

Marine Ecology – Winter 2024

A Guide To Discussing Papers

During section students will discuss peer reviewed journal articles from the primary literature. These articles represent the medium through which scientists communicate their ideas and results to one another. The dissemination of scientific hypotheses and findings in this manner is fundamental to the process and progress of scientific investigation because 1) it (hopefully) maintains the rigor of scientific investigation and the veracity of reported results through peer evaluation, and 2) it makes new findings and hypotheses available to a broad scientific audience, facilitating the assimilation of data across labs, institutions, and disciplines. It is this assimilation which determines the rate and direction of scientific progress. In light of this, the ability to read and interpret articles in the primary literature, both in terms of the specific methods/results and general conclusions/interpretations they convey, is a skill fundamental to scientific investigation.

Things to consider when preparing to discuss a paper:

1. **Motivation – what hypothesis or question motivated the study or analysis?**

Think about the nested nature of the working hypothesis. To carry out the research the authors had to pose one or more specific questions based on the system in which they are working. The results, however, will also be interpreted in a manner that attempts to support or refute more general hypotheses. Try to scale up from the specific questions of the paper to identify the more general scientific hypotheses and principles that are under examination. This is critical to understanding why the science is done and to a large extent why it is published in the journal in which you found it.

2. **Methods and Results – how did the scientists attempt to address the hypothesis or question, and what did they find?**

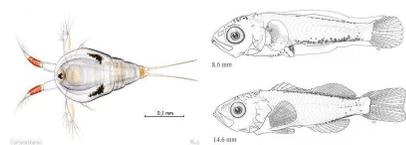
Again, think general to specific. Understand the system-specific methods that the authors employed but also think about the general approach which was used. Is the work experimental, observational, or statistical (e.g. meta-analytical: statistically analyzing results of multiple related papers)? What are the limitations of these approaches, both in general and in terms of the system in which the authors are working? How did they attempt to compensate for these limitations? Which data are most convincing and which data seem “weak”? What additional steps could be taken to strength the results?

Briefly summarize the main, general findings of the study, but do not dwell unnecessarily on specific raw data. Make sure that you can clearly relate the reported data (quantitative measures) to the proposed conclusions (qualitative interpretation)!

3. **Future – what new questions or experiments do the reported findings/interpretations motivate?**

This is particularly relevant if there are alternative interpretations of the data that is provided, or if one or more untested/unmeasured parameters, or unconsidered processes/mechanisms, could have contributed to observed patterns.

4. **Relevance to Course – why did the course instructors assign this paper?**



Sample Paper:

Gaines, S.D, Roughgarden, J 1987 Fish in Offshore Kelp Forests Affect Recruitment to Intertidal Barnacle Populations **Science** 235 (4787) p 479-481

1. **Motivation:** specific to general

- a. How does the abundance of juvenile rockfish in kelp forests offshore of Hopkins Marine Station (Monterey, CA) influence the abundance of barnacle larvae and subsequent recruitment of barnacles in the intertidal at this site?

- b. How do processes associated with kelp forests affect the distribution and abundance of pelagically-dispersing larvae of marine organisms?
- c. How do processes associated with kelp forests affect the distribution and abundance of adult populations of marine organisms with pelagically dispersing larvae?
- d. How are the dynamics of intertidal communities coupled to the dynamics of offshore kelp communities?
- e. How does habitat structure, and spatial/temporal variation in this structure (and related processes), influence the population dynamics of associated organisms?

The two most general questions addressed in this paper are:

- i. What drives spatial and temporal variation in patterns of distribution and abundance of organisms?
- ii. What are the processes and mechanisms that link biological communities?

Think of some other systems, either terrestrial or marine, in which these questions or phenomena might be particularly important to consider. In what systems is spatial/temporal variability especially pronounced, and what are the biological consequences? In what settings, or under what conditions, is ecosystem linkage important, and what are the biological consequences? Finally, what are some examples of the applied relevance of these topics?

