

*Field Guide to the Freshwater Fishes of California*, by Samuel M. McGinnis  
University of California Press/California Natural History Guides, 2006

Page references in **bold** indicate the main discussion of a taxon.

- Aasen, Ken, 255–256  
abbreviations, 53–56, 489  
*Acanthogobius flavimanus*, 18, 84 (key), 298, **352–354**, 353  
(plate), 359  
*Acipenser*  
  *medirostris*, 17, 70 (key), **139–140**  
  *transmontanus*, 16–17, 70 (key), 133, **134–139**, 379  
Acipenseridae, 64, 66 (figure), 70 (key), **131–140**  
  *See also* sturgeons; *individual species*  
African Clawed Frog, 9  
Akihito, Emperor of Japan, 355  
Albion River, 348  
alevins, 148  
algae, 29, 30–31, 33, 34  
  *See also* phytoplankton  
alkalinity tolerance, 221, 310  
*Alosa sapidissima*, 14, 120 (key), **141–143**, 199  
Amargosa Pupfish, 76 (key), 272, 273, **274–275**, 275  
(plate)  
Amargosa River, 274  
Amargosa River Pupfish, 76 (key)  
*Ameiurus*  
  *catus*, 72 (key), **268–269**, 269 (plates), 310  
  *melas*, 74 (key), **263–264**, 385  
  *natalis*, 74 (key), **264**  
  *nebulosus*, 74 (key), **258–262**, 259 (plate), 385  
American Bison, 15–16, 243  
American Eel, 129  
American River, 266  
American River Hatchery, 499  
American River Salmon Festival, 399  
American Shad, 14, 120 (key), **141–143**, 199  
  angling notes, 143  
  weight records, 506  
ammocetes, 123–124, 128, 128 (plate)  
amphibians  
  native vs. introduced, 9  
  *See also* frogs  
amphipods, 34  
anadromous fishes  
  homing behavior, 39, 151, 155–156  
  lampreys, 125, 127–128  
  osmoregulation, 51–52, 295  
  *See also individual species*  
Anadromous Threespine Stickleback, 290  
anatomy and physiology, 37–52  
  body plans, 64–65, 66–67 (figure)  
  Chondrichthyes vs. Osteichthyes, 131  
  coloration, 42, 44–45, 60, 386–387  
  dissections/internal anatomy, 45–48, 46 (figure)  
  energy metabolism, 49–50  
  fins, spines, and rays, 37, 38 (figure), 54  
  gill anatomy and function, 38 (figure), 42–43, 49–50,  
    51–52  
  gonopodium, 37, 281  
  hearing, 42  
  homing behavior, 39  
  anatomy and physiology (*continued*)  
    jaws, 124  
    lateral line, 41  
    mouth position, 38 (figure), 42  
    movement/swimming ability, 36, 37, 124  
    olfaction, 39–40, 41  
    osmoregulation, 51–52, 295  
    oxygen physiology, 48–49, 49–51  
    parr marks, 45, 148, 148 (plate)  
    scales and skin, 44–45, 54  
    swim bladder, 42, 47  
    taste, 41  
    teeth, 43–44, 44 (plate)  
    temperature requirements, 49  
    vision, 40–41  
    *See also specific families and species*  
Anchovy, Northern, 295  
Anderson Return of the Salmon Festival, 399  
angling notes  
  American Shad, 143  
  Bluegill, 313–314  
  Brook Trout, 189–191  
  Brown Trout, 192  
  bullheads and catfishes, 260–262  
  Chinook Salmon, 158–159  
  Coho Salmon, 152–153  
  Common Carp, 230–233  
  crappies, 322  
  Eulachon, 203  
  Golden Trout, 181  
  Green Sunfish, 318  
  Kokanee Salmon, 162–164  
  Lake Trout, 194  
  Largemouth Bass, 324–327  
  Mountain Whitefish, 195  
  Northern Pike, 371–374  
  Pumpkinseed, 316  
  Rainbow Trout, 176–178  
  Redear Sunfish, 315  
  Sacramento Perch, 310–311  
  Sacramento Pikeminnow, 224  
  Smallmouth Bass, 328  
  Steelhead, 176–177, 178  
  Striped Bass, 297–299, 354  
  suckers, 245–246  
  Tuleperch, 347  
  White Bass, 31, 306  
  White Sturgeon, 137–139  
  Yellow Perch, 333–334  
  *See also* fishing  
*Anguilla bostoniensis*, 129  
*Anisotremus davidsonii*, 25  
Anza-Borrego State Park, 275, 400  
aquaculture, 421  
  Atlantic Salmon, 409, 422  
  buying live fish from aquaculturists, 379  
  carp, 227

- aquaculture (*continued*)
- catfish, 258, 266–267, 268, 443
  - Chum Salmon, 166
  - eating farmed fish, 408–410
  - Grass Carp, 243–244
  - species available in markets, 408–409, 421–422
  - tilapias, 337, 338, 341, 342, 343
  - White Sturgeon, 137
- aquariums, 382–387
- for photography/videography, 389–393
  - species selection, 379, 385–387
  - water quality and temperature, 49, 383–384, 385
  - See also* collecting and observing fish; Steinhart Aquarium
- aquatic insects. *See* insects
- aquatic maps, 61, 62–63 (figure)
- aquatic plants, 29, 31, 32 (figure), 33–34
- for home ponds, 388
  - in photographs, 390
- Archoplites interruptus*, 17, 104 (key), **308–311**, 309 (plate), 318
- decline of, 295, 339
  - evolution, 223, 307
- Arctic Grayling, 505
- Arroyo Chub, 24, 116 (key), 213, **214–215**
- Ash Meadows Pupfish, 76 (key)
- Asian Marine Smelt, 200
- Atherinidae, 65, 67 (figure), 98 (key), **286–288**
- See also* Inland Silverside; silversides
- Atherinops affinis*, 286
- Atlantic Salmon, farmed, 409, 422
- Attigobe, Kwablah, 459
- bacterial processes, 29, 30, 33, 36
- Bairdella icistia*, 25
- bait fishes
- California policy/regulation, 237, 238, 287, 288
  - collecting for aquariums, 379
  - introduced species, 18
  - See also individual species*
- barnacles, 355
- Basa, 422
- recipe, 454
- basses, black, 102 (key), **307–308**, **322–330**
- body plan, 65, 67 (figure)
  - Redeye Bass, 102 (key), **329–330**, 506
  - species checklist, 486–487
  - Spotted Bass, 102 (key), 306, **329**, 506
  - See also* Largemouth Bass; Smallmouth Bass
- basses, temperate, 44, 100 (key), **294–306**
- body plan, 65, 67 (figure)
  - species checklist, 486
  - See also* Striped Bass; White Bass
- bass-fishing tournaments, 324–326
- Beale Air Force Base, 335
- Behnke, Robert J., 166–167, 174
- Belted Kingfisher, 181
- Beluga Sturgeon, 133
- Bigeye Marbled Sculpin, 82 (key), **363**
- Bighorn Lake, 181
- Bigscale Logperch, 64, 84 (key), 331, **334–336**, 335 (plate)
- as aquarium specimen, 336, 386
  - introduction and spread, 18, 335–336, 359
- biological control, introductions for, 17, 243–244, 282, 287, 338–339, 340
- birds, native vs. introduced, 8
- Bison, American, 15–16, 243
- black basses. *See* basses, black; *individual species*
- Black Bullhead, 74 (key), **263–264**, 385, 506
- Black Crappie, 104 (key), 307, **320–322**, 321 (plate)
- angling notes, 322
  - bluestoning impacts, 33, 321
  - competitive species, 310, 321
  - obtaining live fish, 379
  - weight records, 506
- Black Rock Rearing Ponds, 500
- blackbass, 230
- Blackfish, Sacramento. *See* Sacramento Blackfish
- Blue Catfish, 72 (key), **267–268**, 506
- Blue Chub, 114 (key), **214**
- Blue Lakes (Lake County), 286
- Blue Tilapia, 80 (key), **341**
- Bluegill, 102 (key), 209, 308, **311–314**, 312 (plate), 335, 401
- angling notes, 313–314
  - as aquarium specimen, 383 (plate), 384, 385
  - color variability, 44–45
  - competitive species, 218, 287, 310, 311, 339
  - cooking notes, 419, 429, 445, 459
  - culinary quality, 224, 313
  - predators, 312, 313, 326, 371
  - Razorback Sucker egg predation, 256, 310
  - stunting, 161, 189, 312–313
  - weight records, 506
- bluestoning, 33, 321
- Bobek, Heinz, 449
- body plans, key to, 64–65, 66–67 (figure)
- Bogus Creek, 159
- Bonytail, 24, 25, 118 (key), **215–216**
- brining fish, 461–463
- Brook Stickleback, 70 (key), 266, **293**
- Brook Trout, 92 (key), **188–191**, 189 (plate), 265
- angling notes, 189–191
  - impacts on native species, 180, 181, 186, 188–189
  - weight records, 505
- Brown Bullhead, 74 (key), **258–262**, 259 (plate)
- angling notes, 260–262
  - as aquarium specimen, 385
  - weight records, 506
- Brown Trout, 92 (key), **191–192**, 265, 363
- angling notes, 192
  - competitive species, 180, 181, 186, 187, 192, 252, 254
  - weight records, 505
- Buena Vista Lake, 13
- Bufo canorus*, 189
- Bull Trout, 92 (key), **187–188**, 192, 505
- Bullfrog, 9
- bullheads, 17, 74 (key), **257–264**
- anatomy and physiology, 37, 41, 205, 257–258
  - angling notes, 260–262
  - Black Bullhead, 74 (key), **263–264**, 385, 506
  - body plan, 64, 66 (figure)
  - breeding behavior, 259–260
  - Brown Bullhead, 74 (key), **258–262**, 259 (plate), 385, 506
  - cooking notes, 429, 443–444
  - handling, 257, 262
  - obtaining live fish, 379
  - skinning/filleting, 416 (figure)

