Chapter 1. What is an Adaptive Conservation Strategy?

Science and Practice: Fostering Conservation Results

In a world of diminishing natural resources, expanding human population, and limited budgets, it is essential that efforts to conserve biodiversity and manage wildlife habitats be guided by the best available scientific knowledge. This notion may seem self-evident. It is, nonetheless, an aspect of conservation practice that is constantly in need of improvement[14,17,21]. Science at its best uses experimental methods and shares results widely. An **Adaptive Conservation Strategy** is designed to foster precisely this approach.

An Adaptive Conservation Strategy includes adaptive management at the site-specific level combined with a process of Adaptive Conservation Planning across sites to more fully integrate scientific knowledge into resource management and share learning among conservation practitioners. Adaptive management is a decades-old method of natural resource management that integrates design, management, and monitoring to systematically test assumptions in order to adapt and learn[20]. Adaptive Conservation Planning is the process of synthesizing monitoring and assessment data from many projects to develop science-based conservation recommendations that can then be shared across projects. Adaptive Conservation Strategies have focused on monitoring of bird populations because many bird species make excellent indicators of ecosystem health and integrity.

Adaptive Conservation Strategy = **Adaptive Management** + **Adaptive Conservation Plans**

definition: an **Adaptive Conservation Strategy (ACS)** consists of **adaptive management** at the site-specific level and, in addition, **Adaptive Conservation Plans** that provide a systematic means of synthesizing data, sharing learning, and influencing policy across sites, regions, and/or ecosystems.

An Adaptive Conservation Strategy emphasizes science-management teams practicing adaptive management. Teams conduct standardized monitoring of bird species and their habitats to evaluate conservation practices, results, and goals at multiple sites. To systematically share learning, data from many adaptively managed sites are then pooled, synthesized, and disseminated by creating *species, habitat, or ecosystem* Adaptive Conservation Plans. Adaptive Conservation Plans (ACPs) are regularly updated with new data and analyses. ACPs contain recommendations for habitat management, restoration, and protection as well as monitoring, research, policy, and education. An important goal is to implement recommendations at additional sites located throughout the habitat or ecosystem of interest. Plan data and recommendations are also used to improve conservation programs, guide funding allocation, and refine resource management policies.

An ACS stresses recognition of the assumptions that underlie resource management; continual reassessment and broad sharing of conservation practices and results; and a collaborative multi-disciplinary approach that seeks to constantly improve and build upon our knowledge of ecosystem function.

Birds as Indicators

What is the justification for developing an Adaptive Conservation Strategy based on birds? Many bird species make excellent indicators of various parameters of ecosystem health and ecological integrity. PRBO Conservation Science (PRBO) views bird population health as both a conservation goal in itself, and an indicator of the success of wildlife/habitat management and restoration.

The Laysan Albatross, a marine predator and indicator species. Photo by Eric Preston.

Good indicator species are those that are more sensitive to environmental change than others, and respond quickly and consistently to environmental stresses or enhancements[4,5,15]. Birds make good indicators of habitat quality in a variety of ecosystems because they may be sensitive to a variety of physical and biological factors, including levels of primary and secondary productivity in the system, the structural and species diversity of vegetation, and the size and connectivity of habitat patches[11]. They are numerous and conspicuous predators near the top of the food chain. In the marine environment, they feed on the same prey as many other top predators, including large fish, sea turtles, seals, sea lions, and whales[13].

Valuable indicators are also those that directly indicate a cause of change rather than simply the existence of change[8,9], i.e., demographic measures such as rates of reproduction or mortality. By monitoring demographic parameters of a wildlife population, some causes of declining trends or extirpated populations may often be identified, which can lead directly to the development of appropriate management actions to stop those declines. For this reason, an assessment of reproductive success

and survival are important components of many bird monitoring programs. Reproductive success can be monitored through nest searching, which is also combined with detailed habitat features in the vicinity of the nest. Individuals can be captured, marked, released, and re-sighted for survival analyses. The methods for collecting such data for birds are well-established and internationally standardized. The most useful indicator species are also those that have populations large enough to be easily monitored and to provide sufficient samples sizes for statistical analysis across sites and/or regions[5].

