the Shellcracker

FLORIDA CHAPTER OF THE AMERICAN FISHERIES SOCIETY

http://www.sdafs.org/flafs

January, 2010

President's Message:

"Ringing in 2010!"

Time certainly flies, and as we ring in the New Year and get ourselves ready for our annual meeting in February, I am reminded that our chapter started in 1980 and so this year's meeting will be the 30th anniversary of our Florida Chapter! The symposium being organized by President-Elect Linda Lombardi-Carlson on *Uncertainties in Fisheries Science* seems even more appropriate as we reflect on what the chapter and its members have done over the years, and where our future will lead us. Registration forms and abstract instructions are included in this Newsletter, so put your pen to paper and send them in as soon as possible….the January 8th deadline is fast approaching!

Fisheries closures appearing left, right and center also remind me that it is important for us to communicate our science and management to those that it directly affects, perhaps more so than ever before. Both recreational and commercial fishers all around us are worried about their ability to put a hook out or continued livelihood. Sometimes our "best available science" used in the stock assessments is far from perfect (and at times far from adequate), contributing to the frustration of all. This is a time to collaborate and learn from each other, rather than have a chasm widen between the users and the people supplying information for management (mostly us!). Next time you're out on the water and your fellow fishers ask you what all those regulations are about, take a minute and talk to them. If they know that we care about the fisheries resources as deeply as they do, then they will be more likely to share their knowledge of the resources that they have gleamed from spending a lot of time out on the water!

In February, we will also be discussing the Southern Division meeting that we are hosting in 2011 in Tampa. Although over a year away, we will need to get organized for the meeting, so please come to our 2010 annual meeting with an eye to volunteering for one of the many positions that will need to be filled to make the 2011 meeting a success. There will be many opportunities for everyone in our chapter to get involved!

As we leave 2009, I wanted to express my appreciation for the opportunity to serve as your chapter president. Many people make it easy to participate in the executive committee of our chapter. Over this past year, Will Patterson as Past-President has been there as a guide and offered his support on many occasions; Linda Lombardi-Carlson as President-Elect has been instrumental in organizing the upcoming meeting, as well as always providing support in other positions; Travis Tuten has taken over the helm of Secretary-Treasurer; Kevin Johnson has kept us informed through the Newsletter; Larry Connor has kept the email list functional, which has added to the speed at which we can contact our members; Eric Nagid and his committee have spent considerable time negotiating a great contract for the Southern Division meeting; Bob Wattendorf stepped up once again and under new website organization has the website active and updated; and Chuck Cichra and his committee have taken the time to consider and divvy out student awards; as well as many others that have volunteered in one capacity or another over this past year. My heartfelt thanks to all of you!

Cheers, Deb Murie
FL Chapter President

Getting in Touch

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Upcoming Events

February 25 – 28: Southern Division AFS spring meeting. Ashville, North Carolina. www.sdafs.org/meetings/2010/default.htm

April 8 – 9: SPECIES Introductions and Re-introductions: Opportunities & Challenges Symposium 2010, AFS & The Wildlife Society co-hosts. Mississippi State University, Starkville, M.S. Abstracts due Feb.1, early registration deadline is Feb. 25. For more information: www.cfr.msstate.edu/wildlife/symposium/index.html

Check out our Parent Society's calendar at http://www.fisheries.org/afs/calendar.html for other events not listed here!

New Titles

Biology and Management of Dogfish Sharks. Vincent Gallucci, Gordon McFarlane, and Gregory Bargmann, editors. 435 pages. Published by the American Fisheries Society. November 2009.

Interested in contributing something to the Shellcracker? Email Kevin Johnson at *kevin.johnson@myfwc.com* with any articles or information that you would like to be included in the next issue. The deadline for the next issue is March 31st, 2010, so start fishing...

Feature Article

Evaluation of procedures to mediate bias in fish growth parameter estimates resulting from size-selective sampling

Daniel C. Gwinn, Micheal S. Allen, and Mark W. Rogers
Program of Fisheries & Aquatic Sciences, University of Florida

Length at age data from size-selective sampling gears can cause bias in growth parameters. Relatively small and/or large fish can be under represented in samples collected with most sample gears (e.g. Bayley and Austen 2002; Taylor et al. 2005; Binion et al. 2009). Reduced vulnerability of smaller fish typically results in negative bias in the estimates of the theoretical age when length is equal to zero (t_o) and negative bias in the estimates of the rate at which fish reach maximum size (k). Reduced vulnerability of larger fish can result in negative or positive bias in the estimates of the mean asymptotic length (L_∞, Taylor et al. 2005). Age-length samples have been corrected for size selective sampling, but these methods typically required multiple years of data (Taylor et al. 2005), tagging information (Troynikov 1999), or independent estimates of size selectivity (Troynikov and Koopman 2009). Thus, accounting for bias in growth parameters is not always feasible.

