

PEER EDITED

COMPILATION OF ISLAND FOX LITERATURE

HOWARD O. CLARK, JR.^{1,3}, AND ROBYN M. POWERS²¹Garcia and Associates, 993 Ezie Avenue, Clovis, California 93611²H. T. Harvey & Associates, Cal Poly Technology Park, Building 83, Suite 1B, One Grand Ave., San Luis Obispo, California 93407³Corresponding author; e-mail: hclark@garciaandassociates.com

Abstract.—The Island Fox (*Urocyon littoralis*) provides a solid lesson in biogeography as well as conservation as all six subspecies are listed as Threatened by the State of California: San Miguel Island Fox (*U. l. littoralis*; Baird 1858), Santa Rosa Island Fox (*U. l. santarosae*; Grinnell and Linsdale 1930), Santa Cruz Island Fox (*U. l. santacruzae*; Merriam 1903), Santa Catalina Island Fox (*U. l. catalinae*; Merriam 1903), San Clemente Island Fox (*U. l. clementae*; Merriam 1903), and San Nicolas Island Fox (*U. l. dickeyi*; Grinnell and Linsdale 1930). The first four subspecies also are listed federally as Endangered. Herein is a compilation of peer-reviewed information on the Island Fox. Gray literature reports, theses, dissertations, and inter-agency articles are not included because, ideally, anything noteworthy in these publications has been published in scientific journals. Also included in this collection are significant conference proceedings, book chapters, and books written on these foxes. Caution should be exercised when reading older works. Recent works either confirm or invalidate older hypotheses, and cross-referencing by the reader is recommended.

Key Words.—Biogeography; Channel Islands; California; Island Fox; North America; *Urocyon littoralis*

- Aguilar, A., G. Roemer, S. Debenham, M. Binns, D. Garcelon, and R.K. Wayne. 2004. High MHC diversity maintained by balancing selection in an otherwise genetically monomorphic mammal. *Proceedings of the National Academy of Sciences* 101:3490–3494.
- Alcover, J.A., and M. McMinn. 1994. Predators of Vertebrates on Islands. *BioScience* 44:12–18.
- Angulo, E., G.W. Roemer, L. Berec, J. Gascoigne, and F. Courchamp. 2007. Double allee effects and extinction in the Island Fox. *Conservation Biology* 21:1082–1091.
- Asa, C. 2004. Recovery of endangered Mexican Gray Wolves (*Canis lupus baileyi*) and Island Foxes (*Urocyon littoralis*). *Integrative and Comparative Biology* 44:518.
- Asa, C.S. 2010. The importance of reproductive management and monitoring in canid husbandry and endangered-species recovery. *International Zoo Yearbook* 44:102–108.
- Asa, C.S., J.E. Bauman, T.J. Coonan, and M.M. Gray. 2007. Evidence for induced estrus or ovulation in a canid, the Island Fox (*Urocyon littoralis*). *Journal of Mammalogy* 88:436–440.
- Baird, S.F. 1857 [1858]. Mammals. Pp. 143–145 in *Reports of Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean*. Baird, S.F. (Ed.). Beverly Tucker, Printer, Washington, D.C.
- Bakker, V.J., D.F. Doak, G.W. Roemer, D.K. Garcelon, T.J. Coonan, S.A. Morrison, C. Lynch, K. Ralls, and R. Shaw. 2009. Incorporating ecological drivers and uncertainty into a demographic population viability analysis for the Island Fox. *Ecological Monographs* 79:77–108.
- Bennett, S.G. 1987. Medically important and other ectoparasitic acarines on vertebrates from Santa Catalina Island, California. *Bulletin of the Society of Vector Ecologists* 12:534–538.
- Bernard, J.K. 2009. Outfoxing species decline: Historic pact teams AMNH and the National Park Service. *Natural History* 118:44.
