The Effects Of Temperature On *Ecklonia Cava* growth and its Implications

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Abstract

Ocean temperatures have been rising over the years and are the cause of declining kelp beds all over the world. *Ecklonia cava* is typically found on the coasts of Asian countries, including Japan and Korea. *E. cava* is not only beneficial for species that rely on it for reproduction and energy, but also has many positive health effects on consumers. This study is to determine the effects of high temperature on the growth of *E. Cava* around the coasts of Japan.
Key Words: *Ecklonia cava*, temperature, photosynthesis, respiration

Introduction

Ocean temperatures have been rising over the years, causing a decline in kelp beds all over the world. One specific species affected by this change in temperature is *Ecklonia cava (E. cava)*. *E. cava* is an edible, brown algae found on the coasts of Korea and Japan, and has been on a decline ever since global ocean temperatures began to rise. This herbal plant found around Japan was first documented in the mid 20th century and began to decline around 1990 (Haraguchi et al., 2009). This plant is valuable because it creates kelp forests that provide breeding grounds and habitats for organisms such as fish, shellfish, and other species (Serisawa et al., 2004; Yotsukura et al., 2010). Animals such as sea urchins and herbivorous fish also graze on *E. cava* beds as a source of energy.

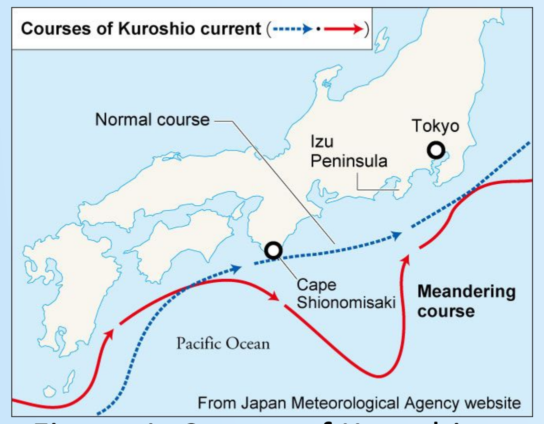


Figure 1. Course of Kuroshio current

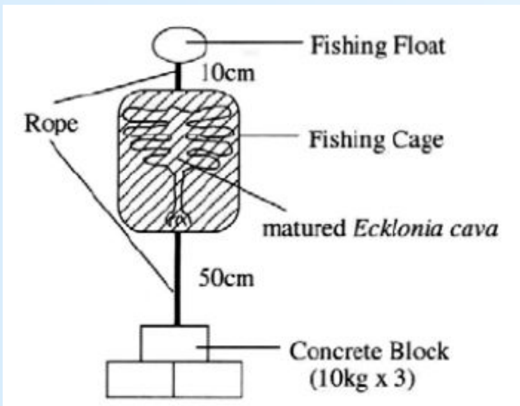


Figure 7. Diagram of the spore bag method

The decline of *E. cava* could end up harming the survival rates of the organisms that depend on *E. cava*. *E. cava* is not only beneficial for the coastal ecosystem, but also has many positive health effects on consumers (Wijesekara et al., 2010). Due to many species benefiting from *E. Cava*, it is important to help prevent the extinction of *E. Cava*. It is an important food source in the ecosystem and also aids fishing industries by sustaining the population of abalone (Haliotidae), which is a type of large sea snail (Serisawa et al., 2004).The income of Japanese fishermen depleted over the following years due to a lack of abalone .

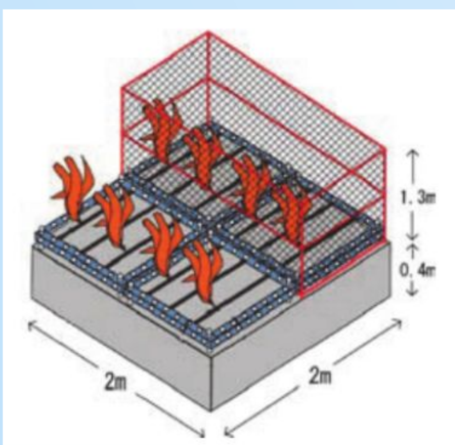


Figure 3. Diagram of the net cage methods


Figure 4. Seedlings on an artificial reef

Purpose

The purpose of this study is to determine the effects of high temperature on the growth of *E. Cava* around the coasts of Japan.

