Unity, Integration, and Action:

DFG's Vision for Confronting Climate Change in California

California Department of Fish and Game
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I. Introduction

California is a hotspot of biodiversity with a unique array of species and habitats found no where else. In fact, California is recognized as one of the most biologically diverse regions in the world with more unique plant and animal species and endangered species than any of the 50 states[1]. California's unique landscapes and species assemblages have been shaped over millions of years by a varied climate. This same climate attracts people from all over the world making California one of the most populated states in the U.S. Much of the state's economy, recreational activities, and quality of life for residents and visitors are tied to this exceptional landscape and the ecosystem services that California's natural resources provide.

Ecosystems currently provide a wide range of life-sustaining services in the form of clean water, clean air, sustainable food resources, recreational opportunities, protection of property from storm, fire, and flood events, and other benefits that determine the quality of life in California. In addition, ecosystems such as forests, grasslands, wetlands, chaparral, and riparian areas, among others, can capture and sequester significant amounts of carbon, helping to reduce the levels of green-house gases (GHG) in the atmosphere. Healthy, functioning ecosystems can contribute to the economic livelihood of California by supporting vital natural products and services that provide billions of dollars in direct economic benefits[2] including maintenance of natural fish stocks for commercial harvest, support of forage and timber production, and natural crop pollination.

A growing body of scientific research indicates California's remarkable diversity of habitats and wildlife is threatened by climate change. Ecological changes, including changes in species' distributions, timing of life cycles, and abundance, have already occurred in California over the past century in concert with increases in average temperature and changes in precipitation patterns.[3] Existing stressors such as human population growth and associated land use changes, water management conflicts, invasive species, and other widespread stressors will be exacerbated by climate change, and could increase negative impacts to ecosystems beyond the effects of individual stressors. Recent estimates have predicted that the total risk to California assets from climate change will be close to $2.5 trillion if we do not take steps to minimize these impacts making maintenance of ecosystem services even more important. Effectively managing for these potential risks to ecosystems and biodiversity will help protect not only species and their habitats, but the services they provide.

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[1] Steinhart, P. (1990). California's Widlife Heritage: Threatened and Endangered Animals in the Golden State. California Department of Fish and Game, California Academy of Sciences, and Sierra Club Books (excerpt available at: http://ceres.ca.gov/ceres/calweb/biodiversity/evolution.html. [last accessed September 2011]).

[2] Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-Being: Biodiversity Synthesis. World Resources Institute, Washington, DC.

[3] CA Natural Resources Agency, 2009. 2009 California Climate Adaptation Strategy. California Natural Resources Agency. Sacramento, CA. http://www.climatechange.ca.gov/adaptation

The Department of Fish and Game (DFG) recognizes that climate change is a major challenge to the conservation of California's natural resources. The DFG is responsible for maintaining native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection and maintenance to ensure the survival of all species and natural communities. Without functioning and intact ecosystems, the maintenance of biodiversity in California becomes increasingly difficult. The expected negative impacts on ecosystems associated with climate change will threaten ecosystem functionality and place the biodiversity of natural systems at risk. Projected increases in temperature are expected to test the tolerable temperature thresholds of numerous species, posing risks to rare, threatened, or endangered species, especially endemic species. In some cases, changes in temperature and precipitation will instigate species migration to a more climatically suitable habitat; the resulting impacts on predator prey relationships and species interactions will alter community composition and structure with potentially negative implications for biodiversity. Shifts in the timing of phenologic events brought on by these kinds of temperature and precipitation changes will also contribute to changes in ecosystem dynamics by causing misalignment between species migratory arrival and availability of food sources at some locations. In addition, changes in temperature and precipitation regimes will impact species and their habitats through effects on flooding, snowpack, streamflow, droughts, and wildfire. Marine ecosystem function is also at risk due to projected sea level rise along the California coast and ocean acidification. Salt water intrusion into freshwater resources and inundation resulting from increased coastal flooding may further pollute aquatic habitats having severe adverse effects on terrestrial and marine ecosystems alike. Recent predictions of the extinction risk associated with climate change have matched recent reports of actual changes in global plant and animal populations[4]. This observation provides empirical support that climate change presents a growing threat to biodiversity, and suggests that the time for action is now.

