

## GAME FISH BY-CATCH IN COMMERCIALY FISHED HOOP NETS IN THE ST. JOHNS RIVER, FLORIDA

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*Abstract:* Incidental game fish capture and mortality in St. Johns River hoop nets is a major source of controversy between sport and commercial interests. The controversy is most severe in that portion of the river from Lake George southward. Project personnel observed 574 hoop nets that had been fished 3,896 hoop net-days over a 12-month period. Four species of catfish comprised 84.8% of the total harvest while the game fish by-catch represented approximately 13%. Harvestable size game fish (that size game fish retained by the sport fisherman) comprised 1.4% of the total harvest. Initial mortality was 2.0% for all game fish caught, but no initial mortality for any harvestable size game fish was observed. On the basis of an estimated total fishing pressure of 3,000 hoop nets in the St. Johns River from Lake George southward, 3,171 game fish were caught daily, 346 of which were of harvestable size. Although hoop nets can be modified to catch large numbers of game fish, results indicated that legal fishing operations had no significant impact upon game fish populations.

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Commercial fishing is an important industry in many of the counties bordering the St. Johns River. Harvest of freshwater catfishes in the river system provides many jobs and adds to the economy of the region. Utilizing 1980 landings data from the major commercial fish houses on the river, it was estimated that approximately 680,600 kg of dressed catfish were harvested with an ex-vessel value of \$1.2 million. Total revenue return to local economy generated by this resource is estimated in excess of \$3 million annually.

The hoop net appears to be the most efficient legal gear available for capture of catfish in the St. Johns River. Approximately 80% of the 1980 St. Johns River catfish harvest was attributed to this gear. The remaining 20% were harvested by pound nets, wire traps and trot lines.

Regulations now in effect allow hoop nets to be used in the St. Johns River from the Seaboard Coastline Bridge in Duval County, upstream to State Road 46 including Crescent Lake, Dunns Creek, and Lakes Beresford, Woodruff, Dexter, Monroe, and Harney. This area spans approximately 230 km of river and 33,400 ha of fresh water lakes.

The quantity of incidental game fish "by-catch" associated with hoop net catches of catfishes is a source of controversy on the St. Johns River, particularly in the area from Lake George southward. Sport fishing interests contend that these nets catch and kill large numbers of harvestable size game fish (that size game fish

retained by sport fishermen) while most commercial interests contend that legal fishing operations have no impact upon game fish species. Hoop nets can be modified to catch large numbers of game fish by use of large mesh netting and modification of funnels. However, these types of nets were not observed in the study area.

Literature searches revealed that little or no work has been conducted on game fish by-catch in hoop nets. The Commercial Fisheries Section of the Florida Game and Fresh Water Fish Commission initiated an investigation into the hoop net fishery of the St. Johns River in an attempt to gather pertinent data. The objectives of this preliminary study were to document the game fish by-catch and to determine initial game fish mortality.

## METHODS

Hoop nets used in the St. Johns River usually consisted of 4 hoops varying from 0.91 m - 1.83 m in diameter with a funnel at each of the front 2 hoops. The front funnel and net wall were constructed of 50.8-mm to 76.2-mm stretch mesh nylon netting, with the rear funnel and wall of 50.8-mm to 57.2-mm stretch mesh. Because many fishermen build their own nets, some variation in design and construction was observed. Nets were anchored to the river bed with 1.2-m sections of 12.7-mm reinforcement rods and nylon rope and were set with funnel openings facing downstream. The hoop nets observed were usually fish unbaited, but occasionally soybean chips were used as bait.

To document game fish by-catch, project personnel accompanied commercial fishermen during hoop net fishing operations. The study area consisted of that portion of the St. Johns River from the jetties south of Lake George to the power plant north of Lake Monroe. A unit of fishing effort was arbitrarily established as a hoop net-day (HND). One HND equalled one hoop net fished for a 24-hour period.

