4 COMPILING BIOLOGY AND HUMAN-USE RESOURCE INFORMATION

Introduction

Producing an ESI atlas involves gathering biological and human-use data from a variety of sources, compiling it into maps, entering the data into a GIS, and creating two final products: ESI maps that are bound together in a hard-copy atlas, and digital data on CD-ROM that can be viewed using ArcInfo, ArcView, ESI Viewer, or in portable document format (PDFs). This chapter describes the methodology for compiling biological and human-use (socio-economic) resources onto maps and data tables for data entry. These guidelines are for biologists or resources managers who compile and edit ESI data.

General Guidelines

The first step in the data compilation phase involves making contacts by phone and email with scientists and resource managers who can provide expert knowledge and suggest relevant source materials for biological and human-use resources in the study area. Please see Table 7 for guidelines on what types of biological information are typically gathered, and how this information is mapped. While making the initial contacts, the biologist responsible for data compilation sets up times to meet with the resource experts at their offices, or in a location where many different resource experts are able to convene. These data collection meetings typically include a group of scientists who research similar species (e.g., four or five bird experts from various agencies that are responsible for part of the study area), or are in the same region, (e.g., fish, bird, and reptile experts from one island in Hawaii or one borough in Alaska). Some phone and email contacts do not require follow-up meetings, but rather the resource experts send digital or hard-copy data.

Before the meetings, the biologist gathers a set of hard-copy base maps that will be used for data compilation. USGS topographic quadrangles are typically used, and the scales of the maps vary, but typically data are compiled onto 1:24,000-scale quads for most areas, and 1:250,000-scale quads for Alaska. NOAA nautical charts are used for data

Table 7. General guidelines for mapping biological resources.

ELEMENT	SUB-ELEMENT	DESCRIPTION
Marine Mammals	Dolphins and whales	Restricted to water. There are no restrictions to offshore or inshore extent.
	Manatees	Restricted to water. Manatees are generally shown in estuarine waters and often associated with cold-weather refuge areas such as springs, river mouths, power plant cooling water outfalls, etc. They may also concentrate in inlet mouths.
	Pinnipeds (seals and sea Lions, Walruses)	Can be displayed on water and land. On land, pinniped haulout and pupping sites may be shown as points or polygons occurring on beaches, rocky headlands, and across small islands.
	Polar bears	Can be displayed on land or water as polygons, or as points to identify denning sites. They are often associated with pack ice, but do not range far inland. They are described as marine mammals because they are classified as such in the Marine Mammal Protection Act.
	Sea otters	Occur in nearshore waters. They may also be associated with kelp beds and invertebrate concentration areas.
Terrestrial Mammals	Small, semi-aquatic furbearing	Typically shown throughout salt, brackish, and freshwater wetlands, and occasionally in other shoreline habitats.
	Bears	In Alaska, they are shown along streams with salmon runs, or where they present a hazard to spill responders. Threatened and endangered species and other special aquatic or wetland concentrations may also be shown.
	Other mammals	Mostly threatened, endangered, or other important species are mapped case-by-case.
Birds	Alcids	Occur in offshore waters and on islands or cliffs where they nest.
	Diving birds	Typically shown in nearshore areas along shorelines, and on tidal flats, islands, and in sheltered bays, estuaries, lagoons, etc.
	Gulls and terns	Usually shown as buffers along shorelines, and on tidal flats, islands, and in sheltered bays, estuaries, lagoons, etc.
	Landfowl	Occur in terrestrial areas, sometimes in and around wetland areas.
	Passerine birds	Endangered, threatened, or rare passerines that rely on coastal or wetland habitats are included when appropriate, especially if nesting occurs in the area.
	Pelagic birds	Occur in offshore waters and on islands or cliffs where they nest.
	Raptors	Occur along rivers, coastal shorelines, in wetlands, and in sheltered waters.

Table 7. Continued.

