Northeast Black Bass Technical Committee Report

July 12, 2006

Submitted to the Northeast Fisheries Administrators Association

Acknowledgments

The Northeast Black Bass Technical Committee (Committee) appreciates the support of the Northeast Fisheries Administrators Association and the Northeast Association of Fish and Wildlife Agencies in addressing issues of regional importance to state and federal fishery management biologists. The Committee benefited from having a strong commitment by members who worked in cooperation to address the assigned charges, providing an opportunity to gather and disseminate the best information available for improved management of our fishery resources. Lastly, the Committee recognizes the Northeastern Division of the American Fisheries Society, who generously donated $3,000 to cover all travel and attendance costs for three invited expert speakers for the Special Black Bass Session at the Northeast Fish and Wildlife Conference.

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Executive Summary

The Northeast Black Bass Technical Committee (Committee) was formed under the supervision of the Northeast Fisheries Administrators Association after approval by the Northeast Association of Fish and Wildlife Agencies in the summer of 2005. The Committee was given three charges to address:

1) Examine the biological and management justification and implications of seasonal black bass fishing closures/regulations in the Northeast;
2) Examine the current status, distribution, and occurrence of largemouth bass virus (LMBV) in the Northeast, synthesize available information, evaluate the risk of spread, coordinate fish health testing and planning, and provide recommendations on measures to address identified issues; and
3) Report on findings via papers presented at a session at the 2006 Northeast Fish and Wildlife Conference (NEFWC).

The Committee membership includes a diverse array of fisheries professionals from State, Federal, and University programs that have expertise in population dynamics and fish health of black bass in the Northeast.

Charge 1 – Biological and Management Justification and Implications of Seasonal Black Bass Fishing Closures/Regulations in the Northeast

- The use of a "closed" spring season appears to be an overly conservative measure at a statewide scale, but may be appropriate for individual water bodies.
- Spring catch-and-release regulations afford a level of protection to sustain black bass populations and their fisheries in the Northeast. This regulation type is in place in 6 of 13 States in the Northeast (includes New York's 2006 change).
- For black bass populations that are not juvenile recruitment limited, spring seasonal restrictions may not be appropriate.
- Published literature has demonstrated angling impacts to nesting success and survival or production of juvenile bass in impacted nests for northern smallmouth bass populations. However, results concerning population level effects, and potential impacts to future adult abundance have been inconclusive.
- Published studies from other regions in the range of black bass have varied applicability to the Northeast due to the type of systems, their size, latitude, and other factors.
- Many studies demonstrate, across a range of systems and latitudes, that large-scale environmental factors may have an over-riding influence on year-class production of black bass.
- State fishery biologists indicate that there are varied levels of concern regarding the effects of spring-time bass angling in the Northeast.
- Since 1990, four states in the Northeast have implemented more restrictive spring regulations and three states have implemented less

restrictive regulations. Changes in either case have been cautious in nature (i.e., reduced bag with high minimum size to catch and release or closed season to catch and release).

- The primary reasons given in 6 of the 13 Northeast States for not having any special spring season regulations were that black bass populations and fisheries are not recruitment limited and have sustained good catch rates.
- Several States utilize special spring gear restrictions such as no live bait to improve survival rates of released fish, reduced bag limits and higher minimum sizes, afford additional spring-time protection.
- Anglers support of spring catch-and-release regulations may vary based upon regional perceptions and management history.
- Regulation development and implementation have been influenced in some cases to a very high degree by anglers or policy boards, resulting in either more restrictive or liberal measures than State biologists had originally proposed.

Based upon a review of the published literature, technical reports, input from States fisheries managers and discussion among research fishery biologists and professional fisheries staff, the following Guidelines were developed by the Committee. These Guidelines were developed to assist State agencies in the process of considering a spring-time black bass regulatory change in the Northeast.

Recommended Guidelines:

The use of seasonal regulations should be considered along a continuum from the most restrictive (complete closure) to a more moderate approach (catch-and-release) to a less restrictive (size and creel limits) and finally to the least restrictive (no special regulations). To determine the most effective regulation, fishery managers and policy makers must consider both the abiotic and biotic factors influencing bass populations, as well as the real or potential level of angler support and/or compliance. Factors that may be considered include short-term weather and long-term climate, the stability of water levels and temperature, the primary black bass species present, the quality of fish and black bass habitat, and seasonal and annual angling pressure. Fishery managers should be confident that the limitation on the development of the fishery is truly recruitment based and not principally driven by other abiotic, biotic, or human factors prior to the consideration of highly restrictive spring angling regulations.

The following guidelines provide a framework for consideration and implementation of seasonal regulations:

1) An understanding of the type and condition of abiotic and biotic factors known to influence black bass population dynamics and how those factors relate to the population(s) is imperative for good management. Season length, type, bag and length limits may be used alone or in combination to achieve desired population objectives. A regulation

proposal should provide an analysis of available data (creel surveys, fishery independent assessments, environmental conditions) relative to the available published literature. Monitoring activities should be encouraged and designed to determine the factors most likely to be attributed to influencing the population's dynamics.

2) Populations experiencing a known reduction in adult black bass biomass or contraction in age structure, coinciding with a known reduction in juvenile production, may be considered for more restrictive regulations. The uses of special regulations (e.g. catch and release) in these instances should consider critical life history time frames and be based on known temperature data.

3) Population assessment data should be collected and analyzed prior to and after regulatory changes to examine if a management effect can be detected and the merit of the rule change can be scientifically evaluated.

4) Proposed regulation changes should involve the angling public and angling organizations at early stages in the process. The interpretation of data and current research should be shared openly and used to frame discussion on expectations, which can then be used to develop alternatives for consideration.

Charge 2 - Examine the current status, distribution, and occurrence of largemouth bass virus in the Northeast, synthesize available information, evaluate the risk of spread, coordinate fish health testing and planning, and provide recommendations on measures to address identified issues.

- A comprehensive review of the published LMBV literature was synthesized, covering; history, distribution, disease effects, transmission, testing, population effects, and research findings.
- LMBV was first detected in 1991 in Florida.
- The virus is only known to be lethal to largemouth bass.
- Documented fish kills attributed to the disease caused by the virus have occurred throughout the southeast and as far north as Michigan.
- LMBV has appeared to spread westward and northward from its origin in the South.
- The virus has been detected in seven of ten Northeast States where testing has occurred. Three States and the District of Columbia have not tested for LMBV.
- Large-scale fish kills of smallmouth bass in the Susquehanna and Potomac River watersheds have included the detection of LMBV. The role of LMBV in the fish kills is unclear.
- Recent research in Alabama has shown that largemouth bass populations not known to have experienced a fish kill, but where the virus was known to exist, experienced significant declines in the

abundance of largemouth bass and a significant increase in the time required to catch a large bass.

- The same research noted sub-lethal effects on largemouth bass that include reduced condition factors and growth rates.
- Additional research has demonstrated that tournament caught fish in infected waters, and held for observation, experienced greatly elevated delayed mortality on the order of >75%.
- The virus may be transmitted through the water, by consuming infected prey, and direct or indirect contact in livewell tanks
- The virus remains detectable in water for up to 7 days.
- The prevalence of the virus among uninfected fish mixed with positive fish was shown to increase significantly and rapidly following containment in livewells.
- Other species that are known to carry the virus include smallmouth bass, chain pickerel, bluegill, redbreast sunfish, and black crappie. The ability of other species to carry the virus, such as baitfish, is not known.
- All Northeast States should develop testing plans for LMBV.
- Sampling to detect the virus requires sacrificing fish.
- Sampling should be conducted in the summer and early fall when the virus/disease is known to be most active.
- The USFWS Lamar Fish Health Unit can conduct tests on shipped samples or assist in field collection, at no charge to State agencies.
- The preferred minimum sample size is 60 fish, but as few as 20 may be processed for a population.
- The long-term implications of LMBV in the Northeast are unclear for largemouth and smallmouth bass populations.
- There are many unknowns regarding the behavior of this virus in northern black bass populations and how it will behave relative to southeastern US experiences.
- The consumption of LMBV infected fish is not known to be harmful to humans. However, any visibly diseased fishes are not recommended for human consumption.

Based upon a review of the published literature, technical reports, input from States and Federal fish health biologists, university researchers, and Committee discussions, Guidelines were developed by the Committee on the topic of LMBV in the Northeast. These Guidelines were developed to assist State and Federal agencies in outlining appropriate steps for dealing with LMBV to restrict spread, reduce effects in tournaments, provide guidance on testing, and describe additional research needs.

Recommended Guidelines:

1) Restrict Spread

a) Do not transfer fish carrying LMBV, even to other water bodies where the fish are known to have LMBV.

b) If a transfer is determined necessary, then all importations of fish into, or liberations and transfers within a State, whether from facility to facility, facility to a water body, or between water bodies; the source fish culture facility or water body should possess a fish health inspection report issued by a fish health biologist indicating that three annual inspections of the fish lot(s) on the facility or water body have been free of LMBV.

c) Boats, trailers, and all equipment in contact with water should be thoroughly cleaned between water bodies. A disinfecting bleach solution of one ounce of standard household liquid bleach per gallon of water should be sprayed inside the live well and other appropriate surfaces. The solution should be allowed to stand for 15 minutes before thoroughly rinsing the areas off. Both of the aforementioned protocols should be performed at home prior to the equipment (boat, trailer, tanks) entering any other water body. CAUTION: Chlorine is extremely toxic to aquatic life, hence thorough rinsing is mandatory.

d) State and Federal agency boats, trailers, sampling gear, tanks or any equipment that comes in contact with water should be thoroughly cleaned between water bodies. These precautions should also be practiced by agency subcontractors such as Universities and other research entities. The previously mentioned disinfection procedure or other equally effective measures should be developed as standard operating procedures.

e) Develop appropriate literature or other media to educate the angling and boating public on LMBV. Outreach or education may be more specifically targeted or highlighted in waters known to have the virus present.

2) Measures to Reduce LMBV Stress in Tournament Caught Fish

a) Encourage all anglers to institute measures to reduce stress during livewell containment in warm water or weather conditions, or other stressful periods.

b) Consider tournament management measures that would reduce holding times, bag limits, or promote paper tournaments during stressful periods. The use of temperature or stress-related triggers should be considered for the enactment of these measures.

3) LMBV Testing Information

a) Results from State, federal, academic, or private fish health testing laboratories should be organized and updated in a centralized database. The USFWS Wild Fish Health Survey may serve this purpose under its “historic data” field, but other options should also be explored. In the absence of a national or regional database other identified organizations should be appraised of developments in the

Northeast (e.g., AFS Southern Division – appropriate committees, B.A.S.S., USFWS Warm Springs Laboratory) at regular intervals.

b) Continued support for the USFWS Wild Fish Health Survey is essential for a consistent standardized sampling approach for LMBV and other disease testing for agencies that would not otherwise have the capability to conduct fish health assessment testing.

c) All States should develop a testing plan for LMBV. The USFWS Lamar Fish Health Unit should be contacted for details on initiating a testing program.
   i. Timing of sampling is important and is recommended to occur during the warmest months to improve the likelihood of virus detection.
   ii. Optimal sample sizes are a function of total population size, prevalence of the virus, and testing method. In general, a sample size of 60 fish is recommended, consisting of largemouth bass greater than 300mm. The smallest sample size recommended by this Committee's Fish Pathologists is 20 fish. It is not clear what the trade-offs are of using known carriers of the virus (other centrarchid spp.) in the sample as opposed to strictly black bass. Refer to Appendix D for more detailed information.
   iii. Existing fish mercury sampling programs provide an opportunity to maximize use of sacrificed fish. Summer tournaments also provide an additional option for specimens at a time of known greatest prevalence for the virus.
   iv. Appropriate fish handling procedures must be adhered to when preparing samples for testing of LMBV. The Cornell University, College of Veterinary Medicine, under the direction of Dr. Paul Bowser have recommended protocols available at: http://www.vet.cornell.edu/public/fishdisease/resources/diagnostics/shipping.htm

4) Future Research Needs

a) Non lethal testing methods should be investigated.

b) Under what conditions, in populations detected as positive for LMBV, will the disease express itself in the Northeast, and what population level responses may result?

c) Are there relationships between LMBV prevalence and factors such as immunity suppression and secondary pathogens, and how might these vary under different environmental conditions or life history stages?

d) Are there long-term risks to Northeast largemouth bass and potentially smallmouth bass populations from exposure to LMBV?

e) How consistent are the strains of LMBV present in the Northeast, and if differences exist how are they expressed?

Charge 3 – Report on Findings via Papers Presented at the 2006 NEFWC, Burlington, VT

Nine oral presentations were given at the NEFWC on the topics of spring seasonal black bass fishing regulations and factors related to spawning success and largemouth bass virus. Three nationally recognized experts on these topics were invited from outside the Northeast region to present and five Committee members covered many of the key aspects of these topic areas. The Special Black Bass Session helped to frame much of the discussion by the Committee at their subsequent meeting at the conference, which focused on refining this report and finalizing recommended guidelines by consensus.

1.0 Introduction

The Northeast Black Bass Technical Committee (Committee) was formed under the direction of the Northeast Fisheries Administrators Association (NEFAA) after approval by the Northeast Association of Fish and Wildlife Agencies (NEAFWA) in the spring of 2005. NEAFWA is comprised of State fish and game agencies that are responsible for the management of these natural resources within the Northeastern United States (Northeast). Associated member agencies include the U. S. Fish and Wildlife Service (USFWS).

The Committee was given three charges to address:

1) Examine the biological and management justification and implications of seasonal black bass fishing closures/regulations in the Northeast;
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Northeast warmwater fisheries biologists, USFWS and State fish health biologists, as well as university researchers serve on the Committee (Appendix A). A fisheries biologist from the USFWS Sport Fish Restoration Program was designated as Chair. The Committee addressed these charges through conference calls, emails, and phone calls leading up to the Special Black Bass Session at the 2006 NEFWC in Burlington, Vermont. This report represents the committee's efforts to address the assigned charges and hopefully will serve as one source of information in the management of the black bass fishery resources in the Northeast.

2.0 Fishery Regulations

2.1 Introduction

Fishery biologists employ a suite of tools in an attempt to influence fish population structure, and subsequently to maintain these populations consistent with specific management goals or a set of objectives. These tools include fish introductions, supplemental stockings, habitat enhancements, and angling regulations. To the angling public, restrictive regulations are usually the most obvious and often have a direct impact on their angling experiences. Consequently, this management tool is often the most controversial and usually requires a merging of science, management, and policy making.

Restrictive angling regulations were first imposed in 1653 in an attempt to restrict the harvest of certain species (Redmond 1986). Since these early attempts to manage fishery resources, State and federal agencies have imposed a multiplicity of regulations in an attempt to restructure fishable populations. Popular regulations include strategies to restrict harvest of certain size cohorts (minimum size or slot limits), limit all harvest (bag or creel limits, quotas), or restrict total harvest (catch-and-release and closure). Another strategy, or opportunity, is to restrict angling techniques during a certain season or period of time. These seasonal-based regulations are usually imposed during a time period when individuals or cohorts (sex, size) are most vulnerable because of behavior or life stage conditions. Angling can be either completely restricted (closure) or allowed under more controlled conditions (e.g., catch-and-release, catch-picture-and release).

2.2 Black Bass Biology, Fishery Management, and Angling Regulations

Black bass, although originally native to the Mississippi, Gulf, and South Atlantic drainages, have been introduced throughout most U.S. States and Canadian provinces. These introductions and subsequent establishment of black bass populations have resulted in increasingly popular fisheries throughout their native and extended ranges. In the Northeast, the primary recreationally important species of black bass are the largemouth bass (*Micropterus salmoides*) and smallmouth bass (*M. dolomieu*) and to a lesser degree spotted bass (*M. punctulatus*).

Although biology does differ among black bass species, reproductive strategies are similar. Males build nests as water temperature and photoperiod increases during the late winter and spring, and attempt to persuade females to spawn. Smallmouth bass initiate spawning when water temperatures approach 15^{o}C and for largemouth bass when water temperatures approach 16^{o}C (Jenkins and Burkhead 1994). Spawning may last as little as six days, (Shuter et al. 1980) or as long as 60 days (Graham and Orth 1986). Hatching duration for largemouth bass in the Tennessee River was reported to be from 6 April to 13 June and initiated when surface water temperatures reached 15^{o}C (Loftis 1996). Studies in New York reported hatching duration of 26 days (Schmidt and Fabrizo 1980), Illinois 36-61 days (Kohler et al. 1993), and North Carolina 67 days (Phillips et al. 1995). Once eggs have been fertilized, males actively guard nests through hatching and continue to guard fry and early juveniles until they disperse from the nest locations. Male smallmouth bass have been reported to guard a nest for up to 6-weeks (Ridgway 1988). Similar durations have been reported for the guarding period of largemouth bass (Scott and Crossman 1973).

Predation of eggs and fry in black bass nests is well-documented (see Steinhart et al. 2004 *for a review*), and high levels of predation have been linked to nest failures for smallmouth bass (Lukas and Orth 1995) and largemouth bass (Swenson 2002). Steinhart et al. (2004), based on observation of round goby predation of both smallmouth bass eggs and fry left unguarded, reported that an entire nest would be consumed within 15-minutes. Others have reported shorter periods of time before all eggs and/or fry were consumed.

Black bass management has followed the process often employed for most recreationally important species. Introductions, supplemental stockings, habitat enhancements, and angling restrictions all have been used to maintain and/or restructure populations in an attempt to enhance angling opportunities. Initially, restrictive regulations were imposed by many State fishery management agencies to protect under-size cohorts, or to restrict the overall harvest. With the increasing acceptance of catch-and-release ethics by black bass anglers, harvest-restrictive regulations have become less valuable as a management tool.

A second strategy by fishery management agencies has been to protect black bass during extremely vulnerable periods by the use of closed seasons, or other restrictive spring or spawning period regulations. The intent of this approach is to protect nest-guarding males during the spawning season. Seasonal black bass fishery regulatory strategies have been described most recently in a comprehensive review by Quinn (2002). A general trend of increasingly restrictive seasonal angling regulations and closures does exist along a grade from southern to northern latitudes in North America. Many factors have influenced this trend including species, biology, watershed characteristics, and regional angler attitudes (Quinn 2002).

A review of Northeast black bass regulations provides an overview of the variety of strategies to manage this valuable fishery (Table 1).

Table 1. Current spring black bass fishing regulations for the thirteen States in the Northeast and the District of Columbia.

State	Spring black bass angling regulations
CT	No special spring regulations
DC	Same regulations as MD tidal, designed to afford some guardian bass protection
DE	No special spring regulations
MA	No special spring regulations
MD	Non-tidal: Closed season (catch and immediate release permitted) for period March 1 through June 15; 12 inch minimum length, 5 fish/day rest of the year. Tidal waters: March 1 through June 15, 15 inch minimum length, 5 fish limit; June 16 through end of February, 12 inch minimum length, 5 fish limit; several "spawning sanctuaries" closed to all fishing March 1 through June 15, several 6 mph speed limit areas in known spawning areas to reduce disturbance
ME	General regulations: April 1 through June 20, 1 fish limit, 12 inch minimum length, artificials only. Many other special regulations including no harvest April 1 to June 20, reduced or special creels, seasonal and year-round catch and release, and higher minimum sizes for specified water bodies.
NH	Ice-in to May 14 and June 16 to June 30, 2 fish daily limit; May 15 to June 15, all fish must be immediately released, artificial lures and flies only.
NJ	Catch and release only, April 15 to June 15.
NY	Open season is third Saturday in June to November 30, 12 inch minimum length, 5 fish limit. Lake Erie, first Saturday in May to third Saturday in June, 15 inch minimum length, 1 fish limit. Effective Oct 1, 2006 change to catch and release fishery same dates, inclusive.
PA	Inland Waters: April 16 through June 17, no harvest, C&R only, no tournaments. Lakes: Jan 1 through April 15 and Nov 1 through Dec 31, 15 inch min, 4 fish limit, June 18 through Oct 31, 12 inch min, 6 fish limit. Rivers: Jan 1 through April 15 and Oct 1 through Dec 31, 15 inch minimum length, 4 fish limit, June 18 through Sept 30, 12 inch minimum length, 6 fish limit. Big Bass Special regs waters have the same catch and release regulations, open season portion of regs have higher minimum size limits (15 to 18 inches). Portions of the Delaware River and Pymatuning Reservoir open year round.
RI	No special spring regulations

VA	No special spring regulations, defer to MD DNR on Potomac River.
VT	Catch and release only, second Saturday in April to the Friday before the second Saturday in June, artificial lures and flies only.
WV	No special spring regulations

Since 1990 changes to Northeast spring black bass regulations have included:

- 1990, New Hampshire imposes catch and release season from general year-round open season
- 1990, Vermont opens catch and release season from closed season
- 1990, Maryland imposes non-tidal closed (catch and release permitted) season from year-round open season
- 1992, Maine imposes a 1 fish spring bag limit from 3 fish limit
- 1993, New Jersey changes spring regulations to catch and release from 1 fish limit, 19-inch minimum length,
- 1994, New York opens fishing season, 1 fish limit, 15-inch minimum length in Lake Erie from closed season
- 2000, Pennsylvania opens a catch and release season from closed season
- 2006, New York will enact a Statewide catch and release season from closed season effective October 1, 2006

2.3 Seasonal Black Bass Angling Regulations and Black Bass Biology

The intent of more restrictive spring or spawning period regulations is to provide some level of protection to nest-guarding male black bass. Male black bass provide the only active parental care for eggs, larvae, and early fry. Removal of the guarding male can result in nest failure. Many investigators have suggested that if the number of surviving fry is a contributing factor to adult population size, managers should consider angling regulations that promote nesting success (Steinhart at al. 2004). Ridgway and Shuter (1997) reported that based on individual modeling methods, the abundance of age-0 smallmouth bass decreased dramatically as the probability of removal of guarding males by anglers increased. Removal during early stages of nest guarding was more deleterious then during later stages. Consequently, these investigators argue that even short-term removal may lead to significant loss of eggs and fry, but certainly long-term and more permanent removal will lead to nest failure.

The removal, or repeated capture and release of guardian males from an Ontario smallmouth bass population resulted in nest abandonment and nest predation, with these rates increasing in relation to the degree and frequency of the disturbance (Philipp et al. 1997; Ridgway and Shuter 1997; Suski et al 2002). Additional research has shown that with increased brood size, guardian males become more aggressive leading to higher angler catch rates (Suski and Philipp 2004). These researchers theorized that males with larger broods have a greater investment, and with increased nest loss of these more aggressive males, selection for smaller less aggressive males may occur. Success of a given nest also has been linked to the size of a defending male. Reynolds and O'Bara (1991) reported that larger parental smallmouth bass males resulted in increased nest success even during years with high river flows and near flood conditions were present. Time of spawning also was a factor in determining nest success (Reynolds and O'Bara 1991).

The linkage of abiotic factors with black bass population trends is well documented. A study of Lake Erie smallmouth bass, examining the effects of spring weather conditions, angling, and the invasive round goby (nest predation), determined that storms had the greatest effect on nest survival (Steinhart et al. 2005). Nest success also was related to angling, but not nest predation (treatments) with angling. Nest survival ranged from 30% for controls, 14% for angling with predation treatments, and 11% for angling without predation (Steinhart et al. 2005).

The question that remains for black bass fishery managers is, "*What is the relationship between spawner abundance and recruitment*?" Ridgway and Philipp (2002) posed this question during the 2000 Black Bass Symposium. A second and as important posed question was, "*Is recruitment overfishing occurring in recreational fisheries either by targeting of spawning/nesting adults or by a level of exploitation that reduces the spawning stock as part of an overall population reduction*?" While this question remains to be resolved, recent publications provide some insight into the many factors that may influence spawning success and survival through the first year of life, as well as recruitment to the recreational fishery.

