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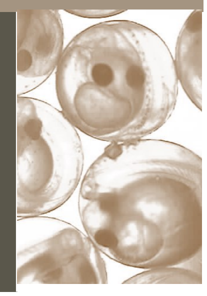
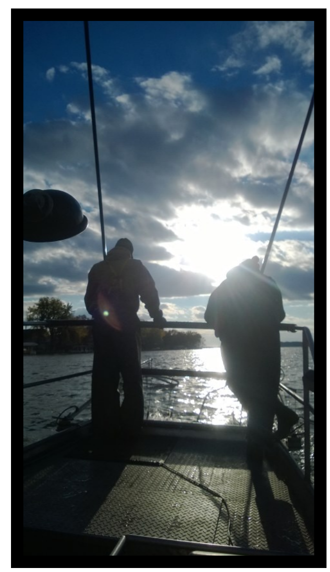
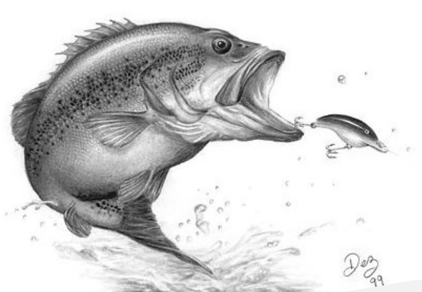
Iowa Chapter of the American Fisheries Society

Lateral Lines



current topics >>>





IN THE NEWS:

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Our Mission:
To improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals.

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President's Corner

Jeff Kopaska

As I write this, the Annual Meeting of the American Fisheries Society is occurring. Over sixteen-hundred students and professionals from across the globe have gathered in Tampa to spend a week talking about fish. Though we are a small chapter, we regularly have members present at the meeting, usually because of their leadership roles in the Society. This year is no different, with Iowa Chapter members currently serving as President or President-elect of three different AFS Sections. Iowans leading at the national level is not a new thing. Joe Larscheid is the third Iowan to serve the Fisheries Administrators Section, Randy Schultz is the third to serve the Fisheries Management Section, and Rebecca Krogman is the second to serve the Fisheries Information and Technology Section. Iowa Chapter members have also served as president of the Education Section (3X), Student Subsection of the Education Section (2X) and President of the North Central Division (6X). Individuals who were chapter members earlier in their careers later served as Fish Culture Section President, Society President (2X), and Executive Director of the Society. Our Chapter has a rich history of serving our peers in the fisheries profession. That is something we should be proud of, and also something we need to work hard to continue. Thank you all for all the time and energy you invest in fisheries, and in the Iowa Chapter.

One of the important topics of the plenary addresses at the Annual Meeting is science communication, and a new AFS Science Communication Section has been created to help professionals deal with this topic. We as a chapter have been dealing with the tentacles of this complicated issue some time, but especially during the last year. It is why we have a separate mailing list, and why we created a Communications Coordinator. I think this issue is one of the big ones we are going to have to deal with as professionals for a while. The talks at AFS, from what I see on social media, seem to be encouraging fisheries professionals to really stick to the science and the data and to defy the "alternate facts" (which regularly are not facts at all). On the other hand, there is political pressure and legislative mandate to hold public opinion on equal footing with data-based decisions. This is evident here in Iowa with the challenges that face lake restoration projects, and a quick peek north to Minnesota shows how troublesome issues can be at a place like Mille Lacs. I think we all need to prepare for more of these types of challenges in the future – don't fear it, just prepare.

I want to thank all of you who found a way to attend the Iowa Chapter meeting in Ames in March. Despite the challenges, it was a success. Big thanks go to Michael Weber and the ISU Student Subunit for all their work. There were a number of good talks, and Tom Isenhart did a nice job talking with us about the science behind the Nutrient Reduction Strategy. I think more knowledge about that will help us as fisheries and water quality issues continue to play out here in Iowa.

As I look back on my year as President of the Iowa Chapter, I think we did some good things. Our expertise was well used by the Iowa Conservation Alliance to push back the effort to legalize hand fishing and to learn more about turtle biology and harvest in regard to that legislation. We submitted comments to the Corps of Engineers regarding management of the Missouri River, and we will comment about the Waters of the United States rule before the end of the month. We are using our expertise in the way we are supposed to, and we are building for the future by supporting students. Let's be proud of our accomplishments, and keep up the good work! It has been a pleasure serving as your President for the last year. Good luck in the next year Jonathan!

