DEPARTMENT OF THE NAVY
COMMANDING OFFICER
NAVAL AIR STATION
700 AVENGER AVENUE
LEMOORE, CALIFORNIA 93246-5001

IN REPLY REFER TO:

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NAS LEMOORE INSTRUCTION 11015.1B

From: Commanding Officer, Naval Air Station Lemoore, CA

Subj: NAVAL AIR STATION (NAS) LEMOORE BIRD AIRCRAFT STRIKE HAZARD PLAN (BASH)

Ref: (a) NAVFAC P-73, Vol. II
(b) OPNAVINST 3710.7 (Series)
(c) OPNAVINST 3750.6 (Series)
(d) CNICINST 3700 (Series)

Encl: (1) NAS Lemoore BASH Plan

1. Purpose. To publish and implement enclosure (1), per references (a) through (d), and sustain a formal program to reduce the potential for collisions between aircraft and birds or other animals.

2. Cancellation. NASLEMINST 11015.1A

3. Background. A variety of techniques and organizations must cooperate to enable the success of any BASH program. The program established herein establishes actions intended to reduce hazards to aviation from birds or other animals, specifically through avoidance and bird control measures, including harassment, grounds maintenance, habitat modification and depredation.

4. Objectives. This plan is designed to identify and mitigate bird strike hazards through prudent and effective means, consistent with environmental constraints.

5. Administration. This plan shall be reviewed and updated annually by the BASH Officer. Recommended changes shall be submitted through the Air Operations Officer.

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NAS LEMOORE BASH PLAN

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CHAPTER 1
INTRODUCTION

1.1 Objectives. The purpose of the BASH program is to identify potential areas of concern and establish procedures to minimize the threat of bird and other animal strikes to aircrews and aircraft at NAS Lemoore. No single solution exists for BASH problems. A variety of techniques and organizations must be involved to ensure success. This program is designed to:

a. Establish a Bird Working Group (BWG) to monitor conditions and develop recommendations to the BASH Program.

b. Establish procedures for identifying and reporting local hazardous bird activity.

c. Identify high hazard situations and broadcast Wildlife Activity Advisories (WAA).

d. Provide for dissemination of information to all local and transient aircrew on bird hazards and procedures for bird avoidance.

e. Establish aircraft and airfield operating procedures to avoid high hazard situations.

f. Provide guidelines to decrease airfield attractiveness to birds and other animals that pose aviation hazards.

g. Provide active and static procedures for dispersing birds when they are present on the airfield.

h. Establish procedures to alter or discontinue flight operations during hazardous conditions.

i. Establish procedures for collecting and reporting damaging and non-damaging bird or animal strikes.

1.2 Background. Bird strikes have plagued Naval Aviation since its early beginnings. The Navy's first loss of life due to a bird strike occurred in 1914, coincidentally the same year it obtained its first aircraft. From 1981-2008, 16,479 bird strikes were reported which resulted in 420 aircraft mishaps,

247 Foreign Object Damaged (FOD) engines and $352,221,726 in damage costs. Ten aircraft were destroyed with one fatality.

The Federal Aviation Administration (FAA) reports about 2,200 wildlife strikes annually. Naval Safety Center data indicates that about 60 percent of all bird strikes occur in or near the airfield environment. The species involved in BASH incidents are generally the common species that occur near airfields. Large, slow-flying birds (raptors), large, wading birds (herons, egrets and ibis), gulls and waterfowl (ducks and geese) are more likely to cause substantial damage to aircraft when hit due to their mass. Waterfowl often congregate at or near ponds and other bodies of water. Smaller birds that often form large flocks can pose a threat to aircraft and aircrew as well. Though a single small bird can cause significant damage to an aircraft, a flock makes collision more likely and damage more severe. Resident adult birds may learn to avoid aircraft, but young birds and migrants may not be aware of the hazard.

1.3 Need. The presence of migratory and resident birds constitutes a hazard with the potential to cause damage to aircraft and loss of human life. Daily and seasonal bird movements create various hazardous conditions. These hazards are somewhat predictable for certain species but not for others. The extent of BASH problems at NAS Lemoore has been historically low, but the volume of air traffic and the abundance of birds surrounding the airfield suggest a potential for an increase in BASH incidents. The annual average of six reported bird or animal strikes at NAS Lemoore likely does not account for all the BASH incidents that occur. BASH incidents may not be reported because either the incident was not noticed or because aircrew and maintenance are not aware of reporting requirements. By regulation, all BASH incidents (including near misses) are to be reported, no matter how small the blood smears or bird remains. (There may be further analysis required of proposed BASH mitigation measures prior to implementation.)

1.4 Local Area. Most of the land area surrounding NAS Lemoore is agricultural, with crops including cotton, barley, wheat, sugar beets, alfalfa, field corn, tomatoes, beans, onion, garlic, safflower and melons. The topography is nearly flat and irrigation ditches are common. Trees and shrubs are uncommon, with most in fencerows, around houses and in fallow fields. Aquatic habitats and open water in the vicinity of NAS Lemoore

are primarily associated with irrigated agriculture, but also include the Kings River, Fresno Slough and Boggs Slough. These habitats range from permanent waters to seasonally flooded areas. Birds and other animals use them as water sources and waterfowl may use them for resting and foraging. Wetland vegetation often develops around the margins of or within these aquatic habitats, but landowners frequently control its growth through cutting and herbicides. The scattered trees and shrubs provide a perching, roosting and nesting habitat for a variety of birds.

1.5 NAS Lemoore. NAS Lemoore comprises 29,823 acres, of which 18,784 acres are Navy-owned and 11,020 acres (primarily along the west side of the station) are under a flight safety easement in agricultural lands. Perpetual easements (roads) consist of 19 acres. For the Navy-owned lands, various facilities (housing, landfill, administrative area) comprise 2,049 acres and the air operations area covers 3,169 acres. Approximately 12,816 acres are leased for agriculture. These leases run for 5 to 9 years and have restrictions on specific crops to reduce BASH problems. The remaining area is comprised of five Natural Resource Management Areas, including Sunset Lake, the East Area Wetland, Tumbleweed Park (managed as an endangered species habitat) and two additional natural or wildlife areas. Windbreaks of eucalyptus, tamarisk, willow and oleander are present within the station.

Reeves Field at NAS Lemoore consists of two parallel 13,500-foot runways (oriented 14/32) that are 4,600 feet apart (Figure 2). Hangars, fueling skids, a fire station, air control tower and parking are located between the runways. Security fencing also surrounds the airfield. Administrative buildings and housing are located in the southeast corner of the base. The wastewater treatment ponds are south of the housing and administrative areas. Areas that are not paved or landscaped are generally mowed grassland or leased for agriculture. Mowed grassland areas are found immediately adjacent to the runways and around the administrative buildings. The remainder of the base's land is mainly used for agriculture. Sunset Lake and the East Area Wetland are in the northeast portion of the station (Figure 1).

FOD checks are made each morning by NAS Lemoore Field Support division staff as well as after any emergencies, such as a blown

tire, bird strike or a report of objects falling from aircraft. Airfield Facilities Services sweep the runways and ramps daily.

1.6 Bird and Animal Hazards.

1.6.1 Bird and Animal Activities. From 1980 to 2010, an average of seven incidents occurred per year at NAS Lemoore. While most of these incidents resulted in only minor damage to the aircraft, the difference between minor damage and loss of an aircraft and aircrew may be only a matter of a few inches. Different species of birds and animals represent different potentials for BASH due to size, flocking behavior, abundance, maneuverability, habits and other factors. The main bird species that could present significant BASH potential at NAS Lemoore include European Starlings, blackbirds, Horned Larks, Red-Tailed Hawks, Burrowing Owls, Barn Owls, Long-Billed Curlews, Mourning Doves, and to a lesser extent, hawks, herons, egrets, sparrows and finches. Coyotes and feral dogs also present a significant risk to safe flight operations. A breakdown of BASH incidents by month and year may be viewed in appendixes E and F.

Birds are found in varieties of habitats at NAS Lemoore, which are described below.

1.6.2 Buildings. Several problem species of birds are associated with buildings on NAS Lemoore. The predominant species that uses hangars and buildings to roost and nest is the pigeon (officially known as a rock dove). Secondary species using buildings to nest include the house sparrow, house finch, cliff swallow, crows and European Starlings. Occasionally, species such as hawks, shrikes and flycatchers use buildings as hunting perches.

1.6.3 Agricultural Fields. Both fallow and in-crop agricultural fields offer a good feeding habitat for many species of birds. Due to lower amount of insect pests and it being poor quality habitat for small mammal species, both of which serve as prey for other various sized birds. In fallow fields, seeds of past crops or weeds offer an abundant food source for seed-eating birds such as finches, sparrows, doves, pigeons and blackbirds. An abundance of insects for birds such as flycatchers, thrashers, gulls, shorebirds, swallows, meadowlarks, horned larks and curlews are present in actively

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farmed croplands. Blackbirds also eat insects, especially during the nesting season. The presence of these birds (as well as small mammals and reptiles also attracted to seeds and insects) attract predators, such as hawks, harriers, shrikes and owls.

1.6.4 Wetlands and Open Waters. Wetlands and open waters associated with irrigation ditches, seasonally flooded areas, Sunset Lake and wastewater treatment ponds provide resting and foraging habitats for water-associated birds such as ducks and species that use the wetland vegetation. These areas can attract large numbers of birds, particularly during spring and fall migrations and the winter wet season.

1.6.5 Other Minor Habitats. Other lesser habitats that occur on the station consist of lawns, ornamental trees and shrubs, windbreaks and other landscaping around buildings. Species such as killdeer, blackbirds, starlings, warblers, phoebes, house sparrows and house finches are found in these areas.

CHAPTER 2
ORGANIZATIONAL TASKS AND RESPONSIBILITIES

2.1 Bird Working Group (BWG).

2.1.1 General. The BWG is organized to implement and monitor the BASH plan. It allows permanent and tenant commands affected by bird problems the opportunity to meet and discuss possible solutions. Attendees shall include the seven standing members and representatives from each organization concerned with bird hazards.

2.1.2 Composition. The BWG shall be composed of the following personnel:

a. NAS Lemoore Natural Resources Manager (Co-Chairperson).

b. NAS Lemoore Air Operations Officer (assigned duties as BASH Officer).

c. NAS Lemoore Airport Biologist, USDA Wildlife Services.

d. NAS Lemoore Public Works Representative.

e. NAS Lemoore Air Traffic Control Tower Representative.

f. NAS Lemoore Security Representative.

g. CSFWP Aviation Safety Officer.

h. Fleet Weather Center Component, Lemoore (as required).

i. Tenant Squadron Aviation Safety Officers (as required).

j. NMC CONUS West Division Representative (as required).

k. Any other NAS Lemoore entity concerned with the specific bird hazard.

2.1.3 Authority. The Commanding Officer, NAS Lemoore, is responsible for the BASH program and is the approval authority for all BWG recommendations. The BASH program falls within the scope of aviation safety, and as such, the NAS Lemoore Aviation

Safety Officer shall monitor the effectiveness of the BASH program.

2.1.4 Meeting Schedule. The BWG should meet at a minimum biannually. Additional meetings shall be scheduled more frequently as needed to stay current on bird and animal hazards and to discuss solutions, results and the effectiveness of the program. An important concept is that the BWG address problems as they develop, before they create a serious safety hazard. To support this effort, BASH is recommended as a standing item on the monthly Enlisted Aviation Safety Council (EASC) and squadron daily maintenance meeting agendas.

2.1.5 Function.

a. Execute and update BASH plan.

b. Monitor base-wide compliance with reference (c).

c. Review all applicable data on bird and animal strikes.

d. Identify and recommend actions to reduce bird and animal hazards.

e. Recommend changes in operational procedures.

f. Prepare informational programs and safety briefings for aircrew.

2.2 NAS Lemoore Air Operations Officer.

a. Designated as NAS Lemoore BASH Officer, Co-Chair BWG meetings.

b. Monitor effectiveness of the BASH program.

c. Conduct periodic reviews of the BASH program using the self-inspection checklist, Appendix A.

d. Ensure that BASH program is part of safety reviews conducted by the Naval Safety Center.

e. Review NAS Lemoore bird strike data and publish trends and advisories as necessary.

2.3 NAS Lemoore Airport Biologist, USDA Wildlife Services.

a. Establish and continue an Integrated Wildlife Damage Management (IWDM) Program incorporating direct assistance and technical recommendations at NAS Lemoore for the mitigation of damage to naval aircraft operations. The secondary objective will be to reduce damage to property and natural resources caused by wildlife at NAS Lemoore.

b. Supplement and enhance the overall Natural Resource Program (NRP) at NAS Lemoore.

c. Monitor wildlife activity while evaluating the effectiveness of IWDM program.

d. Facilitate the annual report preparation, acquisition, and renewal of the annual migratory depredation salvage permit. Obtaining permits is the responsibility of the Public Works Environmental Management Division.

e. Assist in wildlife-strike reporting and monthly briefings on the status of the BASH program.

2.4 Commander Strike Fighter Wing Pacific (CSFWP).

a. Publish operating instructions and checklists and conduct training on the BASH plan as appropriate.

b. Ensure a designated representative is assigned to the BHWG.

c. Issue specific guidance to squadrons on:

(1) Procedures and restrictions to be followed under hazardous bird watch conditions.

(2) Bird/Animal Strike and Near Miss Reporting. The Web Enabled Safety System (WESS) is the main reporting point. A courtesy call shall be provided to the NAS Lemoore Operations Duty Officer, ext. 1023.

(3) Bird and animal remains collection and preservation. Unidentifiable remains should be sent to the Smithsonian Institution's Feather Identification Laboratory.

2.5 Tenant Squadrons.

a. Publish operating instructions/checklists as appropriate to support this BASH Plan and Wing directives.

b. Provide representation on BHWG (as required).

c. Ensure that a bird hazard awareness program is established and briefings conducted to include films, posters and information on seasonal bird hazards.

d. Ensure aircrew briefings are conducted on Bird Hazard Conditions. This briefing should be mandatory for all aircrew members and shall cover in-flight avoidance procedures and go/no-go criteria.

e. Monitor, on a regular basis, aircrew mission briefings.

f. Make BASH a special interest item during spring and fall migration seasons or other high hazard periods.

g. Issue specific guidance to maintenance personnel for reporting observed bird activity to the Tower (via FM radio) or the NAS Lemoore Operations Duty Officer, (ext. 1023).

h. Issue specific guidance to maintenance personnel for reporting of all discovered bird strikes to the Squadron Safety Officer and the NAS Lemoore Airport Biologist, USDA Wildlife Services, (ext. 4096/4070).

i. Issue procedures for preservation of bird remains if discovered on an aircraft (even smallest fragments of a feather and blood smears should be preserved for identification).

j. Ensure aircrews comply with reference (c) for mandatory reporting of all bird strikes and near-misses via WESS.

2.6 Squadron Safety Officers.

a. Ensure bird strikes are reported via WESS and to NAS Lemoore Air Operations Department.

b. Ensure any applicable bird activity data are readily available to aircrews during mission planning.

c. Make seasonal bird hazards a regular topic at flying safety meetings.

d. Attend BHWG meetings (when not deployed).

2.7 NAS Lemoore Air Operations Department.

a. Provide a liaison with all aviation activities at NAS Lemoore concerning BASH issues through the Aviation Safety Officer (BASH Officer).

b. Develop and implement passive, active and static procedures to reduce BASH.

c. Monitor habitat characteristics such as grass height, drainage ditch vegetation, weeds and standing water and report problems to Naval Facilities Engineering Command, Southwest, (NAVFAC Southwest), Public Works Department (PWD), NAS Lemoore.

d. Assist CSFWP in development of in-flight avoidance procedures.

e. If needed, establish and maintain a trained Bird Detection and Dispersal Team (BDDT) in concert with NAS Lemoore Public Works Environmental Site Office.

f. Develop a continuing information and education program to disseminate bird hazard information.

g. Report all discovered bird strikes to the Squadron Safety Officer and the NAS Lemoore Airport Biologists, USDA Wildlife Services (ext. 4096/4070).

h. Conduct periodic exercises and inspections of the BASH program in conjunction with the NAS Lemoore Safety Officer.

i. Provide all bird and animal remains to the NAS Lemoore Airport Biologist, USDA Wildlife Services (ext. 4096/4070).

j. Establish a BASH-awareness training program for all airfield management, ATC and airfield facilities personnel.

k. Designate the BASH Officer, who will co-chair the BHWG.

l. Teach BASH procedures in the Airfield Vehicle Operator Indoctrination Course (AVOC).

2.8 NAS Lemoore Air Traffic Control Tower Branch.

a. Emphasize WAA based on reported sightings.

b. Pass WAA information to Flight Planning.

c. Include WAA information in Automated Terminal Information System (ATIS) (if necessary), broadcasts and update frequently.

d. Issue WAA information to aircraft over air traffic control frequencies per JO 7110.65 and 7210.3.

e. Continually scan airfield with binoculars for bird and animal activity. Alert aircraft as necessary.

f. Establish a training program covering this BASH Plan for all ATC personnel (training to be documented in training jackets and reviewed annually).

g. Ensure BASH procedures are included in the AVOC.

2.9 NAS Lemoore Public Works Environmental Site Office.

a. Recommend changes to environmental conditions and management practices to reduce bird strike potential. Present recommendations to BHWG or Commanding Officer.

b. Initiate necessary environmental documentation for airfield modifications as required by law.

c. Conduct periodic avian/airfield surveys.

d. Periodically review reports of all bird/animal strikes occurring at NAS Lemoore. These files can be obtained via WESS.

e. Provide the following Natural Resources/wildlife service's support:

(1) Obtain and maintain Federal and State permits required for depredation, salvage, collection and possession of all protected avian species.

(2) Assist in training bird dispersal teams (if needed).

(3) Alert airfield management of migration seasons and unusual bird activity.

(4) Notify ODO when conditions are appropriate for a Bird Watch Alert and when such conditions are no longer present.

(5) Coordinate wildlife studies as necessary to improve wildlife hazard control, evaluate the potential effects of wildlife displacement and assess potential impacts of control activities on wildlife populations.

(6) Assist Airport Biologist, USDA Wildlife Services with identification of bird remains.

(7) Provide co-chairperson for BWG.

2.10 NAS Lemoore Public Works (NAVFAC).

a. Maintain runway lateral and approach zones in a manner that is least attractive to birds based on this BASH Plan and any recommendations from the BHWG.

b. Ensure that all trash receptacles near the runways are kept covered and are emptied regularly to prevent overflow.

c. Implement management practices per NAS Lemoore Public Works Environmental Site Office guidance.

d. Report bird/animal activity near runways to ODO, (ext. 1023).

e. Provide BWG representative.

2.11 Bird Detection and Dispersal Team (BDDT). Responsibility for bird detection and dispersal is an Air Operations function. If required, the Air Operations Officer will establish trained teams from Field Support Division to carry out detection and dispersal activities. Training and funding will be a joint venture between Air Operations and the NAS Lemoore Public Works Environmental Site Office.

2.12 Lemoore Navy Flying Club. NAS Lemoore Air Operations shall ensure that club members are informed about the BASH program. The Club Safety Officer shall liaise with NAS Lemoore Aviation Safety Officer or NAS Lemoore BASH Officer to obtain necessary materials and updates.

CHAPTER 3
OPS PROCEDURES

3.1 General. A number of methods have been tried at various locations to reduce BASH incidents by keeping birds away from the aircraft. These have had varying amounts of success. Use of visual repellent devices (scarecrows, cutouts, models and stuffed or dead birds), various sound producing devices, live raptors and model planes produced little success. No cheap, simple and effective method of scaring birds away from airfields has been identified. Habitat manipulation appears to be the best preventative measure, but it has limits. Changing the habitat to discourage one species can result in attracting other problem species. Several methods to discourage birds from perching on posts and other objects have been tried, including installation of spikes and spraying sticky materials. Many of these approaches have proven ineffective or unfeasible on a large scale. Frequent inspections of runways to clean them of trash, dead animals and potential nesting materials can reduce the attractiveness of the area to some species of birds. At NAS Lemoore, FOD checks and sweeping address this issue. The following sections describe methods recommended for use at NAS Lemoore.

3.2 Wildlife Activity Advisories. Wildlife advisories are an important part of every installation BASH Program. These advisories can provide valuable information to the aviators operating in the local airfield environment, on low-level routes and in training areas. Real-time wildlife advisories can provide the aviator with important information in order to make sound decisions regarding flight safety. Wildlife information directly observed from pilots, ground personnel, tower personnel, contractors, fire department, air traffic control and others should be relayed to the tower with as much specificity as possible so the tower can advise flight crews operating in the affected areas.

3.2.1 Specific Wildlife Advisory Examples. Specific advisories should include but not be limited to: species observed numbers, specific location, heading, altitude and behavior. When a specific advisory is broadcast, the installation BDDT or anyone else designated to respond, harass, or depredate the problem wildlife should move quickly to resolve the situation.

Examples:

"12 Canada geese, flying 500 feet above midfield heading northwest."

"Two coyotes feeding on the infield area 100 feet north of Distance Remaining Marker Number 4, Runway 32R."

"Large flock of shorebirds heading south along runway heading for the departure end Runway 32L."

"Approximately 100 swallows feeding along the drainage ditch adjacent to Taxiway Charlie."

3.3 Wildlife Activity Advisory Reporting. The Operations Officer, ODO, or designated representative (NAS Lemoore Airfield Biologist) will ensure that WAAs are reported. Reporting of WAAs will be based on the following:

a. Visual observation of bird activity on or near the airfield by Tower personnel.

b. Information relayed to the Tower from airborne and taxiing aircraft.

c. Observations relayed to the Tower by airfield facilities personnel, ground electronics maintenance personnel, weather observers, airfield lighting technicians, crash crews, arresting gear maintenance personnel, sweepers, mowers, security police, transient line personnel, Landing Signal Officers (LSOs) and any other personnel driving on or around the airfield.

d. Reports of bird hazards should be made by radio or telephone to the ODO (callsign 205) on FM Crash Net (140.1) or at (559) 998-1023 and should include the following:

(1) Identity of caller.

(2) Location.

(3) Altitude.

(4) Time of sighting.

(5) Approximate number of birds.

(6) Type of birds (if known).

(7) Behavior of birds (soaring, hovering, straight flight).

3.4 Wildlife Activity Advisory Communication. Communication of WAAs to aircrews is essential to effective implementation of this BASH Plan. The following describes how WAAs will be disseminated.

3.4.1 Air Traffic Control Tower. Include WAAs on ATIS broadcasts (when necessary).

a. Notify inbound/departing aircraft of new wildlife activity if activity has changed since ATIS was received.

b. Provide additional bird advisories per JO 7110.65.

c. Place a statement on ATIS advising aircrews to contact the appropriate ATC agency for the latest WAA when WAA is rapidly changing.

3.4.2 ODO Communications.

a. Notify the Operations Officer and Wing Ops when wildlife activity is detrimental to flight operations.

b. Notify the weather observers of wildlife activity for inclusion in the weather reports to aircrews.

3.4.3 Weather Observers Communications.

a. Weather observers will post wildlife activity in the remarks section of the weather report.

b. Notify ODO of birds observed.

3.4.4 Flight Planning Communications.

a. Ensure proper wildlife activity is indicated on the Airfield Status Board in Base Operations.

b. Provide wildlife information and warnings to local and transient aircrews.

c. Include packets of material that describe the most common species expected to occur in the area and each species' general behavior. Also include information on details of the Bird Watch Program, the Bird Remains Identification Program and reports of hazardous conditions observed while flying and all bird strikes.

3.4.5 Aircrew Reporting. Notify NAS Lemoore Air Traffic Control, ODO or LSO on any appropriate frequency.

3.5 Bird Control/Dispersal.

3.5.1 General. Where birds are already well-established and pose an aviation safety hazard, removal by trapping or killing may be necessary if other methods have failed. Both need to be conducted in accordance with applicable Federal, State and local environmental laws or regulations (including the Migratory Bird Treaty Act) after obtaining appropriate permits. Removal methods can include shooting (by trained personnel), poisons (Avitrol and toxic perches) and harassment (high pressure air or water). No bird control method has been found to be universally successful. In fact, most have had little or no long-term effect on bird populations or BASH risk. An aggressive program, using a combination of methods, in tandem with the habitat management measures listed below, is most likely to achieve results.

3.5.2 Bird Detection and Dispersal Team (BDDT) Procedures. If a BDDT is needed, the following procedures will be followed:

a. Patrol airfield Monday-Sunday as needed.

b. Coordinate location and methods to be used with the Tower prior to dispersal activities on the duty runway.

c. Use horns and bioacoustic distress calls before pyrotechnics.

d. Use pyrotechnics in conjunction with distress tapes.

e. Relocate propane sound cannons (if used) periodically.

f. Have several birds removed via lethal methods (within depredation permit limits and by authorized personnel) when birds become accustomed to non-lethal hazing.

g. Notify security prior to discharging pyrotechnics near the flight line.

h. Notify the Tower as soon as the birds are dispersed.

i. Maintain a log to document all dispersal operations that includes location, species, methods, and number of birds dispersed.

3.6 Habitat Management at Airfield.

3.6.1 Grass Height. Since grass and other forms of vegetation make up the majority of the habitats found around airfields, the mowing and maintenance of grass and vegetation is the most important passive tool used to manage wildlife. The maintenance of vegetation is highly dependent on the species of wildlife to be managed and the vegetation types. A complete review of the facility bird/wildlife strike database and WHA, will assist in determining grass and vegetation management. Since different species of grasses, weeds and other vegetation all grow at various rates, produce seeds and fruits at varying heights and attract different species of wildlife, the airfield manager will plan and maintain a mowing program tailored for NAS Lemoore. Mowing should begin nearest the runways and proceed away from the runways. Avoid mowing grass shorter nearer the runways and taxiways, since this difference in grass heights is an attractant to wildlife.

3.6.2 Broad-leaved Weeds. Broad-leaved weeds should be kept to a minimum on the airfield. These weeds attract a variety of birds that feed on the seeds or berries produced or may limit grass growth. Herbicides may be used as necessary for their control in accordance with applicable regulations and

specifications. Selection of herbicides for weed control, grass species to be planted, fertilizer and erosion control vegetation should be made in consultation with appropriate agencies (Agricultural Extension Service, Natural Resources Conservation Service [formerly Soil Conservation Service]) and experts on bird habits and habitats. Controlled burns can also be used for weed control.

3.6.3 Bare Areas. When practical, bare ground shall be eliminated on the airfield by planting grass or other plants suitable for the climate and soils as necessary and appropriate to maintain ground cover at 7 to 14 inches in height. Paving can also be used where appropriate.

3.6.4 Dead Vegetation. Dead vegetation such as brush piles and grass clippings should be removed as soon as possible to reduce cover for birds and rodents.

3.6.5 Edge Effect. The airfield should be maintained to have uniform vegetation cover to reduce the transition zone between different habitat types such as grassland and brush or wetlands.

3.6.6 Standing Water. Low areas should be filled to prevent standing water that can attract birds. These areas need to be checked by a trained expert prior to filling to ensure that they are not wetlands. Filling wetlands normally requires appropriate notifications or permits from the U.S. Army Corps of Engineers.

3.6.7 Pest Control. Invertebrates and rodents are food sources for many birds and may need to be controlled periodically. Methods to reduce these pest organisms will need to be in accordance with all applicable regulations. For pesticides, only EPA-approved chemicals can be used. They must be used in accordance with label instructions. Animal pest control will need to be coordinated with the Integrated Natural Resources Management Plan (INRMP) and the Integrated Pest Management Plans (IPMP) for the station. Mammals such as coyotes and feral dogs have been implicated in collisions with aircraft. These species should be discouraged from utilizing land near the airfield. Coyote dens should be removed. Problem animals should be reported to NAS Lemoore Airfield Biologist, for removal from the area.

3.6.8 Drainage Ditches. Drainage ditches need to be inspected regularly to keep them clear of barriers that could cause ponding of water. The banks of these ditches should be maintained as steep as feasible [2:1 (horizontal: vertical) or greater slope] to discourage wading birds and emergent vegetation. Vegetation on banks should be kept at the same height (7 to 14 inches) as grasses around the runways. Drainage may need to be improved to prevent formation of pools. Where feasible, cover ditches in high hazard areas with netting or plastic fencing if bird congregation becomes a problem.

3.6.9 Erosion Control. Erosion should be controlled by planting vegetation that is appropriate for the region and does not produce seeds at heights below about 14 inches.

3.6.10 Waste Disposal. Landfills often attract large numbers of birds, including larger birds such as gulls, crows or ravens. No new landfills should be developed on NAS Lemoore. All solid waste should be taken to local landfills away from the airfield.

3.6.11 Buildings and Structures. Buildings are often used by sparrows, swallows, finches, pigeons and bats for nesting and roosting. Roofs, towers, runway identification signs, other airfield structures and light fixtures are used as perches and sometimes for nesting. Screening windows, blocking holes and closing doors can be very effective in keeping birds out of buildings. Netting can be used under superstructures to keep birds from roosting there but requires regular maintenance that can be costly. Sharp projections or materials such as Nixalite can be used to keep birds off small areas. Design features to minimize bird use can be included in new buildings or during maintenance of existing buildings.

3.7 Agricultural Out-Leases. BASH management shall be considered by Public Works and NAS Lemoore Public Works Environmental Site Office when agricultural lease contracts are established or renewed. Agricultural leases surrounding the airfield have crop restriction to prevent crops that provide an attractant to bird. Crops known to be very attractive to birds shall be evaluated on a case-by-case basis for the leased lands. As information from BASH reporting forms and bird remains identification accumulates and is analyzed, it will increase the understanding of which species are creating problems and which

locations surrounding the airfield are the most hazardous. This knowledge will help determine which crops can be permitted and where. Such fine-tuning of the BASH plan will eventually result in ensuring that the maximum decrease in BASH risk can be achieved while minimizing economic impacts to agriculture. Guidelines for maintenance of ditches that minimize environmental impacts while maintaining proper function of the ditches without attracting birds that could increase the hazard to aircraft shall be developed and included in the leases.

3.8 Habitat Management Off-Base. The Navy cannot control land use off base but should provide safety concerns at public hearings and zoning meetings for projects where changes in land use have the potential to increase or alter bird populations and habits near the base.

3.9 Pest Control and Bird Dispersal Methods. **As per OPNAVINST 5090.1C, CH-1, an environmental impact assessment may be required when an incidental take authorization is required under the Migratory Bird Treaty Act.**

3.9.1 General. **As per reference (d), the Installation Natural Resources Manager shall coordinate and manage all applicable natural resources consultations and permit necessary to support BASH program.** Active control harassment measures 3.9.2 through 3.9.7, with the exception of 3.9.4, can be implemented as needed. In accordance with the Endangered Species Act, any harassment which constitutes "taking" will be referred to the U.S. Fish and Wildlife Service prior to their use where threatened or endangered species could be affected. Active measure 3.9.4 generally requires a specific Federal permit before proceeding. Even in those cases where no specific permit is required, active measures shall not be performed without specific permission of the Commanding Officer or designated representative, such as the NAS Lemoore Airfield Biologist.

3.9.2 Pyrotechnics. Pyrotechnics are noise-producing devices that are effective in bird dispersal. Commercially available pyrotechnic scare cartridges fired from a 12-gauge shotgun, a NJ-8 Very Pistol [with locally manufactured steel sleeve insert (technical order 11W2-9-2-31)], or other suitable gun are authorized. These devices project an explosive charge of 50 to 100 meters where it detonates. Pyrotechnics can be used to flush and direct flocks of birds in a desired direction.

Note: Always coordinate with the Tower before using pyrotechnics so that birds are not directed into the path of arriving or departing aircraft.

3.9.3 Bioacoustics. This technique uses recordings of bird distress calls to disperse birds. The calls may create differing responses by species, ranging from attraction to avoidance of the calls. Thus, the sound source must be placed so that the birds fly away from the runway. Tapes of distress calls for many species are commercially available. Distress tapes are broadcast using a sound system producing 30 to 50 watts of distortion-free sound at 90 to 100 decibels (dB) with a frequency response between 12,000 and 14,000 Hertz (Hz). The system and speaker are mounted in a vehicle. The operator identifies the birds to be dispersed and selects the appropriate tape. The vehicle is driven as close as possible to the birds (minimum of 100 to 200 meters). The distress call is then played for 15 to 20 seconds. If the birds have not moved within 20 seconds, play the call again. Other methods must be used if more than three attempts are needed. Important factors:

a. Identify the bird species so that correct species tape can be used. A variety of tapes may be tried to determine what is effective.

b. Stop the vehicle when the distress calls are played.

c. Play the calls for short times only since birds can habituate to them.

d. Increase effectiveness of distress calls by combining them with other frightening techniques such as pyrotechnics. Distress calls have limited use in many situations. Not all birds are affected by bioacoustics. Birds often react to the calls by flying toward the source, circling it and gradually moving away. This may cause a temporary hazard. To disperse these birds, use pyrotechnics as soon as the birds are in the air in response to the distress call. Gulls, starlings, blackbirds and crows can be effectively dispersed with distress tapes. Although recorded distress calls of different species will frighten a variety of birds, nonspecific distress calls are the most effective.

3.9.4 Depredation. At times, individual birds may need to be killed to reinforce the idea that danger exists. A Federal depredation permit is required from the U.S. Fish and Wildlife Service before killing any protected birds. Only European Starlings, House Sparrows, and Rock Doves (domestic pigeons) are not federally protected and require no permit. The permit specifies the species and numbers of birds that can be taken along with the technique to be used.

Note: California may require additional permits. The Public Works Environmental Site Office, with the assistance of the NAS Lemoore Airfield Biologist, will obtain any such permits that are required at NAS Lemoore. Obtaining permits is the responsibility of the Public Works Environmental Site Office.

3.9.5 Propane Gas Cannons. These devices should be operated as birds come in to feed or roost, especially at dawn and dusk. The cannons must be relocated frequently to avoid habituation to the noise. They are very effective when used in conjunction with other harassment techniques for waterfowl, pheasants and other game birds as well as for gulls and blackbirds.

3.9.6 Falcons. Falcons trained for airfield bird dispersal can be effective when used in combination with other frightening techniques. Their limitations are they can only be used during daylight hours and in good weather. They are also difficult to obtain, train and maintain. They cannot be used when molting or after feeding.

3.9.7 Dogs. Use of dogs to disperse waterfowl can be effective under certain circumstances.

3.9.8 Ineffective Methods. The following methods have been found to be ineffective:

a. Stuffed owls and rubber snakes for buildings.

b. Rotating lights (birds become habituated quickly).

c. Eye spots on aircraft components.

d. Ultra-sonic devices.

3.9.9 Personnel and Equipment. Personnel should be designated and trained for bird dispersal regardless of the severity of airfield bird strike problems. The presence of hazardous birds is often a transient condition that may only require active bird dispersal for short periods throughout the year. Bird dispersal equipment should be stored in a ready service locker on the flight line so that it is readily available when bird hazards arise.

CHAPTER 4
AIRCREW PROCEDURES

4.1 Flight Planning.

a. Check FLIP AP/1 (Supplementary Aerodrome Remarks) and NOTAMS for information about permanent and seasonal bird problems at departure and destination airfields and on route of flight. For recent BASH information, also check internet web site: http://www.safetycenter.navy.mil/ and on the menu selection, click "Aviation" and select "Airfield Operations/BASH."

b. Consult with Squadron Safety Officer, Squadron Duty Officer or ODO for additional BASH information.

c. Brief all crewmembers on potential bird problems and a strong lookout doctrine.

d. Discuss emergency procedures before departure, including aborts following a strike and engine failures.