- bullheads (*continued*)  
 species checklist, 485  
 Yellow Bullhead, 74 (key), **264**  
*See also* ictalurids
- caddis flies, 34, 194  
 calcium levels, 29  
 California Aqueduct, 7 (plate), 18, 201, 297, 299–300, 355, 367  
 California Department of Fish and Game (CDFG)  
 bait fish policies/regulation, 237, 238, 287, 288  
 collection permits, 378–379, 380  
 farm pond stocking recommendations, 313  
 Inland Silversides introduction, 286–287  
 Kaweah Reservoir poisoning, 305–306  
 nonnative introductions policy, 17–18  
 Northern Pike policy/eradication attempts, 372, 373–374  
 pupfish habitat monitoring, 273  
 sportfishing weight records, 503–506  
 tilapia introductions and, 337, 338–339, 341  
 Website, 480  
 White Bass introduction, 302–303  
*See also* hatcheries, hatchery programs
- California Fish and Game Commission, 17, 238  
 bait fish policy, 236, 237  
*See also* California Fish Commission
- California Fish Commission, 15, 16  
 American Shad introduction, 14, 141–142  
 Brown Bullhead introduction, 258  
 carp program, 227  
 White Catfish introduction, 268–269  
*See also* California Fish and Game Commission
- California Golden Trout, 96 (key), 167, **179–181**, 179 (plate)  
 angling notes, 181
- California Killifish, 76 (key), **278–279**, 279 (plate)
- California Quail, 8
- California Red-legged Frog, 283
- California Roach, 22, 116 (key), **206–208**, 207 (plate), 214, 283  
 competitive species, 318  
 predators, 150, 208, 290
- Callinassa californiensis*, 137
- camp-cooking fish, 455–459
- candlefish. *See* Eulachon
- Carassius auratus*, 112 (key), 223, 231, **233–235**, 234 (plate), 282, 347
- carbon dioxide, 28–29
- carp, 110–112 (key), 114 (key)  
 cooking notes, 429, 450  
 farmed, 422  
 Koi Carp, 230  
 Mirror Carp, 422  
 obtaining live fish, 379  
 recipes, 449–450, 459  
 Silver Carp, 234 (plate), 235  
*See also* Common Carp; Goldfish; Grass Carp
- Castaic Lake, 322, 328
- catadromous fishes, mullet, 350
- catfishes, 17, 72–75 (key), **257–258**, **265–270**  
 anatomy and physiology, 37, 41, 205, 257–258  
 angling notes, 260–262  
 Basa, 422, 454  
 Blue Catfish, 72 (key), **267–268**, 506
- catfishes (*continued*)  
 body plan, 64, 66 (figure)  
 breeding behavior, 259–260  
 cooking notes, 419, 429, 432, 443–444  
 farmed, 408, 422, 443  
 Flathead Catfish, 74 (key), 267, **270**, 506  
 handling, 257, 262  
 obtaining live fish, 379  
 recipes, 444, 454  
 skinning/filleting, 416–417, 416 (figure)  
 species checklist, 485  
 White Catfish, 72 (key), **268–269**, 269 (plates), 310, 506  
*See also* Channel Catfish
- Catostomidae, 2, 36, 106–111 (key), 226, **245–256**  
 anatomy and physiology, 41, 42, 205, 245  
 body plan, 65, 67 (figure)  
 lamprey parasitism, 127, 130  
*See also* suckers; *individual species*
- Catostomus*  
*fumeiventris*, 23, 110 (key), **250**  
*luxatus*, 22, 106 (key), **250–251**, 256  
*microps*, 22, 110 (key), **252**  
*occidentalis*, 22, 108 (key), **247–249**, 247 (plate), 248 (plate), 386  
*occidentalis lacusanserinus*, 247  
*platyrhynchus*, 106 (key), **253**, 253 (plate)  
*rimiculus*, 108 (key), **252**  
*santaanae*, 24, 106 (key), **254**  
*snyderi*, 22, 108 (key), **251**  
*tahoensis*, 23, 108 (key), 193, 246, **249**
- cattle, 12
- caviar, 136, 137
- CDFG. *See* California Department of Fish and Game
- Central Valley freshwater habitats, 3, 11, 12, 13–14  
*See also specific rivers and lakes*
- centrarchids (Centrarchidae), 102–105 (key), 208, 230, 295, **307–330**, 400  
 as aquarium specimens, 308, 384, 385  
 body plan, 65, 67 (figure)  
 obtaining live fish, 379  
*See also* basses, black; crappies; sunfishes; *individual species*
- Ceryle alcyon*, 181
- Chameleon Goby, 355
- Channel Catfish, 72 (key), 224, **265–267**, 266 (plate), 267–268  
 cooking notes, 443  
 farmed, 408, 422, 443  
 weight records, 506  
*See also* catfishes
- chars, 147  
*See also* Brook Trout; Bull Trout; Dolly Varden Trout
- Chasmistes*, 22  
*brevirostris*, 22, 106 (key), **256**
- checklist of species, 483–488
- Chinook Salmon (King Salmon), 17, 88 (key), 90 (key), **153–159**, 154 (plate), 155 (plate), 164  
 angling notes, 158–159  
 competitive species, 169  
 dam impacts, 11  
 hatchery programs, 156–158  
 Klamath River fish kill, 159, 176  
 lamprey parasitism, 125

- Chinook Salmon (*continued*)  
 market availability, 409  
 nonmigratory populations, 147, 151  
 observing, 156, 159, 398, 399  
 weight records, 154, 505
- Chondrichthyes, 131
- Chondrostei, 132
- chubs, 22, 114–117 (key), 212  
 Arroyo Chub, 24, 116 (key), 213, **214–215**  
 Blue Chub, 114 (key), **214**  
 Mojave Chub, 7 (plate), 114 (key), **213**, 215  
 Owens Tui Chub, 114 (key), **213**  
 Thicktail Chub, 14, 116 (key), **215–216**, 295, 324  
 Tui Chub, 114 (key), 193, 211, **212–213**, 213 (plate),  
 214  
*See also* California Roach; Fathead Minnow;  
 Lahontan Redside; Speckled Dace
- Chum Salmon, 86 (key), 90 (key), 154, **164–166**
- cichlids (Cichlidae), 17, 78–81 (key), 260, **337–343**  
 as aquarium specimens, 386  
 body plan, 64, 66 (figure)  
 species checklist, 487  
 temperature requirements, 49  
*See also* tilapias
- Clair Engle Lake, 327
- clams, 34  
 Overbite Clam, 135, 199, 301
- cleaning fish, 410–414, 412–413 (figures), 417–418
- Clear Lake, 3, 5 (plate), 30, 31  
 Brown Bullhead, 260  
 carp, 230  
 Inland Silverside introduction, 218, 287–288  
 minnows, 222  
 Sacramento Perch, 310  
 Threadfin Shad, 146  
 Tule Perch, 345, 346
- Clear Lake Hitch, 209
- Clear Lake Reservoir, 310
- Clear Lake Splittail, 118 (key), **218**, 287
- Clupea pallasii*, 129, 135, 141, 295
- Clupeidae, 65, 67 (figure), 120 (key), **141–146**  
*See also* shad; *individual species*
- CO<sub>2</sub>. *See* carbon dioxide
- Coastal Cutthroat Trout, 94 (key), **184–185**
- Coastal Rainbow Trout. *See* Steelhead
- coastal rivers, 3, 7 (plate), 149–150  
 South Coastal Province, 21 (figure), 23–24  
*See also specific rivers*
- Coastrange Sculpin, 82 (key), **362**
- Cobitidae, 488
- Coho Salmon (Silver Salmon), 17, 88 (key), 90 (key), 148  
 (plate), **149–153**, 151 (plate)  
 angling notes, 152–153  
 competitive species, 169  
 endangered species listing, 150, 207  
 market availability, 422  
 nonmigratory populations, 147, 151  
 observing, 398, 400  
 weight records, 150, 154, 505
- Coleman National Fish Hatchery, 399
- collecting and observing fishes, 378–402  
 aquariums, 382–387  
 buying live fish from aquaculturists, 379  
 capture and transport methods, 380–381  
 collection permits, 378–379, 380
- collecting and observing fishes (*continued*)  
 dissections, 45–48, 378  
 fish photography and videography, 389–393  
 fish printing, 379, 394–397, 394 (figure)  
 handling live fish, 44, 380  
 home fish ponds, 387–388  
 observing fishes in the wild, 398–402  
 Steinhart Aquarium, 401
- Colorado Pikeminnow, 17, 24, 43, 118 (key), **225–226**, 225  
 (plate), 229
- Colorado Province, 21 (figure), 24–25
- Colorado River, 24  
 minnows, 215, 216, 225, 238  
 Razorback Sucker, 255  
 shad, 144  
 tilapias, 341, 342  
 White Bass introduction, 303  
 Yellow Bullhead, 264
- coloration, 42, 44–45, 60, 386–387
- Columbia River, 203
- Common Carp, 110 (key), **227–233**, 229 (plate), 232  
 (plate), 234 (plate)  
 angling notes, 230–233  
 competitive species, 229–230, 256, 277, 347  
 culinary qualities, 228  
 farmed, 422  
 Goldfish-Common Carp hybridization, 235  
 teeth, 43, 205  
 weight records, 506  
*See also* carp
- cooking and eating fish, 406–480  
 basic cooking tips, 429–430  
 caring for wild-caught fish, 417–418  
 cooking methods by fish type, 429  
 cutting/filleting, 414–417, 415 (figure), 416 (figure),  
 418–420  
 farmed fish, 408–409  
 grilling and camp cooking, 455–459  
 health benefits, 406, 480  
 health concerns, 407–410, 459–460, 480  
 hot-smoking, 459–465  
 Internet resources, 479–480  
 killing and cleaning, 410–414, 412–413 (figures),  
 417–418  
 oven-cooking, 451–455  
 pan-frying, 445–451  
 recommended cookbooks, 430, 460–461, 481  
 sauces and accompaniments, 465–474  
 sautéing and sauté-poaching, 437–445  
 shopping for fish, 421–426  
 special ingredients, 429–430, 475–478  
 storage/freezing, 420–421, 427, 459–460  
 white-cooking, 431–437  
*See also individual species*
- copper sulfate, 33  
*See also* bluestoning
- Cordone, Almo, 14, 302
- Coregoninae, 147
- Cosumnes River, 329, 330
- Cottidae, 2, 36, 80–83 (key), 336, **359–365**  
 body plan, 64, 66 (figure)  
*See also* sculpins
- Cottonball Marsh, 272, 400
- Cottonball Marsh Pupfish, 76 (key), 273, 276, 400
- Cottonwood Creek (Inyo County), 179–180

Cottonwood Creek (Mono County), 186

*Cottus*

- aleuticus*, 82 (key), **362**
- asper*, 82 (key), **359–361**, 360 (plate), 362, 386
- asperrimus*, 22, 80 (key), **363–364**
- beldingi*, 82 (key), **364**
- gulosus*, 22, 82 (key), **361**
- klamathensis*, 82 (key), **363**
- klamathensis klamathensis*, 363
- klamathensis macrops*, 82 (key), 363
- klamathensis polyporus*, 363
- perplexus*, 82 (key), **362**
- pitensis*, 22, 82 (key), **361**

crappies, 104 (key), 303, **307–308**, **320–322**

- angling notes, 322
- body plan, 65, 67 (figure)
- species checklist, 486–487
- White Crappie, 104 (key), 307, **320–322**

