PACIFIC LEGAL FOUNDATION

July 18, 2022

Hon. Deb Haaland **Via Certified Mail, Return Receipt**
Secretary of the Interior
United States Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Ms. Martha Williams **Via Certified Mail, Return Receipt**
Director, United States Fish and Wildlife Service
United States Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Re: 60-Day Notice of Intent to Bring Citizen Suite Pursuant to 16 U.S.C. § 1540(g)

Dear Secretary Haaland and Director Williams:

Pursuant to 16 U.S.C. § 1540(g), this letter provides notice of intent to commence civil litigation for violation of Section 4(b)(3)(A) of the Endangered Species Act (ESA). *See* 16 U.S.C. § 1533(b)(3)(A). Petitioners the California Sea Urchin Commission and the Commercial Fishermen of Santa Barbara intend to bring a citizen suit after 60 days if the Secretary and the United States Fish and Wildlife Service continue to violate the statutory requirement for making an initial "90-day finding" as to whether Petitioners' petition to remove the Southern Sea Otter from the list of threatened species presents substantial information indicating that the petitioned action may be warranted. *Id*.

On or around February 3, 2021, the PETITION OF THE CALIFORNIA SEA URCHIN COMMISSION AND COMMERCIAL FISHERMEN OF SANTA BARBARA FOR THE REMOVAL OF THE SOUTHERN SEA OTTER FROM THE LIST OF THREATENED SPECIES OR, IN THE ALTERNATIVE, FOR A RULE UNDER SECTION 4(d) OF THE ENDANGERED SPECIES ACT was delivered to the Service. (Attached). On June 2, 2021, Elizabeth Maclin, Branch Chief for Delisting and Foreign Species at the Service's Headquarters Office, confirmed via email that the Service had received all necessary documents and was moving forward with processing the petition. The ESA, Section 4(b)(3)(A), requires the Service "[t]o the maximum practicable, within 90 days after receiving the petition of an interested person . . . to remove a species from, either of the lists published under subsection (c) of this section . . . [to] make a finding as to whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). The deadline for making a 90-day finding fell on or around May 3, 2021. Indeed, it has now been over 12 months since Petitioners filed their petition with the Service, and the Service has still not made an initial finding. As a result, the Secretary failed to perform a mandatory duty or act under Section 4 of the ESA. *See* 16 U.S.C. § 1540(g)(1)(C); *see also Biodiversity Legal Foundation v. Badgley*, 309 F.3d 1166, 1176 (9th Cir. 2002) (holding that the initial finding must be made within one year).

PARTIES

The California Sea Urchin Commission is an entity of the state of California, created to promote sustainable sea urchin harvest, educate consumers and the public about sea urchins, and balance sea urchin harvest with environmental protection. Sea otters voraciously consume sea urchins, depleting the stock and frustrating sustainable harvest efforts. Regulations resulting from the Southern Sea Otter's listing interfere with sustainable harvest by exposing urchin divers to the threat of significant criminal and civil penalties should their activities disturb an otter. For this reason, the Commission supports solutions that promote the Southern Sea Otter's recovery while protecting the interests of fishermen from unfair regulatory burdens and California's sea urchin stock from unmanaged predation.

The Commercial Fishermen of Santa Barbara is a nonprofit corporation organized to integrate regional efforts of fishing communities and to improve the economic and biological sustainability of fisheries. The organization seeks to maintain California's fishing heritage, improve fisheries management, and contribute to the improvement of ocean health. The organization's members operate in fisheries occupied by the sea otter. Consequently, the continued listing exposes those members to the risk of unjustified civil and criminal penalties for their innocent fishing activities.

LEGAL CHALLENGE

The Service has a mandatory and nondiscretionary duty to make an initial finding on a petition to delist a listed species. *See* 16 U.S.C. § 1533(b)(3)(A). While this initial finding generally must be made within 90 days, under no circumstances may the Service's failure to make an initial finding on a petition exceed 12 months. *See Biodiversity Legal Foundation v. Badgley*, 309 F.3d 1166, 1176 (9th Cir. 2002). The Service failed to comply with this requirement respecting Petitioners' petition to remove the Southern Sea Otter from the list of threatened species under the ESA. Unless the Service makes the required finding on the petition within the next 60 days, Petitioners intend to file a citizen suit to compel the Service to perform its duties under Section 4(b)(3)(A) of the ESA.

Sincerely,

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BEFORE THE UNITED STATES DEPARTMENT OF INTERIOR
AND THE UNITED STATES FISH AND WILDLIFE SERVICE

In the Matter of the Removal of the Southern Sea Otter from the List of Threatened Species or, in the alternative, for a Rule Under Section 4(d) of the Endangered Species Act

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PETITION OF THE CALIFORNIA SEA URCHIN COMMISSION AND COMMERCIAL FISHERMEN OF SANTA BARBARA FOR THE REMOVAL OF THE SOUTHERN SEA OTTER FROM THE LIST OF THREATENED SPECIES OR, IN THE ALTERNATIVE, FOR A RULE UNDER SECTION 4(d) OF THE ENDANGERED SPECIES ACT

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INTRODUCTION

Pursuant to 16 U.S.C. § 1533(b)(3) and 50 C.F.R. § 424.14(a), Petitioners California Sea Urchin Commission and Commercial Fishermen of Santa Barbara petition the Secretary of the Department of Interior and the United States Fish and Wildlife Service to delist the southern sea otter (*Enhydra lutris nereis*) from the list of threatened wildlife, 50 C.F.R. § 17.11(h), under the Endangered Species Act, 16 U.S.C. §§ 1531–1544; 84 Fed. Reg. 45,020 (Aug. 27, 2019). Delisting is warranted because the best available scientific and commercial data show that the southern sea otter is no longer in danger of extinction within the foreseeable future throughout all or a significant portion of its range.

Most significantly, the threat of a major oil spill within the range of the southern sea otter has reduced considerably, thanks to regulations enacted since the otter's 1977 listing, new technologies, oil spill preparedness, and evolving market forces. No comparable threat has arisen in the meantime.

Instead, the otter's range has steadily grown and its population has steadily increased. According to the most recent of those surveys, the population currently meets the standard for delisting identified in the 2013 Recovery Plan. Considering the population's rebound and the reduction of threats to the species, no compelling scientific basis exists to justify the southern sea otter's continued listing.

In the alternative, the Service should adopt a tailored 4(d) rule for the southern sea otter under its recently issued regulations, to reward stakeholders for their role in the species' recovery to date and encourage continued progress. In particular, the Service should revive the protections Congress afforded fishermen and other oceangoers under Public Law No. 99-625 and commit to extending the same binding protections to others as a condition for any future translocations.

PETITIONERS

The California Sea Urchin Commission is an entity of the state of California, created to promote sustainable sea urchin harvest, educate consumers and the public about sea urchins, and balance sea urchin harvest with environmental protection. Sea otters voraciously consume sea urchins, depleting the stock and frustrating sustainable harvest efforts. Regulations resulting from the sea otter's listing also interfere with sustainable harvest by exposing urchin divers to the threat of significant criminal and civil penalties should their activities disturb an otter. For this reason, the Commission supports solutions that promote the sea otter's recovery while protecting the interests of fishermen from unfair regulatory burdens and California's sea urchin stock from unmanaged predation.

The Commercial Fishermen of Santa Barbara is a nonprofit corporation organized to integrate regional efforts of fishing communities and to improve the economic and biological sustainability of fisheries. The organization seeks to maintain California's fishing heritage, improve fisheries management, and contribute to the improvement of ocean health. The organization's members operate in fisheries occupied by the sea otter. Consequently, the continued listing exposes those members to the risk of unjustified civil and criminal penalties for their innocent fishing activities.

BACKGROUND

I. The Southern Sea Otter Is No Longer a Threatened Species

As described below, the best scientific and commercial data available show that the continued listing of the southern sea otter is not warranted under the Endangered Species Act's five factors.

A. The present or threatened destruction, modification, or curtailment of habitat

When the southern sea otter was listed in 1977, the primary threat to the species was its limited range, which made the species vulnerable to extinction due to the risk of a large oil spill. *See* U.S. Fish & Wildlife Service, *Southern Sea Otter: 5-Year Review* 15-18 (2015). Since that time, however, the population's occupied range has nearly doubled, from 293 km to 500 km. *Id.*; *see also* The Otter Project, Historical and Current Sea Otter Range.[1] And available, unoccupied habitat could support a tripling of the current population (Hughes et al. 2019). Consequently, southern sea otters are not threatened due to the destruction, modification, or curtailment of habitat (Tinker et al. 2017); (Hughes et al. 2019).

The 2019 USGS census data show that otters have increased in both number and range, albeit slowly and with periodic fluctuations in long-term trends, since systematic counts began in 1983 (Hatfield et al. 2019). Furthermore, the population of sea otters translocated to San Nicolas Island, erroneously declared a failure by the Fish and Wildlife Service in 2012, have increased and continue "a positive trend of about 9.58 percent per year" (Hatfield et al. 2019). Consistent with these data is the fact that there are no data published or in the public domain that indicate the otter's total population or range are threatened by destruction, modification, or curtailment of their habitat, such that this subspecies is likely to be threatened with extinction in the foreseeable future.

