BEFORE THE SECRETARY OF COMMERCE

Petition to List the Taiwanese Humpback Dolphin (*Sousa chinensis taiwanensis*) under the Endangered Species Act

Photograph by J.Y. Wang/*FormosaCetus* Research and Conservation Group

March 9, 2016

Petitioners:

Animal Welfare Institute

Center for Biological Diversity

WildEarth Guardians

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NOTICE OF PETITION

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Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. § 1533(b), Section 553(3) of the Administrative Procedures Act, 5 U.S.C. § 553(e), and 50 C.F.R. § 424.14(a), the Animal Welfare Institute, the Center for Biological Diversity, and WildEarth Guardians (Petitioners) hereby petition the Secretary of Commerce (Secretary), acting through the National Marine Fisheries Service (NMFS), an agency within the National Oceanic and Atmospheric Administration, to list the Taiwanese humpback dolphin *(Sousa chinensis taiwanensis)*, as an endangered or threatened species pursuant to the ESA. 16 U.S.C. §§ 1531-1544.

The Animal Welfare Institute (AWI) is an international non-profit organization that has sought, since its founding in 1951, to alleviate the suffering inflicted on animals by people. AWI has worked for decades to safeguard marine species and their habitats. AWI has more than 40,000 members and constituents throughout the United States and internationally. The organization's efforts focus on curbing humankind's harmful impact by urging governments and other policy makers to halt or prevent damaging actions, as well as educating the public and others about the deleterious effects their actions can wreak on the oceans' inhabitants. AWI works to minimize the impacts of all human actions detrimental to endangered species, engages Congress to strengthen the ESA. Representatives of AWI regularly attend meetings of the International Whaling Commission, including its Scientific Committee as well as meetings of the Convention on Biological Diversity and Convention on International Trade in Endangered Species of Wild Fauna and Flora to advocate for the international protection of threatened and endangered species. More information about AWI is available at www.awionline.org. If any correspondence related to this petition is to be sent by electronic mail, please direct it to Dr. Naomi Rose at naomi@awionline.org.

The Center for Biological Diversity (Center) is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 991,000 members and supporters throughout the United States and internationally. The Center and its members are concerned with the conservation of endangered species and the effective implementation of the ESA.

WildEarth Guardians (Guardians) is a non-profit environmental advocacy organization that works to protect endangered and threatened species. Guardians has more than 130,000 members and supporters throughout the United States and internationally. Guardians' Wild Oceans campaign focuses on protecting diverse marine species under the ESA.

NMFS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on NMFS. Specifically, NMFS must issue an initial 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). NMFS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* Petitioners need not demonstrate that the petitioned action is warranted; rather, Petitioners must only present information demonstrating that such action may be warranted. While Petitioners believe that the best available science demonstrates that listing the Taiwanese humpback dolphin as threatened or endangered is in fact warranted, there can be no reasonable dispute that the available information indicates that listing this species as either threatened or endangered may be warranted. As such, NMFS must promptly make a positive initial finding on the petition and commence a status review as required by 16 U.S.C. § 1533(b)(3)(B).

The term “species” is broadly defined under the ESA to include “any subspecies of fish or wildlife or plants and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” 16 U.S.C. §1532(16). Petitioners ask that the Secretary list the Taiwanese humpback dolphin as a threatened or endangered species because the population is in serious decline, critically endangered, and threatened by one or more of the five listing factors.

Acknowledgment: Special thanks to Penelope Yan, who assisted in drafting this petition.

EXECUTIVE SUMMARY

Taiwanese humpback dolphins (*Sousa chinensis taiwanensis*) are critically endangered, with fewer than 75 individuals (Wang et al. 2012, 2015b; Dungan et al. 2015) and this imperiled subspecies requires protection under the ESA. There are very few individuals remaining and the dolphins are in decline from a variety of threats. Taiwanese humpback dolphins are threatened by pollution and from incidental capture in fishing. The *Sousa* subspecies meets the criteria for protection under the ESA. Petitioners therefore request that NMFS list the Taiwanese humpback dolphin as an endangered or threatened species.

NMFS must reconsider granting ESA protections to the Taiwanese humpback dolphin. This population of humpback dolphins was previously considered for ESA listing as a distinct population segment.[1] NMFS determined that the population was not eligible for protection as a distinct population segment because it did not meet all necessary criteria. Specifically, NMFS concluded that the Taiwanese humpback dolphin population was "discrete," but not "significant" (79 Fed Reg. 74958, Dec. 16, 2014). This petition presents new scientific and taxonomic information demonstrating that this population is actually a subspecies-—the Taiwanese humpback dolphin—which is in danger of extinction from ongoing threats. Because subspecies are eligible for ESA listing without respect to a determination of significance, NMFS' prior negative finding is inapplicable. NMFS must list the Taiwanese humpback dolphin as a subspecies based on the ESA's listing factors.

The best available science shows that the Taiwanese humpback dolphin is a subspecies of the Indo-Pacific humpback dolphin (*Sousa chinensis*) (Wang et al. 2015b). In 2014, NMFS determined that the Eastern Taiwan Strait population of Indo-Pacific humpback dolphins (*Sousa chinensis*) was ineligible for listing as a distinct population segment in response to a petition by WildEarth Guardians (79 Fed. Reg. 74958, Dec. 16, 2014). However, Wang et al. (2015c) examined the taxonomy of the Eastern Taiwan Strait population, determined that it qualifies as a subspecies, and concluded that *Sousa chinensis* should be separated into two subspecies: the Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*) and the Chinese humpback dolphin (*Sousa chinensis chinensis*). This classification has been recently accepted by the Society for Marine Mammalogy (Committee on Taxonomy 2016). Thus, NMFS must consider this subspecies eligible for listing under the Act, which defines "species" as a species, subspecies, or distinct population segment.

