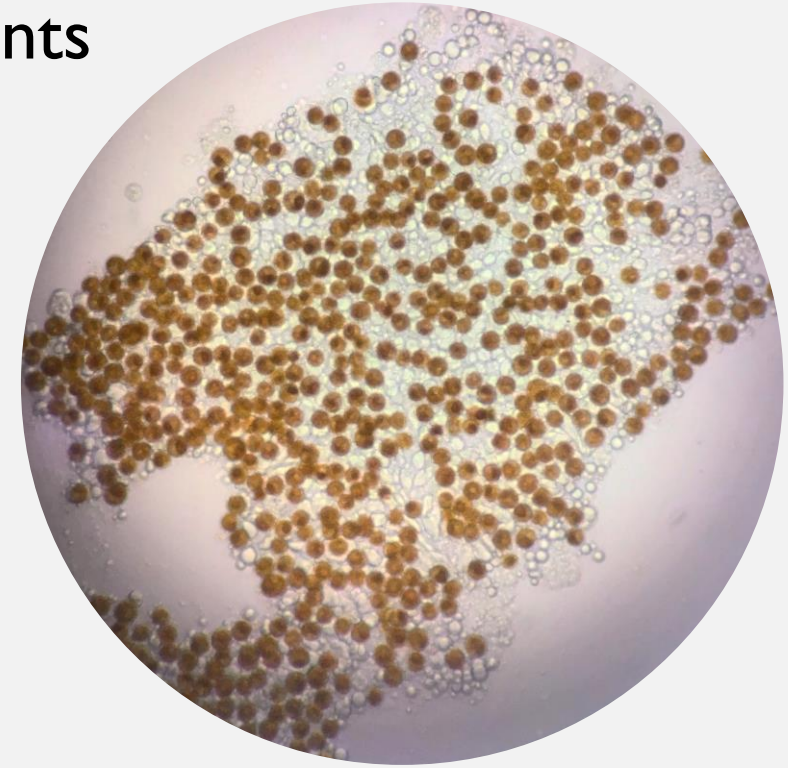
EFFECTS OF THERMAL STRESS ON FLUORESCENCE AND DINOFLAGELLATE DENSITY IN THE CAPTIVE CORAL, *ANTHELIA* SPP.

Joleen Santos

BACKGROUND: CORALS

- Corals are made of polyps
- Mutualism with photosynthetic dinoflagellates[1-4]
- Coral bleaching: expulsion of symbionts
  - Linked to thermal stress[5]



FLUORESCENCE

- Corals produce an abundance of fluorescent proteins[6]
- Potential indicator of health[6,7]
- High fluorescence = healthy coral
- Roth and Deheyn 2013

RESEARCH GOAL

- Determine if fluorescence can be used as an indicator of dinoflagellate density in corals and hence, as a proxy for coral health

HYPOTHESIS AND PREDICTION

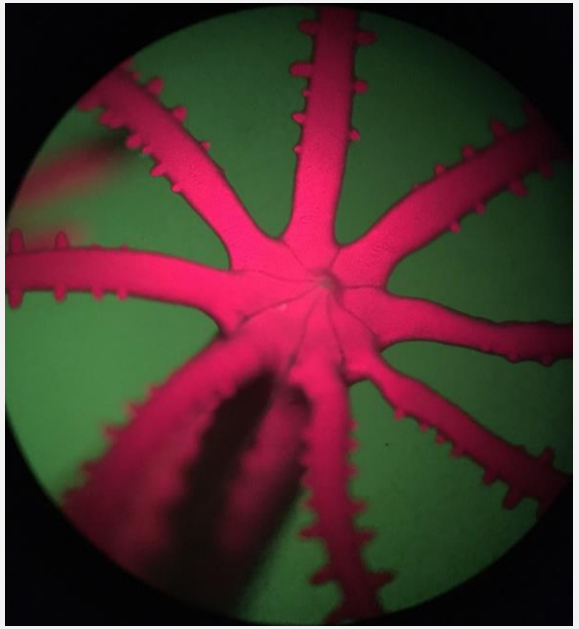
- Fluorescence and dinoflagellate density are indicators of coral health and predict that as temperature gradually increases, coral fluorescence and dinoflagellate density will both decrease

