Evaluation of Sardine Bait-stations for Indexing Black Bears in Southeast Georgia

Wesley A. Abler, *Georgia Department of Natural Resources, Game Management Section, Fitzgerald, GA 31750*

Abstract: A 1985–86 project in southeastern Georgia was conducted in an effort to study the effectiveness of several methods of applying a sardine bait-station technique for indexing black bears (*Ursus americanus*). A total of 120 stations were set out in 20 100-ha experimental replicates during each of 3 months (May, July, and November) with random sampling of equal numbers of stations according to method of hanging baits (hanging or nailing) as well as equal numbers of stations being checked after 4, 8, and 12 days. Chi-square analysis indicated that a bear visit to a bait-station was not dependent on method of presentation. Overall visitation rates were proportionally higher though not statistically different for stations checked after 8 and 12 days than for stations checked after 4 days. Analysis by month sampled indicated significantly more bear visits during May than during July or November.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 42:396–403

One basic problem in managing the mobile and elusive black bear (*Ursus americanus*) is monitoring population densities or trends. This information is vital to better manage and evaluate the effects of hunting, poaching, and land use changes on bear populations. Techniques for monitoring population trends need to be easily implemented by field personnel, reasonably inexpensive in terms of cost and time involved, and readily applied to the bear population.

Abler (1984) initially tested 3 techniques intended to monitor index trends of bears in southeastern Georgia. Track count lines and scent-post lines using a fermented egg attractant were judged unacceptable techniques. A third technique, using sardine-baited stations (Carlock et al. 1983), was also tested. The sardine-bait technique appeared to have promise even though initial index values were relatively low and inconsistent. Lines run during August (13 lines, 237 stations) and October (6 lines, 110 stations) 1982 (Abler 1984) were checked after 5 days and had relatively low average visitation rates (7.4% and 3.6%, respectively). The use of sardine baits was initiated in the Great Smoky Mountains National Park (GSMNP) in 1972 as a prebaiting system at bear trapping sites (Johnson and Pelton 1980, Pelton 1984). The concept of the technique as a valuable population index, based on data

collected between 1972 and 1978, was reported by Johnson (1980) and formed the basis for its extensive use in the southern Appalachian region (Carlock et al. 1983, Carlock 1986, Johnson 1987). Lines run during July in the tri-state area of Georgia, Tennessee, including the GSMNP, and North Carolina were checked after 5 days with average visitation rates for 1983 through 1987 of 27.5%, 25.1%, 28.5%, 32.0%, and 33.0% (Johnson 1987).

Regional evaluation of the sardine-bait technique was suggested by Carlock et al. (1983) and Pelton (1984). Pelton (1984) and Maehr and Brady (1984*b*) indicated that a variety of basic sardine-bait techniques were being used by researchers in other states. Some variations included type of bait hung (burnt meat scraps, smoked bacon, and sardines were typical), how the bait was applied (hung by string from a tree or nailed to the tree), and length of time baits were left out before checking.

My objective was to determine if variations in the sardine-bait method might be useful for indexing bears in southeast Georgia. Method of hanging, season when lines were set out, and time left hanging were considered as variables.

The author thanks R. Warren for assistance in study design and statistical analyses. The assistance of the following Georgia Department of Natural Resources personnel was instrumental to the completion of the project: C. Carpenter, W. DeLoach, W. King, R. Knowlton, B. Reed, J. Stokes, D. Watkins, and E. White. Funding for the project was provided by the Federal Aid in Wildlife Restoration Program (Project W-37) and the Georgia Department of Natural Resources.

Methods

The study area was on the Dixon Memorial Wildlife Management Area (WMA) in Ware County, Georgia. Study sites were located on upland areas no farther than 4 km out from the general periphery of the Okefenokee Swamp. Based on scent-post data (Abler 1984) and empirical judgment, the area within this "band" was felt to contain the highest and most uniform population of bears on the WMA. Also, by selecting only upland sites, differences in habitat would be diminished as study variables.