Swingle's (1950) criteria were used to determine whether game fish caught in hoop nets were of harvestable or non-harvestable size to sport fishermen. Swingle (1950) used the following lengths to distinguish harvestable size fish from those too small to harvest: bluegill (*Lepomis macrochirus*), warmouth (*L. gulosus*), redbreast sunfish (*L. auritis*), redear sunfish (*L. microlophus*), and spotted sunfish (*L. punctatus*),  $\geq 15.24$  cm; black crappie (*Pomoxis nigromaculatus*),  $\geq 22.86$  cm; largemouth bass (*Micropterus salmoides*),  $\geq 25.4$  cm.

Commercial catch information including location of the set, amount of time fished, numbers and total lengths of game fish caught, and initial mortality of netted fish was documented for each hoop net observed. Initial mortality was assigned to the organisms when they could not swim away under their own power before the fishing boat moved to another site. All game fish caught in hoop nets were immediately returned to the water in compliance with the present Florida Game and Fresh Water Fish Commission regulations. Length and weight measurements of catfish were determined from subsamples obtained at fish houses.

## RESULTS AND DISCUSSION

From June 1980, through May 1981, project personnel accompanied commercial fishermen on 31 fishing trips on the St. Johns River, Florida. Five hundred

seventy-four hoop nets were observed that had been fished a total of 3,896 HND. These hoop nets caught a variety of fish, crustaceans, and reptiles. Twenty-four species of fish were taken along with blue crabs (*Callinectes sapidus*), a representative of the genus *Machrobranchium* (the large freshwater shrimp), an alligator (*Alligator mississippiensis*) and an unidentified snake (Table 1). Four species of catfish — brown bullhead (*Ictalurus nebulosis*), yellow bullhead (*I. natalis*), white catfish (*I. catus*), and channel catfish (*I. punctatus*) — represented 84.8% of the total number of fish harvested (Table 1, Fig. 1). Black crappie comprised 9.0% of the total hoop net harvest. The only other fishes representing  $\geq 1\%$  of the total catch were bluegill and warmouth, comprising 1.9% and 1.0% respectively (Table

Table 1. Catch composition of 574 St. Johns River hoop nets fished from June 1980 through May 1981.

Species <sup>a</sup>	Number caught	Percent of total	Number dead	Initial mortality (%)
<u>Commercially Important Species</u>				
Catfish <sup>b</sup>	26,599	84.8	123	0.5
Blueback herring	253	0.8	238	94.1
Blue crab	141	0.4	1	0.7
Gizzard shad	41	0.1	21	51.2
American eel	36	0.1	0	0.0
American shad	3	<0.1	3	100.0
Golden shiner	2	<0.1	1	50.0
Striped mullet	1	<0.1	0	0.0
<u>Game Fish Species</u>				
Black crappie	2,838	9.0	64	2.2
Bluegill	591	1.9	17	2.9
Warmouth	322	1.0	2	0.6
Redbreast sunfish	283	0.9	0	0.0
Redear sunfish	42	0.1	0	0.0
Striped bass	20	0.1	0	0.0
Largemouth bass	16	<0.1	0	0.0
Spotted sunfish	1	<0.1	0	0.0
<u>Other Non-Game Fish Species</u>				
Hogchoker	136	0.4	0	0.0
Atlantic croaker	18	0.1	4	22.2
Atlantic stingray	8	<0.1	0	0.0
Lake chubsucker	7	<0.1	0	0.0
Southern flounder	5	<0.1	3	60.0
Florida gar	4	<0.1	3	75.0

<sup>a</sup> Names follow American Fisheries Society (1970).

<sup>b</sup> Species of catfish caught were brown bullhead, channel catfish, white catfish, and yellow bullhead.

