



Presenting a Poster

Ecology in English
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The first key rule

- Take all the advices and then do it as you see fit



Why do a poster?

- There are a lot of people with data to present, but time does not permit everyone to give a 10-15 minutes talk.
- There are sometimes several hundreds of posters in a conference, there is thus competition of time and attention.
- Presenting a good poster is essential to grab and maintain the readers' attention.



A Poster Is...

....More than Presenting Data

- Enables your contribution to a meeting
- A significant part of professional education
- Provides information
- Develops your experience
- Builds networks and contacts
- Tremendous source of feedback



Posters vs. Papers

- Papers are designed to appeal to readers of a scholarly journal, and to meet the *formal* organizational and informational requirements of publication.
- Posters are designed to appeal to peers and colleagues at conferences and/or public displays, and to meet the organizational and informational requirements of conferences and/or public displays.



Posters vs. Papers (2)

- The audience of a paper is a *person* ; the audience of a poster is *people* .
- A poster presentation allows for question-and-answer sessions, and the exchange of ideas and information regarding your research.
- A paper presents *all* the information; a poster presents the *most important* information.



The message

- Get right to the heart of the matter, and remember : *Keep It Simple!* In clear, jargon-free terms, your poster must explain
- 1) the scientific problem in mind (*what's the question?*),
- 2) its significance (*why should we care?*),
- 3) how your particular experiment addresses the problem (*what's your strategy?*),
- 4) the experiments performed (*what did you actually do?*),
- 5) the results obtained (*what did you actually find?*),
- 6) the conclusions (*what did you think it all means?*), and, optionally,
- 7) caveats (and reservations) and/or
- 8) future prospects (*where do you go from here?*).
- Be brief, and always stay on point



Before starting the poster

- Prepare and submit your abstract
- Determine the one essential concept you would like to get across to the audience.
- Learn about your audience



Starting the poster

- First . . . **READ THE INSTRUCTIONS** supplied by the meeting organizers! Having an idea about these details before you begin will make the whole process much easier.



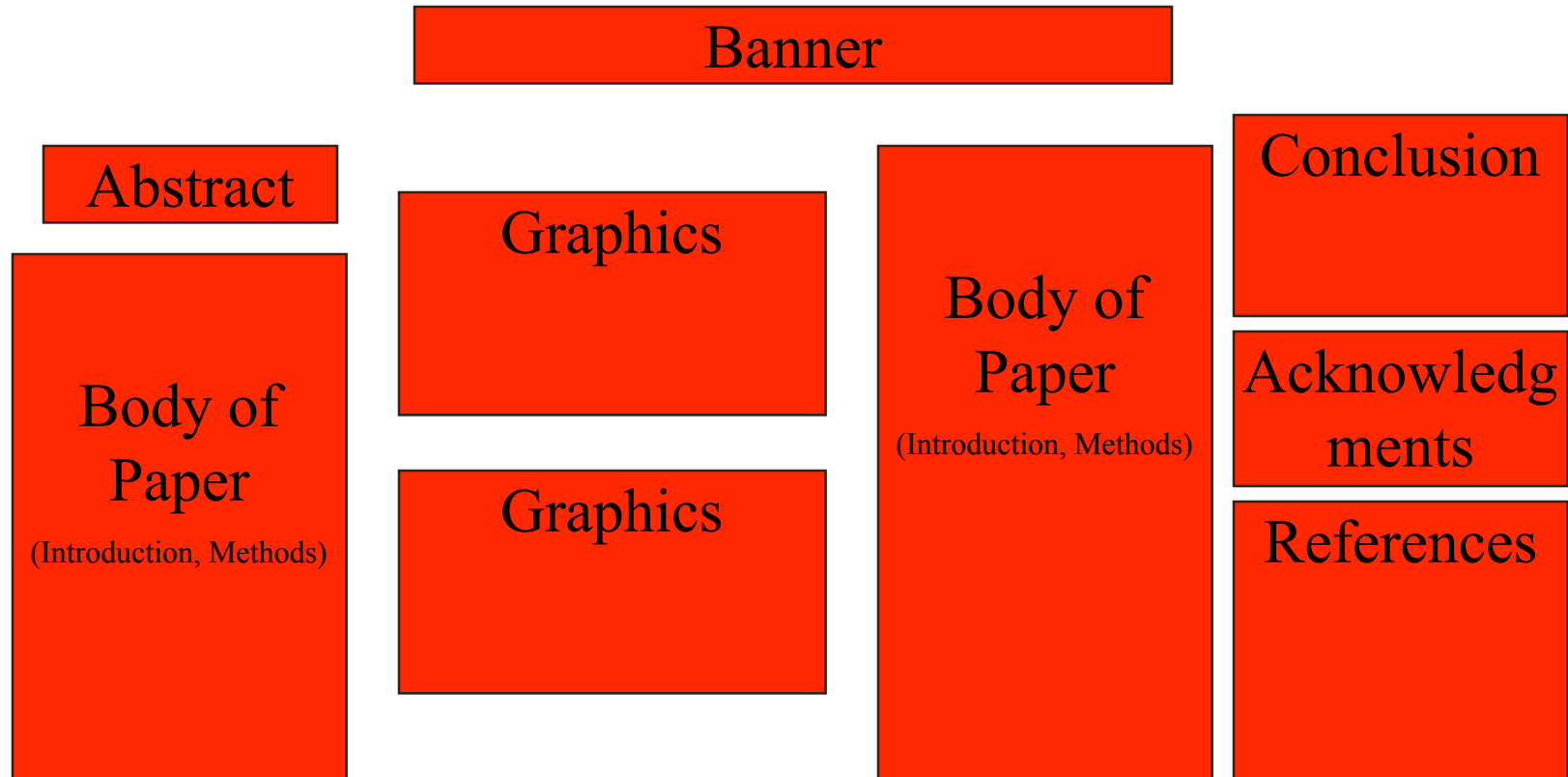
Elements of Your Poster

- Title
- Abstract
- Introduction
- Methods
- Data/Results
- Conclusions
- Acknowledgments
- References



Organization and Layout

- A general guide to poster layout:



Title that hints at the underlying issue or question and is formatted in "sentence case" (i.e., not in "Title Case" and not in "ALL CAPS")

Your name(s) here

Department of Biology, Swarthmore College, Swarthmore, Pennsylvania 19081

Introduction

This is a Microsoft PowerPoint template that has columns widths and font sizes optimized for printing a 16 x 10" poster – just replace the "title" and "text" with your own. "title" appear mostly with actual content. Try to keep your text word count under 1000 words. Use suggestive phrases in every line, every year. More tips can be found at the companion site, "Advice on designing scientific posters," at the Swarthmore College Biology Department web site.