Note: 75 percent of multiple engine strikes occur to engines on the same side of the aircraft.

e. Discuss procedures for lost communications internal to the aircraft, including change of aircraft control.

f. Consider using combination sunglasses and visor during daylight hours and a clear visor at night during all low-level phases of flight to provide personal protection in the event of a bird penetrating the canopy.

g. Avoid flying one hour before and after dawn and dusk to the maximum extent practical.

4.2 Prior to Take-off.

a. Listen to ATIS for current WAAs prior to taxi. Ask the Tower for specific bird locations or additional information as required.

b. Watch for birds when taxiing. Look for raptors circling overhead or perched on airfield structures. Report bird sightings to the Tower.

c. If birds are in a location that presents a danger to any aircraft, notify the Tower and request that they be dispersed prior to takeoff.

4.3 During Flights.

a. Use landing lights during takeoff, climb, descent, approach and landing.

b. Fly above 2,000 feet AGL whenever possible, which is above most birds.

c. If birds are observed ahead, attempt to pass above them, as they usually break downward.

d. If dense bird concentrations are expected, avoid high-speed descent and approach.

e. If flocks of birds are encountered during approach, go around for a second attempt.

f. When possible, descend and climb-out in a straight line.

4.4 During High Levels of Wildlife Activity.

a. During increased levels of wildlife activity, the following aircrew actions are recommended but should be based on pilot judgment:

(1) Inbound aircraft hold until dispersal actions or natural bird movements have lowered the hazard condition, if fuel status and weather conditions permit.

(2) Departing aircraft hold on deck until dispersal actions or natural bird movements have lowered the hazard condition.

(3) Request a different runway from ATC if that runway's hazard is lower, wind and weather conditions permitting.

(4) Delay or terminate practice approaches.

(5) Fly above the hazard.

(6) Increase interval between aircraft on section departures to a minimum of 20 seconds.

(7) Increase spacing to a minimum of 6,000 feet between landing aircraft.

4.5 Actions Following a Bird Strike.

a. Aircrew experiencing bird strikes enroute should comply with aircraft-specific NATOPS procedures and/or Squadron/Wing SOP.

b. After landing, check aircraft for damage and report incident as outlined in Paragraph 4.6.

CAUTION
Bird strikes can cause significant structural damage to aircraft that may be unassessable from the cockpit.

4.6 Reporting Bird Strikes.

a. If airborne, inform the control tower and perform emergency landing, as required.

b. After post-flight inspection, preserve any remains, however minimal, as specified in Appendix B and notify the NAS Lemoore ODO/Airfield Biologist, (ext. 1023), immediately.

c. Report strikes to the Environmental Site Office even if no bird remains are found on the aircraft.

d. Squadron safety officers or designees shall report strike information to the NAS Lemoore Airfield Biologist,(ext. 1023), and complete the standardized on the on-line report, via WESS located on the Naval Safety Center's website: https://wess.safetycenter.navy.mil/wess/index.html. Both damaging and non-damaging strikes shall be reported.

e. Near misses should also be reported via WESS.

CHAPTER 5
BIRD AND ANIMAL REMAINS

5.1 General. The most critical factor in developing and implementing a BASH program is knowledge of which bird and animal species are causing problems. Unfortunately, data is collected sporadically and inconsistently. Additionally, reporting and dissemination of information are haphazard and bird remains are not routinely collected properly and positively identified.

5.2 Collection. The protocol for the collection, handling and shipping of feather and other remains described in Appendix B shall be followed in all cases. Birds can often be identified from a single (or sometimes partial) feather by an expert. Therefore, even small remains should be collected.

5.3 Identification. The NAS Lemoore Airfield Biologist, (ext. 1023), will be responsible for bird identification. If a positive identification to species cannot be made, the remains will be sent to the Navy BASH Program Manager as detailed in Appendix B. Additionally, a consulting agreement should be developed with local bird remains identification experts.

5.4 Record Keeping/Data Analysis. The NAS Lemoore Airfield Biologist, (ext. 1023), should plot the location of BASH incidents on an installation map. Data collected in the BASH program (aircraft strikes, near misses and bird hazard locations) are to be analyzed annually by NAS Lemoore Airfield Biologist and disseminated to the Air Operations Department and CSFWP. Information gathered in the Bird Remains Identification Program should be compiled and analyzed, by the Navy Safety Center in Norfolk, Virginia and Environmental Site Office on an annual basis to assess bird strike hazards and to make recommendations to reduce those hazards. If the analysis of BASH data indicates that a particular location or altitude is resulting in most incidents or near misses, then a warning or change in flight pattern should be considered for addition to this BASH Management Plan during the annual update.

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APPENDIX A

BASH Self-Assessment Checklist

PLANS AND INSTRUCTIONS.

1. Does the facility have a current BASH instruction/plan within the past 5 years?

2. Is the BASH plan referenced in the facility INRMP?

3. Does the facility's pest management plan reference the BASH plan?

4. Does the facility BASH instruction establish a facility BHWG?

5. Does this BHWG meet on a regular basis?

6. Are facility departments including Aviation Safety, Public Works, Environmental, Security and Air Operations involved in the BHWG?

7. Is the Commanding Officer or Wing Commander or their representative(s) involved in the BHWG?

REPORTING.

1. Are both damaging and non-damaging wildlife strikes reported to the Navy Safety Center's WESS System: http://www.safetycenter.navy.mil/wess/default.html

2. Is the process in place and is it mandatory that ALL wildlife strike remains collected are turned in to the Smithsonian Institution for positive species identification?

3. Is wildlife strike data tracked by the facility and analyzed for trend analysis and management recommendations?

4. Does the Dispersal Team or USDA Wildlife Service's Biologist assist squadrons with the collection of wildlife strike remains

and do they have the proper equipment for remains removal and collection?

5. Does the facility have a recent strike reporting dataset from the Navy Safety Center and the Smithsonian Institution for the facility itself and tenant squadrons?

SURVEYS.

1. Has a Wildlife Hazard Assessment or similar survey been conducted for the facility?

2. Are wildlife surveys conducted on the airfield and adjacent areas to observe potential and actual wildlife hazards?

3. Have wetland areas, seasonal ponding areas and food sources for wildlife been evaluated for management strategies to reduce attractiveness to wildlife?

4. Have hangars, airfield buildings and airfield equipment been inspected for nesting birds and documented with the Airfield Manager for necessary removal or deterrent actions?

5. Is there a current bird control and nest removal program for the hangars and airfield buildings? Is there documentation to show where nests have been removed and how many?

6. Do bird droppings cause problems for equipment, aircraft and personnel?

7. Are hangar doors kept closed to limit access of birds and wildlife?

8. Are there habitats within the Air Operations Area (AOA) that are particularly attractive to wildlife that should be managed?

9. Is the airfield grass being managed at a height to discourage local and seasonal problem wildlife? Are the grass height protocols defined in the BASH Plan?

10. Are there manmade areas near the runways that attract wildlife (golf courses, recreation areas, horse stables, storm water retention ponds, drainage ditches, landfills and transfer stations, etc.)?

COMMUNICATIONS.

1. Do Control Tower personnel relay wildlife hazard information received from ground personnel to aircrew within the local area?

2. Does the control tower issue bird hazard conditions via the ATIS?

3. Is the BASH program presented in the Airfield Vehicle Operators Indoctrination Course (AVOIC)?

4. Does the AVOIC course encourage everyone within the AOA to report wildlife hazards to the Tower?

5. Does the AVOIC promote the recovery of all wildlife remains found on the runway surfaces?

6. Do all ATC personnel have a good understanding of the current BASH Plan?

7. Does anyone from the facility attend the annual BASH USA Conference?

8. Are posters, pictures, maps, etc. related to the BASH Program posted in aircrew spaces, safety bulletin boards and base operations/flight planning?

NATURAL RESOURCES MANAGEMENT.

1. Does the facility have agricultural out-leases within the AOA?

2. Are these agricultural leases managed to reduce BASH potential?

3. Have agricultural practices within the airfield environment and public agricultural lands adjacent to the airfield been evaluated for wildlife attractants?

4. Are trees and shrubs located within the Primary Surface and Clear Zones of the runways attractants for wildlife and should they be removed?

5. Is there a hunting program on the facility within the AOA?

6. Does this hunting program support the BASH Program?

7. Has there been an effort to identify BASH attractants on lands adjacent to the facility?

8. Is there a cooperative agreement with adjacent landowners to decrease the BASH potential on the facility?

9. Are Federal or State-Listed plants or wildlife found within the AOA?

10. If so, are these species an issue with the management of the BASH Program?

11. Are there any proposed or planned natural resources programs or projects within the AOA that would increase the risk of a BASH event?

12. Are there any proposed MILCON or other construction projects within the AOA that would cause the increased risk of a BASH event?

WILDLIFE CONTROL.

1. Does the installation have a BDDT patrolling the aerodrome?

2. Is this BDDT active on a daily or on an on-call basis?

3. Is the BDDT equipped with harassment and lethal control equipment?

4. Is a USDA Wildlife Service's (WS) biologist or technician present on the facility?

5. If so, has this person received the USDA WS Airport Certification training?

6. Does the USDA/WS person participate in the BHWG?

7. Does the USDA/WS person participate in Wing or squadron safety stand downs?

8. Does this team control and maintain bird dispersal equipment?

9. Does the facility have a current Depredation and Salvage Permit from the US Fish and Wildlife Service and associated State wildlife agencies?

10. Does the facility have any other wildlife-related permits supporting the BASH Program?

APPENDIX B
COLLECTION, HANDLING AND IDENTIFICATION OF BIRD REMAINS

The following protocols for the collection, handling and shipping of feather and other remains shall be followed in all cases.

1. All post-flight aircraft inspectors shall be made aware of the importance of reporting and collecting data from any BASH incident.

2. Any remains, no matter how slight or how damaged, shall be collected.

3. All material shall be collected (not just representative samples).

4. Do not cut feathers off of a carcass. The base of the feather contains the most significant parts for analysis.

5. Do not mix samples from different bird strikes. Materials collected from each incident must be labeled and bagged individually.

6. All remains should be placed in Ziploc bags, preferably of a size similar to that of the remains. Very small feathers may be placed into small Ziplocs (snack size), and the small Ziploc can be placed into the larger Ziploc with the other feathers.

7. Do not use anything sticky near the feathers. Do not glue or tape them to a sheet of paper, and do not use post-it notes or anything that may stick to the feathers. If a feather comes into contact with such sticky material, it may no longer be possible to analyze it.

8. Deliver entire package to NAS Lemoore Airfield Biologist within two hours or place in freezer and notify the Environmental Site Office for pick-up.

9. The Airfield Biologist will send the material to the Navy BASH Program Manager as soon as possible via overnight mail if positive identification cannot be made by the Environmental Site Manager or a local ornithologist.

Smithsonian Institution
National Museum of Natural History
Division of Birds, E600, MRC 116
P.O. Box 37012
Washington, DC 20013-7012

APPENDIX C
EXPLANATION OF TERMS

1. **Airfield.** Runways, taxiways and other facilities associated with takeoff and landing of aircraft (including helicopters).

2. **Active Bird Dispersal.** Harassment techniques (pyrotechnics, bioacoustics, chasing and depredation) employed to disperse birds or other animals from the airfield.

3. **BASH.** Bird Aircraft Strike Hazard. Term used to describe bird and animal hazards and programs to reduce those hazards.

4. **Bioacoustics.** Recorded tapes of bird distress and predator calls used by BDDT to disperse birds from flight operations areas.

5. **Bird Detection and Dispersal Team (BDDT).** A roving airfield patrol that reports Bird Hazard Condition and disperses problem birds using active dispersal methods.

6. **Bird Strike.** Any contact or near miss between a bird or other animal and an aircraft, whether or not damage occurred.

7. **Bird Watch Alert.** A warning that potential exists for numerous birds to be near airfield due to weather, time of year, or seasonal conditions.

8. **Depredation.** Technique used to remove problem birds permanently from the airfield and buildings when scare tactics are ineffective.

9. **Falconry.** The use of trained falcons for dispersal of problem birds.

10. **Field Carrier Landing Practice (FCLP).** Simulated aircraft carrier landing practice using diagramed carrier landing decks at the approach of the runway.

11. **Models/Decoys.** Various static devices used to disperse birds from airfield areas. May include scarecrows, decoys, Mylar tape and eye spots.

12. **Propane Cannons**. Stationary non-projectile sound producing devices used to disperse birds from airfield areas.

13. **Pyrotechnics**. Noise producing devices, fired from a pistol or shotgun, used by BDDT to scare birds away from flight operations.

14. **WESS**. Web-Based Enabled Safety System: https://wess.safetycenter.navy.mil/wess/index.html. The Naval Safety Center's electronic system used to report all bird and animal strikes or near misses.

15. **Wildlife Activity Advisory (WAA)**. A real-time wildlife hazard alert condition used to warn aircrew of increased wildlife activity.

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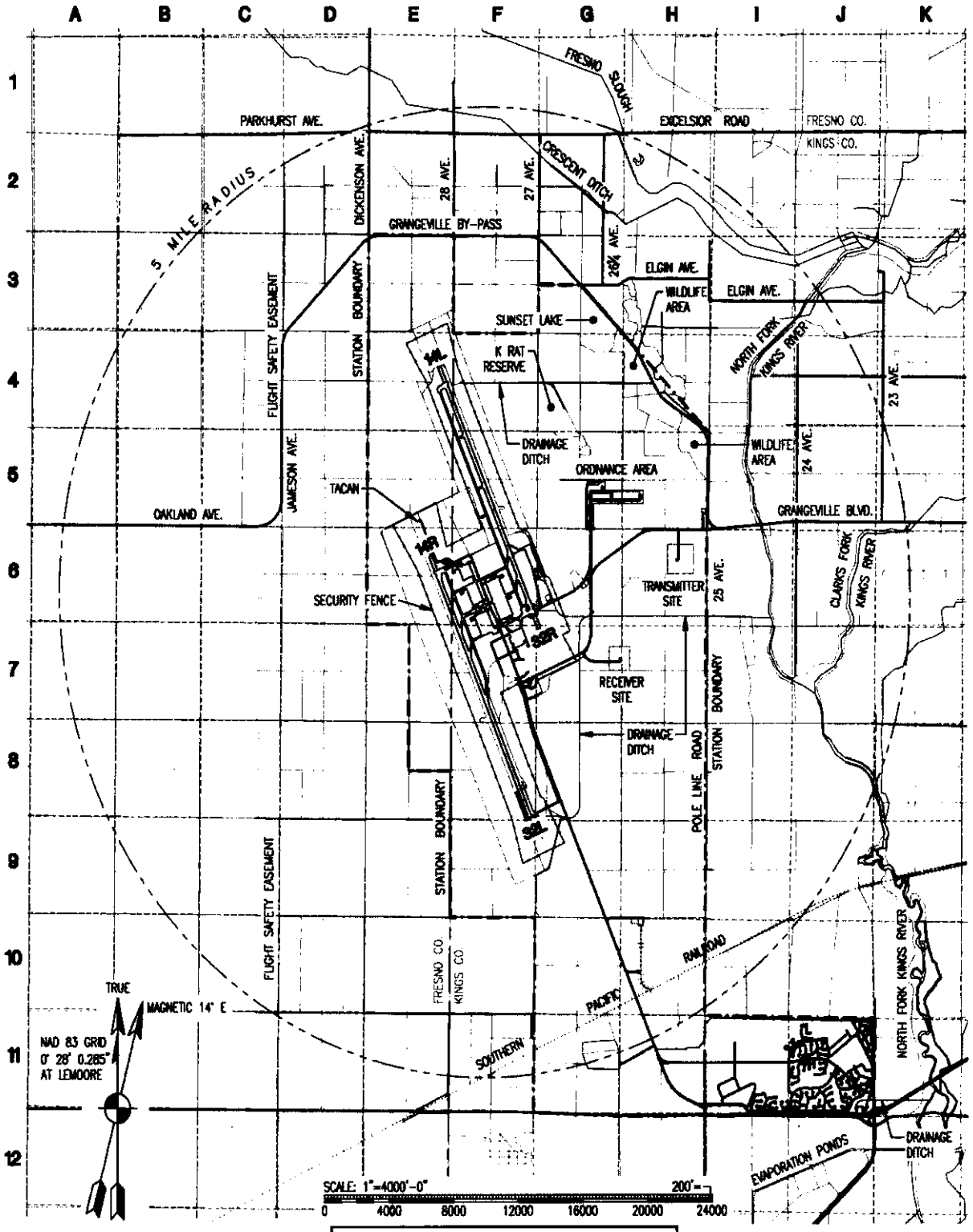
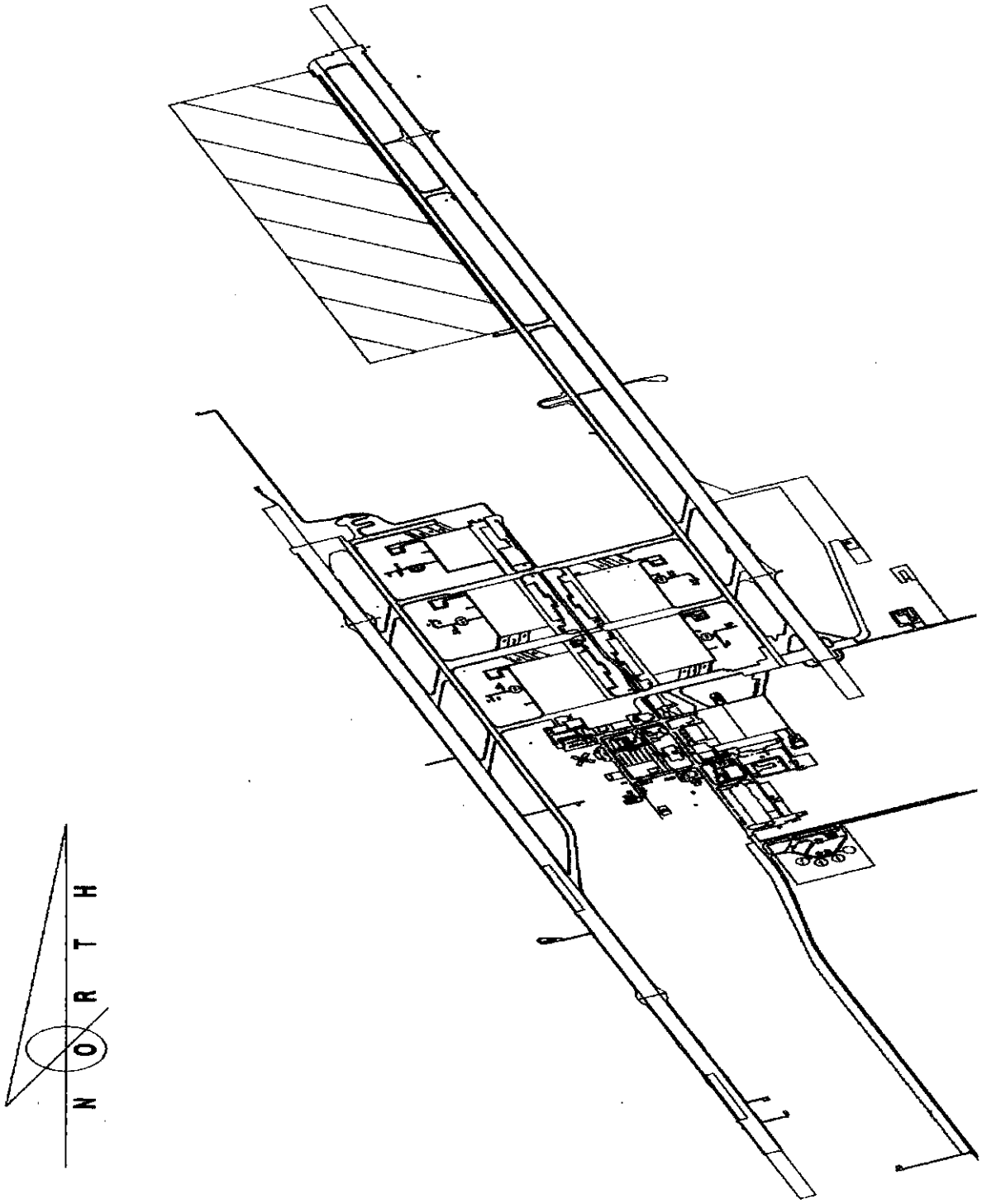


NAS LEMOORE, CA



REEVES AIRFIELD

VIII. Educate Station personnel, residents and other visitors on issues such as not feeding wildlife or feral domestic animals.

IX. Ensure that key staff members are trained in proper wildlife handling protocols and procedures or have a contract in place with a wildlife pest control organization. Create and maintain a resource that includes all migratory bird depredation and handling permits, key personnel to contact, and procedures on handling various species of pest wildlife. Keep the resource current and available on file at the EMD and the Station Police Department.

4.7.2 BASH Program

Background

BASH is defined as the threat of aircraft collision with birds and other wildlife during flight operations, particularly during take-off and landing and low-altitude training exercises. BASH plans are required by the DoD for military installations where there is a potential for a conflict between military activity and wildlife.

BASH program requirements are not eligible for conservation resources (5090.1C CH-1). Naval air installations Safety and Air Operations Offices shall ensure BASH plans are prepared and implemented. Personnel responsible for BASH programs should ensure that bird strike reporting and information exchange is closely coordinated with the Naval Safety Center. The NAVFAC BASH Biologist is available to assist with the development of BASH Plans, implementation of BIRDRAD (avian radar), and other BASH related requirements. The Naval Safety Center has a website with additional BASH information.

Species involved in BASH are generally the common species that occur near airfields. Large, slow-flying birds (broad-winged raptors); large, wading birds (herons, egrets, and ibis); gulls; and waterfowl (ducks and geese) are more likely to do substantial damage to aircraft when hit due to their mass. Though a single small bird can cause significant damage to aircraft, a flock makes collision more likely and damage more severe. Resident adult birds may learn to avoid aircraft, but young birds and migrants may not be aware of the hazard (NAS Lemoore 2012).

Specific Concerns

- Bird strike hazards are of major concern to air operations at NAS Lemoore, especially as the speed and number of aircraft operating at the Station has increased. BASH incidents for military aircraft occur predominantly (95%) below 2,000 feet (610 m). Seventy percent of those are below 500 feet (152 m), and 65% of bird strikes occur at the airfield (NAS Lemoore 2012).
- There has been an increase in BASH incidents recently (approximately 25-30 incidents reported per year). This may be partially due to the increase in fallowed agricultural lands due to reduced irrigation water allocations that create habitat conditions attractive to large raptors (Erichsen 1995, Erichsen et al. 1996, Estep 1989, Kuenzi and Morrison 1998, Smallwood et al. 1996, Woodbridge 1998), and from increased awareness of squadron personnel on the importance of reporting suspected BASH incidents.
- With increased fallowing of agricultural land due to decreased water availability, increased road activity, and increase in numbers of raptors feeding and riding thermal columns in the aircraft flight patterns, there is an increased likelihood of BASH incidents and a corresponding risk of damage to aircraft or loss of human life.
- Particular species of BASH concern include the red-tailed hawk, Swainson’s hawk, white-faced ibis, mourning dove, horned lark, western meadow lark, whimbrel, and long-billed curlew. Red-tailed hawks and Swainson’s hawks tend to glide on thermal columns rising from the fallowed farm land near the airfield; three BASH incidents in 2010 involved Swainson’s hawks. Flocks of 2,000 to 3,000 white-faced

ibis have, in recent years, congregated in alfalfa fields near the airfield. The concern is that once frightened into the air by an aircraft coming in to land, a second aircraft could hit the flocks as they settle back down into the fields. No white-faced ibis aircraft strikes of this manner have been reported to date.

- Potential BASH species also include medium-sized and large mammal predators attracted to the Operations Area by the presence of small mammal prey there.

Current Management

The goal of the BASH program at NAS Lemoore is to identify, reduce, or eliminate known and potential strike hazards from birds or other animals on and around the airfield. The BASH Plan (NAS Lemoore 2012; Appendix D) establishes specific procedures, as well as roles and responsibilities. The BASH Plan also establishes a Bird Hazard Working Group to monitor and implement the BASH program. The NAS Lemoore Natural Resources Manager is the Co-Chair of the Working Group. Program actions include identifying high hazard situations, particularly during critical phases of flight, and aiding supervisors and air crews in altering/discontinuing flying operations when warranted to increase flight safety. Bird avoidance and bird control measures include grounds maintenance, habitat modification, prey base reduction, harassment and depredation. Careful land management practices are designed to discourage bird activity near runways and operational areas. Generally, installations must ensure relevant training opportunities for a staff biologist to address BASH issues. The BASH Plan is updated annually by the NAS Lemoore Safety Officer.

Copies of birdstrike records sent to the Navy Safety Center are retained at NAS Lemoore. Bird/animal-aircraft strike incidents are required to be reported when identified by pilots or maintenance crews. The report records time of day, date, species involved (if known), and location. Remains are also examined and included in reporting when possible and should be sent to the Smithsonian Institution, Feather Identification Lab for positive identification.

Expectations for daily bird use at NAS Lemoore are primarily determined through (a) informal observations from the Natural Resources Manager and others during travel to and from the Operations Area (birds observed are reported to the Flight Operations Tower), or (b) a general understanding of the Flight Operations Tower regarding regular problem areas and bird species. While a significant safety hazard, in relative terms, bird strikes occur less frequently at NAS Lemoore than at other Naval Air Stations (J. Crane, pers. com. 2011; T. Schweizer, pers. com. 2013).

NAS Lemoore lands were evaluated in a Wildlife Hazard Assessment conducted by the USDA Wildlife Services from July 2010 to June 2011 to assess the potential sources of BASH concern including the grassland areas within the Operations Area fence, the agricultural parcels surrounding the airfield, and other natural habitats on the Station that support bird and other wildlife populations (Lang 2012; Appendix E). Results of the study were used to update management actions and the BASH Plan. Bird strike hazards are particularly a concern during migrations (typically February through April and August through November). Examples of management techniques used to prevent animal strikes include:

- Management of the airfield grounds to discourage the presence of birds of any species, especially those most likely to create a BASH problem. To reduce the attractiveness of the area to wildlife, the grassland areas within the Operations Area security fence are regularly mowed to maintain vegetation at a height no greater than 6 to 8 inches.
- The agricultural parcels surrounding the airfield have crop restrictions written into lease documents to discourage significant bird use. Alfalfa is no longer permitted on the approach or departure to the airfield since it attracts more birds than other crops (T. Schweizer, pers. com. 2013). Crops such as cotton have been demonstrated to not attract birds and other wildlife and are compatible with safe

flight operations. Grain crops near the airfield are required to be harvested before they become an attractant to birds while long-term crops such as trees and vineyards are prohibited.

- Wetland areas, which could potentially attract large numbers of wading birds and waterfowl, are purposefully not allowed or enhanced near the airfield. Generally, most wetland areas are located in the northeast portion of the Station, far enough away from the runways and flight zones that they do not represent major BASH concerns.
- A program of prey-base reduction is also currently ongoing within the Operations Area. The goal is to reduce attraction of predators that are a BASH concern. This program is consistent with the Commander, Navy Installation Command BASH Manual, which discusses the reduction of prey base around airfields (T. Schweizer, pers. com. 2014).

NAS Lemoore maintains a USFWS depredation permit to address migratory birds that pose a direct threat to human safety. The EMD manages this permit, submits reports, and renews the permit on an annual basis.

Assessment of Current Management

The BASH plan for NAS Lemoore complies with DoD and Navy directives, and is implemented through NAS Lemoore Instruction (NAS Lemoore Instruction 11015.1B). Improved and systematic monitoring of BASH species would be beneficial in assessing and tracking daily and seasonal strike hazards. The EMD and Flight Operations will continue to manage BASH potential in accordance with the updated BASH Plan, with assistance from the USDA Wildlife Service's Airport Biologist, taking into account impacts on native species.

Management Strategy

Objective: *Promote safe aircraft operations at NAS Lemoore by reducing the potential for bird and other animal aircraft strike hazards.*

I. Implement the BASH Plan. Daily and seasonal bird movements in the vicinity of the Operations Area can create significant hazards to aircraft operations.

- **A.** Update the BASH Plan annually and incorporate recommendations from BASH-related studies as appropriate. The plan review and update is necessary to ensure adaptive management with minimal impacts to bird and other wildlife communities on NAS Lemoore.
  1. Revise relevant training and educational materials for NAS Lemoore pilots, ground personnel, and air traffic control as necessary.
  2. Revise guidelines provided in other Station plans and contracts that are relevant to BASH reduction practices, as necessary.
- **B.** The Natural Resources Manager should, as an important part of the BASH program, maintain a working relationship with the USDA Wildlife Service's Airport Biologist, Flight Operations Tower and Operations Area staff, and the aircrews themselves. The Airport Biologist should provide for issuance of information to all local and transient air crews regarding bird hazards and procedures for bird avoidance.

II. Continue to maintain the USFWS migratory bird depredation permit to manage birds that pose a direct threat to human safety at the airfield.

III. Promote land management practices and guidelines to decrease airfield attractiveness to birds and minimize raptor prey, primarily ground squirrels. Implement safety procedures to recognize, control, and avoid hazardous bird concentrations.

A. Ensure that birds are not unnecessarily attracted to areas which may create hazards with respect to collisions with aircraft.

1. Require adjacent agricultural parcels to employ cropping practices and pest management activities that minimize bird attraction.
2. Maintain vegetation within the Operations Area at a height of six to eight inches to reduce preferred habitat (NAS Lemoore 2012).
3. Minimize presence of broad-leaved weeds on the airfield, which can attract birds.
4. Ensure that habitat enhancement project actions do not encourage bird use near the Operations Area.

B. Implement a prey reduction program around the airfield to control ground squirrels and rodents. The program should at a minimum consist of habitat modification. If habitat modification fails to reduce the ground squirrel population to an acceptable level, then measures for a large-scale control program involving the use of rodenticide should be implemented. Measures to reduce the ground squirrel population with the use of rodenticide can reasonably be expected to result in an adverse impact to the burrowing owl population. Prior to implementing the prey reduction program, the burrowing owl population in this area will need to be relocated to other areas of the Station, region, or state of California using active and passive relocation methods in order to mitigate these adverse impacts (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC), Section 4.7.1 Pest and Predator Control).

IV. Continue to provide NAS Lemoore BASH-related safety concerns at local public hearings and zoning meetings for projects where changes in land use on adjacent lands have the potential to increase or alter bird populations and habits near the Station that may lead to increased BASH.

Objective: *Strengthen the bird/animal hazard and strike monitoring detection program at NAS Lemoore.*

I. Survey and monitor avian species that utilize the NAS Lemoore airfield and adjacent agricultural parcels for foraging and roosting. Document responses to aircraft to evaluate the potential for aircraft impacts.

II. Monitor and document bird strikes and carcasses adjacent to the NAS Lemoore airfield (5090.1C CH-1) (Appendix D).

A. Establish procedures for collecting and reporting damaging and non-damaging bird strikes.

B. Establish a database to track local BASH incidents at NAS Lemoore. Records of BASH incidents should include time of day, date, species involved, and location.

C. Ensure squadron safety officers report BASH incidents for inclusion into the local database (Naval Operations Instruction 3750.6 series).

D. Ensure that feather and/or blood samples of suspected bird/animal strikes are collected and sent to the Smithsonian for positive identification.

4.7.3 Game Species

Specific Concerns

- The number of upland gamebird species (primarily mourning dove and ring-necked pheasant) have decreased greatly at NAS Lemoore over the past decade. For the most part, this decline has been due to the decreasing presence and availability of water resources for gamebird habitat.

WILDLIFE HAZARD ASSESSMENT FOR NAVAL AIR STATION LEMOORE, CALIFORNIA

(July 2010-June 2011)

Submitted by:

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Work Performance per Cooperative Service Agreement 10-73-06-6223-IA
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LIST OF ACRONYMS

AGL Above Ground Level
AOA Air Operating Area
AVOIC Airfield Vehicle Operating Indoctrination Course
BASH Bird Air Strike Hazard
CALA Ordnance Storage and Transfer Site, Located East of Runway 32 Right
CDFG California Department of Fish and Game
CFR Code of Federal Regulations
DOD Department of Defense
EPA Environmental Protection Agency
FAA Federal Aviation Administration
FAR Federal Aviation Regulations
FIFRA Federal Insecticide, Fungicide, and Rodenticide Act
FOD Foreign Object Debris/Damage
ILS Instrument Landing Systems
MBTA Migratory Bird Treaty Act
MOU Memorandum of Understanding
NOTAM Notice to Airmen
T&E Threatened and Endangered Species
USFWS U.S. Department of Interior, Fish and Wildlife Service
WHA Wildlife Hazard Assessment
WHMP Wildlife Hazard Management Plan
WS U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (formerly Animal Damage Control [ADC])

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1.0. INTRODUCTION

1.1. OVERVIEW OF WILDLIFE HAZARDS TO AIRCRAFT

Collisions between aircraft and wildlife are a concern throughout the world because they threaten passenger safety (Thorpe 1996, Cleary et al. 2006), result in lost revenue and costly repairs to aircraft (Milsom and Horton 1990), and can erode public confidence in the air transport industry as a whole (Conover 2009). On January 15, 2009, flight 1549 out of La Guardia Airport crash landed into the Hudson River after colliding with a flock of Canada geese, and sparked a world-wide concern and acceptance of the potential risk and devastation bird strikes can inflict upon aircraft. Fortunately no serious injuries or fatalities occurred with this accident. However, in several instances, wildlife-aircraft collisions in the United States have resulted in human fatalities. The most recent of which occurred in 2008 in Oklahoma when a Cessna Citation aircraft collided with one or more white pelicans over a body of water at 3,100 feet. All five people aboard were killed.

Military aircraft are not immune to wildlife strikes, and may actually be more susceptible to them due to their sleek profile (less visible to wildlife), time spent at low altitude and high speeds, when compared to civil aircraft. The most devastating crash occurred on September 22, 1995 at Elmendorf AFB. An E-3B "AWACS" aircraft struck a flock of Canada geese and crashed less than 1 mile from the runway, killing all 24 crew members. There are other notable military aircraft strikes which resulted in the loss of the aircraft. In 1992 in Duluth, Minnesota an F16 ingested a lesser golden plover and crashed. In that same year in Austin, Texas a red-tailed hawk took down an F-16. In 1993 in Dallas, Texas a T38 crashed due to ingested cliff swallows. In that same year in Lubbock, Texas a T38 crashed due to just one horned lark ingestion.

These hazards are very real and the proportion of wildlife strikes that result in damage is often substantial enough to merit closer scrutiny by the Federal Aviation Administration (FAA) and the U.S Military.

Although military airbases are not subject to scrutiny by the FAA, the guidelines and policies of the Federal Aviation Regulations (FAR) in relation to wildlife hazards may enhance safety of military and civil service personnel as well as save money. NAS Lemoore strives to manage operations to achieve a zero-mishap rate in flight-related and aviation ground mishaps. The FAA is responsible for establishing and enforcing the FARs and policies to enhance public safety. To ensure compliance with Code of Federal Regulations (CFR) 14 Part 139.337 (Appendix 1), the FAA requires certified airports to conduct a wildlife hazard assessment (WHA), and if necessary, establish a wildlife hazard management plan (WHMP) when any of the following events occur on or near an airport:

(1) An air carrier aircraft experiences multiple bird strikes or engine ingestion;

(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance or

flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;

(3) An air carrier aircraft experiences engine ingestion of wildlife; or

(4) Wildlife of a size, or in numbers, capable of causing an event described above.