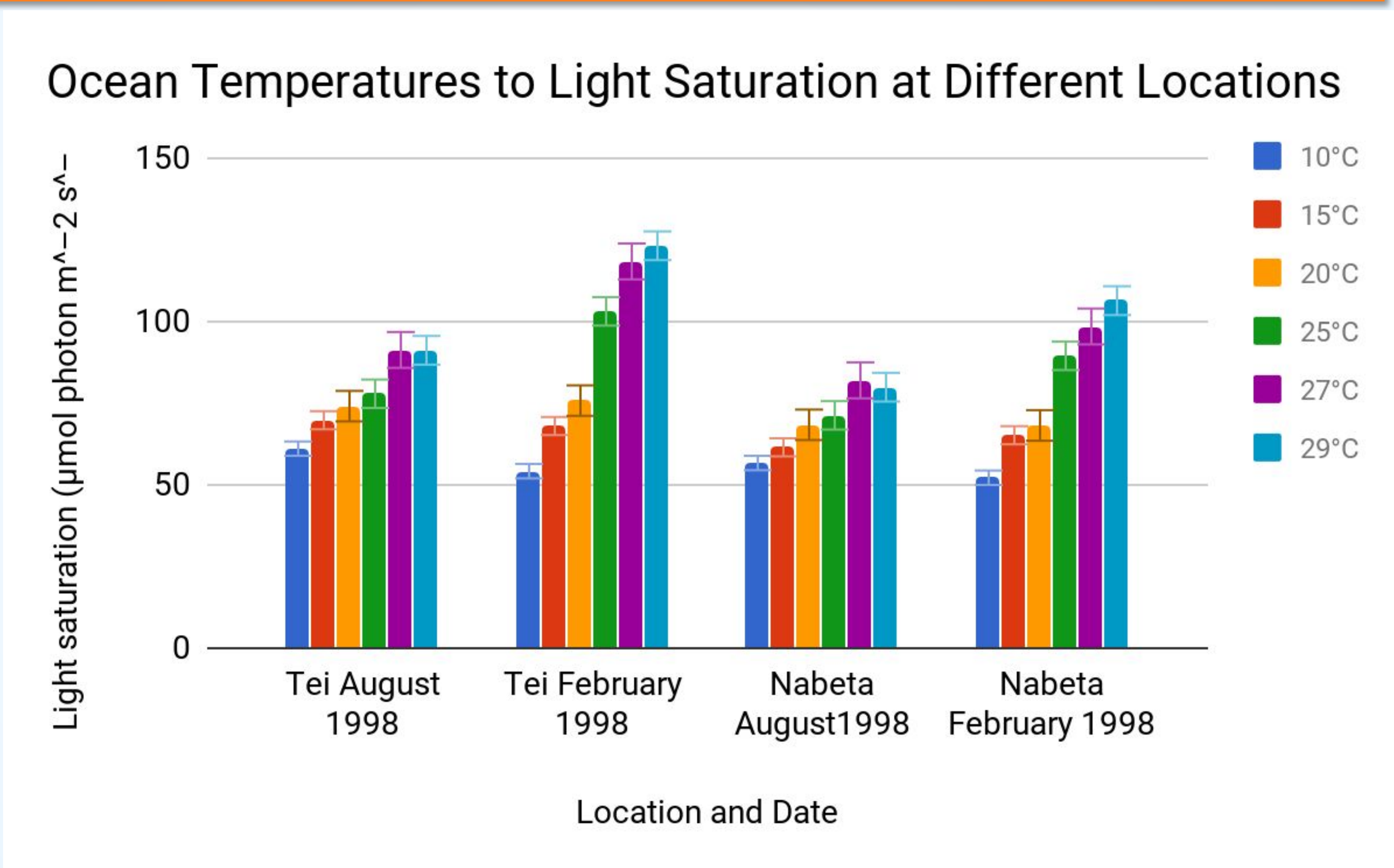
Research Question

Does high temperature affect the growth of *E. Cava* around the coasts of Japan?

