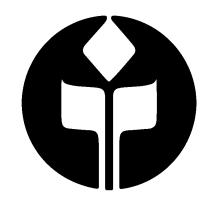
# An Overview of Vertebrate Paleontology in Northern California: Localities, Taxa, and Potential



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## Introduction

Northern California contains relatively few fossiliferous outcrops. Those that exist are interspersed among the remote and rugged igneous and metamorphic landscape that rings the Sacramento Valley. Northern California is arbitrarily defined here as the northern-most 28 counties of the state, the roughly 55,000 square miles north of Sacramento, comprising an area approximately equal to the state of New York (Figure 1).

Most of the organized collecting activity in Northern California took place during the late 19<sup>th</sup> and the first half of the 20<sup>th</sup> centuries as evidenced by the publication record related to the region. Prior to about the 1940s, the papers published included locality descriptions and specimen accounts. After that date, the publications tended to be taxonomic overviews including specimens from the region, but not adding many new finds. That trend reverted a bit in the later part of the century with some renewed collecting in the region. (See Select Bibliography of the region).

Despite the intermittent history of attention paid to the region the area has produced many significant vertebrate paleontology localities. This project was undertaken to summarize the vertebrate fossil localities from Northern California, as a comprehensive examination of the region was lacking. This summary will help direct and inform future research activities in the region.

### Methods

A compilation of the vertebrate sites of Northern California was produced as a preliminary step in developing a characterization of the vertebrate paleontology resources of the region. Vertebrate fossil localities were compiled through a literature review and by examining online collection databases. The vast majority of sites and specimens are from the University of California Museum of Paleontology.

Basic information about each locality was captured in a relational database Specimen-level data was captured in separate tables and related to the locality data. These data were then exported into ArcMap, Geographic Information System (GIS) software, for analysis. Additional data layers can be merged with the specimen and locality data within ArcMap to visualize complex geographic relationships.

For example, the localities were plotted in relation to the state's major biozones (Figure 1). Additionally, the state-wide geologic data available from