Use of biologically logical fixed parameters or removing fish that have biased estimates of mean length at age are options that have been utilized when corrective methods are not possible. For example, Sammons and Maceina (2009) fixed L_∞ to the maximum length observed in their data when estimates were not within 25% of the observed maximum length. Fixing t_o to a value of zero may be a viable option for certain fish species, as the theoretical age when length is zero should have a value near zero for fish that hatch at small sizes (e.g. Taylor et al. 2005). Alternatively, removing data associated with ages that are apparently not fully vulnerable to the sampling gear, as is common when estimating mortality rates with catch curve analysis (King 1995), may be an option to reduce bias in parameter estimates when fitting von Bertalanffy growth curves. These simple procedures may be employed when correcting for size selective sampling is not possible; however, the efficacy of these procedures has not been evaluated. The purpose of this study was to identify simple modifications (e.g., fixing parameters to biologically realistic values) to von Bertalanffy growth model fitting procedures that were most robust under a range of length-based sampling vulnerabilities.

METHODS

We constructed an age and length structured population model to simulate the bias of size-selective sampling on growth model parameter estimates. The model simulated a fish population that experienced fishing at equilibrium. We simulated the effects of size selective fishing on the length composition of the population to provide a biologically realistic context for the analysis. We then simulated sampling of the population using a size-selective process to produce an age and length structured catch that would typically occur from sampling gears in the field (e.g., gill nets, electrofishing). We simulated gear types that would select fish based on asymptotic vulnerability, dome shaped vulnerability and equal vulnerability (i.e., no gear bias).

We evaluated four different procedures to determine if they reduced common biases due to size selective sampling processes. The first procedure was to fix t_o at a value of zero, because for fish with small hatch sizes the value of t_o is biologically near zero. The second procedure was to eliminate fish $\leq$ the age at 50% vulnerability from the analysis. This would often be evident to investigators by having some ages that contained only a few large individuals and a lack of smaller fish of that age (e.g., length-dependent knife-edged selectivity).

The third procedure was a combination of the first two, by eliminating fish associated with ages that were not fully vulnerable to sampling and fixing t_o to a value of zero. The fourth fitting procedure was to fix L_∞ to the maximum value observed in the data. We fitted the von Bertalanffy growth function to the full data set and allowed all parameters to be estimated, which served as reference for comparison to the other four fitting procedures. We simulated 1,000 datasets for each selectivity pattern and iteratively solved for the parameters of the von Bertalanffy growth equation using a lognormal log-likelihood kernel. We then calculated the mean and 95% confidence intervals for the mean parameter values of t_o, k, and L_∞ estimated with each procedure.

RESULTS

None of the tested fitting procedures resulted in a consistent reduction in mean parameter bias across all vulnerability patterns. Some procedures reduced the bias in the average estimates of L_∞ and k, but the appropriate procedure depended on the sampling vulnerability schedule. For example, if vulnerability to sampling was asymptotic, the best estimates of L_∞ and k were produced by fixing t_o at zero and eliminating small, less vulnerable fish from the analysis (Figure 1d, e). This resulted in low bias and high precision relative to the other procedures for this vulnerability pattern. Fixing either t_o or L_∞ tended to increase bias in all estimated parameters for the asymptotic vulnerability (Figure 1d, e, f). Thus, procedures fixing t_o and eliminating less vulnerable ages in combination was the most prudent approach for the asymptotic vulnerability.

No procedure we evaluated eliminated bias in mean von Bertalanffy parameters under the dome shaped vulnerability (Figure 1g, h, i). Fixing L_∞ at the maximum length observed in sample data provided the most bias reduction in average estimates of L_∞ and k among the procedures evaluated (Figure 1g, h). Alternately, procedures fixing t_o and/or eliminating less vulnerable fish from the analysis, either in combination or independently, tended to increase bias in the mean parameter estimates (Figure 1g, h, i). Thus, fixing L_∞ to the maximum observed value was the most prudent procedure under the dome shaped vulnerability pattern, but this procedure created the most biased parameter estimates for both the asymptotic and equal vulnerability schedules (Figure 1a, d, b, e, f).

DISCUSSION

Our simulations did not reveal a procedure that generated robust von Bertalanffy parameter estimates across all vulnerability patterns. Procedures fixing t_o at zero and eliminating smaller, less vulnerable fish from the analysis produced the best results under an asymptotic vulnerability, whereas fixing L_∞ to the maximum observed value produced the best results under the dome-shaped vulnerability. However, selection of the wrong procedure for a given vulnerability schedule substantially increased parameter bias, indicating that knowledge of the sample gear vulnerability pattern is required to adopt any of the procedures we evaluated. Furthermore, all procedures including fitting the model to all the data produced bias in some single model runs, indicating that size-selective sampling gears can cause bias in growth parameters regardless of the fitting procedure or vulnerability pattern.

Growth parameter estimates are often used as surrogates for natural mortality (M) in stock assessments (Pauly 1980; Jensen 1996), and our results demonstrated the potential for substantial bias in growth parameter estimates due to sampling gear size selectivity (i.e., asymptotic or dome-shaped vulnerability). Estimates of k were likely to be biased when fitting the von Bertalanffy function to all the data obtained from size selective sampling, and thus, biased k values used to approximate M will bias predicted exploitation rates for maximum sustainable yield from stock assessments. Bias in k was generally positive for the dome-shaped vulnerability schedule but negative for the asymptotic vulnerability schedule. Thus, use of procedures intended to reduce bias in growth parameters could actually increase bias and lead to inappropriate management policies if not employed with prior knowledge of vulnerability patterns.

Taylor et al. (2005) developed a method to estimate a vulnerability curve and obtain unbiased growth parameter estimates from sampling data, but this method required that fish age and sizes were sampled sequentially through time. Such methods are preferable to the procedures we considered here, but detailed age/size information over multiple time periods is not always possible. Our results indicated that fixing model parameters to biologically meaningful values often had the unexpected impact of increasing the bias they were intended to reduce. Fishery managers should consider these simulations when modeling fish growth using sample data from size selective fishing gears.