ELEMENT	SUB-ELEMENT	DESCRIPTION
	Shorebirds	Typically mapped using a 75-100m buffer (onshore and offshore) along sand and gravel beaches. They are also mapped on tidal flats and in wetland habitats.
	Wading birds	Usually restricted to wetlands, tidal flats, tidal creeks, and the margins of sheltered waters (bays, estuaries, lagoons, sloughs)..
	Waterfowl	Waterfowl (ducks and geese) are usually mapped in nearshore areas, such as bays, estuaries, and lagoons, and are also commonly shown extending through salt, brackish, and fresh wetlands, and into rivers. Some species groups, such as sea ducks, may be mapped further offshore
Reptiles and Amphibians	Turtles	May include sea turtles and diamondback terrapins. Sea turtle nesting and haul-out areas are usually mapped as points or as 75-100m onshore/offshore buffers along sand beaches. Important marine foraging and nursery concentration areas may also be shown. Diamondback terrapins are usually mapped as polygons in wetlands.
	Alligators and crocodiles	Often restricted to sheltered waters (estuaries, bays, etc.), streams, wetlands, and nesting along sand or vegetated shorelines.
	Lizards, snakes, amphibians and other reptiles	In some cases other threatened, endangered, or rare species may be included, such as salt marsh snakes.
Fish		Almost always restricted to water. General distributions are usually defined by bathymetric contours, distance from the shoreline, habitat type (such as reefs), or salinity zone. Anadromous fish are usually mapped as polygons and arcs in streams and rivers, but occasionally a point representing the stream mouth is used instead. Some important concentration areas and spawning areas are also mapped in addition to more general distributions. Occasionally rare species occurrences are mapped as points or polygons.
Invertebrates	Abalones, cephalopods, clams, crabs, echinoderms, gastropods, lobsters, mussels, oysters, scallops, and shrimp	Almost always restricted to water and tidal flats. General distributions are usually defined by bathymetric contours or distance from the shore. There may also be special concentration areas defined by habitat type or fishing concentrations.
	Insects	Typically only depicted if they are threatened, endangered, or rare and associated with coastal, wetland, or aquatic habitats.

Table 7. Cont.

ELEMENT	SUB-ELEMENT	DESCRIPTION
Habitats and Rare Plants	Algae, coral reefs, hard-bottom reefs, eelgrass, kelp, SAV, FAV, worm beds	Generally restricted to water and tidal flats.
	Upland plants	Upland (terrestrial) plants, habitats, or communities; usually restricted to rare species.
	Wetland plants	Wetland plants, habitats, or communities; usually restricted to rare species.

compilation in areas that are beyond the quad boundaries, but are included in the digital data. Meetings typically begin with an explanation of what all involved parties hope to achieve, such as what types of resources should be included, and what types of data are available at the time. During the meetings, resource experts may choose to sketch biological and human-use resource distributions onto compilation maps based on hard-copy data and opinion, as well as provide corresponding concentration and seasonality information for the species mapped. USGS topographic quadrangles are used for data compilation. During the meetings, resource experts also provide hard-copy maps and reports, digital data, and information on other digital data that are available for free download on their agency websites.

Following the meetings, the biologist reviews the information that was compiled onto the maps, as well as the hard-copy and digital data that were provided, to decide how each biological and human-use resource can best be depicted using the available information. Once all of the data have been reviewed, the biologist begins planning how each resource will be mapped throughout the entire study area, rather than deciding on a map-by-map basis as she/he proceeds, which tends to lead to inconsistencies. During this process, it is important to try to limit the number of species that will be mapped to those species that are rare and/or protected, and to those of commercial/recreational/cultural value, so as not to attempt to map the complete inventory of species in an area.

It is also important to consider not mapping the complete distribution of all species, but rather to focus on mapping specific concentration areas during certain life-history stages (e.g., nesting, overwintering, spawning), or ecologically sensitive areas (e.g., rare/endangered species), to assure that the information mapped is as useful as possible,

and not too general and/or overwhelming. During this planning period, resource experts may be sending data unavailable at the time of the meetings, and the biologist may also need to make additional phone calls to contacts who were unable to attend the meetings and to new contacts who were suggested by the meeting participants. Once all of the data have arrived, the biologist may proceed with the next step of compiling the data onto a clean set of topographic maps, as described below.

The biologist draws biological and human-use features as points, polygons, and lines, and uniquely numbers them on the topographic maps and in corresponding data tables for easy identification and editing. Points are typically used for bird nests, Natural Heritage Program data, human-use features (e.g., marinas, boat ramps), pinniped haul-out sites, and to identify stream mouths used by anadromous or native stream species. Lines depict anadromous fish runs in streams. Polygons identify all other biological resources and some human-use features, such as management areas, and can range from small shoreline buffers or wetland polygons, to large polygons that cover the distribution of a species across several maps. When drawing polygons, lines already present on the topographic maps can be used as part of the polygon. For example, a polygon for a species restricted to the water can include the shoreline as the landward extent of the polygon. Following this convention reduces clutter and ambiguity, especially along the shoreline. Roads, contour lines, and bathymetry lines can also be used in this manner.