- Bloeker, J.C. von, Jr. 1967. Land mammals on the southern California Islands. Pp. 245–263 in *Proceedings of the Symposium on the Biology of the California Islands*, Philbrick, R.N. (Ed.). Santa Barbara Botanic Garden, Santa Barbara, California.
- Bremner-Harrison, S., B.L. Cypher, and S.W.R. Harrison. 2013. An investigation into the effect of individual personality on re-introduction success, examples from three North American fox species: Swift fox, California Channel Island fox and San Joaquin kit fox. Pages 152–158 in *Global Re-introduction Perspectives: 2013, Further Case-studies From Around the Globe*. P.S. Soorae (Ed.). IUCN/SSC Re-introduction Specialist Group and Abu Dhabi, UAE: Environment Agency-Abu Dhabi, Gland, Switzerland.
- Calkins, E.S., T.K. Fuller, C.S. Asa, P.R. Sievert, and T.J. Coonan. 2013. Factors influencing reproductive success and litter size in captive island foxes. *Journal of Wildlife Management* 77:346–351.
- Caut, S., G.W. Roemer, J. Donlan, and F. Courchamp. 2006. Coupling stable isotopes with bioenergetics to estimate interspecific interactions. *Ecological Applications* 16:1893–1900.
- Clifford, D.L., J.A.K. Mazet, E.J. Dubovi, D.K. Garcelon, T.J. Coonan, P.A. Conrad, and L. Munson. 2006. Pathogen exposure in endangered Island Fox (*Urocyon*

- on littoralis*) populations: implications for conservation management. *Biological Conservation* 131:230–243.
- Clifford, D.L., R. Woodroffe, D.K. Garcelon, S.F. Timm, and J.A.K. Mazet. 2007. Using pregnancy rates and perinatal mortality to evaluate the success of recovery strategies for endangered Island Foxes. *Animal Conservation* 10:442–451.
- Collins, P.W. 1991. Interaction between Island Foxes (*Urocyon littoralis*) and Indians on islands off the coast of southern California: I. Morphologic and archaeological evidence of human assisted dispersal. *Journal of Ethnobiology* 11:51–81.
- Collins, P.W. 1991. Interaction between Island Foxes (*Urocyon littoralis*) and Native Americans on islands off the coast of southern California. II. Ethnographic, archaeological, and historical evidence. *Journal of Ethnobiology* 11:205–229.
- Collins, P.W. 1993. Taxonomic and biogeographic relationships of the Island Fox (*Urocyon littoralis*) and Gray Fox (*Urocyon cinereoargenteus*) from western North America. Pp. 351–390 in *Proceedings of the Third California Islands Symposium: Recent Advances in Research on the California Islands*. Hochberg, F.G. (Ed.). Santa Barbara Museum of Natural History, Santa Barbara, California.
- Collins, P.W., B.C. Latta, and G.W. Roemer. 2009. Does the order of invasive species removal matter? The case of the eagle and the pig. *PLoS ONE* 4:1–6.
- Coonan, T.J. 2001. Jumping the gun: Island Fox recovery efforts at Channel Islands National Park. Pp. 118–124 in *Crossing Boundaries in Park Management: Proceedings of the 11th Conference on Research and Resource Management in Parks and on Public Lands*. Harmon, D. (Ed.). The George Wright Society, Hancock, Michigan.
- Coonan, T.J., V. Bakker, B. Hudgens, C.L. Boser, D.K. Garcelon, and S.A. Morrison. 2014. On the fast track to recovery: island foxes on the northern Channel Islands. *Monographs of the Western North American Naturalist* 7:373–381.
- Coonan, T.J., and C.A. Schwemm. 1995. Dealing with in-park controversy surrounding resources management actions: a case study of the Island Fox monitoring program at Channel Islands National Park. *The George Wright Forum* 12:19–25.
- Coonan, T.J., C.A. Schwemm, and D.K. Garcelon. 2010. *Decline and Recovery of the Island Fox: A Case Study for Population Recovery*. Cambridge University Press, New York, New York.
