

Behavioural and Physiological Observations of White-winged Scoters with Surgically Implanted Transmitters

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INTRODUCTION

Implanted transmitters have been used in diving ducks since the early 1990's (Olsen et al. 1992, Korschgen et al. 1996). Early studies reported no differences in behavior or physiology of control and transmitter implanted ducks (Korschgen et al. 1996). Paquette et al. (1997), working with mallards (*Anas platyrhynchos*), reported females with backpack transmitters spent less time in nesting activity and had lower survival than did females with implanted transmitters. Hupp et al. (2003) found that Canada Geese (*Branta canadensis parvipes*) implanted with transmitters had no differences in behavior compared with non-implant control geese. No one had studied the effects of implanted transmitters on the nesting ecology, behavior and physiology of seaducks.

The USGS Patuxent Wildlife Research Center in Laurel, Maryland USA maintains a research colony of White-winged Scoters (*Melanitta fusca*) (WWSC). We chose this group for our initial testing of the effects of implanted transmitters on seaducks. Our hypothesis was that there would be no differences between the implanted and control ducks.

METHODS

Four adult female White-winged scoters received 39 gm dummy satellite transmitter implants in November 2007. The dummy satellite transmitters were manufactured by Microwave Telemetry, Inc. (Columbia, Maryland USA) to be identical in external configuration and weight to their commercially available satellite transmitters. Transmitters are gas sterilized using ethylene oxide. White-winged scoters are anesthetized with isoflurane and a standard surgical procedure is used for the implantation.

Blood samples for complete blood counts and serum chemistries were obtained from the four White-winged Scoters and from four other adult females used as controls. Additional blood samples were collected and physical examinations performed at approximately three month intervals to document the health of the ducks. Blood samples were analyzed for total white blood cells, total red blood cells and packed cell volume using standard avian hematology techniques (Dein 1984). Serum was analyzed using a Hemagen Analyst benchtop chemistry system with Vet-16 rotors (Hemagen Diagnostics, Inc., Columbia, Maryland, USA). Our hypothesis is that there would be no statistical differences ($P < 0.05$) in blood values between the implanted ducks and the control ducks.

Focal sampling of the four implanted and four control White-winged scoters was initiated three months before the breeding season and will be followed into the fall. The total duration and proportion of each of several categories of behaviour is being measured, with the hypothesis that there are no behavioural differences between implanted and control White-winged Scoters. All statistical analysis was done using analysis of variance and the Statistix 8 program (Analytical Software, Tallahassee, Florida, USA).

RESULTS

Blood was collected in November 2007, February, April and July 2008. Hematology results show no statistical differences between transmitter implant and control WWSC for white blood cells, red blood cells, and total solids. However, there was a statistical difference between transmitter implant and control WWSC for packed cell volume ($F=34.5$, $P=0.0000$, Table 1, Figure 1). For serum chemistries, there were statistical differences between transmitter implant and control WWSC for AST ($F=12.6$, $P=0.0013$), ALT ($F=5.39$, $P=0.0275$), globulin ($F=5.26$, $P=0.0296$), and albumin/globulin ratio ($F=4.37$, $P=0.0458$). There were no statistical differences for ALK, GGT, amylase, glucose, phosphorus, calcium, cholesterol, uric acid, creatine kinase, creatinine, albumin, and total protein.

Analysis of focal observation data has shown no significant differences for spatial relations (land, $F=2.37$, $P=0.1245$; water, $F=2.38$, $P=0.1245$, Table 2, Figure 2). For event behaviour categories, only sleeping (head tucked under wing, eyes closed, $F=4.27$, $P=0.0397$) was significant at the $P<0.05$ level (Table 2, Figure 3). Only one of the four controls and none of the implanted WWSC nested during the 2008 breeding season. Because of the small sample size, there was no differences seen ($P>0.05$) in nesting behavior between controls and implanted WWSC.

