

First Observations of Harbor Porpoise Mating in Alaska & Preliminary Results from Photo ID Matching: Conservation Implications for this Elusive Species in Kachemak Bay

Josephine C. Shostak^{1,2}, Deborah Boege Tobin, PhD^{1,2,3},Serena A. Tierra^{1,2}, Teresa Becher¹, Carly Hoag^{2,3}, Bruce Schulte, PhD^{3,4}, Marc A. Webber^{1,2,3,5}

¹University of Alaska Anchorage-²Kenai Peninsula College-Kachemak Bay Campus, Homer, Alaska 99603 USA ddtobin@alaska.edu ³Kachemak Bay National Estuarine Research Reserve, Homer, Alaska 99603 USA, ⁴Western Kentucky University, Bowling Green, Kentucky 42101 USA, ⁵The Marine Mammal Center, Sausalito, California 94965 USA, *Denotes Undergraduate Student

Introduction

- Harbor porpoises (*Phocoena phocoena*) are common small cetaceans of temperate and subpolar Northern Hemisphere coastal waters with three stocks in Alaska: the Bering Sea, Gulf of AK, and Southeast AK^[1]
- They have a reputation for being elusive^[2] and surveys in Kachemak Bay (KBay), including Halibut Cove Lagoon (HCL) and Kasitsna Bay (KAS), have been limited^[3]
- Reports of aerial behavior are rare^[2]
- Observations in San Francisco Bay revealed that males have a unique, lateralized mating behavior, where they often became fully or partially airborne as a consequence of rapid sexual approaches to females (69% of approaches, $n = 85$)^[4]
- Males always attempted to copulate by positioning their ventral side on the females' left side (100% of approaches, $n = 142$), typically perpendicular to her level, surface position^[4]
- Harbor porpoises are now known to exhibit site fidelity and distinctive, stable markings which permit reliable resightings and regular behavioral observations^[5]

Methods

- Surveys conducted at multiple locations in KBay (Fig. 1) in various 6-7 m boats with outboard engines under NMFS permit #20386 (07/31/2016-07/31/2022)
- Fall 2022 surveys conducted from > 50m
- HCL surveys were only conducted at high tide due to limited access
- Photographs taken with DSLR cameras and telephoto lenses and processed with Adobe Photoshop and Lightroom
- Photo-ID focused on 8 physical features: pigmentation, scars/lesions, peduncle scars/notches, overall coloration, dorsal fin trailing edge, shape, size, and base width^[6]
- iPhone used to record videos of behavior, such as mating

