

# Effects of Keel Cushions on the Behavior of Western and Clark’s Grebes

## Entering Rehabilitation

Julie Skoglund BS<sup>1</sup>, Rebecca Duerr DVM MPVM<sup>1</sup>, Terra R. Kelly DVM, PhD, Dip. ACZM<sup>2</sup>, Lori Gaskins DVM<sup>3</sup>, DACVB, Christine V. Fiorello DVM, PhD, Dip. ACZM<sup>4</sup>

<sup>1</sup> International Bird Rescue Los Angeles, CA    <sup>2</sup>Wildlife Health Center, School of Veterinary Medicine, University of California - Davis, Davis, CA    <sup>3</sup>St. Matthew's University, School of Veterinary Medicine, Grand Cayman, Cayman Islands, BWI    <sup>4</sup>Oiled Wildlife Care Network, University of California - Davis, Davis, CA

### Introduction:

Keel lesions are a continual problem when working with oiled diving birds such as Western Grebes (Tseng, 1999; Phillips, et al., 2011). This species has comprised a significant proportion of birds collected during coastal oiling events in California (Hampton, et al., 2003). As an example, during the Ventura Oiled Bird Incident in 2005 over 1500 Western and Clark’s Grebes were admitted into care. Keel cushions are routinely used during the rehabilitation of these species to theoretically prevent development or worsening of these injuries during care, but published data regarding cushion use is lacking.



During previous OWCN and International Bird Rescue (IBR) responses these cushions have primarily been constructed of a rolled towel with Vetrap™ used to secure the cushion to the bird (OWCN 2008). The utility of this design is highly dependent on the skill of the person applying the wrap; it is also wasteful of materials, labor intensive, and a high failure rate. Consequently, several designs of reusable pre-manufactured wraps are currently being field tested on animals entering rehabilitation at IBR. Each design has pros and cons, and may elicit different behavioral responses. Calm behaviors are likely to improve individual’s final outcome, whereas, behaviors such as flipping over are likely to be detrimental. This study aims to objectively compare the behavior of birds wearing two reusable designs and the older Vetrap™ and towel style cushion with birds wearing no cushion whatsoever. The ultimate goal of the study is to identify a design that can be mass-produced and used during oil spills.

### Experimental Plan:

Study conducted on forty-one oiled and non-oiled Western and Clark’s Grebes at Los Angeles Oiled Bird Care & Education Center in San Pedro, California. All birds entered in study had not been previously placed on a keel cushion and were cared for using standard IBR/OWCN oiled bird protocols. Each bird was randomly assigned to one of four treatment groups: 1) No keel cushion, 2. Vetrap™ and towel cushion, 3) prefabricated U-shaped cushion, and 4) prefabricated parallel cushion. The same person (JS) applied all keel cushions. Birds were placed in a soft-sided pen and videotaped for 30 minutes undisturbed. Specific behaviors were timed (Table 1). All grebes that flipped over and were unable to return to normal position on their own were manually turned upright after 5 minutes passed.