Table 1. List of fossil vertebrate taxa identified from Northern California

| >   '                     | Order         | Family       | Genus                 | Species       |          | Anura          | Ranidae           | Rana                                     |                            | Gymnogyps       | californicus   |                   | Symbos               |                  |                  | Panthera     | onca           |                | Monodontidae     |                |              |             | Rhiniocerotidae |                |       |
|---------------------------|---------------|--------------|-----------------------|---------------|----------|----------------|-------------------|--|----------------------------|-----------------|----------------|-------------------|----------------------|------------------|------------------|--------------|----------------|----------------|------------------|----------------|--------------|-------------|-----------------|----------------|-------|
|                           |               |              |                       |               |          | Anura          | Ranidae           | Rana plioceneca                          | Falconiformes Accipitridae | Buteo           | borealis       | Camelidae         |                      |                  |                  | Smilodon     |                |                | Physeteridae     | Scaldicetus    |              |             |                 | Aphelops       | -     |
| Batoid                    | idea My       | liobatidae   | Myliobatis            |               | -        | Temnospondyli  |                   | Rhadalognathus boweni                    |                            | Buteogallus     | milleri        |                   | Aepycamelus          |                  | Mustelidae       |              |                |                | Pontoporiidae    |                | -            |             |                 | Teleoceras     |       |
| Batoid                    |               | idae         |                       | binoculata    |          | Urodela        |                   | -  |                            | Urbitinga       | milleri        |                   | Camelops             |                  |                  | Cernictis    | hesperus       |                | •                | Pontoporia     | sternbergi   |             |                 | Teleoceras     | foss  |
|                           | aeriformes Ch |              |                       |               | Reptilia |                |                   | · · · · · · · · · · · · · · · · · · ·    | Cathartidae                | Cathartes       | aura           |                   | Camelops             | hesternus        |                  | Lutra        | canadensis     | Chiroptera     | Phyllostomidae   | Desmodus       | stocki       |             |                 | Trigonias      |       |
|                           | neodontida Ag |              | Helioprion            | sierrensis    |          | Chelonia       |                   |  |                            | Coragyps        |                |                   | Hemiauchenia         |                  |                  | Martes       |                |                | Vespertilionidae | Antrozous      |              |             | Tapiridae       | Tapirus        |       |
|                           |               |              | Acrodus               |               |          |                | Emydidae          | Clemmys                                  |                            | Coragyps        | occidentalis   |                   | Megatylopus          |                  |                  | Martes       | caurina        |                |                  | Antrozous      | pacificus    | Primates    | Hominidae       | Homo           | sap   |
|                           | ,             |              | Acrodus               | wempliae      |          |                | Testudinidae      |  |                            | Gymnogyps       |                |                   | Pliauchenia          |                  |                  | Martes       | nobilis        | Condylarthra   | Periptychidae    | Haploconus     | angustus     | Proboscidia |                 |                | ,     |
|                           |               |              |                       | shastensis    |          |                |                   | Geochelone                               |                            | Gymnogyps       | amplus         |                   | Procamelus           |                  |                  | Mephitis     | mephitis       | Desmostylia    | Desmostylidae    |                | 2            |             | Elephantidae    |                | _     |
|                           |               |              | Hybodus               | Sindsteriolo  |          |                |                   | Stylemys calaverensis                    |                            | Teratornis      | ampies         |                   | Titanotylopus        |                  |                  | Mephitis     | occidentalis   | Desinostyne    | Desinoseynade    | Desmostylus    |              |             | Liepheneidee    | Mammuthus      | _     |
|                           |               |              | Hybodus               | shastensis    |          | Ichthyosauria  |                   | Scylenitys Calaverensis                  | Falconidae                 | Falco           | oorogripus     | Cervidae          | manocyropus          |                  |                  | Mustela      | occidentans    |                |                  | Desmostylus    | hesperus     |             |                 | Mammuthus      | col   |
|                           |               |              | Strophodus            |               |          | Ichthyosauna   | Chartagauridae    | Californacaumus parrini                  | Faconidae                  | - 1             | peregrinus     | Cervidae          | Comune               |                  |                  | Mustela      | franzia        |                |                  |                |              |             |                 |                |       |
| Lamai                     | iformor Co    | orhinidae    | Catarbiaus            | shastensis    |          |                | Shastasauridae    | Californosaurus perrini<br>Shastas augus | Galliformas Odoptophoridae | Faico           | sparverius     |                   | Cervus<br>Odocoileus |                  |                  | Mustela      | frenata        | Incestivera    | Talaidaa         | Paleoparadoxia | latimanus    |             | Gomphotheriidae | Mammuthus      | prin  |
| Lamin                     |               |              | Terrere               | maximus       |          |                |                   | Shastasaurus                             | Galliformes Odontophoridae | Antrozous       | a i ata        |                   | Odocoileus           | an humbing up    |                  |              | vison          | Insectivora    | Talpidae         | Scapanus       | laumanus     |             | Gomphotheriidae |                |       |
|                           |               | nnidae       | Isurus                |               |          |                |                   | Shastasaurus alexandrae                  | Phasiatia                  | Oreortyx        | picta          |                   |                      | columbianus      |                  | Spilogale    |                | Lagomorpha     | Leporidae        |                |              |             |                 | Gomphoterium   |       |
|                           |               |              | Odontaspis            |               |          |                | -                 | Shastasaurus careyi                      | Phasianidae                | -               |                |                   | Odocoileus           | hemionus         |                  | Spilogale    | phenax         |                |                  | Hypolagus      |              |             |                 | Gomphoterium   |       |
|                           | lomorpha Sq   | ualidae      | Squalus               | acanthias     |          |                |                   | Shastasaurus pacificus                   |                            | Bonasa          | umbellus       |                   | Odocoileus           | lucasi           |                  | Taxidea      |                |                |                  | Lepus          |              |             |                 | Haplomastodon  |       |
| teichthyes<br>Acanthodifo |               |              |                       |               |          |                |                   | Thalattosaurus alexandrae                |                            | Dendragapus     |                |                   | Pediomeryx           | ruminalis        |                  | Taxidea      | taxus          |                |                  | Lepus          | californicus |             |                 | Rhynchotherium | n she |
|                           | thodiformes   |              |                       |               |          |                |                   | Thalattosaurus shastensis                |                            | Dendragapus     | gilli          | Merycoidodontidae | Ticholeptus          |                  | Otariidae        |              |                |                |                  | Lepus          | cinerea      |             | Mammutidae      |                |       |
|                           |               | penseridae   | Acipenser             |               |          |                |                   | Toretocnemus                             |                            | Dendragapus     | milleri        | Tayassuidae       |                      |                  |                  | Allodesmus   | kernensis      |                |                  | Lepus          | klamathensis |             |                 | Mammut         |       |
|                           |               | -            |                       | transmontanus |          |                |                   | Toretocnemus californicus                |                            | Meleagris       |                |                   | Platygonus           |                  |                  | Callorhinus  | ursinus        |                |                  | Lepus          | washingtoni  |             |                 | Mammut         | am    |
|                           | Sa            | urichthyidae | Saurichthys           |               |          |                |                   | Toretocnemus perrini                     | Gruiformes Gruidae         |                 |                |                   | Prosthennops         |                  |                  | Dusignathus  | santacruzensis |                |                  | Sylvilagus     |              |             |                 | Miomastodon    |       |
| Atheri                    | riniformes Ex | ocoetidae    | Euleptorhamphus       | peronides     |          |                |                   | Toretocnemus zitteli                     | Ichthyornithidae           | Ichthyornis     |                |                   | Tayassu              |                  |                  | Thalassoleon |                |                |                  | Sylvilagus     | auduboni     |             |                 | Pliomastodon   |       |