- Coonan, T.J., C.A. Schwemm, G.W. Roemer, and G. Austin. 2000. Population decline of Island Foxes (*Urocyon littoralis littoralis*) on San Miguel Island. Pp. 289–297 in *Proceedings of the Fifth California Islands Symposium*. Browne, D.R., K.L. Mitchell, and H.W. Chaney (Ed.). U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, California.
- Coonan, T.J., C.A. Schwemm, G.W. Roemer, D.K. Garcelon, and L. Munson. 2005. Decline of an Island Fox subspecies to near extinction. *The Southwestern Naturalist* 50:32–41.
- Coonan, T.J., A. Varsik, C. Lynch, and C.A. Schwemm. 2010. Cooperative conservation: zoos and *in situ* captive breeding for endangered Island Fox *Urocyon littoralis* spp. *International Zoo Yearbook* 44:165–172.
- Courchamp, F., J.L. Chapuis, and M. Pascal. 2003. Mammal invaders on islands: impact, control, and control impact. *Biological Reviews* 78:347–383.
- Courchamp, F., R. Woodroffe, and G. Roemer. 2003. Removing protected populations to save endangered species. *Science* 302:1532.
- Crooks, K. 1994. Demography and status of the Island Fox and the Island Spotted Skunk on Santa Cruz Island, California. *The Southwestern Naturalist* 39:257–262.
- Crooks, K.R., C.A. Scott, L. Bowen, and D. Van Vuren. 2000. Hematology and serum chemistry of the Island Fox on Santa Cruz Island. *Journal of Wildlife Diseases* 36:397–404.
- Crooks, K.R., C.A. Scott, and D.H. Van Vuren. 2001. Exotic disease and an insular endemic carnivore, the Island Fox. *Biological Conservation* 98:55–60.
- Crooks, K.R., and D. Van Vuren. 1995. Resource utilization by two insular endemic mammalian carnivores, the Island Fox and Island Spotted Skunk. *Oecologia* 104:301–307.
- Crooks, K.R., and D. Van Vuren. 1996. Spatial organization of the Island Fox (*Urocyon littoralis*) on Santa Cruz Island, California. *Journal of Mammalogy* 77:801–806.
- Cuarón, A.D., M.A. Martínez-Morales, K.W. McFadden, D. Valenzuela, and M.E. Compper. 2004. The status of dwarf carnivores on Cozumel Island, Mexico. *Biodiversity and Conservation* 13:317–331.
- Cypher, B., E. Drake, J. Savage, J. King, K. Ralls, T. Coonan, J. Perrine, and C. Duncan. 2014. Evaluation of new telemetry technologies for research on island foxes. *Monographs of the Western North American Naturalist* 7:357–372.
- Cypher, B.L., A.Y. Madrid, C.L. Van Horn Job, E.C. Kelly, S.W.R. Harrison, and T.L. Westall. 2014. Multi-population comparison of resource exploitation by Island Foxes: implications for conservation. *Global Ecology and Conservation* 2:255–266.
- Damasceno, E.M., E. Hingst-Zaher, and D. Astúa. 2013. Bite force and encephalization in the Canidae (Mammalia: Carnivora). *Journal of Zoology* 290:246–254.
- Devenish-Nelson, E.S., P.A. Stephens, S. Harris, C. Soulsbury, and S.A. Richards. 2013. Does litter size variation affect models of terrestrial carnivore extinction risk and management? *PLoS ONE* 8:1–9.
- Doak, D.F., V.J. Bakker, and W. Vickers. 2013. Using population viability criteria to assess strategies to minimize disease threats for an endangered carnivore. *Conservation Biology* 27:303–314.

- Dratch, P., T. Coonan, and D. Graber. 2004. Predators and prey in the Channel Islands. *Science* 205:777.
