Marine Physical Laboratory of the Scripps Institution of Oceanography University of California, San Diego

SCRIPPS Whale Acoustics

California Cooperative Fisheries Investigation Marine Mammal Surveys for 2016-2017

John A. Hildebrand, Amanda J. Debich, and Bruce Thayre

Marine Physical Laboratory
Scripps Institution of Oceanography
University of California San Diego
La Jolla, CA 92037

Photo credit: Z. Hildebrand NMFS Permit 17312

MPL TECHNICAL MEMORANDUM #621
February 2018

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
02-2018	Monitoring report	July 2016 - August 2017

4. TITLE AND SUBTITLE
CALIFORNIA COOPERATIVE FISHERIES INVESTIGATION MARINE MAMMAL SURVEYS FOR 2016-2017

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
John A. Hildebrand
Amanda J. Debich
Bruce Thayre

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Marine Physical Laboratory, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA

8. PERFORMING ORGANIZATION REPORT NUMBER
MPL Technical Memorandum 621

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander, U.S.Pacific Fleet, 250 Makalapa Dr. Pearl Harbor, HI

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Marine mammal surveys, initiated as part of the CalCOFI cruises in 2004, were continued during 2016-2017. Visual monitoring incorporated standard line-transect survey protocol which includes two experienced observers scanning for marine mammals during transits between CalCOFI stations.

Five baleen whale species were recorded during 2016-2017 winter and spring surveys: minke whale, blue whale, fin whale, gray whale, and humpback whale. For the combined period of 2014-2017, most baleen whale sightings occured within 200 nmi of the shoreline. A particular nearshore shift of humpback whales is seen during the spring in the 2016 and 2017 cruises. During summer cruises, there were more baleen whale sightings along the continental slope and in offshore waters. During fall cruises in 2015 and 2016, baleen whale sighting were concentrated in the Channel Islands region.

Eleven toothed whale species were detected during 2016-2017 winter and spring surveys: Baird's beaked whale, short-beaked common dolphin, long-beaked common dolphin, Risso's dolphin, northern right whale dolphin, Pacific white-sided dolphin, killer whale, Dall's porpoise, sperm whale, striped dolphin, and bottlenose dolphin. For the combined period of 2014-2017, in general, short-beaked common dolphins are detected offshore more frequently than inshore. Short-beaked common dolphin sightings during the summer and fall 2016 cruises returned to offshore areas where they were absent during 2015.

15. SUBJECT TERMS					
Monitoring, visual surveys, vessel surveys, marine mammals, baleen whales, toothed whales, dolphins, tagging, abundance, Southern California Range Complex					
16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT** UU	**18. NUMBER OF PAGES** 07	**19a. NAME OF RESPONSIBLE PERSON** Department of the Navy
a. REPORT Unclassified	**b. ABSTRACT** Unclassified	**c. THIS PAGE** Unclassified			**19b. TELEPONE NUMBER (*Include area code)*** 808-471-6391

Project Background

California Cooperative Oceanic Fisheries Investigation (CalCOFI) cruises are conducted in the southern California Bight four times per year and provide a valuable assessment of cetacean abundance, density, distribution and habitat use patterns in an area that is also the location of extensive naval training (Campbell *et al.*, 2014; Debich *et al.*, 2017). Cetacean surveys have been integrated into (CalCOFI) quarterly cruises off southern California since 2004 using both visual and acoustic detection methods (Soldevilla *et al.*, 2006). The objectives of the cetacean monitoring program are to make seasonal, annual and long-term estimates of cetacean density and abundance, to determine the temporal and spatial patterns of cetacean distribution, to provide data for habitat-based density modeling, to quantify differences in vocalizations between cetacean species, and to compare visual and acoustic survey methods and results.

