LAKE JAMES CREEL SURVEY, 1997–1998

FINAL REPORT

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Abstract.—A roving creel survey evaluated the daytime recreational boat and bank fishery on Lake James from June 1997–May 1998. Effort, catch, and harvest estimates were expanded for the overall fishery and for frequently-sought target species. Interviews obtained angler information on trip length, origin, cost, and quality rating, and on a variety of reservoir use issues. Where applicable, results were compared with those of a creel survey conducted from March 1987–February 1988. Total estimated fishing effort of 231,150 angler-hours was substantially lower than 294,817 angler-hours reported in 1987–1988, indicating displacement of day anglers to night fishing or non-fishing activities. Directed effort, particularly for black bass *Micropterus* spp. and walleyes *Sander vitreus*, increased relative to effort for other species, whereas directed effort for white bass *Morone chrysops* and crappies *Pomoxis* spp. was reduced. Overall catch rates, crappie catch rates, proportion of directed effort allocated to black bass and walleyes, angler residency, and trip ratings were similar between the two surveys. Length-frequency comparisons indicated agreement with contemporary biological samples of crappies, walleyes, and white bass, and showed increased size at harvest for black bass and crappies over 1987–1988 values. Lake James anglers typically fished two to four times per month and perceived little or no impact from reservoir crowding on the day interviewed. However, the majority of anglers reported changing fishing habits in response to crowding, and approximately one third reported night fishing activity, mainly targeting black bass, walleyes, catfish, and crappies. Angler preferences regarding potential crappie length and creel limits indicated greater interest in a creel limit. Harvest data did not support the need for a length limit on crappies. Public access points accounted for >90% of observed boat angling use, indicating that future creel surveys of mountain reservoirs should employ access point designs to allow evening and night sampling and avoid inherent difficulties of boat-based roving surveys.

For more than 50 years, the quality of recreational fishing on Lake James has been a subject of concern and controversy for fishery managers and the angling public. The North Carolina Wildlife Resources Commission (NCWRC) is charged with management of the fisheries resources in the reservoir, and biological staff must frequently respond to complaints about poor fishing. Although direct surveys have assessed length structure and age and growth characteristics of the principal gamefish populations in the reservoir, the relationship between these observations and the recreational fishing experience is unknown without direct information from anglers on their fishing objectives and associated rates of success.

Creel survey information was previously collected from Lake James in 1980 (NCWRC, unpublished data) and 1987–1988 (Borawa 1989). More recently, crappie *Pomoxis* spp. anglers have complained about declining size and catch rates, suggesting that length or creel limits should be considered for crappies. Additionally, an evaluation was needed regarding the appropriateness of the existing 381-mm length limit on Lake James walleyes *Sander vitreus*, the only walleye length regulation on North Carolina waters.

Survey objectives for the Lake James creel survey were: 1) to quantify and characterize boat and bank angling effort, catch, and harvest; 2) to characterize the quality and species composition of sport fisheries and evaluate effectiveness of existing fishing regulations; 3) to collect information on angler residency, motivations, access point use, trip success ratings, trip-related expenses, and night fishing activity; and 4) to obtain on-site angler opinions on reservoir crowding and potential regulations to protect the crappie fishery.

Study Area

Lake James is a 2,634-ha hydropower reservoir located in McDowell and Burke counties, North Carolina (Figure 1). Impounded in 1923 and operated by Duke Power Company, the

reservoir consists of multiple dams impounding the Catawba and Linville rivers, Paddy Creek, and associated tributary streams. Besler et al. (2004) provide a complete description of the history, morphology, and limnology of Lake James. The Linville River and Paddy Creek arms of the reservoir are connected by natural topography to form a deep and highly oligotrophic lentic system. The Catawba River arm is more limnologically diverse with mesotrophic conditions near its upstream end, and is connected to the Paddy Creek arm only by a man-made canal beneath the NC Highway 126 bridge. The canal allows boaters to access the entire area of the reservoir from any launch point.

Public boating access to Lake James exists at a variety of points (Figure 1), including three boat ramps operated by NCWRC in cooperation with Duke Power (since this creel survey was completed, the North Fork Access Area was replaced by the larger Black Bear Access Area). A fourth public ramp is operated by Lake James State Park, and a variety of marinas and smaller landings exist. An increasing number of private residences are being built along the shoreline of Lake James, and most of these properties have associated docks, slips, or boathouses. Bank fishing is dispersed throughout the shoreline, including areas near roadways and boat ramps as well as numerous campsites on undeveloped land.

Fish populations of Lake James have been surveyed more frequently than those of other mountain reservoirs, with records dating back as far as 1957 (Richardson and Ratledge 1961). Gear types used include gill nets, trap nets, trammel nets, electrofishing, cove rotenone, limnological studies, and a variety of angler surveys (Besler et al. 2004). In addition to published studies, shad *Dorosoma* spp. populations in Lake James have been assessed using gill nets (NCWRC, unpublished data), purse seines, and hydroacoustics (Duke Power Company, unpublished data). Lake James supports a diverse fishery including largemouth bass *Micropterus salmoides*, smallmouth bass *Micropterus dolomieu*, walleyes, white bass *Morone chrysops*, crappies, a variety of sunfish *Lepomis* spp., yellow perch *Perca flavescens*, catfish *Ictalurus* spp., and muskellunge *Esox masquinongy*. Although gamefish surveys were not conducted concurrently with this creel survey, walleye (Besler 2000a), white bass (Besler 2000b), and crappie (Besler 1999) populations were sampled in subsequent years.

Lake James also has an extensive stocking history (Besler et al. 2004). Recent stocking (Appendix 1) has often resulted from disposal of hatchery surplus of channel catfish *I. punctatus* and various centrarchid species, although this practice was discontinued after 2000. Annual stocking of walleye fingerlings began in 1981 in response to pressure from public representatives and continued until 2004, when it was demonstrated to be ineffective (Besler 2004). Threadfin shad *D. petenense* replenishment typically occurred following winter kills on Lake James; the most recent stocking prior to this creel survey occurred in spring of 1997, and subsequent gill net surveys (NCWRC, unpublished data) confirmed that threadfin shad were established in Lake James throughout the creel survey. In addition to scheduled stocking, escapement from Marion Fish Hatchery (located on a tributary of the Catawba River upstream of Lake James) established a sparse muskellunge population in the reservoir. In spite of the numerous pre-existing and introduced fish species in the system, the limnological characteristics of Lake James limit its ability to support an abundance of gamefish, and the diversity of species present further partitions the available fishery resource.

The most recent previous creel survey of Lake James (Borawa 1989) described a sport fishery consisting of largemouth and smallmouth bass, crappies, other sunfish species, walleyes, and white bass, with smaller components of yellow perch, catfish, and carp *Cyprinus carpio*.

Methods

Creel Survey Design

The Lake James creel survey covered a 12-month period from 1 June 1997 through 31 May 1998. The survey year was stratified into 12 segments corresponding to calendar months, to allow evaluation of seasonal trends in fishery characteristics. All Saturdays and Sundays, Good Friday, Memorial Day, Independence Day, and Labor Day were classified as weekend days; all other dates were classified as weekdays. Initially, five dates of each day type were randomly chosen each month for instantaneous counts and associated angler interviews; to increase interview sample sizes and employ surplus clerk hours, additional random days were dedicated entirely to angler interviews as allowed by clerk work schedules (Table 1). From December 1997 through the conclusion of the creel survey, staffing difficulties reduced the number of dates that could be sampled; however, a minimum of two dates of each day type were sampled each month.

The creel survey employed a roving-roving design (Pollock et al. 1994) using a boat-based "instantaneous" count to expand angling effort, catch, and harvest information obtained from interviews with boat angling parties and bank anglers intercepted by the creel clerk during each work period. Lake James was divided into two survey zones (Figure 1): the Catawba zone west of the NC Highway 126 bridge, and the Linville/Paddy zone encompassing the two large impounded watersheds east of the bridge. Sample days were divided into two work periods of equal duration (4.75–6.75 h depending on solar day length), and each survey zone was assigned a work period in random order; both zones were surveyed each sample day. Once each sample day, a count circuit was performed by boat in each zone to estimate total lake use for the work period. One hour was allocated for each count circuit, with the start time and starting point (mid-lake or dam) randomly assigned within the work period. Interviews were conducted within the remaining time in the work period, before and after the count circuit. On interview-only sample days, no count circuit was performed and available clerk time was evenly allocated between the two survey zones; start times were independently and randomly determined for each work period. Each interview-only day corresponded to a count circuit from day of a similar day type and zone sampling order to allow for effort expansions.

Field Data Collection

All boating parties were identified and classified as anglers or non-anglers when intercepted, but only angling parties were counted or interviewed. For each angling party, the date, work period, and survey zone were recorded. All angling parties were asked to provide the time spent fishing, estimated additional time to conclusion of their fishing trip, the number of party members fishing, the zip code of the bank angler or boat operator, the particular type of fish species sought (if any), the number of fish harvested and released by species, and the total estimated expenditures of the party for the fishing trip. Parties who had been fishing at least 0.5 h were asked to assign a qualitative rating (poor, fair, good, or excellent) to the success of their fishing trip. Harvested fish were identified to species, counted, and measured for total length (mm) whenever possible. When constrained by time, weather, or water conditions, the clerk did not obtain length data. Anglers who released black bass or walleyes were asked if released fish exceeded the minimum length for legal harvest. Interview and count data were recorded on standard forms (Appendix 3 Figure A3.1).

In addition to these trip data, opinion questions were asked of boat and bank angling parties during only their first interview each month (Appendix 3 Figure A3.2), with the boat operator or other party leader providing responses. Angler opinions were solicited on estimated frequency of fishing trips, point of access to the reservoir (boat anglers only), perceptions of and reactions to crowding, frequency and objectives of night fishing trips, and preferences for crappie length and creel limits. Each party was also given the opportunity to make additional comments at the end of their first interview. Responses to open-ended questions were categorized and coded by the creel clerk where applicable. Responses and comments not fitting available codes were noted on the interview form.

Effort, Catch, and Harvest Estimation

Effort, catch, and harvest estimates were stratified by day type (weekday or weekend). Whenever possible, monthly estimates were computed. When monthly sample sizes were too small to calculate sample variance, catch and harvest estimates were developed from pooled data from adjacent months. Estimates and variances for all monthly or pooled survey segments and zones were summed to obtain totals for the survey year.

Effort (angler-hours), catch, and harvest estimation followed roving-roving procedures described by Pollock et al. (1994). For each work period (i), lake-wide boat angling party and bank angler counts were determined, and boat angling party counts were further expanded by the mean party size to determine instantaneous angler count estimates (I_i). Mean boat-angler party size estimates were based on daily totals when this information could be obtained from more than 10% of observed boaters; otherwise, substitute multipliers based on the mean values from all work periods within the sample stratum were used.

Effort (e) for a work period of T_i hours was estimated for each zone as

$$\hat{e_i} = I_i \times T_i$$

and expanded to total effort (E) as

$$\hat{E} = \sum_{i=1}^{n} \left(\hat{e_i} / \pi_i \right)$$

with π_i representing the total probability of sampling for each work period, including the probabilities of sampling the work period within the day and the day within the sample stratum (weekday or weekend/holiday). Approximate standard error (SE) of each effort estimate was computed as

$$\hat{SE}\left(\hat{E}\right) = \sqrt{N^2 \left(\frac{s^2}{n} \right)},$$

where s^2 = variance of effort observations, n = number of days sampled, and N = number of days available for sampling. In addition to total effort, directed effort was estimated for black

bass, crappies, sunfish (all centrarchids other than black bass and crappies), walleyes, white bass, "other" species, and "no preference" (undirected effort). Directed effort expansions included only parties listing the target species (or lack thereof) as the object of their fishing trip, but were otherwise calculated similarly to total effort estimates. Effort estimates were compared to similar data from a creel survey of Lake James from March 1987–February 1988 (Borawa 1989); because standard errors were unavailable for 1987–1988 data, 1997–1998 estimates were assumed to differ if their associated standard errors were less than the difference in estimates from the two surveys.

