Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects – FY 2010

# EFFECTS OF GAVAGE FEEDING AND EXTENDED POST-OPERATIVE CARE ON SEADUCKS AFTER IMPLANTATION OF SATELLITE TRANSMITTERS

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Scott L. Ford, DVM, Dipl. ABVP-Avian
Avian Specialty Veterinary Services of Alaska
6709 Helena Dr. NE
Bremerton, WA 98311
(360) 271-7000
akeaglevet@yahoo.com

Matthew C. Perry, PhD
Patuxent Wildlife Research Center
U.S. Geological Survey
12100 Beech Forest Road
Laurel, MD 20708
(301) 497-5622
mperry@usgs.gov

Alicia M. Berlin, PhD
Patuxent Wildlife Research Center
U.S. Geological Survey
12100 Beech Forest Rd
Laurel, MD 20708
(301) 497-5730
aberlin@usgs.gov

Glenn H. Olsen, DVM, PhD
Patuxent Wildlife Research Center
U.S. Geological Survey
12302 Beech Forest Rd
Laurel, MD 20708
(301) 497-5603
glenn_olsen@usgs.gov

In partnership with: U.S. Geological Survey (Patuxent Wildlife Research Center), Canadian Wildlife Services, Mass Audubon, Cape Wildlife Center


## Project Description

Our objective has been to investigate methods for reducing stress and improving the condition of wild-caught long-tailed ducks (LTDU) and black scoters (BLSC) undergoing implantation of intracoelomic platform transmitting terminals (PTTs). LTDU and BLSC were studied in conjunction with other satellite transmitter projects in Nantucket (November, 2009) and Cape Cod, MA (March, 2010) and in the Bay of Chaleur, New Brunswick (May, 2010). General methodology involved collection of serum and fecal corticosterone samples and blood samples for complete blood counts (CBC) to document physiological effects of stress. Body mass and feather condition were also tracked. Treatments included subcutaneous fluid administration, tube-feeding an elemental diet, keeping the ducks in net-bottomed kennels, and providing opportunities to bathe in water for short periods of time.

## Objectives

As indicated in the Sea Duck Joint Venture Strategic Plan, there are ongoing questions about the effects of implanted satellite transmitters on behavior, reproduction, and survival.[1] This study provided additional data about the physiologic effects of capture, surgical implantation, and post-operative care. In addition, we documented the benefits, and detriments, of tube-feeding (gavage) an elemental diet and allowing extra time post-operatively for re-alignment and cleaning of plumage. The expectation was that data from this project can aid in the further refinement of perioperative management techniques for field surgeries. This should improve post-implantation survival rates and decrease behavioral and reproductive bias induced by surgery.

## Preliminary Results

Twenty-one LTDUs were used in the study at Nantucket in November, 2009. An additional 22 LTDUs (out of 30 captured and implanted) participated in the project in Cape Cod in March, 2010. With BLSC captured at the Bay of Chaleur in May, 2010, blood and fecal samples were not collected although weights were monitored. Also, ducks were held for a shorter time period. These changes were due to time constraints and a higher priority towards implantation of PTTs. In the other two sites, samples gathered included blood smears, serum, and droppings at capture and every morning until release or until day 3 post-capture, whichever came first. Body weight was also recorded 2-3 times daily. Blood and fecal samples were processed at the respective base facilities. A veterinary reference laboratory (Phoenix Veterinary Laboratories, Everett, WA) performed CBC analysis and a zoological endocrinology laboratory (St. Louis Zoo, St Louis, MO) performed corticosterone analyses. All data was received and entered into a custom-built Microsoft Access database that Dr. Ford created.

During each of these trips, Dr. Ford also assisted projects by performing PTT implant surgeries, assisting in capture efforts, and performing general care of the study subjects.

Statistical analyses are still underway. Thus far, capture CBCs have been compared by gender and capture site using single-factor ANOVAs. No significant differences in CBC analytes have been found by gender. By site, it was found that ducks in the Cape Cod group had a significantly ($P<0.05$) higher heterophil to lymphocyte ratio at capture as did ducks captured at Nantucket 3 months earlier. An increased heterophil to lymphocyte ratio can be an indication of acute stress in ducks.

Some helpful observations were made that helped shape our post-operative management on these field trips and could be important for future trips. It is important to realize that these points could change as data are more completely analyzed.

First, there seems to be a correlation between gavage feeding of Carnivore Emeraid and loss of waterproofing, particularly after about 48 hours post-capture. Not all gavage-fed ducks developed waterproofing issues, but all that did were being gavage-fed. We suspect that this is due to contamination of the feathers with either fats or proteinaceous surfactants passed in the feces. There are several potential contributing factors to this including the high fat content of the diet, fecal-contamination of bath water, and the reduced efficiency of digestion inherent to animals under severe stress. Further research is needed to elucidate which of these aspects may be most critical. The Lafeber Company and others are conducting further research into carnivore critical care diets, including supplementation with blended animal proteins, and so there may be more data available and diet improvements in the near future.

Second, there seems to be a weight maintenance advantage to the use of gavage feeding of Carnivore Emeraid. In general, it appears that ducks receiving gavage feeding held weight better or actually increased weight over those receiving only subcutaneous fluids, although the degree of advantage appears quite variable. The difference seemed to be greater the longer the ducks were held in captivity. Again, more detailed analyses of the data are necessary and will follow.

Third, bathing and waterproofing issues were significant. These seemed to be most severe after about 2 days of captivity and, as previously mentioned, only in ducks undergoing gavage treatment. We found that brief dipping of ducks (as opposed to prolonged bathing) was adequate for a quick assessment of feather waterproofing. Brief baths or dipping were preferred when only small bathing pools were available as this prevented contamination of feathers. Also, it seemed that allowing ducks to dry and preen prior to release is preferred as there were fewer immediate post-release issues (sinking, beaching) when ducks were released dry.