Numerous bird species have many of the characteristics of efficient and effective indicators as defined by The Nature Conservancy's "Measures of Conservation Success" framework[17]:

- *Biologically relevant* (i.e., represent an accurate assessment of biodiversity health)
- *Socially relevant* (i.e., value is recognized by stakeholders)
- *Anticipatory*, providing early warning (i.e., indicate degradation before serious harm has occurred)
- *Sensitive to anthropogenic stress* and reflective of changes in stress without extreme variability
- *Measurable* (i.e., capable of being operationally defined and measured using a standard procedure)
- *Cost-effective* (i.e., inexpensive to measure, providing the maximum amount of information per unit effort).

Finally, indicators must be cost-effective and require low impact to the resource[17, 21]. Birds fit this bill, as few organisms are more amenable to observation and identification (to species, sex, and/or age) by sight and sound. Birds often provide scientists with the best evidence of how humanity's actions affect the world's ecosystems and wildlife[25].

> *"A very positive aspect of the monitoring program . . . is the fact that the link between habitat changes caused by restoration and the response of the riparian bird community is being evaluated. In fact, the songbird monitoring on Lower Clear Creek is the best example of an attempt to link restoration actions with a biological response of the target organisms that the Panel has seen during the Adaptive Management Forum."* - California Bay-Delta Authority (CALFED) Adaptive Management Forum Scientific and Technical Panel, 2003[1].

The Adaptive Conservation Strategy

The steps of implementing an Adaptive Conservation Strategy are:

(1) **Use adaptive management**, stressing science-management teams at multiple sites within an ecosystem or with similar natural resources across ecosystems (e.g., riparian habitat).

a. Identify assumptions and set management goals (captured in site-specific adaptive resource management plans).
b. Implement management alternatives.
c. Monitor and analyze response to management.
d. Revise management, goals, or monitoring regime as indicated, and repeat the process.

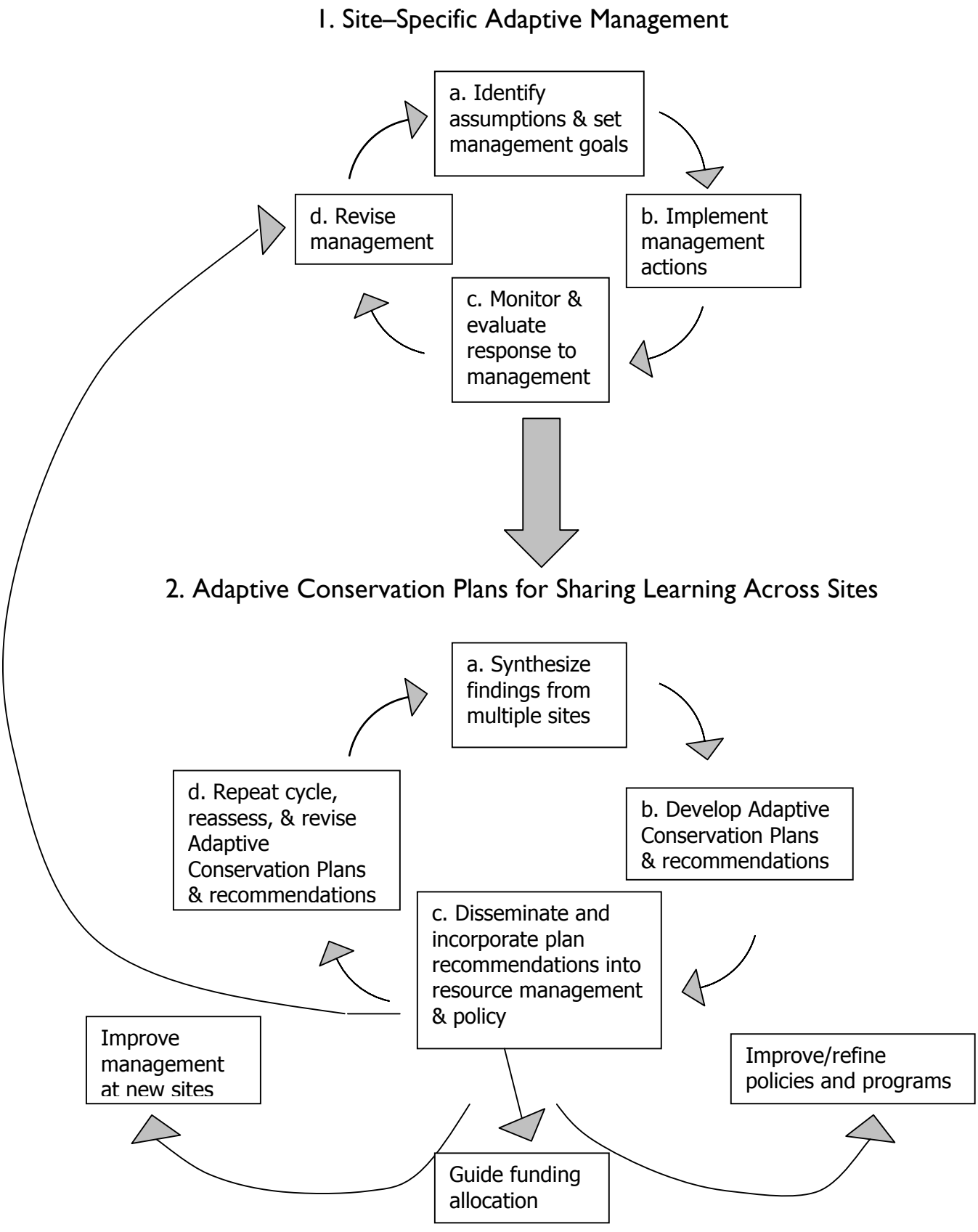
(2) Share learning through **Adaptive Conservation Plans**.