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FIGURES

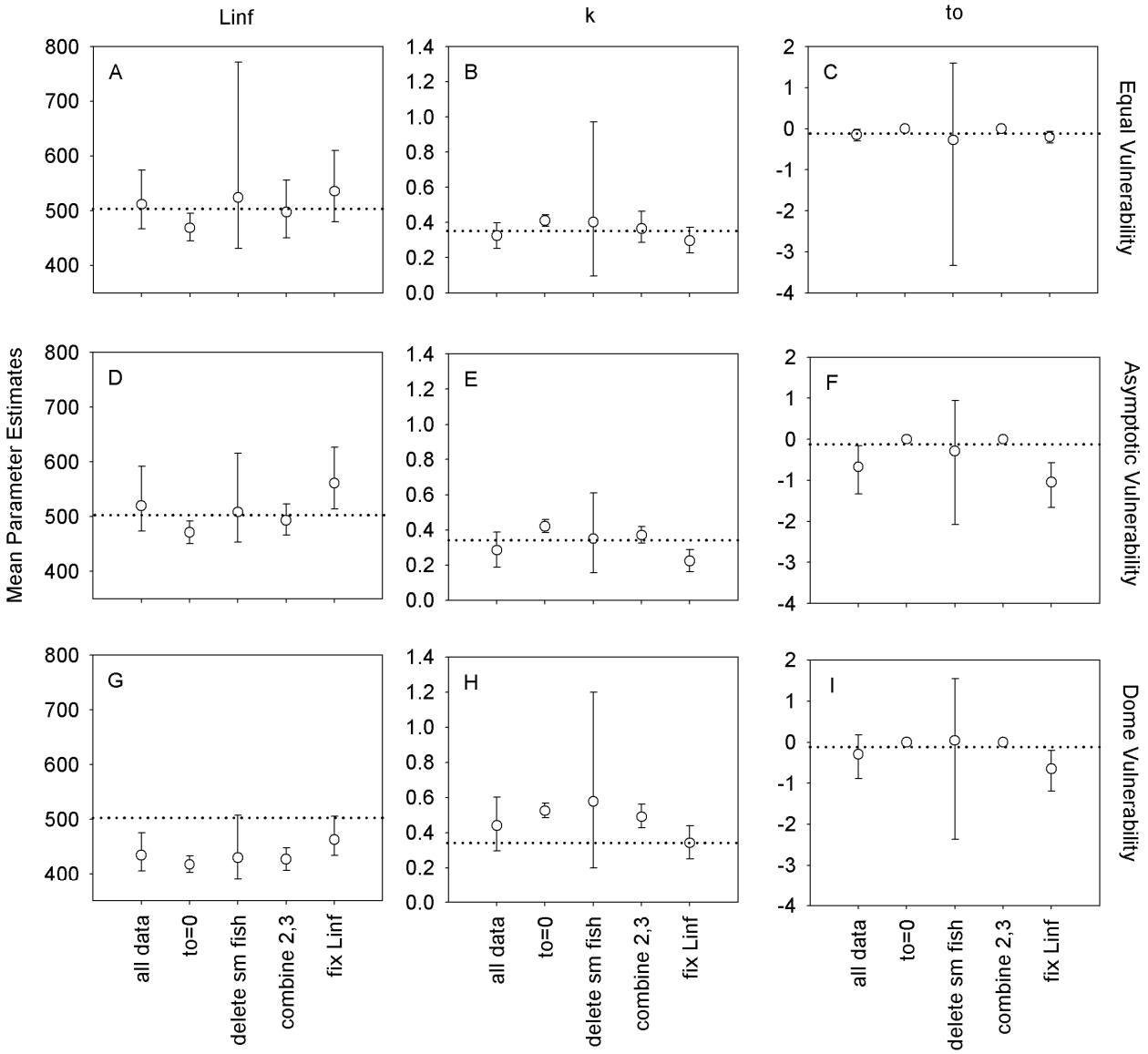

Figure 1. Mean parameter estimates (y-axis) generated from alternate fitting procedures (x-axis). The 95% confidence intervals are indicated by the whisker values. The top panels are results from an equal vulnerability across lengths; the middle panels are results from an asymptotic vulnerability; and the bottom panels are the results from a dome-shaped vulnerability. The left column panels are results for the mean asymptotic body length (Linf); the middle column panels are results for the Brody growth coefficient (k); and the right column panels are the results for the theoretical age when length is equal to zero (to). The dashed lines are the true parameter values used to generate the population data.

Florida Chapter of the American Fisheries Society
4H Camp Ocala, Florida
Annual Meeting Registration: February 16-18, 2010

Official Use Only:
Postmarked:_____
Entered: _____
Deposited: _____

First: _____ **Last:** _____ ☐ **Student (please check)**

Affiliation:_____
This address will be used in our mailing list and should be the one where you want to receive newsletters and other materials.

Street Address:_____

City:_____ **State:**_____ **Zip Code:**_____

Work Phone:_____ **Ext:**_____ **Email:**_____

T-Shirt Size: (Select One) Small Medium Large X-Large XX-Large XXX-Large

Arrival Time: (Select One) Tue Noon Tue PM Wed AM Wed Noon Wed PM Thur AM

Please check the appropriate boxes below.

