

WARREN L DUNLOP

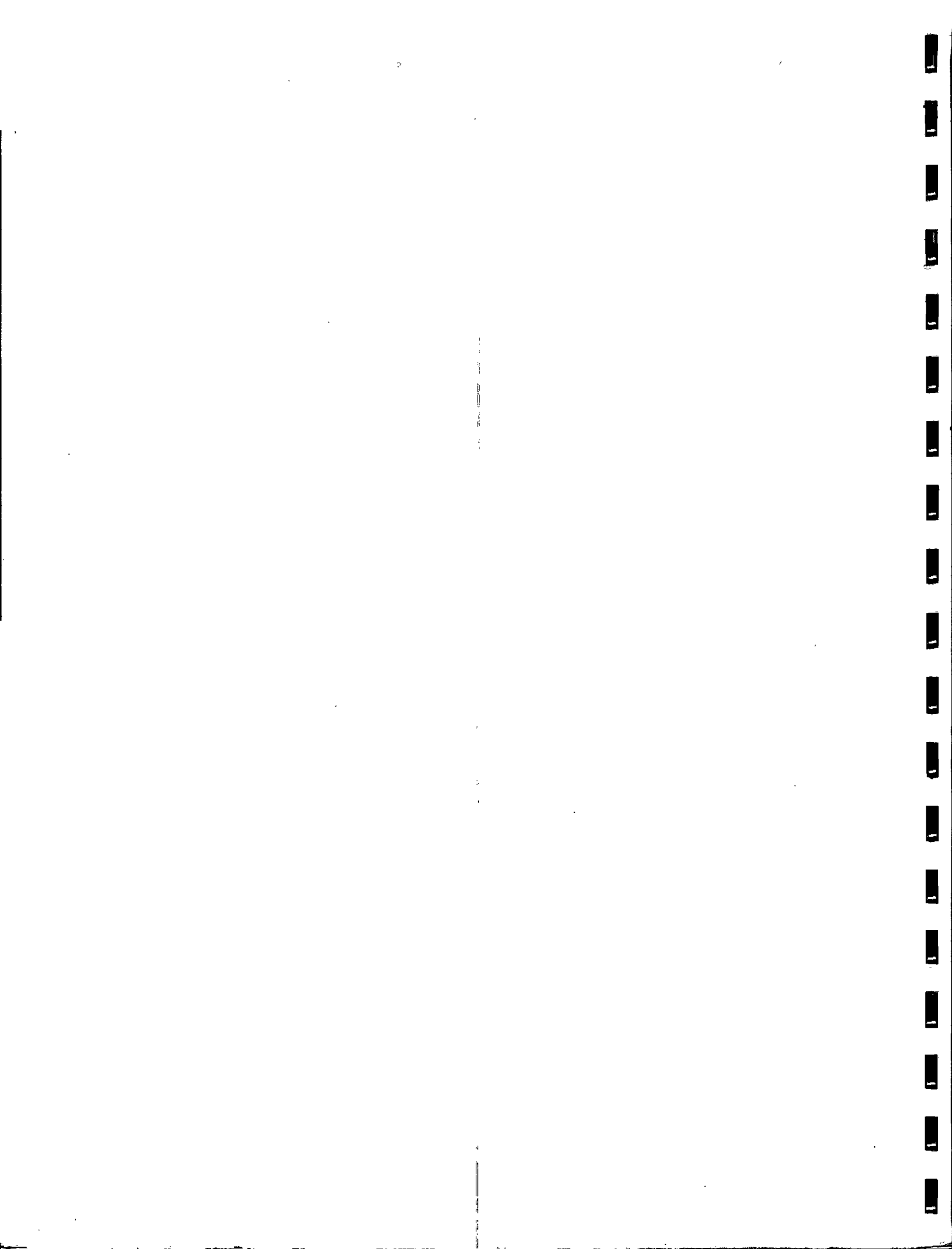
Walleye Catch/Release Mortality:
An Annotated Bibliography

Percid Community Synthesis
Harvest Control Working Group
1995



Ontario

Ministry of Ministère des
Natural Richesses
Resources naturelles



**WALLEYE CATCH/RELEASE MORTALITY:
AN ANNOTATED BIBLIOGRAPHY**

**Percid Community Synthesis
Harvest Control Working Group
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**Ministry of
Natural
Resources**

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INTRODUCTION

The objective of this report is to provide a catalogue of existing information specific to walleye (*Stizostedion vitreum vitreum*) hooking mortality and its potential effect on the Ministry's walleye management program.

