NOAA Technical Memorandum NMFS-AFSC-448

Identification of Demographically Independent Populations Within the Currently Designated Southeast Alaska Harbor Porpoise Stock

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September 2022

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
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Identification of Demographically Independent Populations Within the Currently Designated Southeast Alaska Harbor Porpoise Stock

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EXECUTIVE SUMMARY

Based on differences of trends in abundance and apparent discontinuous distribution of harbor porpoise (*Phocoena phocoena*) within Southeast Alaska inland waters, Dahlheim et al. (2015) suggested population substructure within the currently designated Southeast Alaska stock.

Population genetic analyses were conducted for harbor porpoise throughout Alaska, with a particular emphasis on porpoise in the Southeast Alaska stock. Using multiple genetic markers and sequence data generated from both tissue samples and environmental DNA (eDNA) samples, we identified significant genetic differentiation consistent with population genetic boundaries between different regions within the Southeast Alaska stock.

On the basis of population genetic data, trends in abundance, and distribution data, two demographically independent populations (DIPs) within the currently designated Southeast Alaska stock of harbor porpoise were identified: the Northern Southeast Alaska Inland Waters DIP and the Southern Southeast Alaska Inland Waters DIP. Based on what is known about harbor porpoise stock structure in other areas, it is likely that multiple DIPs exist within the remaining harbor porpoise in the stock, including porpoise in Yakutat Bay, and along the outer coast and offshore waters. However, current data and analyses are insufficient to delineate units within that area at this time. Until additional information is available, we propose grouping these remaining harbor porpoise into a single unit called the Yakutat/Southeast Alaska Offshore Waters unit.

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INTRODUCTION

Three stocks of harbor porpoise in Alaska are currently designated under the Marine Mammal Protection Act (MMPA): 1) the Southeast Alaska stock, occurring from Dixon Entrance to Cape Suckling, including offshore, coastal, and inland waters; 2) the Gulf of Alaska stock, occurring from Cape Suckling to Unimak Pass; and 3) the Bering Sea stock, occurring throughout the Aleutian Islands and all waters west and north of Unimak Pass (Fig. 1; Muto et al. 2021). The boundaries of these stocks, unchanged since they were first delineated in 1997, were identified primarily based on geography or perceived areas of low porpoise density, because small sample sizes precluded evaluation of genetic stock structure in Alaska.

Since 2008, the Alaska harbor porpoise stock assessment reports (SARs) have noted that in some areas outside of Alaska (Chivers et al. 2002), studies of harbor porpoise distribution indicate that stock structure is likely more finely scaled than is reflected in the current Alaska SARs, and based on comparisons with other regions, NMFS considers it likely that several regional and sub-regional populations exist. Given these indications, NMFS has continued to examine population structure and connectivity of harbor porpoise in inland, coastal, and offshore waters of Alaska, with a particular focus on Southeast Alaska. Dahlheim et al. (2015) proposed that harbor porpoise in two areas of higher concentration, notably areas around Glacier Bay, Icy Strait, and Cross Sound (northern Southeast Alaska inland waters) and near Zarembo Island and Wrangell (southern Southeast Alaska inland waters), potentially represented different populations based on contrasting trends in abundance and a possible hiatus in distribution between these two areas.

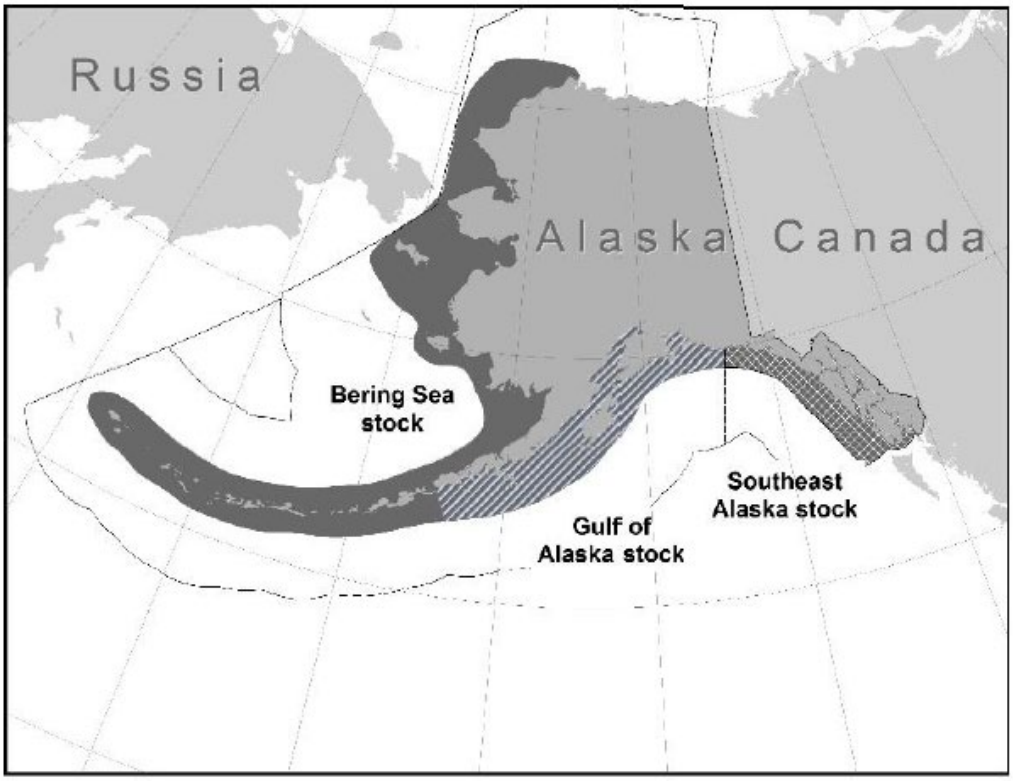

Figure 1. -- Boundaries of the Alaska harbor porpoise stocks as currently defined under the MMPA (Muto et al. 2021).

The first indication of divergent populations of harbor porpoise between these two regions were provided by preliminary results from an analysis of mitochondrial DNA (mtDNA) sequences generated from environmental DNA (eDNA) samples (Parsons et al. 2018). A more comprehensive study, which included tissue samples collected from stranded and bycaught harbor porpoise, additional eDNA samples, and a broader geographic sampling, provided more robust results and confirmed mtDNA-based genetic differentiation between porpoise in Wrangell and Zarembo Island and those around Frederick Sound, Glacier Bay, and Icy Strait (Parsons et al. in prep.).

In this report, we considered the new analyses and other available evidence to evaluate population structure within the currently designated Southeast Alaska stock of harbor porpoise, leading to the identification of the Northern Southeast Alaska Inland Waters demographically independent populations (DIPs), the Southern Southeast Alaska Inland Waters DIP, and the Yakutat/Southeast Alaska Offshore Waters unit.