A variety of authorized methodologies are utilized by WS to decrease wildlife hazards, which are often dictated by the target species, season, habitat characteristics and wildlife attractants in and around the airfield, along with a host of other variables. It is important to consider the ecological characteristics of local and migratory wildlife when establishing a control program. The WHA provides the framework through which a more complete and site-specific understanding of wildlife hazard mitigation on an airport is developed. These assessments typically last one year because wildlife populations, especially migratory birds, exhibit seasonal fluctuations in behavior and abundance. On completion of the assessment, recommendations to reduce wildlife hazards can be made which are based on an analysis of the data collected. If it is determined from the study that significant wildlife hazards are present, a BASH plan aimed at mitigation of these threats should be written and acted upon.

1.2. LEGAL AUTHORITY OF WILDLIFE SERVICES (WS)

The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program has a Memorandum of Understanding (MOU) with the Department of Defense (DOD) (Appendix 2) to resolve animal damage issues on United States military installations. The MOU establishes that Wildlife Services (WS) has the expertise and will provide technical and operational assistance to alleviate wildlife hazards on DOD lands, upon request.

The primary statutory authority by which WS operates is the Animal Damage Control Act of March 2, 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468). WS has the authority to manage migratory bird damage as specified in the CFR, and in conjunction with USFWS approval and permit. In addition, the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 authorizes and directs the Secretary of Agriculture to cooperate with States, individuals, public and private agencies, organizations, and institutions in the control of nuisance mammals and birds deemed injurious to the public.

2.0. OBJECTIVES

The objectives of this WHA were to:

1. Review and analyze available wildlife strike records, and provide management recommendations based on this data.
2. Determine wildlife population parameters such as abundance and periods of activity (e.g. seasonal, and diurnal), with a particular emphasis on the species most threatening to aircraft safety.
3. Identify and quantify attractive wildlife features and land-use practices at NAS Lemoore and the surrounding areas that may contribute to wildlife hazards on the airfield.

4. Provide management recommendations for reducing wildlife hazards at NAS Lemoore to serve as a framework in the development of a BASH plan.

3.0. BACKGROUND

3.1. Naval Air Station Lemoore

NAS Lemoore is located in the heart of the San Joaquin Valley, approximately 80 miles east of the Pacific Ocean (Appendix 3). The city of Lemoore is located seven miles to the east of the base. Agriculture dominates this region of California, producing crops (cotton, alfalfa, barley, safflower, tomatoes and seed crops) as well as livestock production (dairy and beef cattle, poultry, sheep, lambs and hogs). Agriculture is also the dominant land-use at NAS Lemoore comprising three quarters of the total acreage. This provides revenue and local jobs, as well as supports the Navy mission by providing vegetative cover to minimize dust, foreign object damage and BASH potential. NAS Lemoore comprises approximately 18,784 acres, as well as a flight safety easement of 11,020 acres of additional agriculture land. Land and easements were obtained in 1958, and NAS Lemoore was officially commissioned in 1961. The official mission of this station is to support Navy fleet carrier attack and strike-fighter squadrons, and is the permanent station of all Pacific Fleet F/A-18 Hornet and F/A-18E/F Super Hornet fighter jets. NAS Lemoore is an extremely busy airfield with day and night training operations involving these sleek profiled and very fast aircraft.

NAS Lemoore sits at 234 ft. elevation, has cool (average 64 F) and sometimes foggy winters, and warm (average 80 F), dry summers. The average rainfall for this area is 7.8 inches. (http://www.citytowninfo.com/places/california/lemoore).

3.2. AIRCRAFT OPERATIONS

NAS Lemoore is the Navy's largest and only west coast Master Jet base. It supports the Strike-Fighter wing of the U.S. Pacific Fleet, whose mission is to train, man and equip the west coast Strike Fighter squadrons. There are approximately 283 F/A18 Hornet and Super Hornet aircraft residing at NAS Lemoore that flew 250,000 flight operations in 2009 (Naval Air Station Lemoore – Joint Land Use Study, August 2009). Transient military aircraft also frequent NAS Lemoore.

3.3. WILDLIFE STRIKE ANALYSIS

Bird Strike Committee Canada developed a bird strike definition that has since been adopted by the FAA, International Civil Aviation Organization (ICAO), Bird Strike Committee USA, Bird Strike Committee Europe, and the U.S. Air Force. Under this definition, a wildlife strike is considered to have occurred if:

1. A pilot reports a strike.
2. Aircraft maintenance personnel identify damage as having been caused by a bird or mammal strike.

3. Personnel on the ground report seeing an aircraft strike one or more birds or mammals.
4. Bird or mammal remains, in whole or part, are found on any airside pavement area or within 200 ft. of the runway centerline, unless another reason is identified.

Bird strike data for Naval Air Stations is reported to and compiled at the Navy Safety Office. These records date back to 1980, although, until recently detailed information regarding species struck, location, and damage has been lacking. In 2008, the Navy entered into a contract with the Smithsonian Institute for identification of wildlife remains struck by aircraft at Naval stations. Bird remains can be identified to species using DNA material (blood) or feather material. See Appendix 3 for proper collection of bird strike remains.

Wildlife strike data provides valuable information on wildlife hazards at airports, including the species that are struck, seasonality, time of day, altitude and location of the strike and damage incurred. A total of 236 wildlife strikes have been reported from 05 October 1981 to 13 January 2011, of which 41 (only 17%) have been identified to Order, Family or Species (Table 1). As awareness of the importance of bird strike mitigation increases, so should reporting of detailed information and collecting remains for identification. The first step in alleviating wildlife strike risk to aircraft is to identify the threat.

Table 1: Wildlife species involved in recorded BASH incidents at NAS Lemoore (1981 - present)

unknown wildlife species	194
coyote	1
Brazilian free-tailed bat	5
Molissidae species (bat)	1
unknown bat species	1
mourning dove	1
barn swallow	2
cliff swallow	1
unknown shorebird species	1
American white pelican	1
wood duck	1
northern shoveler	1
European starling	3
Blackbird species	3
unknown raptor species	2
Swainson's hawk	3
barn owl	2
red-tailed hawk	1
burrowing owl	1
unknown passerine species	7
song sparrow	1
horned lark	1

Table 1: Wildlife species involved in recorded BASH incidents at NAS Lemoore (1981 - present)	
Wilson's warbler	1
grasshopper sparrow	1
Total	**236**

Figure 1 represents wildlife strikes compiled for each month over the last 30 years. The winter months of January and February recorded the highest number of strikes. Migration and weather patterns may be responsible for the increase in strike reports during the fall, winter and spring seasons. Statistics show that most bird strikes occur from July - November at civilian airports nationwide (Cleary et al. 2005).

Figure 1: Total number of wildlife strikes reported by month at NAS Lemoore (1981 - 2011).

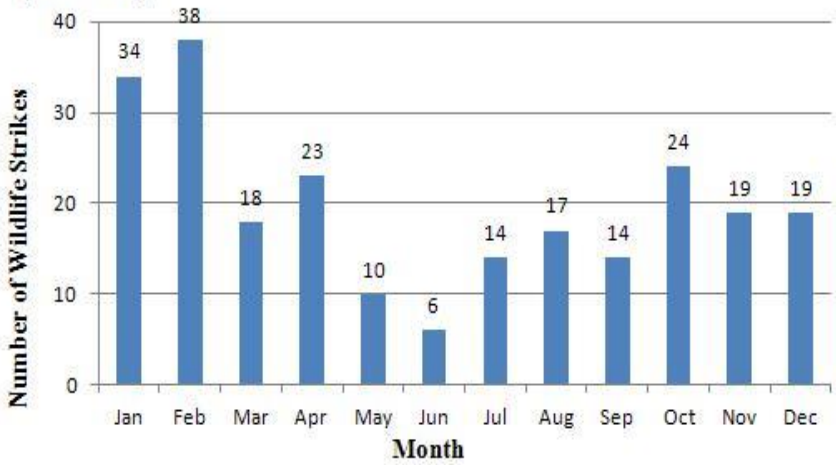
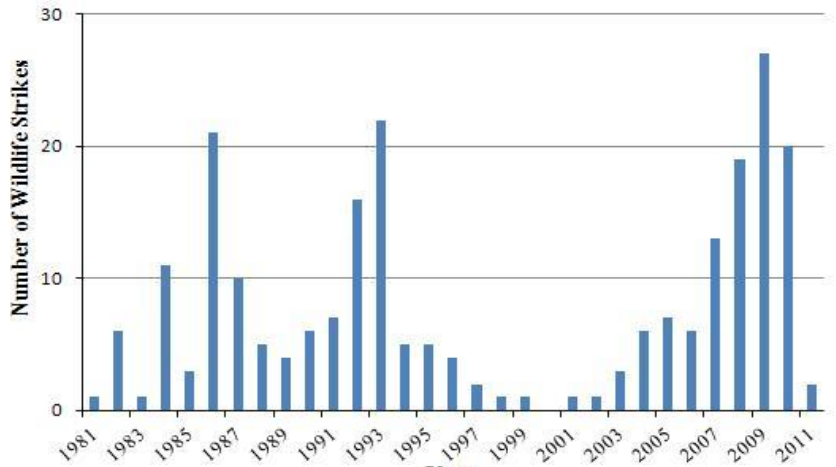


Figure 2 represents the number of strikes per year at NAS Lemoore. The spike in recorded strikes over the past four years may be due to an increased awareness of the importance of BASH data, or an actual increase in strikes. Without detailed information in strike reports, it is difficult to identify what variables are causing this increase in BASH reports. See results and discussion section 7.3 for theories of increased BASH reports as they relate to agriculture adjacent to the airfield.

Figure 2: Total number of wildlife strikes reported by year at NAS Lemoore (1981 - 2011).



The time of day at which strikes are occurring can be helpful in managing wildlife risks as well as to provide for an indication of what species pose a threat. Very little historical strike data addresses this factor. The “short narrative” column within the database provided minimal time

of day data: Three strikes were specifically reported during daylight hours, and 14 strikes were specified to have occurred at night.

The altitude and location in relation to the airfield at which a wildlife strike occurs can be helpful for mitigation in two ways. It can provide assistance identifying what species (if not properly identified) was hit and can also help identify movement patterns related to migration or attractants on the ground (i.e. food, water and/or cover). Unfortunately, this information is limited in the historical strike data, included only eight times (Table 2).

Table 2: BASH incidents recorded including maneuver, location and/or altitude of aircraft at impact at NAS Lemoore (1981 - 2011)

Date	Wildlife	Aircraft Maneuver	Location	Altitude
11-Jul-02	coyote*	FCLP	carrier box 32L	0
3-Jan-03	unknown bird	short final approach	32R	200ft.
20-Aug-03	unknown bird	takeoff	32R	800ft.
7-Jan-04	unknown passerine sp.	climbout departure	14L	?
9-Jan-04	unknown raptor sp.	landing	14L	?
12-May-08	unknown bird	FCLP	32L	?
5-Nov-08	unknown bird	short final approach	32L	?
27-Jul-09	American white pelican	?	32L	?

*a coyote den (2 adults and 7 pups observed) was located in May, 2011, in close proximity to the carrier box on 32L.

Reporting damage and cost caused by wildlife strikes is important in justification for mitigation of wildlife hazards threatening aircraft. It is important to understand that while we can gather dollar amounts for damaged aircraft and equipment, there is no quantitative calculation for the ultimate goal of wildlife hazard management at airports -- human health and safety. Table 3 provides damage data from the Navy Safety Office, which includes dollar amounts or a description of damage to aircraft. Reported dollar damage totals $318,031.

Table 3: BASH incidents recorded including description of damage to aircraft and/or dollar amount of damage at NAS Lemoore (1981 - 2011)

Date	Wildlife	$ Amount	Damage Description
17-Feb-82	unknown bird	?	"14x6x4 hole"
24-Mar-86	unknown bird	?	"1x3 dent"
20-Jan-88	unknown bird	?	"FOD Damage"
7-Aug-88	unknown bird	?	"substantial engine damage"
5-Nov-90	unknown bird	?	"bent comp blade"
29-Apr-91	unknown bird	?	"nicked blades"
3-Apr-95	unknown bird	?	"right engine ingested bird"
11-Jul-02	coyote	1,500	?
10-Apr-04	unknown bird	?	"birdstrike damage discovered after completion of night field carrier"
7-Mar-08	red-tail hawk	16,000	"right engine FCLP"

Table 3: BASH incidents recorded including description of damage to aircraft and/or dollar amount of damage at NAS Lemoore (1981 - 2011)			
9-Feb-09	unknown bird	19,999	?
11-Feb-09	unknown bird	10,000	"starboard inboard leading edge flap impacted by bird"
5-May-09	Swainson's hawk	5,332	?
5-May-09	mourning dove	200	?
27-Jul-09	American white pelican	265,000	bird damaged tailfin

Wildlife strike rates, the number of strikes per 100,000 aircraft movements, provides a useful index for assessing the severity of wildlife hazards at a given airport and for monitoring hazard abatement efforts. Consequently, the number of aircraft operations, coupled with the accurate collection of bird strike data should be a priority for air operations. Bird strike statistics based solely on pilot reports are generally unreliable and yield incomplete information because most strikes go undetected. By collecting the remains of dead birds found on runways during routine runway inspections, air operations can obtain information that would have otherwise been unavailable (Linnell et al. 1996), augmenting a more accurate assessment of the actual bird strike situation, due to factors such as decreased pilot acuity towards birds during critical phases of flight, size of the bird, flock size, weather conditions, time of day, or heightened pilot awareness during migratory seasons (Linnell et al. 1999). In the future, pilots, tower, and airport personnel should be strongly encouraged to submit a detailed BASH record every time a collision with wildlife occurs or the remains of dead wildlife is found on the runway. All bird remains that are found should be retained until they can be positively identified by a qualified individual, or if the remains are unidentifiable, they can be sent to Smithsonian Institute (Appendix 4). In the case of a damaging strike, remains should always be sent to Smithsonian Institute for a positive identification.

3.4. CURRENT WILDLIFE HAZARD MANAGEMENT

WS has conducted pigeon trapping and shooting in hangars aboard NAS Lemoore for the past four years. A total of 712 pigeons have been removed from these hangars significantly reducing pigeon abundance. This reduction in numbers has decreased damage caused by droppings and lowered the BASH risk associated with pigeons. Due to their flocking behavior and relatively dense body structure, pigeons pose a greater risk for damaging strikes.

Special consideration of the selection of crops grown adjacent to the airfield within NAS Lemoore’s outlease program is an important management technique. Crops which may be an attractant to wildlife (i.e. seed and grain) are discouraged in plots near the airfield.

Coyotes pose a threat to aircraft due to their abundance and use of the airfield. Prior to April 2011, the only mitigation for coyote presence on the airfield consisted of harassment by ground maintenance and WS using a vehicle. Coyotes seemed habituated to this technique and effectiveness was limited. In April 2011, WS initiated a trapping program to lethally remove coyotes from the airfield. Eight adult coyotes were caught and removed from the airfield (April 2011 – June 2011).

Annual mowing of the infield reduces food and cover for wildlife within the airfield.

A number of authorized actions can be taken to decrease wildlife hazards, depending on the species, time of year, ecological situations on the airfield, habitat characteristics on the airfield, and a number of other variables. It is therefore necessary to take into account the ecological behavior of wildlife observed on the airfield, particularly in relation to specific environmental characteristics when establishing a wildlife control program (Cleary and Dolbeer 2005). A variety of control methods are available for managing hazardous wildlife species observed at NAS Lemoore. See results section for a species by species discussion of authorized techniques, which does not preclude the use of other effective mitigation measures. It is important to remember that a little imagination and persistence greatly augments the duration and effectiveness of any bird hazard reduction measure.

4.0. LEGAL STATUS OF WILDLIFE SPECIES

Most forms of wildlife and their habitat are protected by one or more Federal, State, and/or Municipal laws. Before administering any control action at NAS Lemoore, whether lethal or not, the legal status of the target species should first be determined and potential non-target animals identified. Many of the agencies involved in regulating wildlife will require permits to harass or lethally control wildlife, and will issue these permits depending on the species and method of control involved. The commanding officer at NAS Lemoore is responsible for adhering to the current regulations regarding wildlife control and for obtaining the appropriate permits to take and/or harass specific types of wildlife.

4.1. FEDERAL REGULATIONS

The U.S. Government has passed several Acts for the protection of wildlife including the Migratory Bird Treaty Act (MBTA), Lacey Act, Endangered Species Act (ESA), Bald and Golden Eagle Protection Act, National Environmental Policy Act (NEPA), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). These are the basis of most wildlife regulations that have been issued in the CFR. Several agencies are responsible for implementing these regulations and many of these regulations affect wildlife control operations at airports. Federal wildlife laws are mostly administered by the U.S. Fish and Wildlife Service (USFWS), and primarily involve birds and animals protected under the MBTA and the Endangered Species Act. NAS Lemoore possesses a Federal depredation permit from the USFWS and this permit must be updated annually unless otherwise stated on the permit. WS can assist NAS Lemoore by completing a Form 37 Migratory Bird Damage Project Report (Appendix 5) to be submitted along with the application for a USFWS Depredation Permit.

4.2. STATE AND LOCAL REGULATIONS

The State of California accepts the Federal depredation permit for nongame bird species, but requires a special permit for mammals and game birds (Table 4). These regulations and statutes are primarily contained in the Fish and Game Code of California. The California Department of Fish and Game (CDFG), the agency responsible for administering wildlife enforcement,

publishes these statutes in a booklet (Fish & Game Code 2011) which is available from them upon request.

Table 4: Permits necessary for lethal control in Kings County

Category	Wildlife Species	State Permit	Federal Permit
Resident nongame birds	Starlings, house sparrows	No	No
Resident game bird	Quail, turkey, ring-necked pheasant, grouse, partridge	Yes	No
Migratory game bird	Ducks, geese, coots, mourning doves	No	Yes
Migratory nongame birds	All species except game birds, resident nongame birds and domestic and exotic birds	No	Yes
Depredation Order Birds	Crows, blackbirds, cowbirds	No	No
Domestic Birds	Rock doves (feral pigeons)	No	No
Furbearers	Fox, Raccoon	Yes	No
Nongame mammals	All species of mammals, including coyotes, except game, furbearers, domestic mammals, and fully protected wildlife listed in Appendix 5	No	No
Game mammals	Deer, elk, bear, wild pig, jackrabbits, other rabbits, tree squirrels	Yes	No
Feral domestic mammals	Dogs, cats, livestock	No	No
Reptiles and amphibians	All reptiles and amphibians except those fully protected listed in Appendix 5	No	No
Fully protected wildlife	Threatened and endangered species listed in Appendix 5, and/or mountain lions	Yes	Yes

5.0. DESCRIPTION OF STUDY SITE AT NAS LEMOORE

This WHA identified wildlife hazards within the fenced-in airfield and agriculture outlease plots directly adjacent to the airfield. Specific emphasis was placed on areas that attract wildlife. Wildlife attractants observed within the 12 month data collection period included: standing water in ditches and low-lying areas, springtime grasses and forbs (prior to mowing) within the airfield providing food cover and nesting sites to a variety of wildlife species and natural and man-made perches used by raptors. Presently, a high prey base of California ground squirrels provides food for predators such as raptors and coyotes. Adjacent to the airfield, attractants included alfalfa farming at the approach of 32R (located on the northeast side of the airfield) and winter wheat

production at the approach of 32L (located on the southwest side of the airfield). A fallow field west of 32L was utilized by coyotes crossing into and out of the infield.

5.1. FACILITIES

The airfield at NAS Lemoore includes two offset parallel runways (32R and 32L) that are 4,600 ft. apart. Runways themselves are 13,500 ft. long flanked by service roads and taxiways. Six hangars lie between the runways, as well as the air traffic control tower, terminal, fire station and administrative buildings. Ordinance storage and transfer sites lie to the east as well as a small arms range. Extensive culverts and canals drain runoff water from paved areas. An eight foot chain link fence encloses the entire operations area.

5.2. WILDLIFE

NAS Lemoore and the surrounding areas are diverse in wildlife. Bird strike data often show that the larger flocking birds, such as gulls, wading birds, and waterfowl, are considered to be more of a potential threat to aviation safety than smaller birds such as starlings, blackbirds, and feral pigeons, which can also present significant hazards in the formation of tight flocks comprised of hundreds of individuals (Barras et al, 2009). Solitary birds, i.e., raptors and turkey vultures, also present a concern due to their soaring and hovering behavior. NAS Lemoore attracts a moderate variety of bird species throughout the year.

Mammals are a hazard at NAS Lemoore. Coyotes are common in and around the airfield and have the potential for damaging strikes with aircraft. The habitat is very suitable for medium and small mammals which in turn provide foraging opportunities for raptors and larger carnivores. Bats are common in the area, and based on historical strike data are a potential hazard.

5.3. HABITATS

The availability of food, water, and cover attracts wildlife to airports and habitat management can provide the most effective long-term solution for excluding wildlife from the airfield. However, before implementing habitat modification, it is important to avoid redirecting wildlife into critical areas on the airfield. For this reason, the identification of existing habitat characteristics need to be incorporated with wildlife use patterns.

Habitats immediately surrounding the airfield at NAS Lemoore include: 1) A matrix of different agriculture plots and fallow fields. 2) Irrigation canals and seasonal flood canals. 3) Windbreaks including tamarisk and eucalyptus tree species

Water – Temporary standing water accumulates in the low lying areas and runoff ditches, almost exclusively on the east side of the airfield (32R) following periods of moderate to heavy rainfall. Long term, seasonal water occurs in the ditch perpendicular to both runways north of hangar 4. The runoff ditch paralleling 32R to the east is also very slow in draining, providing a wildlife attractant. Irrigation of alfalfa provides wildlife (particularly white-faced ibis and long-billed curlews) with a water source ideal for foraging.

Vegetation – Tall grass and weeds (>1m.) dominate the infield at NAS Lemoore in the winter and spring months, providing cover, food and nesting habitat for wildlife. Several large trees east of the approach of 32R provide cover and perches for wildlife. Herbaceous vegetation, dead brush and debris exist in the ditches, providing food and cover for wildlife. Farmed and fallow plots of land surround the airfield. Some crops (alfalfa) may be more of an attractant to wildlife than others (cotton).

Structures – Structures (hangars and buildings) provide perching, roosting and nesting sites for birds. In addition to buildings, the perimeter fence is frequently used by a variety of birds. Multiple bird species perch (and in some cases nest) on ILS structures, runway markers and outbuildings.

5.4. THREATENED AND ENDANGERED SPECIES (T&E)

Kings County hosts a number of T&E species that are granted protection under the auspices of Federal or State regulations (Appendix 6). The USFWS and CDFG should be contacted bi-annually to obtain updated species lists and should be reviewed prior to conducting operational control work such as hazing, shooting, trapping, toxicant utilization, or habitat manipulation to remain in compliance with Federal and State wildlife regulations.

6.0. METHODS

6.1. BIRD SURVEYS

Bird abundance and activity patterns were surveyed on the airfield (June 2010 – July 2011) using a standardized sampling design, based on the USFWS Breeding Bird Survey (Seavy et al. 2005). Ten surveys were conducted each month: including four morning, four evening, one midday and one nocturnal. Morning surveys began within a time range of 10 minutes before sunrise to 3 hours after sunrise. Evening surveys began within a time range of 2 to 3 hours before sunset. Midday surveys were conducted anytime between the morning and evening surveys. Nocturnal surveys using a spotlight were conducted one to three hours after sunset (see below for nocturnal survey protocol). A complete survey took approximately 2 hours. Twelve survey points were determined based on access, vantage point and approximated distance apart (~0.75 miles) to sample the extent of habitat types of Naval Air Station (NAS) Lemoore's airfield (see appendix 7). Surveyors used a vehicle to access points, which were all located on service roads adjacent to both runways. Prior to conducting the survey, time and date, percentage of cloud cover and wind speed were recorded.

At each survey point, observers noted time, exited vehicle and with the aid of binoculars recorded all birds seen and heard within approximately 0.25 miles radius of the point in all directions. This was done in 3-5 minutes. Next, all birds outside of 0.25 miles were recorded by sight in a time range of an additional 1-3 minutes. The surveyor then made every effort to avoid double-counting (i.e. birds were not counted in the direction of the next survey point beyond 0.25 miles). As the surveyor drove from one point to the next, birds seen or flushed by the vehicle which were not previously recorded at a point count location were noted.

6.2 NOCTURNAL SURVEYS

Spotlighting surveys were conducted from a vehicle along perimeter roads and taxiways using a 3,000,000 candle power light. Roadsides were scanned from within the vehicle (out to approximately 500ft.) moving at approximately 5-10 mph, and all mammalian and avian predators were recorded. Night surveys were conducted from 1-3 hours after sunset. One survey constituted a complete loop of the airfield and took approximately 1.5 hours to complete.

6.3 ANALYSIS OF DATA

For analysis purposes, common bird species were categorized into groups or guilds (Appendix 8). Species were placed into their respective guilds based on similar behavioral characteristics, not on phylogenetic (ancestral) or taxonomic relationships, although the guilds often paralleled taxonomic lines. This approach was selected because behavioral attributes play a significant role in predisposing some species of wildlife to collisions with aircraft. In addition, wildlife control strategies are often selected based on their ability to exploit an animal's specific behavior(s) therefore, species that exhibit similar behaviors and life history attributes generally require similar control methods.

6.4 EVALUATION OF WILDLIFE ATTRACTANTS

Birds and mammals require a variety of habitats in order to meet their basic needs for food, water, and cover. Crows, meadowlarks, doves, feral pigeons, starlings, sparrows, and small passerines are attracted to grassy areas of the infield to feed on seeds, insects, and small rodents. Waterfowl and shorebirds feed and loaf in temporary standing water, inside drainage ditches, in low-lying areas following heavy rains, and during a crop irrigation or harvest. Blackbirds feed on grass seeds and breed and roost in the uncut infield in the spring months. Larger raptors, such as red-tailed hawks, Swainson's hawks and northern harriers, perch on runway structures and fly over short grass and ditch areas to feed on small rodents and birds. The airfield provides suitable habitat for burrowing owls due to the large number of California ground squirrel burrows which are utilized by the owls for shelter and nesting. Swallow species forage in and around the airfield and nest underneath overpasses and in large culverts in the spring and summer months.

Habitat management provides the most effective long-term remedial measure for reducing wildlife hazards on or near airports, which includes the physical removal, exclusion, or manipulation of cover, nesting habitat, water sources or food items that attract wildlife. The ultimate goal is to make the environment unappealing to the species posing the greatest hazards to air traffic. This is most easily accomplished by promoting an airport environment with habitat that is monotypic or uniform throughout (Washburn and Seamus 2004).

6.5 AGRICULTURE CROP ANALYSES AS AN ATTRACTANT TO WILDLIFE

Crops in agriculture lands were identified in sections (1 mile squared [640 acres]) directly adjacent to the airfield (Appendix 9). Agriculture was identified in these areas from 2007 through 2010 using pesticide report applications obtained from the Kings and Fresno County Agriculture Department. Eleven sections within Kings County and five sections from Fresno County were queried for historical crop data. The county is obligated to keep five years of

historical crop data on file. Agriculture was quantified by adding up acreage of specific crops grown within these sections. This provided a general picture at what crop was grown and how much (acreage). Type and quantity of crop was then compared to the number of strikes documented at NAS Lemoore in that year.

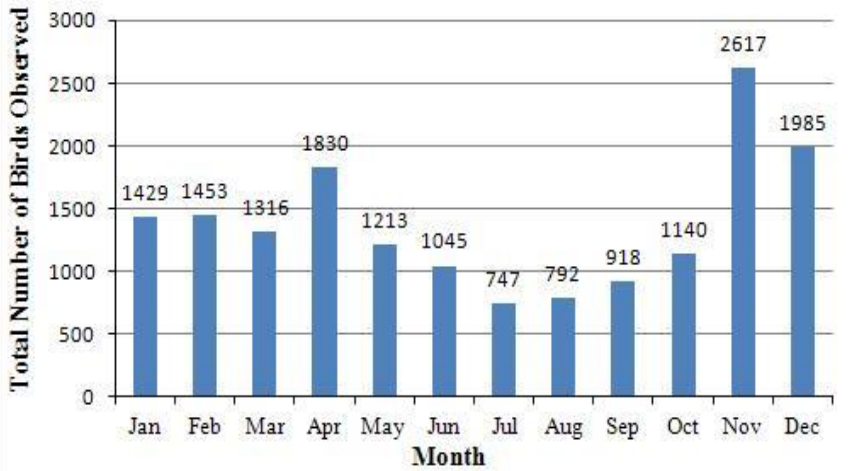
7.0 RESULTS AND DISCUSSION

7.1 BIRD SURVEYS

7.1.1 ALL SPECIES COMBINED AND MONTHLY TRENDS

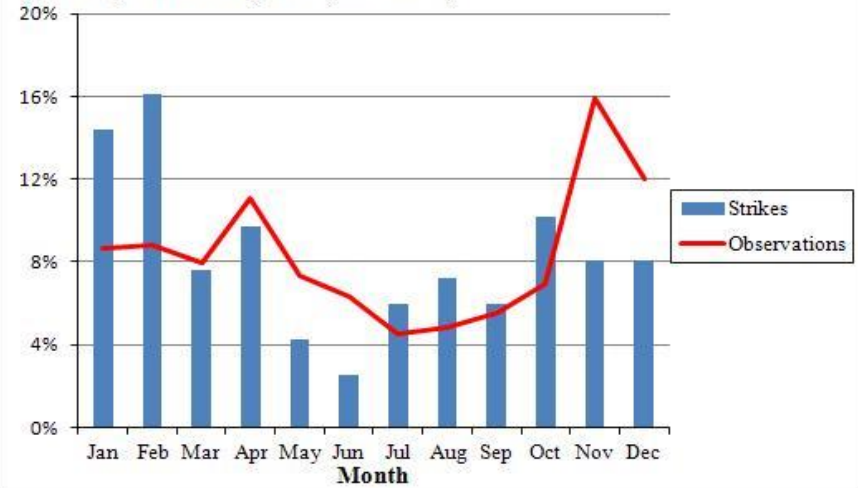
A total of 108 (not including nocturnal spotlighting) surveys were conducted from July 2010 to June 2011, resulting in 16,485 bird observations. Figure 3 illustrates total monthly bird observations throughout the study period. Figure 4 compares bird observations with historical strikes, using percentages of the total number of each. A trend in increased bird abundance and increased strike occurrence in the fall/winter months is noticeable.

Figure 3: Total birds observed at NAS Lemoore (July 2010 - June 2011).



A brief synopsis of monthly survey observations, and what guild and species contributed to these numbers, as well as historical strike data are as follows:

Figure 4: Comparison of percentage of birds observed (July 2010 - June 2011) to percentage of strikes reported (1981 - 2011).



January: There were 1,429 bird observations recorded, ranking January the 5th most bird-abundant month during the study period. The perching bird guild held the highest numbers (accounting for 74% of total birds observed) in the month of January. Species within this guild ranked in order of most abundant, included: 1) horned lark – 55%. 2) Western

meadowlark – 20%. 3) savannah sparrows – 14%. The starling/blackbird guild was the second most abundant group of species observed during surveys, accounting for 17% of the total (European starlings – 69% and blackbird species – 31%). The raptor/vulture guild ranked third in abundance (6% of total). Red-tailed hawks were the most abundant species at 60%, burrowing owls and northern harriers at 28%, and American kestrels at 11%.

This month has the 2nd most recorded bird strikes with 34. There were 28 unknown wildlife species, two passerine species, two raptor species, one unknown shorebird species and one northern shoveler struck in the month of January (1981-2011).

February: There were 1,453 bird observations recorded, ranking February the 4th most bird-abundant month during the study period. The perching bird guild held the highest numbers (accounting for 66% of total birds observed) in the month of February. Species within this guild ranked in order of most abundant, included: 1) western meadowlark – 58%. 2) horned lark – 22%. 3) savannah sparrows and passerine species combined – 19%. The starling/blackbird guild was the second most abundant group of species observed during surveys, accounting for 23% of the total (blackbird species – 71% and European starling – 29%). The raptor/vulture guild ranked third in abundance (8% of total). Red-tailed hawks were the most abundant species at 50%, American kestrels at 24%, northern harriers at 14% and burrowing owls at 12%

This month had the most recorded bird strikes with 38. There were 36 unknown wildlife species, one passerine species and one European starling struck in the month of February (1981-2011).

March: There were 1,316 bird observations recorded, ranking March the 6th most bird-abundant month during the study period. The perching bird guild held the highest numbers (accounting for 46% of total birds observed). Species within this guild ranked in order of most abundant, included: 1) western meadowlark – 54%. 2) horned lark – 19%. 3) savannah sparrows – 15%. The starling/blackbird guild was the second most abundant group of species observed during surveys, accounting for 22% of the total (blackbird sp. – 78% and European starling – 22%). The swallow guild was the third most abundant, accounting for 19% of the total. All swallows close enough to identify to species were cliff swallows.

This month had the 6th most recorded bird strikes with 18. There were 14 unknown wildlife species, one barn owl, one red-tailed hawk, one horned lark and one Brazilian free-tailed bat struck in the month of March (1981-2011).

April: There were 1,830 bird observations recorded, ranking April the 3rd most bird-abundant month during the study period. The starling / blackbird guild held the highest numbers (accounting for 59% of total birds observed). Blackbirds (mostly red-winged blackbirds) accounted for 98% of the species within this guild. Perching birds were the second most abundant guild observed, accounting for 24% of the total. Species within this guild ranked in order of most abundant, included: 1) western meadowlark – 39%. 2) western kingbird – 22%. 3) passerine species – 15%.

This month had the 4th most recorded bird strikes with 23. There were 19 unknown wildlife

species, one Swainson's hawk, one barn owl, one passerine species and one grasshopper sparrow struck in the month of April (1981-2011).

May: There were 1,213 bird observations recorded, ranking May the 7th most bird abundant month during the study period. The starling / blackbird guild held the highest numbers (accounting for 48% of total birds observed). Blackbirds (mostly red-winged blackbirds) accounted for 92% of the species within this guild. Perching birds were the second most abundant guild observed, accounting for 24% of the total. Species within this guild ranked in order of most abundant, included: 1) western meadowlark – 44%. 2) western kingbird – 21%. 3) savannah sparrow – 15%. The swallow guild accounted for 9% of the total. Swallows observed in close enough proximity resulting in species identification were cliff swallows – it may be safe to assume the majority of birds counted within this guild are cliff swallows. The raptor/vulture guild accounted for 8% of the total, with the most abundant species being burrowing owls (55%), followed by red-tailed hawks (38%).

This month had the 9th most recorded bird strikes with 10. There were 6 unknown wildlife species, one Swainson's hawk, one mourning dove, one Wilson's warbler and one Brazilian free-tailed bat struck in the month of May (1981-2011).

June: There were 1,045 bird observations recorded, ranking June the 9th most bird abundant month during the study period. The perching bird guild held the highest numbers (accounting for 26% of total birds observed). Species within this guild ranked in order of most abundant, included: 1) western meadowlark – 50% 2) horned lark – 16%. 3) western kingbird – 13%. The raptor/vulture guild ranked second in abundance (25% of total birds observed). Burrowing owls were the most abundant species at 82% and red-tailed hawks accounting for 14% of this guild. The starling/blackbird guild was the third most abundant group of species observed during surveys, accounting for 25% of the total (blackbird sp. – 79% and European starling – 21%).

This month had the 10th most recorded bird strikes with six (1981 – 2011). All six strikes involved an unknown wildlife species.

July: There were 747 bird observations, ranking July as the 12th most bird abundant month during the study period. The dove/pigeon guild held the highest numbers (accounting for 31% of total birds observed). Mourning doves accounted for 99% of the guilds numbers. The swallow guild ranked 2nd in abundance, accounting for 27% of the total birds observed. Cliff swallows accounted for 100% of their respective guild. Raptors/vultures was the third most abundant guild (accounting for 22% of total birds observed), with burrowing owls accounting for 83% and red-tailed hawks accounting for 15% of this category.