To allow expansion of catch and harvest estimates, weighted mean catch and harvest rates were calculated using unexpanded boat and bank angler interview data. Parties fishing less than 0.5 h at the time of interview were omitted from catch and harvest calculations. In addition to total catch and harvest rates, estimates were computed for black bass, crappies, sunfish, walleyes, white bass, and "other" species. Catch and harvest rates were also calculated for anglers directing effort toward black bass, crappies, sunfish, and walleyes. Rate estimates were also compared to 1987–1988 data (Borawa 1989), using variances associated with 1997–1998 rate estimates, to assess differences between estimates from the two surveys.

Catch (C) and harvest (H) were estimated from boat angling effort and day-wise mean catch (harvest) rates as

$$\hat{C} = \hat{E} \times \hat{R},$$

where

$$\hat{R} = \frac{\sum_{i=1}^{n} c_i / L_i}{n}$$

with c_i = catch and L_i = hours of fishing reported by each party (i) interviewed during the work period. Catch and harvest expansions were based only on sample days when boat angler interviews were obtained. Trip lengths were based on fishing times reported by angling parties. Approximate SE of each catch and harvest estimate was computed from sample variance based on number of days sampled among all available days, applying the same formulae used with effort estimates. In addition to total catch and harvest, expansions were calculated separately for catch and harvest of black bass, crappies, sunfish, walleyes, white bass, and "other" species. For walleyes, separate estimates were also computed for sub-legal (<381 mm) fish. Percentages of fish harvested and numbers of fish released were estimated based on catch and harvest expansions. Walleye harvest and release rates were used to estimate production cost and return to anglers of stocked walleyes, based on hatchery contribution estimates of Besler (2004).

Length-frequency distributions were developed for largemouth and smallmouth bass, walleyes, crappies, and sunfish, and compared with distributions reported by Borawa (1989). Crappie distributions were also compared with trap net data collected in fall 1998 (Besler 1999). Similar graphic comparisons were developed for gill net data collected in fall 1999 for walleyes (Besler 2000a) and white bass (Besler 2000b). Crappie harvest and length data were used to assess potential benefit of regulations being considered for the Lake James fishery.

Characteristics of the Recreational Fishery

Point of origin for fishing trips, as determined by angler zip code, was categorized by state residency and proximity to Lake James. Anglers were classified as "local" if they resided in McDowell or Burke counties. Non-local anglers were classified as "regional" if they resided in a county adjacent to the two local counties. Trip origin information was compared with similar data collected in 1987–1988 by Borawa (1989). Mean trip expenditures were estimated for boat and bank anglers by point of origin, and overall mean expenditures were computed.

Qualitative trip ratings from boat and bank anglers and launch points of boat angling trips were tabulated. Angler responses to first-interview questions on trip frequency, perception of and responses to reservoir crowding, and night fishing frequency were tabulated by three-month season within the survey year, and yearly total responses were computed. Night fishing frequency was also estimated for boat and bank anglers, as well as target species and motivation for night fishing. Preferences regarding crappie length and creel limits were tabulated for boat and bank anglers, and overall preference ratings were computed.

Results and Discussion

Fishing Effort

Total estimated daytime angling effort on Lake James (Table 2) was 231,150 angler-hours (SE = 13,613) for the survey year of June 1997–May 1998, compared to 294,817 angler-hours estimated in the creel survey of March 1987–February 1988 (Borawa 1989). A decline in total effort was also observed on Lake Norman; Baker (1983) estimated 721,685 angler-hours in a 1981–1982 survey but only 634,794 angler-hours in a subsequent survey in 1994–1995 (Baker 1997). Causes for decline in day fishing are unknown, but may result from reduced public interest in fishing, displacement of day anglers by other water users, or variations in weather patterns. Seasonal comparison of effort estimates from the two Lake James creel surveys indicates that competing uses may be at least partially responsible for the observed differences. In both surveys, daytime fishing effort on Lake James was higher in late spring than at other times of the year, with May, April, and June ranking respectively highest for fishing effort (Table 2). However, monthly values differed substantially between the two surveys; effort estimates for the months of June–November 1997 were roughly half those of the same period in 1987, whereas estimates for December 1997–February 1998 were approximately double those of the same months in the earlier survey. The higher estimates for the cooler months, when competing lake uses were at a minimum, imply that fishing interest remained high, and that some portion of the fishing effort in warmer months was displaced to night or off-season fishing.

Boat fishing effort was apportioned equally between weekdays and weekends (Table 2). Borawa (1989) reported a similar apportionment among day types for the 1987–1988 survey. In contrast, estimated bank angling effort in 1997–1998 (4,896 angler-hours; SE = 598) was far lower than the 36,923 angler-hours estimated by Borawa (1989), and this difference accounted for over half of the difference in total observed effort between the two studies. It is possible that the observed difference in bank angling effort represents a dramatic reduction in bank fishing activity, but it is more likely that differences in survey methods between the two studies contributed to the disparity in estimates. During the 1987–1988 creel survey, interviews were obtained during progressive count circuits (Borawa 1989), whereas in the 1997–1998 survey a rapid circuit of each lake zone was completed to obtain an "instantaneous" count of anglers.

Although Pollock et al. (1994) and Wade et al. (1991) report underestimation of effort associated with progressive counts, in the case of Lake James bank anglers the slower circuit may have increased the likelihood of bank anglers in wooded shoreline areas being observed and counted.

Total estimated boat fishing effort of 226,254 angler-hours for Lake James in 1997–1998 represented 85.9 h/ha. Comparable values from contemporary surveys of other North Carolina reservoirs include 179.6 h/ha for Lake Hickory in 1997–1998 (Baker 2002), 118 h/ha for Harris Lake in 1997–1998 (Jones et al. 2000), 50 h/ha for Lake Norman in 1994–1995 (Baker 1997), and 48.1 h/ha for Santeetlah Reservoir in 1998–1999 (Yow et al. 2002). Fishing pressure on Lake James falls well within the range of values from these other reservoirs, and reflects a highly popular resource given the limnological character of the reservoir and its relative proximity to urban areas.

Lake James anglers exhibited a much higher incidence of directed effort in 1997–1998 compared to values reported by Borawa (1989) for 1987–1988 (Table 3). Nearly half of angling parties surveyed in the earlier study represented undirected effort, this angler group represented only 8% of total effort in 1997–1998. The increased directed effort was allocated among all major sport fisheries; black bass and walleyes constituted higher percentages of total fishing effort, whereas their percentages of total directed effort remained unchanged from 1987–1988 estimates. Conversely, directed effort for crappies represented approximately the same percentage of total fishing effort, but the percentage of total directed effort was reduced from 1987–1988 estimates, possibly representing a decline in interest in Lake James crappie fishing relative to other target species. Directed effort for sunfish increased from 1987–1988 to 1997–1998, whereas directed effort for white bass declined. Directed effort for other species, including catfish, yellow perch, muskellunge, and carp, represented less than 2% of total effort in both surveys.

Catch and Harvest

Overall catch rate for Lake James anglers interviewed during the 1997–1998 creel survey (Table 4) was unchanged from the 1987–1988 value of 0.58 fish/h (Borawa 1989); this catch rate is comparable to the rate of 0.57 fish/h estimated for Santeetlah Reservoir (Yow et al. 2002), a reservoir with similar limnological conditions and gamefish species. Overall catch rates of major gamefish species reflected shifts in directed effort, with increased catch rates for black bass and walleyes. Catch rates for crappies and white bass were unchanged from the earlier creel survey, and sunfish catch rate was lower in 1997–1998 than in the earlier survey. Among anglers directing effort toward a particular target species, walleye anglers achieved a higher catch rate in 1997–1998 than in 1987–1988, catch rate of sunfish anglers declined, and crappie angler catch rates remained unchanged. Borawa (1989) did not report a directed effort catch rate for both black bass species combined, and insufficient effort was directed toward other species in the 1997–1998 creel survey to allow computation of annual directed-effort catch rates.

Harvest rates were low for all species (Table 4), with an overall harvest rate of approximately 0.21 fish/h, slightly lower than the rate of 0.27 fish/h estimated by Yow et al. (2002) for Santeetlah Reservoir. Among anglers targeting a specific gamefish species, crappie anglers harvested fish at the highest rate (0.65 fish/h), followed by sunfish anglers (0.41 fish/h). Harvest rate among walleye anglers was relatively low at 0.09 fish/h, and likely reflected the release of sub-legal fish; walleye anglers on Santeetlah Reservoir, where no length limit is in effect, harvested 0.22 fish/h. Black bass anglers harvested few fish; estimated mean harvest rate was 0.06 fish/h, and this likely overestimated actual harvest. Because harvest estimates were

based on the number of fish observed in the possession of angling parties during incomplete fishing trips, bass anglers holding fish for tournament weigh-ins or practice were included in harvest estimates. Irrespective of this presumed bias, estimated black bass harvest rate among Lake James bass anglers was lower than the harvest rate of 0.11 fish/h estimated for bass anglers on Santeetlah Reservoir (Yow et al. 2002), where harvest was determined from exiting parties.

Because of inconsistencies in catch and harvest reporting by a creel clerk during April and May 1998, the majority of the catch and harvest data from this portion of the creel survey was discarded, allowing only pooled estimates from this two-month period. As a result, only annual catch and harvest estimates are reported for the 1997–1998 survey year (Table 5), and no comparisons are made with values from the Borawa (1989) survey.

Total estimated catch for June 1997–May 1998 (Table 5) was 135,168 fish (SE = 26,995). Sunfish constituted 60,029 or 44.4% of all fish caught. Catch of black bass totaled 32,404 fish, followed by walleyes at 18,619 fish and crappies at 12,342 fish. Total estimated harvest was 49,511 fish (SE = 8,428), or 36.6% of total catch. As with catch, sunfish comprised the largest percentage (41.0%) with an estimated 20,295 fish harvested. An estimated 9,145 crappies were harvested, representing 74.1% of the catch of this species. Estimated walleye harvest was 8,379 including approximately 417 fish (5.0%) under the 381-mm length limit, possibly indicating improved angler compliance with the regulation compared to 21% sub-legal fish reported harvested by Borawa (1989). Lake James anglers released an estimated 10,240 walleyes, of which approximately 9,941 (97.1%) were <381 mm.

Because of the high incidence of sub-legal walleyes caught and subsequently released by Lake James anglers, catch-and-release mortality may have a more significant influence on recruitment of walleyes to the 381-mm harvestable size class than illegal harvest. Dead walleyes were frequently observed by clerks in 1997–1998, particularly in late summer and mid-winter when stress from catch depth or surface water temperature would have been highest. Short-term mortality rates of released walleyes reported from other studies ranged from 0.8–47.1% (Fletcher 1987; Payer et al. 1989; Schaefer 1989; Goeman 1991; Fielder and Johnson 1994); applying these percentages to estimated numbers of released sub-legal fish in Lake James gives an estimate of 80–4,682 walleyes lost annually to catch-and-release mortality, compared to the estimated 417 sub-legal fish harvested annually.