Jeff Kopaska

Proposed Statewide Fish Consumption Advisory

Darcy Cashatt and George Scholten, Fish Research ~ Iowa DNR

Mercury is the most prevalent contaminant in Iowa fish and bioaccumulates to its highest levels in top-level predators and slow-growing species. Current Iowa advisories warn anglers to limit consumption to 1 meal-per-week for black bass and other predator species in 13 lakes and 9 river reaches. Although these advisories imply that other species in the same location or predators in other locations are safe to consume, the public is still unsure about the safety of consuming fish from Iowa waters. To overcome this barrier to angling Iowa Department of Natural Resources staff and Iowa State University researchers collected nearly 2,500 fish between 2013 and 2015 and tested them for tissue mercury concentration, with a goal to develop easy-to-follow and comprehensive statewide consumptions guidelines.

Fish sampled included 18 different game species from 40 lakes and 12 interior rivers, the Upper Mississippi and Missouri rivers, and two trout hatcheries. Sample results were used to develop statewide fish consumption guidelines modeled after the 2017 USFDA consumption guidelines indicating fish species as “Best Choices,” “Good Choices,” and “Choices to Avoid” for the at-risk population.

Risk level assessment for consumption guideline development was done by using binary logistic regression to compare probability of mercury contamination with two variables that anglers can readily determine: fish species and fish length. Overall, Iowa fish had very low levels of mercury contamination, including nine species that never exceeded the 1-meal-per week screening value of 0.3 ppm mercury (i.e., Bluegill, Brown Trout, Black Crappie and White Crappie, hatchery-stocked Rainbow Trout, Sauger, Yellow Bass, Hybrid Striped Bass and Yellow Perch). Channel Catfish and White Bass had only a few individuals that exceeded this same screening value. All of these 11 species were listed as Best Choices for consumption without consideration of length. Flathead Catfish, Largemouth Bass, Smallmouth Bass, Muskellunge, Northern Pike and Walleye were all listed among both Best and Good Choices for consumption, with a 1-meal-per-week limitation for the at-risk population above specific lengths (Figure 1).

Fish Species		Recommendations for the at-risk population*
Hybrid Striped Bass White Bass Yellow Bass Black Bass < 14” Flathead Catfish < 28” Channel Catfish Northern Pike < 28”	Bluegill Crappie Trout Walleye, lake < 22” Walleye, river < 17” Sauger Yellow Perch	**Best Choices** Eat 2 to 3 Servings per Week
Black Bass > 14” Flathead Catfish > 28” Northern Pike > 28” Muskellunge < 44”	Walleye, lake > 22” Walleye, river > 17” Freshwater Drum	**Good Choices** Eat 1 Serving per Week
Muskellunge > 44”		**Choices to Avoid** Highest Mercury Levels

*The at-risk population includes women of child-bearing age (ages 16 – 49) and children through age 15.

Figure 1. Draft consumption n guidelines for Iowa fish for the at-risk population.

One species, Freshwater Drum, was classified as a Good Choice in general based upon a high proportion of contaminated samples. Because walleye from rivers had notably higher mercury concentrations at shorter lengths than walleye from lakes, the draft advisory lists consumption guidelines separately by source for this species. Muskellunge was the only species that had a large number of individuals exceeding both the 1-meal-per week screening value (0.3 ppm) and the do-not-eat screening value (1.0 ppm) for mercury. The risk assessment indicated that Muskellunge over 44 inches should be listed as a Choice to Avoid.

Overall, risk level assessment shows that fish in Iowa are very safe to eat, with few mercury-related consumption limitations for the typical angler. Highlighting fishery regulations that allow the harvest and consumption of Best Choices while restricting harvest of fish larger than lengths putting them into the Good Choices category can be used to increase the public's awareness of risks associated with consuming larger fish while reducing the risk to anglers and their families of high mercury exposure. The Iowa DNR Fisheries Bureau continues to work with our partners in the Iowa DNR Water Quality Bureau and the Iowa Department of Public Health to finalize these draft guidelines. Specifics of the analysis as well as management implications and recommendations can be found in Chapter 4 of the completion report (Send requests to George Scholten, george.scholten@dnr.iowa.gov or Darcy Cashatt, darcy.cashatt@dnr.iowa.gov).

