

Keeping Bass Alive

Why bass die — Initial and delayed mortality

One of the things that make black bass such great fish for tournament angling is the fact that they can be "recycled." That is, they are hardy fish that can be caught, weighed in, released and caught again at a later date.

Occasionally, however, fish die during the course of a tournament day. These fish, dead at weigh-in, are referred to as "initial mortalities."

Initial mortality is highly variable. It ranged from zero percent to over 30 percent in 130 live-release tournaments studied since the 1980s. The initial mortality of bass caught in tournaments run by B.A.S.S. has been very good — less than 5 percent. However, B.A.S.S. only operates about 20 events a year. While these large events are nationally publicized, they represent only a small fraction of the tens of thousands of bass tournaments conducted annually across the country.

Universities and state fisheries agencies have conducted studies to determine the survival of bass caught, transported, weighed and released alive after bass tournaments. A Texas Tech University study summarized published reports from 20 separate investigations of 130 individual bass tournaments. That analysis showed that water temperature is the most significant factor related to initial mortality. But other factors — hooking and handling injury, exposure to sustained low dissolved oxygen, temperature shock, toxic chemicals, or chemical shock — can, and do, contribute to initial mortality.

But, initial mortality is only part of the total mortality that bass suffer in tournaments. Some fish, even though they appear active and healthy after weigh-in, die after release. This mortality is called post-release, or delayed, mortality. Delayed mortality was also highly variable among the studied tournaments, ranging from zero to 52 percent.

However, this variability in survival is actually the bright spot! If mortality is low in some events, then it can be improved in all of them. That's exactly what this book is trying to help you achieve.

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Injury

Hooking and handling

Hook wounding is an obvious form of injury, but only a very small percentage of bass landed and released die from these wounds. Hooking mortality probably averages only one to two percent for anglers catching bass on artificial lures.

Even the clearest and cleanest water is home to bacteria and fungi that can cause primary or secondary infections. Fish secrete a protective 'slime' or mucus from glands in their skin as an effective barrier to disease. Disrupting or removing the mucus when you handle a fish makes it more susceptible to these ever-present pathogens. Handling a fish with dry hands, abrasion from a net, and letting a fish flop on a dry boat deck or in a dry livewell will remove its protective mucus coat.

Anyone who has looked at the gills of fish realizes that the feather-like gill filaments are very fragile. Each of the filaments that you see with your eye is adorned with finer structures through which blood flows in capillaries. It is through these microscopic structures that essential oxygen passes from the water to the fish. Anglers should take special care not to touch or damage gill filaments when handling fish for unhooking, placing them in the livewell or holding them for photographs.



Hold bass vertically by the lower jaw. Never try to hold a fish horizontally by the jaw alone.

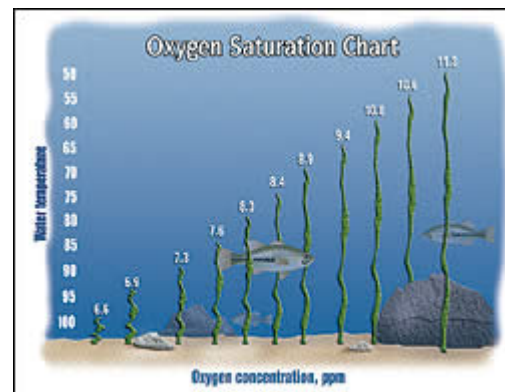
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Dissolved oxygen

Oxygen is essential for fish to survive. How much oxygen a fish needs depends on its oxygen demand. Metabolism, and thus oxygen demand, increases rapidly with temperature and is almost twice as high at 85 degrees F as it is at 50 degrees F. At water temperatures above 80 degrees F, dissolved oxygen concentrations below five parts per million (ppm) are considered stressful, and dissolved oxygen concentrations below three ppm are considered lethal.

Many other factors can affect a bass' oxygen demand, but relative to catching and handling fish, two important factors are oxygen debt and increased metabolism from activity.

Fish can develop an oxygen debt if they fight hard or are played to exhaustion. These fish must consume additional oxygen until the debt is alleviated. Recent research indicates that smallmouth bass played to exhaustion can require two to three hours to recover, even in a well-aerated holding tank.



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Double jeopardy — water temperature and dissolved oxygen

Metabolism, and therefore oxygen demand, increases rapidly with temperature — fish in warm water need more oxygen than do fish in cooler water. Oxygen, like all gases, has a saturation level in water. Saturation level is the amount of oxygen water will hold when it is exposed to air for a period of time. Unfortunately for anglers trying to supply oxygen to fish in warm water, the saturation level of oxygen declines with increasing temperature.

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Water quality

There is a long list of chemicals that are toxic to bass and other fish. Chlorine, for example, will kill bass held in tap water. However, since the water you use to fill your livewell is the same water the bass are living in, we can assume that it has tolerable chemical levels. However, that livewell water quality constantly changes during the tournament day as bass excrete waste carbon dioxide and ammonia.

Carbon dioxide is usually not a problem, because it is removed when the water is aerated. Ammonia (NH₃, the unionized form), on the other hand, is highly toxic and the danger increases with water temperature and pH. At 80 degrees F and pH 8, 10 pounds of bass held in a 15-gallon livewell would excrete enough ammonia in four hours to reach a stressful level of 0.1 ppm; at 88 degrees F a lethal level of 1 ppm could be reached during a tournament day.

All waters contain a multitude of nontoxic chemicals. Some of these chemicals are essential for survival. The amounts of these chemicals differ from one lake or river to the next. Bass acclimate to the chemical composition of the water they live in just as they acclimate to the water temperature. Sudden changes in the chemical composition of the water is another sub-lethal stressor. Therefore, don't fill your livewell with water from somewhere other than the lake or river where you are fishing

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Stress

What causes the delayed mortality of tournament-caught bass that appear lively and healthy at release? In a word, stress. Fish constantly expend energy to maintain body conditions within certain tolerable ranges necessary for survival. Although fish are cold-blooded and do not have to maintain body temperature, they still expend energy to supply oxygen to their tissues, eliminate waste products, process energy reserves, repair damage, secrete mucus, fight disease, and maintain proper concentrations of salts in the body fluid. In the spring, considerable energy is also diverted to spawning and nest guarding.