The paragraph has "justified" margins, but by aware the simple left-justification before paragraph is sufficient better if your font doesn't "leave" words when fully justified. Sometimes spacing difficulties can be fixed by manually inserting hyphens into longer words. (Powerpoint doesn't automatically hyphenate, by the way.)

Your main text is easier to read if you use a "serif" font such as Palatino or Times (i.e., people have done experiments and found this to be the best). Use a two-word font for your title and section headings.

Materials and methods

Be brief, and opt for photographs or drawings whenever possible to illustrate equipment, protocol, or experimental design.

Fig. 1. Photograph or drawing of equipment, device structure or whatever focus of study is. Don't use graphics from the web that look terrible when printed.

Fig. 2. Illustration of important parts of equipment, or perhaps a flow chart summarizing experimental design. Schematic, hand-drawn illustrations are often preferable to computer-generated ones.

Results

The overall layout for this section can, and probably should, be modified from this template, depending on the size and number of charts and photographs your specific experiment generated. You might want a single, large column to accommodate a large map, or perhaps you could arrange 6 figures in a circle in the center of the poster. Do whatever it takes to make your results graphically clear. To see examples of how others have done this template in 16-inch presentation mode, perform a Google search for "scientific poster template 16x10inch.poster".

Paragraph format is fine, but sometimes a simple list of "bullet" points can communicate results more effectively.

- End of 12 insecticide was very good
- Control was compared water heater, on average, than was either brass (Fig. 3b) $t = 0.84$, $d.f. = 11$, $p = 0.42$.



Fig. 3. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

Other you will have some more text-based results between your figures. This text should explicitly guide the reader through the figures.

Fig. 4. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

Fig. 5. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

Fig. 6. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

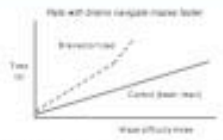


Figure 6. Avoid legs that force readers to stare through unneeded graphics and clutter of the lines (or fonts) and then decide the story very strangely. The above figure would also be greatly improved if you had the ability to draw multiple with a grid and ticks, with these variations being used in the text boxes.

Be sure to separate figures from other figures by generous use of white space. When figures are too cramped, viewers get confused about which figures to read first and which legend goes with which figure.

Figures are preferred for tables in scientific presentations. A table looks best when it is first composed within Microsoft Word, then "exported" as an "Object" if you can add small drawings or icons to your tables, do so!

Table 1. Analysis examining the effects of water treatment, parasite treatment, and initial height of nettle on nettle dry weight.

Source	df	Mean square	F-value	p-value
Water treatment	2	23.505	215.98	<0.0001
Parasite treatment	1	0.045	0.403	0.5271
Nettle initial height	1	0.709	7.029	0.0084
Parasite treatment * nettle initial height	1	0.009	0.022	0.8848
Residual	160	0.108		



Fig. 7. You can use colored lines and arrows to visually guide the viewer through your results. Making legends point the way is much, much better than having it in the text itself! These lines can help clearly lead your poster even when you're not present!

Fig. 8. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

Conclusions

You can, of course, start your conclusions in column form of your results section in "Data table".

Conclusions should not be mere restatements of your results. Instead, you want to guide the reader through what you have concluded from the results. What is the broader significance? Why should anyone care? This section should refer back, explicitly, to the "honing issue" mentioned in the introduction.

Fig. 9. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

Fig. 10. Make sure legends have enough detail to fully explain to the viewer what the results are. Now that you posted it go back to edit some "Materials and Methods" information within the figure legends or onto the figure themselves. It allows the 16x10 section to be smaller, and gives viewer a sense of the experiment(s) even if they have stopped directly to figure. Don't be tempted to reduce font size in figure legends, axes labels, etc. – your viewers are probably more interested in reading your figure and legend!

Literature cited

Shelton, J.L., J.R. Hayes, and R.M. Douglas. 1996. Local and global effects of insecticide on nettle growth. *American Midland Naturalist* 138:410-415.

Shelton, J.L. 1998. The evolution of parasitoid wasps. Pages 41-57 in *The Evolution of Insects*, edited by R. S. Mitter and R. D. Lane. Sinauer, Sunderland, MA.

Webb, J.C. 2000. *Evolution of Invertebrates*, an Introductory Course of California State University.

Source for the Study of Evolution. 2004. *Evolution* as teaching resource. <http://www.evolutionarybiology.org/evolution.html>. Accessed 2007 Aug 8.

Acknowledgments

We thank J. Chen for laboratory assistance, Wang Hui for web site, Earth for the greenhouse space, and M.D. Nelson for critical advice and helpful discussions. Funding for this project was provided by the Swarthmore College Department of Biology and a Merit award grant. Thank the people's names are omitted.

For further information

These contact information are available on the web and related projects can be obtained at www.evolutionarybiology.org. Open for 1981, for general information visit www.evolutionarybiology.org. It has an online PDF version of the poster at www.evolutionarybiology.org.