Research published during the past 15 years has provided some insight into the abiotic factors that influence spawning success and recruitment of black bass. Parkos and Wahl (2002) provided a comprehensive literature review on recruitment mechanisms for largemouth bass and state "*embryo mortality may set year class strength in systems and years with widely fluctuating abiotic conditions, whereas juvenile mortality may be more important in stable environments*." However, the authors noted that, "*a relationship between stock size and recruitment may exist, but there is no evidence from larger systems."* Abiotic factors of importance included water temperatures, that determine when spawning begins, the stability of temperatures during nesting, and the duration and extent of relative warmth during the first summer (Einhouse et al. 2002; Cassleman et al. 2002; Paukert and Willis 2004). In addition to temperature, riverine populations of smallmouth bass have been shown to be adversely influenced by high flow conditions during the nesting season, as well as high winter discharge (Swenson et al. 2002). Abiotic factors have been shown to primarily influence survival of eggs and larvae, but can also affect growth of juveniles (Parkos and Wahl 2002).

The relationship of abiotic factors in reservoirs and largemouth bass population structure has been demonstrated. The effects of high spring flows in large southern reservoirs have been related to poor year-classes (Maceina and Bettoli 1998). Reductions in nutrient inputs, resulting in oligotrophication in a large

Georgia reservoir, were related to decreased largemouth bass population size (Maceina and Bayne 2001). The study also noted fewer, smaller, and less robust largemouth bass resulted from this shift in water quality. In a study of an Oklahoma reservoir, largemouth bass recruitment was shown to be positively related to retained/increased water levels during summer (Boxrucker et al. 2005). Sammons and Bettoli (2000) also demonstrated that year-class strength and recruitment of largemouth bass in a Tennessee reservoir was dependent on high water during spring and summer when fish were age-0. Jackson and Noble (2000a) found that largemouth bass year class size in a North Carolina reservoir was correlated with winter and early spring temperatures, with warm springs producing larger year classes.

Biotic factors also have been suggested in setting year class strength and ultimately recruitment. Size-dependent overwinter mortality and winter severity has influenced age-0 to age-1 survival in northern latitudes (Post et al.1998; Fullerton et al. 2000). However, a field study in seven Ohio impoundments found no relationship of age-0 fish size to subsequent spring abundance (Fuhr et al. 2002). The researchers concluded that the minimum size theory applies to populations in locales with more extreme winters, but a significant relationship of fall age-0 abundance and subsequent spring age-1 abundance was found. Jackson and Noble (2000b) also failed to find a relationship between fall sizes of young-of-the-year largemouth bass and overwinter survival in North Carolina, and found that spring abundances of age-1 bass were most strongly correlated with age-0 abundance early in the summer.

Garvey et al. (2002) reported that densities of age-0 largemouth bass were not related to adult abundance based upon a range of 5-70 adults/ha in Ohio reservoirs. The researchers concluded that no relationship was detected between adult size structure and hatch date. Alternatively, several studies have reported that larger largemouth bass spawn earlier, resulting in larger juveniles that may have improved survival through their first winter (Goodgame and Miranda 1993; Post et al. 1998). For black bass populations exposed to more extreme winters, the potential benefits of these findings have important management implications. Some noted important implications of earlier spawning are potential effects for increased risks of longer hatch time or nest abandonment, due to lower or less stable water temperatures.

A study of smallmouth bass in Ontario, over a 58-year time period, illustrated a high degree of recruitment variability that differed by as much as 34 fold (Shuter and Ridgway 2002). Factors that explained recruitment variation included climate (water temperatures) and adult abundance. Shuter and Ridgeway stated, *“a strong positive effect of adult abundance was evident overall and was recognizable in two of three phases.”* The phases reference this species’ introduction (establishment), expansion, and accommodation. The researchers developed a stock recruitment relationship that exhibited a decline in the ratio of recruits to adults (defined as > age-5) as the number of adults increased. Density dependent effects were noted as being *“modified by a strong abiotic, climate effect.”*

Several studies have directly examined the relationship between angling regulations and black bass population structure. Most of these have been associated with harvest or minimum size limit regulations, but few with seasonal-based regulations.

In a Wisconsin field study, where a largemouth bass population was closed to angling, a number of population responses were noted (Swenson, 2002). A greater proportion of larger older potentially spawning individuals was observed with time after imposing the restrictive regulation. This translated to improved nest protection and a reduction in predators. A positive correlation between the number of nests formed and the estimated adult stock size was found which corresponded to increased age-0 abundances. However, a recruitment index (based on age-1 abundances) indicated "*recruitment was highest early in the study when the number of spawners, nesting success, and August abundances of YOY were lower*." This observation is consistent with the generally accepted contention that spawning adult-recruit relationships are most evident at low levels of adult abundance (Hilborn and Walters 1992). While strategies to restructure a black bass population to increase the proportion of larger/older individuals can lead to opportunities for improved nesting success (earlier spawning, better defense, reduced cannibalism, reduced predator densities), abiotic factors may ultimately determine year class strength.

Buynak and Mitchell (2002) reported on the response of a lotic smallmouth bass population in Kentucky to regulation changes moving from a minimum size to a protected slot size limit. Smallmouth bass year-class production and growth to age-1 were inversely related to spring rainfall and were highly variable (CV of 76 reported for age-1 relative abundance). The authors detected a correlation between smallmouth recruited to the fishery at age-4 and densities of age-1 collected during spring three years prior.

An evaluation of a spring restrictive season (1 fish limit, 15 inch minimum length) from a previously closed spring season in New York's portion of Lake Erie for smallmouth bass, did not result in any population level recruitment effects related to increased fishing pressure (Einhouse et al. 2002). The authors were concerned with potential effects to recruitment, but theorized some logical reasons that would have mitigated spring angling effects. Smallmouth bass nesting occurred in deeper water habitat (>4 m), where targeting by anglers was difficult, and the scale of available smallmouth habitat (40,500 ha) is high relative to low angler effort. While annual angling pressure was shown to increase substantially (2.7 fold increase) after instituting the new spring season, the overall effort per unit area was extremely low at an estimated 4.2 angler hr/ha annually. The authors also reported recruitment was significantly related to mean summer water temperature. The limited angler effort measured in this study is an important factor for consideration in the interpretation of results.

The use of truly closed seasons has been scrutinized in recent years. Research has shown that closed seasons or specific area closures for black bass angling, in waters open to other species, may still allow black bass to be targeted by noncompliant anglers, compromising the utility of the regulation (Suski et al. 2002; Kubacki et al. 2002). In addition to angler compliance issues, closed seasons have been shown to provide large variations in desired protection to spawning bass due to thermal changes over space and time, resulting in limits to its effectiveness over a large geographic area (Kubacki et al. 2002). An extremely comprehensive review and planning approach in Michigan revealed similar results and lead to a recommendation of a Statewide seasonal catch-and-release regulation based on inconsistent levels of protection of black bass during the spawning period under a closed season regulation (Bremigan et al. 2004).

Jackson and Brooking (2005) also argued that opening a spring catch and immediate release would create additional fishing opportunities without obviously jeopardizing black bass populations. Based upon the review of published water temperature data, they determined that New York's closed season was not protecting guardian male bass from angling pressure and that there was little evidence that strong year classes of bass were being produced during those years when nest-guarding activities had likely concluded prior to the opening of the bass season. Jackson and Brooking (2005) indicated that there is no strong evidence that bass year class production in New York is less variable as a result of the current protective closed season, nor that the variability is higher in waters where the season opens prior to completion of the nest-guarding period.

2.4 Summary

The factors influencing black bass recruitment are still not well understood and most likely are extremely complex and variable. It is understood that these factors are dynamic, and are abiotic, biotic, and human-related in form and function. As a result, it is important for fishery managers to attempt to elucidate those factors that can be effectively managed. Only in this approach can fishery managers attempt to enhance black bass populations and consequently angling opportunities and success, which are goals of all fishery management agencies.

Therefore, the question should be, *"What factors can be effectively managed and what will be the probable outcome of these management strategies."* Most fishery resources managers would agree that although we can understand and monitor many abiotic factors related to water quantity and physical attributes, we can not effectively manage many of them. Stochastic events will determine water levels, as well as warming and cooling trends, and these events will influence production of black bass and thus partially affect black bass recruitment. Aquatic biologists understand that primary and secondary production have an influence on fish production at all trophic guilds, but are extremely difficult to effectively manage in large aquatic systems. Fish biologists also understand that the presence and abundance of adequate forage at critical life stages during black bass development also influence recruitment. Thus, fishery managers must integrate these extremely difficult to manage factors with their strategies. These strategies include angling regulations, education, fish introductions, supplemental stockings, and ultimately an integrated approach to successfully managing the black bass fishery.

2.5 Guidelines (Seasonal Closures/Special Regulations)

The use of seasonal regulations should be considered along a continuum from the most restrictive (complete closure) to a more moderate approach (catch-and-release) to a less restrictive (size and creel limits) and finally to the least restrictive (no special regulations). To determine the most effective regulation, fishery managers and policy makers must consider both the abiotic and biotic factors influencing the fishery, as well as the real or potential level of angler support and/or compliance. Factors that may be considered include short-term weather and long-term climate, the stability of water levels and temperature, the primary black bass species present, the quality of fish, habitat, and seasonal and annual angling pressure. Fishery managers should be confident that the limitation on the development of the fishery is truly recruitment based and not principally driven by other abiotic, biotic, or human factors prior to the consideration of highly restrictive spring angling regulations.

The following guidelines provide a framework for consideration and implementation of seasonal regulations:

1) An understanding of the type and condition of abiotic and biotic factors known to influence black bass population dynamics and how those factors relate to the population(s) is imperative for good management. Season length, type, bag and length limits may be used alone or in combination to achieve desired population objectives. A regulation proposal should provide an analysis of available data (creel surveys, fishery independent assessments, environmental conditions) relative to the available published literature. Monitoring activities should be encouraged and designed to determine the factors most likely to be attributed to influencing the population's dynamics.

2) Populations experiencing a known reduction in adult black bass biomass or contraction in age structure, coinciding with a known reduction in juvenile production, may be considered for more restrictive regulations. The uses of special regulations (e.g. catch and release) in these instances should consider critical life history time frames and be based on known temperature data.

3) Population assessment data should be collected and analyzed prior to and after regulatory changes to examine if a management effect can be detected and the merit of the rule change can be scientifically evaluated.

4) Proposed regulation changes should involve the angling public and angling organizations at early stages in the process. The interpretation of data and current research should be shared openly and used to

frame discussion on expectations, which can then be used to develop alternatives for consideration.

3.0 Largemouth Bass Virus

3.1 Introduction

Largemouth bass virus is the only virus known to cause mortality in largemouth bass. It was first isolated in the wild from largemouth bass taken from Lake Weir, Florida in 1991 (Grizzle et al. 2002). The first known fish kill attributed to LMBV occurred in 1995, with the mortality of approximately 1,000 largemouth bass at Santee Cooper Reservoir, South Carolina (Grizzle and Brunner 2003). Other large fish kill events have been reported from throughout the southeastern United States (Hanson et al. 2001). LMBV has been found in black bass populations that have experienced fish kills and also in populations that appear healthy (Goldberg 2002). Outbreaks of the disease caused by the virus are reported to typically occur from August through October (Plumb et al. 1999). Researchers that have tested for the presence of the virus have repeatedly shown that individuals from populations, wild or hatchery, may carry the virus without expressing any of the clinical signs of the disease (Plumb et al. 1999; Woodland et al. 2002).

The virology of the LMBV is provided in several papers that identify it from the family Iridoviridae of the genus *Ranavirus*, and has been described as being nearly identical to doctor fish and guppy virus known from Southeast Asia (Plumb et al 1999). The virus may be carried by other centrarchid species, including smallmouth bass, bluegill, and redbreast sunfish, and has also been found in chain pickerel (Goldberg 2002; Grizzle and Brunner 2003). The earliest published work on the virus described the clinical effects of the disease to include a loss of equilibrium and fish floating at the surface due to an over inflation of the swim bladder, with no other external signs visible (Plumb et al. 1996). A study injecting juvenile largemouth bass with the virus, at what was termed *"low level of the virus"* produced clinical signs that included *"dark pigmentation, spiral swimming, abdominal distention, and lying listlessly on the bottom before death"* (Plumb and Zilberg 1999). Zilberg et al. (2000) described the same observations from a similar study and also noted; necrosis at the site of injection, distended abdomen, corkscrew swimming, lateral recumbency, and internally, pale livers, bright red spleens, and reddened ceca. Lesions on the swim bladder (with occasional exudate) are described as a consistent defining characteristic of the virus and the location that harbors the greatest concentration of the virus, compared to the gills or spleen (Hanson et al. 2001). Another study similarly found the highest virus concentrations in the swim bladder, but also detected the presence of the virus in cutaneous mucus, head kidney, trunk kidney, spleen, gonad, and intestine and further demonstrated that the virus can be transmitted orally to largemouth bass (Woodland et al. 2002).

Initial concern over the potential impacts of the virus lead the Bass Angler Sportsman Society (BASS) to hold a series of five Largemouth Bass Virus Workshops that provided forums for researchers and managers to interact, share information, determine priorities, and develop strategies in an open forum. The most recent Workshop Proceeding (V) can be accessed via the internet at: http://sports.espn.go.com/winnercomm/outdoors/bassmaster/docs/LMBV_V_final_report.mht. The proceedings of these workshops provide a good source of information due to the involvement of academic, state, and federal researchers on the virus.

3.2 Distribution

Since the 1990s research and monitoring has occurred that has shown an apparent spreading of the virus throughout the Southeast, Midwest, and Northeast United States (Figure 1). Grizzle and Brunner (2003) provide a recent published review on the status of the virus and its distribution, which includes the States of Florida, Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Oklahoma, Missouri, Tennessee, South Carolina, North Carolina, Kentucky, Virginia, Indiana, Illinois, Michigan, and a portion of the upper Mississippi (Iowa, Minnesota, Wisconsin) and Lake Champlain (Vermont and New York). In subsequent years, additional testing in the Northeast has detected LMBV in New York, Connecticut, and West Virginia and another water body in Vermont (Figure 1). Individual State reports (Section 4.0) provide additional narrative on State perspectives on LMBV and includes a report from the USFWS Lamar Fish Health Unit (FHU).

A summary of the Northeast State's status of testing for LMBV is presented in Table 2. It is important to note that the known distribution of the LMBV in the Northeast is partially a result of what States have tested for the virus in addition to the extent, and type of the test procedures. A compilation of LMBV testing results for the Northeast is provided in Appendix B. The National Wild Fish Health Survey database may be accessed for queries via the web at: http://www.esg.montana.edu/nfhdb/ . The Maryland DNR Fisheries Service has developed a GIS data layer with associated LMBV testing results conducted by Lamar FHU (Mary Groves, MD DNR, personal communication). An example of this GIS mapping tool, with attached attributes fields, is provided in Appendix C.

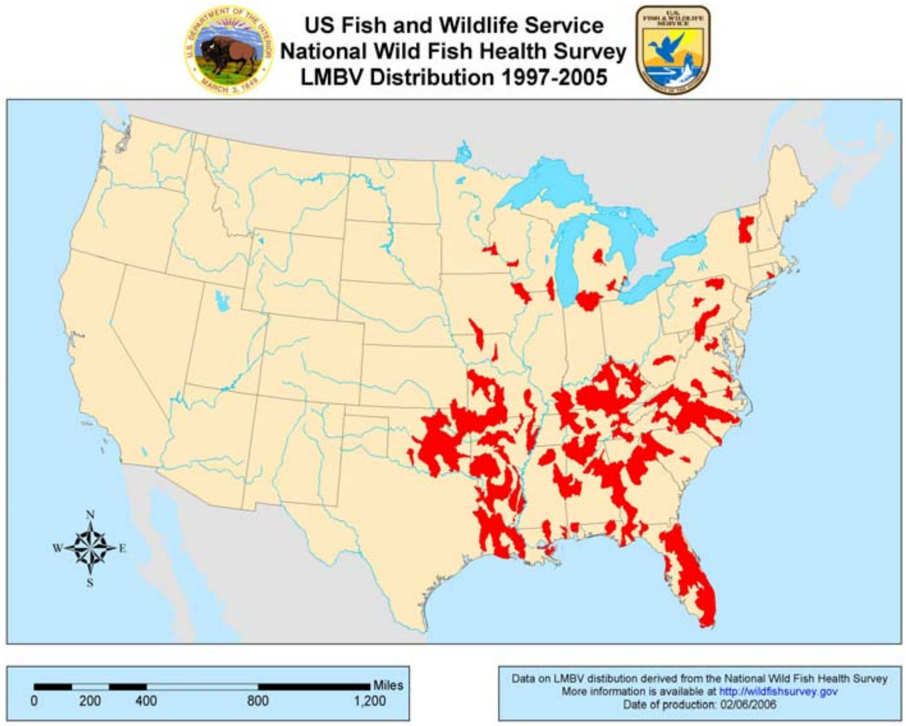

Figure 1. The known distribution of largemouth bass virus taken from the USFWS National Wild Fish Health Survey. This figure does not include largemouth bass populations testing positive in New York (refer to Appendix B).

Table 2. Status of largemouth bass virus testing by State with concerns and or comments.

Agency	Status of testing to date	Concerns/Comments
CT	Initiated testing in 2005 in two waters, one positive	Initiated testing with USFWS. Concern of spread through tournament anglers. Amos Lake had a notable LMB kill (larger fish) in 1998.
DC	No testing done to date, none planned	Not as concerned until nearby areas test positive. Note this has recently occurred.
DE	No testing done to date, none planned	Potential concern with tournament anglers for spread. Not as concerned until nearby waters test positive.
MA	Charles River, small sample all negative	Will cooperate with the USFWS to conduct further testing, no notable kills.
MD	Upper Chesapeake Bay, Choptank R., and Loch Haven Reservoir all tested negative. Potomac R. tested positive	Has used USFWS for testing. Potential concern for spread by tournament anglers. Potomac River basin kills have been in VA and WV tributaries where adults have not been associated with LMBV.
ME	No LMBV detected to date, tests in-house and with USFWS, tests ~ 6 waters annually.	Importation of bass illegal, not currently found in the State.
NH	Testing done for three lakes, all negative	Potential concern of spread by tournament anglers and possibly by boat electrofish or other gear sampling (not disinfecting).

NJ	No testing done to date,	Willing to consider testing waters, no notable kills.
NY	In 2005 tested 6 waters, 4 positives. In 2004, tested 13 waters, 4 positives	No major concerns, no disease outbreaks. Potential concern of spread by tournament anglers or other boater anglers, and possibly by electrofishing or other sampling gear (not disinfecting).
PA	In 2005, LMBV was detected in smallmouth bass from the Juniata River and a portion of the Susquehanna River. Mortalities had LMBV and secondary infections. In 2005, LMBV was detected in largemouth bass from F. J. Sayers Lake.	Has used USFWS for testing. Concerned about recent die-offs of YOY smallmouth bass in rivers. Have heard of similar incidences in MD and VA. Potential concern for spread by tournament anglers, electrofishing, and fish transfers (legal and other).
RI	No testing done to date, plans are in place for the fall of 2006	Potential concern of spread with tournament anglers or boaters in general (virus stays viable in water several days).
VA	Initial testing in 2001 and 2002 detected LMBV present in 7 of 15 waters tested, but only at a very low level of prevalence. In 2005, Shenandoah R. tested positive (redbreast and smallmouth bass)	No further plans for testing at this time. Potential concern with spread from tournament boats.
VT	To date 12 water tested, 2 positives, Lake Champlain and Lake St. Catherine	No issues with the waters that have tested positive. Have a rule against moving fish (like many others)
WV	Ten waters tested to date, virus only detected at Sutton Lake in 2003, used USGS Leetown and Lamar. State hatchery tested positive.	Disinfects sampling gear, potential concern with tournaments and fish transfers.

3.3 Transmission and Disease Effects

Grizzle and Brunner (2003) reported that LMBV transmission may occur through the water, by eating infected prey, or potentially by direct contact. The researchers noted that the virus may have been spread by transporting either fish or water. Interestingly, the virus is noted in their paper to retain 10% of its infectivity after two days and can be detected in water after seven days. Grant et al. (2005) demonstrated that transmission of LMBV from infected to uninfected fish in a segregated livewell (porous divider) was nearly as efficient as those placed in direct contact. However, their study also showed that uninfected fish placed in direct contact had higher viral loads than those kept in the segregated livewell. Another study further confirmed the link between fish density and increased viral load and mortality, showing a modest but significant effect that was attributed to immunity suppression and direct contact (Inendino et al. 2005). Transmission of LMBV from State agency hatcheries or private hatcheries is an important concern. The only published survey on this topic detected the virus in 5 of 15 State hatcheries that were examined from 10 southeastern States (Woodland et al. 2002). The researchers noted that there was no evidence of the disease caused by the virus at the time samples were collected.

A recent study examined the timing and effect of LMBV transmission to largemouth bass through immersion. Beck et al. (*in press*) described, how all experimental fish (n=225) tested positive for the virus after 5 days, but prevalence subsequently decreased. Only 2% of the virus exposed fish in this study exhibited signs of the disease with 2 mortalities and 5 moribund fish reported at the end of a 27 day period. The authors cautioned against drawing direct comparisons to disease outbreaks in the wild, but suggested that if a fish does succumb to LMBV, the disease will develop in a few days following exposure. The likelihood of LMBV disease did decrease with time after the initial exposure. A need to further assess the effects of sub-clinically infected fish was noted as important future research.

Schramm et al. (*in press*) examined the effects of livewell conditions and the interaction of tournament stress and LMBV on tournament-associated mortality of largemouth bass caught during summer months in Mississippi and Alabama. The results documented an extremely high 5 day post release mortality that averaged 75%, a rapid increase in the prevalence of LMBV, pervasive development of external lesions, and a linkage with bacterial disease. Due to the study design, the authors do not believe that this study's estimates of post release mortality can be used to predict the effects of summer tournaments on largemouth bass populations. An additional question noted by the authors is what role LMBV may play in the suppression of immune systems, potentially resulting in the high rate of observed secondary bacterial infections (*F. columnare*).

Schramm et al. (*in press*) could not conclude that LMBV was the sole cause of the unusually high mortality rate, but did present a strong line of evidence to implicate the virus as a critical factor. Other studies examining post tournament release mortality from LMBV infected populations ranged from 39% in Lake Fork, Texas to 69-87% in Mississippi (Schramm and Davis, *in press*). In the upper Mississippi River, post tournament release mortality of largemouth bass infected with LMBV was 75%. These post release mortality rates are substantially greater than the reported typical average of 18% (Wilde 1998).

A laboratory study examining the effects of catch-and-release angling on largemouth bass (water temperatures of 25EC and 30EC) did not detect a significant difference in mortality rates of infected fish between angled and non-angled fish (Grant et al. 2005). This study did show that infected fish experienced increased mortality at the higher water temperature. Interestingly, the researchers noted that the detected viral load of infected fish did not differ significantly between fish held at 25EC and those held at 30EC. These results are somewhat inconsistent with an earlier study conducted by Grant et al. (2003) that showed largemouth bass injected with the virus at increased temperatures (25EC vs. 30EC) experienced higher mortality rates. The researchers reasoned that elevated temperatures may suppress the immune system or facilitate replication of the virus (Grant et al. 2003).