The Taiwanese humpback dolphin is listed as "critically endangered" by the International Union for Conservation of Nature (IUCN), an international authority on the conservation status of species (Reeves et al. 2008). The "critically endangered" assessment is reserved for species for which the best available evidence indicates "an extremely high risk of extinction in the wild"

[1] See page 272 of "Petition to List Eighty-One Marine Species Under the Endangered Species Act," http://www.wildearthguardians.org/site/DocServer/Multi_Species_Marine_Petition.pdf?docID=9702

(IUCN, Undated 1 at 13). This is the highest level of extinction risk for any species (IUCN Undated 1 at 4).

The total population of the Taiwanese humpback dolphin was originally estimated at approximately 99 individuals in 2002 (Wang et al. 2007b, 2007c) and likely faces continuing declines (Wang et al. 2012). In fact, by 2008, the total number of mature individuals was estimated at 50 or fewer dolphins (Reeves et al. 2008). This subspecies is endemic to western Taiwan and has a limited range along a small stretch of coastal waters (Wang et al. 2007c, Ross et al. 2010). The subspecies has extremely high site fidelity and remains near the coast in shallow waters. This population is isolated and faces a high risk of extinction due to multiple threats (Wang et al. 2012).

Several local and regional threats are increasingly endangering the Taiwanese humpback dolphin population. Bycatch, entanglement, habitat destruction and degradation, pollution of coastal and river waters, and boat traffic are among the most important and pervasive threats to these subspecies in the Taiwan Strait. The main threat to the survival of the dolphin is fishing: bycatch and entanglement in fishing gear have population level effects on the Taiwanese humpback dolphin (Wang et al. 2007b). Specifically, Taiwanese humpback dolphins are incidentally caught in trammel nets, gill nets and trawls (Ross et al. 2010; Dungan et al. 2011; Slooten et al. 2013) Thousands of trammel and gill nets operate in the coastal waters of western Taiwan every year (Slooten et al. 2013) and they pose a high threat for the humpback dolphin in this region.

Coastal development and pollution are the main sources of habitat destruction and degradation that directly affect habitat suitability for the subspecies. Coastal development and land reclamation have degraded and reduced habitat availability in western Taiwan (Dungan et al. 2011). Water pollution from industrial, agricultural, and municipal sources affect humpback dolphins by direct skin exposure and toxic fumes may affect respiratory pathways and organs.

This petition summarizes the natural history of the Taiwanese humpback dolphin, population trends and status, and threats to the species and its habitat. In the context of the ESA's five statutory listing factors, the Taiwanese humpback dolphin warrants listing as an endangered or threatened species.

Part I. SPECIES ACCOUNT

Species Description and Taxonomy

Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*)

Order Cetartiodactyla Montgelard, Catzefils and Douzery, 1997
Cetacea Brisson, 1762
Odontoceti Flower, 1867
Family Delphinidae Gray, 1821
Genus *Sousa* Gray, 1866
Species *S. chinensis* Osbeck, 1765
Subspecies S. chinensis taiwanensis Wang, 2015

The Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*), also known as the Eastern Taiwan Strait Indo-Pacific humpback dolphin, is a member of the family Delphinidae found exclusively in coastal and estuarine waters of western Taiwan.

In 2014, Jefferson and Rosenbaum (2014) proposed four species within the genus *Sousa*: Atlantic humpback dolphin (*Sousa teuszii*), Indo-Pacific humpback dolphin (*S. chinensis*), Indian Ocean humpback dolphin (*S. plumbea*), and Australian humpback dolphin (*S. sahulensis*).

In 2015, Wang et al. (2015c) revised the taxonomy of Sousa chinensis and concluded that the species should be divided into two subspecies: the Taiwanese humpback dolphin (Sousa chinensis taiwanensis); and the Chinese humpback dolphin (S. c. chinensis). Relying on that literature, the Taxonomy Committee of the Society for Marine Mammalogy officially updated marine mammal taxonomy to include the Taiwanese humpback dolphin as a subspecies (Committee on Taxonomy 2016).

Wang et al. (2015c) examined the degree of differentiation between the Taiwanese humpback dolphins and Indo-Pacific humpback dolphins inhabiting the Jiulong River and Pearl River estuaries from Hong Kong and Fujian in China, respectively, to determine whether the Taiwanese population is a subspecies.[2] The study compared spotting densities on the bodies and dorsal fins of these adjacent populations, performed a discriminant analysis, and determined that the pigmentation of Taiwanese humpback dolphins is significantly different.

[2] In their 2008 study concerning the pigmentation differences between the Taiwan and Chinese humpback dolphin populations, Wang et al. did not examine the degree of differentiation for purposes of determining whether subspecies recognition was warranted (Wang et al. 2015b). Accordingly, they conducted the 2015 study to remedy that oversight (Wang et al. 2015b).

