2007

Summer Research Reports

VIZ | LAB

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James Allert Department of Computer Sciences

Making tutorials for CS Classes with Adobe Captivate (an e-learning authoring tool)

Project overview:

This project developed a unique online student learning resource that allowed CS-1121 (Visual Basic) and CS-1511 (Computer Science I) students to see how projects are created, as well as how programs are debugged by accessing flash animations. The project created the flash animation library. The library can be found athttp://www.d.umn.edu/~cshelper

Use of the Viz Lab and its resources, Summer 2007

The grant allowed me to employ an undergraduate computer science student, Scot Halvorson, to create the flash animation library using Adobe Captivate 2.0 software. Scot put in up to four hours/day through most of the summer working on the project.

Outcome

The Viz Lab seems to be an excellent facility for the production of multimedia programs, and worked well for the production of these Flash animations. They proved to be very popular with students in both classes, especially early in the semester when they received thousands of hits each week.

Twenty three screen-capture animations were constructed for Visual Basic (CS-1121) and 33 for Computer Science I. Most are several minutes in length.

The website itself is shown in Figure 1.

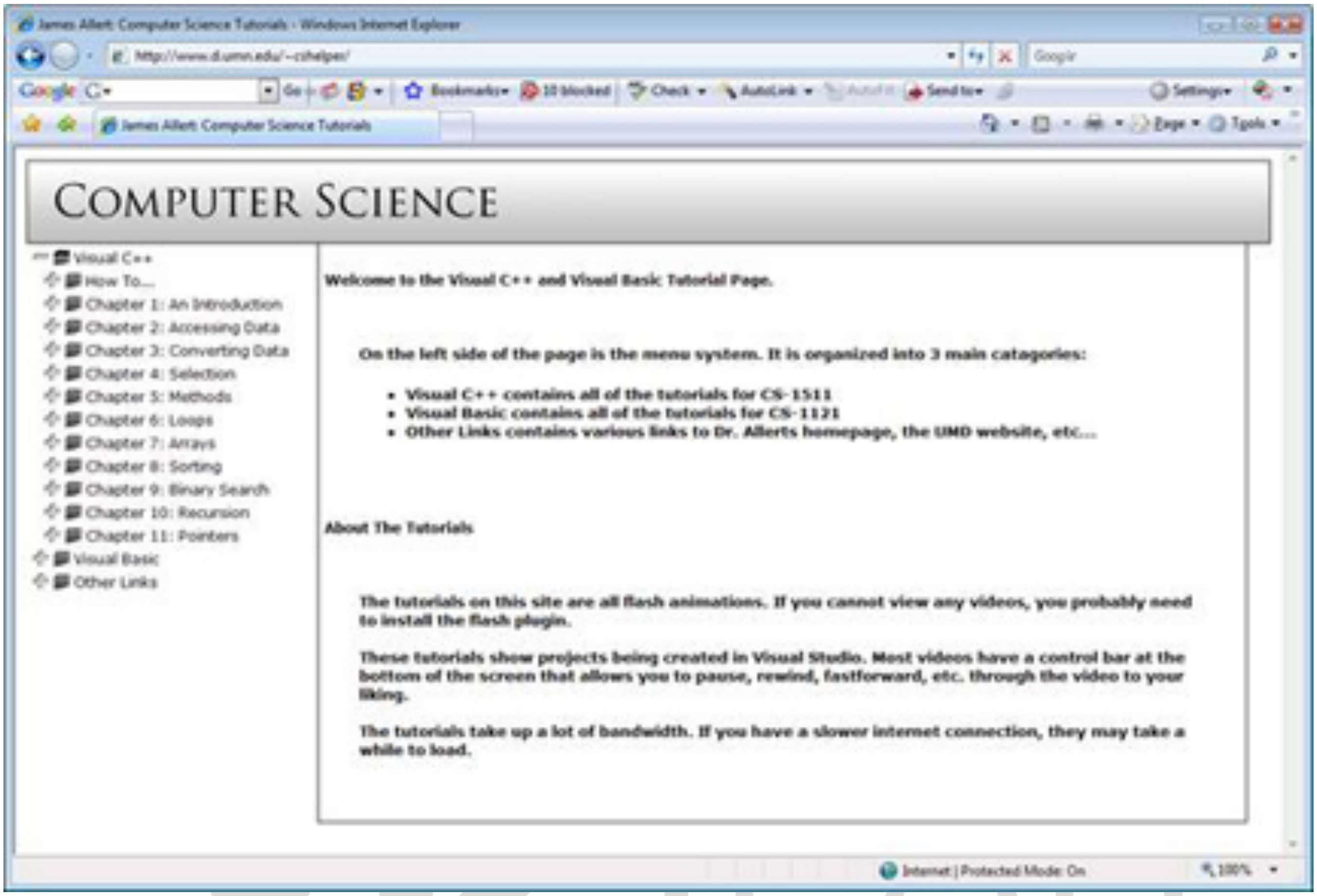


Figure 1 Main page

The categories of animations are shown on the left side of the screen and are expandable to reveal the subcategory lists of individual animations, as shown in Figure 2.

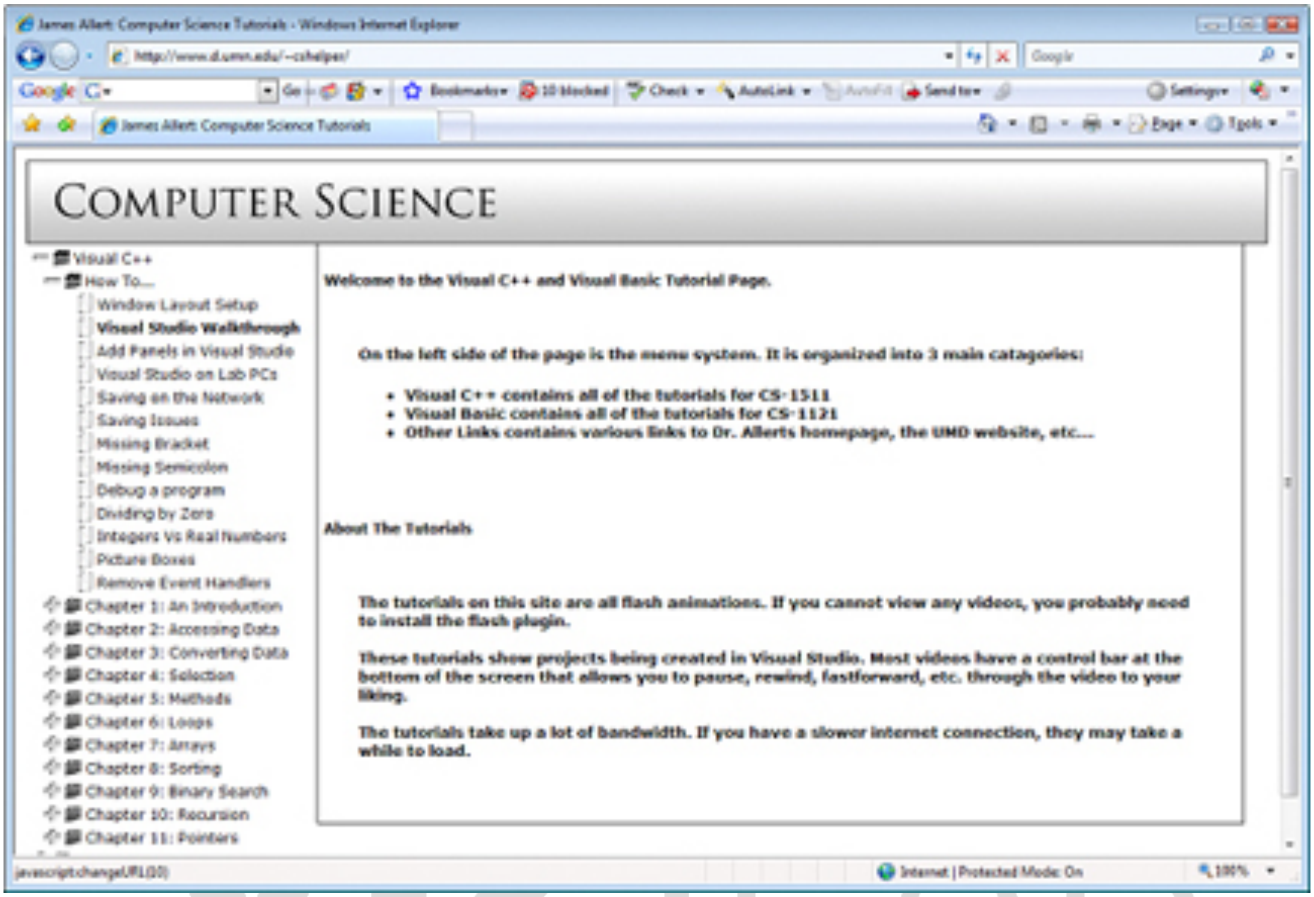


Figure 2 Animation subcategories

The website programming was done in Javascript.

Each animation displays in the window to the right of the animation list, as shown in Figure 3. The animations included mouse movements, menu clicks, button clicks and were explained by accompanying text.

