

The Effect of Photoperiod, Light Level, and Temperature on Conchocelis Growth of *Wildemanina amplissima* (Kjellman) Foslie



University of
New Hampshire

AUTHORS

Riplee Mercer

Advisor: Chris Neefus

AFFILIATIONS

University of New Hampshire Department
of Biological Sciences

01. Introduction

Macroalgae aquaculture is a multibillion-dollar industry. The industry includes the cultivation of nori that started in Asia centuries ago. The US macroalgae industry is relatively small, with the predominant crop being kelp. The goal of this project is to diversify the US macroalgae industry in the Northeast by developing the technology necessary for the aquaculture of *Wildemanina amplissima*, a native species of nori. The goal is to use longlines instead of traditional nets, which would create a similarity in protocol between kelp and nori cultivation. The introduction of nori would extend the macroalgae industry's season in the Northeast. Since kelp is a winter crop, nori would allow growers a longer season because its growing period is spring to early summer.

02. Objectives

Develop methods to

- establish and grow the conchocelis stage in laboratory culture
 - trigger conchospore release and growth
 - produce seeded strings for grow-out
- This past year has focused on these tasks (Figure 1)

Grow-out trials

- 3 location sites along the coastline
- Trials will hopefully be conducted this spring at one of the sites (Figure 2)

