

2012 ANNUAL CASE SUMMARY REPORT
AQUATIC RESEARCH & DIAGNOSTIC LABORATORY

Mississippi State University
College of Veterinary Medicine
Thad Cochran National Warmwater Aquaculture Center
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MISSION STATEMENT

The Aquatic Research & Diagnostic Laboratory is dedicated to the success of Mississippi's commercial catfish industry through service, research, and teaching. Our staff and fish health professionals strive to support the industry's efforts to produce a high quality, economical and profitable product. Our goals are derived from the needs of the industry and aimed at developing management strategies for controlling the impact of diseases that affect profitability. These goals can only be accomplished through mutual respect, cooperation, and the maintenance of a close supportive relationship with our clients.

**2012 CVM AQUATIC RESEARCH & DIAGNOSTIC LABORATORY
SUMMARY**

Diagnostics

In 2012, the Aquatic Research & Diagnostic Laboratory (ARDL) at Stoneville received a total of 635 producer submitted fish diagnostic cases. These cases were received from 41 different farms. This is a 6 % increase in the number of submissions over the 599 cases in 2011. There were an additional 137 cases submitted by researchers for a total of 772 cases. There were 1332 water quality samples that were analyzed representing a 25.66% increase from the 1060 samples received in 2011.

Individual case submissions represent a composite sample of fish collected from a single pond on a given day. The numbers reported are derived solely from submissions processed by the ARDL and do not necessarily reflect actual disease incidence in the field. Routine diagnostic procedures include evaluation of gill clips and skin scrapes for parasites, external and internal examination for signs of disease, bacterial and viral cultures, histopathology, and water quality evaluation. The ARDL works closely with Mississippi Agriculture Forestry and Experiment Station (MAFES) fish health professionals to offer treatment recommendations, monitor disease trends, provide surveillance for new and emerging diseases, provide field service investigation, and maintain a database of epidemiologic information on diseases of catfish. The ARDL supports the research efforts of other National Warmwater Aquaculture Center (NWAC) units, including MAFES, Mississippi State University -Extension Service, College of Veterinary Medicine, and United State Department of Agriculture – Agriculture Research Service (USDA/ARS) Catfish Genetics Research Unit. Furthermore, the laboratory provides an outlet for the dissemination of information gained from research efforts back to producers.

Bacterial diseases dominated the number of cases submitted as in previous years. The more usual trend of higher numbers of columnaris cases versus Enteric Septicemia of

Catfish (ESC) returned reversing what was seen in 2011. There were a total of 185 columnaris cases and 165 ESC cases representing 24.0% and 21.4% of the total cases seen. As single entities there were 53 cases of *Edwardsiella ictaluri* and 51 cases *F. columnare*. Interestingly, no antimicrobial resistance was seen for both these and other pathogenic bacteria isolated. There were also no cases of the virulent strain of *Aeromonas hydrophila* from area farms.

Proliferative gill disease (PGD) remained the most commonly diagnosed parasitic disease and was seen in 109 submissions. Like 2011, there were no submissions with *Ichthyophthirius multifiliis* (Ich) while *Bolbophorus* sp. trematode cases comprised 2.3% of cases submitted, which is higher than the previous year. Farmers are encouraged to continue surveillance efforts and to control rams horn snails (intermediate host of the parasite) with lime or copper sulfate treatments, particularly if pelicans have been observed visiting their ponds. *Bolbophorus* sp. trematodes are capable of killing fingerlings and increasing susceptibility to ESC, as well as decreasing feed consumption in larger fish. This can result in significant economic losses even with mild infestations.

Saprolegnia was seen in 5.4% of the cases submitted. There were only 7 cases of channel catfish virus (CCV) disease which is much lower than the previous year where there were 29 cases. Anemia made up 3.2% of the cases which was lower than the previous year where it made up 5.8% of the total cases. Visceral toxicosis of catfish (VTC) made up 6.1% of the total cases which is higher than the 2011 where it made up 1.5% of cases submitted. These last two diseases are still diseases of research interest because of the economic impact. Producers are highly encouraged to submit cases of these diseases.

With the interest in hybrid catfish, we have listed the numbers of hybrid as well as blue catfish cases submitted by month in the case summary table. Listed here are the specific number of those diseases for each of those catfishes since that specific data are not separated out in the comprehensive case summary table below. Hybrid and blue catfish made up 22.27% of the submissions.