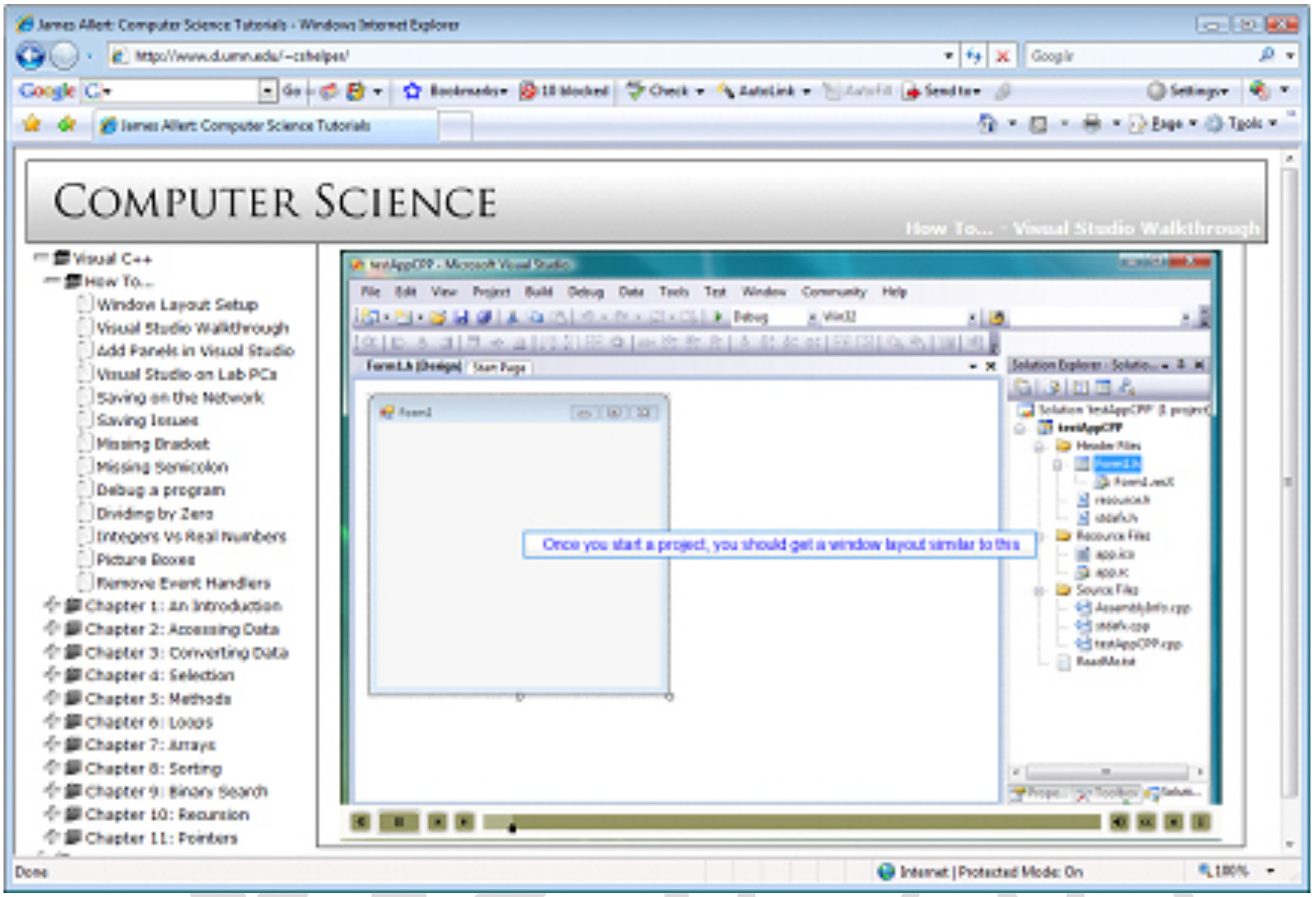


Figure 3 Animation display in main window

As a result of this Viz Lab project an extensive amount reference material and practical demonstrations now exists on the cshelper web page for CS-1511 and CS-1121 students. Students demonstrated the utility of this by accessing it often, especially in the first stages of their course when visual examples were most helpful.

I believe that this software (Adobe Captivate) is a wonderful tool that can greatly aid instructional endeavors whether it is in a course context or as general instruction provided by ITSS. This project was very successful and introduces a set of new possibilities for both students and faculty.

Terry Hams Graduate Student, IBS

Avian Foraging Mechanisms in Relation to Preferences in Goldenrod Gall

Background and methods

The foraging of resident birds in Minnesota is subject to the extremes of the seasons. The birds must therefore find sources of food to cope with these stresses. One method that these birds have discovered is to prey upon insect galls. Downy woodpeckers and Black capped chickadees are resident birds that must seek out sources of protein in the winter to supplement their diets. The chickadees are mostly insectivorous during the summer months and shift their diet to half seeds and half protein during the winter. The woodpeckers are primarily insectivores in the summer and remain that way in the winter as well. These diets require that the birds seek out insect larva and one such source is that of galls.

The goldenrod gallfly is a gall forming insect that is widespread throughout North America. It oviposits eggs into the stems of goldenrod plants in the early summer where they form a spherical gall over the next few months. During the fall the insect will create an exit tunnel to the edge of the gall and then will go into a suspended animation to survive the winter, and will emerge in the late spring as an adult fly. The gallfly must contend with two insect predators in order to survive until the spring. The Eurytoma wasp is a parasitic wasp that attacks goldenrod galls in the summer months and oviposits eggs into the gallfly larva. The second predator is a mordellid beetle that lays it eggs on the surface of a gall where the larvae emerge and bore into the gall. These larvae then tunnel throughout the gall digesting the plant tissue and will consume any other larva that they encounter, such as the gallfly or wasp.

To better understand how these birds choose the galls that they attack during the winter I formulated four hypotheses. The first hypothesis is that birds will prefer to attack the largest galls there by maximizing there reward. The second hypothesis is birds will prefer prairie galls over forest galls. Hypothesis three is the birds will prefer galls that contain both mordellid beetles and gallflies to that of gallflies alone. That last hypothesis is birds will avoid attacking galls that have no exit tunnel present.

To test these hypotheses I created gall stands that were a 2x4 base stand with 100 three foot bamboo stakes placed vertically along it. On these stakes were randomly placed 50 prairie and 50 forest galls all with a diameter between 20 and 25mm. The concentration of mordellid beetle has been shown to be much higher in the prairie galls then the forest galls which is the rational for using these two types. The size range would allow for a small chance of the parasitic wasp to be present as they are size limited in attacking gall by the length of their ovipositor.

Gall stands were placed in natural patches of Goldenrod that had already been predated to assure that the birds were near the area. The sites used were; Hawk Ridge Bird Observatory, Hartley Nature Area, Jay Cooke state park, Lester golf course, UMD research farm, and Enger golf course. Each site had two replicates placed at least 250meters apart. The stands were placed in the field on the second week of January 2007, within three meters of the edge of trees or bushes that provide cover for birds in their foraging. The stands were then surveyed once a week to record any predation by birds or damage from other sources. Once 25% of the galls in a stand were attacked the entire stand was removed and the galls dissected to determine contents. Stands that were not attacked were removed in the middle of April before they warmed up and allow the insects to emerge. The dissections would allow me to determine the factors that the birds were selecting for in choosing to attack these galls such as insect inhabitant, gall diameter, and presence of an exit tunnel. Additionally, I collected galls from natural patches of Goldenrod in some of these areas to observe if the same selection factors were being used by the birds.

Results

The first hypothesis that birds will prefer to attack larger galls was accepted. Analysis of the data allowed us to observe that in the natural patches of goldenrod, the predated galls were significantly larger then mean gall size. When this was organized by the specific avian predator it was observed that the Black capped chickadees attacked the largest galls available while the Downy woodpeckers did not select for large galls (Figure 1). The second hypothesis that birds prefer prairie galls over forest galls was rejected. The birds showed significant selection for forest galls overall. The woodpeckers had a much stronger selection for the forest galls then the chickadees (Figure 2).

Hypothesis three that birds will prefer galls containing both mordellid beetles and gallflies was rejected. The birds showed selection against galls containing mordellid beetles (Figure 3), which may explain the reason that prairie galls were avoided as well. The woodpeckers were more selective then the chickadees in avoiding mordellid beetles. The final hypothesis that birds will prefer galls with exit tunnels was accepted. The woodpeckers strongly selected for this factor while the chickadee selection was weaker yet still significant (Figure 4).

In conclusion the avian predators showed significant selection for many of the tested factors. The woodpeckers and chickadees were selecting for similar factors yet in most cases the woodpecker's selection was stronger then the chickadee's. This may be because the woodpecker has developed senses that allow it to better determine the contents of a goldenrod gall before it expends the energy to excavate it. Chickadees on the other hand may be just selecting the largest galls available in order to increase their chance of finding a gallfly larva to consume. Although excavating larger galls is more costly on the bird it is still likely more profitable then excavating many small galls for the same biomass reward.

Figure 1 Comparison of size of mean gall size of galls attacked by Black capped chickadees and Downy woodpeckers. The mean gall size is represented by the dashed line. Chickadees showed significant ($P<0.05$) selection for larger galls.

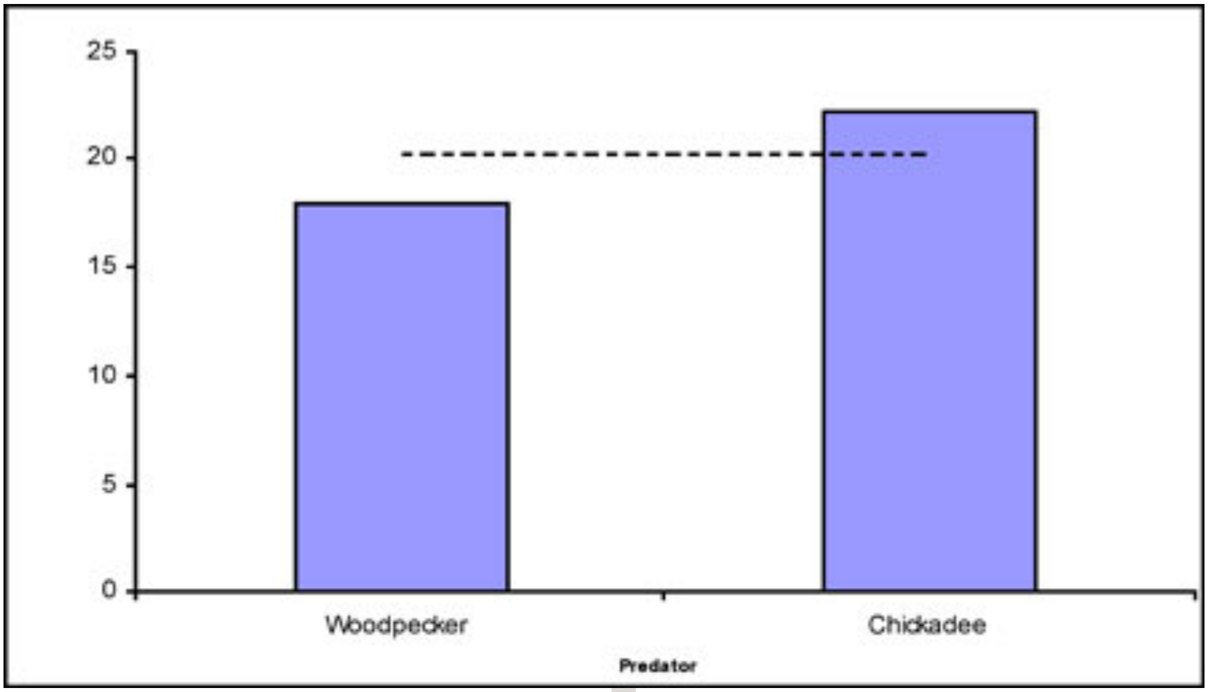


Figure 2 The selection for biome by the avian predators. Both predators showed significant selection for forest gall (P<0.05) but the woodpecker selection was much stronger.

