LB144-Pandemic

2022 edition

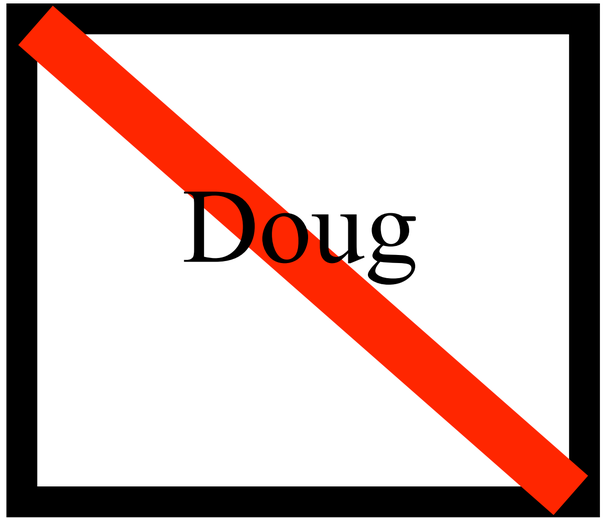
(sec 11 “Manser”, &12 “Bretagnolle”)

1. Clicker Attendance

- Launch your Top Hat app on your smart phone, or load the TopHat.com website, or text to the course phone number.

2. To Opt-OUT of being called upon

- Name Card with red stripe means you Opt-OUT (can Opt-OUT 3 times)



Budgeting homework time (60 min): In Ch. 18, section 18.3 (the second half of on **coral reefs)** is 1932 words in length which should take 10 minutes if you just read it. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, this homework assignment should take you more like 60 minutes (and that's if you are not distracted).

1. _____ **For the third lecture of the semester, read the** second half of section 18.3, after the blue header titled "Information is used by corals during settlement" and as you read it on your computer be sure to take handwritten notes*. You should focus and take detailed notes for everything about coral. Don't worry about the first part of 18.3 where the reading is about moths.

2. _____ **Try to answer some Integrating Question and Review Questions.** As you read the ICB textbook always attempt to answer at least one of the yellow **Integrating Questions** each time you get to a set of them. Also try to answer the green Review questions on coral reefs.

3. _____ (Trifecta): **Prepare to explain (aloud) Figures 18.18, 18.19, and 18.20 in class** (Purpose, Methods, Findings)

4. _____ **Advanced**: Click on the last reference in the Bibliography at the bottom of the page and try to find Figure 1 (not Plate 1) in Dr. Lindsay Harrington's research paper published in the journal *Ecology* in 2004. Just take a peek, read the abstract and in her paper where they talk about Figure 1.

Ecology, 85(12), 2004, pp. 3428–3437
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RECOGNITION AND SELECTION OF SETTLEMENT SUBSTRATA DETERMINE POST-SETTLEMENT SURVIVAL IN CORALS

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Abstract. Habitat recognition and selective settlement by dispersive propagules greatly increases the post-settlement survival chances of sessile organisms. To better understand the key role some species can play in the structure of highly complex coral reef ecosystems, we compare the role of two independent, but sequential, processes: settlement choice and post-settlement survival. This study describes the chemical and physical recognition and ranking of specific settlement substrata by coral larvae. Several species of crustose coralline algae (CCA) are known to induce coral settlement; however they also employ physical and biological anti-settlement defense strategies that vary greatly in effectiveness. We examine the interactions between settling larvae of two common reef building coral species (*Acropora tenuis* and *A. millepora*) and five species of CCA (*Neogoniolithon fosliei*, *Porolithon onkodes*, *Hydrolithon reinboldii*, *Titanoderma prototypum*, and *Lithoporella melobesioides*) that co-occur on reef crests and slopes of the Great Barrier Reef, Australia. Distinct settlement patterns were observed when coral larvae were provided with a choice of settlement substrata. Settlement on the most preferred substratum, the CCA species *T. prototypum*, was 15 times higher than on *N. fosliei*, the least preferred substratum. The rates of post-

Reading Ch. 18.3 (Corals settle)

Information used by corals during settlement

like monkeys in movie Tollgrea Strangus

- Often animals send out signals to say 'this is mine' = occupation of a resource
- Coral, like plants, cannot just move patch to patch to avoid competition. (non-motile)
- Coral animals create coral reefs via secreting hard skeleton, reproduces asexually but also can release sperm + egg into ocean (spawning) – remind you of Mendel's pea plants?
  - larva – baby coral (baby Grout) can swim a little e.g. 3 days after full moon then lands on surface – settlement
  - → settle on stuff like, other corals, mud (too soft), algae soft or harder = coralline – $CaCO_3$ algae = good?!

Research by Dr. Katharina Fabricius' group (Australia, 2004) Great Barrier Reef Queensland, Aus
- → studied two corals Acropora millepora – milli staghorn coral
  A. tenuis – finger

Book has cool coral movie PBS/Nature – introduce "bleaching"

Fig 18.17 photographs of two corals + coralline algae staghorn + brain

Study #1 – Fig 18.8 Fabricius et al "Settlement"

Purpose – what info do coral larvae use to choose place to settle? how impacts survival?

Methods – Collected 5 species coralline algae + placed in outdoor aquariums. Used living vs dead algae plus clay + dead coral.

5 Tanks: Each tank got all surfaces / dead + alive plus clay + coral (12 treatments)
Added 8,000 finger coral larvae in each tank, wait 3 days, + counted number settled on each surface. Plot on log graph.

IQs: What's ratio best vs least? Anybody better than clay tile?

Findings: Coral settlement more on living algae vs dead. (attracted?) Coralline A 15X B more (repelled?)
Since coralline D+E are lower than clay could be repelling

Study #2 Fig 18.19 Fabricius et al "Survival"

Purpose – What is survival (duration) after settlement?

Study #2 (cont.)

Methods: Fig 18.19
- Transfer fragments with settled/attached coral larvae to new tank. Observed for 22 days, count, plot % survival
- Tile did pretty good (control)

Findings: Tile did well, almost best, E+D did poorly + quickly so

Study #3 "Extract" chemical signal?