Blue catfish

Disease Name	Number of Cases
Columnaris	1
No evidence of infectious disease	3
Proliferative Gill Disease, <i>Aeromonas veronii</i>	1
Sertoli cell tumor, seminoma	1
Total	5

Hybrid catfish

Disease Name	Number of Cases
Abscess, muscle	1
Anemia	10
Bacterial myositis	1
Channel catfish virus	2
Columnaris disease	14

Columnaris, Proliferative Gill Disease (GD)	2
<i>Edwardsiella tarda</i>	5
<i>Edwardsiella tarda</i> , Proliferative Gill Disease (PGD)	2
<i>Epistylus</i>	2
Enteric Septicemia of Catfish (ESC)	23
ESC, Anemia	3
ESC, Columnaris	12
ESC, Columnaris, brown blood	1
ESC, Columnaris, PGD	2
ESC, External Columnaris	1
ESC, PGD	4
External Columnaris	1
Gas bubble disease	1
No evidence of infectious disease	36
PGD	13
Red fillet	1
Saprolegnia, external Columnaris	1
Saprolegnia	3
Toxin, anemia	1
VHS testing	24
Visceral Toxicosis of Catfish suspect	1
Total	167

We are here to serve the industry and encourage producers to continue to take advantage of the diagnostic service.

Highlights

In May 2012, Aquaflor® was given final approval for an all freshwater-reared warmwater fish columnaris claim for florfenicol in part from research conducted at MSU CVM. This eliminated the conditional approval of the drug for columnaris (Aquaflor CA-1®) which required a separate blending process from Aquaflor® medicated feed used to treat ESC. The result is one blend of medicated feed which can be used to treat both ESC and columnaris disease in catfish. Aquaflor® medicated feed is still a VFD order drug which requires a prescription from a licensed veterinarian.

Faculty of the ARDL have cooperated with researchers from Alabama and Arkansas in the development of rapid diagnostic methodologies for an unusually virulent strain of *Aeromonas hydrophila*, which has been implicated in significant losses in Alabama. This new diagnostic assay is currently being used to evaluate the transmission of this bacteria, as well as determine its prevalence and persistence in catfish ponds.

Research continues on the life cycle of another digenetic trematode, *Drepanocephalus spathans*, a parasite of double crested cormorants, that has demonstrated the ability to infect juvenile channel catfish. Current research has focused on the longevity of the

parasite in fish, as well as development of a molecular diagnostic assay to detect the parasite in catfish tissues.

Work has continued with the development of molecular based techniques to detect and quantify pathogens in the pond environment. Currently, the ARDL employs assays for detection of *Edwardsiella ictaluri*, *Henneguya ictaluri*, *Bolbophorus damnificus*, and *Aeromonas hydrophila*. Similar assays for *Flavobacterium columnare* and *Edwardsiella tarda* are currently in the final stages of development. These assays allow researchers to measure pathogen levels in the pond, providing a method to evaluate management schemes aimed at controlling diseases caused by these pathogens.

Researchers at the ARDL have demonstrated strong molecular evidence to the existence of a 4th member of *Edwardsiella*. Although biochemically and phenotypically similar to *Edwardsiella tarda*, this new taxa demonstrates distinct genetic characteristics that suggest it is a separate species. Gene sequence data has linked this new taxa to other *Edwardsiella* species typically associated with diseased fish across the globe. Current research is focusing on development of a reliable diagnostic assay to identify and quantify this bacterium and determine its prevalence within the catfish industry.

A cooperative venture with MAFES researchers, as well as scientists at CVM in Starkville continues the elucidation of the life-cycle of the myxozoan parasite *Henneguya ictaluri* in hybrid catfish. The causative agent of proliferative gill disease, *H. ictaluri* does not appear to complete its life cycle as efficiently in hybrid catfish as in channel catfish. Comparatively, blue catfish appear completely refractory to infection by this parasite. Efforts to establish whether or not hybrid catfish can serve as a host in the life-cycle of this parasite will continue in 2013.

In a continuing effort to understand the parasitic fauna associated with pond-raised catfish, researchers at the ARDL, in cooperation with researchers at CVM in Starkville, have molecularly characterized several species of myxozoan parasites present in commercial catfish ponds. This work has led to the elucidation of 2 previously undocumented myxozoan life-cycles, both of which use channel catfish as an alternative host.

In addition, work continues towards developing methodologies that allow for reliable reproduction of the *H. ictaluri* life-cycle in the laboratory. This would provide a valuable research tool in development of management strategies to reduce the incidence and prevalence of proliferative gill disease in farm-raised catfish.

