Proposal to Reduce American Crow Predation on California Least Tern Eggs at the Venice Beach Least Tern Colony.

The American Crow was first noted as a predator on California Least Tern eggs at the Venice Beach Least Tern Colony as early as the mid-1980's. Colony managers effectively countered this threat by placing crow carcasses on the colony and hanging them from the fence. This apparently was sufficient to resolve the problem. In the 2000's efforts were increased to include trapping crows using traps baited with quail eggs. This was also very effective in both reducing the "egg-eating" crow population and appeared to scare the crows off the colony for several days. This gave the terns the opportunity to increase the numbers of nests present, thus the number of adults committed to defend the colony. This was effective until 2008. Since 2008, least tern nest settlement patterns have changed. Fewer nests are being initiated each day at the beginning of the nesting seasons and the adult least terns are departing the colony by 9-10 am. Colony managers speculate that this is related to a lack of foraging resources close to the colony causing adults to spend more time away from the colony.

We suggest that techniques used in past years, including placement of carcasses and trapping using egg baited traps be continued, but will not be sufficient. We suggest that large-scale control of crow populations is unfeasible due to large adjacent replacement populations. Following up discussions among wildlife managers during the 2012 season, we propose the following course of action for the 2013 season.

Employ Conditioned Taste Aversion

It is unlikely that control of local crow populations will ever be a feasible option due to the large potential replacement population in adjacent neighborhoods and unlimited food supplies. Colony managers therefore must deal with the crows as a permanent part of the avifauna of Venice Beach. We suggest training the local crows not to eat eggs using conditioned taste aversion. To form a conditioned taste aversion an animal must ingest a harmful food item and associate the resulting illness after a single or small number of exposures with identity cues of that food (Nicolaus and Nellis 1987). The taste and associated cues such as color, size, shape or smell can all be used to identify a no longer desirable food item. Conditioned taste aversion can be caused deliberately by administering an emetic, and has been successfully tested in a number of predator species for exploitation in non-lethal predator management (e.g. Nicolaus et al. 1983, Nicolaus and Nellis 1987, Conover 1990, Cox et al. 2004).

Currently, several compounds that have been shown to provide non-lethal conditioned taste aversion, Mesurol, carbachol and ipecac. Of these, Mesurol is Federally registered for taste aversion and could be permitted by the California Department of Pesticide Regulation using their Research Authorization. We suggest using Mesurol in Japanese quail eggs and abandoned least tern eggs during the months prior to egg laying by least terns (February 25 to May 10), and continuing treatments until incubation peaks at approximately June 15. We will observe the results both during the trials with the eggs and then how the crows react to the presence of tern eggs to determine the effectiveness of this technique at the Venice Beach Colony.

Proposed Methods

Egg Preparations.

Following the manufacturer's label recommendations, we propose having the biologist prepare eight batches of 48 treated quail eggs within 48 hours of their deployment to the Colony. If we are able to obtain abandoned least tern eggs, these would also be prepared in a similar manner, scaled to the number obtained.

The recipe outlined below is for preparing a batch of 48 treated eggs.

1. Place 48 unbroken, un-cracked eggs in an object such as an egg-shipping container that will hold eggs of the size selected vertically in place.

2. Using a 14-gauge hypodermic needle at least 1-inch long and mounted on a disposable plastic syringe, puncture the large end of each egg. Taking care not to crack the egg shell. Making the hole only large enough for the needle to pass in and out easily. Remove 4 ml of egg contents (white and yolk mixed) from each egg, and transfer this material to a 300-ml glass or plastic beaker.

3. Transfer the combined 192 ml of egg contents withdrawn as indicated above to a blender. Add the entire contents of four additional eggs of the same species. Set the blender to "Low" and mix for 3 seconds. Allow the froth to settle and pour 120 ml of the mixed egg material into a 200-ml beaker. Discard the remainder of the mixture.

4. Place 2 grams of Mesurol 75% Wettable Powder Aversive Conditioning Egg Treatment in a 50-ml beaker and add 30 ml of warm, potable water. Stir contents to suspend the product in the water.