Figure 1. Life cycle of nori

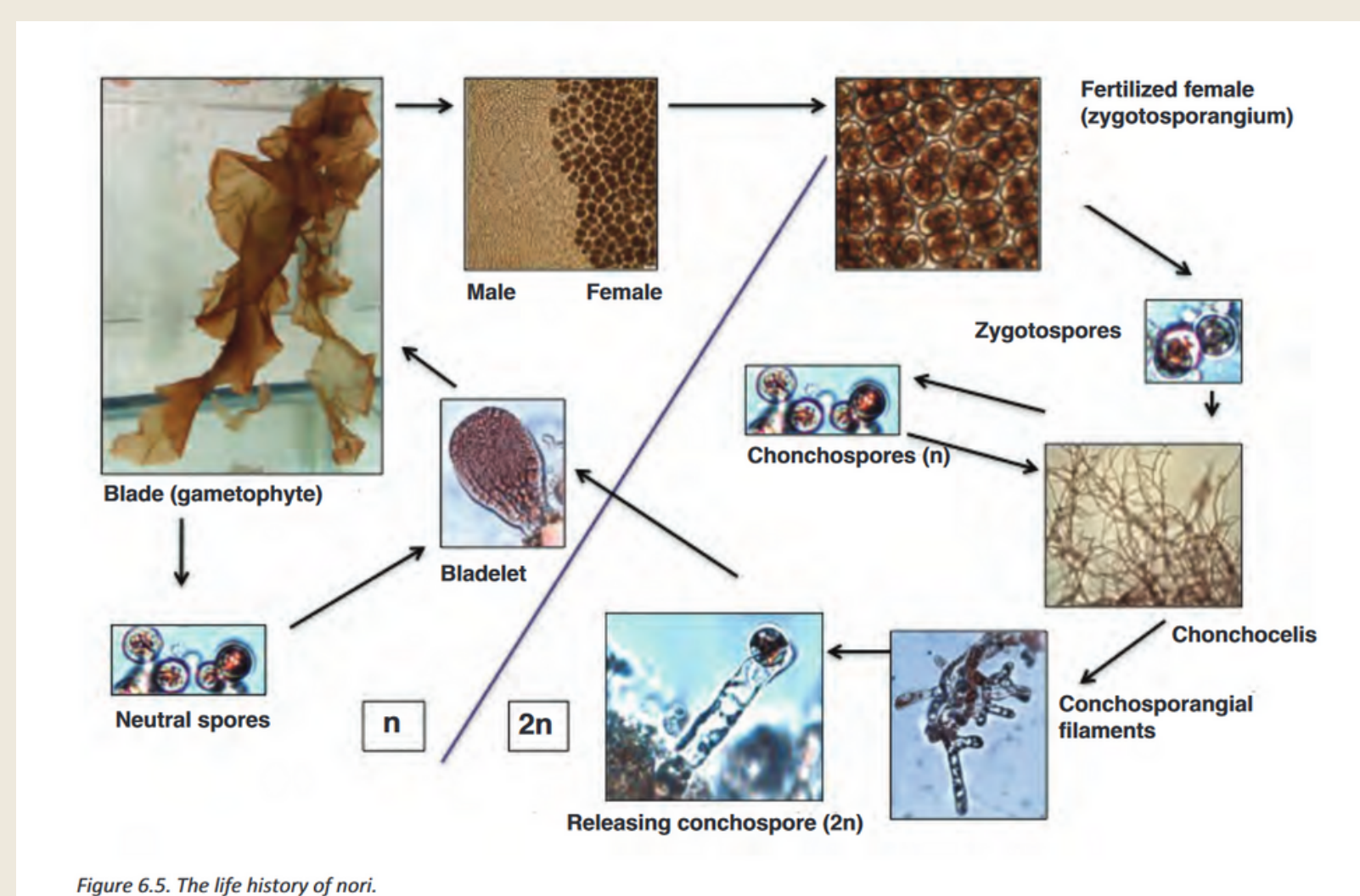
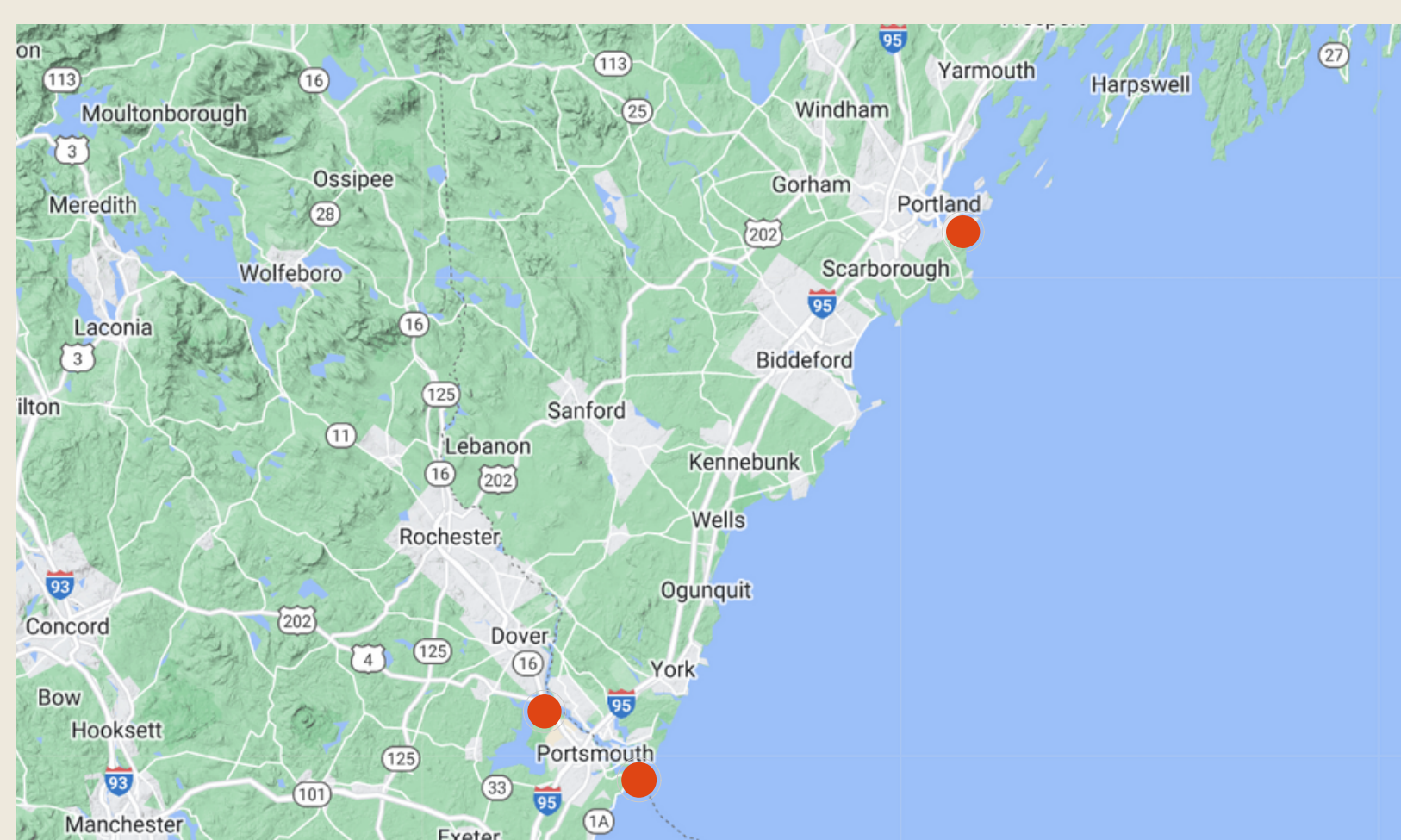


Figure 6.5. The life history of nori.

