

1. [Data Model Manual](#)

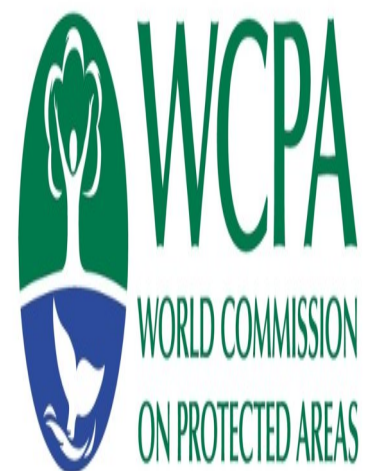
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Data Model Manual



HAWK's **data model** is designed to accommodate wildlife, arthropod, and environmental health data from various sources, including local to national wildlife health surveillance systems, research initiatives, citizen-science based projects, or any other source of wildlife health information. We strongly recommend first learning about the core components of the data model: *Project to Results*, and *Interpretation*.

HAWK structures surveillance data following a hierarchy, capturing relevant epidemiological information at each step. The full hierarchy includes:

1. **Project:** A planned set surveillance operations with specific goals or a common topic, usually

with a defined scope and set of tasks with a common leader and organizer (e.g., a national wildlife health surveillance system).

2. **Surveillance Activity:** Specific surveillance goal and methodology (who, where, when, what, why, how) documented following a standard metadata format.
3. **Field Visit:** A recorded interval during which fieldwork or data collection are conducted.
4. **Location:** Areas where activities are conducted.
5. **Area Effort, Track Effort, and Point Effort:** Units of effort associated with the collection of **Events** (see below) in a determined area (e.g., Events in a sector within protected area) along in a linear feature (e.g., Events in transect or ranger patrol track), or at spatial point (e.g., a set of mist nests placed during a specific period of time for a sampling Event), respectively.
6. **Event:** Point epidemiological unit with a spatiotemporal coordinate (longitude and latitude) where wildlife health surveillance data are collected from.
7. **Source:** An observed, diagnosed, or sampled entity to assess their health status or health hazard presence. There are four Source types:
 - *Group*: more than one individual of the same taxa
 - *Animal*: one individual
 - *Environmental*: a site where measurements on environmental properties are made or samples are collected from (e.g., ponds or feces in the field)
 - *Arthropod*: the population of arthropods at a site
8. **Source Record:** A record of a *Source* at a specific time *t*.
9. **Specimen:** A sample taken from a *Source*.
10. **Diagnostic:** A test conducted on a *Source* or collected *Specimen* to assess health metrics.
11. **Result:** The outcome of a *Diagnostic* for a specific health metric and the corresponding interpretation.
12. **Interpretation:** The final status assigned to a *Specimen* or *Source Record* following documented case definitions.

The main relationships among the basic units of the data model are shown in Figure 1 below:

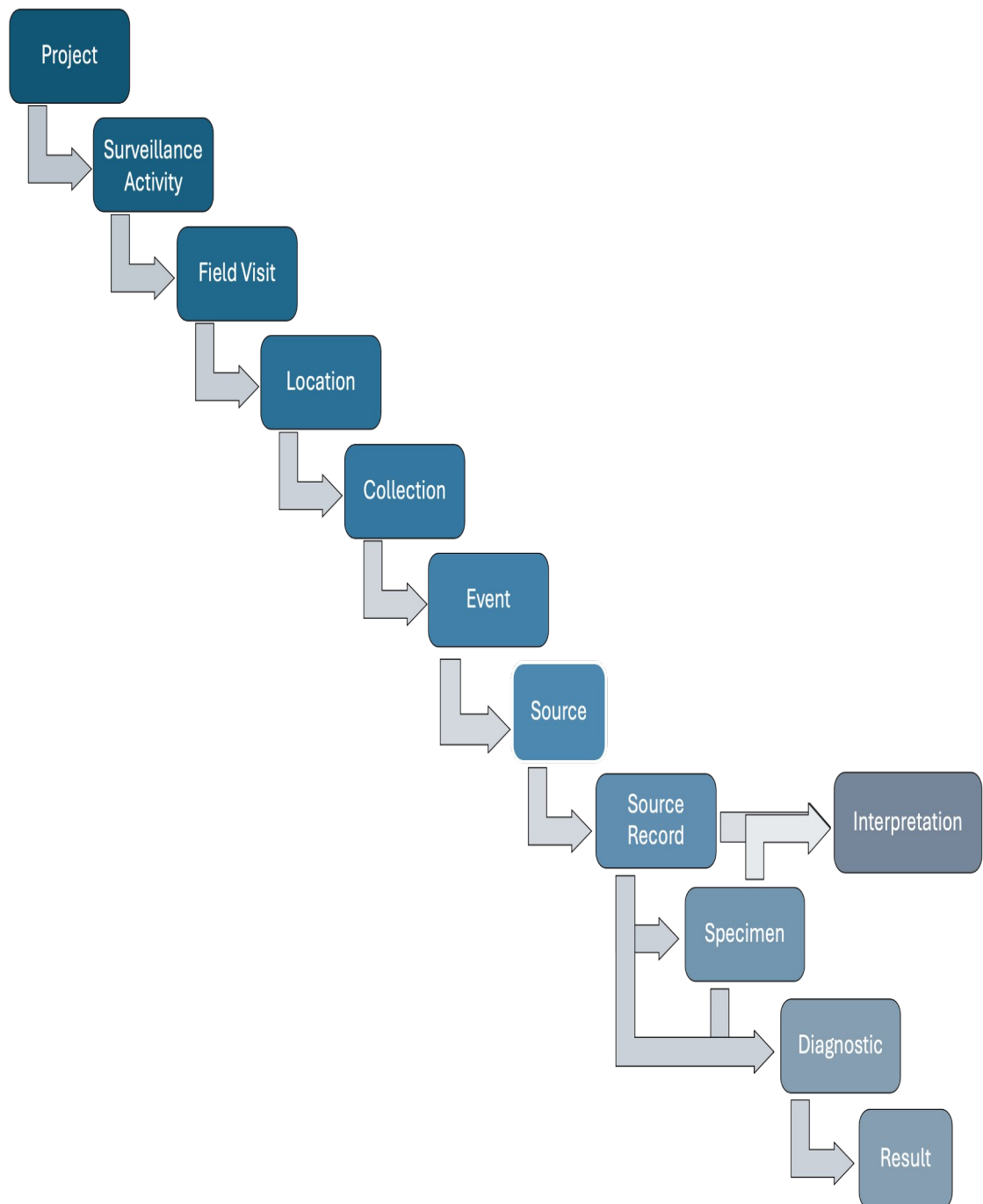


Figure 1: Basic relationships among the basic units of the data model.

HAWK employs a modular approach to the data model, enabling components to be added based on specific user needs.

NoteCase Study 1

When data comes from wildlife mortality reported by a community member through a mobile application:

The Surveillance Activity contains a description of the methodology

The Field Visit could be a day when the mortality was found

The Location could be the site where the mortality was found

An Event is the epidemiological unit with latitude, longitude, and time representing the position where dead animals were found

The Animal Source Records describe the dead animals

No Specimens, Diagnostics, or Results data are generated

No Effort is involved as the animals are found opportunistically

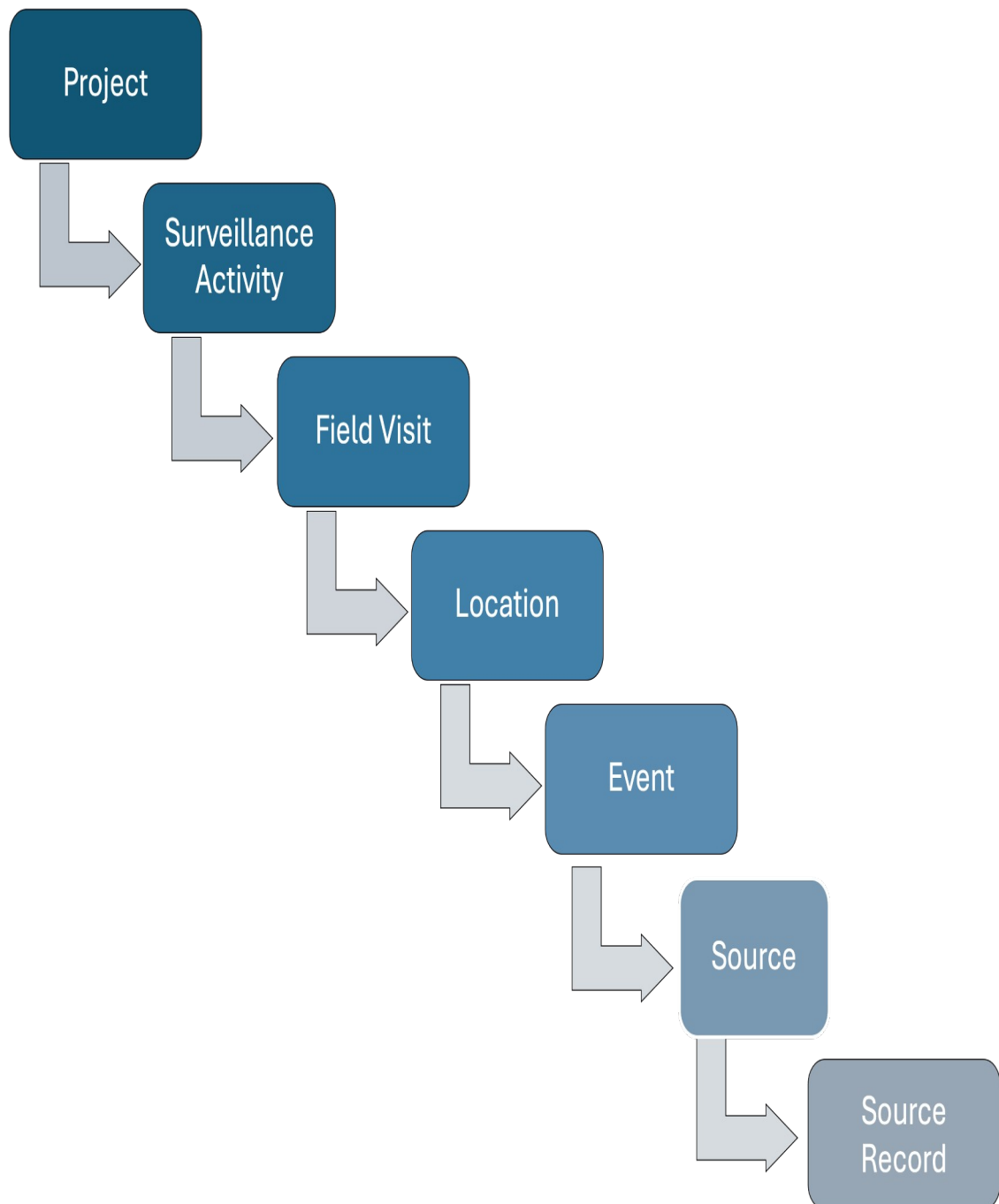


Figure Case Study 1: An illustration of how case study 1 data is structured in the data model.

This flexible structure means the model remains efficient and scalable, adapting to different users and surveillance needs.

Main Units of the Data Model

Project

A **Project** in the data model represents a planned set surveillance operations with specific goals or a common topic, usually with a defined scope and set of tasks with a common leader and organizer (e.g., a national wildlife health surveillance system) supported by specific entities and lead by specific individuals.

Projects serve as the first hierarchical unit in the database under an **Organization** and must contain at least one **Surveillance Activity**. They can be time-limited, spanning a single date, or ongoing for an extended period as needed.

Key properties of a **Project** include:

- Project ID
- Project Code
- Project Cross-Reference ID
- Project Cross-Reference Origin
- Project Leader
- Project Funding Sources

Other attributes are provided in the [Data Dictionary](#) (under construction)

NoteExample

Surveillance of New World Screwworm. The Project includes surveillance of adult flies trapped with baited devices, news sources reporting infestation cases in wildlife, and camera trap videos with wildlife showing wounds compatible with New World Screwworm infestation.

Surveillance Activity

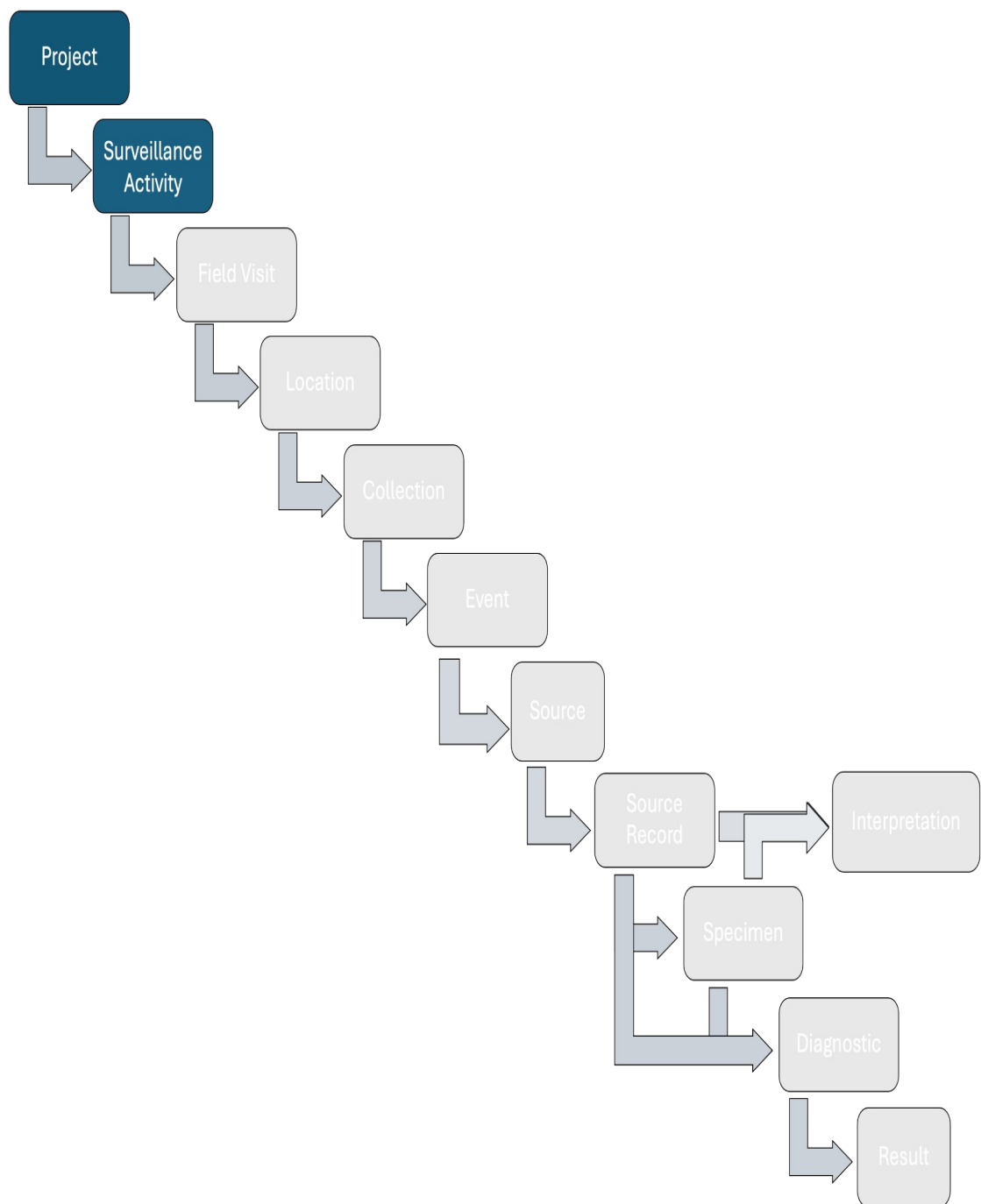


Figure 2: Position of Surveillance Activity in the data model.

A **Surveillance Activity** in the data model refers to a coordinated set of activities aimed at detecting diseases, demonstrating disease freedom, measuring incidence or prevalence, or assessing trends in specific health metrics within defined populations. In general, a **Surveillance Activity** will be characterized by a specific objective, and corresponding methods.

Each **Surveillance Activity** includes metadata describing objectives and methods. Key properties of a **Surveillance Activity** include:

- Targeted species, populations, and hazards
- Samples and collection methods
- Diagnostics conducted and case definitions
- Start and End Dates
- Biological, Chemical, Physical, and Physiological targets
- Taxa included
- Involved partners

- Definitions of Locations, Events, and Sources
- Source identification, Specimens, and Effort methods
- Diagnostic techniques and case definitions

Other attributes are provided in the [Data Dictionary](#) (under construction)

A **Surveillance Activity** can span multiple **Field Visits**, **Locations**, and **Source** types (e.g., *Groups*, *Animals*, *Environmental* and *Arthropod* Sources).

