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Chapter 1

INTRODUCTION

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BACKGROUND

The sea otter (*Enhydra lutris*) is one of the smallest of the world's marine mammals. As an apex carnivore in nearshore coastal marine habitats of the North Pacific Ocean, it is recognized as playing important functional roles in ecosystem structure and dynamics (Estes and Palmisano 1974, Riedman and Estes 1990, Tinker et al. 2017). During the international fur trade of the 18th and 19th centuries, sea otters were extirpated from the Oregon coast and, indeed, from most of the coast of the eastern North Pacific Ocean (Kenyon 1969).

At present, no sea otter population exists in Oregon, although individual animals, thought to be mostly males making long-distance movements from populations to the north (Washington State) and south (central California), are observed from time to time.

In recent years, there has been renewed interest in the possibility of reintroducing sea otters to Oregon, with several motivating objectives:

- restoring the various ecological functions of a keystone species formerly present in Oregon's marine environment;
- restoring the cultural relations between sea otters and human residents along Oregon's coast;
- increasing the capacity for the species overall to survive potentially catastrophic events, such as oil spills, through a broader distribution of sea otter populations on the Pacific coast; and
- improving the gene flow between northern sea otters on the Washington and British Columbia coasts and southern sea otters in California.

The Elakha Alliance, an Oregon nonprofit organization, in cooperation with several partners, has supported the preparation of this feasibility study to determine whether existing habitat, source populations, and political, legal, economic, and social contexts are suitable for a successful reintroduction of sea otters to Oregon.

REINTRODUCTION VS TRANSLOCATION

Wildlife reintroduction programs involve "the intentional movement and release of an organism inside its indigenous range from which it has disappeared," where the goal is "to re-establish a viable population of the focal species within its indigenous range" (IUCN [International Union for Conservation of Nature] 2013). For this study, we use the term *reintroduction* as defined in the previous sentence, although when specifically describing the process of moving animals from one location (e.g., a *source population*) to another location (e.g., a *potential reintroduction site*), we also use the related term *translocation*.

Wildlife translocation and reintroduction as a conservation strategy has been used extensively over the past century, with well-known examples of successful reintroductions including golden lion tamarins in South America (Kleiman and Mallinson 1998), peregrine falcons in the Midwest United States and Canada (Tordoff and

Redig 2001), and fisher populations in the Pacific Northwest United States (Lewis et al. 2012). The translocation and reintroduction of sea otters to their former habitats along the west coast of North America (including Southeast Alaska, British Columbia, Washington, and San Nicolas Island in southern California) proved to be a successful management strategy for recovering this species from near extinction (Jameson et al. 1982, Bodkin 2015; see Chapter 2 for more about prior translocations).

In contrast to these success stories, however, are the many reintroduction efforts that have failed to establish viable populations (Griffith et al. 1989, Wolf et al. 1996). In 1970 and 1971, nearly 100 sea otters from the Aleutian Islands were translocated to the southern Oregon coast (Jameson et al. 1982). Although post-release reproduction of this translocated population was documented and some animals persisted in Oregon for about five years, a permanent population was not established (Jameson 1975).

One cause of failed reintroductions is inadequate planning from a demographic and ecological perspective—for example, not including enough individuals of the appropriate age/sex classes or selecting inappropriate habitats (Kleiman 1989, Wolf et al. 1998). Another reason for failure includes a too-narrow focus on demographic and ecological factors and a lack of attention to other key elements, such as social, economic, and political considerations (Reading et al. 2002).

Reading et al. (2002) identified four main categories of considerations that should be addressed when considering the feasibility of a reintroduction program: (1) biological and technical aspects (population ecology, habitat suitability, translocation and reintroduction techniques, etc.); (2) organizational aspects (the personnel, bureaucratic structure, and relationships between the various agencies and organizations involved); (3) authority/power aspects (legal and political considerations); and (4) socioeconomic aspects (including values, traditions, attitudes, and economies of the affected communities). All these variables can play a role in the success or failure of a reintroduction program; thus, it is important to incorporate this broader suite of considerations into initial feasibility assessments for any reintroduction efforts under consideration.

