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In the film "The One Degree Factor," a study conducted by John Hopkins University researchers George Somero and Jonathan Stillman is discussed. In their study, the two found reason to believe that climate change caused the migration of marine invertebrates living in Monterey Bay intertidal zones. As the water warmed, the invertebrates more accustomed to colder temperatures were forced to move on to other areas. This was surprising, as intertidal organisms have a large temperature range, due to the constant change in sea level. A further study by George tried to see how much of an increase in temperature these intertidal organisms could withstand without dying. This was done by attaching a heart monitor to a local species of crab then submerging it in water. The crabs were then subject to increasingly high temperatures. It was found that a two degree Fahrenheit rise in temperature would kill off these creatures. At the current temperature ranges, this would only be about one degree Fahrenheit greater than the highest outlying temperature.

This subject is related to climate change because it causes the intertidal ecosystem to undergo a temperature change; more sunlight and heat reaching the earth will cause temperature to rise. Some impacts may include the dying of vegetation that relies of photosynthesis, as well as migration of species. These species no longer suited to their old environment will then move on to other areas where they may act as invasive species. This is assuming the survivors have a chance to relocate after the ensuing mass dieoff. When these species either die or move elsewhere, the other organisms that relied on them will also be affected. For instance, there may be no other organism that can take their place in the food chain. By a two degrees Fahrenheit rise in temperature, great changes can be caused. Looking closer at this study, I found a Stanford article about it. Because the film did not cover much in depth information, it helped to clarify the scientific process Saermo and Stillman used in their findings.

The two found that migration had actually occurred in the Monterey Bay intertidal zones. They looked at an older survey of intertidal species taken in the early 1930s, and then conducted one of their own in the same location in the early 1990s. Those species that desired cooler

temperatures were already largely gone, while different species were starting to replace them. In their study on the thermal tolerance limit of crabs, they concluded that intertidal species were at higher risk from climate change than subtidal ones. While both groups of organisms had similar tolerance limits, subtidal species would face less variation in temperature, being far below the tideline. (Shwartz)

In terms of evaluating this article, it seems fairly obvious that it is biased toward both Samero and Stillman, as it is published by their academic institution, Stanford University. Internal reports and studies always have a bias, and in fact George Samero happens to be the director of John Hopkins Marine Station. While this article was published on a school news site, and does not list its sources in an academic way, names are used when referring to previous research. This enables one to look back and affirm true statements. The purpose of this article is fairly transparent, it is to simply present the findings in the study and how it relates to climate change. The spin put on the science is pretty clear too; climate change has negative effects for life in the intertidal zones in the Pacific by causing migration. When comparing the information presented here with that in the film, there is a pretty strong correlation. This article supplements and supports the findings as discussed in the film. For instance, the specific genus of crab used in the study, Petrolisthes is mentioned, rather than being vague. Scientific terms are also defined with more detail, like instead of using the phrase “heart failure” this article uses the term “thermal tolerance level,” defined as the point where an organism's internal temperature and biochemistry break down. (Shwartz) The one, most crucial point in this article was that the intertidal species have less chance to survive a jump in temperatures than subtidal species. (Shwartz)

Another article I looked at similarly defended the claims of the John Hopkins studies. The National Centers for Coastal Ocean Science (NCCOS) has tried to take a proactive approach to this issue, using temperature models to predict the risk to species in certain areas. Their models also factor in what they call “foundation species,” organisms that are important in a given local ecosystem. In February 2007 this organisation was able to predict the mass dieoff of sea urchins in

New Zealand. This proves the truth behind climate change driving population change in intertidal regions. The NCCOS makes it very clear, even from their logo that they are sponsored and partnered with the National Oceanic and Atmospheric Administration. As with the other article, this one cites mostly in-house studies and can be seen to laud their success. There are several places on the site one can read about the 2007 New Zealand model prediction. This article is more informational, and as such does not cite sources; if anything else, it seems like it draws authority from the NOAA logo at the top of the page. It does, however, give a brief description of intertidal temperature ranges that is generally accepted. It remains further non-controversial by posing the question of whether the die-offs from climate change are natural or preventable. The spin put on the science is more or less obvious, NOAA believes that climate change is affecting intertidal marine life in a negative way. This can be seen in the prominent focus on the New Zealand study, as well as links at the bottom of the article, which lead to the NCCOS main page and a page discussing the forecasting model. This article takes the research done by Somero and Stillman a step further and discusses ways that national organisations are acting on it. The most important point taken from this article is the fact that these actions are leading to prediction models that actually are proven.

In trying to find a peer reviewed literature on the subject, the introduction to the report "Predicting intertidal organism temperatures with modified land surface models" proved to be of use. In this section, Wethey reinforces the idea of climate change impacting intertidal ecosystems, to the point that changes there can be used to predict changes on the land. While his main point is not directly relevant to this discussion, his argument relies on the local species being near their thermal tolerance limit, giving credence to Samero's study. Because he is looking to track changes related to climate change on land, Wethey takes the position that it is occurring. As this is an academic paper, the sources he cites are directly linked to as they are referenced. Once again, the information presented here reflects the findings of Samero and Stillman.

It seems as though the findings of the two Hopkins Marine Station researchers have been well backed by the research community, being accepted by both government organisations like

NOAA, as well as individuals citing them in other studies, like David Wethey.

Works Cited.

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