The present direction in fisheries management (more specifically walleye management) is to control angler's harvest through regulatory measures that limit the quantities and/or sizes of fish that can be kept. In order for this strategy to be effective all fish that die after release must be considered part of the harvest.

Hooking mortality is the total of direct mortality (eg. from hooking location) and indirect mortality (eg. handling stress) after release.

There are basically two types of walleye fisheries that have the potential for different impacts on the level of hooking mortality:

- 1) **Competitive Fishery** - derbies or tournament events which may explicitly or implicitly promote: (a) "fishing up" or "culling" (ie. initially keep all the walleye caught and once the specified derby limit is reached start releasing the smaller walleye that have been previously held to make room for larger fish); (b) the holding of walleye, which will be later released, for extended periods of time so that they can be "weighed-in." This puts additional stress on an already stressed fish.
- 2) **Sport Fishing** - by anglers who fish for food and/or recreation. In most cases fish are immediately released if they are not going to be kept for eating or trophies. Some anglers "fish up" or "cull" to achieve a larger sized take home catch. This practice can take place over a period of hours (typical day trip) or days (remote outpost camps). These type of anglers inflict hooking mortalities similar to the tournament angler.

An overview is presented, summarizing the main contributing factor to high levels of hooking mortality, i.e. "**holding time**" and then detailing effects of individual stressors.

METHODS

Twenty-nine individual papers reviewed have been summarized under the following headings: Tournament Rules; Study; Holding Pens; Weather; Immediate Mortality; Delayed Mortality; Weigh-in Mortality; Total Mortality; Good Stuff; Short Comings.

Information search has purposely been limited to walleye and sauger because of the extremely large amount of information available on other species. It was felt the level of information presented here could not have been achievable without limiting the search. It may be possible to make inferences from other species such as bass and salmonids but this has not been done in this report.

RESULTS

1. ANONYMOUS. 1992. The effect of cage stocking density on the post-tournament survivorship of caught walleye, 1992 - Slave Lake catch and release walleye tournament. 7 p. (Unpubl. Ms.)

Tournament Rules: 17" min. weigh-in size; 5 fish/2 man team/day; live well with aeration; no more than 5 fish in live well at time; culling; fizzing; sounding criteria; holding pens 1.5 X 2 X 2 meters.

Holding Pens: Densities 40/25/15 per cage. Held 5 days.
Mortality increased with density.
15/cage=13.3% 25/cage=21.6% 40/cage=35.8%

Weather: Mortality increased with higher winds. (Day 1 calm, Day 2 2 ft. waves)

Immediate Mortality: 7 (2%) of 359 walleye either died or did not meet sounding criteria. Day two was much windier and had 4% immediate mortality.

Delayed Mortality: 27.2% (Dead + Likely to die)
97% had some fin erosion and fin rot.

Good Stuff: **Wind** plays a role in immediate mortality.
Density effects of holding.

Short comings: Overall mortality as a result of tournament was not estimated. From data provided I've estimated 28.7%
Was delayed mortality a factor of handling or holding?
Did not link pre-holding condition of fish with final mortality.
Nothing on results of "fizzing"
Calculation errors.

2. ARMSTRONG, K. 1990. Catch and release panacea or paradox. Ont. Minist. Nat. Resour. 21 p. (Unpubl. Ms.).

This paper is an overview of catch and release information on all species and its potential impact on management. Provides examples of how catch and release mortality can be factored into total angling harvest estimates.

3. BOLAND, T. 1991. An evaluation of walleye/sauger tournament fishing on the Mississippi River bordering Iowa, 1988-1990. Fish Manage. Rep., Iowa Dep. Nat. Resour., Des Moines, Iowa. 18 p.

Tournament Rules: 4 tournaments; 8 or 10 fish/2 man team/day; 2-3 days; 10 fish in livewell; 14" or 15" size limit; Masters Walleye Circuit (MWC), Mariner Classic Tournament (MWC), and Masters Walleye Open (MWO).

Holding Pens: Hatchery Tank or Hoop Net. Held average 3.5 days.

