

# AN EXPERIMENTAL STUDY OF THE IMPACTS OF MILITARY TRAINING ACTIVITIES ON RED-COCKADED WOODPECKERS ON MARINE BASE CAMP LEJEUNE: 2005 UPDATE

Submitted by:

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## Introduction

Results of research on the biology and management of the endangered red-cockaded woodpecker (*Picoides borealis*) conducted from April 1997 through March 2005 by personnel from the Department of Biological Sciences at Virginia Tech University on Camp Lejeune Marine Base, North Carolina were summarized in a report submitted in March 2005 (Walters et al. 2005). This research was conducted through a cooperative agreement under Research Work Orders 47 and 69, Biological Resources Division, U. S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit at Virginia Tech, Department of Fisheries and Wildlife Science, and represented the latest accomplishments of a continuing, long-term study begun in 1986. The research included four components: (1) population monitoring, including monitoring of cavity trees, monitoring of territory occupancy, monitoring of reproduction, and censusing a marked population; (2) creation of new territories through artificial cavity construction, and dividing them into research and control territories; (3) using monitoring information and other data collected from new and previously existing research and control territories to measure impacts of military training activities on red-cockaded woodpeckers experimentally; and (4) determining foraging requirements of the woodpeckers on Camp Lejeune.

The purpose of the current report is to provide updated information on research components related to the military training impacts study based on data collected during the 2005 woodpecker breeding season. Specifically we report fully on component (3) (experimental assessment of impacts of military training activities) and provide updated information on two aspects of component (1) (population monitoring), population growth and changes in group size.

## Background

The red-cockaded woodpecker is endemic to the southeastern United States. It has been extensively studied, and its biology is well known (Thompson 1971; Wood 1983; Walters 1990; 1991; Jackson 1994; Kulhavy et al. 1995; Conner et al. 2001; USFWS 2003; Costa and Daniels 2004). Two unusual aspects of its biology are that it excavates cavities for roosting and nesting

in living pine trees, and is a cooperative breeder. Cooperative breeding refers to a phenomenon, known from more than 300 avian species and more than 100 mammals, in which adults other than the genetic parents, called helpers, regularly assist in raising young (Emlen 1991). Excavating cavities in living pines is a more unusual adaptation that involves excavating an entrance tunnel through the sapwood into the heartwood in which the chamber is constructed. The process takes years to complete, but cavities may be used for more than a decade once constructed (Conner and Rudolph 1995; Harding and Walters 2002; 2004). Each group of birds owns a set of cavities, known as the cavity tree cluster, which includes the individual roost cavities of each group member, perhaps a few extra suitable cavities, and a number of old, inactive, unsuitable cavities.

A new management strategy for the species has been formulated based on the view that the population dynamics revolve around the number and distribution of territories with good cavities. This strategy focuses on territory quality, and is devised to prevent abandonment of existing territories and create additional new territories, as opposed to strategies that focus on demography, and are devised to increase survival and reproduction (Walters 1991; Conner et al. 2001; Rudolph et al. 2004). The strategy includes prescribed burning during the growing season, which eliminates hardwood midstory that otherwise might encroach on cavities, causing the birds to abandon them (USFWS 1985; Jackson 1987; 1994; Walters 1991). It also includes using cavity restrictors, which are metal plates placed around the cavity entrance, to prevent larger cavity-dwelling species from enlarging and thus destroying cavities (Carter et al. 1989), and construction of artificial cavities using one of 2 techniques that have been invented (Copeyon 1990; Allen 1991) to replace lost cavities on existing territories and to create new territories, termed recruitment clusters, to promote population expansion.

The natural resources staff at Camp Lejeune, with assistance from Geo-Marine, Inc., formulated a management plan for red-cockaded woodpeckers, entitled "Marine Corps Base, Camp Lejeune's Mission Compatible Plan for the Comprehensive Long Range Management of the Red-cockaded Woodpecker", that includes the essential elements of the new management strategy. This plan, hereafter the RCW Management Plan, which was formally adopted in late 1999, will guide red-cockaded woodpecker management on Camp Lejeune through the next decade and perhaps beyond. The birds on Camp Lejeune are part of a designated recovery population (USFWS 2003), and thus the appropriate goal for the base is not only to maintain the existing population, but also to manage for population increase to meet recovery objectives.

### Military Training

Current agreements between USFWS and Camp Lejeune require restrictions on military training activities in the vicinity of red-cockaded woodpecker cavity trees. Specifically, a 200 ft buffer is marked around each cavity tree cluster, and within that buffer a number of activities are prohibited, including vehicular traffic, digging foxholes, bivouacking or establishing other fixed positions, girdling trees with wire, burying cable, firing artillery within 600 ft and using anything that produces excessive disturbance (e.g., noise simulators, smoke). Military trainers feel that these restrictions detract from realism of training, and make execution of some training exercises difficult in some areas, causing shifts in location of training.

All existing woodpecker territories in suitable habitat on Camp Lejeune are already

occupied, so the desired continued expansion of the population described in the RCW Management Plan will involve creation of new recruitment clusters in areas not previously occupied by woodpeckers. Military personnel are concerned about the increased training restrictions that will come with increased numbers of woodpecker clusters. Rather than limit the rate of increase of the population in order to limit training restrictions, the RCW Management Plan specifies that half the new territories will be subject to the usual restrictions (control clusters) and half to no restrictions (research clusters).

Thus the potential rate of increase is twice what would otherwise be acceptable to trainers, but birds in half of the new clusters are subject to disturbance from military training. Current restrictions are based on assumptions about likely impacts rather than actual evidence. Some potential impacts involve behavioral disturbance (e.g., noise, firing of artillery), and hence are expected to affect reproduction primarily, whereas others may affect cavity trees (e.g., vehicular traffic, digging foxholes), and thereby lead to territory abandonment. There are no definitive, prior studies that quantify these effects, or even verify that they exist. We designed an experimental study that uses comparisons between control clusters and research clusters to measure impacts of training. This approach not only provides measurements of training impacts, but also compares actual alternatives, namely the current regulations versus an unrestricted environment. Here we update results for effects on woodpecker demography through the 2005 breeding season. We will provide results for effects on woodpecker behavior and cavity trees in a subsequent report.