Responding to Climate Change: DFG's Role

Over the past several years the DFG has taken an active role in planning for and responding to the challenges posed by a changing climate. The DFG has worked diligently to embed its climate change related efforts into an overarching strategic approach that builds on existing tools and partnerships while allowing for new and innovative actions to proactively safeguard California's fish, wildlife, and habitats for future generations. This document illustrates the DFG's current efforts to refine and strengthen its long term vision for addressing climate change in order to ensure a cohesive and strategic approach to developing actions that will provide measurable outcomes.

Climate Science and Renewable Energy Branch

The importance of responding to climate change is clear and the DFG is steadfast in its commitment to address the effects of climate change on the state's fish, wildlife, and habitats. The creation of a Climate Science and Renewable Energy Branch is one of

[4] Ilya M. D. Maclean, Robert J. Wilson. Recent ecological responses to climate change support predictions of high extinction risk. *Proceedings of the National Academy of Sciences*, 2011; DOI: 10.1073/pnas.1017352108

many examples of how the DFG is organizing itself to address climate change adaptation and mitigation in a way that protects fish, wildlife, and habitats while supporting California's economy and its citizens. To date, DFG staff have put extensive effort into bringing together stakeholders to collaboratively craft a robust vision for effectively responding to the challenges posed by climate change. The resulting strategic vision presented in this document provides an overview of the general strategies and objectives that are deemed essential for the DFG to successfully respond to climate change. The DFG's vision for responding to climate change challenges includes three major components, **Unity-Integration-Action**, each of which are important to effectively confronting climate change impacts now and in the future.

Building on Existing Tools

The DFG has both the expertise and a variety of existing tools that will support implementation of this vision. The following examples provide a sampling of some of the many existing programs and projects that the DFG will use to put actions on the ground to respond to climate change. This is by no means an extensive list but provides a few examples of how the DFG is re-tooling itself to build on existing programs, projects, and partnerships.

- **DFG: National, Regional, and Local Coordination[5]:** The DFG is actively engaged in several national, regional and local efforts focused on supporting the dissemination of climate change research, making vital connections to on-the-ground conservation and natural resources management activities, and working collaboratively to maximize effectiveness. For example, the DFG participates on the steering committees of four Landscape Conservation Cooperatives (LCCs) in California; LCCs are unique management-science partnerships developed to address climate change and other stressors within and across landscapes. In addition, the DFG serves on the Steering Committee for the National Fish, Wildlife, and Plants Climate Adaptation Strategy, is Co-Chair of the Association of Fish and Wildlife Agencies Climate Committee, Chair of the Western Association of Fish and Wildlife Agencies Climate Change Committee, participant in the Western Governors' Association, and member of the CA Climate Action Team.
- **California's Wildlife Action Plan[6]** provides a blueprint for addressing future and current climate change challenges and will play a significant role in identifying a course of action for the state.
- The **Natural Community Conservation Planning (NCCP) program[7]** takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. The NCCP program is one of the few programs in existence that already incorporates and addresses climate change adaptation, though efforts are underway to more explicitly identify the beneficial values of the program to adaptation planning.

[5] http://www.dfg.ca.gov/climatechange/activities.html
[6] http://www.dfg.ca.gov/wildlife/WAP/
[7] http://www.dfg.ca.gov/habcon/nccp/