In our analysis (see factor five below, *Other Natural or Man-made Factors Affecting the Population's Continued Existence*), we present new evidence not previously considered by the Service, including scientific and commercial data, and discussion of environmental regulations enacted since the time of the otter's listing, that the Service can use to evaluate the threat of a catastrophic oil spill on this

[1] https://seaotters.com/wp-content/uploads/2018/10/sea-otter-range.jpg

subspecies. This threat was the primary reason for listing the southern sea otter as a threatened species in 1977.

Similarly, in our analysis of factor three (see below), we report on new scientific data, modeling analyses, and insights into the ecology and evolution of the parasite *Toxoplasma gondii*. Those data, analyses, and insights, along with hypotheses consistent with the available scientific data, have not been previously considered by the Service. Data show that this parasite is naturally occurring in the wild, infects virtually every species of mammal, and its presence in the environment from human sources (domestic cats) does not represent destruction or modification of southern sea otter habitat.

B. Overutilization for commercial, recreational, scientific, or educational purposes

The Service has previously determined that overutilization for commercial, recreational, scientific, or educational purposes "is not currently an issue, nor would it become an issue if sea otters were delisted[.]" 2015 Status Review. We are not aware of any more recent data that would undermine this conclusion.

C. Disease or predation

The Service has previously noted that disease and shark predation are the leading causes of sea otter mortality. 2015 Status Review. However, these factors do not threaten the sea otter with extinction in the foreseeable future but are, at most, natural checks on the species' continued expansion.

1. Disease

Southern sea otters, like virtually every other species of mammal, are host to a wide variety of infectious disease and parasites. Influenza A virus, parvovirus, polyomavirus, adenovirus, naso-pharyngeal mite, acanthocephalan peritonitis, *Sarcocystis neurona*, *Streptococcus phocae*, *Toxoplasma gondii*, *Brucella*, *Helicobacter*, and tapeworms are among the pathogens and parasites that have been documented in southern sea otters over decades of intensive study. Similarly, biotoxins produced by *Pseudonitzschia* and *Microcystis* are found in the marine environment and can affect individual sea otters. Wounds, infection, and bacterial septicemia have also been documented to occur from shark bites as well as from male southern sea otters biting females during mating, and during other aggressive interactions. However, none of these parasites, pathogens, toxins, or secondary infections have been shown by data to represent a threat to the continued existence of the southern sea otter, or in combination with other diseases or environmental factors. Southern sea otters, like humans and other species of mammals, are infected by a wide variety of parasites and pathogens, many of which have coevolved with their mammalian hosts. And as with humans and other mammals, these parasites, pathogens, and biotoxins tend to affect individuals differently and have local effects that may vary over time.

Below, we highlight recent data, modeling results, and evolutionary insights on two pathogens, *Toxoplasma gondii* and *Sarcocystis neurona*, that have been reported as one of the leading or contributing causes to mortality of southern sea otters. We give special consideration to *T. gondii* because of the attention it has received in the literature and popular press on the purported link between otter mortality and domestic cats in urban areas, that new data show to be incorrect.

Toxoplasma gondii. *Toxoplasma gondii* is an obligate intracellular parasite in the Phylum *Apicomplexa*, that includes other notable parasites such as *Plasmodium* (malaria) and *Cryptosporidium*. *T. gondii* is not a parasite unique to sea otters. It has a worldwide distribution and infects virtually every species of mammal in the terrestrial and marine environment, most bird species, as well as marine mollusks and some fish. It infects approximately 30% of the human population worldwide, with infection rates varying between 10 to 90% in different regions (Dubey 2010; Torgerson and Mastroiacovo 2013; Ehmen and Lüder 2019). The Centers for Disease Control estimates that 40 million people in the USA are infected with the parasite.[2] Most mammals, as well as most humans, show no signs of illness from acute or chronic infection except in cases where an individual's immune system is compromised, when the infection is acquired during pregnancy, or when infected with virulent strains of *T. gondii* .[3]

As described recently by Jeffers et al. (2018), "Upon initial infection of an immunocompetent host with *Toxoplasma*, an often asymptomatic acute infection (tachyzoites) is followed by establishment of chronic infection, which is marked by the formation of intracellular tissue cysts (bradyzoites). These cysts can persist within the host tissues throughout the life of the host, maintained in the quiescent state by its immune system." These dormant tissue cysts facilitate *T. gondii's* persistence by remaining in the intermediate host until it may be preyed upon or scavenged by felids, thus continuing the parasite's life cycle. If an individual's immune system becomes suppressed, these dormant intracellular tissue cysts (called bradyzoites) can transition back into rapidly proliferating tachyzoites, causing morbidity or mortality.

Sexual reproduction of *T. gondii* begins with the consumption of infected intermediate hosts by wild and domestic felids (i.e., bobcats, mountain lions, and domestic cats in North America). Felids are "definitive hosts" essential to *T. gondii's* life cycle because the sexual reproduction phase of the parasite's life cycle is only known to occur in the guts of felids. The authors of Di Genova et al. (2019) recently discovered why this occurs: "Cats lack an enzyme called delta-6-desaturase, which catalyzes the conversion of linoleic acid to arachidonic acid, accounting for the

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[2] https://www.cdc.gov/parasites/toxoplasmosis/index.html.

[3] http://www.cfsph.iastate.edu/Factsheets/pdfs/toxoplasmosis.pdf

peculiarly high levels of linoleic acid in the cat intestine, but not in other mammals." High linoleic acid is required by *T. gondii* for sexual reproduction. Infected felids shed millions of oocysts in their feces, which are highly persistent in the environment. Oocysts can survive for a year or more in the terrestrial environment before being ingested by both "natural intermediate hosts" (i.e., species that felids prey upon) or "accidental intermediate hosts" (species not preyed upon by felids and therefore "dead-ends" for the parasite, such as humans, livestock, and sea otters). *T. gondii* oocycts are hardy enough to survive being washed into the sea where they may be ingested by marine mollusks and, subsequently, marine mammals and fish (Massie et al. 2010; Shapiro et al. 2014, 2019a; Carlson-Bremer et al. 2015; Krusor et al. 2015).

The continued existence of southern sea otters is not threatened by domestic cats.

Several scientific papers and provocative articles in the press (i.e., Miller et al. 2008; New York Times 2003, 2019; Smithsonian 2019) have claimed that domestic house cats and outdoor cats in urban areas are killing sea otters because they are spreading *T. gondii* infections (Miller et al. 2008, 2013). The most recent articles appear to stem from a press release by UC Davis about a paper by Shapiro et al. (2019b). In the discussion section of that paper, the authors speculate that a spillover of oocysts with a virulent wild type X genotype of *T. gondii* (or its similarly toxic variants) is occurring from wild felids (i.e., bobcats and mountain lions) to domestic cats. That spillover, in turn, will increase the frequency of type X in the much larger domestic cat population, thus leading to more virulent type X genotypes washing into the ocean from urban surface areas, increasing the mortality of sea otters. The implication of this speculation is that domestic cats disproportionately contribute to sea otter mortalities near developed areas, thus the news headlines such as, "*Parasite Spread by House Cats Is Killing California's Sea Otter*" (Smithsonian 2019).

While the wild type X genotypes were found in a handful (n=6) of feral and domestic cats during the limited cross-species sampling by vanWormer et al. (2014), no evidence was presented by Shapiro et al. (2019b), or others, that domestic cats were shedding large numbers of type X oocysts into the environment or that these type X genotypes were sweeping into the domestic cat population. Shapiro et al. (2019b) also downplayed published experimental data and pathology results that indicated a limited ability of domestic cats to shed type X genotypes of *T. gondii* (i.e., wild felid strains). This is an important misstep in their reporting on research because coevolution between domestic cats and *T. gondii* strains in the domestic cat cycle (especially those possessing the monomorphic Chr1a chromosome) limits the transmission of wild felid strains of *T. gondii* to domestic cats, as noted by Galal et al. (2019):

> Experimental infections of domestic cats with domestic strains of *T. gondii* (4 strains for 8 cats) and with wild strains (3 strains for 6 cats) have shown that these two categories of strains do not have the same

> capacity to be transmitted by the domestic cat (Khan et al., 2014). The 4 domestic strains caused oocyst excretion in 6 of the 8 exposed cats (2 strains caused oocyst excretion in only one of the 2 exposed cats) while the 3 wild strains were associated with oocyst excretion in only one of the 6 cats exposed. This monomorphic ChrIa [chromosome] could confer a selective advantage to domestic strains for being disseminated by the domestic cat through oocyst shedding. This adaption could therefore facilitate their spread in the domestic environment and strengthen this dichotomy between a wild cycle and a domestic cycle.

