

Northern Elephant Seal Database

Background

The Vertebrate Integrative Physiology Lab at Cal Poly has launched a formal population monitoring study of the northern elephant seals at Piedras Blancas (San Simeon, CA) and Vandenberg Air Force Base. Our goal is to establish a known population of tagged seals to track events (e.g., presence/absence, reproduction, mating, molting, etc.). This effort includes the contributions of citizen scientists (docents from the Friends of the Elephant Seal), who will assist with resighting (observing an individual at a later date) tagged/known individuals.

We contribute our data to the national database for northern elephant seal research, run by the Smithsonian and UC Santa Cruz (UCSC). However, we have limited access to that database. We need to manage our own data and also convert some of our fields to the appropriate format for uploading into the national database.

Methods

We use a number of ways to identify and keep track of the animals.

Marks: We mark the animals with hair dye, using a combination of letters and numbers. Some animals may receive more than one mark in a single season. The marks only last until the animal molts (sheds) its fur, so the same animal will receive different marks in subsequent breeding seasons. Each mark we deploy is associated only with the current breeding season, and the letter-number combinations reset (and therefore may repeat on different animals) in subsequent seasons.



Flipper tags: These tags are inserted into the hind flippers and typically last for the rest of the animal's lifetime. Some animals receive one flipper tag and others receive two (with different numbers). Flipper tags are color-coded based on the rookery (breeding site) where the animal was born or first tagged. The location of the tag in the flipper adds an additional layer of



identification when we resight the tag. These tags are designed to not irritate/interfere with the animal, and are small. As a result, we sometimes are only able to read a portion of the tag number while observing from a distance.

Age classification: We note the age classification for each animal, which can change over time. Our age classes are: pup, weanling, juvenile, adult female, several stages of subadult male (SA1, SA2, SA3, SA4), and adult male.

Unique identifier: Because we have different identifiers for the same animal, some of which can change over time, we need the database to generate a **unique identifier** for each individual. All of our other identifiers will be associated with this one, unique identifier, so we can associate all of the data for an animal over time.

Functionality

1. Straightforward data entry, including drop-down selections for fields that have finite entry options (e.g., sex, age class, mark position, tag position, Y/N entries).
2. Linking all data associated with a single individual, such that it can be viewed when an individual is selected during a query.
3. Search functionality. Ability to search for an animal using a partial mark or tag (with an underscore for each missing digit). The search query will return all possible individuals for the combination entered, and we can use the associated data to determine which animal is most likely the one we resighted.
 - We would like to have the ability to filter by the various fields, to narrow a search.
 - We would also like to be able to sort the results of a search by fields such as date, location, sex, etc.
 - From the query, we would select an individual to view and bring up all of the available data for that individual. If we determine that is not our individual, we can return to the search query to select another individual.
4. Easy to correct mistakes in data entry, including removal of a resight that was incorrectly associated with an animal.
5. Ability to merge data from 2 animals into one, so all data are associated with one unique identifier.
6. User-friendly interface, particularly for searches.
7. Separation of access between researchers (full functionality, including data entry and mistake correction) and citizen scientists (search functionality, read-only).

Data

These are the data we collect in the field:

*Mandatory fields marked with red asterisk.

*Fields with limited options could have a drop-down menu during data entry.

Field	Description
Date*	Date of mark or tag deployment or resight.
Location*	Specific beach at which the data were collected. *Limited fields
Sex	Male (M) or Female (F), if known. *Limited fields
Age Class	Pup (P), Weanling (W), Juvenile (J), Subadult Males (SA1, SA2, SA3, SA4), or Adult (A). *Limited fields
Pup Age	If the animal is a pup, this is an estimate of its age in days.
Pup?	If the animal is an adult female, this indicates whether she has a pup with her. Will be an integer number (e.g., 0, 1, 2,...)
New Mark?	Indicates whether this is recording a new mark (Y) or is a resight of a previous mark (N). *If a mark is being recorded, this is a mandatory field. *Limited fields
Mark	The number/letter combination for the dye mark. If only part of the mark can be seen clearly (during a resight), we use an underscore (_) to indicate any digit that is unknown. We need a way to record multiple marks on the same animal in the same season (which is rare, but does happen).
Mark Position	Where on the animal the dye mark is located: left side (L), right side (R), or back (B). *Limited fields, but could select one, two, or all three options.
New Tag 1?	Indicates whether this is recording deployment of a new tag (Y) or is a resight of an existing tag (N). *If a tag is being recorded, this is a mandatory field. *Limited fields
Tag #1 Color	Color of the flipper tag. *Limited fields
Tag #1 Number	The letter/number combination for that tag. If only part of the tag can be read (during a resight), we use an underscore (_) to indicate each digit that is unknown. There are some tags for which there is a blank space as a digit. We need a way to include a blank space (but not an underscore) as part of a confirmed tag number.
Tag #1 Position	Indicates which flipper (L or R), the location in the flipper (1, 2, 3, or 4), and the position of the spike on the tag: spike out (so) or spike in (si). Ex: L1-so *Limited fields
New Tag 2?	Indicates whether this is recording deployment of a new tag (Y) or is a resight of an existing tag (N). *If a tag is being recorded, this is a mandatory field. *Limited fields
Tag #2 Color	Color of the flipper tag. Some animals have two flipper tags, so we note both if they have them.
Tag #2 Number	The letter/number combination for that tag. If only part of the tag can