Fourth, ducks seemed to do better when caged in male/female pairs. Housing of two males together, with or without females present, seemed to induce more unrest and physical confrontations. The ducks were also much more fractious when approached. However, when housed in pairs, the ducks stayed close together and did not seem as likely to fly until an attempt was made to capture them. This mimics their behavior during capture on the ocean as often the male would stay very close to the female whether she stayed on the water or flew away. Although physical injuries were limited (abraded wings on one female and a corneal abrasion on one male), they occurred only when ducks were housed singly.

Fifth, there were difficulties in sampling encountered. Body weights collected onboard boats in rough conditions appeared to be highly variable. It is probably best to weigh the ducks immediately after return to the holding area. Waiting until the next morning is probably not adequate as the ducks do seem to lose a significant amount of weight in the first 12 hours post-capture. Treatment (gavage feeding or subcutaneous fluids) immediately after return to the holding area should also be considered. Ducks did not produce sufficient volumes of droppings during sampling periods (9-12 am every morning) and often not upon capture either. A review of the literature indicated that several droppings samples are required to precisely track stress responses (e.g., corticosterone increases), particularly in ducks since there is a high degree of heterogeneity to feces and variable amounts of urates and urine admixed with fecal material. Also, without special caging, collection of feces required frequent disturbance and required individual caging, which is probably more stressful. It was also found that weighing ducks in mesh bags and weighing them more than twice daily was also excessively stressful. Because of this, part way through the study the weight frequency was reduced to twice daily and a covered aluminum container and flat digital scale were utilized to determine body mass.

Based on preliminary data, current recommendations for peri-operative management of seaducks undergoing intracoelomic implantation of PTTs, are:

1. Weigh and band ducks on-shore as soon after capture as practicable.
2. Administer subcutaneous fluids immediately upon admission to the holding area and every 12 hours thereafter until surgery.
3. Surgery should be performed within 12-18 hours post-capture to avoid prolonged periods without alimentation.
4. After surgery, seaducks should receive Emeraid Carnivore gavage at 5% of body weight 2-3 times daily until release.
5. Bathe or dip (or perhaps mist) seaducks briefly in fresh, clean water twice daily. They should be allowed to dry prior to release. Noting dryness of contour feathers and down on the breast, ventral midline abdomen, paramedian abdomen, and interscapular region seems to be a quick and useful method for assessing waterproofing.
6. House seaducks in pairs on net-bottomed racks in cages wide enough to allow extension of the wings. Airline kennels or typical Shorline cages available at most veterinary clinics will suffice. Covers should be used on the cage fronts to limit visual contact with people. Small pet carriers are adequate for transporting ducks, in pairs, from and to the field but not for long-term captivity.
7. Abandon fecal sampling for future stress studies in the field since there seems to be a limited return for the added degree of stress induced. Other sampling techniques may be adjusted pending results of hematology and serum corticosterone measurements. Body mass should continue to be measured twice daily using a stable, covered container and digital scale.
8. Reduce or eliminate subcutaneous fluid administration post-operatively and provide gavage feeding only. This could reduce handling times and care workload significantly. Subcutaneous fluids would still be required pre-operatively.

### Project Status

Study goals were largely met. Fifty-one LTDUs were sampled and should provide enough data to form a basic understanding of weight and stress trends in wild-caught seaducks subjected to captivity and surgery. These data will help refine future related studies.

Obstacles encountered included difficulties in collecting samples in rough boating conditions, limited fecal droppings available for sampling, limited numbers of ducks captured, conflicting research goals, limited assistance for duck husbandry, and limitations in time (e.g., Dr. Ford splitting duties between research activities and surgical activities). Dr. Ford was able to collect blood reliably during rough boating conditions. Body mass could not be precisely measured, but this is easily overcome by weighing ducks on shore. Droppings were variably available and also varied in fecal quality. In the future, corticosterone studies conducted on wild seaducks should probably focus on rapid collection of serum vs. sampling feces. In Nantucket and, to some degree, in Cape Cod, it was difficult to predict the numbers of ducks that would be captured and to catch sufficient numbers of each gender. This will likely continue to be an uncontrollable factor, but could be addressed by ongoing application of the study design to portions of duck catches in future telemetry projects. Conflicting goals were minor but were encountered when the goals of this project conflicted with the rapid release goal of the partnering telemetry study. It is the author's opinion that this can be overcome by compromising on study design and holding ducks for no more than 36-48 hours. Based upon preliminary results, this seems to be a point of diminishing returns in benefits gained by holding the ducks. Also, it would be best to perform some portions of the study on captive groups of seaducks prior to implementation in the field. Limited assistance for husbandry and sample processing was largely due to the inability to provide a dedicated research assistant for this project. This could be surmounted by building in funding for a research assistant in the future. This leads into the last obstacle of PI time. With a research assistant, more ducks and samples could be processed and free up Dr. Ford to more readily collect samples in the field and assist partnering projects with PTT implants.

With further funding from SDJV, the authors would like to see further studies conducted on feather quality, tube-feeding, and in-the-field caging designs for seaducks undergoing intracoelomic implantation of PTTs. These studies should probably start with captive ducks in order to maximize field efficiency and avoid interference with partnering satellite transmitter studies. For example, when significant waterproofing problems were found in Cape Cod, there was real concern for its impact upon the survival of PTT-equipped ducks. Additionally, there were limited options for observation of the ducks after release so time required for re-waterproofing was not known. We

may have been able to predict (and avoid) the severity and duration of waterproofing problems seen at Cape Cod if we had performed some pilot studies with captive ducks first.