Vetrap™ and towel cushion

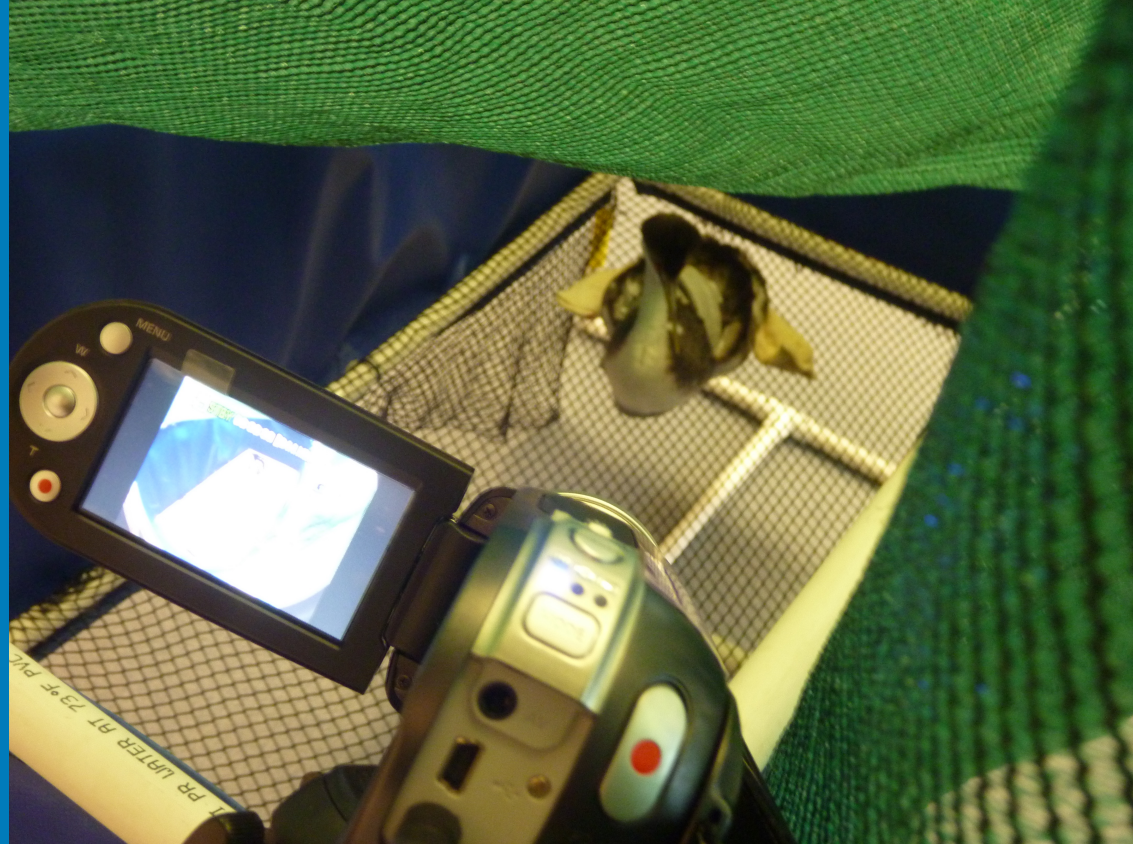


prefabricated U-shaped cushion



prefabricated parallel cushion

All videos were assessed by the same observer (LG), and an ethogram of each bird’s behavior was created (Table 1). Time budgets during each study session were assessed by quantification of seconds spent engaging in each behavior. Behaviors were classified as detrimental or non-detrimental (Table 1). The length of time spent engaging in each behavior was compared among birds in different groups.



Behavior	Behavior Pattern	Classification	Description
Flip	STATE	Detrimental	Roll over into lateral or dorsal recumbancy
Sleep	STATE	Non-detrimental	Sternally recumbent and immobile, with neck flexed and beak resting on bent neck
Stand	STATE	Non-detrimental	Sternal recumbancy, hocks bent and weight resting on keel
Walk	STATE	Non-detrimental	Forward movement while standing from one area of pen to another
Out of Sight	STATE	N/A	Out of view of camera
Vocalize	EVENT	Non-detrimental	Vocalization
Defecate	EVENT	Non-detrimental	Any elimination of droppings from the cloaca
Jump	EVENT	Detrimental	Momentary extension of legs from a sitting position causing forward movement
Flap	EVENT	Non-detrimental	Extend wings and flap up and down
Head Shake	EVENT	Non-detrimental	Shake head laterally from side to side
Pick	EVENT	Non-detrimental	Pick with beak at foot coverings or anything in environment
Preen	EVENT	Non-detrimental	Run beak through feathers or on cushion, or rub head on dorsal back

Table 1. Table of ethogram listing behaviors

### Data analysis:

Kruskal-Wallis and Fisher’s exact tests used to evaluate differences among treatment groups. Pairwise comparisons performed using Mann-Whitney U and Fisher’s exact tests with Bonferroni correction if statistical tests showed significant differences between groups. R statistical software used for data analysis.