When conditions deviate from normal, the fish channels its energy to appropriate organs and tissues to restore normal conditions. Each of these situations is a stressor.

Cortisol and similar hormones trigger the production of energy to alleviate the stress. Hormone levels and physiological functions return to normal within three to five days after the stress is alleviated. But when multiple sub-lethal stresses occur in a relatively short time period, enough energy to fight them and still maintain normal body functions may not be available.

Generally, delayed mortality is a result of prolonged water-salt (osmotic) imbalance — salt concentrations in body fluids drop below the levels necessary for survival. We will describe techniques to greatly reduce this stress.

Stress Reduction

Reducing stress, and thus reducing delayed mortality, requires three things: 1) reducing handling injuries and loss of protective mucus, 2) healthy conditions in the boat livewell, and 3) quick, efficient weigh-ins where fish are subjected to minimal handling while maintained in adequate life-supporting conditions throughout the weigh-in.

Anglers should be aware that simply holding several fish in a livewell adds stress even when the livewell provides otherwise healthy conditions for the bass. Research has shown that the heart rate and oxygen consumption of a single smallmouth bass caught and placed alone in a livewell returned to resting cardiac output levels in about an hour. On the other hand, when two or more fish were caught and placed in the livewell, cardiac activity remained high, even after six hours. Handling is a stressor. If you consider how many times a tournament bass is handled from the time it is caught until it is released, handling can be a significant source of stress. Every time a fish is handled — especially if it tries to escape the angler's grasp, bounces on the boat deck, or becomes active when being measured or weighed — its metabolism increases, its heart rate increases, and it needs more oxygen.

Research has now shown that simply exposing fish to air is also stressful. The point here is that while some handling is unavoidable, it should be kept to a minimum, and fish should not be exposed to air any longer than is absolutely necessary.

15 stress factors

1. Hooking
2. Playing
3. Landing/handling
4. Air exposure
5. Livewell
6. Culling
7. Bagging/handling
8. Staging tanks
9. Judging tray
10. Weighing process
11. Transport from weigh-in
12. Salt-dip
13. Release holding tanks
14. Release handling
15. Release environment

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Hooking and handling

Hook and bait choice

To minimize deep hooking, set the hook as quickly as possible. Allowing fish to run with the bait only encourages them to swallow it deeper, resulting in a higher probability of injury.

Hook type or shape also influences hooking injury. Circle hooks have recently gained favor with live-bait anglers because they rarely hook fish deep in the throat — as do conventional styles. Circle hooks also work with Carolina-rigged soft plastics. Anglers must learn to modify their hook-setting technique, however. These hooks require a slower, sweeping set rather than a quick, hard jerk.

Hooks in or out?

For years it was assumed that it was best to leave the hook in a deeply hooked fish because the metal would rust away, would be dissolved by gastric acids, or would be passed through the digestive tract. Even biologists had recommended cutting the line close to the hook and releasing the fish. Recent studies, however, have confirmed that this may not always be the case. With the increased use of corrosion-resistant metals and special coatings, hooks do not quickly rust away, even in saltwater. Every effort should be made to remove hooks as quickly and with as little tissue damage as possible. If the hook has entered the mouth, jaw, throat or tongue, use long-nosed pliers, hemostat or hook removing tool to get a firm grip on the hook while removing it. Carry a set of strong cutting pliers that are capable of cutting through your stoutest hooks. These can be used to cut the point and barb off of a deeply imbedded hook that has penetrated completely through the throat or gill arch. Once the barb is cut off, the hook can easily be backed out. It is much better to sacrifice a hook than to try to back the hook out, barb intact, and cause more damage.

Playing your catch

Once the fish is hooked, anglers must consider tactics to get the fish to the boat or bank. Studies have shown that fish that are played to exhaustion, then released, recover more slowly and are less likely to return to and defend nests during spawning periods compared to fish that were landed quickly. On the other hand, playing fish quickly and landing them "green" may result in increased handling while trying to secure the squirming fish to remove the hook. A shorter fight, speedy hook removal and quick return to the water or livewell is probably better and is the technique most often used by tournament professionals.

Landing and handling

With bass, the old standby of grasping the lower jaw, or "lipping" the fish, is still the preferred method. This usually immobilizes the fish, provides a good, firm hold and allows the angler to remove the hook(s) without touching the fish's body. Avoid handling the fish any more than is absolutely necessary, to minimize damage to the protective mucus.



Land fish quickly. "Lip" or net big fish. Lift small fish by the line then grasp their lower jaw. Don't flip or swing them into the boat and onto the carpet or deck.

Swinging or flipping fish into the boat and onto the floor is a poor technique! "Rugburn" can cause extensive damage to the mucus coat. Pulling small fish out of the water by the line allows the angler to get a grasp on the lower jaw without having to grasp the fish's body. However, for larger fish, lipping or using a landing net may be preferred.

New-generation landing nets made of soft, woven, knotless nylon do much less damage to the fish than older nets made of hard, knotted nylon twine. Stretchy rubber landing nets are even less abrasive and hooks do not foul in the mesh as easily, making removal from the net easier and faster.

Once the fish is in the boat, hold it vertically, touching it elsewhere as little as possible. Never bend the fish's head down or try to hold the fish horizontally by the lower jaw. At weigh-in, minimize the time fish are out of the water. Simply lift them up and out of the livewell. For photographic purposes, if a fish must be held horizontally, support the body with a wet hand under the belly, near the anal fin.

Air exposure

Unhook fish quickly and measure them on a wet measuring board or rule. Place them in the already filled livewell. When placing them in your weigh-in bag, if possible, place the bag in the livewell to fill it with water. Direct the fish into the bag rather than pulling the fish out of the livewell one at a time.