EVALUATION OF DEMOGRAPHIC INDEPENDENCE

The Guidelines for Preparing Stock Assessment Reports Pursuant to the 1994 Amendments to the MMPA (NMFS 2016) specify that a "population stock" or "stock" is a management unit that identifies a demographically independent population (DIP), where "demographic independence" means:

> *…the population dynamics of the affected group is more a consequence of births and deaths within the group (internal dynamics) rather than immigration or emigration (external dynamics). Thus, the exchange of individuals between population stocks is not great enough to prevent the depletion of one of the populations as a result of increased mortality or lower birth rates*.

The NMFS policy on reviewing and designating stocks and issuing SARs under the MMPA (NMFS 2019) suggests high priority should be given to reviewing stock structure for those stocks meeting certain conditions. The Southeast Alaska harbor porpoise stock meets the two following conditions and is thus considered a high priority for review: 1) the stock is believed to comprise multiple DIPs, and 2) takes of the stock, mainly incidental to commercial fisheries operations, are likely to disproportionally affect a particular DIP (Muto et al. 2021).

The DIP Delineation Handbook (Martien et al. 2019), developed to provide guidance to those tasked with delineating DIPs as part of the process for designating stocks under the MMPA, reviewed the potential lines of evidence (LoEs) according to their strength in delineating DIPs. The LoEs and associated strengths are outlined below and also include the relevance to harbor porpoise:

- **Strong:** This LoE can be used alone to delineate DIPs. For harbor porpoise, strong LoEs include morphology, genetics, and movement.
- **Moderate**: This LoE must be combined with at least one other LoE in order to delineate a DIP. For harbor porpoise, moderate LoEs include distributional hiatus or low-density areas, contaminants, and physiographic or oceanographic differences in habitat.
- **Weak**: This LoE must be combined with multiple additional LoEs in order to delineate a DIP. For harbor porpoise, weak LoEs include stable isotopes and fatty acids, life history, and trends in abundance.
- **Not informative**: This LoE is not informative or potentially misleading. For harbor porpoise, a not informative LoE is acoustics.

- **Unknown**: Utility of this LoE for this species is unknown, meaning that there are no data for this species or a similar species from which generalizations can be made. For harbor porpoise, association data is an unknown LoE.

These rankings assume that there are robust data showing a difference between two groups in that LoE, where "robust data" means that there has been appropriate evaluation of all relevant factors (e.g., age and sex difference, sample size, analytical methods, etc.) such that the observed difference represents real biological patterns, not a sampling or analytical artifact.

Below, we summarize the data available for the Southeast Alaska harbor porpoise stock. We use data from distribution, trends in abundance, and genetics to consider both demographic independence and boundary placement.

Distributional Hiatus

The distribution of harbor porpoise in Southeast Alaska was determined from aerial and ship surveys conducted during the summer season (Dahlheim et al. 2000, 2009, 2015; Hobbs and Waite 2010) as illustrated in Figure 2. Aerial surveys were conducted in coastal areas of the Gulf of Alaska in 1993 (Dahlheim et al. 2000) and in coastal areas and inland waters in 1997 (Hobbs and Waite 2010). Ship surveys were conducted in inland waters in 1991-1993, 2006-2007 and 2010-2012 (Dahlheim et al. 2009, 2015). The species occurs in coastal/offshore waters from Cape Suckling to Dixon Entrance and in inside waters of Southeast Alaska. Possible gaps in distribution in coastal waters occur east of Cape Suckling and off Cross Sound, though survey effort was relatively limited near the latter. Harbor porpoise also occur in relatively high densities in Icy Bay and Yakutat Bay. They are found in most areas in inland waters, but density is greater near northern Southeast Alaska inland waters (Cross Sound, Icy Strait, and Glacier Bay), and southern Southeast Alaska inland waters near Wrangell and Zarembo Island. Low density areas include southern Chatham Strait and southern Clarence Strait. An area of potentially discontinuous distribution occurs near Kuiu, Kupreanof, and Mitkof islands, which may represent a geographic barrier between the northern and the southern areas of Southeast Alaska inland waters. Despite some survey effort in recent years, no harbor porpoise have been observed in the channels connecting these two areas, notably Dry Strait, Wrangell Narrows, and Keku Strait (see section on Boundary Placement below).

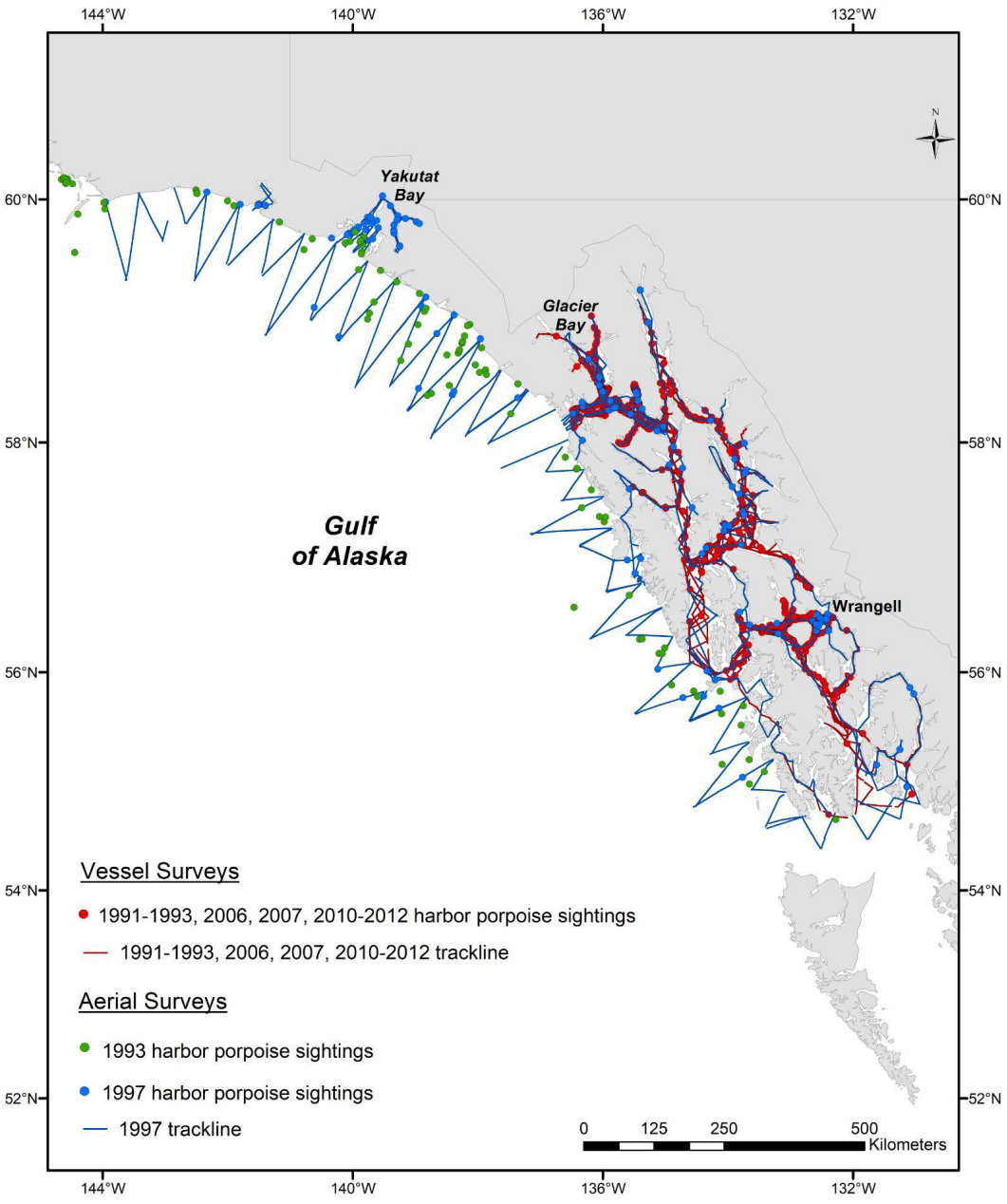

Figure 2. -- Summer distribution of harbor porpoise sightings and trackline effort during ship-based and aerial surveys in Southeast Alaska inland and Gulf of Alaska coastal waters (trackline is not shown for the 1993 aerial survey, which only sampled coastal waters).