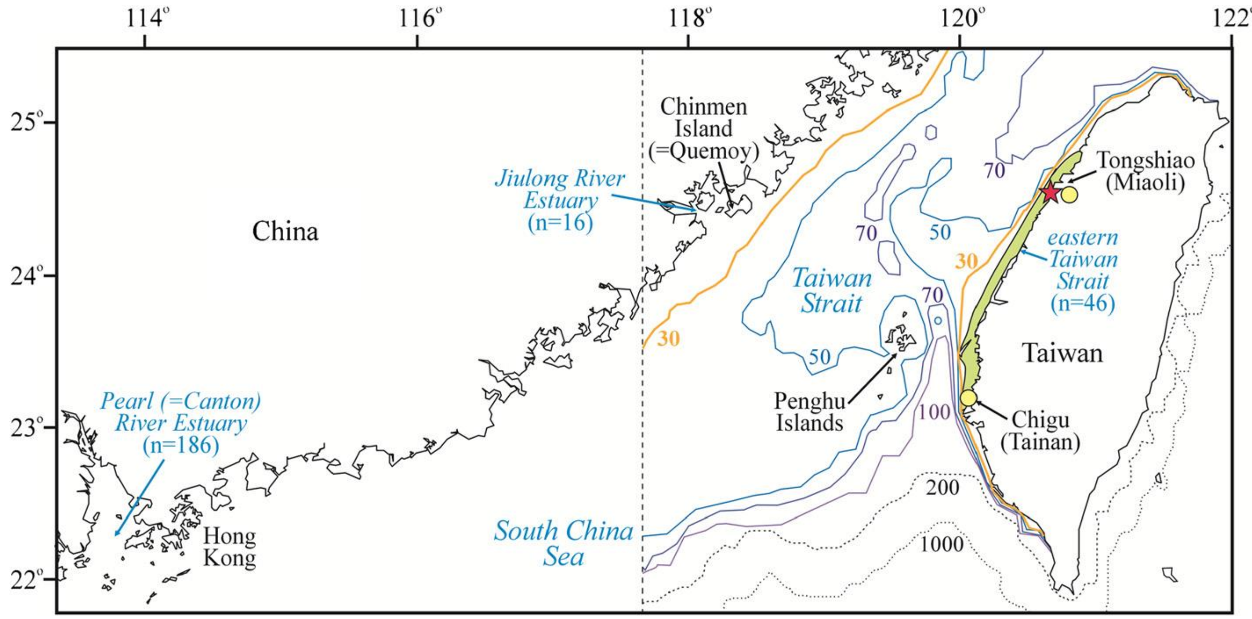

Figure 1. Sampling locations of Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*) analyzed in Wang et al. (2015c). The green shaded area represents the known distribution of these dolphins. Also shown are the locations where the holotype specimen (red star) and paratype specimens (yellow circles) of the Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*) were collected. Source: Wang et al. (2015c).

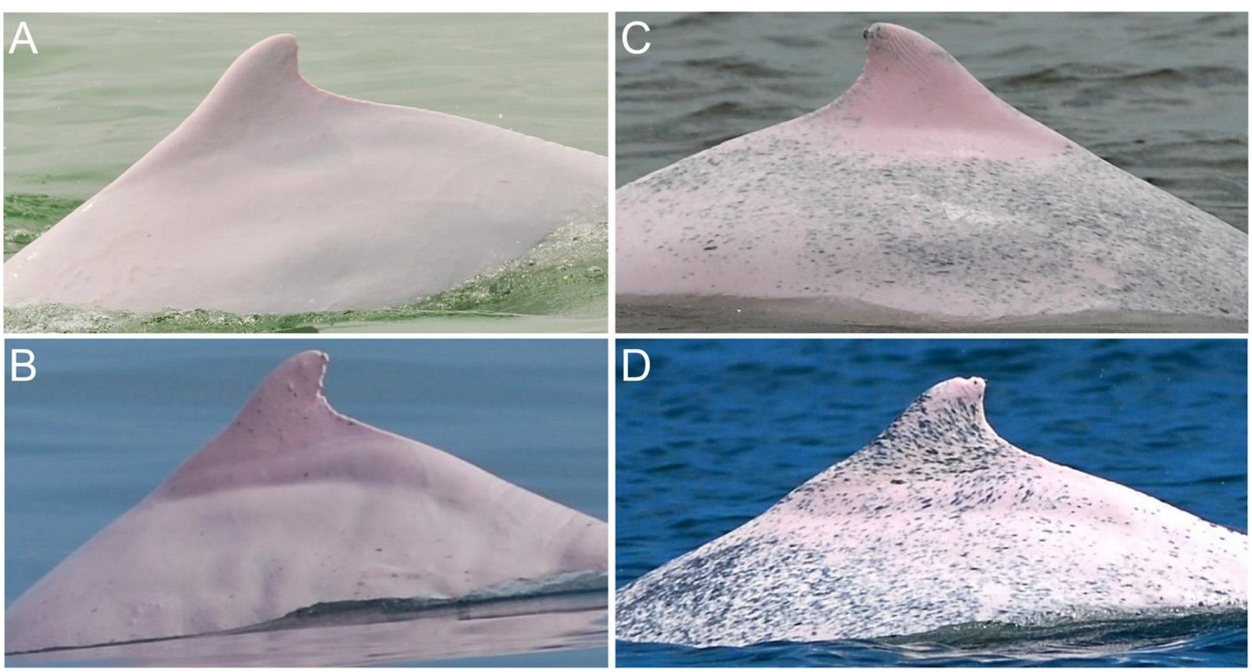

Figure 2. Typical Indo-Pacific humpback dolphins with unspotted and spotted bodies. Photographs of Indo-Pacific humpback dolphins from the Pearl River Estuary (A, B) and the

eastern Taiwan Strait (C, D). Photographs by J.Y. Wang/*FormosaCetus* Research and Conservation Group (Source: Wang et al. 2015b).

Wang et al. (2015b) reaffirmed that the Taiwanese humpback dolphin population is isolated and therefore a distinguishable population, further supporting the population's subspecies designation. For example, Taiwanese humpback dolphins reside only in the Eastern Taiwan Strait (Wang and Yang 2011) and their population does not emigrate to or immigrate from other adjacent dolphin populations (Wang et al. 2015b).[3] Because isolation of these dolphins will likely continue, it is reasonable to predict that they will experience even greater differentiation from those of mainland China in the future (Wang et al. 2015b).

Wang et al. (2015b) summarized the Taiwanese humpback dolphin's main features in support of designating them as a subspecies:

[T]hey are restricted to waters of western Taiwan, which means they are reproductively isolated (but note that reproductive isolation is not a prerequisite of subspecies, which by definition accepts or even expects some low level of continuing gene flow); the morphological differences exist [sic] between the Taiwanese dolphins and their nearest neighbours are not clinal but are diagnosably distinct; the characters examined are not those that maybe [sic] environmentally induced (see Perrin 2009 for examples) but instead are likely a reflection of genetic and developmental differences; these features are consistent with the Taiwanese humpback dolphin being a lineage that is evolving independently from the dolphins of the Jiulong River Estuary + Pearl River Estuary. (p. 9)

In summary, the best available science demonstrates that the Taiwanese humpback dolphin is a subspecies (Wang et al. 2015b).Therefore, as a subspecies, the Taiwanese humpback dolphin is eligible for listing under the Endangered Species Act.