METHODS

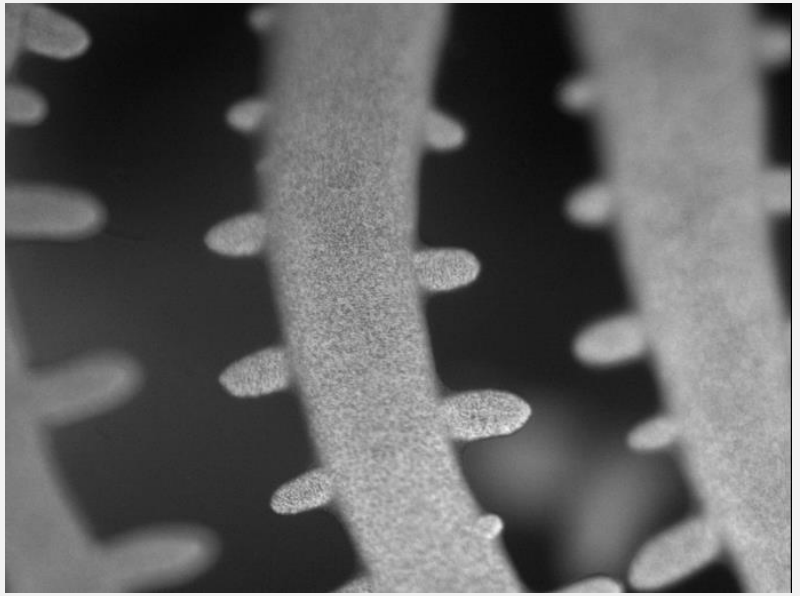
- *Anthelia spp.*
- Temperature-based experiment: 28 , 30 - 33°C
- Control: 28°C first week *and* parallel control tanks
- Statistics: One way ANOVA & Tukey Kramer

METHODS – FLUORESCENCE ANALYSIS

- Fluorescence microscopy
  - cellSens Standard, ImageJ, corrected fluorescence
  - CF = Area x (Mean Gray Value – Mean Background Reading)
  - 4 tentacles
  - 1 fragment, 2 tanks



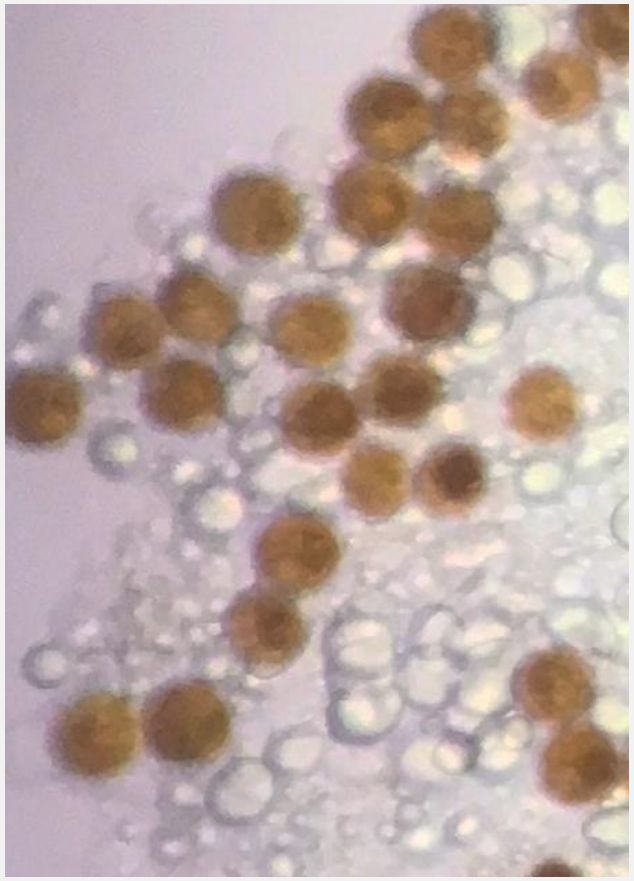
Ocular lens



cellSense Standard

METHODS – DINOFLAGELLATE DENSITY

- Maceration
  - 10 ± 2 mg worth of tentacles
  - 1:10 dilution
  - 2 fragments from 2 tanks



