Ontario

A Review of "Fizzing" - A Technique for Swim Bladder Deflation

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Executive Summary

Fish which are quickly removed from deep water often display signs of depressurization. Symptoms include over-inflated swim bladders, hemorrhaging, erratic swimming behavior and the inability to submerge when released. Death can result from gas embolisms, internal organ damage or from predation and exposure when unable to descend from the water surface.

Recently, a procedure known as "fizzing" has been developed in an attempt to artificially deflate gas from a distended swim bladder. The procedure involves puncturing the swim bladder through the musculature of the fish with a sharp instrument such as a hypodermic syringe.

Despite the relatively widespread use of this technique, particularly at competitive fishing events, there is considerable controversy about the relative merits of this procedure. Numerous North American jurisdictions either prohibit or discourage the practice of "fizzing".

There is a need for more exhaustive research on the practice of artificial air bladder deflation and the examination of alternate techniques for the successful release of fish which have been angled from deep water.

Pending further research and evaluation, the widespread use of "fizzing" should be discouraged in Ontario.

Function of the Swim Bladder

Freshwater fish have an internal organ known as the swim bladder which allows them to regulate the amount of gas in their bodies and, hence, their buoyancy. Neutral buoyancy enables a fish to remain motionless in midwater and reduces energy requirements of swimming. At any time, a fish is in buoyancy equilibrium at one depth only.

There are two basic types of swim bladders in freshwater fish. Physostomous fish possess a pneumatic duct which connects the swim bladder to the alimentary tract. These fish, which include carp, esocids, trout and salmon, can expel gas and make buoyancy adjustments more quickly than physoclistous fish. Physoclistous fish, which include bass, walleye, perch and most panfish, have closed swim bladders with no connecting duct between their swim bladder and alimentary tract. Deflation is accomplished by diffusion of gas via a network of capillaries. As a result, these species are unable to release air quickly.

Natural pressurization of the swim bladder can be a relatively slow process. Sheehan and Shasteen (1997) found that the maximum rate of pressurization for largemouth bass corresponded to approximately 15 cm (6 inches) per hour indicating that it could take as much as a day for a bass to move from 3 to 6 m in depth without having to swim.

Adjustments to volume and pressure of gas in the swim bladder is used to maintain depth. For example, in deeper water gas in the swim bladder is compressed and greater pressure is required in the bladder to maintain equilibrium. When quickly brought to the surface from deeper water, there is a decrease in hydrostatic pressure but swim bladder pressure remains high, the bladder expands and damage occurs to the swim bladder, adjacent tissues and internal organs.

The Problem of Rapid Depressurization

Rapid removal of fish from deep water to the surface by traditional angling techniques does not allow an ample time for depressurization. Effects of depressurization can include:

- Over-inflation of the swim bladder,
- Inability to submerge when released - exposure to predation and solar radiation,
- Abnormal or erratic swimming behaviour,
- Protruding eyes,
- Gas embolisms (blood vessels, gills, skin and brain),
- Protrusion of internal organs through the mouth,
- Internal and/or external hemorrhaging,
- Cloacal protrusions,
- Death.

Although the most obvious sign of depressurization is an over-inflated swim bladder, damage to other critical tissues, including the brain and heart, due to gas bubbles in the blood is often a cause of death.

In Lesser Slave Lake, Alberta, walleye angled from waters between 7.6 and 10.1 m in depth were found to have significantly higher serum aspartate aminotransferase, potassium, and lactate concentrations which indicated increased hypoxia and muscle injury in comparison to the shallow-caught fish (R. L. & L. Environmental Services Ltd. 1995). Based on a relatively small number of studies which have been conducted to date, depressurization of angled fish can be a significant source of mortality (Table 1). Up to 45% of fish caught at depths exceeding 10 m do not survive release (Anonymous 1991_b).

Table 1. Mortality from rapid depressurization recorded for various freshwater fish species.

Fish Species	Depth of Capture (m)	% Mortality	Reference
Black crappie	≥ 12	77%	Childress (1987)
Largemouth bass	9	25%	Feathers and Knable (1983)
	18	42%	
	27	45%	
Lake Trout	12-40	26%	Thurston (1988)
Rainbow trout	1-3	10-33%	Faccin (1983)
	6	50-70%	
Walleye	< 3.5	< 10%	Cano (2001)
	< 10	1.1%	Fletcher (1987)
	8.4-10.4 (mean 9.1)	18.4%	Rowe and Esseltine (2001)
White crappie	13	29%	Hubbard and Miranda (1989)
	16	67%	
Yellow perch	10-15	0-64% (mean 20%)	Keniry et al. (1996)

The impact(s) of rapid depressurization varies among species (Foye and Scott 1965) but is particularly noteworthy for bass (*Micropterus* spp.) and walleye (*Stizostedion vitreum*) - species which are actively sought during competitive fishing events.