Trends in Abundance

Trends in abundance have only been computed for high-density areas in Southeast Alaska inland waters (Dahlheim et al. 2015) from ship-board line transect surveys conducted in the summers of 1991-1993, 2006-2007 and 2010-2012 (Fig. 3). In Glacier Bay, Icy Strait, and Cross Sound (northern Southeast Alaska inland waters), the density of harbor porpoise was relatively stable over the study period. In contrast, near Wrangell and Zarembo Island, a decline was observed between the early 1990s and the mid-2000s, followed by an increase from the mid-2000s and the early 2010s. The overall trend between 1991 and 2010 implied a significant decline of 2-4% per year in harbor porpoise abundance within Southeast Alaska inland waters (Zerbini et al. 2011), but that decline was no longer significant when data from 2011 and 2012 were included.

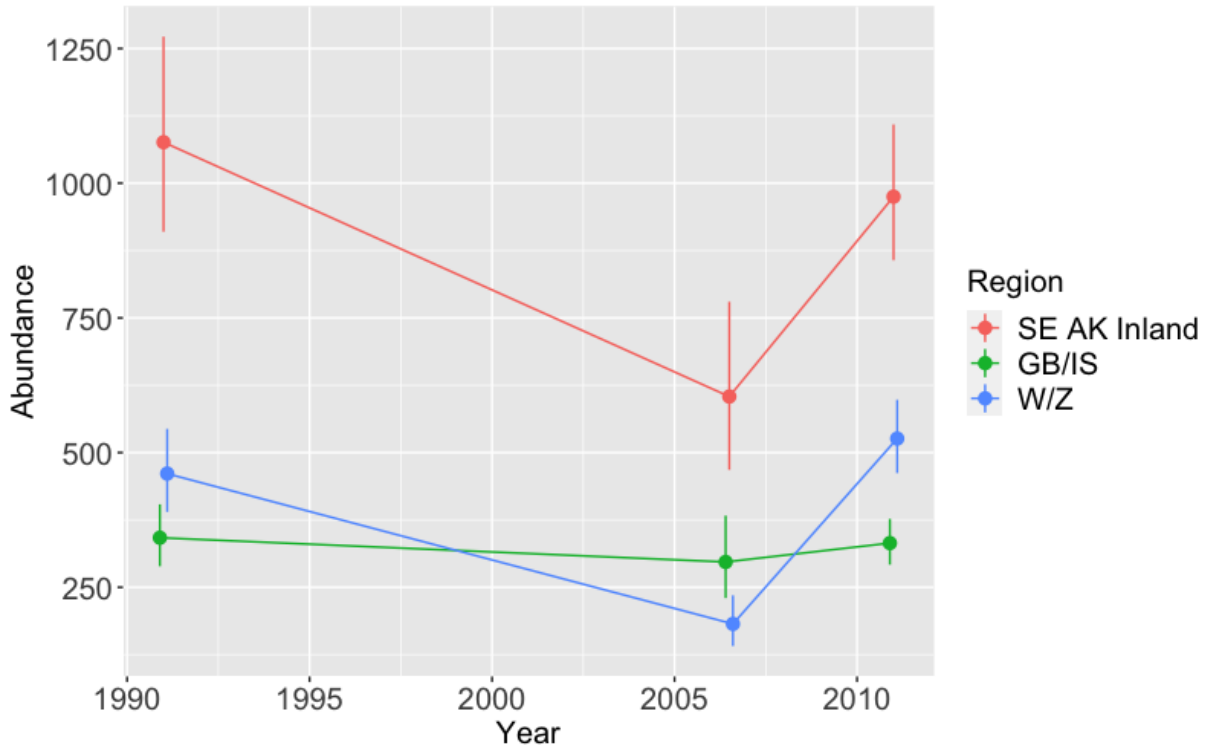

Figure 3. -- Estimates of trends in abundance of harbor porpoise for Southeast Alaska inland waters as a whole (SE AK Inland, red) and for two regions within the inland waters: Glacier Bay/Icy Strait (GB/IS, green), and the region around Wrangell and Zarembo Island (W/Z, blue) (Dahlheim et al. 2015). Dots represent point estimates and vertical lines represent 95% confidence intervals.

Genetics

Genetic data for harbor porpoise from the eastern Gulf of Alaska were generated as part of a larger study examining the population genetic structure of harbor porpoise throughout Alaska waters (Parsons et al. in prep.). Regions in Southeast Alaska were represented by both tissue samples from stranded and incidentally captured porpoise (n = 20), and surface seawater eDNA samples (n = 164) collected in the presence of harbor porpoise, to assess genetic structure of Southeast Alaska harbor porpoise (Parsons et al. 2018, in prep.). A spatially hierarchical approach was used to characterize genetic diversity and differentiation among harbor porpoise within the currently recognized Southeast Alaska stock using both mitochondrial DNA (mtDNA) sequence data and single nucleotide polymorphism (SNP) genotypes generated using a GTseq approach (Fig. 4). Sample sizes varied according to both geographic region (northern Southeast Alaska inland waters, southern Southeast Alaska inland waters, and Yakutat) and genetic marker (Table 1). Tissue samples were used to generate both mtDNA and SNP data. Control region sequences (379bp) were generated from eDNA samples collected in the fluke prints of surfacing harbor porpoise. Data from eDNA samples were incorporated into population genetic analyses based on the collection location and a conservative single count for each mtDNA haplotype generated per sample (Parsons et al. 2018, in prep).

Genetic diversity based on mtDNA control region haplotypes revealed higher haplotypic diversity in northern Southeast Alaska inland waters (h = 0.745, n = 71) than in southern Southeast Alaska inland waters (h = 0.676, n = 23; Fig. 5). Two of the five haplotypes represented in southern Southeast Alaska inland waters were unique to this region. Yakutat was represented by a small sample (n=5), and all individuals shared a common haplotype that was common in northern Southeast Alaska inland waters samples. Significant genetic divergence among regions within the currently recognized Southeast Alaska stock was supported by both F_{ST} and Φ_{ST} metrics for all pairwise comparisons (Table 1). A lack of significant genetic divergence among regions based on nuclear SNP data may reflect a lack of power resulting from small sample sizes, or patterns of male-mediated gene flow (Table 1). However, mean observed pairwise genetic relatedness within each region was found to be significantly higher than the mean expected relatedness (1,000 random permutations of the data) within both northern Southeast Alaska inland waters ($p < 0.001$) and Yakutat ($p < 0.038$), suggesting some degree of natal philopatry to these regions.