The numbering system mentioned above, listed as the wildhab# (biology) or socval# (human-use) in corresponding data tables, includes the topographic map number, a dash, and the feature number. Please see Tables 8-11 for descriptions of the data tables and the attribute fields that are used. For example, wildhab# = 1-01 is map number one, polygon number one. Human-use features are preceded by an "H" (e.g., 1-H1). Biology and human-use resources are treated separately. For example, biological polygons might consist of 1 to 25 on map #1 (1-01 to 1-25), while human-use features might consist of H1 to H11 (1-H1 to 1-H11). If a set of polygons or points on one map contains the same species, concentrations, seasonalities, and sources, all the polygons can be given the same wildhab#. The same convention applies to human-use data. In the digital data, the biological and human-use identifiers are all numeric.

When polygons or lines extend to the edge of a map, they must be edge-matched with the corresponding polygons or lines on adjacent maps. The biological or human-use attributes of the polygons or lines must also be matched, so that the resources listed for

the polygons correspond (including species, concentrations, seasonality, and life-history information, and source).

As an example, if polygon 1-05 (sawfish and sailfish) extends to the right-hand edge of map #1 but does not end there, and the left-hand edge of map #2 is continuous with the right-hand edge of map #1, there must be a corresponding polygon containing sawfish and sailfish with the same attributes as wildhab# 1-05 on map #2. This polygon is then annotated in the biological resources data table for map #2 with a wildhab#, and rather than repeating the attributes for wildhab# 1-05 in the appropriate columns, the phrase "same as 1-05"is used.

Where edge-matching is intended, a note should be written in the map margin indicating which polygon or feature should be edge-matched on adjacent maps. Continuing with the above example, "edge-match 1-05 to 2-01" should be written in the margin of map #1 near the unclosed edges of the polygon #05. On map #2, "edge-match 2-01 to 1-05" should be written in the margin near the unclosed edges of polygon #01. This convention greatly improves communication between the data compiler and the GIS technicians. When a polygon extends to the edge of a map, but not beyond, the polygon should be closed to indicate that it does not continue onto the next map.

Biological Resources

The biological resources to be mapped are arranged hierarchically into elements, sub-elements, and species (see Table 3; Chapter 2). During the biology compilation and editing, colors are used to distinguish among elements:

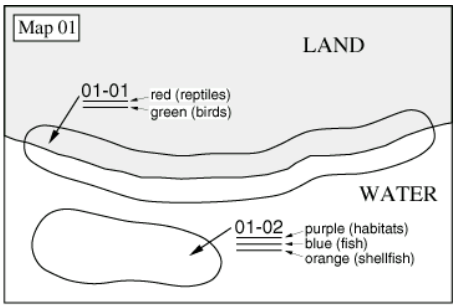
marine mammals	—	brown
terrestrial mammals	—	brown
birds	—	green
reptiles/amphibians	—	red
fish	—	blue
invertebrates	—	orange
habitats	—	purple

These colors resemble the final map product. To efficiently digitize the biological data, each polygon is traced and each wildhab# is underlined with the appropriate color using

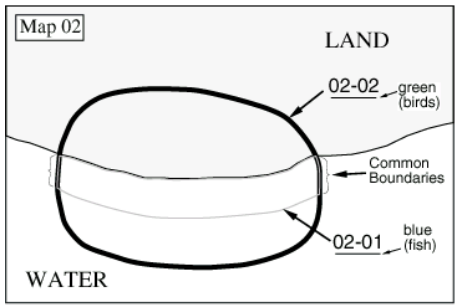
colored pencils. This allows the digitizing technician to separate information into the proper element or data layer.

Overlapping Distributions of Biological Polygons

In most instances, several species will display similar or partially overlapping distributions. If different polygons were displayed for each species, ESI maps would become much too busy, and many features would become wholly or partially obscured. For this reason, individual polygons can contain any number of species, even if they are different sub-elements or elements. Where groups of species have the same or very similar distributions, a single polygon can represent all the species (Figure 2). This multi-resource polygon would be identified by a single wildhab# on the topographic map and in the data tables. The color code for each element would be indicated with colored pencils near the site number on the topographic map.