In cooperation with MAFES researchers, ARDL faculty continue to evaluate the utility of smallmouth buffalo polyculture for reducing incidence and prevalence of proliferative gill disease in channel catfish. Moreover, researchers with the ARDL and MAFES continue to investigate the effects of temperature and other water quality parameters on the benthic oligochaete *Dero digitata*, the intermediate host of *H. ictaluri*. Developing an improved understanding of the oligochaete biology will provide information that can be used to better manage around this disease.

Visceral Toxicosis of Catfish continues to be an area of active research. We would like to continue to enlist the assistance of farmers to bring suspect VTC fish to the ARDL. Ongoing VTC research requires a supply of blood from affected fish and submission of affected fish to the ARDL will help us understand how widespread the disease is and what pond factors may be triggering outbreaks.

We also solicit producers' help with anemia in our efforts to understand its cause. Although there are several diseases and toxins that can result in an anemic condition in fish, the etiology of the profound anemia that is seen typically in foodfish is unknown. Producers with anemic fish are also highly encouraged to submit those fish and keep accurate records on pond information.

Scientific Publications:

Soto E, Kidd S, **Gaunt PS**, Endris R (2012) Efficacy of florfenicol for control of mortality associated with *Francisella noatunensis* subsp. *orientalis* in Nile tilapia, *Oreochromis niloticus* (L.) Journal of Fish Diseases. 8 NOV 2012. DOI: 10.1111/j.1365-2761.2012.01425.x

Giesecker CM, Mayer TD, Crosby TC, Carson J, Dalsgaard I, Darwish AM, **Gaunt PS**, **Gao DX**, Hsu H, Lin TL, Oaks JL, Pyecroft M, Teitzel C, Somsiri T, Wu CC (2012) Quality control ranges for testing broth microdilution susceptibility of *Flavobacterium columnare* and *F. psychrophilum* to nine antimicrobials. Diseases of Aquatic Organisms 101: 207–215.

Gaunt P, Langston C, Wrzesinski C, **Gao D**, Adams P, Crouch L, Sweeney D, and Endris R (2012) Multidose pharmacokinetics of orally-administered florfenicol in the channel catfish (*Ictalurus punctatus*) Journal of Veterinary Pharmacology and Therapeutics doi: 10.1111/j.1365-2885.2012.01426.x.

Chatla K, Gaunt P, Hanson L, **Gao D**, Wills R (2012) Determination of the median lethal dose of botulinum serotype E in channel catfish (*Ictalurus punctatus*) fingerlings. Journal of Aquatic Animal Health. 24:105–109.

Griffin MJ, **Khoo LH**, Quiniou SM, O'Hear MM, Pote LM, Greenway TE, Wise DJ. (2012). Genetic sequence data identifies the cercaria of *Drepanocephalus spathans* (Digenea: Echinostomatidae), a parasite of the double-crested cormorant (*Phalacrocorax auritus*), with notes on its pathology in juvenile channel catfish (*Ictalurus punctatus*). Journal of Parasitology. 98: 967-972.

Soto E, LaMon V, **Griffin M**, Keirstead N, Beierschmitt A, Palmour R. (2012). Phenotypic and genotypic characterization of *Klebsiella pneumoniae* isolates recovered from non-human primates on the island of St. Kitts, West Indies. Journal of Wildlife Diseases. 48: 603-611.

Soto E, **Griffin M**, Arauz M, Riofrio A, Martinez A., Eugenia M. (2012). *Edwardsiella ictaluri* as the causative agent of mortality in cultured tilapia nilotica (*Oreochromis niloticus*). Journal of Aquatic Animal Health. 24: 81-90.

Soto E, **Griffin M**, Wiles J, Hawke JP. (2012). Genetic analysis and anti-microbial susceptibility of *Francisella noatunensis* subsp. *orientalis* (syn. *F. asiatica*) isolates from fish. Veterinary Microbiology. 154: 407-412.

Mischke CC, Greenway TE, **Griffin MJ**, Wise DJ. (2012). Effects of fry age-at-stocking on growth and survival of channel catfish. North American Journal of Aquaculture. 43: 135-139.

Liu S, Zhang Y, Zhou Z, Waldbieser G, Sun F, Lu J, Zhang J, Jiang Y, Zhang H, Wang X, Rajendran KV, **Khoo L**, Kucuktas H, Peatman E, Liu Z. (2012). Efficient assembly and annotation of the transcriptome of catfish by RNA-Seq analysis of a doubled haploid homozygote. BMC Genomics 13:595.