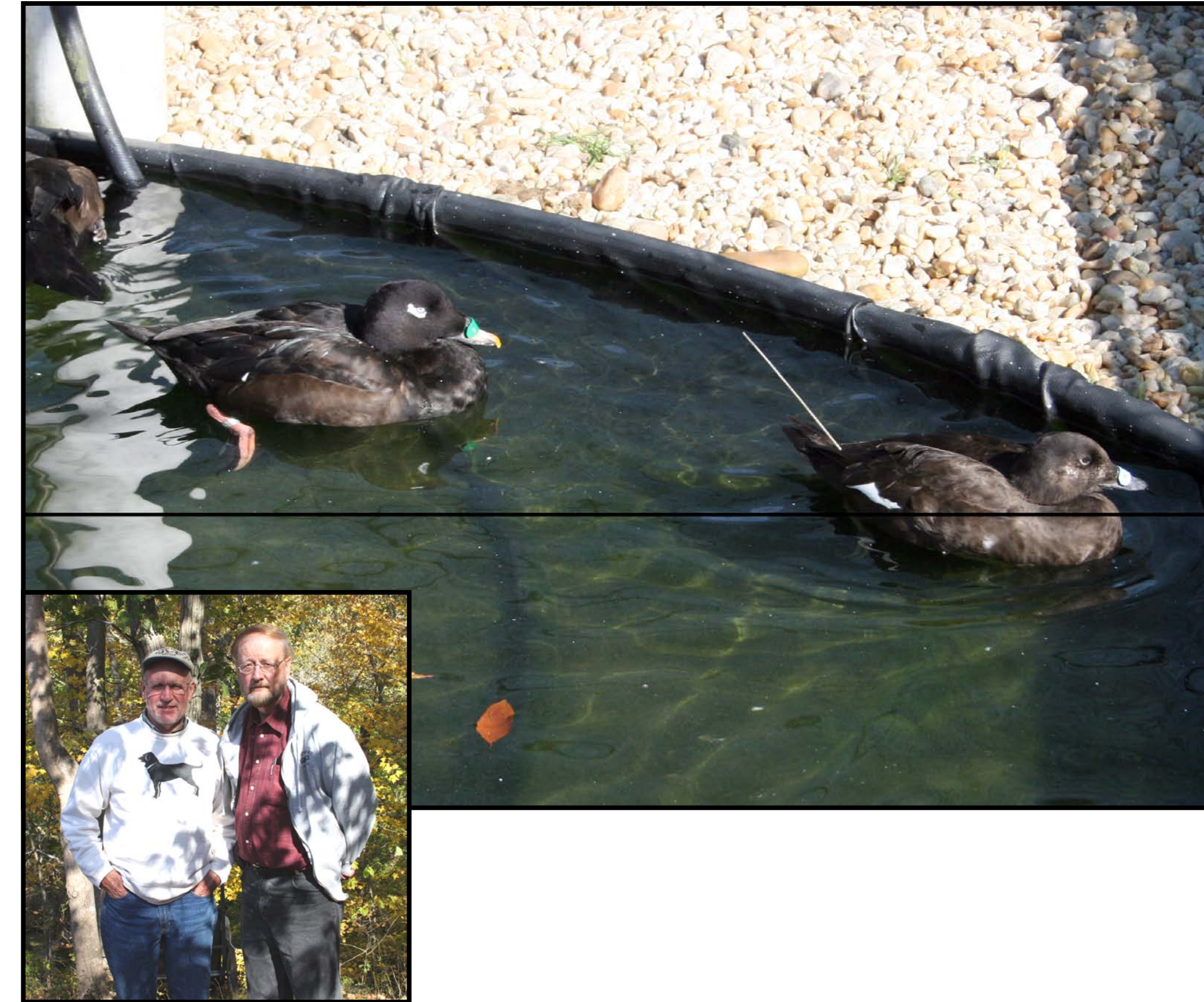


Table 1. Hematology and serum chemistry results for White-winged Scoter implanted with radio transmitters and controls with no implants. Blood samples were collected in November 2007 and February, April and July 2008 at the diving duck research facility at USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