Purpose: Attempt to identify any potential chemical signal coming from surfaces (hostile to invaders = larvae)

Methods: Obtain specific mass of each surface, grind to powder, incubate in aquatic solvent (H_2O + salt?) to extract any chemicals. Mix each extract with filtered sea water to generate 5 concs of each potential extracts. Test dose-response
Place extracts in dishes, add 10-20 coral larvae each dish.
Wait 36 hours, count to determine % settled/grown at each concentration of each extract.
What/how much does each take to have full impact?
If only a little needed – signal is noticed by larvae

Findings: Clay + coral extracts = no growth of settled larvae
Coralline A+B supported much settlement + survival, also secreted signals that were noticed by larvae even at low conc.
D+E supported low settlement + survival produced chemicals that had to be higher conc to be noticed
Larvae chose A+B as "least able to kill me"

NOTE Coralline Algae might not want larvae because the block sunlight for photosynthesis. Also more than just chemical signals used, also "shedding" off surface to kick off larvae.

Three coral reef species

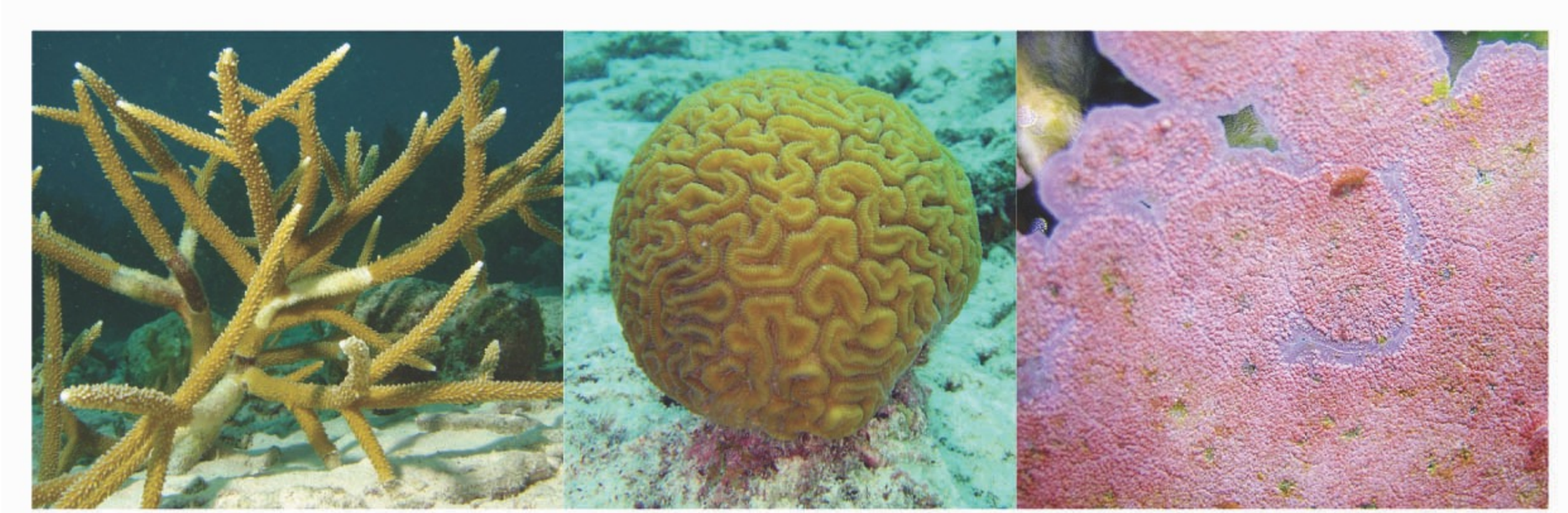


Figure 18.17

A, Adona 9, Creative Commons. B, Public domain. 2007. C, FalsePerc, Creative Commons

Three coral reef species

staghorn cora

ralline algae

finger coral

Figure 18.17

A, Adona 9, Creative Commons. B, Public domain. 2007. C, FalsePerc, Creative Commons

Australia's inaction on climate puts Great Barrier Reef 'in danger,' UNESCO report says

Draft decision for the World Heritage Committee urges country to step up the fight against global warming

22 JUN 2021 · BY DENNIS NORMILE

Trifecta?