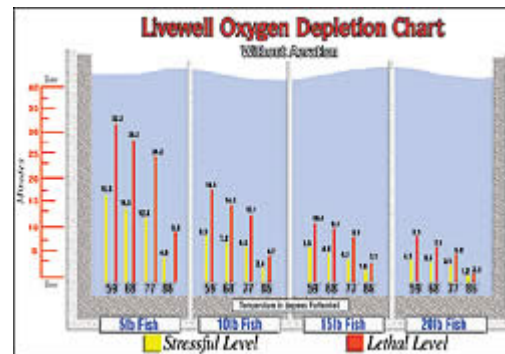
Keep fish submerged while cameras are being readied for photos, pulling the fish up just before the photographer is ready to take the shot. Get the photo, then get the fish back into the water or into your water-filled bag as quickly as possible. Remember, each air exposure adds more stress — during landing, hook removal, while measuring and culling, when pulled from the livewell and placed in a bag, during weigh-in, while being photographed, and when released.

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Livewell

Many of the obstacles to improving the survival of released fish revolve around maintaining adequate water quality in the livewell. No matter how carefully you fight, land and unhook a fish, its chances of survival are greatly diminished if it is subjected to inhospitable livewell conditions.

There are four keys to providing a healthy livewell environment: eliminating the possibility of mechanical injury, maintaining adequate dissolved oxygen, controlling water temperatures, and removing toxic metabolic waste. Mechanical injury is best addressed by proper livewell design and construction. Oxygen level and water temperatures are controlled with aeration or oxygen injection and the addition of fresh water (at water temperatures below 75 degrees F) or ice (at water temperatures above 75 degrees F). Toxic ammonia is removed by periodically flushing the livewell with fresh water.



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Anglers must take an active role in maintaining the health of their catch. Do not assume that the boat's livewell system will automatically do all that is necessary. Having the proper equipment and knowing how to use it are equally important.

Livewell geometry

The greater the volume of water a livewell can hold, the greater number (or pounds) of bass that can be held. With a pressurized oxygen delivery system that will maintain saturated oxygen conditions, anglers should observe a ratio of no more than 1 pound of bass per gallon of water. Be aware that this ratio will tax conventional re-circulating aeration systems and anglers must take even greater care to maintain desirable livewell water temperatures and maximize aeration. In boats with divided livewells or two separate compartments, distribute fish evenly between compartments to reduce crowding and stress.

Livewells that are situated perpendicular to the long axis of the boat, or have internal baffles, allow less water movement inside, thus reducing the possibility of fish injury. Keep fish in rear livewells if possible. Forward livewells are more subject to sloshing and impact from bouncing during rough-water travel.

The livewell interior should have a smooth surface and rounded corners. Aerator nozzles and oxygen diffusers, intakes and drains should be recessed or situated in such a way as to reduce any possibility of injury to fish. Divided or dual livewells allow two anglers to keep their catch separate and facilitate culling. Dual livewells should have a volume of at least 15 gallons each and a single, divided livewell should hold at least 30 gallons.

Culling

In many states and provinces the practice of culling (replacing a fish already in the livewell with another fish) is legal. However, in others a decision to keep or release a fish must be made immediately, before the fish is placed in the livewell. Be sure to read and understand local regulations and tournament rules regarding culling.

If culling is legal, the angler must be able to identify the smallest fish in the livewell so it can be exchanged with a larger fish. Pursuing fish in a livewell adds stress. If livewell space is available, the smallest fish should be kept in a separate compartment. This makes identification and exchange very efficient. Alternatively, using a marker that clearly identifies the smallest fish and provides a "handle" to facilitate capture and removal from the livewell is an acceptable solution. While no studies have been done to evaluate the differences in stress from the marker versus no-marker culling concept, intuitively it seems that rapid identification and removal without hand-sorting the fish is a less stressful technique. Culling systems are now available that utilize small spring clips that clamp over the fish's lip. These clips are attached to a short piece of color-coded floating tubing or rope. The main objective is to use a marking system that allows easy identification and reduces handling stress and/or injury.

Aeration systems

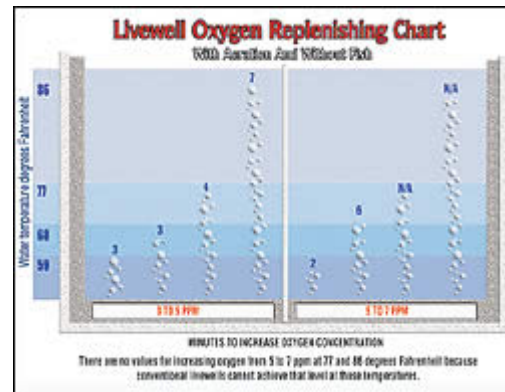
The single most important factor in maintaining the health of your catch is keeping the oxygen level in the livewell water above 5 ppm. And, the most practical way to add oxygen is by using your boat's electrical system to power aeration devices. Aeration systems add oxygen to the water by creating a spray that increases the surface area of water exposed to air, or by pulling air into a flowing stream through a Venturi, as described on page 15. The efficiency of these methods is limited by the surface area of water exposed to air, and by the fact that air is only 21 percent oxygen. When water temperatures are 75 degrees F or less, most modern bass boat

livewell aeration systems can maintain over 5 ppm oxygen, when operated properly. Warmer water may require the addition of ice to lower temperatures to enable the desired concentration of oxygen. Even with ice, some bass boat aeration systems will fail to maintain oxygen levels at 5 ppm with high temperatures and 5 to 10 pounds of fish.

As an aeration device creates surface turbulence or bubbles, oxygen is absorbed from the air-water interface. Greater turbulence and/or more bubbles increase the surface area and the potential oxygen transfer rate. The deeper the bubbles are forced into the water, and the smaller those bubbles are, the longer it takes them to rise to the surface, and the greater the oxygen absorption. If your system is not moving enough water, it will not maintain oxygen levels with a good catch of bass. Consider enhancing your livewell plumbing as shown in the diagram on page 15.

There are several types of aeration devices used in bass boat livewells. The most common type pumps water through a plastic fitting above the full-water level to make a forceful jet or fan-shaped spray, increasing the exposure of water to the air.

There are also Venturi aspirator systems that pull air in through a hole on the top of the device as water is pumped down and out the bottom of a tube. This entrains air and forces bubbles deep into the livewell. The forceful current provides adequate mixing throughout the livewell. Another type of Venturi device pulls air directly into the pump housing, where the impeller breaks the bubbles up into smaller sizes, affording greater oxygen absorption.