	Controls		Implants		F	P
	Mean	SE	Mean	SE		
Hematology:						
PCV %	50.0	0.7	44.1	0.7	34.5	0.0000
Total Solids g/dL	5.83	0.14	5.71	0.15	0.34	0.5625
WBC	1650	480	1921	495	0.15	0.6969
RBC 10 ⁶	2.58	0.0899	2.42	0.0929	1.49	0.2316
Serum Chemistries:						
ALK PHOS U/L	137.69	14.70	171.75	16.98	2.30	0.1414
GGT U/L	3.000	0.704	4.200	0.704	1.45	0.2384
AST U/L	23.375	10.594	77.533	10.941	12.6	0.0013
ALT U/L	19.563	2.868	29.133	2.962	5.39	0.0275
Amylase U/L	549.13	30.54	479.33	31.55	2.53	0.1228
Glucose mg/dL	188.31	12.11	211.53	12.51	1.78	0.1927
Phosphorus mg/dL	2.56	0.25	2.64	0.30	0.04	0.8377
Calcium mg/dL	9.79	0.24	9.83	0.24	0.01	0.9088
Cholesterol mg/dL	279.00	12.63	263.80	13.05	0.70	0.4095
Uric Acid mg/dL	6.10	0.75	5.56	0.75	0.26	0.6178
CK U/L	300.75	29.00	378.07	31.00	3.32	0.0793
Creatinine mg/dL	0.74	0.03	0.77	0.03	0.42	0.5224
Total Protein g/dL	4.83	0.23	5.50	0.25	3.79	0.0616
Albumin g/dL	1.55	0.08	1.56	0.08	0.01	0.9318
Globulin g/dL	3.30	0.19	3.94	0.20	5.26	0.0296
A/G ratio	0.5000	0.0350	0.3929	0.0374	4.37	0.0458

PCV = packed cell volume, WBC = white blood cells, RBC = red blood cells, ALK PHOS = alkaline phosphatase, GGT = gamma-glutamyl transpeptidase, AST = aspartate aminotransferase, ALT = alanine aminotransferase, CK = creatine kinase

Table 2. Spatial and event behavioural observations recorded for White-winged Scoter with and without implanted radio transmitters, during the period of November, 2007 through October 2008 at USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA

	Controls		Implant		F	P
	Mean %	SE	Mean	SE		
Spatial:						
Water	80.388	3.1026	73.373	3.3301	2.38	0.1245
Land	19.613	3.1026	26.626	3.3301	2.37	0.1245
Behaviour:						
Rest	39.609	2.9676	31.364	3.1852	3.59	0.0593
Sleep	19.010	3.2474	28.859	3.4854	4.27	0.0397
Stand	3.491	1.0899	2.612	1.1698	0.30	0.5833
Swim	11.955	1.7379	9.282	1.8653	1.10	0.1734
Walk	1.099	0.2874	1.013	0.3085	0.04	0.8389
Groom	20.086	2.5774	25.217	2.7663	1.84	0.1759
Dive	0.502	0.1945	0.282	0.2088	0.59	0.4421
Nesting	2.500	0.9222	0.000	0.9898	3.41	0.0657
Other	1.748	0.4569	1.372	0.4904	0.31	0.5753

Figure 1. Aspartate aminotransferase values for White-winged Scoter with implanted transmitters (Trans.) and controls. First serum sample collected in November 2007 at the time of the implant surgeries. Subsequent serum collection dates were February, April, and July 2008.

