

# Findings from the Field

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## White Belly Dominance Investigation

Charlotte G

*Adams School, Castine, ME*

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The Calvin Project  
Adams School, Castine Maine  
North Atlantic Right Whale  
Mr. McWeeny, Advisor

White Belly Dominance Investigation  
By Student Scientist Charlotte G.

### **Introduction**

Since I've started to research the North Atlantic right whale, I've come across information about white and black bellies on the right whales. In September of 2018, I joined an organization called 'The Calvin Project'. The Calvin Project is a group of 7th and 8th graders who want to save the North Atlantic right whale. We are named after a whale called Calvin. Calvin is a North Atlantic right whale whose mother, Delilah, was hit by a ship and was killed eight months after Calvin was born. After that, Calvin disappeared. Scientists thought she wouldn't make it. But, a year later, she showed up the same place her mother was killed, which was the Bay Of Fundy. (A whale feeding ground.) Since I've been apart of the Calvin Project, I realised how much I loved researching these whales and how much I want to be a marine biologist. So, I decided to ask this question and see if I'd be able to answer it, are white bellies on whales a dominant trait or a recessive trait? What I mean is, are white or black bellies even passed down from generation to generation? I've been researching this topic for a few weeks, and I've found out a lot more about the topic then I thought I would.



Picture # 1

### Observations

I am doing a project using data already collected about right whales. I am making observations of the data which is sometimes called a metadata analysis. The observations were made on research vessels from 1980 to 2017. The environment was the Atlantic ocean along the east coast of the United States. Most of the observations were made on good weather days using high power cameras to document right whales features. The feature I am studying is white or black bellies of whales. The other data I used is genetic information about the whales. This information is collected at sea also. The research team darts a whale with a hollow arrow tip from a crossbow that collects a small piece of skin from the whale. That skin is then analyzed for sex and other things in a laboratory in Canada at Trent University. So, I did my “observational” research during the hours of 11:40 A.M. - 2:00 P.M. in my school’s science room/lab. I mostly used pen and paper, but I also used my school computer to count and record my observations of the data from the Right Whale Consortium. But before I could start my research, I had to get approval to use the data charts that scientists made at the New England Aquarium. I submitted a data request and received approval. The data charts had a lot of information about all the

567 North Atlantic right whales that have been studied to date. The information I needed was the whale's gender, what year it was born, who the mother was and who the father was, and most importantly if the whale has a white belly or not.

### **Background Information**

The question I was researching is, "Is the black bellied trait dominant or recessive in North Atlantic right whales?" I read a 1999 paper by Cathy Schaeff about ventral skin color in right whales. She assumed that black bellies were dominant but had no proof. She also thought the ventral skin color trait was not a sex linked trait. So my other question was, "Is the belly color trait sex linked?" Finally, Schaeff concluded that the ventral color patterns in right whales had something to do with an evolutionary process. I thought it was interesting that when Ms Schaeff wrote her paper she had no information about fathers, she only had mothers and calves. Now, twenty years later I have access to the father's information also. I should have been able to prove dominance with this information.



Picture # 1

### **Claims and Analysis**

I made a ton of three-whale family trees that look like picture #3. I wanted to observe how many families had two black bellied parents and a white child, or two white bellied parents and a black child. I thought I would find at least one family tree where the two parents were the same trait and the child was a different trait. If I found just one family like that I could prove which trait was dominant (See a proof of black belly dominance in picture #3). There were more black bellied whales than white bellied whales, but that does not prove dominance and I wanted proof.

My data analysis was very interesting even though it did not include proof about which trait, black or white, was dominant. I made 27 small family trees and not one family tree had two parents the same trait and a child of a different trait. This was very, very frustrating! The observation I was looking for was not found and I could not answer my basic question. But Mr. McWeeny pointed out that zero is an important number in the science community. I shared this information with Amy Knowlton, senior scientist at the New England Aquarium who studies right whales and she was quite surprised. She said that with all the families and not one like pair having a different child would show that the whale parents are not selecting mates randomly. It would be statistically impossible for the whales to be selecting each other randomly and not to have two parents the same with a different child. I did discover something after all. This shows that right whale parents seem to be selecting mates on their belly colors which would be more evidence that some kind of evolution is going on in the right whale population! Very exciting. More work needs to be done on this, and I would love to work on this subject.

My work also included just counting the total number of males and females that had white and black bellies. My numbers are shown in the table below:

Males white: 49    Males black: 108    Females white: 41    Females black: 86

These numbers show that there are no differences in sex when it comes to belly color in right whales. If belly color was sex-linked in right whales then you would expect one sex to have “twice” as many black or white bellies as the other.

I also thought that maybe white bellies were a sex-linked trait, which means a certain trait is more common in one gender than the other. We took the numbers of the whales that we put on our charts (409 out of 567) and did the math, and concluded that they are just as common in females as males. So it is not a sex-linked trait. The percentages show no difference:

Males black: 69%    Males white: 31%    Females black: 68    Females white: 32%

### **Conclusion**

Our results were inconclusive. We tried to prove either black or white bellie’s dominance, but we couldn’t find at least one family tree to prove it. We also tried to find out if white or black bellies are a sex-linked trait, and we were able to conclude that white/black bellies are not a sex-linked trait. Amy Knowlton, a scientist at the New England Aquarium, suggested that since there are no two black bellied parents and a white bellied child or the other way around, the females are choosing who they mate with depending on belly color and that might be an evolution process.

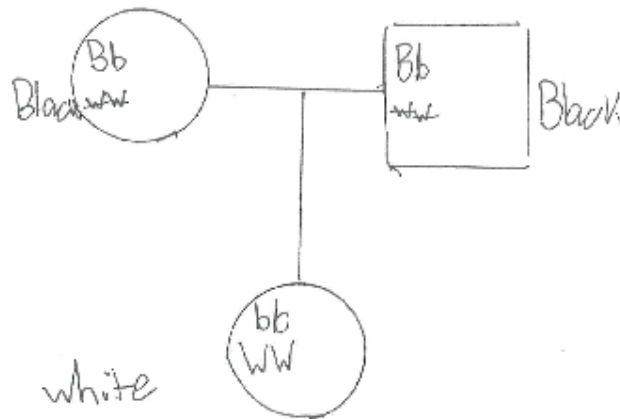
#### REFERNECES:

Schaeff, C.M., Hamilton, P.K., Genetic Basis and evolutionary Significance of Ventral Skin Color Markings in North Atlantic Right Whales (*Eubalaena glacialis*), Biology Department, American University, Washington, DC.

North Atlantic Right Whale Catalogue, New England Aquarium, Central Wharf, Boston, Massachusetts.

Picture # 1 Below:

## Right Whale Proof of Dominance



If black bellies are dominant, it would make sense because even though the two parents have a black belly, they could still have been carrying a <sup>hidden</sup> recessive trait.

If white bellies are dominant, it would not make sense because the parents would not be able to have a hidden dominant trait because then they would just have a white belly.