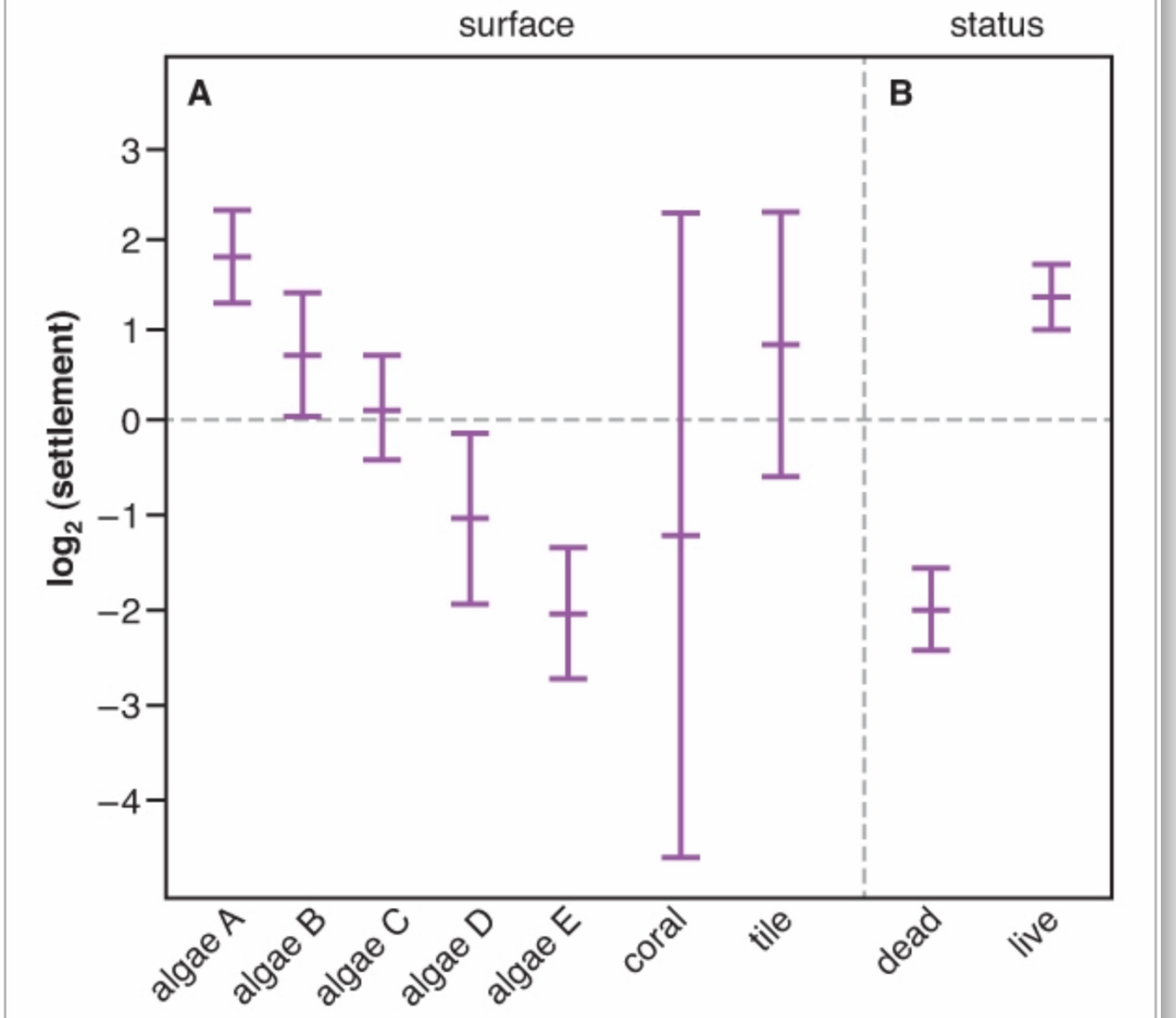
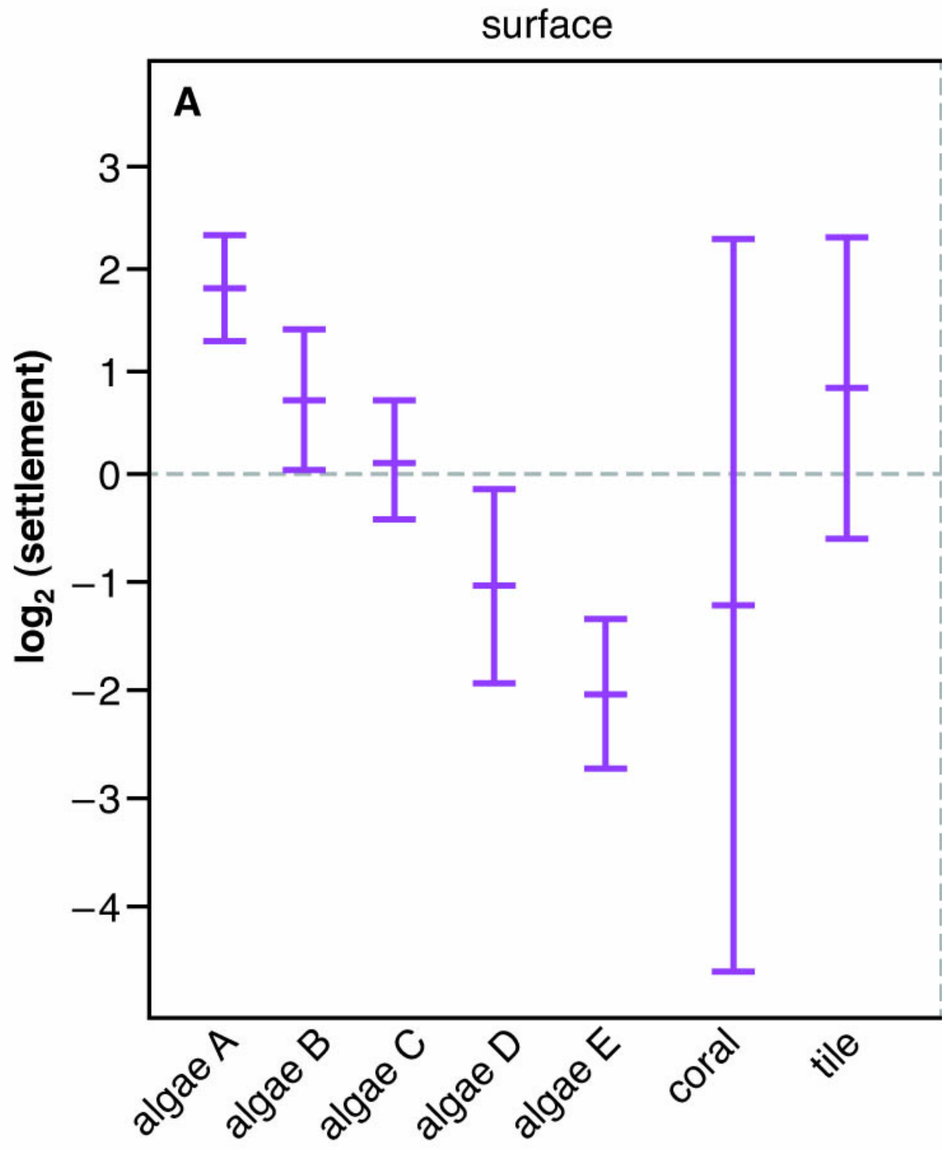


Figure 18.18 Settlement densities of coral larvae. **A,** Effects of various surfaces (five species of coralline algae [mean of live and dead pieces], coral pieces, and clay tile). **B,** Effect of live versus dead coralline algae. Error bars represent 1 standard error. From Harrington, et al. 2004. Figure 1. Reprinted with

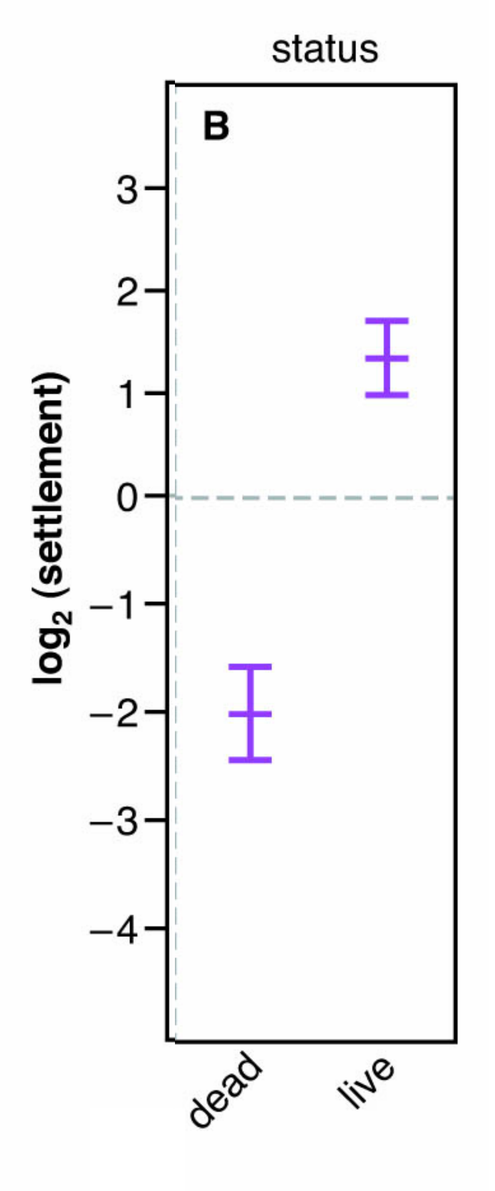
Random call



What do you conclude from these results?