In a winter study of walleye caught and released in Lake Nipissing, Ontario, virtually all mortality was attributed to complications resulting from over-inflation of the swim bladder (Rowe and Esseltine 2001). Distended or ruptured swim bladders were reported in 35% of dead, tournament-caught walleye from Beaver Lake, Alberta, and 22% in Lesser Slave Lake, Alberta (R. L. & L. Environmental Services 1993). Ruptured swim bladders were observed in fish caught from depths as shallow as 5 m. It was recommended that, to maximize post-release survival, walleye should not be taken at depths exceeding 7.5 m.

Shasteen and Sheehan (1997) reported that largemouth bass showed signs of depressurization from depths of 3.5 m and were unable to immediately submerge when depressurized from 8.4 m.

Air Bladder Deflation ("Fizzing)

A procedure to deflate gas from a distended swim bladder, commonly known as "fizzing", has been developed in recent years. The procedure involves the use of a sharp instrument to puncture the swim bladder allowing excess gas to escape.

A number of instruments, including a knife (Anonymous undated$_a$), ice pick (Childress 1987), sharpened football inflation needle (Anonymous undated$_a$) and syringe (Bruesewitz et al. 1993), have been used. Hypodermic syringes, 16-20 gauge and approximately 4-5 cm in length, are the most commonly used device. The key to this procedure is to locate and puncture the swim bladder without damaging other internal organs (See Figure 1).

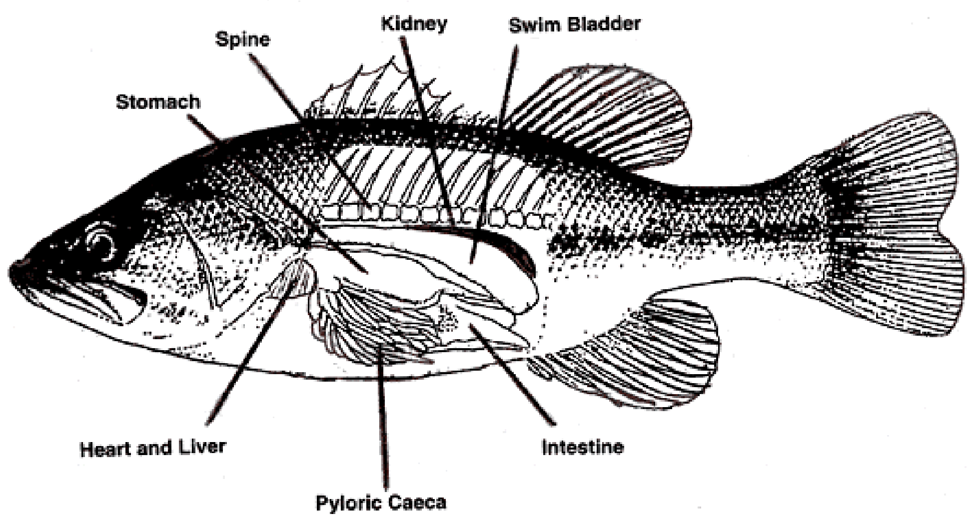
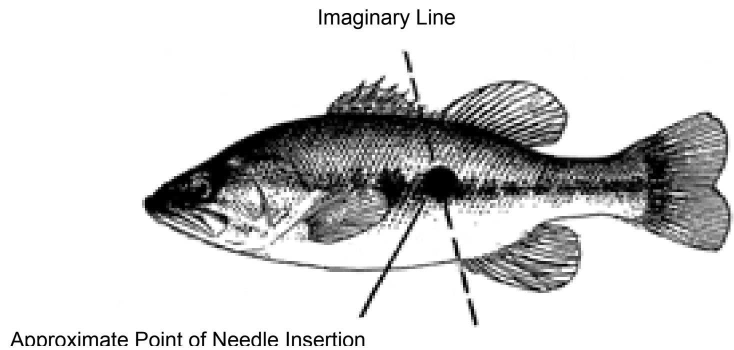