Population level effects attributed to LMBV have not been well described. A recent study by Maceina and Grizzle (2006) examined the prevalence and the potential impact of LMBV on largemouth bass characteristics in five Alabama reservoirs. Their research described reductions in growth rates, survival rates, relative weight, relative abundance, and angler catch rates for larger largemouth bass (>510mm). The observed reductions were based on comparisons of data collected in the mid 1990s and 1999-2001, the later period representing the known presence of LMBV in the study waters. Some of the most dramatic changes included a 3 to 20 fold decrease in angler and electrofishing catch rates for larger bass. The authors were careful to note that they could not draw direct causative relationships to LMBV, but do present a compelling case for the implication of LMBV in observed negative population effects. Continued monitoring has shown afflicted largemouth bass populations to be recovering to pre-LMBV period levels for the described population and fishery measures. The authors noted that only one lake was known to have a reported fish kill and suggested that LMBV effects may occur over a longer time period.

3.4 Laboratory Testing Procedures

Procedures for testing of largemouth bass virus have evolved over the past decade to include evaluations of assay techniques and advances in detection technologies. Early testing techniques included using fathead (FHM) and bluegill (BG) cell cultures to induce a cytopathic effect (CPE), within as few as 48 hours, at 30EC (Plumb et al 1996; Piaskoki et al. 1999). Additional testing using polymerase chain reaction (PCR) amplification was used by Plumb et al. (1999) to isolate and identify the virus. This research helped to establish the belief that LMBV is a recent introduction, closely related to the doctor fish and guppy viruses. Subsequent published studies utilized either a fathead or bluegill cell culture for CPE that were then examined using PCR amplification techniques (Grizzle et al. 2002; Woodland et al. 2002). This approach continued to be refined by Grizzle et al. (2003) in specifically amplifying LMBV DNA, which had not been done to date. The researchers' techniques allowed for a more accurate testing of the LMBV and showed that previous testing techniques, particularly cell culture alone or PCR using isolate DNA from other than LMBV, would have a likelihood of not detecting the virus at low levels of prevalence. More importantly, this technique was noted to allow for the detection of the virus in sub-clinically infected fish.

Additional recent studies on testing procedures for LMBV have evaluated standard cell culture methods. McClenahan et al. (2005a) concluded that BG and FHM cell lines should continue to be the cell lines of choice for detection of LMBV, but noted that if FHM are used, other methods should be used for confirmation of positives. Recent published research has also reported on less intensive techniques for PCR that do not require extraction of DNA (McClenahan et al. 2005b). This study determined that the use of cell culture supernatant (centrifuged to remove cellular debris) could be used to detect a protein gene of LMBV using PCR, noting a substantially improved rate of detection using FHM cultures (82%) compared to BG cultures (47%).

Most recently quantitative PCR (QPCR) techniques have been used that, in addition to the benefits of correctly identifying the DNA of the target virus, provides a measure of the quantity of the virus in the sample, a distinction from straight PCR. At Cornell University, Dr. Paul Bowser has been conducting fish health tests for LMBV using QPCR for the past two years. Dr. Bowser has shown that the QPCR technique is highly sensitive and in those instances when positives are detected, a cell culture assay is run which often does not result in a positive due to an extremely low viral presence, refer to Appendix B (Paul Bowser, personal communication). This is illustrated by the results of Cornell's 2004 testing in which QPCR detected LMBV from four of thirteen water body samples, but subsequent cell culturing of the QPCR positive samples failed to produce positives.

Appropriate sample size, sizes of fish sampled, and timing of sampling when testing for LMBV, and the test type, remains a critical point in the level of certainty in detection. Grizzle and Brunner (2003) provide an example that 145 fish would need to be randomly sampled to obtain a 95% probability of detecting at least one infected fish from a population of 2,000 fish, if 2% of the population was infected. Plumb et al. (1999) cited a 60 fish sample target for pathogen detection and certification, noting that their own reported findings should be interpreted with caution due to small sample sizes.

An analysis of the National Wild Fish Health Testing database was completed by Dr. John Sweka and Trish Barbash of the USFWS Northeast Fishery Center, Lamar, Pennsylvania to determine appropriate sample size to use when testing a population for LMBV. Based upon their review of existing LMBV test data a sample size of 60 largemouth bass per water body is recommended. The researchers state, "*With a sample size of 60 fish, LMBV will be detected in at least one individual with 95% confidence if 5% of the population is infected with the virus.*" The potential use of species other than largemouth bass, surrogate species (e.g. bluegill, black crappie, pumpkinseed), for testing "*may not accurately reflect the presence or absence of LMBV within a water body*," according to the researchers. Refer to Appendix D for their complete report.

Currently there are two laboratory facilities in the Northeast that have been testing for LMBV and would potentially be available to any state or federal agency. The first is the Aquatic Animal Health Program at Cornell University, under the direction of Dr. Paul Bowser. The Cornell testing procedures uses QPCR first and then if a positive is detected, follows up with a cell culture. Dr. Bowser describes this approach as, *"…QPCR is more sensitive than cell culture and… lends itself better to the assay of larger numbers of samples in a shorter time than cell culture*." He also noted that the Blue Book (AFS) currently has cell culture as the primary technique followed by PCR (not QPCR) as the confirmatory technique.

The Cornell University lab charges $56 per fish to perform QPCR on a composite sample of swim bladder, spleen, and kidney. The lab would assay this composite sample three times (standard procedure). If a cell culture is run, that is an additional charge of $56 per fish for the same sample composite. Dr. Bowser suggested that, depending on objectives, pooling of samples may be conducted. For example, *"if the prevalence of LMBV is low, it may be very appropriate to make pools of 5 to 10 fish for processing."* The next question, according to Dr. Bowser, is whether it would be necessary to go back to individual fish in a pool to determine positives on a fish-by-fish basis. In 2005, the Cornell University lab has had one Post-Doc Associate working essentially full-time on performing QPCR on over 200 fish provided by NY DEC, which includes additional side research-related investigations. If there was a large influx of additional samples the lab would need to hire additional technical support staff, according to Dr. Bowser.

The second testing option, widely employed in the Northeast, is the Wild Fish Health Survey conducted by the USFWS Lamar Fish Health Unit (Unit). This National program is designed to monitor the health of fish populations relative to a lengthy list of known pathogens (viral, bacterial, and parasitic). The Unit should be contacted directly to discuss and arrange sampling and testing needs for an agency. The Unit will supply all materials, shipping containers and FEDEX account number to use for shipping. They may also be able to, on a case-by-case basis, be able to assist agencies in the field with collections and processing, if staff is available. The Unit requests a minimum of 2-3 weeks notice for a pre-scheduled sampling effort. However, if a State experiences a fish kill event which is suspect for LMBV, call them immediately. The Unit uses cell culture assay followed by PCR confirmation for any detected positives. Fish Health Biologists John Coll and Trish Barbash are primary contacts for the Unit (Appendix A).

3.5 Summary

Importantly, there have been no known re-occurrences of the disease in populations that have experienced a fish kill and it has been reasoned that antibody development and immune response may occur, decreasing the likelihood or severity of future disease events (Grizzle and Brunner 2003). However, Goldberg et al. (2003) state that *"factors other than the inherent virulence of the pathogen (such as environmental and host-related factors) must contribute significantly to the clinical manifestations of LMBV infection in the field."* This research, coupled with the confirmation of different strains of LMBV (Goldberg et al. 2003), make its continued examination and monitoring an important responsibility of fishery management agencies. How this virus will effect northern black bass populations and fisheries is unclear at this time. However, proactive fish management actions may help to reduce the rate of spread and lessen the severity of effects to populations and fisheries.

3.6 Guidelines (Largemouth bass virus)

1) Restrict Spread

a) Do not transfer fish carrying LMBV, even to other water bodies where the fish are known to have LMBV.

b) If a transfer is determined necessary, then all importations of fish into, or liberations and transfers within a State, whether from facility to facility, facility to a water body, or between water bodies; the source fish culture facility or water body should possess a fish health inspection report issued by a fish health biologist indicating that three annual inspections of the fish lot(s) on the facility or water body have been free of LMBV.

c) Boats, trailers, and all equipment in contact with water should be thoroughly cleaned following removal from any water body. A disinfecting bleach solution of one ounce of standard household liquid bleach per gallon of water should be sprayed inside the live well and other appropriate surfaces to full saturation. The solution should be allowed to stand for 15 minutes before thoroughly rinsing. Both of the aforementioned protocols should be performed at home prior to the equipment (boat, trailer, tanks) entering any other water body. CAUTION: Chlorine is extremely toxic to aquatic life, hence thorough rinsing is mandatory.

d) State and Federal agency boats, trailers, sampling gear, tanks or any equipment that comes in contact with water should be thoroughly cleaned following removal from any water body. These precautions should also be practiced by agency subcontractors such as Universities and other research entities. The previously mentioned disinfection procedure or other equally effective measures should be developed as standard operating procedures.

e) Develop appropriate literature or other media to educate the angling and boating public on LMBV. Outreach or education may be more specifically targeted or highlighted in waters known to have the virus present.

2) Measures to Reduce LMBV Stress in Tournament Caught Fish

a) Encourage all anglers to institute measures to reduce stress during livewell containment in warm water or weather conditions, or other stressful periods.

b) Consider tournament management measures that would reduce holding times, bag limits, or promote paper tournaments during stressful periods. The use of temperature or stress-related triggers should be considered for the enactment of these measures.

3) *LMBV Testing Information*

a) Results from State, federal, academic, or private fish health testing laboratories should be organized and updated in a centralized database. The USFWS Wild Fish Health Survey may serve this purpose under its "historic data" field, but other options should also be explored. In the absence of a national or regional database other identified organizations should be appraised of developments in the Northeast (e.g. AFS Southern Division – appropriate committees, B.A.S.S., USFWS Warm Springs Laboratory) at regular intervals.

b) Continued support for the USFWS Wild Fish Health Survey is essential for a consistent standardized sampling approach for LMBV and other disease testing for agencies that would not otherwise have the capability to conduct fish health assessment testing.

c) All States should develop a testing plan for LMBV. The USFWS Lamar Fish Health Unit should be contacted for details on initiating a testing program.

   i. Timing of sampling is important and is recommended to occur during the warmest months to improve the likelihood of virus detection.

   ii. Optimal sample sizes are a function of total population size, prevalence of the virus, and testing method. In general, a sample size of 60 fish is recommended, consisting of largemouth bass greater than 300mm. The smallest sample size recommended by this Committee's Fish Pathologists is 20 fish. It is not clear what the trade-offs are of using known carriers of the virus (other centrarchid spp.) in the sample as opposed to strictly black bass. Refer to Appendix D for more detailed information.

   iii. Existing fish mercury sampling programs provide an opportunity to maximize use of sacrificed fish. Summer tournaments also provide an additional option for specimens at a time of known greatest prevalence for the virus.

   iv. Appropriate fish handling procedures must be adhered to when preparing samples for testing of LMBV. The Cornell University, College of Veterinary Medicine, under the direction of Dr. Paul Bowser have recommended protocols available at: http://www.vet.cornell.edu/public/fishdisease/resources/diagnostics/shipping.htm

4) *Future Research Needs*

a) Non lethal testing methods should be investigated.

b) Under what conditions, in populations detected as positive for LMBV, will the disease express itself in the Northeast, and what population level responses may result.

c) Are there relationships between LMBV prevalence and factors such as immunity suppression and secondary pathogens, and how might these vary under different environmental conditions or life history stages?

d) Are there long-term risks to Northeast largemouth bass and potentially smallmouth bass populations from exposure to LMBV?

e) How consistent are the strains of LMBV present in the Northeast, and if differences exist how are they expressed?

4.0 State Agency and USFWS Reports Section

4.1 Agency: State of Connnecticut Department of Environmental Protection, Inland Fisheries Division

Committee Member:

Regulations

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Fish Health

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations: No closed season on bass *(exception: most waters stocked with trout are closed March 1 through Opening Day of trout fishing, the 3rd Sat of April)*

Proposed seasonal regulatory changes: None

Rationale for existing or proposed changes: Neither largemouth nor smallmouth bass appear to be recruitment limited in Connecticut. Closed seasons designed to protect spawning bass were instituted in the late 1800s, but were removed in 1970. A Statewide lake and pond electrofishing survey (Jacobs and O'Donnell 1996) revealed that densities of young bass were adequate in almost all waters. In fact, 39% of the lakes surveyed were identified as having stockpiled (under 12 inches) largemouth and/or smallmouth bass populations (Jacobs et al. 1999). It was concluded that Connecticut bass fisheries would be best managed with length and creel limits and that closed seasons unnecessarily restricted angling opportunities.

Corroborative evidence: CT anglers regularly complain that a spring closed season in New York State increases fishing pressure in Candlewood Lake (which is close to the New York border), one of CT's best bass fisheries. It is common for out-of-State bass clubs to schedule tournaments in CT during the spring when they have few other options. The result is that at least one large tournament occurs on Candlewood during every weekend day throughout the spring. Despite obvious heavy fishing pressure during the spawn, densities of large bass in Candlewood have remained consistently high over the past 30 years.

Charge 2: Largemouth bass virus

Status of LMBV in Connecticut: The current status and distribution Largemouth Bass Virus in CT is presently under review with additional sampling planned for 2006. Two lakes were sampled in 2005. One lake was found positive for LMB virus. It is the consensus of CT DEP staff that additional sampling should first occur in Black bass management lakes and/or lakes that have a significant number of tournaments on an annual basis. Additional sampling will provide accurate information as to where the pathogen presently occurs geographically within the State. Dependent on the results of this additional sampling, it will allow CT staff to develop a plan to address the possibility of reducing and/or restricting the spread of this pathogen   Where sampling has occurred in CT, the results of that sampling are shown in Appendix B.

Risk of spread: It is also the consensus of CT DEP staff that tournament angling would pose the highest risk of spreading the LMBV pathogen to other water bodies within the State. Other avenues of concern are the importation of bass to commercial hatcheries with subsequent distribution to private water bodies and although bait species have not been specifically implicated in the possible transmission of this pathogen, with regard to fish health they are unregulated. Since only two water bodies have been tested to date, it may be premature to assess the risk of spread until we ascertain more accurate geographical information. How widespread it is in Connecticut will determine what we develop as a plan to reduce or restrict its spread.

Fish health testing and planning: To coordinate fish health testing we have contacted the Federal Lamar Fish Health Unit in Lamar, PA. The Lamar unit has agreed to provide testing on any samples that we obtain in 2006. To this end we are looking into obtaining some of our samples from a program underway at the University of Connecticut. This program is sampling fish for mercury concentrations and to reduce the number of bass sampled overall we may be able to take our LMBV samples from the same fish. Feasibility of this is presently being reviewed.

Recommendation on measures to address identified issues: Specific recommendations in place include the cleaning and disinfection of all agency watercraft/gear that are used to sample fish populations within CT. We are presently doing this to reduce the potential spread of Zebra mussels and so no additional work by staff was required. In the 2006 CT anglers guide we outline a process to reduce the spread of any ANS and we believe by doing this we will effect a reduction in the potential spread of LMBV. However, there is no reference to disinfection in the anglers guide at this time.

Additional management and research issues of importance to your agency regarding black bass:

1) Effects of special length and creel limits on black bass fisheries.

2) Effects of perturbations to lake environments (e.g., winter drawdown, herbicides, shoreline alteration) on warmwater fisheries and lake ecosystems.
3) Genetic implications of angling on black bass populations - effects of angling on e.g., bass vulnerability, aggressiveness, age-at-maturity.
4) Effects of relocation of bass by tournament anglers.
5) Effects of introduced predators (e.g., walleye, pike) and other exotic species (e.g., milfoil, zebra mussels) on bass and resident warmwater fish populations.

Issues related to LMBV

6) Non lethal testing methods need to be developed.
7) Under what conditions, in populations detected as positive for LMBV, will the disease express itself in the Northeast, and what population level responses may result.
8) What is the relationship between LMBV prevalence and factors such as immunity suppression and secondary pathogens and how do those vary under different environmental conditions or life history stages.
9) What are the long-term risks to Northeast largemouth bass and potentially smallmouth bass populations from exposure to LMBV.
10) How consistent are the strains of LMBV present in the Northeast, and if differences exist how are they expressed.

References

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4.2 Agency: Delaware Division of Fish & Wildlife

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Charge 1: Biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations:
There are no seasonal restrictions on black bass fishing in Delaware.
Regulations governing largemouth bass fishing include:
A general Statewide size limit of 12 inches for largemouth bass, 6 fish/day.
Specialized regulations in four Delaware ponds:
1. Derby Pond & Hearns Pond – protected slot limit 15 to 18 inches, possession limit of 6 bass/day with only one fish > 18 inches.
2. Andrews Lake – protected slot limit of 12 to 15 inches, possession limit of 6 bass/day with only one fish > 15 inches.
3. Becks Pond – minimum length limit of 15 inches, possession limit 2 bass/day.

Regulations governing smallmouth bass:
Protected slot limit of 12 to 17 inches, possession limit 6 fish/day, no more than one fish > 17 inches. Prior to June 12, 2000, the size limit was the general Statewide limit of 12 inches with a daily possession limit of 6 bass/day (combination of black bass).

Proposed seasonal regulatory changes: None at this time. The smallmouth regulation change is being evaluated in 2006 as one facet of a dam removal project on the Brandywine River, the only viable smallmouth fishery in Delaware.

Rationale for existing or proposed changes: Reproduction in most of Delaware's public waters is currently sufficient to maintain the populations of bass, particularly in the heavily vegetated ponds (public ponds range in size from 4 to 189 surface acres). The Statewide minimum size limit serves to allow all male and female bass to spawn at least once before reaching legal length. Additionally, the harvest rate reported by licensed Delaware anglers has historically remained at less than 5 percent so imposition of seasonal closure would do little to increase spawning success. Specialized size regulations have been adopted on several ponds to address specific management objectives. However, the slot limits imposed in Derby Pond (1990) to address over-abundance of smaller bass essentially served as a minimum size limit due to angler reluctance to harvest bass below the protected slot (Martin 1995). This was true despite the vocal support of bass clubs for the regulation during the public hearing process and the development of an educational brochure explaining the function of slot limits.

In tidal rivers, with the Nanticoke system being the largest, reproduction is adversely impacted by turbidity, tides, and currents (Martin 2005, Miller 1980). An evaluation of bass length at maturity in the tidal Nanticoke (Miller 1980) and the ponds (Martin 1978) was used to change the Statewide minimum length limit from 10 to 12 inches in 1979. A stocking program of advanced fingerling largemouth bass from Nanticoke River brood stock has been used to supplement natural reproduction within this river system. Successful reproduction/ recruitment appears to be negatively correlated to precipitation during June and July (Martin 2005). During high precipitation years, the stocked fingerlings serve to bolster year class strength.

Stangl (1999) evaluated the smallmouth bass population in Delaware's Brandywine Creek, which resulted in a size limit change from the historical 12-inch minimum length limit for black bass to the protected slot limit for smallmouth bass noted above.

Fisheries Staff Opinion: This document was reviewed by two fisheries administrators and five fisheries staff. All agreed with the above and no additions were suggested.

Charge 2: Largemouth bass virus

Status of LMBv in Delaware

Although there has been no testing of largemouth bass for LMBv in Delaware waters to date, there has been some discussion about the virus. If adjacent States test positive or a bass fish kill occurs within State waters, testing may be warranted. However, if a regional standard protocol or non-lethal testing method becomes available, the agency is willing to consider testing immediately. This was updated at the April 2006 Technical Committee meeting: the Division can provide 20-30 legal-length bass from a summer fishing tournament on the Nanticoke River for testing by the Lamar USFWS Fish Health Unit. Additional fish collected for mercury screening may also be submitted for LMBv testing.

Concern about the risk of spread is directed primarily toward tournament angling and/or unauthorized stocking by anglers moving fish from one water body to another. The private sector should be discouraged from purchasing LMB for stocking purposes from hatcheries that are not local. Tournament participants should be reminded that LMB exposed to stressful conditions have been associated with potential opportunities for virus transmission. Therefore, maintaining controlled live-well temperatures during the warmer months should be encouraged.

Fisheries Staff Opinion

This section was reviewed by two fisheries administrators and five fisheries staff. All agreed with the above status and plans. We have no pathologists on staff, but have been assisted on past disease issues with MD fish pathologists.

Other Management and Research Issues of Importance

1. Habitat loss, due to shoreline development, loss of riparian buffers, nutrient inputs, and the spread of invasive species, is a major factor affecting bass abundance as well as many other freshwater fish species at this time. The popularity of catch and release fishing (surveys in DE have indicated that most licensed freshwater anglers release over 95% of the fish caught, Martin 2005) indicates that angling is not a major factor on fish abundance.

To address habitat loss, the Division has recently initiated the "GO FISH [**F**ill **I**n **S**tructural **H**abitat] program, a cooperative partnership encouraging angler clubs to "adopt" a public pond and enhance habitat for fish. A manual has been developed describing various types of fish habitat units such as brush piles, spawning beds, etc. The cooperating club selects a pond, determines number and types of structures, obtains materials, and places the units. The Division assists with site selection, provides necessary additional materials and markers, and places a sign documenting the club's participation at the access site.

2. A non-lethal method of screening for LMBv should be developed if possible.

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4.3 Agency: Massachusetts Division of Fisheries & Wildlife

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations: BLACK BASS (largemouth and smallmouth, singly or combined): 5 daily creel 12" length year round

Proposed seasonal regulatory changes: None proposed

Rationale for existing or proposed changes: Current regulations have been in place since 1981 based on survey and creel work showing the populations were stable, and harvest was decreasing

Fisheries Staff Opinion: Creel surveys have shown the voluntary release rate of legal bass in Massachusetts waters runs as high as 90+%. Given this statistic, conventional management tools such as length or creel limits or closed seasons will be of little value.

Charge 2: Largemouth bass virus

The Massachusetts Division of Fisheries & Wildlife is not currently testing for largemouth bass virus. To date, we have not experienced a largemouth bass fish kill which we feel could be attributed to the virus. If accommodations are made to assist with testing, the Division would be interested in cooperating.

Other Management and Research Issues of Importance

- Impacts of nuisance aquatic vegetation on bass populations
- Impacts of lake management techniques on bass populations, particularly drawdowns
- Land use impacts on bass populations, particularly sedimentation infilling of shallow ponds
- How do we get more people fishing and actually encourage harvest of bass in waters where they may be stunting?
- Conduct year round creel surveys to determine angler harvest of black bass. To date, most of our creel survey data is for ice fishing
- If LMBv increases with stress and water temperature, work with BASS to encourage immediate catch and release tournaments during the warmer months

4.4 Agency: Maryland Department of Natural Resources
Fisheries Service
Inland Fisheries Program

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations:

Non-tidal waters - Closed March 1 through June 15. Catch and Release is permitted.

Tidal waters - March 1 through June 15 – 15" minimum size, June 16 through end of February – 12" minimum size. Five fish bag limit for both seasons.

Proposed seasonal regulatory changes: None anticipated

Rationale for existing or proposed changes:

Non-tidal waters - Maryland's seasonal closure is designed to protect the largest fish in the population from excessive harvest during the spawn and pre-spawn periods when they are the most vulnerable. Many of Maryland's impoundments are heavily pressured and bass populations are easily imbalanced toward small fish. Reducing fishing mortality on these large individuals helps to maintain a desirable size structure (target PSD etc…). Maryland bass anglers have expressed a preference for more large fish in their catch over the ability to harvest during the spring. This regulation has been particularly important for smallmouth bass, which become very aggressive during the spawning period.

