From the ground up

An 11-year research project now in progress across Prairie Canada, the Spatial and Temporal Variation in Nesting Success Study (SpATS) looks to shed light on how DUC can get even more out of its habitat programs.

By Dave Howerter and Bob Emery

Two ATVs, travelling in tandem, scribe parallel paths across the hillside. Without warning a bird bursts skyward, wings stretching for purchase in the cool morning air. The ATVs slam to a stop, one rider points to mark the location where the bird emerged while the other claps binoculars to straining eyes as the bird circles low over the scene before settling on a nearby pond. "Mallard" is the proclamation...

Working smoothly as a well-drilled team, the first rider gingerly approaches the spot where the hen broke cover while her partner extracts clipboard, pencil and GPS receiver and begins to fill in the blanks on the lemon-yellow nest observation card. After a short search, the first rider bends at the waist, gently parts the dense vegetation and calls out, "Got it! Seven eggs! Looks like she's probably still laying." A few minutes later gear is stowed, the ATVs sputter to life – and the two young researchers continue on.

THIS SCENE HAS PLAYED ITSELF OUT THOUSANDS OF times since 2002 and the launch of the Spatial and Temporal Variation in Nesting Success Study – SpATS for short. SpATS is scheduled to investigate 120 sites throughout the grasslands and aspen parklands of Alberta, Saskatchewan and Manitoba – the heart of duck country – before it concludes in 2012. At its core, SpATS is a very large study asking a very important question. Most of Ducks Unlimited Canada's (DUC) habitat programs are based on the tenet that conserving existing upland and wetland habitats and restoring those habitats where they have been lost will result in greater duck production. SpATS is designed to evaluate that key assumption.

Building on the Foundation

SPATS, THOUGH A LARGE STUDY BY ANYBODY'S MEASURE, HAS the good fortune of being able to build on information learned during the largest study of duck breeding ecology ever conducted – the Prairie Habitat Joint Venture (PHJV) Assessment study. Conducted by DUC researchers from 1993 to 2000, the Assessment included radio-tagging over 3,600 mallard hens, recording the locations and hatching success of more than 19,000 duck nests, and measuring the survival of ducklings from over 900 mallard broods. This unprecedented investment in learning was designed to evaluate the effectiveness of the suite of habitat conservation programs implemented under the auspices of the PHJV – the largest component of the North American Waterfowl Management Plan – delivered through DUC's Prairie CARE program and by partner agencies. The PHJV has been an unmitigated success with over 3.6 million acres of habitat secured or influenced by partner agencies since 1986. The Assessment helped shape the conservation actions taken on those acres through a process called Adaptive Management (AM) and SpATS is picking up where the Assessment left off to further enhance program implementation.

Learning by Doing

DUC HAS EMBRACED A PHILOSOPHY OF ADAPTIVE MANAGEment as the most efficient way to conserve essential habitats while gaining new information to make conservation programs more cost-efficient. The AM process involves repeated cycles of planning, implementation and evaluation/monitoring and allows DUC to increase program efficiencies while getting on with the business of conservation.

Darin Langhorst (3)

During the course of the Assessment it became apparent that certain programs needed adjustments. For example, rotational grazing systems where cattle are rotated through a number of paddocks annually, provided good agronomic benefits, but did not result in cover sufficiently attractive to nesting ducks. Therefore, the program was refocused. Conversely, natural habitats proved to be more productive than anticipated, so DUC developed new tools like Conservation Easements that allowed natural lands to be protected in perpetuity.

The PHJV from its inception was committed to using the best scientific information available to guide its conservation investments. Implementation plans were developed near the beginning of the PHJV using the then state-of-the-art Computer Planning Tool (CPT). Most of the original data used to develop the CPT were collected in the Dakotas.

When applied to parkland habitats where most of the PHJV conservation activities took place, model predictions fell short. Accordingly – using data collected by the Assessment and specific to the Canadian prairie pothole region – a new planning tool has been developed. This new tool, named appropriately the Waterfowl Productivity Model (WPM), links landscape and habitat-specific information on hatching success of the five most abundant dabbling duck species occurring on the Canadian Prairies: blue-winged teal, mallard, gadwall, northern shoveler and northern pintail.

Above left/previous pages: to locate large numbers of nests, researchers use ATVs connected with a cable-chain device. As the cable-chain is pulled, it rides up in the vegetation and flushes ducks from their nests (left, inset) as it passes over their heads. Above: researchers near Etzikom, Alberta investigate a gadwall nest in a crop of winter wheat.

For each species the WPM combines estimates of the average duck population in a given area, landscape-scale habitat availabilities, the likelihood each bird will attempt to nest, how persistently she will renest if nest attempts fail, estimates of which habitats are most preferred as nest sites and how likely nests are to hatch in each habitat type and for each duck species. By simultaneously incorporating all these factors, the WPM helps account for the complexities surrounding how birds select nest sites in diverse landscapes and the protection each habitat type affords from predators. The spatially explicit WPM is now being used as the basis for a second generation of PHJV planning. In keeping with the AM model where planning, implementation and evaluation all go hand in hand, SpATS is poised to provide key feedback to ongoing conservation actions and to enhance WPM predictions, as needed.