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Air pumps may be factory-installed on a boat or can be added by the angler. These devices simply blow air bubbles into the livewell through an air stone or hose. Tests have shown that, operating alone, these are the least effective supplemental aeration devices.

Livewell pump capacity is a major factor affecting aeration efficiency. Don't assume that all the pumps installed by the boat's manufacturer are adequate. Install pumps that move at least 500 to 750 gallons of water per hour (gph) to assure maximum aeration.

Dual pump systems are recommended — one as an intake pump to fill the livewell, and one that functions only as a re-circulating (aeration) pump. The re-circulating pump is essential to provide aeration when the boat is on plane or being trailered. The intake can be used to provide aerated water if the re-circulating pump fails. Install water-resistant, quick-disconnect fittings on pump wires and carry a spare pump motor to facilitate emergency replacement on the water.

Aerator controls

Most boats have solid-state timing devices that cycle the aerator pumps "on" for a predetermined period of time, every few minutes. Adjustable timers can be set to cycle on from 30 seconds to one minute every three to 15 minutes. Check the operation of your timer. With some brands, "Maximum" means maximum time between aeration cycles — in other words, "Maximum" means minimum aeration. Continuous pump operation is an absolute must for proper aeration when you

have more than a few pounds of bass in the livewell. If the control on your aerator does not provide continuous operation, replace it with a control that has this capability.

Ventilation

Livewell air space ventilation is a fancy term for getting fresh air into the livewell compartment. Aerators depend on mixing air with the water. If the air trapped in the space between the water's surface and the livewell lid is stale, you are not mixing fresh air (or oxygen) with the water. To solve this problem, there are two easy options. First, lift the livewell lids regularly to allow fresh air to circulate into the compartment. Another alternative is to vent the Venturi aspirator so that it is pulling in fresh air. This is accomplished by simply inserting a length of the appropriate-diameter aquarium air tubing into the vent hole on the top of the aspirator and routing the tubing to fresh air. A marine dealer can provide a small fitting for the intake end of this tube, which can be mounted on the inside of the boat's gunwale.

Water quality management

Take responsibility for the care of your catch. That care begins before you make the first cast of the day. Begin by filling your livewell early in the day, at your first fishing spot. Water temperatures are coolest early in the morning. Cooler water holds more oxygen. Take water from open areas, avoiding stagnant backwaters, sloughs, or boat launch sites. While the freshwater system is filling the livewell, turn on the boat's recirculating pump and run it continuously until the livewell is full.

If your boat does not have a re-circulating system, add one. This component is a must to provide proper aeration and waste-gas removal while the boat is moving, or if you must transport fish in your livewell while the boat is being trailered. The components can be purchased at marine or fishing tackle retailers.

Freshwater flow-through

When the water temperature is below 65 degrees F, the livewell fill pump spraying fresh water into the livewell at regular intervals will keep oxygen levels high and water fresh. Test your system and determine what control setting is necessary to facilitate exchanging the entire volume of the livewell. In theory, to exchange the water in a 30-gallon livewell with a 500-gph pump would require running the pump for a total of only four minutes, but few systems are 100 percent efficient in exchanging water. To test how fast your system flushes out "old" water, add a small quantity of food coloring to a full livewell, set the controls for continuous operation, and note how long it takes to remove the colored water. This will give you a more realistic measurement of how long you will need to run your pump. Some systems may require plumbing modifications to rapidly and thoroughly exchange livewell water. See the Appendix for suggestions.

When water temperatures are 65-75 degrees F, it will be necessary to pump fresh water continuously through the livewell to maintain oxygen levels adequate for a large catch of bass and to remove waste products. This fact cannot be emphasized enough.

Re-circulating aeration

When surface water temperatures increase above 75 degrees F, flow-through aeration alone may not be adequate, and may be lethal. As noted earlier, not only does warmer water hold less oxygen, it raises the fish's oxygen consumption and waste production. A 10 degrees F increase in water temperature will cause an almost 20 percent increase in respiration rate. To make matters worse, not only does the fish's oxygen demand increase, the warmer water may hold 10 percent less oxygen.

Under these conditions, it is best to re-circulate temperature-controlled livewell water rather than continuously pump in hot lake water and your system must have sufficient capability to aerate the water, or the fish will consume oxygen faster than the system can add it. Temperature control with ice, partial water exchange to remove metabolic waste, and the addition of salt to aid osmotic regulation are essential to maximize survival.

As water temperatures increase, a timer-controlled aeration system cannot replenish oxygen as fast as a large catch of bass can use it.

Temperature control

Ice cools the water and slows the fishes' metabolism. Cooler water holds more oxygen, and slower metabolic rates reduce oxygen demand and waste production. Rather than trying to achieve a particular livewell water temperature, it is recommended that the water be cooled no more than 10 degrees F below lake water surface temperature. As a guide, one 8-pound block (or two frozen half-gallon milk jugs) of ice cools a 30-gallon livewell 10 degrees F for about three hours. Experiment with your boat's livewell volume and calculate the amount of ice you need to achieve the desired drop in water temperature.

Block ice melts slower than crushed or cube ice, provides more constant temperature modification and can be easily stored for later use. Commercial block ice or water frozen in plastic (milk) jugs works equally well. Don't be concerned about chlorine in the ice. The little that remains when the ice melts will come out of solution with proper aeration.

Some boats have livewell cooling systems installed in their ice chests. Commercially produced livewell-water cooling devices are also now available. With the ice chest system, a pump circulates water from the livewell through a coil that is buried in ice within the boat's ice chest. As heat exchange takes place the ice melts, so additional ice must be added over the course of the day to maintain optimum livewell water temperatures.

With the aftermarket livewell cooling device, a small 12-volt fan blows air across a coil through which livewell water is circulated, using one of the boat's aerator pumps. The coil acts like a tiny radiator, cooling the livewell water approximately 6 degrees to 8 degrees F.

These devices do not have the capacity to cool the livewell water quickly, so adding ice directly can be used for initial cooling, allowing the cooling system to maintain the temperature the rest of the day. While these devices eliminate the need to carry as much extra ice, their cost may deter many anglers from purchasing them to retrofit an existing livewell system. However, included in the cost of a new boat, the extra convenience and functionality could justify the expense.