NoteCase Study 2

The [longitudinal assessment of coronavirus shedding in two *Eidolon helvum* bat roosts in Africa](#) aimed understanding the patterns of coronavirus shedding through their reproductive cycle assessing common patterns in two roost separated by thousands of kilometers where the reproductive season do not match over time. The methods involved collecting a fixed number of fecal samples from the two bat roosts of the same species every month for 12 months, with subsequent testing for *Coronaviridae* sp. The Project in this case was USAID PREDICT and this study was a specific Surveillance Activity. Field Visits were each visit monthly to the roosts, the Locations were the two roosts, the Source Records were the bats at the sampling date each month, and the Specimens are the fecal samples taken from the roost

NoteOutbreak Investigation

Each outbreak investigation is considered a Surveillance Activity. An Outbreak Surveillance Activity can encompass the initial Field Visit that led to the outbreak detection and subsequent Field Visits associated with the investigation and control. The initial Field Visit that led to the outbreak detection may have already been part of another Surveillance Activity and also the Outbreak Surveillance Activity (e.g., routine monitoring of a particular area), and this relationship is maintained to allow traceability on the history of detections.

For instance, an outbreak may first be detected during routine patrols by rangers. In such cases, the initial ranger-conducted Field Visit and its components should belong to both the ranger patrol Surveillance Activity and also the outbreak Surveillance Activity. Follow-up Field Visits (e.g., by veterinarians or public health officers investigating the outbreak) should be assigned exclusively to the outbreak Surveillance Activity.

Field Visit

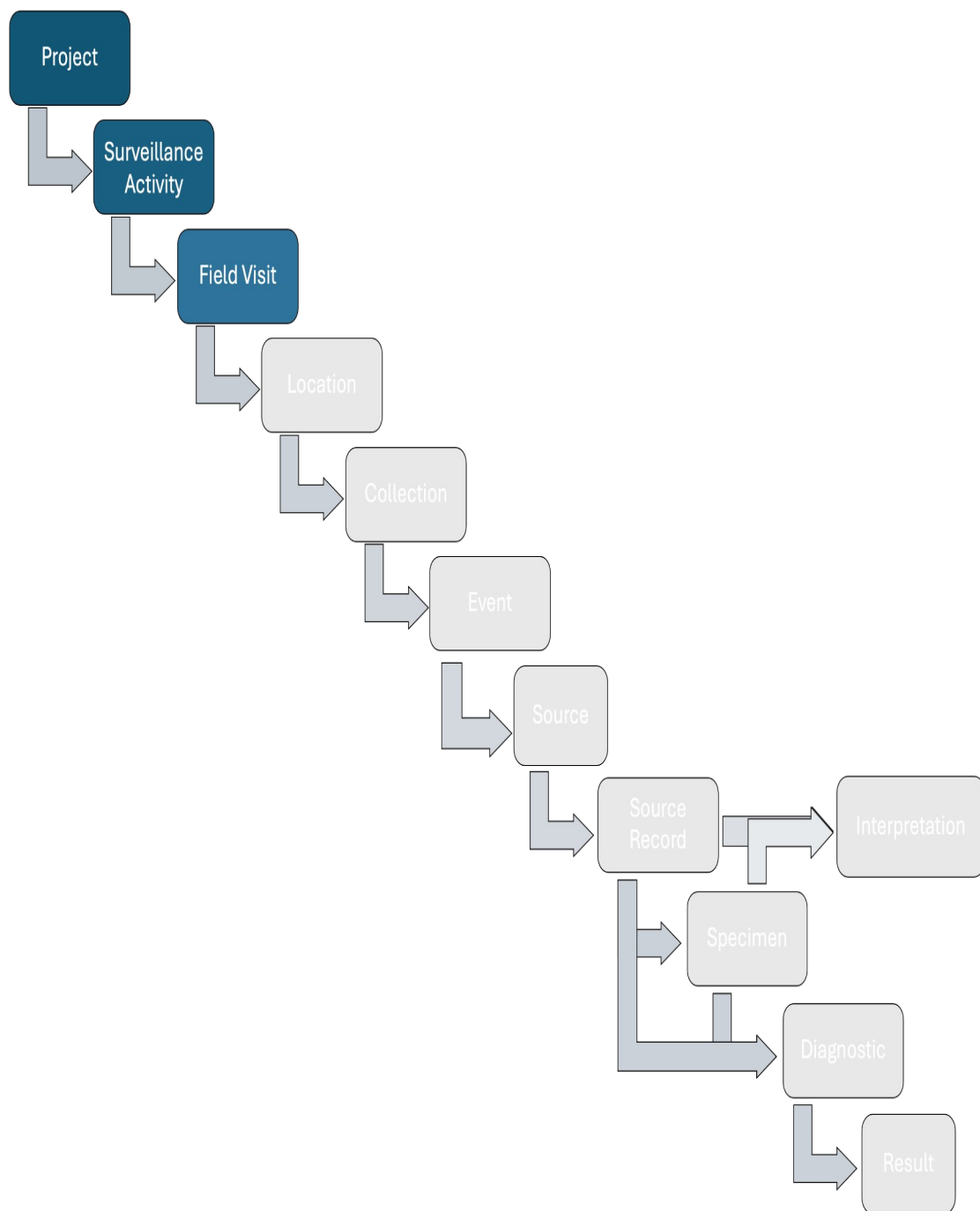


Figure 3: Position of Field Visit in the data model.

A **Field Visit** in the data model represents a defined time period—including a start and end date—during which **Locations** are visited, **Events** and **Sources** are conducted, identified, or observed, and **Specimens** might be collected and documented. The length of a **Field Visit** is flexible. The meaning of a **Field Visit** depends on the methodology of the Surveillance Activity. Users must define what a **Field Visit** represents and document it in the **Surveillance Activity** metadata.

Key properties of a **Field Visit** include:

- Start and End Date
- Field Visit ID and Code
- Field Visit Cross-Reference ID and Origin
- Field Visit Leader

Other attributes are provided in the [Data Dictionary](#) (under construction)

In the monitoring of wildlife anomalies through camera traps (for example, as described [here](#)), a Field Visit refers to the period during which a set of camera traps was deployed in the field

Location

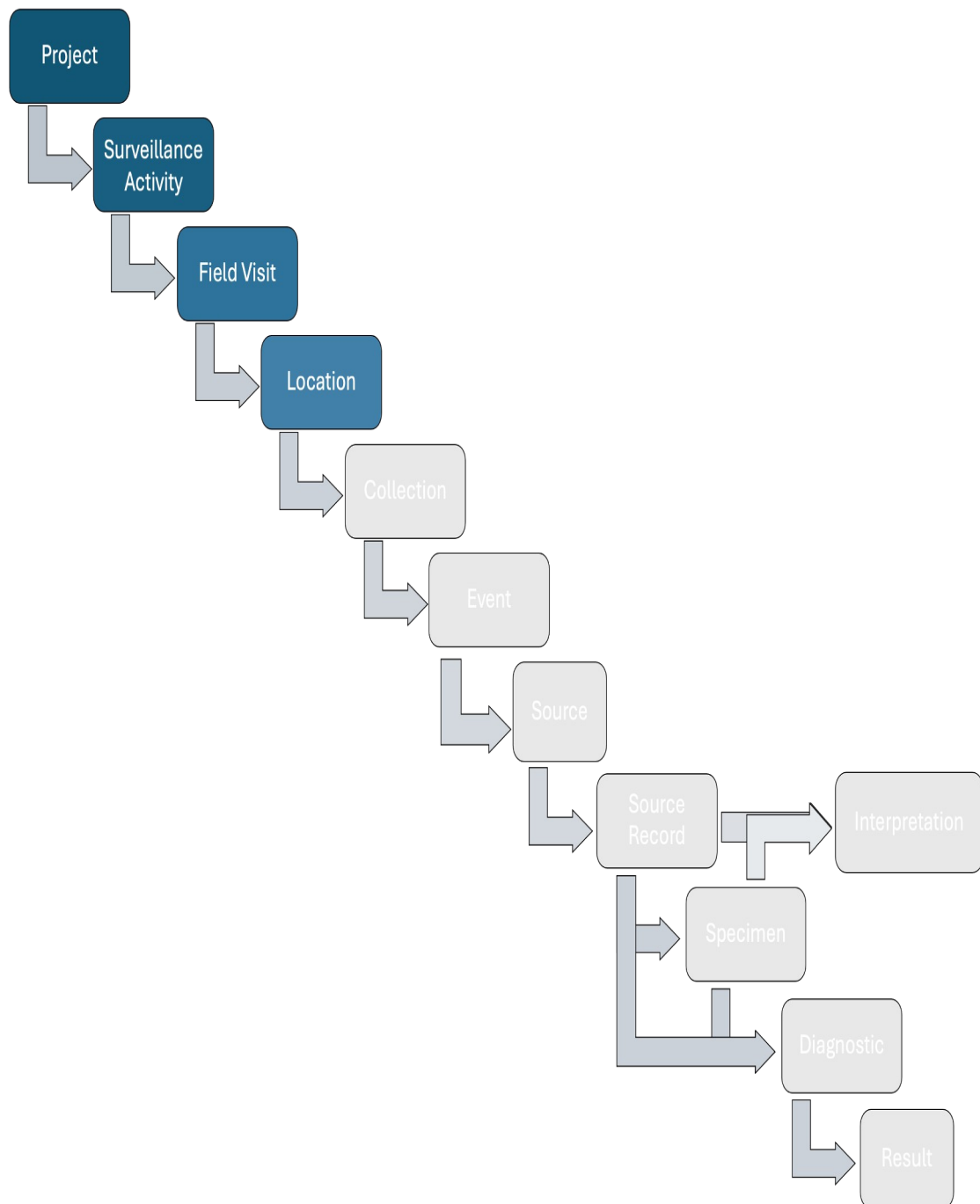


Figure 4: Position of Location in the data model.

In the data model, a **Location** represents a general area where **Field Visits** take place. **Locations** are not defined by exact latitude and longitude coordinates (unlike **Events**, defined later), but they serve as a broader spatial grouping for organizing data. The meaning of a **Location** depends on the methodology of the Surveillance Activity. Users must define what a **Location** represents and document it in the **Surveillance Activity** metadata.

Key attributes of a **Location** include:

- Location ID and Code

- Location Cross-Reference ID and Origin
- Location Type

Other attributes are provided in the [Data Dictionary](#) (under construction)

NoteCase Study 4

In the sampling of wildlife in markets, a Location can refer to a specific market

Effort

In the data model, **Effort** contains the information associated with the spatial and temporal metrics used to actively obtain **Sources** in the field.

When **Source Records** are not linked to an **Effort** (e.g., opportunist finding of dead animals), then no **Effort** is involved.

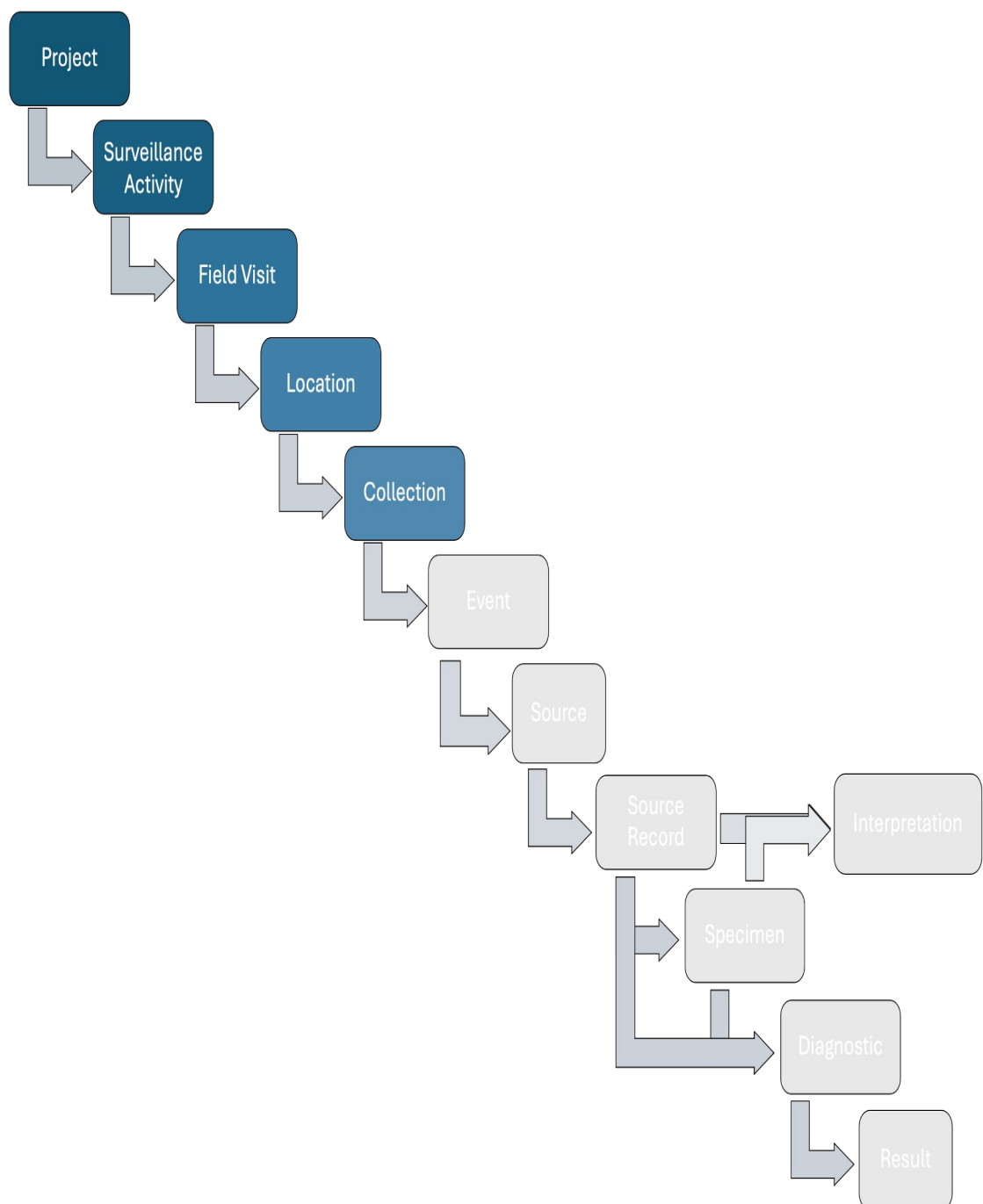


Figure 5: Position of Effort in the data model.

Area Effort

Area Effort refers to the spatial and temporal work to find or document **Events** within an area (e.g., square kilometers explored in x amount of time) within a **Location**. The meaning of **Area Effort** depends on the methodology of the Surveillance Activity. Users must define what a **Area Effort** represents and document it in the **Surveillance Activity** metadata.

Key attributes of a **Area Effort** include:

- The spatial effort unit (e.g., square meters)
- The spatial effort (e.g., 100)
- The temporal effort unit (e.g., hours)
- The temporal effort (e.g., 6)
- The spatial coordinates of the area

Other attributes are provided in the [Data Dictionary](#) (under construction)

NoteCase Study 5

Following recommendations [here](#), in an outbreak investigation, dead marine birds are actively searched in a beach. In this case, the beach is the Location and each area explored within the beach during a specific period of time represents an Area Effort

Track Effort

A **Track Effort** refers to the spatial and temporal work to find or document **Events** in linear features (e.g., kilometers walked through a set of spatial coordinates in an x period of time) within a **Location**. The meaning of a **Track Effort** depends on the methodology of the Surveillance Activity. Users must define what a **Track Effort** represents and document it in the **Surveillance Activity** metadata.

Key attributes of a **Track Effort** include:

- The spatial effort unit (e.g., kilometers)
- The spatial effort (e.g., 15)
- The temporal effort unit (e.g., hours)
- The temporal effort (e.g., 6)
- The spatial coordinates of the track

Other attributes are provided in the [Data Dictionary](#) (under construction)

NoteCase Study 6

Following the ranger-based wildlife morbidity and mortality surveillance described [here](#), a sector within a protected area is the Location and the route traveled by patrolling rangers to find wildlife morbidity and mortality during a specific period of time represents a Track Effort.