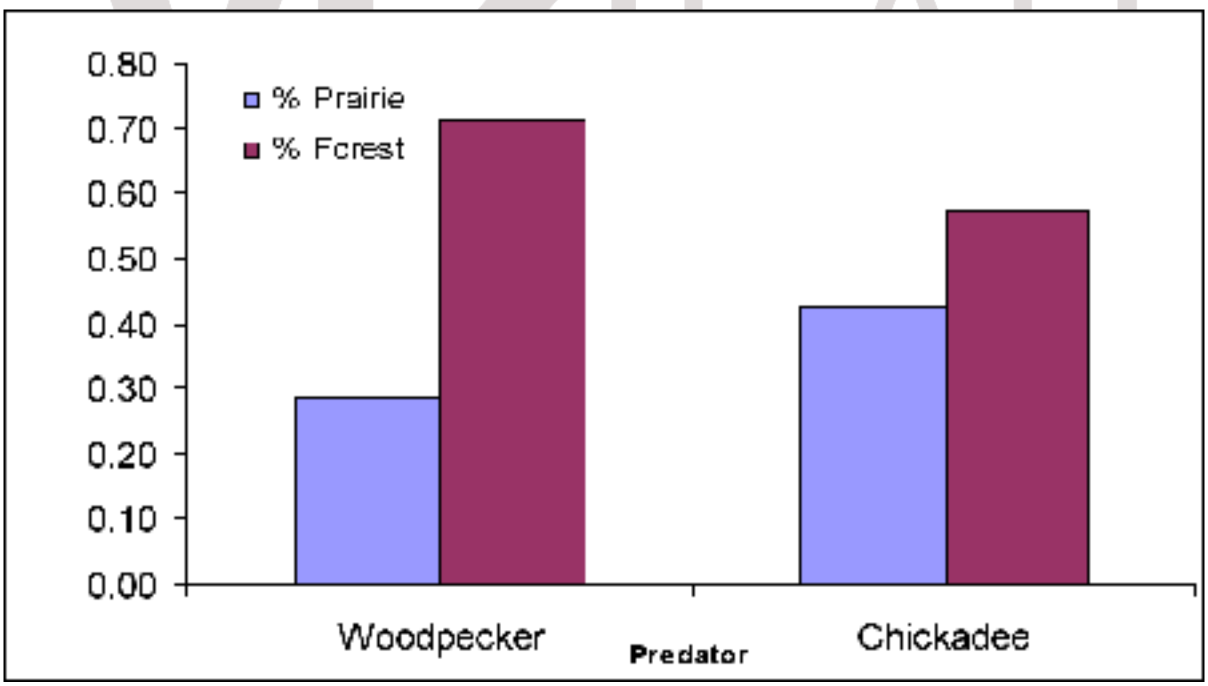


Figure 3 Preference of avian predators for the presence of Mordellid beetles in galls. The woodpecker showed strong selection against the mordellids (P<0.01). The dashed line represents the mean abundance of mordellids in all galls.

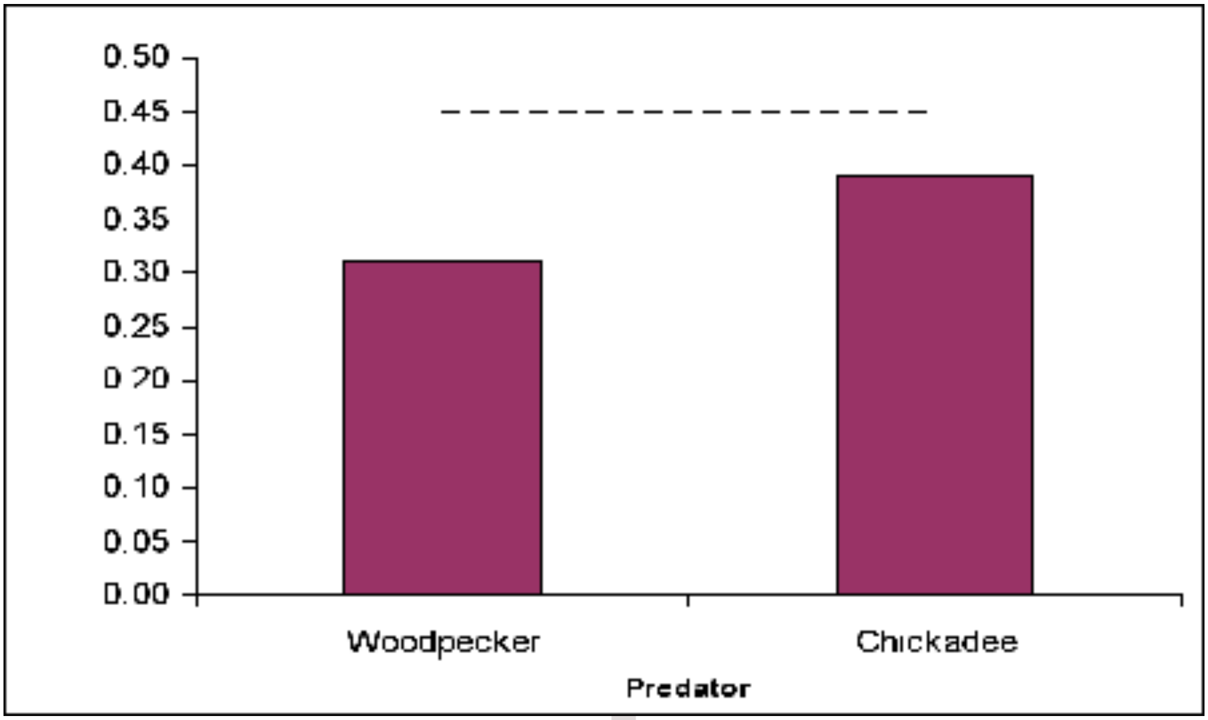
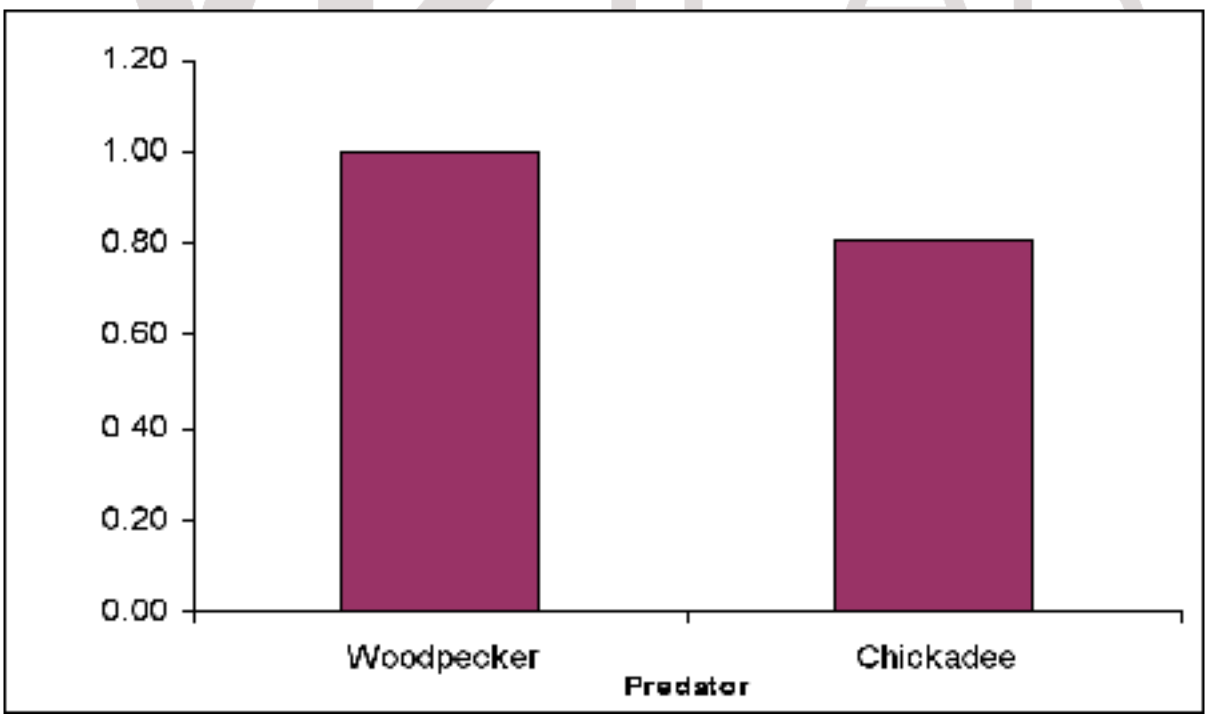


Figure 4 Preference of avian predators for the presence of an exit tunnel. Both predators showed significance for exit tunnels (P<0.05). The dashed line represents the mean abundance of exit tunnels present in the galls.



Modeling

The Viz Lab (Visualization and Digital Imaging Lab) issued me a grant for the summer of 2007 in order to conduct modeling of the avian predations I observed in my experiment. The modeling will be done with the use of the*Forager 1.1* program by Amber Waves Software. This program has five foraging models incorporated within that the data from these experiments can be inserted into. The five foraging models are; dynamic programming, hierarchical matching model, marginal value theorem, marginal value theorem with learning, and the predator-prey model.