#### The Camp Lejeune Red-cockaded Woodpecker Population

Camp Lejeune is located in Onslow Count on the central coast of North Carolina. All of the existing red-cockaded woodpecker groups occur on the Main Base, which includes 110,000 acres, of which 26,000 acres is open water (Figure 1). The Greater Sandy Run Area, purchased in 1992, is adjacent to and southwest of the Main Base, and includes 41,000 acres. Sandy Run is dominated by pine plantations (39%) and pocosin (23%), and contains little habitat currently suitable for woodpeckers. On the Main Base forested areas include high pocosin wetlands, pond pine woodlands, pine savannas, and wet and mesic pine flatwoods (Schafale and Weakley 1990), as well as hardwood areas associated with the New River drainage. Red-cockaded woodpeckers are strongly associated with longleaf pine, although they use loblolly and pond pine habitats to some extent as well.

At the outset of our study, most of the woodpeckers on the Main Base occurred in the vicinity of the training area known as Combat Town and around the G10 Impact Area (Figure 1). The birds on the eastern side of the base are separated by Stone Bay and the New River from a smaller subpopulation in the Verona Loop Training Area on the west side of the base. Dispersal between the different areas on the east side, which includes the Northeast area north of the G10 area (Figure 1), is frequent, but dispersal between the eastern and western subpopulations is rare.

### **Impacts of Military Training Activities**

#### Occupation of Recruitment Clusters

Altogether 22 recruitment clusters have been constructed since the adoption of the RCW Management Plan, 11 control clusters and 11 research clusters. The new recruitment clusters

have been concentrated in the areas where the population was most sparse initially (Figure 1): 10 are located in the Northeast area and six are in the Verona area, compared to a total of six in the G10 and Combat Town areas combined.

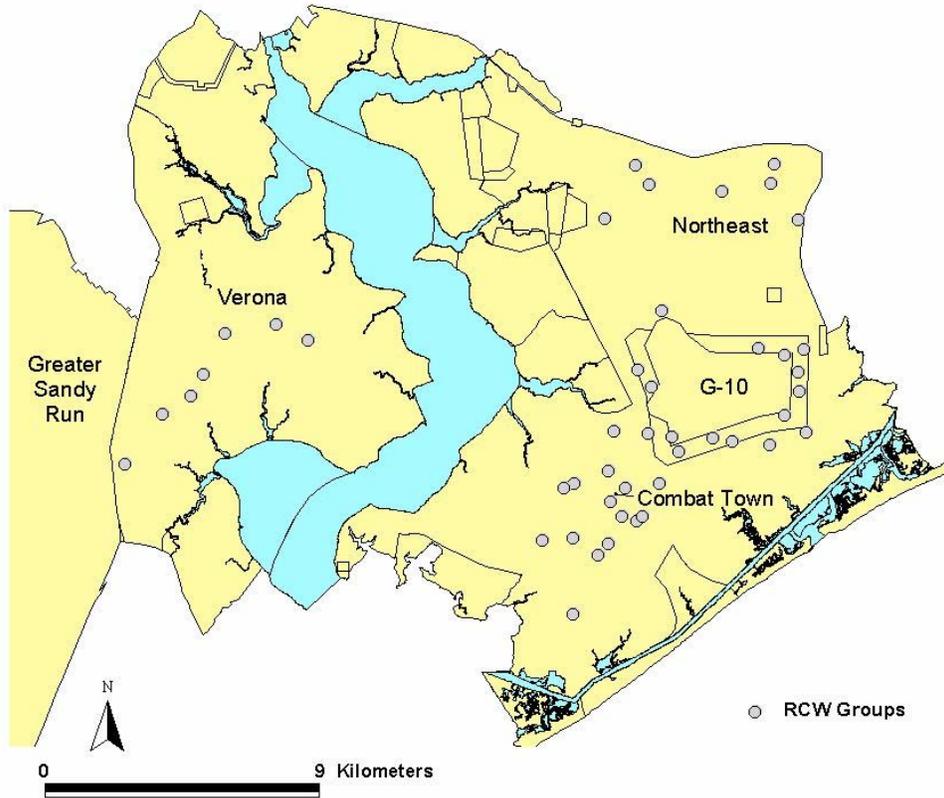


Figure 1. The Camp Lejeune red-cockaded woodpecker population in 1999. Clusters occupied by woodpecker groups in four sections of the base (Northeast, G-10, Combat Town and Verona) are depicted.

Four artificial cavities were constructed in each recruitment cluster using a drilling technique (Copeyon 1990). The cavities were screened initially, and when sap leakage had ceased they were unscreened and made available for occupation by the birds. Generally recruitment clusters constructed in a particular winter were made available to the birds by the subsequent breeding season, but the first five recruitment clusters remained screened for a longer period due to delays in approval of the RCW Management Plan. Control clusters were marked so that military training activity within them was restricted, whereas research clusters remained unmarked so that standard restrictions on military training activity did not apply to them.

Once the cavities in recruitment clusters were unscreened, the clusters were checked for bird occupation monthly until the beginning of the next breeding season. Thereafter they were checked at the beginning and end of each breeding season, until they were occupied. Once occupied, they were subject to standard monitoring procedures (see Population Monitoring

below), and to procedures related to evaluating impacts of military training activity.

