Uniform Field Observation Model Level I (UFO-L1)

Specifications for Minimum Uniformity Requirements

Version 1.0c Documentation

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in cooperation with
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California Department of Fish and Game

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Introduction

The Uniform Field Observation Model - Level 1 (UFO-L1) specification is a set of minimum data requirements for constructing observation datasets by specifying the: who, what, when, where, how, and why of an observation. What UFO-L1 does not do is describe data fields for any specific kind of survey, for example deer surveys or salmon surveys. The Uniform Field Observation Model - Level 2 (UFO-L2) specification, an extension of UFO-L1, will define requirements for more specific types of observations.

Goals for UFO-L1 Specification

- **Define the minimum data fields required for a UFO-L1 observation database**
- **Capture the who, what, when, where, how, and why of an observation**
- **Platform independence**
- **Standard data structure for tabular and spatial data**
- **Geographic features – point, line, polygon, or combination**

Overview

Throughout the Department of Fish and Game (Department), and its many cooperating agencies and partners (indeed, the entire conservation community), there are a great number of data collection efforts that contain similar biological information. Even though these efforts contain similar information, these data are created or maintained by different groups, at different times, for different reasons, using different field methods and various storage mechanisms.

This makes timely evaluation of these data extremely difficult. These disparate data sets would be intrinsically more valuable if all potential users of these data were:

- aware of their existence, location, focus, limitations and owners, and
- were able to consider and analyze them jointly.

There is clearly a need to provide improved access to Department data that are now collected, stored and managed in a variety of incompatible formats.

Submitting a single query or creating a single report that could automatically span all related data would greatly simplify the analysis of statewide biological data. One could envision a single database, all-encompassing in its scope, capable of housing all manner of related biological field data. This is an intriguing idea, until you stop and consider what it implies:

- A single data structure would need to be devised to accommodate the vastly different data needs of many different efforts.
- All data collectors and users would need to agree on this universal structure.
- Because of differing needs, there would be many types of information that could not be included, and many fields would still not be populated.
- Existing data that did not fit the new structure would have to be revisited and updated, or discarded.
- Less sophisticated players, incapable of meeting the standards would not be able to participate.
- A single monolithic database would require centralizing responsibility for development and maintenance.
- Newly identified needs or situations would require a wholesale redesign of the entire database.

In response to these issues the WHDAB in cooperation with the NCNCR Information Services Branch have developed a data model and data management strategy that we refer to as the *Uniform Field Observation Model Data Management Strategy*, or UFO.

The UFO project is based on the premise that complete uniformity among all biological databases is unattainable (and undesirable). Rather than attempt to make a “one size fits all” solution, UFO seeks to identify similarities and group them together in a logical way, creating different levels at which data sets can be said to be uniform.

The Goal of UFO: To create observation data sets in a consistent manner using uniform tools, data structure and protocols.

To accomplish this, participants must agree on common standards regarding how data are collected, stored, and managed.

What will this look like?

Once data are collected and organized in a uniform manner, they can then be stored and accessed in a uniform way from a common location. This common location will be a presence on the World Wide Web. Using the ESRI product, ArcIMS (Internet Map Server) and related technologies, the collected works of all UFO participants will be able to be viewed, browsed, downloaded, and (with some caveats) queried. Data will not necessarily have to be physically located in a central location (although some will be) but could be referenced from a single site. UFO can provide a single point of entry to deposit or retrieve any Department observation data, and performs the role of data integration and distribution.

Specification Levels

UFO databases can be organized into three tiers or levels, and are considered a member of that level if the database conforms to the appropriate specification.

- Level 1: Minimum specification for an observation dataset
- Level 2: Extends a Level 1 with common subclass requirements
- Level 3: Extends a Level 2 with unique requirements

Each level is functionally dependant upon the previous lower level (i.e., a Level 3 database must also meet Level 1 and Level 2 specifications).

Level 1 Specification: Meets minimum UFO requirements
The Level 1 specification is designed to allow any database which contains observation data, a location reference, and adequate metadata to be incorporated and considered jointly with other UFO databases.

Level 2 Specification: Meets subclass requirements
The Level 2 specifications require that a database first meet the requirements to be considered a Level 1 database. In addition, Level 2 databases are created to meet the needs of a specific subclass of data that have a set of unique requirements. Experts in that area define the specifications for each theme. Data fields unique only to certain efforts would not be included.

> **Note:** A *UFO Class* represents a broad category of observations about which the Department has a responsibility or desire to record, such as Project Tracking, Wildlife Management, Fisheries Management, Species Observations, Marine Resources Management, or Law Enforcement. Because of this it is unlikely (but not impossible) that all UFO databases within a given UFO Class will be able to comply with a single Level 2 Specification. Specifications based on specific *subclasses* within a UFO Class will be more common.
>
> **The goal in defining a Level 2 Subclass Specification is to group together, to the greatest extent feasible, all thematic data collection efforts that share a set of common data fields.**
>
> If a data collection effort contains at least all of the fields in a particular subclass and is thematically the same, it can be considered a member of that subclass. If it requires additional fields for a full representation it becomes a candidate for a Level 3 individual specification (while maintaining its membership within the Level 2 subclass specification).

Level 3 Specification: Contains unique requirements

The Level 3 Specification requires that a database meet the requirements to be considered Level 1 and Level 2 databases, and hence is considered uniform at those levels. In addition, to meeting those requirements a Level 3 database will also contain fields unique to a single specific data collection effort (those fields needed to describe circumstances above and beyond what is recorded in a more general Level 2 database). A Level 3 database will be uniform at Level 1 and Level 2, and contain additional unique fields.

Note: Databases which do not meet at least Level 1specifications cannot be considered for inclusion in UFO. Those that do meet the Level 1 specifications usually will contain many fields over and above the required minimum. If the database meets the requirements for an existing Level 2 specification, then it can be considered as a member of that group. If it does not, it will not automatically qualify to become its own Level 2 (since Level 2 specifications imply that more than one databases are represented). However, if other databases have similar requirements, a new Level 2 specification may be designed to accommodate it and its associates. Furthermore, since Level 3 databases are intended to contain additional information beyond what is contained within a Level 2 database, it is most likely that many Level 1databases will remain as such. These will contain valuable data fields, but will never meet the requirements of Level 2 or Level 3 specifications.

UFO Databases

Databases which meet a UFO Specification Level belong to one of two logical groupings: *Central Databases*, or *Contributing UFO Databases*. The Central Databases reside on headquarters servers and manage behind-the-scene administrative issues. As such, they do not concern us here. The Contributing Databases group includes all those databases that meet the definition of a UFO Database by complying with Level 1 or Level 2 specifications. Contributing Databases are subdivided into *Managed Databases* and *Participating Databases*, allowing for a range of flexibility from tightly designed, and controlled, to allowing a high degree of flexibility.

Managed Databases

Managed Databases offer a complete database solution. They are intended to meet the specific ongoing needs of critical Departmental functions. Managed Databases feature custom desktop or web-based applications, connected to a remote database, and allow data input and retrieval from multiple users, statewide. The number of Managed Databases is directly limited to the amount of staff time available to support them. It is not anticipated that, at current staffing levels, the number of Managed Databases will be significant.

Participating Databases

These databases are those which meet Level 1 or Level 2 specifications, but do not have an application front end that supports direct online entry to a remote server (like the Managed Databases). Participating Databases will be single *stand-alone* products, or designed in such a way that multiple copies comprising a Level 2 Class, populated independently, can be *appended* together to form a single complied version. The method of creation of these databases, and the manner in which they are populated will vary greatly. In each case, the database owners must resolve these issues. Neither WHDAB nor NCNCR currently has the resources to design and build database applications for all comers (although guidance and standard tools and models will be available). Several common models include:

- Microsoft Excel (Excel) Spreadsheets
- ESRI ArcView Shapefiles (Shapefiles)
- Microsoft Access Databases (Access)

It is anticipated that Participating Databases will likely supply the majority of UFO records.

Minimum Data Requirements for UFO-L1 Specification

The main guidelines used to develop UFO-L1 are that the specifications must be **a)** easily met and **b)** highly flexible. With that in mind, requirements for a minimum set of information considered useful to the Department were developed. These minimum data requirements are as follows:

1. **Metadata** – For a dataset to meet the UFO-L1 minimum specification, it must be accompanied by metadata describing the who, what, when, where, how, and why of the data. Minimum requirements for this metadata standard can be found in the Metadata table definition.