Of these models I will be using the dynamic programming and hierarchical matching models. The dynamic programming model allows the user to enter data on prey abundance in a patch as well as time spent foraging in a patch. Using this data I can then estimate a fitness response of the predators from the observed results of my experiment and adjust the model to see how the fitness changes. The other model that will be used is the hierarchical matching model. In this model I can enter data on the abundance and palatability of the three different prey items in each patch to observe the habitat use and time spent foraging in the patches. This will allow me to model both the avian predators and prey items and determine the foraging differences.

There are two additions experiments that Viz Lab is providing support for. The first is to quantify the avian predation of galls by verifying avian attack through digital recordings. These recordings will help me to determine exactly which gall was attacked by which avian predator in order to give me more accuracy in the foraging models. At this point determining which bird attacked a gall is subjective in that the chickadee is believed to have a larger attack area then the woodpecker. This has not been tested to assure accuracy and by recording which bird attacked which gall I will be able to observe patterns that each predator shows in its attack.

Figure 5 The traditional method for determining attacked by avian predator. The size of the attack as thus far been used to assign an either a chickadee or woodpecker as the attacker.
http://www.facstaff.bucknell.edu/abrahmsn/solidago/gallkey8.html

The second experiment that is to be conducted is to determine a method for locating exit tunnels in galls without having to dissect them. The woodpecker and possibly the chickadee are able to do this through an undetermined sensory mechanism. I plan on using ultraviolet and infrared light photography to see if the exit tunnels can be observed in this manner. Another possible method may be using small microphones and computer programs to observe the vibration signature of galls to find a pattern for contents.

Beth Holbrook Graduate Student, Biology

Foraging Behavior of Age-0 Lake Trout (Salvelinus namaycush)

Introduction

Lake trout (*Salvelinus namaycush*) are the primary native predatory fish in the Laurentian Great Lakes. In the 1950s, lake trout populations crashed throughout the Great Lakes due to a combination of sea lamprey predation, overfishing, and reduction in spawning habitat. Populations became so low that natural reproduction ceased in all of the Great Lakes, except Lake Superior. The ecological importance of this species combined with its value to the commercial and sport fishing industries resulted in efforts to rehabilitate lake trout populations. These measures include controlling sea lamprey populations, stocking lake trout, eliminating commercial fishing, limiting sport fishing, and establishing refuges where fishing is prohibited. Despite over fifty years of management intervention, Lake Superior is the only Great Lake where natural reproduction occurs and lake trout populations have rebounded.

There is evidence that impediments to natural reproduction may be occurring the first several months after lake trout eggs hatch in the spring, yet little is known about this period of lake trout development. In order to determine whether competition, food availability, or bioenergetic constraints might be limiting survival, it is important to better understand the mechanisms by which age-0 lake trout forage. The purpose of this research was to use Viz Lab software to analyze video images of age-0 lake trout feeding trials to accurately determine parameters used in foraging models.

Overview of research

Foraging potential in fisheries is commonly approximated using mathematical models. One common model is an encounter rate model (*Z*) developed by Gerritsen and Strickler (1978):

$$Z = \left(\frac{\pi R_{ij}^{2}}{3}\right)\left(\frac{3V_{j}^{2} + V_{i}^{2}}{V_{j}}\right)u_{i}$$

where Rij is the reaction distance of the lake trout, Vj is the swimming speed of the lake trout, Vi is the swimming speed of the prey, and ui is the prey density. To estimate daily foraging potential, the encounter rate model is multiplied by the probability that a fish will locate, pursue, attack, and retain a prey item.

The purpose of our research was to accurately estimate these model parameters by conducting a series of age-0 lake trout foraging trials in the laboratory. We replicated Lake Superior temperatures by conducting all experiments in a temperature-controlled chamber at 8ÂºC. We also simulated natural light conditions by using cyan LED lights ranging from 450-550 nm, the predominant wavelengths found at depths greater than 45 m in Lake Superior. The illuminance of the LED lights was varied from 0 lux to 1960 lux to simulate a range of depths and nighttime conditions under which age-0 lake trout may forage.

Lab foraging experiments were conduced with two different prey species, amphipods (*Hyallela* spp.) and mysids (*Mysis relicta*), a freshwater shrimp commonly found in Lake Superior. Previous diet studies have found that mysids are the primary food source for age-0 lake trout; however, they are extremely difficult to culture in the laboratory. Amphipods were used in the experiments until mysids could be captured in the field. Experiments were conducted from March until July, as lake trout grew from approximately 30 mm to 70 mm. Feeding trials were videotaped overhead using a Sony DCR-TRV250 digital video camera recorder with built-in infrared light that was used to capture feeding trials conducted at 2 lux or less.

Application of Viz Lab software

Recorded video of the feeding trials were analyzed by importing digital clips into Quicktime 7 Pro. The clips were exported as *.avi files in black and white, and the frame number was reduced to 15 fps for ease of analysis. The *.avi files were imported into MATLAB 7.0 and digitalized using a customized MATLAB software program (Hedrick 2007). Digitalized coordinates were exported for the length of the lake trout, the length of the prey item, the search speed of the lake trout, the burst speed of the lake trout, the swimming speed of the prey item, and the vector of attack. The coordinates were imported into an Excel spreadseet and scaled to calculate distances (mm), speeds (mm/sec), and angles of attack. Quicktime 7 Pro was also used to view the video clips to analyze the probability that an age-0 lake trout would locate, pursue, attack, and retain a prey item during each feeding trial.

Results

Excluding 0 lux, age-0 lake trout reacted at a similar distance to prey at low light levels compared with high light levels. At 0 lux, lake trout fed unsuccessfully—during our trials we only had one successful capture that occurred at 0 mm (Figure 1). Lake trout searched for prey at a reduced swimming speed compared to their burst speed upon location of prey (Figure 2). Amphipods had a much slower swimming speed than lake trout, and were usually unsuccessful at avoiding capture (Figures 2, 3). The majority of attacks were located anterior to the age-0 lake trout (Figure 4), suggesting that age-0 lake trout relied heavily on visual detection and were not as reliant on other sensory systems such as their lateral line while foraging.

Figure 1 Reaction distance (mm) plotted against light levels (lux) for amphipods. Error bars are 2*SE.

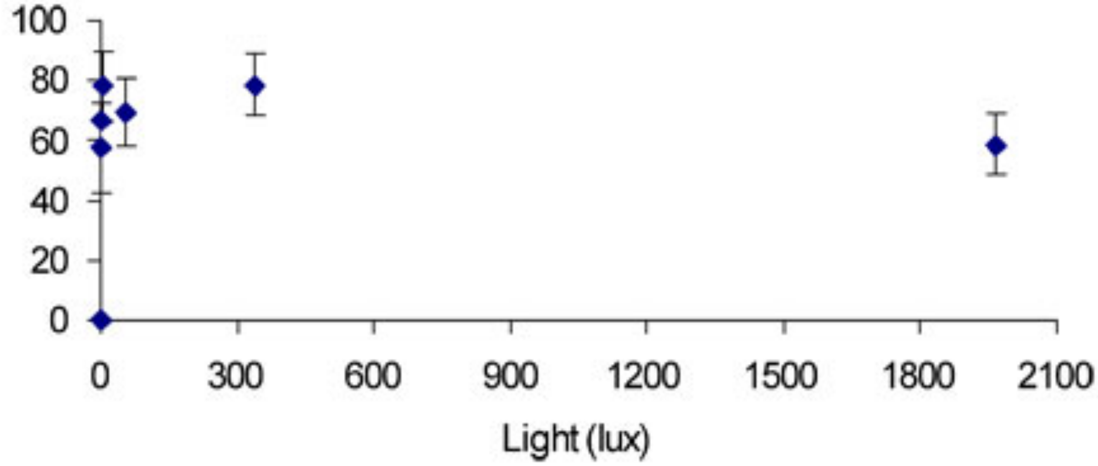


Figure 2 Swimming speed (mm/sec) for lake trout while searching for prey, after detecting prey ("burst"), and swimming speed of amphipods. Error bars are 2*SE.

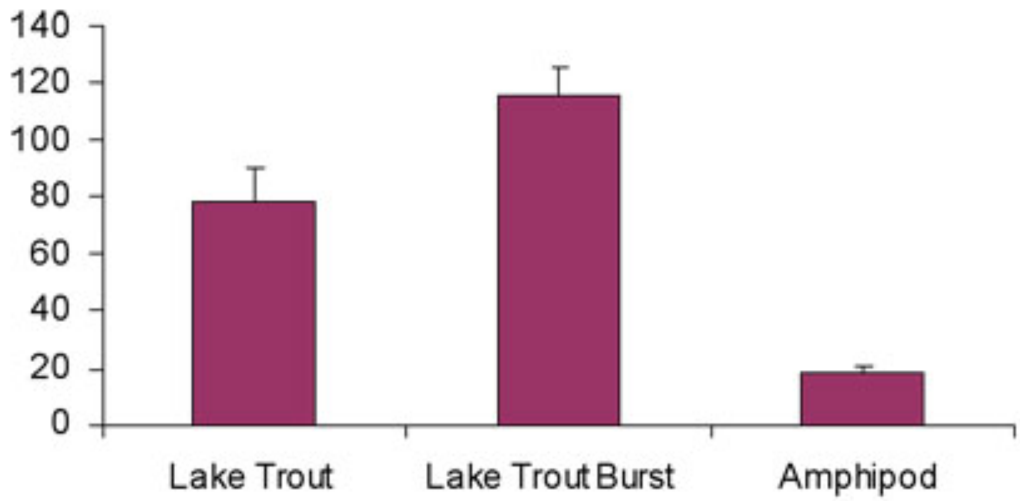


Figure 3 The probability of location, pursuit, attack, and retention. The overall probability for these separate events occurring was 0.69. Error bars are 2*SE.