Track Efforts are not nested in **Areas Efforts**. If a methodology involves **Events** nested in **Track Efforts** nested in **Area Efforts** then, the link between both types of **Effort** can be made through the spatial data and through **Tags** (see “Advanced”).

Point Effort

A **Point Effort** refers to the spatial and temporal work to find or document **Events** at a specific spatio-temporal coordinate (e.g., a device set up at a specific longitude and latitude for x amount of time to capture mosquitoes) within a **Location**. The meaning of a **Point Effort** depends on the methodology of the Surveillance Activity. Users must define what a **Point Effort** represents and document it in the

Surveillance Activity metadata.

Key attributes of a **Point Effort** include:

- The spatial effort unit (e.g., mist net)
- The spatial effort (e.g., 1)
- The spatial coordinates (longitude and latitude)
- The temporal effort unit (e.g., hours)
- The temporal effort (e.g., 2)

Other attributes are provided in the [Data Dictionary](#) (under construction)

NoteCase Study 7

In the counting of dead birds at a wetland from a tower and using binoculars, the **Point Collection** is the position and number of observers recording dead birds from the tower during a specific period of time

NoteCase Study 8

In the monitoring of wildlife morbidity through camera traps, the **Point Collection** is the number camera traps deployed at a specific position to photograph animals and the hours or days active.

Area, Track and Point Effort fields also help capture issues encountered when searching for **Sources**, such as camera traps running out of power, being stolen, or damaged mist nets.

Efforts can contain between zero (e.g., an unsuccessful capture where no animals are caught) and an unlimited number of Source Records**.

Event

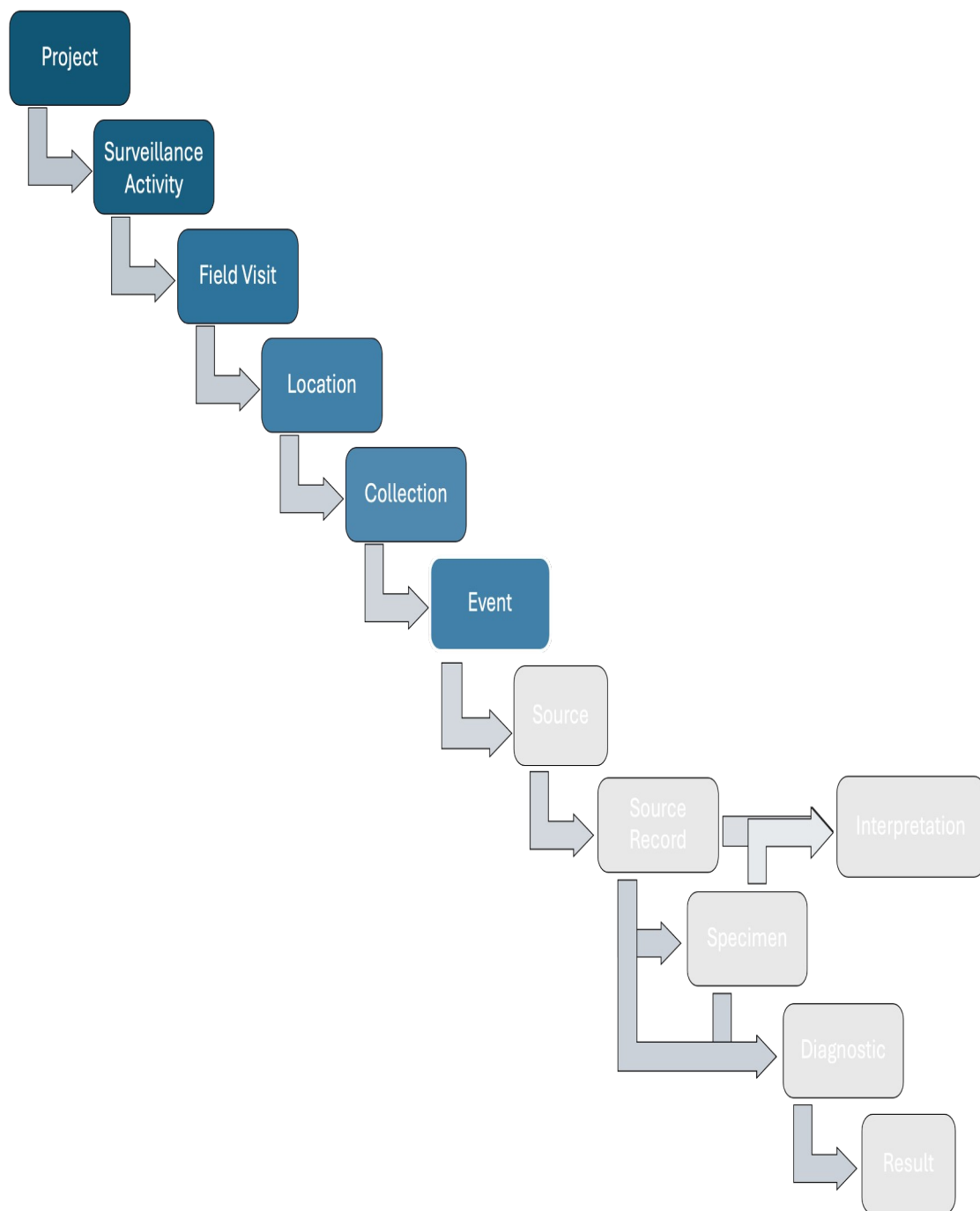


Figure 6: Position of Event in the data model.

In the data model, an **Event** represents a distinct spatio-temporal coordinate where **Source Record** data is collected from (e.g., specific longitude, latitude, and timestamp). The definition of **Event** depends on the methodology of the Surveillance Activity. Users must define what an **Event** represents and document it in the **Surveillance Activity** metadata. We strongly recommend that an **Event** represents the minimal epidemiological unit of interest containing **Source Records** at position p and time t (e.g., the sampling event of animals in a cage, the collection of mosquitoes using a trap, the position of a dead animal found in the field at time t)

Key attributes of a **Event** include:

- Start Date
- Event ID
- Event Code
- Event Cross-Reference ID
- Event Cross-Reference Origin

- Longitude & Latitude
- Coordinate Reference System (CRS) used

Other attributes are provided in the [Data Dictionary](#) (under construction)

NoteCase Study 9

A pair of mist nets are deployed to capture bats and sample them. The **Event** in this case is the sampling of the bats captured at time t using the mist nets. The nets are part of a **Point Effort**. In this case, the **Event** receives the same spatial coordinates as the **Point Effort**

NoteCase Study 10

A dead animal is found during a ranger patrol. In this case the **Event** is the position of the dead animal and the time of encounter

NoteCase Study 11

Injured animals are recorded using a camera trap. In this case the **Event** is each capture of animals by the camera trap and they receive the same spatial coordinates as the **Point Effort**. The **Point Effort** is the camera traps at a specific spatial position and the deployment time

For more examples see [here](#)

Other relevant characteristics of an **Event** include:

An Event might not belong to a Area, Track, or Point Effort. For example, the position of dead birds accidentally found in a beach or sampling of the animals in cages in a wet market.

An **Event** can include more than one **Source** type (see next section for a full description of **Sources**). For example, mosquito traps and collection of wastewater at the same position p and time t .

An **Event** can include or not at-observation normal (“healthy”) animals depending on the definition of **Event**.

An **Event** might not contain any **Source Records** (see next section for a full description of **Sources**). For example, when a mist net is deployed but it fails to capture any animal. The mist net (**Point Effort** is deployed, the sampling **Event** is conducted at time t but no animal is captured).

Source and Source Records

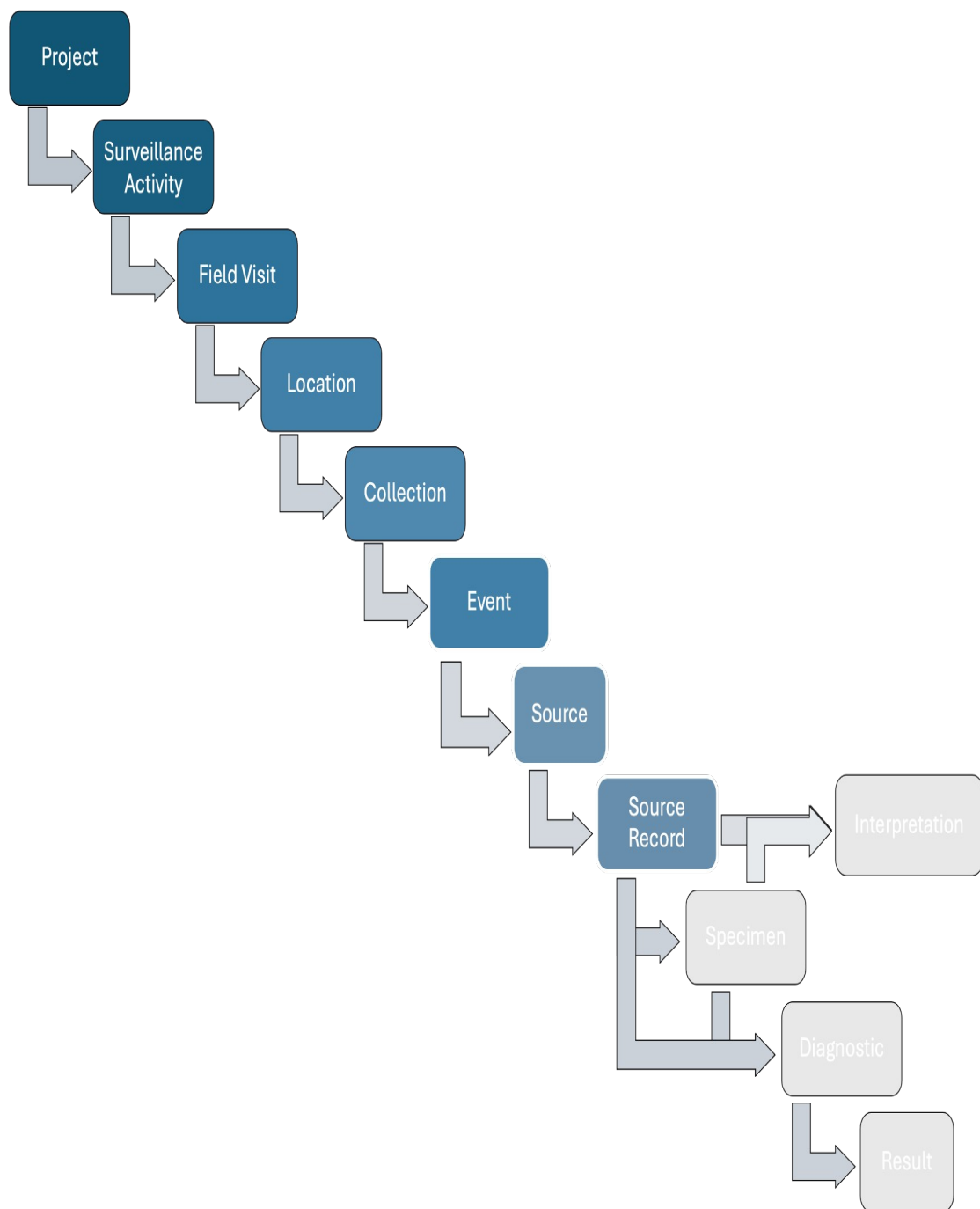


Figure 8: Position of Source Records in the data model.

General Overview

In the data model, a **Source** is an epidemiological unit of interest that can be observed, necropsied, diagnosed, or provide **Specimens** for analysis. The data model manages four types of **Sources**: i) a group of individuals of the same taxa (**Group Source**), ii) individual animal (**Animal Source**), iii) a site providing arthropods (**Arthropod Source**), and iv) a site providing environmental abiotic specimens (e.g., wastewater) or biotic specimens (e.g., feces not linked to a specific animal) or where metrics such as pH can be measured at (**Environmental Source**).

Identified **Sources** can be found at position p and time t in a single or multiple **Events**.

Group Source

A **Group Source** is a unit of individuals of the same taxa that belong to a common entity, such as a herd, roost, area, site, farm, cage, stall, or enclosure, forming a single epidemiological unit. Group

Sources can be observed, captured, diagnosed, and interpreted as a full unit, and provide collective **Specimens** if sampling is conducted. A **Group Source** can be shipped and stored when the individuals are dead.

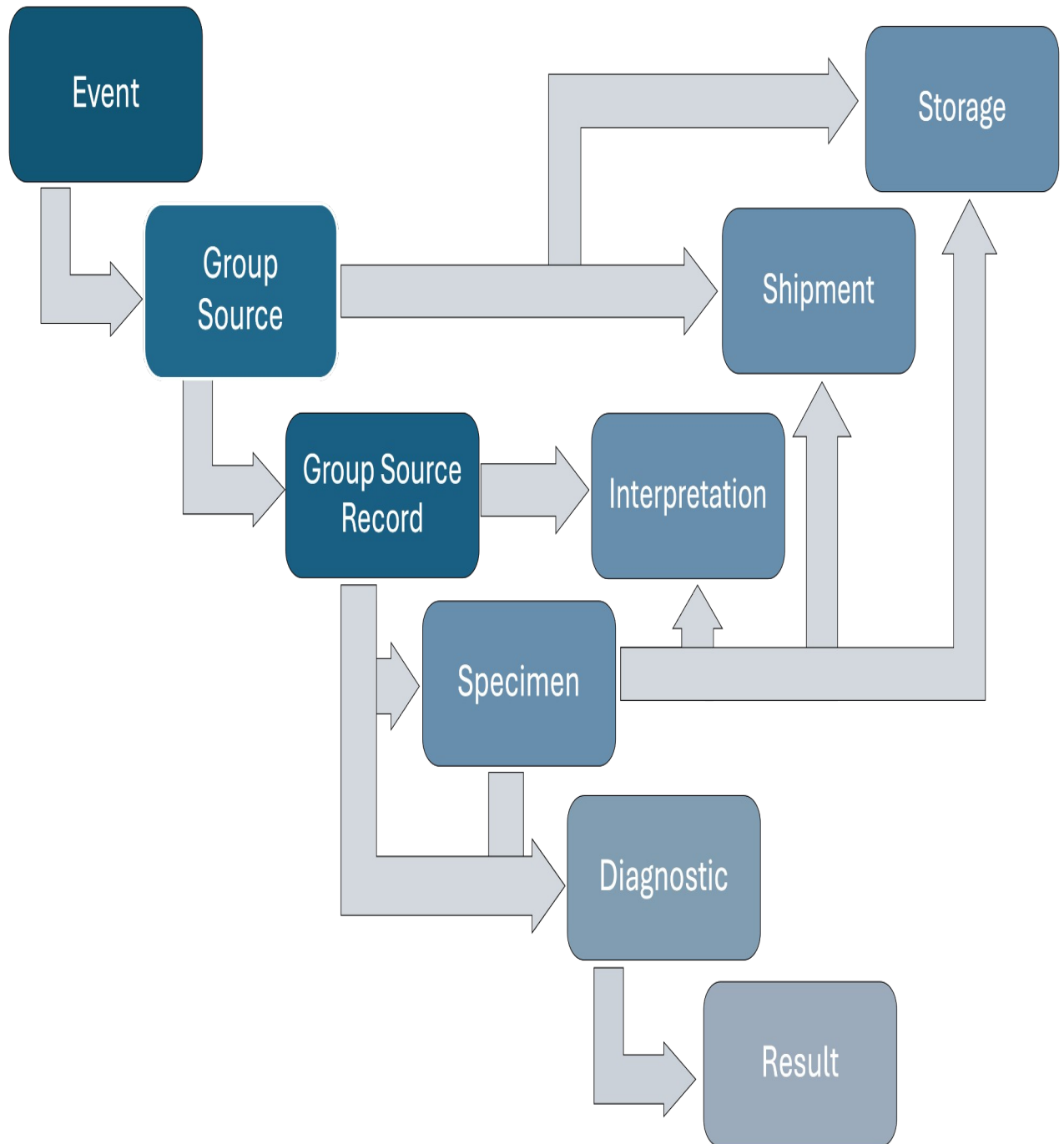


Figure 9: Detailed relationships of Group Source in the data model.

Group Source Record

A **Group Source Record** documents the animals of a **Group Source** at time t , categorized by sex, age, and life status (e.g., live or dead).

Key attributes of a **Group Source Record** include time independent variables:

- Group Source ID
- Record number
- Observed anomalies
- Potential causes of anomalies
- Potential causes of death

Other attributes are provided in the [Data Dictionary](#) (under construction)

Several attributes are recorded at the group level and, therefore, multiple options can be included. For example, several observed anomalies may be listed for a **Group Source Record**, but their distribution across individuals cannot be recorded.