- **Conservation and Mitigation Banks**[8] can be a key component of a climate change adaptation response by providing needed habitat linkages or buffers, particularly when they are strategically located in a system of conserved lands or in areas identified as potential conservation areas.
- The **Regional Advance Mitigation Program (RAMP)** is an emerging concept for responding proactively to the impacts associated with climate change. By planning ahead, mitigation can be focused in key conservation areas, improving connectivity and helping species and ecological processes respond and persist in the face of climate change.
- **Marine Protected Areas (MPAs)** have already been identified as part of a statewide network created to protect the state's marine life and habitats, marine ecosystems, and marine natural heritage. MPAs will contribute directly to the desired statewide network of reserves.
- The **Office of Spill Prevention and Response (OSPR)** is already working to provide protection of California's fish, wildlife, and habitats by preventing, preparing for, and responding to spills of oil and other deleterious materials, and through restoring and enhancing affected resources. This program will continue to be useful should near-shore and inland aquatic ecosystems become contaminated as sea level rises and flooding events occur more frequently.
- Mapping and data-driven analyses such as Phase II of the DFG's **Areas of Conservation Emphasis**[9] **(ACE-II)** mapping and modeling effort involves identifying areas considered to be of highest conservation value for purposes of meeting the DFG's mission and for focusing limited resources. The ACE mapping and modeling effort will directly support efforts to create a system of sustainable, well connected habitat conservation areas across California.
- **Safe Passages,** facilitated by Defenders of Wildlife, is evaluating past linkage projects and applying results to the fragmented habitat matrix in the San Joaquin Valley.
- **The Essential Habitat Connectivity Project**[10] co-developed by the DFG and the California Department of Transportation (CalTrans), is combining results of *Safe Passages* and the *Missing Link*[11] project in developing GIS connectivity maps for the State. Such linkage efforts identify priority conservation areas that will enhance ecosystems' response to change, reduce stressors and contribute to the future system of conservation areas.
- **Climate Change Vulnerability Assessments:** The DFG has several completed or on-going analyses to assess the vulnerability of several taxa (birds, mammals, reptiles and amphibians, rare plants, and fish) to the impacts associated with climate change. The DFG is positioning itself to be a clearing house of sorts for climate change vulnerability assessments in California to better facilitate information sharing and collaboration among partners.

[8] http://www.dfg.ca.gov/habcon/conplan/mitbank/
[9] http://www.dfg.ca.gov/biogeodata/ace/
[10] http://www.dfg.ca.gov/habcon/connectivity/
[11] http://www.scwildlands.org/projects/caltrans.aspx

II. Unity-Integration-Action: DFG's Vision

The vision outlined in the sections below embodies the DFG's commitment to minimizing negative effects of climate change on the state's fish, wildlife and habitats through the development of adaptation and mitigation measures, policies, and practices that provide clear benefits to terrestrial and marine ecosystems and recognize the uncertainty associated with future climatic states. The DFG is cognizant of the uncertainties associated with emerging climate science and is taking an approach that will allow the DFG to be both proactive and adaptive through the use of a variety of planning tools and strategic initiatives. Specifically, the objectives presented in this vision are designed to be part of an adaptive management framework that allows for continual improvement and adjustment of management practices based on new information.

The DFG's vision for responding to climate change challenges includes three major components, each of which are important to the success of effectively confronting climate change. The three components of the DFG's vision include: 1) **Unity:** creating and maintaining vital climate change partnerships and collaborations, 2) **Integration**: integrating climate change into DFG activities, and 3) **Action:** meeting conservation objectives for maintaining healthy ecosystems while taking into account climate change threats and impacts. Each component of the vision is presented with specific objectives that the DFG will strive to meet.

In addition to supporting the concept of adaptive management, the following vision reflects the DFG's strong value of partnerships. The DFG is working diligently to identify, respond, and prepare for climate change through landscape-scale efforts, including California's Wildlife Action Plan, the North American Waterfowl Management Plan, the National Fish Habitat Action Plan, Marine Life Protection Act, and other efforts that support managing robust populations and healthy fish and wildlife habitats. Developing and maintaining partnerships is essential to continuing to pursue these landscape-scale efforts and addressing the broad scope of climate change issues. By working together and taking actions today the DFG and all our partners will be better positioned to anticipate and respond to the effects of future climate change and fulfill our responsibility to conserve fish and wildlife, their habitats, and the beneficial services provided by these ecosystems for future generations to enjoy.