We evaluate responses to four sets of recruitment clusters: (1) response over six years to the first set of five recruitment clusters made available by the 2000 breeding season; (2) response over five years to the seven recruitment clusters constructed in the winter of 2000-2001; (3) response over four years to the six recruitment clusters constructed in the winter of 2001-2002; and (4) response in one year to the four recruitment clusters constructed in the winter of 2004-2005. Four of the initial five recruitment clusters (80%) were occupied in the first year they were available, and all five were occupied within two years. Four of seven recruitment clusters (57%) in the second set were occupied in the first year, five by the third year (71%) and all seven by the fourth year. Response to the third set of recruitment clusters was less positive. Only one of six (17%) was occupied in the first year, two by the second year (33%), three by the third year (50%) and four by the fourth year (67%). Three of four recruitment clusters in the last set were occupied in the first year. Overall 61% of the recruitment clusters were occupied within two years, and 75% within four years (Figure 2).

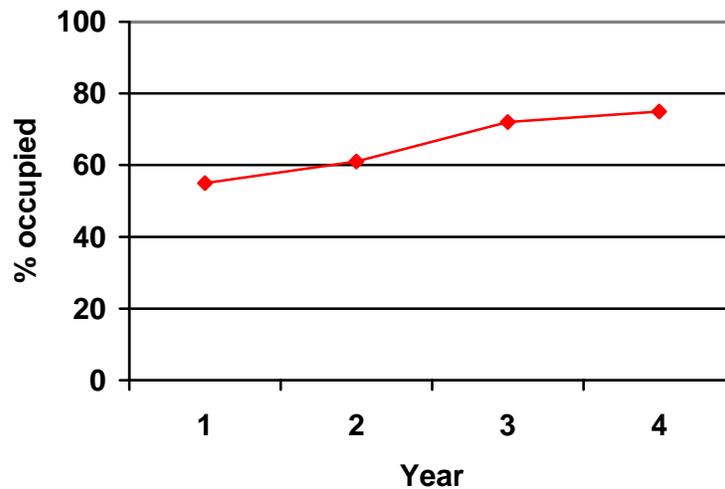


Figure 2. The proportion of recruitment clusters occupied as a function of number of years (i.e., breeding seasons) available to the birds. Sample size is 22 for year 1 and 18 for years 2-4.

Many of the recruitment clusters were occupied by a solitary male or captured by another group (i.e., used for roosting by a group residing in another cluster) the first year they were available, but most contained groups by the second year they were occupied (Figure 3). A few were abandoned after being occupied for 1-2 years.

Response to recruitment clusters was highly positive. There was a delay in the response to the third set of recruitment clusters compared to the first two sets, associated with a slowing of population growth in the last few years of the study period, but the occupation rate increased again in the 2004 and 2005 breeding seasons. In previous studies, the typical rate of response is about 50% occupation within 2 years (Walters et al. 2004), compared to 61% in this study. The statistic that reveals most about the effectiveness of recruitment clusters in stimulating population growth is the number of clusters occupied within 3-4 years, as previous research has

shown that probability of occupancy remains reasonably high through this period, but falls off dramatically thereafter (Walters et al. 2004). High quality recruitment clusters may not be occupied for 3-4 years due to the vagaries of natural population dynamics, but recruitment clusters not occupied by this time probably are of poor quality or otherwise unacceptable to the birds, or are difficult for the birds to locate. Rates of occupancy by 3-4 years for the recruitment clusters constructed at Camp Lejeune under the RCW Management Plan are very high (Figure 2).

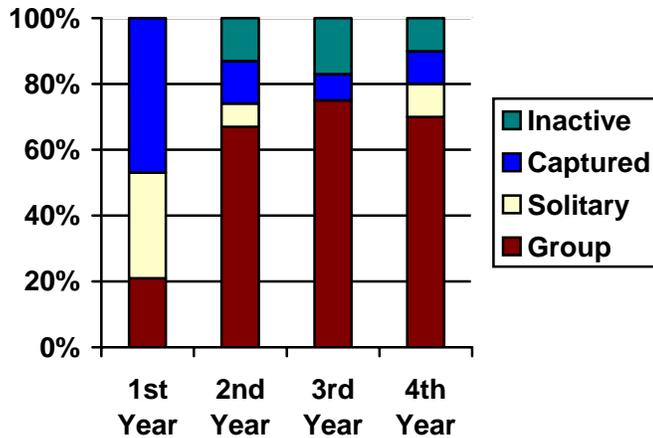


Figure 3. Status of recruitment clusters during the breeding season as a function of number of years since occupation. The percentages of clusters occupied by potential breeding groups (Groups), by unpaired males (Solitary), and by roosting birds from a group residing in another cluster (Captured) are depicted, as well as the percentage that were not occupied (Inactive). Sample sizes are 19 for 1<sup>st</sup> year, 15 for 2<sup>nd</sup> year, 12 for 3<sup>rd</sup> year and 10 for 4<sup>th</sup> year.

#### Assessment of Military Training Impacts

The design of the study of impacts of military training activities involves comparing measures of red-cockaded woodpecker demography, woodpecker behavior and cavity tree dynamics between marked control clusters and unmarked research clusters. For some analyses we will also make comparisons to previously existing natural clusters, termed reference clusters. The study employs a paired design, matching each unmarked research cluster with a marked control cluster in the same area (e.g., G10, Northeast) that is similar in habitat features. The new recruitment clusters whose creation was described in the previous section contributed 22 clusters (11 matched pairs) to the study. In addition, all 16 new clusters arising through natural processes since adoption of the RCW Management Plan were included in the military training impacts study. New clusters can form by budding, in which one group splits into two and divides the existing cavities, or by pioneering, in which birds occupy a previously vacant area and construct new cavities (Hooper 1983; Walters 1991). These processes contributed three matched pairs of clusters formed by budding, four matched pairs of clusters formed by pioneering, one marked control cluster formed by budding that is not yet matched with a

research cluster, and one marked control cluster formed by pioneering that is not yet matched with a research cluster. Finally, through negotiations between USFWS and Camp Lejeune, it was decided that three existing, active natural clusters would be unmarked for inclusion in the study. This contributed six clusters to the study, the three clusters that were unmarked to become research clusters and the three marked, active, natural control clusters with which they were matched.