Weigh-in Mortality: 60 tournament caught walleye that did not go through the weigh-in and went directly to the holding structures had **41.7%** mortality (range 34.8-64.3%). 200 walleye that went through the weigh-in had **85.0%** mortality (range 78.0-92.0%). Data adjusted for fish in poor condition and not expected to live: control not effected but weigh-in ranged from **82.0-100%**. Tournament open to all anglers had lower mortalities than professional anglers.

Good Stuff: **Weigh-in** process caused an additional **49.3%** mortality.
Series of tables showing O₂ vs time, O₂ vs # fish and O₂ vs weight of fish in recirculating and non-recirculating live wells.
Table of mortality vs temperature.
Water temperature, oxygen concentration in the live wells and length of time in the weigh-in were the main mortality contributors.

4. BRUCH, R. 1990. Initial and delayed mortality of tournament live release walleye and sauger-preliminary report. Wisconsin Dep. Nat. Resour. 3 p. (Unpubl. Ms.)

Tournament Rules: (Fond Du Lac, Lake Winnebago; early June 1990)
Bonus and penalty for live and dead fish; circulating live wells; 3 day tournament.

Study: Fish alive after weigh-in tagged and released. 626 walleye and 230 sauger caught.

Weather: This appears to be the only difference between the three days.
Day 1 - 62°F, 5-22 sw wnd, **prtly cldy**; Day 2 - 65°F, 15-25 w wnd, sunny; Day 3 - 67°F, 10-15 nw wnd, sunny.

Immediate Mortality: Day 1 = 4.8%; Day 2 = 12.2%; Day 3 = 13.1%; Average = **10.1%** (Walleye only)

Delayed Mortality: Only follow-up was July 17/90 (11 fish found dead along shore and 9 caught by anglers)

Good Stuff: Shows possible mortality link with **sunny vs cloudy** days.

5. CLARK, R.D. JR. 1983. Potential effects of voluntary catch and release of fish on recreational fisheries. N. Am. J. Fish. Manage. 3:306-314.

Provides theory on the effects of live release on fisheries. (Not specific to walleye)

Good Stuff: < 10% mortality assume effect negligible.
> 10% mortality affects creel census estimates.

6. FIELDER, D.G., AND B.A. JOHNSON. 1992. Weigh-in, delayed and total mortality of walleyes at two live-release fishing tournaments of Lake Oahe, South Dakota. South Dakota Dep. Game Fish Parks, Fish. Res. Dev., Spec. Rep. No. 92-5. 16 p.

FIELDER, D.G., AND B.A. JOHNSON. 1994. Walleye mortality during live-release tournaments on Lake Oahe, South Dakota. N. Am. J. Fish. Manage. 14:776-780, 1994.

Tournament Rules: 3 day tournament (Professional walleye trail circuit)
4 fish daily limit; 15 inch min. length;
aeration and circulation live wells;
bonus or penalty for live or dead fish

Study: 1432 walleye in 1990 and 925 walleye in 1991

Holding Pens: held 3 days
4'x4'x6' floating pens.
222 fish held in 1990 and 165 in 1991

Weather: Temp. 47-52 °F (1990 immediate mortality increased with temp-not significant); Rough to calm (1991 immediate mortality was less on the calm day)

Immediate Mortality: 263 fish (18.4%) in 1990 and 122 (13.2%) in 1991

Delayed Mortality: 5.4% in 1990 and 10.9% in 1991 (2.5% of control died) Net mortality 2.9% and 8.4% after subtracting 2.5%

Total Mortality: 20.9% in 1990 and 20.5% in 1991

Good stuff: **Delay** from catching to weighing seems to be main contributor to mortality.

7. FLETCHER, D.H. 1987. Hooking mortality of walleye captured in Porcupine Bay, Washington. N. Am. J. Fish. Manage. 7:594-596.

FLETCHER, D.H. 1987. Hooking mortality of caught-and-released walleye. p. 170-174 *In* R.A. Barnhart and J.D. Roelofs, [ed.]. *Catch-And-Release Fishing, A Decade of Experience: A National Sport Fishing Symposium*. Humboldt State University, Arcata, CA.

FLETCHER, D.H. 1985. Mortality of walleye caught on sport gear and released. Washington Dep. Game Fish Manage. Div., Olympia. 33 p.