We further note that these same issues were raised by a peer reviewer of the original manuscript submitted by Shapiro et al. (2019b), however, the final manuscript alluded to feral domestic cats, because of their presumed large number, as the primary vector of type X and threat to sea otters. An excerpt of that peer review, provided below, may be found online with the peer reviews and responses.[4]

> 8. 371: The authors argue that "The molecular identity of atypical *T. gondii* strains in sea otters that died due to toxoplasmosis and nearby feral domestic cats demonstrate how land-to-sea flow of lethal pathogens from domestic animals can impact wildlife health in coastal ecosystems." This point is crucial in a framework of species conservation as it attributes the death in sea otters to domestic cats. However, there is no strong evidence that domestic cats are shedding *T. gondii* of type X (which is the virulent type). The fact that domestic cats are found infected by a given strain does not mean that they can shed this strain in the form of oocysts as previously shown in an experimental study (Khan et al., 2014 Plos NTD). The results of this previous study also showed that domestic cats may not efficiently shed wild types of *T. gondii*, although this merits to be verified for a larger diversity of wild types including type X. This is a knowledge gap that deserves to be pointed out in the context of this study as it is a crucial point in terms of species conservation and future policies. **Instead, wild felids, which are also prevailing in the study area, appear to be the most likely definitive hosts for this *T. gondii* type.** [Our emphasis.] Indeed, type X is mainly associated to the wild environment in North America. It was mainly isolated in wild felids, wild intermediate hosts and species that have contact with the wild environment (reviewed by Jiang et al., 2018 IJP).

And finally, Shapiro et al. (2019b) did not mention the critical review by Lafferty (2015), or cite readily-available peer-reviewed medical-evolutionary genetic literature, including Shwab et al. (2018) or Galal et al. (2019). Those publications

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[4] https://royalsocietypublishing.org/action/downloadSupplement?doi=10.1098/rspb.2019.1334&file=rspb20191334_review_history.pdf

obviously conflict with speculation that domestic cats are spreading type X *T. gondii* to sea otters.

Inaccurate claims that domestic cats are killing sea otters by spreading *T. gondii* oocysts have been around since at least 2003 (see Lafferty 2015 for an extensive, critical review). This claim has persisted in the sea otter scientific literature and the press despite abundant contrary evidence. That contrary evidence includes data on the toxicity and clustering of virulent type X genotypes in undeveloped areas that are maintained in a wild felid cycle by bobcats and mountain lions (see Figure 3 of vonWormer et al. 2014). New data and modeling results (Jiang et al. 2018; Shwab et al. 2018; Galal et al. 2019) have also demonstrated how and why natural selection maintains *T. gondii* strains of low virulence in a domestic cat infection cycle but strains of high virulence in a wild felid cycle. This later body of recent, highly relevant medical-evolutionary research literature, and its significance to sea otter conservation, appears to have escaped notice of the U.S. Fish and Wildlife Service as well as leading otter researchers.

The assumption that domestic cats are killing sea otters is part of a popular paradigm that sea otters serve as "sentinels" of ecological health of the ocean and that sea otter morbidity and mortality will map onto human development and activity (i.e., Jessup et al. 2004; Conrad et al. 2005; Miller et al. 2008). This has spawned notable spin-offs such as the "kitty litter hypothesis" and "pet cat hypothesis," based on the assumption that *T. gondii* oocysts from domestic cats are being flushed down the toilets and washed into the sea, subsequently infecting and killing sea otters. This led Governor Schwarzenegger in 2006 to sign into law AB 2485 requiring kitty litter packaging to have labeling admonishing cat owners to dispose of cat feces in the trash rather than the toilet, thereby sparing seas otters toxic *T. gondii* infections.[5] (Outside cats, feral cats, bobcats, and mountain lions were obviously not covered by this legislation because they do not use litter boxes.) However, as noted by Lafferty (2015), this paradigm was already contrary to the available data as of 2014. More recent data and modeling results are in conflict with this paradigm (Shwab et al. 2018 and supplemental materials; Galal et al 2019), yet it persists as speculation and opinions expressed in the discussion sections of various scientific papers (i.e., Shapiro et al. 2019b). Regrettably, such surmise can sometimes be confused with experimental data and rigorously-tested hypotheses by uninformed decision-makers and an uncritical press.

Lafferty (2017) concisely summed up the situation as follows:

> Because stranded sea otters with toxoplasmosis were most common near river mouths (Miller et al. 2002), veterinarians suggested that sea otters were sentinels of a dirty ocean (Jessup et al. 2004), blaming domestic and feral cats and urging pet owners to stop flushing pet waste into the

[5] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200520060AB2485

sewer. To support this contention, researchers devised a study to compare sea otter infection and mortality rates at two locations: the populated Monterey Bay and the rural Big Sur coast (Tinker 2013). Counter to expectations, *T. gondii* was not a substantial mortality source in the study (Miller et al. 2013), and the rural Big Sur otters were many times more likely to become infected with *T. gondii* (Burgess et al. 2013), perhaps due to Big Sur having more bobcats and mountain lions that, like domestic cats, carry the parasite (Lafferty 2015). Ironically, both parasites that impact sea otters are more prevalent where other wildlife is common (Lafferty 2015, Smith 2007), casting doubt on whether these sea otter diseases indicate a degraded environment.

New data, modeling results, and insights into the evolution and maintenance of *T. gondii* strains explain why domestic cats are not a threat to sea otters.

Both Shwab et al. (2018) and Galal et al. (2019) report that natural selection is operating on *T. gondii* virulence (and type X host specificity in particular) very differently in domestic cat versus wild felid populations. Briefly, there is strong selection for lower virulence in domestic cat populations where there are few intermediate hosts, whereas intermediate to high virulence is selected for in wild felids, where there are numerous intermediate host species. This hypothesis is well-supported by multiple lines of evidence and is not in conflict with any data we are aware of.

The mechanisms behind the opposite selective regimes in wild versus domestic cats are straightforward. Less virulent genotypes are favored by natural selection in domestic cat populations because there is low diversity of intermediate hosts preyed upon by domestic cats (primarily the house mouse, *Mus musculus*) and there is only one species of definitive host, the domestic cat. Prolonged, non-lethal *T. gondii* infections to mice allow for subsequent transmission to cats that prey on mice and the deposit of oocysts that subsequently infect the same mouse species, thus favoring low virulence over more virulent strains that prematurely kill these intermediate hosts (i.e., type X strains). However, in the wild (sylvatic) the situation is the opposite: a high diversity of intermediate hosts and definitive hosts favors higher levels of *T. gondii* virulence.

Additionally, experimental evidence has also shown a coevolutionary response of cats to *T. gondii* strains of low to intermediate virulence: when domestic cats are infected with type X strains of *T. gondii*, they do not shed oocysts as efficiently as wild felids (Khan et al. 2014; Galal et al. 2019).

In other words, while spillover of virulent (type X) *T. gondii* strains can occur from wild felids to domestic cats (as shown in Shaprio 2019), natural selection will winnow away the more virulent wild (type X) in the domestic cat population such that they cannot be maintained, as shown in recent modeling (Shwab et al. 2018; Galal et al. 2019).

It is important to note that dormant tissue cysts facilitate *T. gondii's* persistence, especially in the domestic cat/mouse cycle because mice infected with *T. gondii* strains of low to intermediate virulence tend to live longer than those parasitized by virulent strains. This in turn increases the chances of transmission to cats, perpetuating the *T. gondii* life cycle (Shwab et al. 2018; Galal et al. 2019). In contrast, during the sylvatic cycle (in the wild), there is a greater diversity of natural intermediate host species and felid species, as well as transmission through both predation and scavenging. These factors favor the evolution and maintenance of more virulent strains of *T. gondii* (Shwab et al. 2018 and supplemental material).

Fortunately, North America has only four primary clonal strains of *T. gondii* circulating: types I, II, III, and 12 (the type 12 lineage includes type A and X strains from sea otters). The type 12 lineage is the dominant isolate found in wildlife in North America (46.7% of isolates), followed by types II and III that are typically found in domestic animals and humans (Dubey et al. 2011). In contrast, South America has the highest diversity of *T. gondii* found on any continent and many highly virulent strains. New phylogenetic analyses by Bertranpetit et al. (2017) reveal that *T. gondii* strains share a most recent common ancestor in South America. As summarized by Bertranpetit et al. (2017):

> We show that extant strains of the pathogen likely evolved from a South American ancestor, around 1.5 million years ago, and reconstruct the subsequent spread of the pathogen worldwide [first into North America, then through the Bering Strait to colonize Asia, Europe and Africa]. This emergence is much more recent than the appearance of ancestral *T. gondii*, believed to have taken place about 11 million years ago, and follows the arrival of felids in this part of the world. We posit that an ancestral lineage of *T. gondii* likely arrived in South America with felids and that the evolution of oral infectivity through carnivorism and the radiation of felids in this region enabled a new strain to outcompete the ancestral lineage and undergo a pandemic radiation.

A subsequent spread of a few clonal strains worldwide in domestic cats and evolution of a separate domestic cat *T. gondii* cycle is consistent with the development and spread of agriculture, approximately 11,000 years ago. Also, international ship-borne trade starting in the 16th century, "*with ships populated by rats, mice, and cats provided T. gondii with unprecedented migration opportunities*" (Lehman et al. 2006; Bertranpetit et al. 2017; Shwab et al. 2018; Galal et al. 2019).