2. **Geospatial Information** – Each record in an observation-based dataset must be accompanied by information regarding where the observation occurred. This geospatial information can be in the form of a point, line, or polygon, or it can be a reference to a commonly accepted geospatial feature (e.g., a lake, stream, or road). There is no requirement regarding the format of this information; it can be stored as an ArcView shapefile linked to the observation data, as an event table (e.g., an Excel spreadsheet or comma delimited text file), or in a Feature table, such as an Access database containing coordinate information.

3. **Data Entry Information** – Each record must be accompanied by information about who entered the data and the date/time that the data were entered. In the standard configuration this information is stored in the Obs table; however, it can just as easily be stored using two additional fields in a shapefile attribute table, Access database, Excel spreadsheet, or delimited text file.

These minimum specifications can be easily met and are highly flexible in how they can be formatted. They can be used to develop databases for any kind of observation (e.g., incidental wildlife observations, timber harvest plans, amphibian survey results, etc.) and allow for easy conversion of existing datasets to UFO-L1 databases.

It should be noted that meeting minimum UFO-L1 specifications alone does not necessarily make a database useful for Departmental needs; the UFO-L1 specification does not require information such as who the observer was, what kind of observation occurred, when it occurred, as well as additional information that makes an observation record meaningful. The minimum standards for this additional information should be developed as part of UFO-L2 specifications.

Tables

There are only two required tables in the UFO L1 specification.

Table Name	Description
Obs	Maintains data specific to an observation, i.e., circumstances, findings, situations, or activities executed, referenced or noted in the field, about which the Department has a mandate or desire to record, or report.
Metadata	Maintains project level information about a class or subclass of observation data, e.g., program, project, subject, purpose. This table typically contains a only single record.

Note: UFO-L1 does not limit the addition of tables or fields (see Table Definitions)

Entity Relationships

The only relationship in the UFO-L1 Specification is the one that relates the observation to its feature entity. The feature entity is represented by a unique feature identifier. The feature itself resides in a GIS, a tabular format, or as a textual description of the location (Refer to the *Appendix* for examples).

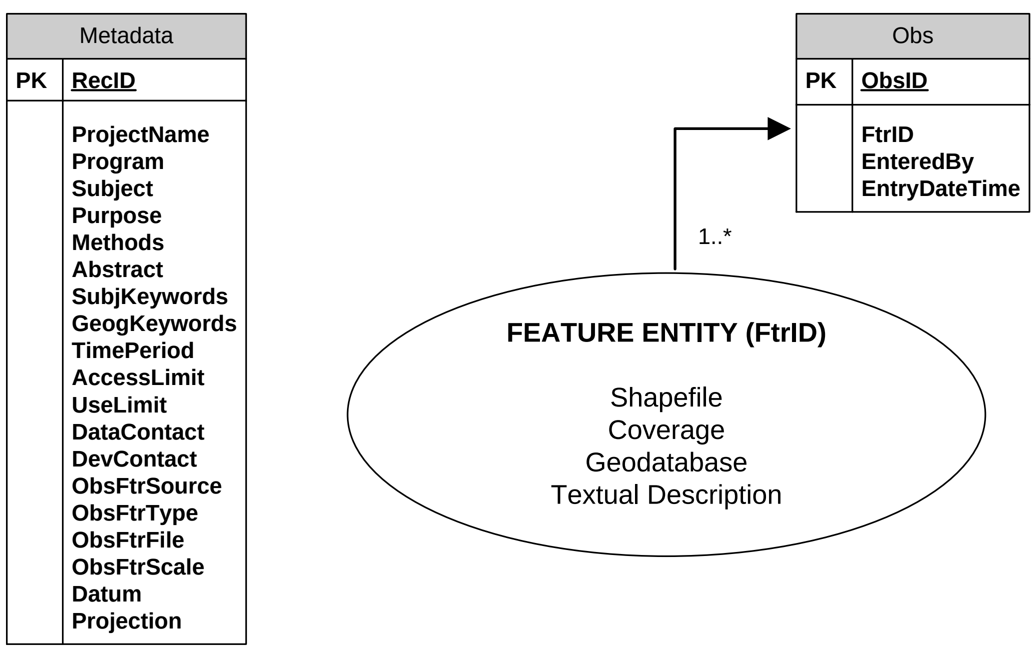


Table Definitions

The UFO-L1 specification does not limit the addition of tables and/or fields; however, in order to comply with the UFO-L1 specification, at a minimum, information captured by the Obs and Metadata tables must be maintained in a UFO database. In addition, for each observation there must exist a GIS counterpart, i.e., a true spatial feature maintained in a GIS, or a tabular representation of the feature maintained in the database (Refer to the *Optional UFO Tables* and *Optional UFO Attributes* sections of the Appendix.).

Note: Below definitions use Access data types; however, UFO-L1 does not restrict developers from using other database implementations.

Obs Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
ObsID	Observation Identifier	Identifier for the observation	Yes	Long Integer	Usually an AutoNumber
FtrID	Location Identifier	Identifier for the feature	Yes	Text(13)	See Feature table
EnteredBy	Entered By	Person who entered the record into the system	Yes	Text(30)	John Doe might be coded as jdoe. The decision whether to use the project coordinator or the data compiler as the entry person would be up to the project lead.
EntryDateTime	Entry Date and Time	Date and time of record entry	Yes	Date/Time	General Date format

Table Definitions (continued)

Metadata Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Convention/Format
RecID	Record Identifier	Record identifier for this metadata (used for indexing)	Yes	Long Integer	Usually an AutoNumber
ProjectName	Project Name	Name of the project for which this database is used	Yes	Text(100)	
Program	Program	DFG program for the project, e.g., RAP, NCWAP, NDDB, Etc.	Yes	Text(100)	
Subject	Subject	Brief description of project subject	Yes	Text(100)	
Purpose	Purpose	Verbal description of project purpose	Yes	Text(255)	
Methods	Methods	Verbal description of project methods	Yes	Text(255)	
Abstract	Abstract	Verbose description of project	Yes	Memo	
SubjKeywords	Subject Keywords	Keywords related to the "what" question (species, activity, etc.)	Yes	Text(100)	
GeogKeywords	Geographic Keywords	Keywords related to the "where" question (e.g., watershed name, creek name, etc.)	Yes	Text(100)	
TimePeriod	Time Period	Beginning and Ending Dates of project	Yes	Text(100)	
AccessLimit	Access Limitations	Description of access restrictions (e.g., no restrictions, distribution by permission, etc.)	Yes	Text(100)	
UseLimit	Use Limitations	Description of use limitations. This includes any use constraints applied to assure the protection of privacy or intellectual property and any other special restrictions or limitation on using the information.	Yes	Text(100)	
DataContact	Content Contact	Contact name and information for person responsible for database content	Yes	Text(255)	
DevContact	Developer Contact	Contact Name and Information for person responsible for database development	Yes	Text(255)	
ObsFtrSource	Observation Location Source	Source of observation's location information (e.g. Garmin 12xl, Trimble differential correction, online maps)	Yes	Text(100)	
ObsFtrType	Observation Spatial Types	Allowed spatial types for observation, e.g., point, line, polygon, combination, etc.	Yes	Text(100)	

Table Definitions – Metadata Table (continued)

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Convention/Format
ObsFtrFile	Observation Filename	Name of the shapefile to maintain the observation's location information. (filename or path)	Yes	Text(100)	
ObsFtrScale	Observation Scale	Minimum scale at which observation data are collected	Yes	Text(50)	
Datum	Map Datum	Datum of the Feature table data	Yes	Text(50)	Projection and datum used depends on specific project needs; however, it is highly encouraged that the DFG standard (Teale-Albers and NAD 83) is used.
Projection	Map Projection	Projection of the Feature and SurveyFtr data	Yes	Text(50)	

Overview of Terms

A good way to understand the UFO model is to organize the terminology used to describe it in logical manner, starting with basic tenets and building gradually one concept at a time. For examples or more information, see the detailed discussion of each term in the UFO - Level 1 Specifications section.

UFO – Abbreviated acronym for the *Uniform Field Observation Model Data Management Strategy*. This strategy contains guidelines, protocols, and tools that allow for the uniform creation, analysis and management of field observation data.

Observation – A circumstance, finding, situation, or activity that is executed, referenced, or noted in the field, about which the Department has a mandate or desire to record or report.

