



Resource Enforcement/Compliance Section

INTRODUCTION

Mission. Marine Corps Installations West-Marine Corps Base Camp Pendleton (MCB CamPen) serves as the Marine Corps' premier amphibious training Base. MCB CamPen provides comprehensive air, sea, and ground assault training to nearly 60,000 service members taking part in approximately 45,000 training events annually. As the busiest United States Marine Corps training base on the West coast, MCB CamPen is home to the First Marine Expeditionary Force (IMEF), including the 1st Marine Division, the 1st Marine Logistics Group, and elements of Marine Aircraft Group 39; and Marine Corps Installations West.

Natural Resources. MCB CamPen is one of the last remaining undeveloped areas on the southern California coast, bordered to the west by the Pacific Ocean, encompassing 17 miles of relatively undisturbed coastline. The 125,000 acres of the Base vary widely and include sandy shores, seaside cliffs, coastal plains, upland scrub, rolling hills, canyons, and mountains rising to elevations of nearly 2,700 feet. Nestled within the 125,000 acres are 18 federally threatened and endangered species, additional State-listed plants and animals, and game that supports a robust hunting and fishing program. The mission of MCB CamPen's Environmental Security is to ensure environmental compliance and promote land use availability for military training. Environmental Security promotes the long-term management of the Base's natural resources through multiple avenues including restoration of listed-species habitat and severely impacted habitats (by flooding and fire), predator control, and management of wildlife carrying capacities via outdoor recreation. When the military is not training, the land is available for outdoor recreation, primarily hunting and fishing on a non-interference basis.

The Team:

- Michael Tucker
CIV, Chief Game Warden
- Gordon Butler
CIV, Game Warden
- Thomas Lhuillier
CIV, Game Warden
- Nate Redetzke
CIV, Wildlife Technician
- Emily Romig
CIV, Game Warden
- Peggy Wilcox
CIV, Wildlife Biologist



Figure 1. Marine Corps Base Camp Pendleton Resource Enforcement/Compliance Section. From left to right: N. Redetzke, P. Wilcox, E. Romig, M. Tucker, T. Lhuillier, and G. Butler.

Team Position Description. The Resource Enforcement/Compliance (REC) Section, “the Team” (Figure 1), of MCB CamPen Environmental Security is responsible for resource, cultural and

environmental program support including Conservation Law Enforcement Officer investigations, managing wildlife conflict, and managing the recreational hunting, fishing and camping programs for quality of life. One major task of the REC Section is managing the Base's mule deer population to promote natural resources conservation. Prior to 2018, the REC Section did not have a method to manage hunting using deer population data. In 2018-2019, the REC Section developed a program with multiple collaborators using scientifically sound and innovative techniques to ensure a stable and thriving mule deer population.

PURPOSE

The REC Section's purpose was to maintain a healthy and sustainable mule deer herd, thus enhancing the ecosystem in addition to supporting MCB CamPen's hunting program.

Camp Pendleton's Mule Deer Population. Human influence on natural resources is especially prevalent and unavoidable in Southern California. Due to loss of habitat, the California mule deer population is approximately one-fifth the size it was fifty years ago (Webb 2016). Mule deer are a key component of the complex food web between predators and plants and occupy an essential niche in the ecosystem for Southern California. They serve as a food source for mountain lions and other predators, while also acting as browsers to maintain habitat. Across the West, one detrimental consequence of a low preferential food supply (i.e., a low mule deer population) for mountain lions is that they have to expand their territories. This expansion often forces lions to move across dangerous freeways and into adjoining lands, increasing the chance of human-lion interactions, such as ranchers euthanizing the lions that attack their livestock on agricultural lands. On MCB CamPen in particular, mountain lions consume approximately 45 deer per year. Therefore, maintaining a steady deer population on MCB CamPen enables the mountain lion population to thrive, thus reducing human conflicts on Base. In addition, mule



Figure 2. Military deer hunters attend the Deer Information Night to learn about ongoing deer research aboard the Base.

deer browse on over 50 types of native vegetation (based on the contents of their rumen), an important function in order to maintain the health of the rare chaparral and critically endangered coastal sage scrub habitats. Without mule deer, local vegetation would become overgrown, which limits the biodiversity of the habitat and results in higher fuel levels during wildfires. The mule deer population plays an important role on MCB CamPen as a food-source and maintaining the ecosystem.