Note: Three papers on the same topic. (Amount of information provided varies)

Study: Two groups of walleye, one angled (jigs with rubber tails and worms) the other electrofished.
 May 4, 1985; 180 walleye angled (ave. 40.1 cm, 52% ripe males no ripe females)
 Caught in 2-10m of water.
 164 electrofished(ave. 29.7 cm, 8% ripe males and 3% ripe females)
 Water temp. 8-11°C

Holding Pens: 7m x 7m x 3m deep. Held in floating pens for 12 days.
Put immediately into holding pens

Delayed Mortality: One angler caught fish died after 1 day another considered dead (lower jaw torn in two) **1.1%** mortality

8. GOEMAN, T.J. 1991. Walleye mortality during a live-release tournament on Mille Lacs, Minnesota. N. Am. J. Fish. Manage. 11:57-61.

Tournament Rules: May 25-27, 1989; limited to 150 anglers; 2 per boat; individual weigh-in. Aeration and circulation live wells and backup; bonus for live fish
 5 fish daily limit; 1 > 20 in TL;
 3 days of pre-tournament fishing

Study: 3 samples (122 walleye pre-tournament same stresses as tournament but no weigh-in or crowding in live wells; 210 from day 1 of tournament; 161 walleye from day 3)

Weather: Day 1 and 2 were very rough; Day 3 and pre-tournament were calm
 Water temp. 55-58°F

Holding Pens: held 5 days, held at 12 ft. depth in a 13' hoop net with throat removed

Immediate Mortality: **1-6.2%**

Delayed Mortality: **5.7-47.1%**

Total Mortality: Day 1 **50.3%**; Day 3 **24.9%**; Tournament **40%**

Good Stuff: Highest mortality Day 1 (**wind speeds 40 mi/hr and 6-8' waves**)
Pre-tournament mortality lowest (**calm, not subject to weigh-in or crowding in live wells**)

9. GOEMAN, T.J. 1990. Walleye tournament mortality, June 28-30 1990, Milles Lacs, Minnesota and August 9-11 1990, Rainy Lake, Minnesota. Minn. Dep. Nat. Resour. 1 p. (Unpubl. Ms. and "Ontario Out of Doors" Feb. 1991 article).

Study: 1. June 28-30, 1990; Milles Lacs, Minn.; 3 day tournament; 1558 walleye sampled; Fish held 5 days.
2. August 9-11, 1990; Rainy Lake, Minn. Cabela's/ In-Fisherman sponsored 3 day tournament; 498 walleye sampled; fish held 2 days; Assumed both similar to 1989 tournament

Immediate Mortality:	Milles Lacs	Rainy Lake
	Day 1 57.4%	Day 1 83.2%
	Day 2 65.7%	Day 2 83.4%
	Day 3 77.7%	Day 3 85.2%

Delayed Mortality:	Day 1 90.6%	Day 1 28.6%
	Day 2 97.2%	Day 2 37.5%
	Day 3 95.2%	Day 3 12.5%

Total Mortality:	98.1%	88%
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Good Stuff? DNR Bio said "walleye unable to cope with stress of handling and being kept in livewells".

Short Comings: Only info available was a table for Milles Lacs and "Ontario Out of Doors" Feb. 91 article for Rainy.
No reasons for high mortality
May be a holding problem (Diff. between 5 and 2 day)

10. HEINRICH, T. 1993. Post release survival of angled walleye and sauger. Minn. Dep. Nat. Resour. 11 p.

Study: August 1992 Lake of the Woods, Minn.
Caught with downriggers at 10.5-11.3m
63 walleye and 50 sauger were attempted to be tethered for 24 hrs.

Weather: Summer coolest since 1915 (Surface water temp 14.3°C and bottom temp

14.3°C)

Delayed Mortality: Due to bad weather only 49 buoys recovered August 20th and 50 on Aug 21st. 8 were retrieved immediately (didn't sound), 81 were alive, 3 dead, 12 missing from tether and 9 not found. All fish retrieved alive were in very good shape, **96% survived**.

Good Stuff: Upon release fish that spent any time on the surface were vulnerable to **predation** by gulls and pelicans. If condition of fish is poor (requires significant revival effort) or if very poor it should not be released. Min. of **84% survived**.

Short Comings: Poor project design.