Book Chapters

Pote, LMW, **Khoo L**, **Griffin M**.(2012) *Henneguya ictaluri*., In: Woo PTK and Buchmann K (editors). Fish Parasites: Pathobiology and Protection. CABI, Oxfordshire, UK. pp. 177-192

Presentations/abstracts/posters:

Gaunt PS. Langston C, Wrzesinski C, Crouch L, **Gao D**, Adams P, Sun F, Endris R Correlation of florfenicol pharmacokinetics in channel catfish (*Ictalurus punctatus*) and minimal inhibitory concentration values for *Edwardsiella tarda* and *Aeromonas hydrophila* to assess potential efficacy in vivo. Aquaculture America, Las Vegas Nevada Feb 28-Mar 2, 2012.

Gaunt PS. Langston C, Wrzesinski C, Crouch L, **Gao D**, Adams P, Sun F, Endris R Correlation of florfenicol pharmacokinetics in channel catfish (*Ictalurus punctatus*) and minimal inhibitory concentration values for *Edwardsiella tarda* and *Aeromonas hydrophila* to assess potential efficacy in vivo. The Catfish Farmers of America 2012 Catfish Research Symposium: Agenda and Book of Abstracts. February 17,2012. Savannah, GA. p.38 . (Poster)

Chatla K, **Gaunt PS**, Hanson L. Botulinium neurotoxin-e heavy chain expressing recombinant channel catfish virus as a potential vaccines for visceral toxicosis of catfish (2012). 49th Interagency Botulism Research Coordinating Committee, Waterfront Marriott, Baltimore, MD.

Chatla K, **Gaunt PS**, Hanson L. Channel catfish virus recombinants that express botulinium neurotoxin-e heavy chain are potential vaccines for visceral toxicosis of catfish (2012). 53rd American Fisheries Society and AFS Fish Health Section Meeting, Radisson Hotel, La Crosse, WI. Jul 31- Aug 3.

Chatla K, **Gaunt PS**, Hanson L. Botulinium neurotoxin-e heavy chain expressing recombinant channel catfish virus as a potential vaccines for visceral toxicosis of catfish (2012). 2012 Annual meeting of the South Central Branch of the American Society for Microbiology. Starkville, MS. October 26 – 27, 2012 Poster #34, p. 40

Gaunt PS, Hanson L, Chatla K, Pechan T, Donaldson J, Griffin M, Greenway T, Epperson W, Beecham R. Visceral Toxicosis of Catfish: Control by optimized botulinum and clostridial detection, risk factor analysis, and pathophysiologic assessment. USDA NIFA Animal Health and Welfare Project Director Meeting, Chicago, IL Dec 1, 2012. (Poster)

Griffin M, Goodwin A, Merry G, Liles MR, Williams M, Waldbieser G. (2012) A rapid genetic test for identification and quantification of an *Aeromonas hydrophila* strain associated with disease outbreaks in Alabama, Arkansas and Mississippi. Proceedings of 53rd American Fisheries Society and AFS Fish Health Section Meeting, Radisson Hotel, La Crosse, WI Jul 31-Aug 3.

Griffin MJ, Quiniou SM, Cipriano R, Cody T, Tabuchi M, **Ware C**, Mauel MJ, Soto E. (2012) Are all *Edwardsiella tarda* the same? Proceedings of 53rd American Fisheries Society and AFS Fish Health Section Meeting, Radisson Hotel, La Crosse, WI Jul 31-Aug 3.

Jones S., Goodwin AE, Merry G, Liles MR, **Griffin MJ**. (2012) Epidemiology of a new motile aeromonad disease in cultured catfish. Proceedings of 53rd American Fisheries Society and AFS Fish Health Section Meeting, Radisson Hotel, La Crosse, WI Jul 31-Aug 3.

