

Unity, Integration, and Action: Climate Change Adaptation Case Studies



California Department of Fish and Game
August 2011

Unity, Integration, and Action: Climate Change Adaptation Case Studies

<i>Unity-Integration-Action: The DFG’s Vision for Confronting Climate Change in California</i>	3
<i>Objective 1: Pursue and Maintain Collaborative Partnerships</i>	3
Pacific Flyway Council and the Central Valley Joint Venture	3
<i>Objective 2: Integrating Climate Change into Department Functions</i>	6
DFG’s Land Acquisition Policy	6
<i>Objective 3: State-wide System of Conservation Areas</i>	7
The Natural Community Conservation Planning Program	7
<i>The Bay Delta Conservation Plan (BDCP)</i>	8
<i>Desert Renewable Energy Conservation Plan</i>	9
Marine Life Protection Program	9
<i>Objective 4: Manage for Enhanced Ecosystem Function</i>	11
Ecosystem Restoration Program-Bay Delta	11
<i>Objective 5: Managing Endemic and Other Priority Species Populations</i>	13
The Fisheries Restoration Grant Program	13
<i>Adaptive Management as a Response to Climate Change</i>	15

Unity-Integration-Action: The DFG’s Vision for Confronting Climate Change in California

The Department of Fish and Game’s (DFG) 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 Department’s vision include: 1) **Unity:** creating and maintaining vital climate change partnerships and collaborations, 2) **Integration:** integrating climate change into Department activities, and 3) **Action:** meeting conservation objectives for maintaining healthy ecosystems with regards to climate change impacts. Each of these components is associated with specific adaptation objectives developed by the Department that exemplify the Unity-Integration-Action framework. These adaptation objectives are listed below along with examples of projects and programs being implemented by the Department and it’s partners that demonstrate efforts currently underway to meet each objective and make progress towards effectively adapting to climate change. For more information on the DFG’s vision for confronting climate change, please visit the Department’s [climate change website](#).

Objective 1: Pursue and Maintain Collaborative Partnerships

The challenges associated with climate change provide opportunities to build on and expand existing partnerships and to leverage the resources and expertise of multiple entities. By working with partners to collectively clarify goals, objectives and priorities, the DFG will be able to represent stakeholder concerns and provide critical information on the current and projected status and vulnerabilities of wildlife and habitats under a changing climate. The DFG recognizes that it cannot address this challenge alone and is focusing on collaborative partnerships and creating a collective vision for conservation in the face of a changing climate. One example of the DFG’s commitment to a collaborative approach is its long standing participation and leadership on the Pacific Flyway Council and the Central Valley Joint Venture.

Pacific Flyway Council and the Central Valley Joint Venture

The Pacific Flyway stretches along the Pacific Coast from Mexico north to Alaska and into Siberia, Russia. Migratory birds use this major migratory route because of its unique biological characteristics and state and federal wildlife agencies have adopted the flyway structure for administering migratory bird resources within the United States. Specifically, The



Pacific Flyway Council forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory birds in western North America. One of the most important wintering waterfowl areas in the Pacific Flyway is the Central Valley of California where more than five million ducks and geese pass through every year. While this seems like a remarkable number of birds it is actually a substantial decrease from historic levels. More than half of the original 221 million wetland acres found in the contiguous U.S. have been lost with the greatest losses in the Central Valley of California.

Recognizing the importance of waterfowl and wetlands and the need for international cooperation to help in the recovery of a shared resource, the Canadian and U.S. governments developed a strategy to restore waterfowl populations through habitat protection, restoration and enhancement. In response, the North American Waterfowl Management Plan (NAWMP) was created in 1986 and its success is dependent upon the strength of partnerships, called joint ventures, involving federal, state, provincial, tribal and local governments, businesses, and conservation organizations. The DFG in particular has a huge stake in the success of this partnership since California hosts approximately 39 different species and subspecies of waterfowl and provides vital winter habitat for about 60 percent (approximately 4 - 6 million birds annually) of the waterfowl population in the Pacific Flyway. Given the predicted impacts and challenges associated with climate change, this plan and its associated partnerships are as important today as they were at inception.