Table 1. -- Pairwise genetic divergence among *a priori* strata for both F_{ST} (SNP data – lower triangle) and $F_{ST}|\Phi_{ST}$ (mtDNA haplotypes – upper triangle). Sample size indicated for each region for nuclear SNPs (left) and mtDNA haplotypes (top). Significance was assessed via 1,000 bootstraps per comparison across loci in *diveRsity* (SNP data, (Keenan et al. 2013) and *StrataG* (mtDNA haplotypes, (Archer et al. 2017)); bolded entries are significant ($p < 0.05$).

	Northern Southeast Alaska Inland Waters (71)	Southern Southeast Alaska Inland Waters (23)	Yakutat (5)
Northern Southeast Alaska Inland Waters (15)	--------	**0.1122 | 0.1575**	**0.3869 | 0.5583**
Southern Southeast Alaska Inland Waters (2)	-0.0014	--------	**0.5149 | 0.7325**
Yakutat (3)	0.0040	0.0099	--------

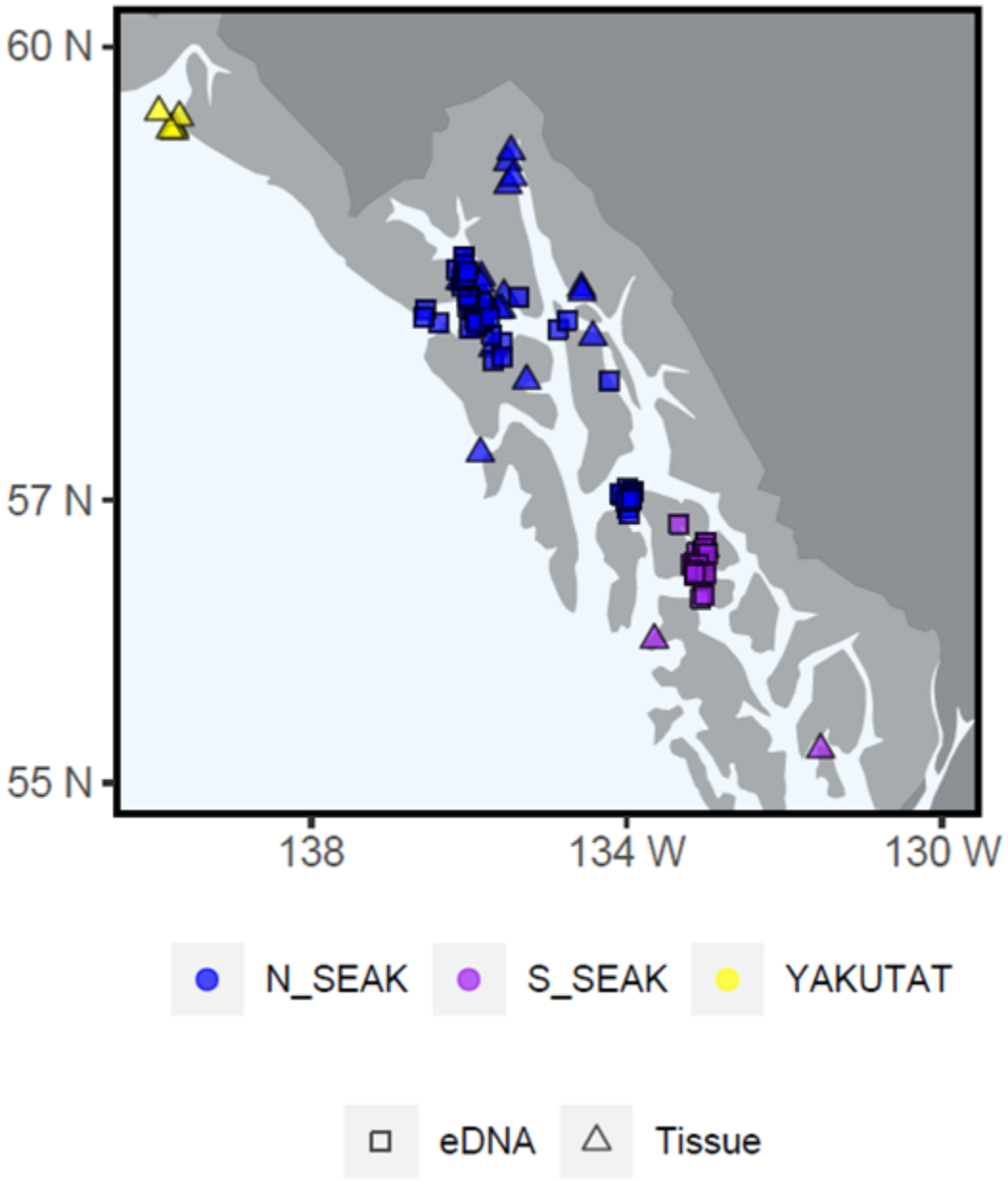

Figure 4. -- Harbor porpoise samples locations collected from fisheries bycatch or strandings (triangles) and eDNA samples (squares) across the three regions within the currently recognized Southeast Alaska stock: N_SEAK = northern Southeast Alaska inland waters, S_SEAK = southern Southeast Alaska inland waters, and Yakutat offshore waters.