The next three sections describe in more detail the components of the DFG's vision and present tangible objectives associated with each. Each section also includes a brief description of existing efforts or early successes that can be built upon to meet these objectives. A summary of the major components of this vision and their accompanying objectives is presented in the box below.

Unity-Integration- Action: DFG's Climate Change Vision

Unity: Creating and maintaining climate change partnerships

- Objective 1: Pursue and Maintain Collaborative Partnerships**.**

Integration: Integrating climate change into Department activities

- Objective 2: Reevaluate existing policies and programs to incorporate climate change and seek regulatory changes as appropriate

Action: Conservation practices to maintain and enhance ecosystem function

- Objective 3: Create a large scale well connected, sustainable system of conservation areas across the State's terrestrial and marine landscapes.
- Objective 4: Manage for restoring and enhancing ecosystem function to conserve both species and habitats in a changing climate.
- Objective 5: Adjust management actions as appropriate to stabilize declining and vulnerable populations.

1. Unity: Creating and Maintaining Climate Change Partnerships

With the publication of the 2009 California Climate Change Adaptation Strategy, the state of California was one of the first to develop a comprehensive approach to addressing climate change adaptation. As the state makes great strides to address policy and management issues concerning climate change impacts on energy production, hazard mitigation, and vulnerability among others, the DFG will continue to work collaboratively with partners to address those impacts related to biodiversity. To ensure that biodiversity conservation gets the attention it deserves, the DFG will need to have a strong strategy in place that can be used to identify priority species and habitats, assess their vulnerability, and identify research and monitoring needs. The challenges associated with developing such a strategy provide opportunities to build on and expand existing partnerships and to leverage the resources and expertise of multiple entities.

Objective 1: Pursue and Maintain Collaborative Partnerships

The DFG will engage in collaborative groups of research scientists, resource managers, and other partners that can work closely together to ensure that the best available science and collaborative approaches are used in management and restoration activities. Bringing together representatives from different agencies and organizations is crucial in developing a collective vision for responding to climate change impacts across the state.

Achievements to Build On: DFG's Climate Change Stakeholder Group

Over the past three years the DFG has successfully maintained a diverse group of stakeholders who are actively working with the DFG to craft a collective vision for climate change adaptation actions for fish, wildlife, and habitats in the state. Stakeholder input and recommendations are reflected throughout this vision, which is an example of how the DFG's climate change stakeholder group has informed the DFG's planning,

policy, and management efforts. The composition of participants in the DFG's climate change stakeholder group includes nongovernmental organizations, state and federal agencies, academic community, private industry, and local land trusts. Working groups composed of partners and led by the DFG, including regional working groups in northern and southern California, have been formed to focus on key issues including outreach, policy, pertinent workshops and research. These highly successful working groups have helped create specific products and have maintained an on-going dialogue that supports the DFG's efforts to collaboratively and successfully implement climate change adaptation actions across the state. The DFG is committed to its climate change stakeholder group and to continuing an open and transparent process where all partners have a role in creating and implementing a collective vision for addressing climate change impacts on fish, wildlife, and habitats in California.

Across our Borders: DFG Coordination at the National, Regional and State Levels

The DFG's responsibility to respond to climate change impacts does not end at the California border. The DFG is part of numerous initiatives and partnerships that promote the principles of sound resource management and the building of partnerships at the regional, national and international levels in order to enhance wildlife conservation efforts and the protection of associated habitats in the public interest. In regards to climate change, the DFG maintains a leadership role at the national, regional, and state levels to encourage coordination and ensure that fish and wildlife are well represented in climate change adaptation discussions. The DFG is an active member of the steering committee for the National Fish, Wildlife, and Plants Climate Adaptation Strategy and DFG staff currently lead technical groups and provide input on this national strategy. The DFG's Executive Staff serve in leadership roles as the co-chair to the Association of Fish and Wildlife Agencies national climate change committee, as well as founder and chair of the Western Association of Fish and Wildlife Agencies' (WAFWA) climate change committee[12]. The WAFWA committee in particular has increased communication among Western states and Canadian provinces on climate change activities and developed several products[13] that are proving useful to members and conservation partners for climate change adaptation planning, communication, and collaboration.