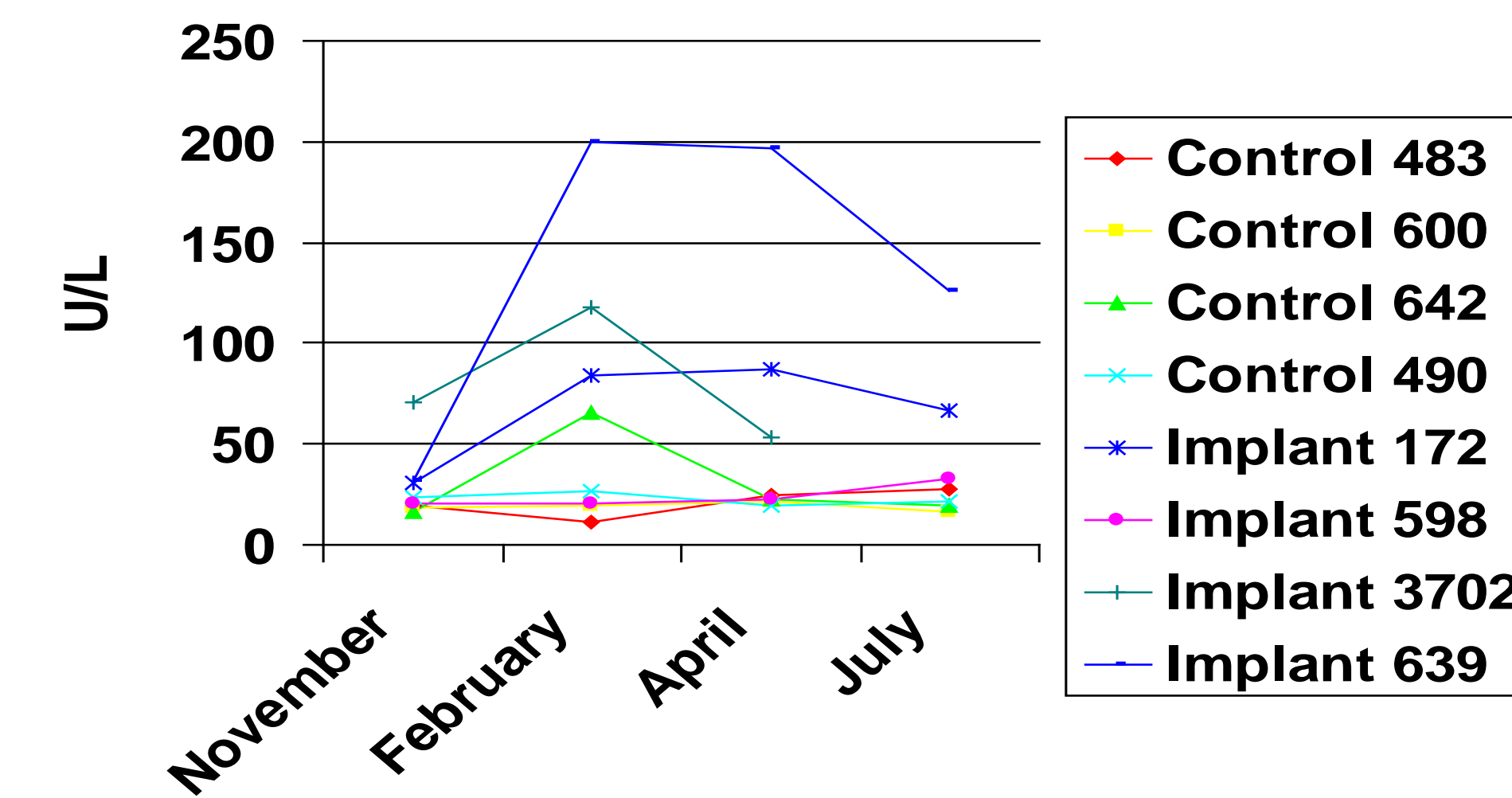


Figure 2. Spatial activity budget of White-winged Scoters with coelomic radio transmitter implants and without (controls) as studied at USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA, November 2007-October 2008.