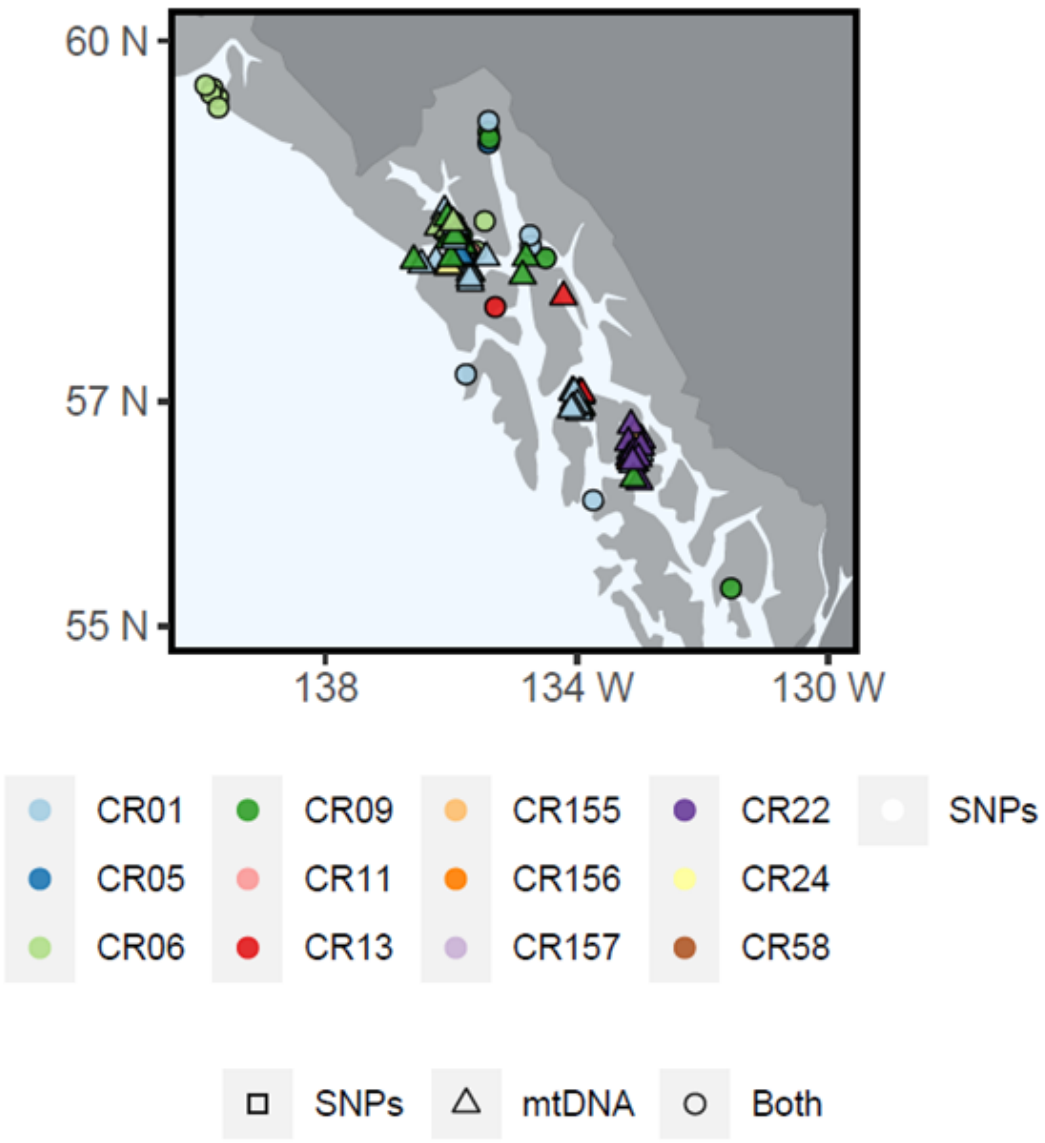

Figure 5. -- Distribution of mtDNA control region haplotypes among sampled harbor porpoise in Southeast Alaska.

DISCUSSION

Robust data from one strong LoE (genetics), one moderate LoE (distributional hiatus or low-density areas), and one weak LoE (trends in abundance) support a finding of two DIPs within the inland waters portion of the currently designated Southeast Alaska harbor porpoise stock: the Northern Southeast Alaska Inland Waters DIP and the Southern Southeast Alaska Inland Waters DIP. Based on what is known about harbor porpoise stock structure in other

areas, it is likely that multiple DIPs exist within the remaining harbor porpoise in the stock, including porpoise in Yakutat Bay and along the outer coast and offshore waters, but data and analyses are insufficient to delineate units within that area at this time. Until such data and analyses are available, we propose grouping these remaining harbor porpoise into a single unit called the Yakutat/Southeast Alaska Offshore Waters unit. The stock structure of the Yakutat/Southeast Alaska Offshore Waters unit shall be revisited as new information becomes available.

Boundary Placement

Yakutat/Southeast Alaska Offshore Waters

The existing boundary that currently separates the Southeast Alaska stock from the Gulf of Alaska stock of harbor porpoise at Cape Suckling (60° 00’ N, 144° 00’ W) remains the boundary separating the Yakutat/Southeast Alaska Offshore Waters unit from the Gulf of Alaska stock.

The proposed boundaries between the Yakutat/Southeast Alaska Offshore Waters unit, the Northern Southeast Alaska Inland Waters DIP, and the Southern Southeast Alaska Inland Waters DIP, are shown in Figure 6 and described in more detail below.

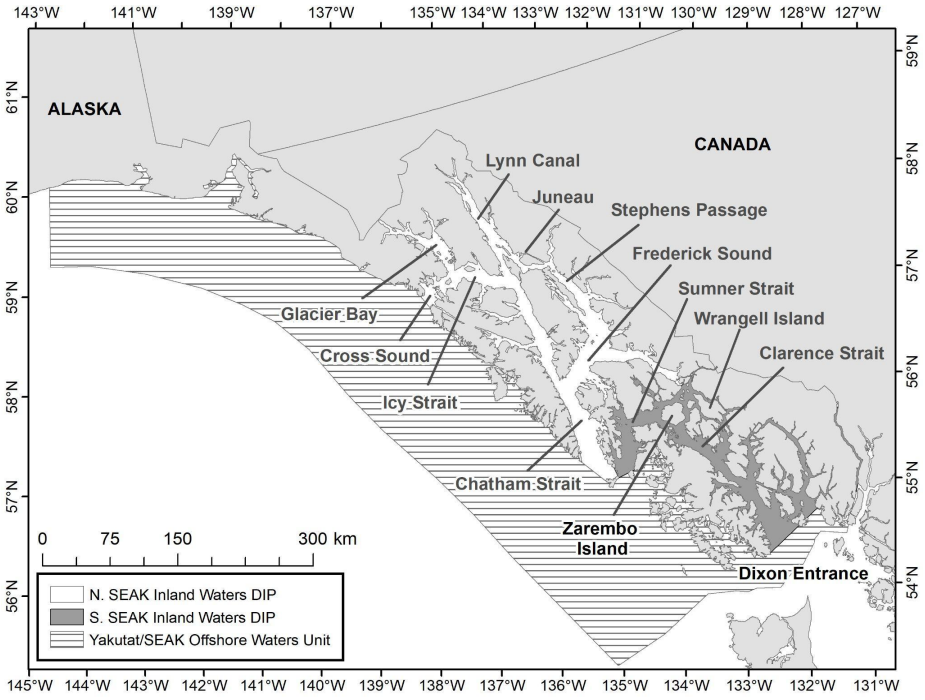

Figure 6. -- Boundaries of the two DIPs in Southeast Alaska inland waters and the Yakutat/SEAK Offshore Waters unit.

We propose to place the boundaries between the Yakutat/SEAK Offshore Waters unit and the Northern Southeast Alaska Inland Waters DIP at the entrance of Cross Sound where a gap in the occurrence of harbor porpoise appears to occur (Fig. 2) and at the entrance of lower Chatham Strait (Fig. 6). We propose to place the boundaries between the Yakutat/SEAK Offshore Waters unit and the Southern Southeast Alaska Inland Waters DIP at lower Sumner Strait, lower Clarence Strait and Revillagigedo Channel. We established these boundaries based on where information on abundance and mortality/serious injury is available. Once new information on the connectivity between harbor porpoise in Yakutat Bay, nearshore and offshore habitats in the Gulf of Alaska, and those from inland waters becomes available, a re-assessment of these boundaries is warranted.