Significance of new research on the evolution of *T. gondii.*

Regrettably, this new data and understanding of *T. gondii* ecology, host specificity, and evolution of virulence has not caught the attention of the sea otter research community. For example, a recent paper by Burgess et al. (2018) reports that they have identified "landscape" risk factors to sea otters for *T. gondii* infections. While the authors of Burgess et al. (2018) demonstrate that *T. gondii* oocycts are more prevalent in sea otters in the vicinity of urbanized watersheds, they omitted any mention of the difference in toxicity to sea otters between the *T. gondii* strains that circulate in wild felid versus domestic cat cycles. That is of critical importance because the toxicity of *T. gondii* strains maintained in the wild felid cycle (i.e., bobcats and mountain lions inhabiting undeveloped land) are demonstrably more virulent to sea otters than those in the domestic cat cycle (from urbanized watersheds), as documented by vonWormer et al. (2014). This difference in toxicity was clearly shown in research data published by vanWormer et al. (2014) and summarized in Figure 1 of Shapiro et al. (2019b): in cases where sea otters died as a result of toxoplasmosis, all of them died from type X strain, not the domestic cat strains typically found in and near urbanized areas. As pointed out by Lafferty (2015), the type X strain and undeveloped lands that harbor it are the primary risk factor to southern sea otters, rather than urban areas.

The significance of these findings is that sea otters have been exposed to *T. gondii* infections spread by wild felids in the sylvatic cycle (one that favors high virulence) for a very long time (i.e., as long as 1.5 million years as it spread via wild felids into North America). And second, while domestic cat strains from urban and agricultural areas are found in sea otters, these strains are of low to intermediate virulence and are not the responsible agent for recent sea otter mortalities.

The implications for sea otters of this data and research results:

1) The exposure of sea otters to type X strains of *T. gondii* comes from the shedding of oocysts by wild felids (bobcats and mountain lions) rather than domestic cats.

2) Natural selection favors the maintenance of clonal, non-virulent, or less virulent strains of *T. gondii* in domestic cat populations, regardless of the (limited) spillover from wild felids to domestic cats. In other words, data and modeling results indicate that with regards to *T. gondii* virulence affecting sea otters, natural selection is more likely than not to maintain genotypic proportions, meaning the situation is unlikely to worsen for sea otters. When near urban areas, otters are less likely to be infected by wild type X *T. gondii,* thanks to natural selection.

3) As concluded by Lafferty (2015), "Although many [scientific] papers and the popular press purport that human actions put sea otter health at risk, these

parasites are a natural, long-standing problem for sea otters." Notwithstanding this refutation and new data discussed above, the popular press has continued the inaccurate narrative, for example: *Parasite Spread by House Cats Is Killing California's Sea Otters*.[6]

4) Annual census data show that the southern sea otter population has experienced an overall increasing trend over the past several decades despite ongoing *T. gondii* infection (California Department of Fish and Wildlife 2019; Hatfield et al. 2019).

5) *T. gondii* infections are not unique to sea otters, and like other mammals, the data do not show that they are population limiting.

6) Sea otters, as well as other mammals, have likely experienced *T. gondii* infections spread by wild felids in the sylvatic cycle for a very long chapter of evolutionary history, and more recently by less virulent or avirulent domestic cat strains.

Sarcocystis neurona.

Similar in life history to *T. gondii*, *Sarcocystis neurona* is found in a broad range of terrestrial and marine mammals including sea otters, harbor porpoises, harbor seals, Steller sea lions, Guadalupe fur seals, Northern elephant seals, Northern fur seals, pygmy sperm whales, Pacific white-sided dolphins, opossums, raccoons, skunks, armadillo, cattle, horses, domestic cats, and Canadian lynx (Dubey et al. 2015; Lafferty 2017). The definitive hosts of *S. neurona* are the Virginia opossum (*Didelphis virginiana*) and South American opossum (*D. albiventris*) (Barbosa et al. 2015). After ingestion or vertical transmission (mother to offspring) the parasite encysts in muscle cells of intermediate hosts without causing apparent clinical symptoms, and may cause encephalomyelitis if it migrates into the central nervous system. Not all opossums are infected, and the frequency of infection varies regionally (5.9% in Central California, to 9.4% in northwestern Washington; Rejmanek et al. 2009; O'Byrne et al. 2019) as well as in degree of virulence, which is relevant to understanding its effect on southern sea otters. These patterns are explained by the fact that the parasite has a simple population structure whereby asexual reproduction can occur in the gut of the opossum, leading to locally acquired, clonal lineages. It is generally assumed, based on similar life history to *T. gondii,* that the definitive host, the Virginia opossum, sheds the infective stage of the parasite on land, which then enters the marine environment through freshwater runoff.

In 2004, a mass mortality event of southern sea otters in Morro Bay (n=40), caused by *S. neurona*, raised concerns about the parasite infecting a greater number of sea otters. However, subsequent research has shown that this was the result of a

[6] https://www.smithsonianmag.com/smart-news/parasite-spread-house-cats-killing-californias-sea-otters-180973014/ - C0sB7k05BrZAFFLu.99.

single virulent strain with a unique genotype not found elsewhere (Miller et al. 2010). Other otters, infected with different strains of *S. neurona*, survived with chronic infections (based on IgM and IgG titers, DNA PCR detection, and histopathology). As noted by Miller et al. (2010), "Similar to *T. gondii* infections of marine species (Miller et al., 2004), strain-specific variations in parasite prevalence, infectivity and pathogenicity may prove to be important in the ecology of *S. neurona* infections of marine mammals." Additionally, "Although opossums are common in California, the terrestrial-to-marine flow of fecal waste from these animals is probably patchy and episodic, entering the ocean through multiple point-source discharges from rivers and stormwater drainages interspersed along the shore." The significance of these findings to southern sea otter conservation is that *S. neurona* is not a range-wide threat but an episodic, local one.

2. White shark predation

Sea otters are not the apex predator in the Southern California coastal ecosystem. That position belongs to white sharks. Therefore, as otters have increased their numbers and expanded their range and habitat use, it should come as no surprise that sharks increasingly take otters, thus the return of a mechanism of natural population regulation that ceased to exist after sea otters were nearly extirpated from the California coast and sharks were apparently at lower density (California Department of Fish and Wildlife 2014). As concluded by Tinker et al. (2016):

> [A] number of lines of evidence indicate that sea otters are at carrying capacity throughout the center portion of their range (Laidre et al. 2001, Tinker et al. 2008, Thometz et al. 2014), and thus range expansion and growth at the northern and southern peripheries of the range will be critical for further recovery (USFWS 2012). Unfortunately, the range peripheries are the very areas where the recent increase in shark mortality has been greatest.

The significance of shark predation to otter management is that expectations as to the rate of otter population increase need to be adjusted in view of the return of otters and sharks to the near-shore coastal ecosystem. While shark predation does occur, there are no data that indicate it has caused the southern sea otter population to decline. Also, it is unclear the extent to which the white shark population may have increased or aggregations near shore have increased, or both (California Department of Fish and Wildlife 2014). Currently, there are no data that indicate the continued existence of the southern sea otter is likely to be threatened in the foreseeable future by white shark predation. On the contrary, the southern sea otter population has continued to increase despite the uptick in shark predation.

D. Inadequacy of existing regulatory mechanisms

State protections for the southern sea otter

If the southern sea otter is delisted as a threatened species under the Endangered Species Act, it will continue to be protected under State of California law. More specifically, the State of California recognizes the sea otter both as a fully protected mammal (Cal. Fish & Game Code § 4700) and as a protected marine mammal (Cal. Fish & Game Code § 4500). A fully protected mammal may not be taken or possessed at any time, unless the CDFW authorizes the taking for necessary scientific research, including efforts to recover such a fully protected species. Public notification of such an authorization is required, via the California Regulatory Notice Register, and public comments considered.

If delisted, funding for research, habitat conservation and other management activities will continue. For example, since 2006, a California State tax check-off has typically provided annual contributions in excess of $250,000 to the California Sea Otter Fund, the proceeds of which are split between the California Department of Fish and Wildlife (CDFW) and the State Coastal Conservancy to benefit the southern sea otter. CDFW and the Coastal Conservancy use the Sea Otter Fund to support scientific research that helps to inform and fund conservation efforts to protect and increase the number of southern sea otters. Donations are made via tax forms to the Rare and Endangered Species Preservation Program and/or the California Sea Otter Fund (www.wildlife.ca.gov/tax-donation and www.facebook.com/seaotterfundcdfw).

Federal regulations may pose an obstacle to the otter's continued recovery

If shark predation continues to inhibit range expansion, establishing additional populations through translocation could become advisable (a possibility on which this petition expresses no view). Indeed, a recent article coauthored by the Service's own Southern Sea Otter Recovery and Marine Conservation Coordinator and several academics suggests that translocating otters to San Francisco Bay—bypassing the shark-infested waters between the current occupied range and the Bay—could lead to the tripling of the sea otter population (Hughes et al. 2019). However, as the article acknowledges, the species' continued listing makes that possibility remote, because of the effects the introduction of a listed predator species would have on other users of the bay. *Id.*

The Service's regulatory actions have exacerbated this problem. In 1986, Congress authorized the Service to translocate otters to San Nicolas Island for the purpose of establishing an additional population. Pub. L. No. 99-625 (1986). To get fishermen and others who use surrounding waters to agree to the Service's plan, Congress conditioned this authority on an exemption under the Endangered Species Act and Marine Mammal Protection Act for incidental take in a zone surrounding the introduced population. 132 Cong. Rec. S17321-22 (Oct. 18, 1986).