|                           |               | peidae       | Ganolytes             | aratus        |          | Ornithischia   | Hadrosauridae     |  | Passeriformes Corvidae     | Corvus          | brachyrhynchos | Carnivora         |                      |                  |                  | Thalassoleon | macnallyae     |                |                  | Sylvilagus     | bachmani     | Rodentia    |                 |                |       |
| Cyprin                    | iniformes     |              |                       |               |          | Ornithischia   | Hypsilophodontida | e Hypsilophodon                          |                            | Cyanocitta      | stelleri       | Canidae           |                      |                  |                  | Thalassoleon | mexicanus      | Perissodactyla | Equidae          |                |              |             | Aplodontidae    | Aplodontia     |       |
|                           | Ca            | ostomidae    |                       |               |          | Plesiosauria   |                   |  | Piciformes Picidae         | Colaptes        | mexicanus      |                   | Borophagus           | diversidens      | Phocidae         | Phoca        |                |                |                  | Equus          |              |             |                 | Aplodontia     | ruf   |
|                           |               |              | Acrocheilus           |               |          | Squamata       |                   |  | Strigiformes Strigidae     | Asio            | wilsonianus    |                   | Borophagus           | parvus           | Procyonidae      | Bassariscus  |                |                |                  | Equus          | simplicidens |             | Arvicolidae     | Microtus       |       |
|                           |               |              | Catostomus            |               |          |                | Boidae            | Charina bottae                           |                            | Bubo            | sinclariri     |                   | Canis                |                  |                  | Bassariscus  | astutus        |                |                  |                |              |             |                 | Microtus       | cal   |
|                           |               |              | Chasmites             |               |          |                | Colubriade        |  |                            | Bubo            | virginianus    |                   | Canis                | dirus            |                  | Procyon      | lotor          |                |                  | Equus          |              |             | Castoridae      | Castor         | car   |
|                           | Cy            | prinidae     |                       |               |          |                | Colubriade        | Thamnophis                               |                            | Glaucidium      | gonoma         |                   | Canis                | latrans          | Ursidae          |              |                |                |                  | Equus          | major        |             |                 | Castor         | sub   |
|                           |               |              | Acrocheilus           |               |          |                | Iguanidae         | Sceloporus                               |                            | Micropallas     | whitneyi       |                   | Canis                | lupus            |                  | Arctodus     |                |                |                  | Equus          | occidentalis |             |                 | Eucastor       | leco  |
|                           |               |              | Gila                  |               |          |                | Viperidae         | Crotalus                                 |                            | Otus            | asio           |                   | Canis                | ochropus         |                  | Arctodus     | pristinus      |                |                  | Equus          | pacificus    |             | Cricetidae      |                |       |
|                           |               |              |                       | coerulea      |          |                |                   | Crotalus potterensis                     | Mammalia                   |                 |                |                   | Cynodesmus           | thooides         |                  | Arctodus     | simus          |                |                  | Equus          | simplicidens |             |                 | Cryptotis      |       |
|                           |               |              |                       | conocephalus  |          |                |                   | Crotalus viridis                         | Artiodactyla               |                 |                |                   | Osteoborus           |                  |                  | Ursus        |                |                |                  | Hipparion      | · · ·        |             |                 | Mimomys        | saw   |
|                           |               |              | Orthodon              |               |          | Thalattosauria | Thalattosauridae  | Nectosaurus                              | Antilocapridae             |                 |                |                   | Tephrocyon           |                  |                  | Ursus        | americanus     |                |                  | Hipparion      | forcei       |             |                 | Neotoma        |       |
|                           |               |              | Ptychocheilus         |               |          |                |                   | Nectosaurus halius                       |                            | Capromeryx      |                |                   | Urocyon              |                  |                  | Ursus        | arctos         |                |                  | Hipparion      | mohavense    |             |                 | Neotoma        | cine  |
|                           | Bir           | geriidae     | Birgeria              | -             |          |                |                   | Thalattosaurus                           |                            | Merycodus       |                |                   | Urocyon              | cinereoargenteus | Cetacea          |              |                |                |                  | Hipparion      | platystyle   |             |                 | Neotoma        | fus   |
|                           | 21            | gemaae       |                       | velor         |          |                |                   | Thalattosaurus alexandrae                |                            | Sphenophalos    |                |                   |                      |                  | Balaenidae       | Balaenula    |                |                |                  | Merychippus    |              |             |                 | Peromyscus     | 105   |
|                           | Pa            | leididae     | Birgeria<br>Colobodus | velox         |          |                |                   | Thalattosaurus shastensis                | Bovidae                    | oprieriopriaios |                |                   | Urocyon<br>Vulpes    | townsendi        | Balaenopteridae  | Daracifula   |                |                |                  | Nannippus      | sumani       |             |                 | Peromyscus     | ma    |
| Dercife                   |               | modytidae    | Ammodytes             | hexapterus    | Avec     |                |                   |  | bovidae                    | Rison           |                |                   | Vulpes               | fulva            | balaenoptendae   | Palaapoptara |                |                |                  |                | tehonensis   |             |                 |                |       |
| Percifo                   |               | -            |                       |               | Aves     | Ancoriformer   | Apatidae          |  |                            | Bison           | hisan          | Ealidae           |                      | loiva            |                  | Balaenoptera |                |                |                  | Nannippus      | cenonensis   |             |                 | Pitymys        | mc    |
| C-1                       |               |              |                       | stomias       |          | Anseriformes   | Anaudae           | 4  |                            | Bison           | bison          | Felidae           | Felis                |                  | e la barte a     | Plesiocetus  |                |                |                  | Neohipparion   | aidlaui      |             |                 | Pitymys        | me    |
| Salmo                     | oniformes Os  |              | Hypomesus             |               |          |                |                   | Anas                                     |                            | Bison           | latifrons      |                   | reiis                | atrox            | Delphinidae      | 0.4.1        |                |                |                  | Neohipparion   | gialeyi      |             | For the second  | Sigmodon       | line  |
|                           | Sa            | monidae      | Oncorhynchus          |               |          |                |                   | Branta canadensis                        |                            | Euceratherium   |                |                   | Felis                | concolor         |                  | Delphinus    |                |                |                  | Plesippus      |              |             | Erethizontidae  | Erethizon      |       |
|                           |               |              | Oncorhynchus          | tschawytscha  |          | Ciconiiformes  | -                 | Accipiter velox                          |                            | Euceratherium   | collinum       |                   | Felis                | fasciatus        |                  | Stenella     |                |                |                  | Pliohippus     |              |             |                 | Erethizon      | do    |
|                           |               |              | Smilodonichthys       |               |          |                | Cathartidae       | Cathartes aura                           |                            | Oreamnos        |                |                   | Felis                | hippolestes      |                  | Stenodelphis | sternbergi     |                |                  | Pliohippus     | coalingensis |             | Geomyidae       | Entoptychus    | mi    |
|                           |               |              | Smilodonichthys       | rastrosus     |          |                | Vulturidae        | Coragyps                                 |                            | Oreamnos        | montanus       |                   | Felis                | oregonensis      | Eurhinodelphidae |              |                |                |                  | Pliohippus     | interpolatus |             |                 | Thomomys       |       |
| Anura                     | a Bu          | onidae       | Bufo                  |               |          |                |                   | Gymnogyps amplus                         |                            | Ovis            |                |                   | Felis                | rufus            | Kentriodontidae  | Loxolithax   | stocktoni      |                |                  | Pliohippus     | leardi       |             |                 | Thomomys       | leu   |