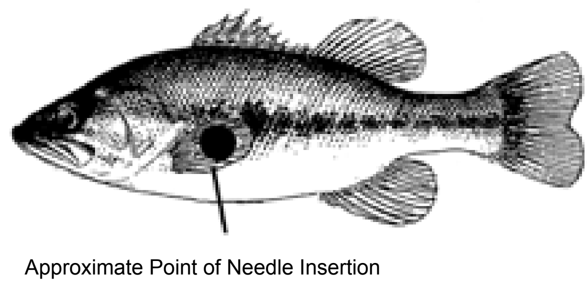
Figure 1: Basic internal anatomy of a largemouth bass

The fish is usually held underwater or on a smooth, wet surface. Several different methods have been described for determining the puncture location and conducting this procedure:

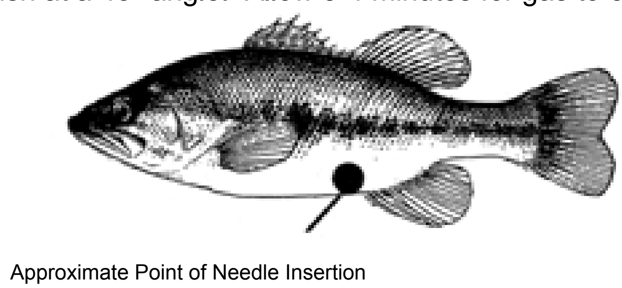
(i) Remove a single scale from the midpoint of a line extending between the anal opening and the space between the soft and spiny rayed portions of the dorsal fin. Insert the hypodermic needle at a 45º angle towards the head of the fish. Once the swim bladder is punctured, press lightly on the stomach of the fish until the sound of air escaping stops (Schramm and Heidinger 1988, Manns 1989, Shasteen and Sheehan 1997, Sak 1999, Rowe and Esseltine 2001).



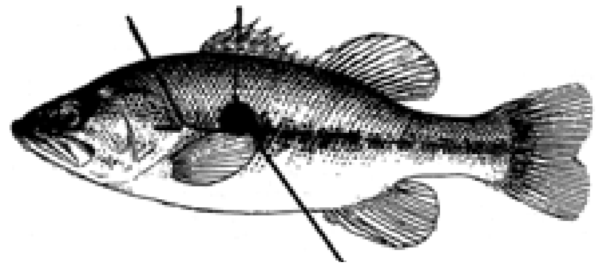
(ii) Locate a point approximately 0.6 cm posterior to the pectoral fin and at least 0.6 cm below the lateral line. Insert the needle under one of the scales at a 45º angle. Place the fish underwater and gently squeeze the belly to allow gas to escape (Lee 1992, Anonymous undated$_c$)



(iii) Select a site 2 scales to the right or left and five scales forward of the anal opening. Insert an 18 gauge needle (approximately 3.8 cm in length) into the fish at a 45º angle. Allow 3-4 minutes for gas to escape (Walters 2000).



(iv) Draw an imaginary line from the fourth dorsal spine straight down to meet an area even with the point of the gill flap and straight with the center of the tail. You may not hit your mark the first time. Insert the needle no farther when a bone (e.g., rib) is felt. Remove the needle, count one or two scales down and back and try again (Dean 2001).



Successful penetration of the swim bladder is usually evidenced by the sound of escaping gas. It is important that too much gas is not released. Dean (2001) recommended that the procedure be conducted with the fish held underwater so that air bubbles could be seen escaping from the punctured swim bladder. Usually, fish are retained for a short period of time to determine if sufficient gas has been released and equilibrium has been achieved.

Does "Fizzing" Work?

Studies conducted to date have not been definitive on the relative merits of "fizzing". Artificial deflation has resulted in a significant reduction in mortality of several marine fish including black sea bass (*Centropristis striata*) and Vermilion snapper (*Rhomboplites aurorubens*) (Collins et al. 1999). Shasteen and Sheehan (1997) concluded that artificial swimbladder deflation should occur for bass caught from depths greater than 6 m and showing signs of stress. On Lake Nipissing, Ontario, Rowe and Esseltine (2001) "fizzed" 6 walleye with overextended swim bladders. After 7 days, 5 of 6 walleye were still alive.

Although Lee (1992) concluded that "fizzing" was not harmful to the fish, others have expressed concerns that this procedure adds injury to handling trauma. There are opportunities for infection and the possibility of piercing another organ, particularly during periods of rough water, is very real. In Alberta, Walty (personal communication) reported a high frequency of kidney punctures and hemorrhaging in walleye which had been "fizzed". Some mortality resulting from fungal infections of "fizzed" fish has been reported (B. Howard, pers. comm.). Brusesewitz et al. (1993) reported that punctured swim bladders of burbot (*Lota lota*) began healing the first week after release and were completely healed within 8 weeks. In Illinois, Shasteen and Sheehan (1997) reported that punctured swim bladders of largemouth bass healed quickly and functioned properly with apprarently no permanent damage.