This month (and September) had the 8th most recorded bird strikes with 14. There were nine unknown wildlife species, one red-winged blackbird, one burrowing owl, one cliff swallow, one American white pelican and one coyote involved in strikes in the month of July (1981-2011).

August: There were 792 bird observations, ranking August the 11th most bird abundant month during the study period. The dove/pigeon guild held the highest numbers (accounting for 38% of total birds observed). Mourning doves accounted 100% of the species in this guild. Raptors/vultures ranked second in abundance (accounting for 23% of total birds observed) with

burrowing owls accounting for 76%, red-tailed hawks accounting for 18% and American kestrels making up the final 6% of this category. The starling/blackbird guild was the third most abundant group accounting for 18% of total species observed. Starling observations accounted for 65% of this guilds total.

August had the 7th most recorded bird strikes with 17. There were 11 unknown wildlife species, two barn swallows, two Brazilian free-tailed bats, one Mollosidae species bat and one unknown species of bat involved in strikes in the month of August (1981-2011).

September: There were 918 bird observations, ranking September the 10th most bird abundant month during the study period. The dove/pigeon guild held the highest numbers (accounting for 26% of total birds observed). Mourning doves accounted 98% of the species in this guild. The starling/blackbird guild was the second most abundant guild (accounting for 25% of total birds observed) during surveys. Blackbird species observations accounted for 83% of this guilds total. Raptors/vultures ranked third in abundance (23% of total birds observed) with burrowing owls accounting for 67%, red-tailed hawks accounting for 21% and American kestrels, Swainson's hawks, northern harriers and one peregrine falcon making up the remainder.

September (and July) had the 8th most recorded bird strikes with 14. There were 12 unknown wildlife species, one European starling and one red-winged blackbird involved in strikes in the month of September (1981-2011).

October: There were 1,140 bird observations, ranking October the 8th most bird abundant month during the study period. The perching bird guild held the highest numbers (accounting for 53% of total species observed). Species within this guild ranked in order of most abundant, included: 1) Finch species – 39%. 2) savannah sparrows – 21%. 3) western meadowlarks – 16%. 4) Passerine species and horned larks – 16%. This increase in abundance of passerine species is likely due to fall migration patterns. The doves/pigeons guild (accounting for 20% of the total birds observed) was the second most abundant group of species observed during surveys. Mourning doves accounted for 100% of this guild. Starlings/blackbirds was the third most abundant guild (accounting for 9% of the total birds observed), with blackbird species accounting for 100% of these numbers.

October had the 3rd most recorded strikes with 24. There were 20 unknown wildlife species, one European starling, one passerine species, one red-winged blackbird and one Brazilian free-tailed bat involved in strikes in the month of October (1981-2011).

November: There were 2,617 bird observations, ranking November the most bird abundant month during the study period. The perching bird guild held the highest numbers (accounting for 73% of total birds observed). Species within this guild ranked in order of most abundant, included: 1) Finch sp. – 28%. 2) horned larks – 25%. 3) western meadowlarks – 21%. 4) passerine species– 20%. This increase in abundance of passerine species is likely due to fall migration patterns. The shorebirds/waders guild was the second most abundant group of species observed during surveys. Mountain plovers (in flocks of up to 150 individuals) were observed for the first time in November, foraging in the infield northeast of RW 32R, accounting for 74% of species observed within this guild. Long-billed curlews accounted for 14% and were observed foraging in groups in multiple areas within the airfield. Killdeer were also observed for

the first time this month and accounted for 12% of this guild.

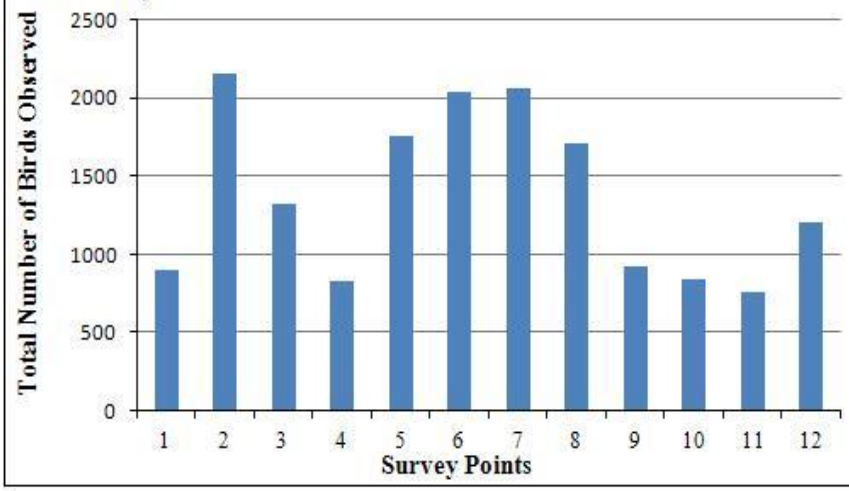
November (and December) had the 5th most recorded strikes with 19. There were 18 unknown wildlife species and one song sparrow involved in strikes in the month of November (1981-2011).

December: There were 1,985 bird observations, ranking December the 2nd most bird abundant month during the study period. The perching bird guild held the highest numbers (accounting for 73% of total birds observed). Species within this guild ranked in order of most abundant, included: 1) western meadowlark – 29%. 2) horned larks – 27%. 3) passerine species – 24%. 4) savannah sparrows – 12%. This increase in abundance of passerine species is likely due to fall migration patterns. The shorebirds/waders guild was the second most abundant group of species observed during surveys. Killdeer were the most abundant species in this guild (43%). Mountain plovers and long-billed curlews accounted for the remaining numbers.

December (and November) had the 5th most recorded strikes with 19. There were 17 unknown wildlife species, one passerine species and one wood duck involved in strikes in the month of December (1981-2011).

Locality of birds observed during surveys can be helpful in managing attractants on and/or directly adjacent to the airfield. Appendix 6 displays the locations of 12 survey points used in the point-count survey within the airfield. Approximately 0.25 mile buffers designate the area in which birds included in analysis were counted. Figure 5 depicts total bird observations for the year at each survey point. An increased abundance of birds were observed at the approach and departure ends (points 2,6,8 and 12) of both runways. Birds at these locations increase BASH threat because a majority of reported strikes occur at low altitude on takeoff and landing (Cleary et. al. 2005). These areas may be attractive to wildlife due to their relatively remote location within the airfield. The approach of 32R (ranked 3rd highest in bird observations) includes several trees, brush, runoff ditches and alfalfa farming in the general area.

Figure 5: Total birds observed at survey points at NAS Lemoore (July 2010 - June 2011).



7.1.2 SPECIES GUILDS

Figure 6 represents the percentage of abundance of species within their respective guilds.

7.1.3 MORNING AND EVENING SURVEYS COMPARED

Figure 7 shows that birds were more abundant in the morning, totaling 9,167 observations. Evening observations totaled 6,297. Figure 8 compares mid-day survey totals throughout the year.

7.1.4 PERCHING BIRDS

Strike History – There are 11 BASH incidents recorded at NAS Lemoore involving species from this guild (Table 1). Although no strikes specifically involving western meadowlarks have been reported at NAS Lemoore, they are commonly hit by planes across the nation. On 10 March 2009 one or more horned larks were struck by an F-18 in the landing pattern.

Description – The perching birds are the most diverse with 11 species (mostly passerines) grouped into this guild (Appendix 8).
These species have a wide range of foraging,

Figure 6: Percentage of birds observed within their respective guilds at NAS Lemoore (July 2010 -June 2011).

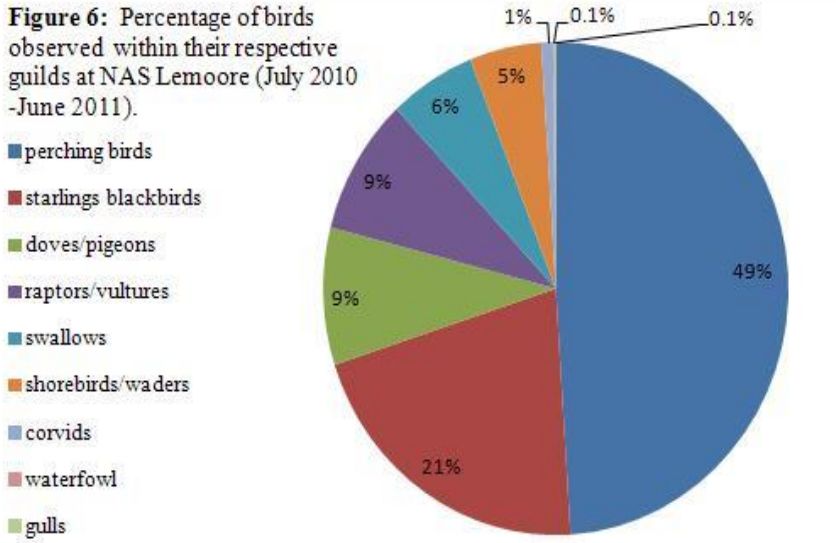


Figure 7: A comparison of morning and evening bird observations at NAS Lemoore (July 2010 - June 2011).

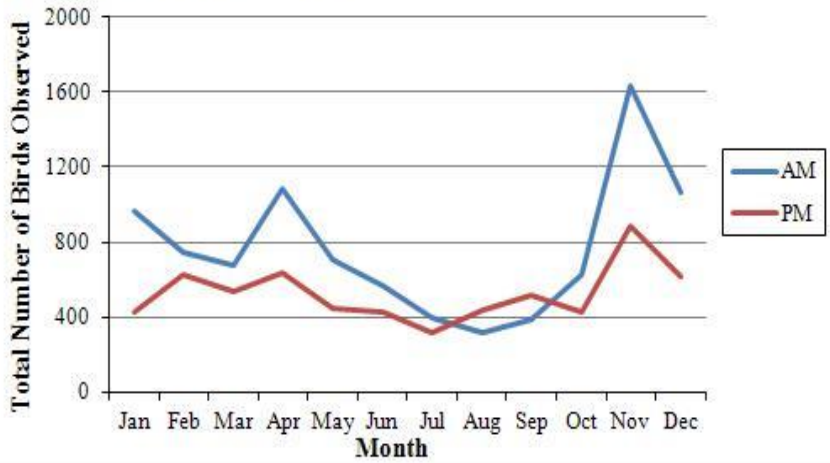
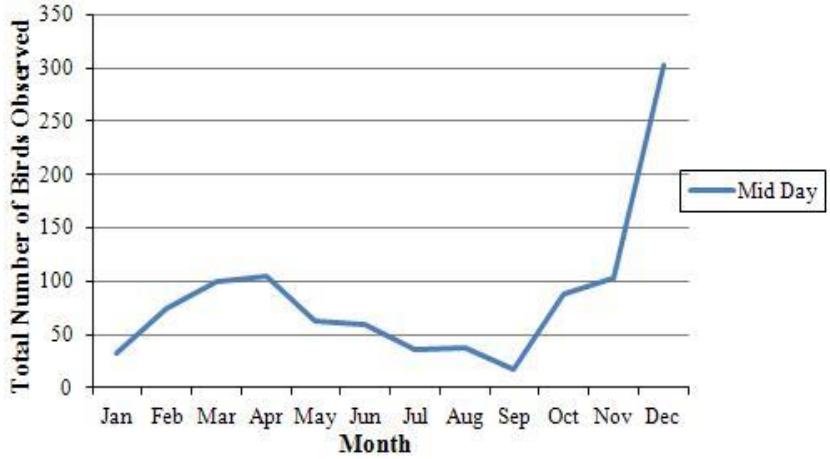


Figure 8: Total birds observed during mid-day surveys at NAS Lemoore (July 2010 - June 2011).



flocking, nesting and roosting behaviors. Generally, perching birds have a small body size.

General Abundance at NAS Lemoore - Perching birds represent the most abundant guild of species surveyed at Lemoore (Figure 6) totaling 7,882 observations throughout the study period. Figure 9 illustrates their abundance by month. Their numbers peaked in the fall months presumably due to migration. The following analysis includes species within the perching bird guild that were most abundant, OR were involved in strikes at NAS Lemoore in the past. Western meadowlarks were the most abundant species surveyed at NAS Lemoore in the perching bird guild, equaling 27% of the total. Meadowlarks were observed all year (Figure 10) and had the greatest abundance in February totaling 554 observations. Horned larks were observed in all months with the exception of July and September (Figure 11), and accounted for 24% of the total perching birds observed. Peak abundance occurred in January with 574 observations. Horned larks were observed singly, in loose flocks and in some cases large, tight groups (250 individuals were seen

Figure 9: Total number of perching birds observed at NAS Lemoore (July 2010 - June 2011).

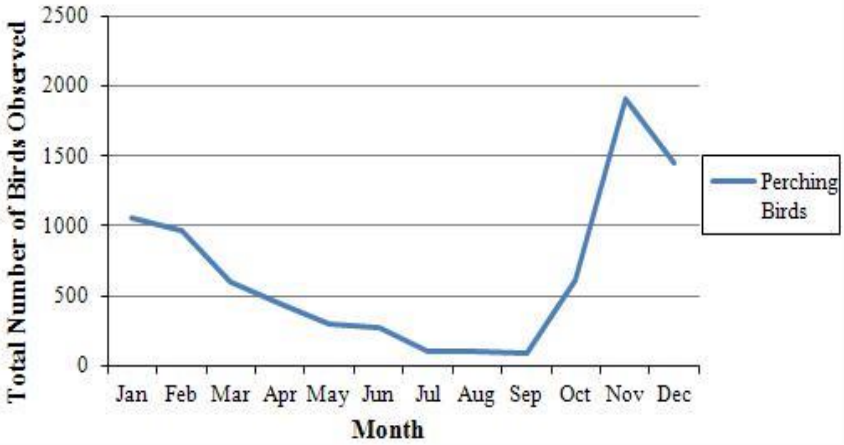


Figure 10: Total number of Western meadowlarks observed at NAS Lemoore (July 2010 - June 2011).

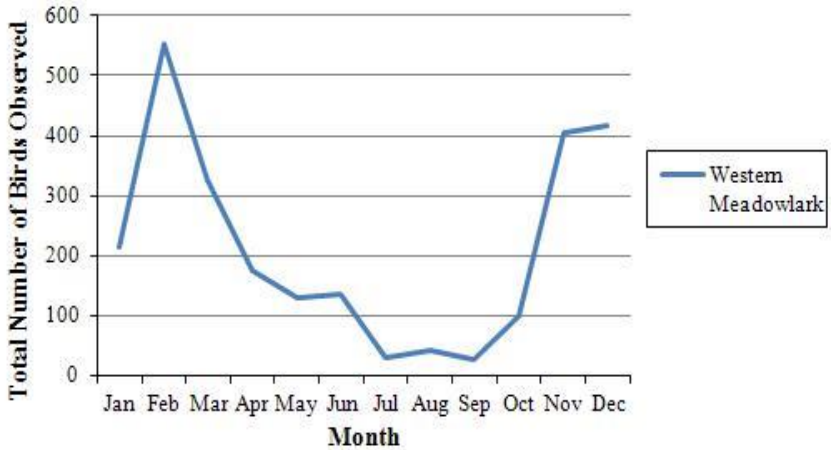
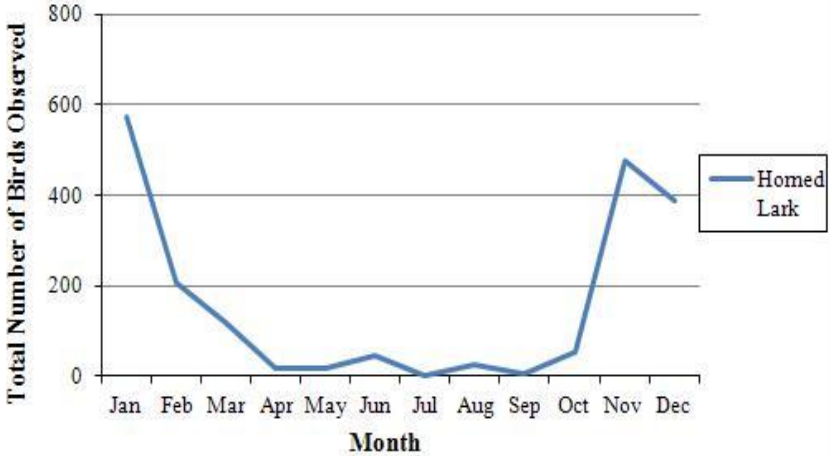


Figure 11: Total number of horned larks observed at NAS Lemoore (July 2010 - June 2011).



foraging adjacent to 32R during a morning survey in January). Although relatively small, their abundance and flocking behavior make them a hazard to aircraft.

At 11% of the total perching bird guild, savannah sparrows were the third most abundant species (Figure 12). December held the greatest abundance of savannah sparrows with a total of 168 observations.

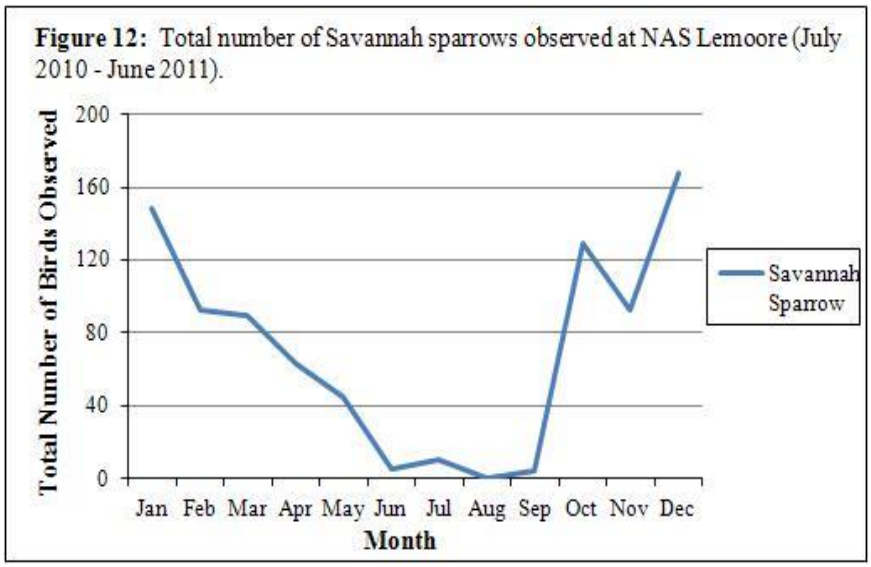


Figure 12: Total number of Savannah sparrows observed at NAS Lemoore (July 2010 - June 2011).

Attractants – Due to the wide ranging natural history of this diverse guild, perching bird attractants (food, water and cover) will favor some species, and limit others. Meadowlarks, horned larks and savannah sparrows are attracted to short grass and agricultural fields where seeds and insects are abundant. These species tend to forage at ground level. Meadowlarks will usually perch above ground on trees, shrubs, high tension wires, and fences, while savannah sparrows spend most of their time on the ground and flying low. Horned larks tended to forage on paved surfaces (runways and taxiways), as well as the infield grass.

Damage - Meadowlark and horned lark flocks aggregate on airfields during the winter migration to forage alongside and in-between the runways. Since large numbers of meadowlarks fly over the runways to reach open grass areas to forage, they are occasionally struck by aircraft. Savannah sparrows may be less of a threat to aircraft due to their tendency to fly low and in small numbers.

Legal Status – All species within this guild (except house sparrows which have no protection due to their non-native status) are migratory nongame birds protected under MBTA and require a USFWS permit for lethal take.

Control Measures - Pyrotechnics and shooting harassment is partially effective in moving the birds from one area to another. Care must be taken when applying these techniques so that birds do not disperse into areas where a strike is possible. Visual repellents, especially raptor kites, helium balloons, and stretched mylar tape can also be used, taking into account their potential to become a hazard as foreign object debris/damage (FOD). WS has had limited success in the use of mist nets at other airports to capture birds flying inside critical zones of the airfield.

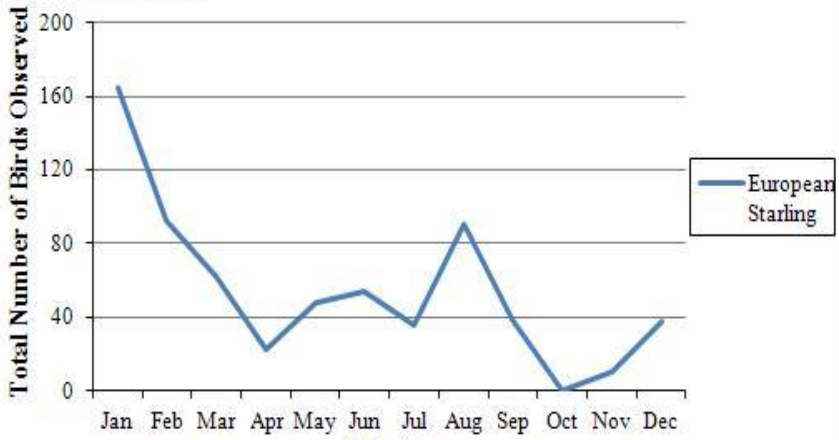
7.1.5 EUROPEAN STARLINGS AND BLACKBIRDS

Strike History – There are six BASH incidents recorded at NAS Lemoore involving species within this guild (Table 1), including three red-winged blackbirds and three European starlings.

Blackbird strikes were reported in October 1982, July 1984 and in October 2010. European starling strikes were reported in October 1981, February 1982 and in October 2005.

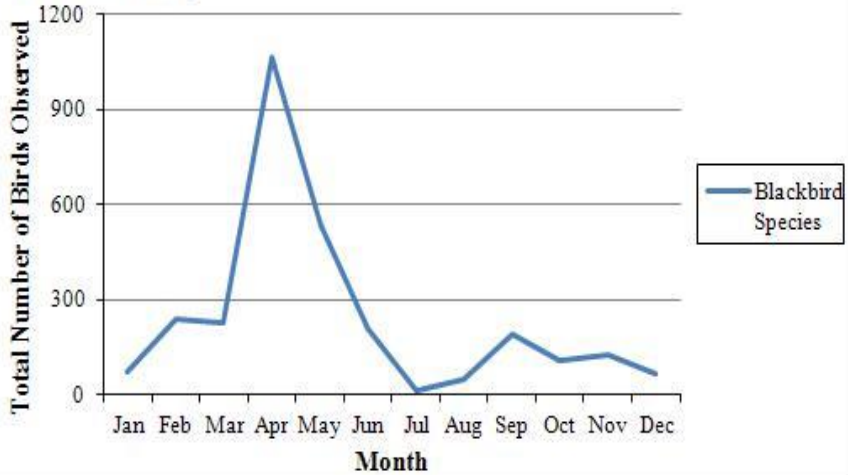
Description - Blackbirds are medium-sized songbirds with heavy bills, medium length tails and iridescent black feathers. Species encountered at NAS Lemoore include red-winged blackbirds (most abundant), Brewer's blackbirds and tri-colored blackbirds. European starlings are small stocky birds with a short tail and bright yellow bills. Adult plumage is black with a purple hue and change to a light heavily speckled brown in fall and winter. Starlings were introduced into North America from Europe, are cavity nesters, and will use any structure with holes for nesting. All are gregarious, especially in winter when they form roosts in the thousands, sometimes comprised of mixed species (Mott 1984, Linz et. al. 2007). Large flocks begin to form roosts as early as August and disband by April.

Figure 13: Total number of European starlings observed at NAS Lemoore (July 2010 - June 2011).



General Abundance at NAS Lemoore - Blackbirds and European starlings are common residents in Kings County. Blackbird species (mostly red-winged blackbirds) were the most abundant within this guild, totaling 2893 observations throughout the study period. They were observed year round, with April and May accounting for the highest numbers (Figure 13). Blackbirds were attracted to the high infield grass in April, and dispersed as the infield was mowed in May and June. Territorial and breeding behavior was observed in the spring as birds congregated in the high grass. Starlings, while not technically classified as blackbirds, were grouped into the same category due to similarities in behavioral and morphological characteristics, especially as it relates to bird strike hazards. Starlings were observed throughout the year (with the exception of October) totaling 657 observations throughout the study period. Peak numbers occurred in January and February (Figure 14).

Figure 14: Total number of blackbird species observed at NAS Lemoore (July 2010 - June 2010).



Attractants - Blackbirds are primarily granivorous, whereas European starlings are omnivorous and require a higher protein diet consisting of mainly fruits, insects, and some grain. Blackbirds are attracted to a variety of habitats depending on the species, while Brewer's blackbirds and starlings are attracted to urban areas, especially parks, golf courses and dairies. Starlings also prefer open areas on the airfield for foraging and hangars and trees for nesting and roosting. NAS Lemoore's primary attractant to blackbirds is the tall grass of the infield in the spring, which provides food, cover and nesting habitat.

Damage - Blackbirds and European starlings are considered a threat to aviation because of the large flocks they form when roosting in wetland vegetation (blackbirds) and foraging in short grass areas (starlings). These species have been attributed with some of the most devastating aircraft crashes. They are also vectors for many diseases transmittable to humans (*Salmonella* and *Chlamydiosis*), cattle (Johne's disease) and swine (transmissible gastroenteritis) (Barras et al. 2009). Starlings can also create a fire hazard in combustible structures due to the annual deposit of flammable dried grasses and twigs in their nests each year.

Legal Status - Blackbirds are classified as migratory nongame birds (Table 4), but can be taken when dense concentrations of birds constitute a health hazard (Appendix 10). However, the starlings are categorized as a non-native introduction, which does not afford it any state or federal protection and can be removed at any time without a permit.

Control Measures – The most effective mitigation effort for blackbird abundance observed at NAS Lemoore was the mowing of tall grass in the infield in the late spring. Flocks of birds foraging on the airfield can also be dispersed with pyrotechnics, bioacoustics, and visual repellents. However, birds often move to another location on the airfield without much effect. To increase the effectiveness of harassment techniques, concentrate efforts in the early morning and late afternoon hours when the birds are most active. Shooting may become a necessary reinforcement technique if the birds become habituated to pyrotechnics. The proper and consistent use of decoy traps can remove the highest number of birds over the shortest period of time. The use of pesticide DRC – 1339 (see below) may be an effective control technique. However, this pesticide can only be applied by WS under strict, hard-to-attain circumstances: intimate and certain knowledge of the baited birds roost site, where they will eventually die. This is especially important at NAS Lemoore due to the possibility of birds dying in an urban area. Additionally, surveys are required at the baiting site to determine if there are any protected species (threatened, endangered or species of conservation/special concern) that may be affected by this control technique. Tri-colored blackbirds (a California species of special concern) have been documented in Kings County, and if present at NAS Lemoore, DRC – 1339 may not be a control option for starlings or blackbirds.

1. Mechanical/Habitat Control at NAS Lemoore – The timely use of harassment techniques provides an immediate effect of bird dispersal from the runway environment. Vehicle/shooting harassment and pyrotechnics can effectively disperse flocks from the airfield when aircraft are not in the process of taking off or landing. Habitat management, such as mowing grass in the infield, removal of trees and securing of outbuildings and hangars (starlings) and cattails in watersheds (blackbirds), can make the area less attractive for feeding and roosting.

2. <u>Chemical Control - DRC-1339</u> - DRC-1339, (3-chloro-*p*-toluidine hydrochloride) under the direction of WS, is available for use in California to target red-winged blackbirds, starlings, and brown-headed cowbirds in non-crop staging areas associated with roosts. When mixed in flocks with one or more of the above mentioned species, American crows, Brewer's blackbirds, and yellow-headed blackbirds may also be considered target species. DRC-1339 can be used to significantly reduce the population when decoy trapping, habitat modifications, and frightening techniques are ineffective. A 98% concentration of the more dilute Starlicide, is a slow acting poison that kills most birds from 12–72 hours after ingestion by disrupting kidney function of the target species. It is species specific and has virtually no secondary toxicity hazards due to the metabolic breakdown of the compound into non-toxic metabolites. Mammals and birds such as house sparrows are unaffected at the delivered concentrations. The secondary poisoning potential of DRC-1339 to scavengers is low as it is less toxic to many other species including raptors and most mammals (DeCino et al. 1966). The label must be strictly followed and the CDFG should be contacted prior to use so they can address issues that may arise if the public reports the finding of dead birds. An application form must be filled out and submitted to the respective County Agriculture Department by the applicator to keep on record and must include the amount of chemical used, the number of birds taken, application sites and the disposition of unused baits.

A. ***Pre-baiting*** - Birds should be pre-baited with untreated grain placed in feeders for at least a week at staging areas away from public access. After most of the birds are accustomed to feeding, untreated baits are replaced with treated baits in the same containers and locations. The pounds of pre-bait used per day needs to be monitored to determine the amount necessary for the first treatment. Bait consumption will drop off daily thereafter, requiring less and less treated baits. Baiting sites must be carefully monitored to make sure non-target birds are not feeding on the bait.

B. ***Baiting with toxicant*** - Prepare baits the day before they are to be put out to give them time to air dry properly. All baits should be used within a week or disposed of according to label instructions; DRC-1339 baits discolor and lose their potency in a short time. Screened cracked corn should be used for blackbirds and a protein pellet such as calf manna can be used for starlings. About two pounds of bait should be prepared for every 1,000 birds in the roost. The abatement program should begin as soon as large numbers of blackbirds or starlings are seen staging at NAS Lemoore prior to going to the roost. Subsequent programs conducted during the same winter should be planned only if warranted. Baits should be placed out approximately two hours before sundown or an hour before sunrise and retrieved when birds stop feeding, usually about three hours later. The applicator must remain on site and the baits should be watched from nearby to ensure that non-target species are not present. Treatment should continue for a week or until all birds have had the chance to feed.

C. ***Clean Up*** - Birds will begin to die at the roost the morning following treatment. They should be picked up immediately by the custodial and field maintenance personnel and the area should be monitored frequently during the day to ensure all birds are picked up. Dead birds and any unused bait should be counted by species and properly disposed of in a hole, 3-6 feet deep in an inaccessible area. Soil binds up and detoxifies DRC-

1339 quickly so that it is not considered an environmental hazard. At the conclusion of the baiting trial, the hole will need to be covered back over with dirt.

3. European Starling Nests and Roosting Sites – Starlings commonly nest in the cavities of man-made structures and trees and should be discouraged from doing so where applicable. Securely fasten quarter inch wire mesh over holes or entrances to exclude them from structures. If this is not feasible, nest box traps can be used to capture target birds by placing the trap near the cavity that starlings are using or are expected to use. Clean out the nests and hang the trap near an active cavity. Inspect the trap frequently during the day, especially early in the nesting season which will commence around early to mid-March. Remove any trapped starlings and euthanize them with an acceptable and humane method such as cervical dislocation (breaking the neck) or the use of carbon dioxide gas. If non-target species are caught, they should be freed immediately. To exclude starlings from roost sites all entrance and exit routes should be blocked.

A. Decoy Traps - European starlings and blackbirds can be caught in decoy traps. The primary trap used is a modified Australian crow trap. This trap can be set up on the airfield in areas where birds are feeding, loafing, and roosting. A 1.75 inch wide opening in the slot-board is recommended.

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Traps should be pre-baited on the top of the trap with dry cat food (starlings) and sunflower seeds (blackbirds) for several weeks until there are signs of active feeding. Once this is accomplished, start baiting the inside of the trap with the door open to allow birds to acclimate to the inside of the trap. After several days, close the door with a supply of food and water and wait until a few birds are captured. Retain approximately 3-5 birds as live decoys to attract the remaining birds to go inside. Remove and euthanize excess birds and maintain fresh food and water daily as needed.

7.1.6 RAPTORS

Strike History – There were nine BASH incidents recorded at NAS Lemoore involving species within this guild (Table 1). Two unknown raptor species were struck in the month of January in 2004 and in 2009. Three Swainson's hawks were struck in April and May (this strike caused a recorded $5,332 worth of damage to an F-18) of 2009 and again in July of 2010. One red-tailed hawk was struck in March 2008, causing $16,000 worth of damage to an F-18. One burrowing owl was struck in July of 2010.

Description - Raptors are predatory birds and scavengers that possess hooked beaks and talons to capture and feed on prey. Raptors include vultures, eagles, hawks, osprey, kites, harriers, falcons, and owls. Raptors range in size from as small as the 8-inch long American kestrel to as large as the 36-inch long golden eagle. Most species have characteristic foraging styles such as soaring (vultures and eagles), low-flying (harriers) and dense forest (accipiters) ambush, hovering (white-tailed kite and kestrel), and watching from perches (red-tailed hawks and owls). Seven species represent the raptor/vulture guild observed during surveys at NAS Lemoore (see Appendix 8).

General Abundance at NAS Lemoore – Raptors represent the third most abundant guild of species surveyed at NAS Lemoore (Figure 6) totaling 1,576 observations throughout the study period. Figure 15 illustrates their abundance by month. Raptor numbers peaked in the summer months due to a large breeding and summering population of burrowing owls. The following analysis includes species within the raptor guild that were most abundant, or were involved in strikes at NAS Lemoore in the past.

Burrowing owls were the most abundant species (and were also involved in one bird strike) surveyed at NAS Lemoore in the raptor guild, equaling 50% of the total. Burrowing owls were observed all year (Figure 16), but spiked dramatically as owls migrated to NAS Lemoore in the summer months. June had the highest number of burrowing owl observations – 217.

Red-tailed hawks were the 2nd most abundant species observed in the raptor guild (accounting for 33% of the total), and

Figure 15: Total number of raptor species observed at NAS Lemoore (July 2010 - June 2011).

Figure 16: Total number of burrowing owls observed at NAS Lemoore (July 2010 - June 2011).

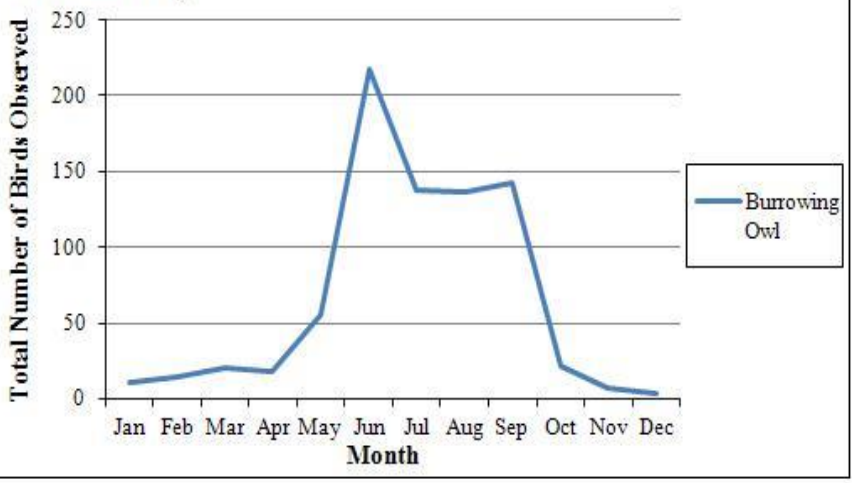
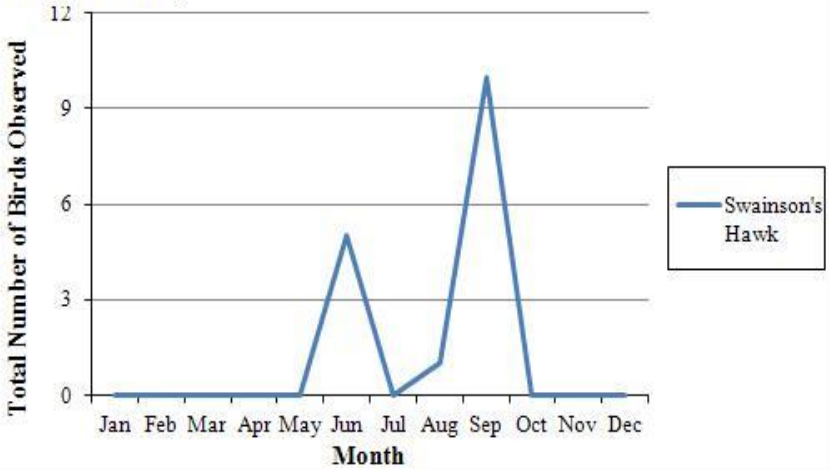


Figure 17: Total number of red-tailed hawks observed at NAS Lemoore (July 2010 - June 2011).

were involved in one damaging strike at NAS Lemoore. Red-tailed hawks were observed all year (Figure 17), but were more abundant in the winter months, as migrating hawks frequented NAS Lemoore. December had the highest number of red-tailed hawk observations – 66.