the California Geological Survey can be overlain on the locality data, which could then be matched with land use/land cover maps to suggest potential areas for fruitful fossil collecting. However, the current locality data are not uniformly precise enough to match localities with thinly exposed formations, but with continued data correction such an effort should produce interesting fossil potential maps. The work is on-going, and these data are preliminary.

#### Results

Presently the Northern California vertebrate locality database contains 560 localities, and 7,051 uniquely curated specimens from those localities. The vast majority of those specimens are from the University of California Museum of Paleontology.

The localities come from a wide geologic time span: Permian, Triassic, Jurassic, Cretaceous, Tertiary, and Quaternary periods, including sites from every epoch of the Tertiary and Quaternary.

Presently the database includes 28 type specimens from the region (Table 2, Fig. 2). For this preliminary study, no concerted effort was made to trace down taxonomic synonymies. Nonetheless, the list shows that many fossil taxa types are from Northern California.

Among the types described from the area are the first representatives of the Triassic reptilian order Thalattosauria (*Thalattosaurus alexandrae* and *T*. *shastensis*); several Ichthyosauria taxa including the shastasaurid taxa Shastasaurus alexandrae, Toretocnemus californicus, Toretocnemus zitteli, and *Californosaurus perrini*; and various mammalian taxa such as *Arctodus* simus, Euceratherium collinum, and Nothrotherium shastensis.

There are 29 Mesozoic sites (17 Triassic, 1 Jurassic, and 11 Cretaceous) (Fig. 3A). All of the Triassic sites are from the Hosselkus Limestone and occur in Shasta County. The Cretaceous sites are primarily from the Chico Formation, and include both Campanian and Maastrichtian aged sites. The single Jurassic site is from the Knoxville Formation and occurs in Tehama County.