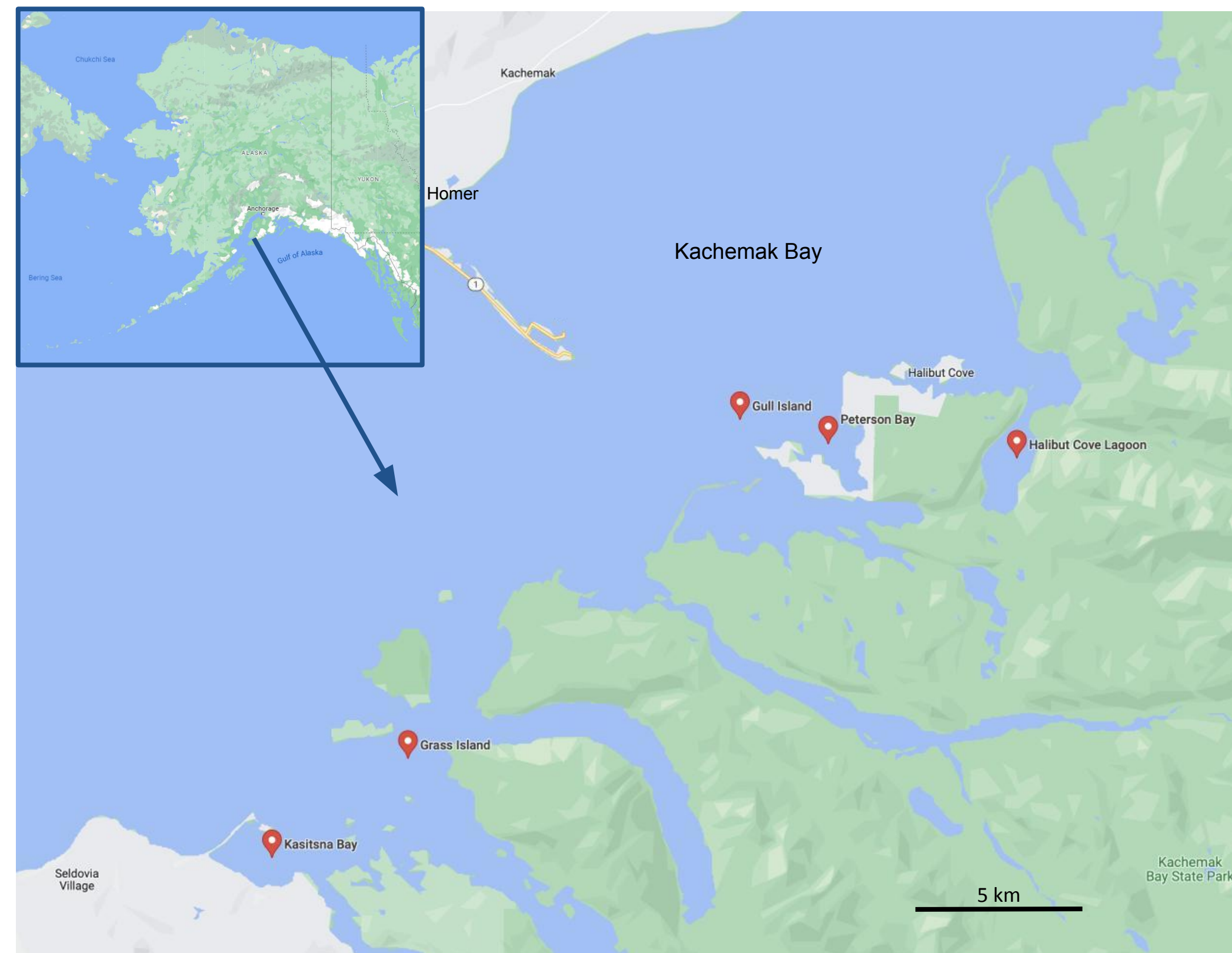


Figure 1. Central Kachemak Bay, in southcentral Alaska, with sites harbor porpoises were observed during this study marked with red points.

Acknowledgements:

Thanks to the undergraduate photographers, particularly M. Napier and J. Daniels, and yearly cohorts of UAA-KPC-KBC Semester by the Bay students who provided field assistance. We also appreciate support from Bill Keener. Funding & logistical/vessel support has been generously provided by Martha Briscoe, KPC Community-Engagement Service Learning mini-grants, NGOS, KBNERR and their staff, particularly Capt. S. Miller.

References: [1] Muto, M.M., Helker, V.T., Delean, B.J., Young, N.C., Freed, J.C., Angliss, R.P., Friday, N.A., Boveng, P.L., Breiwick, J.M., Brost, B.M., Cameron, M.F., Clapham, P.J., Crane, J.L., Dahle, S.P., Dahlheim, M.E., Fadely, B.S., Ferguson, M.C., Fritz, L.W., Goetz, K.T., ..., Zerbini, A.N. (2022). *Alaska marine mammal stock assessments, 2021* (NOAA Technical Memo NMFS-AFSC-441). U.S. Department of Commerce.[2] Jefferson, T.A., Webber, M.A., & Pitman, R.L. (2015). *Marine Mammals of the World: A Comprehensive Guide to their Identification*. Academic Press, 84–87. DOI 10.1016/C2012-0-06919-0 [3] Sheldon, K. E., Agler, B. A., Brueggeman, J. J., Cornick, L. A., Speckman, S. G., & Prevel-Ramos, A. (2014). Harbor porpoise, *Phocoena phocoena* vomerina, in Cook Inlet, Alaska. *Marine Fisheries Review*, 76(1-2): 22–50. DOI 10.7755/mfr.76.1-2.2 [4] Keener, W., Webber, M.A., Szczepaniak, I.D., Markowitz, T.M., & Orbach, D.N. (2018). The sex life of harbor porpoises (*Phocoena phocoena*): Lateralized and aerial behavior. *Aquatic Mammals*, 44(6): 620–632. DOI 10.1578/AM.44.6.2018.620 (Open Access) [5] Elliser, C.R., MacIver, K.H., & Green, M. (2018). Group characteristics, site fidelity, and photo-identification of harbor porpoises, *Phocoena phocoena*, in Burrows Pass, Fidalgo Island, Washington. *Marine Mammal Science*, 34(2): 365–384. DOI 10.1111/mms.12459 [6] Elliser, C.R., van der Linde, K., & MacIver, K. (2022). Adapting photo-identification methods to study poorly marked cetaceans: a case study for common dolphins and harbor porpoises. *Mammalian Biology*. DOI 10.1007/s42991-021-00194-3