Polygon 01-01 = sea turtles and diving birds
Polygon 01-02 = seagrass, fish, and shellfish



Polygon 02-01 = fish
Polygon 02-02 = diving birds

Figure 2. Biological polygons with multiple elements (top) and overlapping biological polygons (bottom).

Digitizing Directions

During the biology data compilation, short digitizing directions can be written on the maps (instead of polygons) when a species or group of species covers large areas, specific habitat types, or major geographical features. During the GIS phases of ESI production, these directions on the compilation maps are converted to polygons that completely fill the areas or habitats specified by the data compiler.

To indicate digitizing directions, a small box is drawn on the map within the area or major geographic feature identified, and a wildhab# is assigned to the box as if it were a polygon. The specific directions are then written inside the box. For example, several species of waterfowl, fish, and invertebrates may occur throughout Fish Bay. A box would be drawn within the bay and "All Fish Bay Waters" would be written in the box along with the wildhab#, for instance "1-34," and the color code for each biological element. During digitizing of the biology, a multi-resource polygon would be created that included all of Fish Bay. In cases where drawn polygons become confusing, written digitizing directions could also be included, and should be located directly under the wildhab#.

Tabular Data Guidelines for Biological Data

As the biological features (polygons, lines, and points) are drawn on the maps, attribute data (species, concentration, seasonality, and source information) are recorded in associated data forms. Attribute data are collected and recorded at the species level. For example, if mallard, black duck, and great blue heron are all mapped in the same wetland and are grouped together into polygon #4-14, then it is necessary to record the concentration, seasonality, and source of the geographic and seasonality information for each species separately. These forms, combined with the maps, allow for complete and accurate data compilation, entry, and processing.

The Biological Resources form (Table 8) identifies the various species associated with the biology polygons on the ESI maps and their individual concentrations. The form also includes fields or columns (Table 9) for seasonality and source numbers that link to other tables. The Seasonality/Life-history forms (Table 11) include fields or columns that must be populated if seasonality and breeding information exist.

Table 8. Biological resources form.

Site #[1] (Map#-Poly#)	**Species Name**[2]	**Concentration**[3] (High, Medium, Low, #)	**Season ID#**[4]	**Geog Source**[5]	**Seasonality**[6] **Source**
1-01	Brown pelican	High	1	1	3
1-02	Brown pelican	High	2	1	3
	Loggerhead turtle	Med	1	2	2
1-03	Piping plover	10 nests	1	4	5
	Least tern	2 nests	1	4	5

1 = unique id indicating the location of the biological resource
2 = species common name
3 = descriptive concentration or # individuals per polygon
4 = number code to differentiate polygons in which the same species has different seasonal distributions
5 = unique id identifying the source that provided locational information
6 = unique id identifying the source that provided seasonality information

Table 9. Column descriptions of the Biological Resources form.

COLUMN	DESCRIPTION
Wildhab# (map#–poly#)	Identifies each polygon by map number and polygon number. The map number is entered in the bottom right corner of the map. Multiple polygons with the same combination of species, concentration, seasonality, and source can be assigned the same wildhab#.
Species Name	Refers to the common name of a species found within a polygon. When a polygon contains an assemblage of species, each species associated with the wildhab# should be listed separately. Species name, in combination with Season ID#, is linked to the Seasonality/Life-history data tables. Species name is also linked to the Atlas Species List.
Concentration	Refers to the concentration of a species within a polygon. Concentration can be given as "high," "medium," or "low," or as another appropriate descriptive term, or as the number of individuals or nests within the polygon. The definition or range of values represented by each descriptive category or numerical value must be described in the introductory pages of the atlas and in the metadata report. If numerical concentrations are used, indicate whether the numbers represent individuals, nests, breeding pairs, etc. If abundance categories are listed by month in the seasonality tables (e.g., for ELMR data), the concentration field is left blank.
Season ID#	Refers to a code number (e.g., 1, 2, 3, etc.) representing the seasonal distribution of a species within a polygon or group of polygons. The code number, in combination with species name, is linked to the seasonal information given in the Seasonality/Life-history data tables (Table 10). When the same species is present in different seasons, different season ID#s are used. For instance, least terns may be present in several different polygons at two different times of the year. They may be listed for wildhab# 1-05 (and other maps and polygons) as being present in spring only, while least terns listed for wildhab# 1-12 are present year round. In this case, the first listings for least terns would have season ID# "1," and the second listing would have Season ID# "2." Follow this convention for all maps and data tables.
Geographic Source	A number that corresponds to the source which provided the locational and concentration information on a species included in a polygon, line, or point feature.
Seasonality Source	A number that corresponds to the source that provided the seasonality information on a species included in a polygon, line, or point feature. The seasonality source may be the same as the geographic source.