Distribution, Habitat Use, and Movement

The primary range of the Taiwanese humpback dolphin is the western coast of Taiwan, from the northern Houlong and Jhonggang rivers (Miaoli County) to the southern Waishanding Zhou sandbar (Chaiyi County) (Reeves et al. 2008). There have been rare sightings outside of this range, including approximately 20 dolphins in the inshore waters of Tainan County (to the south) and a likely stray dolphin at the mouth of that county's Fugang Harbor (Reeves et al. 2008). Otherwise, they are year-round residents of the coastal waters of western Taiwan (Wang and Yang 2011).

[3] In its 12-month petition finding, NMFS made similar observations and ultimately concluded, from the best available data, that the Taiwanese humpback dolphin is geographically isolated from other populations (79 Fed. Reg. 74957, Dec. 16, 2014).

Most of the sightings of Taiwanese humpback dolphins have occurred near the Dadu and Joushuei rivers of western Taiwan (Reeves et al. 2008). Like most *Sousa* species, their movement is limited to shallow water and nearshore habitat (Wang et al. 2015c). They have been sighted in and around the two main estuaries of western Taiwan (Dadu and Joushuei rivers of Taichung, Changhua and Yunlin counties) (Wang et al. 2007b) indicating a limited, closed, narrow home range and strong site fidelity (Wang et al. 2015c OR Wang and Yang 2011). The water depth of the Taiwan Strait isolates the Taiwanese humpback dolphin (Wang et al. 2007b; Ross et al. 2010). In fact, annual surveys since 2002 have not recorded any of these dolphins further than 3 kilometers from the shoreline or in waters deeper than approximately 30 meters (Wang et al. 2007b; Ross et al. 2010). Furthermore, the catalogued photographic data evidences a lack of exchange between Taiwanese humpback dolphins and nearby populations across the Eastern Taiwan Strait (Ross et al. 2010; Wang et al. 2016b).

Diet and Feeding Ecology

There is little information about the feeding habits of the Taiwanese humpback dolphin (Reeves et al. 2008). Observers have seen the dolphins feeding on herring, mullets, croakers, and threadfins (Wang et al. 2007b), suggesting that the subspecies mostly forages in shallower waters, such as estuaries and nearshore coastal environments (Reeves et al. 2008).These feeding patterns are consistent with those observed in other Indo-Pacific humpback dolphins, which typically feed on estuarine and reef fish (Reeves et al. 2008).

Population status and trends

From survey data collected between 2002 and 2006, the initial population estimate of the Taiwanese humpback dolphins was approximately 99 individuals (Wang et al. 2007b). Based on that estimate and a projected decline in the population, the IUCN categorized the Taiwanese humpback dolphin on its Red List of Threatened Species as “critically endangered”—at an extremely high risk of extinction—based on listing criteria C2a(ii) (fewer than 250 mature individuals, a projected decline of the mature population, and at least 90% of mature individuals in only one subpopulation) (Reeves et al. 2008; IUCN 2001).[4]

Subsequent annual surveys between 2007 and 2010 resulted in revised estimates in 2012 of between 54 and 74 individuals (Wang et al. 2012), which further supported the Red List C2a(ii) categorization of “critically endangered.” In addition, assuming 60% of the total population constitutes mature individuals (Jefferson 2000), the updated estimates also satisfied the D

[4] *See* http://www.iucnredlist.org/details/133710/0. Petitioners hereby incorporate all citations and references contained in the IUCN’s Species Report into this petition by reference. If the Secretary does not have access to any of the incorporated citations or references contained in the IUCN Species Report, please contact AWI and copies will be provided upon request. Petitioners presently believe the Secretary has ready access to this incorporated material.

criterion for categorizing the species as "critically endangered" (fewer than 50 mature individuals), supporting a revision of the population's status on the Red List to CR C2a(ii); D (Wang et al. 2012, 2016a).

The IUCN Red List classification system is widely regarded as the most authoritative list of globally threatened species (Akçakaya et al. 2006; IUCN 2001). The general aim of the system is to provide an objective framework for classifying the broadest possible range of species according to their extinction risk (IUCN 2001). While IUCN listing affords no regulatory protection, it is an unequivocal statement from the scientific community that the species is imperiled and warrants protection.

"Sousa spp." is also listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES"). Pursuant to Article II of CITES, Appendix I "shall include all species threatened with extinction which are or may be affected by trade." Resolution Conf. 9.24 (Rev. CoP15) provides further guidance to Appendix listing. Specifically, "species that are or may be affected by trade should be included in Appendix I… if they meet at least one of the biological criteria listed in Annex 1"[5] Annex 1 states:

A species is considered to be threatened with extinction [i.e., subject to Appendix I listing] if it meets, or is likely to meet, at least one of the following criteria:

A. The wild population is small, and is characterized by at least one of the following:
(i) an observed, inferred or projected decline in the number of individuals or
the area and quality of habitat;
(ii) each subpopulation being very small;
(iii) a majority of individuals being concentrated geographically during one or
more life-history phases;
(iv) large short-term fluctuations in population size; or
(v) A high vulnerability to either intrinsic or extrinsic factors.

B. The wild population has a restricted area of distribution and is characterized by at least one of the following:
(i) Fragmentation or occurrence at very few locations;
(ii) Large fluctuations in the area of distribution or the number of subpopulations;
(iii) A high vulnerability to either intrinsic or extrinsic factors; or
(iv) An observed, inferred or projected decrease in any one of the following:
– the area of distribution;
– the area of habitat;
– the number of subpopulations;
– the number of individuals;

[5] (To Res. Conf. 9.24).

– the quality of habitat; or
– the recruitment.