Hossain MJ, Hemstreet W, Waldbieser GC, **Griffin MJ**, **Khoo L**, Goodwin AE, Capps N, Sonstegard T, Schroeder S, Hayden K, Terhune JS, Liles MR. (2012). Identification of genomic islands and unique functions in *Aeromonas hydrophila* strains associated with an epidemic in channel catfish. In Proceedings of the General Meeting of the American Society of Microbiologists. San Francisco, CA. Sep 9-12. (Poster)

Steckler NK., Poudel DB, Erlacher-Reid CS, Hawke JP, **Griffin MJ**, Yanong RPE. (2012) Uh-oh, something's wrong with my danio. In Proceedings of the 37th annual Eastern Fish Health Workshop. Lake Placid, NY. 23-27 April 2012 p. 4

Soto E., **Griffin M**, Krecek T, Jovonovich JA, Overstreet R. (2012) Excuse me amigo, what is this on my fish? In Proceedings of the 37th annual Eastern Fish Health Workshop. Lake Placid, NY. April 2012 p.4

Soto E., **Griffin M**, Arauz M, Riofrio A, Martinez A, Cabrejos ME (2012). Watch out, not only in catfish. In Proceedings of the 37th annual Eastern Fish Health Workshop. Lake Placid, NY. April 2012 p.9

Griffin M, Wise D, Mischke C, Greenway T, Walker J, Byars T. (2012) Using smallmouth buffalo to reduce incidence and prevalence of proliferative gill disease in

catfish aquaculture: An update. In Proceedings of the 37th annual Eastern Fish Health Workshop. Lake Placid, NY. April 2012 p.96

Griffin M., Quiniou S, Wise D, **Khoo L**, Greenway T, Byars T, Walker J, Rosser G, M. O’Hear M, Pote L, Darnall C, Frattini. S (2012) Application of molecular biology in elucidation of parasite life cycles and control of parasitic infections in catfish aquaculture. In Proceedings of the 37th annual Eastern Fish Health Workshop. Lake Placid, NY. April 2012 p.82 . Invited.

Rosser TG, **Griffin MJ**, Quiniou S, Greenway TE, **Khoo LH**, Wise DJ, Pote LM. (2012) A survey of myxozoan actinospores isolated from *Dero digitata* collected from commercial channel catfish ponds in the Mississippi Delta. In Proceedings of the Southern Society of Parasitologists. Pineville, KY. Mar 21-23 2012. Abstract #22

Jones S, Goodwin A, Liles M, **Griffin M.** (2012) Tracking the persistence of a new strain of *Aeromonas hydrophila* in catfish tissues with specific quantitative polymerase chain reaction. In Proceedings of the Annual Meeting of the Arkansas Chapter of the American Fisheries Society. Conway, AR. February 2012.

Griffin M., Goodwin A, Merry G, Liles MR, Williams M, Waldbieser G. (2012) A newly developed genetic test provides more rapid identification and quantification of an *Aeromonas hydrophila* strain associated with disease outbreaks in Alabama, Arkansas and Mississippi. In The Catfish Farmers of America 2012 Catfish Research Symposium: Agenda and Book of Abstracts. February 17,2012. Savannah, GA. p.32 Invited.

Wise D, Greenway T, **Griffin M**, **Khoo L**, Byars T, Walker J. (2012) In-pond vaccination of channel catfish using an orally delivered experimental ESC vaccine. Catfish Farmers of America 2012 Catfish Research Symposium: Agenda and Book of Abstracts. February 17, 2012. Savannah, GA. p.29

Griffin M, Wise D, Quiniou S, O’Hear M, Pote L, Greenway, **Khoo L**. Another trematode that can infect channel catfish: One more reason to keep snails off of your ponds. Catfish Farmers of America 2012 Catfish Research Symposium: Agenda and Book of Abstracts. February 17,2012. Savannah, GA. p.32. (Poster)

Griffin M, Wise D, Mischke C, Greenway T, Walker J, Byars T. (2012) Smallmouth buffalo to control “Hamburger gill” in catfish ponds. Catfish Farmers of America 2012 Catfish Research Symposium: Agenda and Book of Abstracts. February 17,2012. Savannah, GA. p.37. (Poster)

Rosser TG, **Griffin MJ**, Quiniou S, **Khoo L**, Pote LM. (2012) Morphometric and molecular characterization of myxospores isolated from channel catfish (*Ictalurus punctatus*) gills and actinospores found in catfish ponds for the elucidation of myxozoan life cycles. 2012 Annual meeting of the South Central Branch of the American Society for Microbiology. Starkville, MS. October 26-27, 2012 Abstract #9, p 19.