Monitor livewell water temperatures with a plastic aquarium thermometer, or mount a temperature gauge on the dash of the boat with the probe in your livewell. Some sonar units also provide a readout for an auxiliary temperature probe. This will allow the angler to constantly check livewell conditions, and will serve as a reminder to perform necessary water changes at periodic intervals.



Temperature control is essential when water temperature is above 75 degrees F. Four pounds of ice will lower the temperature of a 15-gallon livewell 10 degrees F for about three hours.

Maintain water quality

To flush metabolic wastes, exchange at least half of the livewell water every two hours, refilling with fresh water from areas with good water quality. Avoid adding water from stagnant backwaters or shallow areas that may be extremely warm and low in oxygen. Be sure to add more ice to maintain the 5-10 degrees F lower temperature differential when the lake water temperature is above 75 degrees F.

Oxygen injection

Oxygen uptake in livewell water can be improved by flowing pure oxygen from a pressurized cylinder into the livewell through an air stone or bubble hose. A regulator or pressure valve controls the flow. The tiny bubbles contain 100 percent oxygen and provide a huge surface area for the oxygen to diffuse into the water. These systems will maintain adequate oxygen levels in the livewell under the most extreme conditions. For some anglers this may be a more attractive option than managing oxygen levels by aeration and temperature control (adding ice).

Oxygenation systems can be purchased commercially for \$300 to \$450. A supplier is listed on page 39. Follow the manufacturer's directions very carefully, as there are serious safety requirements when dealing with oxygen. Homemade systems can be assembled from equipment purchased from welding shops, medical apparatus vendors, or aquaculture equipment suppliers. But, DO NOT install a homemade oxygenation system on your boat without the guidance of an expert. If installation guidelines are not strictly adhered to, serious injury could result. If these safety requirements are too restrictive, retrofit the plumbing of your livewell aeration system (see diagram, page 15) to ensure that proper oxygen concentrations can be achieved, even with a heavy load of fish.

Before investing in an oxygenation system, anglers must be totally familiar with the safety considerations regarding its use. U.S. Coast Guard regulations require pressurized gas cylinders to be securely mounted to prevent damage to valves and regulators. The cylinder must be mounted in a well-ventilated location and smoking should be avoided during use.

Never use grease or petroleum-based lubricants on oxygen equipment fittings or connectors. This can cause an explosive fire.

Although some cooling of livewell water will occur as the oxygen bubbles rise out of the diffuser, anglers, under typical summer conditions, must still control water temperature, add salt, and flush the livewell with fresh water periodically. While it will no longer be necessary to run the recirculating aerator pump continuously, occasional cycles of three to five minutes each hour will help remove waste carbon dioxide from the livewell water.

Chemicals

As noted in an earlier section, fish under stress take in more water than normal, diluting their blood. This creates an osmotic imbalance in their systems that can cause delayed mortality. By keeping the salinity of the water in the livewell near what their blood should be, you reduce the effects of stress. To achieve this, make a 0.5 percent solution by adding non-iodized salt at a rate of 1/3 cup per 5 gallons of water. It may be convenient to pre-measure the salt into plastic bags and carry several with you for use during the day. Remember that every time you flush half the water from the livewell and refill with fresh water, you will need to add more salt.

Some commercial water conditioners that are reported to calm the fish, reduce stress, replace lost mucus coating, help regulate salt balance, and fight infections, contain chemicals that are not

approved by the U.S. Food and Drug Administration for use on fish that may be treated, released, then caught again at a later date and possibly eaten by humans. State and federal fisheries agencies cannot recommend the use of these products, not because of ineffectiveness, but because the ingredients have not been certified as safe for human contact or consumption.

Use noniodized salt at a rate of 1/3 cup per 5 gallons of water.

Another chemical that has sometimes been used to treat livewell or holding-tank water is hydrogen peroxide (H₂O₂). Hydrogen peroxide breaks down into oxygen and water in the presence of organic material. However, this chemical can injure fish and should not be used. Most people have used this colorless, odorless, tasteless liquid to disinfect a cut or scratch. You can see it fizzing and bubbling on the skin as it oxidizes. Now imagine what it does in a livewell full of bass. The bass' mucus coating protects its skin from the oxidation reaction, but there is no such protective coating on the delicate gill filaments. Unfortunately, anglers who use hydrogen peroxide often think that if a little is good, a little more should be better. Wrong! Damage to gill filaments, suffocation and death may result.

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Other considerations

Swim Bladder Relief ("Fizzing")

Fish caught from deep water (generally greater than 18-20 feet) can suffer from over expansion of the swim bladder. Fish suffering from this condition cannot maintain a normal upright position. They cannot stay down in the livewell or recovery tank for long, and often float with their tails, heads or sides breaking the surface. A golf-ball-sized lump may appear on the side of the fish.

Inserting a 2-inch-long, 18-gauge hypodermic needle into the swim bladder can relieve the excess pressure.

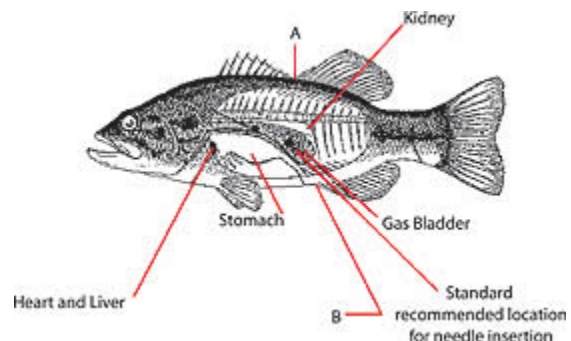
The needles can be obtained from farm and ranch or veterinary supply firms. Tournament officials must be trained and proficient with this technique so they can perform the procedure on fish brought to weigh-in. However, air bladder relief is best done as soon as the fish shows signs of distress. This means that anglers should also become proficient and comfortable with the technique so that the procedure can be performed in the boat.

