

# UC San Diego

## Capstone Papers

### Title

Unmanned: Investigating the Use of Drones with Marine Mammals

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# *Unmanned:* Investigating the use of drones with marine mammals

By Shayna Brody



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## Capstone Proposal

The Center For Marine Biodiversity and Conservation  
Scripps Institution of Oceanography

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### Executive Summary

*Unmanned* is a short investigative documentary that will explore the rapidly advancing technologies of using Unmanned Aerial Vehicles (UAVs), more commonly referred to as drones and Unmanned Aerial Systems (UAS), to observe marine mammals such as whales, dolphins, and sea lions. Drones are quickly becoming a predominate and reliable tool for scientific research, commercial industries, and photographers, but currently regulation has been outpaced by technology. While scientists are often hindered when incorporating UASs into their research due to outdated regulations from the Federal Aviation Association (FAA) and Marine Mammal Protection Act (MMPA), civilians and commercial operators have ambiguous rules and are often unregulated. Through a series of interviews and field observations, this film will explore the experiences of stakeholders from many perspectives, seeking to inform the best practices to keep people and marine mammals safe while using drones.

### Background

Technology for aerial drones has exploded over the past 10 years. UAVs are revolutionizing conservation science as they are incorporated into population and health studies of marine mammals that are difficult to observe otherwise (Koh et al. 2012). As UAVs become more affordable and reliable, a growing number of pilots are taking to the sea to capture footage of marine mammals. The Marine Mammal Protection Act mandates that aircraft may not be flown within 1000 ft. of a marine mammal, while the Federal Aviation Administration requires all drones to stay below 400 ft (Smith et al. 2016). Many civilians are unaware they are breaking the law when operating their UAVs, and several California based tourism companies and other hobbyists may not be flying under current regulations or safely. At the same time, scientists

who are extensively trained and licensed to fly UAVs are often unable to get permits to perform research.

The benefits of using UAVs to conduct scientific studies include a cheaper, safer, and faster alternative to aerial surveys which have been typically conducted using airplanes. Drones UAVs are currently being implemented at NOAA's National Marine Fisheries Service (NMFS) to perform stock assessments of orcas, gray whales, seals, and more (NOAA Fisheries 2017). Drones may have wide sweeping applications if they can be implemented safely and responsibly. In the marine realm, they can be used as a low impact way to survey marine mammals populations, health, and behavior, to enforce correct use of marine protected areas, assist whale stranding and entanglement response teams, and observe bycatch (Smith et al. 2017). Furthermore, they potentially offer a low impact way to allow people to observe whales and dolphins without captivity (King 2015).

As they become more affordable and reliable, UAVs are increasingly accessible to civilian and commercial operations. A growing number of amateur UAV pilots are taking to the sea, capturing footage of marine mammals in their natural habitat. While there are some regulations in place to ensure that marine mammals aren't bothered, there are large gaps in policy, science, and education. Most drone regulation lies in uncharted territory when it comes to marine mammals due to the lack of scientific data that is available and the decreasing cost associated to purchasing UAV technology.

Although drones are becoming commonplace, there is little understanding of the effects of drones on marine mammals, and no pointed studies have been conducted to do so (Smith et al. 2016). This presents a paradox for researchers, as they are often not allowed to conduct studies to understand that reactions of marine life to UAVs due to regulations meant to protect the animals. Observational studies have found that most species have little or no reaction to drones at heights over 40 feet (Smith et al. 2016). However, land based studies on grizzly bears found that the bears heartbeat increased 400% from 41 beats per minute to 160, even though the video shows no reaction from the bear (Dittmer et al. 2015). This indicates that animals may not have observable reactions, but still may be unnecessarily stressed by this technology. *Unmanned* will not conduct research to collect data behavioral or physiological changes of marine mammals.

It seems inevitable that drones will play a large part in the future of studying and observing marine mammals. It is important to establish proper guidelines and practices now to ensure that all stakeholders using UAVs to view marine life will have the ability and education to use them responsibly in the future. This project seeks to gain broader perspectives from those who are currently using UAVs around marine mammals in order to understand best practices and to inform future regulations.

### **Research Questions:**

What are the regulations for each stakeholder group?

What are the needs that UAVs are fulfilling?

How are stakeholders currently operating?

What can be improved?

How can current practices inform and improve future regulation?

How can regulations being clearly communicated and enforced?

### **Specific Objectives & Deliverables**

The goal of this project is to complete interviews from stakeholders of varying perspectives (scientific, commercial, and recreational) as well as future users of this technology. Additionally, I will observe and film UAVs being used in the field. As part of this project, I will be participate in Marine Life Drone Task Force meetings organized by Alicia Amerson. The final deliverable will be a 10-15 minute documentary, as well as a website that can be used as educational material for NGOs and other stakeholders. I also intend to written report of my findings included in the literature review of current research and regulations. Measures of success will include filming of 10+ interviews and completion of the film and website. I plan to use my capstone budget to travel to the International Ocean Film Festival in San Francisco as well as travel across California to conduct interviews and observations.