A **Group Source Record** can be used for a **Diagnostic** (e.g., assessing the body condition of a specific herd using a standardized metric).

Carcasses of a **Group Source Record** can be recorded collectively (e.g., multiple dead frogs in a plastic bag) and they can be stored, shipped, and used collectively in a diagnostic test (see “Storage”, “Shipments”, and “Diagnostic” below).

Carcasses of a **Group Source Record** cannot have a collective necropsy. The individuals animals must be converted to **Animal Sources**.

The total number of animals of a specific taxon in an **Event** is the sum of the individuals of the taxa in the **Group Source Record** and each individual animal of the same taxa recorded as **Animal Source Record**. For example, consider a herd of 20 cows illegally raised in a protected area whose health is assessed at time t . If two cows are sampled, the two sampled cows should be documented as two separate **Animal Source Records** (one per cow), while the remaining 18 cows are recorded as a single **Group Source Record**, categorized by sex, age, and life status. In this scenario, the total number of cows is 20—the 18 recorded in the **Group Source Record** plus the two documented as **Animal Source Records**. The “herd” identity of these 20 cows split in three **Source Records** can be maintained using tags (see Complexities). If, however, the **Group Source Record** incorrectly includes all 20 cows while two of them are also recorded as **Animal Source Record**, the total count would incorrectly sum to 22.

Animal Source

An **Animal Source** represents a single individual. **Animal Sources** can be observed, captured, tested, necropsied, interpreted, and provide **Specimens** directly or during a **Necropsy**. An **Animal Source** can be shipped and stored if the individual is dead.

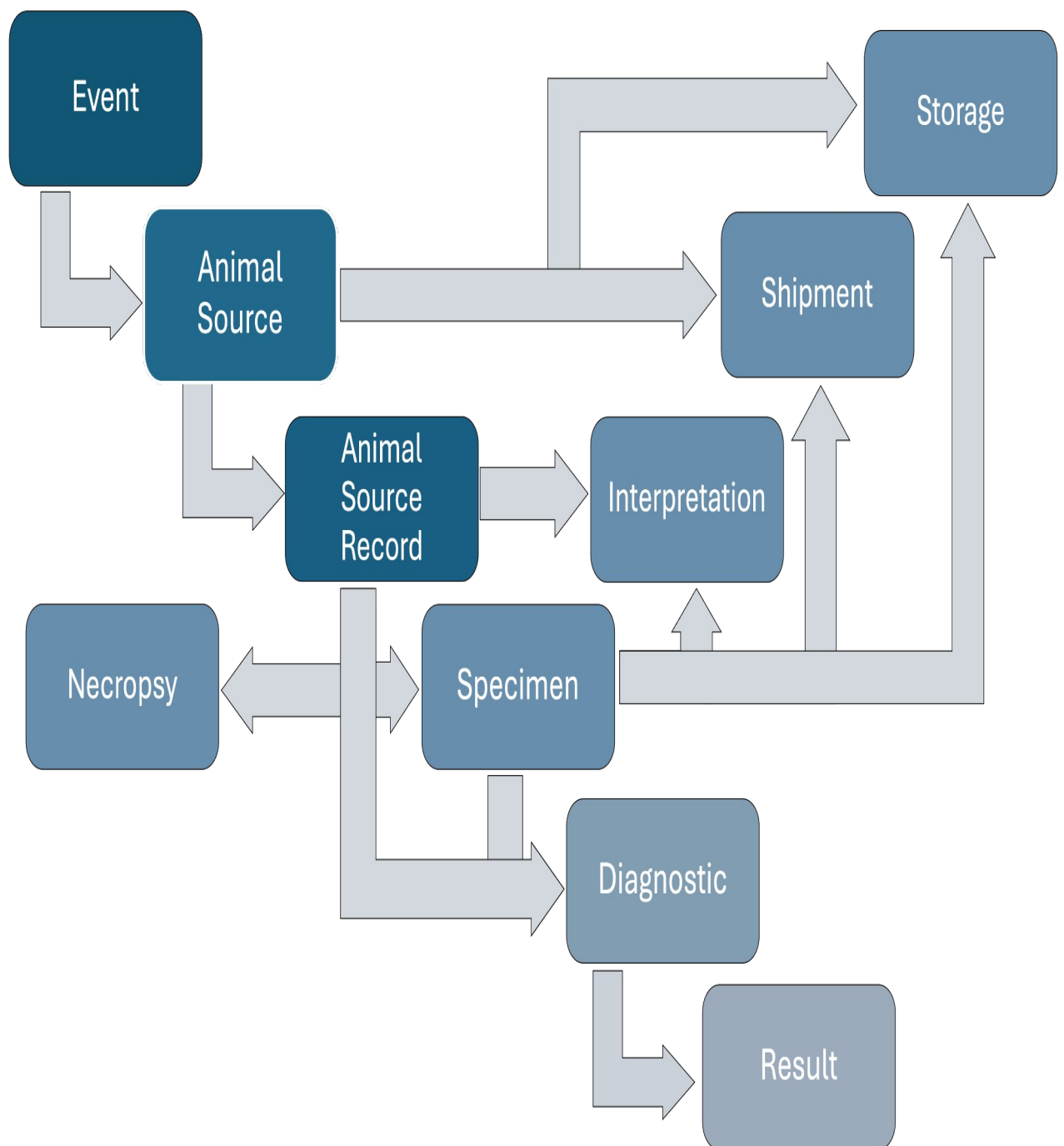


Figure 10: Detailed relationships of Animal Source in the data model.

Animal Source Record

An **Animal Source Record** represents an individual **Animal Source** at time t .

Key attributes of a **Animal Source Record** include:

- Animal source ID
- Record number
- Species
- Sex
- Age
- Life status
- Observed anomalies
- Potential causes of anomalies or death

Other attributes are provided in the [Data Dictionary](#) (under construction)

Some properties of an **Animal Source Record** allow single or multiple selections. For instance, an animal's life status is recorded as one category (e.g., "live" or "dead"), whereas multiple anomalies may be reported for the same individual at time t (e.g., wounds, hair loss, diarrhea).

An **Animal Source Record** can be categorized as dead or live at time t . A live animal at time t can be part of an Event, depending on the Event's definition.

An **Animal Source Record** can be used directly for a **Diagnostic** (e.g., performing X-rays on an animal).

Vaccinations administered to an **Animal Source Record** can be added ensuring that vaccination history accumulates.

The carcass of an **Animal Source Record** can be stored, shipped, and used in a diagnostic test (see "Storage", "Shipments", and "Diagnostic" below). Live **Animal Sources** cannot be shipped or stored.

The carcass of an **Animal Source Record** can be used in a **Necropsy** (see "Necropsy" below).

The total number of animals of a specific taxon in an **Event** is the sum of the individuals of the taxa in the **Group Source Record** and each individual animal of the same taxa recorded as **Animal Source Record**. For example, consider a herd of 20 cows illegally raised in a protected area whose health is assessed at time t . If two cows are sampled, the two sampled cows should be documented as two separate **Animal Source Records** (one per cow), while the remaining 18 cows are recorded as a single **Group Source Record**, categorized by sex, age, and health status. In this scenario, the total number of cows is 20—the 18 recorded in the **Group Source Record** plus the two documented as **Animal Source Records**. The "herd" identity of these 20 cows split in three **Source Records** can be maintained using a cluster (see Complexities). If, however, the **Group Source Record** incorrectly includes all 20 cows while two of them are also recorded as **Animal Source Record**, the total count would incorrectly sum to 22.

Necropsy

A **Necropsy** is linked to a specific **Animal Source Record**. A **Necropsy** can take place in the field or in a facility.

Key attributes of a *Necropsy* include:

- Necropsy Identifier
- Necropsy Cross Reference Identifier
- Necropsy Date
- Findings per system

Other attributes are provided in the [Data Dictionary](#) (under construction)

The **Necropsy** findings are reported through text in fields such as "Gastrointestinal System", "Reproductive System", etc. The list of anatomical components encompassed by each of these elements or systems is provided in the table below and they follow the National Agricultural Library Thesaurus Concept Space (NALT), a controlled vocabulary of terms related to agricultural, biological, physical and social sciences (<https://lod.nal.usda.gov/nalt/en/>).

Eyes/Eyelids

Topography	NALT_URI	Definition_NALT	Alternative_name
retina	https://lod.nal.usda.gov/nalt/38995	The ten-layered nervous tissue membrane of the eye. It is continuous with the optic nerve and receives images of external objects and transmits visual impulses to the brain. Its outer surface is in	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
		contact with the choroid and the inner surface with the vitreous body. The outer-most layer is pigmented, whereas the inner nine layers are transparent.	
eye lens	https://lod.nal.usda.gov/nalt/38989		NA
sclera	https://lod.nal.usda.gov/nalt/290574	The white, opaque, fibrous, outer tunic of the eyeball, covering it entirely excepting the segment covered anteriorly by the cornea. It is essentially avascular but contains apertures for vessels, lymphatics, and nerves. It receives the tendons of insertion of the extraocular muscles and at the corneoscleral junction contains the canal of Schlemm.	eye white
eyes	https://lod.nal.usda.gov/nalt/28392		eye
lacrimal apparatus	https://lod.nal.usda.gov/nalt/28564		lacrimal gland
lacrimal apparatus	https://lod.nal.usda.gov/nalt/28564		conjunctival sac
iris (eyes)	https://lod.nal.usda.gov/nalt/38993	The most anterior portion of the uveal layer, separating the anterior chamber from the posterior. It consists of two layers - the stroma and the pigmented epithelium. Color of the iris depends on the amount of melanin in the stroma on reflection from the pigmented epithelium.	NA
conjunctiva	https://lod.nal.usda.gov/nalt/28561		NA
cornea	https://lod.nal.usda.gov/nalt/29206		NA
eyelids	https://lod.nal.usda.gov/nalt/38991		NA

External Ear/Middle Ear/Inner Ear

Topography	NALT_URI	Definition_NALT	Alternative_name
inner ear	https://lod.nal.usda.gov/nalt/332326	The essential part of the hearing organ consists of two labyrinthine compartments: the bony labyrinthine and the membranous labyrinth. The bony labyrinth is a complex of three interconnecting cavities or spaces (Cochlea; vestibular labyrinth; and semicircular canals) in the temporal bone. Within the bony labyrinth lies the membranous labyrinth which is a complex of sacs and tubules (cochlear duct; saccule and utricle; and semicircular ducts) forming a continuous space enclosed by epithelium and connective tissue. These spaces are filled with labyrinthine fluids of various compositions.	labyrinth (inner ear)
guttural pouch	https://lod.nal.usda.gov/nalt/35107		NA
ears	https://lod.nal.usda.gov/nalt/35074		ear
middle ear	https://lod.nal.usda.gov/nalt/332330	The space and structures directly internal to the tympanic membrane and external to the inner ear (labyrinth). Its major components include the auditory ossicles and the eustachian tube that connects the cavity of middle ear (tympanic cavity) to the upper part of the throat.	tympanum
middle ear	https://lod.nal.usda.gov/nalt/332330	The space and structures directly internal to the tympanic membrane and external to the inner ear (labyrinth). Its major components include the auditory ossicles and the eustachian tube that connects the cavity of middle ear (tympanic cavity) to the upper part of the throat.	tympanic cavity
otoliths	https://lod.nal.usda.gov/nalt/191711	Structures of the inner ear which function in orientation and equilibrium sensing of vertebrates. Otoliths contain calcium concretions useful for species identification and age determination of fish, and provide information about their life history and ecology.	otoconia
otoliths	https://lod.nal.usda.gov/nalt/191711	Structures of the inner ear which function in orientation and equilibrium sensing of vertebrates. Otoliths contain calcium concretions useful for species identification and age determination of fish, and provide information about their life history and ecology.	otolithic membrane
otoliths	https://	Structures of the inner ear which function in	statoconia

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/nalt/191711	orientation and equilibrium sensing of vertebrates. Otoliths contain calcium concretions useful for species identification and age determination of fish, and provide information about their life history and ecology.	
otoliths	https://lod.nal.usda.gov/nalt/191711	Structures of the inner ear which function in orientation and equilibrium sensing of vertebrates. Otoliths contain calcium concretions useful for species identification and age determination of fish, and provide information about their life history and ecology.	otolites
ear canal	https://lod.nal.usda.gov/nalt/339897	The narrow passage way that conducts the sound collected by the ear auricle to the tympanic membrane.	auditory canal
ear canal	https://lod.nal.usda.gov/nalt/339897	The narrow passage way that conducts the sound collected by the ear auricle to the tympanic membrane.	meatus acusticus externus

Nose/Nostrils/Nasal cavity/Vomeronasal organ

Topography	NALT_URI	Definition_NALT	Alternative_name
nose	https://lod.nal.usda.gov/nalt/54351		nostrils
vomeronasal organ	https://lod.nal.usda.gov/nalt/308291	An accessory chemoreceptor organ that is separated from the main olfactory mucosa. It is situated at the base of nasal septum close to the vomer and nasal bones. It forwards chemical signals (such as pheromones) to the central nervous system, thus influencing reproductive and social behavior. In humans, most of its structures except the vomeronasal duct undergo regression after birth.	Jacobson organ
vomeronasal organ	https://lod.nal.usda.gov/nalt/308291	An accessory chemoreceptor organ that is separated from the main olfactory mucosa. It is situated at the base of nasal septum close to the vomer and nasal bones. It forwards chemical signals (such as pheromones) to the central nervous system, thus influencing reproductive and social behavior. In humans, most of its structures except the vomeronasal duct undergo regression after birth.	Jacobson's organ
vomeronasal	https://	An accessory chemoreceptor organ that is	vomeronasal nerve

Topography	NALT_URI	Definition_NALT	Alternative_name
organ	lod.nal.usda.gov/nalt/308291	separated from the main olfactory mucosa. It is situated at the base of nasal septum close to the vomer and nasal bones. It forwards chemical signals (such as pheromones) to the central nervous system, thus influencing reproductive and social behavior. In humans, most of its structures except the vomeronasal duct undergo regression after birth.	
nasal mucosa	https://lod.nal.usda.gov/nalt/53591		NA
nasal cavity	https://lod.nal.usda.gov/nalt/54350		NA

Mouth/Beak/Tongue/Teeth/Palate

Topography	NALT_URI	Definition_NALT	Alternative_name
teeth	https://lod.nal.usda.gov/nalt/32369		dentine
teeth	https://lod.nal.usda.gov/nalt/32369		dentition
beak	https://lod.nal.usda.gov/nalt/16134		NA
gingiva	https://lod.nal.usda.gov/nalt/9531	Oral tissue surrounding and attached to teeth.	interdental papilla
gingiva	https://lod.nal.usda.gov/nalt/9531	Oral tissue surrounding and attached to teeth.	gums (mouth)
lips	https://lod.nal.usda.gov/nalt/50308		NA
salivary glands	https://lod.nal.usda.gov/nalt/2899		NA
palate	https://lod.nal.usda.gov/nalt/26789		roof of the mouth
palate	https://lod.nal.usda.gov/nalt/26789		hard palate

Topography	NALT_URI	Definition_NALT	Alternative_name
palate	https://lod.nal.usda.gov/nalt/26789		soft palate
mouth	https://lod.nal.usda.gov/nalt/33560		buccal cavity
mouth	https://lod.nal.usda.gov/nalt/33560		oral cavity
mouth	https://lod.nal.usda.gov/nalt/33560		periodontium
tongue	https://lod.nal.usda.gov/nalt/53559		NA