Evaluation of Iowa's Standard Fisheries Sampling Program

Rebecca Krogman, Fisheries Research ~ Iowa DNR

Approach 1: Review current fisheries sampling methods and gears and identify issues that require further evaluation

A review of all electrofishing boats owned and operated by Iowa DNR Fisheries Bureau was conducted during FY2017. Details on wiring, anode configuration, safety equipment, control box manufacturer, and generator type were summarized for 26 boats. This summary indicated a broadscale need to review boat wiring, control box function, system resistance, and electrical field size and shape for all electrofishing boats. The most significant issue found was related to electrical safety in which high and low voltage wiring were located in the same conduit. Potential arcing from the high voltage to low voltage wiring could damage equipment or cause injury to operators. A common difference among boats was anode configuration; all boats used two boom-supported anodes but differed in boom and anode size, shape, and configuration resulting in dissimilar electrical fields. This review has led to the replacement of nonstandard control boxes, rewiring of several boats, incorporation of hull pressure-washing into regular maintenance, and addition of voltage stabilizers where necessary. These changes will improve the consistency and safety of electrofishing as a sampling gear. Review of each boat's condition is ongoing and expected to continue during FY2018. This effort should lead to improved electrofishing-based sampling across the state.

Rotenone standard operating protocols were reviewed and revised using input from fisheries managers conducting rotenone applications. During FY2017, a Rotenone User Guide was prepared for use by rotenone applicators in the Iowa DNR Fisheries Bureau. This guide is complete and has been incorporated into the Iowa DNR's standard operating protocols and procedures. No additional work related to rotenone application procedures is planned during the remainder of this study.

Fisheries sampling methods were reviewed on an ongoing basis and thus far do not require additional approaches for evaluation. Several possible directions for review were identified and will be reviewed in full during FY2018.

Study Recommendations: Continue with this study as designed, including review of lake and reservoir comprehensive survey gear combinations, nonwadeable stream sampling protocol, Muskellunge fyke netting procedures, and electrofishing cathode sizes.

Approach 2: Survey current modified fyke net methods and specifications, and determine the most appropriate standard

Results from 2015 fyke net retention tests indicated the inferiority of the standard AFS design (AFS A) compared to the Iowa A and B designs; therefore the AFS standard design was modified to have a single finger throat prior to the 2016 sampling season (AFS B). All three designs (Iowa A, Iowa B, AFS B) were tested again for retention at two waterbodies: Williamson Pond and West Lake Osceola (Table 1). For the AFS design, fish of each species were placed in the cod end. For the Iowa designs, fish were placed between the first and second throats (i.e., the "front end") and in the cod end (i.e., the "back end"). Each stocked fish was clipped with a unique clip identifying its net and position of stocking (i.e., front or back). Nets were fished overnight, encompassing two crepuscular periods, and checked the following morning. Note that lake and year were not considered relevant as stratification factors; only site was considered a useful stratum. A total of 14 unique sites, or replicates, were used in the retention portion of this study.

Table 1. Samples used for assessing fish retention in modified fyke nets using three net designs.

Lake	Date Stocked	Date Sampled	Sites	Species Present
Lake Ahquabi	9/28/15	9/29/15	6	Crappie, Redear Sunfish
Williamson Pond	9/12/16	9/13/16	3	Crappie, Bluegill
Williamson Pond	9/19/16	9/20/16	3	Crappie, Bluegill
West Lake Osceola	9/27/16	9/28/16	2	Bluegill

Overall, net designs had different retention rates for crappies, Redear Sunfish, and Bluegill after adjusting for site-specific differences. Based on the general association Cochran-Mantel-Haenszel statistic, a form of chi-square test for stratified *n*-way tables, probability of fish retention differed among nets for all three species examined (Table 2).

Table 2. Differences in fish retention in modified fyke nets using four net designs. PEscape = probability of fish escape (95% confidence interval), CMH = Cochran-Mantel-Haenszel test for general association, df = degrees of freedom

Species	N	PEscape	CMH	df	p-value
Bluegill	76	0.388 (0.193 – 0.583)	27.3808	2	<0.0001
Crappies	203	0.241 (0.139 – 0.343)	11.7634	3	0.0082
Redear Sunfish	157	0.275 (0.145 – 0.406)	16.6675	2	0.0002

The AFS A design had the highest probability of fish escape for crappies and Redear Sunfish (Table 3). The net design with the lowest probability of fish escape differed by species. Note that the AFS A and AFS B designs were never deployed simultaneously and thus were not directly compared.