Table 10. Seasonality/life-history data form.

element = **BIRD**

		Seasonal Presence[3]												Life-history Stage and Reproductive Timespans			
SEASON[1] ID#	**SPECIES NAME[2]**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**NESTING[4]**	**LAYING[5]**	**HATCHING[6]**	**FLEDGING[7]**
1	Brown pelican	X	X	X	X	X	X	X	X	X	X	X	X	–	–	–	–
2	Brown pelican						X	X	X	X				JUN-SEP	JUN-JUL	JUL-AUG	AUG-SEP

1 = number code that differentiates polygons in which the same species has different seasonal distributions (see Table 1)
2 = species common name
3 = check the months in which the species/season ID# combination is present
4 = the entire time-span in which eggs/young are present (includes laying, hatching, and fledging)
5 = time period when eggs are being laid and incubated
6 = time period when young are hatching
7 = time period when young are being reared (until they leave the nest)

Table 11. Column descriptions of the Seasonality/Life-history form.

COLUMN	DESCRIPTION
Season ID#	Refers to a code number (e.g., 1, 2, 3.) representing the seasonal distribution of a species within a polygon or group of polygons. The code number, in combination with species name, is linked to the seasonal information given in the Seasonality/Life-history Data forms. When the same species is present in different seasons, different season ID#s are used. For instance, least terns may be present in several different polygons at two different times of the year. They may be listed for wildhab# 01-05 (and other maps and polygons) as being present in spring only, while least terns listed for wildhab# 01-12 are present year-round. In this case, the first listings for least terns would have season ID# "1," and the second listing would have Season ID# "2." Follow this convention throughout the set of maps and data tables.
Species Name	Refers to the common name of a species found within a polygon.
Seasonal Presence	Indicated by checking off the months (JAN, FEB, MAR, etc.) when a species is present. If relative abundances are known for the monthly presence, the following number codes may be used: 1 = No Information 2 = Rare 3 = Common 4 = Abundant 5 = Highly Abundant To date, monthly abundance categories have only been used for ELMR fisheries data. These categories should be clearly defined for each element or subelement in the atlas introductory text and metadata reports.
Life-history Time-Periods	Indicated for certain special or sensitive life-history stages or activities. Sensitive life-history stages and activities differ by element (Table 12). Life-history time-periods are listed as a range in months (i.e., APR-JUL). For atlases published after 1999, five fields are available for listing sensitive time periods, and these fields remain consistent by element for all atlases. Reference the atlas-specific metadata for the definition of life activities listed in older atlases.

Table 12. Life-history time periods for each biological element.

COLUMN	DESCRIPTION
Marine Mammals	The life-history activities for marine mammals are mating, calving, pupping, and molting. Mating refers to the time periods when adults concentrate to mate. Calving (dolphins, whales, and manatees) and pupping (seals, sea lions, and sea otters) refer to when females are giving birth to young. Molting refers to the time when seals and sea lions haul out to shed fur and skin.
Terrestrial Mammals / Habitats	Life-history categories are not typically listed for terrestrial mammals and habitats/rare plants. In certain instances (e.g., coral spawning and juvenile periods), they could be indicated, but must be defined in the atlas introductory text and metadata report.
Birds	The life-history activities for birds are nesting, laying, hatching, and fledging. Nesting refers to the entire period when birds are laying eggs, hatching eggs, and fledging young. Laying, hatching, and fledging are subsets of nesting.
Reptiles	The life-history activities for reptiles are nesting, hatching, inter-nesting, and juvenile. Nesting refers to the deposition of eggs by turtles and the time period when turtle eggs are present. Nesting also refers to the laying and tending of eggs and nests by crocodilians. Hatching refers to the time period when young are hatching and emerging from the nests. Inter-nesting is a special category for sea turtles, defined as the period prior to and during nesting when adult males and females concentrate in nearshore waters. Mating often takes place during this time. Juvenile refers to the period when juveniles are present.
Fish	The life-history activities for fish are spawning, eggs, larvae, juvenile, and adult. Spawning includes the actual spawning act and any spawning-related migration or concentration periods, especially those associated with diadromous or estuarine fishes. Eggs refers to the period when eggs are present. Larvae refers to the period when larval stages are present. Juvenile refers to the time when juveniles are present, and is especially emphasized in nursery areas. Adult indicates the seasons when adult (mature) fish are present.
Invertebrates	The special life-history activities for invertebrates are spawn/mate, eggs, larvae, juveniles, and adults. The descriptions of these activities and life stages are generally the same as for the fish (see above). Mating refers to reproductive activities performed by species with internal fertilization (e.g., blue crab), and can include migratory or other concentrations associated with mating. Spawning typically refers to the release of gametes to the water column, but in species that mate, it can also refer to the mass release of fertilized eggs or larvae to the water column.