11. KAMKE, K.K., AND R. BRUCH. 1991. A discussion of tournament mortality and associated problems in the Lake Winnebago System. Wisconsin Dep. Nat. Resour., Oshkosh, Wisconsin. 14 p. (Unpubl. Ms.)

Note: Refers to Bruch's 1990 memo.

Tournament Rules: Two tournaments (June 1-2/91 and June 7-9/91); Bonus for dead fish; 13 inch minimum length; fizzing.

Study: Fish alive after weigh-in tagged and released. Shoreline searched for 5 days after derby. 2016 (979 and 1037) walleye and sauger caught.

Immediate Mortality: (Fish judged unreleasable)
June 1-2 = **48.4%** (474 fish)
June 7-9 = **34.1%** (354 fish)

Delayed Mortality: (These are minimums based on retrieved fish)
June 1-2 = 34.9% of released fish. (**18%** of # caught)
June 7-9 = 12.2% of released fish. (**8%** of # caught)

Total Mortality: June 1-2 = **66.4%** (Minimum)
June 7-9 = **42.1%** (Minimum)

Good Stuff: Author suggests water temp, livewell crowding, livewell O₂, livewell sloshing and handling may have contributed to higher mortalities than found in 1990.

12. MUONEKE, M.I. AND W.M. CHILDRESS. 1994. Hooking mortality: a review for recreational fisheries. *Reviews in Fish. Sci.* 2(2): 123-156.

Literature review of all hooking mortality multi species information prior to 1994.

Good Stuff: Summary matrix by species. Field experiments indicated low hooking mortality for walleye, but fishing tournament-related data suggest otherwise.

Short Comings: Few recent walleye papers missing.

13. O'NEIL, J. AND R. PATTENDEN. 1992. Walleye mortality at four live-release tournaments in Alberta, 1991. Western Walleye Council, High Prairie and District Chamber of Commerce, Alberta Fish Wildl. Div. 64 p.

Tournament Rules: 4 tournaments; Moose Lake (June 1 and 2, 1991); Fawcett Lake (June 15 and 16, 1991); Beaver Lake (July 6 and 7, 1991) and Lesser Slave Lake (Aug 23 and 24, 1991).
Min size 16". Lesser Slave was a tagging tournament vs culling in other 3.

Study: Walleye held 5 days; control made up of pre-tournament angled fish;

Immediate Mortality: Moose 1.0%, Fawcett 1.1%, Beaver 1.7% and Lesser Slave 8.1%

Delayed Mortality: Moose 13.6%, Fawcett 23.2%, Beaver 41.6% and Lesser Slave 64.8%.

Total Mortality: Moose 14.7%, Fawcett 23.6%, Beaver 42.4% and Lesser Slave 67.7%.

Good Stuff: Delayed mortality increased as the summer progressed.
High winds and waves increase mortalities.
Livewells: min. 15 litre/fish; water exchange system run continuously (recirculating system not good enough); position and orientation; mortality increases with time held.
Depth of capture: significant portion of fish suffered from rupturing or hyperdistension of swim bladder.

14. PARKS, J.O. AND J.E. KRAAI. 1991. Walleye hooking mortality at Lake Meredith. Texas Parks Wildl. Dep., Fish. Div., Inland Fish. Br., Auston, Texas., Manage. Data Series No. 52. 5 p.

Study: May 26, 27 and June 5, 1988 (3 reps) fish held at least 72 hrs.; sample size 47 (43 night crawlers, 4 artificial); all angled; surface temp 21°C; confined 0.5 to 5hr in aerated live wells or transport tanks prior to holding net

Total Mortality: 0% mortality

15. PAYER, R.D., R.B. PIERCE AND D.L. PEREIRA. 1987. Hooking mortality of walleye caught on live and artificial baits. N. Am. J. Fish. Manage. 9:188-192.

PAYER, R.D., R.B. PIERCE AND D.L. PEREIRA. 1987. Hooking mortality of walleye caught on live and artificial baits. Minnesota Dep. Nat. Resour. Invest. Rep. No. 390. 18 p.

Study: Compared leeches vs. shad raps
Walleye stocked into ponds then angled
2 year study; 839 marked fish available in ponds;
1985- April 27-30 and April 27-Aug 31
1986- June 3-26 and May 5-June 10

Weather: Water temp 13-28°C

Total Mortality: 0% mortality for shad raps
10% mortality for leeches

Good Stuff: Lure resulted in lip hooking and leeches caused deeper hooking.