Breeding season monitoring results in a determination of the status of each cluster (inactive, captured, occupied by solitary male, occupied by potentially breeding group), a census of each group, and detailed data on reproduction. These data allow comparison between research and control clusters for key variables related to productivity, namely (1) % of clusters occupied, (2) % of active clusters occupied by potentially breeding groups, (3) % of groups that nest, (4) % of nests that fail, (5) number of young fledged from successful nests and (6) number of young fledged per potential breeding group. In each case the null hypothesis is that there is no difference between research and control clusters.

We compare these variables between research and control clusters within years. To increase power, we also make comparisons in which years are combined. To account for year effects in making these comparisons, we also measure these variables in the reference clusters to produce reference values, and analyze the deviations from the reference value for control and research clusters. For measures 1-4 we calculate a single deviation value for the control clusters, and one for the research clusters, each year. The null hypothesis is that the mean deviations for control and research clusters are equal. For measures 5 and 6 we compute a deviation for each cluster each year, and test the same null hypothesis by pooling all deviations across all years.

Because of the delays in adoption of the RCW Management Plan, the initiation of the military training impacts study was delayed by nearly two years. As a result, there were not enough clusters available to generate sufficient sample sizes to permit analysis until 2002. In 2000 there were two control clusters (both bud/pioneer) and two research clusters (both bud/pioneer), and in 2001 there were 11 control clusters (five bud/pioneer, one natural, five recruitment clusters) and nine research clusters (four bud/pioneer, one natural, four recruitment clusters). Here we provide results for the four years (2002, 2003, 2004 and 2005) with sufficient sample sizes for analysis.

The number of recruitment clusters of each type (11) was too small to enable a definitive statistical analysis of the effect of treatment on probability of occupation. However, there was not any trend toward a higher proportion of research clusters being occupied compared to control clusters (Figure 4), suggesting that lack of training restrictions does not inhibit occupancy. Among those recruitment clusters occupied, the percentage containing potential breeding groups was virtually identical in control and research clusters (Figure 5).

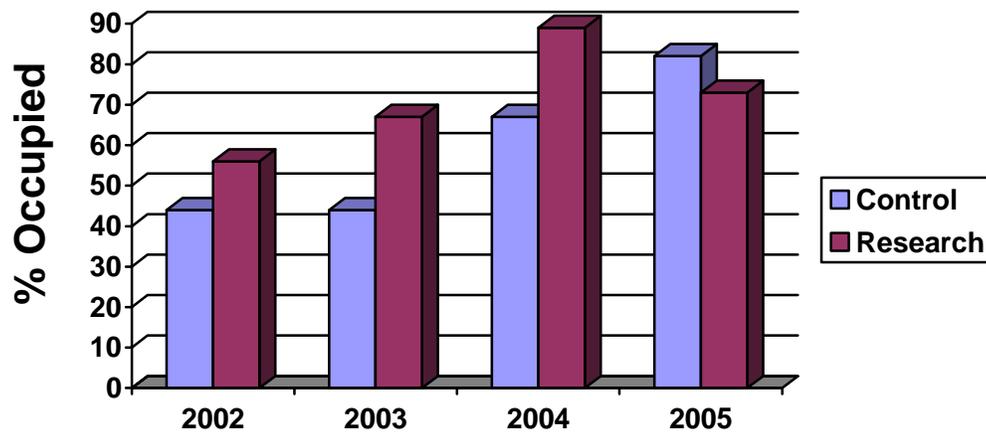


Figure 4. The proportion of control and research recruitment clusters occupied, by year. N = 9 for both types of cluster in 2002-2004, and 11 for both types in 2005.

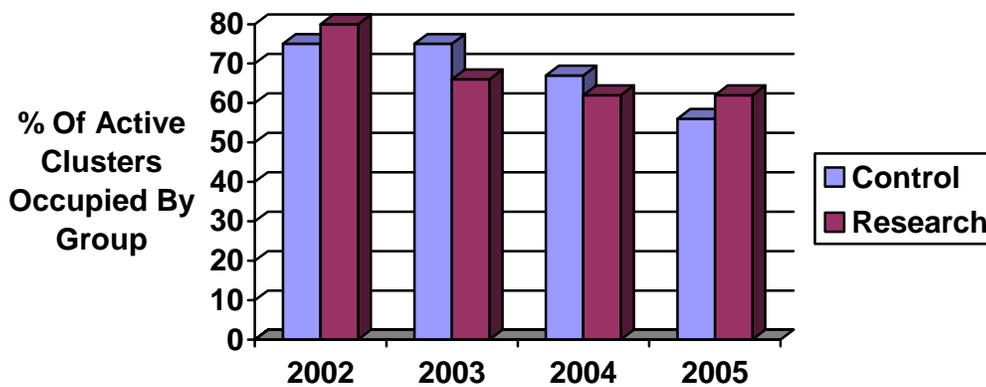


Figure 5. Proportion of occupied control and research recruitment clusters containing potential breeding groups, by year. Sample sizes are as follows (C = control, R = research): 2002 - 4C, 5R; 2003 - 4C, 6R; 2004 - 6C, 8R; 2005 - 9C, 8R.