The annual walleye harvest estimate also facilitates cost assessment of the fingerling stocking program. Besler (2004) recently assessed contribution of annual fingerling stocking to the age-1 walleye population in Lake James and determined that hatchery fish contributed 2.1–3.7% annually to the walleye fishery. Applying these percentages to the estimated annual harvest of 8,379 yields 176–310 hatchery-raised walleyes. Based on annual walleye production costs of US$5,000 (C. J. Kittel, NCWRC, personal communication) and rates of hatchery contribution estimated by Besler (2004), the estimated annual cost of angler-harvested hatchery walleye is $16.13 to $28.41 per fish; these figures are comparable to the estimate of $27.00 per fish for Virginia waters (Murphy et al. 1983). Based on the low return per unit cost and the demonstration by Besler (2004) that the Lake James walleye population is supported almost entirely by natural reproduction, hatchery resources now used for walleye stocking on Lake James should be reallocated to stocking programs with documented need for walleye stocking.

Length Structure of Harvest

Length structures of largemouth and smallmouth bass possessed by anglers at the time of interview (Figure 2) indicate a trend toward larger fish of both species in the 1997–1998 creel

compared to the Borawa (1989) survey. Although no contemporary biological samples of black bass were available for Lake James, it is likely that the observed trend was associated with increased interest in tournament bass fishing. Anglers involved in this activity would be more likely to retain large fish and release smaller individuals, particularly as they filled the five-fish creel limit.

Length structure of harvested walleyes (Figure 3) was similar to two prior creel surveys and the subsequent gill net sample. The slightly (<10 mm) larger modal length indicated from the 1997–1998 creel is likely due to annual variation in the walleye population rather than a trend in walleye growth. The greater availability of fish in this length class may have contributed to the higher rate of compliance with the length limit in 1997–1998 compared to 1987–1988. However, marginally sub-legal fish probably form a substantial annual proportion of caught-and-released walleyes. Additional annual surveys of the Lake James walleye population should be conducted to evaluate the effectiveness of the current 381-mm length limit in relation to fish age, growth, and relative abundance.

As was the case with walleyes, white bass length structure exhibited similar length ranges among both creel surveys and the 1999 gill net sample (Figure 4). However, Lake James white bass showed marked variations in size structure among years, likely due to differences in year class performance. The 1987–1988 creel survey showed a fishery dominated by 300- to 330-mm fish (Borawa 1989), whereas both the 1997–1998 creel survey and gill net data collected in 1999 by Besler (2000b) exhibited length structures with more even distribution among larger length classes. Forage dynamics may have influenced the observed year-to-year variability in white bass length structure. Threadfin shad abundance varies yearly in Lake James because of frequent winter kills and variable availability of source stocks for re-establishment. Spring threadfin shad stocking occurred annually from 1985–1987 (Appendix 1); however no information is available on over-winter threadfin survival for these years. Surface-set gill net samples in 1998 and 1999 (NCWRC, unpublished data) confirmed establishment and over-winter survival of threadfin stocked in 1997. The availability of established threadfin shad forage throughout these years may have contributed to the consistent performance of white bass year classes observed in the 1997–1998 creel and 1999 gill net surveys.

Length structure of crappies harvested during the 1997–1998 creel survey was similar to trap net samples collected in the fall of 1998 (Besler 1999); however, both samples indicated a higher proportion of fish ≥200 mm than the harvest reported by Borawa (1989) from the 1987–1988 creel survey (Figure 5). As with white bass, Lake James crappies may have benefited from consistent abundance of threadfin shad forage from 1997 through 1998. Natural variation in year class strength may have also contributed to the abundance of fish <200 mm in the earlier creel survey compared to 1997–1998 surveys. In addition to possible population effects, sampling effort patterns during the 1997–1998 creel survey may have affected observed crappie length structure. Because of staffing difficulties, less sampling effort was allocated in the spring of 1998 than in the previous fall, producing a length-frequency sample dominated by fall-caught fish. If early age-1 crappies from spring harvest contributed heavily to length-frequency data reported by Borawa (1989), the lower numbers of crappies <200 mm in the 1997–1998 creel survey may have resulted from sampling bias, rather than a trend toward larger fish in the crappie population. Additional trap net surveys of Lake James crappies should further assess possible trends or annual variations in year class strength. Based on 1997–1998 creel survey and trap net data, a length limit on crappies would have little effect on the crappie fishery, with more than 80% of fish in both samples exceeding 203 mm.

Sunfish length structure was similar in both creel surveys (Figure 6). Length frequencies from both surveys indicate that annual sunfish recruitment is consistent and supports existing levels of angler harvest on Lake James.

Angler Characteristics and Preferences

Residency status associated with Lake James angling trips (Table 6) was similar to the previous creel survey (Borawa 1989). Local anglers constituted 56.6% of all parties interviewed in 1997–1998, compared to 50.5% in 1987–1988. Similarly, non-resident anglers accounted for 2.0% of observed fishing trips in 1997–1998, up only slightly from the 1987–1988 estimate of 0.7%. Boat angling accounted for all observed non-resident parties interviewed in 1997–1998. Distance from home appeared to affect trip cost reported by 1997–1998 anglers (Table 6), with local angling parties spending an average of $20.88, slightly less than the average for all angling parties of $23.86. By comparison, Santeetlah boat angling parties surveyed in 1998–1999 spent an estimated $24.61 (Yow et al. 2002). Lake James bank anglers reported a lower average trip cost of $14.42.

Ratings of trip quality (Table 6) were also unchanged from earlier estimates. A "poor" rating was reported by 73.4% of parties interviewed in 1997–1998 compared to 76% reported by Borawa (1989). Trip ratings of "fair" and "good" were reported by 18.4% and 7.8% of parties respectively in 1997–1998, compared to corresponding 1987–1988 ratings of 16% and 6%. An "excellent" rating was reported by less than 1% of respondents in both surveys. The subjective trip rating used in both surveys was heavily weighted toward the lower extreme of the scale of available responses. As a result, no information was obtained that directly addressed the aspects of fishing trips that caused anglers to give high or low ratings. Future opinion surveys on fishing trip quality should explore angler perceptions of resource quality compared to other nearby reservoirs, and solicit specific opinions on different components of fishing trip quality, including adequacy of access facilities and perceptions of NCWRC fisheries programs.

More than 93% of boat angling trips involved use of public and commercial access facilities for launching watercraft (Table 6); 6.9% of boat angling trips originated from private property around Lake James, and one party accessed the reservoir by canoe portage. The three NCWRC-maintained access areas that existed at the time of the 1997–1998 survey accounted for 70.4% of all boat angling access (Black Bear Boating Access Area was constructed after conclusion of the creel survey).

The majority of Lake James boat anglers reported multiple fishing trips each month (Table 7), with somewhat higher trip frequencies reported during warmer portions of the year. More than five trips per month were reported by 45.2% of all boat anglers surveyed, and 6.7% reported fishing more than twelve times per month. Total fishing trip frequencies were higher for Lake James than for Santeetlah Reservoir (Yow et al. 2002), where only 29.4% of boat anglers reported fishing more than five times per month; however the Santeetlah survey only asked this question of first-time interviewees, whereas the Lake James survey asked all anglers in their first interview each month and likely sampled a greater proportion of frequent anglers.

The majority of boat anglers did not find Lake James crowded the day they were interviewed (Table 7). Only 20.8% of respondents perceived any degree of crowding. Perceptions of "crowded" or "very crowded" conditions occurred mainly during spring and summer periods, but accounted for only 5.2% of responses overall. Similarly, safety concerns associated with crowding were only reported by 3.6% of boat parties surveyed, again primarily in spring and summer. Perceptions of crowding were clearly associated with times when

competing uses were higher, but extremely crowded conditions did not occur frequently enough to be reported on most days surveyed. In contrast, the majority of boat anglers (71.4%) reported that they had changed fishing habits in response to reservoir crowding at other times. Angler responses to crowding were evenly split between temporal (48.3) and spatial (46.8) modifications. The most commonly reported temporal displacement of fishing activity was the avoidance of weekends, reported by 30.4% of anglers overall and 47.9% of anglers in spring months. Night fishing to avoid crowding was reported by 12.2% of boat angling parties surveyed, who reported higher frequencies of night fishing trips in spring and summer periods, again corresponding with times of competing reservoir use. Only 3.0% of boat anglers reported night fishing during winter months; however, anglers interviewed during winter months most often listed night fishing as a response to crowding at other times of the year. Angler responses to questions on reservoir crowding may indicate that displacement by competing water uses is at least partially responsible for the decline in daytime fishing effort observed in warmer months during the 1997–1998 creel survey, as well as the increase in winter effort. The lower reports of night fishing activity by anglers interviewed during warmer months likely occurred because those anglers who had shifted to night fishing were unavailable to the daytime survey. Future reservoir creel surveys will require nighttime work periods in order to adequately sample this portion of the sport fishing public during warmer months of the year. Because the present survey did not distinguish different types of spatial responses to crowding, no estimation was possible of the proportions of respondents who changed locations on the reservoir versus exiting for the day or choosing other fishing destinations. Future survey questions on crowding responses should incorporate hierarchical categories for spatial displacement responses.

Night fishing was more common among bank anglers than boat anglers (Table 8); 46.9% of bank anglers interviewed during day sampling reported at least one night fishing trip per month, compared to 33.3% of boat angling parties. Target species of night fishing trips also differed between the two groups, with boat anglers most often targeting black bass, walleyes, and crappies, and bank anglers predominantly seeking catfish. Overall, catfish was more frequently reported as a target species of night fishing trips than as an objective of the fishing trip on the day of the interview. Because most catfish angling was reported to occur at night, it is likely that effort, catch, and harvest estimates derived from the current daytime creel survey underestimate the importance of this fishery on Lake James. Among all Lake James anglers, higher fishing success was most often given as the reason for night fishing, although cooler and less crowded conditions were also important motivations for many night anglers.

Angler preferences regarding crappie regulations (Table 9) were comparable to existing regulations in other waters of the state. Among anglers desiring a length limit, the most commonly recommended length was 203 mm, preferred by 31.3% of respondents. The most preferred creel limit was 25 (27.3%), followed by 20 (23.9%). Although both length and creel limits were recommended by a majority of respondents, 17.8% of respondents felt that no length limit was needed, and 12.6% recommended that no creel limit should be implemented.

Conclusions

Lake James Fisheries Management

As in the earlier creel survey of March 1987–February 1988 (Borawa 1989), daytime fishing effort on Lake James was higher in late spring than at other times of the year. However, total estimated daytime fishing effort was lower in the May 1997–June 1998 creel survey, particularly

during summer and early fall, when competing daytime lake uses may be displacing anglers. Annual estimated boat fishing effort was higher relative to bank fishing effort than in 1987–1988, but remains evenly divided among weekends and weekdays. Daytime fishing effort on Lake James continues to focus on black bass and walleyes; directed effort for these species has increased since 1987–1988. Overall, directed effort represents a greater proportion of total fishing effort than in 1987–1988. Catch rates of crappie anglers appear unchanged; catch rate estimates for walleye anglers were higher in 1997–1998 than in the previous survey, whereas those for sunfish anglers declined slightly. Undersized walleyes were rarely harvested, and represented more than 97% of the walleyes released during the present study, indicating an improved compliance over 1987–1988 estimates. Harvest percentage of caught crappies was considerably higher than that of other species. Length structure of black bass and crappies appeared to differ between the 1987–1988 and 1997–1998 creel surveys; in the case of black bass, this was likely due in part to increased tournament angling and associated culling of smaller bass from live wells during fishing trips. Length structure of walleyes, white bass, and sunfish harvest did not appear to differ substantially between the two creel surveys. Length structure of trap net data appeared to accurately reflect angler harvest of crappies; similarly, gill nets appeared to sample size classes of walleyes and white bass that appeared in angler harvest. Based on catch and harvest data, there is no need for a length limit on crappies in Lake James.