Figure 18.18

From Harrington, et al, 2004, Figure 1. Reprinted with permission from the Ecological Society of America.



What do you conclude from these results?

Figure 18.18

From Harrington, et al, 2004, Figure 1. Reprinted with permission from the Ecological Society of America.

Integrating Questions

36. What is the ratio between the number of larval coral that settled on the most preferred species of algae and the number that settled on the least preferred species?
37. Are there any species of algae for which coral settlement is significantly different from settlement on the abiotic tile surface? Can you develop a hypothesis to explain this result?

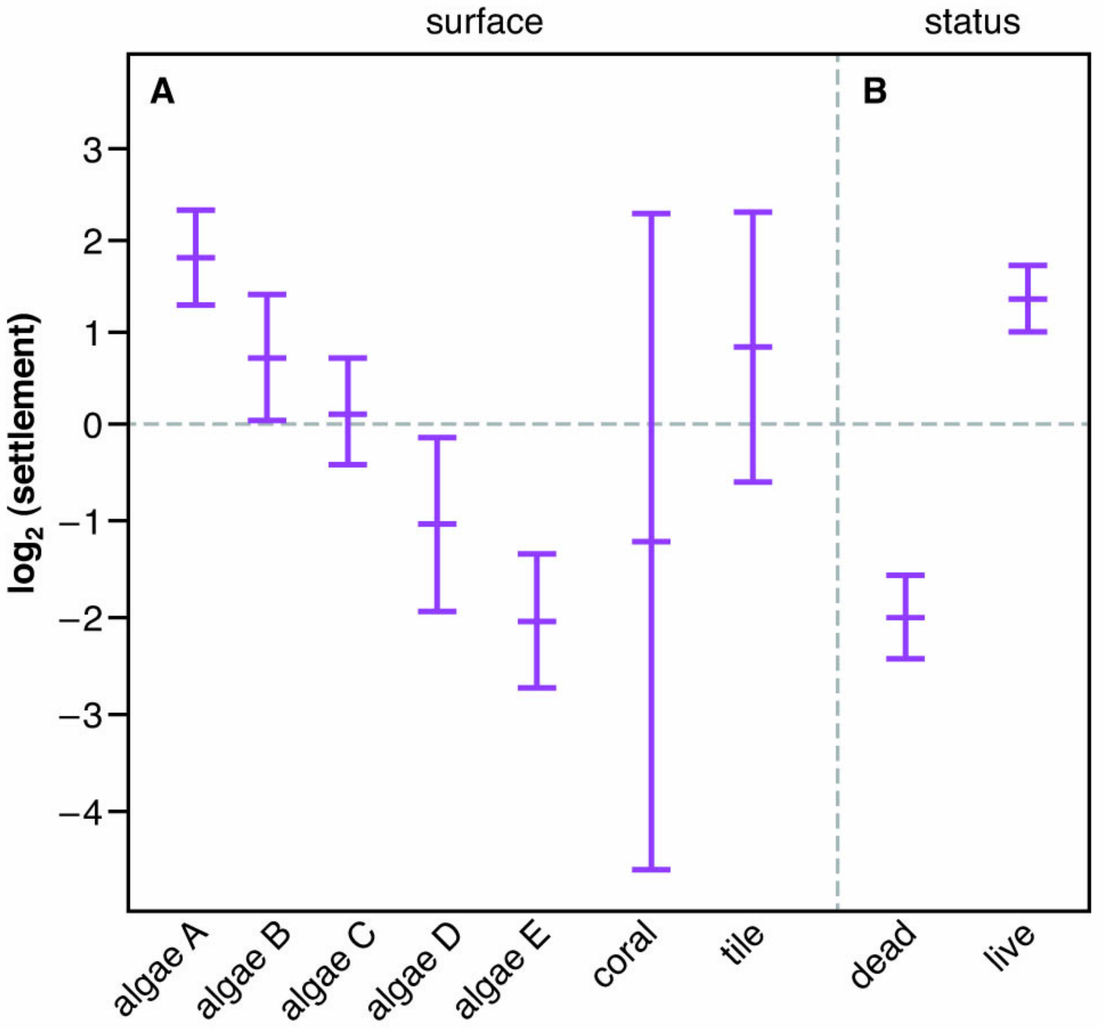


Figure 18.18

From Harrington, et al, 2004, Figure 1. Reprinted with permission from the Ecological Society of America.

Section 18.3 What is a learning goal for this class (what part of biology are we exploring)?

Section 18.3 Is chemical communication used to block competition or defend self?

Biology Learning Objectives

- Evaluate the use of information in *competitive interactions* & *biodiversity* of coral reefs communities.

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What about this experiment?

Trifecta?