See also Black Crappie

crayfish, 34, 194, 195, 219

creeks, 12, 18

See also rivers and streams

Crowley Lake, 250, 310

Crystal Lake Hatchery, 501

*Ctenopharyngodon idella*, 17, 31, 114 (key), 229, **242–244**, 243 (plate)

- farmed, 243–244, 422
- teeth, 43, 205, 242–243

ctenophores, 166

*Culaea inconstans*, 70 (key), **293**

Cutthroat Trout, 17, 94 (key), 96 (key), **183–186**, 223

- Coastal Cutthroat Trout, 94 (key), **184–185**
- Lahontan Cutthroat Trout, 9, 17, 94 (key), **186**, 193
- Paiute Cutthroat Trout, 96 (key), **186**, 192
- weight records, 505

cutting up fish, 414–417, 415 (figure), 418–419

*Cymatogaster aggregata*, 52, 101 (key), 344, **348–349**, 348 (plate), 386

*Cynoscion xanthulus*, 25

*Cyprinella lutrensis*, 18, 112 (key), 238, 254, 379

cyprinids (Cyprinidae), 2, 36, 110–121 (key), **204–244**, 271, 310

- anatomy and physiology, 42, 47, 205–206
- as aquarium specimens, 384, 385
- body plan, 65, 67 (figure)
- communications, 40
- cooking notes, 419, 429, 436
- lamprey parasitism, 127, 130
- See also carp; chubs; minnows; pikeminnows;  
*individual species*

*Cyprinodon*

- diabolis*, 276
- macularius*, 24, 76 (key), 273, **275–276**, 284–285, 339, 400
- nevadensis*, 76 (key), 272, **274–275**, 275 (plate)
- nevadensis amargosae*, 76 (key)
- nevadensis calidae*, 274
- nevadensis mionectes*, 76 (key)
- nevadensis nevadensis*, 76 (key)
- nevadensis pectoralis*, 76 (key)
- radiosus*, 76 (key), **277**
- salinus*, 52, 76 (key), **276–277**
- salinus milleri*, 76 (key), 276

Cyprinodontidae, 76 (key), 183, 213, 221, **271–277**, 278  
body plan, 65, 66 (figure)

Cyprinodontidae (*continued*)

See also Desert Pupfish; pupfishes

*Cyprinus carpio*. See Common Carp  
Cyprinidae, 127

Dace, Speckled, 24, 116 (key), **211–212**, 212 (plate), 236

dams and reservoirs, 9–12, 33–34

damsel flies, 34

*Daphnia*, 163

Darrah Springs Hatchery, 499

darters, 331, 334–335

See also Bigscale Logperch

Davis Reservoir, 372, 374

Death Valley, 23, 272, 274, 276, 284

observing pupfish, 400, 401 (plate)

Delta. See Sacramento-San Joaquin Delta

Delta Smelt, 22, 98 (key), **197–199**, 197 (plate), 200 (plate)

competitive species, 9, 145, 196, 199, 200, 293

predators, 199, 296

Delta-Mendota Canal, 18, 299–300, 353

Desert Fishes Council, 273

desert freshwater habitats, 3, 7 (plate), 8 (plate), 23

Desert Iguana, 271

Desert Pupfish, 24, 25, 76 (key), 273, **275–276**

competitive species, 276, 284–285

observing in the wild, 400

tilapia predation, 275, 339

desmids, 34

Devils Hole Pupfish, 276

Deweese, Christopher, 395

diatoms, 34

Dill, William, 14, 302

*Dipsosaurus dorsalis*, 271

dissecting fish, 45–48, 378

dissolved oxygen. See water oxygen levels

Dolly Varden Trout, 187

*Dorosoma petenense*, 17, 31, 120 (key), **144–146**, 145 (plate), 288

as aquarium specimen, 385

collecting, 379

competitive species, 143, 145–146, 196, 199, 200, 202, 209, 321

predators, 145, 177, 259, 269, 295

dragonflies, 34

drift, 34

Duck-billed Spotted Ray, 232

Eagle Lake, 182–183

Eagle Lake Rainbow Trout, 96 (key), 167, 172 (plate), **182–183**

Eagle Lake Tui Chub, 213

Eastern Red Fox, 8

eating fish. See cooking and eating fish

Eel, American, 129

Eel River, 3, 128–129, 142, 178

Eldorado National Forest Visitor Center, 400

Embiotocidae, 65, 67 (figure), 101 (key), **344–349**

See also perches, viviparous

endangered species, 55, 378

See also protected species

*Engraulis mordax*, 295

environmental factors

biological, 30–36, 32 (figure), 35 (figure)

physical, 26–30

epilimnion, 26, 28

- Esocidae, 44, 65, 67 (figure), 120 (key), 222, **369–374**  
*See also* pike
- Esox*, 369  
*lucius*, 41, 120 (key), 369–370, **370–374**, 371 (plate)  
*masquinongy*, 369
- estuaries, 29
- Etheostomatinae, 331  
*See also* darters
- Eucyclogobius newberryi*, 84 (key), 356, **357–358**
- Eulachon, 98 (key), **202–203**  
 angling notes, 203
- euryaline fish species, 52  
*See also* osmoregulation; salinity tolerance
- eutrophic habitats, 26, 30, 33
- evolution  
 California fish provinces, 20–25, 21 (figure)  
 feeding niches and, 222–223  
 geology and, 4, 19–20
- exotic species. *See* introduced species
- Fall River, 363
- Fallen Leaf Lake, 194, 246, 400
- families, key to, 64–65, 66–67 (figure)
- farm ponds, 313, 314
- farmed fish  
 eating, 408–409  
 market availability, 421–422  
 obtaining live fish, 379  
*See also* aquaculture
- Fathead Minnow, 18, 114 (key), **239–240**, 239 (plate), 379
- Feather River, 158, 266, 329, 332
- Feather River Hatchery, 399, 498
- feeding  
 aquarium feeding behavior, 384  
 evolution and, 222–223  
 generalists vs. specialists, 132  
 gill anatomy and, 43  
 mouth position and, 42  
 teeth and, 43–44
- filleting fish, 414–417, 415 (figure), 418–419
- Fillmore Hatchery, 501
- fins, spines, and rays, 37, 38 (figure), 54
- fish cookery. *See* cooking and eating fish
- fish hatcheries. *See* hatcheries
- fish observation. *See* collecting and observing fishes
- fish printing, 379, 394–397, 394 (figure)
- fish provinces, 20–25, 21 (figure)
- Fish Springs Hatchery, 500
- fishing  
 bass-fishing tournaments, 324–326  
 bow-and-arrow angling, 231–232  
 fly tying, 34, 36  
 handling live fish, 44, 380  
 ice fishing, 194  
 killing and cleaning fish, 410–414, 412–413  
 (figures), 417–418  
 live capture methods, 380–381  
 physiology of hooking/releasing, 50–51  
 spearfishing, 232 (plate), 233  
 storing your catch, 420–421, 427  
 "tickling," 190–191  
 weight records, 503–506  
*See also* angling notes; hatcheries; Native American  
 fishing; *individual fish species*
- Flathead Catfish, 74 (key), 267, **270**, 506
- Florida, introduced species in, 15
- Florida Largemouth Bass, 306, 322
- flounder, righteyed, 72 (key), **366–368**, 488  
 body plan, 64, 66 (figure)  
*See also* Starry Flounder
- fly tying, 34, 36
- Folsom Lake, 260
- Fox Squirrel, 8
- freezing fish, 420–421, 459–460
- Frenchman Reservoir, 369–370, 372
- Friant-Kern Canal, 130
- frogs, 9, 172, 189, 283
- fully protected species, 55, 378  
*See also* protected species
- Fundulidae, 65, 66 (figure), 76–77 (key), **278–280**, 385  
*See also* killifishes
- Fundulus parvipinnis*, 76 (key), **278–279**, 279 (plate)
- Gambusia affinis*, 25, 78 (key), 280, **282–284**, 283 (plate)  
 as aquarium specimen, 386  
 competitive species, 274, 276, 277, 283  
 introduction, 17, 282
- Gasterosteidae, 2, 64, 66 (figure), 70 (key), **289–293**  
*See also* sticklebacks; Threespine Stickleback
- Gasterosteus*  
*aculeatus*. *See* Threespine Stickleback  
*aculeatus aculeatus*, 70 (key), 290  
*aculeatus microcephalus*, 70 (key), 290  
*aculeatus williamsoni*, 24, 70 (key), 290
- Ghost Shrimp, 137
- Gila*, 22, 212  
*coerulea*, 114 (key), **214**  
*crassicauda*, 14, 116 (key), **215–216**, 295, 324  
*elegans*, 24, 118 (key), **215–216**  
*orcutti*, 24, 116 (key), 213, **214–215**
- gill anatomy and function, 38 (figure), 42–43, 49–50, 51–52
- Gillichthys mirabilis*, 25
- gobies (Gobiidae), 84 (key), **352–358**, 379, 386  
 body plan, 64, 66 (figure)  
 Chameleon Goby, 355  
 Longjaw Mudsucker, 25  
 Shimofuri Goby, 18, 84 (key), **355–357**, 356 (plates),  
 359  
 species checklist, 487  
 Tidewater Goby, 84 (key), 356, **357–358**  
 Yellowfin Goby, 18, 84 (key), **352–354**, 353 (plate),  
 359
- Golden Shiner, 18, 112 (key), **235–237**, 237 (plate), 394  
 (figure)  
 as bait fish, 235–236, 298, 379
- Golden Trout, 17, 20, 22, 96 (key)  
 angling notes, 181  
 California Golden Trout, 96 (key), 167, **179–181**, 179  
 (plate)  
 decline of, 9, 180, 181  
 hybridization, 172, 180, 181  
 Little Kern Golden Trout, 96 (key), 167, **181**  
 weight records, 505
- Goldfish, 112 (key), 223, 231, **233–235**, 234 (plate)  
 introduction and spread, 18, 234, 282, 347
- gonopodium, 37, 281
- Goose Lake, 130
- Goose Lake Redband Trout, 183
- Goose Lake Sucker, 247