Angler Characteristics

Bank anglers were observed less frequently in 1997–1998 than in the previous survey, likely due in part to different counting methods used in the two surveys. Angler residency status and trip success ratings were similar to the previous creel survey. The utility of trip rating response data was limited by the predominance of "poor" responses without additional information on reasons for the low ratings. Public access points accounted for over 93% of boat angling launches; over 70% of boat angling parties using one of the three NCWRC-maintained areas for access. Fishing trip frequency of two to four trips per month was typical of boat anglers across all seasons surveyed. Perceptions of reservoir crowding and associated safety concerns were highest during summer but remained low overall; however, many anglers indicated that they had changed their fishing habits in response to reservoir crowding. Temporal responses to crowding were reported as often as spatial responses, with avoidance of weekends being the most common temporal response; questionnaire design did not allow more detailed evaluation of spatial responses. Night fishing was reported by nearly half of summer boat anglers, but rarely occurred in winter; approximately one third of all boat anglers reported at least one night fishing trip. As with day anglers, black bass, walleyes, and crappies were commonly sought by night anglers. Catfish were sought more often by night anglers, particularly bank anglers; sunfish were rarely targeted at night. Estimated return to the creel and associated unit cost of stocked walleyes was very low. More anglers recommended a creel limit than a size limit for crappies, although the preferred creel limits would have little or no effect at existing levels of harvest.

Creel Survey Design

The boat-based, roving-roving design was difficult and costly to administer, and may have produced bias in estimates, particularly regarding black bass harvest. Additionally, substantial components of the recreational fishery were likely missed by the daytime survey, based on the reduced total fishing effort estimates, frequency of reported night fishing activity, and differences among target species reported for day and night fishing trips. In particular, the

importance of catfish angling relative to sunfish and other species was likely underestimated by this survey. Given the relatively minor contribution of private-access fishing trips to the overall recreational fishery, access point designs incorporating evening and night work periods would be more appropriate for surveying recreational fisheries on western North Carolina reservoirs, particularly those with shoreline residential densities comparable to or less than that of Lake James.

Recommendations

Lake James Fisheries Management

1. Continue to manage the reservoir for black bass and walleyes; stock threadfin shad as needed to supplement forage for walleyes, crappies, white bass, and other gamefish, pending availability of threadfin shad source stocks that do not contain alewife *Alosa pseudoharengus* or blueback herring *A. aestivalis*; continue fish habitat enhancements for bass and other littoral gamefish.
2. Discontinue walleye stocking in Lake James.
3. Continue to manage Lake James crappies with no length limit; consider creel limits to address actual or perceived overharvest of crappies.
4. Collect age and growth information on walleyes, white bass, and crappies to compare with other reservoirs and evaluate effects of forage supplements and current regulations; in particular, the potential effects of removal of the 381-mm length limit on walleye should be investigated.
5. Develop standardized sampling protocols for largemouth and smallmouth bass to evaluate possible changes in population structures of both species.
6. Evaluate bank fishing access needs and enhancement opportunities.

Future Reservoir Creel Surveys

1. Abandon the boat-based roving-roving design for creel surveys of mountain reservoirs where proportion of private access is anticipated to be low; use access point survey designs in future reservoir creel surveys.
2. Include evening/night sampling during April–October survey segments.
3. Abandon subjective trip ratings; develop region-specific survey questions to more effectively compare angler perceptions of relative resource quality.
4. Develop more detailed survey questions regarding spatial alterations in angling behavior in response to reservoir crowding.

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References

Baker, B. K. 1983. 1981–82 creel survey of Lake Norman, North Carolina. Research Report PES/83–33. Duke Power Company, Huntersville.

Baker, B. K. 1997. Lake Norman creel survey 1994–95. Duke Power Company, Huntersville, North Carolina.

Baker, B. K. 2002. Lake Hickory creel survey 1997–98. Duke Power Company, Huntersville, North Carolina.

Besler, D. A. 1999. Lake James crappie investigation – survey summary 1998. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-24, Raleigh.

Besler, D. A. 2000a. Lake James walleye investigation – survey summary 1999. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-24, Raleigh.

Besler, D. A. 2000b. Lake James white bass investigation – survey summary 1999. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-24, Raleigh.

Besler, D. A. 2004. Contribution of stocked fingerling walleyes in Lake James. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-24, Raleigh.

Besler, D. A., L. G. Dorsey, K. B. Hodges, K. J. Hining, W. E. Taylor, R. J. Brown, and M. G. Martin. 2004. Fisheries and wildlife management plan for the Catawba River Basin. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh.

Borawa, J. C. 1989. Lake James creel survey, 1987–88. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-24, Raleigh.

Fielder, D. G., and B. A. Johnson. 1994. Walleye mortality during live-release tournaments on Lake Oahe, South Dakota. North American Journal of Fisheries Management 14:776–780.

Fletcher, D. H. 1987. Hooking mortality of walleyes captured in Porcupine Bay, Washington. North American Journal of Fisheries Management 7:594–596.

Goeman, T. J. 1991. Walleye mortality during a live-release tournament on Mille Lacs, Minnesota. North American Journal of Fisheries Management 11:57–61.

Jones, T. W., W. J. Collart, D. Hinshaw, and S. Van Horn. 2000. Harris Lake creel survey, 1997–98. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-23, Raleigh.

Murphy, B. R., L. A. Nielsen, and B. J. Turner. 1983. Use of genetic tags to evaluate stocking success for reservoir walleyes. Transactions of the American Fisheries Society 112:457-463.

Payer, R. D., R. B. Pierce, and D. L. Pereira. 1989. Hooking mortality of walleyes caught on live and artificial baits. North American Journal of Fisheries Management 9:188–192.

Pollock, K. H., C. M. Jones, and T. L. Brown. 1994. Angler survey methods and their applications in fisheries management. American Fisheries Society Special Publication 25, Bethesda, Maryland.

Richardson, F., and H. M. Ratledge. 1961. Upper Catawba River reservoirs and Lake Lure. Pages 161–223 *in* L. B. Tebo, editor. Inventory of fish populations in lentic waters. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh.

Schaefer, W. F. 1989. Hooking mortality of walleyes in a northwestern Ontario lake. North American Journal of Fisheries Management 9:193–194.

Wade, D. L., C. M. Jones, D. S. Robson, and K. H. Pollock. 1991. Computer simulation techniques to assess bias in the roving-creel-survey estimator. Pages 40–46 *in* D. Guthrie, and seven coeditors. Creel and angler surveys in fisheries management. American Fisheries Society Symposium 12, Bethesda, Maryland.

Yow, D. L., C. S. Loftis, and E. Ganus. 2002. Creel surveys of Santeetlah, Cheoah, Calderwood, and Chilhowee reservoirs, 1998–99. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Project F-24, Raleigh.

TABLE 1.—Weekday (WD) and weekend (WE) sample dates and sample period start and end times by month, Lake James creel survey, June 1997–May 1998.

Month	Sample dates			Work period times[a]		
	Day type	Count + interviews	Interviews only	Start	Midday	End
Jun (1997)	WD	3, 9, 19, 23, 26	17, 27, 30	0700	1345	2030
	WE	7, 8, 14, 21, 28	15, 22			
Jul	WD	7, 15, 24, 25, 29	1, 18, 30	0700	1345	2030
	WE	6, 12, 20, 26, 27	4, 5, 13			
Aug	WD	6, 8, 13, 14, 15	1, 18, 19, 26, 28	0700	1330	2000
	WE	3, 10, 24, 30, 31	17, 23			
Sep	WD	3, 5, 17, 22, 23	9, 11, 18, 29	0730	1330	1930
	WE	1, 7, 14, 21, 28	13, 20			
Oct	WD	3, 10, 16, 17, 24	9, 23, 29, 30	0800	1330	1900
	WE	4, 12, 19, 25, 26[a]	5, 11, 18			
Nov	WD	6, 17, 20, 26	5, 10, 11, 19	0730	1230	1730
	WE	1, 2, 8, 9, 15	none			
Dec	WD	4, 15, 19, 23	5	0800	1245	1730
	WE	13, 20, 21[b], 27, 28[b]	6, 7			
Jan (1998)	WD	7, 14[b], 19, 22[b]	2, 29, 30	0800	1245	1730
	WE	10[c], 17, 24, 25, 31	none			
Feb	WD	6, 20, 24[c], 26	3, 9	0730	1245	1800
	WE	1, 8, 15, 21, 22	7, 14			
Mar	WD	5, 12, 27	6, 26	0700	1230	1800
	WE	7, 28	15, 21			
Apr[d]	WD	6, 7, 8[d], 16, 29	1, 3, 22, 24, 28[d]	0730	1345	2000
	WE	4[a], 11, 12, 18, 19	25, 26			
May[d]	WD	8, 15[d], 21, 22[d]	5, 20, 26	0700	1330	2000
	WE	9, 16, 17, 24	2, 3, 10			

[a] Work period times associated with angler counts are given in Eastern Standard Time (EST) for November–March and Eastern Daylight Time for other months. Work period times for 26 October 1997 and 4 April 1998 were 1 h earlier than listed times, to account for EST.

[b] No fishing effort was observed on four dates in late December 1997 and January 1998; dates were included in catch and effort expansions but omitted from catch and harvest rate calculations.

[c] Interview information was insufficient for catch and harvest rate calculations for 10 January and 24 February 1998; dates were omitted from catch and harvest expansions.

[d] Due to creel clerk inconsistencies in catch and harvest data collection in April and May 1998, only four dates were used for pooled expansions of catch and harvest estimates.

TABLE 2.—Estimated monthly and total daytime boat fishing effort (angler-hours) by day type and angler category, Lake James creel survey, June 1997–May 1998. Standard errors are given in parentheses. Corresponding effort estimates from creel survey of March 1987–February 1988 (Borawa 1989) are given for comparison.

	1997–1998				1987–1988	
Date	Weekday boat	Weekend boat	Bank	Total	Date	Total
Jun 1997	11,006	11,826	648	23,480	Jun 1987	38,546
	(1,153)	(1,251)	(147)	(1,707)		
Jul 1997	11,685	6,043	132	17,860	Jul 1987	29,289
	(1,623)	(1,223)	(71)	(2,034)		
Aug 1997	6,829	4,464	135	11,428	Aug 1987	27,265
	(310)	(636)	(82)	(712)		
Sep 1997	8,836	4,218	137	13,191	Sep 1987	26,018
	(660)	(455)	(73)	(805)		
Oct 1997	6,322	4,148	207	10,677	Oct 1987	22,011
	(922)	(871)	(86)	(1,271)		
Nov 1997	3,561	3,276	20	6,857	Nov 1987	12,149
	(1,172)	(543)	(20)	(1,292)		
Dec 1997	6,929	3,483	147	10,559	Dec 1987	5,921
	(2,148)	(1,880)	(116)	(2,857)		
Jan 1998	270	2,330	17	2,617	Jan 1988	2,470
	(139)	(671)	(17)	(685)		
Feb 1998	2,955	2,307	103	5,365	Feb 1988	1,096
	(1,447)	(390)	(56)	(1,500)		
Mar 1998	4,562	17,207	147	21,916	Mar 1987	21,508
	(2,108)	(9,562)	(104)	(9,792)		
Apr 1998	17,404	13,412	1,110	31,926	Apr 1987	39,381
	(2,259)	(1,818)	(324)	(2,918)		
May 1998	34,955	38,226	2093	75,274	May 1987	69,163
	(5,382)	(5,424)	(422)	(7,652)		
Totals	115,314	110,940	4,896	231,150	Totals	294,817
	(7,208)	(11,533)	(598)	(13,613)		

TABLE 3.—Directed effort estimates (angler-hours), percentages of total effort, and percentages of directed effort for major sport fish species and species groups sought by anglers during Lake James creel survey, June 1997–May 1998. Corresponding values from creel survey of March 1987–February 1988 (Borawa 1989) are given for comparison. Asterisks indicate 1997–1998 percentages that differ from 1987–1988 values. Standard errors are given in parentheses for 1997–1998 estimates. ND = no data.