UFO Class - A broad category of *observations* in the most general terms. As a rule, each UFO Class represents a core activity or function in support of which the Department is making observations. Examples of UFO Classes include: Project Tracking, Wildlife Management, Fisheries Management, Species Observations, Marine Resources Management, and Law Enforcement. UFO Classes allow Department data to be easily aggregated at a functional level.

Observation Record – Information about an *observation* represented within a database that stores field observation data in a uniform manner.

UFO Database – A database that contains *observation records* and complies with a standard set of specifications.

UFO Specifications – A set of rules that define the requirements for uniformity within a *UFO Database*. There are three UFO Specification levels:

> **UFO Level 1 Specification** – Minimum specification for an observation dataset. Required elements are basic observation data, a location reference, and adequate metadata.
>
> **UFO Level 2 Specification** – A data structure defined by the information required to adequately represent the essential data of a biological, functional or topical theme within a *UFO Class*. A UFO Level 2 Specification groups together, to the greatest extent feasible, all thematic data collection efforts that share a set of common data fields. All level 2 UFO Databases must also meet the Level 1 specification.

Overview of Terms (continued)

UFO Level 3 Specification – A data structure which is uniform at levels 1 and 2, but also contains fields unique to a single specific data collection effort (those fields needed to describe circumstances above and beyond what is recorded in a more general level 2 database).

UFO Warehouse – A “virtual repository” for all UFO Databases. The UFO Warehouse employs standard tools to accommodate the input, location, display, query and retrieval (and often times storage) of UFO Databases. This allows information regarding all databases registered with the Warehouse to be accessed from a single site on the Internet. There is no requirement, however, that all registered UFO Databases be stored together. Arc Internet Map Server (ArcIMS) technology can work with distributed databases, making it possible to physically house a UFO Database at any location which can serve the data in the form of a *Map Service* available on the Internet.

ArcIMS - An Internet Map Server product from ESRI that allows spatial (GIS) data to be presented over the Internet, accessible by standard web browsers. ArcIMS offers a way to serve maps and spatial data to multiple users without the need for desktop GIS software.

Map Service - A "live" map that is published via the Internet. The map publisher defines the map content and geographic extent. A map service can contain one or more data layers of geographic information depending on the purpose of the map. These map layers can be served as either static images (snapshots) or dynamic features (streamed data).

UFO Registry – Records all of the UFO Databases that have been registered with the *UFO Warehouse*, and plays a central role in categorizing and storing important information about them. The UFO Registry contains a single record for each registered UFO database and stores course level metadata information such as data source name, subject, keywords, contact information, abstract, etc. Searching the UFO Registry allows you to determine which data sets registered with UFO contain specific types of information, without the need to search each individual database.

UFO DataSource – A UFO Database that has been registered with the *UFO Warehouse* and referenced in the *UFO Registry*.

Appendix

Optional UFO-L1 Tables

The optional tables are used for maintaining common relationships between observations as well as maintaining geo-spatial data in a tabular format until such time that it can be converted to true spatial features and stored in a GIS.

Table Name	Description
Coord	This table maintains geo-spatial coordinate information in a tabular format, i.e., the coordinates for point, line, and polygon features. It has a many to one relationship with the Feature table.
Feature	This table provides a way to represent geo-spatial features in a tabular format within a UFO database. It maintains a one to many relationship with the feature identifier (FtrID) in both the Survey and Obs tables. It also maintains a one many relationship with supporting geo-tables, i.e., the Coord, Route, and Lake tables.
Lake	This table maintains feature identifiers for events that occur on a lake.
LakeSection	This lookup table maintains lake section information, i.e., a list of unique sections that are associated with a lake.
Route	This table maintains stream route information, i.e., unique stream identifier, the measure or coordinate upstream to the event, and the measure or coordinate upstream to where the event ends.
RouteSection	This lookup table maintains stream route section information, i.e., a list of unique sections that are associated with a route.
Survey	This table maintains information that relates to a common set of observations, e.g., observations associated with a line transect, survey area, stream measure, or referenced feature.

Optional UFO-L1 Attributes

Coord Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
<u>RecID</u>	Record Identifier	Record identifier for this coordinate (used for indexing).	Yes	Long Integer	Usually an AutoNumber
FtrID	Location Identifier	Identifier for the feature	Yes	Text(13)	Refer to the *Feature* table
FtrNum	Feature Number	Number for the feature within a feature class, e.g., when there are multiple distinct points, lines, or polygons per location.	Yes	Integer	

Optional UFO-L1 Attributes – Coord Table (continued)

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
PtNum	Point Number	Point index for a coordinate entity within a given feature. Point features are always 1.	No	Integer	Consecutive point index number for the feature type and feature number
X_Coord	X coordinate	X coordinate	No	Double	
Y_Coord	Y coordinate	Y coordinate	No	Double	

Feature Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
FtrID	Location Identifier	Identifier for the feature	Yes	Text(13)	This can be any combination of characters and/or numbers as long as they are unique within the table. Typically it would be a random number or AutoNumber converted to a text datatype.
FtrType	Feature Type	Unique identifier for the type of geographic feature	Yes	Byte	1 = point 2 = line 3 = polygon 4 = route 5 = lake
Description	Description	Brief description of the feature	No	Text(255)	In cases where there is only a textual description of the feature, e.g., “Jones’s Landing Access Point,” this field would be required and a brief location description would go here.

Optional UFO-L1 Attributes (continued)

Lake Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
<u>RecID</u>	Record Identifier	Record (used for indexing)	Yes	Long Integer	Usually an AutoNumber
FtrID	Location Identifier	Identifier for the feature	Yes	Text(13)	Refer to the *Feature* table
LLID	Longitude-Latitude Identifier	Lake identifier	Yes	Text(13)	Concatenated coordinates generated at the lake's centroid (Only standardized LLID's are permitted.) Example: x + y → 1203928403928
FtrName	Feature Name	Lake name	No	Text(100)	

Metadata Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
SurveyFtrSource	Survey Location Source	Source of survey's location information (e.g. Garmin 12xl, Trimble differential correction, online maps)	Yes	Text(100)	Required when the Survey table is used
SurveyFtrType	Survey Spatial Type	Allowed spatial types for survey, e.g., point, line, polygon, combination, etc.	Yes	Text(100)	Required when the Survey table is used
SurveyFtrFile	Survey Filename	Name of the shapefile to maintain the survey's location information. (filename or path)	Yes	Text(100)	Required when the Survey table is used
SurveyFtrScale	Survey Scale	Minimum scale at which survey data are collected	Yes	Text(50)	Required when the Survey table is used

Obs Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
SurveyID	Survey Identifier	Foreign key to the survey identifier.	No	Text(30)	
Observer	Observer	Surveyor who collected the sample data	No	Text(30)	

Optional UFO-L1 Attributes – Obs Table (continued)

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
DateTime	Date and Time	Date and time of the observation	Yes	Date/Time	General Date/Time format
Comments	Comments	General comments	No	Text(255)	

Route Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
RecID	Record Identifier	Record identifier for this coordinate (used for indexing).	No	Long Integer	Usually an AutoNumber
FtrID	Location Identifier	Identifier for the feature	Yes	Text(13)	Refer to the Feature table
LLID	Stream Identifier	Longitude-latitude identifier for the stream	Yes	Text(13)	Concatenated coordinates generated at the stream's confluence (Only standardized LLID's are permitted.) Example: x + y → 1203928403928
BegFt	Begin Feet	Number of feet upstream to where stream event begins	Conditional	Long Integer	Required when coordinates are not provided
EndFt	End Feet	Number of feet upstream to where event ends	Conditional	Long Integer	Required when coordinates are not provided
BegX	Beginning X Coordinate	X coordinate where stream event begins	Conditional	Double	Required when BegFt and EndFt are not provided
BegY	Beginning Y Coordinate	Y coordinate where stream event begins	Conditional	Double	Required when BegFt and EndFt are not provided
EndX	Ending X Coordinate	X coordinate where Stream event ends	Conditional	Double	Required when BegFt and EndFt are not provided
EndY	Ending Y Coordinate	Y coordinate where Stream event ends	Conditional	Double	Required when BegFt and EndFt are not provided

Survey Table

Physical Field Name	Logical Field Name	Field Description	Required	Type	Codes/Conventions and Format
SurveyID	Survey Identifier	Unique identifier for the survey	Yes	Text(30)	Unique identifier for the survey
FtrID	Location Identifier	Location identifier for the survey event (i.e. lake ID, watershed ID, transect ID, project boundaries)	Yes	Text(13)	See Feature table
StartDate	Start Date	Date that survey period began	Yes	Date/Time	Short Date format, i.e., mm/dd/yyyy
EndDate	Entry Date and Time	Date that survey period ended	Yes	Date/Time	Short Date format, i.e., mm/dd/yyyy
Description	Description	Brief description about the survey	No	Text(255)	
Comments	Comments	General comments	No	Text(255)	

Examples

Wildlife Survey Spreadsheet

This example demonstrates how the UFO-L1 Specification was used to represent four wildlife observations in an Excel spreadsheet format. The feature type is point, and the location information is maintained with the observation information. The second tab of the spreadsheet contains the metadata information. This straight forward senario can easily be converted to a database with true features in a GIS.