- Goose Lake Tui Chub, 213
- Grass Carp, 17, 31, 114 (key), 229, **242–244**, 243 (plate)  
teeth, 43, 205, 242–243
- Grass Shrimp, 136, 137
- gravel mining, 18
- gravlax  
cooking notes, 431, 437, 451  
recipes, 453–454, 463–465
- grayling, 147, 505
- grazing, 12, 18
- Great Basin Province, 21 (figure), 22, 23
- Great Lakes  
Lake Trout, 193, 194  
salmon, 147, 151–152, 164  
Sea Lamprey, 126  
Steelhead, 169
- Green River, 215
- Green Sturgeon, 17, 70 (key), 131 (plate), **139–140**
- Green Sunfish, 104 (key), **317–318**, 317 (plate), 371  
angling notes, 318  
as aquarium specimen, 385, 386  
impacts on native species, 207–208, 254, 310, 318  
obtaining live fish, 379  
weight records, 506
- Green Swordtail, 24, 488
- grilling and camp-cooking fish, 455–459
- Gulf Croaker, 25
- Guppy, 24, 281, 488
- gyotaku (fish printing), 379, 394–397, 394 (figure)
- habitats, 2–14, 4–8 (plates)  
before European settlement, 2–4  
biological environment, 30–36, 32 (figure), 35 (figure)  
changes after European settlement, 8–14, 18  
desert habitats, 3, 7 (plate), 8 (plate), 23  
lakes and ponds, 3, 13–14, 26–30, 30–34  
physical environment, 26–30  
productivity, 29–30  
reservoirs, 9–12  
rivers and streams, 3, 12, 18, 29, 34–36, 35 (figure)  
water diversions and drainage projects, 13–14, 18, 299–300
- Hardhead, 22, 118 (key), **219–220**, 219 (plate), 231
- Hasler, Arthur D., 39
- Hat Creek, 192, 363
- hatcheries, hatchery programs  
Brook Trout, 188  
catfish, 265  
Coastal Rainbow Trout/Steelhead, 171–175  
Delta Smelt, 198, 199  
Eagle Lake Rainbow Trout, 183  
eating hatchery fish, 408  
farm pond stocking, 313  
Golden Trout, 180  
hybridization, 172, 184–185  
impacts/drawbacks, 18–19, 171–173, 180, 186, 188–189  
listed with addresses, 497–501  
observing fish at, 398–399  
put-and-take stocking programs, 173, 174–175, 323  
salmon, 18–19, 156–158  
Striped Bass, 301–302
- Havas Reservoir, 215
- hearing, 42
- hellgrammites, 195
- herrings, 141  
Pacific Herring, 129, 135, 141, 295  
*Hippolyte californiensis*, 136
- Hitch, 22, 112 (key), **208–209**, 209 (plate)
- Hopkirk, John, 20
- Hot Creek Hatchery, 500
- hot-smoking fish, 459–465
- House Mouse, 8
- Hubbs, Carl, 277
- Humpback Sucker. *See* Razorback Sucker
- hypolimnion, 26, 29
- Hypomesus*  
*japonicus*, 200  
*nipponensis*. *See* Wakasagi  
*transpacificus*, 9, 98 (key), 145, 196, **197–199**, 197 (plate), 293, 296
- Hysterocarpus*  
*traski*, 22, 101 (key), 332, **344–347**, 345 (plate), 386  
*traski lagunae*, 345  
*traski pomo*, 345  
*traski traski*, 345
- ice fishing, 194
- ictalurids (Ictaluridae), 64, 66 (figure), 72–75 (key), 205, **257–270**  
anatomy and physiology, 41, 42, 44, 47, 205, 257–258  
breeding behavior, 259–260  
*See also* bullheads; catfishes; Channel Catfish
- Ictalurus*  
*furcatus*, 72 (key), **267–268**  
*punctatus*, 72 (key), 224, **265–267**, 266 (plate)
- identifying species, 400–401  
body plans, 64–65, 66–67 (figure)  
how to use keys, 60–61
- Iijima, Ted, 426
- illustrated keys, 64–120  
abbreviations, 53–56  
body plans of fish families, 64–65, 66–67 (figure)  
how to use, 60–61
- Imperial Valley, 238
- Inland Silverside, 17, 98 (key), **286–288**, 287 (plate)  
American Shad and, 143  
as aquarium specimen, 385  
basses and, 288, 300, 301, 304, 324  
introduction and spread, 287–288  
native minnows and, 209, 218, 287  
native smelts and, 196, 199, 202  
predators, 259, 269, 304
- insects, 34, 36  
introductions for insect control, 282, 287
- instinctive behavior, 291, 293
- introduced species, 9, 14–19, 125–126, 288, 294  
non-fish fauna, 8–9  
number of, 14, 488  
regulatory agencies and, 15–16, 17–18  
reservoir building and, 9–12  
*See also individual species*
- Iron Gate Dam and Reservoir, 22, 159, 332, 333
- Iron Gate Hatchery, 398, 497
- isopods, 34
- jellyfishes, 166, 355
- Jordan, David Starr, 16, 179, 183

- Kaweah Reservoir, 303, 305–306  
 Kern Brook Lamprey, 22, 68 (key), **130**  
 Kern Lake, 13  
 Kern River, 4 (plate), 179, 180, 181–182  
 Kern River Planting Base, 501  
 Kern River Rainbow Trout, 96 (key), 167, **181–182**  
 killifishes, 76–77 (key), **278–280**  
   as aquarium specimens, 278, 385  
   body plan, 65, 66 (figure)  
   California Killifish, 76 (key), **278–279**, 279 (plate)  
   Rainwater Killifish, 18, 77 (key), **279–280**, 280 (plate)  
   species checklist, 486  
 killing fish, 410  
 King Salmon. *See* Chinook Salmon  
 Kitting, Chris, 392, 393  
 Klamath Largescale Sucker, 22, 108 (key), **251**  
 Klamath Province, 21 (figure), 22  
 Klamath River, 3, 22  
   Brook Stickleback, 293  
   Eulachon, 203  
   lampreys, 130  
   minnows, 214  
   salmon, 158, 159, 164–165, 176  
   sculpins, 363  
   shad, 142  
   Steelhead, 178  
   sturgeons, 139, 140  
   suckers, 250–252, 256  
   Yellow Perch, 333  
 Klamath River Lamprey, 68 (key), **130**  
 Klamath Smallscale Sucker, 108 (key), **252**  
 Koi Carp, 230  
 Kokanee Salmon, 86 (key), 90 (key), 147, **160–164**, 163 (plate), 193, 372, 488  
   angling notes, 162–164  
   competitive species, 161–162, 201  
   Northern Pike and, 371  
   observing in the wild, 399–400  
   as planktivore, 31, 33, 161–162, 163  
   weight records, 505
- Lafayette Reservoir, 332  
 Lagunitas Creek, 150–151, 400  
 Lahontan Cutthroat Trout, 9, 17, 94 (key), **186**, 193  
 Lahontan Province, 21 (figure), 22, 23  
 Lahontan Redside, 116 (key), **210–211**, 210 (plate)  
 Lake Almanor, 310  
 Lake Berryessa, 315, 327, 329  
 Lake Chabot, 10, 31, 33, 229, 321  
 Lake Havasu, 144  
 Lake Lahontan, 23  
 Lake Merced, 160, 347  
 Lake Merritt, 280  
 Lake Michigan, 126, 151–152  
 Lake Mojave, 23  
 Lake Nacimiento, 229, 303, 306  
 Lake Neotoma, 399  
 Lake Perris, 329  
 Lake Shasta, 160, 162, 327, 329  
 Lake Superior, 165, 169  
 Lake Tahoe  
   Kokanee Salmon, 160, 161, 399  
   Lahontan Cutthroat Trout, 186
- Lake Tahoe (*continued*)  
   Lahontan Redside, 210–211  
   Lake Trout, 186, 193–194, 249  
 Lake Temescal, 235  
 Lake Trout (Mackinaw Trout), 92 (key), 126, 186, **193–194**, 249  
   angling notes, 194  
   weight records, 505  
 Lake Van Norden, 258  
 lakes, 3, 23, 30–34  
   Central Valley lake losses, 13  
   dams and reservoirs, 9–12, 33–34  
   nutrient levels and productivity, 29–30, 30–31  
   observing fish in, 402  
   stunting in, 189, 333  
   thermal and oxygen stratification, 26–28, 27 (figure), 29  
   *See also specific lakes*
- Lampetra*  
   *ayresi*, 68 (key), **129**  
   *hubbsi*, 22, 68 (key), **130**  
   *lethophaga*, 22, 68 (key), **129–130**  
   *richardsoni*, 68 (key), **130**  
   *similis*, 68 (key), **130**  
   *tridentata*, 68, 68 (key), 125, **127–129**, 128 (plate)  
 lampreys, 68 (key), **124–130**  
   angling notes, 128  
   body plan, 64, 66 (figure)  
   edibility, 128  
   Kern Brook Lamprey, 22, 68 (key), **130**  
   Klamath River Lamprey, 68 (key), **130**  
   Pacific Lamprey, 68 (key), 125, **127–129**, 128 (plate), 231  
   Pit-Klamath Brook Lamprey, 22, 68 (key), **129–130**  
   River Lamprey, 68 (key), **129**  
   Sea Lamprey, 125–126  
   species checklist, 483  
   Western Brook Lamprey, 68 (key), **130**
- Largemouth Bass, 102 (key), 223, 301, 307, **322–327**, 323 (plate)  
   angling notes, 324–327  
   as aquarium specimen, 385, 386  
   competitive species, 145–146, 310, 324, 329  
   culinary quality/cooking notes, 224, 411, 419, 429, 432  
   declines, 324, 329  
   farmed, 408, 422  
   Florida Largemouth Bass, 306, 322  
   introduction and stocking, 17, 306, 322, 335  
   Owens Pupfish and, 277  
   prey species, 312, 313, 318, 323, 324, 326  
   state record, 328  
   Threadfin Shad and, 145–146  
   weight records, 505  
 lateral line, 41
- Lavinia*  
   *exilicauda*, 22, 112 (key), **208–209**, 209 (plate)  
   *exilicauda chi*, 209  
   *symmetricus*. *See* California Roach
- Lebistes reticulatus*, 24, 281, 488  
 Leopold, Aldo, 15
- Lepomis*  
   *cyanellus*. *See* Green Sunfish  
   *gibbosus*, 102 (key), 308, **315–316**, 316 (plate), 401  
   *gulosus*, 104 (key), **318–319**, 319 (plate)

*Lepomis* (continued)