C. A marked decline in the population size in the wild, which has been either:
(i) observed as ongoing or as having occurred in the past (but with a potential to resume); or
(ii) inferred or projected on the basis of any one of the following:
– a decrease in area of habitat;
– a decrease in quality of habitat;
– levels or patterns of exploitation;
– a high vulnerability to either intrinsic or extrinsic factors; or
– a decreasing recruitment.

Res. Conf. 9.24, Annex I. The listing of "*Sousa spp.*" under Appendix I, the classification reserved for the most endangered species, indicates that the international scientific community considers this species threatened with extinction.

The IUCN's "critically endangered" classification and CITES Appendix I listing provides strong evidence that the petitioned species warrants protection under the ESA. Certainly, an IUCN listing is sufficient to meet the "may be warranted" threshold for initiating a status review. 16 U.S.C. § 1533(b)(3)(B).

Part II. The Taiwanese Humpback Dolphin Satisfies the Statutory Criteria for Listing as an Endangered Species

Section 4 of the ESA and its implementing regulations set forth the procedures for adding species to the federal list of endangered and threatened species. 16 U.S.C. § 1533; 50 C.F.R. Part 424. NMFS may determine that a species is endangered or threatened due to one or more of the five factors described in section 4(a)(1) of the ESA. Each of these factors is discussed below.

The ESA defines a species to include any species, subspecies or distinct population segment. "The term 'species' includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16). Here, the Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*) has recently been classified as a subspecies and is therefore eligible for listing as a species.

The ESA defines an endangered species as "any species which is in danger of extinction throughout all or a portion of its range." 16 U.S.C. § 1532(6). A species is threatened if "it is likely to become an endangered species within the foreseeable future." 16 U.S.C. § 1532(20). In determining whether a species should be listed, NMFS must base its decision on five factors prescribed by the statute:

(A) The present or threatened destruction, modification, or curtailment of habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

16 U.S.C. § 1533(a)(1). The presence of "any one or a combination" of the listing factors requires listing. 50 C.F.R. § 424.11(c). "Each factor is equally important and a finding by the Secretary that a species is negatively affected by just one of the factors warrants a nondiscretionary listing as either endangered or threatened." *See National Wildlife Federation v. Norton*, 386 F. Supp. 2d. 553, 558 (D. Vt. 2005). Further, the listing decision must be made "solely on the basis of the best scientific and commercial data available." 16 U.S.C. § 1533(b)(1)(A). "Economic considerations have no relevance to determinations regarding the status of species." H.R. Conf. Rep. No. 97−835 (1982).

Freshwater-dependent cetaceans such as the humpback dolphin are highly vulnerable to coastal stressors because they occur in a very limited region, the population is isolated, and human activities can be concentrated in coastal areas (Wang et al. 2007b, 2016a; Ross et al. 2010; Dungan et al. 2011). Five major anthropogenic threats have been identified that drastically endanger the existence of the remaining humpback dolphins in the region: fisheries interactions, including bycatch and entanglement; habitat degradation and destruction; reduced freshwater outflow to estuaries; pollution of coastal and river waters; and underwater noise (Wang et al. 2007b, 2016a; Ross et al. 2010; Dungan et al. 2011). These human-caused threats seem to be generalized across a large geographical region and can negatively affect the distribution, behavior and survival of humpback dolphins (Wang et al. 2016a). On the west coast of Taiwan, the species has high site fidelity and the population is geographically separated by the Taiwan Strait from other populations of the east coast of China (Wang et al. 2015d). Because their habitats occur in areas of intensive human activities, local action can eliminate threats from anthropogenic impacts in important areas where dolphins forage, socialize, and reproduce. The magnitude, duration, and frequency of these threats critically endangers the current and future existence of a very small population with fewer than 75 individuals (Wang et al. 2012, 2016a; Dungan et al. 2015) and underscores the need for urgent protection measures. In fact, loss of a single dolphin from this small and isolated population due to anthropogenic causes may be unsustainable (Wang and Yang 2011). Therefore, high survival of this species serves as the population's best chance to persist (Wang et al. 2012).

A. The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Habitat degradation due to freshwater diversion and watershed modification are threats that directly affect the Taiwanese humpback dolphin in estuaries and coastal areas in western Taiwan (Ross et al. 2010). Most rivers and their watersheds in western Taiwan have been modified or dammed to support agriculture, aquaculture, industrial and residential development, and flood control (Wang et al. 2007d; Huang et al. 2009). Continuing and future diversions and modifications have been proposed (Ross et al. 2010). Reduction of freshwater input into estuarine waters as a result of watershed modification alters physical, chemical and biological processes in estuarine ecosystems affecting productivity and species diversity (Kennish 2002; Smith et al. 2009). Those changes not only disrupt the entire estuarine food web by reducing prey availability for freshwater dolphins (Smith et al. 2009; Smith and Reeves 2012), but also affect habitat structure by impacting sandbar and mudflat dynamics that create important features for adequate foraging (Ross et al. 2010). Changes in estuarine habitat dynamics affect populations of humpback dolphins near Hong Kong (Jefferson 2000) and the Taiwanese population also seems susceptible to these changes (Dungan et al. 2011). In addition, less water input in estuarine habitats due to modification in river outflow is likely to increase contaminant concentrations in shallow waters (Ross et al. 2010).

Habitat destruction also affects the viability of Taiwanese humpback dolphin populations. Land reclamation, break-walls, dredging, wind-turbine farms, and expanding coastal development contribute to the destruction of suitable habitat across the west coast of Taiwan (Wang et al. 2007b). Similar threats have been identified for the species in other regions within China and Thailand (Chen et al. 2015; Xu et al. 2015; Jutapruet et al. 2015; Wang et al. 2015c). In Taiwan, a portion of the remaining habitat of the subspecies falls within the central western coast where heavy industrialization (e.g., factories, ports, chemical plants, petrochemical facilities) exists together with the ongoing expansion of coastal development through land reclamation (Wang et al. 2007a, Dungan et al. 2011).