Swainson's hawks were rarely observed during surveys (Figure 18), but were involved in three strikes in 2009 and 2010. One of these strikes was recorded as having caused damage to the aircraft. September observations during the survey peaked at 10 individuals observed foraging together at the approach of 32R. Anecdotal observations in October included 100+ individual Swainson's hawks foraging (on the ground) in a freshly cut alfalfa field east of the CALA (ordnance storage and transfer site). Although these numbers were not captured in the bird survey, they do represent a serious threat to aircraft due to their flocking behavior and large body size. The recorded strikes occurred in spring and summer months, not in concurrence with the large migrating flocks observed in the winter, suggesting that smaller numbers of Swainson's hawks may be breeding in the area.

Figure 18: Total number of Swainson's hawks observed at NAS Lemoore (July 2010 - June 2011).



Attractants - Adequate prey availability (ground squirrels, rodents and insects), open spaces, roosting, and perching structures at NAS Lemoore provide attractive habitat for raptors. Mowed infields ideal for visual hunting, coupled with numerous perching sites (glide slopes, wind socks, buildings and trees) provide raptors with an ideal situation. Agriculture immediately adjacent may also be attractive to raptors for food (i.e. cut alfalfa attracting Swainson's hawks), and windbreak trees for nesting sites.

Damage - Raptors represent a significant hazard to aircraft because they are typically large in size and because their hunting and soaring behavior increases the likelihood of collisions with aircraft.

Legal Status - Raptors are protected under the MBTA and are classified as nongame migratory birds. The bald eagle, golden eagle, Swainson's hawk, and ferruginous hawk are afforded varying degrees of protection under state and/or Federal laws and the respective regulating agencies should be consulted prior to implementing any control action that may affect them. Eagles have further protection under the Bald and Golden Eagle Act of 1940 which requires additional permitting to harass or take. Wildlife control personnel should be aware and have the ability to identify these species to avoid any potential violations of their respective added protection. Other species such as the northern goshawk, merlin, flammulated owl, and burrowing owl are species of special concern and/or birds of conservation concern for State

and/or Federal agencies. Further evaluation is needed before action is taken concerning these species. This list should be reviewed and updated twice a year pending a change in status.

Control Measures - Habitat modifications, specifically tree and shrub removal on and near the airfield, spike stripping and/or other exclusion techniques on man-made structures used as perches, and prey-base reduction (squirrels and rabbits), will have profound effects on the number of raptors using an area. If raptors still persist to remain on the airfield, hazing (pyrotechnics) can be used to deter their presence. The most non-respondent individuals may have to be trapped or shot. Raptors can be captured using several styles of traps including bal-chatri, padded-jaw leghold (WS use only), and Swedish goshawk. Most of these can be used to take and relocate specific individuals. If a hawk becomes trap shy, and continues to pose a risk to flight safety, lethal removal may be the last resort to protect human health. The appropriate permit must be obtained prior to implementing any of the described control methods.

1. Bal-Chatri Trap - These traps are relatively small and are shaped into a semi-cylindrical form. They can be modified to trap specific types of raptors. Live bait is used to lure raptors and nylon nooses entangle their feet, holding the birds. Traps are made of 1" chicken wire (1/4" mesh hardware cloth if mice are used for bait), formed into Quonset-huts, 18" long, 10" wide, and 7" high. Floors are 1" wire mesh or smaller, depending on bait. Tops are covered with about 80 nooses of 20-40 lb. test monofilament line. Traps should be anchored to the ground to prevent birds from dragging them off or breaking the nooses and baited with live rodents for the best attractant. Once a trap has been set, it is important to monitor it continually.

2. Padded-Jaw Leghold Trap (WS use only) – Problem raptors can be caught with sliding padded pole traps. Erect 5-10 foot poles near areas where hawks frequent and place modified # 1 coil spring traps on top of the poles; it is suggested that one of the coil springs be removed and a small perch be mounted to the pan that does not interfere with closing. Jaws must be padded with foam rubber, wrapped by electrician's tape. Run a 12-gauge steel wire through the trap-chain ring and staple it to the top and bottom of the post. This allows a trap to slide to the ground where the bird can safely rest. An anchor of light gauge wire can be used on the opposite side to give the trap stability, but should remain loose so the trap falls to the ground.

3. Swedish Goshawk Trap - These are relatively large traps that can be used to capture all types of perching raptors. They consist of 3'x3'x1' bait cages made of 1" wire mesh with traps mounted on top that consist of wooden A-frames, nylon net panels, and a trigger mechanism. The trigger mechanism is a hinged stick that snugly fits between the panels and collapses when a raptor lands on it. Pigeons, starlings, rats and mice can be used as bait, but the bait cage needs smaller wire mesh for mice.

7.1.7 DOVES

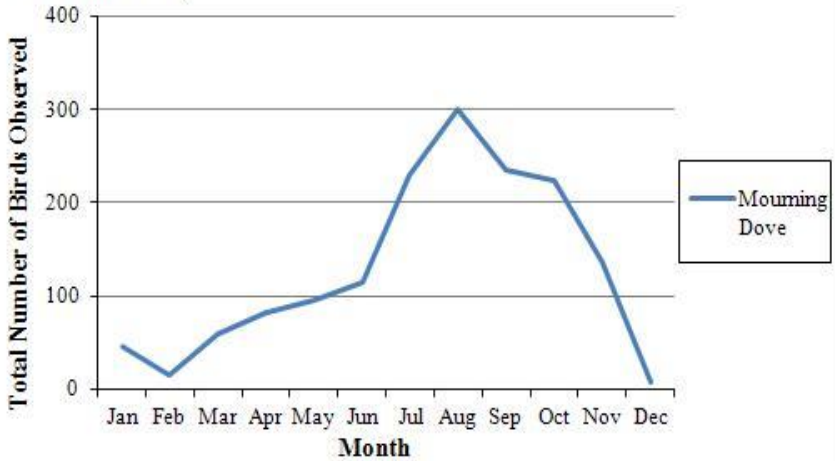
Strike History – There has been one BASH incident recorded at NAS Lemoore involving a mourning dove (Table 1). The strike occurred in May of 2009 and caused a recorded $200 worth of damage to an F-18. No recorded strikes of rock doves (feral pigeons) are documented

at NAS Lemoore, but they have caused damage by excreting waste onto aircraft in hangars. Multiple canopies have been destroyed by their acidic droppings.

Description - Doves are powerful fliers with a robust body, small head, and short beak. Mourning doves and rock doves are the only two species representing this guild. Mourning doves are widespread throughout California and typically fly in pairs or small groups of 3-10 birds close to the ground near cover as they travel between feeding and roosting areas. Rock doves (feral pigeons) were introduced from Europe and have spread across the U.S. into California. They tend to fly in flocks of 10-100 birds at higher altitudes, descending to their destinations in a rapid circling pattern with wings spread back. Although both species are primarily granivorous, they are also well-known for readily accepting handouts from humans.

General Abundance at NAS Lemoore – Doves represent the 4th most abundant guild of species surveyed at NAS Lemoore (Figure 6) totaling 1,574 observations throughout the study period. Mourning doves account for 99% of this guilds total. Figure 19 illustrates mourning dove abundance by month. Observations of rock doves were rare during surveys, presumably due to a control program implemented in 2006, which includes trapping and shooting inside the hangars.

Figure 19: Total number of mourning doves observed at NAS Lemoore (July 2010 - June 2011).



Mourning doves were abundant in the summer and fall months, peaking in August with 300 observations recorded.

Attractants - Mourning doves and rock doves are common in agricultural areas, dairies, open grass fields, disturbed areas, and urban settings. Buildings often provide desirable nesting areas for rock doves, e.g. rafters in hangars and outbuildings. Mourning doves will usually nest in trees or elevated structures, or in brushy areas on the ground.

Damage - Although rock doves are not as large as many other species considered detrimental to air safety, e.g. waterfowl, gulls, and raptors, they are still a concern because of their loose flocking behavior, overall abundance, and dense body structure, all of which increases their potential to damage an aircraft. Rock dove droppings damage buildings and airplanes, which are corrosive to painted and metal surfaces and are vectors for several infectious diseases such as psittacosis, salmonella and histoplasmosis (Haag-Wackernagel 2006). Although not as large as rock doves, mourning doves must be considered a threat due to their prolific abundance at NAS Lemoore.

Legal Status – Rock doves are not regulated by federal or state laws and can be taken at any time. Mourning doves, however, are migratory game birds and are regulated by Federal and State regulations and permits are required for lethal control activities.

Control Measures - Habitat modification, such as elimination of seed producing vegetation and the reduction of available water sources, will reduce the number of doves on the airfield. Building construction plans should include designs to prevent nesting by doves and other birds and pre-existing buildings should be retrofitted with exclusionary netting or types of barriers to block access to eaves and I-beams. Installation of wire slinky coils, porcupine wire, or some other tactile repellent, e.g. Tanglefoot™ or 4-the-birds™, can be applied to problem areas.

Doves can be effectively hazed and removed by shooting with a shotgun or pneumatic air gun, and/or decoy trapping. Hazing birds with pyrotechnics and vehicle/shooting harassment are effective in areas where birds pose an immediate threat to aircraft safety. Shooting does reduce bird abundance on the airfield, and can be used to remove birds from hangars as well as other roosting and nesting structures. Once a large percentage of birds have been removed from these sites, it is prudent to install exclusion barriers or employ continual trapping to prevent birds from re-colonizing the area.

Avitrol[7] (4-aminopyridine), a chemical frightening agent, is also available for rock doves, but it is not recommended for use near airports due to the bird's unpredictable behavior under its influence. In higher doses, Avitrol can be applied as a toxicant.

DRC-1339, (3-chloro-*p*-toluidine hydrochloride) under the direction of WS, is available for use in California to target rock doves. See section 7.1.5 for application instructions.

Decoy or walk-in traps that utilize a swinging door are very effective in removing a significant number of rock doves from buildings that are adjacent to the airfield and the outer perimeter of the airport. To set one, pre-bait a trap with scratch (mixture of cracked corn and millet) and/or bread in an area where birds are loafing and roosting. Capture a decoy and keep it inside the trap with enough feed and water and check the trap weekly. Rotate the trap to new locations as necessary to maintain maximum catch rates. Euthanize captured birds by placing them inside a carbon dioxide chamber, especially large-scale projects, or cervical dislocation and dispose according to regulation.

7.1.8 SWALLOWS

Strike History -- There were three BASH incidents recorded at NAS Lemoore involving species within this guild (Table 1). Two barn swallows were struck in August of 2004 and 2009. One cliff swallow was struck in July of 2010. No damage was reported.

Description– Swallows are a gregarious species and spend much of their time foraging on insects in the air. They are slight in stature and are well known for their mud nests which they build colonially, usually in the eaves of man-made structures or under bridges. Although every swallow observed during a survey was not identified to species due to their small size and erratic flying patterns, the birds that were identified at NAS Lemoore were cliff swallows. For purposes of analysis swallow species were lumped together.

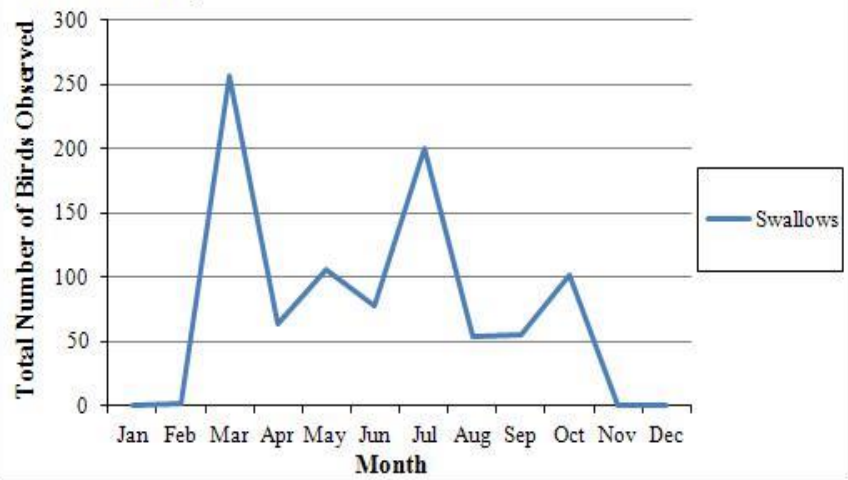
General Abundance at NAS Lemoore - Swallows represent the 5th most abundant guild of Species surveyed at NAS Lemoore (Figure 6) totaling 915 observations throughout the study period. Swallows occurred during spring, summer and early fall months (Figure 20). March and July held the highest numbers observed during surveys, 256 and 200 respectively

Attractants – Swallows need a water source coupled with fine textured dirt in close proximity to their nesting site to construct their mud nests. Wide open country is needed for aerial foraging on insects. NAS Lemoore hosts good habitat for this species: water in drainage ditches, concrete structures (culverts and underpasses) for nesting and abundant foraging grounds.

Damage – Cliff swallows are a commonly struck species by aircraft across the nation (Dolbeer 2009). The tendency for swallows to forage in loose flocks increases the potential for multiple strikes, and their presence on the airfield is a risk to aircraft and should be mitigated for.

Legal Status – Swallow species are protected under the MBTA. A Federal depredation permit will need to be obtained if swallows or their established nests are to be removed.

Figure 20: Total number of swallow species observed at NAS Lemoore (July 2010 - June 2011).



Control Measures – Swallows are controlled by excluding them from preferred nesting sites and/or removal and destruction of nests and eggs. Exclusion techniques include hanging obstructions (rope, chain, plastic sheeting, etc.) at prime nesting sites such as eaves of buildings or under bridges. Non-stick paint can be applied to man-made nesting areas (buildings and concrete structures) to repel mud pellets which make up a swallows nest. In the non-breeding season, old nests should be washed away completely to deter re-nesting in the area. Insect control may decrease swallow abundance by removing their food source, yet can be cost prohibitive.

7.1.9 SHOREBIRDS AND WADING BIRDS

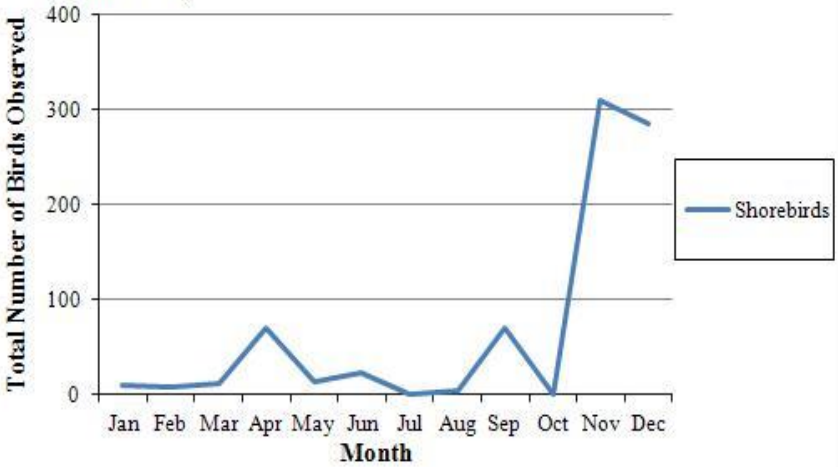
Strike History – There are two BASH incidents recorded at NAS Lemoore involving species within this guild (Table 1). One American white pelican was struck in July 2009, over 32L and caused $265,000 worth of damage. One unknown shorebird was struck in January 2010, with no damage reported.

Description – Wading birds are tall and long-necked birds with wide wingspans, which include egrets and herons. Egrets and herons have long beaks used to catch aquatic organisms, small

rodents and lizards from wetland to dry grassland habitats. Adults migrate to nest in trees near watersheds called rookeries. Since wading birds have large wingspans and generally fly in pairs or small groups, they have the potential to cause severe damage to aircraft components. Shorebirds vary in size and flocking behavior and are generally found near wetland areas. A majority of shorebirds are long range migrants, nesting in Alaska or Canada and wintering in the neotropics.

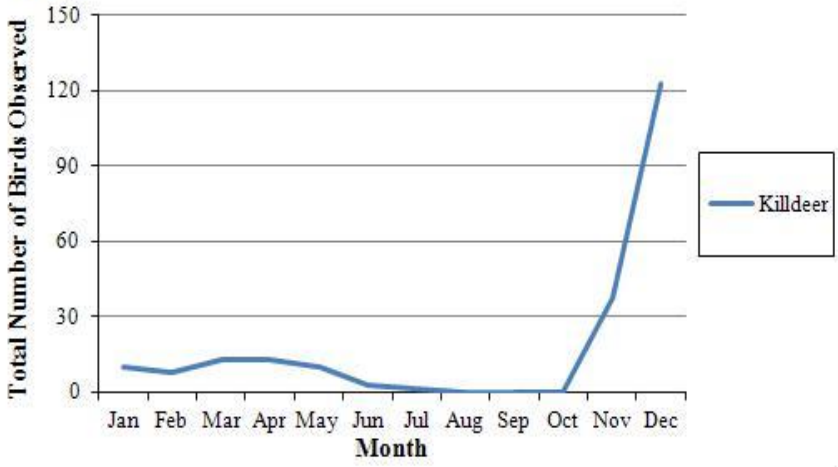
General Abundance at NAS Lemoore – Shorebirds/waders represent the 6th most abundant guild of species surveyed at NAS Lemoore (Figure 6) totaling 808 observations throughout the study period. Figure 21 illustrates their abundance by month. Shorebird numbers peaked in the winter months of November and December, in large part due to migrating mountain plovers foraging in the infield. The following analysis includes species within the shorebird/wader guild that were most abundant, posed an obvious threat to aircraft, or were involved in strikes at NAS Lemoore in the past.

Figure 21: Total number of shorebird species observed at NAS Lemoore (July 2010 - June 2011).



Mountain plovers were observed in only two months yet had the highest numbers within this guild, totaling 327. In November, several large flocks were observed foraging east of 32R, approximately 100-200 yards from the runway. Observations totaled 230 in this month. There were 97 observations of mountain plovers in December, foraging in the same general area. This species accounted for 40% of the total number within this guild, in just two months.

Figure 22: Total number of killdeer observed at NAS Lemoore (July 2010 - June 2011).

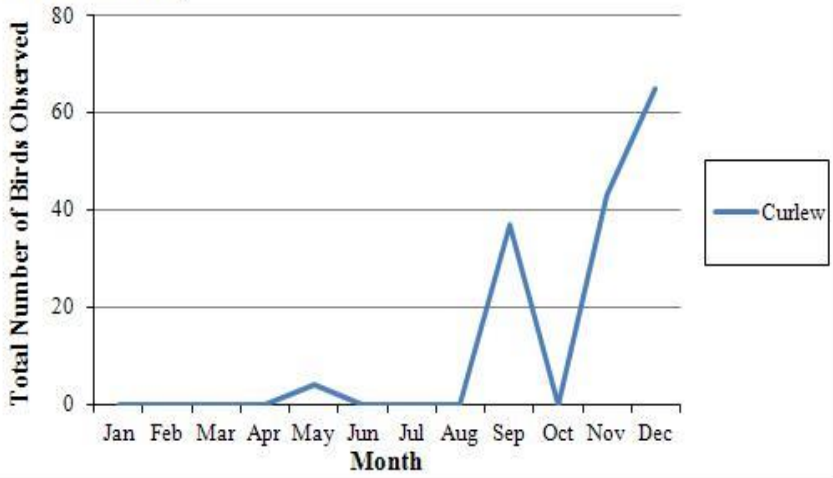


Killdeer were the second most common shorebird species observed accounting for 27% of the total number of species in this guild. They were observed in nine of 12 months, and most abundant in December (Figure 22). Killdeer have a tendency to forage and nest close to or on the runway/taxiways at airports. Although there

have been no reported strikes involving killdeer, they pose a threat and should be mitigated for.

Long-billed curlews were observed in surveys occasionally (Figure 23), yet due to location and behavior posed a significant risk to aircraft. On 30 August at 1915 during an evening point count survey, a large group of shorebirds was observed landing in the freshly cut alfalfa field south of the approach of 32R. This observation was made from the west side of 32L. As birds were landing, a jet made an approach on 32R, flushing approximately 100 birds, which re-landed immediately. At 1940 on that same evening, approximately 500 long-billed curlews were observed foraging in the cut field. Curlew numbers subsided as this field was observed for the next few days. It appeared that curlews were attracted to this field in large numbers for a short amount of time following the alfalfa cut.

Figure 23: Total number of long-billed curlews observed at NAS Lemoore (July 2010 - June 2011).



White-face ibis were observed in surveys in the months of June and September for a total of 34 observations. Like the curlews, ibis were reported as a threat while foraging in the alfalfa field south of the approach of 32R. Ibis preferred using the field during irrigation. Reports included hundreds of ibis flushing after a jet landing on 32R, causing a serious BASH threat to planes landing after they had flushed. The ibis were present in large numbers for the duration of the irrigation – two to three days.

Although American white pelicans were not observed during surveys, they are a concern due to their large size and the fact that they were involved in a damaging strike in 2009. An anecdotal observation occurred on 06 April: four white pelicans were observed flying east over the north end of 32R at approximately 300 feet above ground level (AGL).

Attractants – Wading birds are attracted to temporary or permanent shallow bodies of water (i.e. irrigated alfalfa fields) to feed on aquatic organisms and/or open grassland areas to feed on rodents and lizards. Shorebirds are attracted to semi-permanent wetland areas established long enough to produce invertebrate prey.

Damage –Wading birds due to their large size and relatively slow flight are a potential threat to aircraft. Shorebirds are a hazard due to their flocking behavior and potential for multiple strikes.

Legal Status – Wading birds and shorebirds are protected under the Migratory Bird Treaty Act (MBTA). A Federal depredation permit will need to be obtained if wading birds or shorebirds are to be removed.

Control Measures - The best method of control for shorebirds and wading birds is the removal or exclusion of attractive wetland habitat. Wire grids are effective at 10-20 foot intervals over ponds and other wetlands. Mylar tape stretched between two stakes, 50-100 feet apart at 25 foot intervals are effective for feeding areas. Pyrotechnics work well for some species and can be ineffective on others. The use of trained dogs to haze shorebirds and wading birds can be an effective technique. If they habituate to hazing efforts, it may become necessary to shoot a few individuals to reinforce these methods. Habituation to hazing techniques is most often noticeable with resident birds, but may also occur with migrants during a prolonged stopover. Shorebirds and wading birds are also affected by the use of visual repellents in conjunction with pyrotechnics. A coyote effigy may be an effective deterrent for keeping shorebirds and wading birds away from feeding areas, especially if the birds are migrants just passing through.

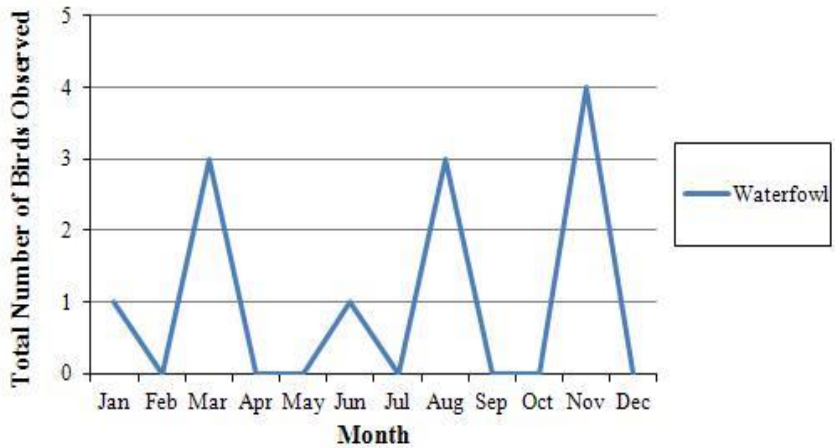
7.1.10 WATERFOWL

Strike History -- There are two BASH incidents recorded at NAS Lemoore involving species within this guild (Table 1). One wood duck was struck in December of 1995 and one northern shoveler was struck in January of 2011 during an FCLP exercise.

Description - Waterfowl are aquatic birds with webbed feet, flattened bills, narrow pointed wings, and short legs. This guild includes ducks, geese, and swans. Ducks are classified as divers or dabblers, i.e., surface feeders. Coots are generally included in the same guild as other waterfowl and appear slate black with a short tail and wings, lobed feet, and a white beak with a black band near the tip. Since waterfowl are large birds and generally fly in tightly grouped flocks, they have the potential to cause severe damage to aircraft components.

General Abundance at NAS Lemoore – There were only 12 observations of waterfowl species recorded during the study period (Figure 24). On 12 November 2010, four white-fronted goose species were observed foraging west of 32L at the north end and were immediately hazed out of the area. Prior to observing these geese, approximately 20 white-fronted geese were seen flying across both runways west to east in the general area of where the four geese were observed foraging. These birds were 75 feet AGL. Mallards were the only other species observed in this guild. Although observations of waterfowl were rare during the survey study period, their strike history at NAS Lemoore warrants concern.

Figure 24: Total number of waterfowl species observed at NAS Lemoore (July 2010 - June 2011).



Attractants - Waterfowl are attracted to temporary and small water bodies to feed, nest, loaf, and escape predators. Geese, swans, and to a lesser extent, ducks and coots, will frequent open grass fields, parks and golf courses to graze. Other waterfowl species, especially the diving ducks, are attracted to open water where they feed on fish and submerged aquatic vegetation.

Damage - Waterfowl can be particularly hazardous to aircraft because of their size and weight, flocking behavior, and relative abundance. The potential for damage by waterfowl was most tragically illustrated in September 1995 when an Air Force jet crashed in Alaska after striking a flock of Canada geese on takeoff, killing all 24 crew members. More recently, Canada geese were also involved in the highly publicized bird strike of flight 1549, where the plane had to make a water landing into the Hudson River.

Legal Status - Waterfowl are protected by the MBTA as a game species. Both Federal and State laws exist for their protection, but most can be hunted during established hunting seasons. Hunting dramatically increases the effectiveness of non-lethal hazing techniques. A Federal depredation permit will need to be obtained if waterfowl are to be removed.

Control Measures - The best method of control for waterfowl is the removal or exclusion of attractive wetland habitat. Wire grids are effective at 10-20 foot intervals over ponds and other wetlands. Mylar tape stretched between two stakes, 50-100 feet apart at 25 foot intervals are effective for feeding areas. Pyrotechnics work well for most waterfowl, especially during the hunting season. The use of trained dogs to haze waterfowl can be an effective technique. If they habituate to hazing efforts, it may become necessary to shoot a few individuals to reinforce these methods. Habituation to hazing techniques is most often noticeable with resident birds, but may also occur in migrants a few weeks after the regular hunting season closes. Waterfowl are also affected by the use of visual repellents in conjunction with pyrotechnics. A coyote effigy may be an effective deterrent for keeping waterfowl from feeding areas, especially if the birds are migrants just passing through.

7.1.11 CROWS AND RAVENS

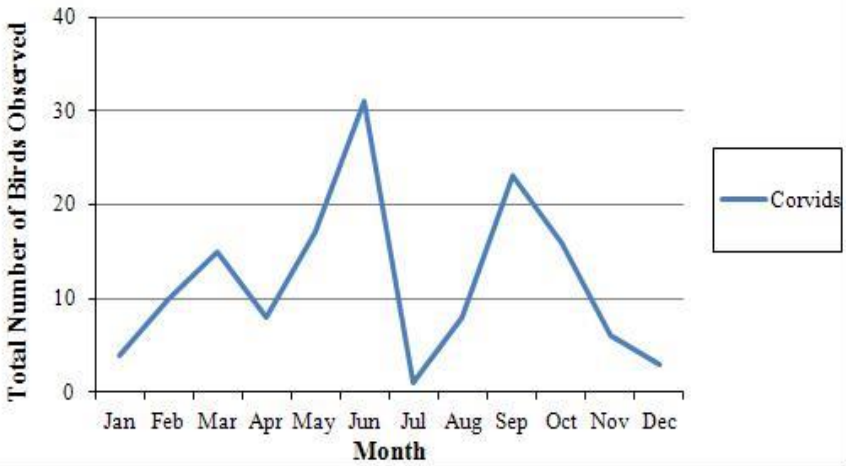
Strike History – There are no recorded strikes involving this guild at NAS Lemoore. Due to the large percentage of strikes involving unknown species, it is possible that they have been hit by planes in the past, and should be considered a realistic threat to aircraft.

Description - Crows and ravens (Corvids) are gregarious birds of exceptional intelligence. They are medium to large sized birds black in color that are omnivorous as they feed on a wide range of food items, including vegetable and grain crops, insects, and refuse.

General Abundance at NAS Lemoore – There were 142 observations of corvid species recorded during the study period (Figure 25), totaling less than one percent of the total species observed. American crows accounted for 79% of the species observed within this guild, and common ravens made up the remainder.

Attractants – American crows and ravens prefer to feed in open areas, especially when there is dense cover nearby such as trees or shrubs. As opportunistic feeders, they will feed on a wide variety of foods to include fruits, nuts, bird hatchlings, lizards, insects, refuse, and carrion. Since mowing activities often attract large numbers of crows and ravens into critical areas on the airfield, rapid response for dispersal would greatly reduce the potential for bird air strikes.

Figure 25: Total number of corvid species observed at NAS Lemoore (July 2010 - June 2011).



Damage – American crows and common ravens are medium to large-sized birds and can inflict severe damage to aircraft. Crows are especially gregarious, sometimes forming large flocks, which increases the threat they pose to aircraft.

Legal Status – American crows and ravens are afforded protection under the MBTA. However, crows and blackbirds, i.e., Brewer's and red-winged, can be taken without a Federal permit under a Federal Depredation Control Order (Appendix 8).

Control Measures - Habitat modifications are helpful in reducing the numbers of crows and ravens on an airfield. This is most effectively accomplished through prey-base reduction and the removal of dense tree stands, refuse, and carrion from runways. Activities such as mowing or irrigation may act as an attractant and should therefore be carefully managed. Crows and ravens can easily be hazed using pyrotechnics, bioacoustics, and visual repellents, but soon habituate to these devices if not enhanced by lethal control. Pyrotechnics are especially effective when supplemented with shooting. Shooting with a pellet gun or shotgun can be useful in removing low to moderate numbers of crows and ravens from an airfield.

1. ***Roost Control*** - If a roost forms on or near the airport, it can be removed by thinning the trees and/or hazing with pyrotechnics and bioacoustics. In addition, a few should be shot for reinforcement. If a hazing effort is conducted, it needs to be done intensively until the roost disperses, usually for 3-4 days. Birds may not return, but if they do, the process should be repeated immediately upon their return.

2. ***Australian Crow Trap*** – Using a 6 by 6 inch drop-in slot, this decoy trap can be effective in capturing crows. The traps should be pre-baited with canned or dry dog food until the first few individuals are caught, which can then be used as decoys. The decoys should be left in the trap with an adequate supply of food and water to act as decoys for attracting other birds.

7.2 MAMMALS AND NOCTURNAL SURVEYS

Strike History -- There are eight BASH incidents recorded at NAS Lemoore involving mammals. This includes five Brazilian free-tailed bats, one Mollosidae species of bat, one unknown species of bat and one coyote. The coyote strike was reported as causing damage to landing gear.

Night operations are routine at NAS Lemoore, and bat strikes may occur with greater frequency than reports indicate.

Description – Mammals observed at NAS Lemoore included coyote, American badger, California ground squirrel, cottontail rabbit, bat species, rodent species, and feral cats. These species are abundant in Kings County. Smaller mammals such as ground squirrels, rabbits and rodent species pose both direct (strikes and undermining of runways and taxiways) and indirect (attracting predators into the airfield environment) threats to aircraft safety. Predators such as coyote and fox, and birds of prey (hawks and herons), forage for small mammals near the runways, which significantly increases the potential for wildlife strikes to occur. Bats also pose a direct threat to aircraft safety. Three species of owls were regularly observed while conducting nocturnal surveys: burrowing owls, barn owls and great-horned owls. These crepuscular and nocturnal species can be hazardous for night operations at airports.

General Abundance at NAS Lemoore – In 12 nocturnal spotlight surveys, 141 observations of mammals and owls were recorded (Table 5). Cottontail rabbits and burrowing owls were most abundant in surveys, accounting for 45% and 33% of total species observed, respectively. Rabbits are prey for avian and mammalian predators alike, and indirectly cause a threat to aircraft. Owl species are mostly nocturnal which make them a safety hazard during night operations.

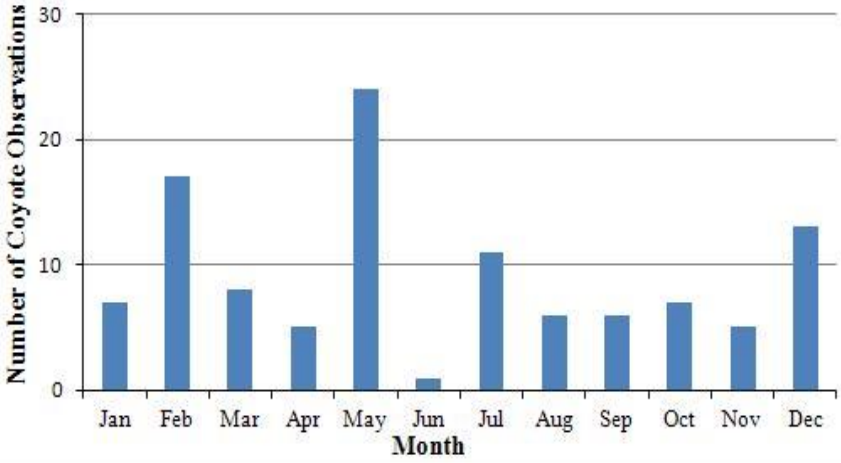
Table 5: Wildlife observed during nocturnal spotlighting surveys at NAS Lemoore (July 2010 – June 2011).

Month	**Owls**				**Mammals**			**Totals**
	burrowing	barn	great-horned	owl species	coyote	cottontail rabbit	feral cat	
Jan	0	1	0	0	0	5	0	6
Feb	1	1	0	1	3	7	0	13
Mar	10	2	0	0	0	7	0	19
Apr	2	0	0	0	1	3	0	6
May	17	0	0	0	2	9	0	28
Jun	6	0	0	0	0	1	0	7
Jul	1	3	0	0	2	8	0	14
Aug	3	2	1	0	1	4	0	11
Sep	3	0	0	0	2	6	0	11
Oct	2	1	2	0	3	5	1	14
Nov	1	2	0	0	0	3	0	6
Dec	0	0	0	0	1	5	0	6
totals	46	12	3	1	15	63	1	**141**

Coyote observations during the day totaled 110. These coyotes were seen as bird surveys were conducted each month (Figure 26). The spike in observations in May is largely due to 14 pup sightings, as there were two confirmed den sites on the airfield.

Soft-catch leghold trapping for coyotes was conducted in the months of April, May and June 2011, at the request of the natural resource program manager, due to coyote abundance on the airfield. A total of eight coyotes were removed and two den sites were gassed during these months.