Gibbs GD, Mauel MJ, **Griffin MJ**, Lawrence ML. (2012) A real-time polymerase chain reaction for detection of *Flavobacterium columnare*. 2012 Annual meeting of the South Central Branch of the American Society for Microbiology. Starkville, MS. October 26 – 27, 2012 Poster #3, p. 28

Khoo L, Wise DJ, Manning BB, Greenway TE, **Griffin MJ**, **McIntyre LM**, Walker JR, Byars TS, **Steadman JM**, **Polk R**. (2012) Anemia in channel catfish re-examined. Abstract #262 Aquaculture America 2012, Las Vegas, NV, Feb 28- Mar 2, 2012.

Wise D, Manning B, Greenway T, Byars T, **McIntyre L**, **Polk R**, **Khoo L**. Channel catfish anemia. Catfish Farmers of America 2012 Catfish Research Symposium: Agenda and Book of Abstracts, Savannah GA, February 17, 2012, p. 30.

Austin F, **Gaunt P**, Riecke D, Jacobs A, Meals K, Dunn A, **Khoo L**. (2012) What skilled the silver carp on the Mississippi River? Proceedings of the 37th Eastern Fish Health Workshop, Lake Placid, NY, April 23-27, 2012, p. 5

Mississippi State University - College of Veterinary Medicine
Aquatic Research & Diagnostic Laboratory - Stoneville, MS
2012 Annual Case Summary
Disease Diagnoses as a Percentage of Total Case Submissions (Diagnostic & Research)

Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Abscess, muscle							1	1					2
<i>Aeromonas hydrophila</i> .								1					1
Anchor Worm Infestation									1				1
Anemia				4		2					1		7
Anemia, saprolegnia		1			6								7
Bolbophorus					1	5	2	1					9
Bolbophorus, Columnaris, ESC, <i>Aeromonas Sobria</i>					1								1
CCV (Channel Catfish Virus)						2	3						5
CCV, Columnaris							2						2
Columnaris		1	6	3	1	7	3	15	8	2		1	47
Columnaris, Anemia								5					5
Columnaris, Bolbophorus						2	1						3
Columnaris, <i>Edwardsiella tarda</i>										1			1
Columnaris, PGD				4		1			1	1			7
Columnaris, PGD, <i>E. tarda</i>				1									1
Columnaris, Saprolegnia		1											1
<i>Edwardsiella tarda</i>				1		4	1						6
<i>E. tarda</i> , PGD				1	2	1							4
<i>E. tarda</i> , PGD, external Columnaris				1									1
Epistylus					2								2
ESC (Enteric Septicemia of Catfish)			2	1	3	9	13	16	7	1		1	53
ESC, Columnaris				1	5	17	22	18	4	1			68
ESC, PGD				2	7	1	1		2				13
ESC, PGD, external Columnaris			1		1								2
External Columnaris	1	1	1		1								4
External Columnaris, Fungus												1	1
External Columnaris, Fungal myositis				1									1
Ext Columnaris, Visceral toxicosis of Catfish (VTC) Suspect			1										1
ESC, Anemia				1				2					3