Species List

The Atlas Species List (Table 13) is linked to the Biological Resources Table using the SPECIES NAME and ELEMENT fields. The atlas species list provides species common name; scientific name (genus/species), state and federal T/E/C (threatened/endangered/species of special concern) listings, element and sub-element classifications, and Natural Heritage Program (NHP) global conservation status ranking (Table 14). The Nature Conservancy (TNC)/NHP rankings include G1 (critically

imperiled), G2 (imperiled), G3 (vulnerable), G4 (apparently secure), and G5 (secure). Definitions of each category are given in Masters (1991), and are also available from TNC and the state NHP programs. This list is particularly useful where there are multiple common names used for the same or different species, when species have different state or federal T/E listings in different geographic locations, and when a new species needs to be added to the nationwide species list. See Table 14 for column descriptions of the Atlas Species List Table.

Table 13. Atlas species list.

SPECIES[1] ID#	SPECIES NAME[2]	SCIENTIFIC NAME[3]	STATE[4]	S/F[5]	T/E[6]	DATE_ PUB[7]	ELEMENT[8]	SUBELEMENT[9]	NHP[10]
118	Brown pelican	*Pelecanus occidentalis*	DE	S	E	51994	BIRD	DIVING	G4
118	Brown pelican	*Pelecanus occidentalis*	NJ	—	—	21994	BIRD	DIVING	G4

1 = species identification code from the ESI Species ID# Master List
2 = common name
3 = scientific genus and species (Latin name)
4 = indicate state for T/E/C species using the two-letter abbreviation code
5 = protection status for federal and/or state
6 = threatened and/or endangered listing
7 = date of list used to determine listing and NHP status
8 = biological element
9 = biological subelement (see Chapter 2, Table 3)
10 = Natural Heritage Program (NHP) global conservation status ranking

Table 14. Column descriptions for the atlas species list.

COLUMN	DESCRIPTION
Species ID#	A number code used to identify and track species during GIS data processing. There is an ESI Master Species List that contains number codes for all species that have been included in previous ESI atlases. The person compiling biological data for an ESI map must have the most recent copy of the Master List (Appendix A) to enter the species code. New species can be added to the Master Species List as needed.
Species Name	The common name of the species listed in the biology tables. The common name can vary geographically and a new species ID# can be added when the common name does not match the existing master species list.
Scientific Name	The Latin genus and species name of the species. This field is extremely important when there are several common names used for the same species.
State	The two-letter state abbreviation code. For a single-state atlas, enter this code only once for all threatened or endangered species. If an atlas spans more than one state, list each state in which the species is threatened or endangered on a separate line.
S/F	Federal and/or State protection status. Indicate both using S/F or just one using either "F" or "S."
T/E	Threatened (T)/endangered (E) /species of special concern (C) status. Indicate status in the same order as the jurisdictional designation.
Date_Pub	Date of reference used to determine T/E listing or status.
Element	Biological element.
Subelement	Biological subelement.
Natural Heritage Program	Natural Heritage Program global conservation status rankings (e.g., G1, G2) compiled by The Nature Conservancy and the state Natural Heritage Programs. Contact the appropriate state NHP office for a list of rankings by species. If a species is not tracked by the NHP, place a"–"in this field.

Human-Use Resources

Each human-use resource is assigned a feature type and feature code (Table 15). Color codes are not used. Human-use features such as recreational areas, access locations, resource extraction sites, and cultural resources as typically drawn as points, while management areas are drawn as polygons. A leader line is attached to each feature and the map and feature number (socval#) are clearly indicated (e.g., 1-H1 would indicate the first human-use resource on map #1). Where a resource, such as an archaeological site or fishing area, appears multiple times on the same map, the same site number can be given to each point symbol. If *a* resource extends across multiple topographic maps, different socval numbers will be given for the different maps (e.g., 2-H1, 3-H2.). The Human-Use Resources form (Table 16) attributes the mapped human-use features. The headings are described in Table 17.