Species or group	Jun 1997–May 1998			Mar 1987–Feb 1988		
	Angler-hours	% total	% directed	Angler-hours	% total	% directed
Black bass	108,104 (10,556)	46.8* (4.6)	50.8 (5.0)	73,378	24.9	47.9
Crappie	14,547 (5,073)	6.3 (2.2)	6.8* (2.4)	15,895	5.4	10.4
Other sunfish	19,517 (2,247)	8.4* (1.0)	9.2* (1.1)	9,521	3.2	6.2
Walleye	64,116 (5,045)	27.7* (2.2)	30.2 (2.4)	43,103	14.6	28.2
White bass	3,155 (502)	1.4* (0.2)	1.5* (0.2)	7,282	2.5	4.8
All other species	3,245 (1,229)	1.4 (0.5)	1.5* (0.6)	3,878	1.3	2.5
No preference	18,467 (3,490)	8.0* (1.5)	ND	141,760	48.1	ND
Totals	231,151	100.0	100.0	294,817	100.0	100.0

TABLE 4.—Overall and directed-effort weighted mean catch and harvest rates (fish/h) for major sport fish species and species groups, Lake James creel survey, June 1997–May 1998. Where applicable, corresponding values are given for the March 1987–February 1988 survey (Borawa 1989; NCWRC unpublished data). Standard deviations are given in parentheses for 1997–1998 data. Bold italics indicate 1997–1998 values that differ from 1987–1988 rates.

	Jun 1997–May 1998		Mar 1987–Feb 1988	
Species or group	All anglers	Directed effort	All anglers	Directed effort
Catch rates				
Black bass	***0.14*** (0.01)	0.31[a] (0.03)	0.10	0.26[a]
Crappie	0.08 (0.02)	0.97 (0.17)	0.06[b]	0.99
Other sunfish	***0.18*** (0.03)	***2.01*** (0.44)	0.26	2.69
Walleye	***0.12*** (0.01)	***0.25*** (0.01)	0.07	0.20
White bass	0.05 (0.01)		0.05[b]	
All other species	0.02[a] (0.01)		0.04[a]	
Total catch rates	0.58 (0.04)		0.58	
Harvest rates				
Black bass	0.04 (0.01)	0.06 (0.01)		
Crappie	0.05 (0.01)	0.65 (0.12)		
Other sunfish	0.05 (0.01)	0.41 (0.10)		
Walleye	0.04 (0.01)	0.09 (0.01)		
White bass	0.02 (0.01)			
All other species	0.01 (0.01)			
Total harvest rate	0.21 (0.02)			

[a] Directed effort catch rates for largemouth bass only are given for 1987–1988; no composite black bass value was available. Overall 1987–1988 catch rate for "all other species" was approximated from multiple species catch rates, some of which were reported as <0.001 (Borawa 1989).

[b] Overall catch rates for crappies and white bass from 1987–1988 survey have been adjusted to compensate for apparent decimal error in 1987–1988 data analysis.

TABLE 5.—Estimated numbers of fish reported caught, harvested, and released, by species or species group, Lake James creel survey, June 1997–May 1998. For harvest and release values, percentages of catch are also given. Standard errors are given in parentheses.

Species or group	Caught	Harvested	H % catch	Released	R % catch
Black bass	32,404	7,355	22.7	25,049	77.3
	(5,451)	(1,613)	(5.0)	(5,207)	(16.1)
Crappie	12,342	9,145	74.1	3,197	25.9
	(3,008)	(2,815)	(22.8)	(1,060)	(8.6)
All other sunfish	60,029	20,295	33.8	39,734	66.2
	(24,199)	(6,679)	(11.1)	(23,259)	(38.7)
Walleye	18,619	8,379	45.0	10,240	55.0
	(2,066)	(1,573)	(8.4)	(1,339)	(7.2)
Walleye <381 mm	*10,358*	*417*	*4.0*	*9,941*	*96.0*
	(1,029)	*(194)*	*(1.9)*	*(1,010)*	*(9.8)*
White bass	7,250	3,060	42.2	4,190	57.8
	(1,518)	(740)	(10.2)	(1,326)	(18.3)
All other species	4,524	1,277	28.2	3,247	71.8
	(1,674)	(541)	(12.0)	(1,585)	(35.0)
Totals	135,168	49,511	36.6	85,657	63.4
	(26,995)	(8,428)	(6.2)	(25,645)	(19.0)

TABLE 6.—Residency, mean trip expenditures, trip ratings, and launch point (boats only) reported during angling trips, Lake James creel survey, June 1997–May 1998. Percentages of column subtotals are given in parentheses where applicable. ND = no data.

Response, by category	Response frequency or trip cost		
	Boat anglers	Bank anglers	All parties interviewed
Residency			
North Carolina			
Local	1,329 (56.4)	49 (65.4)	1,378 (56.6)
Regional	800 (33.9)	19 (25.3)	819 (33.7)
Other NC	181 (7.7)	7 (9.3)	188 (7.7)
Out-of-state	48 (2.0)	0 (0.0)	48 (2.0)
Mean trip expenditure (US$)[a]			
Local anglers	21.08	15.21	20.88
Regional anglers	26.45	12.05	26.11
Other NC anglers	33.38	15.57	32.71
Out-of-state anglers	47.70	ND	47.70
All anglers	24.15	14.42	23.86
Trip rating			
Excellent	7 (0.3)	1 (1.4)	8 (0.4)
Good	180 (7.8)	7 (10.0)	187 (7.8)
Fair	428 (18.5)	11 (15.7)	439 (18.4)
Poor	1,700 (73.4)	51 (72.9)	1,751 (73.4)
Launch point (boat anglers)			
North Fork	481 (27.7)		
Canal Bridge	441 (25.4)		
Linville River	300 (17.3)		
Mimosa	122 (7.0)		
Hidden Cove	70 (4.0)		
Benfield's Landing	70 (4.0)		
Moose Lodge	55 (3.2)		
Mountain Harbor	27 (1.6)		
Goodman's Landing	25 (1.4)		
McDowell Wildlife	23 (1.3)		
Burnette's Landing	2 (0.1)		
Private property	120 (6.9)		
Canoe portage	1 (0.1)		

[a] Total expenditures of anglers in party.

TABLE 7.—Frequency of fishing trips, perceptions of reservoir crowding, safety concerns, and resulting changes in fishing habits reported by boat angling parties, by season and in total, Lake James creel survey, June 1997–May 1998. Percentages of column subtotals are given in parentheses.

Response, by category	Season				Totals
	Jun–Aug	Sep–Nov	Dec–Feb	Mar–May	
Fishing trips per month					
≤1	93 (11.0)	44 (7.8)	25 (24.5)	29 (14.7)	191 (11.2)
2–4	339 (40.0)	269 (47.7)	58 (56.9)	81 (40.9)	747 (43.6)
5–8	243 (28.6)	143 (25.4)	13 (12.7)	45 (22.7)	444 (25.9)
9–12	106 (12.5)	82 (14.5)	4 (3.9)	24 (12.1)	216 (12.6)
>12	67 (7.9)	26 (4.6)	2 (2.0)	19 (9.6)	114 (6.7)
Perception of crowding					
Not very crowded	643 (75.6)	514 (91.1)	94 (93.1)	106 (53.8)	1,357 (79.2)
Somewhat crowded	82 (9.6)	31 (5.5)	7 (6.9)	53 (26.9)	173 (10.1)
Moderately crowded	54 (6.3)	14 (2.5)	0 (0.0)	26 (13.2)	94 (5.5)
Crowded	45 (5.3)	1 (0.2)	0 (0.0)	9 (4.6)	55 (3.2)
Very crowded	27 (3.2)	4 (0.7)	0 (0.0)	3 (1.5)	34 (2.0)
Concern for safety					
Safety concern	46 (5.4)	2 (0.4)	1 (1.0)	12 (6.1)	61 (3.6)
No safety concern	803 (94.6)	557 (99.6)	98 (99.0)	185 (93.9)	1,643 (96.4)
Fishing habits ever changed by reservoir crowding					
Changed	624 (73.5)	357 (63.5)	89 (89.0)	144 (75.8)	1,214 (71.4)
Never changed	225 (26.5)	205 (36.5)	11 (11.0)	46 (24.2)	487 (28.6)
Method to avoid crowding					
Avoid weekends	240 (38.7)	38 (10.7)	21 (23.4)	69 (47.9)	368 (30.4)
Fish nights	72 (11.6)	11 (3.1)	27 (30.0)	38 (26.4)	148 (12.2)
Avoid busy season	25 (4.0)	24 (6.7)	12 (13.3)	8 (5.5)	69 (5.7)
Go to other location	231 (37.2)	283 (79.5)	28 (31.1)	25 (17.4)	567 (46.8)
Other	53 (8.5)	0 (0.0)	2 (2.2)	4 (2.8)	59 (4.9)
Night fishing trips per month					
0	429 (50.9)	487 (87.4)	96 (97.0)	134 (69.1)	1,146 (67.7)
1–2	228 (27.0)	40 (7.2)	3 (3.0)	32 (16.5)	303 (17.9)
3–4	113 (13.4)	17 (3.1)	0 (0.0)	20 (10.3)	150 (8.9)
5–6	31 (3.7)	9 (1.6)	0 (0.0)	3 (1.5)	43 (2.5)
>6	42 (5.0)	4 (0.7)	0 (0.0)	5 (2.6)	51 (3.0)

TABLE 8.—Frequency of night fishing trips, target species, and motivation for night fishing, as reported by boat and bank angling parties interviewed during Lake James creel survey, June 1997–May 1998. Percentages of column subtotals are given in parentheses.

Response, by category	Response frequency		
	Boat anglers	Bank anglers	All parties interviewed
Night fishing trips per month			
0	1,146 (67.7)	34 (53.1)	1,180 (67.2)
1–2	303 (17.9)	17 (26.6)	320 (18.2)
3–4	150 (8.9)	9 (14.1)	159 (9.0)
5–6	43 (2.5)	2 (3.1)	45 (2.6)
>6	51 (3.0)	2 (3.1)	53 (3.0)
Night fishing target species			
Black bass	453 (46.2)	6 (13.0)	459 (44.7)
Walleye	234 (23.9)	5 (10.9)	239 (23.3)
Catfish	120 (12.2)	29 (63.0)	149 (14.5)
Crappie	142 (14.5)	4 (8.7)	146 (14.2)
White bass	4 (0.4)	0 (0.0)	4 (0.4)
Carp	1 (0.1)	1 (2.2)	2 (0.2)
Sunfish	1 (0.1)	0 (0.0)	1 (0.1)
Rainbow trout	1 (0.1)	0 (0.0)	1 (0.1)
No preference	25 (2.5)	1 (2.2)	26 (2.5)
Reason for night fishing			
Higher success	387 (39.5)	17 (37.8)	404 (39.4)
Cooler conditions	235 (24.0)	11 (24.4)	246 (24.0)
Avoid crowding	282 (28.8)	12 (26.7)	294 (28.7)
Other	76 (7.7)	5 (11.1)	246 (7.9)

TABLE 9.—Angler preferences for crappie length and creel limits, Lake James creel survey, June 1997–May 1998. Responses include only those parties that had an opinion regarding limits. Percentages of column subtotals are given in parentheses.