- Erlandson, J.M., T.C. Rick, P.W. Collins, and D.A. Guthrie. 2007. Archaeological implications of a Bald Eagle nesting site at Ferrello Point, San Miguel Island, California. *Journal of Archaeological Science* 34:255–271.
- Faulkner, C.T., S. Patton, L. Munson, E.M. Johnson, and T.J. Coonan. 2001. *Angiocaulus gubernaculatus* in the Island Fox (*Urocyon littoralis*) from the California Channel Islands and comments on the diagnosis of angiostrongylidae nematodes in canid and mustelid hosts. *Journal of Parasitology* 87:1174–1176.
- Fausett, L.L. 1993. Activity and movement of the Island Fox, *Urocyon littoralis*, on Santa Cruz Island, California. Pp. 391–404 in *Proceedings of the Third California Islands Symposium: Recent Advances in Research on the California Islands*. Hochberg, F.G. (Ed.). Santa Barbara Museum of Natural History, Santa Barbara, California.
- Fewkes, J.W. 1889. Across the Santa Barbara Channel. *The American Naturalist* 23:211–217.
- Fewkes, J.W. 1889. Across the Santa Barbara Channel (concluded). *The American Naturalist* 23:387–394.
- Frankham, R. 1998. Inbreeding and extinction: island populations. *Conservation Biology* 12:665–675.
- Fritzell, E.K. 1987. Gray Fox and Island Fox. Pp. 408–420 in *Wild Furbearer Management and Conservation in North America*. Novak, M., J.A. Baker, M.E. Obbard, and B. Malloch (Ed.). Ministry of Natural Resources, Ontario, Canada.
- Gaffney, P.M., D.M. Imai, D.L. Clifford, M. Ghassemi, R. Sasik, A.N. Chang, T.D. O'Brien, J. Coppinger, M. Trejo, E. Masliyah, L. Munson, and C. Sigurdson. 2014. Proteomic analysis of highly prevalent amyloid A amyloidosis endemic to endangered Island Foxes. *PLoS ONE* 9:1–21.
- Garcelon, D.K., G.W. Roemer, R.B. Philips, and T.J. Coonan. 1999. Food provisioning by Island Foxes, *Urocyon littoralis*, to conspecifics caught in traps. *The Southwestern Naturalist* 44:83–86.
- Garcelon, D.K., R.K. Wayne, and B.J. Gonzales. 1992. A serologic survey of the Island Fox (*Urocyon littoralis*) on the Channel Islands, California. *Journal of Wildlife Diseases* 28:223–229.
- George, S.B., and R.K. Wayne. 1991. Island Foxes: a model for conservation genetics. *Terra* 30:18–23.
- Gibson, L. 2006. The role of lethal control in managing the effects of apparent competition on endangered prey species. *Wildlife Society Bulletin* 34:1220–1224.
- Gilbert, D.A., N. Lehman, S.J. O'Brien, and R.K. Wayne. 1990. Genetic fingerprinting reflects population differentiation in the California Channel Island Fox. *Nature* 344:764–767.
- Goldstein, D.B., G.W. Roemer, D.A. Smith, D.E. Reich, A. Bergman, and R.K. Wayne. 1999. The use of microsatellite variation to infer population structure and demographic history in a natural model system. *Genetics* 151:797–801.
- Gompper, M.E., A.E. Petrites, and R.L. Lyman. 2006. Cozumel Island Fox (*Urocyon* sp.) dwarfism and possible divergence history based on subfossil bones. *Journal of Zoology* 270:72–77.
- Gould, N.P., and W.F. Andelt. 2011. Reproduction and denning by urban and rural San Clemente Island Foxes (*Urocyon littoralis clementae*). *Canadian Journal of Zoology* 89:976–984.
- Gould, N.P., and W.F. Andelt. 2013. Effect of anthropogenically developed areas on spatial distribution of Island Foxes. *Journal of Mammalogy* 94:662–671.