Table 3. Probability of escape by species and net design.

Species	Net Design	Mean	Lower CL	Upper CL
Bluegill	AFS B	0.144	-0.137	0.426
	Iowa A	0.789	0.503	1.075
	Iowa B	0.200	0.024	0.376
Crappies	AFS A	0.478	0.175	0.782
	AFS B	0.140	-0.132	0.412
	Iowa A	0.125	-0.012	0.262
	Iowa B	0.272	0.065	0.478
Redear Sunfish	AFS A	0.453	0.146	0.760
	Iowa A	0.291	0.074	0.508
	Iowa B	0.085	-0.038	0.208

The AFS A net never outperformed any other net design, and the relative risk of fish escapement from an AFS A net ranged from 1.2 to 4.8 times more likely than from an Iowa A or B net (Table 4). The modification of the AFS A open throat to a finger throat, yielding the AFS B design, greatly improved retention, making the AFS B net's retention indistinguishable from Iowa B nets and more effective than Iowa A nets (i.e., for Bluegill). Iowa A nets were more likely to allow Bluegill escapement than both AFS B and Iowa B nets, but did not differ in crappie or Redear Sunfish retention. If Bluegills are targeted in modified fyke net sampling, then use of a finger-throated net is essential.

Table 4.Pairwise comparisons between modified fyke net designs, by fish species. k = number of sites, CMH = Cochran-Mantel-Haenszel test for general association, df = degrees of freedom for CMH, MF = Mantel-Fleiss criterion, Relative risk = relative risk of fish escape for first net compared to second net

Comparison	Species	k	CMH	df	p-value	MF	Relative risk
AFS A vs. Iowa A	Crappies	10	5.7053	1	0.0169	7.1078	2.6137 (1.1712 – 5.8328)
	Redear Sunfish	6	0.3276	1	0.5671	12.7935	1.1902 (0.6664 – 2.1256)
AFS A vs. Iowa B	Crappies	12	6.1255	1	0.0133	12.8459	2.1312 (1.1404 – 3.9827)
	Redear Sunfish	6	16.5740	1	<0.0001	10.4076	4.8478 (2.0047 – 11.7227)
AFS B vs. Iowa A	Bluegill	6	22.3947	1	<0.0001	8.2005	0.1318 (0.0384 – 0.4525)
	Crappies	10	4.1613	1	0.0414	0.6768	5.3633 (0.6615 – 43.4838)[1]
AFS B vs. Iowa B	Bluegill	6	1.9845	1	0.1589	2.6250	0.2353 (0.0258 – 2.1488)
	Crappies	12	0.9019	1	0.3423	3.0970	0.5509 (0.1527 – 1.9873)
Iowa A vs. Iowa B	Bluegill	6	14.5153	1	0.0001	9.8485	3.6066 (1.6124 – 8.0722)
	Crappies	12	3.4266	1	0.0642	10.2188	0.4957 (0.2260 – 1.0873)
	Redear Sunfish	6	5.6136	1	0.0178	9.5000	2.8000 (1.1342 – 6.9126)

[1]Logistic estimate of relative risk used due to zero-sum rows and/or columns present.

Catch efficiency was also examined using catch rate from nets that were not pre-stocked with fish (i.e., not part of the retention study). All three designs (Iowa A, Iowa B, AFS B) were deployed at two reservoirs (Williamson Pond and West Lake Osceola) in sets of three. Nets were fished overnight, encompassing two crepuscular periods, and checked the following morning. Results from 2015 indicated that more samples were needed to determine whether Iowa A and Iowa B nets had different catch rates; therefore both Iowa designs were also deployed in 10 lakes and reservoirs across southern Iowa during regular fisheries management monitoring following a systematic random sampling design. Based on generalized linear mixed models predicting catch with net design as a fixed effect and site nested within lake as a random effect, net design was a significant factor affecting catch for Bluegill, crappies, and Redear Sunfish (Table 5). For Bluegill, the Iowa B design caught more fish/net-night than either AFS design (Table 6; Figure 1). For crappies, the AFS A design caught fewer fish/net-night than any other design, and the Iowa B net caught more than the Iowa A net. For Redear Sunfish, the AFS B design caught fewer fish/net-night than any other design, whereas other net designs were indistinguishable from each other. **Given the higher catch rates for Bluegill and crappies, combined with better retention rates, the Iowa B net design was superior to other designs tested and is recommended as the Iowa fyke net sampling standard.**

Study Recommendations: This approach should continue for completion of data analysis and manuscript preparation.