In fact, almost 80% of the west coast of Taiwan has already been altered to build ports, heavy industrial facilities, power plants, aquaculture and agriculture sites, levies and wastewater discharge channels, reducing considerably the “natural” habitat suitable for the humpback dolphin (Wang et al. 2007b). A massive petrochemical facility was planned to be constructed over 4000 ha of artificial infrastructure extending 4-5 kilometers seaward from the shoreline (Ross et al. 2010). This structure was planned to be built along the central portion of this subspecies’ geographical distribution in Taiwan, removing a substantial portion of the dolphin’s preferable habitat (Ross et al. 2010) and potentially fragmenting the habitat. Under heavy criticism and protest from academics, citizen groups, foreign conservation groups and the general public, the sitting government cancelled the project in April 2011. Several other projects for large scale industrial development, offshore wind farms, and land reclamations are still being planned (Liu et al. 2015c). Most recently, a push for "green" energy in Taiwan has resulted in serious consideration for large wind farms to be constructed again in the nearshore waters that comprise the humpback dolphins' habitat. The degradation and loss of suitable habitat due to human alterations restricts this subspecies to even more limited distribution or fragments suitable habitat, splitting the remaining subspecies into smaller groups.

Pollution

Pollution by toxic chemicals, waste waters, and other contaminants is also affecting the Taiwanese humpback dolphin across its endemic range (Ross et al. 2010; Dungan et al. 2011). Several toxic chemicals have been detected in tissue samples of cetaceans from Taiwanese coastal waters, including humpback dolphins (Chou et al. 2004). Humpback dolphins are exposed to toxic chemicals mostly through the ingestion of contaminated prey (Hung et al. 2007), although airborne particles and toxic films in surface waters are known to affect respiratory tracts in other species (Venn-Watson et al. 2015). Among the most concerning toxic chemicals, mercury can accumulate at high concentrations in humpback dolphins from prey (Hung et al. 2004, 2007), especially since the species exclusively eats fish (Parra and Jedensjö 2014; Liu et al. 2015a).

Other chemicals, including polychlorinated biphenyls (PCBs) and DDT, can also accumulate in fat tissue and negatively affect the immune, reproductive, and endocrine systems of the Taiwanese humpback dolphin (Jefferson and Hung 2004; Hung et al. 2006; Ross et al. 2010). PCBs and DDT concentrations in stranded humpback dolphins in Hong Kong and in the Pearl River Estuary in China have exceeded threshold levels considered harmful for marine mammals (Jefferson et al. 2006; Hung et al. 2006; Gui et al. 2014; Karczmarski et al. 2016). In Taiwan, PBCs persist in coastal and estuarine waters posing a high risk for wildlife, including cetaceans (Doong et al. 2008; Jiang et al. 2011; Ko et al. 2014).

Biological pollution from waste water, sewage, and agricultural runoff into estuarine and coastal areas of the west coast of Taiwan also affects habitat suitability and directly impacts the health of Taiwanese humpback dolphins (Ross et al. 2010; Dungan et al. 2011). Biological pollution consists of harmful bacteria, protozoa, and viruses, mainly from sewage and agricultural runoff. Untreated sewage from residential and industrial sources are likely to expose these dolphins to high levels of pathogens (Huang et al. 2016b). Humpback dolphins in Taiwan inhabit coastal areas near dense human population centers and may be under higher risk of pathogens exposure from urban sewage and agricultural runoff (Ross et al. 2010; Ko et al. 2014). Moreover, urban pollution from the city of Taipei seasonally reduces dissolved oxygen in waters of the Danshuei estuary, contributing to hypoxic areas that can reach the coast (Wen et al. 2008). Hypoxic areas reduce ecosystem productivity and prey availability for cetaceans, further reducing habitat suitability for foraging.

Noise pollution

Noise pollution due to boat traffic and offshore seismic exploration can affect the acoustic behavior of Taiwanese humpback dolphins, impacting their ability to communicate among individuals within groups and find prey. The Taiwanese humpback dolphin is exposed to chronic noise from fishing boats, high commercial boat traffic, and industrial shipping in the Taiwan Strait (Dungan et al. 2011). Humpback dolphins use sound to communicate and to locate prey in murky waters; anthropogenic noises may be masking communication and affecting prey detection (Würsig et al. 2016). Pacific humpback dolphins may also change their behavior in the presence of ships and boats (Ng and Leung 2003). Noise from transiting vessels can affect the group cohesion of humpback dolphins by disturbing mother–calf pair communication (Van Parijs and Corkeron 2001). In fact, in Australia, light boat traffic can disturb humpback dolphin vocalization at distances up to 300 m, prompting mothers and calves to increase whistle rates (Van Parijs and Corkeron 2001). The alteration of social behavior and the ability to find prey can negatively affect survivorship and reproductive fitness, compromising population viability (Dungan et al. 2015).

Noise disturbance from coastal percussive pile drilling and offshore seismic surveying is common in the west coast of Taiwan and could affect the hearing and echolocation abilities of Taiwanese humpback dolphins (Dungan et al. 2011). No studies have directly addressed this problem in the west coast of Taiwan; however, noise from seismic exploration or coastal percussive pile drilling can cause temporary or permanent hearing damage in dolphins (Mooney et al. 2009). For example, in bottlenose dolphins, acute and chronic noise can reduce echolocation accuracy and precision, compromising prey detection and intraspecific communication (Mooney et al. 2009; Pirotta et al. 2015). In humpback dolphins, underwater construction noise may disrupt communication behavior (Wang et al. 2014). For example, bridge construction in the Pearl River Estuary in China uses large vibrating underwater hammers for pile drilling. The resulting sounds are likely detectable by the species over distances up to 3.5 km from the drilling area and can substantially reduce auditory capabilities in humpback dolphins (Wang et al. 2014). This type of noise can cause physiological stress, mask important biological sounds, impair the ability to communicate, and may cause permanent hearing damage, which negatively impacts humpback dolphins' social lives (Finneran et al. 2002; Nowacek et al. 2007; Wright et al. 2007; Würsig et al. 2016). A growing body of evidence supports the conclusion that short-term responses to human-created noise may have negative long-term consequences for dolphins (Rako et al. 2012).