Twenty-eight 100-ha circles were designated as experimental replicates on the area. These units were located on a map by establishing points on roads spaced at least 1,128 m from each other (2 times the radius of a 100-ha circle). These points were then used as the center of each 100-ha circle, which was drawn on a map. The center point of each circle thus served as the point of origin for each experimental replicate. A random compass bearing was selected for each circle and served as the first transect for that circle. Two other transects $\pm 120°$ from the first also were placed in the circle. Transect lines were assigned randomly to a check day of either 4, 8, or 12 days after the stations would be set out.

Each point of origin was then located "on the ground" from the center of the road at that approximate map point. A number was painted on an adjacent tree to allow the use of that point for each of the 3 runs of the study. A hand-held compass was used to find and maintain bearings of the previously selected transects from

each point of origin. Transects were "flagged" with paint to insure the use of the same transect during each season the lines were run. Workers used drag-line measuring tapes to locate 2 sardine bait-stations on each transect; the first being 188 m and the second 376 m from the center of the circle.

Baits were hung from the nearest available acceptable tree to the transect at each of these points. The 2 stations on each transect represented the 2 methods of hanging baits. The first station's method was selected by a coin toss; heads being Method 1; tails, Method 2. The method used at the second station was the method not chosen for Station 1.

Method 1 consisted of hanging 3 partially opened sardine cans about 3 m above the ground by use of a 1 m string and hook attached to a tree limb and at least 1 m away from the bole of the tree. In Method 2, 3 sardine cans were partially opened and nailed to a tree, with the openings of the cans facing the tree, approximately 1.5 m above ground level. Each 100-ha unit was treated in the same fashion in order to make 28 replicates of the same design. Because of the time involved in setting out the original transects, only 20 replicates were used for the study. Stations were set up and run from each of the 20 numbered sites during July and November 1985 and May 1986. All stations for each month were set out on the same day. Stations on each transect were then checked only on their randomly assigned check-day (Day 4, 8, or 12). Transect bearings, the day lines were checked, and methods of hanging for all stations were identical for each of the 3 seasonal runs.

Data at each station were recorded as a bear visit (yes) or non-visit (no) based on evidence at the bait site. Chewed-up bait cans, clawed and/or broken trees, and scat piles at the site indicated a bear visit. Data for each season were separated by day checked and method of hanging. Percentage visitation rates were calculated for each day checked and by method of hanging. Overall percentage visitation rates were calculated for each day checked and by method of hanging. Overall percentage visitation rates also were calculated combining all check days. Final analyses of data were accomplished using the FREQ procedure found in the SAS/STAT package for personal computers (Joyner 1985). Statistics used by this procedure were the chi-square 2 x 2 analysis with a continuity correction and Cochran-Mantel-Haenszel statistics. Testing for each objective of the study began with method of hanging followed by day checked, then season. If method of hanging or day checked were found to be independent, those data were combined for the next level of analysis.

Results

Overall results of bear visits and visitation rates are shown in Table 1. In July 1985, overall visitation rates for Days 4, 8, and 12 were 2.5%, 25.0%, and 25.0%, respectively. The total visitation rate for July was 17.5%. In November, the overall rates for Days 4, 8, and 12 were 5.0%, 12.5%, and 20.0%, respectively, with a 12.5% total visitation rate. The May 1986 run had overall visitation rates of 30.0%, 47.5%, and 40.0% for Days 4, 8, and 12, respectively. Total visitation rate was 39.2%.

Table 1. Overall results of an evaluation of several methods of using a sardine bait-station technique in southeast Georgia.