Skin/Integument/Exoskeleton

Topography	NALT_URI	Definition_NALT	Alternative_name
Insect cuticle	https://lod.nal.usda.gov/nalt/9104	NA	NA
Perineum	https://lod.nal.usda.gov/nalt/57466	NA	NA
Scar	NA	NA	NA
Scent glands	https://lod.nal.usda.gov/nalt/59050	NA	Poll glands
Sebaceous glands	https://lod.nal.usda.gov/nalt/38913	NA	Tarsal glands
Skin (animal)	https://lod.nal.usda.gov/nalt/32499	NA	NA
Sweat glands	https://lod.nal.usda.gov/nalt/38914	NA	NA
Wounds and injuries	https://lod.nal.usda.gov/nalt/728	NA	NA
Antlers	https://lod.nal.usda.gov/nalt/10565	NA	NA
Claws	https://lod.nal.usda.gov/nalt/26735	NA	Talons
Claws	https://lod.nal.usda.gov/nalt/26735	NA	Nails (non-primates)
Claws	https://lod.nal.usda.gov/nalt/26735	NA	Claw horn
Comb (integument)	https://lod.nal.usda.gov/nalt/28099	NA	NA
Eyelashes	NA	NA	NA
Feathers	https://lod.nal.usda.gov/nalt/34442	NA	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
Fur	https://lod.nal.usda.gov/nalt/27376	NA	Coat (animal)
Hairs	https://lod.nal.usda.gov/nalt/44301	NA	Scalp hair
Hairs	https://lod.nal.usda.gov/nalt/44301	NA	Hairs (animal)
Hooves	https://lod.nal.usda.gov/nalt/45820	NA	Hoofs
Integument	https://lod.nal.usda.gov/nalt/9103	NA	Exuviae
Integument	https://lod.nal.usda.gov/nalt/9103	NA	Body wall
Nails (integument)	https://lod.nal.usda.gov/nalt/47469	NA	Nails (primates)
Nails (integument)	https://lod.nal.usda.gov/nalt/47469	NA	Nails (human)
Scales (integument)	https://lod.nal.usda.gov/nalt/47470	NA	NA
Wattles	https://lod.nal.usda.gov/nalt/47472	NA	NA

Subcutaneous Fat

Topography	NALT_URI	Definition_NALT	Alternative_name
subcutaneous fat	https://lod.nal.usda.gov/nalt/18338		NA

Musculoskeletal System

Topography	NALT_URI	Definition_NALT	Alternative_name
joints (animal)	https://lod.nal.usda.gov/nalt/36135		NA
tendons	https://lod.nal.usda.gov/nalt/28572	Fibrous bands or cords of connective tissue at the ends of muscle fibers that serve to attach the muscles to bones and other structures.	NA
bones	https://lod.nal.usda.gov/nalt/18497		NA
skeletal muscle	https://lod.nal.usda.gov/nalt/		NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	35050		
fascia	https://lod.nal.usda.gov/nalt/28570		NA
skeleton	https://lod.nal.usda.gov/nalt/53793		NA

Thoracic and Abdominal Cavities

Topography	NALT_URI	Definition_NALT	Alternative_name
mediastinum	https://lod.nal.usda.gov/nalt/51800		NA
body cavities	https://lod.nal.usda.gov/nalt/1610		NA
abdominal cavity	https://lod.nal.usda.gov/nalt/1609		NA
hemocoel	https://lod.nal.usda.gov/nalt/18328	A body cavity of arthropods and some molluscs that contains blood or hemolymph, which functions as part of the circulatory system by directly bathing the organs.	haemocoel
thoracic cavity	https://lod.nal.usda.gov/nalt/18330		NA

Cardiovascular System

Topography	NALT_URI	Definition_NALT	Alternative_name
Heart	https://lod.nal.usda.gov/nalt/9341	NA	Endocardium
Blood plasma	https://lod.nal.usda.gov/nalt/18062	NA	NA
Arteries	https://	The vessels carrying blood away from the heart.	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/nalt/10603		
Inferior vena cava	https://lod.nal.usda.gov/nalt/190442	The venous trunk which receives blood from the lower extremities and from the pelvic and abdominal organs.	NA
Blood veins	https://lod.nal.usda.gov/nalt/18176	NA	NA
Blood vessels	https://lod.nal.usda.gov/nalt/12438	NA	NA
Jugular vein	https://lod.nal.usda.gov/nalt/18177	NA	NA
Coronary vessels	https://lod.nal.usda.gov/nalt/12440	The veins and arteries of the heart.	Coronary arteries
Coronary sinus	https://lod.nal.usda.gov/nalt/190439	A short vein that collects about two thirds of the venous blood from the myocardium and drains into the right atrium. Coronary sinus, normally located between the left atrium and left ventricle on the posterior surface of the heart, can serve as an anatomical reference for cardiac procedures.	NA
Hemolymph	https://lod.nal.usda.gov/nalt/26359	Bloodlike fluid of the hemocoel in open circulatory systems of arthropods and most molluscs.	Haemolymph
Portal vein	https://lod.nal.usda.gov/nalt/18178	NA	NA
Blood	https://lod.nal.usda.gov/nalt/18059	NA	NA
Iliac artery	https://lod.nal.usda.gov/nalt/12442	NA	NA
Hepatic artery	https://lod.nal.usda.gov/nalt/12441	NA	NA
Superior vena	https://	The venous trunk which returns blood from the	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
cava	lod.nal.usda.gov/nalt/190443	head, neck, upper extremities and chest.	
Blood serum	https://lod.nal.usda.gov/nalt/18139	The clear, watery portion of blood that separates out when blood coagulates. It lacks blood clotting factors such as fibrogen and prothrombin.	Serum
Carotid arteries	https://lod.nal.usda.gov/nalt/12439	NA	NA
Caudal vein	https://lod.nal.usda.gov/nalt/254549	NA	Tail vein
Myocardium	https://lod.nal.usda.gov/nalt/22397	The muscle tissue of the heart. It is composed of striated, involuntary muscle cells connected to form the contractile pump to generate blood flow.	Cardiac muscle
Aorta	https://lod.nal.usda.gov/nalt/10602	NA	Aortic root
Thymocytes	https://lod.nal.usda.gov/nalt/50929	NA	NA
Fetal bovine serum	https://lod.nal.usda.gov/nalt/191461	NA	Fetal calf serum
Fetal bovine serum	https://lod.nal.usda.gov/nalt/191461	NA	Fbs (fetal bovine serum)
Pulmonary artery	https://lod.nal.usda.gov/nalt/12444	NA	NA
Umbilical arteries	https://lod.nal.usda.gov/nalt/12445	NA	NA
Saphenous vein	https://lod.nal.usda.gov/nalt/18179	The vein which drains the foot and leg.	NA
Ductus arteriosus	https://lod.nal.usda.gov/	NA	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	nalt/28513		
Umbilical veins	https://lod.nal.usda.gov/nalt/18180	NA	NA
Heart atrium	https://lod.nal.usda.gov/nalt/13743	NA	NA
Vena cava	https://lod.nal.usda.gov/nalt/18181	NA	Venae cavae
Heart valves	https://lod.nal.usda.gov/nalt/44757	NA	NA
Heart ventricle	https://lod.nal.usda.gov/nalt/44758	NA	NA
Mesenteric arteries	https://lod.nal.usda.gov/nalt/12443	NA	NA

Respiratory System

Topography	NALT_URI	Definition_NALT	Alternative_name
Lungs	https://lod.nal.usda.gov/nalt/9345	NA	NA
Larynx	https://lod.nal.usda.gov/nalt/49283	NA	NA
Spiracles	https://lod.nal.usda.gov/nalt/61125	NA	NA
Bronchi	https://lod.nal.usda.gov/nalt/20020	The larger air passages of the lungs arising from the terminal bifurcation of the trachea. They include the largest two primary bronchi which branch out into secondary bronchi, and tertiary bronchi which extend into bronchioles and pulmonary alveoli.	Secondary bronchi
Bronchi	https://	The larger air passages of the lungs arising from	Primary bronchi

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/nalt/20020	the terminal bifurcation of the trachea. They include the largest two primary bronchi which branch out into secondary bronchi, and tertiary bronchi which extend into bronchioles and pulmonary alveoli.	
Bronchi	https://lod.nal.usda.gov/nalt/20020	The larger air passages of the lungs arising from the terminal bifurcation of the trachea. They include the largest two primary bronchi which branch out into secondary bronchi, and tertiary bronchi which extend into bronchioles and pulmonary alveoli.	Bronchus
Bronchi	https://lod.nal.usda.gov/nalt/20020	The larger air passages of the lungs arising from the terminal bifurcation of the trachea. They include the largest two primary bronchi which branch out into secondary bronchi, and tertiary bronchi which extend into bronchioles and pulmonary alveoli.	Tertiary bronchi
Air sacs	https://lod.nal.usda.gov/nalt/5852	NA	NA
Vomeronasal organ	https://lod.nal.usda.gov/nalt/308291	An accessory chemoreceptor organ that is separated from the main olfactory mucosa. It is situated at the base of nasal septum close to the vomer and nasal bones. It forwards chemical signals (such as pheromones) to the central nervous system, thus influencing reproductive and social behavior. In humans, most of its structures except the vomeronasal duct undergo regression after birth.	Jacobson organ
Vomeronasal organ	https://lod.nal.usda.gov/nalt/308291	An accessory chemoreceptor organ that is separated from the main olfactory mucosa. It is situated at the base of nasal septum close to the vomer and nasal bones. It forwards chemical signals (such as pheromones) to the central nervous system, thus influencing reproductive and social behavior. In humans, most of its structures except the vomeronasal duct undergo regression after birth.	Jacobson's organ
Vomeronasal organ	https://lod.nal.usda.gov/nalt/308291	An accessory chemoreceptor organ that is separated from the main olfactory mucosa. It is situated at the base of nasal septum close to the vomer and nasal bones. It forwards chemical signals (such as pheromones) to the central nervous system, thus influencing reproductive and social behavior. In humans, most of its structures except the vomeronasal duct undergo	Vomeronasal nerve

Topography	NALT_URI	Definition_NALT	Alternative_name
		regression after birth.	
Trachea (vertebrates)	https:// lod.nal.usda.gov/ nalt/61127	NA	NA
Bronchioles	https:// lod.nal.usda.gov/ nalt/266347	The small airways branching off the tertiary bronchi. Terminal bronchioles lead into several orders of respiratory bronchioles which in turn lead into alveolar ducts and then into pulmonary alveoli.	NA
Respiratory mucosa	https:// lod.nal.usda.gov/ nalt/202662	The mucous membrane lining the respiratory tract, including the nasal cavity; the larynx; the trachea; and the bronchi tree. The respiratory mucosa consists of various types of epithelial cells ranging from ciliated columnar to simple squamous, mucous goblet cells, and glands containing both mucous and serous cells.	Respiratory epithelium
Gills	https:// lod.nal.usda.gov/ nalt/9339	NA	NA
Pleura	https:// lod.nal.usda.gov/ nalt/58808	NA	NA
Tracheae (invertebrates)	https:// lod.nal.usda.gov/ nalt/61128	NA	NA
Swim bladder	https:// lod.nal.usda.gov/ nalt/61126	NA	Swimbladder
Swim bladder	https:// lod.nal.usda.gov/ nalt/61126	NA	Gas bladder
Swim bladder	https:// lod.nal.usda.gov/ nalt/61126	NA	Air bladder

Topography	NALT_URI	Definition_NALT	Alternative_name
Wounds and injuries	https://lod.nal.usda.gov/nalt/728	NA	NA
Claws	https://lod.nal.usda.gov/nalt/26735	NA	Talons

Topography	NALT_URI	Definition_NALT	Alternative_name
Claws	https://lod.nal.usda.gov/nalt/26735	NA	Nails (non-primates)
Claws	https://lod.nal.usda.gov/nalt/26735	NA	Claw horn
Skin (animal)	https://lod.nal.usda.gov/nalt/32499	NA	NA
Fur	https://lod.nal.usda.gov/nalt/27376	NA	Coat (animal)
Integument	https://lod.nal.usda.gov/nalt/9103	NA	Exuviae
Integument	https://lod.nal.usda.gov/nalt/9103	NA	Body wall
Hairs	https://lod.nal.usda.gov/nalt/44301	NA	Scalp hair
Hairs	https://lod.nal.usda.gov/nalt/44301	NA	Hairs (animal)
Antlers	https://lod.nal.usda.gov/nalt/10565	NA	NA
Hooves	https://lod.nal.usda.gov/nalt/45820	NA	Hoofs
Sebaceous glands	https://lod.nal.usda.gov/nalt/38913	NA	Tarsal glands
Wattles	https://lod.nal.usda.gov/nalt/47472	NA	NA
Scent glands	https://lod.nal.usda.gov/nalt/59050	NA	Poll glands
Perineum	https://lod.nal.usda.gov/nalt/57466	NA	NA
Sweat glands	https://lod.nal.usda.gov/nalt/38914	NA	NA
Insect cuticle	https://lod.nal.usda.gov/nalt/9104	NA	NA
Scales (integument)	https://lod.nal.usda.gov/nalt/47470	NA	NA
Comb (integument)	https://lod.nal.usda.gov/nalt/28099	NA	NA
Feathers	https://lod.nal.usda.gov/nalt/34442	NA	NA
Nails (integument)	https://lod.nal.usda.gov/nalt/47469	NA	Nails (primates)
Nails (integument)	https://lod.nal.usda.gov/nalt/47469	NA	Nails (human)

Esophagus and Gastrointestinal System

Topography	NALT_URI	Definition_NALT	Alternative_name
Esophagus	https://lod.nal.usda.gov/nalt/33554	NA	Oesophagus
Hepatopancreas	https://lod.nal.usda.gov/nalt/9342	NA	NA
Intestines	https://lod.nal.usda.gov/nalt/42441	NA	Intestinal tract
Nasopharynx	https://lod.nal.usda.gov/nalt/54355	NA	Rhinopharynx
Nasopharynx	https://lod.nal.usda.gov/nalt/54355	NA	Nasopharynges
Gastric mucosa	https://lod.nal.usda.gov/nalt/22390	Lining of the stomach, consisting of an inner epithelium, a middle lamina propria, and an outer muscularis mucosae. The surface cells produce mucus that protects the stomach from attack by digestive acid and enzymes. When the epithelium invaginates into the lamina propria at various regions of the stomach, different tubular gastric glands are formed. These glands consist of cells that secrete mucus, enzymes, hydrochloric acid, or hormones.	Gastric glands
Gastric mucosa	https://lod.nal.usda.gov/nalt/22390	Lining of the stomach, consisting of an inner epithelium, a middle lamina propria, and an outer muscularis mucosae. The surface cells produce mucus that protects the stomach from attack by digestive acid and enzymes. When the epithelium invaginates into the lamina propria at various regions of the stomach, different tubular gastric glands are formed. These glands consist of cells that secrete mucus, enzymes, hydrochloric acid, or hormones.	Cardiac glands
Gastric mucosa	https://lod.nal.usda.gov/nalt/22390	Lining of the stomach, consisting of an inner epithelium, a middle lamina propria, and an outer muscularis mucosae. The surface cells produce mucus that protects the stomach from attack by digestive acid and enzymes. When the epithelium invaginates into the lamina propria at various regions of the stomach,	Pyloric glands

Topography	NALT_URI	Definition_NALT	Alternative_name
		different tubular gastric glands are formed. These glands consist of cells that secrete mucus, enzymes, hydrochloric acid, or hormones.	
Gastric mucosa	https://lod.nal.usda.gov/nalt/22390	Lining of the stomach, consisting of an inner epithelium, a middle lamina propria, and an outer muscularis mucosae. The surface cells produce mucus that protects the stomach from attack by digestive acid and enzymes. When the epithelium invaginates into the lamina propria at various regions of the stomach, different tubular gastric glands are formed. These glands consist of cells that secrete mucus, enzymes, hydrochloric acid, or hormones.	Stomach mucosa
Cloaca	https://lod.nal.usda.gov/nalt/26934	NA	NA
Large intestine	https://lod.nal.usda.gov/nalt/23273	NA	NA
Esophageal sphincter	https://lod.nal.usda.gov/nalt/38157	NA	Oesophagogastric junction
Esophageal sphincter	https://lod.nal.usda.gov/nalt/38157	NA	Esophagogastric junction
Esophageal sphincter	https://lod.nal.usda.gov/nalt/38157	NA	Oesophageal sphincter
Liver	https://lod.nal.usda.gov/nalt/9344	NA	Liver (anatomy)
Ileum	https://lod.nal.usda.gov/nalt/46899	NA	NA
Colon	https://lod.nal.usda.gov/nalt/27880	NA	NA
Rectum	https://lod.nal.usda.gov/	NA	NA