- macrochirus*. See Bluegill
- microlophus*, 102 (key), 308, 313, **314–315**, 315 (plate), 401
- Leptocottus armatus*, 80 (key), 298, 354, **364–365**, 365 (plate), 379
- Little Kern Golden Trout, 96 (key), 167, **181**
- livebearers, 78 (key), 271, **281–285**
  - as aquarium specimens, 282, 385
  - body plan, 65, 66 (figure)
  - Green Swordtail, 24, 488
  - Guppy, 24, 281, 488
  - Porthole Livebearer, 24, 78 (key), 281–282, **285**
  - Sailfin Molly, 18, 25, 78 (key), 276, **284–285**, 379
  - Shortfin Molly, 78 (key), 281–282, 285
  - species checklist, 486
- See also Poeciliidae; Western Mosquitofish
- Logperch, Bigscale. See Bigscale Logperch
- Longfin Smelt, 98 (key), **201–202**
- Longjaw Mudsucker, 25
- Los Angeles Basin, introduced species, 24, 488
- Los Angeles River, 254
- Lost River, 250, 256
- Lost River Sucker, 22, 106 (key), **250–251**, 256
- Lower Klamath Marbled Sculpin, **363**
- Lucania parva*, 18, 77 (key), **279–280**, 280 (plate)
  
- Mackinaw Trout. See Lake Trout
- Mad River, 203
- Mad River Hatchery, 398, 497
- mammals, native vs. introduced, 8
- maps
  - California fish provinces, 21 (figure)
  - California rivers and lakes, 61, 62–63 (figure)
- Marbled Sculpin, 82 (key), **363**
- Matern, Scott, 355
- mayflies, 34, 194
- McCloud River, 171, 187, 192
- McCloud River Redband Trout, 180, 182, 183
- Menidia beryllina*, 17, 98 (key), **286–288**, 287 (plate)
  - American Shad and, 143
  - as aquarium specimen, 385
  - basses and, 288, 300, 304, 324
  - native minnows and, 209, 218, 287
  - native smelts and, 196, 199, 202
  - predators, 259, 269, 304
- Merced River Hatchery, 498
- mergansers, 181
- mesotrophic habitats, 30
- Michael, Peter, 27
- Micropterus*
  - coosae*, 102 (key), **329–330**
  - dolomieu*, 102 (key), 220, 256, 307, **327–328**, 328 (plate), 400–401
  - punctulatus*, 102 (key), 306, **329**
  - salmoides*. See Largemouth Bass
- Miller, Robert, 277
- Millerton Lake, 297, 329
- Minnesota, introduced species in, 15
- minnows, 2, 3, 36, 110–121 (key), **204–244**, 271
  - anatomy and physiology, 41, 205–206
  - body plan, 65, 67 (figure)
  - Bonytail, 24, 25, 118 (key), **215–216**
  - Clear Lake Splittail, 118 (key), **218**, 287
  - communications, 40

minnows (continued)

- Fathead Minnow, 18, 114 (key), **239–240**, 239 (plate), 379
- Hardhead, 22, 118 (key), **219–220**, 219 (plate), 231
- Hitch, 22, 112 (key), **208–209**, 209 (plate)
- introductions, 226
- Kokanee Salmon and, 162
- Lahontan Redside, 116 (key), **210–211**, 210 (plate)
- lamprey parasitism, 127
- Red Shiner, 18, 112 (key), **238**, 254, 379
- Sacramento Perch and, 310
- Sacramento Splittail, 22, 118 (key), **216–218**, 217 (plate)
- species checklist, 484–485
- Speckled Dace, 24, 116 (key), **211–212**, 212 (plate), 236
- Tench, 18, 110 (key), **240–242**, 241 (plate)
- See also California Roach; carp; chubs; cyprinids; Golden Shiner; Goldfish; pikeminnows; Sacramento Blackfish
- Mirror Carp, 422
- Misgurnus anguillicaudatus*, 18, 488
- Mississippi River catfishes, 267
- Mississippi Silverside. See Inland Silverside
- Moccasin Creek Hatchery, 499
- Modoc Sucker, 22, 110 (key), **252**
- Mojave Chub, 7 (plate), 114 (key), **213**, 215
- Mojave River, 213, 214–215
- Mojave River Hatchery, 501
- Mokelumne River Hatchery, 498
- Molly, Black, 284
- Molly, Sailfin, 18, 25, 78 (key), 276, **284–285**, 379
- Molly, Shortfin, 78 (key), 281–282, 285
- Mormon Slough, 6 (plate), 339
- Morone*
  - chrysops*. See White Bass
  - saxatilis*. See Striped Bass
- Moronidae, 44, 65, 67 (figure), 100 (key), **294–306**
  - See also basses, temperate; individual species
- Mosquitofish. See Western Mosquitofish
- Mount Shasta Hatchery, 499
- Mount Whitney Hatchery, 500
- Mountain Lion, 372
- Mountain Sucker, 106 (key), **253**, 253 (plate)
- Mountain Whitefish, 92 (key), 193, **194–195**
  - angling notes, 195
  - weight records, 505
- Mountain Yellow-legged Frog, 172, 189
- mouth position, 38 (figure), 42
- Mozambique Tilapia, 25, 80 (key), **337–339**, 338 (plate)
- mucus coating, 44
- Mugil cephalus*, 98 (key), **350–351**
- Mugilidae, 65, 67 (figure), 98 (key), **350–351**
  - See also mullet
- Mule Deer, 8
- Mulkey Creek, 179–180
- mullet, 65, 67 (figure), **350–351**
  - species checklist, 487
  - Striped Mullet, 98 (key), **350–351**
- Muskellunge (Muskie), 369
- Muskrat, 8
- Mylopharodon conocephalus*, 22, 118 (key), **219–220**, 219 (plate), 231

- Native American fishing  
 Chinook Salmon, 154  
 Eulachon, 203  
 Green Sturgeon, 140  
 lampreys, 128  
 Lost River Sucker, 250  
 Razorback Sucker, 255  
 Sacramento Perch, 308  
 Thicktail Chub, 14, 216
- native species  
 California fish provinces, 20–25, 21 (figure)  
 current status and number, 15, 16, 488  
 evolution, 19–20  
*See also individual species*  
*Neomysis mercedi*, 228, 288, 301  
 Nile Tilapia, 80 (key), **342–343**  
 Nimbus Hatchery, 398, 399, 498  
 nonnative species. *See* introduced species  
 Northern Anchovy, 295  
 Northern Pike, 41, 120 (key), 369–370, **370–374**, 371 (plate)  
 angling notes, 371–374  
 cooking notes, 419  
 Norway Rat, 8  
*Notemigonus crysoleucas*, 18, 112 (key), **235–237**, 237 (plate), 298, 379  
 notochord, 124, 131–132  
 nutrient levels and cycles, 29, 30, 34, 36
- observing fishes. *See* collecting and observing fishes  
 olfaction, 39–40, 41  
 oligotrophic habitats, 30  
*Oncorhynchus*  
*clarki*, 17, **183–186**, 223  
*clarki clarki*, 94 (key), **184–185**  
*clarki henshawi*, 94 (key), **186**, 193  
*clarki seleniris*, 96 (key), **186**, 192  
*gorbuscha*, 88 (key), 90 (key), 147, **164–165**  
*keta*, 86 (key), 90 (key), 154, **164–166**  
*kisutch*, 17, 88 (key), 90 (key), 147, **149–153**, 154, 169  
*mykiss*. *See* Rainbow Trout  
*mykiss aguabonita*, 9, 96 (key), 167, **179–181**, 179 (plate)  
*mykiss aquilarum*, 96 (key), 167, **182–183**  
*mykiss gilberti*, 96 (key), 167, **181–182**  
*mykiss irideus*, 3, 90 (key), 94 (key), 142, 151, **167–178**, 168 (plate)  
*mykiss stonei*, 96 (key), 167, **182**  
*mykiss whitei*, 9, 96 (key), 167, **181**  
*nerka*. *See* Kokanee Salmon  
*tshawytscha*. *See* Chinook Salmon
- O'Neill Forebay, 297, 298  
 operculum, 42  
 Opossum Shrimp, 228, 288, 301  
 Orangemouth Corvina, 25  
*Oreochromis*  
*aureus*, 80 (key), **341**  
*mossambicus*, 25, 80 (key), **337–339**, 338 (plate)  
*niloticus*, 80 (key), **342–343**
- Oriental Weatherfish, 18, 24, 488  
 Oroville Salmon Festival, 399  
*Orthodon microlepidotus*, 13, 120 (key), **220–222**, 221 (plate), 326, 379  
 physiology, 48, 221
- Osmeridae, 65, 67 (figure), 98 (key), **196–203**  
*See also* smelts; *individual species*  
 osmoregulation, 51–52, 295  
*See also* salinity tolerance
- Osteichthyes, 131  
 ostracoderms, 124, 125  
 oven-cooking fish, 451–455  
 Overbite Clam, 135, 199, 301  
 Owens Pupfish, 76 (key), **277**  
 Owens River, 250, 277  
 Owens Speckled Dace, 211–212  
 Owens Sucker, 23, 110 (key), **250**  
 Owens Tui Chub, 114 (key), **213**  
 oxygen levels/stratification, 26–28, 27 (figure), 30  
 oxygen physiology, 48–49, 49–51
- Pacific Herring, 129, 135, 141, 295  
 Pacific Lamprey, 68 (key), 125, **127–129**, 128 (plate), 231  
 Pacific Sardine, 295  
 Pacific Staghorn Sculpin, 80 (key), 298, **364–365**, 365 (plate), 379  
 Paddlefish, 379  
 Paiute Cutthroat Trout, 96 (key), **186**, 192  
 Paiute Sculpin, 82 (key), **364**  
 panfish  
 cooking notes, 417, 429, 431–432, 445  
*See also specific types*  
 pan-frying fish, 445–451  
*Panthera concolor*, 372  
 parasites, in fish flesh, 459–460  
 parasitism, lampreys, 125–126  
 parr marks, 45, 148, 148 (plate), 165, 180, 182  
 PCBs, 409  
*Perca flavescens*, 65, 84 (key), 331, **332–334**, 333 (plate), 386  
 perches, 84 (key), 308, **331–336**  
 body plan, 65, 66 (figure), 67 (figure)  
 cooking notes, 429, 445  
 species checklist, 487  
*See also* Bigscale Logperch; perches, viviparous; Sacramento Perch; Yellow Perch  
 perches, viviparous, 101 (key), **344–349**  
 body plan, 65, 67 (figure)  
 Shiner Perch, 52, 101 (key), 344, **348–349**, 348 (plate), 386  
 species checklist, 487  
 Tuleperch, 22, 101 (key), 332, **344–347**, 345 (plate), 386
- Percidae, 84 (key), 308, **331–336**  
 body plans, 64, 65, 66 (figure), 67 (figure)  
*See also* perches; *individual species*  
*Percina macrolepada*, 64, 84 (key), 331, **334–336**, 335 (plate)  
 as aquarium specimen, 336, 386  
 introduction and spread, 18, 335–336, 359
- Petromyzon marinus*, 125–126  
 Petromyzontidae, 64, 66 (figure), 68 (key), **124–130**  
*See also* lampreys  
 pharyngeal teeth, 43–44, 44 (plate)  
 photographing fishes, 389–393  
 physical environmental factors, 26–30  
 physiology. *See* anatomy and physiology  
 phytoplankton, 30–31, 33, 36  
 pickerel, 369  
 pike, 44, 120 (key), 222, **369–374**, 488

