Hard and Soft Mast Survey Report
Western North Carolina, Fall 2006
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North Carolina Wildlife Resources Commission (NCWRC) personnel have surveyed hard mast in the Mountain Region of North Carolina since 1983. From 1983-2005, North Carolina's hard mast surveys were conducted and reported using a method developed by Whitehead (1969) with slight modifications (Wentworth et al. 1992). This same protocol was used in whole or part by Georgia and Tennessee for many years and was adopted by South Carolina in the 1990's. In an effort to reduce costs and manpower commitments, while maintaining quality data and standard methodology among neighboring states, the member states of the Southern Appalachian Black Bear Study Group (SABBSG, Georgia, North Carolina, South Carolina, and Tennessee) have long searched for an improved technique for monitoring hard mast surveys. Beginning with the 2006 survey, we are using a new protocol and formula for determining mast indices (Greenberg and Warburton, In Press). The new protocol only requires simple calculation of percent crown with acorns in the field. In order to maintain consistency with the old technique, the new technique uses statistically verified equations to convert mast index values to numbers previously used with the Whitehead (1969) method. Hard mast results reported in this document utilize the techniques described in Greenberg and Warburton (In Press) and are described using the scale used by our agency since 1983. Due to small sample sizes, results will no longer be reported for individual routes for hickory and beech, but overall values for these species will be reported. Sample sizes are sufficient to allow the reporting of values for both the white oak and red oak groups by route.

The 2006 hard mast survey was conducted on 12 routes in western North Carolina. A total of 1,290 trees were sampled including 509 from the white oak group, 605 from the red oak group, 136 hickories, and 40 beeches. Combining all groups of species, mast was rated in the poor range with an overall index of 1.8 (Table 1). This is the second lowest rating recorded since 1997. White oak production (1.7) was in the high part of the "poor" range and near the long-term average of 1.83, but red oak production (1.4) was in the lower part of the poor range and well below the long-term average (2.90) for the species. Hickory production (3.2) was above the long-term average (2.36) for the species, and beech production (4.1) was close to its long-term average (4.25) in the "good" range. As in previous years, hard mast production varied significantly by location and species (Table 2). However, unlike most prior years, there was only one area where production of any oak group was in the good range with Cold Mountain reaching this level. Beech has the highest long-term average (4.25) of any major group, and it appears to be a consistent mast producer in most years. We should consider putting more effort into monitoring this mast resource where possible. In years with reduced oak production, beech may be a critical species for wildlife.

A soft mast survey was implemented during the summer and fall of 1993 to document berry production and abundance. The technique used for evaluating the soft mast survey has remained consistent throughout this period including the current year. Summer soft mast surveys have been conducted in conjunction with the Sardine Bait Station Survey (SBSS). During summer 2006, based on an agreement with the member states of the SABBSG, we did not conduct the SBSS. Review of data from the SBSS indicates that we can obtain long-term bear population trend information by conducting the survey every other year. Because of the

new schedule, the summer soft mast survey will be conducted in odd years in the future. The last survey was conducted in 2005 (Table 3), and the next survey will be conducted and reported in 2007.

The 2006 fall soft mast survey, which is conducted in conjunction with the hard mast survey, yielded varying results by species (Table 4). All species except cherry were above long-term averages. As usual, local areas experienced variable production of fall soft mast with levels from 0 to 9 depending on species and area (Table 5). Fall soft mast varied by species and location and may supplement hard mast crops in some areas.

This season's hard mast crop is one of the lowest we have recorded in recent years with only one lower ranking since 1997. Red oak production was particularly poor relative to long-term averages for the species group. Hopefully, the slightly higher than average hickory and soft mast crops along with a normally abundant beech crop will offset the poor oak crops. Beech, which appears to be a consistent long-term producer in areas where it is found, may be especially important as a supplement to reduced oak crops in poor oak production years. Based on results of past seasons, we may see increased bear harvests in local areas due to the low availability of oak acorns. NCWRC and SABBSG efforts to refine and improve the mast survey technique should be continued. Furthermore, the management implications of the long-term mast survey should be examined in order to maximize the benefits of this survey in our state and regional black bear management efforts.

LITERATURE CITED

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Wentworth, J.M., A.S. Johnson, P.E. Hale, and K.E. Kammermeyer. 1992. Relationship of Acorn abundance and deer herd characteristics in the southern Appalachians. Southern Journal of Applied Forestry 16:5-8.

Whitehead, C.J. 1969. Oak mast yields on wildlife management areas in Tennessee. Tennessee Game and Fish Commission, Nashville, USA.

Table 1. Hard Mast Survey Results for Western North Carolina, 1983-2006.