There have been some indications that "fizzing" may not be appropriate for all species, particularly percids. Kamke (2000) reported greater mortality for tournament-caught walleye which had been "fizzed" compared to those which had not been treated. A three year evaluation of air bladder deflation in tournament-angled walleye from Lake Erie was conducted by the Ohio Department of Natural Resources (Walters 2000). They reported substantial mortality with this procedure especially during periods of bad weather. As a result of this study, Ohio does not recommend "fizzing" tournament-caught walleye. In an Alberta study (R. L. & L. Environmental Services Ltd. 1995) swim bladder deflation did not affect the survival rates of walleye captured from depths less than 6 m or between 6.1 and 7.5 m. For walleye angled from waters 7.6-10.1 m in depth and "fizzed", there was a lower survival rate (42.9-66.0%) than for "unfizzed" walleye (89.5-90.0%).

Puncturing the swim bladder has been found to improve the short-term survival and not decrease the long-term survival of yellow perch (Keniry et al. 1996). Bruesewitz et al. (1993) found no increase in survival of burbot after being caught from deep water and having their swim bladder deflated.

Undoubtedly, the success of "fizzing" depends on the conditions at the time and also on the training and experience of the individual performing the procedure. It is a difficult procedure to perform accurately and, from an anatomical perspective, there is very little room for error.

Whether the "fizzing" technique should be utilized also depends on the species of fish. For example, salmonids, such as lake trout, which are able to expel excess gas more quickly, may be more suited to be returned to their original depth of capture by other techniques.

"Fizzing" Policies in North America Jurisdictions

Surveys on the administration and regulation of competitive fishing activities have recently been conducted in both the United States (Kamke 2000) and Canada (Kerr 2001). In both surveys, one question was "Does your agency advocate "fizzing" fish (releasing air from the air bladder with a hypodermic needle) to enhance survival?"

The vast majority of respondents both in the United States and Canada do not promote this practice (Table 2).

Table 2. Survey responses on the practice of "fizzing" in various North American jurisdictions (based on surveys by Kamke (2000) and Kerr (2001)).

Jurisdiction	Response to the question "Do you advocate fizzing"
Canada	
Alberta	• No - absolutely not
British Columbia	• No
Manitoba	• No
New Brunswick	• No
Newfoundland	• No policy on "fizzing"
Northwest Territories	• No policy on "fizzing"
Nova Scotia	• No - but not an issue with shallow lakes
Ontario	• No formal policy but generally discouraged
Prince Edward Island	• No policy on "fizzing"
Québec	• No
Saskatchewan	• No
Yukon	• No
United States of America	
Alabama	• No, but not discouraged
Alaska	• No - technique not used
Arizona	• Yes, but also looking at other options
Arkansas	• Neither advocate nor discourage
California	• Yes
Connecticutt	• No policy - waters too shallow
Delaware	• Not necessary, waters too shallow
Florida	• Not necessary, waters too shallow
Georgia	• Yes

continued…..

Table 2 (cont'd)

Jurisdiction	Response to the question "Do you advocate "fizzing"
Hawaii	• No, fizzing is a problem
Idaho	• No, but allow it to be done
Illinois	• Possibly on Lake Michigan
Indiana	• No formal policy
Iowa	• No
Kansas	• No
Louisiana	• No
Maine	• No policy
Maryland	• No but commonly used
Massachusetts	• Neither advocate nor discourage
Minnesota	• No - not allowed
Mississippi	• Not done (only one deep lake in state)
Missouri	• Not opposed to fizzing- it is regularly done
Montana	• No, advocate other methods instead
Nebraska	• Yes
Nevada	• Yes
New Hampshire	• No
New Jersey	• No
New Mexico	• No
New York	• No
North Carolina	• No
North Dakota	• No - It is discouraged
Ohio	• No
Oklahoma	• Yes
Oregon	• No
Pennsylvania	• No
Rhode Island	• No
South Carolina	• Yes - in some locations
South Dakota	• No - It is discouraged
Tennessee	• No policy
Texas	• No
Utah	• Yes
Vermont	• No
Virginia	• No
Washington	• No
West Virginia	• No
Wisconsin	• No policy on fizzing
Wyoming	• No

In Ontario, "fizzing" is not believed to occur on a widespread basis although there is increasing interest. Some Ontario tournaments are known to prohibit this activity. In at least two tournaments which have endorsed "fizzing" for walleye, there has been significant post-release mortality. Generally, the practice is not supported by most field staff within the Ontario Ministry of Natural Resources however no legal means presently exists to restrict or prohibit this practice.