5. Pour the Mesurol suspension into the 200-ml beaker containing the mixed egg material. Stir the resulting mixture until the components are thoroughly combined.

6. Using another 5-ml plastic syringe equipped with a different 14-gauge hypodermic needle, inject each egg with 3 ml of the combined Mesurol-egg mixture. Inject the material slowly and throughout the inside of the egg to prevent contents from oozing out of the hole. Retain any residual Mesurol-egg Mixture for disposal as pesticide waste at an approved waste disposal facility.

7. Seal the egg with hot-melt glue or an almond or white-colored caulking compound.

8. A nylon black cable tie will be superglued to it along 2 cm of their widest side, or eggs can be superglued to a block of wood that would prevent to crow from moving the egg outside of the colony fence.

9. Mark each treated egg with the word "POISON" and refrigerate until time for use. Place treated eggs in a container marked "POISON" before transporting or distributing eggs.

10. Follow proper handling procedures. To prepare eggs with Mesurol 75% Wettable Powder Aversive Conditioning Egg Treatment, applicators and other handlers must wear:

- Coveralls over short-sleeved shirt and short pants
- Chemical-resistant or waterproof gloves
- Protective eyewear
- Chemical-resistant footwear plus socks
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing, or loading
- Handlers must wear:
- Disposable Dust Filtering Respirator. A dust mask must be worn while mixing loading the wettable powder formulation.

All Users Will:

- Wash hands thoroughly with soap and water after handling this product and before eating, drinking, or using tobacco.
- Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.
- Follow the manufacturer's instructions for cleaning and maintaining PPE. If no such instructions are provided for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately if product gets inside and dispose of PPE according to State and Local regulations. Wash exposed body parts thoroughly and change into clean PPE to continue working with this product. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. Wash exposed body parts thoroughly and change into clean clothing.

Egg Deployment

We would deploy the 48 treated eggs during 5- days of every week from March 4 to June 15, deploying eggs on Mondays, checking them daily, then removing them on Friday (or Wed if they needed to be removed after 3 days, see below). If the mean high temperature for the period is 80 degrees Fahrenheit or higher, then treated eggs would be replaced after three days. Eggs will be checked daily and, if available, and time permits, predated or damaged eggs will be replaced. Treated eggs would be placed within the colony >300 ft from Ballona Creek and >300 ft from the high-tide line of the Pacific Ocean and >100 ft from the existing fence line. Six eggs will be placed within each of 8 of the existing 20 x 20 study grids randomly selected to meet distance criteria (no more than 20 per acres in any one acre). We will place eggs in areas typical of least tern nests, on small rises and dune tops, at first creating small false scrapes, then placing them within scrapes made by arriving least terns. Each egg will be attached to an anchor using the cable tie or glued to a wooden block so that it cannot be removed from the colony. Least tern decoy will be deployed adjacent to some treated eggs.

Upon initial deployment, an observer will remain at the colony from deployment to sunset, and then from sunrise to sunset the following day when the eggs are first deployed. Upon subsequent deployments the eggs will be observed for six-hours on the day of redeployment. During all other days that the baited eggs are available to crows within the enclosure, a 1-hour observation period will be implemented and eggs will be inspected. The purpose of the observation periods will be to observe the reaction of crows and least terns to the eggs, document instances of egg removal and/or predation, attempt to determine the fate of missing or disturbed eggs by studying any tracks that were left behind in their vicinity, and to determine if any illness or mortality has been caused to non-target species. During these checks, the ground may be smoothed adjacent to the treated eggs in order to better detect wildlife tracks.

We will measure success of the taste aversion in several ways.

1) **Observe Crow Behavior.** An observer with a spotting scope will position themselves within a blind from which they can observe a large number of the treated eggs. They will observe crows that land within 3 m of the egg. They will note if the crow approaches and observes the egg within 1 m. if it touches the egg, if it breaks the eggs, if it consumes the contents, and any visible reaction to consuming the contents (i.e. no reaction, appears lethargic or disoriented, shows signs of physical debilitations such as stumbling, inability to fly, vomits, loses consciousness, etc.). These observations will be made on a daily basis following egg deployment. Success will be measured by crows consuming treated eggs and exhibiting illness, lethargy or other distressed behaviors.