PRE-REGISTRATION: registration form postmarked by Friday, January 8, 2010
☐$ 30.00 One-day Registration ☐$ 40.00 Full Registration

LATE-REGISTRATION: registration form postmarked after Friday, January 8, 2010
☐$ 35.00 One-day Registration ☐$ 47.00 Full Registration

Meals and Lodging

Tuesday, February 16, 2010
- ☐ $7.00 Lunch
- ☐ $14.50 Dinner
- ☐ $26.00 Lodging

Wednesday, February 17, 2010
- ☐ $6.50 Breakfast
- ☐ $7.00 Lunch
- ☐ $14.50 Dinner
- ☐ $26.00 Lodging

Thursday, February 18, 2010
- ☐ $6.50 Breakfast
- ☐ $7.00 Lunch

Dietary Needs:
- ○ Vegetarian
- ○ Low Fat
- ○ Other: _____

Full Meals and Lodging ☐ **$115.00**
Linens (please bring own, limited supply) ☐ $ 6.00

Florida Chapter dues (calendar year 2010) ☐ **$10.00** ☐ FL Chapter dues paid via AFS annual membership.

Total Amount: _____

Total Enclosed: _____ ○Cash ○Check
(Minimum $10)

Balance Due: _____ ○Cash ○Check ○Credit

Please Make Checks Payable to Florida Chapter, AFS and mail to:

Travis Tuten
FWC
7922 NW 71st Street
Gainesville, FL 32653

Phone: (352) 955-3220 ext. 113
Fax: (352) 955-3210
Email: travis.tuten@myfwc.com

*Checks not payable to 'Florida Chapter, AFS' will be returned to sender.

Registration Forms may be sent via fax (attention: Travis) or via email: (subject: 2010 AFS FL).
A minimum amount of $10 must be mailed to validate your registration.

Note: This is a cafeteria-style service and food must be ordered a week in advance.
Since meals are pre-paid, **please** submit your registration form *by Monday, February 8th, 2010.*
Registrations will still be accepted at the meeting.
We can only accept **non-FWC VISA** or **MASTERCARD** on the meeting date**.**
Credit card charges are submitted by our parent organization, AFS, after the meeting.
If you would like to pay your meeting fees with a credit card, then please send a $10 check for your deposit.

Annual Meeting and Symposium Announcement – 2nd Call for Papers
30th Annual Meeting of the Florida Chapter of the American Fisheries Society

February 16-18, 2010

Ocala 4H-Camp, Altoona, Florida

The 2010 meeting is now less than a month away, and it is time to submit your abstract, register, and otherwise make your plans to come to the meeting! The meeting format will consist of both invited and contributed oral presentations and posters. The symposium on Wednesday will be 'Uncertainties in Fisheries Science.' As either marine or freshwater fisheries biologists, we need the ability to explain the uncertainties in our data and how management can be affected. This year's symposium will review areas of uncertainty and methods to correct for these uncertainties. Our keynote speaker this year is Dr. Carl Walters, a Professor at the University of British Columbia, Fisheries Centre. Dr. Walters is a world renowned quantitative fisheries biologist, published hundreds of manuscripts, authored several books, and developed the concept of adaptive management that involves large scale experimentation to fully understand fish population dynamics to facilitate management regulations.

All abstracts are due ***Friday, January 8, 2010***, for full consideration in the symposium or contributed sessions. Please send your abstract (<300 words) and associated information (following the format given below) to **linda.lombardi@noaa.gov**; in the subject line of your email, please list the author(s) as they will appear in the program (e.g., SchaubMooreMajikowski.doc). Platform presentations will be 20 minutes (15 minutes for presentation and 5 minutes for questions or discussion). We will have **PowerPoint 2003** loaded on a laptop capable of accepting your presentation on a CD, DVD or flash-drive. All posters will be formally presented on Tuesday evening, February 16, and can be left up for the entire meeting. Posters should be no larger than 150 X 100 cm (60" X 40"), but they can be set up either as portrait or landscape format on an easel. For updated guidelines and tips for oral presentations and posters visit the Chapter's website (http://www.sdafs.org/flafs/meetings.html).

Students: There is still time to apply for travel awards (Deadline January 31st). The application form is available on the Chapter's website at http://www.sdafs.org/flafs/awards.html. Master's and doctoral students are also eligible for the Roger Rottmann Memorial Scholarship (Deadline January 16th), for which the recipient(s) will be announced at the Annual Meeting. More information and the application materials are available at http://www.sdafs.org/flafs/awards.html.

Abstract Format:
Limit abstracts to ≤ 300 words and follow this format **(2003 MS WORD is preferred)**:

Presenter: Schaub, M.; Email: MattShaub@HoustanTexans;
Author(s): Schaub, M.[1], S. Moore[2], and D. Majikowski[3]. Affiliation. Address.

Title: The Sometimes Rocky Road of a University of Virginia Quarterback

Abstract: You know how this works: <300 words (MS Word will count it for you!)

Student Presentation: no (versus yes, work reported was completed while a student).