Figure 26: Total number of coyotes observed at NAS Lemoore (July 2010 - June 2011).



Attractants – Desirable habitat, water and food availability attracts mammals to NAS Lemoore. Open grassland on the airfield and agriculture nearby attract a variety of small mammals and birds, which in turn attracts coyotes, badgers and owls. The run-off ditches in the airfield retain water for most of the year and also provide cover and movement corridors for larger species such as coyotes. Culverts, ditches, burrows, vegetation and surrounding cropland provide food, water and cover for mammalian and avian wildlife. Structures on and around the airfield can provide roosting sites for bats, and insect populations provide for foraging opportunities.

Damage - Because of their moderate to large size, coyotes can easily damage the landing gear on an aircraft when struck or deflect into an engine in-take on take-off or landing. Coyotes often cross runways, taxiways, paved areas, and roads as travel corridors in search of prey, which increases the potential for wildlife strikes. Badgers have the potential to be hit by planes, and can undermine paved areas on the airfield with aggressive digging. Squirrels and rabbits can also undermine asphalt roadways to include runways and taxiways and chew electrical wires in ILS systems. Bats are a commonly struck species across the nation (Cleary et.al. 2005) and can be damaging.

Legal Status –Federal and state permits are not needed to remove coyotes, feral dogs, feral cats, squirrels, skunks, rabbits and raccoons from the airfield. NAS Lemoore resides on the fringe of San Joaquin kit fox critical habitat as designated by the U.S. Fish and Wildlife Service, which does limit some methods of control for certain species (i.e. snares).

Control Measures – Coyotes can be effectively controlled by habitat modification, exclusion and permanent removal by shooting and trapping. Dispersals can be difficult near runways due to their unpredictable behavior. Airfield Operations staff are encouraged to report sightings of coyotes on or near the runways to initiate control measures.

1. ***Habitat Alteration/Exclusion*** - The ideal scenario would be to fence the entire airfield with at least an 8- foot high fence including an Aburied apron™, which is a two-foot wide strip of fence attached to the base of the fence at a perpendicular angle and buried 12-24 inches underground. Unfortunately, this may not be feasible due to installation costs and erosion problems. Clearing or thinning trees and shrubs at least 1000ft from the runway centerline, leveling dirt mounds to remove vantage points for predators and reduction of the prey base through trapping and pesticide application may be a feasible option in high risk areas such as the approach/departure ends of the runways. However, the cost of covering the entire airfield may be prohibitively expensive.

2. ***Hazing*** - Harassment with pyrotechnics may disperse mammals from critical areas, providing short-term relief of a potentially hazardous situation. Before initiating a hazing action, the potential response of the individual(s) should be considered because they may respond in an unpredictable manner when frightened. If the animal is an airfield resident, harassment methods will not provide a long-term due to habituation. If the animal does not respond to hazing methods, it may have acclimated to loud noises and people or is possibly sick or injured and should be approached with extreme caution.

3. ***Catch-Pole*** - If a free-roaming dog is on the airfield and is approachable, i.e., wagging its tail and/or wearing a collar, it may be captured with a catch pole and placed in a kennel or live trap until the animal can be taken to the local Animal Control.

4. ***Trapping*** – The use of padded leg-hold traps are currently illegal in the State of California, except for the protection of T&E species and human health and safety (e.g. airport wildlife hazard mitigation). Leg-hold traps are specialized equipment and should only be applied by a qualified individual that is familiar with its function and regulations. They can be a very effective way to capture coyote, fox and feral dogs. Cage traps are effective for removing feral cats, opossums, raccoons, skunks, and squirrels**.**

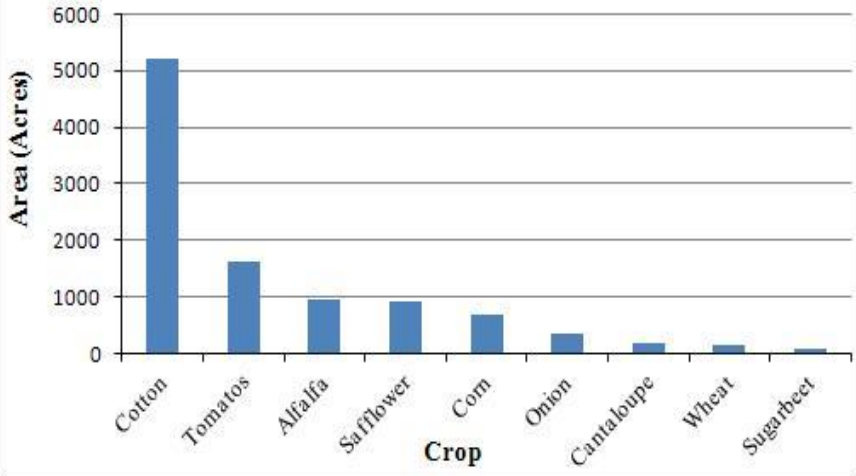
5. ***Shooting*** - Shooting is a very selective control method, which eliminates chance of removing a nontarget species. If shooting is not feasible, trapping and snaring can be used to remove hazardous mammals.

7.3 AGRICULTURE CROPS ADJACENT TO THE RUNWAY

Cotton is the most abundant crop grown in close proximity to the airfield (2007-2010). It accounts for an average of 47.5% of all crops grown in this area. Alfalfa is the second most abundant crop (15%), and tomatoes are third (14.5%). Additional crops in order of abundance include onion, safflower, wheat, corn, garbanzo beans, barley, garlic, cantaloupe, sugar beets and chili peppers. Acreage of fallow fields does not exist in this data, but can be looked at comparatively within the years studied. By comparing the number of acres of crops treated with pesticides between years (via pesticide applications), it may be possible to approximate how much fallow ground occurred in that particular year. Fallow ground may provide more of an attractant to wildlife than cultivated fields, due to heterogeneity of habitat. Rainfall data (www.weather-warehouse.com) for that year is also included due to the possibility that it may influence crops, or lack thereof.

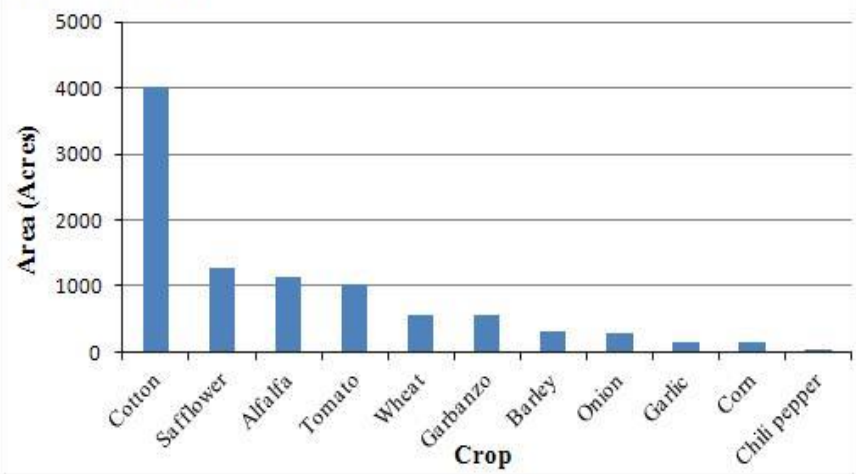
2007 – Figure 27 illustrates crops grown within the study area in the calendar year 2007, based on pesticide applications. A total of 10,161 acres of crops were treated with pesticides. There were 13 reported strikes at NAS Lemoore in 2007. This was a very dry year with only 2.37 inches of rain.

Figure 27: Acreage of crops in agricultural fields adjacent to the airfield at NAS Lemoore in 2007.



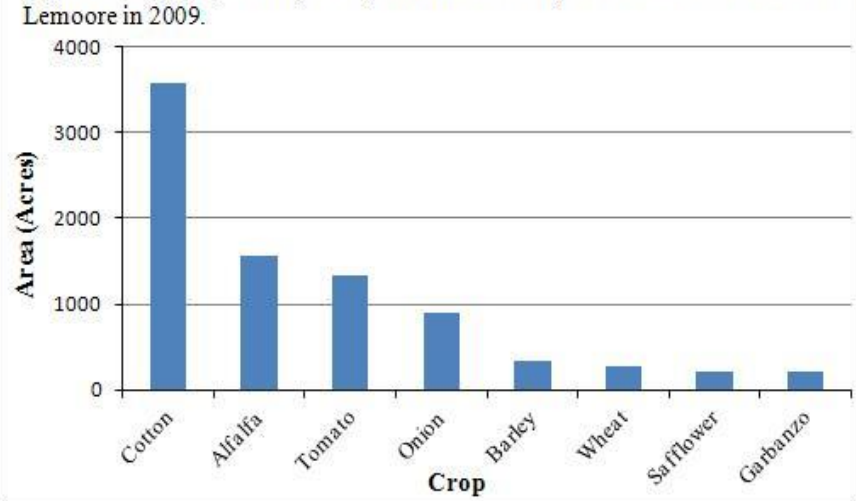
2008 – Figure 28 illustrates crops grown within the study area in the calendar year 2008, based on pesticide applications. A total of 9,483 acres of crops were treated with pesticides, suggesting an increase in fallow lands of over 600 acres. The increase in fallow lands may be an effect of the dry year in 2007. There was an increase in precipitation this year, with rainfall totaling 5.11 inches. There were 19 reported strikes at NAS Lemoore in 2008.

Figure 28: Acreage of crops in agricultural fields adjacent to the airfield at NAS Lemoore in 2008.



2009—Figure 29 illustrates crops grown within the study area in the calendar year 2009, based on pesticide applications. A total of 8,369 acres of crops were treated with pesticides, suggesting another increase in fallow ground of over

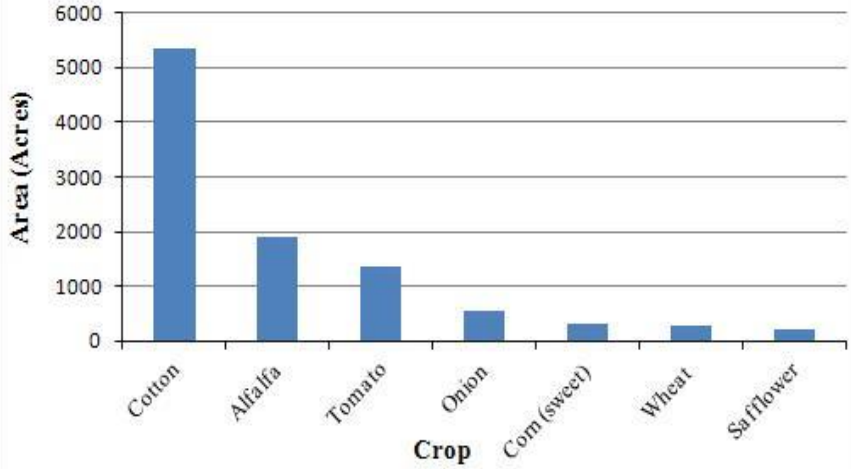
Figure 29: Acreage of crops in agricultural fields adjacent to the airfield at NAS Lemoore in 2009.



1100 acres from the previous year. Rainfall totaled 4.33 inches in this calendar year. Reported BASH incidents peaked to 27 in 2009, the highest number in recorded history. Factors attributing to this number are unclear, but may have been in part due to increased awareness of bird strikes due to the infamous crash-landing of flight 1549 which occurred in January of this year, or, in part due to increased fallow lands surrounding the airfield. Increased vigilance and data collection in the future may shed light on factors contributing to bird strikes at NAS Lemoore.

2010 – Figure 30 illustrates crops grown within the study area in the calendar year 2010, based on pesticide applications. A total of 9,936 acres of crops were treated with pesticides, suggesting a decrease in fallow ground compared to that with 2009. This year was extremely wet with 10.34 inches of rain. Reported strikes remained relatively high at 20, when compared to years past.

Figure 30: Acreage of crops in agricultural fields adjacent to the airfield at NAS Lemoore in 2010.



In summary, it is difficult to make any conclusions or correlations regarding bird strikes and agriculture adjacent to the airfield. Anecdotal evidence (alfalfa attracting shorebirds) may be the most valuable information attained regarding crops and wildlife hazards during the study period.

8.0. RECOMMENDATIONS

The following recommendations are offered as a means to alleviate the hazards observed at NAS Lemoore during the WHA. The main purpose of these recommendations is to enhance the reduction of current wildlife hazards at NAS Lemoore. Moreover, they do not diminish the need for NAS Lemoore to report new hazards as airport conditions change.

Focus on Reduction of Prey Base

Several hazardous species of wildlife including coyotes and raptors frequent the airfield to forage on abundant ground squirrels and cottontail rabbits. Reducing this prey base will, in turn, lower the number of predators on-site. Ground squirrel burrows attract burrowing owls which they use for nesting sites and cover. Removal methods should include, but not be limited to poisoning, trapping, shooting and destruction of burrows. Efforts should first be directed at approach and departure ends of runways, developing into full-scale removal efforts throughout the airfield. Keeping prey animals at a low level will involve constant monitoring and removal efforts.

As ground squirrels are removed, their burrows should also be destroyed which will deter burrowing owls from using the airfield. Exclusion devices may be effective on burrowing owl-inhabited squirrel holes: after the owl is evicted, the burrow can then be destroyed without harming the owl. Finding an alternate site for burrowing owls and enticing them with artificial burrows would decrease BASH hazards on the airfield and would also keep the owls out of harm's way.

Rodent abundance should be addressed due to their potential to attract predators. Baseline abundance data should be collected and management options considered.

Habitat Modification

Although time consuming and expensive, habitat modification is the single most effective method for reducing wildlife abundance. Food, water and shelter are necessary for all species of wildlife, and if they can be eliminated or reduced, wildlife will disperse and intrusive methods (hazing, lethal take) may be employed less frequently. A monotypic habitat type is less attractive to wildlife. In the airfield, this would include grass at the same height, and the elimination of brush, trees and standing water. In adjacent croplands, this would include the propagation of a single or dominant crop, preferably with no food value to wildlife (i.e. cotton). A variety of anti-perching methods are available for employment on man-made structures utilized as perches on the airfield (i.e. ILS structures, windsocks and runway markers)

Proactively Discourage, Haze and/or Remove Hazardous Wildlife from the Airfield

Adopt a policy of zero-tolerance on the airfield toward all hazardous wildlife. Continue lethal removal of coyotes and pigeons. Initiate a relocation program targeting raptors, as well as exclusion techniques for burrowing owls on the airfield. Reduce the attractiveness of the infield to blackbirds and lark species in the spring by keeping the grass mowed. Couple harassment (pyrotechnics) with lethal removal (shooting) of flocking shorebirds and waterfowl.

Locate and Exclude Bat Species from Roosting in the Area

Night operations at NAS Lemoore increase the risk of bat strikes. Identification of bat roosting sites (i.e. hangars and buildings adjacent to the airfield), and the employment of exclusion methods may reduce the risk of strikes at night.

Encourage Agriculture Outlease Farmers to Grow Cotton

Research is being conducted by USDA Wildlife Services National Wildlife Research Center in Sandusky, Ohio related to best agriculture practices around airfields. Based on initial observations and a literature review, it appears that cotton can be grown with minimal concerns of it being a bird attractant (T. DeVault, pers. comm.). Soybeans are also a crop showing promise of minimal bird attraction. Based on observations in Ohio and on-site, alfalfa is an attractant to birds, and should be avoided, especially adjacent to approach and departure lanes at NAS Lemoore. Research on this subject needs to be followed, and as conclusive results emerge, farming practices can be managed for aircraft safety.

Obtain the Necessary Permits to Control Wildlife

NAS Lemoore currently possesses a USFWS depredation permit to control wildlife protected by the State and Federal governments. The ability to respond to hazardous situations in a prompt and efficient manner is paramount to ensuring flight safety and may sometimes require the lethal removal of hazardous wildlife. To enable a rapid response, NAS Lemoore should keep a current depredation permit from the USFWS. WS is available to assist in the application/renewal process.

Develop an Active BASH Plan Using the Wildlife Hazard Assessment to Prioritize Mitigation

One of the objectives of a WHA is to identify and prioritize wildlife hazards for mitigation. It is our opinion that an active BASH plan is necessary at NAS Lemoore because it provides the framework from which a wildlife dispersal program operates. Airports are dynamic environments, which require an annual review to determine if changes to the plan are necessary and to consider how the wildlife deterrent program can be improved or modified.

Train Personnel in Wildlife Hazing Procedures and Species Identification

All personnel that have duties requiring them to access the Air Operating Area (AOA) should be trained to recognize and respond to potential wildlife hazards in an appropriate manner. Depending on the situation, responding may entail an active hazing or shooting action or it may simply require the employee to notify the on-staff biologist or other responsible entity of the hazard. Every employee that might encounter wildlife hazards on the airfield should be made aware that it is their responsibility to recognize and respond to the situation and not just the role of the on-staff biologist. Employees should also be familiar with the damage caused by wildlife and how to respond to potentially hazardous situations. Inherent in this decision process is that employees should be trained in species identification of the most hazardous wildlife or at least the general category/guild of wildlife, i.e., gulls, waterfowl, crows, hawks, and pigeons. A field guide is very useful for achieving this goal and should be made readily available to those who would use it. There are many guides that are easy to use and can be purchased at a local bookstore for $15 - $20 such as *Stokes Field Guide to Birds - Western Region*, *All the Birds of North America*, and *Field Guide to the Birds of North America*. All appropriate personnel should be trained in the safe handling and most effective use of hazing devices to avoid creating hazardous situations, i.e., chasing birds into the path of an approaching aircraft. This training may be conveniently added to the AVOIC content requirements.

Increase Thoroughness of BASH Incident Reports

Historical BASH data for NAS Lemoore leaves much to be desired. All personnel that have duties requiring them to access the Air Operating Area (AOA) should be trained to recognize evidence of a BASH incident, and to pick up all wildlife remains found within the AOA and secure as evidence. A thorough account of each BASH incident should include the following information: location, time, date, altitude, speed, maneuver, type of aircraft, effect on flight, weather conditions, species of wildlife struck (Smithsonian identification laboratory), contact information of reporting party, observations (i.e. solitary bird or flock), damage (monetary costs including downtime), where damage occurred on plane and photographs of damage and/or struck

wildlife species. This information will benefit mitigation of BASH hazards. Again, training regarding this responsibility of all personnel on the airfield may be included with AVOIC requirements.

Have Control Supplies (Pyrotechnics, Cannons, Effigies, Etc.) On Hand

It is recommended that vehicles regularly operating on the airfield be equipped with a 15mm single or double shot pyrotechnic launcher and an accompanying supply of bangers and screamers. This will enable all airport personnel to quickly and easily haze any birds they may encounter while conducting their primary duties. As a minimum, the airport should have on hand at least: 1) 15 mm pyrotechnic pistol launchers and caps (5 ea.); 2) bird bombs/bangers (10 boxes); and 3) bird screamers (10 boxes). Additional supplies such as distress calls and effigies may be necessary as specific situations arise and it is up to the airport to ensure these static deterrents are procured in a timely manner.

Continue Monitoring Wildlife Populations and Use Patterns on the Airfield

The intent of this WHA has been to document general occurrence, land-use patterns, and population characteristics of wildlife at NAS Lemoore. It must be realized that wildlife abundance and use patterns on airfields are affected by a host of variables that are rarely the same from year-to-year. Hence, conclusions based on wildlife populations and patterns during this study are only meant to be a guide and may or may not be consistent in subsequent years. Survey routes and methods were cognitively established in a manner that facilitates continued monitoring by airport personnel. Data from this study will provide a baseline for comparison in subsequent years and NAS Lemoore should continue to monitor wildlife populations by conducting monthly surveys using the same stations established in this assessment. While surveys conducted in subsequent years by airport personnel will not be conducted with the same frequency or intensity as this initial hazard assessment, they will still provide general insights into wildlife use patterns over time and enable NAS Lemoore to gauge the effectiveness of its control efforts.

Evaluate Potential Wildlife Hazards When Planning New Construction or Land Use Changes

Airports are constantly undergoing expansion and improvement projects. It is critical to consider wildlife attractants during these planning phases. Several aspects to consider will be the planting of new vegetation, which may provide food to wildlife in the form of seeds and fruits and the creation of water bodies or drainage basins that provide fresh water. Contact WS for review of airport plans and recommendations. In addition, adjacent off-site projects (i.e. sensitive species habitat enhancement) need to be considered as potential wildlife attractant hazards and dealt with accordingly.

Guild – Specific Management Techniques

Perching Birds: Pyrotechnics and shooting harassment is partially effective in moving the birds from one area to another. Care must be taken when applying these techniques so that birds do not disperse into areas where a strike is possible. Visual repellents, especially raptor kites, helium balloons, and stretched mylar tape can also be used, taking into account their potential to

become a hazard as foreign object debris/damage (FOD). WS has had limited success in the use of mist nets at other airports to capture birds flying inside critical zones of the airfield.

European Starlings and Blackbirds: The most effective mitigation effort for blackbird abundance observed at NAS Lemoore was the mowing of tall grass in the infield in the late spring. Flocks of birds foraging on the airfield can also be dispersed with pyrotechnics, bioacoustics, and visual repellents. However, birds often move to another location on the airfield without much effect. To increase the effectiveness of harassment techniques, concentrate efforts in the early morning and late afternoon hours when the birds are most active. Shooting may become a necessary reinforcement technique if the birds become habituated to pyrotechnics. The proper and consistent use of decoy traps can remove the highest number of birds over the shortest period of time. The use of pesticide DRC – 1339 may be an effective control technique. However, this pesticide can only be applied by WS under strict, hard-to-attain circumstances: intimate and certain knowledge of the baited birds roost site, where they will eventually die. This is especially important at NAS Lemoore due to the possibility of birds dying in an urban area. Additionally, surveys are required at the baiting site to determine if there are any protected species (threatened, endangered or species of conservation/special concern) that may be affected by this control technique.

1. Mechanical/Habitat Control at NAS Lemoore - The timely use of harassment techniques provides an immediate effect of bird dispersal from the runway environment. Vehicle/shooting harassment and pyrotechnics can effectively disperse flocks from the airfield when aircraft are not in the process of taking off or landing. Habitat management, such as mowing grass in the infield, removal of trees and securing of outbuildings and hangars (starlings) and cattails in watersheds (blackbirds), can make the area less attractive for feeding and roosting.

2. Chemical Control - DRC-1339 - DRC-1339, (3-chloro-*p*-toluidine hydrochloride) under the direction of WS, is available for use in California to target red-winged blackbirds, starlings, and brown-headed cowbirds in non-crop staging areas associated with roosts. When mixed in flocks with one or more of the above mentioned species, American crows, Brewer's blackbirds, and yellow-headed blackbirds may also be considered target species. DRC-1339 can be used to significantly reduce the population when decoy trapping, habitat modifications, and frightening techniques are ineffective. A 98% concentration of the more dilute Starlicide, is a slow acting poison that kills most birds from 12–72 hours after ingestion by disrupting kidney function of the target species. It is species specific and has virtually no secondary toxicity hazards due to the metabolic breakdown of the compound into non-toxic metabolites. Mammals and birds such as house sparrows are unaffected at the delivered concentrations. The secondary poisoning potential of DRC-1339 to scavengers is low as it is less toxic to many other species including raptors and most mammals (DeCino et al. 1966). The label must be strictly followed and the CDFG should be contacted prior to use so they can address issues that may arise if the public reports the finding of dead birds. An application form must be filled out and submitted to the respective County Agriculture Department by the applicator to keep on record and must include the amount of chemical used, the number of birds taken, application sites and the disposition of unused baits.

A. Pre-baiting - Birds should be pre-baited with untreated grain placed in feeders for at least a week at staging areas away from public access. After most of the birds are

accustomed to feeding, untreated baits are replaced with treated baits in the same containers and locations. The pounds of pre-bait used per day needs to be monitored to determine the amount necessary for the first treatment. Bait consumption will drop off daily thereafter, requiring less and less treated baits. Baiting sites must be carefully monitored to make sure non-target birds are not feeding on the bait.

B. ***Baiting with toxicant*** - Prepare baits the day before they are to be put out to give them time to air dry properly. All baits should be used within a week or disposed of according to label instructions; DRC-1339 baits discolor and lose their potency in a short time. Screened cracked corn should be used for blackbirds and a protein pellet such as calf manna can be used for starlings. About two pounds of bait should be prepared for every 1,000 birds in the roost. The abatement program should begin as soon as large numbers of blackbirds or starlings are seen staging at NAS Lemoore prior to going to the roost. Subsequent programs conducted during the same winter should be planned only if warranted. Baits should be placed out approximately two hours before sundown or an hour before sunrise and retrieved when birds stop feeding, usually about three hours later. The applicator must remain on site and the baits should be watched from nearby to ensure that non-target species are not present. Treatment should continue for a week or until all birds have had the chance to feed.

C. ***Clean Up*** - Birds will begin to die at the roost the morning following treatment. They should be picked up immediately by the custodial and field maintenance personnel and the area should be monitored frequently during the day to ensure all birds are picked up. Dead birds and any unused bait should be counted by species and properly disposed of in a hole, 3-6 feet deep in an inaccessible area. Soil binds up and detoxifies DRC-1339 quickly so that it is not considered an environmental hazard. At the conclusion of the baiting trial, the hole will need to be covered back over with dirt.

3. ***European Starling Nests and Roosting Sites*** - Starlings commonly nest in the cavities of man-made structures and trees and should be discouraged from doing so where applicable. Securely fasten quarter inch wire mesh over holes or entrances to exclude them from structures. If this is not feasible, nest box traps can be used to capture target birds by placing the trap near the cavity that starlings are using or are expected to use. Clean out the nests and hang the trap near an active cavity. Inspect the trap frequently during the day, especially early in the nesting season which will commence around early to mid-March. Remove any trapped starlings and euthanize them with an acceptable and humane method such as cervical dislocation (breaking the neck) or the use of carbon dioxide gas. If non-target species are caught, they should be freed immediately. To exclude starlings from roost sites all entrance and exit routes should be blocked.

A. ***Decoy Traps*** - European starlings and blackbirds can be caught in decoy traps. The primary trap used is a modified Australian crow trap. This trap can be set up on the airfield in areas where birds are feeding, loafing, and roosting. A 1.75 inch wide opening in the slot-board is recommended.

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Traps should be pre-baited on the top of the trap with dry cat food (starlings) and sunflower seeds (blackbirds) for several weeks until there are signs of active feeding.

Once this is accomplished, start baiting the inside of the trap with the door open to allow birds to acclimate to the inside of the trap. After several days, close the door with a supply of food and water and wait until a few birds are captured. Retain approximately 3-5 birds as live decoys to attract the remaining birds to go inside. Remove and euthanize excess birds and maintain fresh food and water daily as needed.

Raptors: Habitat modifications, specifically tree and shrub removal on and near the airfield, spike stripping and/or other exclusion techniques on man-made structures used as perches, and prey-base reduction (squirrels and rabbits), will have profound effects on the number of raptors using an area. If raptors still persist to remain on the airfield, hazing (pyrotechnics) can be used to deter their presence. The most non-respondent individuals may have to be trapped or shot. Raptors can be captured using several styles of traps including bal-chatri, padded-jaw leghold (WS use only), and Swedish goshawk. Most of these can be used to take and relocate specific individuals. If a hawk becomes trap shy, and continues to pose a risk to flight safety, lethal removal may be the last resort to protect human health. The appropriate permit must be obtained prior to implementing any of the described control methods.

1. Bal-Chatri Trap - These traps are relatively small and are shaped into a semi-cylindrical form. They can be modified to trap specific types of raptors. Live bait is used to lure raptors and nylon nooses entangle their feet, holding the birds. Traps are made of 1" chicken wire (1/4" mesh hardware cloth if mice are used for bait), formed into Quonset-huts, 18" long, 10" wide, and 7" high. Floors are 1" wire mesh or smaller, depending on bait. Tops are covered with about 80 nooses of 20-40 lb. test monofilament line. Traps should be anchored to the ground to prevent birds from dragging them off or breaking the nooses and baited with live rodents for the best attractant. Once a trap has been set, it is important to monitor it continually.

2. Padded-Jaw Leghold Trap (WS use only) - Problem raptors can be caught with sliding padded pole traps. Erect 5-10 foot poles near areas where hawks frequent and place modified # 1 coil spring traps on top of the poles; it is suggested that one of the coil springs be removed and a small perch be mounted to the pan that does not interfere with closing. Jaws must be padded with foam rubber, wrapped by electrician's tape. Run a 12-gauge steel wire through the trap-chain ring and staple it to the top and bottom of the post. This allows a trap to slide to the ground where the bird can safely rest. An anchor of light gauge wire can be used on the opposite side to give the trap stability, but should remain loose so the trap falls to the ground.

3. Swedish Goshawk Trap - These are relatively large traps that can be used to capture all types of perching raptors. They consist of 3'x3'x1' bait cages made of 1" wire mesh with traps mounted on top that consist of wooden A-frames, nylon net panels, and a trigger mechanism. The trigger mechanism is a hinged stick that snugly fits between the panels and collapses when a raptor lands on it. Pigeons, starlings, rats and mice can be used as bait, but the bait cage needs smaller wire mesh for mice.

Doves: Habitat modification, such as elimination of seed producing vegetation and the reduction of available water sources, will reduce the number of doves on the airfield. Building construction plans should include designs to prevent nesting by doves and other birds and pre-existing buildings should be retrofitted with exclusionary netting or types of barriers to block access to

eaves and I-beams. Installation of wire slinky coils, porcupine wire, or some other tactile repellent, e.g. Tanglefoot™ or 4-the-birds™, can be applied to problem areas.

Doves can be effectively hazed and removed by shooting with a shotgun or pneumatic air gun, and/or decoy trapping. Hazing birds with pyrotechnics and vehicle/shooting harassment are effective in areas where birds pose an immediate threat to aircraft safety. Shooting does reduce bird abundance on the airfield, and can be used to remove birds from hangars as well as other roosting and nesting structures. Once a large percentage of birds have been removed from these sites, it is prudent to install exclusion barriers or employ continual trapping to prevent birds from re-colonizing the area.

Avitrol[7] (4-aminopyridine), a chemical frightening agent, is also available for rock doves, but it is not recommended for use near airports due to the bird's unpredictable behavior under its influence. In higher doses, Avitrol can be applied as a toxicant.

DRC-1339, (3-chloro-*p*-toluidine hydrochloride) under the direction of WS, is available for use in California to target rock doves. See section 7.1.5 for application instructions.

Decoy or walk-in traps that utilize a swinging door are very effective in removing a significant number of rock doves from buildings that are adjacent to the airfield and the outer perimeter of the airport. To set one, pre-bait a trap with scratch (mixture of cracked corn and millet) and/or bread in an area where birds are loafing and roosting. Capture a decoy and keep it inside the trap with enough feed and water and check the trap weekly. Rotate the trap to new locations as necessary to maintain maximum catch rates. Euthanize captured birds by placing them inside a carbon dioxide chamber, especially large-scale projects, or cervical dislocation and dispose according to regulation.

Swallows: Swallows are controlled by excluding them from preferred nesting sites and/or removal and destruction of nests and eggs. Exclusion techniques include hanging obstructions (rope, chain, plastic sheeting, etc.) at prime nesting sites such as eaves of buildings or under bridges. Non-stick paint can be applied to man-made nesting areas (buildings and concrete structures) to repel mud pellets which make up a swallows nest. In the non-breeding season, old nests should be washed away completely to deter re-nesting in the area. Insect control may decrease swallow abundance by removing their food source, yet can be cost prohibitive.

Waterfowl, Shorebirds and Wading Birds: The best method of control for waterfowl shorebirds and wading birds is the removal or exclusion of attractive wetland habitat. Wire grids are effective at 10-20 foot intervals over ponds and other wetlands. Mylar tape stretched between two stakes, 50-100 feet apart at 25 foot intervals are effective for feeding areas. Pyrotechnics work well for some species and can be ineffective on others. The use of trained dogs to haze waterfowl, shorebirds and wading birds can be an effective technique. If they habituate to hazing efforts, it may become necessary to shoot a few individuals to reinforce these methods. Habituation to hazing techniques is most often noticeable with resident birds, but may also occur with migrants during a prolonged stopover. Waterfowl, shorebirds and wading birds are also affected by the use of visual repellents in conjunction with pyrotechnics. A coyote effigy may be an effective deterrent for keeping waterfowl, shorebirds and wading birds away from feeding areas, especially if the birds are migrants just passing through.

Crows and Ravens: Habitat modifications are helpful in reducing the numbers of crows and ravens on an airfield. This is most effectively accomplished through prey-base reduction and the removal of dense tree stands, refuse, and carrion from runways. Activities such as mowing or irrigation may act as an attractant and should therefore be carefully managed. Crows and ravens can easily be hazed using pyrotechnics, bioacoustics, and visual repellents, but soon habituate to these devices if not enhanced by lethal control. Pyrotechnics are especially effective when supplemented with shooting. Shooting with a pellet gun or shotgun can be useful in removing low to moderate numbers of crows and ravens from an airfield.

1. Roost Control - If a roost forms on or near the airport, it can be removed by thinning the trees and/or hazing with pyrotechnics and bioacoustics. In addition, a few should be shot for reinforcement. If a hazing effort is conducted, it needs to be done intensively until the roost disperses, usually for 3-4 days. Birds may not return, but if they do, the process should be repeated immediately upon their return.

2. Australian Crow Trap - Using a 6 by 6 inch drop-in slot, this decoy trap can be effective in capturing crows. The traps should be pre-baited with canned or dry dog food until the first few individuals are caught, which can then be used as decoys. The decoys should be left in the trap with an adequate supply of food and water to act as decoys for attracting other birds.

Mammals: Coyotes can be effectively controlled by habitat modification, exclusion and permanent removal by shooting and trapping. Dispersals can be difficult near runways due to their unpredictable behavior. Airfield Operations staff are encouraged to report sightings of coyotes on or near the runways to initiate control measures.

1. Habitat Alteration/Exclusion - The ideal scenario would be to fence the entire airfield with at least an 8- foot high fence including an Aburied apron™, which is a two-foot wide strip of fence attached to the base of the fence at a perpendicular angle and buried 12-24 inches underground. Unfortunately, this may not be feasible due to installation costs and erosion problems. Clearing or thinning trees and shrubs at least 1000ft from the runway centerline, leveling dirt mounds to remove vantage points for predators and reduction of the prey base through trapping and pesticide application may be a feasible option in high risk areas such as the approach/departure ends of the runways. However, the cost of covering the entire airfield may be prohibitively expensive.

2. Hazing - Harassment with pyrotechnics may disperse mammals from critical areas, providing short-term relief of a potentially hazardous situation. Before initiating a hazing action, the potential response of the individual(s) should be considered because they may respond in an unpredictable manner when frightened. If the animal is an airfield resident, harassment methods will not provide a long-term due to habituation. If the animal does not respond to hazing methods, it may have acclimated to loud noises and people or is possibly sick or injured and should be approached with extreme caution.

3. Catch-Pole - If a free-roaming dog is on the airfield and is approachable, i.e., wagging its tail and/or wearing a collar, it may be captured with a catch pole and placed in a kennel or live trap until the animal can be taken to the local Animal Control.

4. ***Trapping*** - The use of padded leg-hold traps are currently illegal in the State of California, except for the protection of T&E species and human health and safety (e.g. airport wildlife hazard mitigation). Leg-hold traps are specialized equipment and should only be applied by a qualified individual that is familiar with its function and regulations. They can be a very effective way to capture coyote, fox and feral dogs. Cage traps are effective for removing feral cats, opossums, raccoons, skunks, and squirrels**.**

5. ***Shooting*** - Shooting is a very selective control method, which eliminates chance of removing a nontarget species. If shooting is not feasible, trapping and snaring can be used to remove hazardous mammals.