16. PRESTON, G. 1983. Assessment of mortality for a live release walleye tournament on Lake Nipissing. Ont. Minist. Nat. Resour.. 4 p. (Unpubl. Ms.)

Tournament Rules: 2 day Tournament 2nd weekend June in 1982 and 83; 2 person teams; artificial baits only; 6 fish > 14"/day; live release bonus; live wells

Study: Lake Nipissing Assessment Unit
Mark recapture study of tournament released walleye. 152 walleye caught 1982 (122 tagged and released) and 149 in 1983 (122 tagged and released). Holding pens 2km away and released into 12' of water in 82, 1983 holding pens at weigh-in site and released into 2' of water.
Returns of tagged fish compared to MNR tagging during spawning.

Weather: 1982- cool, cloudy and windy
1983- sunny, hot and calm

Immediate mortality: 15.1% in 1982 and 16.1% in 1983

Delayed Mortality: 1982 tag return rate same as control (2% mortality)
1983 tag return rate less than control (25% mortality)

Good Stuff: Attribute weather affecting release mortality

17. ROBERT, L.J. 1992. Delayed walleye mortality study, Lac du Bonnet 1992. Manitoba Dep. Nat. Resour. Fish. Br. 18 p. (Unpubl. Ms.)

Tournament Rules: June 20 and 21, 1992; Lac du Bonnet Tournament; 2 anglers / boat; 106 boats; 8 walleye / team; criteria for registering fish based on length not weight as in other tournaments

Study: Held fish for 5 days; 3 groups (Day 1, Day 2 and Pre-tour.); Day 1 100 fish, Day 2 130 and Pre cancelled).
Looked at actual tournament mortality and post release mortality.
320 walleye caught.

Holding Pens: 3.66 X 3.66 X 2.44 m deep. Held max. of 2hrs prior to being put in pens.

Weather: Day 1 24°C, calm and sunny; Day 2 16°C, 15 kph wind and cloudy with showers.

Immediate Mortality: 1 of 320 fish died (suspect use of injected methyl hydrate)

Delayed Mortality: **30 died**; 7 died as a result of mishandling(1 died from fizzing, 1 internal organ damage from squeezing, 1 from a deep hook, 4 from rough handling); the remaining 23 died from algal infections.

Total Mortality: **13%**

Good Stuff: Visible **bruising** and death of fish < 1 kg. by holding the fish by the tail without supporting the body weight.(**died after 48 hrs.**)
Anglers take better care of larger fish.
Weigh-in contributes to spread of *Saprolegnia*
Density and time in **live wells** contribute to algae infections.

18. RYAN, P.A. AND J.F. TOST. 1987. Short term mortality of walleye (*Stizostedion vitreum*) caused by catch and release fishing at Lac des Mille Lacs, Ontario. Ont. Minist. Nat. Resour., Thunder Bay District, Quetico-Mille Lacs Fish. Assess. Unit Rep. 1987-1. 65 p.

Study: Quetico-Mille Lacs Assessment Unit
July 1987
Fish held for 24hrs in holding nets. Assessed holding net mortality; catch and immediate release mortality; catch and delayed release mortality (stringers)

Holding Pens: Circular nets 122cm dia.X 6.1 or 10.7m Held at 6.1 and 9.8 meters

Immediate Mortality: **2.9%** mortality catch and immediate release (Range of 0-3%)

Delayed Mortality: Mortality = 0.381 (stringer time)

Good Stuff: Control: No mortality, after 24 hrs in holding structure, of trapnetted fish.(i.e. all mortalities can be attributed to catch and release)
Stringer held fish should not be released.
 Hooking location: estimate **21%** deeply hooked fish die (4.6-37%)

19. SANTUCCI, V.J. JR. AND D.H. WAHL. 1993. Factors influencing survival and growth of stocked walleye (*Stizostedion vitreum*) in a centrarchid-dominated impoundment. Can. J. Fish. Aquat. Sci. 50 No. 7:1548-1558.