Importance

Objectives

- Document the occurrence and social behavior of harbor porpoises in KBay
- Compile a photo-ID catalog of individuals, and a database of sightings
- Assess movements using photo-ID methodology
- Assess site fidelity in HCL and adjacent waters
- Track seasonal and year-to-year changes in occurrence, distribution, and calving
- Examine habitat use
- Compare our findings with researchers globally
- Identify conservation issues

Key Findings

- Resightings of 3 well-marked individuals (Figs. 2-4), including one match between study sites, and 2 possible resightings of poorly-marked individuals (Figs. 5 & 6)
- Resightings have shown travel distances of at least 29 km
- 35 individual harbor porpoises identified in KBay (Figs. 7 & 8A), and as part of a searchable spreadsheet (Fig. 8B)
- First 5 photo and 2 video records of lateralized and aerial mating behaviors of harbor porpoises in AK and evidence of females throwing tail flukes towards males (Fig. 9)
- Calves frequently accompanied mothers in KBay, and were present at one of the mating events documented in AK (Figs. 9D & 10), as occasionally seen in CA^[4]

Photo-ID Results

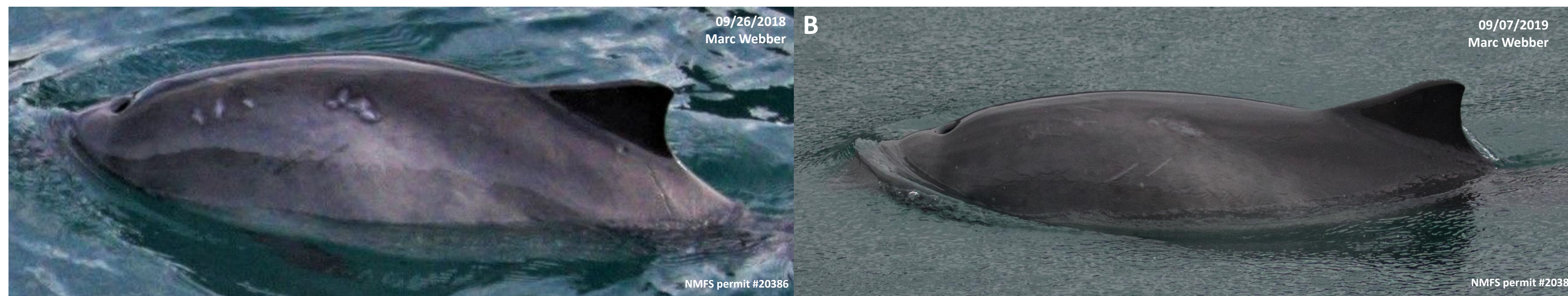


Figure 2. The first photo-ID match in KBay. A. Individual in HCL on 09/26/2018. B. The same individual in HCL almost one year later, on 09/07/2019.



Figure 3. The first photo-ID match between study locations in KBay, approximately 29 km apart. A. 22003 in KAS on 08/24/2022. B. 22004 in HCL on 09/21/2022. C. 22003 in HCL on 09/24/2022. This porpoise has been identified as a female due to the presence of a calf on this day (Fig. 2E) and during the previous sighting. D. 22003 in HCL on 09/25/2022.