	A	B	C	D	E
1	**ObsID**	6200116	6200117	6200118	6200119
2	**FtrID**	P49001712	P49001713	P49001714	P49001715
3	**EnteredBy**	J Doe	J Doe	J Doe	J Doe
4	**EntryDateTime**	7/5/2001 15:10	7/5/2001 15:10	7/5/2001 15:10	7/5/2001 15:10
5	**DateTime**	6/30/2001 16:16	6/30/2001 16:21	6/30/2001 16:26	6/30/2001 16:35
6	**FtrType**	1	1	1	1
7	**X_Coord**	-71926.24942	-70659.83623	-71440.98829	-70446.79476
8	**Y_Coord**	380465.78133	381057.5632	381803.20835	382205.62001
9	**Observer**	J Doe	J Doe	J Doe	J Doe
10	**SppCode**	wtd	wtd	wtd	wtd
11	**Estimated**	None	None	None	None
12	**TotalObs**	1	5	3	1
13	**Males**	1	1	0	1
14	**Females**	0	3	3	0
15	**Juveniles**	0	1	0	0
16	**Unknown**	0	0	1	0
17	**Distance**	0	0	0	0
18	**Bearing**	0	0	0	0
19	**Comments**	Pit River corridor between Canby and Kelly Hot Springs (SW Plot)	Pit River corridor between Canby and Kelly Hot Springs (SE Plot)	Pit River corridor between Canby and Kelly Hot Springs (NW Plot)	Pit River corridor between Canby and Kelly Hot Springs (NE Plot)

Obs / Metadata

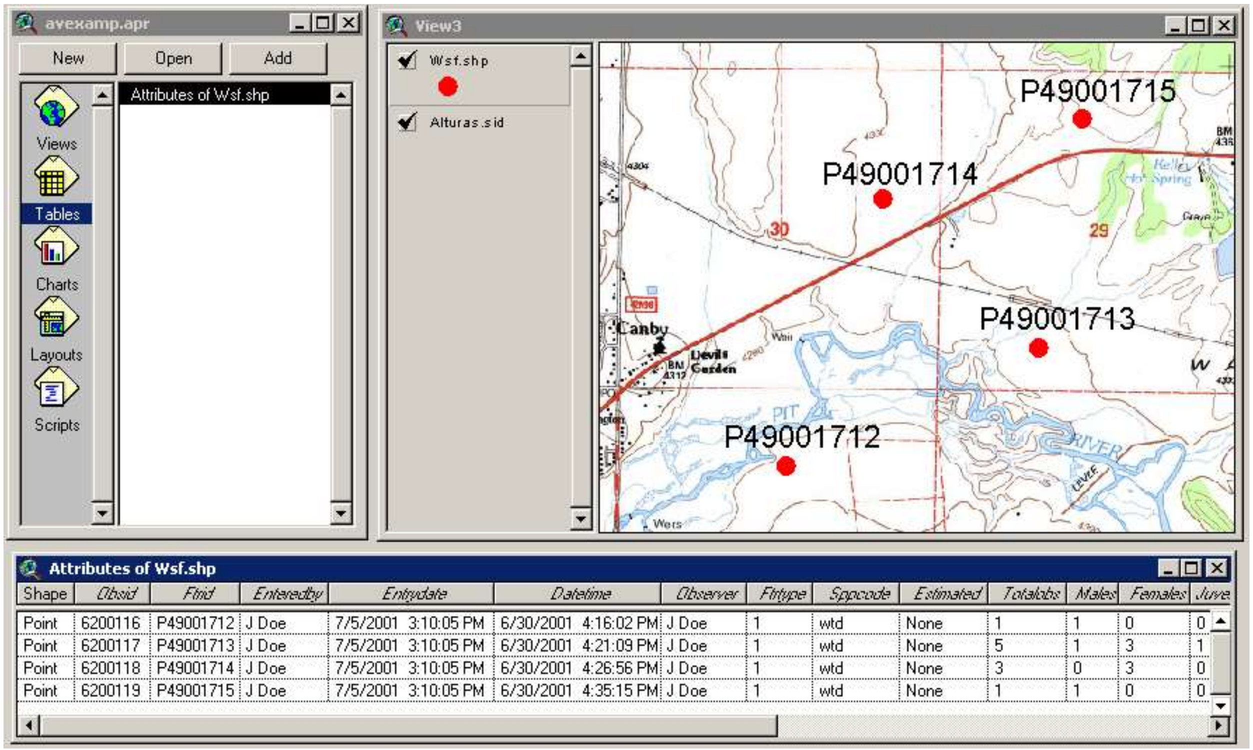
	A	B
1	**ProjectName**	Wildlife Observations Database
2	**Program**	NCNCR (Region 1) Wildlife Program
3	**Subject**	Wildlife Observations throughout Region 1
4	**Purpose**	Develop a systematic, randomized approach to observing
5	**Methods**	Arial observations along predetermined survey transacts
6	**Abstract**	Data represents wildlife observations that were sampled
7		randomly throughout northern California.
8	**SubjKeywords**	Wildlife, five-miler
9	**GeogKeywords**	NCNCR, Northern California, Region 1
10	**TimePeriod**	Spring 2001
11	**AccessLimit**	None
12	**UseLimit**	None
13	**DataContact**	Dave Smith - Wildlife Biologist
14		NCNCR Headquarters
15		601 Locust Street,
16		Redding, CA 96001
17	**DevContact**	Clint Kellar - Research Analyst II
18		NCNCR Headquarters
19		2440 Athens Ave
20		Redding, CA 96001
21	**ObsFtrSource**	GPS point locations adjusted with estimated bearing and
22	**ObsFtrType**	Point Locations
23	**ObsFtrFile**	WildlifeObs.shp
24	**ObsFtrScale**	10000
25	**Datum**	NAD27 Conus
26	**Projection**	Albers (converted from Geographic)

Obs / Metadata

Examples (continued)

Wildlife Survey ArcView 3.x

Below is an ArcView 3.x variation of the above example**.** The geo-spatial entities, i.e., the four points where the observations occurred, can be stored as a feature in an ArcView shapefile format, and the observation record stored in the shapefile's attribute table.

