

Supplementary File 2 - California Drowning Study Bodies of Water Definitions and Coding Methods

Definitions

The following definitions were adapted from the Royal Life Saving Australia Drowning Data Definitions Manual (2014) and the Surf Life Saving Australia Coastal Fatality Dataset definitions (2020).

Location Category	Examples	Explanation
Bathtub	Baths, showers, spa baths	Receptacles for water commonly used for bathing that are emptied after use. Spa baths are receptacles for water commonly used for both bathing and relaxation that generally have water jets and are emptied after use. Note a spa and spa bath are slightly different. Normally a spa has a filter, and a spa bath does not, and rather is emptied on a regular basis. Showers included in this code.
Coastal	Ocean, beach, harbor, bay, wetlands, estuary, rock platform	Open ocean waters and large bodies of tidal waters (e.g. harbor/bay/inlet/estuary). Includes areas up to three nautical miles offshore. At the mouth of a river, the coastal boundary is the point upstream calculated by multiplying the width of the river/inlet mouth by five. (Adopted from the Resource Management Amendment Act 1993 – New Zealand). Note - San Francisco/ Suisun Bay is classified as 'Coastal' until the Legal Delta Boundary as established under the Delta Protection Act, Section 12220 of the California Water Code (1959)
Lake/pond/reservoir	Lake, pond, reservoir, dam, lagoon (non-tidal), swimming hole, gorge, pond	A body of water, either fresh or salt water, which may vary in size and is surrounded by land and predominantly stagnate (e.g. Swimming holes or gorges). May be naturally occurring or man-made.
River/Canal	River, creek, stream, canal, aqueduct, slough, flood plain, weir, irrigation channel	A natural or man-made waterway generally fed by other bodies of water. Can vary in water flow, length, width and depth. Use this category where water moves or has the ability to move generally in one direction.
Swimming Pool	Includes the following types of Swimming pools – · Aquatic amusement · Home · Temporary residence · Portable · Public · Spa/Jacuzzi	As defined in the 1995 California Swimming Pool Safety Act: <i>“Swimming pool” or “pool” means any structure intended for swimming or recreational bathing that contains water over 18 inches deep. “Swimming pool” includes in-ground and aboveground structures and includes, but is not limited to, hot tubs, spas, portable spas, and nonportable wading pools.</i> This location category does not include spa baths.

	· Other Unknown	
Other	Fountain, container, fish pond, drain, sink, washing machine, tank, toilet, feeding trough, holes in ground, pipes, ditches, Arroyo/wash	Code used for cases where location is less common or does not fit into above codes.
Unknown Natural Water	Unknown	Location of the drowning incident is not known, but the underlying or record axis multiple cause codes indicate that the drowning occurred in "Natural Water" (W69/W70)
Unknown	Unknown	Location of the drowning incident is not known

Coding Location Categories from Death Data

Ideally, each case should be manually verified, and a body of water determined. However, it may be impractical and unfeasible to do this when working with a large number of case files, as with the initial body of water location coding for the California Drowning Study. The following methodology was developed to reduce the number of cases where manual verification is required.

First, we developed a "location scrape" field by combining the text from the "Place of injury", "Describe how injury occurred", and "Injury location description" variables into a single character string separated by a semicolon. Next, in an iterative development process, we wrote a short script using the dplyr package in R Studio (Wickham et al. 2021, R Core Team 2020) to automatically designate the body of water based on an ordered, multi-part "if/then" key word search.

While developing the optimal order and words to include, we checked word frequencies in the "Location Scrape" category to refine and improve the auto classification procedure. Of note, several cases were auto classified for manual review (e.g. body of water designation includes the word "check"). Manual verification was completed by a single researcher who consulted with a second member of the research team if there was ambiguity or unclear information, and included:

- Any case where body of water keywords appeared together, or in the city name (e.g. "backyard pool in Lakeside"; "river mouth near ocean beach").
- All cases with the words "Spa", "Jacuzzi", or "Driver" were manually reviewed: spa/jacuzzi cases can be confusing and are frequently coded as swimming pool deaths, and searches for the word "river" incorrectly auto classified cases including the word "driver".
- Cases where key words might refer to more than one category were mapped and manually checked. For example, where a "beach" or "marina" might refer to an inland lake vs the more common coastal site.

The final ordered, if/then key word auto designation is below in Table 1.

Table 1: Order of autoclassification body of water designation based on specific variables

Order	Body of Water Designation	Search Fields		
		Underlying ICD10 Cause of Death	Location Scrape	Injury Location City
1	Check - SPA		SPA OR JACUZZI OR HOT TUB	
2	CHECK - DRIVER		DRIVER	
3	CHECK - MULTI		OCEAN AND RIVER	
4	CHECK - MULTI		OCEAN AND LAKE	
5	CHECK - MULTI		OCEAN AND POOL	
6	CHECK - MULTI		LAKE AND RIVER	
7	CHECK - MULTI		LAKE AND POOL	
8	CHECK - MULTI		RIVER AND POOL	
9	CHECK - MULTI		POND AND CREEK	
10	CHECK - MULTI		LAKE AND CREEK	
11	CHECK - CITY		RIVER	RIVER
12	CHECK - CITY		BEACH	BEACH
13	Bathtub	bathtub		
14	Bathtub		bathtub OR bath tub	
15	Pool	swimming pool		
16	Pool	swimming-pool		
17	Pool		POOL	
18	Coastal		OCEAN	
19	River/Canal		RIVER	
20	Lake/Pond		LAKE	
21	Geo Check - Beach		BEACH	
22	Geo Check - Bay		BAY	
23	River/Canal		CANAL	
24	Pond		POND	
25	Lake/Pond		RESERVIOR OR RESERVOIR	
26	River/Canal		CREEK	
27	River/Canal		AQUEDUCT	
28	River/Canal		SLOUGH	
29	Geo Check - Lagoon		LAGOON	
30	Geo Check - Harbor		MARINA OR HARBOR	
31	Other		DITCH	
32	Other		FOUNTAIN	
33	Other		BUCKET	
34	UNKNOWN NATURAL WATER	NATURAL WATER		
36	Manual Check Required			

References

- California Delta Protection Act (1959). California Water Code, Section 12220. Available from: https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PRC&division=19.5.&title=&part=&chapter=1.&article=
- California Swimming Pool Safety Act (1995). California Health and Safety Code, Division 104, Part 10, Chapter 5: Safe Recreational Water Use. Available from: https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=104.&title=&part=10.&chapter=5.&article=2.5.
- New Zealand Resource Management Amendment Act of 1993. Public act No. 65; 1993. Available from: <http://www.legislation.govt.nz/act/public/1993/0065/latest/DLM302693.html>
- R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>.
- Royal Life Saving Australia (2014). Drowning data definitions manual. Royal Life Saving Australia, Sydney.
- Surf Life Saving Australia (2020) Coastal Fatality Dataset definitions. Surf Life Saving Australia, Sydney.
- Wickham, H., François, R., Henry, L., Müller, K. (2021). dplyr: A Grammar of Data Manipulation. R package version 1.0.7. Available from: <https://CRAN.R-project.org/package=dplyr>.