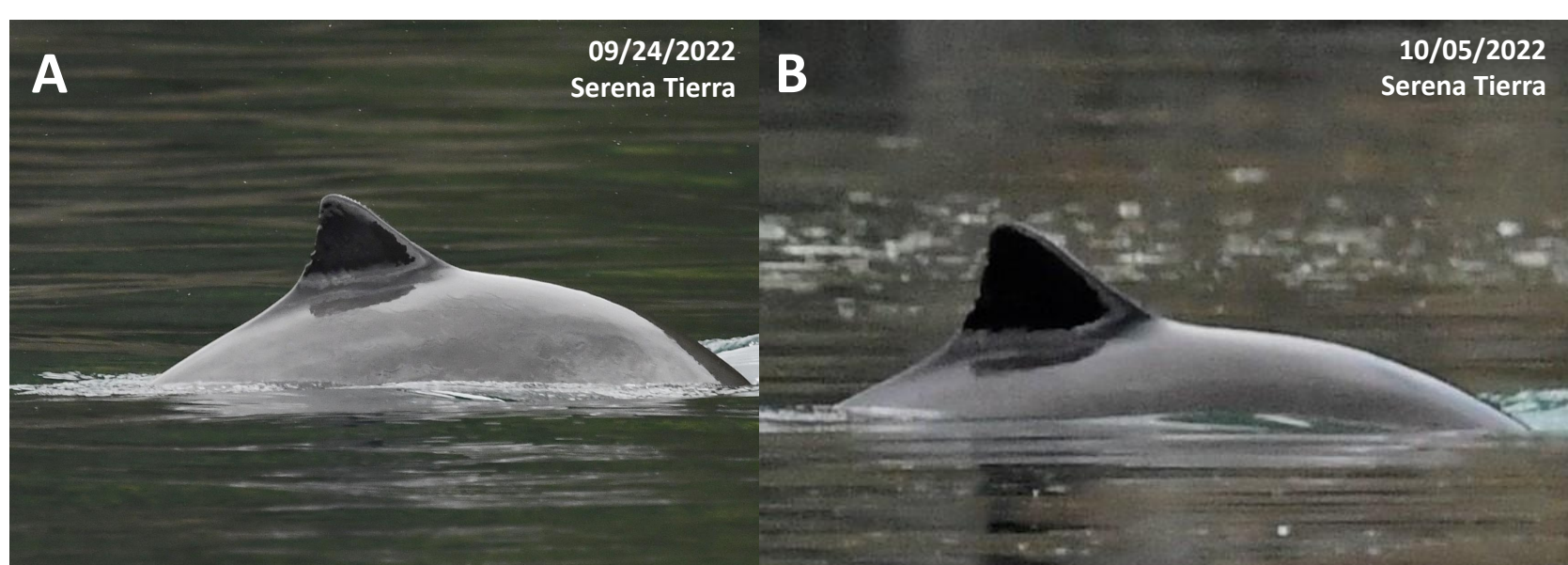


Figure 4. The third photo-ID match. A. 22021 in HCL on 09/24/2022. B. 22021 in HCL on 10/05/2022.