The majority of the sites are Cenozoic (355 Tertiary, and 174 Quaternary sites) (Fig. 3B). The following North American Land Mammal Ages (NALMA) are represented within the study area: Tiffanian, Wasatchian, Bridgerian, Uintan, Chadronian, Orellan, Arikareean, Hemingfordian, Barstovian, Clarendonian, Hemphillian, Blancan, Irvingtonian, and Rancholabrean.

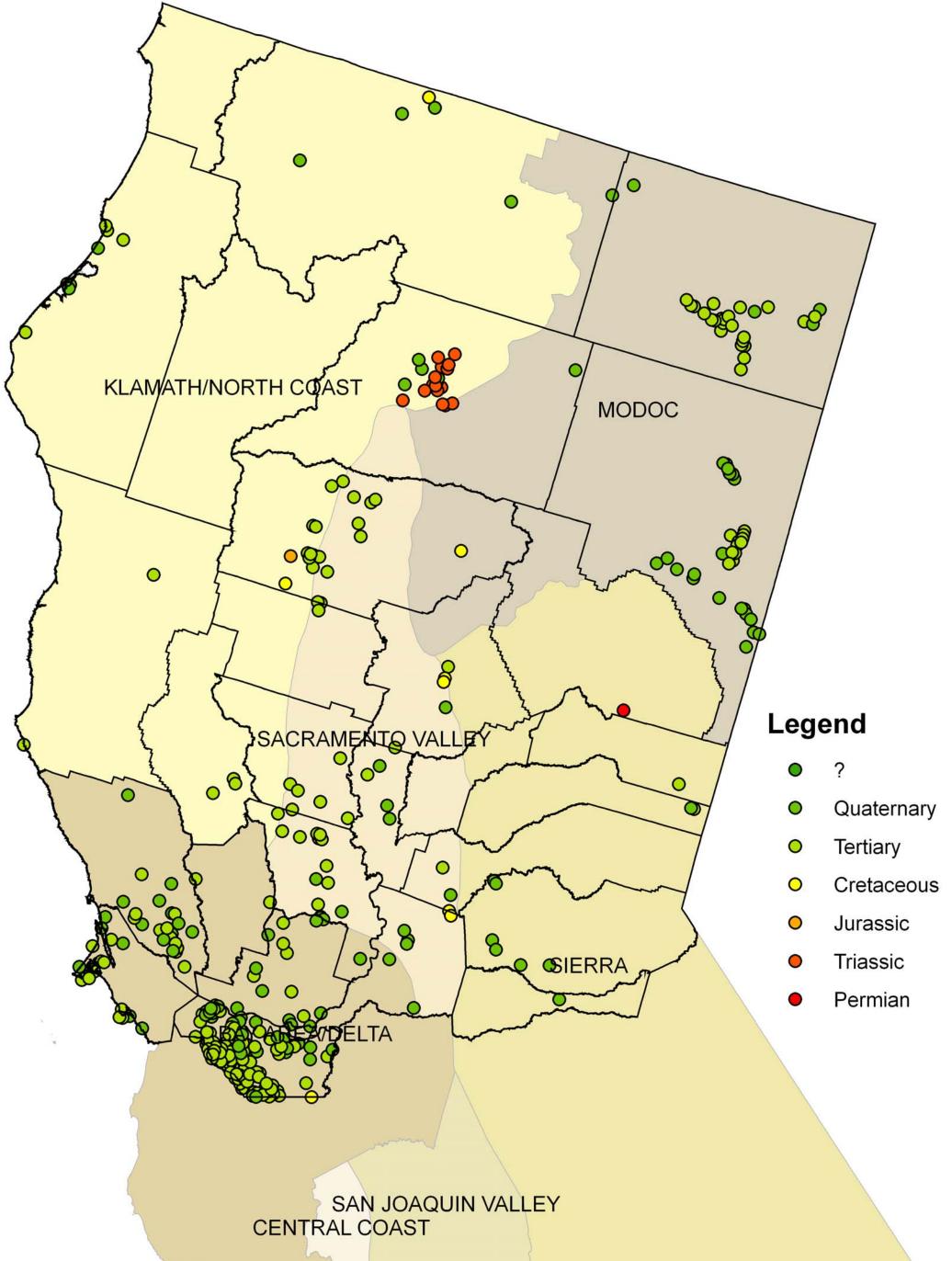


Figure 1. Vertebrate fossil localities in Northern California plotted by geologic periods, along with county boundaries and the generalized biozones of the state.