Table 5.Fixed effect tests and least-square means from generalized linear mixed models in which net design is a fixed effect.

Species	P-value of test for fixed effect (F, df)	n	Net	Least-square means				
				Linear predictor	Standard error	df	t-value	p-value
Bluegill	0.0005	124	AFS A	1.6857	0.3792	120	4.44	<0.0001
	(6.36, 3)		AFS B	1.1649	0.4912	120	2.37	0.0193
			Iowa A	2.2571	0.1783	120	12.66	<0.0001
			Iowa B	2.9178	0.1765	120	16.53	<0.0001
Crappies	<0.0001	124	AFS A	1.2311	0.3035	120	4.06	<0.0001
	(14.47, 3)		AFS B	3.3242	0.3235	120	10.28	<0.0001
			Iowa A	2.7465	0.1294	120	21.23	<0.0001
			Iowa B	3.3086	0.1288	120	25.68	<0.0001
Redear Sunfish	0.0036	80	AFS A	3.1346	0.4060	76	7.72	<0.0001
	(4.91, 3)		AFS B	0.4433	0.5728	76	0.77	0.4414
			Iowa A	2.1475	0.2651	76	8.10	<0.0001
			Iowa B	2.2126	0.2644	76	8.37	<0.0001

Table 6.P-values from pairwise comparison of least-square means from generalized linear mixed models in which net design is a fixed effect.

*** = result significant at $\alpha = 0.10$, ** = result significant at $\alpha = 0.05$**

Species	Net	AFS B	Iowa A	Iowa B
Bluegill	AFS A	0.4030	0.1753	0.0039**
	AFS B	-	0.0387	0.0011**
	Iowa A	-	-	0.0096*
Crappies	AFS A	<0.0001**	<0.0001**	<0.0001**
	AFS B	-	0.0999	0.9643
	Iowa A	-	-	0.0026**
Redear Sunfish	AFS A	0.0003**	0.0453	0.0608
	AFS B	-	0.0085**	0.0064**
	Iowa A	-	-	0.8625

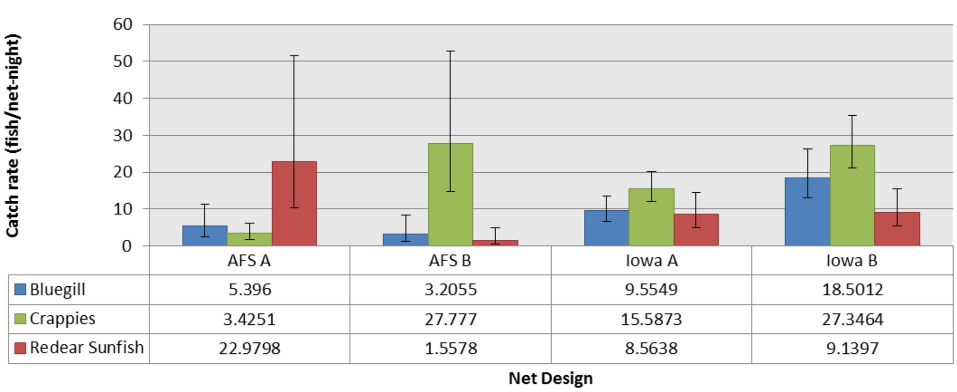

Figure 1. Least-square mean catch rate of Bluegill, crappies, and Redear Sunfish by four modified fyke net designs. Standard error bars shown.