The location for needle insertion varies with fish size, but in general, draw an imaginary line between the notch in the dorsal fins (Diagram A) and the anus (Diagram B). Draw another line from the tip of the pectoral fin to the fork in the tail. Where these lines intersect, remove a scale or two and push the needle straight into the body cavity. Hold the fish underwater during the procedure so bubbles can be seen escaping from the needle. Do not squeeze or press on the fish

to force out more gas. When the bubbles stop, the fish should be able to right itself and swim normally. The larger the fish, the farther toward the head of the fish you need to insert the needle.



Hold the bass underwater when "fizzing." A stream of bubbles will be seen escaping from the end of the needle when it has been inserted in the proper location.



On fish over 5 pounds you may need to insert the needle within an inch of the tip of the pectoral fin.

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The weigh-in site

The location of the weigh-in site can affect the survival of fish by increasing or decreasing the time they are out of good life support conditions, and affect the organization of the weigh-in. Here are characteristics of good and bad weigh-in sites:

Good weigh-in site

- Facilities close to where boats are moored.
- Contestants can walk from boats to weigh-in area in less than one minute.
- Facilities close to good release site: a low pier within a short walk, or situated so the live-release boat, truck or trailer can be parked close to the weigh-in station.
- Weigh-in facilities in the shade. A portable awning or event tent is a good investment.
- Room for spectators without interfering with the movement of contestants.

Bad weigh-in site

- Facilities far from boat mooring area.
- Requires contestants to carry bags of fish for long distances, over one minute away.
- Facilities far from good release site: no pier or dock, no possibility of parking live-release boat, trailer or truck a short distance from weigh-in station.
- Weigh-in facilities in bright sun, windy location.
- Cramped location that impedes traffic flow and slows anglers trying to get bags of fish to the scales.

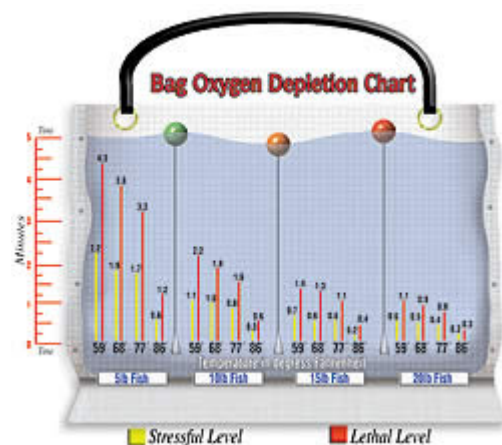
Keeping Bass Alive

The weigh-in process: From the boat to the scales

The weigh-in can strongly influence the stress level of fish because they must be removed from the water to be judged live or dead, measured for minimum length, and weighed. The two most important elements of a successful weigh-in that minimize stress to the fish achieving the highest survival are 1) minimal handling, and 2) minimal time when the fish are not in a "life support system." In the following sections, we describe equipment and procedures that will minimize mortality attributed to the weigh-in.

The weigh-in bag

This is not just a plastic bag in which you carry fish. This is the bag that keeps fish alive and organizes the weigh-in. This bag can make a difference in



[Click here to enlarge image.](#)

mortality because it prevents delays in weigh-ins and minimizes the time fish are not in good life support conditions. Ten pounds of bass in a bag containing about one to two gallons of water will reduce oxygen to lethal limits in two minutes, therefore you must frequently exchange water in the bag while waiting to weigh-in.

Bag water must be exchanged quickly and often while waiting to weigh in.

If the weigh-in uses a Life Support Tank, contestants will use perforated bags. The holes allow "used" water to drain out of the bag and encourage contestants to refill the bag with fresh, oxygenated water. If a Life Support Tank is not used, the bags should have no holes, but provisions must be available to exchange water or move fish quickly to weigh-in and release. The decision about the use of a Life Support Tank will be discussed below.

The weigh-in bag is a heavy plastic bag strong enough to carry about 15 pounds of fish and at least 2 gallons (16 pounds) of water. Sources of good weigh-in bags are listed on page 39. Perforated bags can be made by punching 1/4-inch holes in the bag with a paper punch. Punch a row of holes 4 to 6 inches apart, near the bottom seam of the bag. We strongly recommend making the investment in good-quality, reinforced, reusable weigh-in bags rather than cheap, thin vinyl bags that can split at the seams, leaving fish bouncing across the lawn or parking lot.

Careful coordination of bag distribution will ensure that the weigh-in runs smoothly without delay and, at the same time, that only a few anglers at a time are using the Life Support Tank(s). Contestants should fill their bags with livewell water, not lake water, before putting their catch into the bag. Instruct the contestants to put only five fish in a bag, fewer if they have fish over 4 pounds each. Give each contestant a second bag if needed. The contestants carry their bags of fish to the weigh-in facility and immediately immerse the bag in the Life Support Tank.

If the contestants are familiar with the judging and weigh-in procedures (for example, a club tournament that uses the same procedures all the time), it is acceptable for contestants, one at a time, to bring their fish to be weighed in water-filled (non-perforated) bags. The Cardinal Rule of weigh-ins still applies: Minimize the time fish are out of water, and maintain good water quality in the bag by exchanging or adding fresh water.



Do not allow anglers to simply submerge their weigh-in bags in the life support tank. Contestants must refill their bags with fresh, oxygenated water either by dipping their bags into the water or from the aerator fittings mounted on the sides of the tank

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The life support tank

Contestants should transport their fish from the boat livewell to the weigh-in facility in perforated bags, immediately immerse their bag in the Life Support Tank and allow fresh water to flow into the bag. What the Life Support Tank looks like is of little importance — the water quality is what counts. The 100- to 150-gallon polyethylene or fiberglass tank should contain cool, oxygenated lake water and salt (1 pound per 25 gallons of water). It is best to use water from the same body of water where the fish are caught to reduce stress and prevent osmotic shock.

Use enough tanks to assure that all anglers waiting to weigh in never have bags out of the water longer than a minute. Limit the number of anglers waiting with bags of fish by controlling the number of bags distributed and asking them to immediately bag their fish and proceed to the weigh-in.