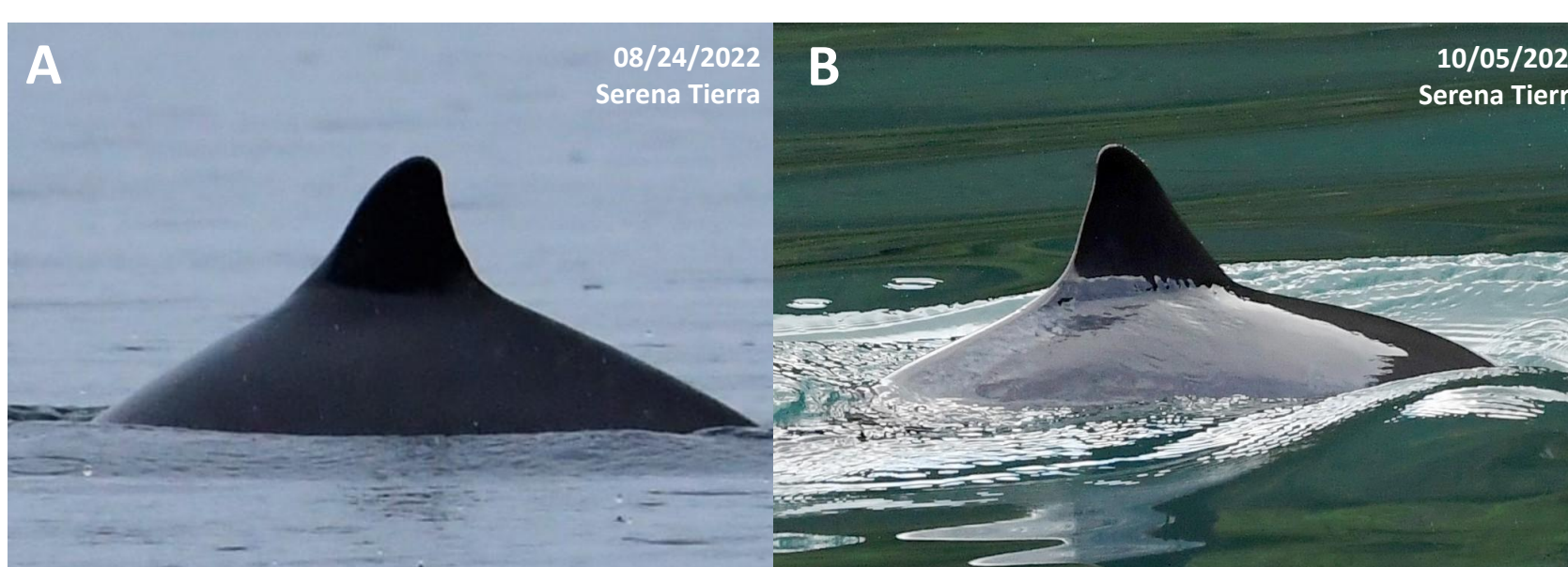


Figure 6. A second possible photo-ID match without distinctive confirmation markings. A. 22004 in KAS on 08/24/2022. B. 22035 in HCL on 10/05/2022. Note the tall, narrow dorsal fin with a hooked/rounded tip.



Figure 8. QR codes for our two-part catalog. A. The photo catalog. B. The searchable spreadsheet and sighting history of individuals.