Presentation type: oral (versus poster)

Symposium consideration: Indicate topic
Topic – 1. Research Uncertainties, 2. Observational & Reporting Uncertainties,
3. Theoretical Uncertainties and 4. Other Forms of Uncertainties

Are you willing to be a moderator? Yes or No If yes, Oral or Poster

DRAFT PROGRAM SCHEDULE
30th Annual Meeting of the Florida Chapter American Fisheries Society
February 16-18, 2010

4-H Camp Ocala, Altoona, Florida
Tuesday, February 16
1100-1800 h Registration
1200-1300 h Lunch
1300-1700 h Contributed Papers
1700-1900 h Poster Setup
1800-1900 h Dinner
1900-2000 h Formal Poster Session ….Followed by the ***Bonfire Social***

Wednesday, February 17
0700-0800 h Breakfast
0730-1800 h Registration
0800-1200 h **Symposium:** *Uncertainties in Fisheries Science*
1200-1300 h Lunch
1300-1700 h Contributed Papers
1700-1800 h Student Subunit Meeting (all students); Time to relax (all others)
1800-1900 h Dinner
1900-2000 h **Chapter Business Meeting**
Awards presentation: Student Awards – Travel and Roger Rottmann Scholarship &
Professional Awards – Outstanding Achievement and Rich Cailteux
Followed by **THE RAFFLE, AUCTION,** and the ***Bonfire Social***

Thursday, February 18
0700-0800 h Breakfast
0730-0900 h Registration
0800-1200 h Contributed Papers
1200-1300 h Lunch
1300-1310 h **Awards Presentation**: Best Papers/Best Posters; Power Tie and Lampshade Awards

Directions to Ocala 4-H Camp

The Ocala 4-H Center is located in the Ocala National Forest on Sellers Lake. Directions are provided below for those traveling from different parts of the state. Mileage estimates are to be used for general reference only.

From SW:
Take I-75 N to 44 E, head towards Leesburg, turn right onto 441 S, in Eustis, take exit for 19N (on right), turn left at light and head north on 19 N for ~19 mi., turn left onto NFS 535 at the Fire Control Center/Camp Ocala 4-H Center sign. Center will be on the right about 1/2 mi.
From SE:
Take Turnpike N to 429 N towards Apopka, turn left onto 441 N, once in Eustis, take a right onto 19 N., go for ~19 mi. and turn left onto NFS 535 at the Fire Control Center/Camp Ocala 4-H Center sign. Center will be on the right about 1/2 mi.
From NW:
Take I-75 S to Ocala, take the exit for 326 E, when 326 ends, turn left onto 40 E, turn right onto 19 S, go for ~4.5 mi. and turn right onto NFS 535 at the Fire Control Center/Camp Ocala 4-H Center sign. Center will be on the right about 1/2 mi.
From NE:
Take 17 S to Palatka, turn right onto 19 S, go for ~42 mi. and turn right onto NFS 535 at the Fire Control Center/ Camp Ocala 4-H Center sign. Center will be on the right about 1/2 mi.

Reminder for:

NEW AWARDS!!!

The Awards Committee is seeking nominations for the Florida Chapter's newly established Outstanding Achievement and Rich Cailteux Awards. Send nominations (letter outlining the accomplishments of the individual that meet the criteria of each award) to Eric Nagid (eric.nagid@myfwc.com) by **January 8th, 2010**. Applications should be limited to one page, but descriptive enough to convey why the individual is deserving of the award.

Outstanding Achievement Award

The purpose of the Outstanding Achievement Award is to recognize individuals for singular accomplishments and contributions to fisheries, aquatic sciences, and the Florida Chapter. The award aims to honor individuals for distinct contributions to the fisheries profession and enhancing the visibility of the Chapter. The Outstanding Achievement Award is the highest honor Florida AFS may bestow upon an individual member or collaborating group.

Candidates will be evaluated according to the following criteria:

- Original techniques or research methodology
- Original ideas, viewpoints, or data which contributed to fisheries management or our understanding of aquatic resources
- Important ecological discoveries
- An original fishery research or management program of statewide importance
- Activities in public education and outreach that have statewide impacts

Rich Cailteux Award

The purpose of the Rich Cailteux Award is to recognize individuals who have maintained a long-term commitment to research, management, and/or conservation of Florida fisheries and aquatic resources. This award aims to honor individuals for their career contributions to the fisheries profession and enhancing the visibility of the Florida Chapter.

Candidates will be evaluated according to the following criteria:

- A minimum of 20 years spent in a fisheries related field in Florida
- Substantial career contributions to Florida aquatic resources and the fisheries profession
- An imaginative and successful program in fisheries and aquatic sciences education
- A history of mentoring young fisheries professionals, and involvement and leadership with the Florida Chapter of the American Fisheries Society

Announcements!

Candidates for Upcoming Election for Florida Chapter Officers

This year's candidates for President-Elect have been identified and an announcement along with a biography for each will be sent out to the chapter's email list prior to the meeting; voting will be held during the Business Meeting at the Florida Chapter's Annual Meeting in February. Travis Tuten will remain as Secretary-Treasurer.

Meeting Raffle

Please begin soliciting wherever and whatever you can of our meeting raffle. Last year we had some outstanding trip packages and general prizes that brought in a substantial amount of money for our student travel grants. Student attendance and participation at the meetings has been remarkable over the last several years, and I believe the travel grants have had a great deal to do with it. I challenge all members to bring at least one item to raffle off during the meeting.

Contact your Raffle Committee Chair, Andy Strickland at andy.strickland@myfwc.com for more information on how you can help.