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10.0. APPENDICES

Appendix 1: Code of Federal Regulations Part 139.337.

TITLE 14 - AERONAUTICS AND SPACE

CHAPTER I - FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

SUBCHAPTER G - AIR CARRIERS AND OPERATORS FOR COMPENSATION OR HIRE: CERTIFICATION AND OPERATIONS

PART 139 - CERTIFICATION OF AIRPORTS

subpart d - OPERATIONS

139.337 - Wildlife hazard management.

(a) In accordance with its Airport Certification Manual and the requirements of this section, each certificate holder must take immediate action to alleviate wildlife hazards whenever they are detected.

(b) In a manner authorized by the Administrator, each certificate holder must ensure that a wildlife hazard assessment is conducted when any of the following events occurs on or near the airport: (1) An air carrier aircraft experiences multiple wildlife strikes; (2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component; (3) An air carrier aircraft experiences an engine ingestion of wildlife; or (4) Wildlife of a size, or in numbers, capable of causing an event described in paragraphs (b)(1), (b)(2), or (b)(3) of this section is observed to have access to any airport flight pattern or aircraft movement area.

(c) The wildlife hazard assessment required in paragraph (b) of this section must be conducted by a wildlife damage management biologist who has professional training and/or experience in wildlife hazard management at airports or an individual working under direct supervision of such an individual. The wildlife hazard assessment must contain at least the following: (1) an analysis of the events or circumstances that prompted the assessment.

(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences.

(3) Identification and location of features on and near the airport that attract wildlife.

(4) A description of wildlife hazards to air carrier operations.

(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

(d) The wildlife hazard assessment required under paragraph (b) of this section must be submitted to the Administrator for approval and determination of the need for a wildlife hazard management plan. In reaching this determination, the Administrator will consider (1) The wildlife hazard assessment; (2) Actions recommended in the wildlife hazard assessment to reduce wildlife hazards; (3) The aeronautical activity at the airport, including the frequency and size of air carrier aircraft; (4) The views of the certificate holder; (5) The views of the airport users; and (6) Any other known factors relating to the wildlife hazard of which the Administrator is aware.

(e) When the Administrator determines that a wildlife hazard management plan is needed, the certificate holder must formulate and implement a plan using the wildlife hazard assessment as a basis. The plan must (1) Provide measures to alleviate or eliminate wildlife hazards to air carrier operations; (2) Be submitted to, and approved by, the Administrator prior to implementation; and (3) As authorized by the Administrator, become a part of the Airport Certification Manual.

(f) The plan must include at least the following: (1) A list of the individuals having authority and responsibility for implementing each aspect of the plan.

(2) A list prioritizing the following actions identified in the wildlife hazard assessment and target dates for their initiation and completion: (i) Wildlife population management; (ii) Habitat modification; and (iii) Land use changes.

(3) Requirements for and, where applicable, copies of local, State, and Federal wildlife control permits.

(4) Identification of resources that the certificate holder will provide to implement the plan.

(5) Procedures to be followed during air carrier operations that at a minimum includes (i) Designation of personnel responsible for implementing the procedures; (ii) Provisions to conduct physical inspections of the aircraft movement areas and other areas critical to successfully manage known wildlife hazards before air carrier operations begin; (iii) Wildlife hazard control measures; and (iv) Ways to communicate effectively between personnel conducting wildlife control or observing wildlife hazards and the air traffic control tower.

(6) Procedures to review and evaluate the wildlife hazard management plan every 12 consecutive months or following an event described in paragraphs (b)(1), (b)(2), and (b)(3) of this section, including: (i) The plan's effectiveness in dealing with known wildlife hazards on and in the airport's vicinity and (ii) Aspects of the wildlife hazards described in the wildlife hazard assessment that should be reevaluated.

(7) A training program conducted by a qualified wildlife damage management biologist to provide airport personnel with the knowledge and skills needed to successfully carry out the wildlife hazard management plan required by paragraph (d) of this section.

(g) FAA Advisory Circulars contain methods and procedures for wildlife hazard management at airports that are acceptable to the Administrator.

Read more: http://cfr.vlex.com/vid/139-337-wildlife-hazard-management-19562217#ixzz0xfRoiCQM

Appendix 2: Memorandum of Understanding (MOU) between DOD and USDA.

Memorandum of Agreement Between
the Federal Aviation Administration,
the U.S. Air Force,
the U.S. Army,
the U.S. Environmental Protection Agency,
the U.S. Fish and Wildlife Service, and
the U.S. Department of Agriculture
to Address Aircraft-Wildlife Strikes

PURPOSE

The signatory agencies know the risks that aircraft-wildlife strikes pose to safe aviation.

This Memorandum of Agreement (MOA) acknowledges each signatory agency's respective missions. Through this MOA, the agencies establish procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the United States. These efforts are intended to minimize wildlife risks to aviation and human safety, while protecting the Nation's valuable environmental resources.

BACKGROUND

Aircraft-wildlife strikes are the second leading causes of aviation-related fatalities. Globally, these strikes have killed over 400 people and destroyed more than 420 aircraft. While these extreme events are rare when compared to the millions of annual aircraft operations, the potential for catastrophic loss of human life resulting from one incident is substantial. The most recent accident demonstrating the grievous nature of these strikes occurred in September 1995, when a U.S. Air Force reconnaissance jet struck a flock of Canada geese during takeoff, killing all 24 people aboard.

The Federal Aviation Administration (FAA) and the United States Air Force (USAF) databases contain information on more than 54,000 United States civilian and military aircraft-wildlife strikes reported to them between 1990 and 1999[1]. During that decade, the FAA received reports indicating that aircraft wildlife strikes, damaged 4,500 civilian U.S. aircraft (1,500 substantially), destroyed 19 aircraft, injured 91 people, and killed 6 people. Additionally, there were 216 incidents where birds struck two or more engines on civilian aircraft, with damage occurring to 26 percent of the 449 engines involved in these incidents. The FAA estimates that during the same decade, civilian U.S. aircraft sustained $4 billion worth of damages and associated losses and 4.7 million hours of aircraft downtime due to aircraft-wildlife strikes. For the same period, USAF planes colliding with wildlife resulted in 10 Class A Mishaps[2], 26 airmen deaths, and over $217 million in damages.

[1] FAA estimates that the 28,150 aircraft-wildlife strike reports it received represent less than 20% of the actual number of strikes that occurred during the decade.
[2] See glossary for the definition of a Class A Mishap and similar terms.

Approximately 97 percent of the reported civilian aircraft-wildlife strikes involved common, large-bodied birds or large flocks of small birds. Almost 70 percent of these events involved gulls, waterfowl, and raptors (Table 1). About 90 percent of aircraft-wildlife strikes occur on or near airports, when aircraft are below altitudes of 2,000 feet. Aircraft-wildlife strikes at these elevations are especially dangerous because aircraft are moving at high speeds and are close to or on the ground. Aircrews are intently focused on complex take-off or landing procedures and monitoring the movements of other aircraft in the airport vicinity. Aircrew attention to these activities while at low altitudes often compromises their ability to successfully recover from unexpected collisions with wildlife and to deal with rapidly changing flight procedures. As a result, crews have minimal time and space to recover from aircraft-wildlife strikes. Increasing bird and wildlife populations in urban and suburban areas near airports contribute to escalating aircraft-wildlife strike rates. FAA, USAF, and Wildlife Services (WS) experts expect the risks, frequencies, and potential severities of aircraft-wildlife strikes to increase during the next decade as the numbers of civilian and military aircraft operations grow to meet expanding transportation and military demands.

SECTION I.

SCOPE OF COOPERATION AND COORDINATION

Based on the preceding information and to achieve this MOA's purpose, the signatory agencies:

A. Agree to strongly encourage their respective regional and local offices, as appropriate, to develop interagency coordination procedures necessary to effectively and efficiently implement this MOA. Local procedures should clarify time frames and other general coordination guidelines.

B. Agree that the term "airport" applies only to those facilities as defined in the attached glossary.

C. Agree that the three major activities of most concern include, but are not limited to:

1.airport siting and expansion;
2. development of conservation/mitigation habitats or other land uses that could attract hazardous wildlife to airports or nearby areas; and
3. responses to known wildlife hazards or aircraft-wildlife strikes.

D. Agree that "hazardous wildlife" are those animals, identified to species and listed in FAA and USAF databases, that are most often involved in aircraft wildlife strikes. Many of the species frequently inhabit areas on or near airports, cause structural damage to airport facilities, or attract other wildlife that pose an aircraft-wildlife strike hazard. Table 1 lists many of these species. It is included solely to provide information on identified wildlife species that have been involved in aircraft-wildlife strikes. It is not intended to represent the universe of species concerning the signatory agencies, since more than 50 percent of the aircraft-wildlife strikes reported to FAA or the USAF did not identify the species involved.

E. Agree to focus on habitats attractive to the species noted in Table 1, but the signatory agencies realize that it is imperative to recognize that wildlife hazard determinations discussed in Paragraph L of this section may involve other animals.

F. Agree that not all habitat types attract hazardous wildlife. The signatory agencies, during their consultative or decision making activities, will inform regional and local land use authorities of this MOA's purpose. The signatory agencies will consider regional, local, and site-specific factors (e.g., geographic setting and/or ecological concerns) when conducting these activities and will work cooperatively with the authorities as they develop and implement local land use programs under their respective jurisdictions. The signatory agencies will encourage these stakeholders to develop land uses within the siting criteria noted in Section 1-3 of FAA Advisory Circular (AC) 150.5200-33 (Attachment A) that do not attract hazardous wildlife. Conversely, the agencies will promote the establishment of land uses attractive to hazardous wildlife outside those siting criteria. Exceptions to the above siting criteria, as described in Section 2.4.b of the AC, will be considered because they typically involve habitats that provide unique ecological functions or values (e.g., critical habitat for federally-listed endangered or threatened species, ground water recharge).

G. Agree that wetlands provide many important ecological functions and values, including fish and wildlife habitats; flood protection; shoreline erosion control; water quality improvement; and recreational, educational, and research opportunities. To protect jurisdictional wetlands, Section 404 of the Clean Water Act (CWA) establishes a program to regulate dredge and/or fill activities in these wetlands and navigable waters. In recognizing Section 404 requirements and the Clean Water Action Plan's goal to annually increase the Nation's net wetland acreage by 100,000 acres through 2005, the signatory agencies agree to resolve aircraft-wildlife conflicts. They will do so by avoiding and minimizing wetland impacts to the maximum extent practicable, and will work to compensate for all associated unavoidable wetland impacts. The agencies agree to work with landowners and communities to encourage and support wetland restoration or enhancement efforts that do not increase aircraft-wildlife strike potentials.

H. Agree that the: U.S. Army Corps of Engineers (ACOE) has expertise in protecting and managing jurisdictional wetlands and their associated wildlife; U.S. Environmental Protection Agency (EPA) has expertise in protecting environmental resources; and the U.S. Fish and Wildlife Service (USFWS) has expertise in protecting and managing wildlife and their habitats, including migratory birds and wetlands. Appropriate signatory agencies will cooperatively review proposals to develop or expand wetland mitigation sites, or wildlife refuges that may attract hazardous wildlife. When planning these sites or refuges, the signatory agencies will diligently consider the siting criteria and land use practice recommendations stated in FAA AC 150/5200-33. The agencies will make every effort to undertake actions that are consistent with those criteria and recommendations, but recognize that exceptions to the siting criteria may be appropriate (see Paragraph F of this section).

I. Agree to consult with airport proponents during initial airport planning efforts. As appropriate, the FAA or USAF will initiate signatory agency participation in these efforts. When evaluating proposals to build new civilian or military aviation facilities or to expand existing ones, the FAA or the USAF, will work with appropriate signatory agencies to diligently evaluate alternatives that may avoid adverse effects on wetlands, other aquatic resources, and Federal

wildlife refuges. If these or other habitats support hazardous wildlife, and there is no practicable alternative location for the proposed aviation project, the appropriate signatory agencies, consistent with applicable laws, regulations, and policies, will develop mutually acceptable measures, to protect aviation safety and mitigate any unavoidable wildlife impacts.

J. Agree that a variety of other land uses (e.g., storm water management facilities, wastewater treatment systems, landfills, golf courses, parks, agricultural or aquacultural facilities, and landscapes) attract hazardous wildlife and are, therefore, normally incompatible with airports. Accordingly, new, federally-funded airport construction or airport expansion projects near habitats or other land uses that may attract hazardous wildlife must conform to the siting criteria established in the FAA Advisory Circular (AC) 150/5200-33, Section 1-3.

K. Agree to encourage and advise owners and/or operators of non-airport facilities that are known hazardous wildlife attractants (See Paragraph J) to follow the siting criteria in Section 1-3 of AC 150/5200-33. As appropriate, each signatory agency will inform proponents of these or other land uses about the land use's potential to attract hazardous species to airport areas. The signatory agencies will urge facility owners and/or operators about the critical need to consider the land uses' effects on aviation safety.

L. Agree that FAA, USAF, and WS personnel have the expertise necessary to determine the aircraft-wildlife strike potentials of various land uses. When there is disagreement among signatory agencies about a particular land use and it's potential to attract hazardous wildlife, the FAA, USAF, or WS will prepare a wildlife hazard assessment. Then, the appropriate signatory agencies will meet at the local level to review the assessment. At a minimum, that assessment will:

1. identify each species causing the aviation hazard, its seasonal and daily populations, and the population's local movements;
2. discuss locations and features on and near the airport or land use attractive to hazardous wildlife; and
3. evaluate the extent of the wildlife hazard to aviation.

M. Agree to cooperate with the airport operator to develop a specific, wildlife hazard management plan for a given location, when a potential wildlife hazard is identified. The plan will meet applicable FAA, USAF, and other relevant requirements. In developing the plan, the appropriate agencies will use their expertise and attempt to integrate their respective programmatic responsibilities, while complying with existing laws, regulations, and policies. The plan should avoid adverse impacts to wildlife populations, wetlands, or other sensitive habitats to the maximum extent practical. Unavoidable impacts resulting from implementing the plan will be fully compensated pursuant to all applicable Federal laws, regulations, and policies.

N. Agree that whenever a significant aircraft-wildlife strike occurs or a potential for one is identified, any signatory agency may initiate actions with other appropriate signatory agencies to evaluate the situation and develop mutually acceptable solutions to reduce the identified strike probability. The agencies will work cooperatively, preferably at the local level, to determine the causes of the strike and what can and should be done at the airport or in its vicinity to reduce potential strikes involving that species.

O. Agree that information and analyses relating to mitigation that could cause or contribute to aircraft-wildlife strikes should, whenever possible, be included in documents prepared to satisfy the National Environmental Policy Act (NEPA). This should be done in coordination with appropriate signatory agencies to inform the public and Federal decision makers about important ecological factors that may affect aviation. This concurrent review of environmental issues will promote the streamlining of the NEPA review process.

P. Agree to cooperatively develop mutually acceptable and consistent guidance, manuals, or procedures addressing the management of habitats attractive to hazardous wildlife, when those habitats are or will be within the siting criteria noted in Section 1-3 of FAA AC 5200-33. As appropriate, the signatory agencies will also consult each other when they propose revisions to any regulations or guidance relevant to the purpose of this MOA, and agree to modify this MOA accordingly.

SECTION II.

GENERAL RULES AND INFORMATION

A. Development of this MOA fulfills the National Transportation Safety Board's recommendation of November 19, 1999, to form an inter-departmental task force to address aircraft-wildlife strike issues.

B. This MOA does not nullify any obligations of the signatory agencies to enter into separate MOAs with the USFWS addressing the conservation of migratory birds, as outlined in Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, dated January 10, 2001 (66 *Federal Register*, No. 11, pg. 3853).

C. This MOA in no way restricts a signatory agency's participation in similar activities or arrangements with other public or private agencies, organizations, or individuals.

D. This MOA does not alter or modify compliance with any Federal law, regulation or guidance (e.g., Clean Water Act; Endangered Species Act; Migratory Bird Treaty Act; National Environmental Policy Act; North American Wetlands Conservation Act; Safe Drinking Water Act; or the "no-net loss" policy for wetland protection). The signatory agencies will employ this MOA in concert with the Federal guidance addressing wetland mitigation banking dated March 6, 1995 (60 *Federal Register*, No. 43, pg. 12286).

E. The statutory provisions and regulations mentioned above contain legally binding requirements. However, this MOA does not substitute for those provisions or regulations, nor is it a regulation itself. This MOA does not impose legally binding requirements on the signatory agencies or any other party, and may not apply to a particular situation in certain circumstances. The signatory agencies retain the discretion to adopt approaches on a case by-case basis that differ from this MOA when they determine it is appropriate to do so. Such decisions will be based on the facts of a particular case and applicable legal requirements. Therefore, interested parties are free to raise questions and objections about the substance of this MOA and the appropriateness of its application to a particular situation.

F. This MOA is based on evolving information and may be revised periodically without public notice. The signatory agencies welcome public comments on this MOA at any time and will consider those comments in any future revision of this MOA.

G. This MOA is intended to improve the internal management of the Executive Branch to address conflicts between aviation safety and wildlife. This MOA does not create any right, benefit, or trust responsibility, either substantively or procedurally. No party, by law or equity, may enforce this MOA against the United States, its agencies, its officers, or any person.

H. This MOA does not obligate any signatory agency to allocate or spend appropriations or enter into any contract or other obligations.

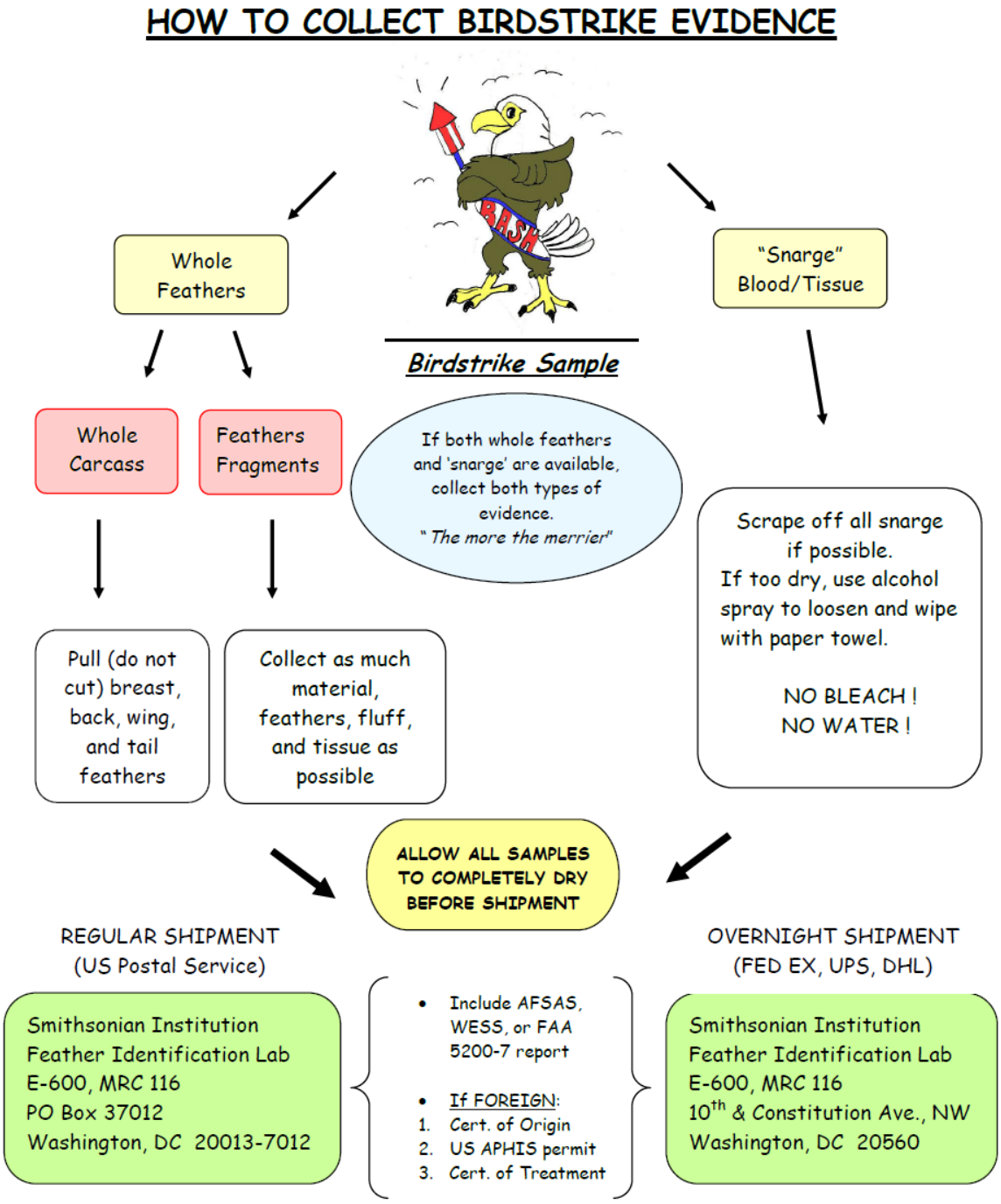
I. This MOA does not reduce or affect the authority of Federal, State, or local agencies regarding land uses under their respective purviews. When requested, the signatory agencies will provide technical expertise to agencies making decisions regarding land uses within the siting criteria in Section 1-3 of FAA AC 150/5200-33 to minimize or prevent attracting hazardous wildlife to airport areas.

J. Any signatory agency may request changes to this MOA by submitting a written request to any other signatory agency and subsequently obtaining the written concurrence of all signatory agencies.

K. Any signatory agency may terminate its participation in this MOA within 60 days of providing written notice to the other agencies. This MOA will remain in effect until all signatory agencies terminate their participation in it.

Appendix 3: Map of NAS Lemoore and surrounding area.

Appendix 4: How to collect bird strike evidence.



Guidelines For
Collecting Birdstrike Material

Feather Identification Lab, Smithsonian Institution

COLLECTING REMAINS

Feathers:

Whole Bird - Pluck a variety of feathers (breast, back, wing, tail)
Partial Bird - Collect a variety of feathers with color or pattern
Feathers only - Send all material available
Do not cut feathers from the bird (we need the downy part at the base of the feathers)
Do not use any sticky substance (no tape or glue)

Tissue/blood ("Snarge"):

Dry material - Scrape or wipe off into a clean re-closeable bag **or** wipe area with pre-packaged alcohol wipe **or** spray with alcohol to loosen material then wipe with clean cloth/gauze. (*please do not use water, bleach, or other cleansers – they destroy DNA)
Fresh material - Wipe area with alcohol wipe and/or clean cloth/gauze **or** apply fresh tissue/blood to an FTA® DNA collecting card

- Always include any feather material available
- Include copy of report (AFSAS, WESS, or FAA 5200-7)
- Always secure all remains in re-sealable plastic bag

SHIPPING

Routine / Non-Damaging Cases
US Postal Service
▼
Feather Identification Lab
Smithsonian Institution
NHB, E600, MRC 116
P.O. Box 37012
Washington, DC 20013-7012

Priority / Damaging Cases
Overnight Shipping
▼
Feather Identification Lab
Smithsonian Institution
NHB, E600, MRC 116
10th & Constitution Ave., NW
Washington, DC 20560-0116

WEBSITES

Birdstrike Committee: www.birdstrike.org
Air Force: http://www.afsc.af.mil/organizations/bash/index.asp
Civil Aviation: http://wildlife-mitigation.tc.faa.gov
Navy: www.safetycenter.navy.mil/aviation/operations/bash

Feather Lab Contact Information

202-633-0801
dovec@si.edu
heackerm@si.edu
dahlanno@si.edu
whattonj@si.edu

"MAKE-YOUR-OWN" - BIRDSTRIKE COLLECTING KITS

Birdstrike Collecting Kits are cheap to make and easy to assemble. Having pre-made kits available improves birdstrike reporting and encourages the sampling of birdstrike remains. Most folks assemble the contents into individual bags or envelopes and keep a supply in field vehicles or office supply cabinets for quick access. Below is a list of recommended items to include in your birdstrike collecting kits; mix and match as budgets permit:

Re-sealable plastic bags
A variety of sizes for various amounts of debris; Re-sealable bags help contain liquids and keeps odors to a minimum.

Sharpie Markers
Permanent markers are water resistant and used for writing data (date, time, aircraft, etc) directly on the bag of remains.

Alcohol Wipes
Pre-packaged alcohol hand-wipes can be used to wipe "snarge" off aircraft. Alcohol is better than water at preserving DNA, preventing mold growth, and is more sanitary for humans. Alternatively, use a spray bottle with 70% alcohol to spray the area before wiping with paper towels.
*Do not use wipes with bleach or other cleansers, it destroys DNA.

FTA® Micro Card and Sterile Applicators
If you send a lot of fresh blood/tissue samples for DNA identification, you may want to look into getting Whatman FTA® DNA cards. The material is sampled with a sterile applicator and placed onto the surface of the card that "fixes" the DNA in the sample. For more information on ordering these items contact the Feather Lab.
*Note: If you only occasionally send blood/tissue samples, a paper towel with alcohol, or alcohol wipe is still a good option for this type of material.

Miscellaneous Items for Birdstrike Collecting
Kitchen shears – good for cutting feet, wings, bills
Tongue depressors, tweezers, cotton swabs/cotton-tipped applicators
Hand cleaners, or other alcohol based gel hand sanitizers.

(collecting kits cont.)

Extra Safety Items

Latex Gloves
Protective Eyewear
Face Masks: Regular surgical-type hygiene masks. If avian flu is a concern, the Center for Disease Control recommends NIOSH rated N95 face masks. (These may be referred to as respirators.) There is a disposable version of these masks by 3M that looks similar to the regular "cup" style face masks.
Hand sanitizing gels

Reminders

Always encourage proper hygiene & provide personnel easy access to cleaning/hygiene supplies.
Do not cut off the fluffy down at the bottom of feathers.
Do not use water, bleach or other cleansers on samples.
Be sure personnel are briefed on proper carcass disposal protocols.
Stay informed to the status of the HPAI H5N1 avian flu virus.

The following websites have excellent coverage on current avian flu info:

U.S. Geological Survey Wildlife Health Center
http://www.nwhc.usgs.gov/

Centers for Disease Control and Prevention
http://www.cdc.gov/flu/avian/gen-info/facts.htm

The American Ornithologists' Union Ornithological Council
http://www.nmnh.si.edu/BIRDNET/OC/avianinfluenza.html

Smithsonian

Contact Information:
The Feather Identification Lab
Smithsonian Institution
MRC 116, E-600,
PO Box 37012
Washington, DC 20013-7012
(202) 633-0801

Email:
dovec@si.edu
heackerm@si.edu
dahlanno@si.edu
whattonj@si.edu

(rev 09/09 jfw)

Appendix 5: Form 37 Migratory Bird Damage Project Report.

Reset Form

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL DAMAGE CONTROL

MIGRATORY BIRD DAMAGE PROJECT REPORT

1. COOPERATOR NAME, ADDRESS, AND TELEPHONE NUMBER (Include *business* agency name *if appropriate)*	2. LOCATION OF DAMAGE	
	3. COUNTY	4. STATE CA
TELEPHONE ☐ Home ☐ Work AC: ( )		

5. RESOURCE

A. RESOURCE CATEGORY	B. SPECIFIC RESOURCE(S) DAMAGED	C. NATURE OF DAMAGE
☐ Agricultural ☐ Natural Resource ☐ Property ☐ Human Health/Safety		

6. DAMAGE ESTIMATE

A. QUANTITY OF LOSS AND UNIT OF MEASURE *(Pounds, acres, each, etc.)*		B. DOLLAR LOSS *(If available)*	C. LOSS CONFIRMED BY ADC
		☐ Per Unit $ ☐ Total	☐ Yes ☐ No
D. DURATION/TIME PERIOD OF DAMAGE	E. DATE ASSISTANCE REQUEST RECEIVED	F. DATE OF INVESTIGATION	G. INVESTIGATION TYPE ☐ Site Visit ☐ Telephone ☐ Letter ☐ Other

7. MIGRATORY BIRD SPECIES

A. DEPREDATING SPECIES	B. NUMBER INVOLVED	C. COMMENTS
1.		
2.		
3.		
4.		

8. ADC ASSISTANCE PROVIDED

A. TYPE OF ASSISTANCE PROVIDED
☐ Direct Control ☐ Equipment Loan ☐ Other (specify)
☐ Technical Assistance ☐ Supplies

B. RECOMMENDED ACTION(S)
☐ Harassment or hazing techniques ☐ Lethal trapping ☐ Trap and relocate
☐ Habitat alteration and/or barriers ☐ Shooting ☐ Other (specify)

C. METHODS ATTEMPTED, RESULTS, COMMENTS

9. DEPREDATION PERMIT

ADC RECOMMENDS PERMIT BE ISSUED. ☐ Yes ☐ No
If "YES" suggested conditions of permit.

10. ADC INVESTIGATOR NAME AND ADDRESS *(Print)*	12. FOR USE BY DEPREDATION PERMIT AGENCY
TELEPHONE AC: ( )	
11. ADC INVESTIGATOR'S SIGNATURE	

ADC FORM 37
(DEC 90)

Reset Form

PART 1 - PERMITTING AGENCY

Appendix 6: List of state and federally threatened, endangered, candidate, and species of concern in California.

State of California
The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Biogeographic Data Branch
California Natural Diversity Database

STATE & FEDERALLY LISTED ENDANGERED & THREATENED ANIMALS OF CALIFORNIA

July 2010

This is a list of animals found within California or off the coast of the State that have been classified as Endangered or Threatened by the California Fish & Game Commission (state list) or by the U.S. Secretary of the Interior or the U.S. Secretary of Commerce (federal list).

The official California listing of Endangered and Threatened animals is contained in the California Code of Regulations, Title 14, Section 670.5. The official federal listing of Endangered and Threatened animals is published in the Federal Register, 50 CFR 17.11. The California Endangered Species Act of 1970 created the categories of "Endangered" and "Rare". The California Endangered Species Act of 1984 created the categories of "Endangered" and "Threatened". On January 1, 1985, all animal species designated as "Rare" were reclassified as "Threatened".

Animals that are candidates for state listing and animals proposed for federal listing are also included on this list. A state candidate species is one that the Fish and Game commission had formally noticed as being under review by the Department for addition to the State list. A federal proposed species is one for which a proposed regulation has been published in the Federal Register.

Code Designation:	Totals as of July 2010
SE = State-listed as Endangered	46
ST = State listed as Threatened	35
SR = State listed as Rare – old designation, all animals reclassified to Threatened on 1/1/85	0
FE = Federally listed as Endangered (21.2% of all U.S. listed endangered animals as of 7/19/10)	88
FT = Federally listed as Threatened (24.1% of all U.S. listed threatened animals as of 7/19/10)	40
SCE = State candidate (Endangered)	0
SCT = State Candidate (Threatened)	0
SCD = State Candidate (Delisting)	1
FPE = Federally proposed (Endangered)	1
FPT = Federally proposed (Threatened)	1
FPD = Federally proposed (Delisting)	0
Total number of animals listed (includes subspecies & population segments)	157
Total number of candidate/proposed animals for listing	2
Number of animals State listed only	31
Number of animals Federally listed only	71
Number of animals listed under both State & Federal Acts	55

Common and scientific names are shown as they appear on the state or federal lists. If the nomenclature differs for a species that is included on both lists, the state nomenclature is given and the federal nomenclature is shown in a footnote. Synonyms, name changes, and other clarifying points are also footnoted.

Critical Habitat is defined in Section 3 of the federal Endangered Species Act as specific areas, both occupied and unoccupied, that is essential to the conservation of a listed species and that may require special management considerations or protection.

Recovery Plans are discussed in Section 4 of the federal Endangered Species Act. Each plan incorporates site-specific management actions necessary for the conservation and survival of the species.

The "List Date" for **final** federal listing and **final** Critical Habitat designation is the date the listing or designation becomes effective, this is usually <u>not</u> the date of publication of the rule in the Federal Register; it is usually about 30 days after publication, but may be longer.

If a taxa that was previously listed or proposed for listing no longer has any listing status the entry has been grayed out.

For taxa that have more than one status entry, the current status is in bold and underlined.

Changes to this update of the list are denoted by *

Endangered and Threatened Animals of California

	LISTING STATUS				CRITICAL HABITAT		RECOVERY PLAN	
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
GASTROPODS								
Trinity bristle snail *Monadenia setosa*[1]	ST[2]	10-02-80						
Morro shoulderband (=banded dune) snail *Helminthoglypta walkeriana*			FE	1-17-95	Final	3-09-01	Final	1998
White abalone *Haliotis sorenseni*			FE	6-28-01	*Not prudent	6-28-01	Final	2008
Black abalone *Haliotis cracherodii*			FE	2-13-09				
CRUSTACEANS								
Riverside fairy shrimp *Streptocephalus woottoni*			FE	8-03-93	Final[3] Proposed Final	5-12-05 4-27-04 6-29-01	Final	1998
Conservancy fairy shrimp *Branchinecta conservatio*			FE	9-19-94	Final[4] Proposed Final Proposed	2-10-06 12-28-04 8-06-03 9-24-02	Final	2005
Longhorn fairy shrimp *Branchinecta longiantenna*			FE	9-19-94	Final 4 Proposed Final Proposed	2-10-06 12-28-04 8-06-03 9-24-02	Final	2005
Vernal pool fairy shrimp *Branchinecta lynchi*			FT	9-19-94	Final 4 Proposed Final Proposed	2-10-06 12-28-04 8-06-03 9-24-02	Final	2005
San Diego fairy shrimp *Branchinecta sandiegoensis*			FE	2-03-97	Final Proposed[5] Final	1-11-08 4-22-03 10-23-00	Final	1998
Vernal pool tadpole shrimp *Lepidurus packardi*			FE	9-19-94	Final 4 Proposed Final Proposed	2-10-06 12-28-04 8-06-03 9-24-02	Final	2005
Shasta crayfish *Pacifastacus fortis*	**SE** ST	2-26-88 10-02-80	FE	9-30-88			Final	1998
California freshwater shrimp *Syncaris pacifica*	SE	10-02-80	FE	10-31-88			Final	1998
INSECTS								
Zayante band-winged grasshopper *Trimerotropis infantilis*			FE	2-24-97	Final	3-09-01	Final	1998

[1] Current taxonomy is *Monadenia infumata setosa*.

[2] On January 1, 1985, all species designated as "rare" were reclassified as "threatened", as stipulated by the California Endangered Species Act.

[3] The Federal Circuit Court vacated critical habitat for the Riverside fairy shrimp on 10-30-02. The judge instructed the USFWS to begin the process of re-designating critical habitat for this species. New critical habitat was proposed 4-27-04 and finalized effective 5-12-05.

[4] On October 28, 2004 the courts ordered the USFWS to reconsider the areas excluded from the final critical habitat designation made August 6, 2003. The December 28 2004 proposed rule is only for lands previously excluded and does not affect the areas included in the August 6, 2003 final rule. The non-economic exclusions made to the August 6, 2003 final rule were confirmed effective March 8, 2005

[5] Due to court order the previously designated critical habitat was vacated and the USFWS was directed to re-proposed critical habitat.