Year	White Oak	Red Oak	All Oaks	Hickory	Beech	Total
1983	1.43	2.59		1.99	5.51	2.25
1984	1.08	2.73		3.05	4.28	2.30
1985	2.01	3.66		0.80	3.06	2.80
1986	1.32	1.98		2.25	5.22	1.90
1987	1.16	0.56		3.57	5.75	1.31
1988	3.16	4.07		2.04	4.25	3.57
1989	0.43	4.89		2.78	6.44	3.14
1990	1.85	2.62		1.20	1.89	2.17
1991	2.38	1.93		3.75	6.89	2.43
1992	1.07	2.45		0.72	1.17	1.78
1993	0.65	3.58		2.43	4.77	2.48
1994	2.06	3.48		2.02	6.20	2.85
1995	2.80	5.60		2.48	0.36	4.22
1996	3.70	1.99		2.81	4.31	2.72
1997	0.53	1.79		1.17	2.35	1.29
1998	2.26	4.68		3.27	4.70	3.69
1999	3.28	2.76		2.80	6.22	3.05
2000	0.50	2.11		2.73	5.71	1.82
2001	2.83	4.92		2.88	3.97	3.98
2002	1.90	3.01		1.75	3.44	2.47
2003	1.24	0.68		3.58	5.42	1.33
2004	3.99	2.93		1.32	1.65	3.09
2005	0.70	3.11		1.86	4.30	2.14
2006	1.70	1.40	1.50*	3.20	4.10	1.80
1983-2006 average	**1.83**	**2.90**	**N/A**	**2.36**	**4.24**	**2.52**

Numerical Rating = Crop Quality	
0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
4.1 to 6.0 = Good	6.1 to 8.0 = Excellent

* Not reported for prior years.

Table 2. Hard Mast Survey Results by Area, 2006.

Area	White Oak	Red Oak	All Oaks
Avery Creek	3.6	1.2	2.3
Cold Mountain	4.1	0.4	2.2
Edgemont	1.0	2.8	1.9
Fires Creek	1.2	2.8	1.9
Harmon Den	1.5	0.4	0.9
Linville Mtn.	2.2	1.6	2.0
Nantahala	1.1	0.8	0.8
Poplar	1.2	0.4	0.7
Santeetlah	2.1	1.0	1.5
Sherwood	1.5	1.0	1.1
South Mountains	0.4	2.9	1.5
Standing Indian	0.4	0.4	0.4

Table 3. Results of Mountain Summer Soft Mast Surveys, 1993-2006.

Year	Blueberry	Huckleberry	Blackberry	Pokeberry
1993	3.20	3.60	3.80	2.40
1994	3.20	3.50	3.50	1.40
1995	1.90	2.50	3.10	1.20
1996	2.00	2.00	3.40	1.50
1997	2.80	3.00	3.80	2.00
1998	1.90	1.20	3.30	2.33
1999	2.72	2.45	2.90	1.78
2000	2.70	2.72	2.99	1.64
2001	2.27	2.73	2.87	0.87
2002	1.87	2.22	3.55	1.32
2003	2.27	2.74	3.20	1.02
2004	1.67	1.61	4.25	1.41
2005	1.57	1.41	4.07	1.48
2006*				
1993-2005 Average	**2.32**	**2.43**	**3.45**	**1.56**

* Not conducted in 2006

Table 4. Results of Mountain Fall Soft Mast Surveys, 1993-2006.

Year	Pokeberry	Cherry Index	Grapes Index	Blackgum
1993	2.00	2.70	2.10	0.40
1994	3.10	2.00	3.80	1.70
1995	2.70	5.00	2.20	1.80
1996	2.40	1.60	3.30	1.80
1997	4.20	1.30	3.10	0.80
1998	4.63	2.67	2.80	1.50
1999	2.40	2.70	3.25	1.10
2000	2.20	2.70	3.30	1.00
2001	2.80	3.30	4.18	2.33
2002	1.10	2.45	2.73	1.27
2003	2.33	3.00	2.55	2.22
2004	1.67	2.70	3.00	1.44
2005	2.45	2.09	1.36	1.55
2006	3.73	2.00	3.17	2.50
1993-2006 Average	**2.69**	**2.59**	**2.91**	**1.53**

Table 5. Local Results of Mountain Fall Soft Mast Surveys, 2006.

Area	Pokeberry	Cherry	Grapes	Blackgum
Avery Creek	6	2	2	4
Cold Mountain	*	2	2	2
Edgemont	2	2	4	2
Fires Creek	2	2	6	2
Harmon Den	9	2	2	4
Linville Mtn.	2	1	1	6
Nantahala	4	0	2	0
Poplar	2	4	4	0
Santeetlah	2	2	9	2
Sherwood	6	3	3	4
South Mountains	2	*	2	4
Standing Indian	4	2	1	0
Average of all Areas:	**3.73**	**2.00**	**3.17**	**2.50**

* Species was not rated because it was not fruiting or was still green