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Short-Term Hooking Mortality of Summer Flounder In New York and Virginia

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Abstract

Summer flounder support an important recreational fishery in the Mid-Atlantic region of the United States. State fishery management agencies have imposed size and creel limits in an attempt to reduce summer flounder fishing mortality, in conjunction with overall mortality reduction guidelines as specified in amendments to the Summer Flounder, Scup and Black Seabass FMP jointly authored by MAFMC and ASMFC. Despite these management measures, few data are available for the estimation of angling mortality following the catch and release of sub-legal fish. The authors and numerous volunteer anglers captured a total of 461 summer flounder (216 - 650mm TL) using sport-angling tackle in New York and Virginia during the period September 1997 to October 1998. All animals were caught with barbed hooks (sizes 2/0 to 4/0) using natural baits. Hook style, hook size, hook wound site, and presence or absence of bleeding were recorded for each capture event. Mean short-term mortality was estimated at 13.7 %, with a 95% confidence interval of 10.6% - 16.7%. The presence of bleeding associated with hook removal was a significant predictor of fish death. Mortality did not differ significantly among fish caught on any of three hook types (sproat, wide-gap, and circle). These results should allow for more accurate VPA-derived spawning stock biomass estimations for the summer flounder in the Mid-Atlantic region.

Introduction

Few data are available with which to calculate the post catch-and-release angling mortality in the summer flounder fishery (Lucy and Holton,1998). Information given here may be useful to the representatives of the Summer Flounder Monitoring Committee, ASMFC Summer Flounder Board, and the Demersal Species Committee of the MAFMC. The work presented here stems from a small grant (ACFMCA funds) awarded to the senior author and funding support both from VIMS and the Virginia Sea Grant Virginia Marine Advisory Program. Additional experimentation is planned for the spring and summer of 1999. A more in-depth report will be prepared following the conclusion of the 1999 field work.

Methods

The authors and numerous volunteer anglers conducted a total of 22 hooking mortality trials in 1997 and 1998. The sampling generated a total catch of 461 summer flounder (216-650mm TL) using sport-angling tackle aboard party/charter and research boats in New York and Virginia.

In New York, 147 fish were collected in the course of 4 trials during the period July through September 1997 aboard several open boats fishing out of Captree State Park, near Fire Island Inlet in Great South Bay. During the period September though October 1998, an additional 104 fish were collected during 6 trials aboard Captree vessels specifically chartered for hooking mortality research. In Virginia, 12 trials (210 fish) were completed during the period September though October 1998. The Virginia

field work was done aboard small, open research vessels on the western and eastern shore sides of lower Chesapeake Bay (south of the Rappahannock River mouth (Gwynn Island) and the Cape Charles Harbor-Kiptopeke State Park areas, respectively).

Fish were caught on medium action spinning and bait casting rods using 12-17 pound test line. Natural baits (e.g. frozen or live minnows, sometimes in combination with squid strips or cut bait) were fished on conventional bottom rigs without skirts or spinners on leaders/hooks. Following capture, individual fish were placed in onboard 378 liter aerated tanks (NY) or 113 liter containers (VA). In the Virginia field work, dissolved oxygen levels were maintained by frequent water exchange. In both states, fish densities were kept at or below 0.4 lbs/gal during fishing trials, which lasted from 1 to 4 hours. Prior to being placed in holding tanks all fish were marked with T-Bar anchor tags (Floy® Tag & Manufacturing, Inc., Seattle, WA, USA and Hallprint Ltd., Holden Hill, South AUS).

Fish were caught on one of 6 barbed hook types and sizes: 2/0 sproat (Mustad©); 3/0 circle hook (Eagle Claw© L197 and Owner© Mutu Light); 4/0 circle hook (Eagle Claw© L197); 2/0 and 3/0 wide gap (Mustad©). For each capture event, hook type, hooking location (jaw, internal but anterior to pharynx, internal and posterior to pharynx), and presence or absence of severe bleeding were recorded.