Electrofishing Equipment and Safety Workshop Summary

Lewis Bruce, Fish Research ~ Iowa DNR

Iowa AFS and ETS Electrofishing Systems LLC sponsored an electrofishing workshop in early August. The workshop was held at Iowa Lakeside Laboratory on West Okoboji Lake in Milford, Iowa. We had a fantastic group of instructors with several years of experience in the electrofishing field from control box design to system evaluations and survey work. Jan Dean, Jim Reynolds, and Mike Siepker led the lectures and field work over the three day course. Chad Dolan presented his work in Iowa on anode configurations. Burke and Mark O'Neal of ETS Electrofishing Systems LLC were onsite each day of the workshop to answer questions and work on equipment. Although the agenda was 8:00 am to 5:00 pm the instructors took on a barrage of questions and analyzed data from field work during breaks, meals, and into the evening hours. The 32 attendees were comprised of fisheries staff from Iowa DNR, Nebraska Game and Parks, and Iowa State University.

So what was the goal of this workshop and what was accomplished? Our first step was getting everyone thinking about electrofishing and how their boat is working when power is applied to the water. After a person has a basic understanding of some electrofishing concepts questions start forming. A few frequently asked questions were about anode configuration, cathode size, and power applied to fish.

We may not have answered the question about cathode size but we did learn what an anode array should and should not look like. Jan recommended rings or spider arrays have a diameter of 14 to 24 inches and six evenly spaced droppers. This size allows the induvial dropper fields to more smoothly merge into a cylindrical array field. From a field use perspective this diameter may also lead to less entanglement issues. Power connections should be fixed if possible; the spinner style arrays can produce an intermittent electrical connection. We were able to demonstrate the intermittent connection on a few boats at the workshop. Adjustable covered droppers were not recommended and Jan was able to demonstrate this with the data collected during the field exercises. The droppers hanging from each ring should have 12"- 24" of exposed metal in the water. The exposed portion of the dropper should start approximately 6" below the surface. If the exposed portion of the dropper is always under the water the electrical field will be consistent. This would be favorable for standardizing surveys and keeping the control box meters from fluctuating. Each dropper should be constructed of 3/8 to ½ inch stainless steel cable or stainless steel tubes between ¾ and 1 inch diameter. If tubes are used they should be weighted to maintain a vertical position while moving through the water.

As previously mentioned power applied to the fish was also a question. Applied voltage and power have been used to standardize surveys in the past. Jan recommended using a peak current goal to standardize boat electrofishing. Even though different anode configurations were used during the field tests current was less variable than applied voltage and power. The mobile app to build a current goal table can be found at Electrofishing.net under the tools tab. Workshop attendees also have the excel sheets used to create current goal tables in addition to power and resistance tables.

This was a quick look at a few topics covered in the workshop. Several tools are available on the Electrofishing.net website along with informative blogs. The workshop answered many questions and will help the participants be more aware of what is happening in the water when they turn on a generator and flip the switch on an electrofishing control box.

Parasite Living Inside Fish Eyeball Controls its Behavior

The parasite made me easy to catch

Dr. Andrew Lee/Solent News/REX/Shutterstock

By **Elizabeth Preston**

A common parasite that lives in fish eyeballs seems to be a driver behind the fish's behaviour, pulling the strings from inside its eyes.

When the parasite is young, it helps its host stay safe from predators. But once the parasite matures, it does everything it can to get that fish eaten by a bird and so continue its life cycle.

The eye fluke *Diplostomum pseudospathaceum* has a life cycle that takes place in three different types of animal. First, parasites mate in a bird's digestive tract, shedding their eggs in its faeces. The eggs hatch in the water into larvae that seek out freshwater snails to infect. They grow and multiply inside the snails before being released into the water, ready to track down their next host, fish.

The parasites then penetrate the skin of fish, and travel to the lens of the eye to hide out and grow. The fish then get eaten by a bird – and the cycle starts again.

In a 2015 study, Mikhail Gopko at the Severtsov Institute of Ecology and Evolution in Moscow and his colleagues showed that fish infected with immature fluke larvae swam less actively than usual – making themselves less visible to predators – and were harder to catch with a net than uninfected controls.

Now, the same team has tested rainbow trout harbouring mature eye flukes – parasites ready to reproduce inside their bird hosts. The team found that these trout swam more actively than uninfected controls and stayed closer to the water's surface.

Both traits should make fish more conspicuous to birds. When the researchers simulated a bird attack by making a shadow swoop over the tank, the fish froze – but infected fish resumed swimming sooner than uninfected ones.

Gopko says both studies show that how eye flukes manipulate their host's behaviour depends on their age. Immature parasites "are too young and innocent to infect a next host", he says, so their goal is to protect the fish they are living in. Mature parasites, however, are ready to reproduce – and to do so they need to get inside a bird's gut.