If you'd like more information, please contact:
John C. Webb




Sequencing the document

- The poster should use photos, figures, and tables to tell the story of the study. For clarity, it is important to present the information in a sequence which is easy to follow:
- Determine a logical sequence for the material you will be presenting.
- Organize that material into sections (Methods, Data/Results, Implications, Conclusions, etc.).
- Use numbers (Helvetica boldface, 36 - 48 points) to help sequence sections of the poster.
- Arrange the material into columns.
- The poster should not rely upon your verbal explanation to link together the various portions.



Organization and Layout

- Logistics:
 - Find out the size regulations before you begin
 - The standard is usually A0 but it may differ from meeting to meeting.



Organization and Layout

- Make it easy on your information-saturated audience.
- Remember the competition for attention
- Be concise and clear



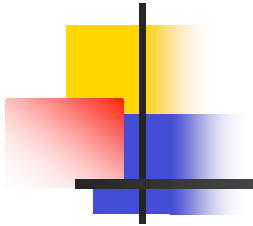
Organization and Layout

- Fonts:
 - Use the same font style throughout the poster.
 - Remember to adjust the size according to the importance of the sections, and that people will be standing 2 meters away or more while reading your poster.
 - Use fonts that are simple and easy to read.
 - Add emphasis with bold, underline or color--italics are harder to read.



Fonts

- Don't pick a font that's a pain to read. Don't get too creative : no one wants to struggle through a poster in *Brush Script* or **PORTAGOL** or HERCULANUM or similar.
- Don't vary the type sizes and/or typefaces excessively throughout the poster. For example, don't use something different for every bit of text and graphics. Use different size for different headings



Layout

- Don't make your reader jump all over the poster area to follow your presentation. Be consistent and help with numbers, arrows and logics
- Organize materials in either a columnar or counterclockwise fashion starting in the upper left corner
- Make section headings distinct from the body of your writing



Layout

- Lay out the poster segments in a logical order, so that reading proceeds in some kind of linear fashion from one segment to the next, moving sequentially in a raster pattern.
- The best way to set up this pattern is columnar format, so the reader proceeds *vertically first*, from top to bottom, then left to right.
- This has the advantage that several people can be all reading your poster at the same time, walking through it from left to right, without having to exchange places.
- Consider numbering your individual poster pieces (1, 2, 3,...) so that the reading sequence is obvious to all.
- And always make sure that all figure legends are located immediately adjacent to the relevant figures

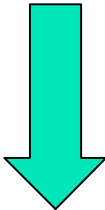
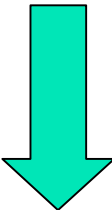
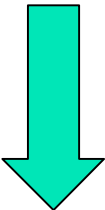


START

1

3

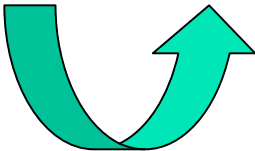
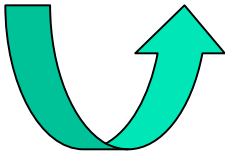
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2

4

6



FINISH



Readability

- Don't use too small a typesize for your poster. *This is the single most common error.* Never ever, use 10- or 12-point type. Don't use it in your text, *anywhere*. Don't use it for captions. Don't use it for figure legends, and annotations, footnotes, subscripts, or anything else. Don't *ever* use small type on a poster. Remember, no one ever complained that someone's poster was too easy to read. Got it?! Good!
- Use a typesize that can be read easily at a distance of ~2 meters or better. You do want a large crowd to develop around your poster, don't you? Think of 14-point type as being suitable only for the fine print and work your way up, (never down) from there. For text, 20-point type is about right. Not enough space to fit all your text? Then shorten your text!



Colours

- In addition to the background, use colors in your poster, and always try to use them in a way that helps to convey additional meaning.
- Select colors that draw attention but don't overwhelm. Make sure that the colors actually mean something and serve to make useful distinctions. Make sure that the color scale being used is tasteful, sensible, and above all, intuitive.
- Also. be mindful of color contrast when choosing colors; *never place isoluminous colors in close proximity* (dark red on navy blue, etc.), and remember that a lot of people out there happen to be red/green colorblind. Please remember this advice when you create color slides and transparencies as well



Elements of Your Poster

- Title
- Abstract
- Introduction
- Methods
- Data/Results
- Conclusions
- Acknowledgments
- References



Title banner

- Title
 - Catching, simple, able to be seen from 6 meters away. This is supposed to attract, so it needs to be seen from afar.
- Author(s)
 - The authors names may be printed smaller, at 72 points
- Institution
 - Affiliations can be even smaller, at about 36 - 48 points



The title

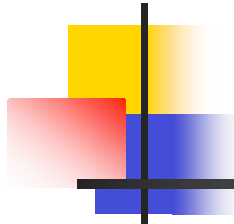
■ Think BIG!

- Make it descriptive: the reader should be able to decide quickly whether to read more or not. In case of doubt, he/she may walk to the next poster. Consider using a title that suggests some of your conclusions



Title sizes

- The most important parts of the title banner, the title itself, should be readable from about 6-7 meters away. Your title will lure viewers closer to see your imaginative and exciting study.
- The size of letters in the title itself should be a 96 point size.
- The rest of the poster, should be readable from about 3 feet away. A good way to check that is to print an A4 paper and see if you can read everything at arm length.



Title

- It should never occupy more than two lines. If things don't fit, shorten the title; don't reduce the typesize.
- Titles in all capital letters are harder to read.
- Some people put a photo of them next to the title. Either an ID photo, or a photo in working situation. Or a funny photo. It is very practical for the audience to find the author of the poster.



Names and affiliations

- Put the names of all authors and institutional affiliations just below your title.
- Don't use the same large type size as you did for the title; use something smaller and more discreet. This is not the cult of personality.
- Author(s)
 - It's a nice touch to supply first names rather than initials
 - Drop titles (PhD) and middle initials
- Institution
 - Institution and department.
 - City names and state names can be dropped.