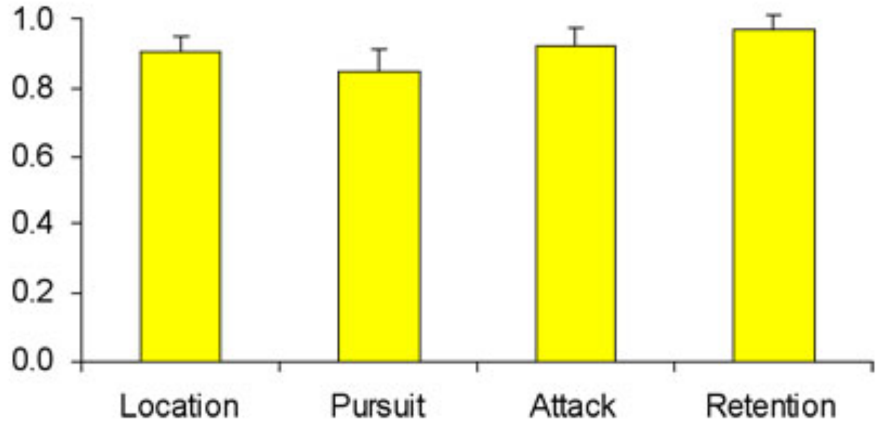
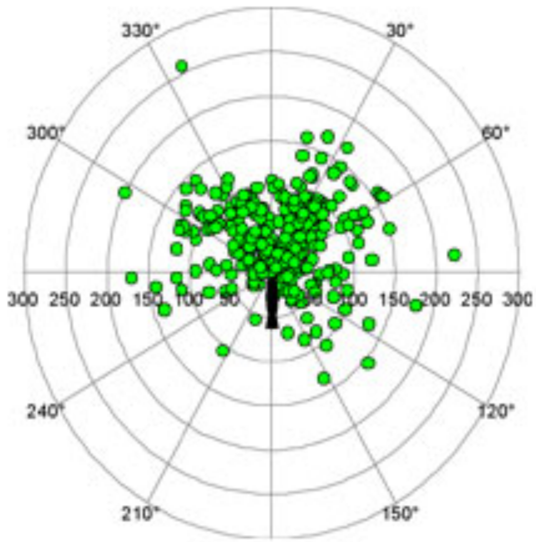


Figure 4 Reaction angles and distances of attack. Each point represents a prey item that was attacked, with the age-0 lake trout oriented vertically (shown by the dark shape in the middle of the polar plot). The majority of attacks occurred between 90Â° and 280Â°.



References

Gerritsen, J., Strickler, J., 1978. *Encounter probabilities and community structure in zooplankton: a mathematical model*. J. Fish. Res. Board Can. 34, 73—82.

Hedrick, Tyson L. "DLT Data Viewer 2", *Digitizing and DLT in MATLAB*. 2007. http://www.unc.edu/~thedrick/digitzing/

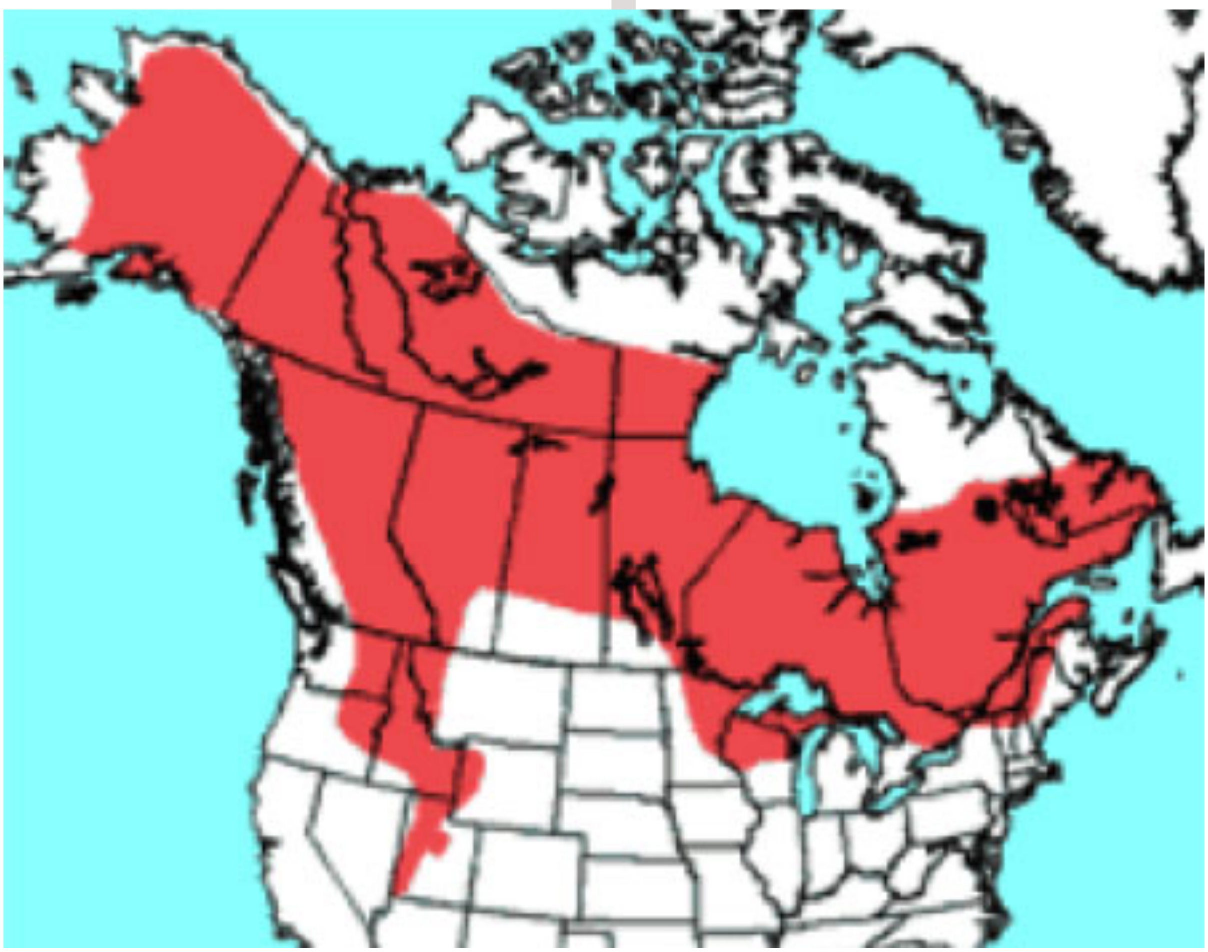
Julie Palakovich Carr Graduate Student, Biology

Predicting the impacts of climate change on the Canadian Lynx

Introduction

Canada lynx (*Lynx canadensis*) is a medium sized carnivore and a member of the cat family (Felis). It is a species well adapted to the cold temperatures and deep snows of the boreal forests of Alaska and Canada, as the animals have thick fur and large feet. Lynx also occur in a few places in the lower 48 states of the U.S., including in northeastern Minnesota. Lynx primarily eat snowshoe hares. Lynx prefer to live and hunt in regenerating conifer forest stands approximately 20-40 years old as well as mature forest.

Canada lynx are federally protected in the lower 48 states under the Endangered Species Act. They were listed as a threatened species in 2000 due to the low abundance of animals in the southern portion of their range. This listing has prompted research into the ecology of this species. One of the major concerns for the continued survival of this species in its southern range is global climate change.



Climate change and lynx

Global climate change is a manmade climate phenomenon in which global air temperatures are rising over time due to a buildup of carbon dioxide and other greenhouse gases in the Earth's atmosphere. As the Earth warms other aspects of our planet are changing, including rising sea levels and changes in precipitation patterns. As climate changes, the geographic range of species are predicted to change. This will most likely occur as a northward movement by each species. These predicted changes create a concern that some species may no longer occur where they do presently. This could be true for Canada lynx, especially in Minnesota, given that the species occurs at the southern extreme of its range in the contiguous U.S.

Climate change will likely impact Canada lynx in several ways. Higher summer temperatures could cause heat stress in animals or may cause them to avoid activity at the hottest times of the day. Higher winter temperatures could cause more precipitation to fall as rain instead of snow. Lynx are adapted to hunt in deep snow and declines in snow depth may allow bobcats to invade the range of lynx, causing increased competition between the species.

The purpose of this project is to visualize historic and predicted future changes in temperature and snow depth across the range of Canada lynx in order to plan for the continuing conservation of this species.

Methodology

Three climate variables were modeled across the range of Canada lynx in Canada and the United States: average summer temperature, average winter temperature, and average maximum winter snow depth. Summer was defined as June, July, and August; winter was defined as December, January, and February. Data for the U.S. was obtained from the National Climatic Data Center (www.ncdc.noaa.gov) and for Canada from Environment Canada (www.climate.weatheroffice.ec.gc.ca). All data was obtained for individual weather stations. Data from the U.S. was largely only available after 1948, therefore two historic time periods were modeled: 1950-1975 and 1975-present. Maximum snow depth was used instead of mean snow depth because data for mean snow depth was not available for the U.S.

The data for each climate variable was visualized in ArcMap (ESRI) at each weather station. To create a continuous map of each climate variable from point data at individual weather stations, the data was interpolated. I used inverse distance weighted interpolation to predict the climate data at locations where weather stations did not exist. The data was then clipped to the extent of the range of Canada lynx.

Climate predictions were taken from online maps created by the Canadian government (www.atlas.nrcan.gc.ca/site/english/maps/climatechange/scenarios). These global predictions of changes in summer and winter temperature and precipitation were made for 2050 and 2100. All changes are relative to the period of 1975-1995. I saved each map as a jpeg, imported them into ArcMap, and then rectified the images to make them spatially explicit. The maps were then digitized to improve image quality. Lastly, the map algebra tool was used create maps of predicted temperature and snow depth.