Translocating otters proved more difficult than the Service had estimated, causing the Service to introduce only half the anticipated number of otters. 77 Fed. Reg. 75,266, 75,280 (Dec. 19, 2012) (139 otters introduced out of the 250 permitted). Consequently, the population was initially smaller than expected. Three years into the program, the San Nicolas Island population fell eight otters short of the Service's goal. 77 Fed. Reg. 75,287-88.[7] However, it has since expanded considerably and continues to enjoy impressive growth. In 2019, 121 otters were observed on San Nicolas Island, having sustained a nearly 10% annual growth rate for the previous decade. USGS, *California Sea Otter (Enhydra lutris nereis) Census Results, Spring 2019* 5.[8] Unfortunately, the Service recently terminated the protections afforded fishermen and others under Public Law No. 99-625, based on the population missing the three-year goal decades earlier. 77 Fed. Reg. 75,266.[9]

If establishing additional otter populations in San Francisco Bay or other locations becomes advisable, the unjust treatment of the fishermen and others who agreed to Public Law No. 99-625's compromise would serve as a significant obstacle. Any other stakeholder considering whether to cooperate with the Service would have little confidence that the Service will uphold its end of the bargain even if, as on San Nicolas Island, the project resulted in a successful otter population.

E. Other natural or man-made factors affecting the population's continued existence

Oil spills

At the time of the southern sea otter ESA listing in 1977, the threat of a substantial tanker or super-tanker oil spill at the northern and southern extent of otter core range was clearly a hazard that was likely to increase in the years to follow (U.S. Fish and Wildlife Service 1977). At the time of the listing, the United States was dependent upon oil imports, and oil tankers were single-hulled, without redundant steering systems and navigated by traditional means (i.e., pre-GPS navigation era). Oil tankers and many other vessels operated with little environmental oversight. It was also a time, following the 1973–1974 OPEC oil embargo, that the size of oil tankers was increasing as a result of demand and the economy of scale: from typical 30,000–50,000 deadweight (DWT) tankers, to

[7] If the population goal were adjusted in proportion to the number of otters actually transported, the San Nicolas Island population would have exceeded the 1990 target. The Service only released 56% of the 250 otters allowed under the program. Despite this, the 1990 population was nearly 70% of the Service's goal.

[8] https://pubs.usgs.gov/ds/1118/ds1118.pdf.

[9] Petitioners challenged that decision, arguing that Congress gave the Service no authority under Public Law No. 99-625 to terminate these protections once it established the population. The Ninth Circuit upheld the decision, reasoning that the statute's silence on whether the Service has such authority should be deemed an implicit delegation under *Chevron v. NRDC*. *See California Sea Urchin Commission v. Bean*, 883 F.3d 1173 (9th Cir. 2018).

supertankers of 100,000–550,000 DWT, capable of carrying up to 4.2 million barrels of oil (Alcock 1992; Spyrou 2011). The threat of a large-scale tanker-related oil spill occurring from navigational error, mechanical failure, accidental collision, grounding, fire, tanker-to-shore pipeline accident, or sinking was an issue of increasing concern. To the U.S. Fish and Wildlife Service in 1977, such an event appeared highly probable (U.S. Fish and Wildlife Service 1977).

In 1977, the probability of a tanker-related oil spill in the range of the remaining southern sea otter population was increased by the fact that there were two offshore oil tanker offloading facilities and one offshore oil tanker loading facility in operation. On the northern extent of the sea otter range, there was an offshore oil unloading facility at Moss Landing, for tankers of up to 50,000 DWT.[10] There were also multiple large (up to 2.5 million gallon) storage tanks located onshore to fuel the Moss Landing electrical power plant. At the same time, there were also proposals to expand the capacity of deepwater unloading facilities at Moss Landing for supertankers to provide crude oil to a proposed oil refinery that would require 50,000 barrels of oil a day from offshore tanker deliveries (Battelle 1973; U.S. Fish and Wildlife Service 1977). Moss Landing, at the mouth of Elkhorn Slough, was the location of the largest concentration of remaining southern sea otters, and therefore a particularly sensitive location.

At the southern extent of the sea otter range, oil tankers were regularly unloading at an offshore mooring to provide fuel to the Morro Bay electrical power plant.[11] Similar to Moss Landing, the powerplant stored oil in a near-shore tank farm adjacent to the powerplant.

Between Moss Landing in the north and Morro Bay in the south, an oil tanker terminal extended offshore at Estero Bay. That facility had exported crude oil from Kern County and the Kettleman Hills since the 1920's and was also proposed to be scaled up into a supertanker port for larger-scale exports.[12]

The closing of offshore crude oil loading and unloading facilities at Moss Landing, Estero Bay, and Morro Bay eliminated the major threat to the southern sea otter: a near-shore tanker or supertanker oil spill.

Market forces and air quality regulations resulted in the Moss Landing and Morro Bay electrical power plants being converted from oil-fueled to natural gas-fired plants by 1995. The secondary benefit from these conversions was the elimination of oil spill hazards associated with oil tankers supplying these facilities via offshore

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[10] https://montereybay.noaa.gov/intro/mp/archive/original_eis/partII_sIII.html.

[11] https://www.slc.ca.gov/wp-content/uploads/2018/09/MND-4.pdf.

[12] U.S. Fish and Wildlife Service 1977; and https://www.newtimesslo.com/sanluisobispo/say-goodbye-to-the-chevron-marine-terminal/Content?oid=2944553 and https://www.morro-bay.ca.us/DocumentCenter/View/513/LCP-Chapter-VII-Energy_Industrial-Development?bidId=.

pipelines. The Morro Bay plant was officially closed in 2014, and the offshore unloading facilities and pipelines were decommissioned and removed in 2019.[13] The Moss Landing power plant is in the process of being converted to an electrical storage facility, using banks of utility-grade lithium-ion storage batteries and the former oil storage tanks removed. Lastly, the Estero Bay oil tanker-loading facility became obsolete and ceased operations in 1999 with the construction on the inland Pacific Pipeline that transferred crude oil directly to Los Angeles refineries.[14] The Estero Bay pipelines and onshore tank farm were subsequently removed in 2011.

Currently, in 2020, the threat of an oil spill endangering the southern sea otter has passed. Substantial changes have occurred in oil tanker design, navigational technology, regulation, oil spill response, and liability, as well as market forces and regulations that resulted in the phase-out of oil at Moss Landing and Morro Bay electric generating facilities, and closure of the Estero Bay offloading facility. While oil spills do occur at sea, the trend has been downward in terms of number and volume (U.S. Coast Guard 2011), such that the threat of oil spills at a magnitude that could potentially endanger the southern sea otter population has become highly unlikely.

Post *Exxon Valdez* regulatory changes and new technologies to improve oil tanker safety further reduced the oil spill threat to the southern sea otter.

Ironically, two major tanker-related oil spills in 1989 and 1990 were largely responsible for global changes to oil tanker operations that dramatically increased their safety. After the 1989 *Exxon Valdez* oil spill in Alaska's Prince William Sound and the 1990 *American Trader* oil spill south of Long Beach, California, regulatory steps were taken to substantially reduce the risk of oil tanker spills in coastal waters. First, the California legislature passed the Oil Spill Prevention and Response Act of 1990 (Chapter 1248, Stats.1990; commonly referred to as SB 2040). And second, the U.S. Congress passed the Oil Pollution Act of 1990 (33 U.S.C. §§ 2701–2761 and other related sections). As a result of this legislation, actions were implemented to increase vessel safety, vessel traffic control, and to prevent tanker-related oil spills off the California coast and within California ports.

Most significantly, the Oil Spill Prevention and Response Act of 1990 ordered the immediate phase out in U.S. waters of single-hulled tankers. The Act required all new oil tankers to be double-hulled, and older single-hulled tankers to be phased out starting in 1995 with the final date for phase out in 2015. This date was subsequently moved up to 2010. In 2007 the European Union (EU) implemented a mandatory requirement for all oil tankers to be double-hulled in order to use EU ports or to drop anchor in their territorial waters. And finally, the International Maritime

[13] https://longitude123.net/l123_home/featured-project/.

[14] http://historicalmorrobay.org/wp-content/uploads/2019/06/STANDARD-OIL-AND-ESTERO-BAY.pdf.

Organization (the United Nations agency for shipping) implemented a similar phase out of all single-hulled tankers by 2010 (Stenman 2005), as well as other mandatory safety requirements specific to oil tankers, including: duplication of navigational equipment and steering gear; inert gas systems to prevent fires in oil storage tanks; towing arrangements with fixtures fore or aft on hulls to facilitate towing at sea in the event of engine failure; placement of water ballast tanks to protect main tanks in the event of a grounding or collision; enhanced inspections to detect safety deficiencies including corrosion, wear and tear, and hull girder strength; and the carriage of automatic identification systems (AISs) that provide continuous information about the ship and its location, to other ships and to coastal authorities.[15] The AIS system is a safety measure that allows ship captains to identify all vessels and direction of travel in surrounding waters and establish radio communications with those ships as needed to avoid collisions.

Regulations have improved vessel traffic control in the range of the southern sea otter, thus minimizing the probability of an oil spill.