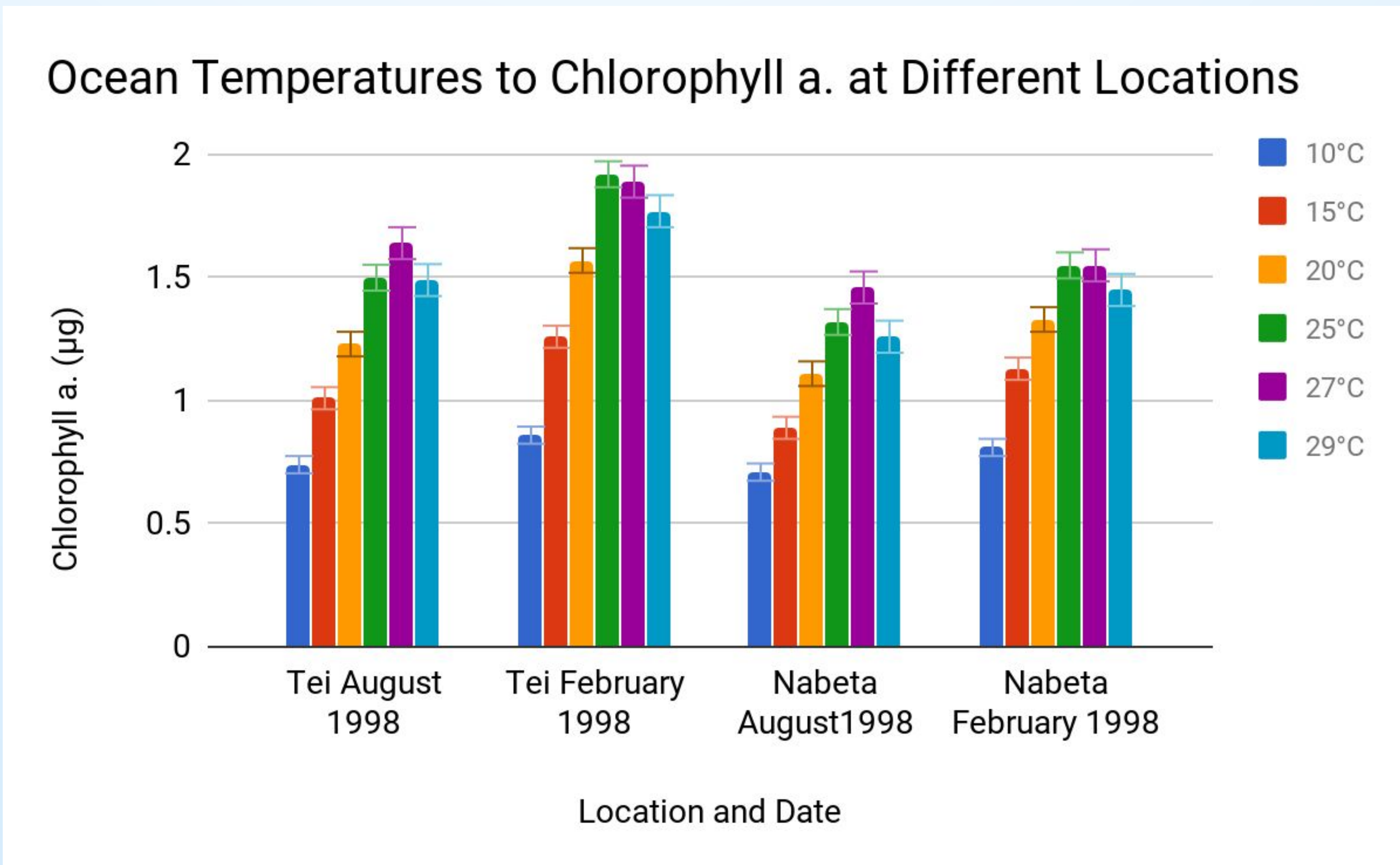
Methods

Systematic review was used to collect articles for the research. EBSCOhost, Google Scholar, ResearchGate, human kinetics journals, CLU Library, CSUCI databases, PLOS, SpringerLink, etc. were used to collect data. Researchers who have access to more articles have also been of assistance in article collection. Keywords such as *Ecklonia cava*, temperature, photosynthesis, and respiration were used to collect articles. Data from 1800 to the present was collected because the decline of *E. cava* was first recorded in this year, so the data from this time period would be most beneficial to the research.

Results



Graph 1. The bladelet light saturation measured at different temperatures and locations



Graph 2. The bladelet chlorophyll a. measured at different temperatures and locations

Discussion

With the systematic review taken place to analyze multiple articles, it was discovered that high temperatures do harm the growth of *E. cava*. The hypothesis proposed was correct, and this supports the decline of *E. cava*. Due to higher temperatures, the *E. cava* has been declining. Data was found correlating increasing temperatures with lower *E. cava* population levels.

The data collected showed that 27°C was the optimal temperature level for the growth of *E. cava*. Up until 26°C, the growth rate was constantly increasing. However, after 27°C, the light saturation, Chlorophyll a. content, and area started to decline. The data collected from the two areas were very similar. In both Tei and Nabeta, the increasing light intensity led to a linear increase in the photosynthetic rate until it reached the light-saturation point. After this point, both photosynthetic rates started to drop. This was due to the light-saturation point limiting the function of light as a growth factor. However, the increase in temperature allowed the light-saturation point to exceed its normal level. The light-saturation point was able to increase until the temperature reached 27°C, where it started to decline.

Conclusion

In this study to determine whether increasing ocean temperatures were causing the decline of *E. cava*, evidence was gathered that increasing temperatures harm the growth rate of *E. cava* at a certain point. This systematic review provides evidence that supports the hypothesis of this study that temperature changes in the ocean do harm the growth of *E. cava*. A correlation was shown between temperature and photosynthetic rate until 27°C, concluding that the most suitable temperature for *E. cava* growth is around 27°C.

Further Work

To further contribute to this study, more research on potential solutions to this problem could be done. Knowing that temperature is one of the main causes of the decline of *E. cava* can be used to solve that problem. Relocating the habitats of *E. cava* to areas with lower temperature levels could assist the growth of *E. cava* and help it repopulate. More research on specifically *E. cava* can also be done to gain more data on the species. Health benefits can also be researched to support why *E. cava* is important to humans and the coastal ecosystem.

References

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