The results of five marine mammal surveys are reported here. These surveys were conducted during: 10 - 27 Jul 2016; 06 - 22 Nov 2016; 05-29 Jan 2017; 28 Mar - 15 Apr 2017 and 01 Aug - 16 Aug 2017. During each of these cruises visual monitoring incorporated standard line-transect survey protocol which included two experienced observers scanning for marine mammals during transits between CalCOFI stations. Information on all cetacean sightings were logged systematically, including species, group size, reticle of cetacean position relative to the horizon, relative angle from the bow, latitude, longitude, ship's heading, behavior, environmental data and comments.

Results

The total effort for these five cruises involved 8,182 km of trackline observations which yielded 401 marine mammal sightings with 18,182 animals sighted from 17 different species of animals.

On-effort visual detections of baleen whales for 2014-2017 are shown in Figure 1. During winter and spring cruises, most baleen whale sightings occur within 200 nmi of the shoreline. A particular nearshore shift of humpback whales is seen during the spring in the 2016 and 2017 cruises. During summer there are more baleen whale sightings along the continental slope and in offshore waters. During fall cruises in 2015 and 2016 baleen whale sighting were concentrated in the Channel Islands region.

Odontocete detections for 2014-2017 are shown in Figure 2. In general, short-beaked common dolphins (*Delphinus delphis*) are detected offshore more frequently than inshore. Short-beaked common dolphin sightings during the summer and fall 2016 cruises returned to offshore areas where they were absent during 2015. A list of sightings and species abbreviations is given in Table 1.

These data will be used for specialized studies to model the spatial and temporal patterns of marine mammal occurrence, and to quantify differences in vocal behavior between species.