Northern and Southern Southeast Alaska Inland Waters DIPs

There are four possible ways for harbor porpoise to move between the northern and the southern Southeast Alaska inland waters DIPs: (1) through Dry Strait, (2) through Wrangell Narrows, (3) through Keku Strait, and (4) through the passage between Cape Decision (Kuiu Island) and Coronation Island (Fig. 7). The rationale for establishing these boundaries is discussed below.

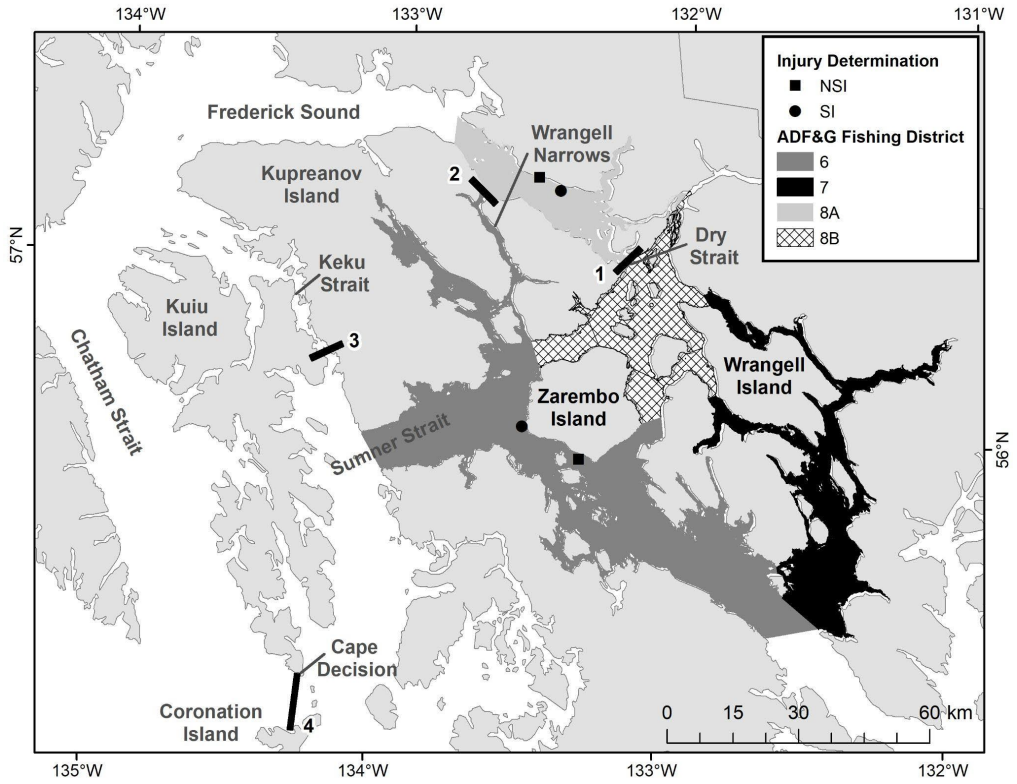

Figure 7. -- Boundaries between the northern and southern Southeast Alaska inland waters DIPs (numbers 1 to 4 refer to geographical limits between the two DIPs as referred to in the text). The map also shows the Alaska Department of Fish and Game (ADF&G) areas where the salmon driftnet gillnet fishery was monitored by the Alaska Marine Mammal Observer Program in 2012 and 2013 (Manly 2015) and locations of harbor porpoise entanglements (both serious [SI] and non-serious [NSI] injuries).

Dry Strait

Despite being a relatively wide strait (1.2 km), Dry Strait is shallow (~0.2-0.3 fathoms according to NOAA's Raster Navigational Charts, Appendix 1) and strongly influenced by the shoaling waters of the Stikine River Delta. The Stikine River Delta is continually expanding and depositing sediment on the ocean floor, creating tidal flats throughout the strait. The area is not commonly used by vessels. Vessel traffic between Wrangell and Petersburg generally uses the narrower Wrangell Narrows between Mitkof and Kupreanof islands. It is unclear whether harbor porpoise use the strait. The area has not been surveyed by vessel because of navigational constraints, but no harbor porpoise were detected within the strait during NMFS' 1997 aerial survey (Hobbs and Waite 2010).

We propose a boundary at the southern end of Dry Strait, between Mitkof Island and Dry Island (Fig. 7, line 1). This boundary likely represents a natural geographic/ecological boundary between the southeast end of Frederick Sound due to shallow waters and constant deposition of sediment and is consistent with the boundary between the Alaska Department of Fish and Game (ADF&G) Fisheries sub-areas 8A and 8B (Fig. 7).

Wrangell Narrows

We propose a boundary at the northern end of the Wrangell Narrows (Fig. 7, line 2). Harbor porpoise have only been documented in the southern end of the Narrows in the early 1990s (Dahlheim et al. 2015), but not throughout the strait. In recent surveys, porpoise have not been seen in the region (Hobbs and Waite 2010, Dahlheim et al. 2015, Zerbini et al. in prep.). The proposed boundary at the northern end of the Narrows is also consistent with the boundaries of the ADF&G fisheries districts 6 and 8A (Fig. 7).

Keku Strait

Keku Strait is a narrow channel between Kupreanov Island and Kuiu Island (Fig. 7), with complex bathymetry and shallow areas in its narrowest portion (Appendix 2). The northern end of Keku Strait (near the town of Kake) was surveyed during the 2019 harbor porpoise abundance surveys (Zerbini et al. in prep.) and eDNA samples collected there suggest that porpoise in that area are closely related to porpoise from Glacier Bay and Icy Strait (Parsons et al. in prep.) and, therefore, part of the northern Southeast Alaska inland waters DIP. It is unclear whether porpoise will cross the narrow parts of Keku Strait towards Sumner Strait (which is part of the southern Southeast Alaska inland waters DIP). The region was only surveyed once by NMFS' 1997 aerial survey and no porpoise were detected (Hobbs and Waite 2010). The geography and the bathymetry at the narrow parts could represent a geographic barrier to porpoise, separating animals from the northern and southern inland waters DIPs. Therefore, we propose to place a boundary between the two DIPs at the narrower portion of the strait (Fig. 7, line 3).

Passage between Cape Decision (Kuiu Island) and Coronation Island

The passage between Cape Decision and Coronation Island separates two relatively large straits in Southeast Alaska: lower Chatham and lower Sumner straits. Harbor porpoise have been documented in lower Sumner Strait, to the east of Cape Decision (Dahlheim et al. 2015, Zerbini et al. in prep.) and occasionally in lower Chatham Strait (Hobbs and Waite 2010). Whether harbor porpoise move between the two straits (or whether animals from offshore areas move into the straits) is presently unknown. For the time being, while new information is

not available, we propose a boundary extending from Cape Decision to Coronation Island (Fig. 7, line 4).