Response, by category	Response frequency		
	Boat anglers	Bank anglers	All parties interviewed
Crappie length limit (mm)			
None	238 (17.5)	14 (25.9)	252 (17.8)
127	2 (0.1)	0 (0.0)	2 (0.1)
152	125 (9.2)	4 (7.4)	129 (9.1)
178	177 (13.0)	9 (16.7)	186 (13.1)
203	427 (31.3)	18 (33.3)	445 (31.4)
229	119 (8.7)	4 (7.4)	123 (8.7)
254	251 (18.4)	5 (9.3)	256 (18.1)
279	1 (0.1)	0 (0.0)	1 (0.1)
305	20 (1.5)	0 (0.0)	20 (1.4)
356	1 (0.1)	0 (0.0)	1 (0.1)
381	1 (0.1)	0 (0.0)	1 (0.1)
Crappie creel limit			
None	172 (12.5)	9 (16.1)	181 (12.6)
<10	16 (1.2)	1 (1.8)	17 (1.2)
10	141 (10.2)	7 (12.5)	148 (10.3)
12	26 (1.9)	1 (1.8)	27 (1.9)
15	189 (13.7)	14 (25.0)	203 (14.2)
20	330 (23.9)	9 (16.1)	339 (23.6)
25	376 (27.3)	9 (16.1)	385 (26.8)
30	109 (7.9)	5 (8.8)	114 (7.9)
>30	20 (1.4)	1 (1.8)	21 (1.5)

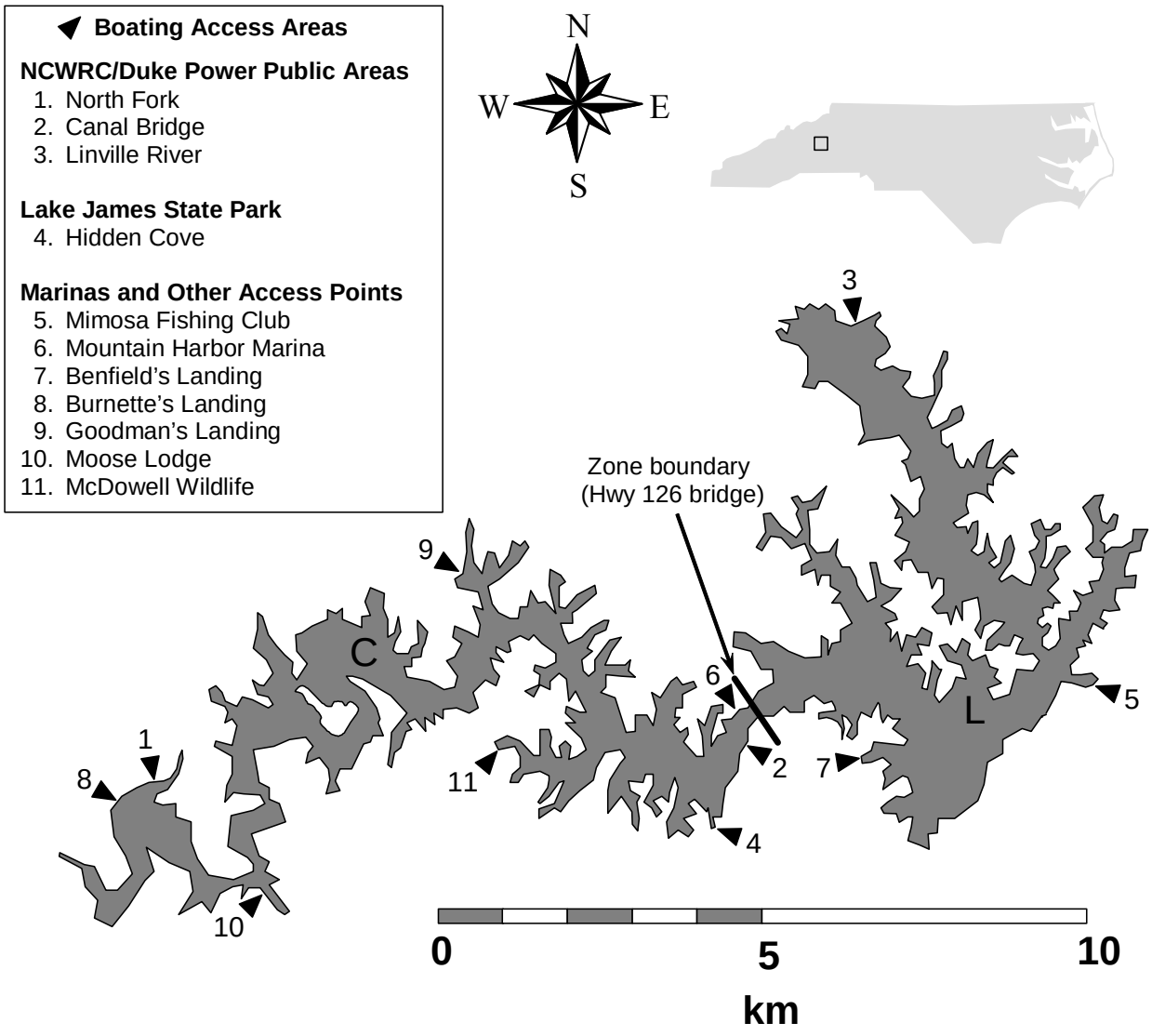


FIGURE 1.—Map of Lake James showing Catawba (C) and Linville/Paddy (L) creel survey zones and boating access areas used during the Lake James creel survey, June 1997–May 1998.

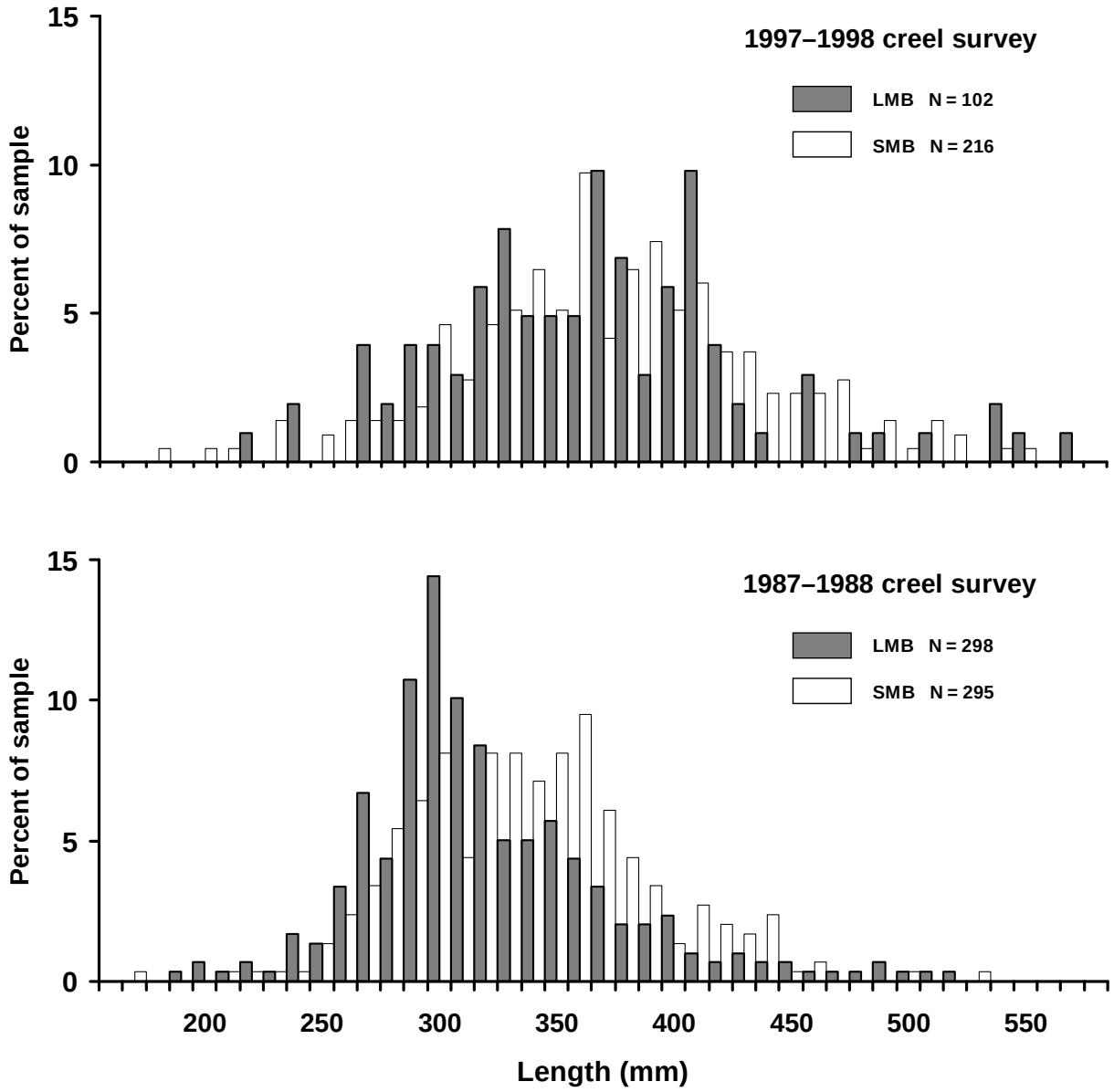


FIGURE 2.—Length-frequency distributions of largemouth and smallmouth bass possessed by anglers at the time of interview, Lake James creel surveys. Upper figure shows data from June 1997–May 1998. Lower figure shows similar data from March 1987–February 1988 creel survey (Borawa 1989).