THE GOAL OF THE FEASIBILITY STUDY

The feasibility study's overall goal is to assist the Elakha Alliance, relevant state and federal agencies, stakeholders, and the public in identifying, understanding, evaluating, and addressing environmental, economic, social, legal, and other factors relevant to restoring a population of sea otters on the Oregon coast. It is intended to provide the Elakha Alliance and all parties with the best available scientific, economic, and legal information and analyses to guide consideration of future steps toward restoration in regard to

1. implications for the viability of source populations and newly established populations
2. suitability of habitat and the potential for positive and negative effects on ecosystems
3. social and economic impacts, both positive and negative
4. administrative and legal requirements
5. logistical constraints and steps for implementation

It is also important to emphasize what this study is not intended to be: Specifically, it is not intended as a definitive statement about whether reintroducing sea otters to Oregon is advisable or, indeed, whether it is practically feasible from all perspectives. Such decisions are left to others. The purpose of this study is to provide a comprehensive source of pertinent information, history, and the best available science, which we believe will be useful for a wide range of stakeholders, resource managers, and decision-makers going forward.

At a superficial level, the question of whether reintroducing sea otters to Oregon is conceptually "feasible" is almost self-evident: Successful sea otter reintroductions conducted previously (see Chapter 2), combined with historical docu-

mentation that sea otters were once abundant in coastal Oregon (see Chapter 4), argue for feasibility in the broadest definition of the word.

This study is not intended to provide a yes or no answer to the question of whether reintroduction is advisable, nor is it designed to convince the reader of one opinion or another. Rather, we intend to amass and synthesize the relevant information we believe a person (or community of people) would need to make an informed decision about whether to proceed with a proposal to reintroduce sea otters to Oregon. Secondarily, we seek to provide guidance about what elements such a proposal should include.

CONTENTS OF THIS STUDY

Twelve chapters (including this introductory chapter) focus on different considerations germane to a comprehensive assessment of the feasibility of reintroducing sea otters to coastal Oregon. A set of appendices to this study contain more detailed documentation, maps, and resources alluded to in various chapters.

Chapter 2, "History of Prior Sea Otter Translocations," begins with an overview of the history of previous sea otter translocation and reintroduction efforts over the past century. By comparing the methods, goals, and outcomes of these previous efforts, we draw some basic inferences about the factors that seem to predict success or failure in sea otter reintroductions, as well as some key variables that need to be considered in any future reintroductions.

Chapter 3, "Population and Demographic Considerations," assesses feasibility from the perspective of population biology, examining some of the demographic variables that can determine a reintroduction effort's success. A principal tool in this assessment is the Oregon Sea Otter Population Model (ORSO), a computerized population model built upon the foundation of previously published population models for sea otters. This model provides a quantitative modeling framework for evaluating probable outcomes and associated uncertainties of various reintroduction scenarios. The model methods are explained in detail in Appendix A, and a web-based user interface allows any interested user to explore the implications of different assumptions, variables, and alternative logistical strategies for the potential viability and likely future abundance and distribution of sea otters in Oregon.

ORSO uses a stage-structured matrix model of sea otter demography to project future trends in abundance and changes in the spatial distribution of reintroduced sea otter populations. The model is structured and parameterized based on extensive data from other sea otter populations and reintroduction outcomes. It incorporates density dependence, Allee effects,[1] environmental and demographic stochasticity, and realistic dispersal and range expansion behaviors. Thus, while any one simulation trajectory is unlikely to reliably predict future outcomes for a proposed reintroduction scenario, the range of projections over many model iterations will tend to encompass the most likely future outcomes.

Chapter 4, "Genetic and Historical Considerations of Oregon Sea Otters," explores the implications of reintroducing sea otters to Oregon from genetic and historical perspectives. This chapter provides an overview of the deep history of sea otters in North America, and Oregon in particular, and summarizes published information on genetic diversity and the relatedness of extant sea otter populations. The chapter examines the implications of an Oregon reintroduction for genetic diversity and connectivity of sea otter populations overall.