Abstract

- Not always needed. A poster is short already, so if you really think you need one, may it ultra-short
- Identify what is being studied, how you are studying it, and what your variables are.
- Identify your hypothesis.
- State your findings.



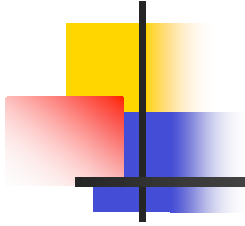
Introduction

- Avoid to put a huge chunk of text. One or two short paragraphs
- Less *in-depth* than an introduction for a paper. Bring the reader up to date on your topic and establish the importance of your own research
- Highlight and focus on:
 - Questions raised and answered by previous research.
 - The question you are asking and why you are asking it.



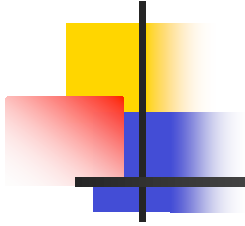
Methods

- Prefer figures and diagrams to text.
- Present only the basics--your audience isn't trying to replicate your study at this moment, they just want to know basic experimental design.



Data/Results

- Again, be concise
- Use graphic/visual elements:
 - Tables
 - Charts
 - Pictures
 - Graphs



Data/Results

- Include a descriptive label for each graphic.
- Below each graphic include a brief written description of what the graphic is and the interpretation of its data.



Conclusion

- Be concise and clear.
- Highlight:
 - What you found, and its importance.
 - Parallels and discrepancies with previous research and theory.
 - The direction of future research.



Acknowledgments

- Acknowledge those professionals and research assistants that contributed to your study, and the funding if any.
- Be brief.
- This section is not a requirement.



References

- Here again, not required but helpful
- Use the same references as in your original research paper.



Before you go any further...

- Save & back up your work!
- Don't say I didn't warn you . . .



Aesthetic Issues

- Color:
 - Used effectively, color is an effective method of attracting people to your poster.
 - If you use color, stick to using a set number of colors in a consistent pattern.
 - Limit your color use to 2-3 colors.



Aesthetic Issues

- Use contrasting colors for readability and a professional look.
- Sometimes a photo (light version) is used as a background. This is really nice, but make sure it is 1/ light enough so that the text can be read easily 2/ of high quality so that it can be enlarged without being pixelised

(it is not the case here!)



Aesthetic Issues

- Layout:
 - Limited space doesn't mean you can cram things together.
 - Use a consistent spacing rule between each element of your poster.
 - Try to align corners along vertical and horizontal lines.
 - Use graphics, but only those that are necessary



Edit!

- Don't ever expect anyone to spend more than 3-5 min at your poster. If you can't clearly convey your message pictorially in less time than this, chances are you haven't done the job properly
- **There ALWAYS is too much text in a poster.**
- Posters primarily are visual presentations; the text materials serve to support the graphic materials.
- Look critically at the layout. If there is about 20% text, 40% graphics and 40% empty space, you are doing well.
- When in doubt, rephrase that text or delete it. (Keep chanting this mantra: There *always* is too much text. *Always* too much text.)
- Use active voice when writing the text; *It can be demonstrated* becomes *The data demonstrate*.
- Delete all redundant references and filler phrases, such as *see Figure*
...



Edit Ruthlessly!

- Remove all material extraneous to the focal point of the poster.
- Since the abstract is usually published, there is no need to repeat it in the poster. The brief introduction should be sufficient to identify the purpose of the study.
- Same for References and Acknowledgments: you can often do without
- Since graphs & figures will have explanatory captions, there is no need to label the graphic with *Figure 1*, *Table 2*, etc.
- The poster is not a publication of record, so excessive detail about methods, or vast tables of data are not necessary. This material can be discussed with interested persons individually during or after the session, or presented in a handout.



Visual impression

- Restrained use of large type and/or colored text are the most effective means of emphasizing particular points.
- Use short sentences, simple words, and bullets to illustrate discrete points.
- Justify the paragraphs. This makes reading the poster less difficult.
- Avoid using jargon, acronyms, or unusual abbreviations.



Visual impression (2)

- Remove all non-essential information from graphs and tables (data curves not discussed by the poster; excess grid lines in tables)
- Label data lines in graphs directly, using large type & color. Eliminate legends and keys.
- Artful illustrations, luminous colors, or exquisite computer-rendered drawings do not substitute for CONTENT.
- Lines in illustrations should be larger than normal. Use contrast and colors for emphasis.
- Use colors to distinguish different data groups in graphs. Avoid using patterns or open bars in histograms.
- Use borders around each figures. Border colors can be used to link related presentations of data.



Personal touch

- Use some original/personal points
- A poster is a 2D presentation, but you can use the third dimension (flaps, wheels, moving arrows, etc...).
- For example, colored transparency overlays are useful in comparing/contrasting graphic results
- Make sure that it doesn't detract from the science or trivialize your work in some way. Use good judgment here.



Don't ever

- Don't ever supply long tables; no one has the time or inclination to wade through these.
- Don't ever lift long sections of text directly from some manuscript and use these as a part of your poster. A poster is not a worked-over manuscript.
- Don't forget typos and spelling errors, use a spell checker (it works on Powerpoint!)



Oh, and don't Forget...

- You will be talking to others, and talking with others, about your poster. Prepare how to explain things
- Bring a copy of your original paper for reference.
- Bring A4 copies of your poster and prepare a display so that people can take them.
- Put your email address on your poster, as well as a website if you have one



Plan ahead!