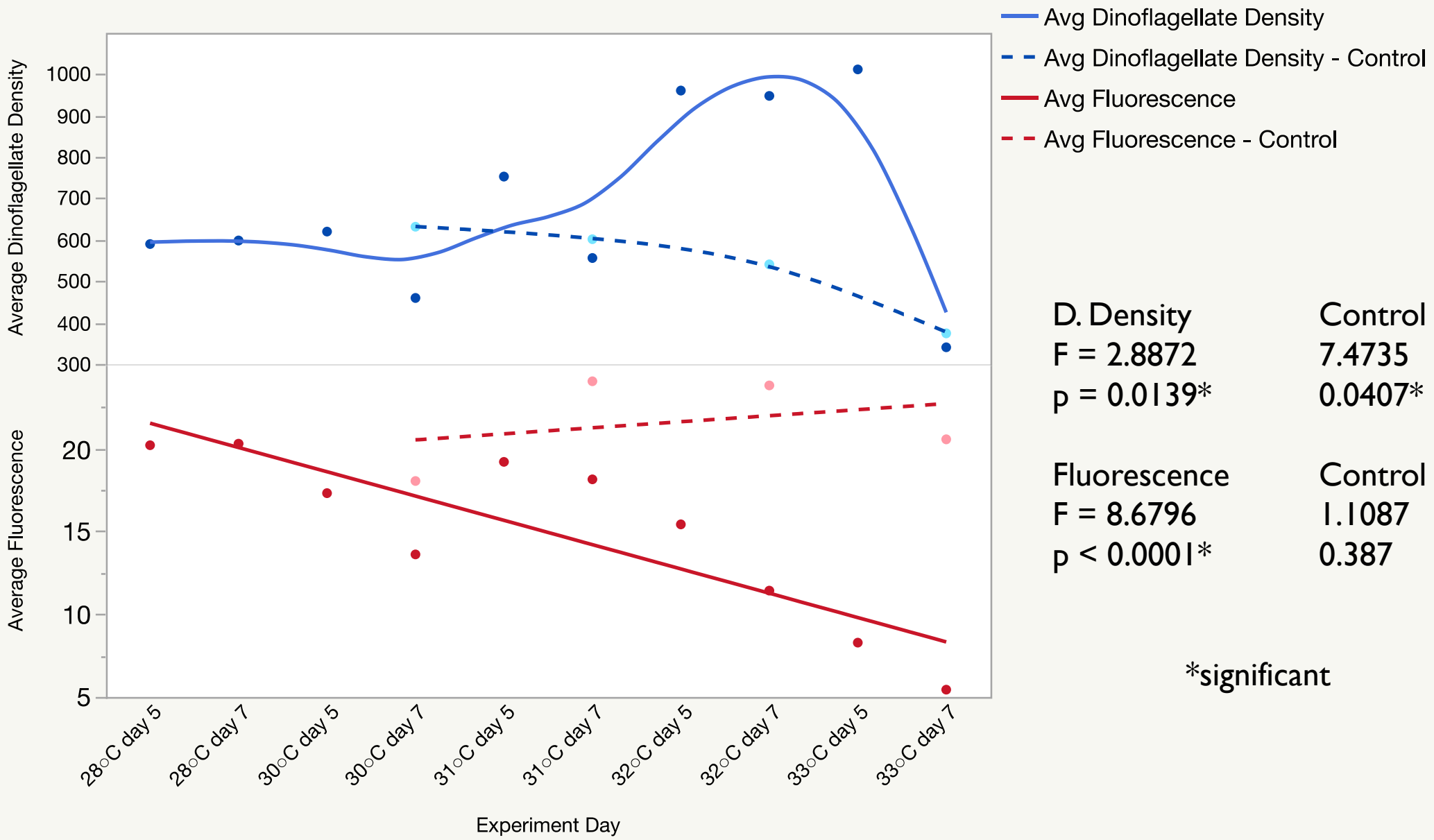
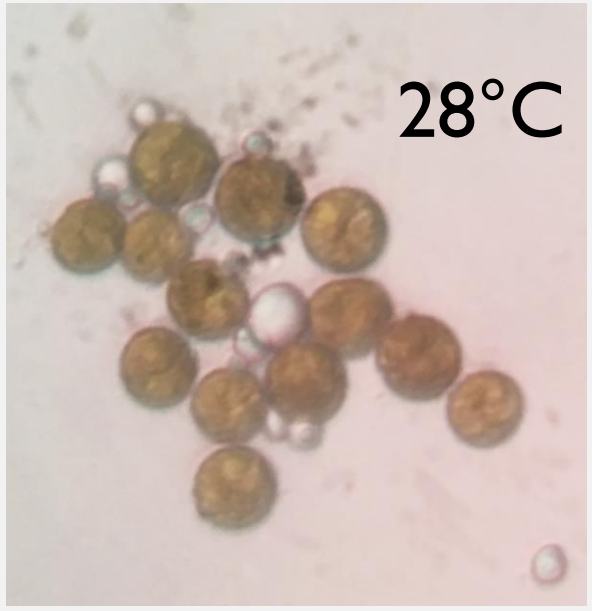