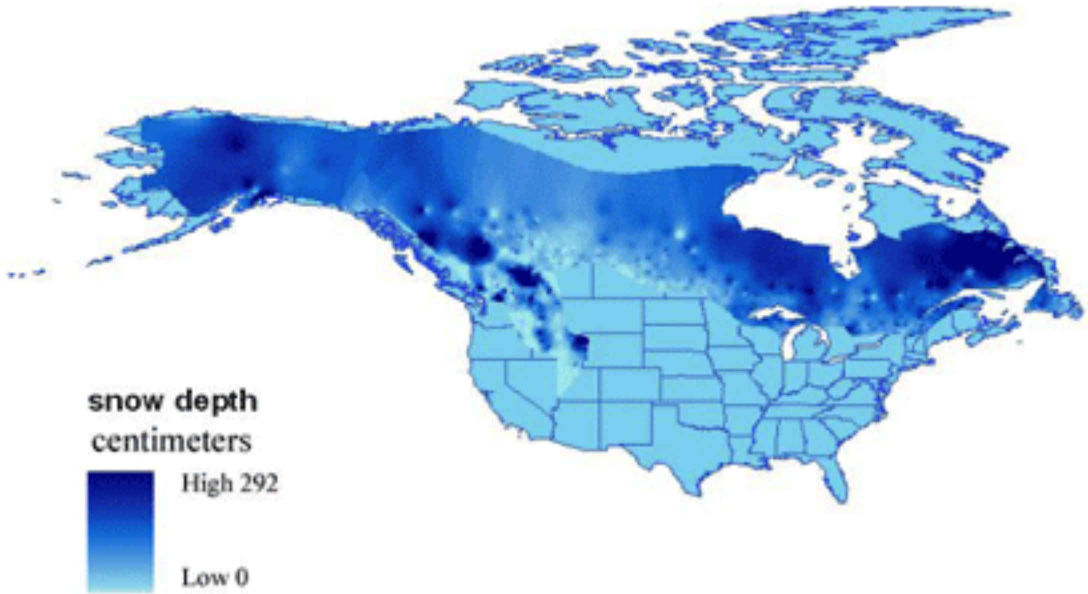
The final maps for each of the three climate variables were saved as jpegs and imported into Image Ready in order to become animations. Separate animations were created for each climate variable. Each animation consisted of four frames (i.e. time periods): 1) 1950-1975, 2) 1975-present, 3) 2050, and 4) 2100. The final animations were exported from Image Ready as QuickTime movies.

Animations

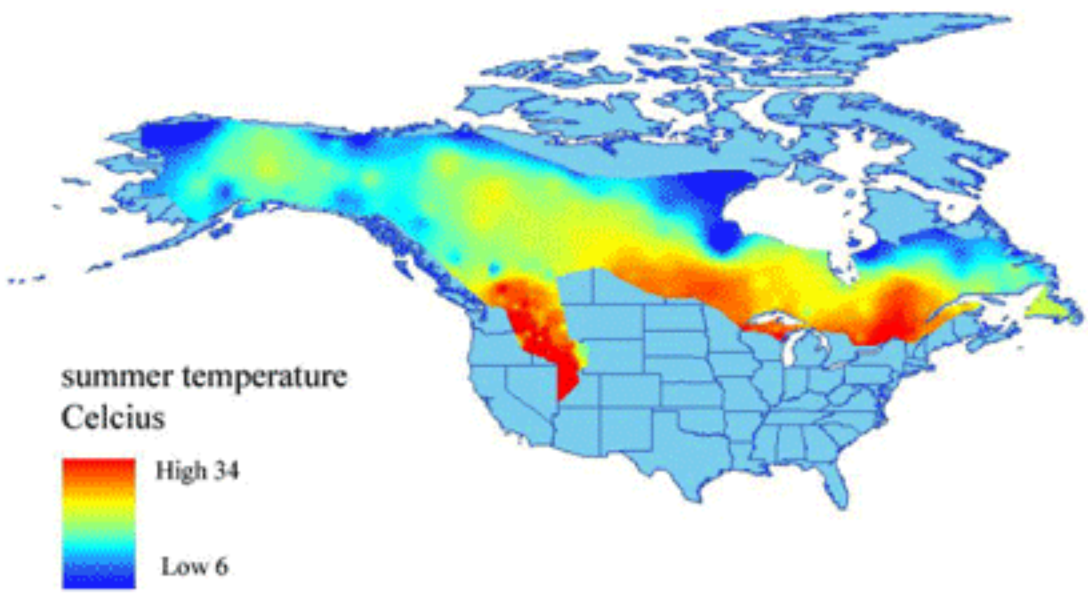
Winter temperature has warmed and is expected to warm further throughout the entire range of lynx. Similarly, summer temperatures have warmed in the last 30 years and are predicted to continue to rise. Alaska may become a refuge for lynx given predicted cooling in 2100.

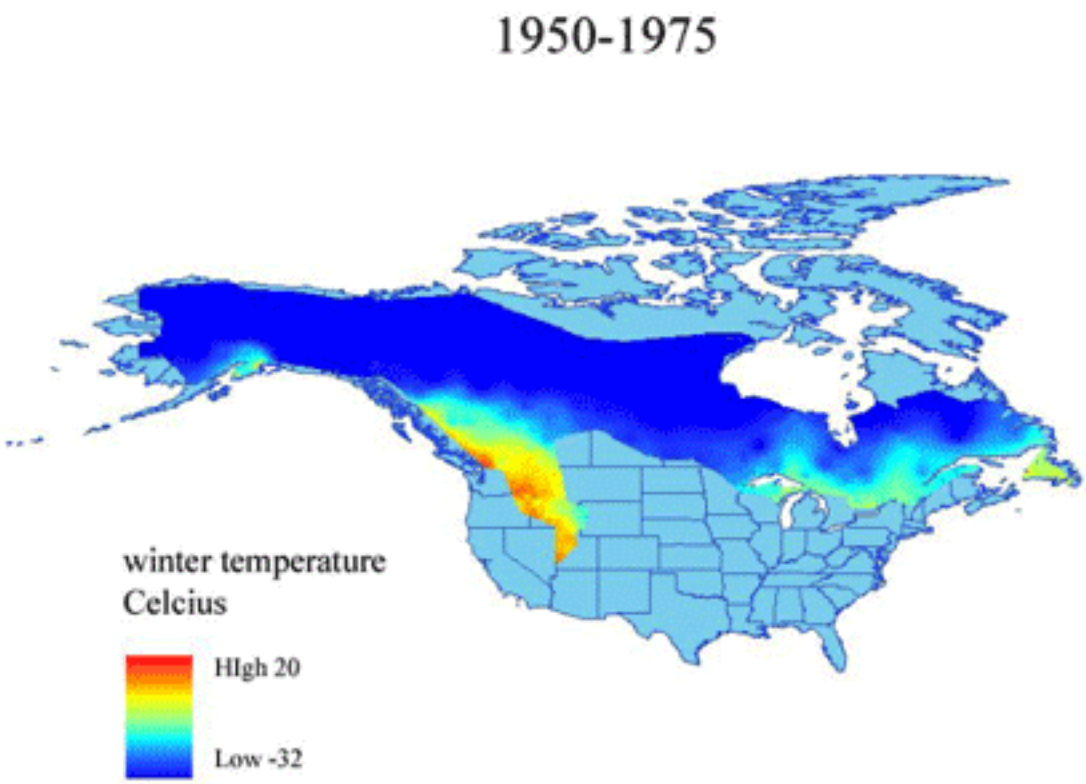
Snow depth has not changed greatly to date nor does it appear to change much in the future. However, these results should be regarded with caution as maximum snow depth is modeled. Average snow depth may change over time. Also, generalizations from this data are limited by the methods employed to predict future snow depth, namely assuming a constant ratio of rain to snow depth. Also, future warming will likely cause more precipitation to fall as rain instead of snow and also cause further melting of snow.

1950-1975



1950-1975





Implications for lynx

Climate has already started to change throughout the range of Canada lynx and is predicted to continue to do so during the next century. Warming winter and summer temperatures, especially in the southern portion of the species range, will likely have the largest impacts on lynx. If temperatures warm to the extent predicted, the future of lynx in the lower 48 states is at jeopardy.

Robert Wittig Art + Design

Podcasting in the Digital Arts

For this Summer project, I focused on utilizing one of the VizLab's great strengths—its well-chosen selection of sound recording and production equipment—to investigate technical and creative aspects of the new communication format of podcasting. Using the bundled software and applications contained in Apple's GarageBand program, I experimented with the creation of podcasts in a variety of formats and under a variety of conditions.

Technically: I investigated input modes—everything from the built-in microphones on laptop computers, to headset microphones used for internet telephony, to the VizLab's professional-grade microphones and connection devices. Using the powerful machines in the VizLab, I pushed the limits of GarageBand's recording and editing capabilities, in order to know the practical boundaries of the software. I also was able to use ProTools, a professional sound recording program, to contrast quality and feature issues and thereby further evaluate the GarageBand package. In addition I learned how to use GarageBand to create RSS feeds

Creatively I was able to experiment with the recording side of podcasting, experimenting with situations that simulated uses for: journalism and on-the-spot reporting, live recording of events, broadcasting, and filmmaking. As for production, I studied and learned a number of new tricks that allow me now to imitate production styles of radio news, radio entertainment, filmmaking, and to explore unique new styles that belong only to podcasting.

Pedagogically: this grant worked hand-in-hand with a summer Special Topics course I taught. I was able to lay the groundwork for keeping my students completely up-to-date on the latest versions of technology, and to (hopefully) inspire them to work in styles unique to the present day.

I am very appreciative for this opportunity to do a burst of intense research. I not only feel "caught up" on the technology...but (for a while at least) I feel I can lead students into the future.

Thank you for supporting UMD's Vizlab. It is an amazing resource for us as educators and researchers. The VizLab's commitment to technological excellence, the informative programming and special events, and above all the helpful and knowledgeable staff make it one of the very best aspects of scholarly life at UMD. In terms of UMD's Graphic Design and Digital Arts programs, the VizLab helps keep our professors up-to-date and creatively supported, and therefore keeps our program a highly reputed, powerhouse program in the upper Midwest.

