**Jeffrey Brown Summer 2013 Protocol**

**QUESTION:** Why is there a higher abundance of spiders on Guam than on the surrounding Mariana Islands?  
  
**Potential Explanations:**

1. Loss of birds caused release from predation
   1. **Hypothesis:** Loss of birds has caused an increase in spider abundance due to the release from predation.
   2. **Field comparison:**
      1. **Methods:** 2-weeks of Web monitoring on Saipan and Guam
      2. **Prediction:** There should also be a lower mortality rate (spider is gone, but web remains) of spiders on Guam as oppose to on Saipan.
   3. **Field experiment:** 
      1. **Methods:** Saipan bird exclosures and spider survival/behavior
      2. **Prediction:** Spiders within exclosures should have lower rates of web abandonment/higher survival rates than spiders not in exclosures
2. Loss of birds leads to increased food abundance (release from competition)
   1. Hypothesis: Due to bird loss, spiders have less inter-guild competition, and thus have increased abundance of prey.
   2. Field comparison:
      1. Methods: Survey lots of webs on each island for prey capture
      2. Prediction: Prey capture rates will be higher on Guam than on Saipan.
   3. Lab experiment:
      1. Methods: At Rice- raise spiders, feed varying amount of food to see how it affects population growth rates.
      2. Prediction:
3. Loss of birds causes spiders to lose less web to birds for nest-building, or flying through nests, so spiders need to build/repair webs less often.
   1. Hypothesis: The release from predation has allowed spiders to remain in successful locations longer and reduced the energy loss associated with relocating webs.
   2. Observations: video tape webs in frames in jungle on Saipan to see predation, web disturbance, silk-stealing by birds.
   3. Field comparison:
      1. Method: Web monitoring compare web duration on Guam to Saipan
      2. Prediction: Spider’s should relocate their webs less often (spider and web are both gone) on Guam than on Saipan, and webs on Saipan will be more disturbed (spider and web present, but web damaged) than on Guam.
   4. **Field experiment:** 
      1. **Methods:** Saipan bird exclosures and spider survival/behavior
      2. **Prediction:** Spiders within exclosures should have lower rates of web abandonment/higher survival rates than spiders not in exclosures
   5. Lab experiment:
      1. Methods: Webs in frames- physically damage some web, remove some web- compare reproduction rates, growth rates etc.
      2. Prediction:
4. **Without predators, spiders build bigger webs 🡪greater prey capture and reproductive output**
   1. Field comparison:
      1. Method: compare spider size and web size between Guam and Saipan.
      2. Prediction: spider and web size in Guam should be larger on average resulting in greater prey capture
   2. Field experiment:
      1. Methods: Perhaps none
      2. Prediction:
   3. Lab experiment:
      1. Methods: - expose spiders to birds compare web size to spiders not exposed to birds.
      2. Predications: Spiders exposed to birds should build smaller webs on avaerage

**Methodology:** Spider webs will be marked in the field and various measurements will be taken. Web size, spider size, absence or presents of stabilimentum, as well as the duration of time the web has existed will all be recorded. Out of this information the most important is the length of time a spider web stays in the same location. The other data will be used to help make web comparisons more standardized and will also help rule establish patterns of abandonment --- i.e. younger spiders (typically those before the 7th nstar) tend to have higher web abandonment rates which are driven by non-predatory related factors.

**Marking Webs:** Marking and observing webs will be how the majority of information for this study is collected. This may change with the implementation of frames but this is unlikely.

Materials: Sharpie, marking tape, tape measure, pencil, note book, (optional nail polish/whiteout)

1. Locate a web of *Argiope appensa.*
   1. The common name for the particular spider is the Banana or Garden Spider
2. Name the web.
   1. Naming is alphabetical. The very first spider web named in the study should be A.
   2. After all 26 letters are used, primes will be used. Example: A’ would be the 27th spider observed
   3. Once primes are exhausted, the pattern will repeat adding another letter. Example: A’A would be the 53 spider observed. A’A’ would be the 79 spider, and so on.
   4. Writing a note as to the location of the web is also useful for finding it again.
3. Write the date so you know when the web was first observed
4. Use the measuring tape to measure the length of the spider’s cephalothorax and abdomen.
5. Measure the diameter of the web.
   1. Note that not all webs are perfect circles so measure the SHORTEST distance across the web.
   2. The measurement starts where the outermost spiral is. This is the web which is sticky and goes across the support stands
6. Note whether or not there is an stabilimentum
   1. Also note the shape of it as well
7. Note whether the web has any damage or not.
8. Take note of anything else which may be of importance such as presences of other species of spiders within the web
9. Mark the web with flagging tape.
   1. Flagging tape should be placed on at least both of the trees/branches that the web is connected two. Generally three or four pieces of flagging should be used and placed near where the supporting strands of the web attach to their support structure (tree/branch/etc.).
   2. At least on piece of flagging should have the web name written on in sharpie in order to identify the web in the future
10. If possible place a dab of nail polish or white out on the spider in order to identify it.