Recreational Program. As directed by the Sikes Act, MCB CamPen's Integrated Natural Resources Management Plan (INRMP) ensures the conservation and rehabilitation of natural resources on military installations in the sustainable multipurpose use of natural resources supporting military training, as well as outdoor recreation. Starting in 1942, hunting is the oldest established recreational program on MCB CamPen, which allows for archery, shotgun, and rifle hunting. Annually, the MCB CamPen recreation program supports over 2,000 fishing patrons

and over 500 hunting patrons. Game includes squirrel, rabbit, coyote, dove, quail, waterfowl and mule deer. The Base embraces deer hunting as a training tool for service members as hunting improves military readiness through camouflage, observation, stealthy movement, navigation, planning, tracking, and marksmanship. The REC Section trains new hunters through monthly hunter education courses and information nights, which reinforces military hunting skills, discusses hunting ethics and wildlife management principles (Figure 2).

Mule Deer Management Program. Goals for the REC Section included creating a self-sustaining mule deer management program that was low cost, fulfilled military training requirements, aligned with the mission of protecting natural resources on Base, used innovative technology, and could easily be recreated and implemented in the future. The program's critical outcome was to not over-harvest the mule deer during the permissible hunting season. The biggest accomplishment of the program was collaborating with the Air National Guard and United States Marine Corps Infantry Battalions using unmanned aerial vehicles (UAVs) that collected important data in an innovative way, while maintaining military training objectives. Using data collected from UAVs in combination with deoxyribonucleic acid (DNA) sampling of harvested deer, a deer pellet study using DNA sampling, tracking of game through wildlife cameras, hunter education, and increased hunter involvement created a sustainable method to manage mule deer populations. The REC Section collaborated with 2nd Battalion, 4th Marines; 2nd Battalion, 5th Marines; California Air National Guard's 196th Attack Squadron; the United States Geological Survey (USGS); the California Department of Fish and Wildlife (CDFW); and the Base Sportsmans' Club and hunters to design, organize, and conduct scientific and sound research to support a sustainable mule deer population.

SUMMARY OF ACCOMPLISHMENTS

Unmanned Aerial Vehicles. To manage the Base mule deer herd, the REC Section needed mule deer population data to monitor changes over time that is safe to collect and accurate. For decades, big game managers have utilized low elevation helicopter surveys to measure population size over large areas. Following suit, prior to 2018, the CamPen REC Section flew a



Figure 3. LCpl Dannie Barnes launches a RQ-20 Puma UAV for a nighttime deer survey. Photo credit LCpl Alison Dostie.

low elevation helicopter survey for three subsequent days at significant risk to human life. Low elevation helicopter surveys are hazardous with three fatal low elevation deer survey mishaps in the last 10 years in Washington, Texas and California. Unfortunately, highlighting the safety issues with helicopter surveys, the MCB CamPen REC Section had a close call in 2016 when their survey helicopter cut a high-tension power line forcing an emergency landing and the evacuation of an electrified helicopter. This incident, although free of injuries, led

the REC Section to develop a new survey technique utilizing military UAVs. In addition, the use of UAVs provides valuable training to pilots and staff for reconnaissance missions. Searching for mule deer in the rolling hills of MCB CamPen challenges the operators to hone their skills more than a traditional surveillance training mission with staged role players or static equipment.



Figure 4. This infrared image shows a mule deer as seen from a MQ-9 Reaper at 14,000' above ground level. This deer would be difficult to detect from a helicopter as it is well-camouflaged and motionless.

In 2018, the REC Section partnered with 2nd Battalion, 4th Marines and the California Air National Guard's 196th Attack Squadron to search for deer with UAVs. The Marine Infantry Battalion flew a RQ-20 Puma (Figure 3) while the Air National Guard flew a MQ-9 Reaper. The Puma could not identify deer on its own; through the Puma's infrared camera, deer looked similar to boulders. However, the Reaper identified deer with the infrared camera from 14,000 feet in elevation (Figure 4). The image was even clear enough to see the animals twitch their ears!