2) **Comparison of Crow Attendance with Prior Years.** Observers will score crow activity at the colony in the same manner as volunteers have for the past 5 breeding seasons by 1) estimating the total number of crows in the area between the lifeguard tower and the breakwater, 2) counting the total number of fly overs, landing and egg predations and averaging them by hour. Rates over the course of the study will be compared to rates collected in previous years to look for differences in crow attendance over time that treated eggs are deployed. Decreased crow landings will be used as a proxy to indicate decreased interest in foraging within the colony area.

3) **Measure increasing/declining attacks on treated eggs.** Each day biologists will observe each of the egg bait stations and determine the number of eggs that have been a) approached, b) pecked at, c) consumed, or d) untouched/ignored. This will be recorded daily, if available and practical, damaged eggs will be replaced. Success will be gauged by an overall decrease in pecked and consumed treated eggs during the course of the study as measured and tested by regression. This will be partitioned into three periods, pre-tern arrival, arrival to egg laying, and post egg laying to account for any potential impact of the presence of non-treated least tern eggs on consumption of treated quail eggs.

4) **Impact on predation of Least Tern Eggs.** The ultimate success criterion will be whether predation of least tern eggs by crows is reduced or eliminated. A decrease in egg

predation and an increase in incubation success would indicate that taste aversion is a technique that may contribute towards a decline in the local resident crows being egg predators.

At the conclusion of the least tern nesting season we will prepare a report of our results that includes the collected data and observations, an analysis of results, and a discussion of the efficacy of taste aversion training for reducing California least tern egg predation within the Venice Beach tern colony. If taste aversion training is supported as a management technique, the report will recommend modifications to the management protocol that could be incorporated to improve management and cost effectiveness. Throughout the California least tern breeding season, we will be in regular contact with representatives of both the USFWS and CDFG regarding crow predation at the colony.

Endangered Species and Wildlife Permitting

Mr. Ryan's Federal Recovery Permit authorizes him to take (harass by survey, locate and monitor nexts, capture, handle, band and color-band, float eggs, collect up to 50 abandoned/ non-viable egger per year for the Venice Beach colony predator control program, and attach/ remove geolocators to 50 adult individuals) the California least tern in conjunction with population studies, foraging ecology studies, and management activities for the purpose of enhancing their survival. The proposed crow aversion training proposal has been coordinated closely with the Carlsbad Fish and Wildlife Office who has determined that, subject to review and approval of a detailed proposal as part of the required 15-day pre-survey notification, this activity is consistent with Mr. Ryan's take authorization. Contingent upon receiving the necessary funding, this document has been prepared to include as part of the 15-day pre-survey notification for Venice Beach.

One component of this study includes a request to receive California Least Tern eggs that have already been determined to be abandoned and are being stored by other permitted researchers. Such researchers will need to request authorization from the USFWS to release the collected eggs to Mr. Ryan's possession for use in the aversion training proposal. Once this authorization has been given and the eggs have been obtained, due to what is likely to be a limited supply of tern eggs, they will be prepared for use as baited eggs once the California least terns have returned to Venice Beach and have begun to lay eggs. The tern eggs will be prepared and deployed in the same manner as the Japanese quail eggs described above. We suggest that there is no threat to the least tern from these treated abandoned eggs as they will contribute to taste aversion in the predatory crows and there are no known accounts of consumption of least tern eggs by other least terns.

Pesticide Permit

Mesurol/Methiocarb is a registered pesticide in CA. The U.S. EPA does not require Experimental Use Permits for research done on ten acres or less of land. However, the CA Department of Pesticide Regulation (DPR) requires a research authorization (RA) for any experimental, unregistered use of a pesticide in California, regardless of the size of the test area. An RA is not under the jurisdiction of U.S. EPA. Research Authorization is effective for one year. We will need the RA before we can purchase Mesurol/Methiocarb. The county agricultural commissioner (CAC) must be notified before initiation of the trial. Upon completion, an "Experimental Trial Report" must be submitted to the CAC and an Experimental Pesticide Use Report must be returned to DPR.