Topography	NALT_URI		Definition_NALT	Alternative_name
	nalt/10589			
Stomach	https://lod.nal.usda.gov/nalt/9350	NA		NA
Crop (digestive system)	https://lod.nal.usda.gov/nalt/30108	NA		Honey sac
Small intestine	https://lod.nal.usda.gov/nalt/34888	NA		NA
Rumen	https://lod.nal.usda.gov/nalt/41231	NA		NA
Pancreas	https://lod.nal.usda.gov/nalt/2897	NA		NA
Anus	https://lod.nal.usda.gov/nalt/8441	NA		Anal sphincter
Cecum	https://lod.nal.usda.gov/nalt/20837	NA		Caecum
Gall bladder	https://lod.nal.usda.gov/nalt/9338	NA		Gallbladder
Omasum	https://lod.nal.usda.gov/nalt/41229	NA		NA
Duodenum	https://lod.nal.usda.gov/nalt/34887	NA		NA
Gizzard	https://lod.nal.usda.gov/nalt/33557	NA		NA
Gastric fundus	https://lod.nal.usda.gov/nalt/42409	NA		Stomach fundus
Reticulum	https://	NA		NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/ nalt/41230		
Pharynx	https:// lod.nal.usda.gov/ nalt/33561	NA	Pharynges
Oropharynx	https:// lod.nal.usda.gov/ nalt/234524	The middle portion of the pharynx that lies posterior to the mouth, inferior to the soft palate, and superior to the base of the tongue and epiglottis. It has a digestive function as food passes from the mouth into the oropharynx before entering esophagus.	NA
Abomasum	https:// lod.nal.usda.gov/ nalt/1770	NA	NA
Jejunum	https:// lod.nal.usda.gov/ nalt/48097	NA	NA
Pylorus	https:// lod.nal.usda.gov/ nalt/60608	NA	NA
Proventriculus	https:// lod.nal.usda.gov/ nalt/33562	NA	NA

Urinary System

Topography	NALT_URI	Definition_NALT	Alternative_name
Ureter	https:// lod.nal.usda.gov/ nalt/66771	NA	NA
Urethra	https:// lod.nal.usda.gov/ nalt/66772	NA	NA
Kidneys	https:// lod.nal.usda.gov/ nalt/9343	NA	Head kidney
Kidneys	https:// lod.nal.usda.gov/ nalt/9343	NA	Anterior kidney

Topography	NALT_URI	Definition_NALT	Alternative_name
Bladder	https://lod.nal.usda.gov/nalt/17878	A musculomembranous sac along the urinary tract. Urine flows from the kidneys into the bladder via the ureters (ureter), and is held there until urination.	Urinary bladder
Urinary tract	https://lod.nal.usda.gov/nalt/17881	NA	NA
Reproductive System			
Topography	NALT_URI	Definition_NALT	Alternative_name
Spermatic cord	https://lod.nal.usda.gov/nalt/51286	NA	NA
Animal ovaries	https://lod.nal.usda.gov/nalt/29278	NA	Mammalian ovary
Oviductal ampulla	https://lod.nal.usda.gov/nalt/8132	NA	NA
Cervix	https://lod.nal.usda.gov/nalt/24102	NA	Cervix uteri
Cervix	https://lod.nal.usda.gov/nalt/24102	NA	Uterine cervix
Cloaca	https://lod.nal.usda.gov/nalt/26934	NA	NA
Epididymis	https://lod.nal.usda.gov/nalt/22094	NA	NA
Caput epididymidis	https://lod.nal.usda.gov/nalt/22093	NA	NA
Gynoecium	https://lod.nal.usda.gov/nalt/22619	A collective term for the female reproductive structures of a flower.	NA
Ovipositor	https://	NA	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/ nalt/39793		
Uterine tissue	https:// lod.nal.usda.gov/ nalt/9538	NA	NA
Uterus	https:// lod.nal.usda.gov/ nalt/39795	NA	NA
Seminiferous tubules	https:// lod.nal.usda.gov/ nalt/62834	NA	NA
Prostate gland	https:// lod.nal.usda.gov/ nalt/38912	NA	NA
Oviducts	https:// lod.nal.usda.gov/ nalt/39792	Ducts that serve exclusively for the passage of eggs from the ovaries to the exterior of the body. In non-mammals, they are termed oviducts. In mammals, they are highly specialized and known as fallopian tubes.	NA
Rete testis	https:// lod.nal.usda.gov/ nalt/61147	NA	NA
Prepuce	https:// lod.nal.usda.gov/ nalt/57285	NA	NA
Shell gland	https:// lod.nal.usda.gov/ nalt/9347	The specialized glandular part of the oviduct that forms the egg's shell.	Egg shell gland
Shell gland	https:// lod.nal.usda.gov/ nalt/9347	The specialized glandular part of the oviduct that forms the egg's shell.	Eggshell gland
Scrotum	https:// lod.nal.usda.gov/ nalt/51285	NA	NA
Cervical mucus	https:// lod.nal.usda.gov/ nalt/24105	NA	NA
Myometrium	https:// lod.nal.usda.gov/	NA	NA

Topography	NALT_URI		Definition_NALT	Alternative_name
	nalt/54164			
Bulbourethral gland	https://lod.nal.usda.gov/nalt/20331	NA		Bulbo-urethral gland
Oviductal isthmus	https://lod.nal.usda.gov/nalt/47917	NA		NA
Ovarian follicles	https://lod.nal.usda.gov/nalt/30722	NA		Subordinate follicles
Ovarian follicles	https://lod.nal.usda.gov/nalt/30722	NA		Dominant follicles
Vaginal mucosa	https://lod.nal.usda.gov/nalt/53592	NA		NA
Testes	https://lod.nal.usda.gov/nalt/43422	NA		Testicles
Testes	https://lod.nal.usda.gov/nalt/43422	NA		Testis
Embryo sac	https://lod.nal.usda.gov/nalt/36821	NA		NA
Accessory sex glands	https://lod.nal.usda.gov/nalt/2139	NA		Accessory sex organs
Accessory sex glands	https://lod.nal.usda.gov/nalt/2139	NA		Male ampulla
Accessory sex glands	https://lod.nal.usda.gov/nalt/2139	NA		Ampulla (male)
Inferior ovary	https://lod.nal.usda.gov/nalt/333770		An inferior ovary is one that is situated entirely below the point of attachment of the other floral parts in a flower.	NA
Endometrium	https://	NA		NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/nalt/37037		
Cauda epididymidis	https://lod.nal.usda.gov/nalt/23129	NA	NA
Ductus deferens	https://lod.nal.usda.gov/nalt/34844	The excretory duct of the testes that carries spermatozoa. It rises from the scrotum and joins the seminal vesicles to form the ejaculatory duct.	NA
Penis	https://lod.nal.usda.gov/nalt/51284	NA	NA
Fallopian tubes	https://lod.nal.usda.gov/nalt/188598	A pair of highly specialized muscular canals extending from the uterus to its corresponding ovary. They provide the means for ovum collection, and the site for the final maturation of gametes and fertilization.	Uterine tubes
Fallopian tubes	https://lod.nal.usda.gov/nalt/188598	A pair of highly specialized muscular canals extending from the uterus to its corresponding ovary. They provide the means for ovum collection, and the site for the final maturation of gametes and fertilization.	Salpinges
Fallopian tubes	https://lod.nal.usda.gov/nalt/188598	A pair of highly specialized muscular canals extending from the uterus to its corresponding ovary. They provide the means for ovum collection, and the site for the final maturation of gametes and fertilization.	Mammalian oviducts
Superior ovary	https://lod.nal.usda.gov/nalt/333769	A superior ovary is one that is situated entirely above the point of attachment of the other floral parts in a flower.	NA
Vagina	https://lod.nal.usda.gov/nalt/39796	NA	NA
Seminal vesicles	https://lod.nal.usda.gov/nalt/2142	NA	Vesicular gland
Corpus epididymidis	https://lod.nal.usda.gov/nalt/29276	NA	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
Vulva	https://lod.nal.usda.gov/nalt/39797	NA	NA

Lymphatic System

Topography	NALT_URI	Definition_NALT	Alternative_name
Spleen	https://lod.nal.usda.gov/nalt/9348	NA	NA
Peyer's patches	https://lod.nal.usda.gov/nalt/50921	Lymphoid tissue on the mucosa of the small intestine.	Peyer patches
Adenoids	https://lod.nal.usda.gov/nalt/240180	A collection of lymphoid nodules on the posterior wall and roof of the nasopharynx.	Pharyngeal tonsils
Bursa of fabricius	https://lod.nal.usda.gov/nalt/20540	NA	Bursa fabricii
Lymph nodes	https://lod.nal.usda.gov/nalt/50915	NA	Lymphnodes
Thymus gland	https://lod.nal.usda.gov/nalt/37012	NA	NA
Tonsils	https://lod.nal.usda.gov/nalt/9351	A round-to-oval mass of lymphoid tissue embedded in the lateral wall of the pharynx. There is one on each side of the oropharynx in the fauces between the anterior and posterior pillars of the soft palate.	Palatine tonsils
Lymph	https://lod.nal.usda.gov/nalt/18343	NA	NA
Thoracic duct	https://lod.nal.usda.gov/nalt/50922	NA	NA

Endocrine System

Topography	NALT_URI	Definition_NALT	Alternative_name
Posterior pituitary	https://lod.nal.usda.gov/nalt/54725	Neural tissue of the pituitary gland, also known as the neurohypophysis. It consists of the distal axons of neurons that produce vasopressin and oxytocinin in the supraoptic nucleus and the paraventricular nucleus. These axons travel down through the median eminence, the hypothalamic infundibulum of the pituitary stalk, to the posterior lobe of the pituitary gland.	Neurohypophysis
Posterior pituitary	https://lod.nal.usda.gov/nalt/54725	Neural tissue of the pituitary gland, also known as the neurohypophysis. It consists of the distal axons of neurons that produce vasopressin and oxytocinin in the supraoptic nucleus and the paraventricular nucleus. These axons travel down through the median eminence, the hypothalamic infundibulum of the pituitary stalk, to the posterior lobe of the pituitary gland.	Posterior pituitary gland
Posterior pituitary	https://lod.nal.usda.gov/nalt/54725	Neural tissue of the pituitary gland, also known as the neurohypophysis. It consists of the distal axons of neurons that produce vasopressin and oxytocinin in the supraoptic nucleus and the paraventricular nucleus. These axons travel down through the median eminence, the hypothalamic infundibulum of the pituitary stalk, to the posterior lobe of the pituitary gland.	Infundibular stalk
Thyroid gland	https://lod.nal.usda.gov/nalt/37013	NA	Thyroid (gland)
Parathyroid glands	https://lod.nal.usda.gov/nalt/37009	NA	NA
Pituitary gland	https://lod.nal.usda.gov/nalt/9900	A small, unpaired gland situated in the sella turcica tissue. It is connected to the hypothalamus by a short stalk.	Hypophysis
Adrenal cortex	https://lod.nal.usda.gov/nalt/4339	NA	Zona fasciculata
Adrenal cortex	https://lod.nal.usda.gov/nalt/4339	NA	Zona reticularis
Adrenal cortex	https://lod.nal.usda.gov/nalt/4339	NA	Zona glomerulosa

Topography	NALT_URI	Definition_NALT	Alternative_name
Thymus gland	https://lod.nal.usda.gov/nalt/37012	NA	NA
Endocrine glands	https://lod.nal.usda.gov/nalt/4351	Ductless glands that secrete hormones directly into the blood circulation. These hormones influence the metabolism and other functions of cells in the body.	NA
Adrenal glands	https://lod.nal.usda.gov/nalt/4343	NA	NA
Adrenal medulla	https://lod.nal.usda.gov/nalt/4352	NA	NA
Anterior pituitary	https://lod.nal.usda.gov/nalt/4132	The anterior glandular lobe of the pituitary gland, also known as the adenohypophysis. It secretes the adenohypophyseal hormones that regulate vital functions such as growth; metabolism; and reproduction.	Adenohypophysis
Anterior pituitary	https://lod.nal.usda.gov/nalt/4132	The anterior glandular lobe of the pituitary gland, also known as the adenohypophysis. It secretes the adenohypophyseal hormones that regulate vital functions such as growth; metabolism; and reproduction.	Anterior pituitary gland

Nervous System

Topography	NALT_URI	Definition_NALT	Alternative_name
Ganglia	https://lod.nal.usda.gov/nalt/1617	NA	Ganglion
Cerebrospinal fluid	https://lod.nal.usda.gov/nalt/18339	NA	NA
Optic lobe	https://lod.nal.usda.gov/nalt/19228	NA	NA
Meninges	https://lod.nal.usda.gov/nalt/23678	NA	NA
Mesencephalon	https://	The middle of the three primitive cerebral	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/nalt/334166	vesicles of the embryonic brain. without further subdivision, midbrain develops into a short, constricted portion connecting the pons and the diencephalon. midbrain contains two major parts, the dorsal tectum mesencephali and the ventral tegmentum mesencephali, housing components of auditory, visual, and other sensorimotor systems.	
Optic tectum	https://lod.nal.usda.gov/nalt/334171	The anterior pair of the quadrigeminal bodies which coordinate the general behavioral orienting responses to visual stimuli, such as whole-body turning, and reaching.	Anterior colliculus
Optic tectum	https://lod.nal.usda.gov/nalt/334171	The anterior pair of the quadrigeminal bodies which coordinate the general behavioral orienting responses to visual stimuli, such as whole-body turning, and reaching.	Superior colliculi
Optic tectum	https://lod.nal.usda.gov/nalt/334171	The anterior pair of the quadrigeminal bodies which coordinate the general behavioral orienting responses to visual stimuli, such as whole-body turning, and reaching.	Superior colliculus
Hippocampus	https://lod.nal.usda.gov/nalt/19223	A curved elevation of gray matter extending the entire length of the floor of the temporal horn of the lateral ventricle.	Ammon's horn
Hippocampus	https://lod.nal.usda.gov/nalt/19223	A curved elevation of gray matter extending the entire length of the floor of the temporal horn of the lateral ventricle.	Hippocampal formation
Amygdala	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Archistriatum
Amygdala	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Massa intercalata
Amygdala	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Amygdaloid nuclear complex
Amygdala	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Corpus

Topography	NALT_URI	Definition_NALT	Alternative_name
Amygdala	lod.nal.usda.gov/nalt/8210	anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	amygdaloideum
	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Intercalated amygdaloid nuclei
	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Amygdaloid body
	https://lod.nal.usda.gov/nalt/8210	Almond-shaped group of basal nuclei anterior to the inferior horn of the lateral ventricle of the temporal lobe. The amygdala is part of the limbic system.	Nucleus amygdalae
Spinal cord	https://lod.nal.usda.gov/nalt/23679	NA	NA
Cerebellum	https://lod.nal.usda.gov/nalt/8211	NA	NA
Cerebral cortex	https://lod.nal.usda.gov/nalt/24050	NA	NA
Thalamus	https://lod.nal.usda.gov/nalt/19229	Paired bodies containing mostly gray substance and forming part of the lateral wall of the third ventricle of the brain. The thalamus represents the major portion of the diencephalon and is commonly divided into cellular aggregates known as nuclear groups.	NA
Brain	https://lod.nal.usda.gov/nalt/9337	NA	Forebrain
Brain	https://lod.nal.usda.gov/nalt/9337	NA	Midbrain
Brain	https://lod.nal.usda.gov/nalt/9337	NA	Protocerebrum
Brain	https://	NA	Tritocerebrum

Topography	NALT_URI	Definition_NALT	Alternative_name
	lod.nal.usda.gov/nalt/9337		
Brain	https://lod.nal.usda.gov/nalt/9337	NA	Deutocerebrum
Brain	https://lod.nal.usda.gov/nalt/9337	NA	Hindbrain
Thoracic ganglia	https://lod.nal.usda.gov/nalt/42317	NA	Thoracic ganglion
Ependyma	https://lod.nal.usda.gov/nalt/79494	A thin membrane that lines the ventricles of the brain and the central canal of the spinal cord.	NA
Hypothalamus	https://lod.nal.usda.gov/nalt/19224	NA	NA
Brain stem	https://lod.nal.usda.gov/nalt/19221	The part of the brain that connects the cerebral hemispheres with the spinal cord. It consists of the mesencephalon; pons; and medulla oblongata.	Locus coeruleus
Brain stem	https://lod.nal.usda.gov/nalt/19221	The part of the brain that connects the cerebral hemispheres with the spinal cord. It consists of the mesencephalon; pons; and medulla oblongata.	Brainstem
Brain stem	https://lod.nal.usda.gov/nalt/19221	The part of the brain that connects the cerebral hemispheres with the spinal cord. It consists of the mesencephalon; pons; and medulla oblongata.	Truncus cerebri
Medulla oblongata	https://lod.nal.usda.gov/nalt/19225	NA	NA
Neocortex	https://lod.nal.usda.gov/nalt/199435	NA	NA
Abdominal ganglia	https://lod.nal.usda.gov/nalt/1615	NA	Abdominal ganglion
Subesophageal	https://	NA	NA

Topography	NALT_URI	Definition_NALT	Alternative_name
ganglia	lod.nal.usda.gov/ nalt/42316		
Cerebrum	https:// lod.nal.usda.gov/ nalt/19222	NA	NA
Frontal lobe	https:// lod.nal.usda.gov/ nalt/286312	NA	Frontal cortex
Motor cortex	https:// lod.nal.usda.gov/ nalt/281208	NA	NA
Preoptic area	https:// lod.nal.usda.gov/ nalt/46761	NA	NA
Paraventricular hypothalamic nucleus	https:// lod.nal.usda.gov/ nalt/46760	NA	Paraventricular nucleus of the hypothalamus
Cerebral ventricles	https:// lod.nal.usda.gov/ nalt/24054	NA	NA
Prefrontal cortex	https:// lod.nal.usda.gov/ nalt/286315	NA	Orbital cortex
Prefrontal cortex	https:// lod.nal.usda.gov/ nalt/286315	NA	Orbitofrontal cortex
Olfactory bulb	https:// lod.nal.usda.gov/ nalt/19227	NA	NA

Arthropod Source

An **Arthropod Source** is a site where arthropods exist and can be taken (e.g., a water fountain with mosquito larvae). An **Arthropod Source** can be observed, interpreted, and provide **Specimens**. An **Arthropod Source** cannot be diagnosed, shipped, or stored.