Figure 2. Collection sites along coastline



03. Methodology

Fertile blades were collected from the 3 sites. Zygospore release was triggered through 2 methods, 1) induced by environmental stressors and then isolated into well-plates using drawn out glass pipettes or 2) fertile blades macerated in a blender, sieved through various mesh sizes and poured over sterilized oyster shells. Culture-chamber experiments were run on the conchocelis stage to see if temperature (10, 14, 18°C), photoperiod (12L:12D and 16L:8D), and light levels (30 and 60 μM/m²/s) influence growth rate. The experiment ran for 7 weeks, with the conchocelis area being calculated weekly using ImageJ. Growth rate was calculated from linear regression of Area vs Week, Growth Rate (% per week) = Slope/Intercept. Conchospore production was encouraged through increased aeration and container size, as well as culture condition changes to simulate the transition to spring (ex. longer warmer days). Any containers that exhibited conchospore release had string added to allow for seeding.

04. Results



Figure 7. Oyster shell seeded with conchocelis through blender extraction

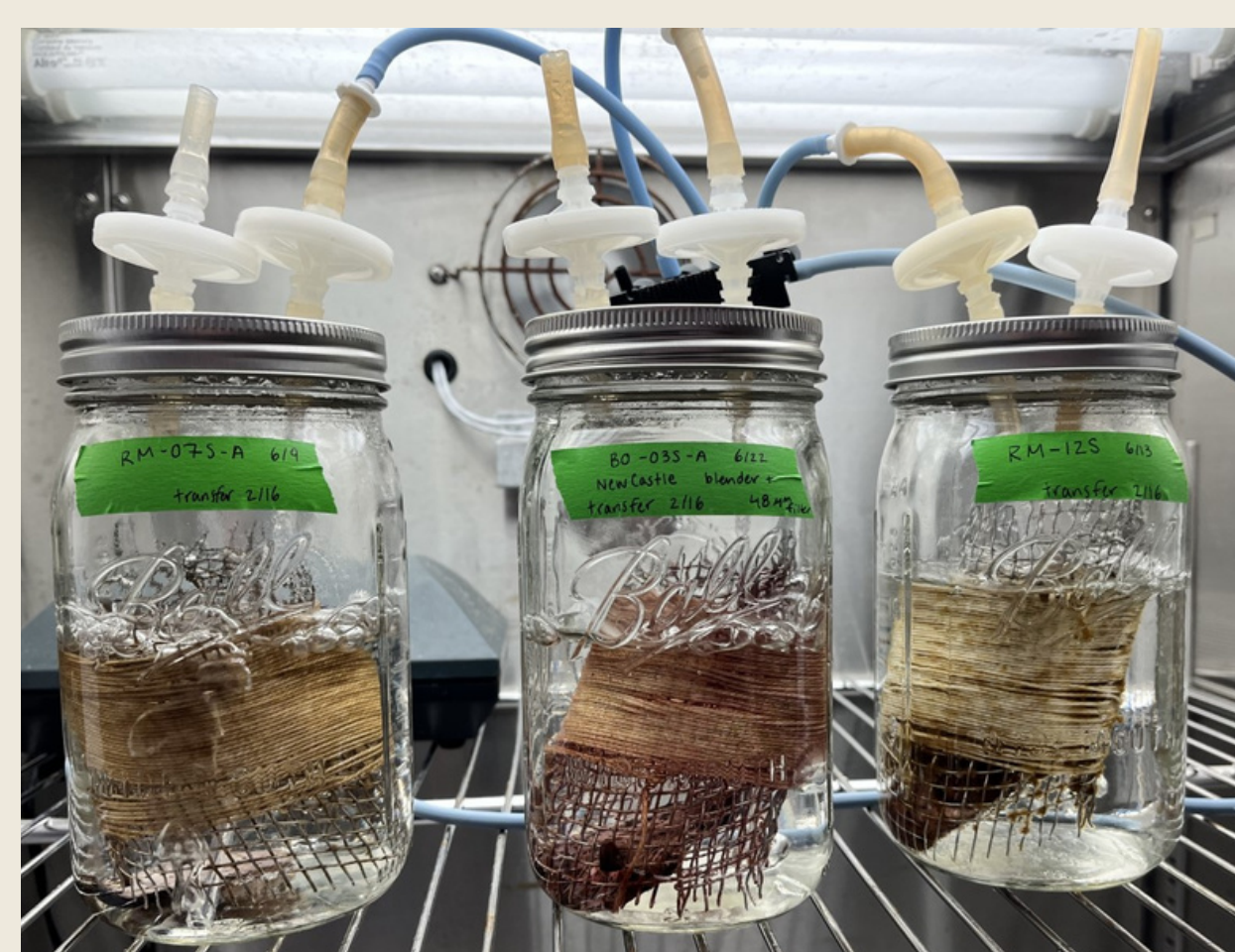


Figure 8. String seeded with conchospores

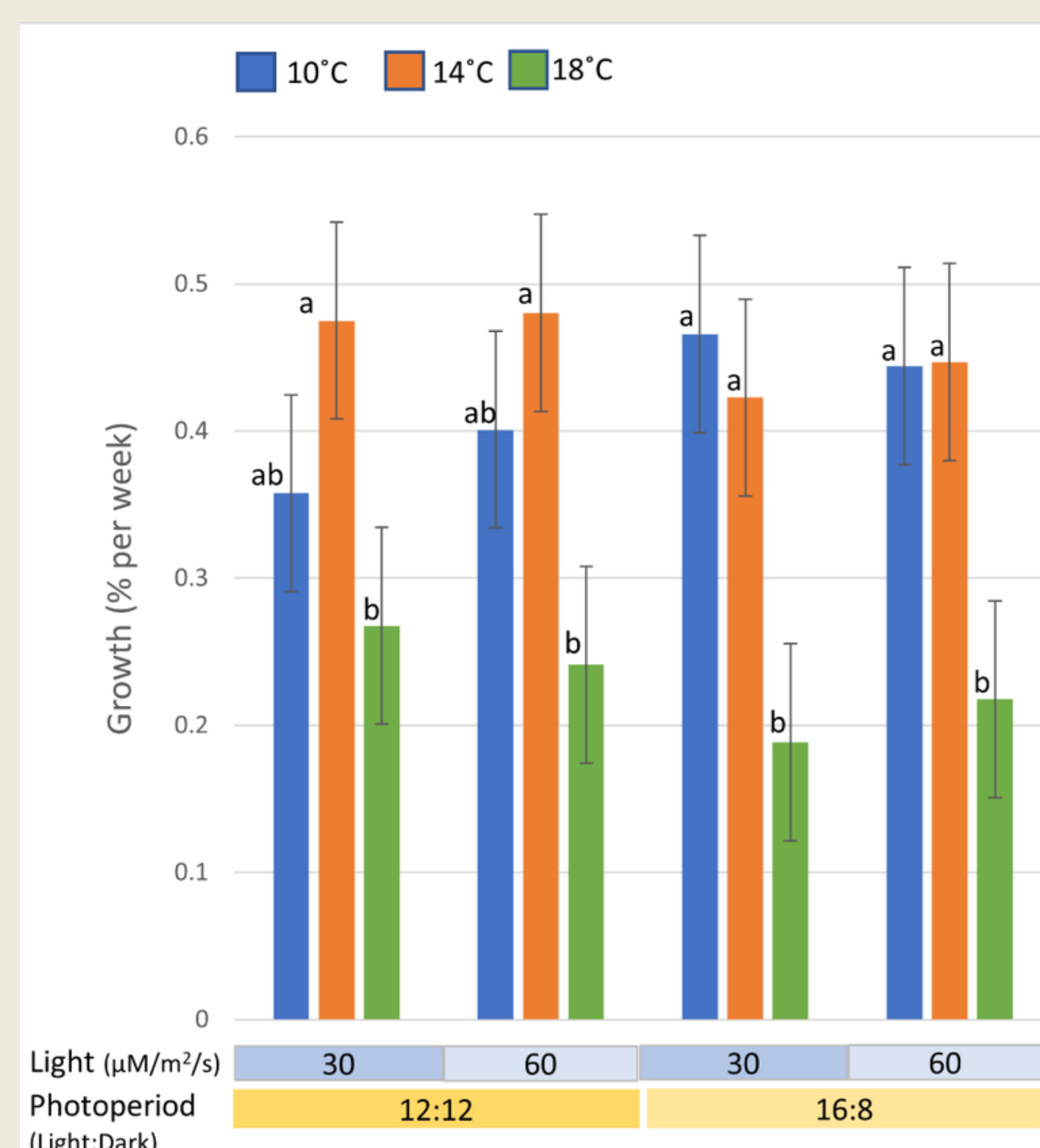


Figure 9. Conchocelis Growth Rate vs Photoperiod, Temperature and Light