The taxonomic diversity of specimens collected from Northern California is remarkable. The database currently contains 359 distinct taxonomic combinations attributed to curated specimens (Table 1). The following genera have over 100 individual specimens assigned to them: *Neotoma* (1,606); Spermophilus (635); Odocoileus (475); Euceratherium (380); Lepus (357); Ursus (316); Equus (209); Arctodus (204); Aplodontia (180); Dendragapus (112); and *Felis* (111).

With the referential database, it is a simple matter to search the specimens, for example for taxonomic assignment, and plot those localities met by the selection criteria. A few interesting examples are provided in Fig. 4.

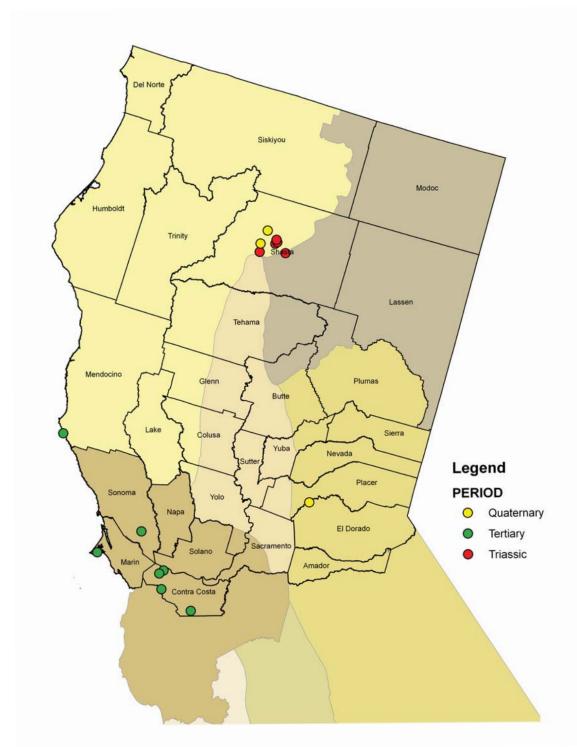


Figure 2. Localities from Northern California from which type specimens have been identified, plotted by geologic period. All the Triassic localities are related to the marine reptile order Thallatosauria, while the Tertiary and Quaternary sites include a variety of avian and mammalian taxa.

Table 2. List of taxa whose type specimens come from the study area. Listed by county.

| County       | Class          | Genus           | Species      | Authority      |
|--------------|----------------|-----------------|--------------|----------------|
| Contra Costa | Amphibia       | Rana            | plioceneca   | Zweifel 1954   |
|              | Mammalia       | Borophagus      | parvus       | Wang, Tedford  |
|              | Mammalia       | Cernictis       | hesperus     | Hall 1935      |
|              | Mammalia       | Hipparion       | platystyle   | Merriam 1915   |
|              | Mammalia       | Eucastor        | lecontei     | (Merriam 1896  |
| El Dorado    | Aves           | Urbitinga       | milleri      | Howard 1932?   |
| Marin        | Mammalia       | Thalassoleon    | macnallyae   | Repenning and  |
| Mendocino    | Mammalia       | Paleoparadoxia  | weltoni      | Clark 1991     |
| Shasta       | Chondrichthyes | Strophodus      | shastensis   | Bryant 1914    |
|              | Reptilia       | Shastasaurus    | alexandrae   | Merriam 1902   |
|              | Reptilia       | Thalattosaurus  | shastensis   | Merriam 1905   |
|              | Reptilia       | Toretocnemus    | californicus | Merriam 1908   |
|              | Reptilia       | Shastasaurus    | careyi       | Merriam 1902   |
|              | Reptilia       | Thalattosaurus  | alexandrae   | Merriam 1905   |
|              | Reptilia       | Californosaurus | perrini      | (Merriam 1902  |
|              | Reptilia       | Toretocnemus    | zitteli      | (Merriam 1903  |
|              | Reptilia       | Crotalus        | potterensis  | ?              |
|              | Reptilia       | Nectosaurus     | halius       | Merriam 1905   |
|              | Aves           | Dendragapus     | milleri      | Jehl 1967      |
|              | Aves           | Gymnogyps       | amplus       | Miller 1911?   |
|              | Aves           | Bubo            | sinclariri   | ?              |
|              | Mammalia       | Nothrotherium   | shastensis   | Sinclair 1905  |
|              | Mammalia       | Arctodus        | simus        | (Cope 1879)    |
|              | Mammalia       | Thomomys        | microdon     | Sinclair 1905  |
|              | Mammalia       | Euceratherium   | collinum     | Furlong & Sind |
|              | Mammalia       | Martes          | nobilis      | Hall 1926      |
|              | Mammalia       | Sciurus         | griseus      | Kellogg 1912?  |
| Sonoma       | Mammalia       | Neohipparion    | gidleyi      | Merriam 1915   |
|              |                |                 |              |                |