To analyze the proportion of potential breeding groups that attempted nesting, we combined all types of clusters included in the study, that is recruitment clusters, previously existing natural clusters, and clusters formed by budding and pioneering. The proportion of groups attempting nesting varied among years, but treatment had no significant effect on this parameter (Figure 6). In this analysis the sample size is the number of years, and hence is very small (n=4). However, there was no clear trend in the data, suggesting that if there is any difference between treatments, it is not a large one: control clusters performed better than research clusters in the first two years, but this trend, more easily viewed in the annual deviations from reference values (Figure 7), did

not persist over time. Note that deviations tend to be negative for both control and research clusters, indicating that a smaller proportion of groups nest in these clusters compared to reference clusters. This is presumably because new groups that formed in recruitment clusters make up a large proportion of the control and research groups, and new groups typically contain young breeders that are less productive than older birds (Walters et al. 1995; 2004).

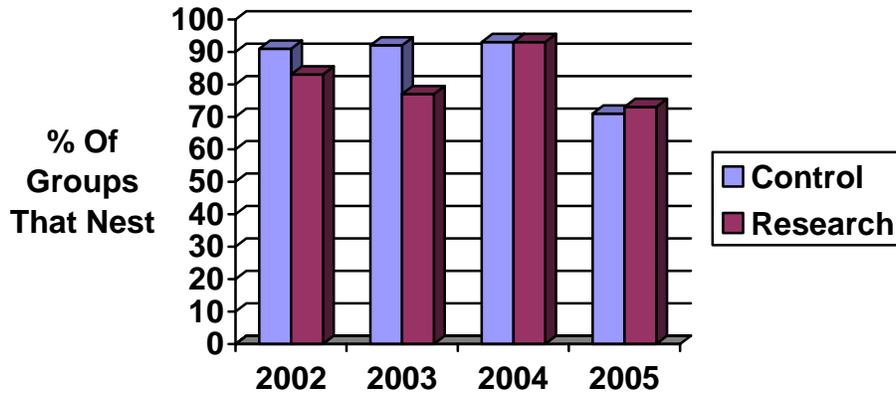


Figure 6. Proportion of potential breeding groups that attempted nesting in control and research clusters, by year. Sample sizes are as follows (C = control clusters, R = research clusters): 2002 - 11C, 12 R; 2003 - 12C, 13R; 2004 - 15C, 14R; 2005 - 17C, 15R.

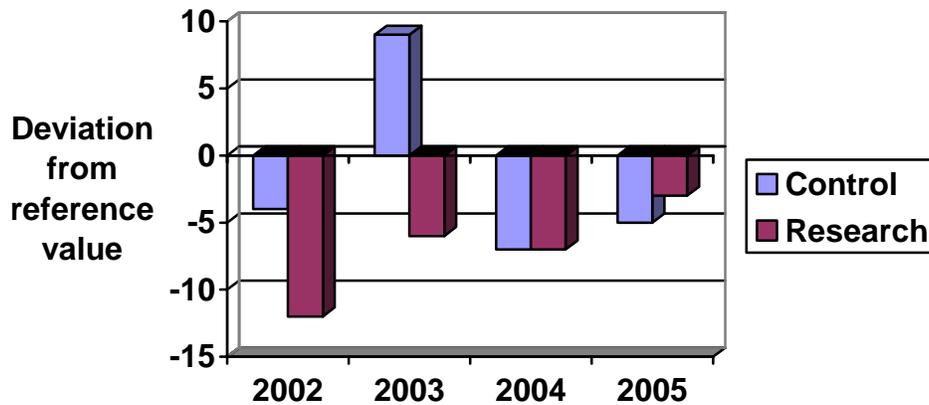


Figure 7. Deviations from reference values for proportion of potential breeding groups that attempted nesting, for control and research clusters, by year. Sample sizes are as in Figure 6.

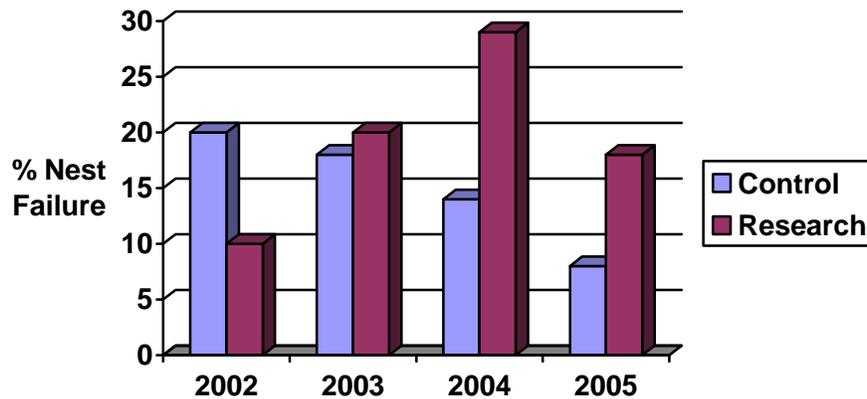


Figure 8. Proportion of nesting groups whose first nest failed in control and research clusters, by year. Sample sizes are as follows (C = control clusters, R = research clusters): 2002 - 10C, 10 R; 2003 - 11C, 10R; 2004 - 14C, 14R; 2005 - 12C, 11R.

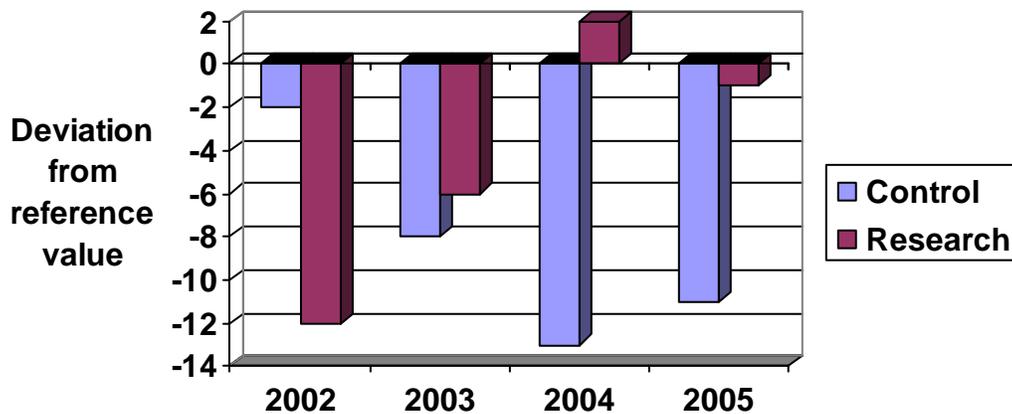


Figure 9. Deviations from reference values for proportion of nesting groups whose first nest failed, for control and research clusters, by year. Sample sizes are as in Figure 8.