Focus on Nesting Success

EARLY PLANNING FOR THE PHJV ASSUMED THAT REDUCED nesting success – the proportion of nests that survive to hatch –

Above: researcher Tracy Sutherland candles a blue-winged teal egg during a 2004 visit to a SpATS study site near Etzikom, Alberta. SpATS is scheduled to investigate 120 sites – each twice – across the grasslands and aspen parklands of Alberta, Saskatchewan and Manitoba before the study concludes in 2012. To date, 72 sites have been paid at least a single visit.

Left: Darin Langhorst

was the factor limiting duck populations in the prairie pothole region. This assumption was confirmed through the Assessment. Nesting success, especially of older birds, is the life-cycle stage that most influences population growth rates *(see sidebar, below)*. So accordingly, SpATS is focusing on factors that affect nesting success.

The Prairies are very dynamic. Many factors can affect nesting success, including some over which we have no control. These factors include precipitation patterns, predator disease cycles and the abundance of so-called "alternative prey" (small mammals, insects, etc.) that can either attract predator populations to a particular piece of habitat, or fill their bellies so that they don't spend as much time searching for duck nests. Each of these factors can change from year to year and can make it difficult to determine how conservation actions are affecting nesting – statistical effects of conservation actions can be obscured by the uncontrolled variation in the natural system.

To overcome this "noise" requires large sample sizes. That's why SpATS will study 120 sites. Each of the sites will be visited twice during the course of the study, though return intervals vary. In some cases the same sites will be studied two years in a row; in other cases they'll be separated by up to 10 years. In this manner we'll be able to statistically account for the uncontrolled temporal variation and get a clearer picture of the effect changes to the landscape habitat composition – through conservation programs or otherwise – have on duck production.

Sites are arranged in clusters of six. Within each cluster, sites were selected to have high (60 to 100 per cent), medium (30 to 60 per cent) and low (zero to 30 per cent) amounts of nesting cover and high (more than 40) or medium (20 to 40) pairs of breeding ducks per square kilometre. The expectation is that on sites with more nesting cover, ducks will experience higher nesting success on average than on sites with less cover. Study sites are distributed throughout the grassland and parkland portions of the prairie pothole region.

Prior to SpATS, data was scarce for the Canadian grasslands. Early in the PHJV, the decision was made to concentrate habitat programs in the parklands because wetlands tend to be deeper there and are less susceptible to drought. Therefore, the reasonable assumption was made that habitat programs delivered in the parklands would be used by birds more regularly than ones delivered in the more drought-prone grasslands. Because the Assessment was designed to evaluate PHJV habitat programs it, too, focused on the parklands. By simultaneously studying both prairie and parkland sites, SpATS will provide new insights into how these systems function.

At each SpATS site, eight quarter sections (0.65 square-kilometre blocks of land) are selected for detailed study. Within each quarter section pair populations are surveyed and habitats are searched for nesting ducks. When a nest is found, its location is plotted using a satellite-based GPS system, eggs are "candled" to determine how long it's been since the nest was started, and a variety of cover measurements are made.

Subsequently, nests are revisited every seven to 10 days to determine if they hatched or were destroyed by predators or some other factor. Additionally, all wetlands within the focal quarter sections are visited and classified, and small mammal and predator abundances are estimated. Finally, aerial images of the study area are digitized for incorporation into a geographical information system (GIS). This will allow detailed analyses of how the spatial arrangements of habitat features affect duck production.

To date, SpATS biologists have studied 72 sites. Twelve sites were visited for the second time in 2005 and 18 more will receive their second visit in 2006. Though it's still early in the study, some patterns are starting to emerge. These data will provide key feedback to ongoing conservation actions and to enhance WPM predictions as the study moves along. First and foremost, the key assumption that nesting success increases with increased amounts of good nesting cover on the landscape seems to be supported. Interestingly, a second emerging pattern is a tendency for nesting success to be substantially higher in grassland than in parkland landscapes. In most cases nesting success in grassland landscapes seems high enough to support an increasing duck population. These patterns, if they hold through the remainder of the study, will have interesting and important ramifications for how we manage duck populations.

Meanwhile, dozens of young researchers will continue to sweep the countryside collecting vital information about how landscapes and ducks interact, and the AM cycle will continue to spin – leading to more cost-efficient conservation.

Visit www.ducks.ca/conserve/research/projects/spats/index.html to learn more about the SpATS study and to receive periodic updates about study progress.

Sensitivity analyses: pinpointing DUC's efforts

Sensitivity analyses don't have anything to do with how emotional ducks are. Rather, they are powerful tools used by biologists to gain insight into the life-cycle of the organism of interest, and they also provide useful insights about how best to manage the population to achieve population objectives. In this case we used information on mallard life-cycle parameters (or vital rates) estimated during the PHJV Assessment – plus survival rates of mallards estimated for the time they are not on the nesting grounds – to develop a model that projects population growth or decline. Vital rates were estimated both for birds entering their first breeding season (SY, or second-year birds) and older birds (ASY, or after-second-year). Then, by sequentially altering each vital rate in turn within the model by a small amount while holding the other rates constant, it is possible to see which vital rate has the strongest influence on population growth. For mallards, nesting success – and specifically nesting success of the ASY birds – was by far the most influential vital rate *(right)*. This then indicates that influencing nesting success through habitat management activities will have the largest impact on population dynamics.