#### Detrimental behavior - flipping over, able to return to normal position on own:

- Five of 10 grebes in each U-shaped and Vetrap™ treatment groups flipped over. Only three of 11 grebes in parallel treatment group flipped over, and none of the 10 grebes in control group flipped over (Figure 1).
- Proportion of grebes in U-shaped, Vetrap™, and parallel treatment groups that flipped over during experiment all significantly higher than control group ( $p = 0.03$  for all three comparisons).
- Number of times grebes flipped over during the experiment significantly higher in U-shaped and Vetrap™ treatment groups relative to control group ( $p = 0.01$  for both comparisons). No difference in number of times grebes flipped over between parallel treatment group and control group.

#### Detrimental behavior - flipping over, unable to return to normal position on own:

- Six grebes (3 with U-shaped treatment, and 3 with Vetrap™ treatment) flipped over and required manual manipulation to return to normal position.
- Proportion of time grebes in U-shaped treatment group spent flipped over during the experiment was significantly higher than control group ( $p = 0.01$ ) (Figure 2).

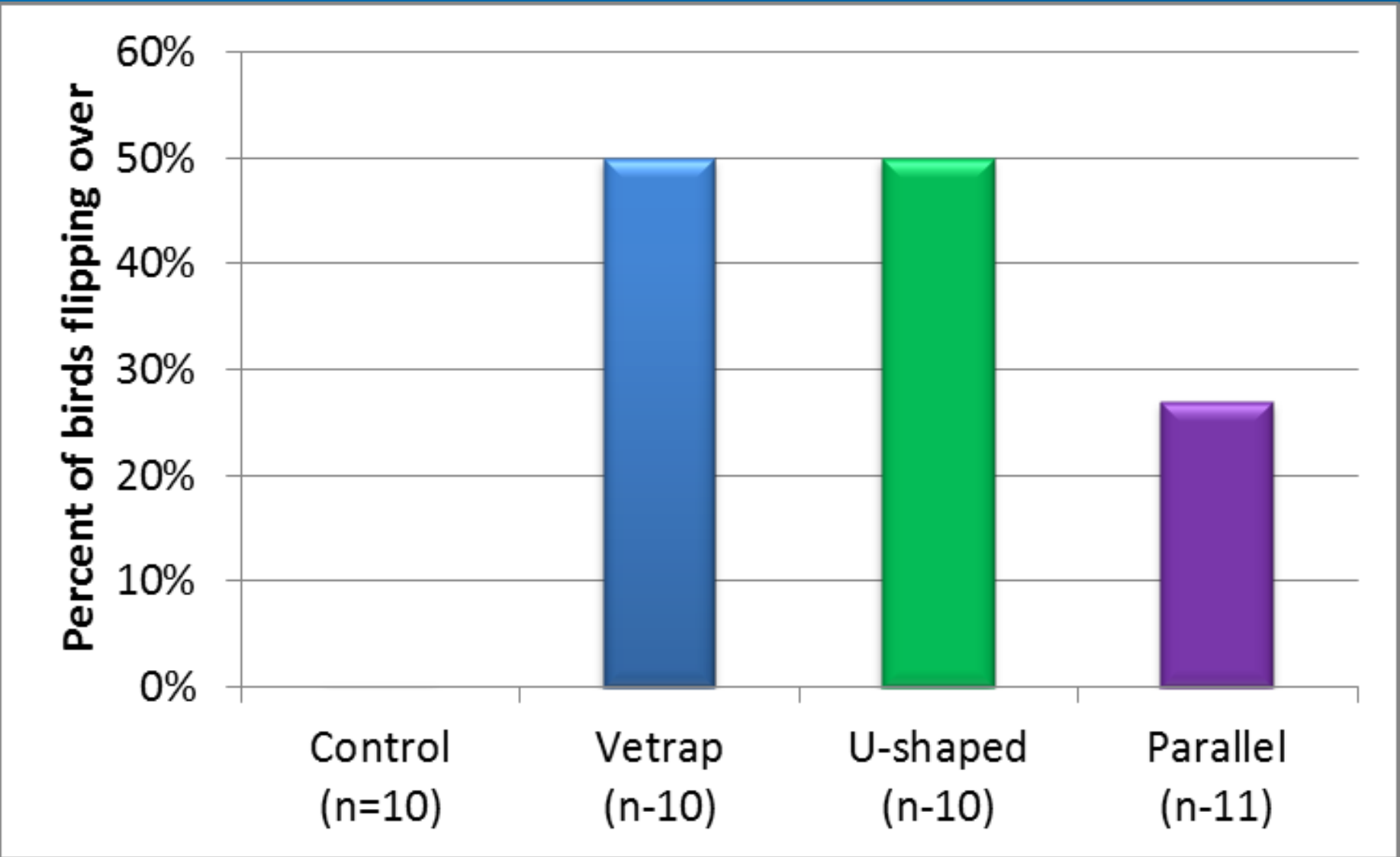


Figure 1

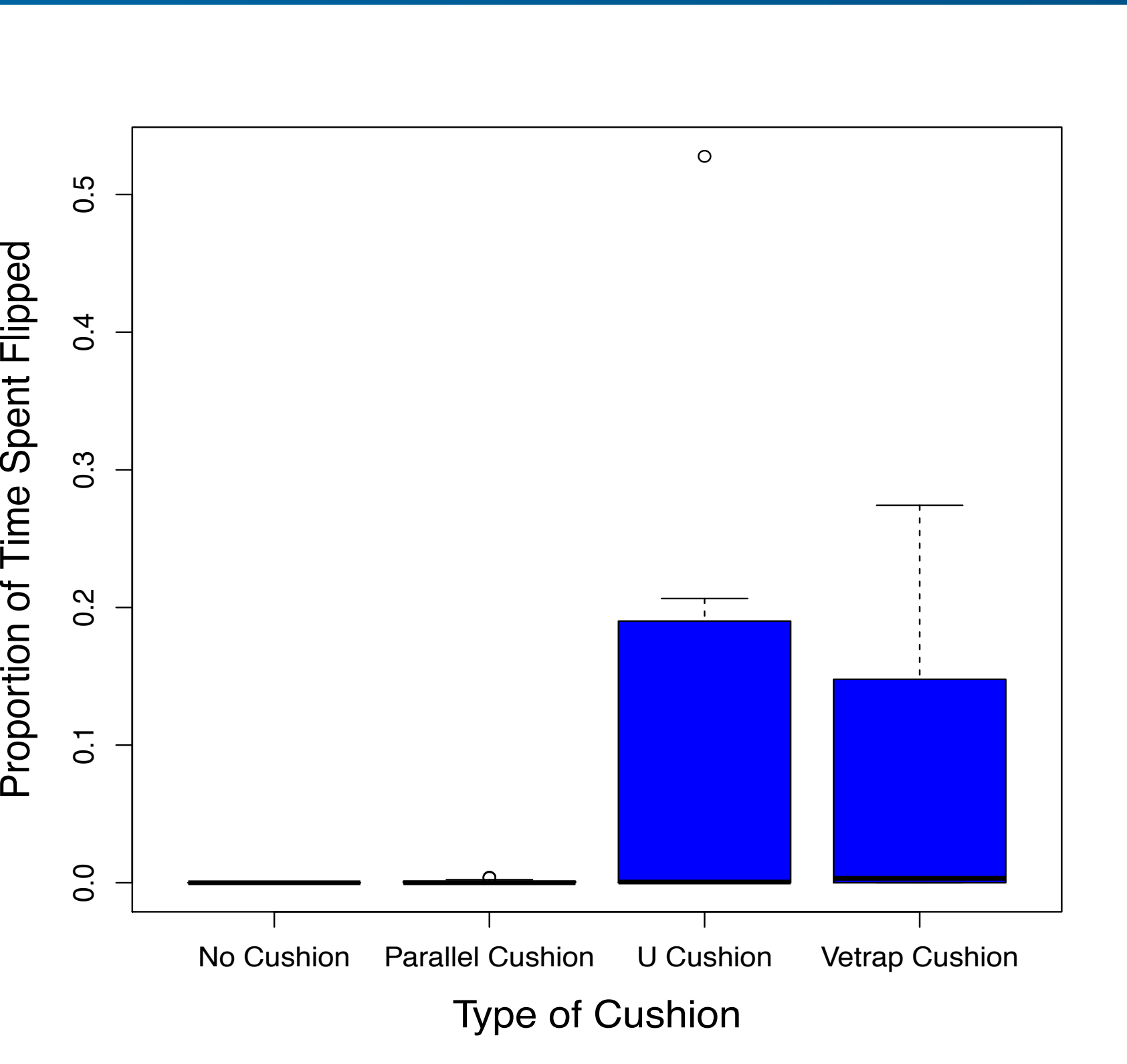


Figure 2

- Proportion of time grebes in Vetrap™ treatment group spent flipped over was significantly higher than control group ( $p = 0.01$ ) (Figure 2).
- Proportion of time grebes spent flipped over between control and parallel treatment groups was not significant (Figure 2).
- No other significant differences in the proportions of grebes exhibiting the different behavior types between control and treatment groups.
- Proportion of time spent exhibiting behaviors and number of times grebes exhibited behaviors were not significantly different between the control and treatment groups for any other behaviors evaluated in this study.