The proportion of nesting groups whose first nest failed did not differ significantly between control and research treatments, but again the sample size is the number of years of observation and therefore is small, and in this case there is a trend toward higher rates of nest failure in research clusters (Figure 8). Since increased nest failure is an expected manifestation of disturbance, this trend warrants further study and more complex analysis, which we will present in a subsequent report that will include behavioral measures. Surprisingly, deviations from reference values tend to be negative (Figure 9), indicating lower nest failure rates in control and research clusters than in reference clusters. One would expect the opposite, given that some of the research and control groups are new ones with young breeders that formed in recruitment

clusters. This also calls into question the idea that research clusters may suffer higher nest failure rates due to increased disturbance, since failure rates in them are lower than in reference clusters, all of which are marked and thus subject to training restrictions.

There was no difference between control and research clusters in the number of fledglings produced per successful nest from first nesting attempts, and the trend was toward larger brood sizes in research clusters (Figure 10). In 2002 deviations from reference values were large and negative indicating that control and research groups produced smaller broods than reference groups (Figure 11) as expected, given the young ages of the breeders and small group sizes in the new groups inhabiting these clusters. In 2003 and 2004, however, control and research groups produced slightly larger broods than reference groups, and in 2005 they produced much larger broods. Thus the groups in these clusters are now more productive than expected.

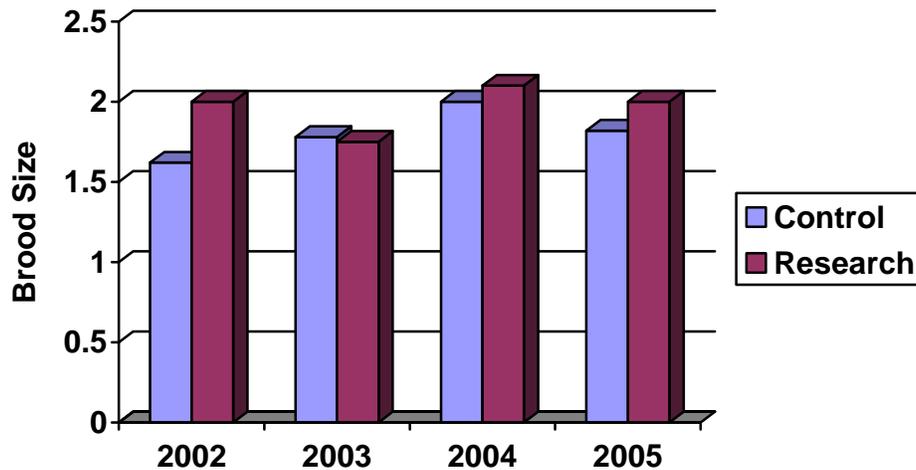


Figure 10. Number of young fledged from successful first nests (brood size) for control and research clusters, by year. Sample sizes are as follows (C = control clusters, R = research clusters): 2002 - 8C, 9R; 2003 - 9C, 8R; 2004 - 12C, 10R; 2005 - 11C, 9R.

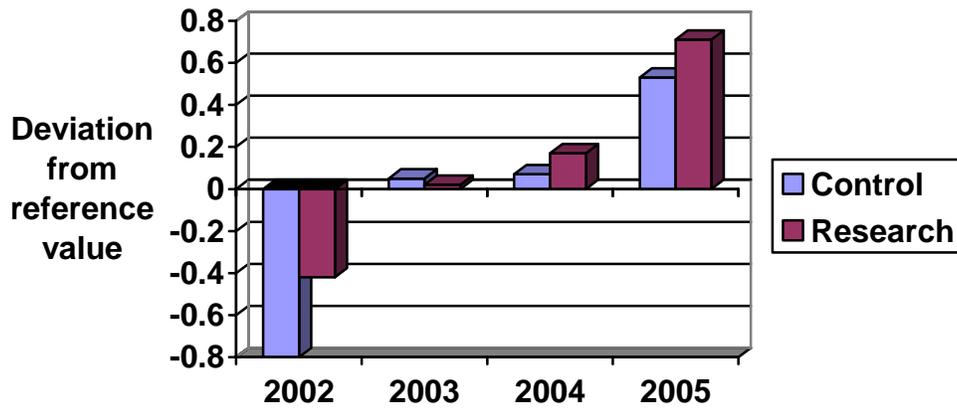


Figure 11. Deviations from reference values for number of young fledged from successful first nests, for control and research clusters, by year. Sample sizes are as in Figure 11.

The number of fledglings produced per potential breeding group provides an overall measure of productivity that integrates impacts on all the elements of reproduction analyzed above. By this measure, control groups have been more productive than research groups in three of the four years of the study (Figure 12), but this trend is not significant and the differences are very small. In our initial report we identified this trend as an important one to watch, but it did not persist in the last year (2005) of the study. Therefore we now think it unlikely that there is any difference in productivity between research and control clusters.