Study: Major direction was looking at stocking, hooking mortality was an add on. 5-6 ha. experimental fishing lake stocked with walleye fry on top of largemouth bass, bluegill, crappie and channel catfish. Opened to public all walleye placed into floating creel, held over night in cages then released. (April to Oct)

Delayed Mortality: **14%** delayed mortality of angler caught walleye; nearly all mortality occurred within 1 hr of release into cages

Good Stuff: **18%** mortality of walleye caught with live bait **5%** mortality of walleye caught with artificial lures

20. SCHAEFER, W.F. 1989. Hooking mortality of walleyes in a Northwestern Ontario lake. N. Am. J. Fish. Manage. 9:193-194.

Study: Esnagami Lake in Geraldton Dist
 July 11-26, 1985
 Compared: shad raps vs single hooks baited with minnows and barbed vs barbless
 Angled by trolling, casting and drifting; held in boat up to 1 hr then put in holding pens for 48 hrs.; 240 walleye caught; 3 reps.

Holding pens: 1.5 X 1 X 1 meter; 20 fish /pen

Weather: Water temp 16-20°C

Immediate Mortality: **0.8%** (2 of 240) 1 hooked in gills with barbless shad rap and other hooked in stomach with barbless single baited hook

Delayed Mortality: **0%** (no additional mortality)

Good Stuff: **No difference** in barbed or barbless hooks

21. SOBCHUCK, M. AND N. DAWSON. 1988. Physiological response of walleye (*Stizostedion vitreum*) to hooking/playing and hooking/holding stress. Ont. Fish. Tech. Rep. Ser. No. 25. 15 p.

Study: Kawashkagama River in Geraldton Dist.
May 10-18, 1984
Angled with unbaited Mr. Twisters then blood samples taken or held on stringers (through mandible) for 1, 2, 3 or 4 hrs then blood samples taken. (Fish sacrificed so no long term mortality studied)

Total Mortality: Hooking/playing and Hooking/holding resulted in changes to blood parameters but **no mortalities**.

22. SULLIVAN, M.G. 1992. Use of a special-interest angler group to obtain biological and catch rate data for a walleye fishery. Northeast Region, Fish Wildl. Div., Alberta Forestry, Lands and Wildlife., Edmonton. 63 p. (Unpubl. Ms.)

Study: July 27 and 28, 1991; Touchwood Lake; 177 walleye caught; all boats with live wells, max density of live wells 3 or 5 depending on winds, and held max 2 hrs.

Holding Pens: 2 X 2 X 1.5 meter; anchored in 4 m water; max density 13/m³
mortality appeared to increase as density increased

Delayed Mortality: **50% dead**

Good Stuff: **81% mortality of fish with visible damage**
55% mortality with baited lures
38% mortality with artificial lures
Baited vs unbaited difference not significant
Large sized walleye had higher mortality rates than smaller walleye (not statistically significant)

23. WALTY, D. 1992. Walleye hooking mortality. Peace River Region, Alberta Fish Wildl. Div. 4 p. (Unpubl. Ms.)

Study: June 20, July 18 and August 15, 1992; Sturgeon Lake; Volunteer anglers; any gear; put into cages within 20 min. of capture; held in cages for 5 days; 171 walleye.

Holding Pens: 2 X 1.5 X 1 m at 4 m depth

Delayed Mortality: June **1.6%**, July **0%** and August **0%** (Total **0.6%**)
Only fish to die was deeply hooked in roof of mouth.

Good Stuff: 94% of the walleye that **bled survived**

24. WALTY, D. in prep. Effects of swim bladder deflation ("fizzing") and depth of capture on walleye survival. Western Walleye Council and Peace River Region, Alberta Fish Wildl. Div. 51 p. (Uncompleted Draft).

Good Stuff: Swim bladder deflation (fizzing) **did not affect** the survival rates of walleye that were captured from depths **less than 6 m**.
Fizzing **did not affect** survival of walleye caught at **6.6 - 7.5 m**.

Statistically **significant difference** in survival of fish caught at **7.6 - 10.1 m** and control. (Control survival 89.5 - 90.0%) and (**Fizzed** survival **46.7 - 66.0%**)

25. WIEDENHEFT, B. 1991. Immediate, delayed and total mortality from catch and release walleye tournament Fort Peck Reservoir, Montana. Montana Dep. Fish Wildl. Parks. 8 p. (Unpubl. Ms.)