A high-capacity 12-volt bilge pump is used to circulate and aerate the water and maintain high oxygen levels in the Life Support Tank. A convenient and efficient system to replenish water in the weigh-in bags is a pump connected to a manifold with four to six outlets. Each contestant places his bag of fish in the Life Support Tank and holds the top of the bag open under one of the nozzles. Well-oxygenated water flows past the fish and out the perforations at the bottom of the bag. Tournament officials must insist that contestants either utilize the freshwater nozzles and/or scoop water into the tops of the bags to exchange the water. Simply holding the bags in the Life Support Tank does not provide enough water exchange through the perforations to supply oxygen for the fish. And it should be obvious that non-perforated bags offer no freshwater exchange at all.

Maintaining saturated oxygen levels in the Life Support Tank may be easier to accomplish with a pressurized oxygen delivery system. Construction and calibration of such a system are described on page 39. The 12-volt bilge pump and manifold system are still a good idea to deliver oxygenated water to the contestants' weigh-in bags. The pump also serves as a "back-up" aeration system. Remember, tap water often has very low or no oxygen. If tap water is the only option, it must be aerated or oxygenated hours before the weigh-in begins.



A bilge pump, hose and spray bar provide water circulation and aeration. A more efficient system uses a larger pump and several spray nozzles around the tank that both aerate the water and provide locations for contestants to refill their weigh-in bags.

Temperature control

Measure the surface water temperature of the tournament water in the morning. Thermometers accurate for the temperature range you are likely to encounter are available at pet stores or aquaculture suppliers. If the lake water temperature is 75 degrees F or cooler, maintain the water in your Life Support Tank at that temperature. If the temperature is above 75 degrees F, you should maintain tank water temperature 5-10 degrees F cooler, but never higher than 85 degrees F. The Life Support Tank water temperature will rarely remain the same as the lake water temperature over the course of the day. Even during cool seasons, the water in the tank(s) on a warm, sunny day will heat up. Proper water temperature is easily maintained with block ice. Eight pounds of ice will cool 30 gallons of water about 10 degrees F for about three hours. Again, block ice is preferred because it melts slowly, cools longer, and avoids abrupt temperature changes. If block ice is not available, use bags of ice cubes, but don't open the bag. The "lump" of ice cubes will melt and cool water similar to an ice block.



Lake water in the life support tank is cooled with bags of ice and continuously aerated.

Length and live/dead judging

Most tournaments have a minimum length limit and all tournaments should have a dead-fish penalty. Thus, all catches must be inspected for short fish and dead fish. Both are done using a "Fish Judging Basket" (a plastic laundry basket). The Fish Judging Basket should be approximately 20 inches long by 12 inches wide. A number of large holes are drilled in the bottom so water will drain quickly and completely. Several baskets will be needed and each basket must weigh the same. Fine adjustments to equalize the weights can be achieved by drilling away additional material.



Fish are poured from the weigh-in bag directly into the weighing basket to reduce handling.

The bag containing the contestant's catch and water are poured into the Fish Judging Basket. They are not removed by hand. It is very convenient to put the basket in a plastic or fiberglass utility sink. These sinks, complete with detachable legs, can be purchased at plumbing suppliers or home centers. The sink provides a stable, high-sided place for the Fish Judging Basket while fish are being inspected. There is no water retained in the sink. A flexible hose attached to the drain can be positioned to direct the water away from the people working the weigh-in.

As necessary, small fish are measured by putting a measuring board into the basket and sliding the fish onto it. Fish are also judged live or dead. Handle the fish only with wet hands or wet latex gloves. Minimize time fish are out of the water by measuring only the smallest fish.

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Weighing the fish

The basket is passed to the weigh-master or, if they have been poured back into the bag after judging length and live/dead, they are poured into a basket. A plate made from plastic or rubber (the dimensions of the basket bottom) is placed over the fish to keep them from jumping out of the basket during weighing. Attach a handle to the center of each plate so it can be readily lifted on and off the fish. Install all fasteners so they cannot injure a fish.

All water is drained and the basket is put on the scale. The weight is recorded. If the contestant has caught a big fish and it is necessary to get a separate weight for that fish, it is placed into a second basket after the entire catch has been weighed rather than weighing it first, then adding the remaining fish one by one. The lid is placed over the single big fish and the weight is recorded.

Use electronic scales that can "tare" or "zero" the weight of the empty basket and "lock-in" a weight. This will greatly speed up weigh-ins and minimize arguments about weights. Do not put dead fish back into holding tanks, because it can reduce the survival of live fish. Remove dead fish from the tournament site and dispose of them properly and legally.



A heavy plastic or rubber lid is placed over the fish in the basket to reduce movement and allow for faster, more accurate weighing.

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The salt dip

B.A.S.S., some of its Federations and other larger tournament organizations use release boats, trucks or trailers with tanks that hold large volumes of water treated with the same 0.5% salt solution used in livewells. For smaller events where bass are released directly back into the tournament waters, the salt dip procedure described below is highly recommended.

A quick immersion in a 3 percent salt solution significantly reduces stress and prevents disease. The solution is made by mixing 3.5 pounds of salt to 15 gallons of water. Another utility sink works well for the salt dip. As necessary, use small amounts of ice to cool the salt dip temperature to that of the Life Support Tank. The temperature must be adjusted before the salt dip is used, because there will not be room for ice when the basket is placed into the sink.



A 10 to 15 second "salt dip" stimulates mucous secretion and helps increase post-release survival.

The basket containing the fish is removed from the scale and put in the 3 percent salt dip for 10-15 seconds — no more. Some fish may lose their equilibrium and roll on their sides. This is a normal reaction, and as long as you do not exceed 15 seconds in the salt dip, it is not a problem. When released, the fish will right themselves and swim away.

The fish will slough a lot of mucus in the salt dip. Therefore, the salt solution should be drained and replaced after 20-30 baskets of fish. Have your next batch of salt dip water mixed, pre-cooled, and ready to go. Be careful where you drain the salt solution — it is highly corrosive and will kill grass or other plants, but can be poured into the lake without causing any damage. Regardless of the ultimate release method chosen (described below), the salt dip is done immediately after the fish are weighed, to avoid additional handling.

Keeping Bass Alive

Releasing the fish

Diligent anglers and a well-conducted weigh-in will not achieve maximum survival if the fish are released in the wrong place. Here are some, but by no means all, characteristics of good and bad release sites.