Student Sub-Unit News

The Florida Chapter Student Sub-Unit elects new officers each year for President, Vice-President, and Treasurer. So, if you are a student and are planning on attending this year's annual meeting, please consider running for one of these positions.

For questions about their responsibilities please contact Alecia Adamson at alecia.adamson@ufl.edu

Student Section

Student Research Highlight

Modeling the impacts of habitat management on largemouth bass fisheries at the Kissimmee Chain of Lakes, Florida

Patrick O'Rouke, Program in Fisheries and Aquatic Sciences, University of Florida

INTRODUCTION

The Kissimmee Chain of Lakes (KCOL) hosts some of Florida's most prominent largemouth bass *Micropterus salmoides* fisheries. A growing human population in the Orlando area over the past century required lake water level regulation (which historically fluctuated greatly between seasons and years) to prevent flooding. This regulation has modified aquatic plant communities in the KCOL, and lake managers used drawdowns in the past to counter these changes. The invasion of hydrilla *Hydrilla verticillata* in the 1980s further altered KCOL plant composition and abundance.

Largemouth bass recruitment (i.e., survival to age-1) can be influenced by aquatic plant abundance and changes in water levels. I evaluated current available information describing the relationships of these factors to largemouth bass recruitment and built a population model to evaluate how habitat variables may influence largemouth bass populations at Lakes Tohopekaliga and Kissimmee. I tested the model's viability by comparing model-predicted catch and harvest to historical Florida Fish and Wildlife Conservation Commission creel surveys. I then explored a range of policy options at each lake using the model.

MODEL STRUCTURE

I built an age-structured, constant recruitment population model to simulate impacts of changing hydrilla coverage (Tate et al. 2003), water level fluctuations (Bonvechio and Allen 2005), and drawdowns on largemouth bass recruitment. I applied both natural and fishing mortalities (the latter were scaled based on angler effort trends) to each cohort in every year. Fishing mortality came from a combination of harvested fish and legal and/or sublegal released fish to which I applied a discard mortality rate. I used logistic curves to model vulnerability of each cohort to angler catch and harvest, based on a length at age determined from von Bertalanffy growth parameters.

RESULTS

I estimated of the proportion of largemouth bass which were caught by anglers and the proportion which were harvested by anglers at both lakes. This allowed fishing mortality to change based on FWC estimates of total angler effort. The estimated proportion of fish harvested by anglers decreased at both lakes over the study period.

I simulated largemouth bass populations in the past at both lakes by applying habitat values present during 1983-2007 and running a Monte Carlo simulation of the model with 1,000 iterations. Creel survey estimated catch and harvest remained within model-estimated 95% confidence intervals with few exceptions. At Lake Tohopekaliga, the model underestimated creel survey results for catch harvest in 2002 and overestimated harvest in 2006 and catch in 2004-2007 (Figure 1). At Lake Kissimmee, the model underestimated harvest in 1991 (Figure 1). For most years, however, the model mimicked the same trends seen in field creel survey estimates. Therefore, I believe that the model was effective for predicting the average response to habitat changes at both lakes.

I applied six different management scenarios to the model for Lake Tohopekaliga to examine their relative contributions to the largemouth bass fishery via recruitment (Figure 2). The scenario simulating high hydrilla coverage provided the greatest relative benefit to the fishery. The scenario simulating baseline conditions had the second-greatest impact on the fishery. The four remaining scenarios all showed lower population responses than the baseline scenario, with eradication of hydrilla representing the lowest values.

I applied seven different management scenarios to the model for Lake Kissimmee (Figure 3). The scenario simulating high hydrilla coverage again provided the greatest relative benefit to the fishery, though the increase over baseline values was not as great as at Lake Tohopekaliga. The scenario simulating added water level fluctuations at Lake Kissimmee had the second-greatest impact on the fishery. The managed hydrilla and hydrilla eradication scenarios both showed lower population responses than the baseline scenario.