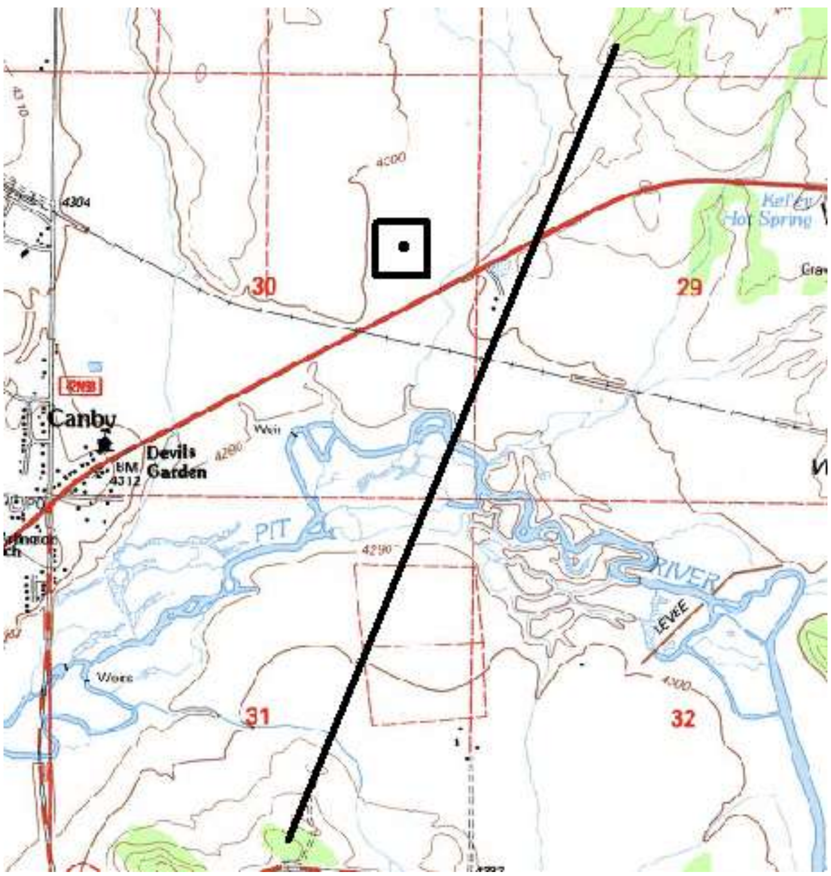


Shape	Obsid	Ftrid	Enteredby	Entrydate	Datetime	Observer	Ftrtype	Sppcode	Estimated	Totalobs	Males	Females	Juve
Point	6200116	P49001712	J Doe	7/5/2001 3:10:05 PM	6/30/2001 4:16:02 PM	J Doe	1	wtd	None	1	1	0	0
Point	6200117	P49001713	J Doe	7/5/2001 3:10:05 PM	6/30/2001 4:21:09 PM	J Doe	1	wtd	None	5	1	3	1
Point	6200118	P49001714	J Doe	7/5/2001 3:10:05 PM	6/30/2001 4:26:56 PM	J Doe	1	wtd	None	3	0	3	0
Point	6200119	P49001715	J Doe	7/5/2001 3:10:05 PM	6/30/2001 4:35:15 PM	J Doe	1	wtd	None	1	1	0	0

Examples (continued)

Wildlife Survey Geodatabase

The below map view illustrates a variation of the above example, i.e., instead of each observation being associated with a specific point, the observation is a randomly selected point within a two-mile grid that is associated with a survey transect. The point is the focus of a 50 meter observation radius. Geo-spatially this is a more complex sampling method, and not very likely to occur; however, the spatial entity, i.e., the transect line, sample grid, and point, is assigned a single feature identifier and has a one to many relationship with a unique observation record. This scenario only works with a geodatabase, and it must be a *UFO Managed Database*. The data would be maintained on a server in either a SQLServer or Access database; the feature information would reside in a geodatabase format, and the attribute information, i.e., observations, metadata, and supporting tables, in a tabular format.



Wildlife Survey Geodatabase Example (continued)

Metadata Table

ProjectName	Wildlife Observations Database
Program	NCNCR (Region 1) Wildlife Program
Subject	Wildlife Observations throughout Region 1
Purpose	Develop a systematic, randomized approach to observing wildlife throughout Northern California.
Methods	Arial observations along predetermined survey transacts using randomly selection areas
Abstract	Data represents wildlife observations that were sampled randomly throughout northern California.
SubjKeywords	Wildlife, five-miler
GeogKeywords	NCNCR, Northern California, Region 1
TimePeriod	Spring 2001
AccessLimit	None
UseLimit	None
DataContact	Dave Smith - Wildlife Biologist NCNCR Headquarters 601 Locust Street, Redding, CA 96001
DevContact	Clint Kellar - Research Analyst II NCNCR Headquarters 2440 Athens Ave Redding, CA 96001
ObsFtrSource	GPS point locations adjusted with estimated bearing and direction
ObsFtrType	Point Locations
ObsFtrFile	WildlifeObs.shp
ObsFtrScale	10000
Datum	NAD27 Conus
Projection	Albers (converted from Geographic)

Species Table

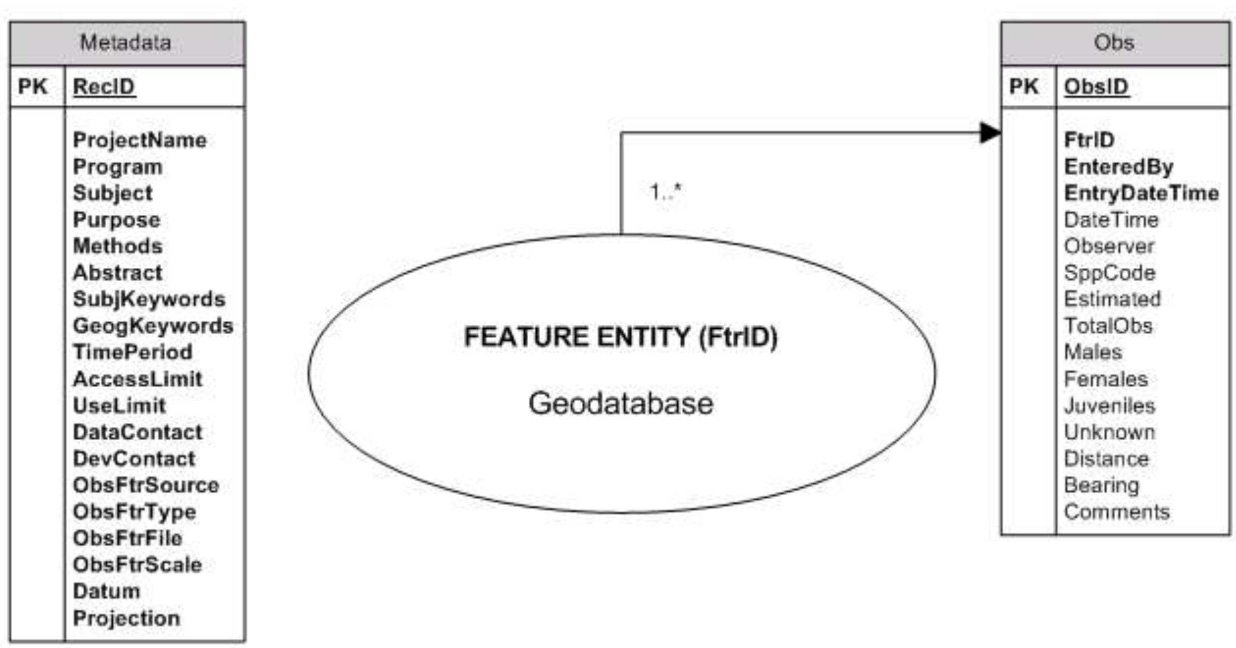
SppCode	wtd
TSN	180697
Scientific	Odocoileus Rafinesque
Common	white-tailed deer
Description	Rafinesque, 1817
Comments	Obtained from ITIS website at www.itis.usda.gov

Wildlife Survey Geodatabase Example (continued)

Obs Table

ObsID	6200118
FtrID	P49001710
EnteredBy	J Doe
EntryDateTime	7/5/2001 3:10:05 PM
DateTime	6/30/2001 4:26:56 PM
Observer	J Doe
SppCode	wtd
Estimated	None
TotalObs	10
Males	3
Females	6
Juveniles	1
Unknown	0
Distance	0
Bearing	0
Comments	Pit River corridor between Canby and Kelly Hot Springs