Season	Type set	*N* sets	*N* visits	% visitation rate
	hang	60	11	18.3
	nail	60	10	16.7
Jul 1985	overall	120	21	17.5
	hang	60	6	10.0
	nail	60	9	15.0
Nov 1985	overall	120	15	12.5
	hang	60	22	36.7
	nail	60	25	41.7
May 1986	overall	120	47	39.2

Analysis of the data tested the hypothesis that each factor in the 2 x 2 table was independent or, conversely, a bear visit was not dependent on either factor. Results of these analyses indicated that a bear visitation was not significantly dependent on method of presentation (hanging or nailing). A bear was equally likely to find and accept a sardine bait whether it was hung from or nailed to a tree. When examined overall there was an apparent difference in visitation rates depending on the day lines were checked. Overall, there were proportional, though not significant, differences between Days 4 and 8 and Days 4 and 12. Days 8 and 12 were not significantly, nor apparently different. When the effect of check-day was analyzed by month sampled, there were no significant differences for May, November, or July samples. Therefore, a bait-station did not depend on being left 4, 8, or 12 days in order to be classified as successful. Analysis by month sampled, in the 12-month period of my study, indicated May was significantly ($P = 0.052$) more likely to have successful bait-stations than either July or November.

Discussion

Method of Presentation

Bear visits were apparently not influenced by the method of presentation. The method of hanging the baits from a tree is the accepted method used in northern Georgia, Tennessee, and North Carolina (Carlock et al. 1983, Carlock 1986, Johnson 1987). The study area in this project consisted of upland sites that were primarily in pine plantations. Because trees in these pine plantations have few sound limbs within reach, it was not practical to hang the cans according to the criteria (3 m above ground, 1 m from the bole of the tree) described by Carlock (pers. commun.). Nailing the cans appeared to be an acceptable alternative in my situation. By using nails at least 7.6 cm long (3 in.), the cans could be secured to the trees so that bears had to mark the tree as well as the cans. By partially opening the cans and facing the openings toward the tree, the ability of raccoons to raid the station would hopefully be reduced. Johnson and Pelton (1980) found no instance of hung prebaits

being taken by other animals in the GSMNP. K. M. Weaver (pers. commun.), however, found a high incidence of hanging baits being taken by raccoons and opossums in northeast Louisiana.

During my study, 70 visits were attributed to raccoons (19.4% of all stations). Fourteen (20.0%) visits were noted on Day 4, 15 (21.4%) on Day 8, and 41 (58.6% on Day 12. Twenty-six (37.1%) visits were at stations hung from trees while 44 (62.9%) were at stations nailed to trees. The number of visits by raccoons at stations hung from trees could conceivably have been higher because the cans were always pulled from the limb and sometimes never found. A visit was recorded by species only if it could be positively attributed to a bear, raccoon, etc. Cans and nails remaining in the trees were removed when the station was checked.

Month Sampled

July was the sample month as reported by Carlock et al. (1983), Carlock (1986), and Johnson (1987). Surveys conducted during this month should take advantage of heightened activity patterns (Garshelis 1978 cited in Carlock et al. 1983) and stable social structures that would insure sampling of a "resident" bear population (Rogers 1977 and Garshelis 1978 cited in Carlock et al. 1983). Trapping records from a 1979–83 study in southeast Georgia (Abler 1984) showed that of 36 bears captured, 8 (22.2%) were trapped in May, 11 (30.6%) in July, 5 (13.9%) in November, and 7 (19.4%) in December. My results indicated that bear visitation rates were significantly higher during May than either July or November of the year I conducted this study.

It is my hypothesis that bears were especially active during May because they were in a transition between different types of food supplies. Maehr and Brady (1984*a*) found bears in Florida ate mostly herbaceous plant materials in spring and switched to soft mast in summer. May could possibly represent a time of year when new palatable spring growth in herbaceous plants is less available and the soft mast crops of summer have not yet arrived. Rogers (1987) found that mature males in Minnesota began roaming activities upon emerging from their dens prior to the availability of spring foods while the onset of roaming in females and subadult males coincided with the availability of spring foods. A number of other researchers have also indicated that shifts in home range activities were linked to seasonally available foods (Garshelis and Pelton 1981, Young and Ruff 1982, Carlock et al. 1983, Garrris 1983, Rogers 1987). Pelton (1984) reported that 3 years of seasonally repetitive bait station indexes, verified by simultaneous telemetry data, reflected seasonal habitat shifts by bears on the Pisgah National Forest. Therefore, it seems reasonable that future research with this bear population should attempt to correlate seasonal food availability with bear activity as measured by visitation rates at bait-stations. Competition with an available preferred food source could bias the results of a bait-station survey. During the 1978–83 study in southeast Georgia (Abler 1984) field workers suggested that this may have been the case during October runs of bait-station lines. Bears visited oak trees and ate acorns without touching sardine-baits they had passed while traveling to the oak trees. Similar occurrences have been