Alternate Release Techniques

There are alternative techniques for releasing fish caught from deep water. These include:

(i) **Hannon Deep Water Release** (from Manns 1986). This technique, commonly used for release of bass, involves threading monofilament line through a hole in the fish's jaw (not bone) and through the eye of a 3-6 ounce sinker. The end of the line is held by the angler and the fish is lowered down to the desired depth (usually at least 3-4 m). At the desired depth, the line is released and the sinker is retrieved by reeling in the line which pulls the line through the jaw of the fish until it is free.

(ii) **Davis Deep Water Release** (from Reid and McIntyre, pers. comm.). This technique, originally developed for lake trout, involves inserting the "hook" end of a weighted device into the opercular (gill) opening of the fish as closely as possible to the mouth (to avoid the gill filaments). The fish is placed head down in the water allowing the weighted device to pull the fish down while the line on your reel is "free wheeling". At the desired depth, you simply need to stop the line and the fish is released. It is important that there is adequate weight for the fish being released so that the fish is pulled down fast enough that it does not drop off prematurely.

Figure 2: Apparatus used for deep release of lake trout (photo courtesy of D. Reid, Ministry of Natural Resources, Owen Sound)

A similar technique can be devised for releasing other species, including walleye and bass. This technique (see Manns 1989) involves the use of a 4-6 ounce release sinker with a barbless hook mounted point down and attached to your rod. The barbless hook is gently inserted downward through the soft flesh of the lower jaw and the fish is lowered to the desired depth. The fish is unhooked by reeling up the release sinker.

(iii) **Submersible cage** (Wegman pers. comm.) - In some instances a small cage has been used to lower fish back down to their original depth of capture. In these instances, the fish are held at the desired depth for a period of time (usually overnight) before they are released from a door which can be opened from the surface. To date, this method has been used primarily at some small bass tournaments on the Great Lakes.

Best Management Practices

There are several issues associated with the successful release of fish angled from deep water. The technique of "fizzing" is controversial but not illegal in Ontario.

Based on the information assembled, several best management practices for addressing this issue have been identified:

1. Avoid fishing deeper waters

- Refrain from fishing deeper (5-6 m) waters if you intend to release your catch.
- Consider the depth of capture when deciding which fish to release and which to retain for consumption.
- Schedule tournaments at a time when fish are in shallow water. Avoid scheduling events for walleye during mid summer (e.g., July-August) when fish are in deeper water.

2. Practice sound catch-and-release practices

- Land the fish quickly.
- Keep the fish wet when removing the hook.
- Avoid injuries to sensitive areas such as the eyes and gills.
- Cut the line in a deeply hooked fish.
- Release the fish quickly after it is landed. Tissues around the swim bladder are often capable of preventing a pronounced increase in size for a few minutes after the pressure outside of the fish decreases (Anonymous undated$_b$). Many fish can re-submerge if released quickly (e.g., within 1-2 minutes).
- Consider the use of alternate techniques to lower the fish back to its depth of capture for release. Fish should not be released in water deeper than where they were captured nor should they be released in oxygen-poor water below the thermocline.

3. Techniques for artificial swim bladder deflation

- Artificial air bladder deflation should only be considered in cases where a fish displays the inability to re-submerge in the water column after release or it is obvious that the fish will die without assistance. Fish which are deeply hooked, bleeding profusely or have badly damaged gills are not candidates for this procedure.
- "Fizzing" may not be appropriate for certain fish species (e.g., walleye).
- Artificial air bladder deflation is difficult to perform accurately and should only be conducted by experienced, trained individuals.

- "Fizzing" should not be done during periods of rough water conditions.
- Do not force protruding organs back into the body cavity.
- Fish which have had their airbladder deflated should be returned to their original depth of capture as quickly as possible.

Research Requirements

Clearly, artificial air bladder deflation is an area where further research is required in terms of:

- Determining critical depths for different fish species and various sizes of fish.
- Analyzing physiological and biochemical parameters of depressurized fish.
- Documenting post-release mortality involved with artificial gas bladder deflation for various fish species.
- Evaluating other techniques for releasing fish back to deep water.

Direction on the use of this technique must be based on a thorough study of its merits and impacts. Pending further research and evaluation, its widespread practice (e.g., at tournaments) should be discouraged in Ontario.

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