Entity Relationships

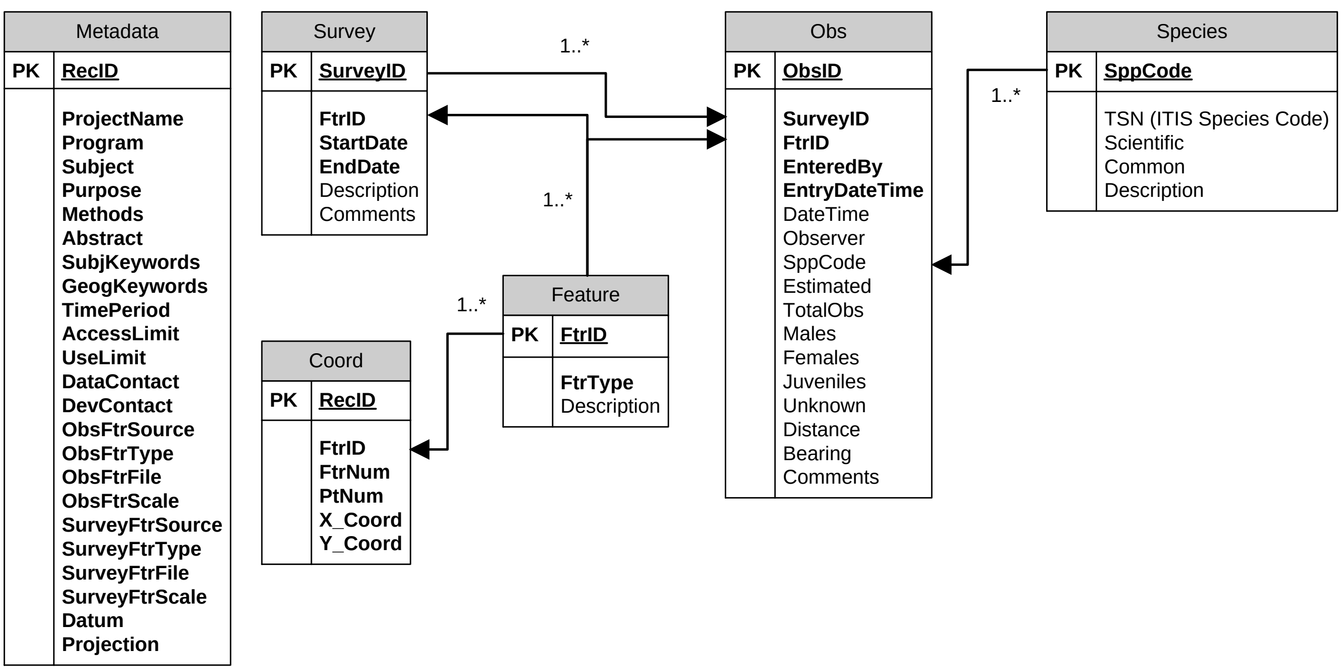


Examples (continued)

Wildlife Survey Tabular

This two part example demonstrates a four plot variation of the wildlife survey scenario. Data is represented in a purely tabular manner using a *UFO Participating Database*. The data resides in a personal computer. As needed, it can be pooled with other participating databases of the same Class and migrated to a *UFO Managed Database,* where the feature data would be converted into true geo-spatial features, i.e., the feature entities would reside in a GIS. The tabular representation allows for associating the feature identifier with more than one feature entity, e.g., more than one point, line, or polygon; however, it does not allow for the feature identifier to be associated with different feature types, e.g., a single feature identifier cannot be associated with a point, line, and polygon as in the preceding example. In this example the optional Survey table is used to demonstrate how the survey line transect in the previous example can be treated as a distinct feature, and associated with more than one observation.

Entity Relationships



Wildlife Survey Tabular Example (continued)

Metadata Table (Metadata table is the same for both parts of this example.)

ProjectName	Wildlife Observations Database
Program	NCNCR (Region 1) Wildlife Program
Subject	Wildlife Observations throughout Region 1
Purpose	Develop a systematic, randomized approach to observing wildlife throughout Northern California.
Methods	Arial observations along predetermined survey transacts using randomly selection areas
Abstract	Data represents wildlife observations that were sampled randomly throughout northern California.
SubjKeywords	Wildlife, five-miler
GeogKeywords	NCNCR, Northern California, Region 1
TimePeriod	Spring 2001
AccessLimit	None
UseLimit	None
DataContact	Dave Smith - Wildlife Biologist NCNCR Headquarters 601 Locust Street, Redding, CA 96001
DevContact	Clint Kellar - Research Analyst II NCNCR Headquarters 2440 Athens Ave Redding, CA 96001
ObsFtrSource	GPS point locations adjusted with estimated bearing and direction
ObsFtrType	Point Locations
ObsFtrFile	WildlifeObs.shp
ObsFtrScale	10000
SurveyFtrSource	Randomized Transects (describe methodology here)
SurveyFtrType	Line Transects (roads)
SurveyFtrFile	WildlifeSurvey.shp
SurveyFtrScale	24000
Datum	NAD27 Conus
Projection	Albers (converted from Geographic)

Wildlife Survey Tabular Example (continued)

Species Table (Species table are the same for both parts of this example.)

SppCode	wtd
TSN	180697
Scientific	Odocoileus Rafinesque
Common	white-tailed deer
Description	Rafinesque, 1817
Comments	Obtained from ITIS website at www.itis.usda.gov

Survey Table (Survey table is the same for both parts of this example.)

SurveyID	S36000000001
FtrID	LT33606302001
StartDate	6/30/2001
EndDate	6/30/2001
Description	Transact S36
Comments	Line transact across Pit River corridor between Canby and Kelly Hot Springs

Wildlife Survey Tabular Example (continued)

Part I

This observation record uses the survey identifier, i.e., the SurveyID, to indicate that it is part of a survey event, i.e., a line transect in this case. The observation's feature identifier, i.e., the FtrID, references a multiple polygon feature entity consisting of four grid plots, or polygons.

Obs Table

ObsID	6200118
SurveyID	S36000000001
FtrID	P49001711
EnteredBy	J Doe
EntryDateTime	7/5/2001 3:10:05 PM
DateTime	6/30/2001 4:26:56 PM
Observer	J Doe
SppCode	wtd
Estimated	None
TotalObs	10
Males	3
Females	6
Juveniles	1
Unknown	0
Distance	0
Bearing	0
Comments	Pit River corridor between Canby and Kelly Hot Springs (all plots)

Wildlife Survey Tabular Example – Part I (continued)

The Feature and Coord tables represent the survey transect line as a linear geo-spatial entity, and relate to a record in the Survey table. Also, they represent the four grid plots as a multiple polygon geo-spatial entity, and relate to a record in the Obs table. (Refer to the map view)

Feature Table

FtrID	FtrType	Description
S36000000001	2	Line transact across Pit River corridor between Canby and Kelly Hot Springs
P49001711	3	Pit River corridor between Canby and Kelly Hot Springs (NW Plot)

Coord Table

RecID	FtrID	FtrNum	PtNum	X_Coord	Y_Coord
1	S36000000001	1	1	-71867.07124	379566.2729
2	S36000000001	1	2	-70636.16496	382548.8535
3	P49001711	1	1	-72027.21067	380576.44997
4	P49001711	1	2	-72027.21067	380352.85415
5	P49001711	1	3	-71803.61485	380352.85415
6	P49001711	1	4	-71796.83922	380576.44997
7	P49001711	2	1	-70753.39206	380942.33404
8	P49001711	2	2	-70753.39206	381165.92986
9	P49001711	2	3	-70543.3475	381165.92986
10	P49001711	2	4	-70536.57187	380955.8853
11	P49001711	3	1	-71532.58961	381938.35178
12	P49001711	3	2	-71580.01903	381728.30722
13	P49001711	3	3	-71369.97447	381687.65344
14	P49001711	3	4	-71342.87195	381924.80052
15	P49001711	4	1	-70543.3475	382087.41566
16	P49001711	4	2	-70543.3475	382317.78711
17	P49001711	4	3	-70326.52731	382317.78711
18	P49001711	4	4	-70326.52731	382094.19129

Wildlife Survey Tabular Example (continued)

Part II

The below observation records use a common survey identifier, i.e., the SurveyID, to indicate association with each other. In this case each grid plot represents a single polygon geo-spatial entity, one for each observation, and relates to the feature identifier, i.e., the FtrID. (Refer to the map view)

Obs Table

ObsID	6200121	6200122	6200123	6200124
SurveyID	S36000000001	S36000000001	S36000000001	S36000000001
FtrID	P49001716	P49001717	P49001718	P49001719
EnteredBy	J Doe	J Doe	J Doe	J Doe
EntryDateTime	7/5/2001 15:10	7/5/2001 15:10	7/5/2001 15:10	7/5/2001 15:10
DateTime	6/30/2001 16:16	6/30/2001 16:21	6/30/2001 16:26	6/30/2001 16:35
Observer	J Doe	J Doe	J Doe	J Doe
SppCode	wtd	Wtd	wtd	wtd
Estimated	None	None	None	None
TotalObs	1	5	3	1
Males	1	1	0	1
Females	0	3	3	0
Juveniles	0	1	0	0
Unknown	0	0	0	0
Distance	0	0	1	0
Bearing	0	0	0	0
Comments	Pit River corridor between Canby and Kelly Hot Springs (SW Plot)	Pit River corridor between Canby and Kelly Hot Springs (SE Plot)	Pit River corridor between Canby and Kelly Hot Springs (NW Plot)	Pit River corridor between Canby and Kelly Hot Springs (NE Plot)

Wildlife Survey Tabular Example – Part II (continued)

As in Part I, the Feature and Coord tables represent the survey transect line as a linear geo-spatial entity, and relate to a record in the Survey table; however, in this case, each of the four grid plots, or polygon geo-spatial entities, represent individual observations and are assigned different feature identifiers or FtrID's.