noted in the tri-state area and GSMNP (Pelton, pers. commun.). The availability of abundant natural foods were found to affect the utilization of baited trap sites (Erickson 1957 and Miller et al. 1973 cited in Johnson and Pelton 1980); however, Johnson and Pelton (1980) felt this may have been due to reduced movements rather than food preferences.

Trapping results on the Dixon Memorial WMA for 1979–83 (Abler 1984) indicated a preponderance of males (75%) in the May sample (8 bears). The July sample (11 bears), however, was only 55% male. Males, especially young males, tend to travel greater distances than females (Garshelis and Pelton 1981, LeCount 1982, Beecham 1983, Rogers 1987). This factor may make them more vulnerable than females to trapping during dispersal periods (Johnson and Pelton 1980, LeCount 1982). If males were more active than females during May, then bait-station results for this month may not accurately reflect bear index trends.

May 1986 lines were run 10 months after the initial lines set out in July 1985. Many unmeasured variables could have been introduced during this period of time. It is not known if these unmeasured variables had an influence on the differences among the May, July, and November samples. Future bait-station research should compare rates for May and July of the same calendar year to insure that the influences of annual variations can be minimized.

Check-days

Overall bear visitation rates in this study appeared to be higher when checked after 8 or 12 days as compared to 4 days after stations were set out. A number of variables, including road density, road type, habitat type, degree of public access, and seasonal and annual shifts in habitat utilization may affect bear activity in a given area. Pelton (1984) suggested that bait-station utilization may be a means of relating the effect of these environmental factors on bear activities. Carlock (1986) tested the relationships between percent visitation at bait-stations and wildlife management areas, open forest land, elevation, road types, and forest types in northern Georgia. He found that his analyses resulted in no clear-cut answers. Pelton (1984) and Carlock (1986) indicated that the micro-locations of bait-station placement including proximity to game trails, natural foods, and specific micro-sites and travel lanes within habitat types may be extremely important variables affecting bait-station utilization. Bears in this insular population have a wide choice of foods that are available over the entire year. Bears may take longer to cover their ranges for feeding purposes than bears in more northern populations. Thus, except for periods of unusual activity patterns (high or low) or in areas with low population densities, baits may have to be left unchecked for longer periods of time than they were in other studies. If bears were more active in May, for whatever reason, contacts with bait-stations may have been more frequent. Thus the effect of "day checked" may have been influenced by bear movements rather than population abundance. Stations in the tri-state area (Johnson 1987), northern Georgia (Carlock 1986), and the southeastern Georgia study (Abler 1984) were set out at 0.81-km intervals, while those in my study were 188 m from at least 1 other station. Because my study was

not concerned with an evaluation and comparison of an index based on visitation rates, distance between bait-stations was not of primary importance. Further testing of check-days from 5 to 8 days for stations set at 0.81-km intervals as well as the relationship of specific micro-locations would probably be appropriate for future projects.

Recommendations

This project was designated as "step one" in the development of an index technique applicable to black bears in the southeastern Georgia population. Future studies should address the question of food availability and its possible influence on bear activity patterns and thus visitation rates during May and July. Concurrent trapping and marking efforts should allow evaluation of activity patterns, by sex, during these months as well as provide a better definition of current bear density on the study area. Peripheral bait-station lines need to be set up and evaluated in bear habitat outside of the well-defined and protected Dixon Memorial WMA. This concept is currently being used in the tri-state area and northern Georgia (Carlock 1986, Johnson 1987). Constant monitoring of the legal bear harvest and the development of a suitable index technique are of primary importance in managing this bear population.