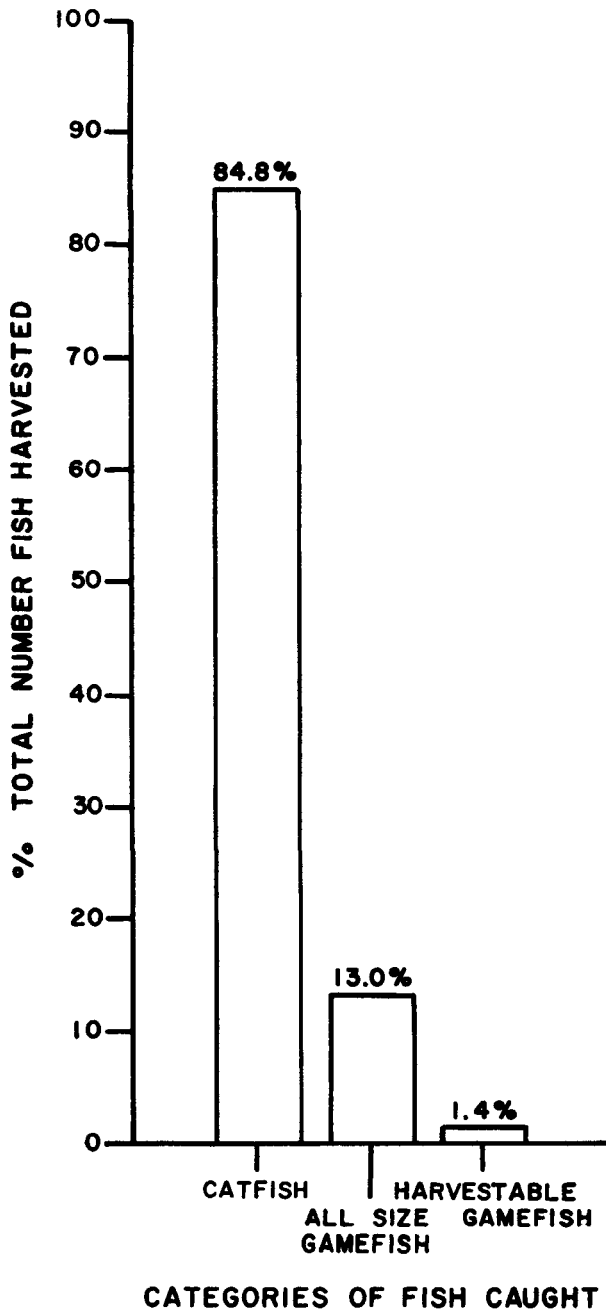


Fig. 1. Composition of hoop net harvest from samples observed during the study period.

1). In all, game fishes of all sizes made up slightly more than 13% of the total catch (Fig. 1).

Bluegill suffered the greatest initial mortality among the game fish species (2.9%). Black crappie and warmouth experienced 2.2% and 0.6% initial mortality, respectively. No initial mortality was observed for redbreast sunfish, largemouth bass, striped bass (*Morone saxatilis*), redear sunfish or spotted sunfish (Table 1).

Black crappie and bluegill represented 83.4% of all the game fish caught (69.0% and 14.4%, respectively), but only comprised 37.8% of the harvestable size game fish (Table 2). Warmouth and redbreast sunfish made up 7.8% and 6.9% of the game fish catch, respectively, but accounted for 58.3% of the harvestable size game fish. The redear sunfish was the only other game fish comprising  $\geq 1\%$  of the total game fish harvest, representing 1.0% of the total catch and 2.9% of the harvestable size game fish. Since the controversy in question concerns species favored by anglers, it should be noted that warmouth and redbreast sunfish (2 species that appear in anglers' creel incidentally) made up 58.3% of all the harvestable game fish caught in hoop nets while black crappie, bluegill, largemouth bass, and redear sunfish, the species most often sought by sport fishermen, comprised 41.6% of the harvestable size game fish.

Table 2. Composition of game fish harvest from 574 hoop nets in the St. Johns River, Florida, from June 1980 through May 1981.

Species	Percent of total	Percent harvestable size
Black crappie	69.0	21.6
Bluegill	14.4	16.2
Warmouth	7.8	32.3
Redbreast sunfish	6.9	26.0
Redear sunfish	1.0	2.9
Striped bass	0.5	0.0
Largemouth bass	0.4	0.0
Spotted sunfish	<0.1	0.0

In 3,896 hoop net-days, 4,113 game fish were caught which represented 1.056 game fish/HND (Table 3). Of the 4,113 game fish caught, 449 (10.9%) were of harvestable size, which equalled 0.115 harvestable size game fish caught per hoop net-day. Less than 1 hoop net-day was required to catch a game fish of any size while 8.7 HND were required to catch one of harvestable size. Initial mortality of all game fish sizes was 2.0% or 0.021 game fish/HND. Therefore, 1 hoop net of the type studied here would have to be fished 47.6 days to cause the initial mortality of one game fish. No initial mortality for any harvestable size game fish was observed.