Table 15. Human-use feature types and codes.

Feature Type	Code
Airport	A
Access Location	A2
Area Boundary	AB
Aquaculture Facility	AQ
Artificial Reef	AR
Archaeological Site	AS
Beach	B
Boat Ramp	BR
Campground	C
Casino	C2
Commercial Fishing	CF
Coast Guard Facility	CG
Designated Critical Habitat	CH
Community	CO
Collection Point	CP
Diving Site	DV
Equipment	EQ
ESI/RSI	ER
Ferry	F
Factory	F2
National Forest	FO
Field Station	FS
Hoist	H
Hatchery	HA

Table 15. Cont.

Feature Type	Code
Heliport	HP
Historical Site	HS
Hazardous Waste Site	HW
International Boundary	IB
Ice Extent	IE
Indian Reservation	IR
Lock and Dam	LD
High Water Leakage Points	LP
Log Storage	LS
Marina	M
Mining	M2
Management Area	MA
Marine Sanctuary	MS
Nature Conservancy	NC
National Park	NP
Oil Facility	OF
State or Regional Park	P
Process Facility	P2
Platform	PF
Pipeline	PL
Recreational Fishing	RF
Road	R
Scenic River	SR
Subsistence	S
Surfing	S2
State Border	SB
Sewage Outfall	SO
Staging Site	ST
State Waters	SW
Well	W
Waste Disposal Site	WD
Water Intake	WI
Wash Over	WO
Wildlife Refuge	WR

Table 16. Human-use resources form.

Site #[1] (Map#-Feat.#)	Resource Type[2]	Resource Name[3]	Geog[4] Source	Attribute[5] Source
001-H01	WR	Wild Goose Chase National Wildlife Refuge	4	4

1 = location of the socio-economic resource
2 = type of human-use resource (access, recreational beach, water intake, etc.)
3 = name of the facility
4 = unique id identifying the source that provided locational information
5 = unique id identifying the source that provided attribute information

Table 17. Column descriptions for the human-use resources form.

COLUMN	DESCRIPTION
Socval# (map#–feature#)	Refers to the location of each human-use resource by map number and feature number. The feature # is always preceded the letter "H" to denote human-use resources.
Resource Type	Refers to the type of human-use resource e.g., wildlife refuge) (Table 15).
Resource Name	Refers to the name of the resource (e.g., Sabine Pass National Wildlife Refuge). Some resource types may not have names.
Contact	Refers to the name of the agency or person who should be contacted in case of an oil spill or other emergency.
Phone	Refers to the phone number of the contact agency or contact person.
Geographic Source	A number that corresponds to the source which provided the location information for the human-use resource included in a polygon or point feature. This number references the sources in the Source Master List.
Attribute Source	A number that corresponds to the source that provided attribute information for the human-use resource, such as the feature name or contact information. This number references the sources in the Source Master List.

Source (Metadata) Documentation

Two forms are used to document source information. The Source Master List (Table 18) provides detailed information on the sources used to compile biological and human-use data. The source information is needed for metadata documentation of the ESI atlas (Table 19). The human-use data require listing all sources that provided spatial (G_source) and attribute (A_source) features. For the biological data, sources for spatial and concentration information (G_source) and seasonality and life-history information (S_source) are documented.

Table 18. Source master list.