Justin Rubin Music

Virtual Instrument Sequencing

My work entailed becoming familiar with the process of creating demonstrations of my music compositions that have yet to be premiered through the use of virtual instruments. In the Viz Lab I began by entering the music into the Finale engraving program then exporting the scores as MIDI (Musical Instrument Digital Interface) files. Next, I brought them into Pro Tools and from there patched the MIDI information through the Garritan Personal Orchestra plug-in (Garritan is the virtual sampled instrument library). Setting each MIDI track to a specific instrument in Garritan then allowed me to play the music back with a near-realistic sound.

One aspect to this experience that I did not anticipate was the idea of changing the orchestration as I originally envisioned. The use of virtual instruments made this very easy and I could experiment with changing the flute part (for example) to an oboe, or maybe a trumpet, deciding which worked best, adjust the original score, and then save a virtual performance of the work. This process I found to be far more useful than simply listening to the General MIDI instruments which do not have an artificial, synthesized sound. I also adjusted tempi and dynamic balances before adding appropriate reverb to enhance the realistic sound.

I was immediately able to apply my newfound abilities to my professional creative activities when a music publisher (T.D. Ellis Music) contacted me with interest in possibly publishing some of my works. However, some of the pieces had yet to find a first performer, so I fashioned sound files through the process I learned this summer to give the editor a reasonable idea of what the piece sounded like.

Secondly, I began to learn how to use the East West Symphonic Choirs virtual instrument. As this library uses samples of real voices, I had to also learn how to use WordBuilder so that text could be input and allow the choir to enunciate the words clearly while singing. While I was able to learn how to fundamentally use the two programs together, the more subtle applications of WordBuilder I only touched slightly (such as changing the duration of consonants, adjusting the overtone emphasis of particular text articulation, etc.).

Tory Olson Graduate Student, Biology

Comparing native and invasive zooplankton using grayscale analysis

Introduction

Invasive species are a problem in many ecosystems. *Bythotrephes longimanus*, an invasive zooplankton originating from Eurasia, invaded the Laurentian Great Lakes in the 1980s (Lehman 1987; Berg and Garton 1988).*Bythotrephes* has since been observed in inland Minnesota lakes (Branstrator *et al.* 2006). *Bythotrephes* is a predacous Cladoceran that preys upon and depletes native zooplankton populations, such as *Daphnia*. Zooplankton diversity is also depleted with the introduction of the spiny water flea.

Two major morphological features of *Bythotrephes* are its large, dark compound eye and long, stiff caudal spine which serves as a postcontact morphological defense against fishes (Branstrator 2005). Due to the high visibility of *Bythotrephes* from their large body size and eyespot diameter, fishes larger than 100 mm in body length seem to have a strong preference for *Bythotrephes*, even when they are the least abundant prey (Mookerji et al.1998; Coulas et al. 1998). In fact, *Bythotrephes* has often become the dominant food source for fish planktivores once they have established themselves in a lake (Bur and Klarer 1991; Berg and Grimaldi 1966). Research has been done regarding this matter of visibility; however, either linear weight or eyespot diameter regression models were used to determine visibility. No methods have been developed to analyze total body visibility. Using software in the Viz Lab gave me the opportunity to analyze whole specimens in an attempt to quantitatively determine if *Bythotrephes* were more visible than *Daphnia*, based on total body grayness.

Methods

Photos were taken at several magnifications (1-5x) of multiple *Daphnia* and*Bythotrephes* under a dissecting microscope in Donn Branstrator's laboratory (UMD). Photos of first, second, and third instar *Bythotrephes*were taken. The color photos were converted to black and white in Adobe Photoshop (Version 9.0). The background noise was reduced in Photoshop by using the magic wand function to select the organism. The selected organism was then pasted into a new blank page. Sometimes similarly colored background would also be selected because the magic wand could not differentiate between the organism and the similarly colored background. If this occurred, the eraser tool was used to delete as much background gray as possible. Finally, the pictures were saved as *.tif files to be compatible with SCION (Figure 1).

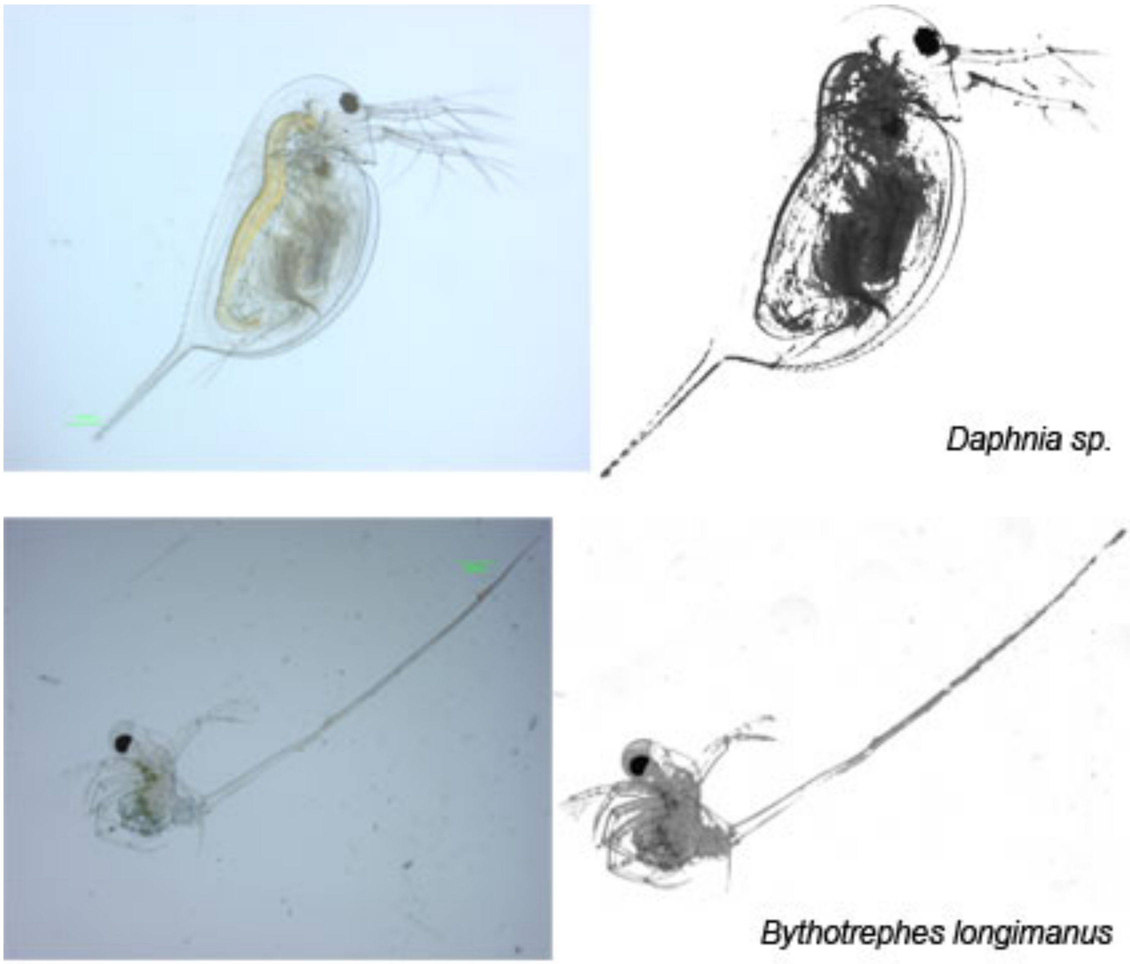


Figure 1 Photos of *Daphnia sp.* and *Bythotrephes longimanus*. Photos were converted to black and white in Adobe Photoshop (Version 9.0) to analyze total grayness in SCION.

The free version of SCION was downloaded from the SCION website (http://www.scioncorp.com/). The grayscale of *Daphnia* and *Bythotrephes*were compared using 3 *Bythotrephes* individuals for each instar and 3*Daphnia* total. First, I had to select “Options” > “Threshold” to allow for a histogram to be created. By selecting “Analyze” > “Show histogram,” the pixel histogram was created as a means to quantify the total “grayness” of an individual. I summed the pixel count at each gray level from 106 to 250 (i.e., sum of level*pixel count) of the total gray scale ranging from 0 to 255. Magnification was corrected for by dividing the sum by the square of the magnification (e.g., if 2x, divide by 4; if 3x, divide by 9). The mean and variance of total grayness for each group of organisms was then calculated and graphed in Microsoft Excel 2003.

Results

As seen in Figure 2, *Daphnia* had the lowest total grayness [sum of (gray level) x (pixel count at that level)], with a mean of 21.08 and a variance of 1.55 (all results in millions). First instar *Bythotrephes* had a total grayness mean= 24.22 (variance= 58.44), while second instar *Bythotrephes* total grayness mean equaled 65.32 (variance= 6.29). Finally, third instar*Bythotrephes* had the greatest total grayness, with a mean of 83.48 and a variance of 5.48. Thus, third instar *Bythotrephes* are approximately 4 times more visible than *Daphnia* based on total grayness. Second instar*Bythotrephes* are approximately 3 times more visible than *Daphnia*, while the total grayness of *Daphnia* and first instar *Bythotrephes* were not significantly different. Overall, *Bythotrephes* increase in visibility with age (i.e., instar), as expected. Furthermore, the increase between first and second instar *Bythotrephes* (41.1 million) is 2.25 times greater as compared to the increase between second and third instar (18.16 million).