The DFG is a member of the Pacific Flyway Council and has a small unit within the Wildlife Programs Branch that works cooperatively with others in the [Pacific Flyway](#) and within the DFG to conserve and manage the waterfowl resource. Specifically, the DFG's on-going activities in the Waterfowl Program (population assessments, developing management plans, cooperating with researchers, and developing hunting recommendations) are also providing a foundation to integrate climate change adaptation planning and consideration of climate change related impacts. By working together to preserve this migratory pathway, we can conserve waterfowl habitat and help maintain ecosystem structure and function in the Central Valley.

In addition to the DFG's efforts as part of the Pacific Flyway Council, the joint ventures serve as the mechanism for implementing objectives on the ground. The Central Valley Joint Venture (CVJV) was one of the first joint ventures to be formed and has been highly successful in generating objectives for wetland restoration, wetland protection, wetland enhancement, and agricultural enhancement, and to identify the water needs to accomplish these goals.

The DFG's Wildlife Conservation Board (WCB) is a charter member of the CVJV, and in 1990 created the Inland Wetlands Conservation Program. In conjunction with other CVJV partners, this program works to protect, restore and enhance wetlands and waterfowl habitat in the Central Valley of California; an especially important effort in light of predictions regarding changes in temperature and precipitation associated with climate change. The program's legislative authority provides great flexibility for the WCB to authorize grants and loans to nonprofit organizations, local governmental agencies and state departments. This menu of "programmatic options or authority," provides the ability to create and respond to opportunities designed to address all of the CVJV objectives. This kind of program will be useful as the impacts associated with climate change unfold allowing for an adaptive and proactive response to protect and conserve this key migratory pathway. By working collaboratively with partners the DFG is able to pursue landscape-scale initiatives that will contribute to a robust and multifaceted response to the impacts associated with climate change.

Objective 2: Integrating Climate Change into Department Functions

Over the past several years the Department has been involved in developing a climate change strategy that fully integrates existing policies and program implementation. This strategy involves working diligently to integrate a climate change thought process into all natural resources activities. DFG's Land Acquisition Policy is one example of how the DFG has integrated climate change into the policy process and ensured that climate change is a consideration in the DFG's acquisition process.

DFG's Land Acquisition Policy

Land acquisition is an important part of habitat conservation planning. State funds are used to protect habitat areas that are home to sensitive plant and wildlife species or areas that are at risk of conversion to agriculture or urban development. The DFG often works with partners to share the cost of the acquisitions and utilize opportunities to receive grant funds from federal land acquisition fund sources and foundations.

The DFG's Lands Committee advises the [Wildlife Conservation Board](#) (WCB) on the Department's land acquisition priorities. One of WCB's primary responsibilities is the selection, authorization, and allocation of funds for the purchase of land and waters suitable for preservation, protection and restoration of wildlife habitat. WCB also acquires lands for recreational purposes such as piers for fishing access, boat ramps, and wildlife areas for hunting access. WCB can also grant funds to other governmental entities or nonprofit organizations to acquire real property or rights in real property. All acquisition activities are carried out in conjunction with DFG, with DFG recommending priorities for proposed acquisitions.

In 2009, DFG land acquisition proposals were modified to include direct considerations of climate change. Specifically all proposals must now address the potential of an area 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 to 1) conduct a more thorough evaluation of how an acquisition might facilitate adaptation to climate change (including the establishment or improvement of corridors, reliable water sources, and topography that allows upward migration of plants and animals) and 2) provide considerations for how climate change might threaten current resource values including likely drying of wetlands, changes of habitat type, and loss of coastal marshes to the sea.

In 2011 the Wildlife Conservation Board (WCB) earmarked \$39.4 million to help restore and protect fish and wildlife habitat throughout California. The 23 funded projects will provide benefits to fish and wildlife species, including some endangered species, increase public access to these lands, and help safeguard species and habitats in the face of a changing climate. Several projects also demonstrate the importance of protecting working landscapes and integrate economic, social and environmental stewardship practices beneficial to the environment and the landowner.

Objective 3: State-wide System of Conservation Areas

An important objective of the Department's climate change adaptation planning efforts is the need to maintain and create where needed a network of terrestrial and marine reserves (conservation areas) that builds on existing conservation investments. Proactive planning efforts that identify, improve, and connect conservation areas will help maintain and increase ecological integrity and provide habitat and refuge areas to help species persist in a changing environment. A periodic reexamination of this kind of 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.

