Lesser Scaup Mortality from Commercial Trotlines on Lake Okeechobee, Florida

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Abstract: Mortality of lesser scaup (*Aythya affinis*) from commercial trotlines was studied on Lake Okeechobee, Florida, from November 1985 to March 1986. Of 27 scaup removed from 118 trotlines, 81% were hooked in body parts other than the mouth. An estimated 7,458 scaup, or 8% of the estimated average winter population of 97,071, were killed during 5,675 man-days of fishing. Potential impacts on scaup populations are discussed.

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In January 1985, the Florida Game and Fresh Water Fish Commission was alerted to potentially large numbers of ducks being caught on commercial trotlines in Lake Okeechobee. If accurate, this information represented an important and controllable source of mortality. A similar problem was examined on the Texas Gulf coast. McMahan and Fritz (1967) estimated that 5% of the wintering redhead (*Aythya americana*) population in Laguna Madre were hooked by trotlines, with approximately 50% of the hooked birds killed or classified as having poor chances of survival.

Knowledge of causes, timing, and extent of mortality is important in assessing factors limiting waterfowl populations (Anderson and Burnham 1978, Kirby and Cowardin 1986), but few studies provide this type of information (Kirby and Cowardin 1986). This study was conducted during winter 1985–86 to determine the number of ducks killed by commercial trotlines, and the factors which influenced this mortality.

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Methods

Lake Okeechobee is a 190,000-ha freshwater lake in south-central Florida which provides important wintering habitat for a wide variety of waterfowl (Chamberlain 1960, Bellrose 1980). The lake is shallow ($\bar{x}$ = 2.5 m) and contains extensive areas of emergent, submergent, and floating leaved plants around its perimeter (Pesnell and Brown 1977). A large levee encircles the lake, and water control structures are located on all major inlets and outlets (Brooks 1974, Pesnell and Brown 1977).

Trotlines used by commercial fishermen consist of a mainline about 0.5 km in length and 500 hooks terminally positioned on short "drop lines." Each hook and dropline is spaced at 1-m intervals along the mainline. Trotlines are baited and placed on or just above the lake bottom, primarily in open water, in an effort to catch catfish (*Ictalurus* spp.). The mainline ends are anchored securely, while the position of the hooks in the water column is adjusted by increasing or decreasing line tension, and by using various combinations of small floats and weights attached at intervals along the main line. Commercial fishermen typically set 8 lines and pull them in within 1 or 2 days.

Fish house purchase-records and commercial license receipts were used to determine the number of commercial trotline fishermen and man-days of fishing effort. The estimated mean number of lines/man-day, fishing methods (e.g. line position and bait), and areas fished were determined from interviews with fishermen.

Data were collected during the peak wintering-waterfowl period of November through March (Bellrose 1980) 1985–86 by periodically accompanying fishermen when they picked up lines. Additionally, we set 4 trotlines approximately once a week using the same methods as those of commercial fishermen. The lines were set out during afternoons and usually retrieved the following morning, but always within 48 hours. The baits used were those most often selected by fishermen on Lake Okeechobee: grass shrimp (*Palaemonetes* sp.), hand soap, crickets (*Gryllus* spp.), and honey bees (*Apis mellifera*). Areas fished were based on locations used by commercial fishermen.

Data derived from our trotlines and from observations of fishermen were used to estimate lake-wide mortality of ducks during the 19-week study period. The total catch of ducks (T) was estimated as the product of total man-days of fishing (M), estimated average lines/man-day (ℓ), and ducks caught/line (d):

$$\hat{T} = M \cdot \hat{\ell} \cdot \hat{d}, \text{ and } \hat{var}(\hat{T}) = M \cdot \hat{var}(\hat{\ell} \cdot \hat{d})$$

where the variance of the product of the two random independent variables is expressed as

$$\hat{var}(\hat{\ell} \cdot \hat{d}) = [\hat{\ell}^2 \cdot \hat{var}(\hat{d})] + [\hat{d}^2 \cdot \hat{var}(\hat{\ell})] + [\hat{var}(\hat{\ell}) \cdot var(\hat{d})]$$

(Mood et al. 1963). M is assumed to be measured without error because (1) all fishermen are required by law to possess a commercial license, and Lake Okeechobee is patrolled heavily by law enforcement personnel, (2) the penalties for fishing

without a license and the nominal cost ($8) warrant its possession, and (3) fish houses also must be licensed and must submit weekly purchase records which list fishermen by date of purchase (i.e. effort).

Biweekly aerial surveys (N = 10) were conducted on Lake Okeechobee to provide wintering waterfowl population estimates. Sample transects (0.2 km wide, variable length) were located 6 km apart along lines of longitude. Transects were stratified into marsh or open water habitats to reduce variability.

Results and Discussion

Twenty-seven ducks, all lesser scaup, were removed from 118 trotlines (Table 1). Most birds (81%) were hooked in body parts other than the mouth, and no bird actually swallowed a hook. It is unclear whether birds hooked in the mouth attempted to ingest the bait, or merely picked up the baited hook incidental to other feeding activities. An insufficient number of ducks were caught to identify vulnerability of birds to different fishing methods and baits.