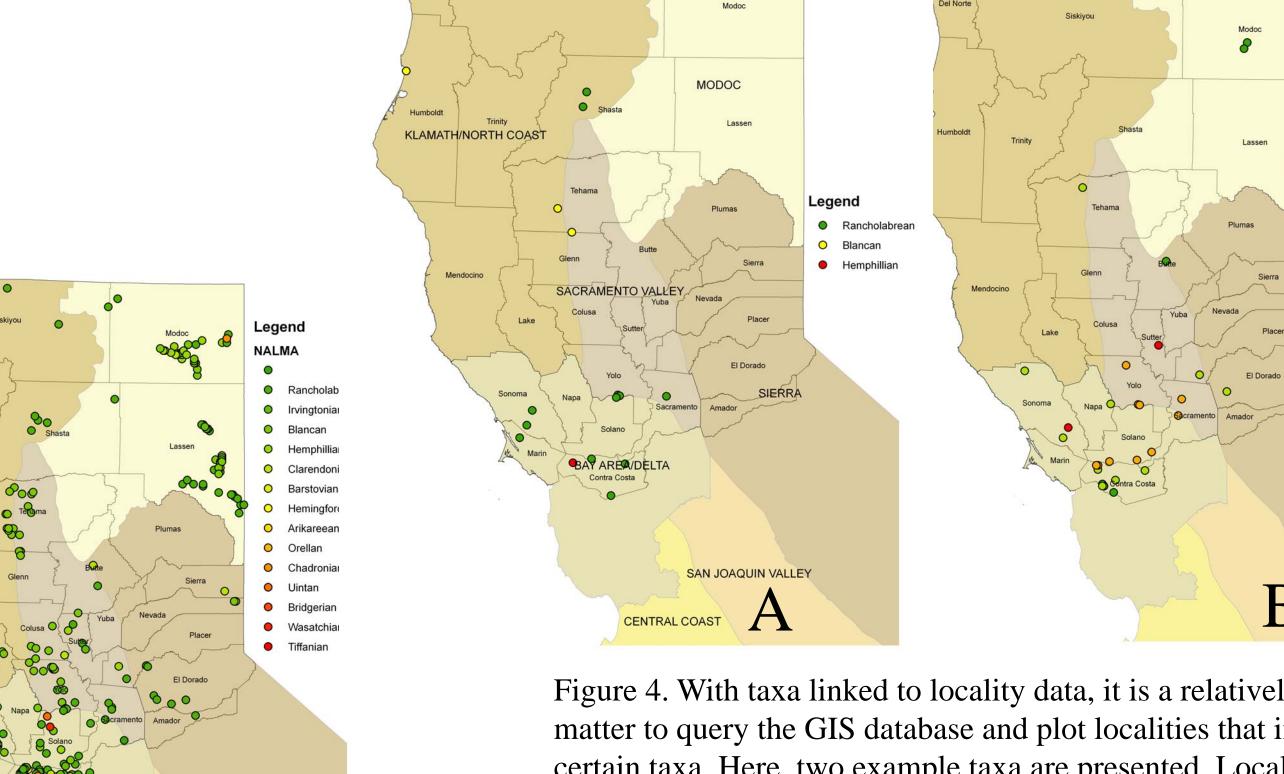


Figure 4. With taxa linked to locality data, it is a relatively simple matter to query the GIS database and plot localities that include certain taxa. Here, two example taxa are presented. Localities including the mammalian order Xenarthra are plotted by North American Land Mammal Age (A), and localities including the mammalian order Proboscidea are plotted by family level taxonom