a. **Synthesize findings** from multiple adaptively managed projects.
b. **Develop an Adaptive Conservation Plan** focused on the species, habitat, or ecosystem of interest. The plan incorporates findings from step a, as well as peer-reviewed literature, gray literature, and expert opinion. Conservation plans advance recommendations to guide resource management and policy and are available on-line as well as in hard copy.
c. **Disseminate and incorporate plan recommendations** into resource management and/or policy by partnering with or conducting outreach to appropriate audiences.
d. **Reassess and revise** both site-specific resource management plans/practices and Adaptive Conservation Plans, and repeat the process.

The Adaptive Conservation Planning cycle (Fig. 1) can be conceptualized as two separate iterative cycles that regularly exchange information and expertise: (1) the site-specific adaptive management cycle, where monitoring data are collected and Adaptive Conservation Plan (ACP) recommendations are implemented, and (2) the plan cycle, which develops ACPs with general goals of species, habitat, or ecosystem conservation and which cover a region containing many site-specific projects and their associated data.

Useful indicator species are those that have populations large enough to be easily monitored and to provide sufficient samples sizes for statistical analysis across sites and/or regions. Photo by Eric Preston.

Figure 1: Components and Process of an Adaptive Conservation Strategy



Adaptive Management

The approach to developing an Adaptive Conservation Strategy outlined in this guide is based on the general principles of adaptive management, a process for the management of natural resources that emphasizes interaction between managers and scientists. Because there is so much uncertainty inherent in our understanding of ecological systems,[3,19,20] management practices require continual monitoring and adaptation[12]. Adaptive management involves the evaluation of alternative management actions through quantitative model building and/or experimentation, in which the results of previous actions are monitored and used to modify future management[12, 19]. It emphasizes the need to treat policies and decisions explicitly as hypotheses and opportunities for learning rather than as final solutions[2].

Passive adaptive management does not include controls, replication, or randomization. Active adaptive management employs management programs that are designed to experimentally compare selected policies or practices by evaluating alternative hypotheses about the system being managed[3, 23, 24]. Active adaptive management is a valuable component of an Adaptive Conservation Strategy; however, an ACS also incorporates ecological insights gained from non-experimental monitoring projects (passive adaptive management) and basic research as well.

True adaptive management is rarely implemented even though many resource planning documents call for it and numerous resource managers refer to it. "There are startlingly few examples in wildlife management in which the adaptive management 'loop' has been completed[9]." The reasons for this are many: an eagerness for quick "on-the-ground" results to the exclusion of the effort and time required to assess long-term results; a focus on simple measures of success (for example, using seedling survival alone to measure the success of a forest restoration project planted to benefit wildlife); and the "build it and they will come" school of thought, which assumes that wildlife will respond favorably to most kinds of habitat restoration. An unwillingness to raise funds to cover the costs of monitoring and assessment is also sometimes a factor.