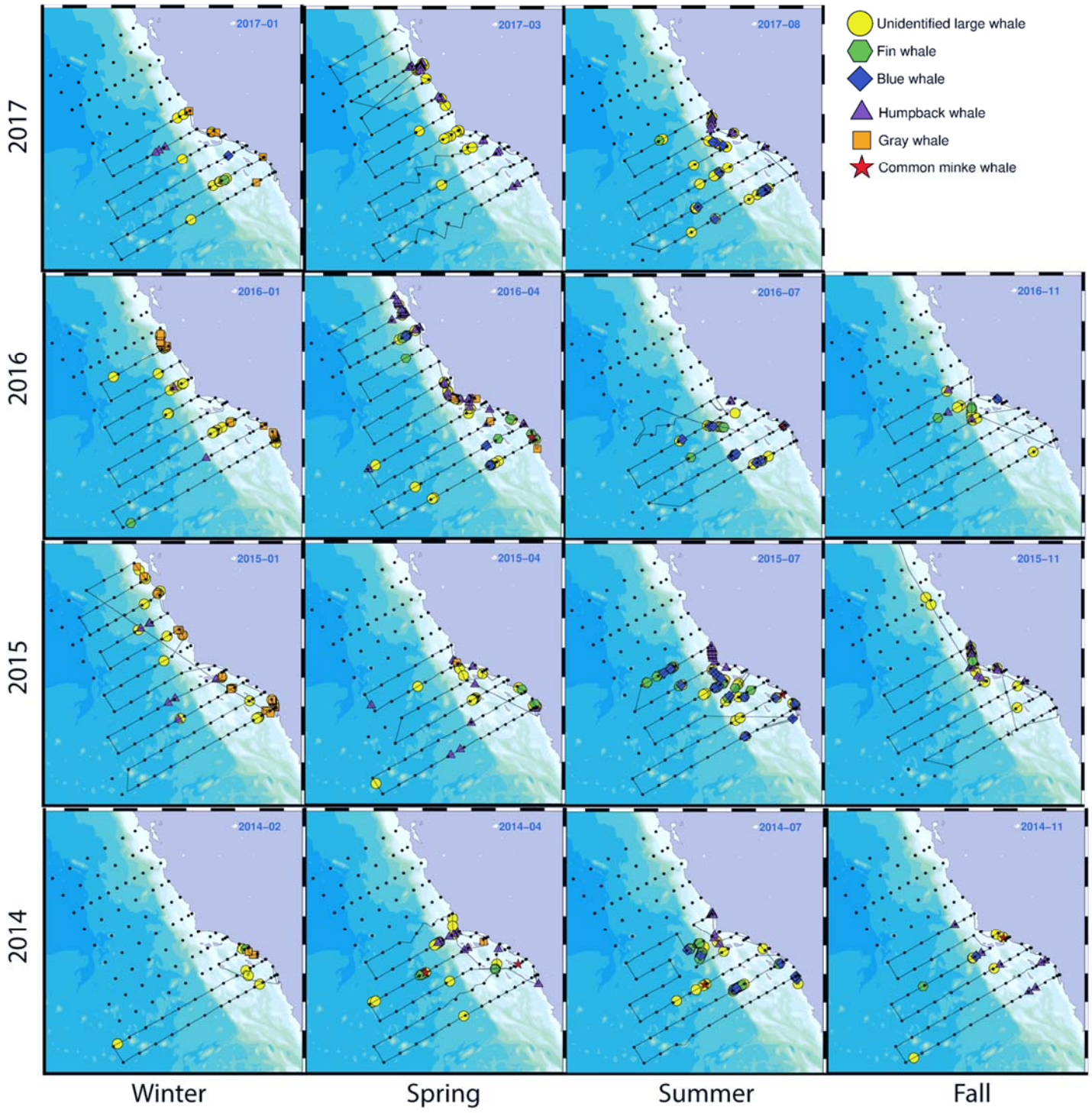

Figure 1. On-effort baleen whale sightings during CalCOFI cruises 2014-2017. CalCOFI stations are represented by black dots and the ship's trackline is represented as a solid black line between stations. Symbol shapes and colors denote different species, as per legend.