- Grinnell, J., and L.M. Linsdale. 1930. Two new foxes from the southern California Islands. *Proceedings of the Biological Society of Washington* 43:153–156.
- Grinnell, J., J.S. Dixon, and L.M. Linsdale. 1937. *Furbearing Mammals of California: Their Natural History, Systematic Status, and Relations to Man*. University of California Press, Berkeley, California.
- Hale, A., and R. Salls. 2000. The canine ceremony: dog and fox burials of San Clemente Island. *Pacific Coast Archaeological Society Quarterly* 36:80–112.
- Hanson, C.C., W.J. Jolley, G. Smith, D.K. Garcelon, B.S. Keitt, A.E. Little, and K.J. Campbell. 2015. Feral cat eradication in the presence of endemic San Nicolas Island foxes. *Biological Invasions* 17:977–986.
- Harris, N.C., T.J. Coonan, J.L. King, R.R. Dunn, and M. Fitzpatrick. 2013. Endemism in host-parasite interactions among island populations of an endangered species. *Diversity and Distributions* 19:377–385.
- Hedrick, P. 2004. Foxy MHC selection story. *Heredity* 93:237–238.
- Helgen, K.M. 2004. Predators and prey in the Channel Islands. *Science* 205:777–778.
- Hofman, C.A., T.C. Rick, M.T.R. Hawkins, W.C. Funk, K. Ralls, C.L. Boser, P.W. Collins, T. Coonan, J.L. King, S.A. Morrison, S.D. Newsome, T.S. Sillett, R.C. Fleischer, and J.E. Maldonado. 2015. Mitochondrial genomes suggest rapid evolution of dwarf California Channel Islands Foxes (*Urocyon littoralis*). *PLoS ONE* 10:1–15.
- Hudgens, B.R., and D.K. Garcelon. 2011. Induced changes in Island Fox (*Urocyon littoralis*) activity do not mitigate the extinction threat posed by a novel predator. *Oecologia* 165:699–705.
- Inoue, H., D.L. Clifford, T.W. Vickers, T.J. Coonan, D.K. Garcelon, and D.L. Borjesson. 2012. Biochemical and hematologic reference intervals for the endangered Island Fox (*Urocyon littoralis*). *Journal of Wildlife Diseases* 48:583–92.
- Jacobs, G.H., J.F. Deegan, M.A. Crognale, and J.A. Fenwick. 1993. Photopigments of dogs and foxes and their implications for canid vision. *Visual Neuroscience* 10:173–180.
- Johnson, D.L. 1975. New evidence in the origin of the fox, *Urocyon littoralis clementae*, and feral goats on

- San Clemente, Island, California. *Journal of Mammalogy* 56:925–928.
- Jones, K.L., D.H. Van Vuren, and K.R. Crooks. 2008. Sudden increase in a rare endemic carnivore: Ecology of the Island Spotted Skunk. *Journal of Mammalogy* 89:75–86.
- King, J.L., C.L. Duncan, and D.K. Garcelon. 2014. Status of the Santa Catalina Island Fox thirteen years after its decline. *Monographs of the Western North American Naturalist* 7:382–396.
- Kohlmann, S.G., G.A. Schmidt, and D.K. Garcelon. 2005. A population viability analysis for the Island Fox on Santa Catalina Island, California. *Ecological Modelling* 183:77–94.
- Laughrin, L. 1973. The Island Fox. *Environment South-west* 458:6–9.
- Laughrin, L. 1980. Populations and status of the island fox. Pp. 745–749 in *The California Islands: Proceedings of a Multidisciplinary Symposium*. Power, D.M. (Ed.). Santa Barbara Museum of Natural History, Santa Barbara, California.
- Luikart, G., and P.R. England. 1999. Statistical analysis of microsatellite DNA data. *Tree* 14:253–256.