Management Considerations if DIPs/Unit are Designated as Separate Stocks

If the Southeast Alaska harbor porpoise stock is split into three stocks reflecting the two DIPs and one unit identified here, data are available to assess each stock. As defined, the DIPs/unit do not overlap geographically, so prorating abundance or mortality/serious injury (M/SI) estimates is not needed. Mortality and serious injury could be assigned to a stock based on location. In 2012-2013, the Alaska Marine Mammal Observer Program documented harbor porpoise interactions in the Southeast Alaska salmon drift gillnet fishery within ADF&G's commercial fisheries districts 6, 7, and 8. The observed M/SI and resulting estimates were assigned to the Southeast Alaska harbor porpoise stock in the SAR (Manly 2015, Muto et al. 2021). The boundary between the northern and southern Southeast Alaska inland waters DIPs corresponds with the boundary between ADF&G fishing district sub-areas 8A and 8B (Fig. 7). As such, the estimated M/SI for sub-area 8A could be assigned to the northern Southeast Alaska inland waters DIP, while the estimated M/SI for fishing districts 6, 7, and sub-area 8B could be assigned to the southern SEAK inland waters DIP.[1]

Abundance estimates could be generated to reflect the boundaries identified here. A recent vessel survey (2019) in inland waters of Southeast Alaska will provide estimates of abundance for the northern and southern SEAK inland waters DIPs (Zerbini et al. in prep.), from which estimates of PBR could be computed. Because there is no recent estimate of abundance for Yakutat and the Gulf of Alaska outer coast and offshore waters, calculation of PBR for the Yakutat/Southeast Alaska Offshore Waters unit may be considered undetermined.

[1] Manly (2015) estimated 23 harbor porpoise M/SI from observer data in ADF&G Districts 6, 7 and 8 for the period 2012-2013 (an average of 12 individuals per year). In developing the present report, the authors identified errors in that analysis. Two individuals caught in sub-area 8A were reported to be serious injuries (Manly 2015), but upon review of the data, it was confirmed that one of these individuals should have been classified as having a non-serious injury, as documented in Helker et al. (2015). Additionally, the porpoise captured in sub-area 6A and classified as a non-serious injury in Manly (2015) was in fact a seriously injured animal (Helker et al. 2015). The location of the corrected injury determinations is provided in Figure 7 above. These corrections require a review of the estimated bycatch in these sub-areas, and a revised estimate for each sub-area will be presented in the 2022 SAR.

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CITATIONS

Archer, F. I., P. E. Adams, and B. B. Schneiders. 2017. stratag: An r package for manipulating, summarizing and analysing population genetic data. Mol. Ecol. Res. 17:5-11.

Chivers, S. J., A. E. Dizon, P. J. Gearin, and K. M. Robertson. 2002. Small-scale population structure of eastern North Pacific harbour porpoises (*Phocoena phocoena*), indicated by molecular genetic analyses. J. Cetacean Res. Manage. 4(2):111-122.

Dahlheim, M., A. York, R. Towell, J. Waite, and J. Breiwick. 2000. Harbor porpoise (*Phocoena phocoena*) abundance in Alaska: Bristol Bay to Southeast Alaska, 1991-1993. Mar. Mamm. Sci. 16: 28-45. https://doi.org/10.1111/j.1748-7692.2000.tb00902.x

Dahlheim, M. E., P. A. White, and J. M. Waite. 2009. Cetaceans of Southeast Alaska: distribution and seasonal occurrence. J. Biogeogr. 36(3):410-426.

Dahlheim, M. E., A. N. Zerbini, J. M. Waite, and A. S. Kennedy. 2015. Temporal changes in abundance of harbor porpoise (*Phocoena phocoena*) inhabiting the inland waters of Southeast Alaska. Fish. Bull., U.S. 113(3):242-255.

Helker, V. T., B. M. Allen, and L. A. Jemison. 2015. Human-caused injury and mortality of NMFS-managed Alaska Marine Mammal stocks, 2009-2013. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-300, 94 p.

Hobbs, R. C., and J. M. Waite. 2010. Abundance of harbor porpoise (*Phocoena phocoena*) in three Alaskan regions, corrected for observer errors due to perceptions bias and species misidentification, and corrected for animals submerged from view. Fish. Bull., U.S. 108:251-267.

Keenan, K., P. McGinnity, T. F. Cross, W. W. Crozier, and P. A. Prodöhl. 2013. diveRsity: An R package for the estimation and exploration of population genetics parameters and their associated errors. Meth. Ecol. Evol. 4:782-788.

Manly, B. F. J. 2015. Incidental takes and interactions of marine mammals and birds in districts 6, 7, and 8 of the Southeast Alaska salmon drift gillnet fishery, 2012 and 2013. Final Report to NMFS Alaska Region. 52 p.

Martien, K. K., A. R. Lang, B. L. Taylor, S. E. Simmons, E. M. Oleson, P. L. Boveng, and M. B. Hanson. 2019. The DIP delineation handbook: a guide to using multiple lines of evidence to delineate demographically independent populations of marine mammals. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-622.

Muto, M. M., V. T. Helker, B. J. Delean, N. C. Young, J. C. Freed, R. P. Angliss, N. A. Friday, P. L. Boveng, J. M. Breiwick, B. M. Brost, M.F. Cameron, P. J. Clapham, J. L. Crance, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, K. T. Goetz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, K. L. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2021. Alaska marine mammal stock assessments, 2020. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-421, 398 p.

NMFS. 2016. Guidelines for preparing stock assessment reports pursuant to the 1994 amendments to the MMPA. National Marine Fisheries Service Instruction 02-204-01, 25 p.

NMFS. 2019. Reviewing and Designating Stocks and Issuing Stock Assessment Reports under the Marine Mammal Protection Act. National Marine Fisheries Service Procedure 02-204-03, 9 p.

Parsons, K. M., M. Everett, M. Dahlheim, and L. Park. 2018. Water, water everywhere: environmental DNA can unlock population structure in elusive marine species. Royal Soc. Open Sci. 5:180537. DOI: dx.doi.org/10.1098/rsos.180537.