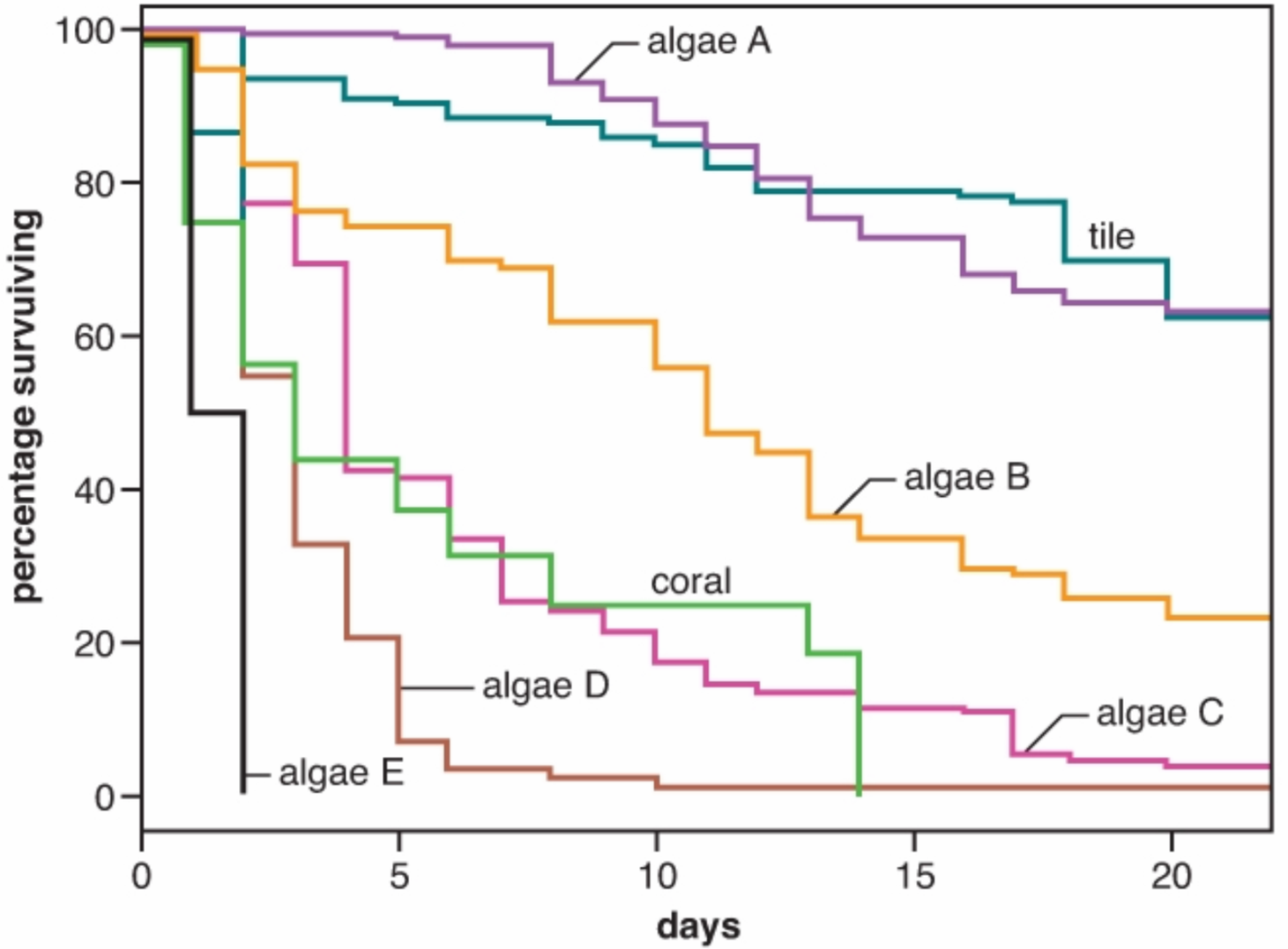

Figure 18.19 Survival of finger coral larvae over 22 days, showing the effects of various surfaces on daily survival. From Harrington, et al, 2004, Figure 2. Reprinted with permission from the Ecological Society of America.

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Survival of finger coral larvae; compare settlement with survival

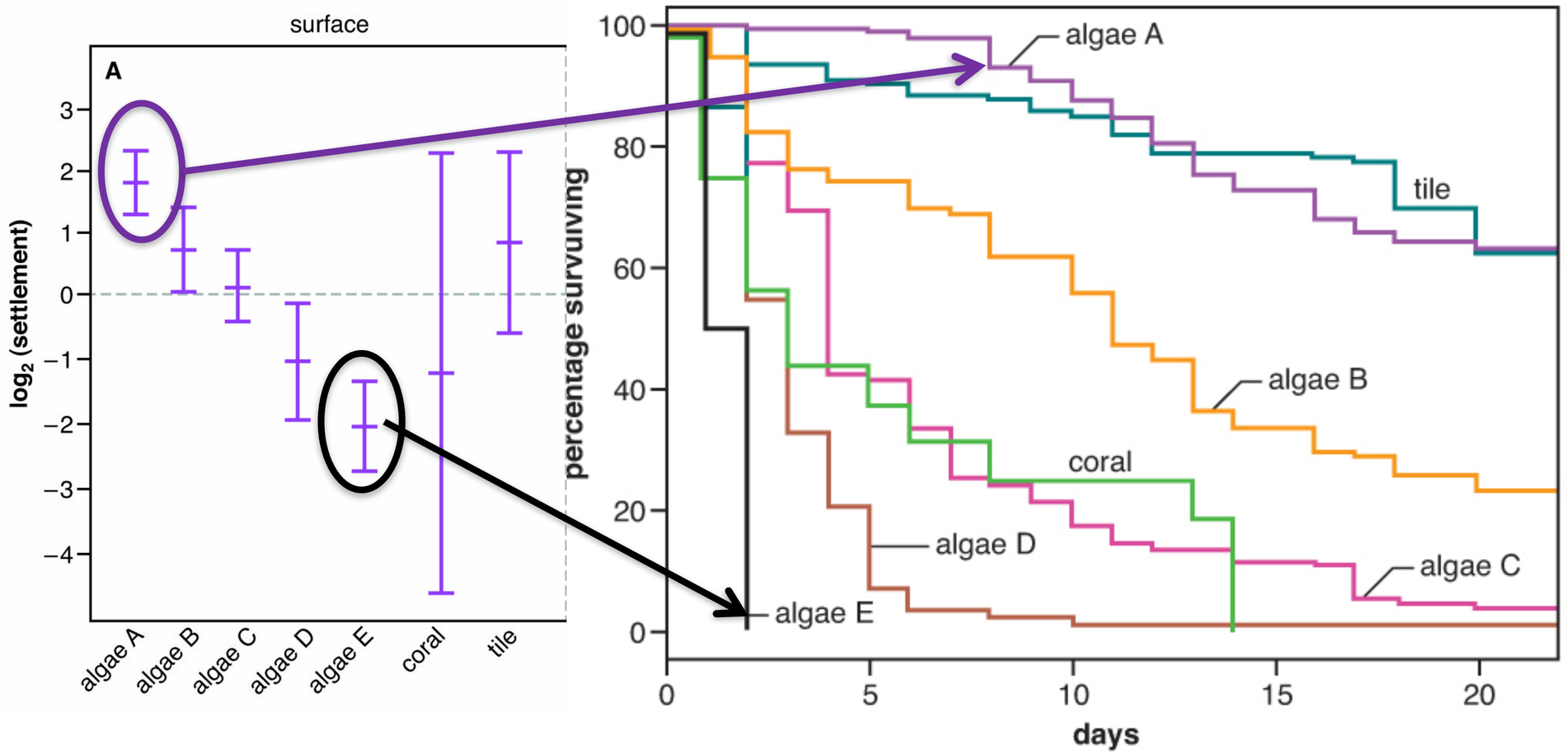


Figure 18.18A & 19 From Harrington, et al, 2004, Figure 1. Reprinted with permission from the Ecological Society of America.