At the state and regional levels, the DFG remains committed to existing collaborative efforts such as the North American Waterfowl Management Plan and associated joint ventures. In addition, the Director has assigned staff to participate in the development of newly created Landscape Conservation Cooperatives[14] (LCC's), four of which fall within California state lines. The LCC's are intended to foster management-science partnerships that inform integrated resource management actions addressing climate change and other stressors within and across landscapes. In addition, the Director serves on the California Climate Action Team[15] (CAT) which oversees climate change activities across state agencies. The DFG is the lead on the CAT Biodiversity Working Group.

[12] http://www.dfg.ca.gov/climatechange/wafwa/
[13] http://www.dfg.ca.gov/climatechange/wafwa/committee.asp
[14] http://www.fws.gov/science/shc/lcc.html
[15] http://www.climatechange.ca.gov/climate_action_team/index.html

2. Integration: Integrating Climate Change into DFG Activities

The DFG recognizes that its ability to respond to the challenges associated with climate change is dependent on building capacity within existing staff and providing tools and resources to integrate climate change thinking into DFG responsibilities. At the end of the day it is the DFG's employees that are the driving force of the DFG's work on the ground, and climate change is one challenge among many that we face together.

Objective 2: Integrate Climate Change into DFG Functions

Members of the DFG will continually seek opportunities to incorporate climate change into policy and management branches to ensure that climate change is being effectively and correctly addressed whenever appropriate. The DFG's Climate Change Task Force, which is comprised of representatives from all the DFG's policy branches, reviews regulations, policies, and practices to examine how the DFG might reduce its carbon footprint and better respond to the effects of climate change on fish, wildlife, and the services they provide. The Task Force also provides recommendations to the Director regarding actions and initiatives the DFG should consider to address both climate change adaptation and mitigation. In addition, an employee led regional climate change committee has been established and others are under consideration. Regional employee led committees provide guidance to regional staff and input to the Climate Change Task Force related to on the ground conservation efforts for both climate change adaptation and mitigation.

Achievements to Build On: Policy and Program Changes

The DFG is already working to identify existing programs and new initiatives that will be critical to addressing climate change and implementing actions on the ground. Staff that are working on climate change are involved in policy development, legislative review, and identification of funding opportunities. In addition, the DFG is actively considering climate change impacts on projects regulated under the **California Environmental Quality Act (CEQA)** process. The DFG is completing internal guidance for staff on how to address climate change adaptation concerns for applicants to ensure that climate change impacts are appropriately addressed in CEQA documents. In addition, **DFG land acquisition proposals** have been modified to include direct considerations of climate change. Specifically all proposals must address the potential of an area under consideration to help facilitate adaptation of species, habitats and communities to climate change and the potential of climate changes to diminish key wildlife and habitat values. The result is a more thorough evaluation of acquisition proposals that are examining how a proposed acquisition might facilitate adaptation to climate change or threaten current resource values.

DFG Going Green

The DFG has focused not only on adaptation but mitigation efforts as well. In order to track and report its annual greenhouse gas emissions, the DFG has been a member of the California Climate Action Registry[16] since 2007. Additionally, on October 30, 2009 a

[16] http://www.climateregistry.org/

Director's Bulletin[17] was sent out to all staff announcing the completion of a guidance document[18] to help the DFG reduce its carbon footprint and save valuable resources. Following the release of this document the Director initiated a **Going Green** working group to focus on implementing some of the key actions that were identified in the document and to initiate select pilot projects to explore options for reducing paper use. The Going Green effort has strong support from both the Director and executive staff as well as employees from across the state.

3. Action: Conservation Practices to Maintain and Enhance Ecosystem Function

Protecting California's unique array of species and ecosystems from adverse effects of climate change will require coordinated and targeted efforts. The three conservation objectives defined in this section are the same primary objectives detailed in the Biodiversity and Habitat Chapter of the California Adaptation Strategy[19]. These objectives are focused on actions that seek to maintain healthy, connected, genetically diverse populations; improve and enhance ecosystem functions; reduce non-climate stressors on ecosystems; develop adaptive management models for game and commercial species management; and adopt adaptation approaches that reduce risks to species and habitats while providing opportunities for adjusting to new conditions.