2. **Methods/Results:** to address these questions the authors needed to first pick a system and then gather information relevant to their questions:
- a. Site: central California coast at Hopkins Marine Station: any thoughts on why they might have selected this site? Is this an appropriate place to address their questions and if so why?
 - b. Data collection and Results:
 - i. Kelp forest parameters: the authors are interested in kelp forest size. Since they are only working at one site the authors cannot address spatial variation in kelp size. They gather info on temporal variation in kelp forest size using aerial photographs of canopy cover. What other methods could have been used and why did they likely go with this one? Might other methods provide more accurate estimates and if so how?
 - ii. Barnacle parameters: the authors needed to gathered information on larval barnacle abundance inside and outside of the kelp bed at Hopkins, and on adult barnacle abundance (via recruitment) in the intertidal at Hopkins. Temporal variability in larval abundance was measured by collecting plankton samples at 3 "pumping stations" between April and December. Two different larval stages were distinguished. They measured adult recruitment by photographing 4 fixed survey plots in the intertidal.
 - iii. Rockfish predation – the mechanism!: the authors attempt to convince you that rockfish are driving observed patterns. They present data on interannual changes in rockfish abundance, but no other data are presented. This is likely due to the length constraints on papers in this journal. Anecdotal information is presented on the diets of juvenile rockfish based on stomach contents. Seasonal changes in rockfish abundance were measured on SCUBA at Hopkins.

The study involves no experimental manipulation and no mathematical modeling. Most data were collected by the authors, with info on rockfish diet, natural history, and distribution/abundance taken from the literature

- c. Results: the important patterns/results presented in this paper are:

- i. Figure 1: negative relationship between kelp bed size and abundance of adult barnacles in the intertidal. This pattern motivated the study.
- ii. Figure 2: seasonal variation in the barnacle larvae gradient across the kelp bed. When juvenile rockfish are abundant in midsummer (no data presented) many more barnacle cyprids are present outside kelp bed. These larvae are being transported to Hopkins from other barnacle populations. Abundance of nauplii larvae shows the opposite pattern: more abundant inside the kelp bed when juv. rockfish are abundant. These larvae are being produced by adults in the Hopkins intertidal and are being transported away from Hopkins. For both types of larvae, dramatic reductions in abundance occur as they cross the kelp bed, presumably because juv. rockfish are eating them. Controls: copepods (another prey item of juv. rockfish) show a similar decline in abundance as they cross the kelp bed moving towards the intertidal. Barnacle molts, which are not a prey item of juv. rockfish but which, like the larvae, are transported across the kelp bed by ocean currents, show now changes in abundance.
- iii. Table 1: linking kelp canopy area (a proxy for kelp bed size), rockfish density, and barnacle recruitment. The kelp canopy area and rockfish density are positively correlated, and barnacle recruitment is negatively correlated to both.

larger kelp bed \Rightarrow more juvenile rockfish \Rightarrow more incoming barnacle larvae eaten \Rightarrow fewer barnacles recruit \Rightarrow population size of adult barnacles should be inversely related to size of offshore kelp bed

3. **Future directions:** some other questions raised by these findings include:
 - a. How do adult barnacle populations which occur in intertidal areas that either are or are not bordered by kelp beds contribute differentially to the larval pool?
 - b. Does this predation by juvenile rockfish affect other intertidal organisms in a similar way?
 - c. What sorts of ecological or evolutionary strategies might be observed in these organisms that would allow them to avoid this selective pressure? How could we test for an effect of this selective pressure?
 - d. What patterns are observed in areas where rockfish (or ecologically equivalent planktivores) are not present? Could juvenile rockfish be experimentally removed from a site to test the observed pattern?
 - e. What are the community level impacts of this phenomenon? Barnacles are primary space holders and may play important roles in determining intertidal succession and diversity. How could changes in their abundance influence biotic and abiotic characteristics of the intertidal?
 - f. By what mechanisms, and at what frequency/intensity do changes in kelp bed size occur?
4. **Relevance:** this paper would probably appear in conjunction with lecture discussions of pre-settlement processes and their affects on distribution/abundance. Here, predator/prey interactions (biotic forces) have a strong influence on recruitment rates.