- You have probably heard this again and again. That is because it is ***IMPORTANT!***



Plan ahead! (2)

- With an increasing reliance placed upon poster presentations for information transfer at meetings, there comes an increased impatience with poorly presented materials.
- Although the poster preparation will expand to fill whatever time you allow it, don't be caught with an unfinished poster!
- Planning ahead is particularly important if you want to have the poster printed in one piece (highly recommended, and assumed in the following)



Plan ahead! (3)

- Preparing a poster will take as much time as you let it. Allocate your time wisely. • There are always things that go wrong, so do not wait until the last minute to do even a simple task.
- This is a public presentation; by planning carefully, striving to be clear in what you say and how you say it, and assuming a professional attitude you will avoid making it a public spectacle.
- If you have little experience making posters, it will take longer (estimate 1 week at the minimum).
- Too much lead time, however, encourages endless fussing about. Do the poster to the best of your ability, then go do something else.



The poster session

- There is always one (or several) session reserved to view the posters and discuss with their authors.
- It is important to optimize this time: your poster is essential, but the **PRESENTATION** of your poster is at least as much so



The poster session (2)

- Don't stand directly in front of your poster at the session, or get too close to it. Don't become so engrossed in conversation with any single individual that you (or they) accidentally prevent others from viewing your poster
- Try to stay close by, but off to the side just a bit, so that passers-by can see things also so that you don't block the vision of people already gathered 'round



The poster session (3)

- Don't be an eager beaver and badger the nice people who come to read your poster
- Give them some space. Allow them to drink it all in. If they engage you with a question, then that is your opening to offer to take them through the poster or discuss matters of mutual scientific interest. Conversely, don't ignore people who look as though they may have questions, especially by becoming engrossed in talking to all your buddies



The poster session (4)

- Stick around. It's your poster, your- work. Your boss paid you the trip to whatever so that you could present it. It's not the time for you to go for a beer. Try to hang around for as long as you can.



The poster session (5)

- Be a good scout, and come prepared to your poster, armed with reprints of any of your own relevant papers that you might have, plus extra copies of any material you may wish to share. Have ready some cards, or slips of paper you can use to provide colleagues with your address (e-mail address). Posters are a terrific way to get scientific suggestions and meet like-minded individuals. And postdoc propositions. Don't oversell these though.
- Knowing who will be there (so as to recognize names and remember a bit about the names and research of the big cheeses) can be quite helpful and avoid embarrassment

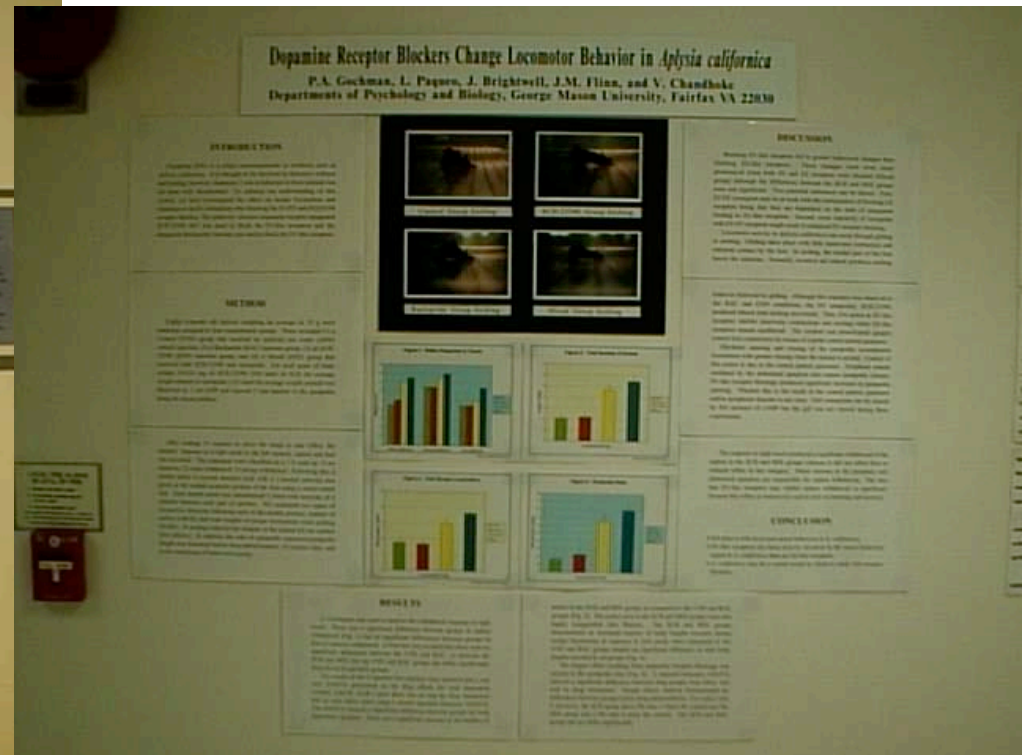
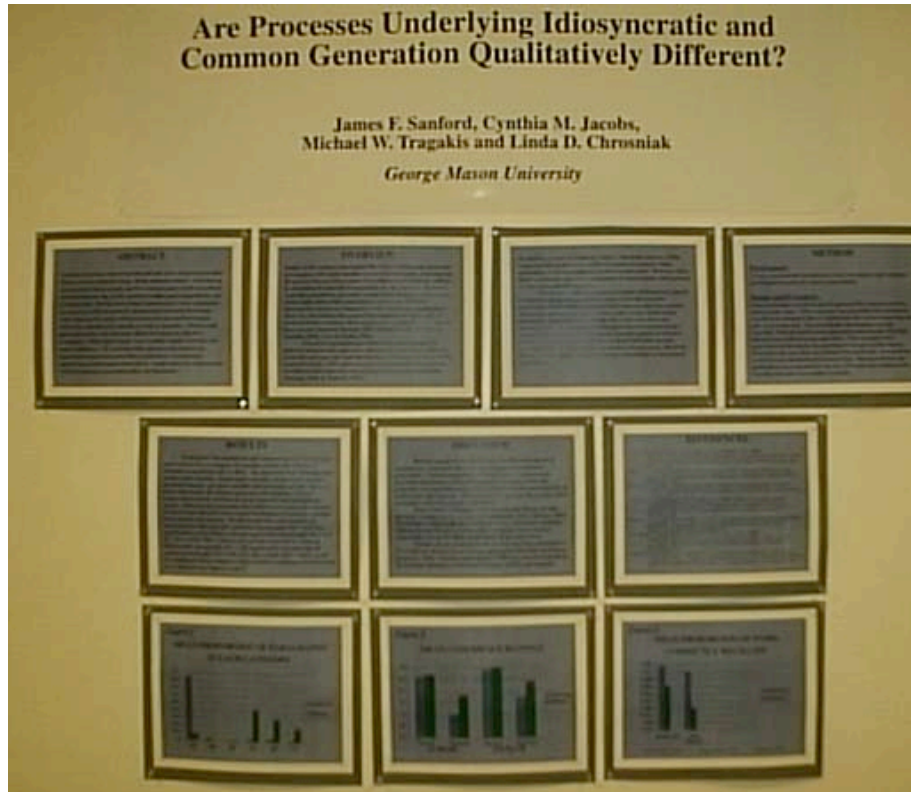
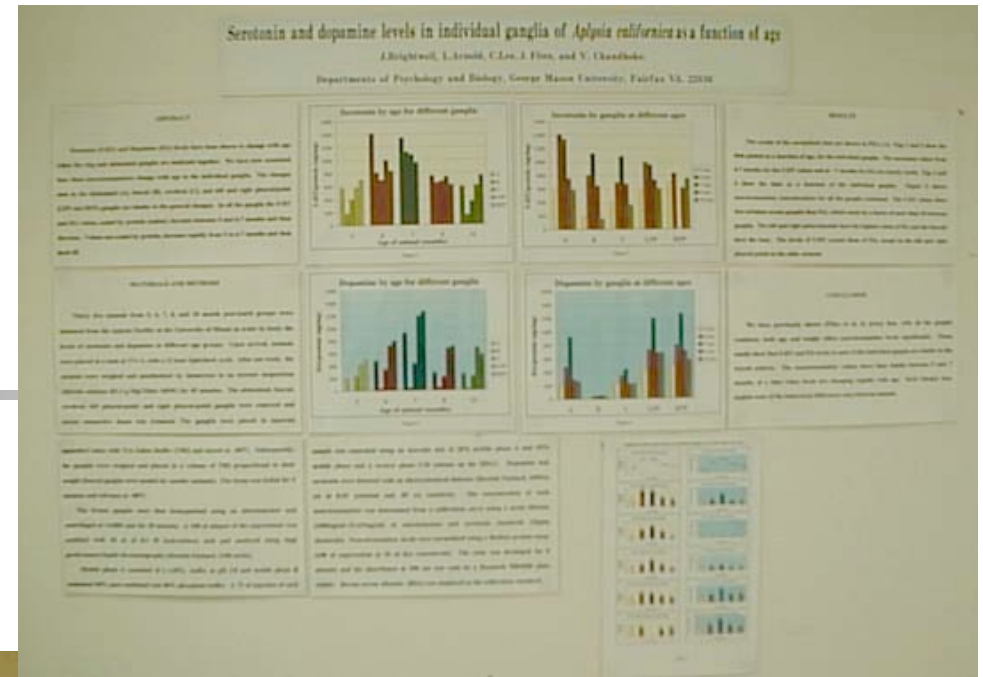