An April 1- June 15 closure was first initiated in Deep Creek Lake, Maryland's largest impoundment, in 1987. Biologists concluded there were immediate improvements in black bass populations due to this regulation. They noted that "tagging study results obtained in 1987 and 1988, indicated that the 'catch and immediate release' season reduced bass fishing harvest by 30% over that observed in 1986 (MDNR, 1991). They also noted increases in the percentage of tournament caught fish over 15" and in percentage of bass over age 7. As a result of these observations, this regulation was made Statewide in non-tidal waters in 1990 and extended to March 1 – June 15.

A secondary purpose for a spring seasonal closure is too maximize spawning potential by allowing bass to immediately return to their nest after capture. Tournament fishing has become extremely popular in Maryland and although virtually all black bass tournaments have a live release policy, they may still have negative impacts on reproduction. Besides the immediate or delayed mortality and possible physiological effects of stress on ripe males and egg bearing females, removal of bass from their nest likely produces high mortality of eggs and fry (Heidinger, 1975) (Kramer and Smith, 1962). Managers noted in the same Deep Creek Lake study cited above that smallmouth bass young of year indices for the three years after implementation of the closure were higher than any of the previous eight years on record.

Analysis of the 30-year time-series of Potomac River smallmouth bass survey showed several changes which coincided with implementation of the spring closure regulation. Mean CPUE of Quality (≥280 mm) bass increased in the post-regulation period. River-wide PSD increased from 9.8 to 17.8 and was significantly higher for this period as well. Annual mortality which was estimated at 62.6% for pre-regulation years, dropped to 50.5% for post-regulation years. Mean length increased significantly for age 4 and 5 bass and while this did not appear to be due to growth (mean length was essentially unchanged for younger fish) it may have been due to reducing selective harvest of large fish during pre-regulation years. (These results are being prepared as an in-house Technical Series report.)

Tidal waters - The 15" minimum size (March 1 – June 15) was implemented in July 1989. This regulation was designed to "protect at least 60% of male black bass on the nest and thereby enhance recruitment" (Fewless, 1991). Although the 15-inch minimum does not protect the larger females, it has been suggested that that they quickly deposit their eggs and move away from the nesting area making them less vulnerable to angling then males and less important in guarding the nest. As noted earlier, without protection, many bass eggs and fry would likely experience near 100% mortality. Given the amount of tournament and non-tournament angling in Maryland tidal waters (20.5 angler hours/ha spring/summer 1991), year-class size could be negatively impacted.

It is unclear how the 60% estimate was arrived at. However Fewless noted that a Potomac River State Qualifying Tournament in May 1989 produced many male bass with signs of nesting behavior (abraded fins and maxillary). The same tournament in May 1990 displaced 60% fewer bass. Fewless also presented fall electrofishing CPUE for Potomac River age 0 largemouth bass as evidence of improvement from the Spring 15" Minimum Size regulation (p=0.01). CPUE for 1990, 1992, and 1993 were 13.67, 12.60 and 19.25. During the pre-regulation years of 1984 and 1985 CPUE was 3.83 and 2.50. No specific analysis to determine the effects of this regulation have been performed and changes in methods in the late 1990's and uncertain status of historical raw data may preclude this possibility.

Evidence that these population changes were directly due to the spring seasonal closure is only circumstantial. A five fish daily creel was also initiated during this period. Angler ethics were also changing over this same period toward more year round catch and release angling. Ironically this catch and release ethic might preclude the removal of the spring closure from many of Maryland's small impoundments. Even though many of them have consistently high annual recruitment and probably would not be negatively impacted by this change.

Fisheries Staff Opinion: The above discussion incorporates staff views. Regional managers were all in agreement that Spring Closure has provided benefits to bass populations.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: Following the initial detection of LMBV in Santee Cooper Reservoir in South Carolina in 1995, Maryland began to examine the possibility of the pathogen being present in the State. The decision was made to target areas frequented by national bass tournament boats and anglers.

The first tests for LMBV were conducted on the tidal portion of the Potomac River in 1999 in a section that hosts numerous black bass tournaments each year. All largemouth bass sampled tested negative.

The Department of Natural Resources committed to sampling in other Maryland waters in 2002 in cooperation with the wild fish health survey being conducted by U.S. Fish and Wildlife Service. In 2002, largemouth bass from the tidal Potomac River, the Susquehanna Flats, St. Mary's Lake and Loch Raven Reservoir were tested and all were negative for LMBV.

In 2004, testing of non-tidal Potomac River smallmouth bass for the intersex condition in male fish was conducted. Since male and female fish were collected, and organs were available, samples were also submitted for LMBV testing. These fish tested negative for LMBV. At the time of the testing, the Potomac had experienced successive hurricanes subjected the fish in that portion of the Potomac to extremely high flows and subsequent runoff.

In 2005, early sampling in the same area of the non-tidal Potomac as the 2004 samples found some young of year smallmouth bass with sores. In view of significant die-offs of smallmouth in Pennsylvania and Virginia that summer caused by columnaris infections, staff decided to submit fish for testing. Symptomatic and asymptomatic smallmouth bass of several year classes, redbreast sunfish and redhorse suckers were submitted to laboratories at Leetown, WV and Lamar, PA in August 2005. Fish were pooled for LMBV testing and 1 pooled redbreast sample and 4 pooled smallmouth bass samples showed positive results for LMBV under PCR confirmation. At the time of testing, the Potomac was still feeling the impacts of high water resulting from hurricanes in 2004.

Status of LMBV in your State: The first positive tests for LMBV were found in 2005 (Appendix C). While staff recognizes that this is probably not an isolated case, they have not seen any massive problems in fish populations that can be impacted by the pathogen. Our fish may be infected with the LMBV, but may not show clinical signs until the target fish species are stressed, so we need to err on the side of caution, particularly when dealing with any black bass species. Maryland is in the early stages of dealing with the pathogen. Plans are currently being formulated to test other areas, particularly those from which brood bass are collected to supply production hatcheries. Discussions are underway to begin to formulate management strategies in dealing with the pathogen. Every attempt will be made to limit spread and exposure of new areas to the pathogen and include an education component to inform the public and make them an active participant in any prevention strategy.

Risk of spread: Maryland is just beginning to deal with the LMBV pathogen. The risk of spread is always present with any pathogen, but standard precautions should be developed to deal with equipment and tanks that would cover a variety of pathogens. Some measures are already in practice to protect coldwater hatcheries and coldwater habitats. To date, we have not dealt with these issues with warmwater fish species in as much detail.

Fish health testing and planning: Maryland is beginning a sampling commitment with the Lamar National Fish Health Center and is developing a sampling plan to identify and monitor LMBV in the State.
(LMBV discussion contributed by Susan Rivers, Fish Health Specialist, MDDNR, Fisheries Service)

Recommendations on measures to address identified issues: Maryland currently prohibits the introduction of black bass to waters of the State from out-of-State suppliers unless they are certified LMBV free. However we have had difficulties in creating specific certification guidelines for suppliers. As a result, each supplier sends a letter from their Certifying entity and we judge each on its individual merits.

Although it has been discussed, it is not yet official policy to prohibit the introduction of bass from areas known to harbor LMBV to other watersheds or upstream locations. The extent of such a prohibition is being discussed.

Additional management and research issues of importance to your agency regarding black bass: Recent smallmouth bass kills in some Potomac River tributaries have been limited geographically but have had significant impact on local populations and as yet are unexplained. Research should be focused on the cause of these kills and roles that LMBV and inter-sex condition may play.

Maryland hatchery operations rely on wild brood collections. There is a need for relatively quick non-lethal method of testing for LMBV that can be applied to select healthy individuals.

Additional work should be done on the roles of live-well use and water temperatures to determine the effects on LMBV expression in individual fish and transmission rates. This should be aimed at setting possible guidelines for seasonal/temperature restrictions on tournaments and other live-well use.

Although it cant be determined with 100% certainty that a population of fish is LMBV free, guidelines should be developed which could be used for legal purposes for the sale, transportation and stocking of fish.

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Pavol, K.W., and A. Klotz, 1991, Deep Creek Lake Black Bass Investigations. Maryland, Sportfish Restoration Fed. Aid Report, F-29-R, 17 pp.

4.5 Agency: Maine Department of Inland Fisheries and Wildlife

Committee Member: Rick Jordan, Maine Dept. of Inland Fisheries and Wildlife, P.O. Box 220, Jonesboro, ME 04648. Phone (207) 434-5925, email address : richard.jordan@maine.gov

Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations:

Maine

Season Dates	Bag limit	Minimum Length limit
April 1 – June 20	1 bass	12" in southern counties. 10" in 4 northern and eastern counties
June 21 – September 30	3 bass	Same minimum lengths as above, except that only 1 bass may exceed 14"
January 1 – March 31 (ice fishing)	1 bass	12" in southern counties. 10" in 4 northern and eastern counties

Proposed seasonal regulatory changes: No proposed changes in general law.

Rationale for existing or proposed changes: Maine's existing general law was adopted in 1992. The 1 fish daily bag limit during pre-spawn and the spawning period was promulgated by Maine's Advisory Council over biologist's recommendation to practice catch and release fishing. Biologists' desired catch and release during spawning because nesting bass are highly visible and easily targeted and caught. Mark Ridgeway's work had shown that larger bass tend to spawn earlier, their progeny can experience a longer growing season, attain a larger size, and may be highly valuable individuals in surviving the first winter's 190-200 day starvation period observed in Maine. But the Advisory Council, which must approve of all regulation changes, desired a 1 bass limit during spawning to permit anglers catching a trophy bass to keep it.
Most bass in Maine have completed spawning and defense of fry by June 20 and have spread out from spawning sites, so Maine's daily bag limit changes to 3

from June 21-September 30, with the provision that only 1 may exceed 14”. The purpose of allowing only 1 bass >14” is to prevent over harvest of quality sized bass; because a 14” bass in Maine is commonly age 8 or older, and because Maine’s bass are totally self-sustaining populations, any over harvest of larger, older individuals would take at least 8 years to replace.

Maine’s winter bag limit of 1 bass represents the lowest possible bag limit. It was imposed to prevent over harvest at a period when bass tend to be congregated in a few winter habitats in the lakes. While bass in many Maine lakes are rarely caught, they tend to become more active in late winter, larger fish are more often caught than smaller fish, and anglers locating the winter habitat may catch numerous bass.

Fisheries Staff Opinion: I write Maine’s Black Bass species assessment that is submitted to the USFWS. I also Chair ME Dept. of Inland Fisheries and Wildlife’s Bass Committee, which meets annually to discuss, review, and plan black bass management and fieldwork. We feel that Maine’s existing bass regulations, in conjunction with a high degree of the catch & release ethic amongst anglers, have been highly valuable in protecting and maintaining some excellent bass fisheries in Maine.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: Maine’s Fish Pathologist, Dr. Russell Danner (DVM) has tested numerous samples of largemouth bass in Maine and has never documented any LMBV. Refer to Appendix B.

Other waters that have been examined
Natanis Golf Course Pond: 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005
Anabessacook Lake: 2001; 2005, 2006
Branch Pond: 1998, 2000.

Status of LMBV in your State: Maine’s Fish Pathologist, Dr. Russell Danner (DVM) has tested numerous samples of largemouth bass in Maine and has never documented any LMBV.

Risk of spread: sportfish and baitfish movement, contaminated fishing equipment.

Fish health testing and planning: Bass are tested during fish kills and before scheduled bass transfers for stocking purposes.

Recommendations on measures to address identified issues: No sources have been identified in Maine. Disinfection, biosecurity & aquatic nuisance species addressed as public information issues currently.

Additional management and research issues of importance to your agency regarding black bass:
1. Assess effects of special length and bag limits on black bass fisheries.
2. Collect samples of bass from Maine lakes, assess age & growth,
and apply the most appropriate special regulations governing bag limit and length limit to best manage that lake's fishery, keeping in mind that the objective of Maine's black bass species plan is to manage for improved size quality where appropriate.

4.6 Agency: NH Fish and Game Department

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations: Lakes and Ponds: Ice-in to May 14 and June 16 to June 30- 2 fish. May 15 to June 15- catch and immediate release using artificial lures and flies only. July 1 to ice-in – 5 fish.
Rivers and Streams: January 1 to May 14 and June 16 to June 30- 2 fish. May 15 to June 15- catch and immediate release using artificial lures and flies only. July 1 to October 15 – 5 fish. October 15 to December 31- closed. (some sections of rivers are managed under lake and pond regulation (see above) and as such have no closed season).

Proposed seasonal regulatory changes: None at this time.

Rationale for existing or proposed changes: Spring catch and release regulations are a method used to allow bass fishing opportunities while still affording protection to bass populations from harvest and displacement during most of the spawning season. Lower daily limits (2 fish) before and after the "main" spawning season are a conservative measure to protect bass populations during years and/or locations when spawning and/or guarding occurs outside of the May 15 to June 15 catch and release season. The 5 fish daily limit was enacted in 1949, likely as a result of similar limits in other New England States.

Fisheries Staff Opinion: Staff generally concurs with current regulations.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: Testing has been conducted from fish sampled from Lake Winnipesaukee, Rockwood Pond, and Spofford Lake, all samples tested negative for the virus. We know of no documented fish kills that would suggest LMBV was the cause of mortality.

Status of LMBV in your State: Unknown

Risk of spread: The risk of spread will always be present while live wells are in existence. Recently NH passed a law that makes it an offense to leave a body of water in possession of any live fish (other than baitfish), which is intended to halt the spread of illegal introductions, and potentially fish diseases. Transfers of warmwater species among water bodies by NHFG is minimal.

Fish health testing and planning: New Hampshire hopes to test additional water bodies in coming years with the help of the Service's Lamar Fish Health Unit in Lamar, PA. Samples will likely be obtained from bass tournament mortalities collected at tournaments held in July and August.

Recommendations on measures to address identified issues:

Additional management and research issues of importance to your agency regarding black bass: Examine the influence of bass tournaments on initial and delayed mortality and potential negative factors related to fish displacement. Examine need for special angling regulations on specific water bodies and if enacted, the influence of special regulations on bass populations, angler satisfaction and catch and harvest rates. Detail angler harvest rates during winter and open-water and obtain information relative to angler's opinions and satisfaction of bass fishing and bass management in NH.

4.7 Agency: New Jersey Division of Fish and Wildlife/Bureau of Freshwater Fisheries

Committee Member:

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations: New Jersey has a catch and release season from April 15 to June. 15.

Rationale for existing or proposed changes: In an attempt to improve the size structure of the State's largemouth bass populations and in response to public comment, the Division took measures to restrict the harvest of largemouth bass during the 1980's. These measures included a restricted harvest season during the spawning period which was later replaced by an increase in the size limit from 9 to 12 inches. In 1993, the Division reinStated the restrictive harvest season, however, instead of the proposed one fish 18 inch minimum, a catch and release season was adopted as a result of public comment. The public's perception has been that these restrictions have worked well, however, no detailed investigations have been conducted to evaluate this regulation change.

Fisheries Staff Opinion: The staff feels that our current black bass seasonal regulation is appropriate for the management of the State's black bass fishery. Although it is not based on biological investigations, anglers overall appear to be satisfied. In fact, a recent survey of anglers, overwhelmingly favored a catch and release season on the Delaware River the only water in the State that maintained an open season. This regulation was implemented in 2005.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: The status of LMB virus in New Jersey is not known. No testing has been performed on hatchery-reared or wild fish by the NJ Division of Fish & Wildlife (DFW). Based upon findings elsewhere in the Northeastern U.S., it appears likely that LMBV will be found at some point in time if testing is performed.

There is no evidence at present to suggest that mortalities due to the virus have occurred in New Jersey. During the 18-year period from 1988 to 2005, DFW documented seven fish kills in New Jersey lakes where adult largemouth bass were the predominant or only species involved. Largemouth bass virus disease was not suspected in any of the cases; however, no virologic testing was done. Six of the seven cases occurred in April and May when water temperatures were below 70°F. The only case documented during summer months was in August 1993, and it was suspected to be due to hypoxia.

Evaluate the risk of spread: Grizzle & Bruner (2003) indicated two likely modes of transport of LMBV: direct transfer through fish stocking, or via water in live wells of boats. Because it is not known where, or if, LMBV is present in New Jersey, all stocking or transfers of bass in New Jersey have an unknown degree of risk. Stocking of fish for recreational fishing in public waters in NJ is conducted by the DFW, and stocking by private individuals or organizations is regulated by DFW through a stocking permit system.

Fish Stocking
Stocking of LMB and SMB by DFW are generally limited to new impoundments. A limited number of LMB are stocked together with other centrarchids, primarily bluegill and pumpkinseed sunfish, in park ponds for children's fishing derbies. A small LMB brood stock of approximately 100 individuals is held at the Hackettstown SFH to provide the necessary bass for the stocking program. Smallmouth bass are only stocked in new impoundments. Because the need for SMB is not an annual event, brood stock are captured in a nearby water supply reservoir, Yards Creek Reservoir, when needed. Yards Creek Reservoir is not open to public fishing. As a general precaution, smallmouth bass are reared in a section of the hatchery separate from largemouth bass and other centrarchids. During the period 1996 through 2005, DFW stocked 121,000 fingerling LMB and approximately 230,000 other centrarchids (primarily bluegill) in NJ lakes and ponds. Since precautions are taken to avoid introduction of pathogens into the Hackettstown SFH, the degree of risk associated with stocking from the hatchery is believed to be low. Testing of both LMB and SMB brood stocks for LMBV is planned within the next year.

Private stocking of fish regulated by DFW in New Jersey can be grouped into two categories: (1) fish purchased from commercial sources and stocked in ponds for recreational fishing, and (2) fish salvaged from lake or ponds that have been drained or lowered, and relocated to other water bodies.

Over a ten-year period from 1996-2005, one hundred forty-six (146) permits were issued to individuals who purchased largemouth bass for stocking in New Jersey waters, and 135 permits were issued for stocking other centrarchids. Of the 146 LMB-stocking permittees, 42 purchased bass from commercial sources outside of New Jersey and 102 purchased bass from sources within the State. Although all hatcheries supplying fish contend that LMBV is not present in their stocks of fish, only one hatchery (accounting for 4 of the 42 out-of-State transfers) was able to provide documentation that the fish had been inspected and found free of the virus. Lacking adequate documentation, stocking of bass must be considered a potential source of introduction of LMBV into the State and for its dissemination throughout the State.

During the ten-year period from 1996 through 2005, thirty-four permits were issued to transfer salvaged largemouth bass into other water bodies within New Jersey. To minimize the risk of dissemination of parasites and disease, a general condition placed on those permits was that the transfers were restricted to waters within the same drainage system. That condition also serves to minimize the spread of LMBV.

Live Bait Fish
Another potential source of introduction of fish pathogens in NJ is the use of live fish for bait. The bait fish industry in New Jersey is only partially regulated. Species of bait fish most commonly used by freshwater anglers in NJ are golden shiner, fathead minnow, and landlocked alewife. Golden shiners and fathead minnows sold by bait shops are provided by commercial sources. It is assumed that most of these fish originate from hatcheries in the Southeastern U.S.; however, the importation and sale is not regulated by NJ DFW. Landlocked alewife are commercially harvested from reservoirs in New Jersey and sold in bait shops throughout the State. The harvest of alewife from NJ reservoirs is regulated by NJ DFW; however, fish health inspections are not part of the regulatory process. Although none of those bait fish are species commonly associated with LMBV, they remain a potential source of introduction into New Jersey and dissemination throughout the State.

Recreational Fishing / Boats
Sport fishing for largemouth bass is popular in New Jersey as it is throughout the U.S. Tournament bass fishing on State-owned Wildlife Management Area (WMA) lakes is regulated under permit by DFW. An average of 125 tournaments are held each year on 25 WMA lakes, with most of the activity taking place on 12 of the lakes. DFW staff who are most familiar with recreational bass fishing estimate that over 1000 tournaments are held each year in New Jersey. The most popular lake in the State, Lake Hopatcong, may host as many as 5 club tournaments each weekend during the peak season.

The high interest in bass fishing in New Jersey suggests that it would play a role in the epizootiology of LMBV disease. However, no fish kills associated with competitive bass fishing have been documented in the State. Division biologists have estimated the direct (non-delayed) mortality from tournament bass fishing to be less than 2%.

Fish Health Testing & Planning: Adequate assessment of the status of LMBV in NJ is considered necessary before any specific regulatory measures are considered. Initial testing of hatchery and wild stocks is planned for the summer of 2006. Proposed stocks for testing are:

Largemouth bass from the Hackettstown SFH
Smallmouth bass from Yards Creek Reservoir
Largemouth bass from Lake Hopatcong
Largemouth bass from Salem Canal.

Samples will be collected by DFW personnel and virologic testing will be performed by the USF&WS Lamar Fish Health Unit.

Recommendations: No specific policies regarding LMBV are in place or being considered at the present time.

Additional research and management needs:

1. Effects of aquatic vegetation control on black bass populations.
2. Effects of spring tournaments (catch and release)on recruitment and the initial and delayed mortality of all tournaments on bass populations in heavily fished tournament lakes.
3. Effects of introduced predators (e.g. walleye, pike and muskellunge) on black bass populations.

4.8 Agency: New York State Department of Environmental Conservation

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations:

Statewide: Open season: 3rd Saturday in June – November 30
Minimum Length: 12" Daily Limit: 5

Other special regulations

There are a variety of water or area specific regulations that vary from Statewide regulation, the most common being a 10" minimum length limit (Statewide season and limit) which is generally applied in several river sections throughout the State. Other regulations include 15" minimum size limit, 15" minimum size limit and 3 fish limit, no season or size limit, 12-15" slot limit, April 1- November 30 season with no size limit, April 1-November 30 season with no size and creel limit, catch and release year round, catch and release artificial lures only, 3rd Saturday in June-Mar 15th, 3rd Saturday in June-Mar 15th plus catch and release season from 1st Saturday in May – Friday before 3rd Saturday in June, 3rd Saturday in June – November 30 plus catch and release from December 1st – 1st Saturday in June, and Saturday in June – November 30 plus catch and release from December 1st – March 1st.

-

Proposed seasonal regulatory changes:

Statewide: Open season: 3rd Saturday in June – November 30
Minimum Length: 12" Daily Limit: 5

Catch and release, artificial lures only: December 1 – day before 3rd Saturday in June
Note: Exceptions (some areas or water bodies will retain current closed season)

Rationale for existing or proposed changes:

Objective

To provide additional bass fishing opportunities in waters throughout the State while minimizing risks to bass populations through the establishment of a catch and release only (artificial lures only) regulation during the winter and spring months.

Rationale

Black bass populations in New York (both smallmouth and largemouth) are largely stable and robust in waters across the State. Establishing a catch and release only season (artificial lures only), in addition to the existing 3rd Saturday in June through November 30 season (12 inch minimum length and daily limit of 5 fish during this period) will create additional angling opportunity without posing undue risk to the stability of bass populations.

Members of the Cornell Biological Field Station concluded a recent review of available data pertaining to an early opening of the black bass season in New York, which included evaluating angling activity during black bass spawning periods (Jackson and Brookings 2005). Conclusions drawn from that evaluation strongly suggest that in most waters of New York State, allowing catch and immediate release fishing will create additional recreational opportunities without jeopardizing the sustainability of bass populations.

Highlights from the review:

- Published water temperature data indicates that it is unlikely that the current closed season in NY is protecting guarding male bass from angling pressure. In any given year, bass may still be nest-guarding when the current season opens.

- Data concerning potential increased vulnerability of male bass to angling during the nest-guarding period is inconclusive.

- Abundances of black bass populations throughout New York vary widely, black bass populations in a particular water often change through time, and there is little evidence that strong year classes of bass are produced during those years when nest-guarding activities have concluded prior to the opening of bass season.