- Meighan, C.W., and H. Eberhart. 1953. Archaeological resources of San Nicolas Island, California. *American Antiquity* 19:109–125.
- Melstrom, R.T. 2014. Managing apparent competition between the feral pigs and native foxes of Santa Cruz Island. *Ecological Economics* 107:157–162.
- Merriam, C.H. 1903. Eight new mammals from the United States. *Proceedings of the Biological Society of Washington* 16:73–78.
- Milius, S. 2004. Fox selection. *Science News* 165:132–133.
- Miller, G.S., Jr. 1899. Descriptions of two new gray foxes. *Proceedings of the Academy of Natural Sciences of Philadelphia* 51:276–280.
- Moore, C.M., and P.W. Collins. 1995. *Urocyon littoralis*. *Mammalian Species* 489:1–7.
- Namekata, M.S., D.L. Clifford, R.W. Kasten, J.B. Henn, D.K. Garcelon, T.J. Coonan, and B.B. Chomel. 2009. Seroprevalence of *Bartonella* spp. in the endangered Island Fox (*Urocyon littoralis*). *Veterinary Microbiology* 136:184–187.
- Newsome, S.D., P.W. Collins, T.C. Rick, D.A. Guthrie, J.M. Erlandson, and M.L. Fogel. 2010. Pleistocene to historic shifts in Bald Eagle diets on the Channel Islands, California. *Proceedings of the National Academy of Sciences* 107:9246–9251.
- Orrock, J.L. 2010. When the ghost of predation has passed: Do rodents from islands with and without fox predators exhibit aversion to fox cues? *Ethology* 116:338–345.
- Orrock, J.L., and R.L. Fletcher, Jr. 2014. An island-wide predator manipulation reveals immediate and long-lasting matching of risk by prey. *Proceedings of the Royal Society B* 281:1–7.
- Padgett, K.A., and W.M. Boyce. 2004. Life-history studies on two molecular strains of *Mesocestoides* (Cestoda: Mesocestoididae): identification of sylvatic hosts and infectivity of immature life stages. *Journal of Parasitology* 90:108–113.
- Padgett, K.A., and W.M. Boyce. 2005. Ants as first intermediate hosts of *Mesocestoides* on San Miguel Island, USA. *Journal of Helminthology* 79:67–73.
- Parker, J.A. 2002. Channel Island Fox recovery efforts. *Endangered Species Update* 19:58–61.
- Pearson, O.P. 1951. Additions to the fauna of Santa Cruz Island, California, with description of a new subspecies of *Reithrodontomys megalotis*. *Journal of Mammalogy* 32:366–368.
- Petrosyan, V.G., O.N. Tokarskaya, T.A. Kashentseva, L.I. Korochkin, and A.P. Ryskov. 2003. Assessment of population differentiation using DNA fingerprinting and modified Wright's F_{ST} -statistics. *Russian Journal of Genetics* 39:172–177.
- Petrosyan, V.G., O.N. Tokarskaya, T.A., Kashentseva, and A.P. Ryskov. 2003. Assessment of population differentiation using DNA fingerprinting and modified Wright's F_{ST} -statistics. *Genetika* 39:229–235.
- Phillips, R.B., and C.S. Winchell. 2011. Reducing non-target recaptures of an endangered predator using conditioned aversion and reward removal. *Journal of Applied Ecology* 48:1501–1507.
- Phillips, R.B., C.S. Winchell, and R.H. Schmidt. 2007. Dietary overlap of an alien and native carnivore on San Clemente Island, California. *Journal of Mammalogy* 88:173–180.
- Ralls, K., J.N. Sanchez, J. Savage, T.J. Coonan, B.R. Hudgens, and B.L. Cypher. 2013. Social relationships and reproductive behavior of Island Foxes inferred from proximity logger data. *Journal of Mammalogy* 94:1185–1196.
- Resnik, J.R., and W.F. Andelt. 2012. Reproductive ecology and characteristics of denning sites of the San Clemente Island Fox. *The Southwestern Naturalist* 57:170–175.