SOURCE_ID[1]	ORIGINATOR[2]	DATE or PUB. DATE[3]	TITLE[4]	CONTRIBUTION /COVERAGE NAMES[5]	DATA FORMAT/ GEO PRESENTA-TION[6]	PUBLICATION[7] INFORMATION	SCALE[8]	TIME PERIOD/ CONTENT DATE[9]	CURRENTNESS[10]	SOURCE MEDIA[11]
1	Audubon, C.E. (The Byrd Society, Wingtown, ST)	2001	Pelican nesting sites*	Bird polygons	Expert knowledge	Unpublished	N/A	2001	Date of communication	Personal communi-cation
2	State Natural Resources Agency, City, ST	1998	Turtle Nesting Locations*	Reptile polygons	Digital points	http://www.stateagency.gov/turtlenests.html	Unknown	1965-1997	Dates of surveys	Online
3	Murre, J. and D.Thorough	2000	ACME Atlas of Breeding Birds	Bird polygons and points	Hard-copy text	ACME University Press, Campus City, ST, 12 pp.	N/A	2000	Date of publication	Paper
4	Geographer, J., (USFWS, GIS Director), Washington, D.C.	1999	NWR Boundaries*	Wildlife refuges	Digital polygons	Data contact: J. Geographer, (USFWS, Office of Map Resources, 202/555-3093)	24000	1999	Date of compilation	Floppy disk
5	State Office of Aquaculture	1996	Aquaculture lease beds	Soc_econ points	Digital points	Data contact: S. Johnson, (State Aquaculture, 888/555-3698)	24000	1990-1996	Dates of surveys	Email

1 = unique id for each source in the database
2 = the author, editor, database manager, expert, etc. who produced the original information
3 = publication or release date
4 = title of the source document, map, or database
5 = the biological or human-use elements for which the source provided information
6 = format type (see Table 17 for allowable descriptions)
7 = information that would be needed for a reference citation
8 = original scale at which data were mapped
9 = dates over which the original data were collected, or date to which the information is current
10 = event on which the time period/content date is based
11 = media by which information was attained

Table 19. Column descriptions for the source master list.

COLUMN	DESCRIPTION
Source ID	The unique id for each source in the database, which is assigned sequentially and is referenced by Geographic Source, Attribute Source, and Seasonality Source.
Originator	The author, editor, database manager, agency, department within an agency, or expert who produced the original information used. Originator does not necessarily refer to the person who provided a document or information during ESI data collection, an agency or group that published or funded a study or document, or a person who interpreted an original source during a data collection meeting. For instance, if John Smith of State DNR used the "Atlas of Colonial Breeding Water Buffalo" sent to him by Jane Doe of the USFWS (the project officer for the study), the originator would be neither John nor Jane nor either of the agencies they work for, but rather the author(s) of the Atlas. For persons providing expert knowledge, the agency or affiliation of the originator should be included.
Date	The date of publication or data collection if expert knowledge. If there are multiple dates, then the most recent date is used.
Title	The title of the source document, map, or database. If the source does not have a title, a brief description is used.
Coverage Name	The name should include the specific biological elements (e.g., terrestrial mammal, reptile, habitat) or human-use elements for which information was gathered from this source, and the types of features that were mapped using this source (e.g., polygons, points). Many sources cover a variety of resources. However, only those resources for which information was gathered from the source should be listed. For example, the title of a source book could be "ACME Coastal Resource Guide." This publication might cover birds, fish, invertebrates, marine mammals, commercial fisheries, recreation areas, and archaeological resources. If only fish and invertebrate distributions were derived using this source, "fish and invertebrate polygons" should be the only resource elements listed.
Data Format	The type of source used. Acceptable data formats includ: expert knowledge, hard-copy text, hard-copy map, vector digital data, raster digital data, hard-copy table, and digital table.

Table 19. Cont.

Publication Information	All information that would be needed for a reference or bibliographic citation, except for the author, date, and title that are listed in other fields. Information for this field usually includes the publisher or agency name, city, and state; the journal name, volume, and pages; the report or map number; and the total number of pages. If the source is unpublished, enough information should be provided so that readers would be able to locate the document or database. Agency affiliations listed for persons contributing expert knowledge (listed under originator) should provide information needed by persons interested in contacting expert sources.
Scale	Applies to digital maps, hard-copy maps, and some digital databases. For instance, one common map scale is "1:24,000." Only the scale denominator without commas is entered in this field. If scale does not apply, "N/A" is placed in this field, and if the scale is not known, "Unknown" is used.
Time Period	The dates over which data were collected by a source, the date the source was published, or the expert was contacted. For survey data and some digital databases, this may be a year or range of years (e.g., "1979-1982.") For published documents, the year of publication is typically used. For expert knowledge, the year the source was contacted is usually given as the source time period, indicating the date to which the information was current.
Currentness	Currentness refers to the basis for the entry in the "time period" field. Acceptable terminology for the currentness field includes date of communication, date of survey, date of publication, and date of compilation.
Source Media	Refers to the media that was used to transfer the source information. Acceptable terminology for the source media field includes personal communication, paper, online, CD-ROM, email, and floppy disk.