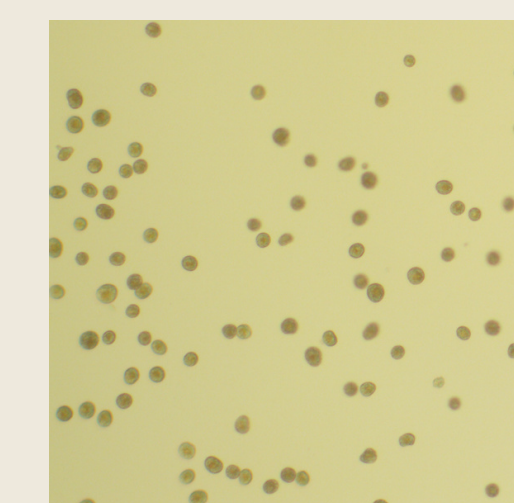


Figure 3. Zygospore release with glass pipette



Figure 4. Zygospore release with blender



Figure 5. 12-well plate setup

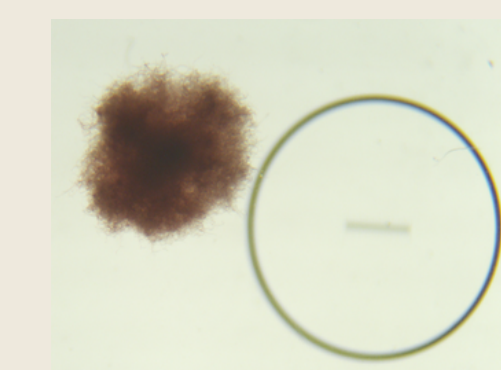


Figure 6. Conchocelis growth

05. Discussion

It was found that the whole tissue blender extraction method for zygospore extraction was a more efficient way to initiate cultures, compared with isolation method using the drawn-out glass pipette. Conchocelis growth is not particular about light levels, photoperiod, or temperature, though it was concluded 18 degrees is too warm. We have not yet found conditions to reliably trigger conchospore development.

Acknowledgment

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Related literature

- Hasan, A. H., Van der Aa, P., Küpper, F. C., Al-Bader, D., & Peters, A. F. (2022). *Kuwaitiella rubra* gen. et sp. nov. (Bangiales, Rhodophyta), a new filamentous genus and species from the north-western Indian Ocean. *Phycological Research*, 70(4), 192-202.
- Hughey, J. R. (2016). Genomic and phylogenetic analysis of the complete plastid genome of the California endemic seaweed *Wildemanina schizophylla* (Bangiaceae). *Madroño*, 63(1), 34-38.
- Kim, J. K. (2008). Mechanism of nitrogen assimilation of *Porphyra* from New England. University of Connecticut.