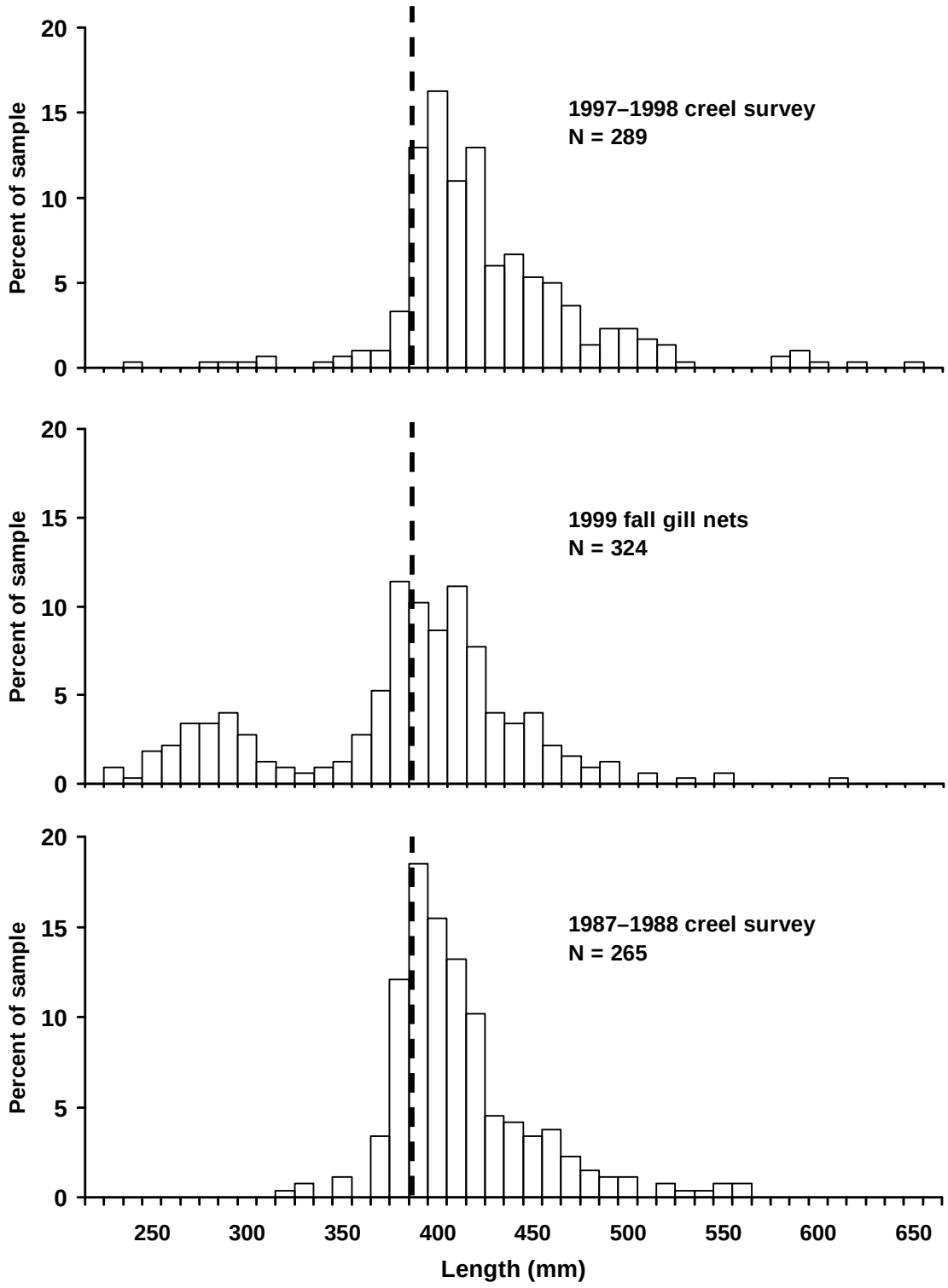


FIGURE 3.—Length-frequency distributions of walleyes harvested during Lake James creel surveys, compared with subsequent gill net catch. Upper figure shows data from June 1997–May 1998. Middle figure shows fall 1999 gill net catch (Besler 2000a). Lower figure shows harvest data from March 1987–February 1988 creel survey (Borawa 1989). Vertical dashed line indicates 381-mm length limit, in force during all years surveyed.

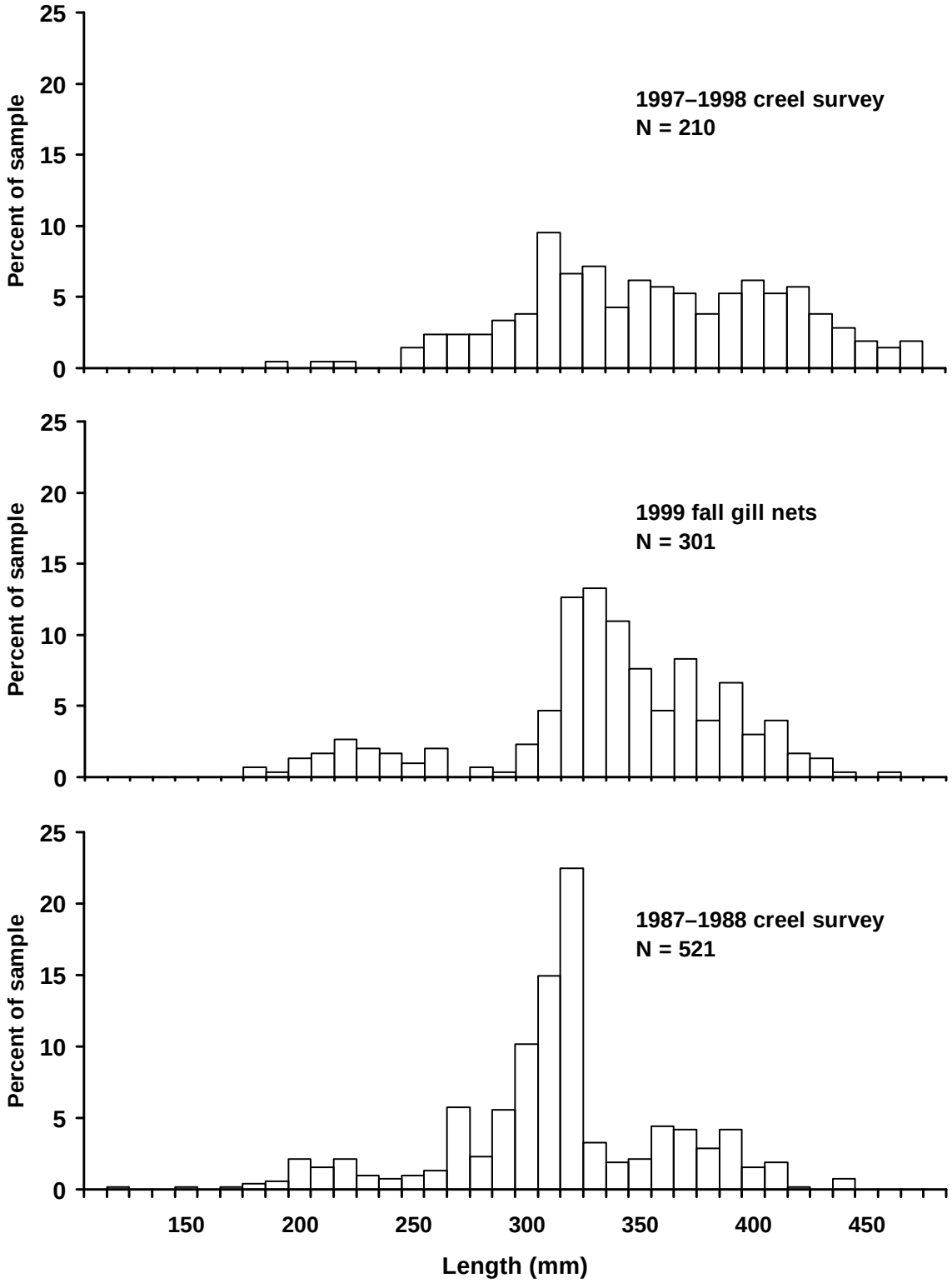


FIGURE 4.—Length-frequency distributions of white bass harvested during Lake James creel surveys, compared with subsequent gill net catch. Upper figure shows data from June 1997–May 1998. Middle figure shows fall 1999 gill net catch (Besler 2000b). Lower figure shows harvest data from March 1987–February 1988 creel survey (Borawa 1989).

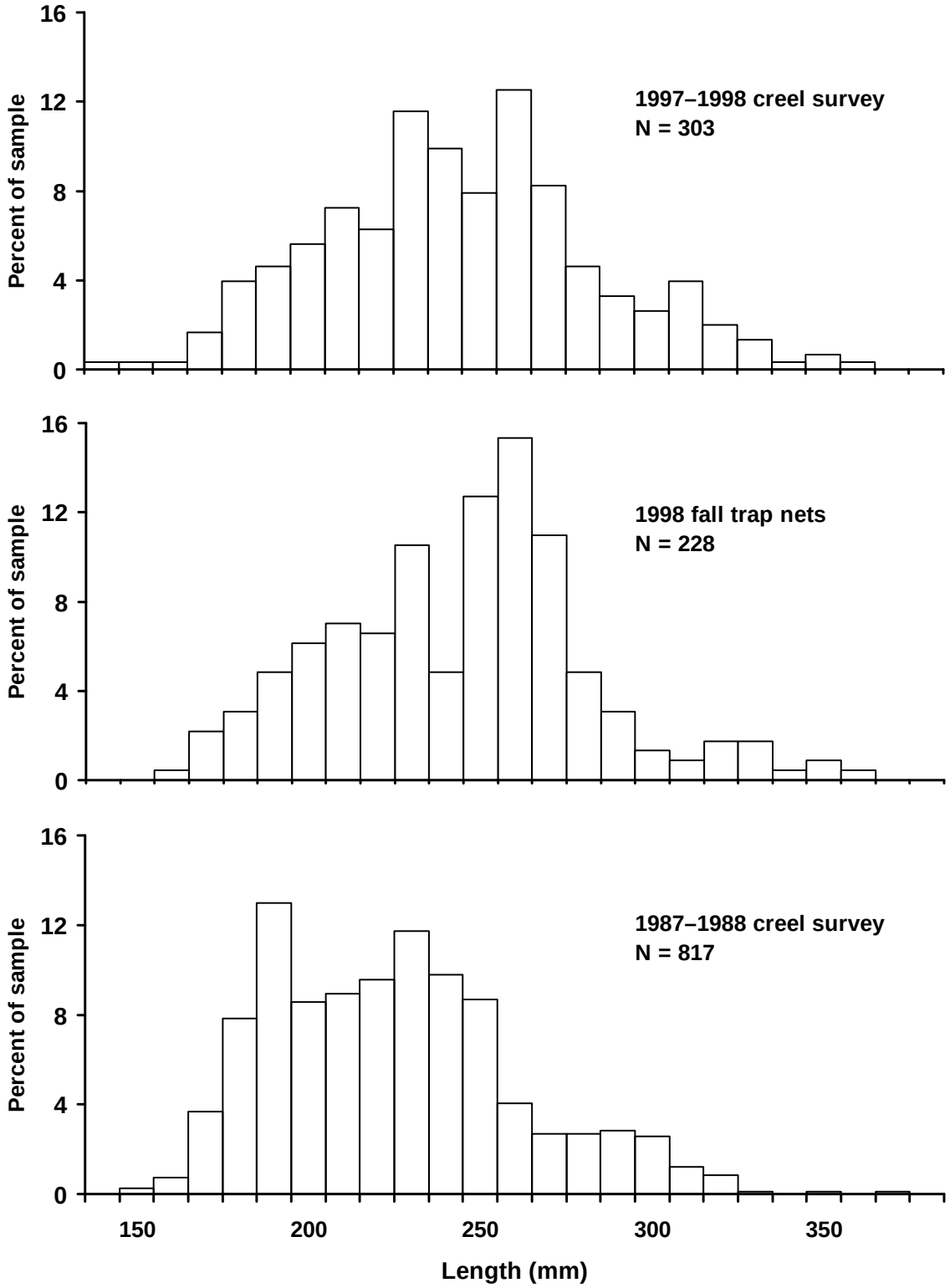


FIGURE 5.—Length-frequency distributions of crappies harvested during Lake James creel surveys, compared with subsequent trap net catch. Upper figure shows data from June 1997–May 1998. Middle figure shows fall 1998 trap net catch (Besler 1999). Lower figure shows harvest data from March 1987–February 1988 creel survey (Borawa 1989).