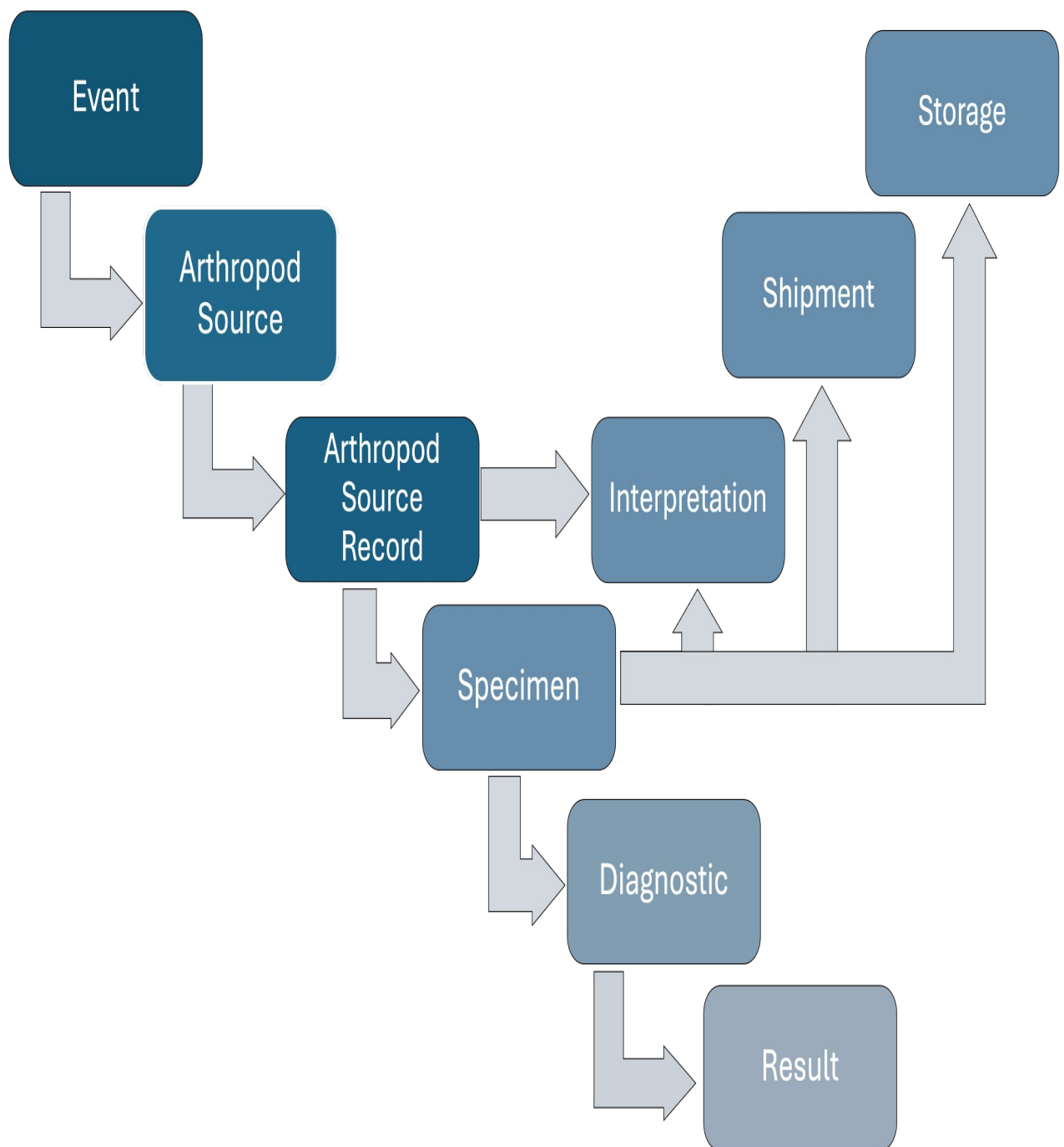


Figure 11: Detailed relationships of Arthropod Source in the data model.

If the interest of the Surveillance Activity is at the individual arthropod level (e.g., butterflies with problems in their wings or with parasites), then the user should consider these arthropods as Animal Sources. Arthropods from Animals Sources (attached ticks, lice, fleas, mites) are Specimens (see “Specimens”) from those Animal Source and not Arthropod Sources.

Arthropod Source Record

An Arthropod Source Record represents the set of arthropods collected from an Arthropod Source at time t . For example, mosquitoes captured using a CO₂ trap.

Key attributes of a Arthropod Source Record include:

- Arthropod Source ID
- Record Number
- Number of individuals (full individual, head, thorax, or abdomen) by species, development stage, sex, and condition (for females only).

Other attributes are provided in the [Data Dictionary](#) (under construction)

A key characteristic of an Arthropods Source Record is that there can be several species under the Source Record level. For example, mosquitoes collected from a specific site (**Source**) will be identified and counted by species in the **Arthropod Source Record**.

When arthropods are collected without effort (**No Effort**), for example, opportunistically using a brine shrimp net, then the collection method is reported at the **Arthropod Source Record** level. When the collection implies an effort, the methodology can be inferred from the **Point Collection**.

Environmental Source

An **Environmental Source** is a site where measurements on environmental properties can be made or samples can be collected from. An **Environmental Source** can be observed, tested, and provide abiotic or biotic **Specimens**. An **Environmental Source** cannot be shipped or stored.

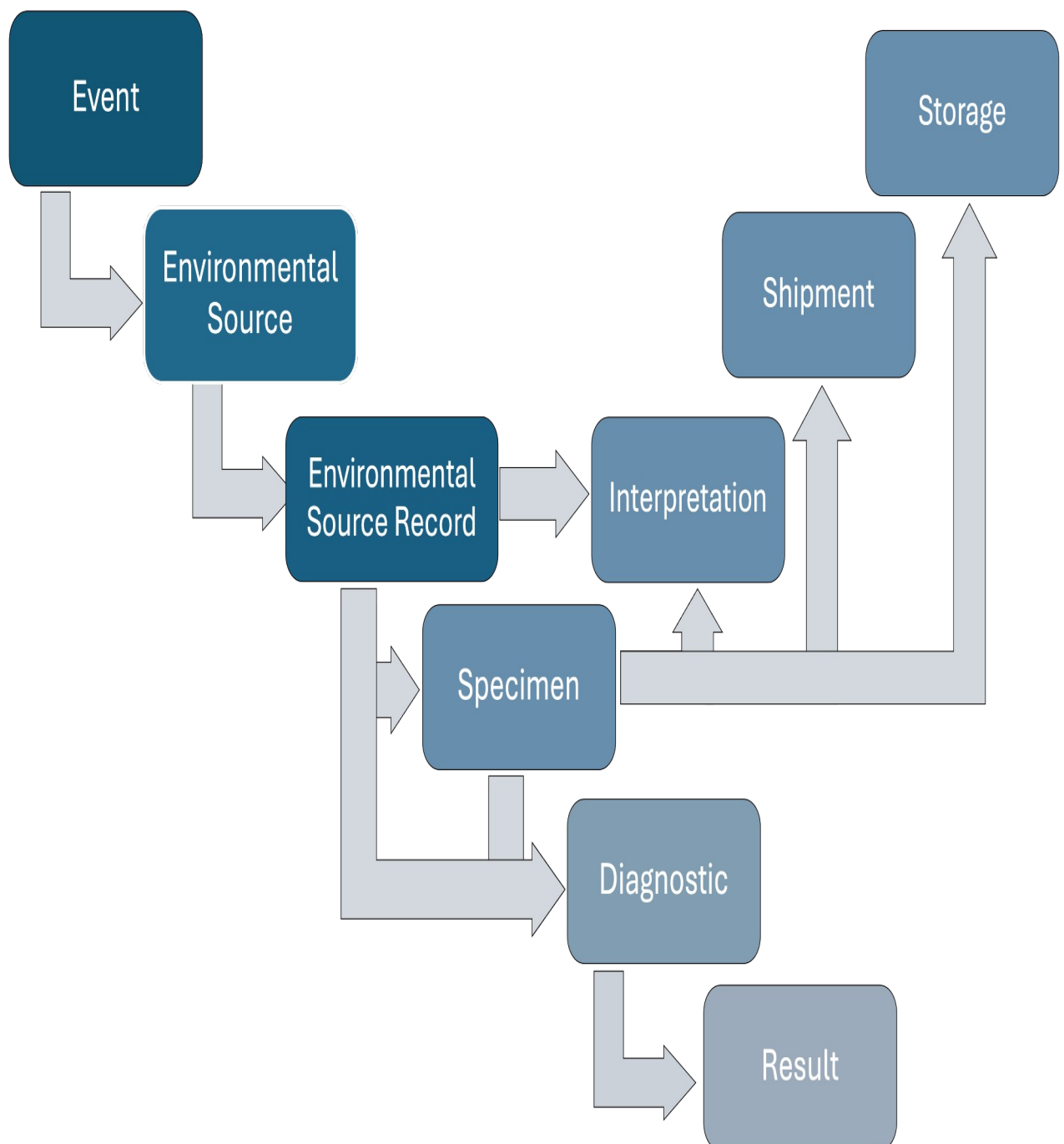


Figure 12: Detailed relationships of Environmental Source in the data model.

Environmental Source Record

An **Environmental Source Record** is a site where measurements on environmental properties are made or samples are collected at time t . Many types of samples can be obtained from a **Environmental Source Record**, for example, feces (with unknown animal origin), water, sediment, and air.

Diagnostics can be conducted on site without requiring the retrieval of specimens and, therefore, they apply to the **Environmental Source Record** directly. For example, measuring the turbidity of the water at the **Environmental Source** at time t . The type of substratum used for these direct **Diagnostics** (e.g., water, air, etc) must be provided.

Key attributes of a **Environmental Source Record** include:

- Environmental Source ID
- Record Number
- Environmental type

Other attributes are provided in the [Data Dictionary](#) (under construction)

Specimen

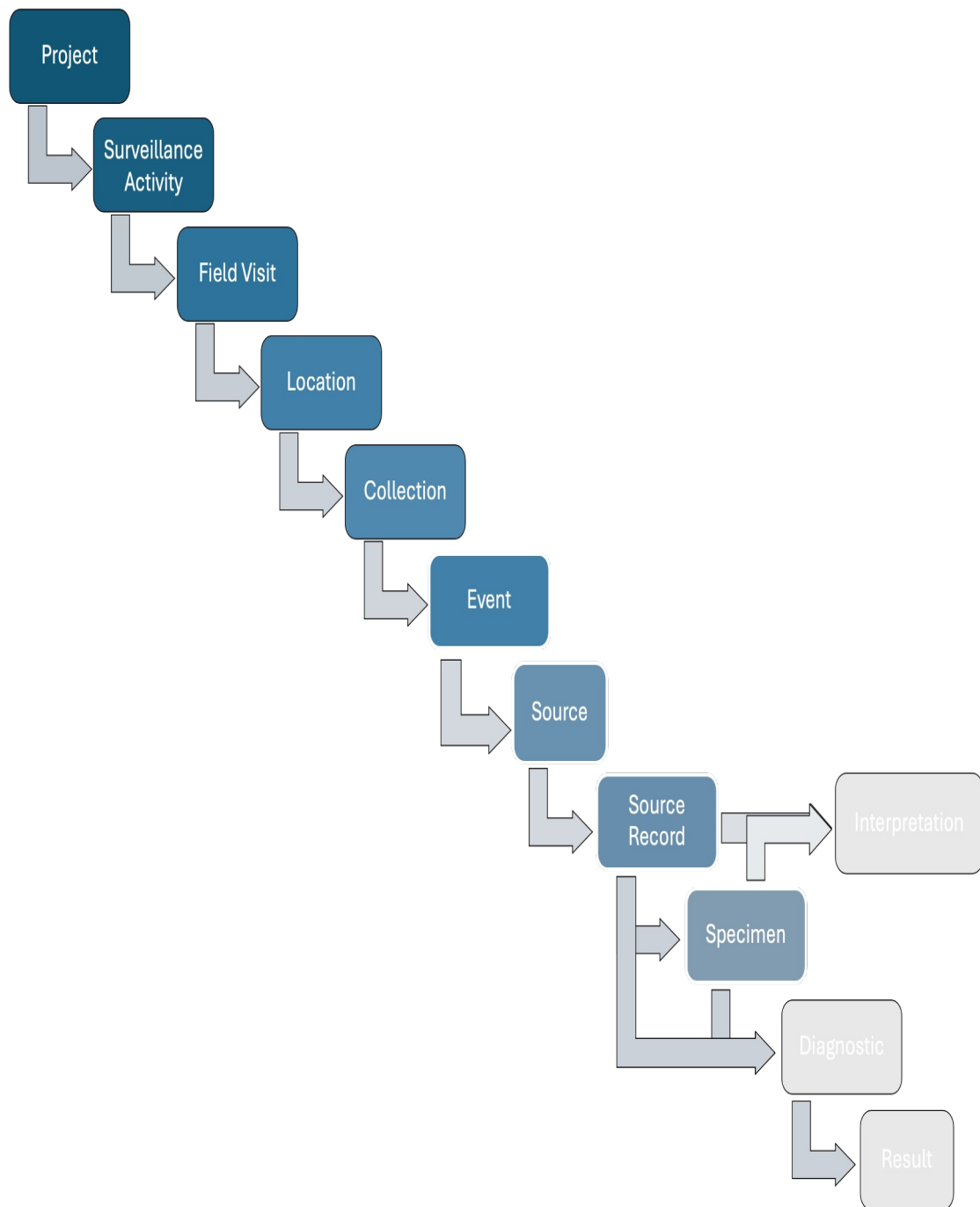


Figure 13: Position of Specimens in the data model.

Generalities

In the data model, a **Specimen** refer to a sample collected to conduct **Diagnostics** (see “Diagnostics”).

Specimens originate from the following:

- Sampled **Group Source Record** (e.g., urine collected under a bat roost and the urine cannot be linked to a specific individual of the roost) and **Animal Source Records** (e.g., an oral swab from an individual animal). These **Specimens** may consist of either a single sample type (e.g., blood) or multiple tissue types (e.g., mixed blood and saliva).
- Pools of arthropods comprised of the arthropods present at an Arthropod Source Record.
- Samples collected from the environment with abiotic origin (e.g., water) or biotic origin (e.g., feces found in the field)

Key attributes of a **Specimen** include:

- Specimen ID
- Type
- Specimen Original Amount
- Specimen Current Quantity Stored
- Origin
- Ownership

Other attributes are provided in the [Data Dictionary](#) (under construction)

Specimens can be stored, and their storage may change multiple times as they are transferred within and between facilities. Similarly, **Specimens** can be shipped multiple times.

Specimens without any amount of tissue left remain in HAWK so the last **Storage**, **Shipment**, and use in **Diagnostics** can be traced.

Pooled Specimens (under construction)

Specimens in Containers

In situations where space or materials are limited, it is possible that multiple **Specimens** are stored in a unique container. This approach is clearly not ideal because it can lead to cross-contamination and make actual **Specimen** tracing more complex. However, the data model has a Container Identifier as a **Specimen** property (see Data Dictionary). Specific properties for each individual **Specimen** within the container, such as type, quantity, etc, should allow their visual identification within the container.