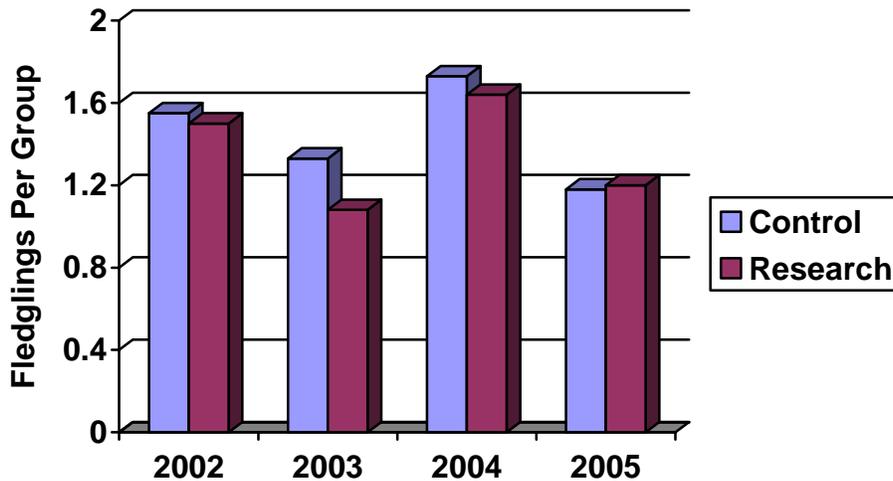


Figure 12. Number of fledglings produced per potential breeding group in control and research clusters, by year. Sample sizes are as follows (C = control clusters, R = research clusters): 2002 - 11C, 12R; 2003 - 12C, 13R; 2004 - 15C, 14R; 2005 - 17C, 15R.

Deviations from reference values indicate that control and research groups initially were less productive overall than reference groups, but by the last year of the study they were slightly more productive than reference groups (Figure 13). Again, the latter is an unexpected result. It may be that by the end of the study groups had been established in control and research clusters long enough that they had become comparable to previously existing groups in their productivity.

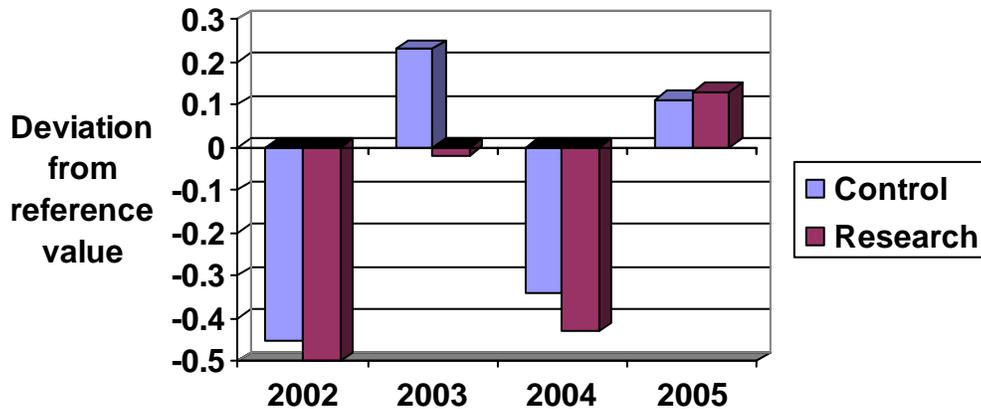


Figure 13. Deviations from reference values for number of fledglings produced per potential breeding group, for control and research clusters, by year. Sample sizes are as in Figure 12.

There is no indication in this preliminary analysis of large effects of military training activities on reproduction of red-cockaded woodpeckers. The trend was toward better performance in research clusters for some aspects of reproduction (proportion of recruitment clusters occupied, number of young fledged per successful first nest), and for others there was no clear trend (proportion of occupied recruitment clusters containing potential breeding groups; proportion of groups that attempted nesting). There was a trend toward poorer overall productivity in research clusters, but this difference did not hold in the last year of the study, and the differences observed were small. The only negative impact of reduced training restrictions in research clusters that may exist is increased nest failure, which could be caused by disturbance at nests. This does not have a noticeable impact on overall productivity, however.

We will provide definitive analyses of nest failure rates and all other parameters measured in our subsequent report to be completed later this year. These analyses will include more complex statistical models that use data from each cluster each year, and in addition analyses of behavioral data, particularly nest attendance data, that will provide a better context for evaluating reproductive parameters because of the relevance of the behavioral data to the mechanisms by which military training activities could impact reproduction. Finally, some additional analyses will focus on aspects not covered in this report, particularly cavity tree dynamics.

### **Population Monitoring**

We continued monitoring of the Camp LeJeune red-cockaded woodpecker population, ongoing since 1986, for an additional year in 2005. Monitoring includes determining the activity status of each cavity tree each breeding season, maintaining a completely marked population of birds, determining the number of active clusters, unpaired males and groups, recording breeding attempts and associated data (clutch size, brood size, nesting success, number of young fledged) and determining the number, identity and status (e.g., breeder, helper) of all group members in all groups. Population monitoring followed well-established procedures (Walters et al. 1988) proven effective on Camp LeJeune over the previous 19 years. We visited all known woodpecker cavity trees on the base in April and recorded data on their activity. We determined whether each cavity tree cluster was active or inactive based on the April checks of cavity trees, and monitored all active clusters for reproductive activity during the breeding season (May-July), and further categorized them as occupied by a potential breeding group, occupied by a solitary male, or captured based on censusing of adults. To monitor for reproductive activity, we visited active trees every 7-9 days to check for the presence of a nest using a Tree-top Peeper. When nests were discovered, we revisited them every week until nestlings were old enough to be banded (i.e., age 6-10 days). Nestlings then were extracted from the cavity, fitted with unique combinations of colored leg-bands and a USFWS aluminum band, and placed back in the cavity. We returned and followed the group after the projected fledging date to determine which of the banded young fledged. Censusing involved identifying all group members from their band combinations, and determining their status (i.e., breeder, helper, floater, solitary male, intruder from another group) using well-established criteria (Walters et al. 1988). Censusing was accomplished by following groups during the day or by observing them coming to roost in the evening. We captured any unbanded adult woodpeckers observed from roost cavities and marked them with a USFWS band and colored leg-bands.