Chapter 5, "Ecosystem Effects of Sea Otters," broadens the assessment from biological and demographic considerations to the ecosystem-level implications of a sea otter reintroduction. Sea otters are often considered a textbook example of a keystone species, defined as a species that has disproportionately large effects on its ecosystem relative to its abundance (Paine 1969). As sea otters have been reintroduced to or naturally recovered in other coastal

1 The Allee effect is a phenomenon in biology whereby population size or density is correlated with mean individual fitness (often measured as per capita population growth rate). A positive association may (but does not necessarily) give rise to a critical population size below which the population cannot persist. More at https://www.nature.com/scitable/knowledge/library/allee-effects-19699394/.

areas in North America, they have caused substantial perturbations to the structure and dynamics of nearshore food webs. Some of these effects are perceived as beneficial for people, and some are perceived as negative. This chapter provides a brief primer on the ecological concepts necessary to interpret the direct and indirect effects of sea otter recovery, reviews these effects, and discusses their implications for nearshore ecosystems and human communities in coastal Oregon.

Chapter 6, "Habitat Suitability," examines the corollary of sea otter effects on ecosystems: that is, the effect of ecosystems on sea otters. The chapter explores how different attributes of Oregon's nearshore habitats are likely to affect their potential to support sea otter populations in the future, an exercise often referred to as habitat suitability analysis. This analysis is important for evaluating the potential viability of sea otters in different areas of Oregon based on the availability of critical habitat features. Such an analysis represents an important step in selecting prospective sites for future reintroduction efforts. Also, it can be used to assess the areas where sea otters are most likely to concentrate in the future and, therefore, where there is potential for conflicts with human activities.

Chapter 7, "Socioeconomic Considerations," assesses socioeconomic considerations of a sea otter reintroduction. This assessment begins with a broad overview of the existing literature and previous examples of sea otter socioeconomic impacts. It then focuses on Oregon more specifically. This discussion of socioeconomic impacts is primarily conducted qualitatively. A separate document offering an economic impact assessment has been completed for the Elakha Alliance (2022) and provides a more quantitative examination.

Chapter 8, "Administrative and Legal Considerations," further examines the social dimensions of sea otter reintroduction, reviewing the legal and policy considerations. As with any reintroduction effort, many legal issues are involved. The reintroduction of a marine mammal protected by international, federal, state, and tribal laws is especially complex, with multiple statutory and regulatory processes that need to be considered. Relevant laws and processes are listed and discussed concerning different applications depending on the reintroduction scenario, especially the selection of a source population.

Chapter 9, "Implementation and Logistical Considerations," discusses practical and logistical considerations of alternative reintroduction scenarios. The logistics considered include some of the topics addressed elsewhere in the study, such as the selection of a source population and release site (or sites), as well as methodological issues, such as how to capture, transport, release, and monitor sea otters. While this chapter is in no way meant to represent a detailed proposal for sea otter reintroduction, it does provide a useful overview of the topics that would need to be addressed in a detailed proposal.

Chapter 10, "Animal Health and Welfare Considerations," addresses a specific set of risks inherent in sea otter reintroductions, centered on sea otter health and welfare considerations. There is rich and extensive literature addressing sea otter health, disease, and environmental threats; many of these previously reported diseases and threats could affect the success of a newly established sea otter population in Oregon. We provide a review of this literature, with discussion and interpretation tailored to the factors most likely relevant to a reintroduced population in Oregon.

Chapter 11, "Stakeholder Concerns and Perspectives," provides a brief overview of the wide range of views and concerns associated with sea otters and sea otter reintroductions. This chapter is not intended to be an exhaustive analysis of all different views. Still, it is intended to help foster an open and candid discussion about some societal challenges associated with sea otter recovery. Also, it is meant to encourage respect for the diverse and sometimes conflicting views about this subject.

Chapter 12, "Conclusions," summarizes some of the key findings and points raised in previous chapters and provides some final thoughts about how these findings might be explored further or developed in any next steps that might occur.

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