Perhaps the most important reason has been the breakdown of information sharing between scientist and manager. This breakdown may occur because managers and scientists do not view themselves as part of the same management team; because scientists have not sought to tie monitoring and assessment programs directly to resource management[9]; and because many managers think monitoring means only tracking population trends.

Science and Management Teams

A key premise of Adaptive Conservation Planning is that conservation practitioners and conservation scientists must work together as a team to ensure that questions and answers obtained from monitoring are relevant to natural resource management issues. From a conservation perspective, scientific data are only as valuable as the extent to

which they are applied—whether to shed new light on key questions about the environment or to guide actual conservation projects.

Benefits to Conservation Biologists of the Team Approach[26]

- Every conservation scientist has a vested interest in working with land and ocean managers to ensure that their data are integrated into natural resource management decisions.
- Public land and ocean managers, in particular, can generate public outreach and conservation education opportunities otherwise unavailable to scientists, by providing controlled public access and interpretation of applied conservation science.
- Land and ocean management partners can help generate a source of matching funds, as well as testimonials on the value of scientific work, to assist private scientists and organizations in fundraising efforts. Fundraising may often be more successful with collaborative proposals that cover multiple jurisdictions.

Natural resource managers also benefit in many ways by teaming with science organizations to conduct adaptive management.

Benefits to Resource Managers of the Team Approach[26]

- Science partners can provide "turn-key" programs that supply expertise complementary to that of a particular land or ocean management agency. Science organizations can also train land management staff in standardized monitoring and data analysis protocols.
- Science partners can tailor their monitoring and evaluation programs to answer questions of particular interest to habitat managers and to address new questions of interest as they arise.
- Several years of comprehensive ecological surveys can provide a huge increase in knowledge about birds and other wildlife.
- Science partners may be able to provide continuity over the long-term by maintaining datasets and enabling data sharing with a wider audience (i.e., they are not subject to the same shifting political winds). Since many Department of Interior agencies are now under a mandate to outsource whenever possible, science partners with established records of success are a logical choice for outsourcing.
- Partnerships between scientists and natural resource management agencies who have jurisdiction over broad or adjoining areas can result in a wider context for interpreting research and monitoring results. Regional perspectives, landscape analyses, and greater statistical power can result when data are shared, compared, and analyzed across projects.

Adaptive Conservation Planning

The development of Adaptive Conservation Plans (sometimes titled Bird Conservation Plans), is actually an attempt to foster "learning projects" and "learning organizations." i.e., to capture and share project learning with other practitioners so that they can avoid making the same mistakes over again and can begin generating new knowledge[20,21]. The ACP process makes this possible by developing updateable conservation plans that pool the results of many adaptively managed projects, as well as the latest scientific literature and expert opinion, to develop a set of science-based conservation recommendations for specific habitat types or ecosystems.

An important assumption in creating ACPs is that management recommendations generated from pooled datasets can be applied in other similar habitats or sites within the bioregion and across bioregions (within reason—taking into account altitude, historic use, species occurrence, and biogeographic differences, for example)[10]. In this way, habitat managers who lack the resources for monitoring and assessment programs can still take advantage of a wealth of knowledge from similar sites and from the literature. On the other hand, the recommendations can and should be tested at new sites whenever possible through monitoring of birds and other wildlife response. As new data are generated at the project level, they are used to update and revise conservation plan recommendations as necessary. Plans also acknowledge the gaps in current knowledge and emphasize the need to test hypotheses and assumptions involved in conservation planning. Managers have access to all of this information, and much of the supporting data, online.

Standardized monitoring for all birds, including colonial nesters such as this Great Blue Heron, is a crucial component of ACP. Photo by Kim Kreitinger.

Standardized monitoring methodology of birds and associated habitat parameters is thus a crucial component of an Adaptive Conservation Strategy[6]. Internationally standardized techniques for landbirds, as well as seabirds and colonial nesters, have been defined[18, 22]. Standardized monitoring allows for comparison and analysis of data across time and space (locally, regionally, and continentally), which is essential for the analyses of combined datasets that

characteristically support ACPs. Standardized monitoring provides the "common language" for evaluating and guiding management actions at multiple sites.