Vessel traffic control has been recognized as a key step to reduce the risk of vessel mishaps off the California coast or within California ports. The following safety measures have been implemented offshore:

- *Traffic Separation Schemes* have been designated to direct offshore vessel traffic along portions of the California coastline including the Santa Barbara Channel. Analogous to air traffic lanes, these are internationally recognized vessel routing designations which separate opposing flows of vessel traffic into lanes, and include a buffer zone between lanes (U.S. Coast Guard 2000.[16]

- *Areas to be Avoided* (ATBA) have been established to restrict the movement of tankers and barges carrying oil as cargo. The ATBA off the Southern California coast requires that all cargo-carrying ships avoid the area which encompasses the Channel Islands National Marine Sanctuary, except those bound to ports at one of the islands in the sanctuary.[17]

- *NOAA Whale Advisory Zones* and also a 10-knot-or-less speed limit reduce the risk of ships striking whales, while reducing the probability of ship-to-ship collisions. These are current voluntary speed restrictions, along with coastal Traffic Separation Schemes and shipping lanes on the approaches to San Francisco Bay to the north (Cordell Bank to Half Moon Bay) and

[15] http://www.imo.org/en/OurWork/Safety/Regulations/Pages/OilTankers.aspx; *see also* http://www.oilspillprevention.org/oil-spill-sources/ships.

[16] Chart available at https://charts.noaa.gov/PDFs/18720.pdf and https://charts.noaa.gov/PDFs/18700.pdf.

[17] Chart available at: https://charts.noaa.gov/PDFs/18720.pdf.

approaches to the Los Angeles/Long Beach Harbor in the south (Dana Point to Pt. Arguello). These are posted on regularly updated NOAA navigation charts and alerts.[18]

- *Vessel Traffic Information Services* are in operation in the Ports of Los Angeles/Long Beach and San Francisco Bay to monitor traffic within harbors and approaches and prevent accidents that could result in oil spills.[19]

- *Precautionary areas* were designated in congested areas near harbor entrances to set speed limits, prescribe vessel routing, or establish other safety precautions.[20]

- *Safety fairways* have been established to prohibit the permitting and placement of structures such as oil platforms between a port and the entry into a Traffic Separation Scheme.[21]

- *Harbor Safety Committees* were established for the harbors of San Diego, Los Angeles/Long Beach, Hueneme, San Francisco, and Humboldt. These committees have developed harbor safety plans for each port and identify key safety issues for resolution by the California Office of Spill Prevention and Response.[22]

Collectively, the changes described above have had a measurable positive effect in reducing the potential for a major oil spill along California's coastal areas that are inhabited by the southern sea otter.

Many of these regulatory measures have also carried over to the international shipping industry where annual shipping losses (i.e., spills and sinking) worldwide have fallen by more than 65% over the past decade—from 132 in 2009 to 46 in 2018 and are now at their lowest level this century (Allianz 2019).

Offshore oil rigs are not a threat to southern sea otters because of improved regulations, technology, and industry practices.

The 1969 Santa Barbara Oil Spill from Platform A in the Santa Barbara Channel off of Southern California occurred in the early years of minimally-regulated offshore drilling, with practices that would be unacceptable, if not illegal, today. Most

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[18] https://www.navcen.uscg.gov/pdf/lnms/lnm11252019.pdf see pages 38-39.

[19] https://www.navcen.uscg.gov/?pageName=vtsLocations.

[20] https://inport.nmfs.noaa.gov/inport/item/39986.

[21] https://inport.nmfs.noaa.gov/inport/item/39986.

[22] http://oilspilltaskforce.org/ourwork/harbor-safety-committees-best-maritime-practices/ and https://wildlife.ca.gov/OSPR/Marine-Safety/Harbor-Safety.

notably, the drill casing used was inadequate to contain the pressures encountered (causing the sea floor to fracture near the surface, releasing additional oil) and there was no blowout preventer installed on the wellhead at the time of the blowout (Clarke and Hemphill 2002; Wheeling and Ufberg 2017; Pinkston and Flemings 2019). Moreover, there were no oil spill contingency plans, no agency responsible for directing clean-up, no accepted clean-up procedures, and no mandated liability. Since then, the situation has changed.

Oil spills of 1,000 gallons or more from ships, offshore platforms, and pipelines, in all U.S. waters combined, have decreased from a high of 842 in 1974 to 24 in 2011. Smaller spills of 101–1,000 gallons have decreased from 1,457 to 117 in the same time period (U.S. Coast Guard 2011). The notable exception to these trends was the Deepwater Horizon/Macondo exploratory well spill in the Gulf of Mexico during 2010. However, that spill, like the Exxon Valdez tanker spill of 1989, led to extensive investigations into contributing causes (National Research Council 2012; U.S. Chemical Safety and Hazard Investigation Board 2016; Pinkson and Flemings 2019) and substantive improvements in technology, industry practices, and regulatory oversight by the Coast Guard, the Department of Interior's Bureau of Safety and Environmental Enforcement, and Bureau of Ocean Energy Management (Bureau of Safety and Environmental Enforcement 2016, 2019a,b). Regulations included the Drilling Safety Rule (Oct. 2010), Safety and Environmental Management Systems (SEMS I) in October 2010, and SEMS II in April 2013, in order to improve the safety of offshore operations. Subsequently, the Department of Interior's Bureau of Safety and Environmental Enforcement (BSEE) published the Blowout Preventer Systems and Well Control final rule (the WCR) on April 29, 2016, and the Oil and Gas and Sulfur Operations in the Outer Continental Shelf-Blowout Preventer Systems and Well Control Revisions, effective July 15, 2019 (Bureau of Safety and Environmental Enforcement 2019a and b).

Concurrently, four Joint Industry Task Forces (JITFs) were assembled to focus on critical areas of offshore activity: (1) the Joint Industry Offshore Operating Procedures Task Force, (2) the Joint Industry Offshore Equipment Task Force, (3) the Joint Industry Subsea Well Control and Containment Task Force, and (4) the Joint Industry Oil Spill Preparedness and Response Task Force. These task forces,

> brought together Industry experts to identify best practices in offshore drilling operations and oil spill response; with the definitive aim of enhancing safety and environmental protection. The ultimate goal for these JITFs is to improve well containment and intervention capability, spill response capability, and industry drilling standards to form comprehensive safe drilling operations; not only through evaluation and revision of Industry guidelines and procedures, but also active engagement with regulatory processes. (American Petroleum Institute 2015).

Collectively, new regulations and industry safety initiatives increased safety standards for well design, well control, and blowout preventers, while adapting to more refined technologies and industry practices including operations off the coast of Southern California. Additionally, only 27 offshore platforms remain and several are now in the process of being plugged, decommissioned, and slated to become part of the Rigs-to-Reefs program (Bull and Love 2019).

We note that there is also a fundamental difference in the operational safety and oil spill risk between deep water and shallow water offshore oil and gas platforms because shallow water platforms are easier to inspect and service, such as those off of Southern California. At the southernmost extent of southern sea otter range, platforms are drilled in water 120 to 300 feet deep, as compared to deepwater wells, such as the Deepwater Horizon/Macondo well, that was drilled in water 5,000 feet deep. Using analysis of incident data and water depth, Muehlenbachs et al. (2013) reported that "each 100 feet of added depth increases the probability of a company-reported incident by 8.5%." Industry sources report similar data (Institute for Energy Research 2010).

Collectively, scientific and commercial data indicate the risk of a catastrophic oil spill from offshore oil and gas operations at the southern extent of the current southern sea otter range is greatly reduced from where it was even a decade ago. As a result, it does not represent a threat to the continued existence of the southern sea otter in the foreseeable future.

Modeling the fate of oil spills.

Modeling tools provided by NOAA now allow for the prediction of oil spill surface and subsurface transport and fate, providing decision-makers with a range of options for oil recovery actions and response strategies including the use of chemical dispersants to enhance dilution in open water and increase biodegradation, thus reducing shoreline impacts (National Research Council 2005; Bejarano and Mearns 2015). The General NOAA Oil Modeling Environment (GNOME) is the most widely used of these modeling tools.[23] None of these modeling tools existed at the time of the ESA listing in 1977 and none have received mention by the Service in their 2003 Recovery Plan or most recent status review.

In contrast to the above scientific and commercial data, and regulatory policies, the 2015 five-year status review stated that, "Despite significant advances in techniques for washing oiled sea otters made during the last 20 years at the CDFW's Marine Wildlife Veterinary Care and Research Center, it is clear that a spill of sufficient magnitude to cause population-level effects would overwhelm the capacity of rehabilitators to rescue sea otters and return them to the wild." In support, the authors of the status review cited an obsolete 2002 ship collision study that was

[23] https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/response-tools/gnome-suite-oil-spill-modeling.html.

conducted prior to the implementation of required AIS location transmitter systems (West Coast Offshore Vessel Traffic Risk Management Project Final Project Report and Recommendations July 2002).[24] Despite that omission, the authors of the status review concluded that increased tanker and ship traffic would occur between the San Francisco and Los Angeles Harbors and surmised that this would increase the probability of a catastrophic oil spill having a population level-effect on southern sea otters. A single oil spill event in 2007 of 53,569 gallons of fuel oil in the San Francisco Bay after a ship struck the San Francisco Bay bridge (outside the southern sea otter range) was cited as proof that oil spills have the potential to occur and could kill large numbers of sea otters. However, no mention was made of the U.S. Coast Guard response and subsequent clean-up. Similarly, no data on oil spill history, frequency, size, or hazards along the southern sea otter range was presented.