With the information from the 2018 flights, the REC Section planned another UAV mission to survey deer the following year (late 2019, FY20), with a goal of conducting a base-wide Reaper survey and pushing the capabilities of the Puma further. The REC Section designed and implemented two studies in 2018 and 2019, a deer pellet study and camera trap study, to strengthen the future UAV flights, as discussed below.

DNA Sampling of Harvested Deer. With the dramatic decline in the mule deer population, Southern Californian land managers are researching deer migration and habitat fragmentation within the region. The USGS partnered with MCB CamPen for data collection in 2018 to conduct a multi-year study gathering mule deer DNA in the Southern California region. This expansive and time-consuming effort was established to answer the following questions about mule deer: migration between habitat fragments, genetic inter-relatedness between sub-populations, and population vulnerability. Following scientific protocols, the REC Section operated a check station (providing labor only and no additional cost) during the 2018 deer season to collect DNA from each deer harvested on Base. These samples were provided to USGS with approximately half of the studies' samples originating from the MCB CamPen collection. Preliminary results indicate that Base deer interbreed with other deer throughout the backcountry of San Diego County, but not with the geographically closer suburban deer. Combined with DNA collected from deer pellets to map movement, researchers are better understanding how to design wildlife corridors for the mule deer. Effective corridors mean more useful habitat for the struggling species and an opportunity to increase genetic diversity within Southern California. This research will have an important legacy for mule deer survival as the region continues to develop.

Deer Pellet Study. On a local level, in 2018 the MCB CamPen REC Section and the California Department of Fish and Wildlife analyzed DNA collected from deer pellets; this time the DNA

study on MCB CamPen focused on territory size (Figure 5). The REC Section collected the pellets over a month-long period, walking 30 kilometers of deer trails weekly. DNA analysis was funded by deer tags sold on MCB CamPen. The location of the deer pellet collection and the DNA analysis indicated that the bucks had a territory of approximately one square kilometer while the does had a territory of approximately 2 square kilometers. The study area held at least 1.5 deer per square kilometer based on the number of the individuals detected in the area. This matched the density determined in previous helicopter surveys, indicating the deer pellet DNA collection method accurately depicted the deer population in the area. Population and territory size data was consequently used to validate the proposed FY20 UAV survey technique.



Figure 5. California Department of Fish and Wildlife biologist CIV Russ Furnas shows Team Members Peggy Wilcox, Nate Redetzke and Emily Romig how to collect deer pellet samples for DNA analysis.

Camera Trap Study. Determining that mule deer on Base have territories around two square kilometers or smaller from the deer pellet study led the REC Section to develop a camera trap study in 2019 to determine the deer distribution. Over the course of three months, the REC Section set up 60 camera tracking stations, all distributed randomly and at distances greater than two kilometers from each other to avoid double counting of deer (Figure 6). The study



Figure 6. Two mule deer captured with a trail camera during the REC Section's base-wide camera study.

concluded that deer on MCB CamPen live in higher densities in areas with native vegetation and areas with less south facing exposures. The southern exposures have more open vegetation due to an increased amount of sunlight (from the Earth's tilt), which equates less cover and less food for the deer. Deer distribution was consequently used to validate the new FY20 UAV survey technique by categorizing habitat as high deer density or low deer density areas.

Hunter Engagement. Wildlife management must include the human element to succeed. MCB CamPen's hunting program is an extremely popular recreational activity. Therefore, changes in hunting management requires collaboration and education with the hunters with the ultimate goal of avoiding over-hunting. In 2018 and 2019, the REC Section limited firearm deer tags to 250 from 400, and limited the amount of time and location hunters were in the field. This practice continued into the FY20 season. To implement this program in 2018, the REC Section educated the Base hunters by publishing an online video explaining these hunting strategies. In 2019, the REC Section partnered with the MCB CamPen Sportsmans' Club to host hunting information nights that presented research on Base (such as the deer pellet study) and explained the hunting management strategies. These engaging and well attended outreach presentations kept the constantly rotating population of military hunters informed, and will continue into the future.

Additionally, the REC Section organized many volunteer work parties with the Sportsmans' Club. During the FY18 and FY19 hunting seasons, the Sportsmans' Club provided volunteers to maintain the Base's 25 artificial watering holes, or guzzlers. These guzzlers are often located in remote locations, making maintenance challenging and labor intensive. MCB CamPen's frequent drought conditions make the guzzlers critical to wildlife, with approximately 1,500 animals visiting the guzzlers per day during the dry season.