### **Population Growth**

The red-cockaded woodpecker population on Camp Lejeune continued to grow in 2005, increasing from 73 to 81 active clusters (11%) and from 70 to 73 potential breeding groups (4%) (Figure 14). These increases are comparable to the high population growth high rates achieved under the RCW Management Plan in previous years, which we analyzed and discussed in our previous report (Walters et al. 2005). The Camp Lejeune population continues to exhibit one of the highest growth rates of any existing population, and is particularly unique in the high frequency with which pioneering occurs (Walters 2004). Another new group formed by pioneering in 2005. The remaining increases were due to occupation of recruitment clusters.

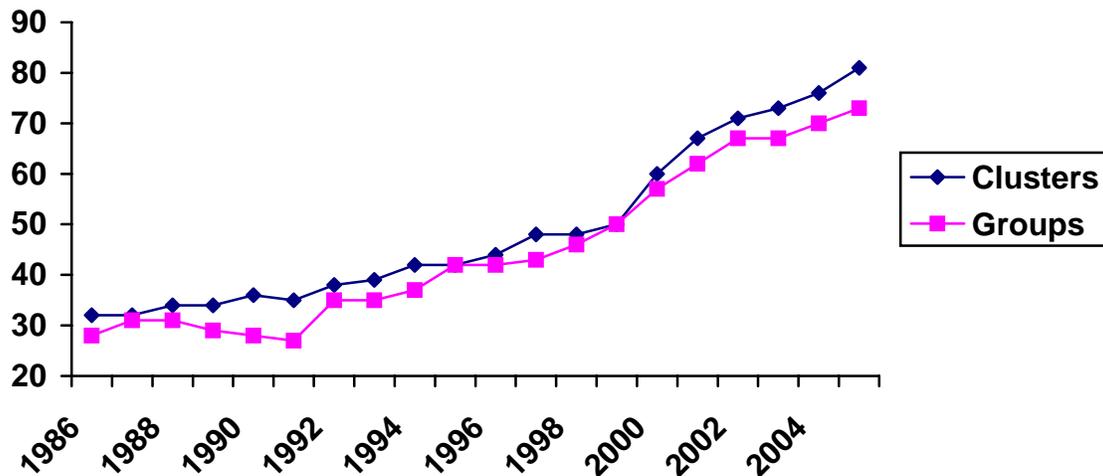


Figure 14. Number of active clusters (clusters) and potential breeding groups (groups) on Camp Lejeune, 1986-2005.

#### Group Size

Group size is an indicator of the health of the population, as it reflects the size of the helper class, and helpers are critical to population dynamics because they buffer the population against periods of high mortality and low productivity (Walters et al. 2002). Helpers provide a source of replacement breeders, so that periods of high breeder mortality result in a decrease in the helper class (because many helpers transition to breeder status) rather than a decrease in the number of breeding groups. Similarly, low productivity results in reduced recruitment to the helper class rather than a reduced rate of breeder replacement. Floaters act in a similar way; hence the presence of many helpers and floaters is indicative of a healthy population.

We expressed some concern about trends in group size in our previous report (Walters et al. 2005) because group size, which had averaged more than 3.0 birds per group since 1998 and reached a peak of 3.16 birds per group in 2003, suddenly declined to 2.76 birds per group in 2004 (Figure 15). In 2005 average group size increased to 2.92. This suggests that the decline in group size may have been only a temporary aberration, and that group size may recover to its previous level. It further suggests that the factor causing the decline may have been a singular event such as a disease epidemic, rather than an enduring change in a habitat or mortality factor. If this is the case, group size should continue to increase over the next few years.

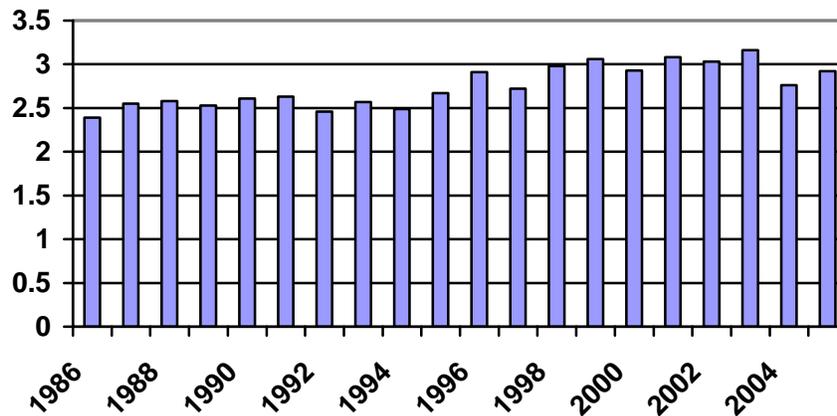


Figure 15. Mean number of adults per group, by year. Only helpers and breeders are included as group members: solitary males and floaters are excluded from these calculations.

### Conclusions

This update affirms the major conclusions of our previous report (Walters et al. 2005) with respect to the military training impacts study and population dynamics. No major effects of reducing restrictions on military training within red-cockaded woodpecker clusters on productivity of the birds are evident. That overall productivity is reduced in research clusters now appears a less likely possibility than it did previously, and that nest failure rates are increased in research clusters appears a more likely possibility. The performance of both control and research clusters was comparable to or better than that of reference clusters in 2005 for all parameters measured except proportion of groups nesting.

The population continued to grow at a high rate in 2005, as it has continuously since 1991. Concerns about reduced group size raised in the previous report (Walters et al. 2005) were alleviated by an increase in this parameter in 2005. All indicators suggest that the Camp Lejeune population continues to move toward recovery.

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