The example above is presented because it illustrates the speculation published in the sea otter literature and regulatory documents regarding a hypothetical, worst-case oil spill occurring in the southern sea otter range, threatening the population (i.e., Hughes et al. 2019). However, the most recent USCG compendium on oil spills into U.S. waters reveals how significantly oil spills have diminished overall, especially in California waters (inland and coastal combined): in 2011, 159 spills occurred, with a total volume of 3,900 gallons, a maximum spill size of 990 gallons, and an average spill size of 24.5 gallons.

Climate change

Speculation exists about the effects of climate change on southern sea otter food resources and population trends (i.e., U.S. Fish and Wildlife Service 2015, 2017), however, no reliable predictions of trends into the reasonably foreseeable future currently exist.

As an initial matter, there is difficulty in determining the relative contributions of long-term non-anthropogenic global warming trends (i.e., Holocene warming) and trends resulting from anthropogenic inputs (i.e., greenhouse gasses). Next, it is problematic to make long-term predictions of regional climatic trends (e.g., along coastal waters of Southern California) because of the decadal and intra-decadal variation introduced by variation in the Pacific Decadal Oscillation (PDO) and El Niño Southern Oscillation (ENSO). As noted by the most recent IPCC report on *Observed Climate Variability and Change* (Folland et al. 2001), "On decadal time-scales, the Pacific Decadal Oscillation (PDO) and the related Inter-decadal Pacific Oscillation (IPO) may account for approximately half the global mean variation in surface temperatures." Graphic examples of the extent and frequency of this variation may be seen at the Joint Institute for the Study of Atmosphere and Ocean[25] and in

[24] http://library.state.or.us/repository/2010/201007070951103/index.pdf.

[25] http://research.jisao.washington.edu/pdo/.

Figure 2.29, of Folland et al. (2001), "El Niño-La Niña variations from 1876 to 2000 measured by sea surface temperature in the region 5°N to 5°S, 150 to 90°W." Reliably quantifying these potential interactions is equivocal, as reported by Folland et al. (2001):

> There is ambiguity about whether inter-decadal Pacific-wide features are independent of global warming. In the longer Folland et al. (1999) analyses since 1911 they appear to be largely independent, but in the Livezey and Smith analysis of more recent SST [sea surface temperature] data they are an integral part of a global warming signal. Using a different method of analysis of data since 1901, Moron et al. (1998) find a global warming signal whose pattern in the Pacific is intermediate between these two analyses.

An additional problem is identifying and quantifying (with reasonable certainty) the specific cause and effect mechanisms that could link predictions of coastal water temperatures and weather patterns to observed sea otter vital rates and demography.

We note that, to date, not even the most simplified effects hierarchy of factors affecting southern sea otter abundance has been proposed.

Compounding these issues is the localized population structure of southern sea otters, where "*processes that regulate population abundance (including density-dependent resource abundance) also occur locally*," rather than range-wide (Tinker et al. 2019). These can also shift over time. In other words, there is local heterogeneity in the factors that affect southern sea otters, making simplified, range-wide predictions problematic, if not impossible.

Taken collectively, the implications of these issues is clear: predicting long-term sea otter population trends into the foreseeable future on the basis of long-term, broad-scale global model predictions is an exercise fraught with uncertainty.

In our view, the best available scientific data for quantifying southern sea otter population trends are empirical data (i.e., Hatfield et al. 2019). And those data reveal an overall increasing trend.

Human influence on the coastal environment.

The final conclusions of Tinker et al.'s (2019) 225 page compilation of 15 years of research provides a succinct summary of the data, results, and their significance to the population status of southern sea otters: *Southern sea otter population biology at Big Sur and Monterey, California—Investigating the consequences of resource abundance and anthropogenic stressors for sea otter recovery* (see Chapter 11.

Synthesis and Conclusions.[26] What makes those conclusions both powerful and compelling is that they were based upon hypothesis testing against empirical data, in the tradition of strong inference in science (Popper 1957; Platt 1964).

The testing of these four hypotheses is important because they have served as working hypotheses for over a decade, guiding the interpretation of research, as well as policy and management of southern sea otters. However, like all scientific hypotheses, they are open to testing with new data. Hypotheses whose predictions are inconsistent with the data are rejected, while those consistent with the data are provisionally accepted and used to revise and guide future research and adaptive management. In the case of southern sea otters, three of the four working hypotheses were not supported by empirical data. Therefore, as noted by Tinker (2019), the results require "*a reevaluation of some of our assumptions about factors driving trends in sea otter abundance in central California*."

Because the Tinker study represents the best available science on the factors affecting sea otter abundance, and discredits the analytical lens favored by prior researchers, we present the General Conclusions of Tinker (2019) in their entirety below, along with our clarifications [in brackets]:

> The various modules of the Big Sur-Monterey population study reported in the preceding chapters represent the culmination of one of the most expansive studies of sea otter biology ever conducted. The breadth of topics covered and the diversity of results are complex, and distilling all this information down to a few simple conclusions is no easy task. All the analyses presented in this report were conducted with the aim of testing one or more of the primary hypotheses, often using multiple lines of inquiry. Considered together, the various lines of investigation encompassed by this study generally were consistent with respect to their degree of support (or lack of support) for each of the four primary hypotheses, as described here.
>
> 1. **Sea otters living in areas adjacent to human population centers and areas heavily impacted by runoff or sewage (for example, Monterey) are more likely to be exposed to pathogens and toxins of public health importance than those in more pristine areas (for example, Big Sur)**. This hypothesis was *not supported* by the results of our study. An epidemiological analysis of *Toxoplasma gondii* infections (chapter 9) indicated that sea otters in the highly impacted site were significantly *less* likely to be exposed than were otters from the pristine area. Necropsies of study animals that died during the study indicated that the frequency of the domoic acid exposure (a biotoxin produced from diatom blooms) as a contributing

[26] https://doi.org/10.3133/ofr20191022.

cause of death was approximately equal between the two study sites (occurring in 50-percent of recovered carcasses at Big Sur and 44-percent of recovered carcasses at Monterey; chapter 10). Gene expression analysis indicated no significant differences between sites in patterns indicative of physiological responses to pathogens or toxins, with the exception of elevated response to organic contaminants in sea otters from Big Sur in 2008 (possibly due to effects of Big Sur wildfires that year; chapter 3). We did not conduct laboratory tests of blood contaminant levels, owing to funding constraints (although blood samples have been archived to permit such analyses in the future), so we cannot rule out the possibility that there may have been differences in exposure to specific contaminants that were consistent with this hypothesis; however, physical exams and blood diagnostic tests showed no evidence of health effects that would suggest such a pattern, and the minor differences in health parameters that were reported indicated more abnormalities in sea otters from Big Sur, the pristine site (chapter 2).

2. **Patterns of survival and causes of death will differ between heavily impacted and pristine environments, indicating differences in pathogen and toxin exposure**. This hypothesis was *not supported* by our results. The comprehensive analysis of sea otter survival and weaning success showed that sea otters from the pristine site (Big Sur) had lower age-specific survival rates than did sea otters from the heavily impacted (Monterey) study site, and female weaning success rates showed a similar pattern (chapter 8). These differences were explained almost entirely by the differences in resource abundance and body condition of animals at the two sites; after controlling for the effect of age-specific body mass, there were no significant differences in survival rates between the two sites. In terms of causes of death of study animals (chapter 10), necropsies indicated that the same suite of causal factors were evident at both sites in roughly equal proportions, with the exception of boat strikes which only occurred at the Monterey site (2 out of 9 cases). [To clarify, only two cases of suspected (not confirmed) mortality due to boat strike were documented over the four years and nine months of the study.]

3. **Environmental risk factors will vary between sites, corresponding to the differing land-use patterns**. This hypothesis was for the most part *not supported* by our results, with some important caveats. As discussed in hypothesis 1, the health assessments (chapter 2) and gene expression analyses (chapter 3) suggested no consistent differences in environmental risk factors, with the exception of up-regulation of certain genes in sea otters captured at Big Sur in 2008 suggestive of increased exposure to organic contaminants. [Those

organic contaminants were attributed to runoff from two unusually large wildfires along Big Sur in 2008: the 66,500 ha Basin fire (caused by lightning strike) and the 6,240 ha Chalk fire (cause unknown) based on Bowen et al. (2015). Such one-off stochastic events are not indicative of long-term trends in exposure to fire-related organic contaminants. Gene transcript profiles were found to return to baseline levels the following year. Any long-term health effects on the sea otters are purely speculative.] Epidemiological analysis (chapter 9) indicated that exposure to the protozoal parasite *Toxoplasma gondii* was significantly greater at Big Sur than at Monterey. Thus, our results indicate variation in environmental stressors across sites, and over time; however, the differences were not clearly attributable to differences in human population densities or land-use patterns. [To state the results more precisely, *T. gondii* infection of otters is not correlated with human population densities or land-use patterns. The predominant *Toxoplasma* strain along Big Sur is the wild type X strain and its closely related variants. Type X strain is virulent to sea otters and is part of a natural *T. gondii* cycle in wild felids (bobcats and mountain lions). Strains of *T. gondii* associated with the domestic cat cycle are of comparatively low virulence to otters and were found near Monterey.]