Feature Table

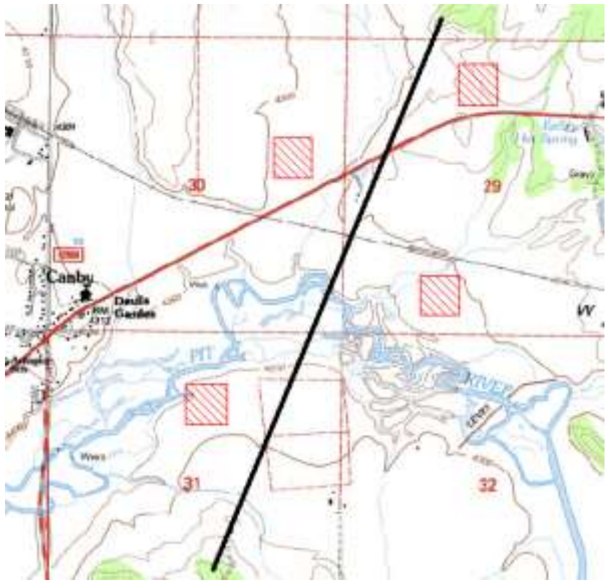
FtrID	FtrType	Description
S36000000001	2	Line transact across Pit River corridor between Canby and Kelly Hot Springs
P49001716	3	Pit River corridor between Canby and Kelly Hot Springs (SW Plot)
P49001717	3	Pit River corridor between Canby and Kelly Hot Springs (SE Plot)
P49001718	3	Pit River corridor between Canby and Kelly Hot Springs (NW Plot)
P49001719	3	Pit River corridor between Canby and Kelly Hot Springs (NE Plot)

Coord Table

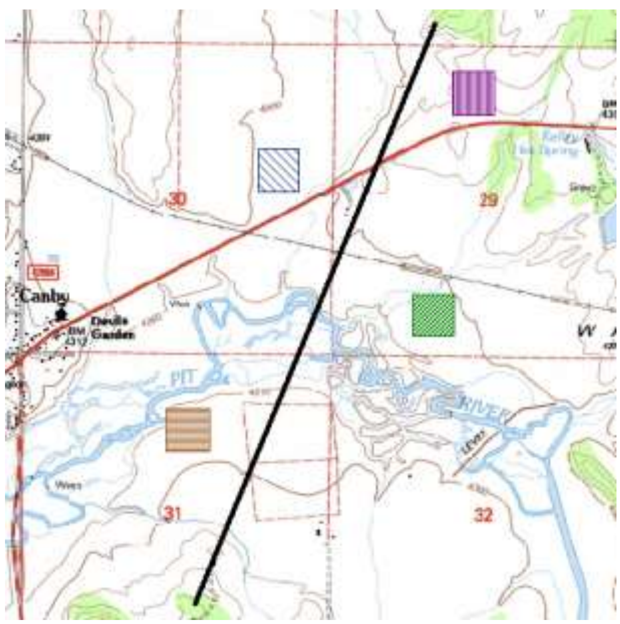
RecID	FtrID	FtrNum	PtNum	X_Coord	Y_Coord
1	S36000000001	1	1	-71867.07124	379566.2729
2	S36000000001	1	2	-70636.16496	382548.8535
3	P49001716	1	1	-72027.21067	380576.44997
4	P49001716	1	2	-72027.21067	380352.85415
5	P49001716	1	3	-71803.61485	380352.85415
6	P49001716	1	4	-71796.83922	380576.44997
7	P49001717	1	1	-70753.39206	380942.33404
8	P49001717	1	2	-70753.39206	381165.92986
9	P49001717	1	3	-70543.3475	381165.92986
10	P49001717	1	4	-70536.57187	380955.8853
11	P49001718	1	1	-71532.58961	381938.35178
12	P49001718	1	2	-71580.01903	381728.30722
13	P49001718	1	3	-71369.97447	381687.65344
14	P49001718	1	4	-71342.87195	381924.80052
15	P49001719	1	1	-70543.3475	382087.41566
16	P49001719	1	2	-70543.3475	382317.78711
17	P49001719	1	3	-70326.52731	382317.78711
18	P49001719	1	4	-70326.52731	382094.19129

Wildlife Survey Tabular Example (continued)

Map View – Part I
Survey (linear feature) and observation (multi-polygon feature) geo-spatial entities.



Map View – Part II
Survey (linear feature) and observation (distinct polygon features) geo-spatial entities.



Examples (continued)

Stream Survey

Using the optional Feature and Route tables the UFO-L1 model is capable of referencing a length of stream in a standardized routed hydrography GIS layer. In this example a length of Old Cow Creek will be referenced. Using standardized routed hydrography, the unique stream identifier (LLID) for Old Cow Creek is determined to be 1222302405556. Either with a GPS unit or a GIS driven stream measure tool, the survey's begin coordinates are determined to be -168812.29711 and 290936.11222, respectively. The end coordinates are determined to be -167809.16435 and 291185.61869, respectively. Assuming that the coordinates are in the same projection and datum as the standardized hydrography, then these five values, i.e., LLID, begin x-coordinate, begin y-coordinate, end x-coordinate, and end y-coordinate, are all that is needed to reference a length of surveyed stream.

Feature Table

FtrID	FtrType	Description
R49001720	4	Access road below radio facility to lower Whitmore

Route Table

RecID	1
FtrID	R49001720
LLID	1222302405556
BegX	-168812.29711
BegY	290936.11222
EndX	-167809.16435
EndY	291185.61869

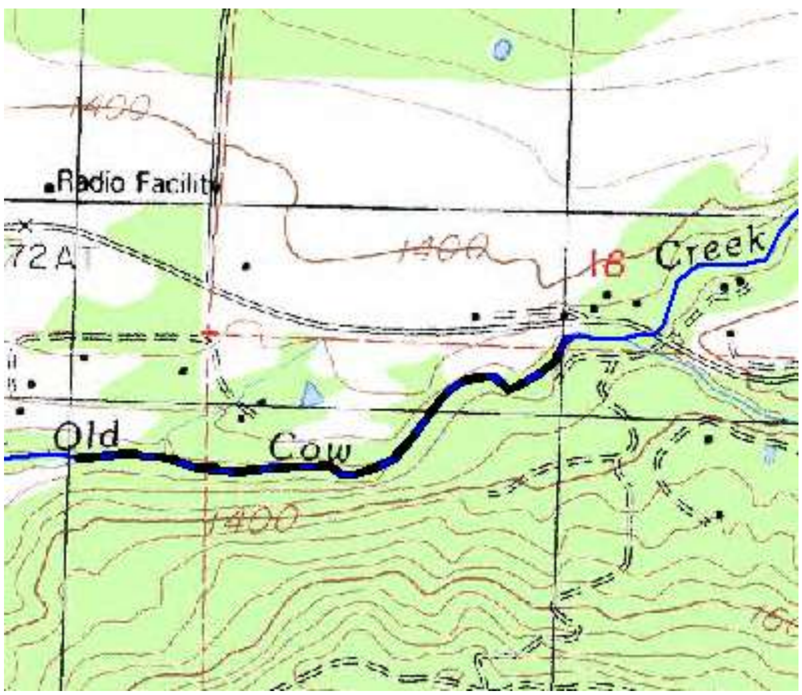
Stream Survey Example (continued)

Alternatively, if we can determine the measures, in feet, up stream to where the survey begins and ends, then only three values are needed, i.e., LLID, begin feet up the stream, and end feet up the stream. The foot measures must be calculated based on the hydrography used, e.g., using hip chain measurements would not be accurate. For the preceding example the begin and end measures are 55980 and 59755 feet, respectively. This alternate route table scenario is illustrated below.