Frozen fish

Some earlier studies suggested fluke-infected fish act differently because of impaired vision. But the authors say vision problems wouldn't explain changes to unfreezing time, or the opposite effects of mature and immature parasites.

The researchers also tested how long it took fish to unfreeze after attack when they were infected with both mature and immature parasites at once. Their behaviour matched that of fish carrying only mature parasites. When the parasites' goals conflict, Gopko says, "mature guys are clear winners".

This fits a pattern of young parasites decreasing their host's likelihood of being preyed on, while older parasites increase it, says Nina Hafer, a parasitologist at the Max Planck Institute for Evolutionary Biology in Plön, Germany. Few studies have pitted mature and immature parasites against each other in one host, she says.

"It contributes to showing how many traits and species can be affected by host manipulation, which should make it an important factor in how parasites alter the ecological interactions of their hosts," she says.

Estimating Fish Mortality Rates Using Telemetry and Multistate Models

Fisheries Abstracts, Fisheries News & Science, News

By Joseph E. Hightower and Julianne E. Harris.

April 1, 2017

AMERICAN FISHERIES SOCIETY

We simulated and evaluated multistate capture–recapture models to estimate mortality rates using telemetry data. Four field designs were considered: (A) fixed receivers to estimate total instantaneous mortality (*Z*), (B) manual searches to estimate instantaneous fishing (*F*) and natural (*M*) mortality, (C) fixed receivers combined with external high-reward tags to estimate *F* and *M,* and (D) manual searches combined with external high-reward tags to estimate *M* and fishing mortality rates associated with harvest (*Fh*) and catch-and-release death (*Fcr*) as well as the probability of death due to catch and release (α). Estimates generally appeared to be unbiased for a simulated study with five periods and releases of telemetered fish at the start of periods 1–4. Compared to estimating *Z*, larger sample sizes are needed to achieve reliable estimates of component rates (*F* and *M*).

Information on seasonality of natural mortality can suggest key mortality sources such as spawning (Waters et al. 2005) or extreme temperature (Ellis 2014), which help us better understand biology, elucidate annual variability in population size, and inform the timing of harvest regulations. Sources of mortality can be evaluated at a very fine temporal scale using telemetry.

Estimates of component rates were more precise when that source of mortality was directly observed (*M* in design B, *F* in design C). The field design us- ing fixed receivers and high-reward tags should be especially useful in practice, because manual searches are not required to estimate *F* and *M*. Multistate models are useful for clarifying the connection between field observations and ecological processes. Reliable estimates of mortality rates, coupled with information on behavior, habitat use, and movement, make telemetry a highly valuable tool for improving fisheries management and stock assessment.

Application form

Fisheries Project Grant

Iowa Chapter – American Fisheries Society

Project Name:____

Project Description: ____.
____
____
____

Attach map or supplementary information

Project Location:

Water Body:____

Address:____

_____________________County:_____________________

Start Date: _______________ End Date:________________

Project Personnel:____
____

Fisheries Benefits:____
____

Iowa Chapter Representative: ____

Amount needed: $ _______.____ Total project cost: $________.____

Money will be used for: ____
____
____
____

Up to $1,000.00 per project.

Approved by Excom Committee Date:____________

The Iowa Chapter of the American Fisheries Society is offering to help finance worthwhile fisheries related projects. The completed application form needs to be transferred to the Iowa Chapter President by an Iowa Chapter Member.

Project Name – Give the project name.

Project Description – Give a brief review of the intended project. Include the work to be done, the methods and material that will be used in the project.

Attach a map and any supplementary information that you think will help the Excom Committee evaluate the project.

Project Location – Where will the work be done.

Start and End dates for the project. Month and calendar year will do.

Project Personnel – Include organizations and or individuals who will be directly involved in the work.

Fisheries Benefits – A very important part of the project should be direct benefits to Iowa's fishery. How does the project help and who is the beneficiary?

Iowa Chapter Representative – All projects need to have and Iowa Chapter member as a sponsor.

Amount needed – Tell us how much you need and the total project cost.

Money will be used for – Be as specific as you can. Will the money be used to hire people, buy, equipment, be seed money for a grant, etc.

There is a $1,000.00 limit for each project.

The Excom Committee of the Iowa Chapter will review the application and approve or reject the request.