When they have many similarities and many differences, the question comes to mind, is there a difference in something as small as the composition of their diet?

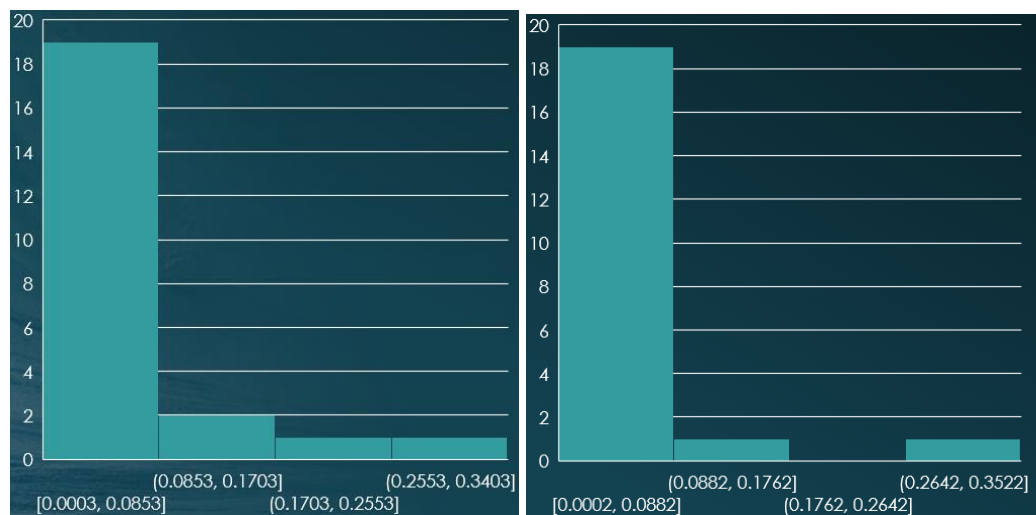
Research Question and Descriptive Statistics

To be exact, does the mean proportion of diet composition by weight of west coast adult pelagic sharks have a lower mean proportion of diet composition by weight than that of west coast adult skates/rays? To find out, I will be sourcing data from the NOAA Fisheries Northwest Fisheries Science Center. The data set is called **West Coast fish, mammal, and bird species diets: West coast fish, mammal, bird diets by Functional Group** by Isaac Kaplan. Kaplan does not say how data was collected however, it was used in the **NOAA Technical Memorandum U.S. DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration National Marine Fisheries Service a Synthesis of Diets and Trophic**

Ecosystem Model of the California Current's food web and oceanography.

[illegible]

Confidence Intervals and Histograms



Despite appearing similar, there is a difference in the dispersion of data. Both data sets lean heavily to the left, but the west coast adult pelagic shark data is more evenly distributed.

Adult Skates/Ray			Adult Pelagic Shark		
0.0456		COUNT	21.00		
0.0444		MEAN	0.05		
0.0828		STANDARD DEVIATION	0.07	0.0043	COUNT
0.0276		STANDARD ERROR	0.02	0.0037	23.00
0.0032				0.0545	MEAN
0.1659		Confidence Interval	95%	0.0262	STANDARD DEVIATION
0.0048		Level of Significance	0.05	0.2246	STANDARD ERROR
0.0173				0.012	Confidence Interval
0.0431		CONFIDENCE INTERVAL		0.0096	95%
0.0002		t-critical	2.086	0.0317	Level of Significance
0.0112		Lower Limit	0.016019866	0.1156	
0.0018		Upper Limit	0.078884896	0.0049	CONFIDENCE INTERVAL
0.0177				0.0359	t-critical
0.0639				0.2556	2.074
0.0391				0.0384	Lower Limit
0.0034				0.1019	Upper Limit
0.2956				0.0024	
0.0009				0.0322	
0.0042				0.0089	
0.0704				0.0089	
0.0534				0.0048	
				0.0121	
				0.0003	
				0.0088	
				0.0027	

Based on the above confidence intervals, the plausible values for the true mean pelagic shark diet weight are between 0.013572727 and 0.073383795, while the true mean skate/ray diet is between 0.013352037 and 0.044873127. When comparing the numbers, the diet weight of adult pelagic sharks has a larger range than that of the skate/ray diet. Additionally, the confidence intervals would seem to indicate that the pelagic shark does not have a lower mean proportion of diet composition of weight than the skates/rays. The confidence intervals overlap because the upper limit of the adult pelagic shark diet is higher than the upper limit of the rays and skates diet weight proportions. The lower limit of the skates and rays' diet is less than that of the pelagic shark. This implies that there could be a population percentage of pelagic sharks and skates/rays that share the same diet proportions. However, it is more likely that pelagic sharks will lean into one category of food more heavily than skates/rays.

Hypothesis Testing and Conclusion

The null hypothesis is that there is no difference between west coast adult pelagic sharks diet weight composition and that of west coast adult skates/rays. The alternative hypothesis is that there is a difference in the diet weight composition between west coast adult pelagic sharks and west coast adult skates and rays.

$$\text{Null Hypothesis: } H_0 = \mu_1 - \mu_2 = 0$$

$$\text{Alternative Hypothesis: } H_a = \mu_1 - \mu_2 \neq 0$$

Adult Skates/Rays	Adult Pelagic Shark				
0.0456	0.0043	SAMPLE 1: COUNT	21.00	SAMPLE 2: COUNT	23.00
0.0444	0.0037	SAMPLE 1: MEAN	0.05	SAMPLE 2: MEAN	0.04
0.0828	0.0545	SAMPLE 1: STANDARD DEVIATION	0.07	SAMPLE 2: STANDARD DEVIATION	0.07
0.0276	0.0262	SAMPLE 1: STANDARD ERROR	0.02	SAMPLE 2: STANDARD ERROR	0.01
0.0032	0.2246				
0.1659	0.012	Confidence Interval	95%		
0.0048	0.0096	Level of Significance	0.05		
0.0173	0.0317				
0.0431	0.1156	HYPOTHESIS TEST RESULTS			
0.0002	0.0049	t-statistic	0.1905		
0.0112	0.0359	p-value (1-tail)	0.4254		
0.0018	0.2556	p-value (2-tails)	0.8508		
0.0177	0.0384				
0.0639	0.1019				
0.0391	0.0024				
0.0034	0.0322				
0.2956	0.0089				
0.0009	0.0089				
0.0042	0.0048				
0.0704	0.0121				
0.0534	0.0003				
	0.0088				
	0.0027				

The hypothesis test states that the significance level is 0.05, the test statistic is 0.1905, and the p-value is 0.85 as this is a two tailed test. With this information, we can conclude

that we must accept the null hypothesis. At a 5% significance level, there is not enough evidence to support the claim that there is a difference in mean proportion of diet composition of adult west coast pelagic sharks compared to adult west coast rays/skates. If we follow the null/alternative hypothesis equations, there is a difference of 0.01 however there is not enough data for this to be statistically significant. This is demonstrated by $P > \alpha = 85\% > 5\%$.

References

Florida Museum of Natural History. (n.d.). *Skate & ray biology*. Discover Fishes.

<https://www.floridamuseum.ufl.edu/discover-fish/skates-rays/biology>

Kaplan, Isaac; 06/30/2017. NOAA Fisheries Northwest Fisheries Science Center. West Coast

fish, mammal, and bird species diets: West coast fish, mammal, bird diets by Functional

Group

(https://www.webapps.nwfsc.noaa.gov/apex/parrdata/inventory/tables/table/west_coast_fish_mammal_bird_diets_by_functional_group)