### Conclusion:

The results of this study show that applying any one of the 3 keel cushion designs to a Western or Clark’s Grebe initially causes increased stress. This study also shows the greatest risk to grebes is the use of a U-shaped or Vetrap™ keel cushion. The parallel keel cushion shows an improvement in the grebe behavior as compared to the other two designs, although a larger sample size is needed to explore this outcome more thoroughly. The shape of the parallel cushion might make it easier for the birds to return to normal position, but we know anecdotally from rehabilitation in our clinics that birds do flip over and get stuck on their backs in the parallel keel cushions. No keel cushion shows the least risk to the grebes’ overall, but development of a keel lesion from no keel cushion could also lead to their death since it is common to euthanize birds with keel lesions during oil spills. If a keel cushion is going to be used, the parallel keel cushion would be the preferred keel cushion, but it too would need to be used with caution and each individual would need to be monitored closely.

Further research needs to be done to examine other keel cushion designs for grebes. Specifically, the following questions need to be explored:

- Do keel cushions successfully prevent the injuries we are hoping they prevent (i.e. keel lesions and hock lesions)?
- Do the benefits of application outweigh the time investment during busy spills that could be invested in other care activities (e.g. more meals delivered)?
- What is the frequency of injury and death caused by applying keel cushions?
- How do detrimental behaviors such as flipping vary when different people apply keel cushions, with various skill levels?