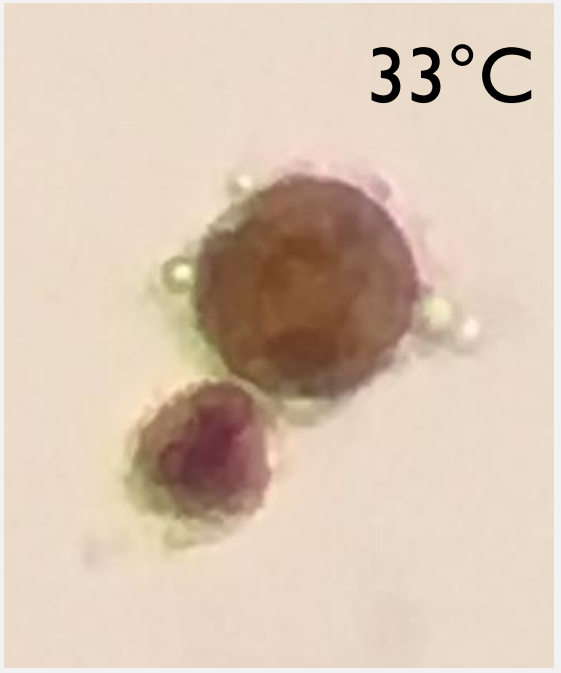