- pike (*continued*)  
 body plan, 65, 67 (figure)  
 Muskellunge (Muskie), 369  
 Northern Pike, 41, 120 (key), 369–370, **370–374**, 371  
 (plate), 419  
 Pike, Walleye. *See* Walleye  
 pikeminnows, 17, 43, 118–121 (key), 222–223  
 cooking notes, 429  
*See also* Bonytail; Clear Lake Splittail; Colorado  
 Pikeminnow; Hardhead; Sacramento  
 Blackfish; Sacramento Pikeminnow;  
 Sacramento Splittail  
 pikeperches, 331  
*Pimephales promelas*, 18, 114 (key), **239–240**, 239 (plate),  
 379  
 Pink Salmon, 88 (key), 90 (key), 147, **164–165**  
 Pister, Phil, 277  
 Pit River, 130, 361, 363  
 Pit Sculpin, 22, 82 (key), **361**  
 Pit-Klamath Brook Lamprey, 22, 68 (key), **129–130**  
 plants. *See* aquatic plants  
*Platichthys stellatus*, 52, 64, 72 (key), 366, **367–368**, 368  
 (plates), 386  
 Platy, 281  
 Pleuronectidae, 64, 66 (figure), 72 (key), **366–368**  
*See also* flounder, righteyed  
*Poecilia latipinna*, 18, 78 (key), 276, **284–285**, 379  
 Poeciliidae, 37, 78 (key), 271, **281–285**, 385  
 body plan, 65, 66 (figure)  
*See also* livebearers; Western Mosquitofish  
*Poeciliopsis*  
*gracilis*, 24, 78 (key), 281–282, **285**  
*mexicana*, 78 (key), 281–282, 285  
*Pogonichthys*  
*ciscoides*, 118 (key), **218**, 287  
*macrolepidotus*, 22, 118 (key), **216–218**, 217 (plate)  
 pollution, 18  
 toxins in fish, 407–409  
 pollution tolerance, 240  
*Polyodon spathula*, 379  
*Pomoxis*  
*nigromaculatus*, 33, 104 (key), 307, 310, **320–322**,  
 321 (plate), 379  
*annularis*, 104 (key), 307, **320–322**  
 ponds  
 home wild fish ponds, 387–388  
 lake and pond environment, 30–34  
 stunting in, 161, 312–313, 317, 339  
*See also* lakes  
 Pope Creek, 327  
 Poppé, Julius, 227  
 Porthole Livebearer, 24, 78 (key), 281–282, **285**  
*Potamocorbula amurensis*, 135, 199, 301  
 Prickly Sculpin, 82 (key), **359–361**, 360 (plate), 362, 386  
 Pronghorn Antelope, 8  
*Prosopium williamsoni*, 92 (key), 193, **194–195**  
 protected species, 15, 55  
 Bull Trout listing, 188  
 categories and abbreviations, 55–56  
 Coho Salmon listing, 150, 207  
 collection permits, 378  
 Colorado Pikeminnow listing, 226  
 Cutthroat Trout listings, 186  
 Delta Smelt listing, 198–199  
 Little Kern Golden Trout listing, 181  
 protected species (*continued*)  
 Owens and Mojave Tui Chub listings, 213  
 pupfish listings, 273  
 Steelhead listing, 167, 176, 207  
 sucker listings, 250–251, 252, 254, 255, 256  
 Thicktail Chub and Bonytail listings, 216  
*Ptychocheilus*  
*grandis*, 17, 43, 118 (key), 219, **222–224**, 223 (plate),  
 252  
*lucius*, 17, 43, 118 (key), **225–226**, 225 (plate), 229  
 Pumpkinseed, 102 (key), 308, **315–316**, 316 (plate), 401  
 angling notes, 316  
 pupfishes, 23, 76 (key), **271–277**, 278  
 Amargosa Pupfish, 76 (key), 272, 273, **274–275**, 275  
 (plate)  
 Amargosa River Pupfish, 76 (key)  
 as aquarium specimens, 272, 276, 387  
 Ash Meadows Pupfish, 76 (key)  
 body plan, 65, 66 (figure)  
 coloration, 387  
 Cottonball Marsh Pupfish, 76 (key), 273, 276, 400  
 current status, 213, 273  
 Devils Hole Pupfish, 276  
 observing in the wild, 400–401  
 Owens Pupfish, 76 (key), **277**  
 physiological adaptations, 183, 207, 221, 271–272  
 Salt Creek Pupfish, 23, 52, 76 (key), **276–277**, 400  
 Saratoga Springs Pupfish, 76 (key)  
 species checklist, 486  
 Tecopa Pupfish, 274  
 Warm Springs Pupfish, 76 (key)  
*See also* Desert Pupfish  
 Putah Creek, 327  
*Pylodictis olivaris*, 74 (key), 267, **270**  
 Pyramid Lake, 23  
 Pyramid Reservoir, 297  
 Rae Lakes, 4 (plate)  
 railroad, impacts of, 9, 15–16  
 Rainbow Trout, 17, 20, 96 (key), **167–178**, 172 (plate),  
 223, 361  
 angling notes, 176–178  
 as aquarium specimen, 290, 385  
 Brown Trout and, 192  
 culinary quality, 246  
 Eagle Lake Rainbow Trout, 96 (key), 167, 172  
 (plate), **182–183**  
 farmed, 409, 422  
 Golden Shiners and, 236  
 hatchery/stocking programs, 171–175, 180, 183, 185,  
 186, 200  
 impacts on subspecies, 9, 172, 180, 186  
 Kern River Rainbow Trout, 96 (key), 167, **181–182**  
 prey species, 145, 177, 200, 249, 290  
 subspecies listed, 167  
 temperature and oxygen requirements, 27–28, 48–49  
 Threadfin Shad and, 145, 177, 200  
 weight records, 505  
 wild trout management, 175–176  
*See also* Golden Trout; Redband Trout; Steelhead  
 Rainwater Killifish, 18, 77 (key), **279–280**, 280 (plate)  
*Rana*  
*aurora draytonii*, 283  
*muscosa*, 172, 189  
 Razorback Sucker, 24, 25, 108 (key), 226, **255–256**

- recipes  
   grilled and camp-cooked fish, 455–459  
   hot-smoked fish, 459–465  
   oven-cooked fish, 451–455  
   pan-fried fish, 445–451  
   sauces and accompaniments, 465–474  
   sautéed or sauté-poached fish, 437–445  
   white-cooked fish, 431–437  
   *See also specific types of fish*
- Red Shiner, 18, 112 (key), **238**, 254, 379
- Redband Trout, **178–183**  
   Goose Lake Redband Trout, 183  
   McCloud River Redband Trout, 183  
   Sacramento Redband Trout, 96 (key), 167, **182**  
   *See also Golden Trout*
- Redbelly Tilapia, 78 (key), 275, **340–341**
- Redear Sunfish, 102 (key), 308, 313, **314–315**, 315 (plate), 401  
   angling notes, 315  
   weight records, 506
- Redeye Bass, 102 (key), **329–330**, 506
- Redside, Lahontan, **210–211**, 210 (plate)
- reptiles, 8
- reservoirs, 9–12, 33–34  
   *See also specific reservoirs by name*
- Resident Threespine Stickleback, 290
- Reticulate Sculpin, 82 (key), **362**
- Rhinichthys osculus*, 24, 116 (key), **211–212**, 212 (plate), 236
- Richardsonius egregius*, 116 (key), **210–211**, 210 (plate)
- Riffle Sculpin, 22, 82 (key), **361**
- righteyed flounder. *See* flounder, righteyed; Starry Flounder
- Ring-necked Pheasant, 8
- River Lamprey, 68 (key), **129**
- rivers and streams, 34–36, 35 (figure)  
   California river map, 61, 62–63 (figure)  
   coastal rivers, 3, 7 (plate), 149–150  
   creek degradation, 12, 18  
   dam-building impacts, 10, 11–12  
   nutrient levels/distribution, 29, 34, 36  
   observing fish in, 402  
   Sierra streams, 2, 4 (plates), 12  
   *See also specific rivers*
- Roach, California. *See* California Roach
- Rogue River, **362**
- Roosevelt, Teddy, 180
- Rough Sculpin, 22, 80 (key), **363–364**
- Russian River  
   American Shad, 142  
   minnows, 3, 206, 219  
   Tule Perch, 345, 346, 347
- Sacramento Blackfish, 13, 22, 120 (key), **220–222**, 221 (plate), 326  
   farmed, 422  
   obtaining live fish, 379  
   physiology, 48, 221  
   recipe, 436–437
- Sacramento Perch, 17, 22, 104 (key), **308–311**, 309 (plate), 318, 394 (figure)  
   angling notes, 310–311  
   decline of, 295, 339  
   evolution, 223, 307  
   weight records, 506
- Sacramento Pikeminnow, 17, 22, 43, 118 (key), 219, **222–224**, 223 (plate), 252  
   angling notes, 224  
   cooking notes, 419
- Sacramento Province, 20, 21 (figure), 22
- Sacramento Redband Trout, 96 (key), 167, **182**
- Sacramento River, 2, 20  
   American Shad, 14, 141–142  
   dam impacts, 11  
   Delta Smelt, 198  
   lampreys, 129, 130  
   minnows, 216, 219  
   Riffle Sculpin, 361  
   Striped Bass, 295, 296, 298, 299  
   sturgeons, 134, 135, 139  
   Tule Perch, 345, 346  
   *See also Sacramento-San Joaquin Delta*
- Sacramento Splittail, 22, 118 (key), **216–218**, 217 (plate)
- Sacramento Sucker, 22, 108 (key), **247–249**, 247 (plate), 248 (plate), 386  
   cooking notes, 419
- Sacramento Valley. *See* Central Valley
- Sacramento-San Joaquin Delta, 2–3, 6 (plates)  
   Bigscale Logperch, 335  
   catfishes and bullheads, 260  
   gobies, 352–353, 354, 355  
   habitat losses, 215, 216–217  
   Inland Silverside, 287–288, 301  
   minnows, 215–216, 216–217, 222  
   Northern Pike introduction and, 373  
   Sacramento Perch, 310  
   sculpins, 365  
   shad, 142, 144, 146  
   smelts, 196, 198–199, 202  
   Starry Flounder, 367  
   Striped Bass, 294, 297, 299–300  
   sturgeon fishing, 137  
   water diversion impacts, 299–300  
   White Catfish introduction, 268–269  
   Yellow Perch, 332  
   *See also San Francisco Estuary*
- Sage Grouse, 8
- Sailfin Molly, 18, 25, 78 (key), 276, **284–285**, 379
- salamanders, 49
- salinity tolerance  
   killifishes, 278, 279–280  
   Mozambique Tilapia, 338  
   osmoregulation, 51–52, 295  
   pupfishes, 272, 275–276  
   Salton Sea species progression and, 24–25  
   Striped Mullet, 351  
   Threespine Stickleback, 290
- Salmo trutta*. *See* Brown Trout
- salmon, 3, 86–91 (key), 147, **149–166**  
   American Shad and, 142  
   Atlantic Salmon, 409, 422  
   body plan, 65, 67 (figure)  
   Chum Salmon, 86 (key), 90 (key), 154, **164–166**  
   cooking notes, 429, 431, 445, 451, 453, 454, 457, 463  
   farmed, 166, 409, 422, 424  
   fry identification, 90 (key)  
   gravlax, 431, 437, 451, 453–454, 463–465  
   hatchery locations, 497–498  
   killing and cleaning, 418  
   lamprey parasitism, 125, 127