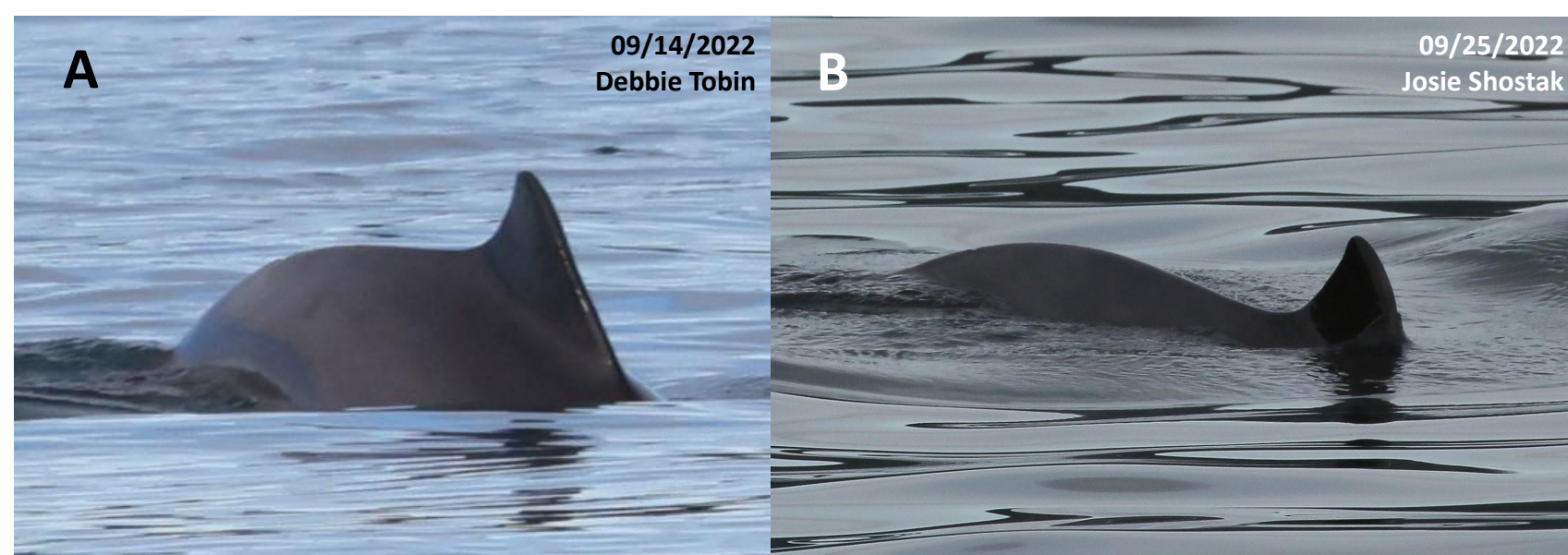
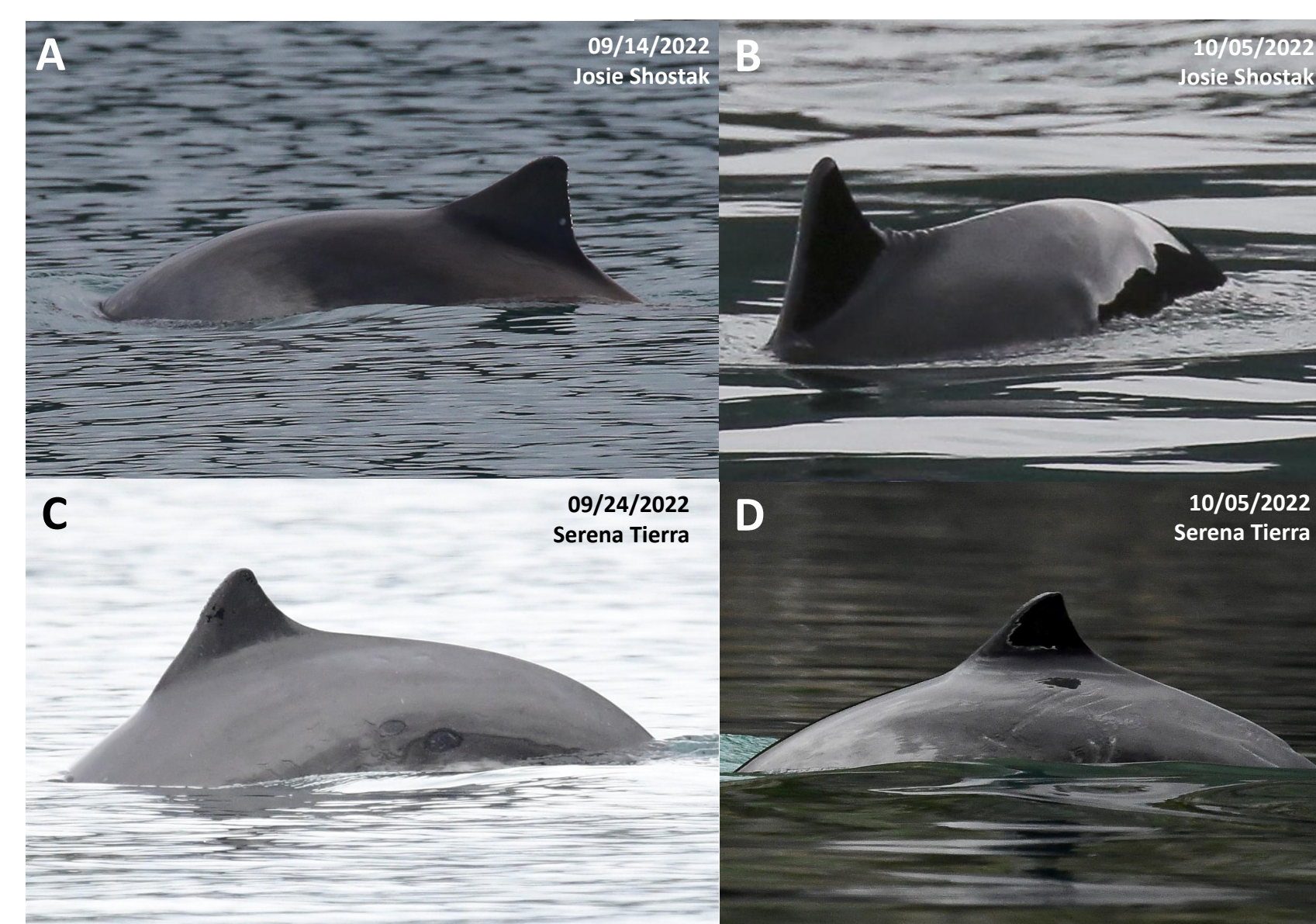


Figure 5. A possible photo-ID match without distinctive confirmation markings. A. 22012 in KAS on 09/14/2022. B. 22025 in HCL on 09/25/2022. Note the single notch on the peduncle and falcate dorsal fin.



Figures 7A-D. Harbor porpoises depicting distinctive confirmation markings.