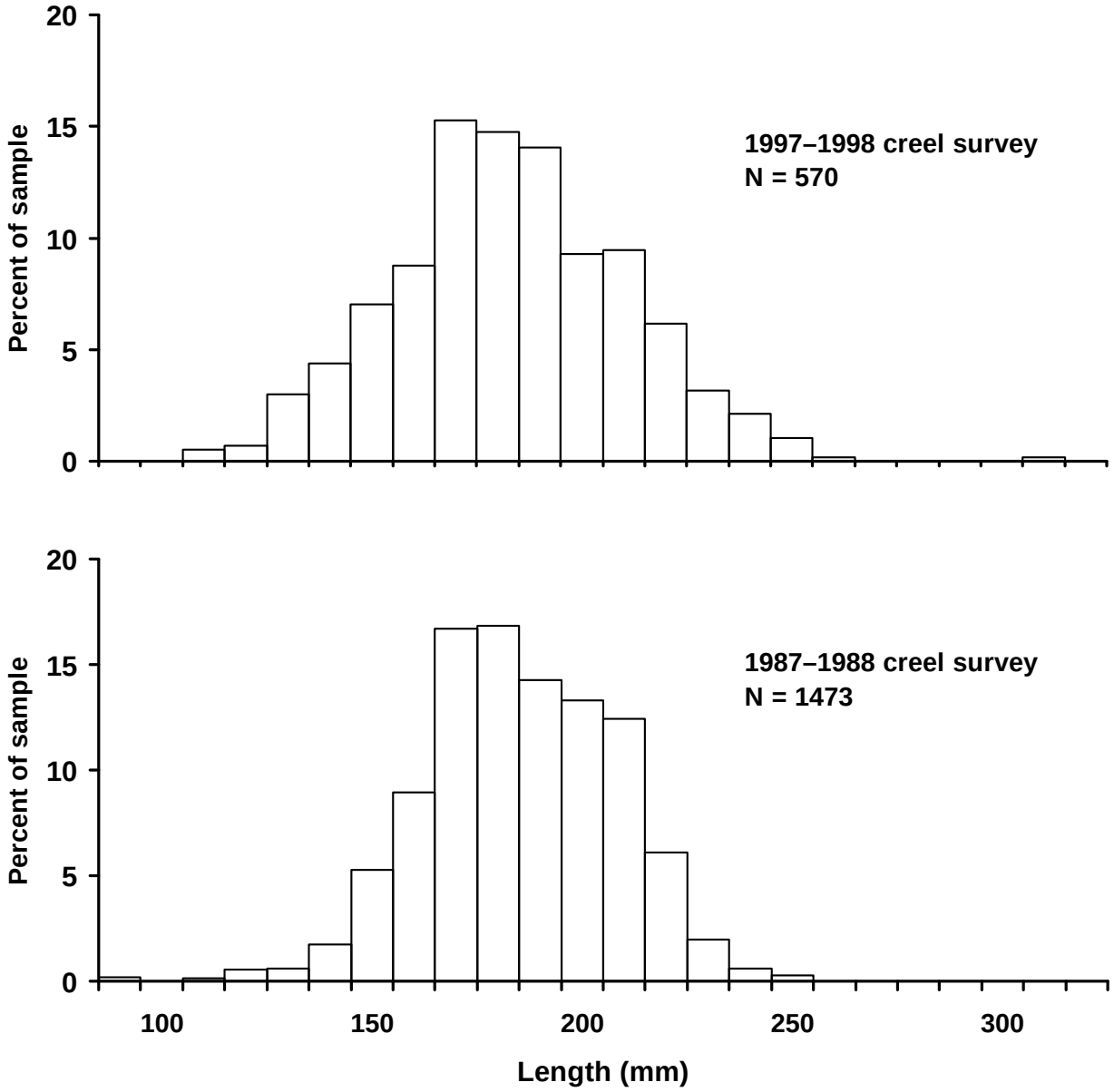


FIGURE 6.—Length-frequency distributions of sunfish harvested during Lake James creel surveys. Upper figure shows data from June 1997–May 1998. Lower figure shows similar data from March 1987–February 1988 creel survey (Borawa 1989).

Appendix 1: Recent stocking history of Lake James.

TABLE A1.1.—Fish species stocked in Lake James, with dates of most recent stockings. A complete stocking history of Lake James is provided in Besler et al. (2004).

Species	Last stocked prior to 1998	Years stocked 1985–1998
Bluegill[a]	1972	None
Channel catfish	1992	1992
Largemouth bass	1995[c]	1995
Redear sunfish	1997	1997
Smallmouth bass	1987	1985–1987
Threadfin shad	1997	1985–1987, 1990–1992, 1995, 1997
Steelhead trout	1983	None
Walleye	1998[b]	1985–1986, 1989–1998
White bass	1961	None

[a] Species not confirmed; typically listed as "bream" in early stocking records.

[b] Annual walleye stocking continued 1999–2004.

[c] Largemouth bass stocked again in 2000; all recent bass and sunfish stocking resulted from hatchery surplus, not management need. Hatchery surplus is no longer stocked into Lake James, although escapement likely occurs from Marion Fish Hatchery into the Catawba River upstream of the reservoir.

Appendix 2: Fishing regulations in effect during Lake James creel survey.

TABLE A2.1.—Fishing regulations in effect on Lake James at the time of creel survey (June 1997–May 1998). Recent regulation changes are noted.

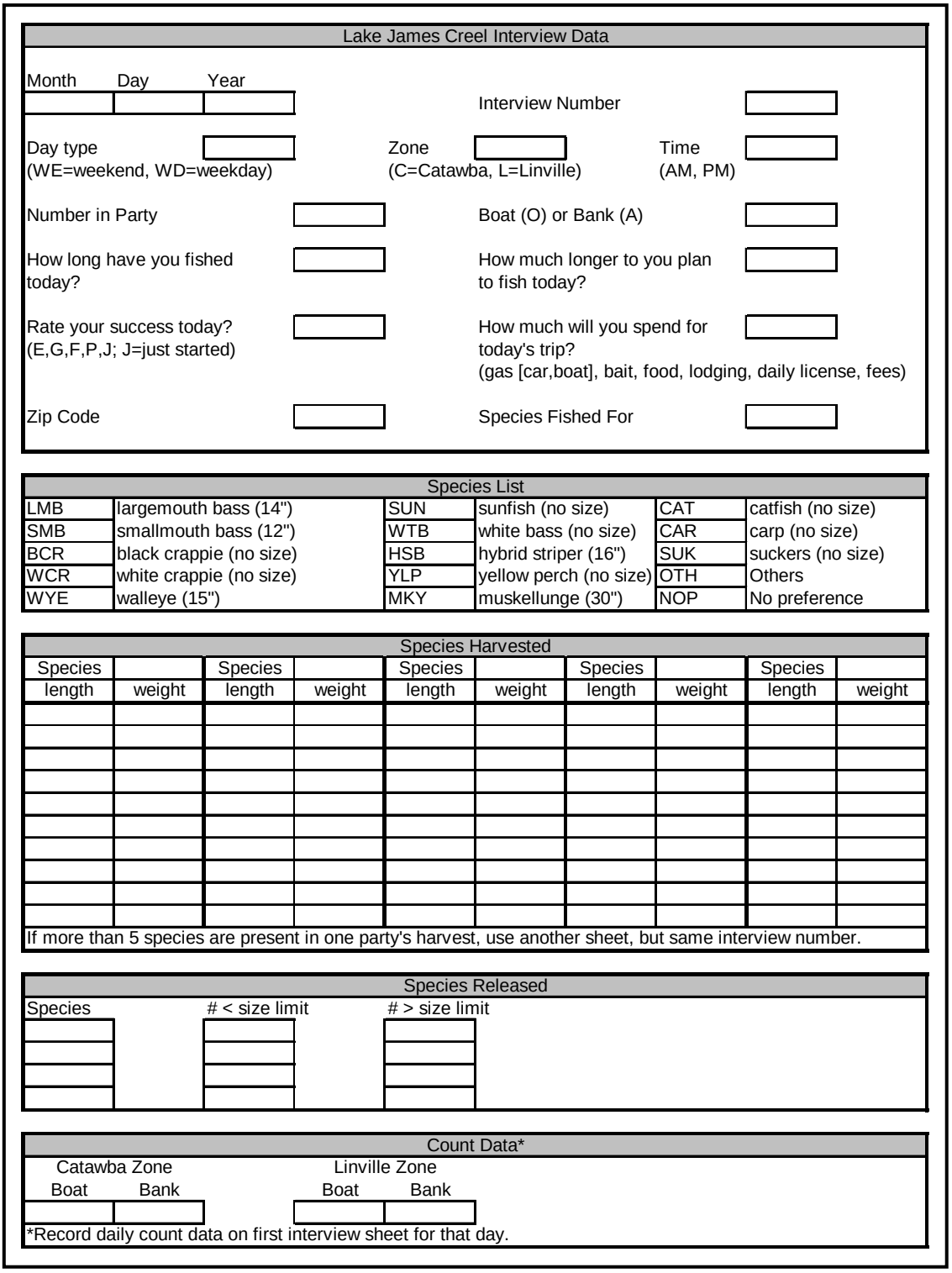
Species	Creel limit	Length limit (mm)	Exceptions
Crappie[a]	None[b]	None	None
Largemouth bass[a,c]	5	356	Two fish under size may be harvested
Muskellunge	2	762	None
Smallmouth bass[a,c]	5	305	Two fish under size may be harvested
Walleye	8	381	None
White bass	25	None	None
All others	None	None	None

[a] Creel limits for black bass are total daily harvest limits for all black bass species combined; similarly, crappie creel limits apply to black and white crappies in aggregate.

[b] A creel limit of 20 became effective 1 July 1998 for crappies (both species combined) in Lake James.

[c] The aggregate creel limit for black bass was 8 fish in 1987–1988, but was changed to 5 effective 1 July 1991.

Appendix 3: Field data sheet, Lake James creel survey.



Lake James Creel Interview Data

Month	Day	Year		
			Interview Number	
Day type (WE=weekend, WD=weekday)		Zone (C=Catawba, L=Linville)		Time (AM, PM)
Number in Party		Boat (O) or Bank (A)		
How long have you fished today?		How much longer to you plan to fish today?		
Rate your success today? (E,G,F,P,J; J=just started)		How much will you spend for today's trip? (gas [car,boat], bait, food, lodging, daily license, fees)		
Zip Code		Species Fished For		

Species List

LMB	largemouth bass (14")	SUN	sunfish (no size)	CAT	catfish (no size)
SMB	smallmouth bass (12")	WTB	white bass (no size)	CAR	carp (no size)
BCR	black crappie (no size)	HSB	hybrid striper (16")	SUK	suckers (no size)
WCR	white crappie (no size)	YLP	yellow perch (no size)	OTH	Others
WYE	walleye (15")	MKY	muskellunge (30")	NOP	No preference

Species Harvested

Species		Species		Species		Species		Species	
length	weight	length	weight	length	weight	length	weight	length	weight

If more than 5 species are present in one party's harvest, use another sheet, but same interview number.

Species Released

Species	# < size limit	# > size limit

Count Data*

Catawba Zone		Linville Zone	
Boat	Bank	Boat	Bank

*Record daily count data on first interview sheet for that day.

FIGURE A3.1.—First page of interview sheet used for creel survey of Lake James, June 1997–May 1998. Upper portion contains questions asked of all angling parties. Middle portions contain fields for catch and harvest data. Lower portion contains count data entry fields.

Appendix 3: Continued.

Recreational Survey Data

1. Have you been asked these additional questions **this month**?
   Y or N If Yes, do not ask remaining questions.

2. How many times will you fish this lake **this month**?

3. **Specifically**, where did you launch **today**?
   NF=North Fork, CB=Canal Bridge, HC=Hidden Cove, LN=Linville
   BF=Benfield's, GM=Goodman's, MH=Mountain Harbor, ML=Moose Lodge,
   MM=Mimosa, MW=McDowell Wildlife, PP=Private Property

4. On a scale of 1 to 5, how crowded is the lake **today**?
   1=not very, 2=somewhat, 3=moderately, 4=crowded, 5=very crowded

5. Does the number of watercraft on the lake **today** pose a boating safety concern for you?
   Y or N

6. Has the crowding **ever** caused you to change when or where you fish?
   Y or N

7. If Yes, then how?
   AW=avoid weekends, FN=fish nights, AB=avoid busy season
   GO=go to other lakes, OT=other

8. How many times will you night fish **this month**?
   A=None, B=1-2, C=3-4, D=5-6, E=7+

9. When night fishing, what species do you mainly fish for?
   Use same species codes as previous page

10. Why do you fish at night?
    HS=higher success, WE=weather (i.e. cooler), AC=avoid crowds, OT=other

11. What size limit would you prefer for crappie?
    6, 7, 8, 9, 10 inches (Enter 0 if person does not want a size limit)

12. What creel limit would you prefer for crappie?
    5, 10, 15, 20, 25, 30 fish (Enter 0 if person does not want a creel limit)

FIGURE A3.2.—Second page of interview sheet used for creel survey of Lake James, June 1997–May 1998. Responses were obtained only from angling parties being interviewed for the first time each month.