4. **Sea otters from high-density populations (and [or] areas that have been occupied longer) will have lower rates of foraging success compared to sea otters from low-density populations (and [or] areas that have been more recently occupied) due to prey resource depletion, and these patterns will be indicated by (a) greater percentage of time spent feeding, (b) more pronounced individual diet specialization, (c) poorer body condition, and (d) lower survival rates of adults and pups**. This hypothesis was *well supported* by data collected in the current study and in previous similar studies. Sea otters at Big Sur and Monterey study sites (both of which have supported high-density populations for many years) had relatively low rates of energy gain while feeding as compared to low-density, growing populations in California, Washington, British Columbia, Alaska, and Russia (chapter 6). Big Sur sea otters had slightly lower energy intake rates than did otters in Monterey, and also spent slightly more time feeding (chapter 5) and had slightly greater levels of diet specialization (chapter 6), although these latter metrics were high at both sites as compared to low-density populations. A comparison of body condition and survival rates across six sites in California (chapters 7 and 8, respectively) showed that lower foraging success in high-density sea otter populations was indicated by poorer body condition and decreased survival, and pup weaning success rates, with strongly significant correlations among all of these parameters.

Based on the hypothesis tests described here, not all of our predictions were supported by empirical datasets, requiring a reevaluation of some of our assumptions about factors driving trends in sea otter abundance in central California. The enormous scope and inter-disciplinary nature of this project, and the extensive sample sizes available from both the current study and from previous similar studies conducted over the past 15 years, allow us to update our understanding of southern sea otter population biology. Four general conclusions about the sea otter populations of central California, and the factors driving trends in abundance, have emerged from this work:

1. Density-dependent population regulation driven by per-capita resource abundance is the most significant factor currently limiting population growth in the center part of the range (approximately from the Monterey Peninsula to Estero Bay). [The otter population along the central coast is naturally self-limiting. As the otter density increases to carrying capacity, food resources are depleted, competition increases, and population growth rate slows. This is not a threat to the population and it can be expected to occur in other areas as otters expand their range.]

2. Spatial and temporal variation in environmental and anthropogenic stressors also can affect sea otter health, based on previous research (for example, Miller and others, 2002; Johnson and others, 2009; Miller and others, 2010), but patterns of variation are complex and are not simply a function of proximity to human populations. [It would be more accurate to characterize the patterns as discernable rather than "complex" as the cause and effect mechanisms operating at local scales over short time periods are easily understood by those with a basic understanding of ecology and evolutionary biology.]

3. Exposure to environmental stressors (either natural or anthropogenic in origin) does not act independently of resource limitation. [In other words, environmental stressors such as disease or exposure to wildfire runoff have a more pronounced effect on individual otters where they are food-limited. This occurs along the Big Sur coast where the population density and competition for food resources is highest.]

4. Sea otter populations are structured at small spatial scales, and the processes that regulate population abundance (including density-dependent resource abundance) also occur locally. [In other words, sea otters tend to remain in their natal areas or local home ranges and are naturally reluctant to disperse into unfamiliar areas. And because local environmental conditions, as well as risk factors, can differ among sites

and over time, it should come as no surprise that productivity, survivorship, and population growth rates also differ among sites. The significance of that finding is that there are no data to suggest the existence of a single (i.e., range-wide) threat of consequence to the southern sea otter's persistence.]

II. In the Alternative, the Service Should Issue a Rule Under Section 4(d) of the Endangered Species Act and Public Law No. 99-625 to Provide Relief to Fishermen and Other Water Users and to Encourage Further Recovery Efforts

If the Service determines the southern sea otter does not yet merit delisting, Petitioners ask, in the alternative, that it issue a rule under Section 4(d) of the Endangered Species Act and Public Law No. 99-625 to restore the protections guaranteed to fishermen and others under the latter statute. Such a tailored approach is advisable because of the significant improvement in the species' status overall and of the San Nicolas Island population in particular. It would also reduce conflicts that could otherwise hamstring the Service's ability to implement additional recovery efforts for the sea otter, including establishing additional populations by translocation.

In August 2019, the Service revised its regulations for prohibitions to threatened species, recognizing that tailoring regulations to the needs of individual species better promotes species recovery and is fairer to the regulated community. 84 Fed. Reg. 44,753. However, this reform only applies to species listed as threatened after September 26, 2019. *Id.* For species listed earlier, like the southern sea otter, a blanket take prohibition continues to apply.

Under Section 4(d) and the recent reform, the Service should regulate take of a threatened species only to the extent "necessary and advisable" for the conservation of the species. 16 U.S.C. § 1533(d). Although this is a broad standard, some of the factors the Service must consider are clear. First, what are the conservation benefits to the species of regulating particular instances of take, if any? Second, what costs are imposed on the Service, the regulated community, and other environmental goals? *See Michigan v. EPA*, 576 U.S. 743, 752 (2015) (broad standards like "necessary and advisable" require consideration of costs because "[o]ne would not say that it is even rational, never mind "appropriate," to impose billions of dollars in economic costs in return for a few dollars in health or environmental benefits.").

These factors counsel in favor of a rule restoring Public Law No. 99-625's exemption. First, the conservation benefit to the species of forbidding this incidental take is small. Less restrictive regulations can greatly reduce any harms commercial fishing might otherwise cause. Indeed, existing regulations likely already serve this purpose. In the 1970s and 1980s, the sea otter population declined because of entanglement with fishing gear. 2003 Recovery Plan at viii. However, California adopted regulations to address this concern and "the population immediately began to increase again." *Id.* Likewise, the Service has concluded that incidental take by commercial fishermen has not prevented other otter populations from growing rapidly. *Id.* (discussing otter populations in Alaska, Washington, and Canada).

Indeed, tailoring the take regulation for the southern sea otter would have conservation benefits, by creating the goodwill needed for further recovery action. Rewarding with relaxed regulations fishermen and others for their role in the species' progress to date will incentivize further actions for this and other species. *See* 84 Fed. Reg. 44,755 (explaining that "regulatory relief" under Section 4(d) is anticipated to incentivize conservation); Jonathan Wood, *The Road to Recovery: How Restoring the Endangered Species Act's Two-Step Process Can Prevent Extinction and Promote Recovery*, PERC Policy Report (2018) (explaining that a gradual reduction of regulation as threatened species recover would best align the incentives of regulated parties with the interests of rare species).[27] Indeed, this approach has already been shown to work for the southern sea otter. Exemptions from incidental take regulation under Public Law No. 99-625 secured the cooperation of fishermen and others in the establishment of the San Nicolas Island population, which has contributed significantly to the species' recovery over the last decade. USGS, *California Sea Otter (Enhydra lutris nereis) Census Results, Spring 2019* 5.[28]

By contrast, the costs of regulation are high. For every other species regulated under the Endangered Species Act and Marine Mammal Protection Act, federal agencies have broad discretion to issue permits authorizing incidental take, thereby reducing the costs imposed on the regulated community. However, Public Law No. 99-625's exemptions are the exclusive means of approving incidental take affecting the California sea otter. *See* 16 U.S.C. § 1387(a) (authorizing permits for incidental take of any marine mammal except for the California sea otter and cross-referencing Public Law No. 99-625).[29]

The Service's 2012 decision to terminate the exemption assumed these costs would be minor because the San Nicolas Island population would not expand in the foreseeable future. 77 Fed. Reg. at 75,292. That prediction has not been borne out. Instead, the San Nicolas Island population has sustained a 10% annual growth rate during the last decade, and is expected to continue expanding into the surrounding fishery. USGS, *California Sea Otter (Enhydra lutris nereis) Census Results, Spring 2019* 5.[30] Indeed, otters may have already migrated from San Nicolas Island to other Channel Islands or the mainland. USGS, Press Release, *Annual Southern Sea Otter*

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[27] https://www.perc.org/wp-content/uploads/2018/04/endangered-species-road-to-recovery.pdf

[28] https://pubs.usgs.gov/ds/1118/ds1118.pdf

[29] Public Law No. 99-625 also exempts incidental take from regulation under the Marine Mammal Protection Act.

[30] https://pubs.usgs.gov/ds/1118/ds1118.pdf.

Survey: Despite Small Population Dip, Species Moves a Step Closer to Recovery (Sept. 29, 2017).[31] In any event, and in consideration of the lack of any authority to otherwise permit incidental take, the Service should consider all those costs that will be incurred as sea otters expand into other fisheries.[32]

CONCLUSION

The southern sea otter has achieved an impressive recovery, thanks to decades of work by federal biologists, state agencies, conservationists, and the regulated community. Now, that work should be rewarded by acknowledging the species recovery and delisting the species. Alternatively, it should be rewarded with a rule under Section 4(d) of the Endangered Species Act and Public Law No. 99-625 to provide appropriate regulatory relief and foster the goodwill needed for further recovery efforts.

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Respectfully submitted,

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[31] https://www.usgs.gov/news/annual-southern-sea-otter-survey-despite-small-population-dip-species-moves-a-step-closer.

[32] Indeed, if the Service minimizes these costs by assuming few or no incidental takes will occur, this would also necessarily mean the prohibition would provide no or minimal benefits to the species. Consequently, the costs and benefits would continue to weigh in favor of restoring the exemption.

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