What about this experiment?

Trifecta?

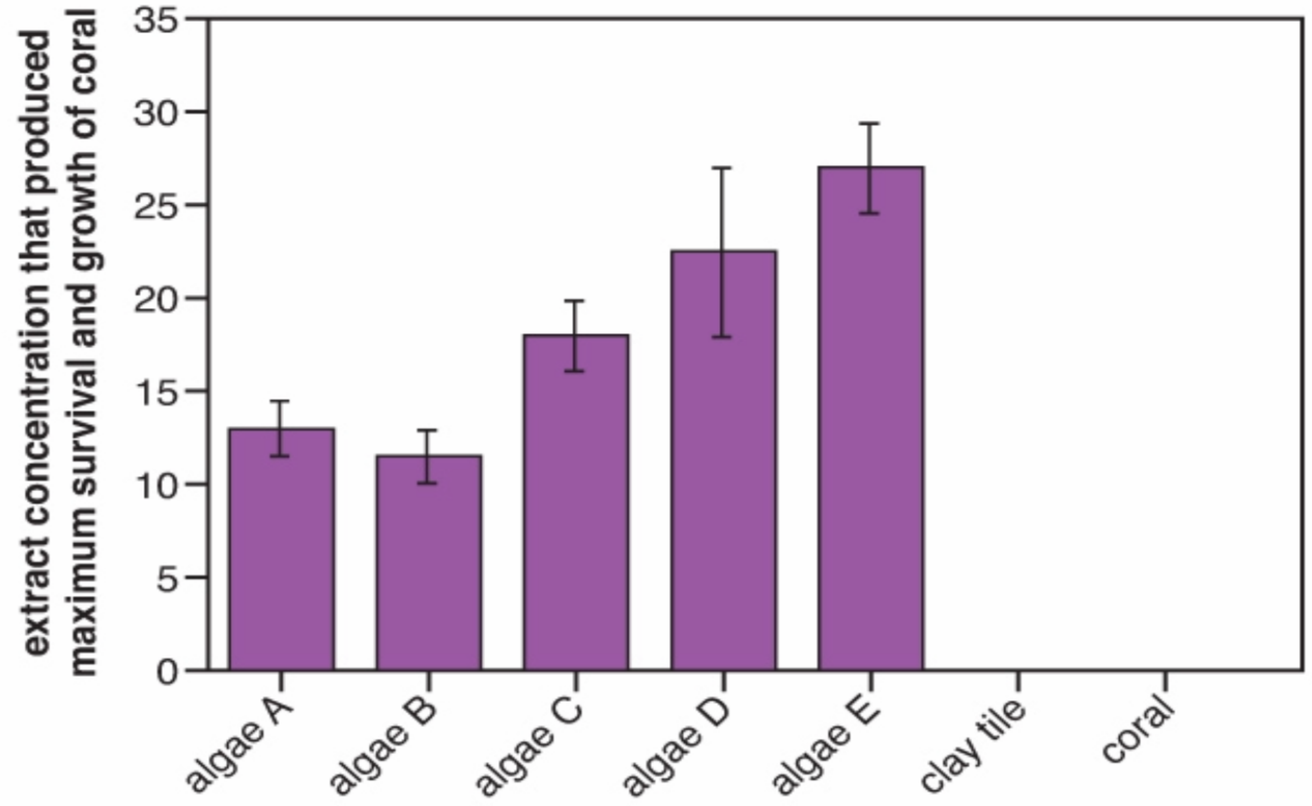
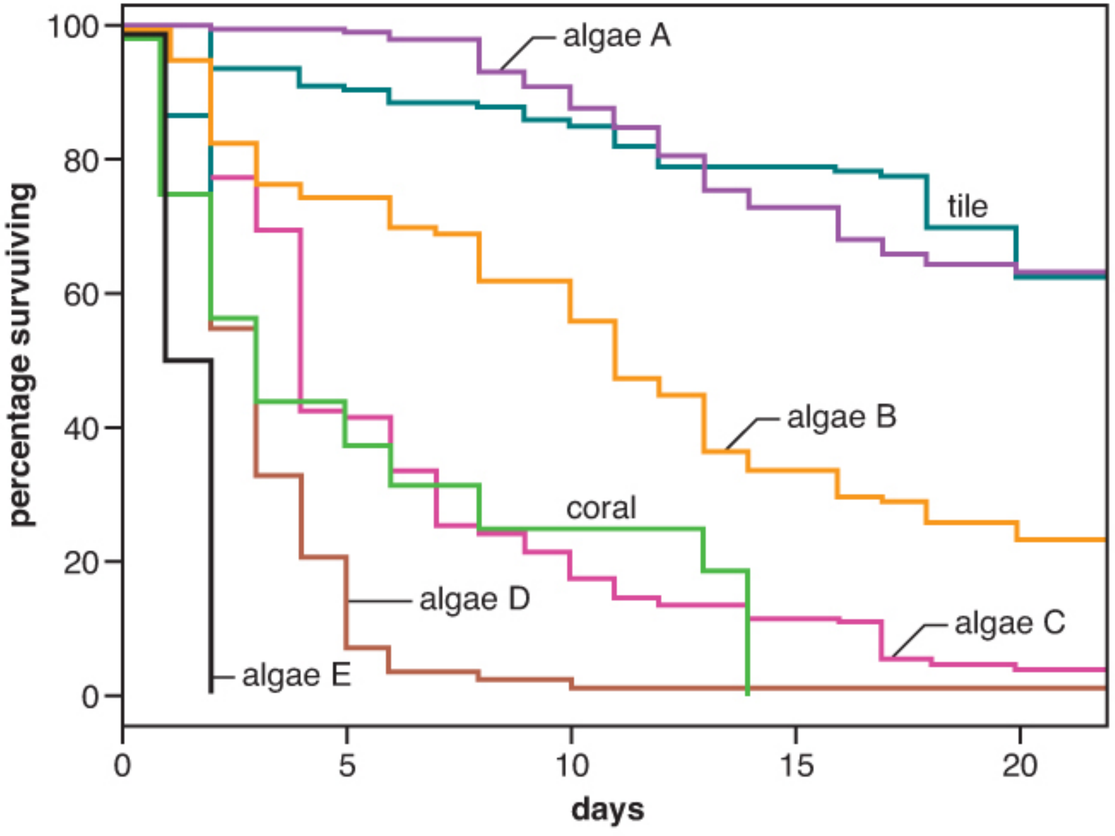