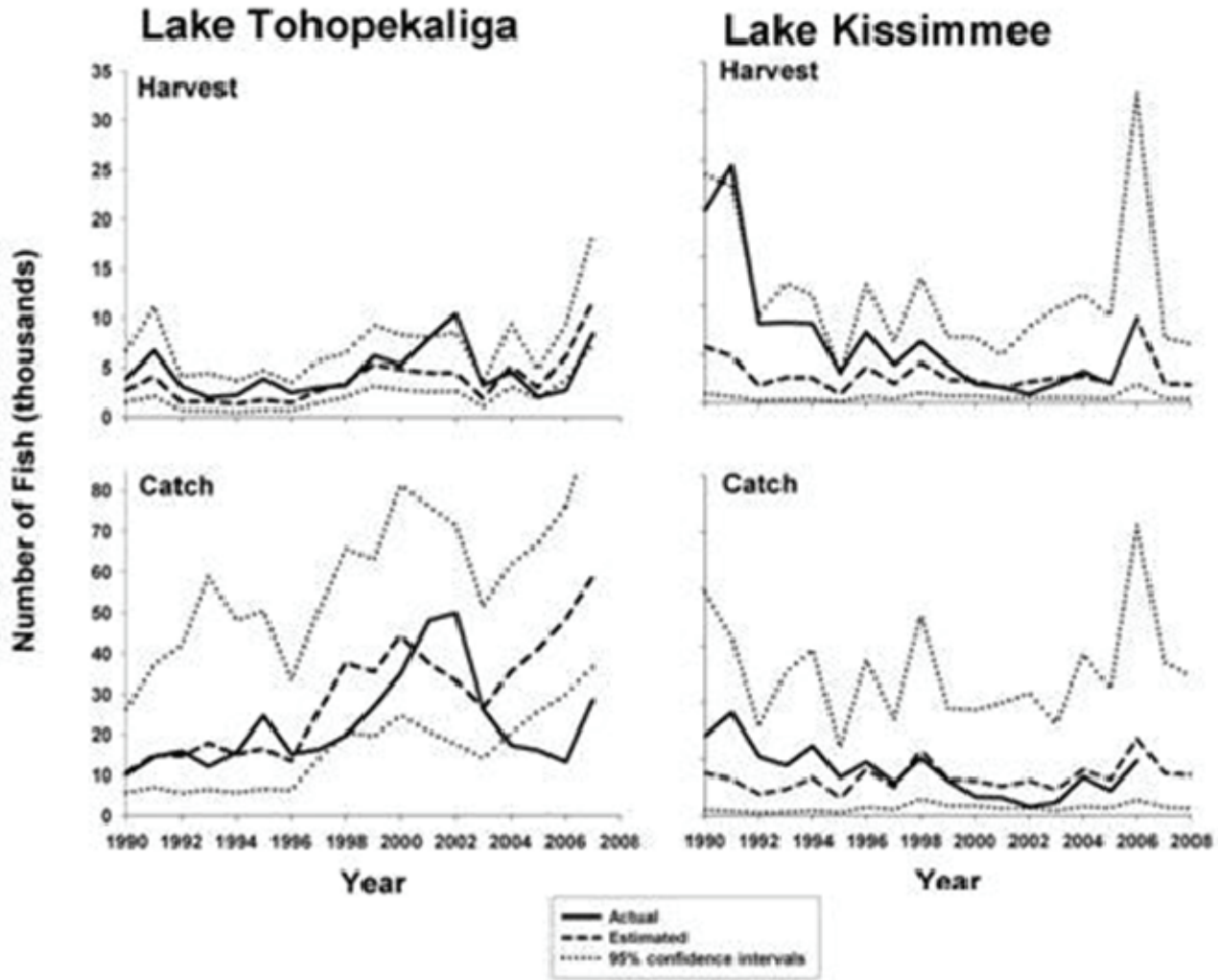

Figure 1. Observed and model-predicted (with 95% confidence intervals) harvest and catch at Lake Tohopekaliga and Lake Kissimmee from 1990-2008. The observed data represent FWC creel survey estimates. Predicted values and 95% confidence intervals are from model runs of 1,000 iterations.

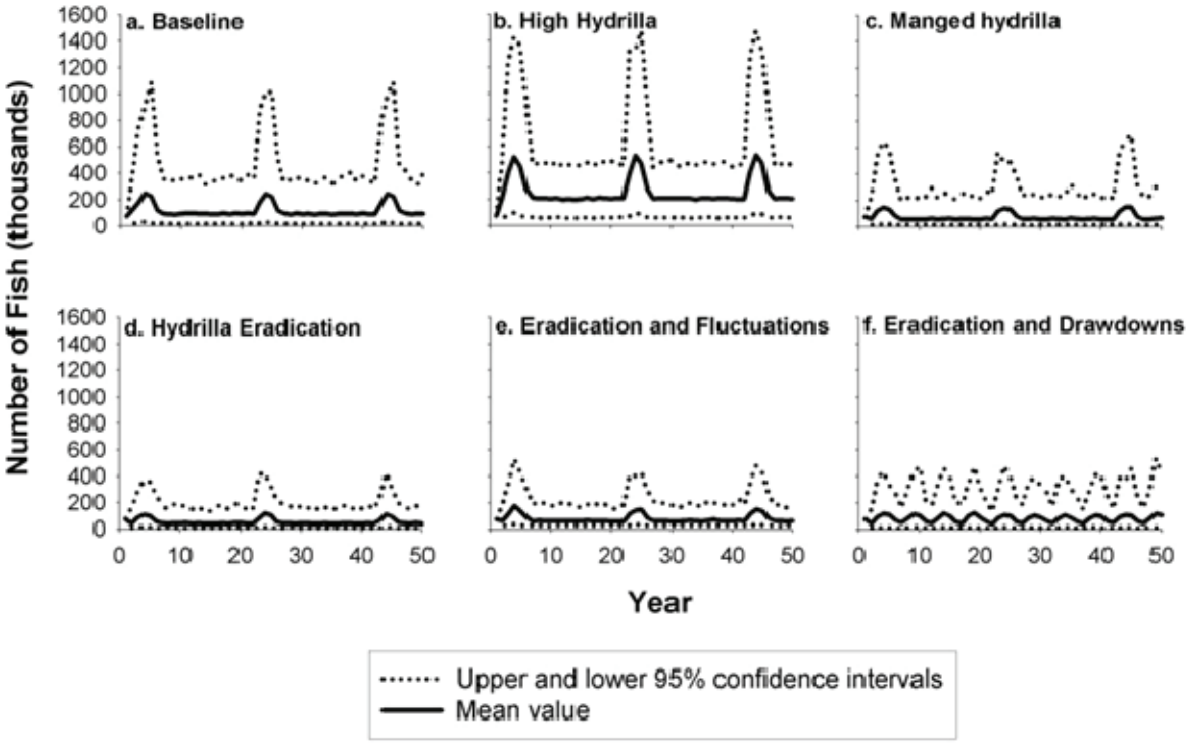

Figure 2. Model-predicted recruitment (age-1) of largemouth bass for six different management scenarios at Lake Tohopekaliga based on a Monte Carlo analysis utilizing 1,000 iterations over 50 years. Solid lines represent mean values and dotted lines represent upper and lower 95% confidence intervals, respectively.