Twenty-five (93%) of the hooked birds died, presumably from drowning, and 2 (7%) survived because they were able to pull the trotline to the surface. Both birds were released and appeared to be in good condition. Small hooks used by trotline fishermen did not appear to cause wounds that alone would cause death. If trotlines are not pulled tight when set, hooked birds are able to reach the surface, and thus have a good chance of survival. Interviews indicated that fishermen do release snagged ducks.

The total catch of scaup during the 19-week period was estimated at 8,019 (SD = 222) based on 5,675 man-days of fishing, $\hat{\ell} = 7.5$ ($N = 21$, SE = 0.22), and $\hat{d} = 0.19$ ($N = 26$, SE = 0.08). Assuming a 7% survival rate, the estimated number of scaup killed on trotlines was 7,458. Ducks caught per line did not seem to vary either with the estimated scaup population or the number of ducks observed in vicinity of trotlines. We suspect that scaup spatial distribution and behavior (i.e.

Table 1. Observed number (% in parentheses) of lesser scaup caught on Lake Okeechobee trotlines by hook location and condition class from 15 November 1985 to 28 March 1986.

Hook location	Condition class		
	Dead	Alive	Total
Mouth	5	0	5(19)
Head	2	0	2(7)
Wing	2	0	2(7)
Body	5	1	6(22)
Foot	8	1	9(33)
Unknown (other than mouth)	3	0	3(11)
TOTAL	25(93)	2(7)	27(99)[a]

[a]Not 100 due to rounding error.

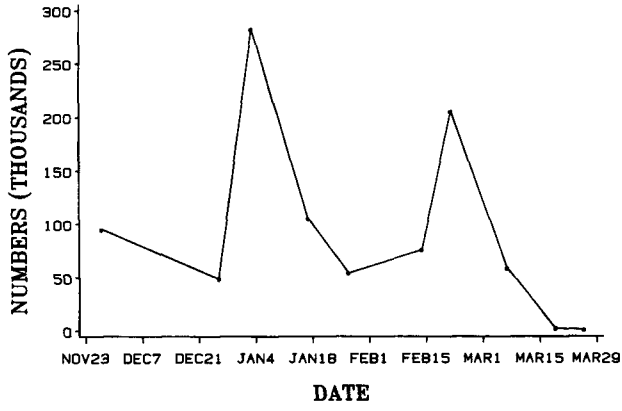

Figure 1. Estimated number of scaup on Lake Okeechobee, Florida, by survey date, November 1985 through March 1986.

feeding vs. loafing) at a given fishing site were more important factors influencing catch per line.

Lesser scaup populations peaked at an estimated 282,367 birds, with an average population ($\hat{S}$) of 97,071 (SE = 2,296) (Fig. 1). Virtually all scaup (99.5%) were located in open-water areas. Chamberlain (1960) reported Florida's major scaup populations were found on the Indian and Banana rivers and bays and estuaries of Charlotte and Lee counties. Only several thousand were found annually on Lake Okeechobee (Chamberlain 1960), probably because inventories were limited to the lake marshes. We suspect that if open water areas were surveyed, the number of scaup recorded would have been considerably higher. Thus, it appears that Lake Okeechobee has become, and possibly always has been, a major wintering area for lesser scaup.

Scaup mortality appeared dependent on numerous factors, including fishing intensity, methods and location, scaup behavior and distribution, and weather. Thus, an estimated 8% mortality to the lake population is imprecise, and compounding sampling error from 2 estimates ($\hat{T}$ and $\hat{S}$) further decreases precision. In addition, it was impossible to determine if annual losses of such magnitude have had an adverse impact on continental scaup populations. Breeding ground surveys conducted annually by the United States and Canada (Bellrose 1980) suggest a growing continental population ($t = 2.65$, df = 30, $P = 0.01$). Estimates of lesser scaup harvest and harvest/hunter day (U.S. Fish and Wildl. Service, unpubl. data) suggest a stable ($t = 1.61$, df = 23, $P = 0.12$ and $t = 1.21$, df = 20, $P = 0.24$, respectively) wintering population in Florida. Given that commercial trotline fishing on Lake Okeechobee has taken place at varying levels since 1900 (Will 1977), we have no evidence that it is appreciably impacting population status.

The commercial trotline catch during the study was 1.4 million pounds (D. D. Fox et al., unpubl. rep., Fla. Game and Fresh Water Fish Comm., Okeechobee,

Fla., 1986), with an estimated dockside value of $500,000. Given the substantial economic value this resource represents, and the limited impacts on scaup populations, we believe no action is necessary at this time. Nevertheless, the situation bears watching, and should fishing effort increase appreciably, we recommend regulatory action to reduce scaup mortality. Possible measures include placing quotas on commercial licenses, restricting or eliminating fishing during the winter period, and/or restricting fishing to within 1-2 km of shore or vegetation. Requiring fishermen to set loose lines may be effective in reducing duck mortality, but would be virtually impossible to enforce.

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