Objective 3: State-wide System of Terrestrial and Marine Conservation Areas

An important objective of the DFG's vision is the need to maintain and create where needed a network of terrestrial and marine reserves (conservation areas) across the state that builds on existing conservation investments and the wide array of projects and planning efforts undertaken by partners. Efforts to develop this system would complement ongoing activities such as the current reevaluation and redesign of the system of Marine Protected Areas (MPAs) mandated by the Marine Life Protection Act (MLPA). The MPAs along with other landscape scale planning efforts such as the Natural Communities Conservation Planning program (NCCP) serve as important models for conservation, restoration, and acquisition efforts. To fully promote persistence of species and key populations in the face of climate change, conservation areas should support all aspects of ecosystem structure, composition, and function within aquatic, terrestrial, marine, and near-shore marine habitats. A periodic reexamination of the conservation area network will be needed, and modifications made, as more is learned about the full impacts of climate change and species migration/movement in response to these changes.

Achievements to Build On: Areas of Conservation Emphasis Mapping & Modeling Tool

The creation of connected conservation areas has been under development for many years throughout California; however, a changing climate adds additional impetus to accelerate these efforts. The success of a state-wide system of conservation areas will in part be

[17] http://www.dfg.ca.gov/climatechange/bulletins.html
[18] http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=16161
[19] CA Natural Resources Agency, 2009. 2009 California Climate Adaptation Strategy. California Natural Resources Agency. Sacramento, CA. http://www.climatechange.ca.gov/adaptation

driven by how species adapt or adjust to their surroundings and will require ongoing research and monitoring. To this end, the DFG recently completed Phase II of the DFG's Areas of Conservation Emphasis[20] (ACE-II) mapping and modeling effort that involves identifying areas considered to be of highest conservation value for purposes of meeting the DFG's mission and for focusing limited resources. The ACE maps include layers of information on biodiversity, endemism, stressors and threats (including sea level rise predictions), protected status of lands, and connectivity and corridor information that can be overlaid to contribute to setting conservation priorities statewide. The ACE mapping and modeling tool will directly support climate change adaptation planning efforts by building on and contributing to efforts to identify a network of sustainable, well connected habitat conservation areas across California.

Objective 4: Manage for Enhanced Ecosystem Function

Maintaining and restoring ecosystem function is a cornerstone of natural resource adaptation planning because it is essential for creating healthy ecosystems and ensuring the preservation of important ecosystem services. In order to maintain ecosystem function, the DFG will pursue actions that increase resistance to climate change, promote resilience, enable ecosystem responses, and realign restoration and management activities to reflect changing conditions[21]. Actions intended to **resist** climate change forestall undesired effects of change and/or manage ecosystems so they are better able to resist changes resulting from climate change. **Resilience** focuses on managing for viable ecosystems to increase the likelihood that they will accommodate gradual changes related to climate and tend to return to pre-disturbance conditions. **Response** is an intentional management action intended to accommodate change rather than resist it by actively or passively facilitating ecosystems to respond as environmental changes occur. **Realigning** management activities focuses on the idea that rather than restoring habitats to historic conditions, or managing for historic range of variability the managing entity would realign restoration and management approaches to current and anticipated future conditions. The DFG foresees the need to integrate all of these different kinds of approaches depending on the particular project or scenario at hand. Species will respond differently to climate change, and strategies will need to evolve as research and monitoring produce new information.