At the conclusion of each angling session, all New York fish were transferred to a 3.5 m^3 holding cage constructed of PVC drain pipe and plastic mesh (Malchoff and Heins, 1997). The Virginia holding cages were smaller (0.6m x 2.4 m x 0.3 m) totaling 0.43 m^3, and were constructed of a PVC pipe floatation collar and 2.5 cm mesh galvanized wire with fine mesh screen wire covering the cage floor. Maximum cage stocking densities in the New York and Virginia trials were 8.7 and 10.4 fish /m^2, respectively. Shade was provided by use of fine mesh black plastic screen tops (Virginia trials) or by placement of the holding cage beneath a concrete Coast Guard station pier (New York trials). All fish were held for 3 d without food, at which point mortalities were enumerated, and survivors were released.

The 72 h holding period was chosen based on previous studies in both fresh and marine systems which document that most mortality occurs during this period either from hook wounding or as a result of physiological disruptions linked to stress (Warner and Johnson 1978; Beggs et al. 1980; Wood et al. 1983; Ferguson and Tufts 1992; Matlock et al. 1993). Following conclusion of the holding period all fish were recovered, measured and enumerated by condition (i.e., dead or alive).

Water temperatures and salinities at the holding sites were recorded at the beginning and end of each trial. Water temperatures averaged 21°C in NY in 1997, and 17 °C in 1998. Virginia water temperatures averaged 25°C (range: 21 to 28°C) during

the 6 week project period. Salinity in the New York trials averaged about 26 ‰ (range 25-31‰) and 21.5‰ (range 17-26‰) at the Virginia sites.

Descriptive statistics were used to estimate mean survival. Bootstrapping (1000 samples, N=461) was used to calculate a 95% confidence interval from a cumulative binomial distribution. Calculated p values were ordered (lowest to highest), enabling selection of those corresponding to $p \leq 0.25$ and $p \geq 0.975$. Fisher's exact test was used to examine whether mortality differed between the six hook styles, and whether severe bleeding was a significant predictor of mortality. Statistical analyses were conducted with SYSTAT software (SYSTAT, Inc. 1997).

Results and discussion

Length distribution of the samples are given in table 1. The majority of the fish were below the established minimum size of 381mm (15 inches).

Table 1. Length distribution (by category and state) of summer flounder samples.

State	< 380 mm (15")	381-456 mm (15"-18")	> 457 mm (18")
NY	178	44	10
VA	191	16	3

Mean short-term mortality across all of the trials was estimated to be 13.7 %, with a 95% confidence interval of 10.6% - 16.7%. This estimate was similar to that observed by Lucy and Holton (1998) in flow-through tank experiments and boat live wells during fishing trials (mean mortality of 11.2% [95% CI 3.0%-23.6%] and 8.1% [95% CI 4.5%-12.6%], respectively). The presence of bleeding associated with hook removal was a significant (Fisher exact test, $p<0.001$) predictor of fish death.

Similar analysis indicated that mortality was not significantly different between trials using wide gap hooks sizes 2/0 and 3/0 and between trials with Eagle Claw©, (model L197) 3/0 and 4/0 circle hooks (Fisher's exact, $p>0.99$, and $p>0.30$ respectively). Based on these results, data were pooled from the original six size/style hook groups into three categories as follows; sproat, which included only size 2/0; wide gap, which included sizes 2/0 and 3/0; and circle hook, including sizes 3/0 and 4/0. These pooled data similarly indicated no difference in mortality rates betwee the three hook types (Pearson Chi-square, $p>0.63$). (*Note: subsequent logistic regression analysis of these pooled data, along with bleeding and hook position data will be reported elsewhere*) Observed mortality estimates for each of these three hook size/style groups are summarized in table 2.

Table 2. Observed mortality of summer flounder hooked in various sites using three hook types. Hook positions: 1= external (hook point visible); 2= internal, anterior to pharynx; 3= internal, posterior to pharynx; 4= foul hooked

	Sproat			Wide Gap			Circle Hook		
Hook Position	N	# Dead	Mortality %	N	# Dead	Mortality %	N	# Dead	Mortality %
1	111	5	4.5	95	10	10.5	174	13	7.4
2	21	4	19.0	7	2	28.5	6	2	33.3
3	10	8	80.0	10	6	60.0	23	13	56.5
4	0	0	0.0	0	0	0.0	4	0	0.0
Totals	142	17	12.0	112	18	16.1	207	28	13.5

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