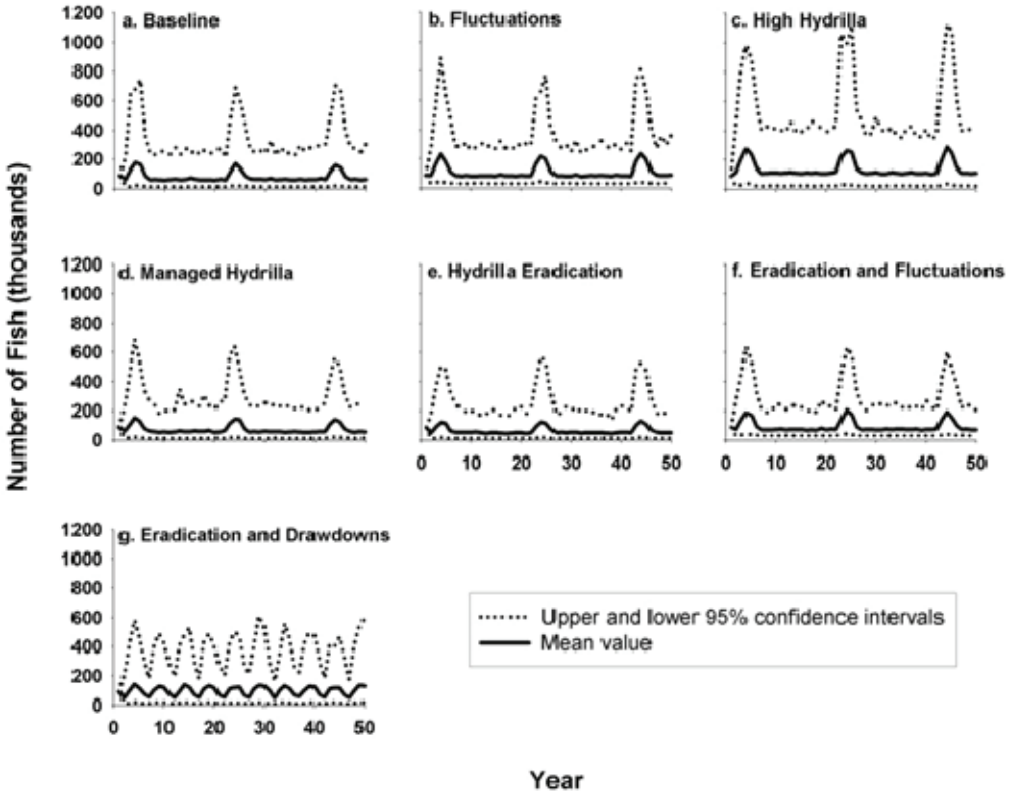

Figure 3. Model-predicted recruitment (age-1) of largemouth bass for seven different management scenarios at Lake Kissimmee based on a Monte Carlo analysis utilizing 1,000 iterations over 50 years. Solid lines represent mean values and dotted lines represent upper and lower 95% confidence intervals, respectively.

DISCUSSION

The model simulation results suggest that allowing expansion of hydrilla to the maximum acceptable level (i.e. accounting for boating access, aesthetics, water control structure safety, etc.) would likely benefit the largemouth bass populations at both lakes. Hydrilla has become a major habitat component at the KCOL since its introduction, particularly at greater than 50% coverage. Total elimination of the plant (e.g. from grass carp introduction or heavy herbicide application) would likely result in reduced largemouth bass catch and harvest at both lakes via reduced recruitment. Hydrilla coverage will likely be lower at Lake Kissimmee than at Lake Tohopekaliga in most years due to lower available light (Caffrey et al. 2007) therefore hydrilla values at Lake Kissimmee were lower in each respective scenario.

A new water level regime at Lake Kissimmee allowing for greater fluctuations should also provide modest benefits, though a similar change at Lake Tohopekaliga would provide less noticeable benefits. This increase in fluctuations may lengthen the intervals needed between drawdowns in the future. Drawdowns will likely still be necessary to prevent lake succession, but their immediate fishery benefits are too sporadic and short-lived to justify their use as anything other than a maintenance tool.

CONCLUSIONS

While this model provides a prediction of the largemouth bass population response to habitat changes at the KCOL, all models inherently contain error and the actual response of the systems in question will likely differ from the mean predicted response from the model. The process of constructing a population model can suggest areas where the existing data may be improved for future modeling exercises. Opportunities exist to further explore the relationships of habitat changes to largemouth bass recruitment at the KCOL. Additionally, data related to factors such as largemouth bass growth vulnerability to angling can be refined and applied to the model. As the input parameters are re-evaluated and tested, the model could more accurately reflect conditions present in the largemouth bass fishery at the KCOL.

LITERATURE CITED

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