- Kim, J. K., Kraemer, G. P., Neefus, C. D., Chung, I. K., & Yarish, C. (2007). Effects of temperature and ammonium on growth, pigment production and nitrogen uptake by four species of *Porphyra* (Bangiales, Rhodophyta) native to the New England coast. *Journal of Applied Phycology*, 19, 431-440.
- Kim, J. H., Choi, S. J., & Lee, S. (2019). Effects of temperature and light on photosynthesis and growth of red alga *Pyropia dentata* (Bangiales, Rhodophyta) in a conchocelis phase. *Aquaculture*, 505, 167-172.
- Knoop, J., Griffin, J. N., & Barrento, S. (2020). Cultivation of early life history stages of *Porphyra dioica* from the British Isles. *Journal of Applied Phycology*, 32, 459-471.
- Kucera, H., & Saunders, G. W. (2012). A SURVEY OF BANGIALES (RHODOPHYTA) BASED ON MULTIPLE MOLECULAR MARKERS REVEALS CRYPTIC DIVERSITY 1. *Journal of phycology*, 48(4), 869-882.
- Lavik, A. Q. (2016). Developing a laboratory cultivation protocol for local species of *Porphyra* spp (Master's thesis, NTNU).
- Redmond, S., Green, L., Yarish, C., Kim, J., & Neefus, C. (2014). New England seaweed culture handbook: nursery systems.
- Sutherland, J. E., Lindstrom, S. C., Nelson, W. A., Brodie, J., Lynch, M. D., Hwang, M. S., ... & Müller, K. M. (2011). A new look at an ancient order: generic revision of the Bangiales (Rhodophyta) 1. *Journal of phycology*, 47(5), 1131-1151.