In discussing this matter with Mr. Don Antonowich, it appears that the RA is valid for one year and requires an approximately 10 day turn around for his office to process. We would need to fill out an application and provide our research proposal. He recommended that we also schedule a meeting and discuss our plan with the County Agricultural Commissioner as soon as possible. We would then need to notify them within 24 hours of deployment. They would require that we adhere to the label requirements (Appendix 1) and wear required PPE. He also suggested that for purposes of environmental review we not deploy it within 300 ft of any water body and as far from public access as possible.

Personnel & Roles

Thomas Ryan, Project Manager & Biologist. Mr. Ryan possesses a Federal Recovery Permit, State MOU, and State Scientific Collecting Permit. These will be modified to allow the activities stated above. Mr. Ryan is the current project biologist and colony manager at the Venice Beach Least Tern Colony. He has worked here since 2004. His role in the project would be to oversee the implementation of the research proposal. To help prepare the eggs, conduct the first deployment of eggs; conduct the first several observations of the crow response to the eggs. Correspond with State and Federal agencies regarding successes/failures/modifications. They would then review the data collected, analyze it and provide a report of the outcome of the study.

Stacey Vigallon, Project Biologist. Ms. Vigallon has worked as a project biologist at the Venice Beach Least Tern Colony since 2008 and is covered under Mr. Ryan's Federal Recovery Permit and State MOU. She acts as the volunteer coordinator and project biologist at Venice Beach and is a Scientific Illustrator. Her role would be to assist in preparing the eggs, deploying and monitoring the eggs, and conducting crow behavioral observations.

Student Interns – (2-3). We would like to use 2-3 local students to assist in the preparation of eggs, deployment of eggs, monitoring of eggs and crow behavioral observations. The student's resumes would be provided to USFWS and CDFG and they would work under the supervision of Mr. Ryan and Ms. Vigallon. Initially, they would be supervised 100% of the time, and then when they demonstrated proficiency in preparing and deploying eggs, making crow behavioral observations, and the ability to handle material safely, they would be allowed to

work independently. They would be allowed to enter the colony without supervision prior to the tern's arrival, but once the terns arrived; they would be accompanied by Mr. Ryan or Ms. Vigallon and would remain within 3 m of them.

PROPOSED BUDGET

Task 1. Agency Coordination, Permitting & Project Set-up (30 hrs) **$2,250**

The Project Manager and Project Biologists will work to revise existing Recovery Permit and State MOU, an MBTA Permit, conduct an informal consultation with the USFWS, and obtain the Research Authorization from the State Department of Pesticide Regulation. They would communicate with other researchers to procure existing abandoned least tern eggs. They would then purchase the needed supplies (see above) and prepare data sheets and protocols for data collection.

Task 2. Egg Preparation, Deployment & Observation (372hrs) **$15,660**

The Project Team will prepare and deploy 48 Treatment eggs and 8 Control eggs weekly between March 1 and June 15 using methods described above.. We propose that it will take approximately 8 hours to prepare the 48 eggs and 4 hours to deploy them each week. Then one hour for a student to conduct a daily check of the eggs (< April 1) and then for a biologist to check the eggs (>April 1) (3 hrs/week)

Task 3. Data Organization, Analysis & Report Writing (88 hrs) **$5,000**

The Project Manager and Project Biologists will organize and review the data and observations and write a report summarizing each of the methods being used to determine success and make recommendations of how the technique might be used at this and other sites.

Expendable Supplies			**$1,025**
750 quail eggs	$225		
100 abandoned least tern eggs			
1200 zip ties	$30		
50 anchor stakes		$75	
Mesurol		$400	
200-ml beaker		$10	
400-ml beaker		$10	
16 14-gauge hypodermic needle with 5 ml plastic syringes		$25	
PPE		$250	

Mileage **$700**