Programmatic/Policy Applications of Adaptive Conservation Plans

Increasingly, those who manage funding programs for conservation, whether in the private sector or in government, are seeking to ensure the best possible expenditures of scarce conservation dollars. For example, the National Fish and Wildlife Foundation requests that bird habitat restoration and management proposals include information on how the proposed project addresses recommendations in the applicable Bird Conservation Plans developed by California Partners in Flight, PRBO, and other organizations. This information helps the National Fish and Wildlife Foundation ensure that funded projects are contributing to broader conservation priorities[27].

A priority for the WHIP program is the conservation of riparian habitat. Photo by Eric Preston.

The Natural Resources Conservation Service (NRCS) in California, which is slated to receive millions of dollars annually for habitat conservation programs on private lands, has been partnering with PRBO and California Partners in Flight in the development of criteria for its Wildlife Habitat Incentives Program (WHIP). WHIP program objectives and funding criteria have incorporated key conservation principles and recommendations from three ACPs, the *Riparian Bird Conservation Plan,* the *Grassland Bird Conservation Plan*, and the *Southern Pacific Shorebird Conservation Plan*. The top priority WHIP program objective in California is conservation of riparian habitat, with an emphasis on restoration and management of declining or threatened native habitats. Additionally, WHIP project ranking criteria based on adaptive conservation plan recommendations include (1) an emphasis on restoration plantings establishing more than 2 species, with higher ranking for 5 or more species; (2) an emphasis on benefits to neotropical migrants, grassland birds, and shorebirds; (3) an emphasis on a landscape perspective in which WHIP projects are ranked higher if located nearer to areas that are already under conservation management; (4) and an emphasis on habitat management practices during nesting season that do not disturb nesting birds[28].

Conservation Accounting

Unprecedented levels of federal, state, and local dollars are being spent on ambitious ecosystem restoration and management projects, including the California Bay-Delta Ecosystem, Central Valley wetlands, San Francisco Bay, the Salton Sea, and the Channel Islands Marine Reserve. This level of investment, combined with the new era of fiscal accountability and scarce conservation dollars, has spurred major environmental organizations and funders to begin developing a system of "conservation accounting" to measure the success of conservation efforts in biological terms[7,17,21]. The ultimate goal is to develop a process and set of measures that can be used to audit not only the financial, but also the ecological results of conservation projects, thereby ensuring the most biodiversity bang for each conservation buck invested[7].

It is imperative that managers continually ask, and answer, the question, "Are our efforts improving native wildlife values?" If this question is not regularly addressed, then well-intentioned conservationists may not only waste scarce funds but may inadvertently contribute to wildlife and ecosystem decline[6]. An Adaptive Conservation Strategy provides a means of "auditing" results of conservation investments by (1) using standardized monitoring across multiple projects; (2) focusing on bird species that are generally good indicators of ecosystem health and integrity; (3) providing a means of sharing and analyzing pooled datasets across multiple spatial and temporal scales; and (4) disseminating results widely to promote learning and greater success in conservation.

Chapter 1 References

1. Bilby, R. E., T. Dunne, M. C. Healey, R. A. Mussetter, N. L. Poff, P. L. Redmond, M. L. Scott, and C. A. Shaw (Adaptive Management Forum Scientific and Technical Panel). 2003. Lower Clear Creek Adaptive Management Forum Report. California Bay-Delta Authority and UC Davis Information Center for the Environment.

2. Blann, K. and S. S. Light. 2000. The key ingredients of an adaptive probe. Report contained in the Foundations of Success "Measuring Conservation Impact" database, http://www.fosonline.org/fos/MCI_Database1.asp.

3. British Columbia Forest Service. 2000. Definitions of adaptive management. Government of British Columbia. (http://www.for.gov.bc.ca/hfp/amhome/Amdefs.htm).

4. Caro, T. M., and G. O'Doherty. 1999. On the use of surrogate species in conservation biology. Conservation Biology 13:805-814.

5. Chase, M. K., and G. R. Geupel. *In press*. The Use of Avian Focal Species for Conservation Planning in California. *In* Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in

Flight Conference 2002 (C.J. Ralph and T.D. Rich, eds.). U.S.D.A. Forest Service, General Technical Report.

6. Cohen, E. M. 2003. Birds and Conservation Accounting. Manuscript for Special Session, "Migratory Bird Conservation: A Foundation for Broader Wildlife Conservation?" Submitted to Transactions of the 68th North American Wildlife and Natural Resources Conference, March, 2003, Winston-Salem, North Carolina.