Achievements to Build On: The Ecosystem Restoration Program

The Ecosystem Restoration Program (ERP) in the Delta is one example of how the DFG is focusing resources on developing long-term comprehensive plans to restore ecosystem health and support important ecosystem services. Specifically, the ERP is intended to improve and increase aquatic and terrestrial habitat and to improve ecological functionality in the Bay-Delta in order to support sustainable populations of diverse and valuable plant and mineral species. Continuing to implement the strategies set forth under the ERP program will contribute significantly to the DFG's climate change adaptation efforts by protecting species and habitats that provide valuable ecosystem services and are an integral part of a variety of ecosystem processes. By creating a plan that is

[20] http://www.dfg.ca.gov/biogeodata/ace/

[21] Millar, C. I., N. L. Stephenson, and S. L. Stephens. 2007. Climate change and forests of the future: Managing in the face of uncertainty. Ecological Applications 17:2145-2151.

amenable to adaptive management, this restoration program embodies one of the major tenets of climate change adaptation. In addition, recent efforts to develop performance measures and track project progress will be vital to creating the informative feedback loop that is necessary for effective long-term management and success in the face of changing climatic conditions.

Objective 5: Manage Endemic and Other Priority Species Populations

Under a changing climate it will become increasingly important to identify and protect critical habitat for vulnerable and declining populations under current and future climate conditions. Through the use of data driven analysis, the DFG can identify areas that could become important habitat for vulnerable populations in the future or serve as important stepping stone patches or corridors to aid species' movements. Data driven analysis can also be used to inform restoration and other stewardship activities that will aid in the conservation and management of these species and their habitats. Management actions that address declining and vulnerable populations can then be evaluated and modified as necessary to build adaptive management strategies that will help stabilize these populations.

Achievements to Build On: Climate Change Vulnerability Assessments

Climate change vulnerability assessments provide the scientific basis for developing or enhancing climate adaptation strategies and combining information about future climate scenarios with ecological information about climate sensitivity and adaptive capacity to help managers anticipate how a species or system is likely to respond under the projected climate change conditions. The relative vulnerability of species or habitats can be used to set goals, determine management priorities and inform decisions about appropriate adaptation strategies. The DFG has several completed or on-going analyses to assess the vulnerability of several different taxa including birds, mammals, reptiles and amphibians, rare plants, and fish. This research will inform DFG-wide management and research efforts as well as directly informing the revision of the Action Plan.

III. Next Steps

Investing in and implementing the objectives presented in this strategic vision will increase the DFG's capacity to deal with uncertainty and ensure that California's fish, wildlife, and habitats are maintained for generations to come. Over the coming years the DFG will pursue endeavors that support implementation of the vision including funding, capacity building, collaborative partnerships, and education and outreach. In the interim, the DFG will continue to leverage existing programs, projects, and partnerships to make progress towards meeting these objectives and putting a process in place to respond to climate change challenges in a timely and effective manner. To further support these efforts and help the DFG articulate its climate change related activities, DFG staff have compiled a series of **climate change adaptation case studies**[22] to illustrate some of the DFG's programs and projects that are helping to plan for or minimize the impacts associated with climate change.

[22] http://www.dfg.ca.gov/climatechange/

DFG leadership and staff look forward to continuing to work with our stakeholders and sister state and federal agencies to build a strong, coordinated, and cohesive response to climate related challenges facing fish, wildlife, and habitats in California and beyond our borders. The objectives developed in this document are a product of several collaborative efforts with staff and partners including workshops held by the DFG to integrate climate change into California's Wildlife Action Plan[23] (Action Plan), input from public meetings, and comments submitted during the development of the Biodiversity and Habitat Sector of the California Climate Adaptation Strategy[24] (CAS). The DFG will continue to develop and implement this strategy as capacity and resources allow. Specifically, more detailed recommendations for how the DFG intends to meet the vision and objectives outlined in this document will be further developed and integrated into the revision of California's Wildlife Action Plan that is currently underway and scheduled to be completed by 2015. This document is considered a working document and will continue to be revised and updated based on new scientific information and the input of stakeholders.

For more information on the CA Dept of Fish and Game Climate Science program please visit http://www.dfg.ca.gov/climatechange/ or email climatechange@dfg.ca.gov

[23] http://www.dfg.ca.gov/wildlife/WAP/
[24] http://www.climatechange.ca.gov/adaptation/