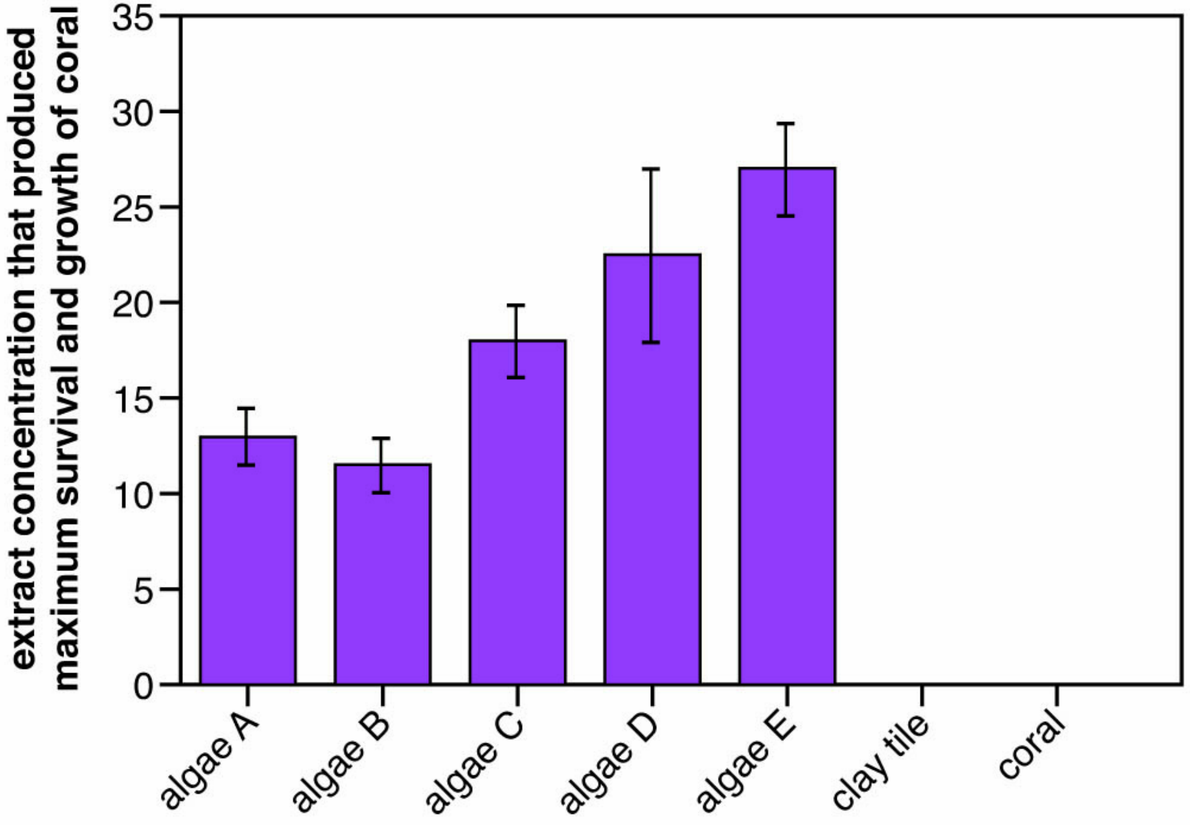
Figure 18.20 Extract concentrations that produced maximum survival and growth of settled coral larvae in laboratory experiments (with 95% confidence intervals). Concentrations that were both lower and higher than indicated produced less coral growth and maturation. From Harrington, et al, 2004, Figure 2. Reprinted with permission from the Ecological Society of America.

Random call

Integrating Questions

38. Describe the effects of the various substrates on survival of finger coral larvae in Figure 18.19.
39. To which coralline algae extract are the finger coral most sensitive, in terms of their survival and growth (Figure 18.20)? To which are they least sensitive? Support your answer with data.
40. Coralline algae that are covered by corals will not be able to obtain light for photosynthesis and will die. What is the evolutionary advantage of a chemical that prevents settlement of coral larvae? What is the advantage of a chemical that promotes settlement?
41. Rank each algal species in each of the three categories: which facilitates the most settlement, which facilitates the most survival, and which has the lowest concentration of extract to produce maximum growth? Compare the three ranked lists of species, and describe any pattern you observe. What are the relationships between coral larval settlement, survival, and optimal extract concentration among the five species of coralline algae?





Extract concentrations that produced maximum survival and growth of settled coral larvae in laboratory experiments