February and March represent the primary spawning period for black crappie in the St. Johns River. A movement of black crappie from lake to riverine habitat was observed at this time. This influx of spawning black crappie accounted for the larger numbers of harvestable size game fish caught per hoop net-day during February and March 1981 (Table 3).

Table 3. Catch and effort (c/f) and initial mortality data from 574 St. Johns River hoop nets fished from June 1980 through May 1981.

Month	Number HND <sup>a</sup>	Number		Total number game fish	Number		Dead game fish c/f	Total game fish c/f	Harvestable game fish c/f
		harvestable game fish	game fish		dead game fish	game fish			
Jun	217	23	153	0	0.705	0.106			
Jul	210	11	199	8	0.948	0.052			
Aug	644	26	550	13	0.854	0.040			
Sep	245	25	183	2	0.747	0.102			
Oct	301	26	313	10	1.040	0.086			
Nov	693	128	1,084	30	1.564	0.185			
Dec	354	33	213	2	0.602	0.093			
Jan	91	4	129	8	1.418	0.044			
Feb	220	49	287	5	1.304	0.233			
Mar	398	83	463	1	1.163	0.208			
Apr	306	25	263	0	0.859	0.082			
May	217	16	276	4	1.272	0.074			
$\Sigma$	3,896	449	4,113	83	1.056	0.115			
$\bar{X}$									

<sup>a</sup> HND refers to hoop net-day.

The harvest of 1 black crappie of any size took 1.37 hoop net-days, while 40.16 HND were required to catch a harvestable size black crappie. An average of 6.59 HND were required to catch 1 bluegill of any size and 92.76 HND and 243.50 HND to catch 1 redear sunfish and 1 largemouth bass of any size, respectively. To catch 1 bluegill, redear sunfish, and largemouth bass of harvestable size required 53.37 HND, 299.69 HND, and 974.00 HND, respectively.

Based on interviews with commercial fishermen and the State Wildlife Officers that patrol the St. Johns River, it was estimated that there were approximately 3,000 hoop nets being fished from Lake George to Lake Harney during the period of the study. Using this value, the number of all game fish caught per day and the number of harvestable game fish caught per day was estimated for each species (Table 4). An estimated 3,171 game fish were caught per day while 346 harvestable size game fish were caught daily. Of the harvestable size game fish, 144 or 41% were those species most sought by anglers. Warmouth and redbreast sunfish were the only other game fishes of harvestable size caught, with 112 and 90 caught per day, respectively.

Table 4. Number of game fish caught per day in the estimated 3,000 hoop nets being fished in the St. Johns River.

Species	Number all sizes/day	Number harvestable size/day
Black crappie	2,190	75
Bluegill	455	56
Warmouth	248	112
Redbreast sunfish	218	90
Redear sunfish	32	10
Striped bass	15	0
Largemouth bass	12	3
Spotted sunfish	1	0
$\Sigma$	3,171	346

## SUMMARY

The objectives of this study were to estimate incidental by-catch of game fish and their initial mortality in the hoop net harvest.

Catfish comprised 84.8% of the total harvest while game fish comprised 13%. Harvestable game fish (that size game fish retained by sport fishermen), made up 1.4% of the total harvest. Initial mortality was 2.0% for all game fish caught, but no initial mortality for any harvestable size fish was observed.

On the basis of an estimated fishing pressure of 3,000 hoop nets (area from Lake George to Lake Harney), analysis of data indicates a daily catch of 3,171 game fish of which 346 were of harvestable size.

Although nets can be modified to catch large numbers of game fish, results showed that legal fishing operations had no significant impact upon game fish populations.

## LITERATURE CITED

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