Route Table

RecID	1
FtrID	R49001720
LLID	1222302405556
BegFt	55980
EndFt	59755

Stream Survey Map View



Stream Survey Example (continued)

The optional RouteSection table can be used to reference a particular section of the stream length. The term “section” would be defined by the UFO Class, or simply by a project lead. A “section” would be created for location information that cannot be described by the Route table alone, e.g., side of the stream and directionality. The below tables demonstrate how the RouteSection table can be used. For the purpose of this example, it is assumed that “right” and “left” bank refer to the banks as they would appear to a person looking upstream. Referencing a section of a route might be useful in a creel census survey, where the creel checker often times must interview anglers on one bank or the other, or moving in one direction or the other

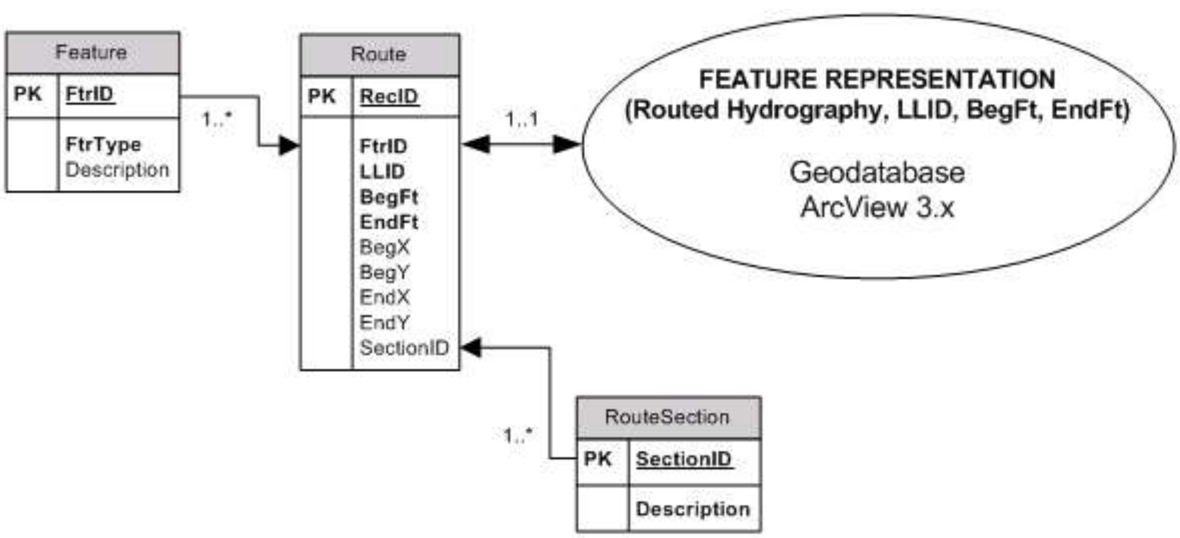
RouteSection Table

SectionID	Description
1	Right bank heading upstream
2	Right bank heading downstream
3	Left bank heading upstream
4	Left bank heading downstream

Route Table

RecID	1
FtrID	R49001720
LLID	1222302405556
BegFt	55980
EndFt	59755
SectionID	3

Entity Relationships



Examples (continued)

Lake Survey

Lakes can be referenced using a standardized lakes GIS layer, and the optional Feature and Lake tables. Each lake has a unique identifier (LLID) that is used to represent the entire lake. To reference specific sections of a lake the optional LakeSection table must be used. The below tables and entity relationship diagram illustrate how this is done for a survey taking place on the Pit River arm of Shasta Lake.

Feature Table

FtrID	FtrType	Description
L49001721	5	Lake Shasta, Shasta County

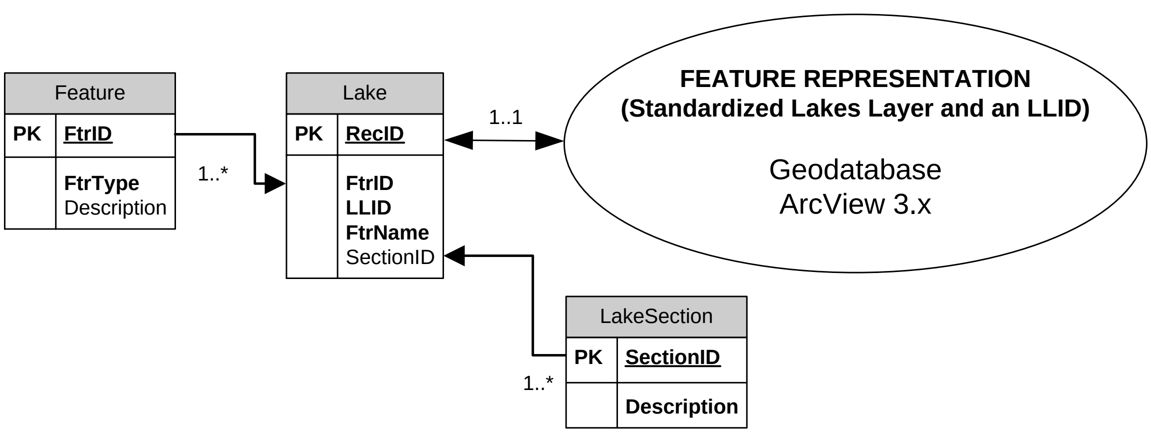
Lake Table

FtrID	L49001721
LLID	1223722407754
FtrName	Shasta Lake
SectionID	2

LakeSection Table

SectionID	Description
1	Main Body
2	Pit River Arm
3	McCloud River / Squaw Creek Arm
4	Sacramento River Arm

Entity Relationships



Examples (continued)

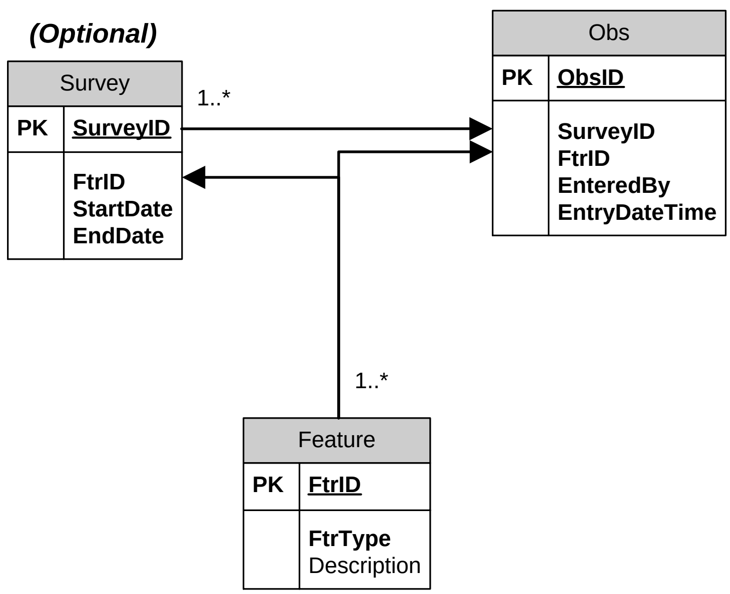
Textual Description

If an otherwise UFO-L1 compliant database does not have a geo-spatial counterpart, either in a GIS or as a tabular representation, then it is not a true UFO database; however, in situations where there is a textual location description, this information can act as a "place-holder" until the geo-spatial entity has been created. To do this, simply provide the optional Feature table with a unique feature identifier for the location, a feature type, and a brief description of the location. The table and entity diagram below illustrates how this was done for three osprey nesting sites. Since the sites are well known locations, at a future time someone can return to GPS the coordinates.

Feature Table

FtrID	FtrType	Description
A49001720	3	Packers Bay Study Area, Shasta Lake, Shasta County
P49001721	1	North side promontory at mouth of Packers Bay inlet, Shasta Lake, Shasta County
P49001722	1	South side promontory at mouth of Packers Bay Inlet, Shasta Lake, Shasta County
P49001723	1	200 meters south along shoreline from Packer's Bay inlet, Shasta County

Entity Relationships



Examples (continued)

Participating Database Alternate Approach

Alternatively, the UFO-L1 tables, with their minimum field configurations, can be added to an existing observation database; the Obs table can be joined to the parent table of the database using the ObsID field. Referential integrity will be enforced by the parent table and its child table relationships. This is the least intrusive way to create UFO-L1 compliancy when an observation database already exists.

The following Access Relationships window illustrates how this was done with a creel census survey database project (Metadata and Survey tables are not displayed.). The Obs table was linked to the existing creel census survey database by joining the ObsID and EffortID fields in a one to one relationship.