The fish should be released into water at least 3 feet deep. Often, pouring the fish into the lake from the end of a pier is sufficient. If a pier is not available, pouring the fish over the stern of a boat nosed onto the bank may work.

Have another cooler with ice in it at the release site. Put any fish that do not swim away within 30 minutes into this cooler. Remove them from the tournament site and dispose of them properly and legally. At an ideal weigh-in site, a good fish release location or the live-release boat, truck or trailer are only a few steps away from the scale.

Have you been counting? How many times have the fish been handled? Every time a fish is handled, more stress is added. Admittedly, the fish have been disturbed and exposed to air, and thus stressed, on and off for about five minutes, but the fish have been handled only three or four times.

Release options

Tournament organizers have four proven methods for releasing fish:

1. Release Boat with one or more transport tanks: This is an expensive option, but worth the investment for an organization with many relatively large tournaments, especially if the tournaments are repeatedly held at the same location. The fish can be transported to ideal release sites and distributed throughout a larger area. This prevents stockpiling fish that may lead to high catches by anglers fishing at a confined release site.

Good release site

- Clear water. Good water circulation — for example, on the main lake or in a large bay or cove near the main lake.
- Hard, clean bottom.
- Away from boat traffic.
- Launch areas away from heavy public use.
- Deep water or deep water nearby.
- Relatively cool water.
- Good water quality.

Bad release site

- Turbid water.
- Poor water circulation — for example, small bays, canals, areas of dense aquatic vegetation.
- Soft bottom, a lot of sediment or organic matter.
- Areas with high public use.
- Shallow water with no deep water nearby.
- Areas affected by storm run-off or marsh drainage.
- Near discharge from power plants, industrial effluents, water treatment plants.

Transport tanks can be purchased from an aquaculture supply company or, like the Life Support Tank, can be made from polyethylene stock tanks. The tanks should have a 6- or 8-inch diameter bottom drain with a gate valve so fish can be flushed out of the tank at the release site. Drain fittings can be purchased from an aquaculture supplier. The tanks should have a cover to keep fish from jumping out. Ideally, the cover will have a small collapsible hatch so fish can be put into the tank with little risk of others jumping out. Again, the fish are simply poured from the Fish Judging Basket into the tank; they are never handled. Water pumps will be necessary to fill and flush the tanks.

Water temperature in the transport tank should be the same as in the Life Support Tank. Add salt to the tank at the rate of 1 pound per 25 gallons of water.



Large tournament organizations or weigh-in locations that host frequent tournaments will benefit from a live-release boat or trailer.

Caution: One gallon of water weighs 8 pounds. A full 250-gallon transport tank, which will hold and transport a maximum of 250 pounds of bass, weighs 2,000 pounds (1 ton) plus the weight of the fish, tank and aeration system. Be sure that the boat used to carry the transport tank has sufficient passenger and cargo capacity.

Maximum tank capacity with an ideal aeration or oxygen delivery system is 1 pound of fish per gallon of water. You will need to calibrate your aeration or oxygen delivery system to be sure that you are maintaining adequate oxygen as you approach the tank's maximum capacity.

2. Truck or trailer-mounted transport tank: The tank(s) would be the same as those used on a release boat, except mounted on a trailer or put on the bed of a truck. As with all transport tanks, water temperature must be controlled, an aeration or pressurized oxygen delivery system must be used to maintain saturated oxygen conditions, and salt is added at 1 pound per 25 gallons of water.

A truck- or trailer-mounted transport tank is a good option because it can easily be parked next to the weigh-in scale and the salt-dip tank. However, this option is only desirable if there is a good launching ramp on the main part of the lake, reservoir or river where fish can be released. Check the characteristics of a good release site. Attaching a release chute or tube (see below) to the transport tank drain after you have backed down the launch ramp will help release the fish into deeper water and farther from shore.

3. Contestant Boats: Each contestant has a transport tank — the boat livewell. This release method is useful for small events, like a club tournament, if release conditions are poor at the weigh-in site. The livewell should be kept at the proper temperature, have high oxygen levels, and contain a 0.5 percent salt solution. If this option is used, ask the contestants to leave their livewell aerators running while weighing their fish. This will ensure adequate oxygen concentrations when the fish are poured back into the livewell.

After the fish have been salt-dipped, they are poured back into a weigh-in bag and returned to the angler. The angler quickly carries the fish to his or her boat and pours the fish back into the livewell. Tell the angler where to release the fish. A downside to this release method is that the

fish are out of water for a brief period of time and must be handled again when they are removed from the livewell and released back into the lake.

Is a live-release boat good for your event? How many fish will be caught? What will be the average weight? How much transport tank capacity will you need? What do you do when the transport tank is full but only half the contestants have weighed in? Although live-release boats are a boon to tournaments, they are not a "silver bullet" and, indeed, may not be suitable for all events. Carefully evaluate the plusses and minuses before investing time and money in a live-release boat, truck- or trailer-mounted transport tank.

4. A Release Tube: This can be a PVC drain pipe long enough to get the fish away from shore directly from the weigh-in location and into deeper water. This option may be necessary if the pier is high above the water or if riprap, dense vegetation, or a steep bank slope makes access to the water difficult or unsafe.

The drainpipe must be at least 8 inches in diameter. If it is necessary to use several sections of pipe, join them so the coupler ("bell") end is pointed away from the water. This will allow the fish to slide smoothly down the pipe. The pipe should be angled at a maximum of 1:3 (rise to run) pitch and a minimum of 1:6 pitch. The outlet end of the pipe should be no more than 6 inches to 1 foot above the water. Sufficient water must be available to pour down the pipe with each basket of fish to keep the inside of the pipe wet. A 12-volt bilge pump and hose assembly works well to keep a continuous flow of water running through the release pipe. A funnel or chute will facilitate sliding the fish from the Fish Judging Basket into the pipe.

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Fish survival: Other considerations

Reduced limits

Reducing the bag limit per angler or team will help reduce the number of fish held in the livewell and, consequently, the oxygen demand. This is particularly applicable to draw-for-partner events where the livewell may be holding two limits of fish.

Flights

For large tournaments, assigning anglers to "flights" with different tournament take-off and weigh-in times can prevent overcrowding at the boat landing area and facilitate a more orderly weigh-in.