Fig. 1 Effect of temperature on dinoflagellate density and fluorescence

RESULTS - DINOFLAGELLATE MORPHOLOGY

- Variation in size
  - Consistent in controls



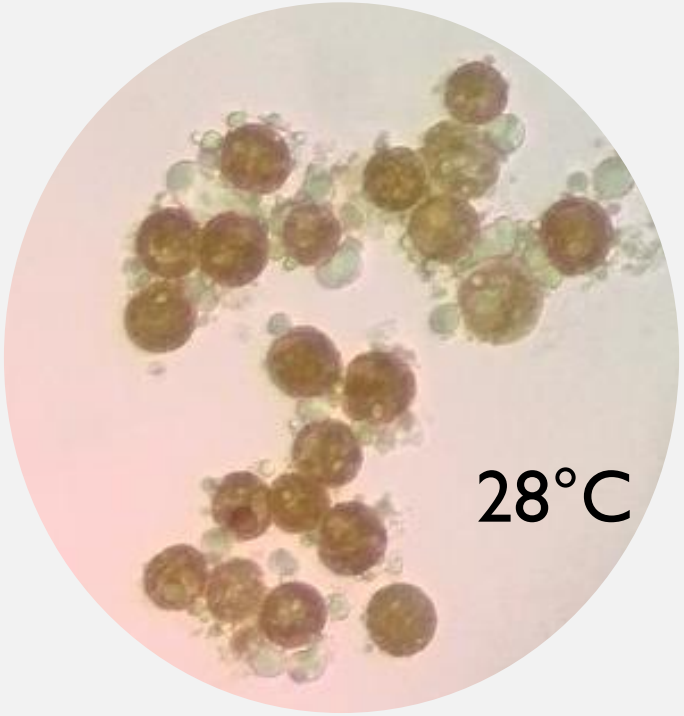


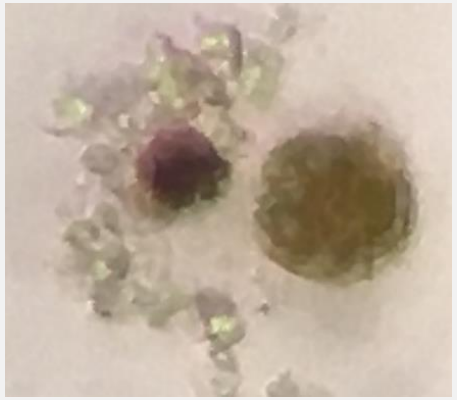
DISCUSSION

- Fluorescence is an indicator of coral health
- Density increased as health declined?
  - Increased mitotic rate → less photosynthates for host
  - Review by Woolridge (2013)

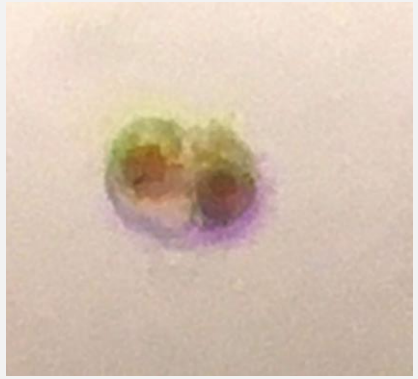
INCREASED MITOTIC RATE

- Emergence of smaller-sized cells may support a higher rate of cell division





33°C



- Cells as doublets at 33°C

DISCUSSION

- Chen et al. (2005)
  - Monitored fluctuation in algal communities for 1.5 years
  - Clade C increase followed by sudden drop in hottest month
- Implications of current study's results?

SIGNIFICANCE AND FUTURE DIRECTIONS

- Supports fluorescence as health indicator
- Potential to predict bleaching in *Anthelia* spp.
- Current methods insufficient
- Build on control sample size
- Different species and stressors

ACKNOWLEDGEMENTS

- Jill Anderson and all lab techs
- Tara Androschuk & Averil Jones
- Dr. Ross Shaw

REFERENCES

- 1. Davy SK, Allemand D, Weis VM (2012) Cell Biology of Cnidarian-Dinoflagellate Symbiosis. *Microbiol Mol Biol Rev* 76(2):229–261.
- 2. Yonge CM (Charles MS, Yonge CM (Charles M, History) BM (Natural, (1928-29) GBRE (1930) Great Barrier reef expedition, 1928-29 : scientific reports. 1(January):544.
- 3. Hatcher BG (1988) Reef Primary Productivity : Beggar ' Banquet s. *Tree* 3(5).
- 4. Hoegh-Guldberg O, et al. (2008) Change and Ocean Acidification. *Science (80-)* 318(December 2007):1737–1743.
- 5. Sheppard, C.R.C., Davy, S.K., and Pilling, G.M. (2009) *The Biology of Coral Reefs,* 1st Ed., Oxford University Press, Oxford, NY
- 6. Roth MS, Latz MI, Goericke R, Deheyn DD (2010) Green fluorescent protein regulation in the coral Acropora yongei during photoacclimation. *J Exp Biol* 213(21):3644–3655.
- 7. Roth MS, Deheyn DD (2013) Effects of cold stress and heat stress on coral fluorescence in reef-building corals. *Sci Rep* 3. doi:10.1038/srep01421.
- 8. Woolridge SA (2013) Breakdown of coral-algae symbiosis: towards formalising a linkage between warm-water bleaching thresholds and the growth rate of the intracellular zooxanthellae. *Biogeosciences* 10. doi: 10.5194/bg-10-1647-2013.
- 9. Chen CA, Wang JT, Fang LS, Yang YW (2005) Fluctuating algal symbiont communities in Acropora palifera (Scleractinia: Acroporidae) from Taiwan. *Mar. Ecol. Prog. Ser* 295. doi: 10.3354/meps295113.

REFERENCES (WEBSITE LINKS)

- Fluorescence: https://www.nano-reef.com/totm/2014/dec/torch.jpg