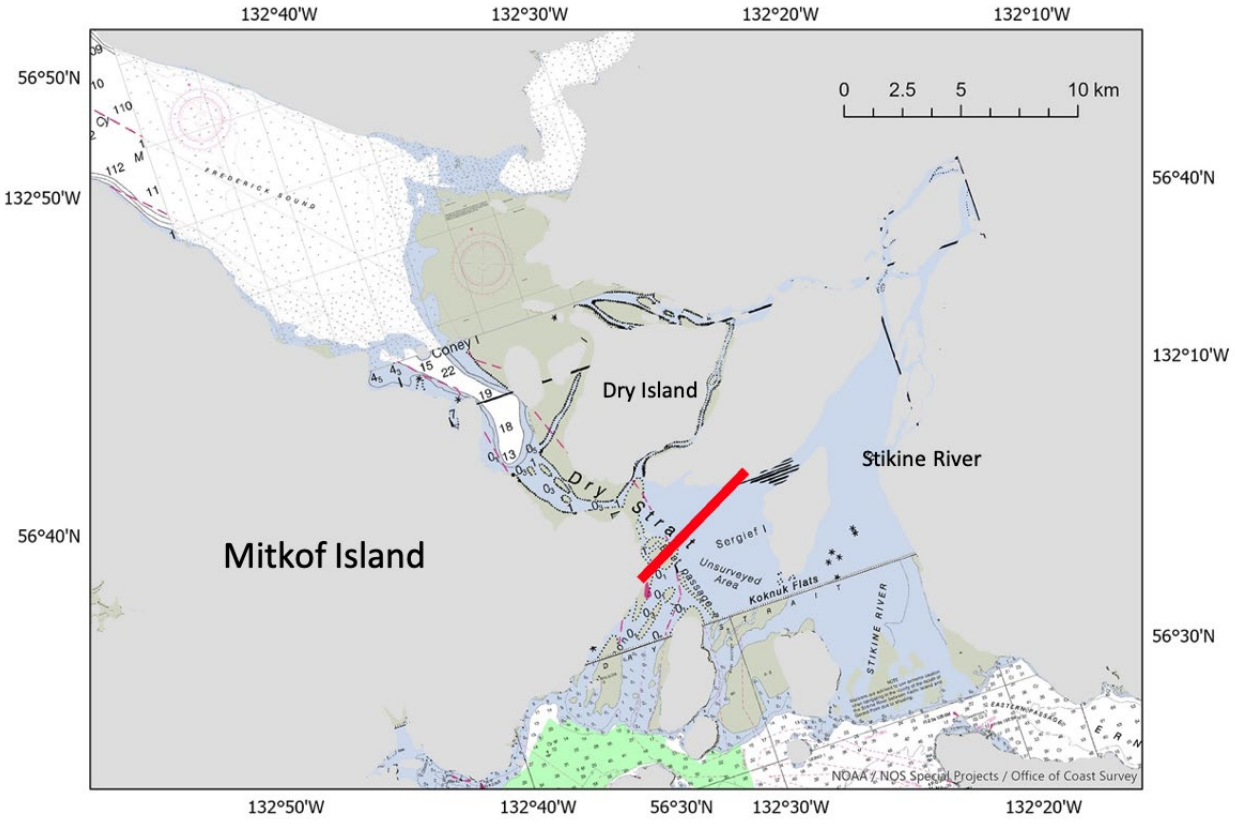
Parsons, K., S. May, M. Dahlheim, C. Gabriele, J. Straley, J. Moran, K. Goetz, A. Zerbini, Z. Gold, L. Park, and P. Morin. In prep. Supplementing population genetic analyses with eDNA samples for cryptic marine species: characterizing the population genetic structure of harbor porpoise in Alaska. Target journal: Molecular Ecology.

Zerbini, A. N., M. E. Dahlheim, J. M. Waite, A. S. Kennedy, P. R. Wade, and P. J. Clapham. 2011. Evaluation of population declines of harbor porpoise (*Phocoena phocoena*) in Southeastern Alaska inland waters, p. 23. *In* Book of Abstracts, 19th Biennial Conference on the Biology of Marine Mammals, Tampa, Florida, USA, 28 November-2 December 2011.

Zerbini, A. N., K. T. Goetz, K. Forney, and C. Boyd. In prep. Estimating abundance of an elusive cetacean in a complex environment: harbor porpoises (*Phocoena phocoena*) in inland waters of Southeast Alaska. Target journal: Frontiers in Marine Science.

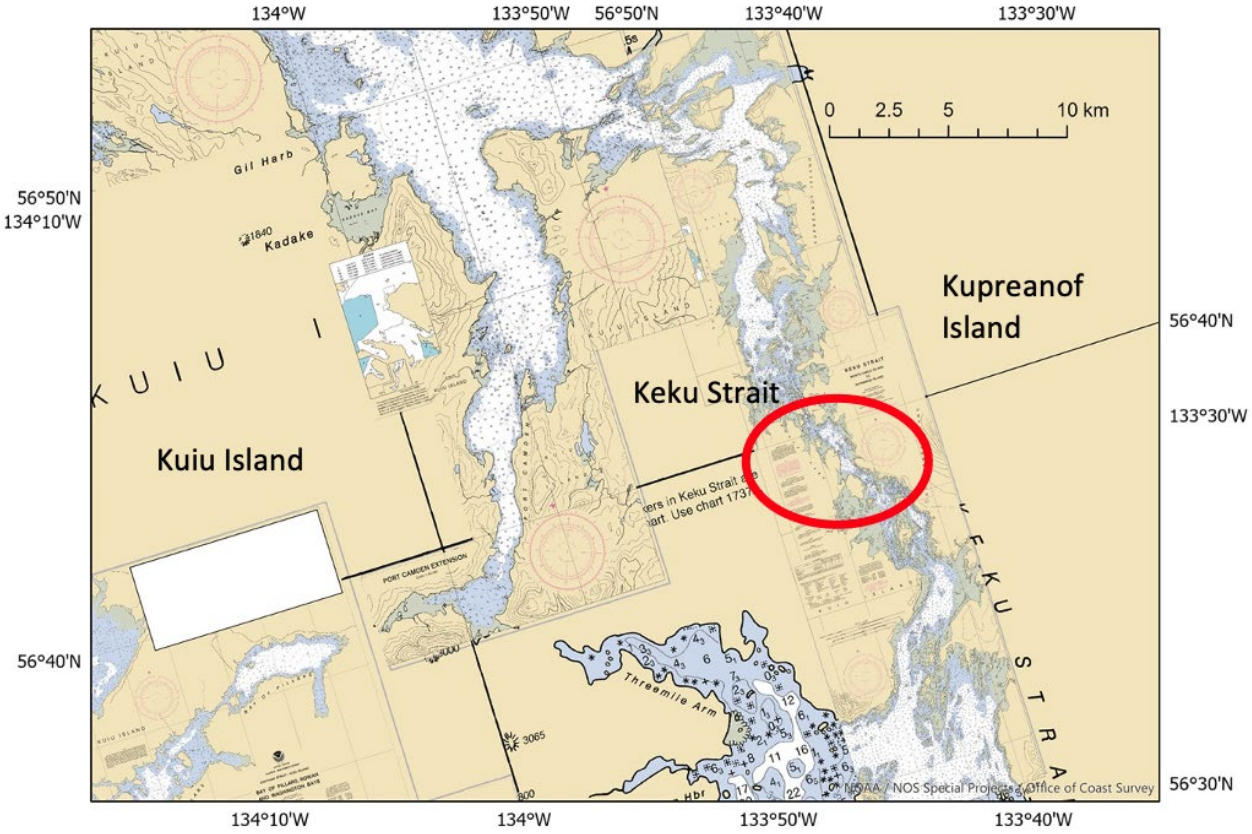
APPENDIX 1

Chart showing the geography and bathymetry of Dry Strait where a boundary between the Northern and Southern Southeast Alaska Inland Waters DIPs is proposed.



APPENDIX 2

Nautical chart showing the geography and bathymetry of Keku Strait where a boundary between the Northern and Southern Southeast Alaska Inland Waters DIPs is proposed. The red oval represents the narrowest point at the strait.



U.S. Secretary of Commerce
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