- What is the rate of keel cushion malfunctions (i.e. cushion slippage or rotation) when various people apply keel cushions, with various skill levels?
- What is the success of keel surgeries and are they are a more viable investment of time and resources?
- Does the use of more elevated keel cushions help with hyperflexion of the hocks or with the prevention or worsening of pressure sores on the hocks?
- How do grebes adjust or get use to wearing a keel cushion over time?
- How do other species do with different keel cushion designs?
- What depths of keel cushion is required for grebes and different species?
- Is the parallel keel cushion an optional depths for Western and Clark’s Grebes?

### References Cited:

Hampton S, Ford R, Carter H, Abraham C, Humple D. 2003. Chronic oiling and seabird mortality from the sunken vessel S.S. Jacob Luckenbach in central California. Marine Ornithology 31: 35-41.  
Oiled Wildlife Care Network. Keel cushion application. Available at: <http://www.vetmed.ucdavis.edu/whc/owcnpdfs/keelcushion.swf>. Accessed July 20, 2011.  
Phillips EM, Zamon JE, Nevins HM, Gobble CM, Duerr RS, Kerr LH. 2011. Summary of birds killed by a harmful algal bloom along the south Washington and north Oregon coasts during October 2009. Northwestern Naturalist 92: 120-126.  
Tseng FS. 1999. Considerations in care for birds affected by oil spills. Sem Avian Exotic Pet Med. 8:21- 31.

### Acknowledgments:

This project was supported by the California Department of Fish and Wildlife’s Oil Spill Response Trust Fund through the Oiled Wildlife Care Network. Many thanks to the staff at Santa Barbara Care Network, California Wildlife Center and International Bird Rescue who cared for these animals, and assisted with coordinating expedited transport for the study.