- Information suggests that differences in bass abundance are likely to result from causes other than the timing of the nest-guarding period in relationship to the opening of bass season. While the Statewide angling regulations have been consistent for bass, annual year class production in New York varies dramatically, but on the same order as that observed in States with no closed season. There is no strong evidence that bass year class production in New York is less variable as a result of the current protective regulations, nor that variability is higher in waters where the season opens prior to completion of the nest-guarding period.

- Periodic large year classes of bass seem adequate to maintain quality fisheries

- Information from NY waters indicates that healthy bass populations exist where restricted angling is permitted during the nest-guarding period (Lake Erie and western Finger Lakes), or where the season often opens prior to the end of nest-guarding (Lake George)

- It should be recognized that some level of preseason angling is already taking place, either as noncompliance and/or by anglers pursuing other species (with open seasons)

Fisheries Staff Opinion: Internally, there was varied opinion on the proposed regulation, but the majority of staff supported it. Each of the Regional Fish Managers (9 regions) were consulted one last time before moving the proposal forward, and almost all supported advancing the regulation.

Charge 2: Largemouth bass virus

Known occurrences of LMBV:

Status of LMBV in your State: LMBV survey of New York waters is summarized in Appendix B. To date, no LMBV-related fish kills have occurred in the State, although the virus is now widespread in New York. All surveys were conducted by the Aquatic Animal Health Program in the College of Veterinary Medicine at Cornell University using Quantitative PCR and cell culture. [Contributing review by Andrew D. Noyes, Pathologist 2 (Aquatic), NYS DEC and Dr. Paul Bowser, Aquatic Animal Health Program, College of Veterinary Medicine, Cornell University – Appendix B]

Risk of spread: The spread of LMBV is considered to be rapid and the mode of transmission is still unknown. LMBV can survive in water for more than seven days, suggesting that horizontal transmission may occur in fish containment devices such as live wells when boats travel from lake to lake, but this unclear. Little is known about other possible biological modes of transmission such as from birds or bait. [Contributing review by Andrew D. Noyes, Pathologist 2 (Aquatic), NYSDEC]

Coordinate fish health testing and planning: The Fish Pathology Laboratory at the Cornell University College of Veterinary Medicine has been performing a preliminary survey of the distribution of LMBV in New York State Waters. The “Fish Pathology Laboratory” is a collaborative effort between the Division of Fish, Wildlife and Marine Resources of the New York State Department of Environmental Conservation (NYS DEC) and the Aquatic Animal Health Program of the College of Veterinary Medicine, Cornell University, Ithaca, New York. The Laboratory was developed to address cases of severe fish kills or other abnormalities encountered by the Fishery Biology staff of the NYS DEC. The LMBV detection effort is closely associated with the Fish Pathology Laboratory, which is funded by NYS DEC to investigate wild fish kills. Dr. Paul Bowser (College of Veterinary Medicine, Cornell University) currently coordinates the program.

In 2004 and 2005 the Laboratory asked contacts within NYS DEC and the Cornell Fishery Researchers at the Cornell Biological Field Station, Oneida Lake, to save any largemouth bass they collected from various waters that they had been surveying for their already scheduled population dynamics studies. So basically, sources of fish were those where they could obtain bass from colleagues conducting field studies.

The Laboratory would like to continue the screening effort. At this time, the effort is a couple of steps above informal, essentially relying on the good will of those who work in the field to provide the laboratory with fish to process. If the laboratory were to undertake a large survey with scheduled sampling they would need additional resources to process all the fish and the subsequent samples generated. It is believed that it would be pretty easy to deplete all the financial resources they have through the Fish Pathology Laboratory (the NYS DEC-funded effort).

It is important to note that the Laboratory is currently testing the samples by two methods; the traditional use of the Fathead Minnow Cell (FHM) culture system and a quantitative PCR test that was developed by Rod Getchell (Aquatic Animal Health Program of the College of Veterinary Medicine, Cornell University). The quantitative PCR test is considered by the lab to be far more sensitive in detecting the LMBV than is the Fathead Minnow Cell culture system.

Recommendations on measures to address identified issues: Fishermen should be encouraged to immediately disinfect live wells or any other equipment that remains damp for extended periods of time. Disinfection should occur before boats and other equipment travel to other bodies of water. People should also be discouraged from moving any fish species from one lake to another, especially since LMBV infects a wide range of fish species.

Additional management and research issues of importance to your agency regarding black bass: The relationship (and potential affects) of bass tournaments to bass populations and how much of the bass angling in NY is from tournaments.

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4.9 Agency: Pennsylvania Fish and Boat Commission

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations: Within Pennsylvania, two major sets of harvest regulations apply: (1) State wide regulations and (2) "Big Bass" regulations. Big bass regulations are applied to reservoirs and rivers where specific biological and water quality criteria accommodate greater densities of black bass. Regulations applicable to lotic habitats (rivers and streams) and lentic habitats (reservoirs and lakes) differ slightly, the rationale for this is described below.

Regulation Program	Black Bass Seasonal Harvest Rules since 2000			
State-wide Lakes	Jan 1 to Mid-April 15 in MSL 4 DCL	Mid-April to Mid-June (targeting of nesting bass prohibited) Catch & Immediate Release no Tournaments	Mid-June through October 12 in MSL 6 DCL	November to December 15 in MSL 4 DCL
Statewide Rivers	Jan 1 to Mid-April 15 in MSL 4 DCL	Mid April to Mid-June (targeting of nesting bass prohibited) Catch & Immediate Release no Tournaments	Mid-June Through September 12 in MSL 6 DCL	October to December 15 in MSL 4 DCL

Regulation Program	Black Bass Seasonal Harvest Rules since 2000			
Big-Bass* Lakes	Jan 1 to Mid-April 15 in MSL 4 DCL	Mid-April to Mid-June Catch & Immediate Release (targeting of nesting bass prohibited) no tournaments permitted	Mid-June through October 15 in MSL 4 DCL	Novermber to December 15 in MSL 4 DCL
Big-Bass* Rivers	Jan 1 to Mid-April 18 in MSL 2 DCL	Mid April to Mid-June (targeting of nesting bass prohibited) Catch & Immediate Release no tournaments permitted	Mid-June Through September 15 in MSL 4 DCL	October to December 18 in MSL 2 DCL

*Big Bass Program applies to selected Reservoirs and Rivers in Pennsylvania that meet criteria which accommodate greater densities of black bass.

Proposed seasonal regulatory changes: In 2000 Pennsylvania substituted a catch and release spring season (mid-April to mid-June) for a previously closed season. Previous or prior regulations can be described as follows:

Regulation Program	Black Bass Seasonal Harvest Rules previous to 2000

State-wide Lakes & Rivers	Jan 1 to Mid-April 12 in MSL 4 DCL	Mid-April to Mid-June Closed Season No Tournaments	Mid-June through December 12 in MSL 6 DCL

Regulation Program	Black Bass Seasonal Harvest Rules previous to 2000		
Big Bass* Lakes & Rivers	Jan 1 to Mid-April 15 in MSL 4 DCL	Mid-April to Mid-June Closed Season No Tournaments	Mid-June through December 15 in MSL 4 DCL

*Big Bass Program applies to selected Reservoirs and Rivers in Pennsylvania that meet criteria which accommodate greater densities of black bass.

Rationale for existing changes: Changes in 2000 were designed to clearly define what was permissible under the closed black bass season. Some anglers felt that it was acceptable to catch and immediately release black bass at this time, others felt that such activity was not permissible. The regulation specifically required unharmed return of any fish caught out of season (during the closed season). However the angling public requested greater clarification as to the acceptability of spring fishing in Pennsylvania. A literature review, public input, and simulation of various management scenarios yielded the following observations/conclusions:

(1) Fishing for all species, excepting black bass, was permissible on all Pennsylvania waterways from mid-April to mid-June. Consequently some incidental catch and release and some purposeful catch and immediate fishing for black bass was taking place.
(2) Loss of nest/young associated with guardian male removal was not yet demonstrated to affect abundance at the population level, but affected survival of individual nests.
(3) Loss of some adults to catch and release immediate release fishing was expected to occur if catch and release fishing was clearly permitted as occurred in 2000.
(4) Mitigation for loss was provided for through greater harvest restrictions in cold weather months. Since limited fishing occurred on rivers in cold weather months differences in temporal harvest restrictions were necessary to “save” sufficient numbers of black bass. Anticipated “loss” and various harvest restrictions to accomplish “savings” to make up for loss were simulated using a population dynamics model for lotic and lentic habitats separately. Pennsylvania strongly favored a mitigation approach to make up for anticipated loss where spring angling were permitted.

Recommendations associated with this regulation clarification or restructuring unwaveringly focused upon maintaining bass population density and maintaining bass fishing quality. The responsibility to maintain the integrity of Pennsylvania’s bass resource challenged PFBC staff, that challenge ultimately lead to development of a 3-tiered bass season, described above, which made up for direct losses associated with catch and release fishing in mid-April to mid-June. A second challenge originated from an un-documented, but suspected effect that temporary removal of a bass from a nest during a Spring catch and release fishing period, might reduce future population levels. Although no study demonstrates that there is a population level effect associated with fishing over spawning bass, some studies suggest a potential effect based upon partial or complete loss of some nests during temporary absence of the nest-guarding male (Keiffer et al. 1995, Philipp et al. 1997, Ridgeway and Shuter 1997). Other studies which have taken a population level approach to examining catch and release fishing in Spring suggest there is no effect, or that any effect is so slight it is not measurable (Schneider et al. 1991). This is presumably due to the relatively high number of young produced in some years which sustain fishing.

In a detailed study of nest success (percent of nests producing fry) of both smallmouth and largemouth bass in Lake Charleston (Ontario) it was found that nest success was 44 percent in that portion of the lake open to catch and release angling and 63 percent in that portion of the lake closed to angling (Phillip et al. 1997) suggesting angling reduced nest success. Generally Phillips et al. (1997) found that nest success was lower where there was more intense catch and release fishing for nesting bass in lakes studies. Other detailed studies of nest success or production of young, show that production of young are more influenced by a variety of environmental factors versus temporary removal from nests by anglers.

A detailed study involving monitoring reproductive success of smallmouth bass in a Wisconsin lake revealed that angler induced nest abandonment and loss consisted of 6 of 141 nests that were being monitored or 4 percent of monitored nests (Raffetto et al. 1990). Researchers indicated that nesting bass were conspicuous and anglers often intensely fished over nesting bass (Raffetto et al. 1990), although fishing intensity was not directly measured in this study. In other lake studies where smallmouth bass nesting success was measured, cold windy conditions resulted in 33 (Lake Erie) and 34 percent (Lake Opeongo, Ontario) success whereas warm calm conditions resulted in 88 and 92 percent success (Goff 1986; Ridgeway and Friesen 1992). Although angler induced nest loss was not measured in these two studies it appears that environmental conditions played a major role in nest success.

In six southeastern Michigan Lakes substitution of a catch-and-release season in Spring for a closed season did not cause gross changes in production of young black bass as measured by electrofishing surveys following implementation (Schneider et al. 1991). In the case of largemouth bass, less detailed studies indicate that the number of spawners or the number of nests produced were not related to the number of young produced, rather environmental and biological factors have been cited as factors that had influence upon the number of young produced (Heidinger 1976, Kramer and Smith 1962, Newberg 1975, Schneider et al. 1991). For largemouth bass, high water levels in lakes during spawning which lead to flooded vegetation, tend to bolster production of young as observed by Pennsylvania Area Fishery Managers and other researchers (Heidinger 1976). Examination of river studies of nesting success and production of young suggest environmental conditions during spawning play a major role in governing each. It should be noted, however, that Philipp et al. (1997) found that a lower percentage of successful nests were associated with higher levels of catch-and release fishing in two rivers studied. In the Mississippi River (Ontario) a site with low angling intensity yielded a nest success rate of 84 percent, whereas the St Lawrence River, with greater levels of angling intensity yielded a nest success rate of 58 percent (Philipp et al. 1997).

In a detailed study of a Virginia stream 45 of 105 smallmouth bass nests (43 percent) and 42 of 81 males (52 percent) successfully produced free-swimming larvae (Lucas and Orth 1995). Fifty one nests failed after high flows (85 percent), five nests (8 percent) never received eggs, two nests (3 percent) failed due to angling, and two nests (3 percent) may have failed due to nest predators (Lucas and Orth 1995). Detailed study of those factors affecting smallmouth bass year class abundance in the Susquehanna River drainage suggest that decreases in spring water temperature and increased flows substantially reduce the production of young, presumably due to reduced survival of nests and reduced survival of newly hatched smallmouth bass (McCosh 1994). On Pennsylvania rivers PFBC biologists have observed very high and very low young-of-year abundance indices for smallmouth bass during periods when bass fishing and harvest were permitted year-round (1981- 1990). This suggests that circumstances other than angler induced nest losses or circumstances in addition to angler induced losses are the cause of fluctuations in production of young smallmouth bass. With respect to production of young, most certainly temporary removal (catch and release) of adults from nests would lead to some nest depredation. There may be reduced production of young bass due to partial or complete nest loss associated with catch-and-release fishing in Spring, however, due to the generally high annual production of young in waters studied, it has not been established that angler induced loss of individual nests results in measurable reductions in production of adults in those waters studied. Generally, in those waters where smallmouth bass nest success and production of young have been studied environmental conditions have played a major role in determining the level of survival in addition to any effect of angling induced nest loss. In those studies where nest success was observed, subsequent abundance of yearlings or adults was not reported, consequently any effect upon adult production is undocumented, although some studies were reportedly in progress at the time this change was made (Philipp et al. 1997).

Despite the apparent and obvious adult losses associated with catch-and-release fishing during the spawning period, and loss of young associated with angler induced nest losses, which may potentially lead to a reduction of adults, we believe losses and reductions can be mitigated or minimized. Angler induced nest losses can be reduced by eliminating catch and release fishing on waters where there is a potential risk of affecting the adult bass population. Adult and nest losses can be minimized by informing anglers how to release Spring caught bass such that survival of the bass and it's nest are maximized. Direct losses associated with catch and release mortality can be mitigated by reducing harvest related mortality by placing greater restrictions on harvest during the open season as detailed in here. We feel the risk of causing any change in Pennsylvania bass populations would be very small given the conservative approach taken to mitigate and reduce all losses associated with catch and release fishing from mid-April to mid-June. Also we feel the risk would be small given that 34 of 48 States in the continental U.S. have a year-round bass season; 10 of 48 have a catch and release season, limited harvest season, or a year round season with exceptions; and only 4 States were regulated by a statewide closed bass season at the time this change was made (Pennsylvania, Michigan, Minnesota, and New York; Quinn, 1993).

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Fisheries Staff Opinion: There is staff consensus that accommodating fishing in spring (mid-April to mid-June) paved a rather well worn path, since fishing for most all warmwater and coldwater species was permissible and black bass were incidentally or intentionally captured and released at this time. Since implementation of the catch and release spring season tournament angler catch rates for black bass have not exhibited trends suggestive of dramatic changes in density associated with implementation in 2000, however detailed Statewide electrofishing assessment of black bass populations has not occurred in the current decade (since 2000).

Charge 2: Largemouth bass virus

Known occurrences of LMBV: In the past decade Pennsylvania has provided USFWS (Lamar) virology experts or University virology experts with a variety of fish or fish tissue samples for LMBV screening from a variety of locations across the State. Testing in Pennsylvania is largely carried out to identify the cause of a fish mortality or cause of a disease condition of fish. Testing of fish derived from seven (7) waterways has yielded positive results on 3 waters with smallmouth bass and largemouth bass producing positive results. A non-acute fish kill was reported by tournament anglers at Sayers Lake (Centre County), however the mortality was not verified by agency personnel. Sayers Lake was the only reservoir in Pennsylvania where a positive result was derived from largemouth bass. All LMBV positives were derived from samples from the Susquehanna River drainage.

Status of LMBV in your State: Largemouth bass virus LMBV occurs in Pennsylvania. Fish derived from Susquehanna River Drainage waters have yielded all known positive results. Limited testing in the Ohio River drainage and the Delaware River drainage have not yielded positive results. Testing and incidence levels are reported in Table 1 by K. Stark, Fish Health Specialist Pennsylvania Fish and Boat Commission.

Risk of spread: Within Pennsylvania risk of spread is high since existing regulations do not prevent transfer of many game fish species (includes black bass) that occur in a particular watershed from being move to another watershed where the species is also indigenous or naturalized.

Fish health testing and planning: In Pennsylvania testing is largely carried out on an as needed basis based upon observation or report of disease or anomalous conditions in/on fish or fish mortality. Broader more comprehensive testing is being discussed among staff.

Recommendations on measures to address identified issues: To prevent or delay spread of LMBV in Pennsylvania the PFBC has taken steps to (1) educate the public relative to occurrence of the disease, (2) educate staff relative to prevention or movement of aquatic exotics (including disease organisms), and (3) has and is providing guidelines to tournament anglers that outline disinfection procedures that prevent spread of LMBV. (Recommendations to Tournament anglers and Tournament hosts are attached, following references cited).

Additional management and research issues of importance to your agency regarding black bass: In Pennsylvania, in 2005 young-of-year smallmouth bass in the Susquehanna drainage were observed to exhibit disease and dead specimens were observed by anglers and brought to the attention of Agency personnel. Bacteriological examination and viral examination revealed evidence of columnaris disease as well as LMBV. Fish health experts at USFWS Lamar and the PFBC Fish Heath Specialist (K. Stark) concluded that the cause of mortalities was likely due to columnaris infection with 50% of a random sample of smallmouth bass young-of-year exhibiting systemic infection. Since, columnaris disease is stress mediated, a broad examination of environmental features which might cause stress was examined during a public forum where experts from the US Geological Survey, Pennsylvania Department of Environmental Protection, Pennsylvania Fish and Boat Commission, Susquehanna River Basin Commission, and Virginia Department of Inland Game and Fish spoke about fish stress and environmental conditions in 2005 (Austen 2006). A Fisheries Scientist from the New York Department of Environmental Conservation was also in attendance. The forum revealed that the summer of 2005 was the third warmest on record characterized by periods of consistent low flow. Nutrients such as total phosphorus, total nitrogen, suspended solids revealed no increasing trends. Water withdrawal and use within the basin was increasing with consideration for reserve storage. Daytime summer dissolved oxygen levels exhibited greater depression in 2005 compared to annual summer levels during the period of monitoring (1998-2005). In addition, pre-dawn dissolved oxygen levels, infrequently measured, exhibited sufficient depression to cause stress in warmwater fish. The precise cause of disease, or stressor, has not been identified, however the synergistic effects of low flow, very warm temperatures, and low dissolved oxygen levels, particularly in shallow water habitats inhabited by smallmouth bass young-of-the-year may have contributed to stress. The contribution of the 2005 year class to the smallmouth bass population in the Susquehanna drainage remains undetermined. The young of year index was above average when measured in the summer of 2005, however, the epizootic was occurring during measurement.

Austen, D. A. 2006. Susquehanna River Smallmouth Bass Workshop. Pennsylvania Angler and Boater. March/April 2006

Tournament Participant Check List:

► **If surface water temperatures are below 65º F (18.3º C):**

☐ Use the livewell fill pump to spray in fresh oxygen rich lake/river water at **regular intervals** in order to exchange the entire volume of your livewell during each pumping session.

► **If surface water temperatures are between 65º and 75º F (18.3-23.9º C):**

☐Use the livewell fill pump to **continuously** exchange your livewell's volume by spraying in fresh oxygen rich lake/river water.

► **If surface water temperatures are above 75º F (23.9º C):**

☐ Internally re-circulate aerated temperature-controlled water in your livewell, do not re-circulate your livewell with hot lake water (See Appendix for aeration outfit options).

☐ Add 8 pounds (2 half-gallon milk jugs) of block ice to a 30-gallon livewell every 3 hours (do not cool your livewell more than 10º F below lake water surface temperature).

☐ Add **non-iodized** salt to the livewell (1/3 cup per 5 gallons of livewell water). More salt will need to be added each time you follow the next step.

☐ Flush stale water (containing metabolic wastes) by replacing half of the livewell water every 2 hours with freshwater (avoid stagnant backwater, boat launches and shallow areas during exchange).

► **At every tournament:**

☐ Fill livewell to maximum capacity to reduce excessive sloshing (rear livewells experience less sloshing than forward livewells).

☐ Distribute fish evenly between your rear livewell compartments.

► **Hooks, in or out:**

If using a corrosion-resistant or specially coated hook (for example, bronzed, stainless steel, tin-cadmium, nickel):

☐ Every effort made to remove hooks using pliers, hemostat or hook remover with as little tissue damage as possible. Cut off the hooks from artificial lures to facilitate hook removal. (Cutting pliers can also be used to cut the barb and point, which allows the hook to be easily backed out).

If the hook cannot be removed:

☐Cut line above hook leaving a short piece of line. Cut off hooks from artificial lures when the lure cannot be extracted from the fish.

► **Released bass that float after capture from deep water:**

In Pennsylvania capture of bass from deep water typically occurs in a few deep water lakes (example: Lake Erie, Raystown Lake and Lake Wallenpaupack). Bass caught from deep water may experience difficulty in submerging and swimming normally due to an over-inflated swim bladder. Procedures exist to expel pressure from the swim bladder using a hypodermic needle. Since the procedure requires knowledge of the location of the swim bladder, injury and death to the fish can result if carried out improperly. Anglers interested in mastering this procedure should consult publications that detail proper application such as the B.A. S. S. publication "Keep Bass Alive" and apply the procedure only if they are comfortable that they will cause no harm to released bass. Studies have shown that when properly carried out, survival of deep water caught bass with over-inflated swim bladders is enhanced. In most Pennsylvania waters this condition will not be evident and the procedure will not be necessary. Remember, releasing fish alive and unharmed is a regulatory requirement in many situations.

► **Disinfection after the weigh-in process:**

To prevent "aquatic hitch hikers" and fish disease organisms from being moved from one water to another via boats and trailers, thoroughly clean both:

☐ Empty and thoroughly rinse fish holding and handling equipment at the site. Be sure to remove any aquatic plant debris from boat trailers and boats.

☐ Dead fish should be place in a cooler on ice for later consumption or properly disposed of when you return home. Dead fish should never be disposed of at any waste containers at the access area.

☐ Biological disinfection should be carried out by cleaning all fish holding and handling equipment. This can be accomplished by adding 1 cup of laundry bleach per 15 gallon livewell for one hour. CAUTION: This concentration is many times (20x) that of drinking water, can irritate skin and eyes and should not be used where splashing would allow this solution to get on skin or into eyes. Protective eyewear and gloves are recommended for persons involved in cleaning. The bleach solution should be circulated through livewell pumps for one hour while the boat is away from any waterway. Solution should be properly disposed of away from all waterways, plants and animals. Following cleaning, all equipment should be thoroughly flushed and rinsed from the system since corrosive action could affect valves and damage plastics parts. After thorough rinsing, allow equipment to dry completely. This cleaning and disinfection protocol has not been tested on all commercially available livewell equipment, and the disinfection protocol may damage some equipment. Therefore, check with the manufacturer prior to cleaning and disinfecting, and use these procedures at your own risk. Adopting this protocol ensures that organisms not visible to the naked eye will be eliminated from fish holding and handling equipment.

☐Never, Never move fish, aquatic plants, or any organism from one water to another. The potential to unintentionally introduce a nuisance aquatic species is too great.

Appendix

† You can retrofit your livewell with an *internally* re-circulating aeration system for under $30 (this is a must if the boat is moving or on the trailer).