- salmon (*continued*)  
 observing, 147–148, 159, 162, 398–400  
 osmoregulation, 51–52, 295  
 Pink Salmon, 88 (key), 90 (key), 147, **164–165**  
 wild-caught, 409, 422, 459–460  
*See also* Chinook Salmon; Coho Salmon; Kokanee Salmon; salmonids
- salmon festivals, 399
- salmonids (Salmonidae), 2, 86–97 (key), 142, **147–195**  
 anatomy and physiology, 39, 49, 52  
 body plan, 65, 67 (figure)  
 dam impacts, 11  
 evolution and biology, 147–149  
 habitat losses, 18  
 hatchery programs, 18–19  
 homing behavior, 39, 151, 155–156  
 species checklist, 483–484  
 taxonomy, 147  
*See also* salmon; trout; *individual species*
- Salmoninae, 147  
*See also* char; salmon; trout
- Salt Creek, 23, 276–277, 400, 401 (plate)
- Salt Creek Pupfish, 23, 52, 76 (key), **276–277**, 400
- Salton Sea, 24–25, 276  
 Desert Pupfish, 25, 275  
 livebearers, 25, 281–282, 284, 285  
 Striped Mullet, 350–351  
 tilapias, 25, 275, 338, 339
- saltwater tolerance. *See* salinity
- Salvelinus*  
*confluentus*, 92 (key), **187–188**  
*fontinalis*, 92 (key), 180, 186, **188–191**, 189 (plate), 265  
*malma*, 187  
*namaycush*, 92 (key), 126, 186, **193–194**, 249
- Samuel P. Taylor State Park, 400
- San Felipe Creek, 275, 276
- San Francisco Bay  
 Longfin Smelt, 201  
 Longjaw Mudsuckers, 25  
 Rainwater Killifish, 280  
 Starry Flounder, 367  
 Striped Bass, 298, 299  
 White Sturgeon, 138–139
- San Francisco Estuary, 2–3, 14  
 Inland Silverside, 288  
 shad, 142, 143, 145  
 Shimofuri Goby, 355, 356–357  
 smelts, 9, 145, 197, 200, 201  
 Striped Bass, 295, 298, 300  
 sturgeons, 133, 135, 140  
 sunfishes, 300  
*See also* Sacramento-San Joaquin Delta; San Francisco Bay; San Pablo Bay; Suisun Bay
- San Francisco Garter Snake, 241, 242
- San Gabriel River, 254
- San Joaquin Hatchery, 500
- San Joaquin River, 2, 6 (plate), 11, 20, 339  
 Brown Bullhead introduction, 258  
 Inland Silverside, 288, 301  
 lampreys, 129, 130  
 minnows, 217, 219  
 shad, 142, 146, 288, 298  
 Striped Bass, 146, 288, 295, 296, 297, 298, 299, 301  
 Tule Perch, 345
- San Joaquin River (*continued*)  
 White Sturgeon, 134, 135  
*See also* Sacramento-San Joaquin Delta
- San Joaquin Valley. *See* Central Valley
- San Lorenzo River, 149
- San Luis Reservoir, 201, 230, 297, 353
- San Pablo Bay, 140, 145, 198
- San Pablo Reservoir, 5 (plate)
- A Sand County Almanac* (Leopold), 15
- Santa Ana River, 254
- Santa Ana Speckled Dace, 212
- Santa Ana Sucker, 24, 106 (key), **254**
- Santa Clara River, 254
- Saratoga Springs, 274
- Saratoga Springs Pupfish, 76 (key), **274–275**
- Sardine, Pacific, 295
- sardines, 141
- Sardinops sagax*, 295
- Sargo, 25
- Sauger, 331
- sautéing and sauté-poaching fish, 437–445  
 basics, 437–439, 444–445  
 recipes, 439–444
- scales, 44
- scaling fish, 410–411, 412 (figure)
- Scientific Collecting Permit, 378–379, 380
- sculpins, 2, 36, 80–83 (key), 336, **359–365**  
 body plan, 64, 66 (figure)  
 Coastrange Sculpin, 82 (key), **362**  
 Marbled Sculpin, 82 (key), **363**  
 Pacific Staghorn Sculpin, 80 (key), 298, 354, **364–365**, 365 (plate), 379  
 Paiute Sculpin, 82 (key), **364**  
 Pit Sculpin, 22, 82 (key), **361**  
 Prickly Sculpin, 82 (key), **359–361**, 360 (plate), 362, 386  
 Reticulate Sculpin, 82 (key), **362**  
 Riffle Sculpin, 22, 82 (key), **361**  
 Rough Sculpin, 22, 80 (key), **363–364**  
 species checklist, 487–488
- Sea Lamprey, 125–126
- Senator Wash Reservoir, 255–256
- Serranidae, 294
- shad, 120 (key), **141–146**  
 American Shad, 14, 120 (key), **141–143**, 199, 506  
 angling notes, 143  
 body plan, 65, 67 (figure)  
 species checklist, 483  
*See also* Threadfin Shad
- Sharp-tailed Grouse, 8
- sheep, 12
- Shimofuri Goby, 18, 84 (key), **355–357**, 356 (plates), 359
- Shiner Perch, 52, 101 (key), 344, **348–349**, 348 (plate), 386
- shiners, 112–113 (key)  
 Red Shiner, 18, 112 (key), **238**, 254, 379  
*See also* Golden Shiner; Hitch
- Shortfin Molly, 78 (key), 281–282, 285
- Shortnose Sucker, 22, 106 (key), **256**
- Shoshone Springs, 274
- shrimps  
 Ghost Shrimp, 137  
 Grass Shrimp, 136, 137  
 Opossum Shrimp, 228, 288, 301
- Sierra lakes, 3, 4 (plate)  
*See also specific lakes*

- Sierra rivers and streams, 2, 4 (plates), 12  
*See also specific rivers and streams*
- sign stimuli, 293
- Silver Carp, 234 (plate), 235
- Silver King Creek, 186
- Silver Salmon. *See* Coho Salmon
- Silverado Fisheries Base, 499
- silversides, 98 (key), **286–288**  
 body plan, 65, 67 (figure)  
 species checklist, 486  
 Topsmelt, 286  
*See also* Inland Silverside
- Silverwood Reservoir, 297
- Siphateles*, 212  
*bicolor*, 114 (key), 193, 211, **212–213**, 213 (plate), 214  
*bicolor mohavensis*, 114 (key), **213**, 215  
*bicolor snyderi*, 114 (key), **213**
- skin, 44–45, 411
- skinning fish, 411, 413 (figure), 414, 416, 416 (figure)
- Smallmouth Bass, 102 (key), 307, **327–328**, 328 (plate), 400–401  
 angling notes, 328  
 impacts on native fishes, 220, 256  
 weight records, 505
- smell (olfaction), 39–40, 41
- smelts, 98 (key), **196–203**, 286  
 body plan, 65, 67 (figure)  
 Eulachon, 98 (key), **202–203**  
 Longfin Smelt, 98 (key), **201–202**  
 species checklist, 484  
*See also* Delta Smelt; Wakasagi
- Smith River, 164–165, 185
- smoking fish, 459–465
- smolts, 149
- snails, 34, 219
- Sockeye Salmon, 86 (key), 90 (key), 160, 161, 488, 505  
*See also* Kokanee Salmon
- Soda Lake, 8 (plate), 213
- soil erosion, 18
- South Coastal Province, 21 (figure), 23–24
- spearfishing, 233
- species checklist, 483–488
- species diversity, 4, 19–20
- species of special concern, 56, 378  
*See also* protected species
- Speckled Dace, 24, 116 (key), **211–212**, 212 (plate), 236
- Spirinchus thaleichthys*, 98 (key), **201–202**
- Splittail, Clear Lake, 118 (key), **218**, 287
- Splittail, Sacramento, 22, 118 (key), **216–218**, 217 (plate)
- sportfishing  
 weight records, 503–506  
*See also* angling notes; fishing; *individual species*
- Spotted Bass, 102 (key), 306, **329**, 506
- Spruce Grouse, 8
- Staghorn Sculpin, Pacific, 80 (key), 298, 354, **364–365**, 365 (plate)
- Stanislaus River, 5 (plate)  
 American Shad, 142  
 carp, 228–229, 232  
 Redeye Bass, 330  
 White Sturgeon, 134–135
- Starry Flounder, 64, 72 (key), 366, **367–368**, 368 (plates)  
 as aquarium specimen, 386  
 freshwater-saltwater migration, 52, 367
- state fish hatcheries. *See* hatcheries
- Steelhead (Coastal Rainbow Trout), 3, 17, 94 (key), 151, **167–178**, 168 (plate), 172 (plate), 184–185  
 American Shad introduction and, 142  
 angling notes, 176–177, 178  
 coloration and parr marks, 90 (key), 94 (key), 148 (plate), 169  
 cooking notes, 429  
 dam impacts, 11  
 endangered species listing, 167, 176, 207  
 hatchery locations, 497–498  
 market availability, 409, 422  
 observing at hatcheries, 398  
 weight records, 505
- Steinhart Aquarium, 401
- sticklebacks, 3, 70 (key), **289–293**  
 body plan, 64, 66 (figure)  
 Brook Stickleback, 70 (key), 266, **293**  
 species checklist, 486  
*See also* Threespine Stickleback
- Stizostedion*  
*canadense*, 331  
*vitreum*, 331
- Stoasodon narinari*, 232
- stone flies, 34
- Stony Ridge Lake, 194
- storing fish, 420–421, 427
- Striped Bass, 17, 100 (key), 224, 288, **294–302**, 296 (plate), 297 (plate)  
 angling notes, 297–299, 354  
 cooking notes, 419, 429, 451, 453  
 Delta Smelt and, 199, 296  
 farmed, 409, 422  
 hatchery program, 301–302  
 identification tips, 65  
 Northern Pike and, 371  
 obtaining live fish, 379  
 osmoregulation, 51–52, 295  
 population declines, 299–301  
 prey species, 324  
 recipes, 454  
 Sacramento Perch and, 295, 310  
 Striped Bass-White Bass hybrids, 304, 304 (plate)  
 Threadfin Shad and, 146, 295, 296  
 weight records, 505
- Striped Mullet, 98 (key), **350–351**
- striper. *See* Striped Bass
- The Study of Instinct* (Tinbergen), 291, 293
- stunting  
 Bluegills, 161, 189, 312–313  
 Green Sunfish, 317  
 Mozambique Tilapia, 339  
 Yellow Perch, 333
- sturgeons, 70 (key), **131–140**, 372  
 angling notes, 137–139  
 Beluga Sturgeon, 133  
 body plan, 64, 66 (figure)  
 cooking notes, 444, 445, 451, 457, 459  
 Green Sturgeon, 17, 70 (key), 131 (plate), **139–140**  
 recipes, 454  
 species checklist, 483  
*See also* White Sturgeon
- suckers, 2, 22, 36, 106–111 (key), **245–256**  
 anatomy and physiology, 41, 42, 205, 245  
 angling notes, 245–246