- Rick, T.C., B.J. Culleton, C.B. Smith, J.R. Johnson, and D.J. Kennett. 2011. Stable isotope analysis of dog, fox, and human diets at a Late Holocene Chumash village (CA-SRI-2) on Santa Rosa Island, California. *Journal of Archaeological Science* 38:1385–1393.
- Rick, T.C., J.M. Erlandson, R.L. Vellanoweth, T.J. Braje, P.W. Collins, D.A. Guthrie, and T.W. Stafford, Jr. 2009. Origins and antiquity of the Island Fox (*Urocyon littoralis*) on California's Channel Islands. *Quaternary Research* 71:93–98.
- Roemer, G.W., T.J. Coonan, D.K. Garcelon, J. Bascompte, and L. Laughrin. 2001. Feral pigs facilitate hyperpredation by Golden Eagles and indirectly cause the decline of the Island Fox. *Animal Conservation* 4:307–318.
- Roemer, G.W., T.J. Coonan, D.K. Garcelon, C.H. Starbird, and J.W. McCall. 2000. Spatial and temporal

- variation in the seroprevalence of canine heartworm antigen in the Island Fox. *Journal of Wildlife Diseases* 36:723–728.
- Roemer, G.W., and C.J. Donlan. 2004. Biology, policy, and law in endangered species conservation: I. The case history of the Island Fox on the northern Channel Islands. *Endangered Species Update* 21:23–31.
- Roemer, G.W., and C.J. Donlan. 2005. Biology, policy and law in endangered species conservation: II. A case history in adaptive management of the Island Fox on Santa Catalina Island, California. *Endangered Species Update* 22:144–156.
- Roemer, G.W., C.J. Donlan, and F. Courchamp. 2002. Golden Eagles, feral pigs, and insular carnivores: how exotic species turn native predators into prey. *Proceedings of the National Academy of Sciences* 99:791–796.
- Roemer, G.W., D.K. Garcelon, T.J. Coonan, and C. Schwemm. 1994. The use of capture-recapture methods for estimating, monitoring, and conserving Island Fox populations. Pp. 387–400 in *The Fourth California Islands Symposium: Update on the Status of Resources*. Halvorson, W.L., and G.J. Maender (Ed.). Santa Barbara Museum of Natural History, Santa Barbara, California.
- Roemer, G.W., M.E. Gompper, and B. Van Valkenburgh. 2009. The ecological role of the mammalian mesocarnivore. *BioScience* 59:165–173.
- Roemer, G.W., D.A. Smith, D.K. Garcelon, and R.K. Wayne. 2001. The behavioural ecology of the Island Fox (*Urocyon littoralis*). *Journal of Zoology (London)* 255:1–14.
- Roemer, G.W., and R.K. Wayne. 2003. Conservation in conflict: The tale of two endangered species. *Conservation Biology* 17:1251–1260.
- Roemer, G.W., R. Woodroffe, and F. Courchamp. 2004. Predators and prey in the Channel Islands. *Science* 205:778.
- Sanchez, J.N., and B.R. Hudgens. 2015. Interactions between density, home range behaviors, and contact rates in the Channel Island Fox (*Urocyon littoralis*). *Ecology and Evolution* 5:1–12.
- Schaefer, J.D., R.W. Kasten, T.J. Coonan, D.L. Clifford, and B.B. Chomel. 2011. Isolation or detection of *Bartonella vinsonii* subspecies *berkhoffii* and *Bartonella rochalimae* in the endangered Island Foxes (*Urocyon littoralis*). *Veterinary Microbiology* 154:135–139.
- Schutz, H., P.D. Polly, J.D. Krieger, and R.P. Guralnick. 2009. Differential sexual dimorphism: Size and shape in the cranium and pelvis of Grey Foxes (*Urocyon*). *Biological Journal of the Linnean Society* 96:339–353.