‡ You can retrofit your livewell with an oxygen injection system that will maintain adequate oxygen levels in more extreme conditions. One system, which requires a pressurized cylinder, regulator, hoses, and an air stone, can be purchased for $300-$450.

Other systems use new proprietary electronic technology, cost less, but cannot be used with salt additives (see www.aquainnovationsinc.com). The Pennsylvania Fish and Boat Commission is aware of these systems, which we believe benefit survival of released bass. We have not tested or compared the effectiveness of these systems, interested anglers should review manufacture information to make informed decisions. Use of trade names does not constitute endorsement by the Pennsylvania Fish and Boat Commission.

-For more information please refer to: Gilliland, G., & H. Schramm. (2002). Keeping Bass Alive. B.A.S.S. Montgomery, AL. On line at: http://sports.espn.go.com/outdoors/bassmaster/news/story?page=b_cons_bass_alive_launch

Tournament Director Checklist:

► **Tournament organization:**

If tournament has over 50 participants:

- ☐ Structure weigh-in and departure times in small groups to avoid long waits at the weigh-in facility.

All tournaments:

- ☐ Structure departure and weigh-in time concisely to avoid long waits at the weigh-in facility.
- ☐ Penalize early and late arrivals.
- ☐ Limit the number of weigh-in bags (No more than 5 bags per 20 contestants or teams).
- ☐ Identify specific release locations and instructions (See Appendix)
- ☐ Prominently display surface water temperatures.

► **Choosing a good weigh-in site:**

- ☐ Contestants can walk from boats to weigh-in area in less than one minute.
- ☐ The site is close to a good release site: a low pier within a short walk, or situated near the live-release boat, truck or trailer (good water quality, adequate depth, low traffic area).
- ☐ The weigh-in site is shaded (a portable event tent or tarp is a good investment).
- ☐ The site allows room for spectators without interfering with the movement of contestants.

► **The weigh-in process:**

If the weigh-in facility uses a Life Support Tank:

- ☐ Weigh-in bags are strong, reinforced, **perforated**, and reusable plastic.

If the weigh-in facility does not use a Life Supply Tank:

- ☐ Weigh-in bags are strong, reinforced and reusable plastic with no holes. Fish must not remain in bags without holes for longer than one minute. Dissolved oxygen declines dramatically in un-perforated bags over a very short time period.

Life Support Tank(s) contain(s):

☐ 12V bilge pump used to circulate and aerate water (Simply holding perforated weigh-in bags in a tank does not insure exchange with fresh oxygenated water, contestants must be encouraged to scoop or dip fresh water into perforated bags).

☐ 1 pound of salt per 25 gallons of water (0.5% salt solution).

☐ At least 100 gallon capacity tank for every 20 contestants.

If the lake water temperature is 75º F (23.9º C) or cooler:

☐ Maintain the Life Support Tank at that temperature.

If the lake water temperature is above 75º F (23.9º C):

☐ Maintain the Life Support Tank temperature 5-10º F cooler than lake/river temperature, but not cooler (8 pound of block ice will cool 30 gallons of water about 10º F for 3 hours).

Handling of fish:

☐ Handle fish with wet hands.

☐ Minimize the handling of fish.

☐ Use a drainable fish weighing basket outfitted with a measuring board and plastic lid.

☐ Remove dead fish from the tournament site quickly and dispose of them properly.

☐ Slides set up to quickly return fish to the lake or river must contain a continuous flow of water to prevent injury to the fishes' skin.

► **Clean and Disinfect after the weigh-in process:**

To prevent "aquatic hitch hikers" and fish disease organisms from being moved from one water to another through fish holding devices:

☐ Empty and thoroughly rinse fish holding and handling equipment at the site. Be sure to remove any aquatic plant debris and dead fish from holding equipment.

☐ Dead fish should be place in a cooler or on ice for later consumption or properly disposed of when you return home. Dead fish should never be disposed of at any waste containers at the access area.

☐ Biological disinfection should be carried out by cleaning all fish holding and handling equipment. This can be accomplished by adding 1 cup of laundry bleach per 15 gallon livewell for one hour. CAUTION: This concentration is many times (20x) that of drinking water, can irritate skin and eyes and should not be used where splashing would allow this solution to get on skin or into eyes. Protective eyewear and gloves are recommended for persons involved in cleaning. The bleach solution should be circulated through livewell pumps for one hour while the boat is away from any waterway. Solution should be properly disposed of away from all waterways, plants and animals. Following cleaning, all equipment should be thoroughly flushed and rinsed from the system since corrosive action could affect valves and damage plastics parts. After thorough rinsing, allow equipment to dry completely. This cleaning and disinfection protocol has not been tested on all commercially available livewell equipment, and the disinfection protocol may damage some equipment. Therefore, check with the manufacturer prior to cleaning and disinfecting, and use these procedures at your own risk. Adopting this protocol ensures that organisms not visible to the naked eye will be eliminated from fish holding and handling equipment.

Appendix

† Gilliland and Schramm recommend a salt dip (3 percent solution, 3.5 pounds per 15 gallons of water) after weighing just prior to release. After weighing, bass are taken from the scale in the weigh-in basket, immediately submerged for 15 seconds in the dip and then immediately released.

‡ Release site should have good water quality and adequate depth, low traffic areas are recommended. Avoid releasing fish at the shoreline if possible.

For more information please refer to: Gilliland, G., & H. Schramm. (2002). Keeping Bass Alive. B.A.S.S. Montgomery, AL.
On line at: http://sports.espn.go.com/outdoors/bassmaster/news/story?page=b_cons_bass_alive_launch

4.10 Agency: Rhode Island Fish & Wildlife

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations: Year-round regulations, 12 inch minimum length, 5 fish daily limit.

Proposed seasonal regulatory changes: Not considering any changes at this time.

Rationale for existing regulations: Current regulations have been in effect for many years and there are no data available to suggest changes are warranted to improve black bass populations. Current regulations are consistent with the State of Massachusetts.

Fisheries Staff Opinion: Black bass populations appear to be stable Statewide. The overall condition and density of bass in RI waters is adequate.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: No testing done to date.

Status of LMBV in your State: Unknown

Risk of spread: Fisheries staff is concerned with the detection and spread of the virus in RI waters.

Fish health testing and planning: RI plans on testing selected systems in 2006 and has been coordinating with USFWS/Lamar Fish Health Center.

Recommendations on measures to address identified issues: As with the spread of invasive plant species, begin educating the general public about LMB virus and ways to prevent the spread of the disease.

Additional management and research issues of importance to your agency regarding black bass: Positive and negative effects of black bass populations with other species, including anadromous fish and carp species.

4.11 Agency: Vermont Fish and Wildlife Department

Committee Member:

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Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations:

Catch and Release Season – Statewide
Season: 2nd Sat. in April to Friday before 2nd Sat. in June
Gear Restriction: Artificial lures and flies only
Creel Limit: All bass must be Immediately released

Regular Season – Statewide
Season: 2nd Sat. in June to Nov. 30
Creel Limit: 5 bass
Length Limit: 10" minimum

Ice Fishing Season
Season: 3rd Sat. in January to March 15
Creel Limit: 5 bass
Length Limit: 10" minimum
Locations: Not Statewide but only on specific lakes

Proposed seasonal regulatory changes: None

Rationale for existing or proposed changes: Regular Season and minimum length was created a long time ago. The catch and release season was created in the 1991 for a number of reasons. First it appeared that the season would have limited impacts on the fisheries because recruitment in most of our lakes was not limited. By using the artificial only portion of the regulation it intended to reduce hooking mortality which is often caused by bait fishing. There appeared to be only a limited amount of biological concerns and there was strong public support for the season.

Ice Fishing Season – In 1966 a few lakes were selected to evaluate winter ice fishing for trout, salmon and bass. The program was well received by anglers. After the evaluation a winter ice fishing season for bass was established on many of Vermont large inland Lakes.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: Sampling for LMBV in the Start of Vermont started in 2002. All testing was performed by USFWS, Lamar Fish Health Unit using cell culture for the primary screening for the virus.

Since the start of the testing, largemouth bass, from 2 out of 12 locations sampled, tested positive for LMBV (see Table 2). Through standard necropsy procedures, no clinical signs of LMBV were witnessed in any of the fish collected.

Status of LMBV in your State: See attached Table 2.

Risk of spread: The risk of the virus continuing to spread is high considering the growing popularity of bass fishing. It appears that larger bass waters that host tournaments tend to be infected while smaller bodies of water sampled have tested negative for largemouth bass virus in Vermont.

Published studies in other regions have demonstrated:

- ➢ In the natural environment, high water temperatures increase LMBV associated mortality.

- ➢ In live wells, confinement and high water temperatures show increase prevalence and mortality of LMBV with respect to tournament caught fish from infected waters.

- ➢ LMBV can survive for at least 72 hours without water

Controlling these factors during tournaments may reduce viral transmission and or fish mortality (see 2.5 below).

Fish health testing and planning: To access the current distribution of LMBV, Vermont plans to continue sampling waters that haven't been sampled to date. Previous positive waters may also be sampled.

Recommendations on measures to address identified issues:
1) To Reduce Spread

a) Do not transfer bass or any fish to other water bodies even though the new water body may also be LMBV positive.

In regard to all fish importations into or liberations and transfers within a State, whether they be from a facility to a facility, a facility to a water body or between water bodies, the source fish culture facility or water body should possess a fish health inspection report issued by a fish health inspector indicating that three (3) annual inspections of the fish lot(s) on the facility or water body have been free of LMBV.

b) Boats, trailers and all equipment should be thoroughly cleaned between water bodies, preferably on site when the boat is removed from any particular water body, or off site away from and before entering a different water body.

c) LMB virus can survive for at least 72 hours dry. Live wells should be disinfected. A disinfecting bleach solution of one (1) ounce of standard household liquid bleach per gallon of water (~400ppm) should be sprayed inside the live well to fully saturate all interior surfaces. Allow solution to stand for a minimum of 15 minutes before thoroughly rinsing the live well. CAUTION: Chlorine is extremely toxic to aquatic life. Treated water should be disposed of in a manner that will not impact the environment.

2) To reduce LMB virus prevalence and mortality in tournament caught fish:

a) Temperature and confinement tend to show increase prevalence and mortality of LMB virus with respect to tournament caught fish. As a standard, maintain live well temperature at 76 degrees Fahrenheit or below.
b) A recommendation should be made that tournaments not be held or paper tournaments be held when water temperatures exceed 80 degree Fahrenheit.

B.A.S.S organization has recommendations entitled “Keeping Bass Alive”. This information addresses many topics relevant to handling bass during tournaments. http://sports.espn.go.com/outdoors/bassmaster/index

Additional management and research issues of importance to your agency regarding black bass:

None provided.

4.12 Agency: Virginia Department of Game and Inland Fisheries

Committee Member: John Odenkirk, 1320 Belman Road, Fredericksburg, VA 22401. 540-899-4169 x117, John.Odenkirk@dgif.Virginia.gov.

Charge 1: Examine the biological and management justifications and implications of seasonal black bass fishing closures in the Northeast.

Existing black bass seasonal regulations in Virginia: None, with the exception of tidal Potomac River tributaries for consistency (ease of enforcement with overlapping jurisdictions) with Maryland's tidal Potomac black bass seasonal restriction of "No bass less than 15" from March 1 through June 15".

Proposed seasonal regulatory changes: None.

Rationale for existing or proposed changes: None needed.

Fisheries Staff Opinion: Staff agrees that most variability in black bass populations can be traced to environmental factors (e.g., flow regimes) rather than angler behavior. It is believed seasonal closures or restrictions would have minimal impact, if any, on bass populations while simultaneously restricting legitimate angling activity and adding unneeded regulations to an existing array of creel and harvest restrictions.

Charge 2: Largemouth bass virus

Known occurrences of LMBV: Refer to Appendix B.

Status of LMBV in your State: We recognize LMBV has been documented in Virginia at low levels in several waters, but we have not attributed any fish kills to LMBV.

Risk of spread: At this point, staff opinion is that risk of spread is moderate, based on the level of tournament activity and the proclivity of bass anglers to fish multiple waters within short time periods. However, based on data which show LMBV prevalence existing at low levels across Virginia, the lack of fish kills attributed to LMBV, the topic has taken a lower priority over the past two years.

Fish health testing and planning: Currently, no future plans.

Recommendations on measures to address identified issues: None being considered at this time.

Additional management and research issues of importance to your agency regarding black bass: Continuing to evaluate special regulations (e.g., restrictive slot limits and trophy regulations) on waters that retain a consumptive or harvest component to the bass fishery. Evaluating the genetic composition of the State's bass fisheries and investigating correlations between FL allele composition and trophy bass abundance including F1 stocking in small impoundments to alter genetic composition. Further identifying factors which contribute to successful year classes, and refining models which predict year class strength. Evaluating supplemental stocking in cases where year class failures may impact future angling success. Identifying tournament impacts to bass populations (quantifying tournament mortality as a component of fishing morality and assessing population-level impacts).

4.13 Agency: West Virginia Division of Natural Resources

Committee Member:

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CHARGE 1: EXAMINE THE BIOLOGICAL AND MANAGEMENT JUSTIFICATIONS AND IMPLICATIONS OF SEASONAL BLACK BASS FISHING CLOSURES IN THE NORTHEAST.

Existing Black Bass Seasonal Regulations:

Statewide

No Closed Season:
No Gear Restriction:
No Minimum Size Limit:
Creel Limit: 6 in aggregate (largemouth, smallmouth, spotted)

Special Regulations

1. 12-inch minimum, 5 fish per day creel limit: Jennings Randolph Lake (w/MD)

2. Catch-and Release:
   Lakes (<500 acres): Dunkard Fork, Elk Fork, Kimsey Run, Millers Fork, North Bend, O'Brien, Rockhouse, Tuckahoe, Upper Mud
   Lakes (>500acres): Stonewall Jackson
   Rivers: New River: 12-mile section
   South Branch of Potomac River: 17.5 mile section

3. Minimum 12-inch Size Limit:
   Lakes (<500 acres): Barboursville, Chief Logan, Conaway Run, South Mill Creek
   Lakes (>500acres): Beech Fork
   Rivers: Wheeling Creek

4. Slot Limit:
   Lakes (>500acres): East Lynn 12-16 inch must be released
   Rivers: Greenbrier River 12-16 inch must be released, but only 1 black bass > 20 inches may be harvested.

Proposed seasonal regulatory changes: 2005 Seasonal Catch and Release on the Ohio River (April 1-May 31st), Not implemented

Rationale for existing regulations:

Statewide: Harvest of black bass (largemouth, smallmouth and spotted bass) was historically encouraged and not thought as a problem with maintaining a fishable population.
Catch and Release: Most of the water bodies with a catch and release regulation were fairly new when the regulation was enacted and the belief was that black bass could potentially be over harvested. Several are now older than 10-20 years and regulations have become well-entrenched.
Other Special Regulations: Most were the result of concern from a special interest and a desire to improve the size-structure of the black bass population.

Rationale for proposed regulations: The Ohio River black bass population has experienced extremely variable recruitment and a general decline. Angling success also has been variable, but has been in decline over the last 10-15 years. Several natural environmental conditions have been suspected including spring water levels and river discharge. In addition, the Ohio River has been greatly modified for navigational use and is now a series of connected pools with locks and dam complexes. Associated with the creation of a more lotic system has been the well-documented aging of the typical reservoir-like system, as well as the associated deterioration of embayments and backwater habitat due to sedimentation and water quality problems. Most small to medium size embayments have evolved into wetland type habitat and are not suitable for black bass spawning and nursery activities. The few large embayments that have remained viable are heavily fished during the spring and early summer. Competitive and non-competitive anglers also have reported the movement (in access of 25-miles and through multiple locks and dam complexes) of up to 60% of black bass caught prior to release. It is extremely unlikely that these black bass return to their native pool. The rationale for this proposed regulation was to limit the time that black bass were removed from a potential nest in light of the reduced and limited available spawning habitat which are targeted by anglers. In addition, it was proposed to reduce the inter-pool movement of black bass during periods of high angling activities.

CHARGE 2: LARGEMOUTH BASS VIRUS

Known occurrences of LMBV: Sampling for LMBV was initiated in 2002. Since then one wild population (1 of 13) has been found to have LMBV (Table 3). In addition, hatchery-reared largemouth bass acquired from another State were found to be LMBV positive. These fish were initially stocked prior to the knowledge of the presence of LMBV, but other cohorts were destroyed once LMBV was detected.

Risk of spread: The risk of LMBV to spread in West Virginia waters is considered high. Many surrounding States have reported the presence of LMBV and many anglers frequently fish in adjacent States. In addition, commercially hatchery-reared largemouth bass are transported and sold for stocking into private ponds.

Fish health testing: Largemouth bass will be tested prior to the acceptance from other State or federal warmwater hatchery facilities. Black bass broodstock source will be tested every two-years. Hatchery-reared largemouth bass will be tested annually and prior to stocking. Wild populations from popular water bodies will be tested on a three-year schedule. Testing will only occur if USFWS laboratory are agreeable to perform assessments. WVDNR does not have capabilities to perform tests.

Recommendations on measures to address identified issues:

1) To reduce spread

- a) Insure LMBV free black bass in any stocking program.
- b) Educate anglers in the proper techniques to reduce the risk in spreading LMBV.
- c) Educate tournament directors in the proper techniques to reduce the risk in spreading LMBV.
- d) Control the movement of LMBV positive largemouth bass from commercial facilities.

2) Increased testing and monitoring

- a) Ensure that reputable laboratory facilities are maintained to conduct testing.
- b) To develop a non-lethal testing technique.
- c) To provide an understanding of the techniques and testing requirements.
- d) To encourage all States to participate in a monitoring program.

Additional management and research issues of importance to your agency regarding black bass:

1) Increase understanding of delayed mortality in tournament-caught fish in more northern water bodies. Most studies are either model-based or from southern or western water bodies.
2) Increased understanding of spawning potential and the interaction of spawning success with recruitment to a fishery in either seasonal or habitat limited environments.
3) Increased understanding of the interactions of black bass with other predators (i.e. percids and esocids).
4) Increased understanding of over winter habitat requirements in large riverine systems.
5) Increased understanding of other fish health issues potentially affecting black bass and other fish populations.
6) An understanding and educational tool to represent the “realistic” black bass fisheries in northern water bodies as compared to other more warmwater systems (i.e. Can Northeast systems produce a black bass fishery compatible to a southern reservoir).

7) An educational tool to explain why LMBV testing and control is important.
8) An educational tool to explain why black bass regulations are important and when these regulations are appropriate.

4.14 Agency: U.S. Fish and Wildlife Service, Lamar Fish Health Center

Committee Members:

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Status of Wild Fish Health Testing Program

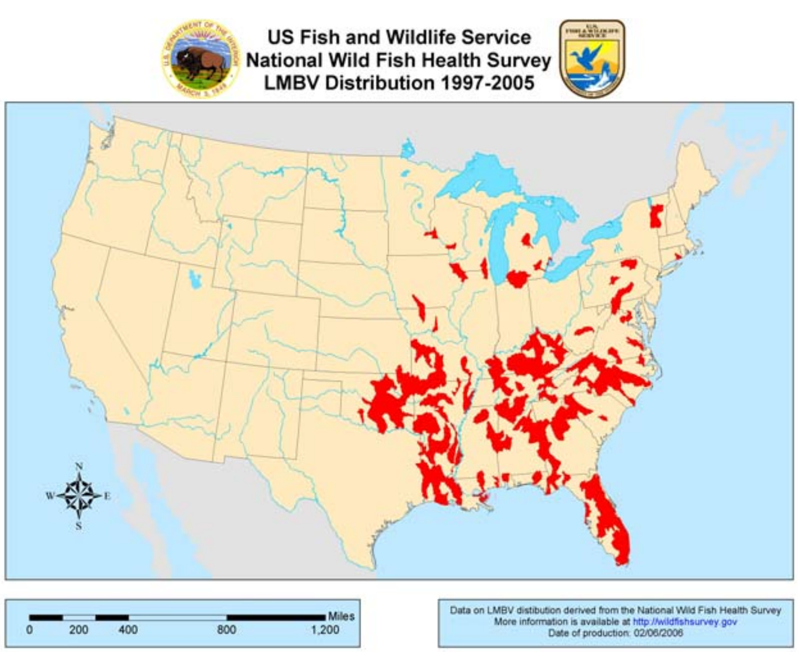
Operating within the National Wild Fish Health Survey (Survey), the Lamar Fish Health Center is able to cooperate with federal, State, tribal, and local agencies sampling fish within their jurisdictions. By establishing and maintaining these partnerships, the Fish and Wildlife Service maximizes efforts in pathogen and parasite analysis rather than sample collection. This collaboration also allows the Survey to be partnership driven, that is sampling occurs in an area of interest and on a species of concern, rather than a simple inventory.

The National Wild Fish Health Survey continues to get specific funding since it's inception in 1997. This year, fiscal year 2006, is no exception and Lamar is willing and able to run assays for LMBV as well as other pathogens listed in the Survey.

Most current known distribution of LMBV on a national scale

Initially, LMBV was a "pathogen of regional concern" in the National Wild Fish Health Survey. Now, as more is known about the range of the virus, it is listed nationally, with all nine Service Fish Health Centers conducting investigations.

Compliments of the Survey database coordinator, Joshua Bradley, distribution of LMBV plotted on a national map appears below:



Current testing protocols

The adopted standardized laboratory methods for isolating and identifying LMBV can be found in the USFWS-AFS/FHS Standard Procedures for Aquatic Animal Health Inspections, available on the Internet. Simplified these involve collection of kidney/spleen/swim bladder tissues which are homogenized and assayed on fathead minnow (FHM) or bluegill fry (BF-2) cells at 20-25^0 C for 14 days, followed by a repeat assay (blind passage) for another 14 days. Suspicious findings require molecular testing of cell culture fluids for LMBV DNA (PCR test). Although frozen fish carcasses can be utilized, fresh samples on ice are best.

National Wild Fish Health Survey Database

After experiencing technical difficulties with the data entry, the database has been revised, updated in a new format. Lamar (and other Fish Health Center) data will soon be updated. As a standard adopted rule with partners participating in the Survey, results will be provided to those providing the samples and entered into the database 30 days later.

Recommendations

As we continue to learn more about the disease and the FHC continues to receive funding for the Survey, it is recommended that interested partners continue (or start) to provide samples from free ranging centrarchids for LMBV testing. Data available on the Survey Database website should be utilized by resource agency managers to further assess regulatory and other actions that may help to minimize effects of pathogens in free ranging species as well as prevent the spread of a particular disease, such as LMBV.

5.0 Special Black Bass Session at the 62nd Annual Northeast Fish and Wildlife Conference, Burlington, Vermont

A special Black Bass Session was organized for the 62nd Annual Northeast Fish and Wildlife Conference in Burlington, Vermont (April 24 and 25, 2006). Committee members agreed on the topics for oral presentations that would address important aspects of seasonal black bass fishery closures and largemouth bass virus. A number of committee members came forward to present information specific to the Northeast region and several key outside experts were identified for invitations to speak (Table 3). Abstracts for the oral presentations are in Appendix E.

Table 3. Speaker schedule for Special Black Bass Session at the NEFWC.