Engaging with the hunters through the Sportmans' Club has created a positive feedback loop. For example, hunters reported the location of their hunts, and the amount of time spent in each training area; this information allowed the REC Section to manage the firearm hunt throughout the season by evenly spreading the effort between training areas. This prevents over hunting and under hunting throughout the Base. In addition, hunters bring the carcass of the deer to the REC Section for weighing and sampling for Chronic Wasting Disease (CWD). Although CWD is not currently present in California, surveillance for the disease is a priority for CDFW. MCB CamPen's efforts support CDFW early detection policy to help control the spread of the disease if detected.

Weighing and sampling the deer on Base also provides a method to track population health; for example, the REC Section was able to link the amount of rainfall to the weights of the deer, which is useful information for future conservation efforts.



Figure 7. Combat wounded amputees SSgt Jason Pacheco (Ret.) and Pfc Isaac Blunt (Ret.) hunt deer during a special limited mobility hunt on MCB CamPen.

The REC Section implemented a new program in FY19 to support combat wounded amputees by organizing special "limited mobility" hunt days (Figure 7). These special hunts provided a high quality hunting area with accessible entry points for hunters using prosthetic legs and all-terrain wheelchairs. The REC Section scheduled the hunts on days where they could assist the amputee hunters in recovering a deer if necessary. This opportunity brought big smiles to MCB CamPen's amputee hunters as they could participate in an activity they enjoyed before their injury. From their own description, the hunts made them forget about their injuries and made them feel "very alive and happy".

FUTURE PROGRAM IMPROVEMENTS

In 2019 (FY20), the REC Section partnered with 2nd Battalion, 5th Marines to fly the RQ-20 Puma and the Air National Guard to fly the MQ-9 Reaper. This time, after a successful proof of concept the previous year, the REC Section developed a search pattern for the MQ-9 Reaper to successfully determine deer density on Base. The location and configuration of the search patterns relied on the previous deer pellet and camera trap studies with the MQ-9 Reaper surveying in both the high density and low-density population areas. Positive results of the FY20 MQ-9 Reaper flight demonstrated that the Reaper survey would yield a density result that matches the deer pellet, camera, and previous helicopter surveys. Also in 2019 (FY20), the RQ-

20 Puma was flown at lower elevation in the early morning hours on a cold night to enhance the capabilities of the infrared sensor. This successful flight detected deer, and demonstrated that the RQ-20 Puma could replace the more-expensive and rare MQ-9 Reaper for deer surveys.

The REC Section will build off the success and develop a base-wide deer survey technique for the RQ-20 Puma in 2020 or 2021. As scheduling and training requirements allow, the REC Section will collaborate to fly the MQ-9 Reaper as well. Since these UAV flights fulfill the unit training mission, they incur no additional cost to the REC Section. The REC Section will present this information at the National Military Fish and Wildlife Association's 2020 conference to spread the information and support safer and more efficient big game surveys off-base.

SUMMARY

The REC Section addressed the declining mule deer population through their innovation and collaboration. UAVs demonstrated the ability to conduct deer surveys in a safer and more efficient manner. This groundbreaking technique leads to better data collection of big game species throughout the United States and abroad, as well as reduce the number of the hazardous low elevation helicopter surveys.

The REC Section partnered with 2nd Battalion, 4th Marines; 2nd Battalion, 5th Marines; California Air National Guard's 196th Attack Squadron; the United States Geological Survey; the California Department of Fish and Wildlife; and the Base Sportsmans' Club and hunters, resulting in novel management strategies. Research and excellent hunting management has created better and new opportunities for hunting as well as maintaining the ecological niche of the mule deer population in Southern California. The mobilization of deer hunters to support habitat enhancements and research has created a corps of avid conservationists on Base. The MCB CamPen REC Section's deer management efforts, with its partners, truly embodies the values of the Department of the Navy's Natural Resource initiatives.

CITATIONS

Webb, G. K. 2016. Public Management Decisions Related to the Decline of California Deer Populations: A Comparative Management Approach. *Environment and Ecology Research*, 4(2), 63-73.