Evaluation

- based on five criteria:
 - visual attractiveness,
 - quality of information,
 - relevance,
 - originality,
 - balance of text, graphics, and illustrations.

Examples

(don't know the authors,
found them on the Internet)



Examples

A good example ...
...of a bad poster

Importance of theory for the control of invasive species

3 examples



The introduction of animal and plant species recently constitutes a major disturbance to ecosystems on oceanic islands

- Invasive species are characterized by a very high **growth rate**.
- They have a high **dispersal ability** and a **high survival rate**.
- They have a **high fecundity** and a **high survival rate**.

Mathematical modelling can help design conservation programs to prevent biological invasions on remote islands

- Current programs usually consist of **eradicating** the species, but this is often a **very expensive** and **time-consuming** task.
- In some cases, the species can be **controlled** rather than **eradicated**.
- The **control** of the species can be **achieved** by **eradicating** its **main source**.
- The **control** of the species can be **achieved** by **eradicating** its **main source**.



1 Set up of new control methods

Biological control

When a species is introduced to a new area, it can become a pest. The goal is to control its population. This can be done by introducing a natural enemy (predator or parasite) from its native range. This is a complex process that requires careful planning and monitoring.

Selection of best control agent

Choosing the right control agent is crucial. It should be effective against the pest, have a high survival rate, and not harm the native ecosystem. The agent should also be easy to transport and release.

Control by biological control

Biological control involves the use of natural enemies to control pest populations. This can be achieved through various methods, including the introduction of predators, parasites, or pathogens. The success of biological control depends on the compatibility between the control agent and the pest.

2 Optimisation of control strategies

Mathematical modelling is a powerful tool for optimizing control strategies. It allows us to simulate different control scenarios and predict their outcomes. This helps us to choose the most effective and cost-efficient strategy for controlling the pest population.

Biological control

Biological control is a sustainable and environmentally friendly method of pest control. It involves the use of natural enemies to control pest populations. This can be achieved through various methods, including the introduction of predators, parasites, or pathogens.

3 Prevention of secondary effects

While biological control is a promising approach, it can also have unintended consequences. For example, the introduction of a control agent can sometimes lead to the extinction of native species or the emergence of new pests. Therefore, it is essential to carefully monitor the effects of biological control and take steps to prevent secondary effects.

Biological control

Biological control is a sustainable and environmentally friendly method of pest control. It involves the use of natural enemies to control pest populations. This can be achieved through various methods, including the introduction of predators, parasites, or pathogens.