Time	Title	Presenter
	Monday, April 24	
3:00-3:20	The utility and use of spring seasonal black bass fishery restrictions in the Northeast United States	Ken Sprankle, *USFWS Federal Assistance*
3:20-3:40	Managing a highly dynamic black bass fishery in a large riverine system	Chris O'Bara, *WV DNR*
3:40-4:00	Recent changes in fishing season regulations for black bass in Michigan	Jim Breck, *MI DNR*
4:00-4:20	Early opening of black bass fishing seasons in New York State: A review of issues and available data	James (Randy) Jackson, *Cornell University*
	Tuesday, April 25	
8:20-8:40	A review of largemouth bass virus	Andy Noyes, *NY DEC*
8:40-9:00	Detection of LMBV in the United States – USFWS National Wild Fish Health Survey and other findings	Patricia Barbash, *USFWS Lamar FHU*
9:00-9:20	Detection of LMBV in the Northeastern United States – USFWS National Wild Fish Health Survey and other findings	Patricia Barbash, *USFWS Lamar FHU*
9:20-9:40	The relation of LMBV to largemouth bass population metrics in five Alabama reservoirs	Mike Maceina and John Grizzle, *Auburn University*
9:40-10:00	Live-release largemouth bass tournaments in the largemouth bass virus zone	Hal Schramm et al., *USGS Coop. Unit, MS State University*

Three speakers from outside the Northeast region were identified as important experts on the topic of spring season regulations and their evaluation (Jim Breck, MI DNR Fisheries Research Biologist) and largemouth bass virus (Hal Schramm, USGS, MS State University and Mike Maceina, Auburn University). These three invited speakers were only able to attend the conference due to a generous grant from the Northeastern Division of the American Fisheries Society (AFS-NED). The AFS-NED awarded a $3,000 grant to cover all the costs of these invited speakers to attend and participate in the Special Black Bass Session and the scheduled technical committee meeting. The Committee greatly appreciates the financial support provided by the AFS-NED.

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Appendix A

Northeast Black Bass Technical Committee members, invited speakers, and associates

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Appendix B. The results of largemouth bass virus testing for Northeast States are shown here. Results include all test results from the USFWS Wild Fish Health Survey and Cornell University. The State of Maine has conducted other tests for LMBV in waterbodies not shown in this table, all of which have tested negative for LMBV.

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
CT	Pattaconk Lake	10/5/05	Connecticut River	20	22.5-37.5	No	n/a	Lamar FHC	Cell culture	Negative
CT	Amos Lake	11/1/05	Thames River	20	20.8-42.0	No	n/a	Lamar FHC	Cell culture w/ PCR Confirm	Positive in 6 of 20 samples
MA	Charles River	8/24/05		10	Adult	No		Lamar FHC	Cell Culture[B]	All Negative
MD	Potomac River-Shepardstown	8/22/05	Potomac River	21 smallmouth 10 redbreast sunfish 13 redhorse suckers	10- 25 10-15 15-30	No		Lamar FHC	Cell culture w/PCR confirmation	Positive: 4 of 5 smallmouth bass, 1 of 3 redbreast sunfish
MD	Potomac River-Shepardstown	10/04	Potomac River	16 smallmouth bass		No	n/a	Lamar FHC	Cell Culture[B]	All Negative
MD	Potomac (Charles Co.) + Susquehanna	Brood stock collected	Potomac and Susquehanna Rivers	60 largemouth bass hatchery		No		Lamar FHC	Cell Culture[B]	All Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
	Flats	April 2002		fingerlings from wild brood						
MD	St. Marys Lake	2002	Potomac	60 largemouth	Adults and yearling	No		Lamar FHC	Cell Culture[B]	All Negative
MD	Loch Raven Reservoir	2002	Gunpowder	60 largemouth	Adults and yearling	No		Lamar FHC	Cell Culture[B]	All Negative
MD	Potomac River Charles Co	1999	Potomac	26 largemouth	Adults	No		Lamar FHC	Cell Culture[B]	All Negative
MD	Susquehanna River, Conowingo Dam	4/29/99	Susquehanna	10 largemouth 10 smallmouth	Adults	No		Lamar FHC	Cell Culture[B]	All Negative
MD	Susquehanna River, Conowingo Dam	5/9/2000	Susquehanna	10 smallmouth 10 rock bass	Adults	No		Lamar FHC	Cell Culture[B]	All Negative
MD	Susquehanna River, Conowingo Dam	5/1/2001	Susquehanna	4 rock bass 1 bluegill 2 redbreast sunfish 5 smallmouth 1 largemouth	Adults	No		Lamar FHC	Cell Culture[B]	All Negative
ME	Annabessacook Lake	5/1/06 8/1/06	Kennebec	5 30	25-30 30-40	Yes No	50 (25-40cm)	ME IFW	Cell Culture[B]	All Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
NH	Lake Winnipesaukee	6/23/02		6 smallmouth 10 redbreast sunfish 6 largemouth 4 pumpkinseed 5 bluegill 9 bl. crappie 7 pickerel 10 y. perch	Adults	No		Lamar FHC	Cell Culture[B]	All negative
NH	Rockwood Lake	6/30/99		8 largemouth	Adults	No		Lamar FHC	Cell Culture[B]	All negative
NH	Spofford Lake	5/24/00 & 6/27/00		10 rock bass 5 pumpkinseed 30 bluegill 20 smallmouth	Adults	No		Lamar FHC	Cell Culture[B]	All negative
NY [A]	Cayuta Lake	2004		5	adult	No		CU	Cell culture	Negative
NY	Oneida Lake	2004		18	adult	No		CU	Cell culture Q-PCR	Negative 1+/18
NY	Tully Lake	2004		3	adult	No		CU	Cell culture	Negative
NY	Hyde Lake	2004		5	adult	No		CU	Cell culture Q-PCR	Negative 1+/5
NY	Clear Lake	2004		5	adult	No		CU	Cell culture	Negative
NY	Red Lake	2004		5	adult	No		CU	Cell culture	Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
NY	Saratoga Lake Saratoga Lake	2004 2004		4 4	adult	No		CU	Cell culture Q-PCR	Negative 4+/4
NY	Round Lake	2004		5	adult	No		CU	Cell culture	Negative
NY	Jamesville Reservoir	2004		2	adult	No		CU	Cell culture	Negative
NY	Cayuta Lake (2nd Sample)	2004		3	adult	No		CU	Cell culture	Negative
NY	Lake Erie	2004		7	adult	No		CU	Cell culture	Negative
NY	Silver Lake	2004		10	adult	No		CU	Cell culture	Negative
NY	Canadarago Lake	2004		9	adult	No		CU	Cell culture	Negative
NY	Chautauqua Lake	2004		10	adult	No		CU	Cell culture	Negative
NY	Conesus Lake	2005		5	Adult	No		CU	Q-PCR	Negative
NY	Oneida Lake	2005		13	Adult	No		CU	Q-PCR Cell Culture	7+/13 0+/13
NY	Eaton Brook Reservoir	2005		5	Adult	No		CU	Q-PCR Cell Culture	5+/5 0+/5
NY	Buffalo River	2005		15	Adult	No		CU	Q-PCR Cell Culture	3+/15 2+/15
NY	Niagara River	2005		13	Adult	No		CU	Q-PCR	0+/13
NY	Seneca River	2005		7 smallmouth	Adult	No		CU	Q-PCR Cell Culture	6+/7 2+/7

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
NY	Hudson River, Coxsackie	9/98 & 10/99	Hudson	3 largemouth 48 striped bass 2 bluegill 23 pumpkinseed 4 smallmouth 45 wh. perch	Adult	No		Lamar FHC	Cell Culture[B]	Negative
NY	Hudson River, Poughkeepsie to Newburg	10/9/02	Hudson	30 striped bass 15 bluegill 3 smallmouth 1 pumpkinseed	Adult	No		Lamar FHC	Cell Culture[B]	Negative
PA	Lackawaxen River	7/25/01		5 smallmouth 5 bluegill 10 pumpkinseed 10 rock bass 2 pickerel	Mixed	No		Lamar FHC	Cell Culture[B]	Negative
PA	Blue Marsh Lake	08/19/1998	Delaware	3	n.a.	Yes	n.a.	Lamar FHC	Cell Culture[B]	Negative
PA	Pymatuning Sanctuary	05/10/2004	Ohio	15	n.a.	No	n.a.	Lamar FHC	Cell Culture[B]	Negative
PA	Sayre Dam	06/16/2004	Susquehanna	5 black crappie	n.a.	Yes	n.a.	Lamar FHC	Cell Culture[B]	Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
PA	Juniata River	07/11/2005	Susquehanna	15 smallmouth	4.5-8.0	Yes	n.a.	Lamar FHC	Cell Culture[B] w/PCR confirmation	Positive: 3 of 3, 5-fish tissue pools
PA	Sayre Dam	08/12/2005	Susquehanna	5	9.0	Yes	n.a.	Lamar FHC	Cell Culture[B] w/PCR confirmation	Positive: 1, 5-fish tissue pool
PA	Sayre Dam	08/12/2005	Susquehanna	3 yellow Perch	8.0-9.0	Yes	n.a.	Lamar FHC	Cell Culture[B]	Negative
PA	Susquehanna River	08/17/2005	Susquehanna	15 smallmouth	5.0-10.0	Yes	n.a.	Lamar FHC & Auburn University	Cell culture w/PCR confirmation	Positive: 15 of 15
PA	Susquehanna River	09/14/2005	Susquehanna	3 smallmouth	38.0-40.5	Yes	n.a.	Lamar FHC	Cell culture	Negative
PA	Allegheny River	09/20/2005	Allegheny	30 smallmouth 3 Spotted Bass	7.2-21.5 10.4-19.5	No	n.a.	Lamar FHC	Cell Culture[B]	Negative
PA	Delaware River	09/22/2005	Delaware	35 smallmouth	6.9-25.0	No	n.a.	Lamar FHC	Cell Culture[B]	Negative
PA	Sayre Dam	10/23/2005	Susquehanna	2	n.a.	Yes	n.a.	Lamar FHC	Cell culture w/PCR confirmation	Positive, 2 of 2
VA	Mataponi River	5/18/99		35 striped bass	Adult	No		Lamar FHC	Cell Culture[B]	Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
VA	South Holston Lake	8/21/01		60	Mixed	No			Cell culture w/PCR confirmation	Positive: 1 of 60
VA	Claytor Lake	8/22/01		60	Mixed	No			Cell culture w/PCR confirmation	Positive: 4 of 60
VA	Kerr Reservoir	8/22/01		60	Mixed	No		Lamar FHC	Cell culture w/PCR confirmation	Positive: 1 of 60
VA	Smith Mountain Lake	8/22/01		60	Mixed	No		Lamar FHC	Cell culture	Negative
VA	Briery Creek off Rt 15	8/22/01		60	Mixed	No		Lamar FHC	Cell culture	Negative
VA	Chickahominy River	8/27/01		60	Mixed	No		Lamar FHC	Cell culture	Negative
VA	Occoquan Reservoir	8/28/01		60	Mixed	No		Lamar FHC	Cell culture w/PCR confirmation	Positive: 1 of 60
VA	Nottaway River, Courtland	8/28/01		28	Mixed	No		Lamar FHC	Cell culture	Negative
VA	Chesdin Lake	8/28/01		60	Mixed					

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
VA	Lake Anna	8/29/01		36	Mixed	No		Lamar FHC	Cell culture	Negative
VA	Shenedoah River	9/4/01		60	Mixed	No		Lamar FHC	Cell culture	Negative
VA	Lake Robertson	9/4/01		28	Mixed	No		Lamar FHC	Cell culture	Negative
VA	James River	10/30/01	James River	140	Mixed	No		Lamar FHC	Cell Culture[B]	Positive: 3 of 28 pools
VA	S. Fork Shenandoah River	6/4/05 & 3/30/06	Shenandoah	28 smallmouth 15 largemouth 23 redbreast sunfish	Adult	No		Lamar FHC	Cell Culture[B]	Negative
VA	N. Fork Shenandoah River	3/26/06	Shenandoah	20 smallmouth 10 largemouth 10 redbreast sunfish	Adult	No		Lamar FHC	Cell Culture[B]	Negative
VA	Shenandoah River Mainstem	3/31/06	Shenandoah	20 smallmouth 10 largemouth 10 redbreast sunfish	Adult	No		Lamar FHC	Cell Culture[B]	Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
VA	Cowpasture River	3/27/06	Shenandoah	10 rock bass 10 redbreast sunfish 20 smallmouth	Adult	No		Lamar FHC	Cell Culture[B]	Negative
VT	Baker Pond	6/3/04	Dog River	10	n/a	No		Lamar FHC	Cell Culture[B]	Negative
VT	Lake Fairlee	6/9/04	Ompompanoosuc River	10	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Wrightsville Reservoir	6/9/04	Winooski River	1	n/a	No		Lamar FHC	Cell Culture	Negative
VT	Dewey's Pond	6/10/04	Ompompanoosuc River	60 pumpkinseed	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Bristol Pond	8/4/04	Lewis Creek?	17	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Lake St. Catherine	8/10/04	Poultney River	5	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Kent Pond	8/23/04	Ottauquechee River	10	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Baker Pond	10/26/04	Dog River	60 pumpkinseed	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Bristol Pond	5/7/05	Lewis Creek?	19	n/a	No		Lamar FHU	Cell Culture[B]	Negative
VT	Lake Bomoseen	5/29/02	Poultney River	10 10 Smallmouth	Adult	No		Lamar FHC	Cell Culture	Negative Negative

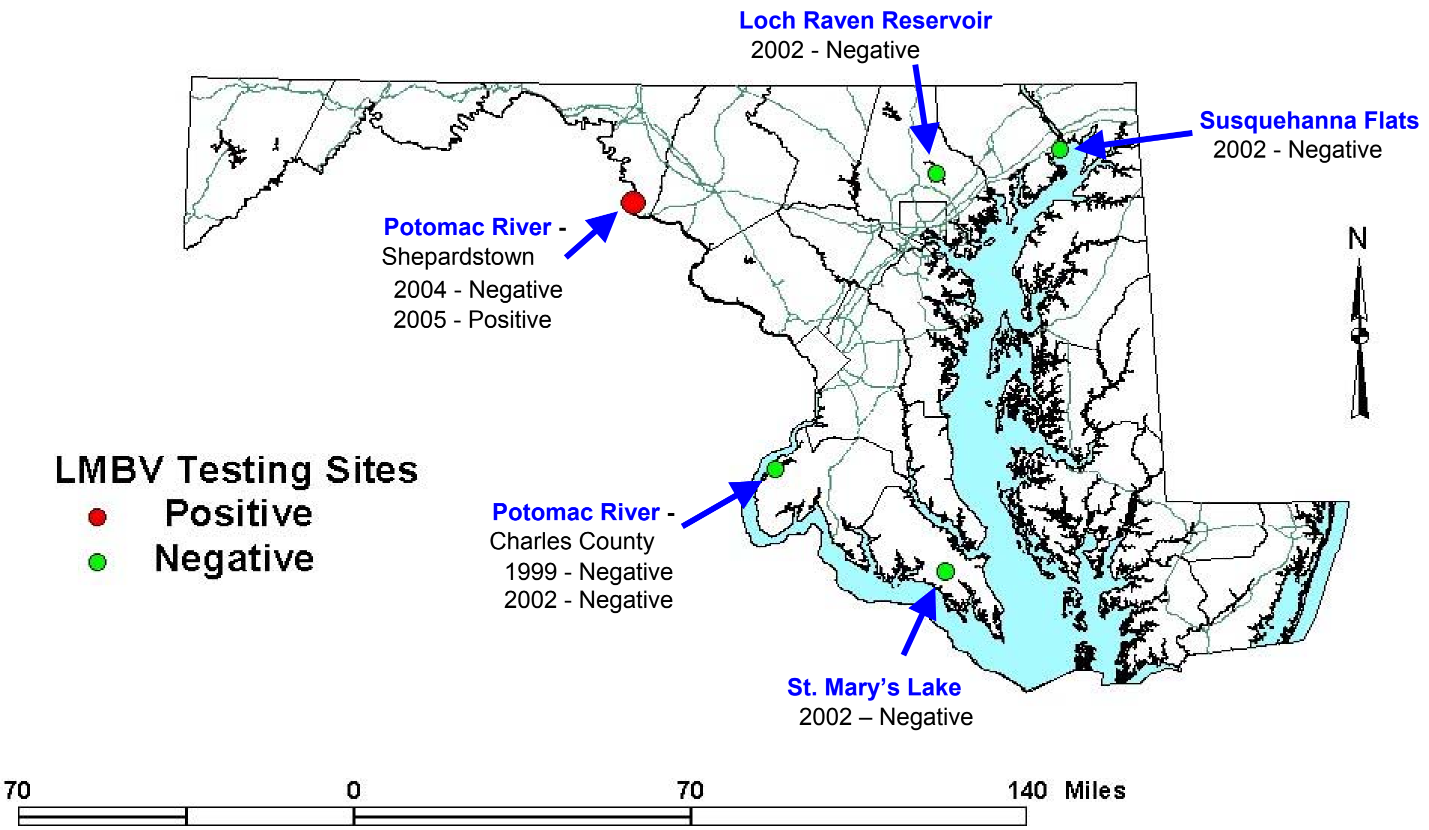
State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
VT	Lake Champlain - Mallets Bay	8/26/02	Lake Champlain	20	Adult	No		Lamar FHC	Cell Culture	Positive
VT	Lake Champlain - Crown Point	9/16/02	Lake Champlain	9	Adult	No		Lamar FHC	Cell Culture	Positive
VT	Lake Hortonia	7/8/03	Negative	11	Adult	No		Lamar FHC	Cell Culture	Negative
VT	Lake Champlain - Chittenden County	9/18/03	Lake Champlain	15 15 Smallmouth	Adult	No		Lamar FHC	Cell Culture	Negative Negative
VT	Lake St Catherine	7/15/03	Negative	15	Adult	No		Lamar FHC	Cell Culture	Positive
VT	Stoughton Pond	5/27/04	Black River	15	Adult	No		Lamar FHC	Cell Culture	Negative
VT	Lake Morey	6/2/04	Connecticut River	11	Adult	No		Lamar FHC	Cell Culture	Negative
WV	Monongahela River	9/2003	Ohio River	30 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	East Lynn Reservoir	9/2003		30 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	Upper Mud Lake	9/2003		30 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	Mt. Storm Reservoir	10/2003		25 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	Stonewall Jackson Reservoir	6/2004		20 largemouth				Lamar FHU	Cell Culture[B]	Negative

State	Water body	Date(s)	Major drainage basin	Sample Size (largemouth bass unless otherwise noted)	Fish size range (cm)	Mort Y/N	Mort #'s & Size	Testing Facility	Test type	Results Pos. or Neg.
WV	Cheat Reservoir	6/2004		30 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	Sutton Reservoir	6/2004		30 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	Summerville Reservoir	6/2004		30 largemouth				Lamar FHU	Cell Culture[B]	Negative
WV	WV DNR Hatchery System	2005	Ohio River	60 largemouth	Juvenile	Yes		Lamar FHU	Cell Culture/PCR confirmation	Positive

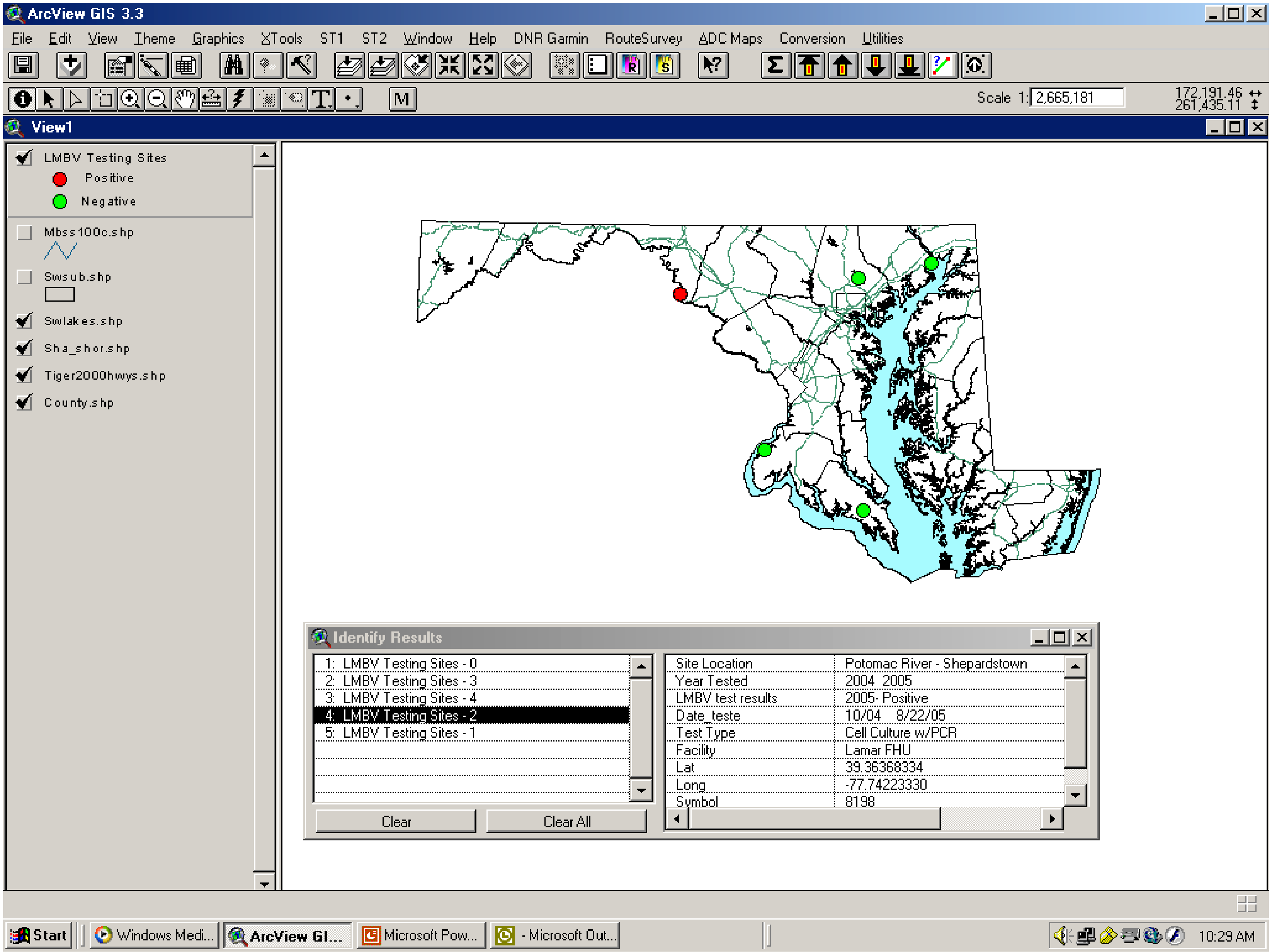
[A] Samples were tested by the Aquatic Animal Health Program, College of Veterinary Medicine, Cornell University. Samples were first tested by Quantitative-PCR. If they were Q-PCR positive, they were then tested by cell culture.

[B] Samples were pooled up to five fish per pool for cell culture assay. Fish were not assayed individually (Lamar FHC).

Maryland Largemouth Bass Virus Testing Sites



Appendix C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File Edit View Theme Graphics XTools ST1 ST2 Window Help DNR Garmin RouteSurvey ADC Maps Conversion Utilities
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172,191.46
261,435.11
View1
LMBV Testing Sites
Positive
Negative
Mbss100c.shp
Swsub.shp
Swlakes.shp
Sha_shor.shp
Tiger2000hwys.shp
County.shp
Identify Results
1: LMBV Testing Sites - 0
2: LMBV Testing Sites - 3
3: LMBV Testing Sites - 4
4: LMBV Testing Sites - 2
5: LMBV Testing Sites - 1
Clear
Clear All
Site Location | Potomac River - Shepardstown
Year Tested | 2004 2005
LMBV test results | 2005- Positive
Date_teste | 10/04 8/22/05
Test Type | Cell Culture w/PCR
Facility | Lamar FHU
Lat | 39.36368334
Long | -77.74223330
Symbol | 8198
Start
Windows Medi...
ArcView GI...
Microsoft Pow...
Microsoft Out...
10:29 AM

Potomac River - Shepardstown

Date tested: 8/22/2005
Species: 21 smallmouth bass (10-25cm)
10 redbreast sunfish (10-15cm)
13 redhorse suckers (15-30cm)
Testing facility: Lamar FHU
Test type: Cell culture w/PCR confirmation

Results: **Positive** in 4 of 5 smallmouth bass, 1 of 3 redbreast sunfish, and 0 of 3 redhorse sucker samples.