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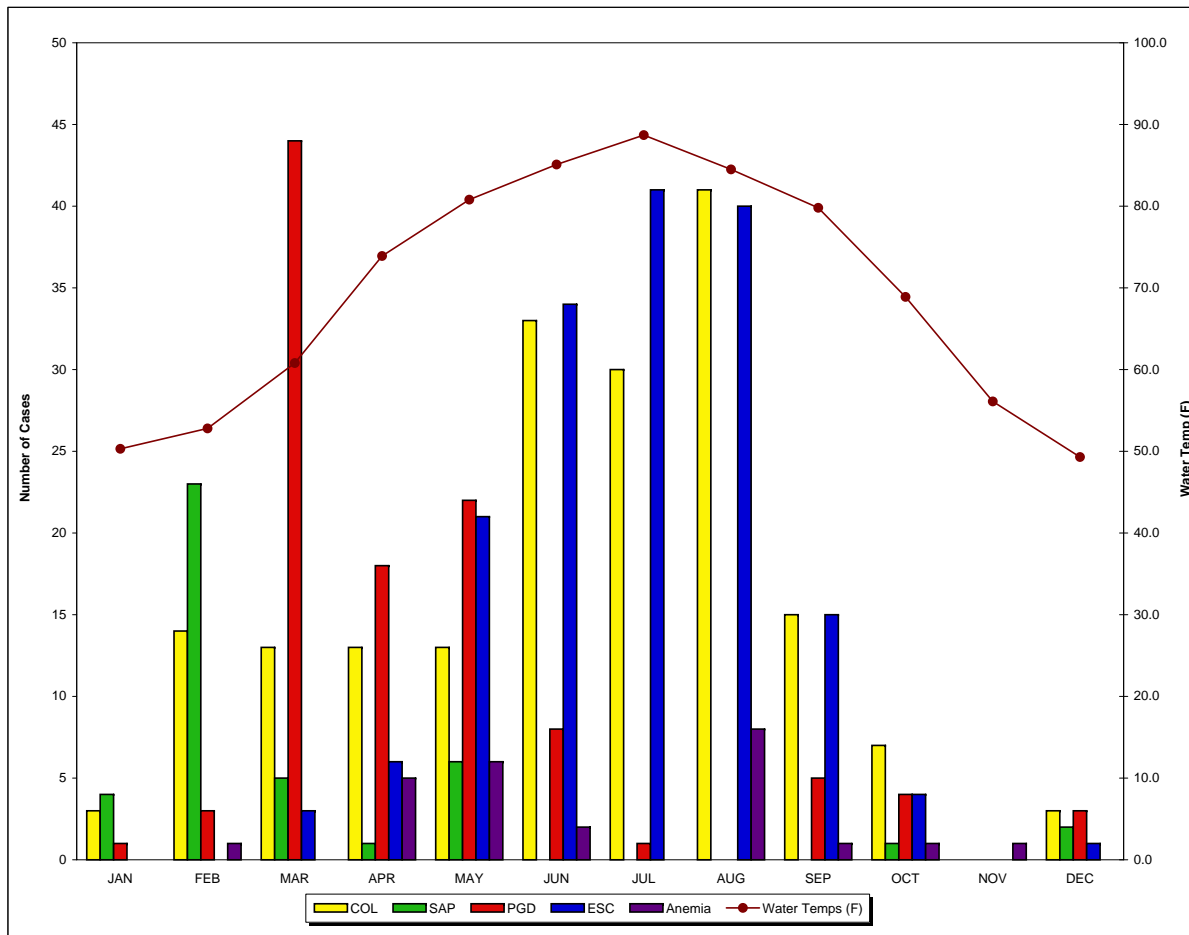
Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
ESC, Bolbophorus						1	3	1					5
ESC, Columnaris, Anemia								1	1				2
ESC, Columnaris, Bolbophorus					1	2	2						5
ESC, Columnaris, Bolbophorus, PGD					1								1
ESC, Columnaris, Methemoglobinemia									1				1
ESC, Columnaris, PGD				1	2	1				1			5
ESC, Columnaris, Saprolegnia				1									1
ESC, External Columnaris						3		2		1			6
Fungal Myositis				1									1
Gas Bubble Disease					1		1						2
Histology								4		1			5
<i>Klebsiella pneumoniae spp</i>		1											1
Methemaglobinemia												1	1
Methemaglobinemia, Anemia										1			1
Methemaglobinemia, external Columnaris		1											1
Myositis, bacterial							1						1
Nematoditis	1												1
Nephritis, bacterial						1							1
No Evidence of Infectious Disease	2	17	22	5	26	5	20	15	14	1		11	138
Oxygen Depletion							3						3
PGD (Proliferative Gill Disease)			42	8	9	2			2	1		2	66
PGD, <i>Aeromonas veronii</i>					1								1
PGD, Bolbophorus						2							2
PGD, Saprolegnia, ext. Columnaris, Methemaglobinemia		1											1
PGD, Urinary Bladder Dist. & Cystitis, Co-join twin										1			1
PGD, VTC suspect	1	1											2
Renal, splenic & GI tract necrosis		1											1
Red fillet									1				1

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Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Research			20	15	16	3	9	10		1			74	
Salmonella spp	1												1	
Saprolegnia	2	7								1		1	11	
Saprolegnia, external Columnaris	2	7	3										12	
Saprolegnia, PGD, external Columnaris		1	1									1	3	
Saprolegnia, VTC suspect		2	1										3	
Saprolegnia, VTC suspect, external Columnaris		2											2	
Sertoli cell tumor, Seminoma					1								1	
Toxin				1			1						2	
VHS testing	10	21	4							10	42	20	107	
<i>Vibrio cholerae</i>							1						1	
VTC (Visceral Toxicosis of Catfish) confirmed		5	4										9	
VTC, Saprolegnia		1											1	
VTC, suspect	6	17	6										29	
Cases submitted by Farmers														
	24	88	91	34	65	65	65	65	39	20	43	36	635	
Cases submitted for Research														
	2	1	23	19	23	6	25	27	3	5	0	3	137	
Channel catfish cases														
	16	81	101	38	47	53	68	65	21	9	38	33	570	
Blue catfish cases														
			1		3				1				5	
Hybrid catfish cases														
	8	6	5	13	37	18	18	22	18	16	1	5	167	
Other Species														
	2	2	7	2	1		4	5	2	0	4	1	30	
TOTALS													772	
Water Farms														
	3	10	14	21	19	10	8	7	11	6	2	8	119	
Quality Ponds														
	23	125	142	161	203	92	91	148	165	102	13	67	1332	