Mating Behavior Events

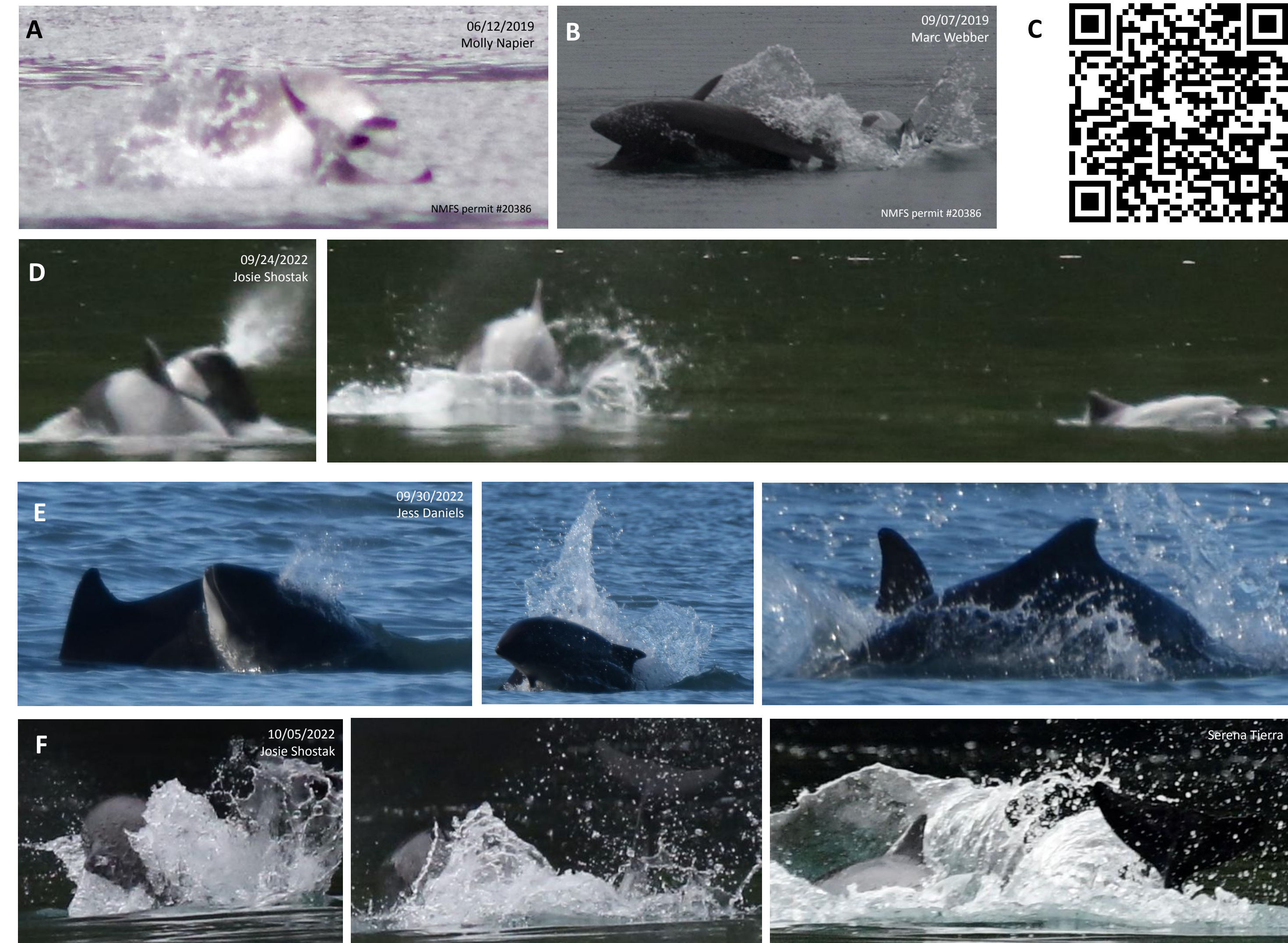


Figure 9. The first documented mating behavior events in AK. A. The first documented event in HCL. B. The second event in HCL. C. QR code for two videos recorded in KAS. D. Sequence of photos of an event in HCL where a calf was temporarily separated from its mother. E. Sequence of photos from Peterson Bay. F. Sequence of photos in HCL.

Mother-Calf Pairs



Figure 10. Photo-identified mother-calf pairs. A. 22005 and calf in KAS. B. 22008 and young calf with fetal folds in KAS. C. 22003 and calf in HCL.

Future Research

- Increase number of vessel surveys
- Vessel-based surveys will be expanded and augmented by drone surveys, in-water video, eDNA sampling, & behavioral observations at different tidal heights
- Continue to observe, document, and record individuals movements and behavior
- Additional observations of energetic surface and aerial porpoise behavior sought from harbor porpoises in AK
- Researchers should be aware that aerial behavior and rapid approaches to conspecifics may be a sign of mating activity
- Observations of such behaviors should factor into conservation decisions affecting potential breeding hotspots