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The most severe threat to the survival of Taiwanese humpback dolphins is fisheries interactions. Bycatch due to entanglement in fishing gear such as trammel nets, gillnets, and trawls likely causes the most anthropogenic mortality for the Taiwanese humpback dolphin (Ross et al.

2010; Dungan et al. 2011; Slooten et al. 2013; Wang et al. 2016a). The main threat for bycatch and entanglement for the subspecies likely comes from commercial fisheries for grey mullet (Wang et al. 2007b, 2007c). Dolphins entangled in fishing gear often sustain severe injuries, leading to death (Jefferson and Curry 1994; Lewison et al. 2004, 2014). Along the west coast of Taiwan, thousands of fishing boats use gillnets and trammel nets in waters that humpback dolphins inhabit (Wang et al. 2004). Hundreds of fishing nets are set across the subspecies' range, and bycatch and entanglements appear common, evidenced by scars and wounds observed on dolphins (Wang et al. 2007a; Ross et al. 2010). Over 30% of known individuals have scars likely caused by fisheries interactions (Wang et al. 2007b). Fishermen seem unlikely to report incidental catch or entanglement because the species is legally protected and reporting may affect fisheries activities. Negative encounters will continue as long as fisherman and humpback dolphins compete for the same fish resources in Taiwanese waters (Liu et al. 2015b).

Injuries from fishing gear and boat collisions can compromise the health of individuals and their capacity to adjust to other stressors, or cause death (Dungan et al. 2011). Boat traffic (including whale watching boats) can increase the probability of collisions and fatalities or separations of mother and calves (Ku et al. 2014). Because the current Taiwanese humpback dolphin population is small (less than 100), the removal of a few individuals due to fisheries interactions can disproportionally reduce population viability and could eventually lead to the extinction of the subspecies (Ross et al. 2010; Dungan et al. 2011; Slooten et al. 2013) Studies show that to ensure recovery of the Taiwanese humpback dolphin, mortality caused by fishing gear must be reduced to less than one individual every seven years (Slooten et al. 2013).

C. Disease and Predation

The Taiwanese humpback dolphin also exhibits relatively high prevalence of diseases. A photo identification study conducted between 2006 and 2010 found that out of 97 individuals photographically examined, 36 individuals (37 %) had one or multiple skin conditions (Yang et al. 2013). Most of the individuals affected were mature and the most prevalent skin conditions were pox-like lesions, pale lesions, ulcer lesions, orange film, and nodules on the body (Yang et al. 2013). The pathogens associated with these skin conditions include viruses, bacteria, protozoan, and fungi (Van Bressem et al. 2007). For example, skin nodules were the most prevalent condition in Taiwanese humpback dolphins (>15%) (Yang et al. 2013). Skin nodules are similar to nodular skin disease found in Guiana dolphins (*Sotalia guianensis*) (Yang et al. 2013), a lobomycosis–like disease caused by the fungus *Lacazia loboi* (Van Bressem et al. 2009). On the other hand, orange film in dolphins is commonly associated with diatom overgrowth (Maldini et al. 2010), which may suggest slower skin generation or slower swimming speeds related to health problems (Yang et al. 2013). These various skin conditions are linked to several environmental factors, including water salinity, temperature, pollution, and contaminants (Wilson et al. 1999), and may indicate that the marine environment is severely degraded (Van Bressem et al. 2009). Finally, predation by sharks has been reported in some areas of the species range (Wang et al. 2007c); however, the impact on populations is unknown and is likely small.

D. Inadequacy of Existing Regulatory Mechanisms

The two existing regulatory mechanisms addressing Taiwanese humpback dolphin conservation have been in place for years without reversing the trend toward extinction.

The Taiwanese humpback dolphin is currently listed under Appendix I of CITES, which restricts trade in endangered wildlife. However, CITES has been insufficient to protect the Taiwanese humpback dolphin because the population is not threatened by trade. While this subspecies faces many threats to its survival, it is not targeted for commercial harvest and is mostly a victim of incidental bycatch.

Taiwanese conservation efforts have also failed to prevent the decline of the Taiwanese humpback dolphin. Over the past ten years, steps have been taken to better understand this dolphin population and the threats to its existence, and to incorporate relevant knowledge into Taiwanese conservation efforts (Wang et al. 2007a). However, there is no evidence that this integration of threats into the environmental impact assessment and mitigation processes has been applied in any practical sense to date, or what level of protection the population would be offered even if this integration were applied (Wang et al. 2007a). As such, this effort cannot represent sufficient protection, especially for a population facing such serious threats and at such critically low numbers.

In addition, although the petition filed in January 2008 regarding interagency action on the five threats resulted in proposed important habitat designation under Taiwan's Wildlife Protection Act, this very basic protection has been delayed. A listing abroad is projected to assist the incoming government with taking habitat protection seriously.

E. Other Natural or Manmade Factors Affecting its Continued Existence

In addition to the primary threats of habitat destruction and incidental bycatch, Taiwanese humpback dolphins are threatened by ocean warming and acidification. The synergistic effects of threats amplifying each other create stressors more severe than would be expected from the sum of the threats, to the detriment of the dolphin's continued survival and recovery.

Climate change and ocean acidification

Climate change and ocean acidification can indirectly affect humpback dolphins on the west coast of Taiwan by magnifying and worsening anthropogenic stressors. Climate change may magnify the effect of coastal pollution and erosion. Heavy precipitation on the west coast of Taiwan, which is projected for the near future due to intensify monsoon seasons (Wang et al. 2015a), will increase runoff of contaminated water and nutrients from landslides and river basins into coastal environments (Shou and Yang 2015).Increasing sedimentation rates and river discharge due to erosion occurred before during the Early-Mid Holocene, a period of maximum summer monsoons affecting southwestern Taiwan (Huang et al. 2016a). Near-future climate change is forecast to be similar to Early-Mid Holocene conditions, with the consequence that the flux of silt and sediments from Taiwanese rivers toward the Taiwan Strait, unchanged for thousands of years (Liu et al. 2008), would increase. The consequences for coastal and estuarine ecosystems—and humpback dolphins—are unknown but are likely to be negative due to increased contaminant concentrations and changing productivity and prey distribution.