- suckers (*continued*)
- as aquarium specimens, 384, 386
  - body plan, 65, 67 (figure)
  - cooking notes, 419, 429
  - culinary quality, 246
  - Goose Lake Sucker, 247
  - Klamath Largescale Sucker, 22, 108 (key), **251**
  - Klamath Smallscale Sucker, 108 (key), **252**
  - lamprey parasitism, 127, 130
  - Lost River Sucker, 22, 106 (key), **250–251**, 256
  - Modoc Sucker, 22, 110 (key), **252**
  - Mountain Sucker, 106 (key), **253**, 253 (plate)
  - Owens Sucker, 23, 110 (key), **250**
  - pikeminnow predation, 225–226
  - Razorback Sucker (Humpback Sucker), 24, 25, 108 (key), 226, **255–256**
  - Santa Ana Sucker, 24, 106 (key), **254**
  - Shortnose Sucker, 22, 106 (key), **256**
  - species checklist, 485
  - Tahoe Sucker, 23, 108 (key), 193, 246, **249**, 253 (plate)
  - See also* Sacramento Sucker
  - Suisun Bay, 198, 217, 224, 301
  - sulfide tolerance, 278
  - summer kill, 30
  - sunfishes, 102–105 (key), 208, 230, 295, **307–319**, 401
    - anatomy and physiology, 42
    - as aquarium specimens, 308, 384, 385
    - body plan, 65, 67 (figure)
    - collecting, 379
    - cooking notes, 429
    - Pumpkinseed, 102 (key), 308, **315–316**, 316 (plate), 401
    - species checklist, 486–487
    - Warmouth, 104 (key), **318–319**, 319 (plate), 506
    - See also* Bluegill; Green Sunfish; Redear Sunfish; Sacramento Perch
  - surf perches, 332
  - swimming ability, 36, 37, 124
- Tahoe Sucker, 23, 108 (key), 193, 246, **249**, 253 (plate)
- taste, fishes' sense of, 41
- Taylor Creek, 160, 162, 399–400
- Tecopa Hot Springs, Tecopa Bore, 274
- Tecopa Pupfish, 274
- teeth, 43–44, 44 (plate)
- temperature. *See* water temperature
- Tench, 18, 110 (key), **240–242**, 241 (plate)
- Thaleichthys pacificus*, 98 (key), **202–203**
- Thaninophis sirtalis tetrataenia*, 241
- thermal requirements. *See* water temperature
- thermal stratification, 26, 27 (figure), 28, 29
- thermocline, 26, 153
- Thicktail Chub, 14, 116 (key), **215–216**, 295, 324
- Threadfin Shad, 17, 31, 120 (key), **144–146**, 145 (plate), 288, 298
  - American Shad and, 143
  - as aquarium specimen, 385
  - basses and, 145–146, 295, 296, 304, 324
  - collecting, 379
  - crappies and, 321
  - Hitch and, 209
  - introduction and spread, 144–145, 146, 200
  - native smelts and, 145, 196, 199, 202
  - predators, 145, 177, 259, 269, 295, 296, 304
- threatened species, 55, 378
  - See also* protected species
- Threespine Stickleback, 24, 70 (key), **289–293**, 289 (plate), 291 (plate)
  - as aquarium specimen, 291, 385, 386
  - as mosquito control, 283
  - spines, 37, 289–290
- Thymallinae, 147
- Tidewater Goby, 84 (key), 356, **357–358**
- Tiger Trout, 191
- Tilapia zillii*, 78 (key), 275, **340–341**
- tilapias
  - Blue Tilapia, 80 (key), **341**
  - farmed, 337, 338, 341, 342, 343, 409, 422
  - Mozambique Tilapia, 25, 80 (key), **337–339**, 338 (plate)
  - Nile Tilapia, 80 (key), **342–343**
  - Redbelly Tilapia, 78 (key), 275, **340–341**
- Tinbergen, Niko, 291, 293
- Tinca tinca*, 18, 110 (key), **240–242**, 241 (plate)
- Topminnows, 278
- Topsmelt, 286
- Tridentiger bifasciatus*, 18, 84 (key), **355–357**, 356 (plates), 359
- Trinity River
  - salmon, 164–165
  - Steelhead, 178
  - suckers, 248, 252
- Trinity River Hatchery, 497
- trout, 92–97 (key), 147, **166–195**, 167, 236, 301, 364
  - anatomy and physiology, 36, 44, 49
  - body plan, 65, 67 (figure)
  - Bull Trout, 92 (key), **187–188**, 192, 505
  - cooking notes, 429, 431, 435–436, 445, 463
  - Dolly Varden Trout, 187
  - Eagle Lake Rainbow Trout, 96 (key), 167, 172 (plate), **182–183**
  - farmed, 409, 422
  - hatchery locations, 499–501
  - hatchery/stocking programs, 171–175, 180, 183, 185, 186, 188–189, 200, 323
  - killing and cleaning, 418
  - Lake Trout (Mackinaw Trout), 92 (key), 126, 186, **193–194**, 249, 505
  - Redband Trout, **178–183**
  - Sacramento Redband Trout, 96 (key), 167, **182**
  - taxonomy, 166–167
  - Tiger Trout, 191
  - wild trout management, 175–176
  - See also* Brook Trout; Brown Trout; Cutthroat Trout; Golden Trout; Rainbow Trout; salmonids; Steelhead
- Tui Chub, 114 (key), 193, 211, **212–213**, 213 (plate), 214
- Tulare Lake, 13, 305, 306
- Tuleperch, 22, 101 (key), 332, **344–347**, 345 (plate)
  - angling notes, 347
  - as aquarium specimen, 386
- turnover, 28, 30, 33
  - See also* thermal stratification
- Unarmored Threespine Stickleback, 24, 290
- Upper Klamath Lake, 22
- Upper Klamath Marbled Sculpin, **363**
- Upper Klamath Subprovince, 22
- U.S. Fish and Game Commission, 371

U.S. Fish Commission, 16, 265–266

vegetation control, species introductions for, 17, 243–244, 338–339, 340

videotaping fishes, 393

vision, 40–41

viviparous perch. *See* perches, viviparous

Wakasagi, 98 (key), **200–201**, 200 (plate)

American Shad and, 143

basses and, 300, 324

native smelts and, 9, 196, 199, 202, 293

Walker Lake, 23

Walleye, 331, 422

Walnut Creek, Chinook Salmon in, 158–159

Walton, Izaak, 230

Warm Springs Hatchery, 398, 498

Warm Springs Pupfish, 76 (key)

Warmouth, 104 (key), **318–319**, 319 (plate), 506

water diversions, impacts of, 18, 299–300

water oxygen levels

algal die-offs and, 30

oxygen physiology, 48–49, 49–51

oxygen stratification, 26–28, 27 (figure)

water quality, aquariums, 382–383

water temperature

aquariums, 49, 383–384

dam releases, 11

fish physiology and, 49, 383

thermal stratification in lakes, 26, 27 (figure), 28, 29

for transporting live fish, 381

Weberian ossicles, 42, 205

weight records, 503–506

Western Brook Lamprey, 68 (key), **130**

Western Mosquitofish, 25, 78 (key), 280, **282–284**, 283 (plate)

as aquarium specimen, 386

competitive species, 274, 276, 277, 283

introduction, 17, 282

White Bass, 100 (key), 295, **302–306**, 305 (plate), 321

angling notes, 31, 306

homing ability research, 39

identification tips, 65

recipes, 454

weight records, 505

White Bass-Striped Bass hybrids, 304, 304 (plate)

White Catfish, 72 (key), **268–269**, 269 (plates), 310, 506

White Crappie, 104 (key), 307, **320–322**

angling notes, 322

weight records, 506

White Sturgeon, 17, 70 (key), 131 (plate), 132 (plate), 133 (plate), **134–139**

angling notes, 137–139

cooking notes, 429

farmed, 408, 422

obtaining live fish, 379

size and weight records, 133, 135, 140, 505

*See also* sturgeons

white-cooking fish, 431–437

basics, 431–435

recipes, 435–437

whitefishes, 147, 212, 422

Mountain Whitefish, 92 (key), 193, **194–195**, 505

Wild Turkey, 8

wipers, 304, 304 (plate)

*Xiphophorus*

*helleri*, 24, 488

*maculatus*, 281

*Xyrauchen texanus*, 24, 108 (key), 226, **255–256**

Yellow Bullhead, 74 (key), **264**

Yellow Perch, 84 (key), 331, **332–334**, 333 (plate)

angling notes, 333–334

as aquarium specimen, 386

culinary quality, 332

identification tips, 65

weight records, 506

Yellowfin Goby, 18, 84 (key), 298, **352–354**, 353 (plate), 359

culinary quality, 354

Yosemite Toad, 189

Yukon River, 165

zooplankton, 30, 31, 33, 34, 36

Zzyzx Springs, 7 (plate)