**Mississippi State University - College of Veterinary Medicine
 Aquatic Research & Diagnostic Laboratory - Stoneville, MS
 2012 Annual Case Summary
 Seasonal Occurrence of Major Farm Diseases**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
COL	3	14	13	13	13	33	30	41	15	7	0	3	185
SAP	4	23	5	1	6	0	0	0	0	1	0	2	42
PGD	1	3	44	18	22	8	1	0	5	4	0	3	109
ESC	0	0	3	6	21	34	41	40	15	4	0	1	165
Anemia	0	1	0	5	6	2	0	8	1	1	1	0	25
Water Temps (F)	50.3	52.8	60.8	73.9	80.8	85.1	88.7	84.5	79.8	68.9	56.1	49.3	



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2012 Annual Case Summary**

Major Disease Diagnoses as a Percentage of Diagnostic Case Submissions^(*1)

Disease	Total # Disease Cases	% Total Disease Cases
Columnaris	185	24.0%
ESC	165	21.4%
PGD	109	14.1%
Saprolegnia	42	5.4%
CCV	7	0.9%
Anemia	25	3.2%
Brown Blood	5	0.6%
Ich	0	0.0%
VTC	47	6.1%
Health Check ^(*2)	0	0.0%
Bolbophorus	18	2.3%

(*1) A case may be represented by more than one disease.

(*2) Cases from healthy ponds for monitoring/pre-purchase exams.

**Mississippi State University - College of Veterinary Medicine
 Aquatic Research & Diagnostic Laboratory - Stoneville, MS
 2012 Annual Case Summary
 Incidence of Antibiotic Resistance**

Organism	# Tested	Romet (%)	Terramycin (%)	Aquaflor® (%)	Romet & Terramycin (%)	Romet & Aquaflor® (%)	Terramycin & Aquaflor® (%)
<i>Flavobacterium columnare</i>	185	0	0	0	0	0	0
<i>Edwardsiella ictaluri</i>	165	0	0	0	0	0	0
<i>Edwardsiella tarda</i>	7	0	0	0	0	0	0
<i>Aeromonas spp.*</i>	3	0	0	0	0	0	0
<i>Vibrio cholerae</i>	1	0	0	0	0	0	0
<i>Salmonella spp.</i>	1	0	0	0	0	0	0
<i>Klebsiella pneumoniae spp.</i>	1	0	0	0	0	0	0

* includes *A. hydrophila*, *A. sobria*, *A. veronii*

**Mississippi State University - College of Veterinary Medicine
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 2012 Annual Case Summary
 Yearly Trends in Disease Diagnosis as a Percentage of Submissions**

Disease	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Columnaris	44.7	40.9	48.3	68.4	37.5	36.7	24.6	26.8	19.6	24.0	37.2%
ESC	34.7	30.8	33.8	56.5	32.8	18.6	15	18.1	22.9	21.4	28.5%
PGD	10.8	10.7	8.9	17.8	18.4	33.7	21.4	15.9	14.3	14.1	16.6%
Saprolegnia	5.3	3.7	4.1	8.4	8	9.2	9.4	4.5	4	5.4	6.2%
CCV	8.9	10.8	9.2	5.9	2	0	7.2	4.7	3.4	0.9	5.3%
Anemia	5.2	2.1	4.6	4.9	10.7	2.7	2.8	5	5.8	3.2	4.7%
Ich	0.5	5	1.3	0.8	0.6	0.8	3.1	0.5	0	0	1.3%
Bolbophorus	1.1	2.6	3.6	0.7	1.5	0.3	1.8	1.8	1.1	2.3	1.7%
VTC	3.7	3.2	1.0	3.1	1.3	5.4	3.4	1.9	1.5	6.1	3.1%
No Pathogens	18.3	20.8	12.4	20.3	17.1	17.5	16.1	15.1	10.4	17.9	16.6%
Number of Cases	832	778	602	845	1144	630	678	623	852	772	775.6