	LISTING STATUS			CRITICAL HABITAT		RECOVERY PLAN		
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Mount Hermon June beetle *Polyphylla barbata*			FE	2-24-97			Final	1998
Casey's June beetle *Dinacoma caseyi*			FPE	7-09-09	Proposed	7-09-09		
Delta green ground beetle *Elaphrus viridis*			FT	8-08-80	Final	8-08-80	Final Final	2006 1985
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*			FT	8-08-80	Final	8-08-80	Final	1984
Ohlone tiger beetle *Cicindela ohlone*			FE	10-03-01			Final	1998
Kern primrose sphinx moth *Euproserpinus euterpe*			FT	4-08-80	Proposed	7-03-78	Final	1984
Mission blue butterfly *Icaricia icarioides missionensis*[6]			FE	6-01-76	Proposed	2-08-77	Final	1984
Lotis blue butterfly *Lycaeides argyrognomon lotis*[7]			FE	6-01-76	Proposed	2-08-77	Final	1985
Palos Verdes blue butterfly *Glaucopsyche lygdamus palosverdesensis*			FE	7-02-80	Final	7-02-80	Final	1984
El Segundo blue butterfly *Euphilotes battoides allyni*			FE	6-01-76	Proposed	2-08-77	Final	1998
Smith's blue butterfly *Euphilotes enoptes smithi*			FE	6-01-76	Proposed	2-08-77	Final	1984
San Bruno elfin butterfly *Callophrys mossii bayensis*			FE	6-01-76	Proposed	2-08-77	Final	1984
Lange's metalmark butterfly *Apodemia mormo langei*			FE	6-01-76	Proposed	2-08-77	Revised	1984
Bay checkerspot butterfly *Euphydryas editha bayensis*			FT	10-18-87	Final Proposed Final	9-25-08 8-22-07 5-30-01	Final	1998
Quino checkerspot *Euphydras editha quino (=E.e.wrighti)*			FE	1-16-97	Proposed[8] Final Proposed	1-17-08 5-15-02 2-07-01	Final	2003
Carson wandering skipper *Pseudocopaeodes enus obscurus*			FE	8-07-02			Final Draft	2007 2005
Laguna Mountains skipper *Pyrgus ruralis lagunae*			FE	1-16-97	Final	1-11-07		
Callippe silverspot butterfly *Speyeria callippe callippe*			FE	12-05-97	Proposed	3-28-80		
Behren's silverspot butterfly *Speyeria zerene behrensii*			FE	12-05-97			Draft	2004
Oregon silverspot butterfly[9] *Speyeria zerene hippolyta*			FT	7-02-80	Final	7-02-80	Revised	2001
Myrtle's silverspot butterfly *Speyeria zerene myrtleae*			FE	6-22-92			Final	1998
Delhi Sands flower-loving fly *Rhaphiomidas terminatus abdominalis*			FE	9-23-93			Final	1997

[6] Current taxonomy is *Plebejus icarioides missionensis*
[7] Current taxonomy is *Plebejus idas lotis*
[8] Proposed rule is to revise designated Critical Habitat
[9] Current common name is Hippolyta frittilary

	LISTING STATUS			CRITICAL HABITAT		RECOVERY PLAN		
FISHES	**State**	**List Date**	**Federal**	**Effective List Date**	**Designation**	**Effective Date**	**Version**	**Date**
Green sturgeon – southern DPS			FT[10]	6-06-06	Final	11-09-09		
Acipenser medirostris					Proposed	9-08-08		
Chinook salmon-Winter-run[11]	SE	9-22-89	**FE**[12]	8-29-05	Final	3-23-99	Draft	2009
Oncorhynchus tshawytscha			FE	2-03-94				1997
Chinook salmon-California coastal ESU[13]			**FT**[14]	8-29-05	Final	1-02-06		
Oncorhynchus tshawytscha			FT[15]	11-15-99	Proposed	12-10-04		
					Rescinded	4-30-02		
					Final	2-16-00		
Chinook salmon-Spring-run	ST[16]	2-05-99	**FT**[17]	8-29-05	Final	1-02-06	Draft	2009
Oncorhynchus tshawytscha			FT[18]	11-15-99	Proposed	12-10-04		
					Rescinded	4-30-02		
					Final	2-16-00		
Coho salmon-Central California Coast ESU	SE[19]	3-30-05	**FE**[20]	8-29-05	Final	6-04-99	Final	2004
Oncorhynchus kisutch			FT[21]	12-02-96			(state)	
Coho salmon-So. Oregon/No. Calif ESU	ST[22]	3-30-05	**FT**[23]	8-29-05	Final	3-17-00	Final	2004
Oncorhynchus kisutch			FT[24]	6-05-97			(state)	
Little Kern golden trout			FT	4-13-78	Final	4-13-78	Exempt	
Oncorhynchus mykiss whitei								
Lahontan cutthroat trout			**FT**	7-16-75			Final	1995
Oncorhynchus clarki henshawi			FE	10-13-70				
Paiute cutthroat trout			**FT**	7-16-75			Revised	2004
Oncorhynchus clarki seleniris			FE	3-11-67[25]			Final	1985
Steelhead-Northern California ESU[26]			**FT**[27]	2-06-06	Final	1-02-06		
Oncorhynchus mykiss			FT	8-07-00	Proposed	12-10-04		

[10] Includes all spawning populations south of the Eel River

[11] Federal: Sacramento River winter run Chinook salmon

[12] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs, 10 of these in California. The 29 Aug 2005 list date refers to the final designations made as a result of those status reviews.

[13] ESU = Evolutionarily Significant Unit

[14] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs, 10 of these in California. The 29 Aug 2005 list date refers to the final designations made as a result of those status reviews.

[15] Naturally spawned coastal spring & fall Chinook salmon between Redwood Creek in Humboldt County & the Russian River in Sonoma County.

[16] State listing is for the Sacramento River drainage.

[17] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs, 10 of these in California. The 29 Aug 2005 list date refers to the final designations made as a result of those status reviews.

[18] Federal: Central Valley Spring-Run ESU. Includes populations spawning in the Sacramento River & its tributaries.

[19] The Coho south of San Francisco Bay were state listed in 1995; in February 2004 the Fish and Game Commission determined that the Coho from San Francisco to Punta Gorda should also be listed as Endangered. This changed was finalized by of Office of Administrative Law on March 30, 2005.

[20] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs, 10 of these in California. The 29 Aug 2005 list date refers to the final designations made as a result of those status reviews.

[21] The Federal listing is limited to naturally spawning populations in streams between Punta Gorda, Humboldt County & the San Lorenzo River, Santa Cruz County.

[22] The Fish and Game Commission determined that the Coho from Punta Gorda to the Oregon border should be listed as Threatened on February 25, 2004. This determination was finalized by the Office of Administrative Law on March 30, 2005.

[23] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs, 10 of these in California. The 29 Aug 2005 list date refers to the final designations made as a result of those status reviews.

[24] The Federal listing is for populations between Cape Blanco, Oregon & Punta Gorda, California.

[25] All species with a list date of 03-11-67 were listed under the Endangered Species Preservation Act of Oct 15, 1966.

[26] Naturally spawned populations residing below impassable barriers in coastal basins from Redwood Creek in Humboldt County to, and including, the Gualala River in Mendocino County.

	LISTING STATUS			CRITICAL HABITAT		RECOVERY PLAN		
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Steelhead-Central California Coast ESU[28] *Oncorhynchus mykiss*			**FT**[29] FT	2-06-06 10-17-97	Final Proposed Rescinded Final	1-02-06 12-10-04 4-30-02 3-17-00		
Steelhead-South/Central Calif Coast ESU[30] *Oncorhynchus mykiss*			**FT**[31] FT	2-06-06 10-17-97	Final Proposed Rescinded Final	1-02-06 12-10-04 4-30-02 3-17-00		
Steelhead-Southern California ESU[32] *Oncorhynchus mykiss*			**FE**[33] FE	2-06-06 10-17-97	Final Proposed Rescinded Final	1-02-06 12-10-04 4-30-02 3-17-00	Draft	2009
Steelhead-Central Valley ESU[34] *Oncorhynchus mykiss*			**FT**[35] FT	2-06-06 5-18-98	Final Proposed Rescinded Final	1-02-06 12-10-04 4-30-02 3-17-00	Draft	2009
Bull trout *Salvelinus confluentus*	SE	10-02-80	FT	12-01-99	*Proposed (revised)[36] Final	1-14-10 10-26-05		
Delta smelt *Hypomesus transpacificus*	*SE ST	1-20-10 12-09-93	FT	3-05-93	Final	12-19-94	Final	1996
Longfin smelt *Spirinchus thaleichthys*	*ST SCE	4-09-10 2-02-08						
Eulachon – southern DPS *Thaleichthys pacificus*			*FT	5-17-10				
Mohave tui chub *Gila bicolor mohavensis*	SE	6-27-71	FE	10-13-70			Final	1984
Owens tui chub *Gila bicolor snyderi*	SE	1-10-74	FE	8-05-85	Final	8-05-85	Final	1998
Cowhead Lake tui chub *Gila bicolor vaccaceps*			withdrawn FPE	10-11-06 3-30-98				
Tecopa pupfish (**Extinct**) *Cyprinodon nevadensis calidae*	delisted SE	1987 6-27-71	delisted FE	1-15-82 10-13-70				
Bonytail[37] *Gila elegans*	**SE** SR	1-10-74 6-27-71	FE	4-23-80	Final	3-21-94	Revised Revised	2002 1990

[27] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs. The 6 Feb 2006 list date refers to the final designations made as a result of those status reviews. There was no change in listing status for the steelhead ESUs in California.
[28] Coastal basins from the Russian River, south to Soquel Creek, inclusive. Includes the San Francisco & San Pablo Bay basins, but excludes the Sacramento-San Joaquin River basins.
[29] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs. The 6 Feb 2006 list date refers to the final designations made as a result of those status reviews. There was no change in listing status for the steelhead ESUs in California.
[30] Coastal basins from the Pajaro River south to, but not including, the Santa Maria River.
[31] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs. The 6 Feb 2006 list date refers to the final designations made as a result of those status reviews. There was no change in listing status for the steelhead ESUs in California.
[32] Coastal basins from the Santa Maria River (inclusive), south to the U.S.-Mexico Border.
[33] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs. The 6 Feb 2006 list date refers to the final designations made as a result of those status reviews. There was no change in listing status for the steelhead ESUs in California.
[34] The Sacramento and San Joaquin Rivers and their tributaries.
[35] The NMFS has completed comprehensive status reviews for 27 west coast salmon & steelhead ESUs. The 6 Feb 2006 list date refers to the final designations made as a result of those status reviews. There was no change in listing status for the steelhead ESUs in California.
[36] There is no designated or proposed Critical Habitat for bull trout in California.
[37] Federal: Bonytail chub

	LISTING STATUS			CRITICAL HABITAT		RECOVERY PLAN		
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Sacramento splittail *Pogonichthys macrolepidotus*			deleted[38] FT	9-22-03 3-10-99				
Colorado squawfish[39] *Ptychocheilus lucius*	SE	6-27-71	FE	3-11-67	Final	3-21-94	Revised Revised	2002 1991
Lost River sucker *Deltistes luxatus*	**SE** SR	1-10-74 6-27-67	FE	7-18-88	Proposed	12-01-94	Final	1993
Modoc sucker *Catostomus microps*	**SE** SR	10-02-80 1-10-74	FE	6-11-85	Final	6-11-85	Exempt	
Santa Ana sucker *Catostomus santaanae*			FT[40]	5-12-00	*Proposed (revised) Final	12-09-09 2-03-05		
Shortnose sucker *Chasmistes brevirostris*	**SE** SR	1-10-74 6-27-71	FE	7-18-88	Proposed	12-01-94	Final	1993
Razorback sucker *Xyrauchen texanus*	**SE** SR	1-10-74 6-27-71	FE	10-23-91	Final	3-21-94	Revised Final	2002 1998
Desert pupfish *Cyprinodon macularius*	SE	10-02-80	FE	3-31-86	Final	3-31-86	Final	1993
Cottonball Marsh pupfish *Cyprinodon salinus milleri*	ST	1-10-74						
Owens pupfish *Cyprinodon radiosus*	SE	6-27-71	FE	3-11-67			Final	1998
Thicktail chub (**Extinct**) *Gila crassicauda*	delisted SE	10-02-80 1-10-74						
Unarmored threespine stickleback *Gasterosteus aculeatus williamsoni*	SE	6-27-71	FE	10-13-70	Designation should not be made [41] Proposed	9-17-02 11-17-80	Final	1985
Tidewater goby *Eucyclogobius newberryi*			With-drawn FPD[42] **FE**	12-09-02 6-24-99 2-04-94	Final Proposed Final	3-03-08 11-28-06 11-20-00	Final	2005
Rough sculpin *Cottus asperrimus*	ST	1-10-74						
AMPHIBIANS								
California tiger salamander (central valley DPS) *Ambystoma californiense*	*ST[43] [44]	5-20-10	FT[45]	9-03-04	Final[46] Proposed [47]	9-22-05 8-10-04		

[38] On 23 June 2000, the Federal Eastern District Court of Calif. found the final rule to be unlawful and on 22 Sept 2000 remanded the determination back to the USFWS for a reevaluation of the final decision. After a thorough review the USFWS removed the Sacramento splittail from the list of threatened species.

[39] Current nomenclature and federal listing: Colorado pikeminnow

[40] Populations in the Los Angeles, San Gabriel and Santa Ana River basins.

[41] Full explanation of this situation is given in the Federal Register notice.

[42] Proposal to delist refers to populations north of Orange County only.

[43] The state listing refers to the entire range of the species.

[44] The Fish and Game Commission determined that the California tiger salamander should be listed as Threatened on May 20, 2010. This determination still needs to be finalized by the Office of Administrative Law.

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	LISTING STATUS				CRITICAL HABITAT		RECOVERY PLAN	
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
California tiger salamander (Santa Barbara County DPS) *Ambystoma californiense*	*(ST)		FE [45]	9-15-00	Final[48]	11-24-04		
California tiger salamander (Sonoma County DPS) *Ambystoma californiense*	*(ST)		FE [45]	3-19-03	Proposed [49]	8-18-09 8-02-05		
Santa Cruz long-toed salamander *Ambystoma macrodactylum croceum*	SE	6-27-71	FE	3-11-67	Proposed	6-22-78	Draft	1999
Siskiyou Mountains salamander *Plethodon stormi*	SCD ST	9-30-05 6-27-71						
Scott Bar salamander *Plethodon asupak*	ST[50]	6-27-71						
Techachapi slender salamander *Batrachoseps stebbinsi*	ST	6-27-71						
Kern Canyon slender salamander *Batrachoseps simatus*	ST	6-27-71						
Desert slender salamander *Batrachoseps aridus*[51]	SE	6-27-71	FE	6-04-73			Final	1982
Shasta salamander *Hydromantes shastae*	ST	6-27-71						
Limestone salamander *Hydromantes brunus*	ST	6-27-71						
Black toad *Bufo exsul*[52]	ST	6-27-71						
Arroyo toad[53] *Bufo californicus*[54]			FE	1-17-95	Proposed (Revised) Final Proposed [55] Final	10-13-05 5-13-05 2-14-05 4-27-04 3-09-01	Final	1999
California red-legged frog[56] *Rana aurora draytonii*			FT	5-20-96	*Final Proposed [57] Final	4-16-10 9-16-08 4-12-01	Final	2002

[45] In 2004 the California tiger salamander was listed as "threatened" statewide. The Santa Barbara County and Sonoma County Distinct Vertebrate Population Segments (DPS), formerly listed as "endangered", were reclassified to "threatened". On Aug 19 2005 U.S. District court vacated the downlisting of the Sonoma and Santa Barbara populations from "endangered" to "threatened". Therefore, the Sonoma & Santa Barbara populations are once again listed as "endangered"

[46] Final rule published Aug 23, 2005 is for the central valley population only.

[47] Critical Habitat proposal published Aug 10, 2004 is for the central valley population only.

[48] Final rule published Nov 24, 2004 is for the Santa Barbara County population only.

[49] Proposed rule published Aug 2, 2005 is for the Sonoma County population only. The proposed rule published Aug 18, 2009 encompasses the same geographic area as the Aug 2, 2005 proposal.

[50] Since this newly described species was formerly considered to be a subpopulation of *Plethodon stormi*, and since *Plethodon stormi* is listed a Threatened under the California Endangered Species Act (CESA), *Plethodon asupak* retains the designation as a Threatened species under CESA.

[51] Current taxonomy: *Batrachoseps major aridus*.

[52] Current taxonomy: *Anaxyrus exsul*

[53] Former taxonomy: *Bufo microscaphus californicus*.

[54] Current taxonomy: *Anaxyrus californicus*

[55] The Federal Circuit Court vacated critical habitat for the Arroyo toad on 10-30-02. The judge instructed the USFWS to begin the process of re-designating critical habitat for this species. New critical habitat was first proposed on 4-27-04 and proposed with revisions on 2-14-05. A new final rule became effective 5-13-05.

[56] Current taxonomy: *Rana draytoni*

[57] Proposed rule is for revised Critical Habitat boundaries

	LISTING STATUS			CRITICAL HABITAT			RECOVERY PLAN		
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Mountain yellow-legged frog – Southern California DPS[58][59] *Rana muscosa*			FE	8-01-02	Final Proposed	10-16-06 9-13-05		
REPTILES								
Desert tortoise *Gopherus agassizii*	ST	8-03-89	FT	4-02-90	Final	2-08-94	*Draft Revised Final	2008 1994
Green sea turtle *Chelonia mydas*			**FT** FE	7-28-78 10-13-70	Final	3-23-99	Revised	1998
Loggerhead sea turtle – North Pacific DPS[60] *Caretta caretta*			*FPE **FT**	3-16-10 7-28-78	Proposed	3-19-80	Revised	1998
Olive (=Pacific) Ridley sea turtle *Lepidochelys olivacea*			FT	7-28-78	Proposed	3-19-80	Revised	1998
Leatherback sea turtle *Dermochelys coriacea*			FE	6-02-70	Proposed (Revised) Final	1-05-10 3-23-99	Revised	1998
Barefoot banded gecko[61] *Coleonyx switaki*	ST	10-02-80						
Coachella Valley fringe-toed lizard *Uma inornata*	SE	10-02-80	FT	9-25-80	Final	9-25-80	Final	1985
Blunt-nosed leopard lizard *Gambelia silus*[62]	SE	6-27-71	FE	3-11-67			Final	1998
Flat-tailed horned lizard *Phrynosoma mcallii*			Withdrawn[63] FPT[64]	6-28-06 11-29-93				
Island night lizard *Xantusia riversiana*			FT	8-11-77			Final	1984
Southern rubber boa *Charina bottae umbratica*[65]	ST	6-27-71						
Alameda whipsnake *Masticophis lateralis euryxanthus*	ST	6-27-71	FT	12-05-97	Final Proposed[66] Vacated[67] Final	11-01-06 10-18-05 5-09-03 10-03-00	Draft	2003
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	SE	6-27-71	FE	3-11-67			Final	1985
Giant garter snake *Thamnophis couchi gigas*[68]	ST	6-27-71	FT	10-20-93			Draft	1999

[58] Federal listing refers to the distinct population segment (DPS) in the San Gabriel, San Jacinto & San Bernardino Mountains only.
[59] The current common name for this species is Sierra Madre yellow-legged frog.
[60] 1978 listing was for the worldwide range of the species. The Mar 16, 2010 proposed rule is for the north pacific DPS (north of the equator & south of 60 degrees north latitude).
[61] Current nomenclature: Barefoot gecko.
[62] Current taxonomy: *Gambelia sila*.is the scientific name and bluntnose leopard lizard is the common name
[63] On June 28, 2006 the USFWS determined that the posposed listing was not warranted and the proposed rule that had been reinstated on Nov 17, 2005 was withdrawn.
[64] On November 17, 2005, the U. S. District Court for the District of Arizona vacated the January 3, 2003 withdrawal of the proposed rule to list the flat-tailed horned lizard and reinstated the 1993 proposed rule.
[65] Current taxonomy: *Charina umbratica*.
[66] The proposed rule redesignates Critical Habitat that was vacated in 2003.
[67] Due to legal action on 9 May 2003, the Critical Habitat designation has been completely vacated; there is currently no Critical Habitat for Alameda whipsnake.
[68] Current taxonomy and Federal listing: *Thamnophis gigas*.

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	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Marbled murrelet	SE	3-12-92	FT	9-30-92	Proposed[76]	7-31-08	Final	1997
Brachyramphus marmoratus[75]					Final	5-24-96		
Xantus's murrelet	ST[77]	12-22-04						
Synthliboramphus hypoleucus								
Western yellow-billed cuckoo	**SE**	3-26-88						
Coccyzus americanus occidentalis	ST	6-27-71						
Elf owl	SE	10-02-80						
Micrathene whitneyi								
Northern spotted owl			FT	6-22-90	Final	9-12-08	Final	2008
Strix occidentalis caurina					Proposed	6-17-07	Draft	2007
					Final	1-15-92		
Great gray owl	SE	10-02-80						
Strix nebulosa								
Gila woodpecker	SE	3-17-88						
Melanerpes uropygialis								
Gilded northern flicker[78]	SE	3-17-88						
Colaptes auratus chrysoides								
Willow flycatcher	SE[79]	1-02-91						
Empidonax traillii								
Southwestern willow flycatcher	(SE)		FE	3-29-95	Final	11-18-05	Final	2002
Empidonax traillii extimus					Proposed	10-12-04		
					Final[80]	7-22-97		
Bank swallow	ST	6-11-89					Final (state)	1993
Riparia riparia								
Coastal California gnatcatcher			FT	3-30-93	Final	1-18-08	Exempt	
Polioptila californica californica					Proposed[81]	4-24-03		
					Final	10-24-00		
San Clemente loggerhead shrike			FE	8-11-77			Final	1984
Lanius ludovicianus mearnsi								
Arizona Bell's vireo	SE	3-17-88						
Vireo bellii arizonae								
Least Bell's vireo	SE	10-02-80	FE	5-02-86	Final	2-02-94	Draft	1998
Vireo bellii pusillus								
Inyo California towhee[82]	SE	10-02-80	FT	8-03-87	Final	8-03-87	Final	1998
Pipilo crissalis eremophilus								
San Clemente sage sparrow			FT	8-11-77			Final	1984
Amphispiza belli clementeae								
Belding's savannah sparrow	SE	1-10-74						
Passerculus sandwichensis beldingi								
Santa Barbara song sparrow **(Extinct)**			**delisted**	10-12-83				
Melospiza melodia graminea			FE	6-04-73				

[75] Federal: *Brachyramphus marmoratus marmoratus* with a proposal (7-31-08) to change the name to *Brachyramphus marmoratus*.

[76] Proposed rule to revise the previously designated Critical Habitat.

[77] The Fish and Game Commission determined that Xantus's murrelet should be listed as a Threatened species February 24, 2004. As part of the normal listing process, this decision was reviewed by the Office of Administrative Law. The listing became effective on Dec 22, 2004.

[78] Current taxonomy: Gilded flicker (*Colaptes chrysoides*).

[79] State listing includes all subspecies.

[80] On May 11, 2001 the 10th Circuit Court of Appeals vacated the previously designated Critical Habitat

[81] Due to court order the previously designated critical habitat was vacated and the USFWS was directed to re-propose critical habitat.

[82] Federal: Inyo California (=brown) towhee.

	LISTING STATUS				CRITICAL HABITAT		RECOVERY PLAN	
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
MAMMALS								
Buena Vista Lake shrew *Sorex ornatus relictus*			FE[83]	4-05-02	Final Proposed	2-23-05 8-19-04	Final	1998
Lesser long-nosed bat *Leptonycteris yerbabuenae*			FE	10-31-88			Final	1997
Riparian brush rabbit *Sylvilagus bachmani riparius*	SE	5-29-94	FE	3-24-00			Final	1998
Point Arena mountain beaver *Aplodontia rufa nigra*			FE	12-12-91			Final	1998
San Joaquin antelope squirrel[84] *Ammospermophilus nelsoni*	ST	10-02-80						
Mohave ground squirrel[85] *Spermophilus mohavensis*	ST	6-27-71						
Pacific pocket mouse *Perognathus longimembris pacificus*			FE	9-26-94			Final	1998
Morro Bay kangaroo rat *Dipodomys heermanni morroensis*	SE	6-27-71	FE	10-13-70	Final	8-11-77	Draft revision Final	2000 1982
Giant kangaroo rat *Dipodomys ingens*	SE	10-02-80	FE	1-05-87			Final	1998
Stephens' kangaroo rat *Dipodomys stephensi*[86]	ST	6-27-71	FE	9-30-88				
San Bernardino kangaroo rat *Dipodomys merriami parvus*			FE[87]	9-24-98	Final[88] Final	11-17-08 5-23-02		
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	SE	6-11-89	FE	7-08-88			Final	1998
Fresno kangaroo rat *Dipodomys nitratoides exilis*	**SE** SR	10-02-80 6-27-71	FE	3-01-85	Final	1-30-85	Final	1998
Salt-marsh harvest mouse *Reithrodontomys raviventris*	SE	6-27-71	FE	10-13-70			Final	1984
Amargosa vole *Microtus californicus scirpensis*	SE	10-02-80	FE	11-15-84	Final	11-15-84	Final	1997
Riparian woodrat *Neotoma fuscipes riparia*			FE[89]	3-24-00			Final	1998
Sierra Nevada red fox *Vulpes vulpes necator*	ST	10-02-80						
San Joaquin kit fox *Vulpes macrotis mutica*	ST	6-27-71	FE	3-11-67			Final	1998
Island fox *Urocyon littoralis*	ST[90]	6-27-71						
San Miguel Island Fox *Urocyon littoralis littoralis*	(ST)		FE	4-05-04	Final[91] (none) Proposed[92]	12-09-05 10-07-04		

[83] Federal: Buena Vista Lake ornate shrew
[84] Current taxonomy: Nelson's antelope squirrel
[85] Current taxonomy: Xerospermophilus mohavensis
[86] Federal: includes *Dipodomys cascus.*
[87] Federal: San Bernardino Merriam's kangaroo rat
[88] This final revised designation constitutes a reduction of approximately 25,516 acres from the 2002 designation of Critical Habitat.
[89] Federal: Riparian (=San Joaquin Valley) woodrat
[90] State listing includes all 6 subspecies on all 6 islands. Federal listing is for only 4 subspecies on 4 islands

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	LISTING STATUS				CRITICAL HABITAT		RECOVERY PLAN	
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Santa Rosa Island Fox *Urocyon littoralis santarosa*	(ST)		FE	4-05-04	Final [91] (none) Proposed [92]	12-09-05 10-07-04		
Santa Cruz Island Fox *Urocyon littoralis santacruzae*	(ST)		FE	4-05-04	Final [91] (none) Proposed [92]	12-09-05 10-07-04		
Santa Catalina Island Fox *Urocyon littoralis catalinae*	(ST)		FE	4-05-04	Final [91] (none) Proposed [92]	12-09-05 10-07-04		
Guadalupe fur seal *Arctocephalus townsendi*	ST	6-27-71	**FT** FE	1-15-86 3-11-67			Draft (revised)	2007
Stellar (=northern) sea lion *Eumetopias jubatus*			FT	4-05-90	Final	3-23-99	Revised Final	2008 1992
Wolverine *Gulo gulo*	ST	6-27-71						
Southern sea otter *Enhydra lutris nereis*			FT	1-14-77			Revised Final	2003 1981
Pacific fisher *Martes pennanti(pacifica)* DPS	SCT or SCE[93]	*Listing Not warranted						
Gray whale **(Recovered)** *Eschrichtius robustus*			delisted FE	6-15-94 6-02-70				
Sei whale *Balaenoptera borealis*			FE	6-02-70				
Blue whale *Balaenoptera musculus*			FE	6-02-70			Final	1998
Fin whale *Balaenoptera physalus*			FE	6-02-70			Draft	2006
Humpback whale[94] *Megaptera novaeangliae*			FE	6-02-70			Final	1991
Right whale[95] *Eubalaena japonica*[96]			FE	6-02-70			Final	1991
Sperm whale *Physeter macrocephalus*			FE	6-02-70			Draft	2006
Killer whale (Southern resident DPS) *Orcinus orca*			FE[97] FE	4-04-07 2-16-06 12-22-04			Final	2008
California (=Sierra Nevada) bighorn sheep *Ovis canadensis californiana*[98]	**SE** ST	8-27-99 6-27-71	FE	1-03-00	Final Proposed	9-04-08 7-25-07	Final Draft	2008 2003

[91] The USFWS did not find any habitat on the 4 islands occupied by the foxes that meets the definition of Critical Habitat under the Act. Therefore, the final rule does not designate any Critical Habitat

[92] The USFWS did not find any habitat on the 4 islands occupied by the foxes that meets the definition of Critical Habitat under the Act. Therefore, the proposal is that zero Critical Habitat be designated.

[93] The Fish and Game Commission notice of finding states that the Pacific fisher is a candidate for listing as either an endangered or a threatened species. At the June 23, 2010 meeting the Commission determined that the listing was not warranted.

[94] Also known as Hump-backed whale.

[95] Also known as Black right whale.

[96] The scientific name was clarified in the Federal Register Vol. 68, No. 69 April 10, 2003.

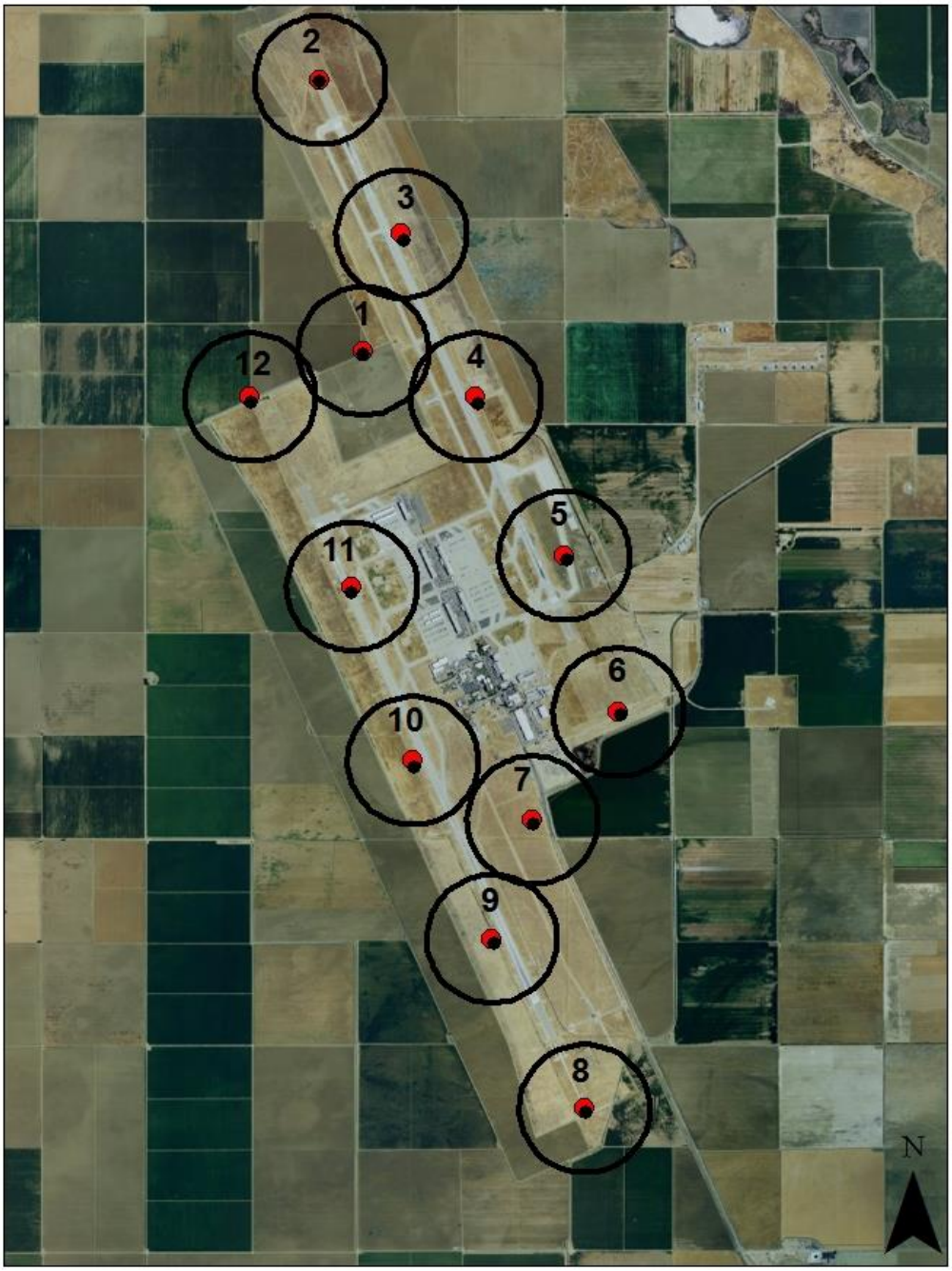
[97] The killer whale was listed as endangered by the NMFS on Feb 16, 2006 and by the USFWS on Apr 4, 2007.

[98] Current & Federal taxonomy: Sierra Nevada bighorn sheep (*Ovis canadensis sierrae)*

	LISTING STATUS				CRITICAL HABITAT		RECOVERY PLAN	
	State	List Date	Federal	Effective List Date	Designation	Effective Date	Version	Date
Peninsular bighorn sheep DPS[99] *Ovis canadensis cremnobates*	ST	6-27-71	FE	3-18-98	Final	5-14-09	Final	2000
					Proposed (Revised)	10-10-07		
					Final	3-05-01		

[99] Current taxonomy: the subspecies *O.c. cremnobates* has been synonymized with *O.c. nelsoni*. Peninsular bighorn sheep are now considered to be a Distinct Vertebrate Population Segment (DPS).

Appendix 7: Map depicting point count survey stations at NAS Lemoore.



Appendix 8: List of bird species recorded at survey stations and grouped into their respective guilds.

Guild	Species Included
corvids	American crow common raven
swallows	cliff swallow
doves/pigeons	mourning dove rock dove
perching birds	logger-headed shrike western meadowlark western kingbird northern mockingbird passerine species savannah sparrow horned lark song sparrow finch sp. flycatcher sp. northern flicker
raptors/vultures	red-tailed hawk American kestrel burrowing owl northern harrier Swainson's hawk peregrine falcon turkey vulture
shorebirds/waders	killdeer great egret snowy egret long-billed curlew white-faced ibis mountain plover tern sp. whimbrel
starlings blackbirds	European starling blackbird sp.
waterfowl	mallard white-fronted goose
gulls	gull sp.

Appendix 9: Study area of agricultural lands adjacent to the runway.

Appendix 10: Depredation order for blackbirds, cowbirds, grackles, crows, and magpies

TITLE 50 - WILDLIFE AND FISHERIES

CHAPTER I - UNITED STATES FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

SUBCHAPTER B - TAKING, POSSESSION, TRANSPORTATION, SALE, PURCHASE, BARTER, EXPORTATION, AND IMPORTATION OF WILDLIFE AND PLANTS

PART 21 - MIGRATORY BIRD PERMITS

subpart d - CONTROL OF DEPREDATING BIRDS

21.43 - Depredation order for blackbirds, cowbirds, grackles, crows and magpies.

A Federal permit shall not be required to control yellow-headed red-winged, rusty, and Brewer's blackbirds, cowbirds, all grackles, crows, and magpies, when found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance: Provided: (a) That none of the birds killed pursuant to this section, nor their plumage, shall be sold or offered for sale, but may be possessed, transported, and otherwise disposed of or utilized.

(b) That any person exercising any of the privileges granted by this section shall permit at all reasonable times including during actual operations, any Federal or State game or deputy game agent, warden, protector, or other game law enforcement officer free and unrestricted access over the premises on which such operations have been or are being conducted; and shall furnish promptly to such officer whatever information he may require, concerning said operations.

(c) That nothing in this section shall be construed to authorize the killing of such birds contrary to any State laws or regulations; and that none of the privileges granted under this section shall be exercised unless the person possesses whatever permit as may be required for such activities by the State concerned.

[39 FR 1178, Jan. 4, 1974, as amended at 54 FR 47525, Nov. 15, 1989]