Warming waters and changes in the Pacific Decadal Oscillation and Oceanic Niño Index, which directly drive weather patterns in the Taiwan Strait (Belkin and Lee 2014), can change the distribution and abundance of humpback dolphin prey. Fish species composition has changed in coastal areas of northwest Taiwan during periods of climate change (Lu and Lee 2014). In fact, climate variability has had a long-term substantial impact on grey mullet (*Mugil cephalus*) distribution, shifting one of the most important commercial fisheries in the Taiwan Strait to the north (Lan *et al.* 2014) and affecting the availability of important prey for humpback dolphins (Liu et al. 2015a). As humpback dolphins follow prey movements during wet and dry seasons (Chen et al. 2010; Lin et al. 2014; Dares et al. 2014), changes in prey distribution in response to warming seas and changes in river discharge may affect the geographical range of the species, challenging any potential conservation measures.

Ocean acidification may intensify the effects of other stressors such as noise pollution and contaminants, and change primary production affecting prey availability for Taiwanese humpback dolphins. Average global pH levels have decreased by 0.1 units (Doney et al. 2009), with observed impacts on marine ecosystems (Orr et al. 2005; Hoegh-Guldberg et al. 2007; Fabry et al. 2008; Pandolfi et al. 2011). Although ocean acidification has not been monitored along the west coast of Taiwan, it is likely that pH levels substantially fluctuate due to daily and seasonal variability in river outflow and coastal upwelling (Chen et al. 2004). Moreover, coastal waters can experience extreme fluctuations in acidity due to the input from anthropogenic sources, eutrophication, hypoxia, and daily metabolic variations, which magnify the effects of ocean acidification in shallow coastal waters (Feely et al. 2010; Cai et al. 2011; Melzner et al. 2012). Ocean acidification can also magnify noise pollution, as sound tends to travel further in acidic waters (Hester et al. 2008). Thus, humpback dolphin hearing capabilities may be more compromised in more acidic waters. Acidic waters can also increase the toxicity levels of harmful algae blooms (Fu et al. 2012; Tatters et al. 2012, 2013), which have been connected to cetacean unusual mass mortalities in other regions (Geraci et al. 1989; de la Riva et al. 2009; Fire et al. 2011). Harmful algal blooms may be common seasonally along the west coast of Taiwan (Dai et al. 2013), as is already the case in the East China Sea, fueled by warming waters and nutrients from river runoffs during wet seasons (Lou and Hu 2014; Li et al. 2014).

Toxins from harmful algal blooms can travel through the food web and accumulate in tissue, eventually causing stranding and death in dolphins (Geraci et al. 1989; Fire et al. 2011, 2015). The potential impacts of ocean acidification on humpback dolphins must be further explored and considered.

Synergistic or cumulative effects of multiple stressors

The stressors described above for the Taiwanese humpback dolphin affect the subspecies simultaneously across a limited geographical range. The synergistic or cumulative effects of multiple stressors can adversely affect the Taiwanese dolphin population (Wang et al. 2016a). Thus, the main threats for the subspecies must be analyzed in combination to determine possible interactions among stressors that disproportionally affect individuals and reduce population viability and recovery potential. For example, high or prolonged exposure to chemical toxins, biological pollution, or stress from noise pollution can compromise dolphins' immune systems, reducing their capacity to recover from wounds from boat encounters or fishing gear entanglements. Similarly, in contaminated waters, wounds and cuts may be more vulnerable to infection and healing time may increase considerably. Multiple stressors ought to be reduced or eliminated in those areas that are important for the species for foraging and reproduction. Ultimately, the designation of essential habitat as a marine protected area will be necessary to prevent the extinction of the subspecies (Liu et al. 2015b).

The Taiwanese humpback dolphin is already at risk because of the relatively low number of individuals remaining. The species complex tends to have low fecundity (ref), rendering them more vulnerable to synergistic impacts of multiple threats. The Taiwanese humpback dolphin population, as noted above, is highly specialized in its ecological niche. This, in combination with its low population level, increases its extinction risk. Indeed, rarity alone leads to higher extinction risk, while ecological specialization decreases a population's ability to cope with threats by shifting range or changing diet (Davies et al. 2004). Environmental threats especially predispose large-bodied, long-generation, and low-fecundity species, such as the Taiwanese humpback dolphin, to population declines, as they cannot recover quickly from depletion (Johnson 2002; Brook and Bowman 2005; Cardillo et al. 2005).

Since this population faces a multitude of threats, it is likely that the synergistic effects of those threats will cause extinction pressure more severe than their additive impact alone. As such, the synergistic effects of the aforementioned threats represent yet another reason why the Taiwanese humpback dolphin should be given ESA protections.

Part III. Requested Designation

Petitioners hereby request that the National Marine Fisheries Service list the Taiwanese humpback dolphin (*Sousa chinensis taiwanensis*) as "endangered" or "threatened" under the

Endangered Species Act. Listing is warranted, given the formidable threats facing the subspecies, which is already small and in decline. The Taiwanese humpback dolphin is threatened by at least four listing factors under the ESA: the present destruction or modification of habitat due to pollution and development; overutilization via bycatch; inadequate existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. The loss of this population would represent a significant loss of biodiversity.

Federal listing of this species under the ESA would help ensure prohibition on import, export, or possession of this species by U.S. individuals and corporations. Listing this subspecies could also increase awareness, incentivize research, or provide financial, technical and law enforcement assistance for international and local conservation efforts under Section 8. The protections provided by the ESA can help reverse population declines in Taiwanese humpback dolphins and support recovery of the species.

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