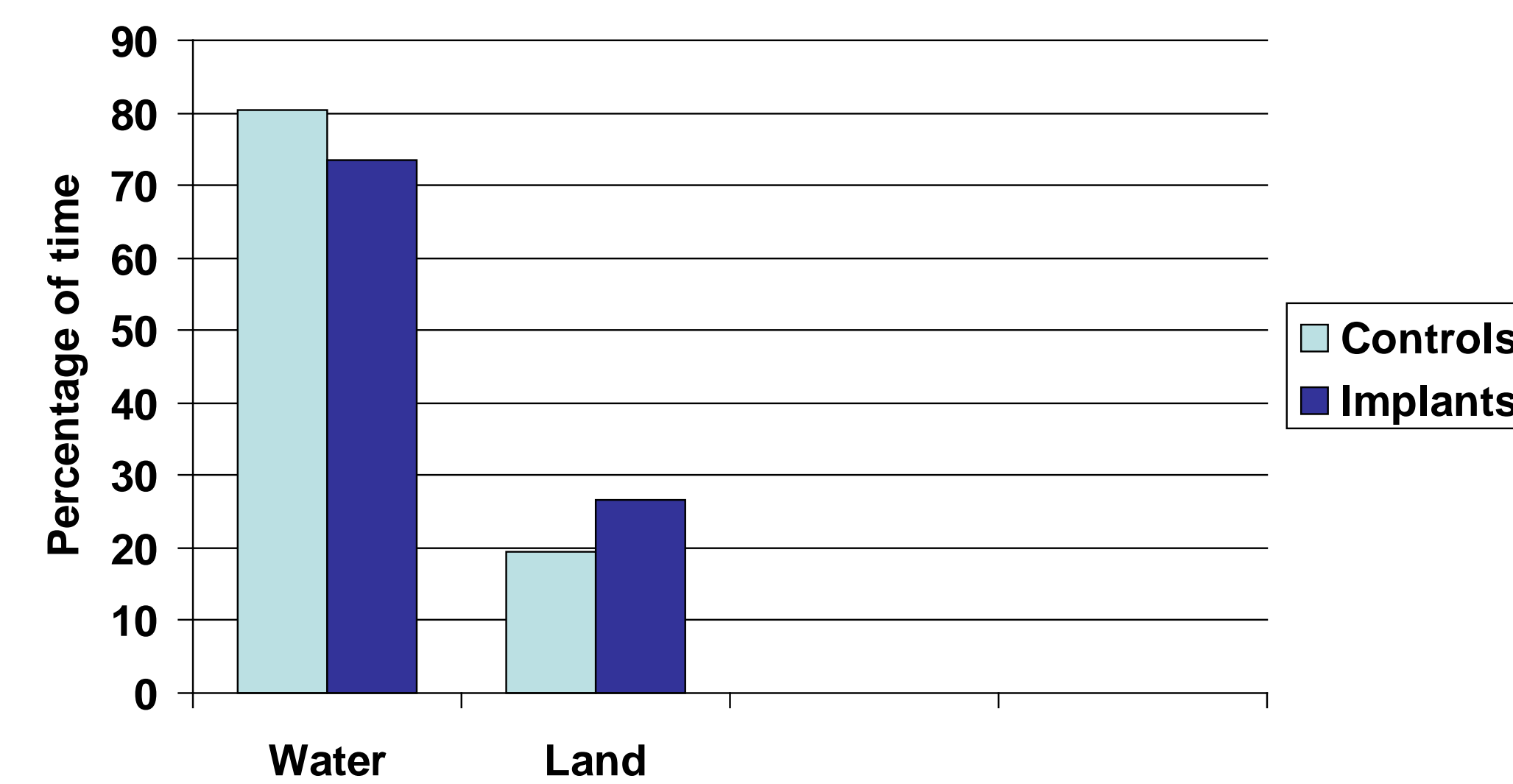
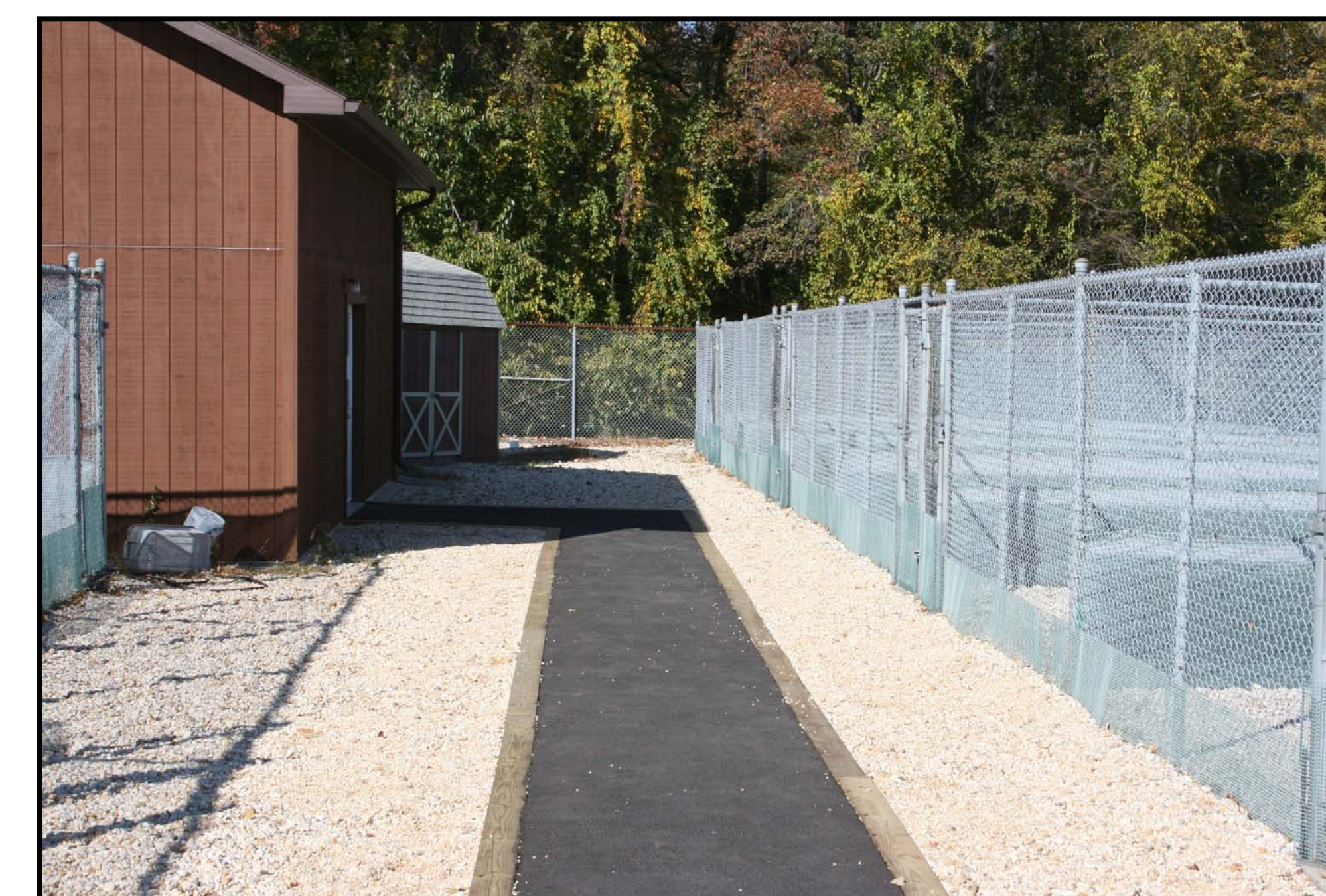
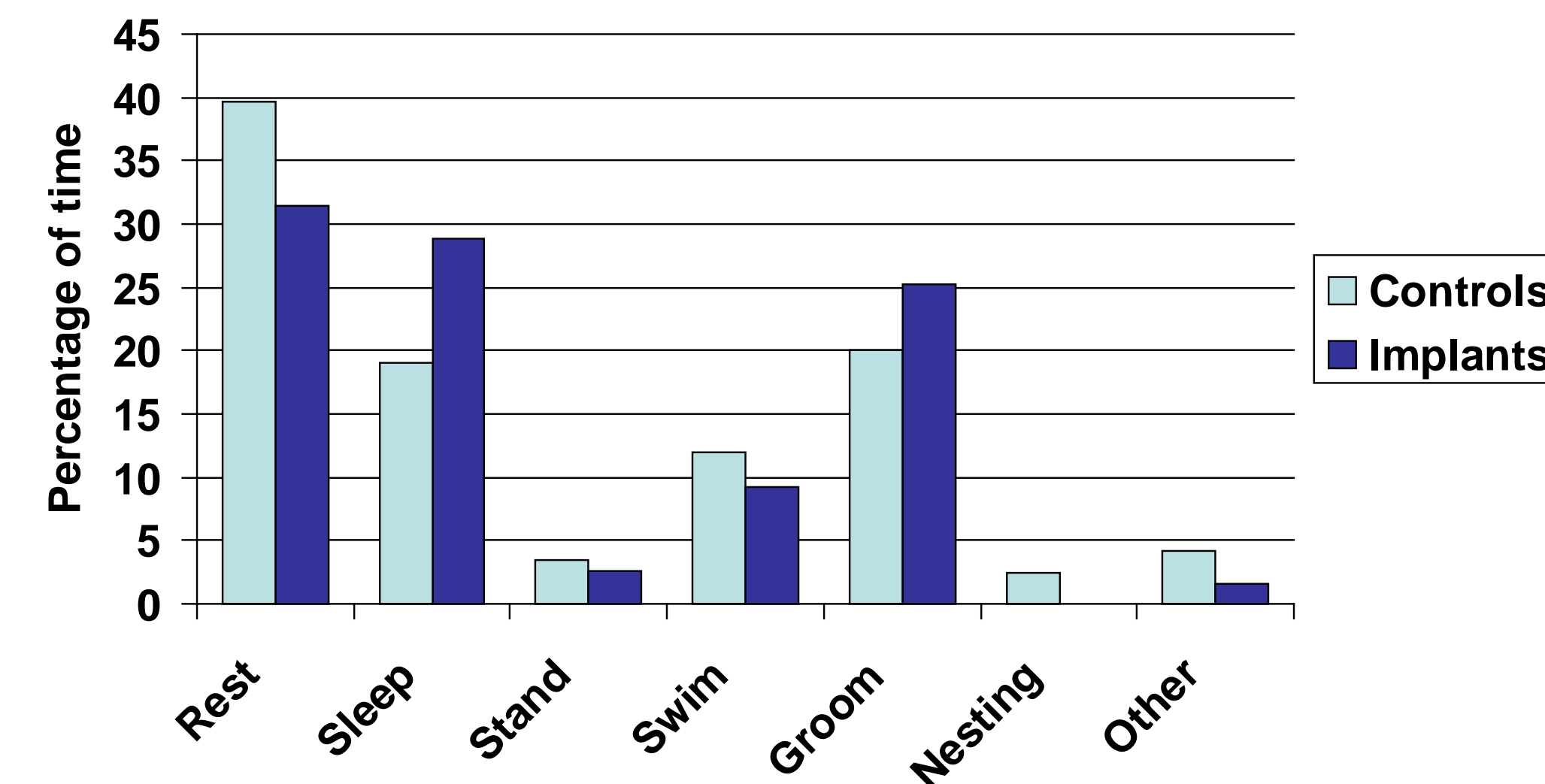


Figure 3. Behaviour activity budget for White-winged Scoters with surgically implanted radio transmitters or without (controls) at USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA during the period November 2007-October 2008.



DISCUSSION

These results show problems with the hematology and serum chemistry levels. Packed cell volume is significantly lower for transmitter implanted scoter than for the controls. Enzymes associated with the liver (aspartate aminotransferase, AST) and globulin are elevated in the implanted scoters as compared to the controls. These birds were implanted with the larger 39 gm transmitters which may be large enough to cause some rubbing or irritation on the right liver lobe. Possibly the 26 gm transmitter would be a better choice to avoid this problem. It should be noted that this elevated AST level did not occur in all four implanted scoters.

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