Examples

- A little better

Biological invasions as a major cause of species extinction through direct and indirect effects

Franck Courchamp, Josh Donlan, Rosie Woodroffe and Gary Roemer



Direct effects

Biological invasions are currently viewed as the second most important cause of species extinction. The harmful impact the poorly adapted local populations through simple and direct processes of competition or exploitation.



Fast invaders can be very efficient competitors and rapidly remove local plants and the animals that depend on them.



Herbivores, such as goats, can have a very severe impact on plant communities which are not adapted to the heavy grazing of such invaders.



Cats are among the most notorious invaders and are responsible of many local species extinctions through predation.



As omnivores, rats have a large impact on shaded ecosystems, as they can rely on two food types and thrive even in the absence of one (wheat, dogwood).

Indirect effects

Biological invaders can however also have a major impact on species by indirect processes, such as the one highlighted in the California Channel Islands, USA.

There, the endemic island fox, *Urocyon v. littoralis*, disappeared by an introduced prey, the feral pig, through indirect interaction only.

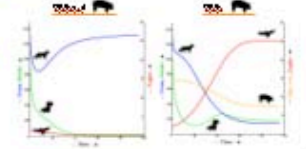
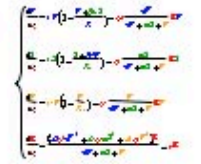
Prior to the introduction of pigs on those islands, fox and skunk populations did not provide enough prey for the eagles to breed.



As a supplemental food, pigs have facilitated colonization of the islands by golden eagles, which began preying on local prey as well as pigs.

Bigles expected local prey more than the better adapted pigs causing a drastic decline in populations of the endemic fox.

Skunk populations increased following the resulting fox competitive release.

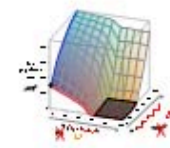
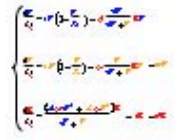


Conservation strategies

Indirect effects are often overlooked in conservation programmes, thus hindering success or even generating failure.

Here, because of their direct and indirect impacts, removal of pigs seemed the best conservation strategy.

Eliminated main food of either pig or eagles or both to us that eradication of pigs while eagles still remain would not lead to fox recovery but to its extinction. Because of the indirect effect on local species, introduced pigs have so much altered the functional ecological forces shaping the community that their cause removal is no longer sufficient to restore the ecosystem.



There are many processes through which invading species cause biodiversity loss, among which several indirect mechanisms. As those are less conspicuous, it requires careful studies for the causes of species extinction to be removed without any further unexpected disequilibrium being triggered by unforeseen indirect interactions.

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Examples

(much better)

Endangering the endangered: how the value we place in rarity can trigger extinction

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1. Context

Humans associate value with rare items (eg diamonds). Rare species are also disproportionately valued

Economic theory predicts that human exploitation should not lead to species extinction, due to the rising costs of finding the last individuals

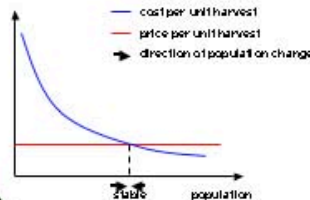
However, if a species' value increases with its rarity, exploitation is sustained even at low population levels. This may result in species extinction



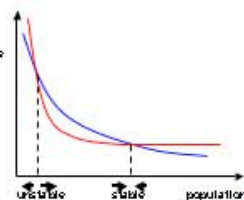
3. A simple model for poaching predicts the conditions for extinction

The Gordon-Schaeffer model for open-access exploitation was used to test the effect of a rarity-dependent market price on the equilibrium exploited population size (where the cost per unit harvest equals the price per unit harvest)

When price is independent of rarity, hunting does not result in extinction



When price increases faster than exploitation costs at low population levels, extinction occurs (AAE)



5. Activities which could lead to an AAE

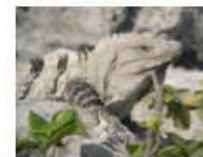
Trophy hunting



Hobby collections



Exotic pet trade

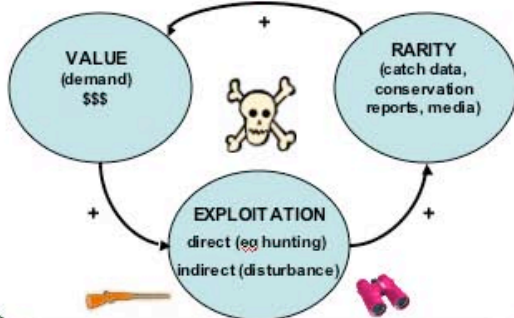


Wildlife-watching

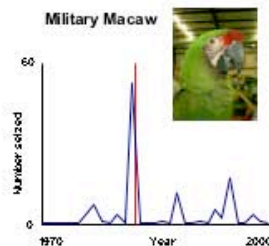


2. The Anthropogenic Allee Effect (AAE)

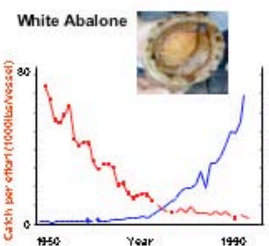
Key idea: A positive feedback between species rarity and economic value can drive species into an extinction vortex



4. Data suggests value and rarity are linked



Illegal trade peaks when species is 'officially' declared rare (red line indicates change in CITES status)



Decrease in commercial catch leads to a corresponding increase in price

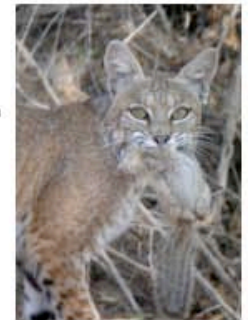
6. Conclusions

Rarity itself can trigger overexploitation and species extinctions. Prevention strategies must focus on the three components of the feedback loop:

RARITY - Regulate how much information on species abundance is available in the public domain