7. Christensen, J., November 5, 2002. Fiscal Accountability Concerns Come to Conservation. The New York Times.

8. DeSante, D. F. 1991. Monitoring avian productivity and survivorship (MAPS): a sharp, rather blunt, tool for monitoring and assessing landbird populations. Pages 511-521 *in* D.R. Mccullough and R. H. Barrett, editors. Wildlife 2001: populations. Elsiveier Applied Science. New York, New York. USA.

9. Gibbs, J., H. Snell, and C. Causton. 1999. Effective monitoring for adaptive wildlife management: lessons form the Galápagos Islands. Journal of Wildlife Management 63:1055-1065.

10. Golet G. H. 2001. Book Review: The Riparian Bird Conservation Plan. Western Birds 32:184-185.

11. Griggs, T. and S. Small. 2000. Riparian Vegetation White Paper for CALFED. Draft of 27 March 2000. 64 pages. Available from tgriggs@jps.net.

12. Holling, C. S. (Editor). 1978. Adaptive Environmental Assessment and Management. John Wiley & Sons. Toronto.

13. Hyrenbach, K. H. and Pelagic Working Group. 2002. Pelagic Predators, Prey and Processes: Exploring the Scientific Basis for Offshore Marine Reserves. Proceedings of the First Pelagic Working Group Workshop. January 17, 2002. Santa Cruz, prbo.org/marine/p4_report_0505.pdf

14. Johnson, R. C. Baxter, and S. Mott. 2003. A new paradigm for bird conservation – the role of applied science in conserving the full spectrum of North American birds through regional partnerships. Submitted to Transactions of the 68th North American Wildlife and Natural Resources Conference, March, 2003, Winston-Salem, North Carolina.

15. Landres, P. B., J. Verner, and J. W. Thomas. 1988. Ecological uses of vertebrate indicator species: A critique. Conservation Biology 2:316-328.

16. Nur, N., S. Jones, and G. R. Geupel. 1999. A statistical guide to data analysis of avian monitoring programs. US Department of the Interior, Fish and Wildlife Service, Biological Technical Publication BTP-R6001-1999, Washington, D.C.

17. Parrish, J. D., D. Braun, and R. Unnasch. *In press*. Are we conserving what we say we are? Measuring ecological integrity in evaluations of protected area management effectiveness. Bioscience.

18. Ralph, C. John; Geupel, Geoffrey R.; Pyle, Peter; Martin, Thomas E.; DeSante, David F. 1993. Handbook of field methods for monitoring landbirds**.** Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 41 p. http://www.psw.fs.fed.us/publications/Documents/gtr-144/00-front.html.

19. Ringold, P. L., J. Alegria, R. L. Czaplewski, B. S. Mulder, T. Tolle, and K. Burnett. 1996. Adaptive monitoring design for ecosystem management. Ecological Applications 6:745-747.

20. Salafsky, N., R. Margoluis, and K. Redford. 2001. Adaptive management: A tool for conservation practitioners. Washington, D.C.: Biodiversity Support Program.

21. Salafsky, N., R. Margoluis, K. H. Redford and J. G. Robinson. 2002. Improving the practice of conservation: a conceptual framework and research agenda for conservation science. Conservation Biology 16(6):1469-1479.

22. Steinkamp, M., B. Peterjohn, V. Byrd, H. Carter, R. Lowe, and K. Mills. *In prep.* Breeding Season Survey Techniques for Seabirds and Colonial Waterbirds throughout North America. Information available from kmills@prbo.org.

23. Walters, C. 1986. Adaptive management of renewable resources. MacMillan, New York, NY.

24. Wilhere, G. F. 2002. Adaptive Management in Habitat Conservation Plans. Conservation Biology 16:20-29.

25. Youth, H. 2003. Winged Messengers, the decline of birds. Worldwatch Paper 165. The Worldwatch Institute, Washington, DC.

26. Derived from a synthesis of case study interviews (see personal communications listed as sources in Chapter 2).

Personal Communications

27. Peter Stangel, Southeast Office Regional Director, National Fish and Wildlife Foundation, 5-03.
28. Alan Forkey, Natural Resources Conservation Service, 4-03.