Date tested: 10/2004
Species: 16 smallmouth bass
Testing facility: Lamar FHU
Test type: Cell culture

Results: **Negative**

Appendix D

Sampling for the Presence of Largemouth Bass Virus

John Sweka and Trish Barbash
U.S. Fish & Wildlife Service, Northeast Fishery Center, Lamar, PA

The following is an analysis of existing largemouth bass virus (LMBV) data and recommendations for future sampling intended to determine if the virus is present in a given waterbody.

Presence/Absence of a Pathogen: Determining whether a pathogen, such as LMBV, is present within a fish population is a common sampling objective for managers and fish health experts. The probability of detecting a pathogen within a population is a function of the proportion of the fish in the population that carry the pathogen and the number of fish that are sampled from the population. In general, as the prevalence of the pathogen increases within the population, fewer samples need to be taken in order to detect it within the population (Figure 1).

The null and alternative hypotheses being tested are: H_o: $p = 0$ versus H_a: $p > 0$. The null hypothesis is rejected when 1 or more infected fish are found in the population, thus the proportion of infected fish within the population is greater than 0. The appropriate number of sample to take to test the above hypotheses is given by the equation:

$$n = \log(\mathbf{1} - Power)/\log(\mathbf{1} - p)$$

where *n* is the necessary sample size, *p* is the proportion of the population infected with the pathogen, and *power* refers to the probability of rejecting H_o when it is actually false. For detection of a pathogen within a population, we would like to have a high statistical power to reject H_o when it is actually false (i.e. a high probability of detecting the pathogen if it is present). As an example, suppose that a pathogen is prevalent in 5% of a fish population, how many fish would need to be sampled to be 95% certain that at least one of the sampled fish would test positive for the pathogen?

$$n = \log(\mathbf{1} - \mathbf{0.95})/\log(\mathbf{1} - \mathbf{0.05}) \approx \textbf{60 fish}$$

The above equation can be rearranged to determine the *power* of a survey for a given prevalence of the pathogen, *p*, and a given sample size.

$$Power = \mathbf{1} - (\mathbf{1} - p)^n$$

Also, for a given sample size we can determine the minimum *p* for the population that would yield at least one infected individual in the population for a given level of *power*.

Appendix D

$$p = 1 - (1 - Power)^{1/n}$$

For example, if 40 fish are tested and no fish tests positive for a pathogen, then we can say that the proportion of the population infected with the pathogen is 7% or less with 95% confidence.

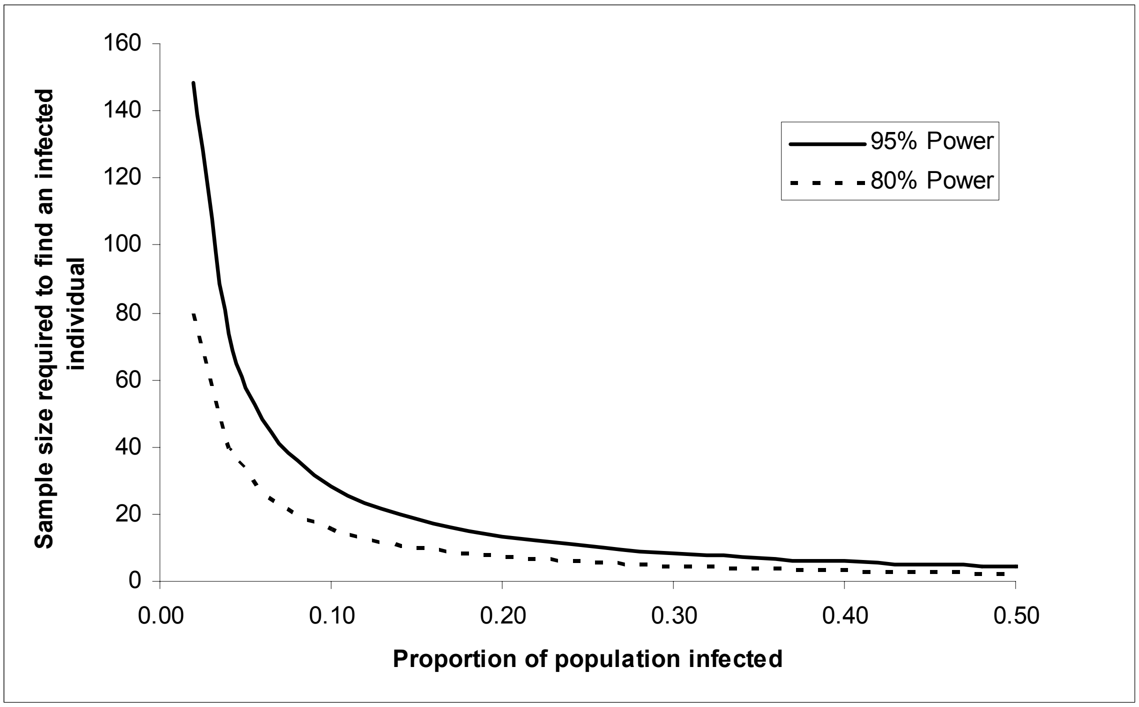

Figure 1: Sample size requirements to a find single infected individual given some level of prevalence of the pathogen in the population.

<u>Sample Sizes for LMBV Detection:</u> The above equations are of little help to fisheries managers in determining optimum sample sizes if the proportion of the population infected with the pathogen, *p*, is unknown. If previous sampling has occurred, and data exists for other populations, we may be able to use previous estimates of *p* (denoted as $\hat{p}$) to estimate appropriate sample sizes.

In the case of LMBV, many waterbodies, have been sampled to determine if the pathogen is present and these data have been stored in the Wild Fish Health Survey (WFHS) database. We examined these data to determine if there was any consistency in the proportion of fish from a sample infected with LMBV ($\hat{p}$). We screened WFHS data for inclusion in this analysis in the following manner:

1. We only used data from surveys where LMBV was detected.

2. We did not include any data from surveys coming from fishing tournaments, fish kills, confined fish, or fish showing clinical signs because under these conditions the true *p* for the population may be overestimated. Our purpose was to make sample size recommendations for random samples of fish.

3. We only used data from surveys that tested individual fish for LMBV. Data where fish were pooled were omitted because it was impossible to determine what proportions of the sampled fish were actually infected.

4. We only used surveys in which at least 20 fish were sampled.

The average and range of $\hat{p}$ was then estimated by species, region (north vs. south), and time of year (summer vs. other times). Previous LMBV observations have suggested that the virus is more prevalent during summer months compared to other times of the year. We considered summer data as that coming from surveys during June – September. Summary statistics are shown in Table 1.

Table 1: Summary statistics for the prevalence of LMBV in population where it has been detected. "North" refers to the States of Connecticut, Maryland, Pennsylvania, and Virginia, and "South" refers to the States of Alabama, Arkansas, Florida, Georgia, Kentucky, Missouri, Mississippi, North Carolina, and Oklahoma. "Summer" refers to the months of June – September.

Region	Species	Season	Number of surveys	Avg. $\hat{p}$	Min. $\hat{p}$	Max. $\hat{p}$
North	Largemouth Bass	Summer	4	0.03	0.02	0.06
		Other	1	0.30	0.30	0.30
South	Largemouth Bass	Summer	37	0.25	0.02	0.63
		Other	39	0.13	0.01	0.53
	Spotted Bass	Other	2	0.16	0.13	0.18
	Suwannee bass	Other	1	0.05	0.05	0.05

The prevalence of LMBV within sampled populations varied widely. Unfortunately, low sample sizes within a region and/or season combined with this variability prevent the use of historic data for making sample size recommendations. We therefore recommend that a minimum sample size of 60 fish be used when surveying a water body for the presence of LMBV. With a sample size of 60 fish, LMBV will be detected in at least one individual with 95% confidence if 5% of the population is infected with the virus.

Geographic coverage: LMBV has been detected over a wide geographic range. Once it is within a major drainage system, it is likely that it will spread throughout that drainage. The map in Figure 2 illustrates which drainage systems LMBV has been detected. Managers should focus fish health survey efforts in those drainages where it has NOT yet been detected to gain a better understanding of the distribution of the virus. Also, it should be noted that if a given sample of fish does not yield any positive results for LMBV, that the virus may still be present in that water body, but at levels lower than could be detected with the sample size of fish used in the survey.

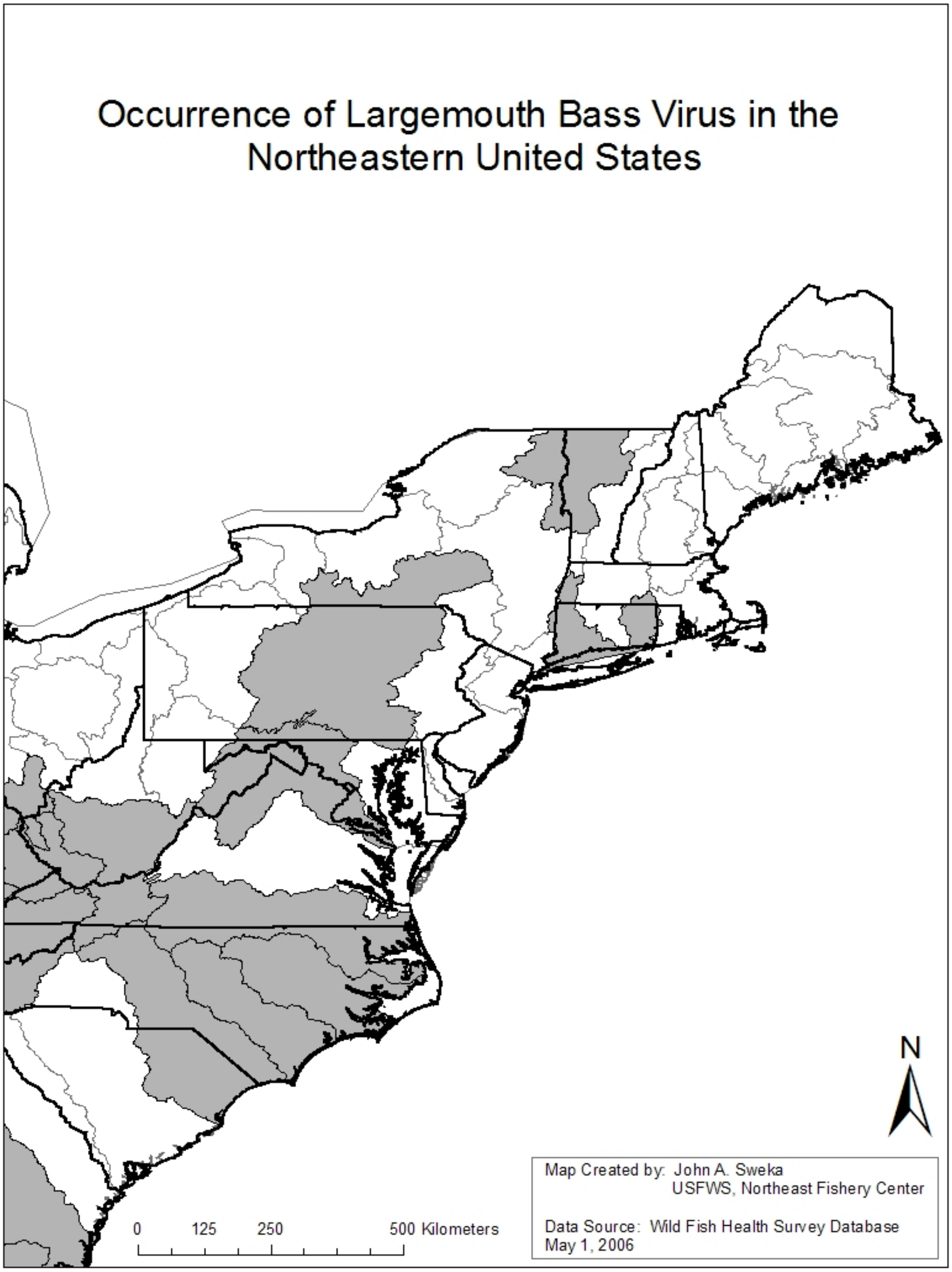

Figure 2: Known occurrence of LMBV in the major drainage systems of the Northeastern United States. Shaded areas represent those drainages where fish have tested positive for LMBV. ** *NYDEC Biologists commented that this figure does not include drainages where fish have tested positive*.**

Appendix D

Surrogate Species: Because the sacrifice of adult largemouth bass for LMBV detection may not be popular with the angling public, surrogate sunfish species may be used to determine if the virus is in a water body. At this point in time, however, surrogate species may not accurately reflect the presence or absence of LMBV within a water body. It is recommended, therefore, that largemouth bass be the primary target sample species, with smallmouth bass and sunfishes serving as supplementary, surrogate species when the appropriate number of largemouth bass samples are not available.

Appendix E

Title: The utility and use of spring seasonal black bass fishery restrictions in the Northeast United States

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Abstract:

Spring black bass fishing regulations in the Northeast United States have evolved over time to primarily ensure black bass populations are not negatively impacted by reduced juvenile recruitment as a result of removal of guardian male bass from nests. Currently, eight out of fourteen (State and District of Columbia) natural resource agencies in this region have a variety of regulations that range from the most restrictive complete closed season to defined catch-and-release seasons or reduced bag limits and size restrictions. The remaining six resource agencies have no special spring-time restrictive regulations. There continues to be a strong desire by the resource agencies to allow the utilization of bass fisheries by anglers, but also to ensure adequate juvenile recruitment and fishery sustainability. Increasingly, new research or analyses of existing data sets are being used to reevaluate these regulations. This paper will discuss the evolution of spring black bass regulations, current management trends, and future directions based upon recent studies and specific management issues.

Appendix E

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Managing a highly dynamic black bass fishery in a large riverine system

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The Ohio River is one of the great rivers of North America. From its origins in the northern Appalachian Mountains of New York, Pennsylvania, and West Virginia to its confluence with the Mississippi River, the Ohio River provides a diverse ecosystem for both humans and aquatic life. The Ohio River supports a diverse recreational fishery for West Virginia anglers of which black bass are one of the most popular. Largemouth bass, smallmouth bass, and spotted bass comprise the fishery which is primarily confined to the limited embayments and tributaries, as well as suitable mainstem reaches. The black bass fishery has been characterized by dynamic shifts in angler success ranging from a high of 0.23 fish per hour to a low of less than 0.05 fish per hour over a 30-year period. This dynamic nature has lead to periodic angler dissatisfaction and an appeal by black bass anglers for the WVDNR to improve angling. Since 2000, biologists have engaged in extensive data-mining and field-based efforts to attempt to identify contributing factors and develop remedial methods to improve black bass angling. The primary factor was identified as the overall poor recruitment to age-1 by all three black bass species, and consequently to the fishery. Habitat degradation in the limited embayments and seasonal river stage fluctuations appear to be at least partially responsible for the poor recruitment. In 2005, a management plan was proposed that included appropriate habitat enhancements, supplemental stocking of largemouth bass and smallmouth bass based on spring river stages, and a catch-and-release angling regulation during peak spawning periods. This plan was implemented in late-2005 except for the angling regulations. Future efforts will be focused on habitat enhancements and gaining a better understanding of spawning requirements and periodicity.

Appendix E

Title: Recent changes in fishing season regulations for black bass in Michigan

Authors: James E. Breck (1) and Michael Thomas (2), Fisheries Division, Michigan Department of Natural Resources.

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The Michigan Department of Natural Resources recently decided to change the fishing season regulations for black bass. Beginning in 2006 anglers can fish for bass during a catch-and-immediate-release season prior to the possession season. The decision to change the regulations followed an extensive process. This included meetings of Fisheries Division biologists with invited speakers to discuss the issues, preparation of a white paper by a committee of fisheries biologists, public meetings to discuss alternative regulations and obtain public input, and a mail survey of a random sample of licensed Michigan anglers. The white paper included a review of black bass ecology and reproduction, a summary of bass regulations in Michigan and other States and provinces, and a series of alternatives for regulations. The committee considered several regulations and evaluated how the season could be changed to allow additional opportunity for recreational bass fishing while minimizing risk to the sustainability and quality of bass fisheries and the associated fish populations and aquatic ecosystems. It is hoped that monitoring and research studies can be initiated to evaluate the response of anglers and bass populations to the new regulations and to improve our understanding and management of black bass in Michigan.

Appendix E

Year class production in the black basses: the potential influence of spawning season regulations

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The black basses are the most sought after sportfish species in North America, and arguably the most intensively managed. The use of closed seasons to protect spawning bass was once common, but current trends are towards more liberalized regulations, and closed seasons are now largely restricted to Northeastern States. The biological rationale for closed seasons is based primarily on assumed high vulnerability of guarding males to angling and well-established reductions in survival of eggs and fry when males are removed from nests. The potential impacts of loss of individual nest production to overall year class strength are not well-understood, and the influence of angling on year class variability is largely unknown. A survey of data available from New York State indicates that the current closed season offers variable levels of protection to guarding males, dependent on annual variability in water temperatures. In Oneida Lake, where long-term records of smallmouth bass year class strength are available, no relationship between level of protection and year class strength was detected. Similar results were found for both largemouth and smallmouth bass in Canadarago Lake. While directed studies of angling impacts on bass production are still needed, available evidence that year class strength is not closely tied to early season protection.

Appendix E

A Review of Largemouth Bass Virus

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Rome Field Station
New York State Department of Environmental Conservation
Rome, NY 13440

Largemouth bass virus (LMBV), family *Iridoviridae*, was first isolated from largemouth bass (*Micropterus salmoides*) in 1991 in Florida and is now found as far west as Texas and as far north as New York and Vermont. The first reported case of disease caused by LMBV occurred in 1995 in Santee Cooper Reservoir, South Carolina where approximately 1000 largemouth bass died. Since then, the number and severity of fish-kills caused by LMBV remains uncertain because the estimated number of dead fish in these cases was very low and subsequent fish-kills may have been undetected. To date, LMBV has been isolated from 14 different fish species including 9 from the family Centrarchidae, but LMBV disease has only been reported in largemouth bass. In most cases, populations of infected fish display no apparent disease. Largemouth bass virus disease occurs during warm summer months and usually affects large fish (>30 cm TL). Recent studies have examined the relationship of infection prevalence relative to size and age structure of largemouth bass populations. Continued monitoring of populations has shown decreases in detected LMBV prevalence over time. It is too soon to know what impact LMBV may have if it becomes widespread in the northern U.S.

Appendix E

Detection of Largemouth Bass Virus in the Northeastern United States – US Fish & Wildlife National Wild Fish Health Survey and Other Findings

Patricia Barbash
US Fish & Wildlife Service
Northeast Fishery Center
Fish Health Center
Lamar, PA

The USFWS Fish Health Center in Lamar PA has collected data since 1998 while conducting the National Wild Fish Health Survey on the occurrence of largemouth bass virus (LMBV) in the Northeast region. Since 1998, 8 of the thirteen States in the Northeast region have submitted samples from a variety of species presently known to carry LMBV. The first detections occurred in Virginia in 2001, and since then, the Fish Health Center has collected samples from over 70 locations in these eight States, examining 17 species of centrarchids and esocids suspected of carrying LMBV. Of these, 11 locations have produced LMBV positive results from largemouth bass, in addition to smallmouth bass and redbreast sunfish. LMBV has also recently been detected from hatchery reared fish in West Virginia. Details of these sampling efforts and results will be discussed.

Detection of Largemouth Bass Virus in the United States – US Fish & Wildlife National Wild Fish Health Survey and Other Findings

Patricia Barbash
US Fish & Wildlife Service
Northeast Fishery Center
Fish Health Center
Lamar, PA

The USFWS National Wild Fish Health Survey (NWFHS) has been involved with sampling wild fish for the detection of several important fish pathogens since 1996. Data available on the NWFHS database website displays sample locations of 24 States when queried for all centrarchids and esocid fish for LMBV. These findings, as well as more recent data that have not yet been uploaded to the NWFHS database will be discussed in detail.

Appendix E

The Relation of Largemouth Bass Virus to Largemouth Bass Population Metrics in Five Alabama Reservoirs

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Between the early-mid 1990s and 1998 to 2000, angler and electrofishing catch rates of memorable-size ($\geq$ 2.27 kg or 51 cm) largemouth bass *Micropterus salmoides* declined 3 to 20 fold in five Alabama reservoirs. Largemouth bass virus (LMBV) has been implicated in widespread fish kills of this species, and we documented the prevalence of LMBV and attempted to quantify the impact of LMBV on growth, body condition, and size and age structure in an attempt to account for the loss of memorable-size fish in these five populations. Fish were collected primarily with electrofishing between 2000 and 2002, and two methods were used to detect LMBV from lakes Wheeler, Demopolis, Eufaula, Guntersville, and Weiss. Among these five reservoirs, LMBV infection was most common in fish that ranged from about 25-40 cm and young to intermediate age fish (range 1-2 to 6 years). Prevalence of LMBV was rare in fish under 100 mm (age 0) and over 500 mm ($\geq$ age 7). Fish infected with LMBV generally expressed lower relative weight (W_r) and grew slower after age 3 than uninfected fish. Prevalence of LMBV was not as great in older and larger fish, and possibly the lack of LMBV was due to death of these larger fish prior to our collection. The decline in memorable-size fish in these five reservoirs in the late 1990s to 2000 was due to slower growth, poorer body condition, and increased mortality of older fish and was circumstantially linked to LMBV. However, the prevalence of LMBV in the Lake Eufaula population was nil after 2001, where a fish kill was associated with LMBV in 1997. None of 349 fish we assayed from Lake Eufaula in 2002 were infected with LMBV, growth rates improved, and memorable-size fish were more common in electrofishing samples and angler catches in 2003. Although we could not definitively demonstrate LMBV caused the loss of memorable-size largemouth bass in Alabama reservoirs, LMBV prevalence appeared to be linked to this phenomenon.

Appendix E

Live-Release Largemouth Bass Tournaments in the Largemouth Bass Virus Zone

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This study evaluates the effect of improved livewell conditions on mortality of largemouth bass *Micropterus salmoides* caught in summer tournaments held on reservoirs in which largemouth bass populations were infected with largemouth bass virus (LMBV). Improving livewell conditions by cooling water 2-5°C, adding salt (NaCl), and continuous aeration reduced initial mortality of largemouth bass from 7% to 3%. However, post-tournament mortality of fish held for 5 days was not reduced by the improved livewell conditions and averaged 76% for all tournament fish, a value much higher than measured in tournaments before the known occurrence of LMBV. The percentage of angler-caught fish infected with LMBV at the end of the tournaments (14%) was significantly higher than the population levels (7%), and the prevalence of LMBV continued to increase through the post-tournament retention. Many of the fish developed bacterial diseases during the post-tournament retention, so the effect of LMBV on mortality could not be determined. However, the higher mortality of both tournament-caught and reference fish in our study compared to previous tournaments presumed free of LMBV suggests that this newly discovered pathogen influences largemouth bass survival in live-release bass tournaments.

Keywords: Largemouth bass, tournament mortality, catch and release, largemouth bass virus