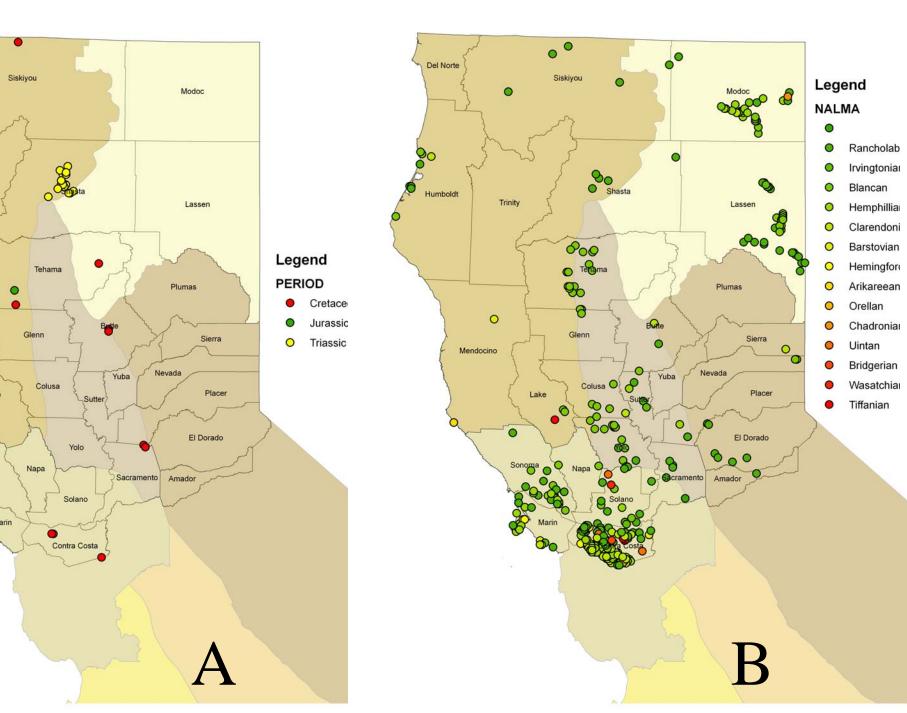


Figure 3. Mesozoic (A) and Cenozoic (B) aged localities separated out within the study area. There are 29 Mesozoic aged sites, and 355 Cenozoic aged sites in the study area identified to date.

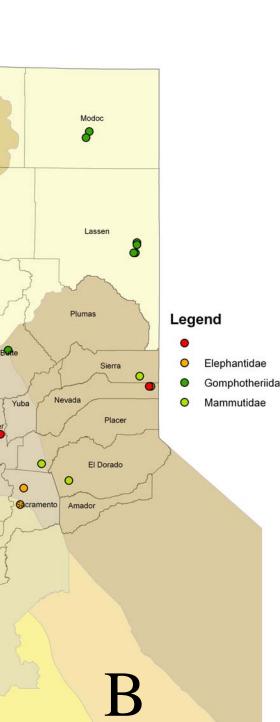
|           |                | Thon  |
|-----------|----------------|-------|
|           |                | Thon  |
|           | Heteromyidae   | Pero  |
|           | Muridae        | Neot  |
|           |                | Neot  |
|           |                | Neot  |
|           |                | Neot  |
|           | Sciuridae      |       |
|           | Celandae       | Callo |
|           |                | Callo |
|           |                | Callo |
|           |                |       |
|           |                | Euta  |
|           |                | Glau  |
| 0         |                | Marn  |
|           |                | Marn  |
|           |                | Sciur |
|           |                | Sciur |
| 8         |                | Sciur |
|           |                | Sper  |
| 3         |                | Sper  |
|           |                | Sper  |
|           |                | Tami  |
| Sirenia   |                |       |
|           | Dugongidae     | Dusis |
| Xenarthra |                | -     |
|           | Megalonychidae |       |
|           |                | Mega  |
|           | Megatheriidae  | Noth  |
|           | Mylodontidae   | Gloss |
|           | Hylodonddae    | Gloss |
|           |                | Gloss |
|           |                | Thing |
|           |                | mine  |

el 1954 , Tedford, & Taylor 1999 m 1915 am 1896) d 1932? nning and Tedford 1977 m 1902 m 1905 m 1908 m 1902 m 1905

am 1902) iam 1903) am 1905 967

1905 1879) r 1905 ng & Sinclair 1904 g 1912?

am 1915



| omys         | microdon     |
|--------------|--------------|
| omys         | monticola    |
| nathus       |              |
| oma          |              |
| ma           | cinerea      |
| ma           | douglasii    |
| ma           | occidentalis |
|              |              |
| spermophilus |              |
| spermophilus | chrysodeirus |
| spermophilus | chrysodomus  |
| nias         |              |
| omys         |              |
| omys         | sabrinus     |
| omys         | tehonensis   |
| omys         | volans       |
| ota          |              |
| ota          | flaviventris |
| opterus      | klamathensis |
| 15           |              |
| 15           | griseus      |
| nophilus     |              |
| nophilus     | beecheyi     |
| nophilus     | douglasii    |
| asciurus     | douglasii    |
|              |              |
| iren         |              |
|              |              |
|              |              |
| lonyx        |              |
| lonyx        | jeffersoni   |
| lonyx        | leptostomus  |
| lonyx        | wheatleyi    |
| otherium     | shastensis   |
| otherium     |              |
| otherium     | harlani      |
| otherium     | robustus     |
| badistes     |              |
|              |              |

#### Conclusions

Vertebrate paleontology in Northern California is diverse in both geologic time and taxonomic diversity. Many type specimens have come from the region. Historically, collecting within the region was done primarily in the first half of the twentieth century, and only intermittently explored since. The results of this preliminary overview and characterization of the fossil resources suggests that renewed collection efforts are warranted and will likely to be fruitful for a wide variety of vertebrate forms.

Locating fossiliferous outcrops can be challenging in the rugged terrain of Northern California. The establishment of this GIS database and the utilization of additional data layers in the future should help guide and inform future collecting ventures.

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