Diagnostic

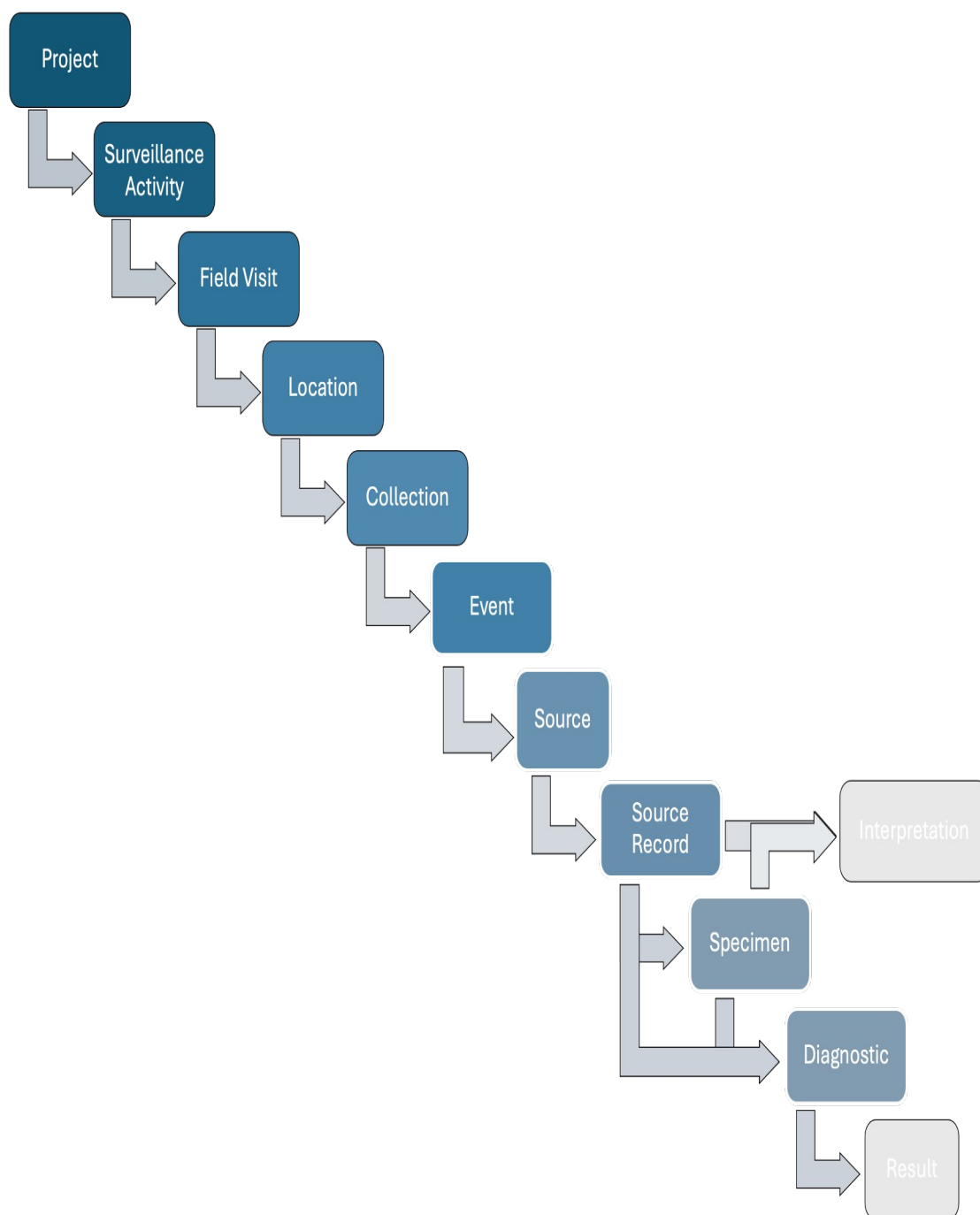


Figure 14: Position of Diagnostic in the data model.

Diagnostics in the data model encompass various methods used to measure health targets of biological, chemical, physical or physiological nature in either Records of Animal, Group, and Environmental Sources or Specimens obtained from Source Records of any type. Diagnostics can range from the clinical examination of an **Animal Source** to advanced techniques such as metagenomics to sequence nucleic acids present in a **Specimen**.

Diagnostics report the type and name of the diagnostic method used and who conducted the diagnostic. The actual outcome of a **Diagnostic** is recorded as a **Result** (see “Results” below). A single **Diagnostic** can detect one or multiple targets; therefore, each **Diagnostic** can have more than one **Result**.

Key attributes of a **Diagnostic** include:

- Diagnostic Method
- Diagnostic Name
- Laboratory

- Date Conducted

Other attributes are provided in the [Data Dictionary](#) (under construction)

In the data model, **Diagnostics** can be conducted in a Laboratory or similar (see Laboratory below) but it is also possible to include field-based assays.

Anomalies in a **Group Source Record** or **Animal Source Record** detected through observation or smell (e.g., missing an ear) are not recorded through a **Diagnostic** but as characteristics of the **Group Source Record** or **Animal Source Record**. Similarly, abnormal findings at a specific site detected through observation, smell, or hearing (e.g., smoke) are not recorded through a **Diagnostic** but they are a property of the **Event**.

Result

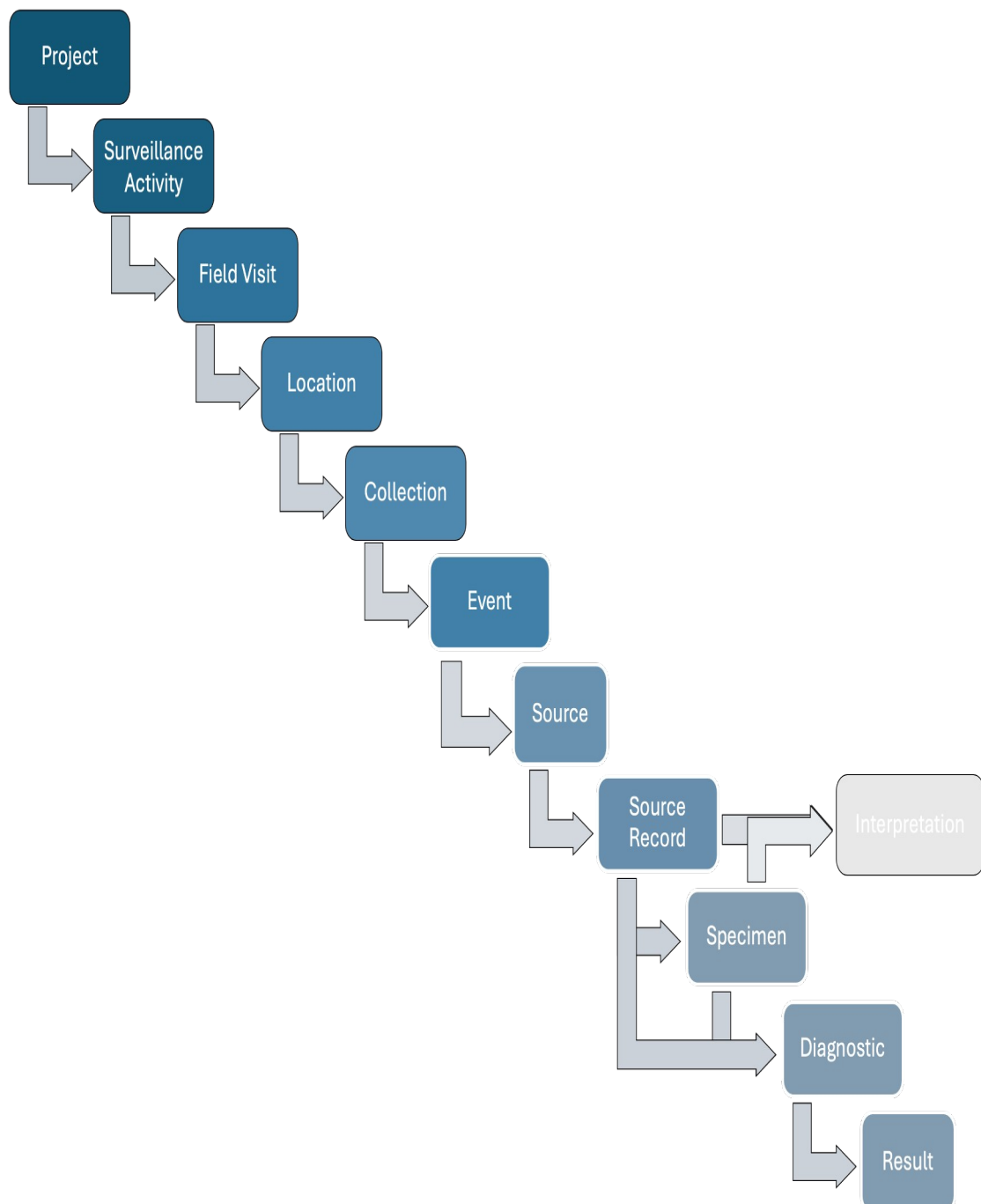


Figure 15: Position of Result in the data model.

A **Result** request information on the **Diagnostic** outcome for a single target, in quantitative or qualitative

units. A **Result** can be more specific, reporting the outcome with respect to a gene of a specific pathogen that the **Diagnostic** can detect. For example, a real-time PCR can target the detection of Influenza A nucleic acid by the amplification of genes X and Z. The **Result** reports the Ct value for the amplification of either gene X or Z of Influenza A viruses.

Key attributes of a **Result** include:

- Target Name
- Unit
- Result
- Interpretation

Other attributes are provided in the [Data Dictionary](#) (under construction)

The **Result** of a **Diagnostic** can be interpreted as positive, negative, or undetermined, based on the case definition for the parent diagnostic test (reported in the **Surveillance Activity** metadata).

Storage

A **Storage** indicates the facility where carcasses of **Group Source Records**, the carcass of an **Animal Source** or **Specimens** are stored. The storage position can be as specific as the exact row of a cryo box in which a vial containing a **Specimen** is located.

Key attributes of a **Storage** include:

- Quantity stored
- Quantity unit
- Storage type
- Facility
- Building
- Room
- Storage Unit
- Storage problems

Other attributes are provided in the [Data Dictionary](#) (under construction)

Multiple **Storage** units can be added for each **Source** or **Specimen**. In the case of **Specimens**, the recorded **Storage** units allow to track the current amount available versus the original amount and the reason of the differences over time.

Shipment

A **Shipment** indicates the movement of carcasses of **Group Source Records**, the carcass of an **Animal Source** or **Specimens** across facilities.

Key attributes of a **Shipment** include:

- Quantity shipped
- Quantity unit
- Origin
- Destination
- Storage method during shipment
- Status

Other attributes are provided in the [Data Dictionary](#) (under construction)

Interpretation

Interpretation of Specimens

In the data model, a **Specimen** can receive an **Interpretation** with respect to the hazards targeted in the corresponding **Surveillance Activity** based on a case definition for a positive, negative, or undetermined **Specimen** provided in the **Surveillance Activity** metadata. The **Interpretation** follows the **Results** from the **Diagnostics** conducted using the **Specimen** and their interpretations.

Specimens can receive multiple **Interpretations** if they are used in several **Diagnostics** targeting different hazards.

NoteCase Study 12

The presence of a single target (e.g., SARS-CoV-2) is assessed in a **Specimen** using three different **Diagnostics**. The first and second **Diagnostic** are positive, whilst the **Result** for the third **Diagnostic** is negative. Based on these mixed **Results**, the SARS-CoV-2 status of the **Specimen** must be interpreted (positive, negative, inconclusive).

Interpretation of Source Records

In the data model, a **Source Record** can receive an **Interpretation** with respect to the hazards targeted in the corresponding **Surveillance Activity** based on a case definition for a positive, negative, or undetermined **Source Record** provided in the **Surveillance Activity** metadata. An **Interpretation** for a **Source Record** depends on the field findings, **Interpretations** for the **Specimens** of the corresponding **Source Record**, **Results** of **Diagnostics** conducted with the **Source Records** (for **Group Source Records** and **Animal Source Records**) and **Necropsy** findings (for **Animal Source Records**).

A **Source Record** can receive multiple **Interpretations** depending on the hazards targeted.

NoteCase Study 13

The presence of a single target (e.g., Foot and mouth disease virus) is assessed in an **Animal Source Record** using three different **Diagnostics** completed with one **Specimen** and the results of a **Necropsy**. The **Results** for the first and second **Diagnostic** are positive, whilst the **Result** for the third **Diagnostic** is negative. The **Interpretation** for the **Specimen** is “positive”. Moreover, the **Necropsy** do not reveal any important lesions. Based on these **Results**, the Foot and mouth disease virus status of the **Animal Source Record** must be interpreted (positive, negative, inconclusive).

Key attributes of a **Interpretation** include:

- Quantity shipped
- Quantity unit
- Origin
- Destination
- Storage method during shipment
- Status

Other attributes are provided in the [Data Dictionary](#) (under construction)

Complexities

Tagging Units

The structure of the data model **could be enough to record the hierarchical data**. For example, rangers collecting information during patrols (**Tracks Effort**) in Protected Areas (**Locations**) at specific points (**Events**) where dead animals (**Source Records**) are found at any given time t .

However, the data in another **Surveillance Activity** with animal captures could have the following data structure:

- Visit (**Field Visit**)
 - Protected area (**Location**),
 - Zones within protected area (Spatial cluster level 1),
 - Grid cells within each zone (Spatial cluster level 2),
 - Capture site (**Event**)
 - Mist nets at the capture site (**Point Effort**),
 - Bats captured (**Source Records**)

Looking at the examples above, **the units Location, Event, and Effort might not be enough to accommodate the data structure of certain designs**. To solve this limitation, the data model allows to tag units (from **Surveillance Activities** up to **Diagnosis**) with labels that allow to further group them in different categories.

NoteCase Study 14

The following example shows a potential data structure for the sampling of animals in markets:

- Visit (**Field Visit**)
 - City (Spatial cluster level 1)
 - Neighborhood (Spatial cluster level 2)
 - Market (**Location**)
 - Vendor (Spatial cluster level 3)
 - Stalls (Spatial cluster level 4)
 - Sampling of animals in a cage (**Event**)
 - Animal sampled (**Source Records**)
 - Rectal Swab (**Specimens**)

In this case, tagging **Events** with the corresponding stall id and with the corresponding vendor id will group them by stall and vendor. **Locations** can be tagged with the corresponding neighborhood and city.

Tags can group units spatially, temporally, or in another way. **Tags** can be nested, non-nested, or a combination of both.

Unavoidably, the number of Tags, what Tags represent, what they group, the number of categories per group will vary among Surveillance Activities. Therefore, Tag properties must be reported in the Surveillance Activity metadata. In the data model, the only default property for each Tags are the name and the type.

Units Belong to more than One Surveillance Activity

Field Visits, Locations, Events, Sources, Source Records, Specimens, and Diagnostics usually belong to a single **Surveillance Activity**. This is the **Surveillance Activity** that lead to generate these data, creating **Events, Sources, and Specimens**.

However, units can belong to more than one **Surveillance Activity**:

- When a Surveillance Activity uses stored carcasses to test them for cardiomegaly and the carcasses were obtained through a previous Surveillance Activity
- When a Surveillance Activity uses stored specimens to test them for a health target and the carcasses were obtained through a previous Surveillance Activity

NoteCase Study 15

An agency decides to test stored deer samples for SARS-CoV-2. The blood samples have been stored for over a year. The current surveillance initiative is only recycling the samples already collected, its funding source is different, and its objectives and methods are different

In the data model, a new **Surveillance Activity** is created documenting the new methods and objectives. Then, the **Source Records** or **Specimens** to be reused and their parent **Field Visits**, **Locations**, **Efforts**, and **Events** are added to this new **Surveillance Activity**. The exception is a field for **Field Visit** that request its origin. The **Field Activity** in the original **Surveillance Activity** has this field completed with “Current Surveillance Activity” whilst in the new **Surveillance Activity** it should be completed with “Previous Surveillance Activity”. Moreover, **Field Visits** with origin as “Previous Surveillance Activity” need to report the original Surveillance Activity ID.

New **Necropsy**, **Specimens**, **Diagnostic**, **Result**, and **Interpretation** units can be added under the new **Surveillance Activity**

Outbreak Investigation

As explained in the section “Surveillance Activity”, an outbreak investigation is a **Surveillance Activity**. An outbreak can be first detected by rangers patrolling a protected area. Therefore, the **Field Visit**, **Location**, **Event**, and **Source Records** by the rangers belong to the Ranger Patrol” **Surveillance Activity** and also to the outbreak investigation **Surveillance Activity**.

[Presentation](#)

[Data Model Dictionary \(Under construction\)](#)