VALUE - Change the perception that owning goods derived from rare species conveys wealth and social standing

EXPLOITATION - Increase fines and jail sentences for illegal hunting and disturbance



(a very good one)

USING STABLE ISOTOPES TO CHARACTERISE TROPHIC RELATIONSHIPS

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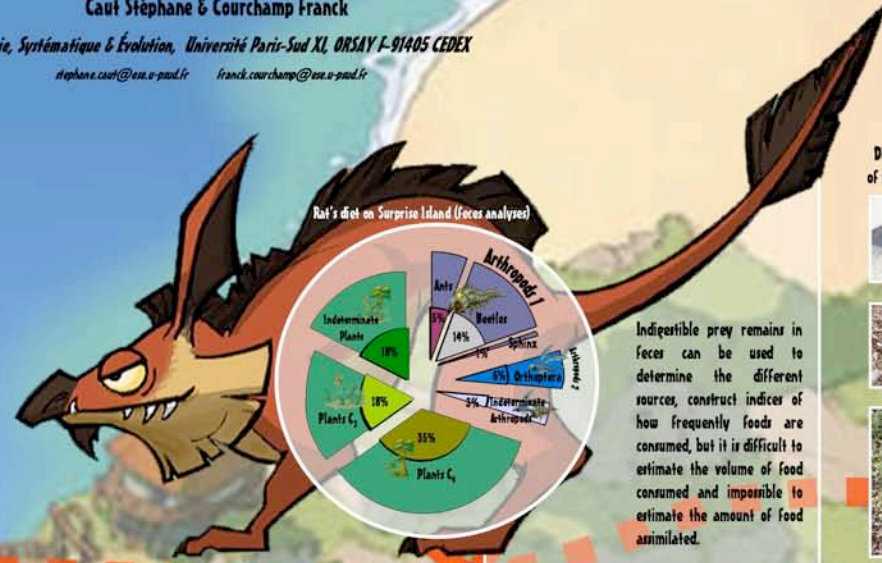
Interspecific interactions are often difficult to elucidate, when diet breadth is important. Recent advances in analysis of stable isotopes have demonstrated the utility of this technique for studying trophic interactions. We are interested in characterizing the impact of rats introduced into an insular (i.e. closed) ecosystem. In this regard, we combined studies based on isotopic and classical diet analysis.

Surprise Island



2

We selected the study site so that the characterisation of the entire ecosystem was feasible. We chose to work on Surprise Island a 24 ha island, off New Caledonia, where we conducted classical diet analysis of the introduced rat.



Direct observations of rat's consumption

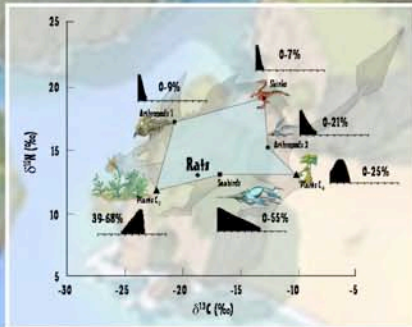


Indigestible prey remains in feces can be used to determine the different sources, construct indices of how frequently foods are consumed, but it is difficult to estimate the volume of food consumed and impossible to estimate the amount of food assimilated.

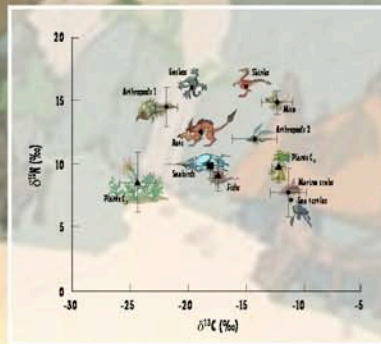
3



On Surprise Island introduced rats prey mainly on seabirds and plants. When combined with conventional techniques for quantifying diet and detailed investigation of predator-prey interactions, stable isotope analysis can a powerful tool for determining potential impact of invasive species on native communities. However, this method needs to be complemented by classical diet analyses. In addition, several factors provide challenges to inferring species interactions (geographic variation in isotopic signatures, differential isotope fractionation, tissue routing, animal condition, and diet breadth...).



Once the isotopic values of all potential resources are determined and actual resources are identified, a mathematical model can calculate the distribution of feasible contribution from each source to the rat diet. Seabirds and plants appeared constitute the majority of the diet.



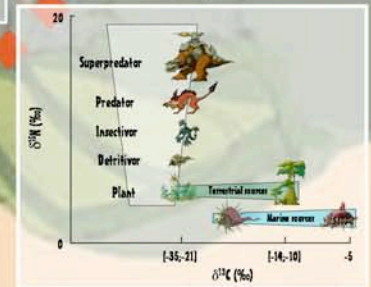
But the isotope analysis must be complemented by conventional techniques (dietary analyses based on stomach contents, feces contents or direct observations) to select actually eaten resources.



4

We thus sampled each species for isotope analysis:

- Carbon (δ¹³C) and nitrogen (δ¹⁵N) are the most widely used isotope ratios for identifying diet sources.
- Carbon isotopes permit distinction between the consumption of marine vs. terrestrial prey.
- Nitrogen isotopes are used to determine diet source and also trophic position (δ¹⁵N increased by 3-4‰ per trophic level).



6

5



Now your turn: good luck!

- Optional work:
- You will use the article that you present tomorrow to make a poster
- You will make it in Powerpoint and email it directly to me
- You have until next year (send it to me the day after the holidays, at the latest)
- Remember to print an A4 version to get a visual impression
- It will not be marked, but I will send you some comments



Presentation partly based on documents by:

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 - George Mason University, Writing Center
- Steven M. Block
 - Department of Molecular Biology, Princeton University, USA
- Joan M. Lakoski, Ph.D.
 - Department of Pharmacology, Office of Academic Career Development, University of Pittsburgh
- And other untraceable sources...