**Checking Webs:** If possible, webs should be visited daily. The daily visit does not take as long as marking since less is required

Materials: pencil, notebook, tape measure

1. Relocate a previously marked web
2. Note whether or not the web and spider are present
   1. If the spider is not present stop after step 3.
   2. If the spider is present skip to step 4.
3. Note whether or not there is any web remaining and remove the flagging tape
4. Record whether or not a stabilimentum is present.
5. Record the size of the web using the same method as when marking webs
6. If the web has been present over a week rerecord spider size.
7. Record any other major changes observed in the web such as damage or the presence of additional species of spiders.

**Frame Potential**: Frames have been used in many experiments under lab conditions. However, there are no (this statement may need to be changed. It should read, “I have not come across a single paper”) papers which use frames in the field. Frames would allow spider webs to be placed in exact locations but would also provide a “standardized web”. That is, the webs within the frames would all be approximately the same size and shape. This would allow for more exact comparisons of things like capture rate on between islands. Frames may also have future potential for comparing response to web damage as well as for allowing percentage of web damage to be better assessed.

**Frame Construction**

Materials: ½ inch PVC pipe, ½ inch PVC elbows, string, (Optional: cutting device)

1. Cut half inch PVC pipe into segments one foot eight inches
2. Sand these segments of pipe with rough (60) sand paper
   1. This is meant to increase the ability of spiders to grip the pipe
3. Sand half inch PVC elbow connectors
4. Connect the half inch pipes and half inch connectors to form square frames.
5. If possible hang this frame from a post with nothing near it from only one end

Frame

Supporting Structure

Supporting String

**Establishing Spiders in Frames**Materials: frame, small containers

1. Collect spiders
   1. I used small Gladwaretm containers
   2. Place the container behind the spider while it’s on its web
   3. Close lid over the spider pushing it into the container
   4. Poke small holes in the container to allow spiders air
2. Orient the frame vertically either by having the frame either suspended from one corner or placing it on a flat surface with one corner on the surface and one hand holding the opposite corner
3. Release the spider onto the frame
4. As the spider walks on the frame be sure that the spider does not walk off the bottom of the frame if it is not suspended or to make sure the spider does not walk up the string hanging frame
5. The spider typically will have created a couple strands of silk within the first 10 minutes, after it does this it will begin to balloon out silk
   1. When it does this it will suspend itself from a single strand and dangle vertically
   2. You will also be able to visibly see silk being spun
6. When the spider balloons out silk slowly spin the frame on its axis
   1. This will cause the silk being ballooned out to get caught on the sides of the frame
   2. This has to be repeated on multiple instances
   3. It will generally take an hour or so before the spider stops sending out silk
   4. This varies depending on time
      1. The spiders more actively build web during the early morning and at night
7. Once the spider has stopped sending out silk the frame can be let in a secure location where it will not be damaged
8. Generally the spider will build a full web within 24 hours

**Transferring an already existing web to a frame**

1. Make sure to have frame already constructed
2. Find a web that is approximately the same size of the frame
   1. The support strands can be longer but the central part of the web should not exceed the size of the frame
3. Start by slowly placing the frame behind the web so that the web is in between you and the frame
4. Next find all the supporting strands
5. One by one, pull the supporting strand off of the branch/leave/etc. it is attached to and then wrap the supporting strand around the frame. Repeat this until all supporting strands are attached to the frame.
   1. Note this may damage the web a little but so long as the majority of the web is connected it will not have an impact
6. After the web has been placed leave the frame in a secure location (preferably one that has it suspended by the topmost corner) and leave the web overnight
7. The spider should rebuild its web in the frame in the next 24hrs.