Tournament Rules: 2 tournaments July 10-13, 1991; live wells in all boats

Study: Compared control (netted) vs tournament angled fish
1,051 walleye/sauger; alive fish after weigh-in held in cages for 24 or 48 hrs.; max. of 26 tournament fish and 6 control fish /cage; held at 20'

Holding Pens: 4' X 4' X 6'

Weather: Air temp 84, 80, 83 and 91°F (Day 1, 2, 3 and 4) Water temp 74, 68, 72 and 70°F
Wind 7, 16, 8 and 15 mph

Immediate Mortality: **14.3%** mortality (range 11.8-20.0%)

Delayed Mortality: After **48 hrs: 67%** of control and **86%** angler caught
After **24 hrs: 22%** of control and **30%** angler caught
(Assumed warm water (66-68°F) the cause of high mortality of control fish)

Good Stuff: Immediate mortality was higher on days of higher **winds** (Day 2 and 4)
Tournament fish died at a higher rate than control fish

Short Comings: High loss of control fish prevented accurate assessment of delayed mortality.
Walleye and sauger lumped
Control fish subjected to weigh-in? (assume not)

DISCUSSION

Walleye hooking mortality is generally not an issue in catch and **immediate** release unless one or more significant stressors are present (see below). Catch and immediate release therefore does not generally pose a threat to management programs that require selected fish to be released. This is based on the very low mortality, **0% to 2.9% range**, as a result of hooking mortality (Fletcher 1987; Parks et al 1991; Ryan and Tost 1987; Schaefer 1989). The key to survival is that a fish must be **immediately** released. Any delay in release increases the probability of mortality.

Walleye hooking mortality **does** pose a threat to management programs if catch and **delayed** release is practised, which occurs in tournaments or when holding devices are used (such as: stringers, live wells, fish baskets, holding pens at outpost camps, etc.) This results in higher mortalities in the range of **14.7% to 100%** (Anonymous 93; Boland 1991; Fielder 1992; Goeman 91 and 90; Kemke and Bruch 1991; O'Neil and Pattenden 1992; Ryan and Tost 1987; Sullivan 1992).

STRESSORS

There is a wide variety of factors that cause anglers to inflict different levels of stress on "live released" walleye. Some of these are angler induced (gear type, holding method, handling, flogging, etc.) while others are beyond the anglers' control (weather, water temperature, etc.).

Barbed vs Barbless Hooks:	Not Significant Walleye literature shows no difference. (20)
Hooking Location:	Significant Generally the deeper the hook penetrates or the more sensitive the hooking location the higher the associated mortalities. The type of terminal tackle affects hooking location and severity of hook penetration. (7, 14, 15, 17, 18, 19, 20, 22, 23)

- Depth Caught:** **Significant**
The literature generally does not deal in any detail with this situation but acknowledges that depressurization is a problem. **This is an area that needs additional work.**
(10, 13, 24)
- Holding Devices:** **Significant**
- Live wells:** Mortality increases with fish density and time held. (Water exchange system better than recirculating better than cooler). High winds and temperature contribute to higher mortalities in live wells.
(1, 3, 8, 9, 11, 13, 17, 22)
 - Holding Pens:** Mortality increases with fish density due to any combination of pen size, fish size, number of fish and/or time held. The longer the time held the higher the chance of mortality related stress, such as fungal infections.
(1, 6, 8, 9, 17, 22)
 - Stringers:** Should not be used on any fish if it might be released.
(18, 21)
- Handling:** **Significant**
The more roughly the fish is handled the higher the chances of mortality. All released fish should be assessed for equilibrium prior to release. If the fish does not "sound" it should not be released unless regulations prohibit its retention.
(3, 6, 7, 8, 9, 11, 17, 23)
- Weather:** **Significant**
- Temperature:** Mortalities increase with water temperature.
(3, 6, 10, 11, 16, 25)
 - Wind:** Higher winds reduce the length of time fish can be held (retention time) by increasing stress.
(1, 4, 6, 8, 11, 13, 16, 25)
 - Sunlight:** Direct sunlight increases stress. (Mortalities appear to be less on cloudy days. (4, 16)

Fizzing:

Significant

Fizzing deep-caught walleye increases mortality rates. (17, 24)

Tournaments:

Significant

 Weigh-in:

Mortality increases with time to do the weigh-in. Also all above factors contribute to increased mortalities during tournaments. (1, 3, 6, 8, 9, 11, 13, 17)

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