- Scott, S.M., E.N. Bodine, A. Yust. 2014. An agent-based model of Santa Cruz Island Foxes (*Urocyon littoralis santacruzae*) which exhibits an allee effect. *Letters in Biomathematics* 1:97–109.
- Snow, N.P., and W.F. Andelt. 2013. Capture success higher near roads for San Clemente Island Foxes. *Wildlife Society Bulletin* 37:623–630.
- Snow, N.P., W.F. Andelt, and N.P. Gould. 2011. Characteristics of road-kill locations of San Clemente Island Foxes. *Wildlife Society Bulletin* 35:32–39.
- Snow, N.P., W.F. Andelt, T.R. Stanley, J.R. Resnik, and L. Munson. 2012. Effects of roads on survival of San Clemente Island Foxes. *Journal of Wildlife Management* 76:243–252.
- Swarts, H.M., K.R. Crooks, N. Willits, and R. Woodroffe. 2009. Possible contemporary evolution in an endangered species, the Santa Cruz Island Fox. *Animal Conservation* 12:120–127.
- Thorne, R.F. 1969. The California Islands. *Annals of the Missouri Botanical Garden* 56:391–408.
- Timm, S.F., L. Munson, B.A. Summers, K.A. Terio, E.J. Dubovi, C.E. Rupprecht, S. Kapil, and D.K. Garcelon. 2009. A suspected canine distemper epidemic as the cause of a catastrophic decline in Santa Catalina Island Foxes (*Urocyon littoralis catalinae*). *Journal of Wildlife Diseases* 45:333–343.
- Vellanoweth, R. 1998. Earliest Island Fox remains on the southern Channel Islands: evidence from San Nicolas Island, California. *Journal of California and Great Basin Anthropology* 20:100–108.
- Voge, M. 1953. New host records for *Mesocestoides* (Cestoda: Cyclophyllidae) in California. *American Midland Naturalist* 49:249–251.
- Voge, M. 1955. A list of cestode parasites from California mammals. *The American Midland Naturalist* 54:413–417.
- Wayne, R.K., and P.A. Morin. 2004. Conservation genetics in the new molecular age. *Frontiers in Ecology and the Environment* 2:89–97.
- Wayne, R.K., S.B. George, D. Gilbert, P.W. Collins, S.D. Kovach, D. Girman, and N. Lehman. 1991. A morphologic and genetic study of the Island Fox, *Urocyon littoralis*. *Evolution* 45:1849–1868.
- Wittmer, H.U., R. Serrouya, L.M. Elbroch, and A.J. Marshall. 2013. Conservation strategies for species affected by apparent competition. *Conservation Biology* 27:254–260.



HOWARD O. CLARK, JR., is a Certified Wildlife Biologist with 20 y of professional wildlife and research experience. He earned his Master's degree in Biology from California State University, Fresno in 2001. His work as a researcher focused on the fauna and ecosystems of Northern, Central, and Southern California, and the Mojave Desert provinces and included extensive baseline mammalian inventories, surveys focused on rare animals, habitat assessment, radio telemetry, and long-term ecological studies on several endangered species. He is currently a Senior Wildlife Ecologist and Project Manager with Garcia and Associates, Fresno, California. (Photographed by Graham Bidy)



ROBYN M. POWERS is a Senior Wildlife Ecologist and Project Manager in the H. T. Harvey & Associates' San Luis Obispo office. She has particular interest and experience in endangered species research and monitoring and in mammal ecology. Much of her work has been in California ecosystems, including the Channel Islands, coastal scrub and oak woodland communities, the Sierra Nevada, and the Mojave Desert. Robyn is also the Program Manager for the firm's ecological scent-detection dog program. Robyn received an M.S. in physiology and behavioral biology from San Francisco State University and a B.S. in environmental science from the University of Denver. (Photographed by Robyn Powers)