### **Methodology**

- Perform a literature review of current research, guidelines, and regulations.
- Film interviews of stakeholders including NOAA biologists, California tourism operators, recreational drone operators, policy makers, NGOs, California Fish and Wildlife representatives, etc.
- Observe UAV use in the field from a scientific, commercial, and recreational perspective
- Edit using Final Cut Pro in the Hubbs Media Lab

### **Equipment & Capstone Budget**

#### **Equipment owned**

Canon 60D

Sony A6000

#### **Equipment wanted**

AJI Phantom 3 Advanced

Video tripod

[Zoom H5 Digital Voice Recorder - 2 GB](#)

### **Budget**

<b>Expense</b>	<b>Cost (\$)</b>
International Ocean Film Festival Ticket	\$70
Travel to Monterey, Ventura, Santa Cruz, Newport	\$350

Whale Watching tickets & boat rentals for observations	\$600
Accommodations during travel (~5 nights)	\$500
Travel to Baja, Mexico	\$500
Drone Pilot Certification	\$300
Equipment	\$1000
Expected total:	\$3300

## Storyline/Strategy

**12-15 minutes in length. Potential to split footage into shorter videos for promotion/outreach/education**

### Part I

Introduction to topic

- Marine mammals are inherently difficult to observe and study, drones have given us a unique perspective that is quickly advancing our understanding of them.
- They are important to study because they give us understanding of the health of our ecosystems
- Fast advancing technology with a lot of applicable uses
- Drones are cheaper, safer, and more effective than previous methods

Introduction to conflict

- Drone technology is outpacing regulations
- Drone use is rapidly growing - commercial sales doubled in the past year
- Complexity of issue - many factors, stakeholders
- Science is hindered by regulations, while recreational users & whale watching boats are poorly regulated
- Existing regulations are poorly communicated, confusing, and not well enforced
- Harassment of marine mammals is on the rise
- What is known about marine mammal reaction to drones - need for more research on this topic

### Part II

Scientific uses

- Introduction to photogrammetry, snot bot, population studies
- Issues with regulations in science
- Interaction with MMPA, FAA
  - Explanation of "Take"
- What could be improved

Photography uses

- Amazing view into behavior of whales, dolphins, etc.
- Slater Moore uses, insight, footage
- Louis Psihoyos uses for OPS
- Whale watching uses

Recreational Drone use

- Trystan Snodgrass, recreational photographer
- Experience with regulation, ease of use

### Part III

#### Clarification of regulations

- Permitting process
- Confusion
- What you should know as a drone pilot
- What needs to be improved
- How to ensure marine mammals are not harassed

#### Future of drone use

- Future of regulations
- Potential new uses for scientific observation
- Mention of the UAS marine life task force?
  - MPA monitoring,
  - acoustic drone deployment
  - disentanglement tool
- Coming advances

#### **B-roll Shot list**

- Drones being deployed from boats
- Drone footage of whales (many shots!) collect from others as well
- Drone footage over coastal areas
- Spark Aerial office and drones
- NOAA drone office shots
- Underwater footage of whales
- Footage of casual drone users
- Footage of whale watching boats using drones
- Footage of drones for sale in Bestbuy/amazon
- Photogrammetry processing shots (over shoulder computer shots)
- Footage of regulatory documents
- Capitol building footage Sacramento
- Grizzly bear footage
- Timelapse of ocean
- Timelapse of drone training
- Shots of NOAA building
- Footage of news clippings
- Relevant still photography

#### **Schedule**

March 28-April 2 - Travel to San Ignacio to capture up close footage of gray whales (hopefully underwater and above water) for b-roll.

April 3-April 7 - Purchase/borrow remaining supplies necessary to conduct interviews. Finalize script

April 7 - UAS Marine Life Task Force Call

April 8 - Boat day with Trystan Snodgrass, collect interview and b-roll

April 9 - Interview Holly Fearnbach & Wayne Perryman

April 10 - Process interview footage.

April 11 - Meeting with Morgan Heim (visiting from Colorado, discuss strategy and equipment and conduct potential interview).

April 12-April 17 - Travel to Monterey/Bay Area to conduct interviews with

- Slater Moore - Wildlife photographer
- Paul Michel/Scott Kathey - MBNMS Drone use

- Louis Psyihoyos - Oceanic Preservation Society use of drones
- Ryan Berger - Point Blue

April 18- 22 - Return to San Diego, process footage.

April 23-28 - Go on local boats to collect footage

- Captain Dave Anderson of Capt. Dave's Dolphin and Whale Safari in Dana Point
- Dana Wharf Sport Fishing & Whale Watching Captain Frank Brennan
- Newport Coastal Adventure
- Davey's Locker Charter

April 29-30 - get boat based footage & interview with Radley Angelo

April 31-May 3 - Process and edit footage, create backbone of video

May 4 - Tentative interview date with John Durban

May 5 - Process interview footage

May 6 - 12 - Second coastal road trip to conduct final interviews and b-roll footage. Travel to Sacramento for 1-2 days for meetings/interviews with Ryan and Alicia.

### **Sacramento**

Ryan Wulff

Alicia Amerson

### **Bay Area**

Geoff Shester

### **Los Angeles**

Wil Cashem - UAS Education - the future

Nick Sardpour - California Seagrant

Justin Viezbicke - Potential uses for disentanglement

May 13-15 collect b-roll drone footage, timelapses

Skype interviews ([Dr. Johnston, Murdoch University](#), [Matt Leslie](#))

May 15-20 edit first full draft of film, potential additional days for local whale watching boat shoots

May 20 - send draft to Capstone Committee & UAS Marine Task Force for review, comments

May 21-22 - Create website for film showcase and blanket information about drone regulations

May 23-June 1 - Continue editing, work on credits, effects, title

June 1 - 7 - Final touch ups, work on written paper

June 8 - Present Video at Capstone Symposium

June 14-15 - Submit final video, paper, and website to committee for grading

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