Literature Cited

Abler, W. A. 1984. Bear population dynamics on a study area in southeast Georgia. Ga. Dep. of Nat. Resour., Final Rep., Fed. Aid Proj. W-47-R, Study LIII, Atlanta. 91pp.

Beechman, J. J. 1983. Population characteristics of black bears in west central Idaho. J. Wildl. Manage. 47:405–412.

Carlock, D. M. 1986. Distribution and density of black bears in north Georgia. Ga. Dep. of Nat. Resour., Final Rep., Fed. Aid Proj. W-47-R, Study XIX, Atlanta. 19pp.

———, R. H. Conley, J. M. Collins, P. E. Hale, K. G. Johnson, A. S. Johnson, and M. R. Pelton. 1983. Tri-State black bear study. Tenn. Wildl. Resour. Agency Tech. Rep. 83–9, Nashville. 286pp.

Erickson, A. W. 1957. Techniques for live-trapping and handling black bears. Trans. North Am. Wildl. Nat. Resour. Conf. 22:520–543.

Garris, R. S. 1983. Habitat utilization and movement ecology of black bears in Cherokee National Forest. Tenn. Wildl. Resour. Agency, Tech. Rep. 83–5, Nashville. 109pp.

Garshelis, D. L. 1978. Movement ecology and activity behavior of black bears in the Great Smoky Mountains National Park. M.S. Thesis, Univ. Tenn., Knoxville. 117pp.

——— and M. L. Pelton. 1981. Movements of black bears in the Great Smoky Mountains National Park. J. Wildl. Manage. 45:912–925.

Johnson, K. G. 1980. Developing population indices for black bears in the Great Smoky Mountains National Park. Annu. Sci. Res. Meet. Natl. Park Serv., Southeast Reg. 6:33. (Abstr.)

———. 1987. Bait-station surveys to determine relative density, distribution and activities of black bears in the southern appalachian region. Annu. Prog. Rep., Univ. Tenn., Knoxville. 68pp.

——— and M. R. Pelton. 1980. Prebaiting and snaring techniques for black bears. Wildl. Soc. Bul. 8:46–54.

Joyner, S. P., ed. 1985. SAS/STAT guide for personal computers, version 6 ed. SAS Inst. Inc., Cary, N.C. 378pp.

LeCount, A. L. 1982. Characteristics of a central Arizona black bear population. J. Wildl. Manage. 46:861–868.

Maehr, D. S. and J. R. Brady. 1984*a*. Food habits of Florida black bears. J. Wildl. Manage. 48:230–235.

——— and ———, eds. 1984*b*. Proc. 7th East. Workshop Black Bear Manage. Res., Fla. Game Fresh Water Fish Comm., Gainesville. 85pp.

Miller, R. L., E. R. McCaffery, and G. B. Will. 1973. Recent capture and handling techniques for black bears in New York. Trans. Northeast Wildl. Conf. 30:117–137.

Pelton, M. R. 1984. Bait station indices: where we are and where we need to go. Pages 43–47 *in* Maehr and Brady, eds. Proc. 7th East. Workshop Black Bear Manage. Res., Fla. Game Fresh Water Fish Comm., Gainesville.

Rogers, L. L. 1977. Social relationships, movements, and population dynamics of black bears in northeastern Minnesota. Ph.D. Diss., Univ. Minn., Minneapolis. 194pp.

———. 1987. Effects of food supply and kinship on social behavior, movements, and population growth of black bears in northeastern Minnesota. Wildl. Monogr. 97:1–72.

Young, B. F. and R. L. Ruff. 1982. Population dynamics and movements of black bears in east central Alberta. J. Wildl. Manage. 46:845–860.