	be read (during a resight), we use an underscore (_) to indicate each digit that is unknown. There are some tags for which there is a blank space as a digit. We need a way to include a blank space (but not an underscore) as part of a confirmed tag number.
Tag #2 Position	Indicates which flipper (L or R), the location in the flipper (1, 2, 3, or 4), and the position of the spike on the tag: spike out (so) or spike in (si). Ex: R3-so *Limited fields
Molt %	Estimate of how much the animal has molted, in percent (0-100). *Limited fields: must be a number between 0 and 100, inclusive.
Standard Length	Straight-line length of the animal, in cm. *Limited fields: must be an integer number. Should warn user if number is higher than 200.
Curvilinear Length	Curved length of the animal, in cm. *Limited fields: must be an integer number. Should warn user if number is higher than 200.
Axillary Girth	Circumference of the seal at its widest point, in cm. *Limited fields: must be an integer number. Should warn user if number is higher than 200.
Total Mass	Mass of the animal in the weigh bag, as measured in the field, in kg. *Limited fields: must be a number (with one decimal place).
Mass Tare	Mass of the weigh bag and bar, without the animal, in kg. *Limited fields: must be a number (with one decimal place).
Animal Mass	Difference between Total Mass and Mass Tare (calculated by the database, not by us in the field), in kg. *Limited fields: must be a number (with one decimal place).
Comments	This allows us to make notes and associate those comments with the particular deployment or resight.

These are the additional fields we need to help organize the data:

Field	Description
Unique Animal ID	This will be the one identifier (generated by the database) that will connect all of the other data for an individual.
Breeding Season	This lumps dates together by breeding season, because marks are only associated with a single breeding season and will reset the next year. The breeding season is December-April, and each season is denoted by the year associated with that January. (For example, December 2018 – April 2019 is breeding season 2019.)
Rookery	Because we work at two different rookeries, we need to associate the individual beaches with the larger location. Piedras Blancas = PB, Vandenberg Air Force Base = VAFB.
Field Leader	This indicates the field team leader(s) under whom the data were collected in the field. May be multiple people.
Data Recorder	This indicates who entered the data into the database.
Last Seen as Pup	This records the date we last resighted this individual with its mother. (Only applies to pups in current breeding season.)

First Seen as Weaner	This records the date we first resighted this individual without its mother. (Only applies to weaners in current breeding season.)
Wean Date Range	Difference (in days) between date First Seen as Weaner and date Last Seen as Pup. This allows us to prioritize animals for weighing, based on the precision of our wean date estimate.
Procedure	This indicates whether the animal was included in a focused study or experiment.

These are the fields we need to automatically convert to a format compatible with the national database:

Field	Description
Location	Our beach names are coded differently from the same beaches in the UCSC database. We would like to retain our local codes and automatically generate the corresponding UCSC location codes for ease of entry into the national database.
Tag Position	Similarly, we code the tag positions differently from how they are coded in the UCSC database. We want to retain our codes and automatically generate the corresponding UCSC tag position codes.
Tag ID	The national database incorporates tag color as the first letter of the tag number. Ex: Green 9814 in our database would become G9814.

These are the possible choices for fields with limited data:

Field	Entry Options
Location	ACU, ACL, DCU, DCC, DCL, VP3DC, VP3U, VP3L, ALU, ALLn, ALLs, ALL, LTU, LTC, LTL, VAFB *This one is cumbersome as a drop-down menu. May work better to warn user if entry is not one of these options. We may need to add to this list in the future, so we need the ability as administrators to alter the list on the back end.
Sex	M, F
Age Class	P, W, J, A, SA1, SA2, SA3, SA4
New Mark?	Y, N *This is a required field if mark data are being entered.
New Tag 1?	Y, N *This is a required field if data are being entered for tag #1.
Tag 1 Color	White, Blue, Green, Pink, Violet, Red, Yellow, Orange *This would work as a drop-down menu.
New Tag 2?	Y, N *This is a required field if data are being entered for tag #2.
Tag 2 Color	White, Blue, Green, Pink, Violet, Red, Yellow, Orange *This would work as a drop-down menu.
Molt %	This must be an integer number between 0 and 100, inclusive.

These are the conversions between our data fields and those for the national database:

Category	Our Database	National Database
Location	ACU	PPB2
	ACL	PPB1
	DCU	PPBK ₁
	DCC	PPBK ₂
	DCL	PPBK ₃
	VP3DC	PPBL
	VP3U	PPBM
	VP3L	PPBM ₁
	ALU	PPBR
	ALLn	PPBR
	ALLs	PPBR
	ALL	PPBR
	LTU	PPBS
	LTC	PPBS
	LTL	PPBS
	VAFB	VAFB
Tag Position	R1-so	R-ou-So
	R2-so	R-iu-So
	R3-so	R-il-So
	R4-so	R-ol-So
	L1-so	L-ou-So
	L2-so	L-iu-So
	L3-so	L-il-So
	L4-so	L-ol-So
	R1-si	R-ou-Si
	R2-si	R-iu-Si
	R3-si	R-il-Si
	R4-si	R-ol-Si
	L1-si	L-ou-Si
	L2-si	L-iu-Si
	L3-si	L-il-Si
	L4-si	L-ol-Si
Tag Color	White	W
	Blue	B
	Green	G
	Pink	P
	Violet	V
	Red	R
	Yellow	Y

	Orange	O
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This is the information we would want associated with each user account:

- Username
- Password
- Full name
- E-mail address
- Affiliation (e.g., Cal Poly, Friends of the Elephant Seal, CA State Parks)