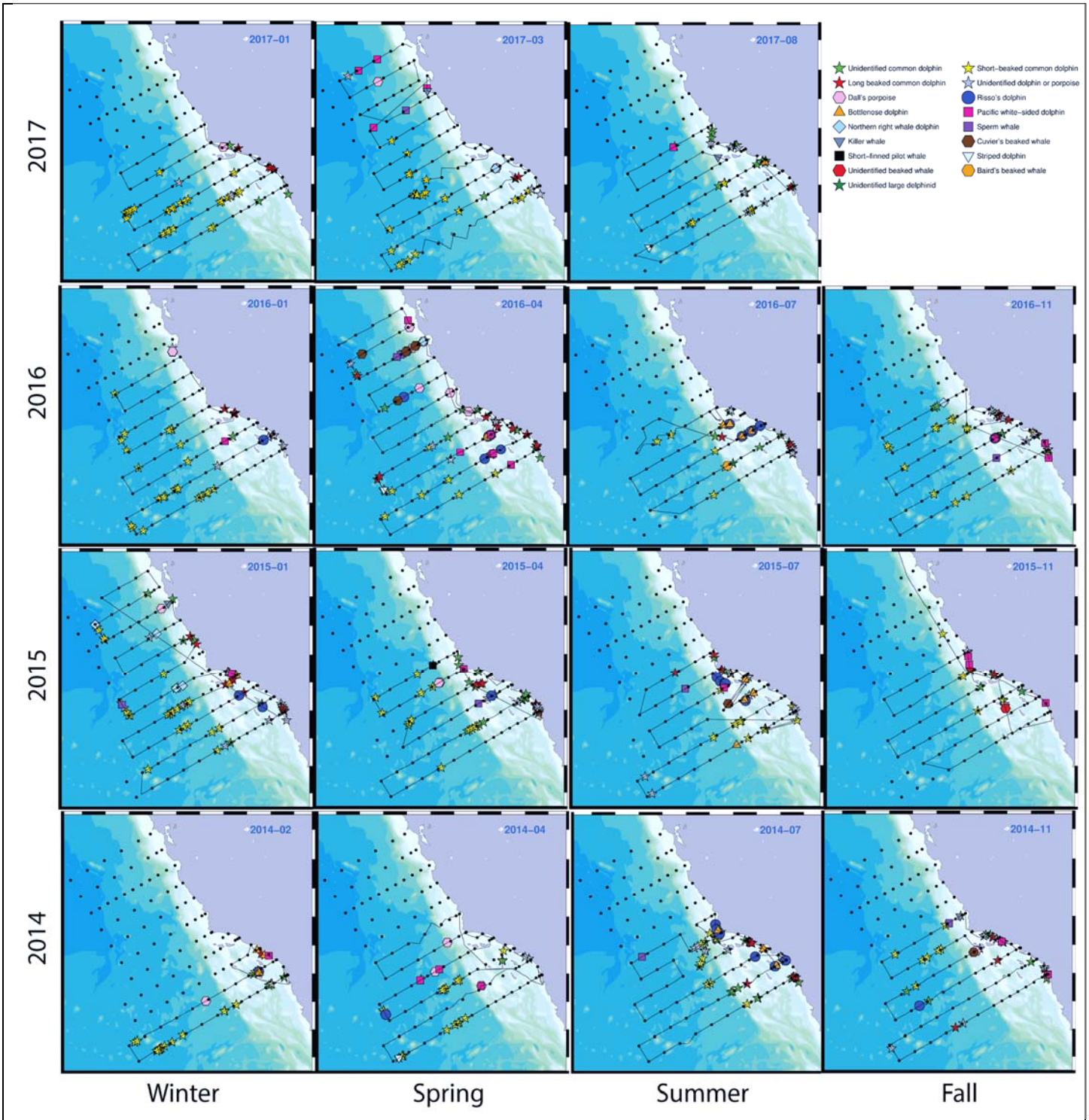

Figure 2. On-effort odontocete sightings during CalCOFI cruises 2014-2017. CalCOFI stations are represented by black dots and the ship's trackline is represented as a solid black line between stations. Symbol shapes and colors denote different species, as per legend.

References

Campbell, G., Roche, L., Whitaker, K., Vu, E., and Hildebrand, J. (**2014**). "Marine Mammal Monitoring On California Cooperative Oceanic Fisheries Investigation (Calcofi) Cruises: 2012-2013 " in *Marine Physical Laboratory Technical Memorandum 549* (Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA).

Debich, A. J., Thayre, B., and Hildebrand, J. A. (**2017**). "Marine Mammal Monitoring on California Cooperative Oceanic Fisheries Investigation (CALCOFI) Cruises: Summary of Results 2012-2016 " in *Marine Physical Laboratory Technical Memorandum 609* (Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA), p. 16.

Soldevilla, M. S., Wiggins, S. M., Calambokidis, J., Douglas, A., Oleson, E. M., and Hildebrand, J. A. (**2006**). "Marine mammal monitoring and habitat investigations during CalCOFI surveys," California Cooperative Oceanic Fisheries **47**, 79-91.

Table 1. Sighting during summer 2016 – summer 2017 CalCOFI cruises. Ns number of sightings, Ni number of individuals. Species list appended below.