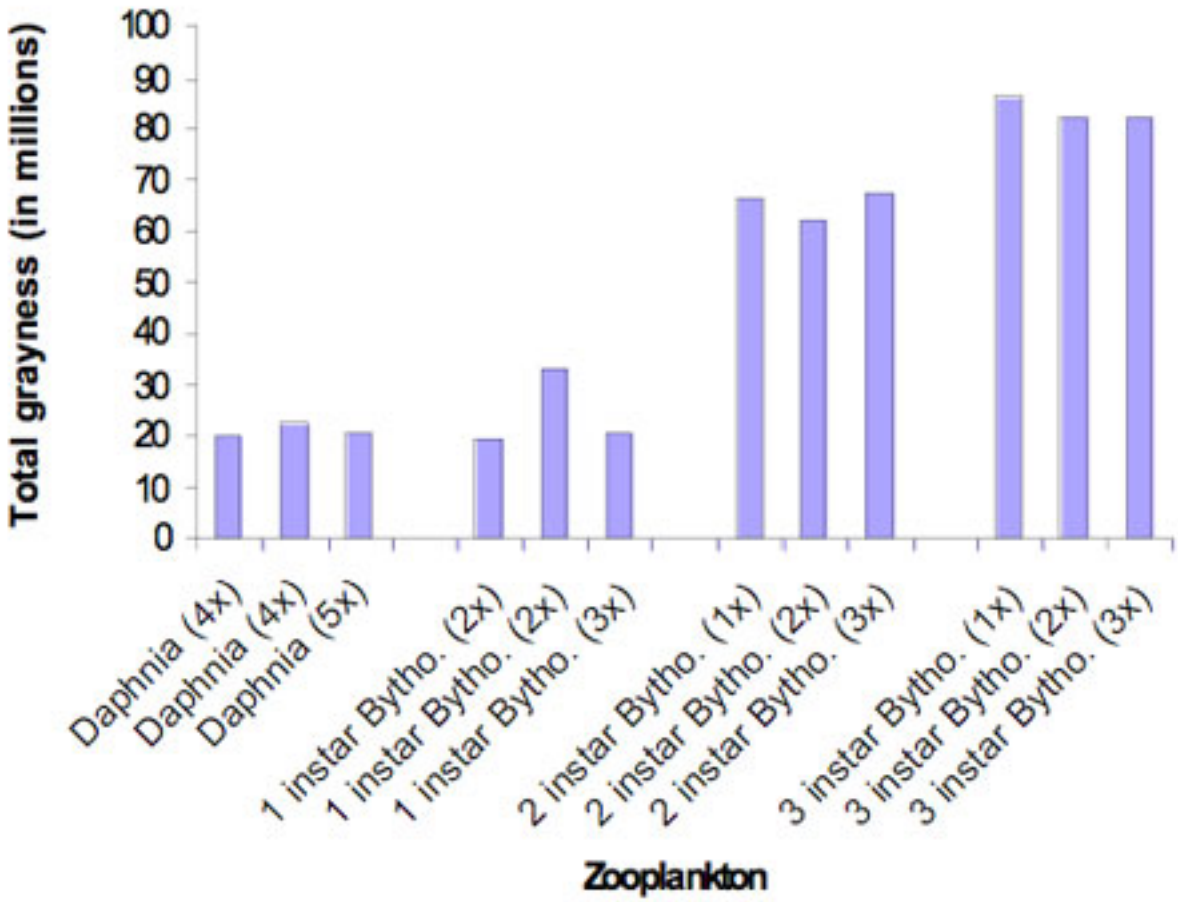


Figure 2 Total grayness (in millions) of *Daphnia* and first, second, and third instar *Bythotrephes*. Values were corrected for magnification level (1-5x).

Discussion

These results support the theory that fish preferentially select for*Bythotrephes* due to their increased visibility as compared to native*Daphnia*. If not gape-limited, fish should select for the largest, most visible*Bythotrephes* available. These results may be used in future studies to predict the ratio of food present in the planktivore's stomach (i.e., dietary proportions). Assuming all else to be equal (e.g., zooplankton densities equal, no outside selection pressures, fish large enough to easily consume all sizes of zooplankton, etc.), the planktivore's expected stomach content ratio of 3 instar *Bythotrephes*: 2 instar *Bythotrephes*: 1 instar *Bythotrephes*:*Daphnia* would be 4:3:1:1. However, more work must be done with larger sample sizes and more native species to better explain total grayness variation in *Bythotrephes* and native zooplankton.

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No Loser, No Weeper

The fantasy land the American culture, of Mickey Mouse, does not deal with the subject of mourning and widowhood, only good, clean family fun. But, in the real world, sorrow, loss, separation, loneliness, and death are a part of living. We are culturally paralyzed by and inability to mourn.

Over the past nine years, in addition to the usual client driven graphic design, I have explored ways of expressing grief and mourning for the loss of my life's partner in a vehicle accident. As an artist creating in the present, my work is shaped by the legacy of trauma in my personal history. Although I cannot fully know the trauma of victims of recent historic events, such as 911 and Hurricane Katrina; I know privately the devasting effect of traumatic loss; spouse, home, security, identity. I am struck by the realization of my own mortality and the limitations of my remaining years. I must rebuild my present.

Early work looked at garments needed to cover myself. Because my trauma is personal, those around me prefer to reject the existence of my wounds.

Weedy-wearing mourning weeds

Waede-a garment or clothing, archaic Anglo Saxon

Weed-black morning clothes especially those worn by a widow

Weed-black morning band, as of crepe worn on a man's hat or sleeve

Widow, widowed-of or pertaining deprived or bereaved of one's mate

Grass widow-discarded mistress, unmarried woman who has had a child,

widow's peak

I explored and continue to explore the means to bear witness to grief, to love and to the objects of love that remain; to memory and how to represent the unrepresentable. Current work seeks to commemorate my artist partner. I am exploring traditional purposes for art, commemoration and memorial; expressions such as shrines, casting, shadows. Although the content is historically specific, the work is theoretically broad.

Quoting Adorno, "After Auschwitz to write poetry is barbaric", yet I have found the poem "No Looser, No weeper" by Maya Angelou that is a partial expression of my motivations. The conflict of the "space between impossibility and possibility, deferral and realization, repression and acknowledgement" is the most challenging to an artist in pursuing such a body of work as "Widow's Journey".

During the 2007 Viz Lab Summer Grant period, a series of works based on Maya Angelou's poem were produced, as well as a separate direction of work creating shrines. Technologically I updated my knowledge of the recent Adobe CS3 upgrade. I printed a large format work from the series that was juried and exhibiied in a national show and won a juror's award summer fall 2007.

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Lisa Saltzman. *Anselm Kiefer and Art after Auschwitz*. Cambridge University Press, UK. 1999

The Complete Collected Poems of Maya Angelou. Random House, New York. 1994

Janice D. Kmetz, professor, December 2007

No Loser, No Weeper Powerpoint Presentation (67mb)

Doug Dunham Computer Science

Hyperbolic Geometry Program

The proposed research was to add the ability to draw rays and complete hyperbolic lines to a hyperbolic pattern-drawing program, which previously did not have those capabilities. This project was carried out and completed by the PI and a Computer Science Master's student, Ajit Marathe, who described the results in his thesis, "Incorporating Points at Infinity in a Hyperbolic Drawing Program." Unlike Euclidean and spherical geometry, there is no smooth distance-preserving embedding of hyperbolic geometry into Euclidean space. Thus we have to rely on models of hyperbolic geometry (that perforce distort distance). One such model is the Poincare circle model whose points are enclosed in a Euclidean circle. The lines of that model are represented by circular arcs that are perpendicular to the bounding circle (including diameters). In the past, my students and I developed a program to draw repeating patterns in this model. However, that program only drew finite hyperbolic line segments. The summer project extended the program to draw complete hyperbolic lines (with both endpoints at infinity - i.e. on the bounding circle) and rays or "half lines" (with one finite endpoint inside the bounding circle and one infinite endpoint on the bounding circle). Mr. Marathe's thesis is available at: http://www.d.umn.edu/~ddunham/ajitmrpt.pdf

In addition, several other projects were either started or completed during the summer grant period. During the month of July I attended three conferences and presented papers at two of them. The first one was the fifth Mathematics and Design Conference, in Blumenau, Brazil, at which I presented a paper, "Creating Regular Repeating Hyperbolic Patterns" which was published in the conference proceedings (ISBN 978-85-7114-175-4). There isn't an online version of this paper yet.

The third conference was the 10th Bridges Conference in San Sebastian, Spain. I presented a paper titled "A Circle Limit III Calculation", which was also published in the conference proceedings (ISBN 0-9665201-8-1). An online version is at: http://www.d.umn.edu/~ddunham/dunbrid07.pdf

There were no proceedings of the second conference, Communicating Mathematics, at UMD, which honored Joe Gallian and his work with undergraduate researchers. However, the attendees were asked to submit chapters for a book based on the conference, also called Communicating Mathematics. On December 14 I submitted a chapter titled "Hamiltonian Paths and Hyperbolic Patterns" for that book.

At the Math and Design conference, we were asked to submit extended abstracts for the 13th International Conference on Geometry and Graphics by one of the organizers of the ICGG. On Dec. 15 I submitted an abstract for consideration titled "Use of Models of Hyperbolic Geometry in the Creation of Hyperbolic Patterns".

During the summer I made more progress on an ongoing research project that generalizes the hyperbolic "Circle Limit III"" pattern by the Dutch artist M.C. Escher. This built upon the work presented at the 2007 Bridges Conference, mentioned above. "Circle Limit III" is usually considered to be Escher's most attractive hyperbolic pattern. But, in my view, it is also the most mathematically interesting. On September 20 I submitted an abstract for a talk based on this new work that was presented at the Joint Mathematics Meeting (January 6-9, 2008) in San Diego. The talk was titled "A formula for the intersection angle of backbone arcs with the bounding circle for general `Circle Limit III' patterns". I plan to submit an expanded paper based on these new results to the 2008 Bridges Conference.

Jean "Rudy" Perrault Music

Music in Haiti: Caught between two Worlds

I traveled to Haiti to document a portion of the Holy Trinity Summer Camp (Léogâne Sainte Trinité) using video, audio and still cameras.

The mediums were combined in the Viz Lab to create a multimedia presentation on the people and music of Haiti. I was at the École de Musique Dessaix Baptiste and Camp Léogâne Sainte Trinité, as a String Instructor, Clinician, Soloist and Conductor. My multimedia presentation is about the impact of music on restoring hope in Haiti. This presentation will travel to as many cities as possible in an effort to generate, first, interest in the plight of the Haitian people, and second, interest in generating an endowment at UMD for music students, especially international students.

Please view the video to learn more about music camps in Haiti and this project.

Music in Haiti: caught between two worlds
(Quicktime 7 minutes—12Mb)