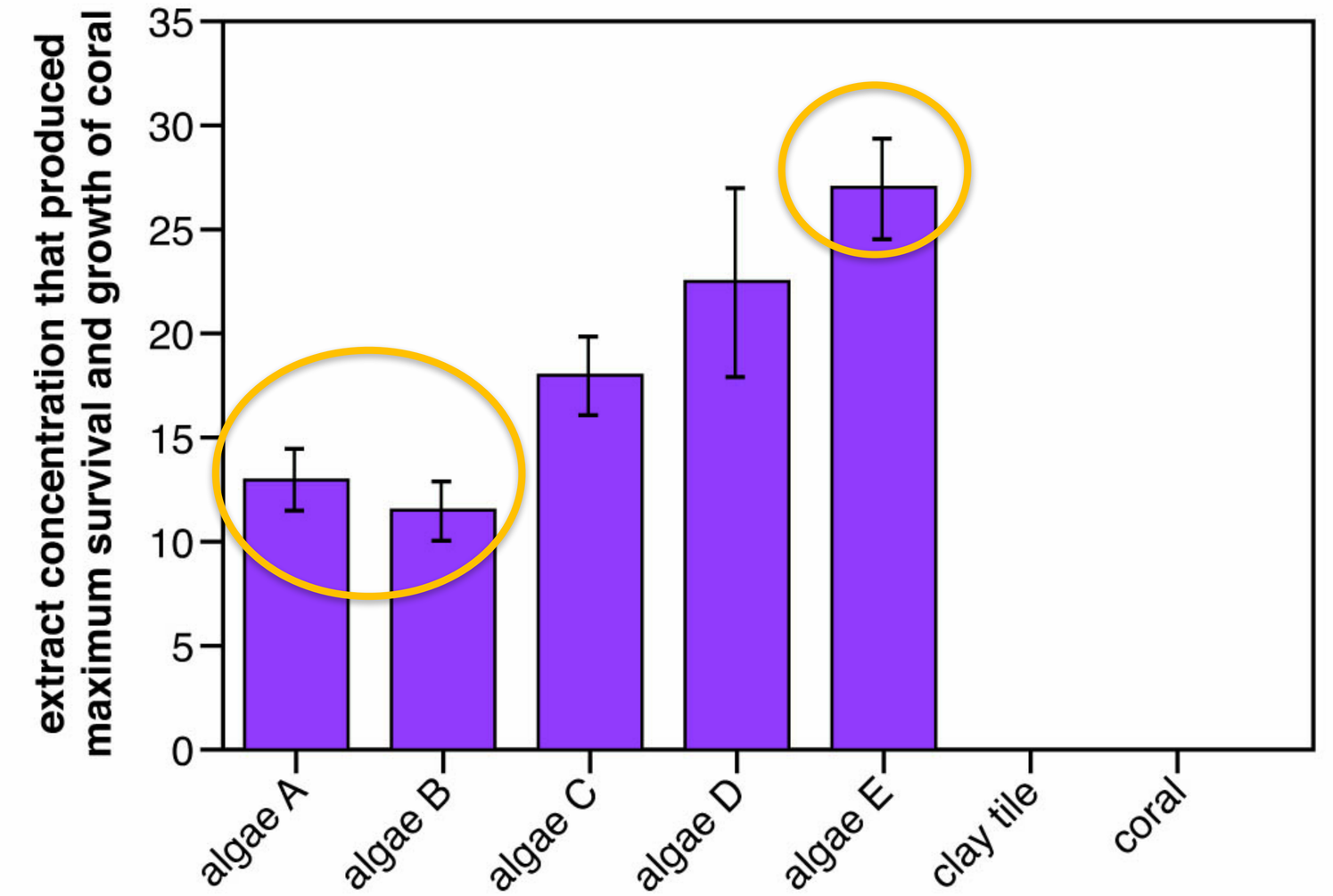


Figure 18.20

Survival of finger coral larvae; compare settlement with signals

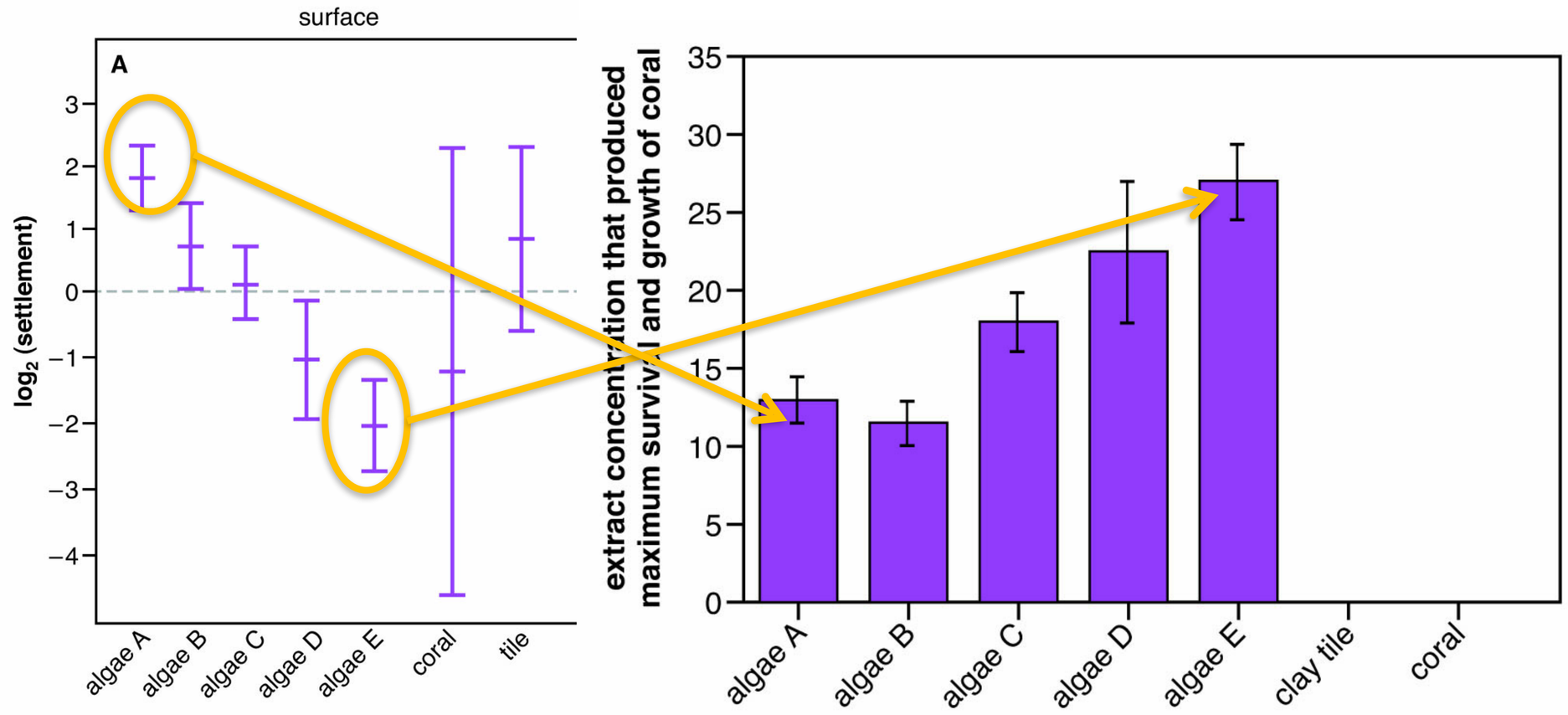


Figure 18.18A and 20

Announcements

1. TYPOs in Pink Pages: “Tuesday” “Thursday” lectures should say “Online” “In-person/Wednesday” (the online course pack is correct).
2. **Online lecture** (lecture #2 on TopHat) who thought Rachel Page’s research findings of “bats teaching each other” were insanely cool?
3. Next online lecture (lecture #4 on TopHat) **We brought in the *experts*, they literally wrote the book. Textbook author: Chris Paradise!**
4. **Q: whats DUE next week in lab? Email link+slides by 11pm Mon.**
5. **“Contract”:** *144 Contract* in syllabus, sign, hand-in; DUE Friday 5pm.
6. **Clicker points**: attendance 1pt (here start to end), participation 1pt each question correct (reward for those who read, notes, study). *BUT only need to earn a 50% to get full credit for “Participation” this term.*

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