	2016 July		2016 November		2017 January		2017 April		2017 August	
Species	Ns	Ni	Ns	Ni	Ns	Ni	Ns	Ni	Ns	Ni
BA	1	1	0	0	0	0	0	0	0	0
BB	1	27	0	0	0	0	0	0	0	0
BBO	0	0	0	0	0	0	0	0	0	0
BBO/BE	0	0	0	0	0	0	0	0	0	0
BE	0	0	0	0	0	0	0	0	0	0
BM	11	15	1	1	1	2	0	0	10	15
BP	5	43	3	3	1	2	0	0	4	4
DC	4	435	5	3059	4	1369	3	372	7	1570
DD	8	285	11	974	31	1730	23	1314	5	183
DSP	10	1236	10	356	3	246	12	787	20	2224
EJ	0	0	0	0	0	0	0	0	0	0
ER	0	0	0	0	6	19	0	0	0	0
GG	5	168	2	96	0	0	0	0	0	0
GM	0	0	0	0	0	0	0	0	0	0
LB	0	0	0	0	0	0	1	118	0	0
LO	0	0	3	25	0	0	4	461	1	15
MN	3	4	3	3	4	5	24	47	12	20
OO	0	0	0	0	0	0	1	6	1	2
PC	0	0	0	0	0	0	0	0	0	0
PD	0	0	0	0	1	5	2	7	0	0
PM	0	0	1	1	0	0	1	1	0	0
PP	0	0	0	0	0	0	0	0	0	0
SB	0	0	0	0	0	0	0	0	0	0
SC	0	0	0	0	0	0	0	0	1	160
TT	4	125	1	145	0	0	0	0	1	15
UD	3	208	8	195	2	84	4	47	7	371
ULW	15	25	13	71	11	19	28	38	33	45
UNIDLDEL	0	0	0	0	0	0	0	0	0	0
UNIDMDEL	0	0	0	0	0	0	0	0	0	0
UNIDPORP	0	0	0	0	0	0	0	0	0	0
UNID_CETAC	0	0	1	9	0	0	0	0	0	0
UNID_OBJCT	0	0	0	0	0	0	0	0	0	0
UNZIPH	0	0	0	0	0	0	0	0	0	0
UPINN	0	0	0	0	0	0	0	0	0	0
USM	0	0	0	0	0	0	0	0	0	0
ZICA	0	0	0	0	0	0	0	0	0	0
Totals	70	2572	62	4938	64	3481	103	3198	102	4624
Effort [km]	1629.73		1168.34		1192		2527.44		1666.36	
Effort [nmi]	879.98		630.85		643.63		1364.71		899.76	

BA = *Balaenoptera acutorostrata* (Minke whale)
BB = *Berardius bairdii* (Baird's beaked whale)
BBO = *Balaenoptera borealis* (Sei whale)
BBO/BE = *Balaenoptera borealis/edenii* (unid Sei/Bryde's whale)
BE = *Balaenoptera edenii* (Bryde's whale)
BM = *Balaenoptera musculus* (Blue whale)
BP = *Balaenoptera physalus* (Fin whale)
DC = *Delphinus capensis* (Long-beaked common dolphin)
DD = *Delphinus delphis* (Short-beaked common dolphin)
DSP = *Delphinus spp.* (unidentified common dolphin)
EJ = *Eubalaena japonica* (North Pacific Right Whale)
ER = *Eschrichtius robustus* (Grey whale)
GG = *Grampus griseus* (Risso's dolphin)
GM = *Globicephala macrorhynchus* (Short-finned pilot whale)
LB = *Lissodelphis borealis* (Northern right whale dolphin)
LO = *Lagenorhynchus obliquidens* (Pacific white-sided dolphin)
MN = *Megaptera novaeangliae* (Humpback whale)
OO = *Orcinus orca* (Killer whale)
PC = *Pseudorca crassidens* (False killer whale)
PD = *Phocoenoides dalli* (Dall's porpoise)
PM = *Physeter macrocephalus* (Sperm whale)
PP = *Phocoena phocoena* (Harbor porpoise)
SB = *Steno bredanensis* (Rough-toothed dolphin)
SC = *Stenella coeruleoalba* (Striped dolphin)
TT = *Tursiops truncatus* (Bottlenose dolphin)
UD = Unidentified dolphin
ULW = Unidentified large whale
UNIDLDEL = Unidentified large delphinid (Pseudorca, Orca or Globicephala)
UNIDMDEL = Unidentified medium delphinid (Feresa, Grampus, Steno or Tursiops)
UNIDPORP = Unidentified porpoise (Phocoena or Phocoenoides)
UNID_CETAC = Unidentified cetacean
UNID_OBJCT = Unidentified object
UNZIPH = Unidentified Ziphiid whale (Unidentified beaked whale)
UPINN = Unidentified pinniped
USM = Unidentified Marine Mammal
ZICA = *Ziphius cavirostris* (Cuvier's beaked whale)