California has a legacy of proactive conservation planning and any future efforts to create or connect habitat areas to help species respond and persist in a changing climate will easily build on existing conservation



investments. For example, the current reevaluation and redesign of the system of Marine Protected Areas (MPAs) mandated by the Marine Life Protection Act (MLPA) and other terrestrial landscape scale planning efforts such as the Natural Communities Conservation Planning (NCCP) program are important models for conservation, restoration, and acquisition efforts.

The Natural Community Conservation Planning Program

[The Natural Community Conservation Planning program](#) (NCCP) 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 is designed to facilitate the adaptation of wildlife to climate change. These plans build ecological resilience by creating landscape-scale interconnected reserve networks that are based on the major tenets of conservation biology, including representativeness, multiplicity, and redundancy of large habitat blocks and natural communities. NCCP reserve networks typically occupy hundreds of thousands of acres across the entire range of environmental gradients in a planning area, and because of this and their high level of connectivity, NCCP reserve systems readily provide for the natural movement of individual organisms, and species and habitat distributional shifts, in response to climate change. In addition, where possible, NCCP reserves and linkages also provide interconnections to large blocks of federal and other publicly-owned lands to help ensure that species and habitats on public lands have access to the broadest range of ecological gradients over which to adapt. NCCPs also require protection and restoration of key ecological processes which

are essential to maintaining sustainable landscapes and populations. NCCPs acknowledge a high degree of scientific uncertainty and use conceptual predictive models to identify and resolve critical uncertainties, including effects of climate change, in an adaptive management framework that is regularly evaluated through regional effectiveness monitoring.

The Bay Delta Conservation Plan (BDCP)

The Bay-Delta (Sacramento/San Joaquin River Delta-San Francisco Bay Estuary) is a vital estuary ecosystem that sits at the crossroads of federal and state operated water delivery systems for the state. The Bay-Delta supports a \$30 billion agricultural industry, provides drinking water for more than 20 million people, supports several threatened and endangered species, and is a popular recreational and commercial fishing industry.

The alteration of river corridors, channels, and adjacent floodplains in the Delta has significantly and permanently changed the natural habitat, diminishing the ability of the ecosystem to support native species. In recent years, below average precipitation has resulted in the decline of the Delta



fishery and the collapse of California's salmon fishing industry. In addition, climate change related research in California has indicated that changes in precipitation and temperature linked to climate change will affect the timing of snow pack release into the Delta, further impacting fish habitat and the economy surrounding the Delta. The combination of decreased water availability and water restrictions to protect threatened and endangered species have already created a difficult and often tense political situation, one that will be exacerbated over time with future impacts associated with climate change.

The purpose of the BDCP is to create a stable regulatory framework to conserve and recover at-risk native species and natural communities in the Delta and provide reliable water supply to the state. The DFG is involved in developing and recommending conservation actions that would restore these remnants of natural habitat and where possible expand habitat to mimic natural conditions to minimize future impacts associated with climate change and other stressors. When complete, the plan would be implemented over the next 50 years and is a long-term conservation strategy with an adaptive management framework that sets forth actions needed for a healthy Delta in the face of a changing climate.

Desert Renewable Energy Conservation Plan

The Desert Renewable Energy Conservation Plan (DRECP) is a [Natural Community Conservation Plan](#) (NCCP), which will help provide for effective protection and

conservation of desert ecosystems while allowing for the appropriate development of renewable energy projects.

While the NCCP process has inherently always allowed for planning efforts in the face of uncertainties such as climate change, the DRECP is one of the first of its kind to explicitly identify and work to incorporate climate change adaptation research and goals. Specifically, the conservation



actions within the climate change adaptation related actions will consider retention of representative natural communities and habitat types in a matrix with sufficient flexibility to accommodate anticipated climate change outcomes¹. The DFG is committed to a planning process that will result in a final plan that explicitly addresses climate change uncertainty and includes planning goals that identify and incorporate climate change adaptation research, management objectives, and/or policies as appropriate.

Marine Life Protection Program

Under the direction of the Marine Life Protection Act (MLPA), the DFG is currently reevaluating and redesigning its state-wide system of Marine Protected Areas (MPAs) to protect California's marine life and habitat. MPAs are designed to meet overarching program goals, including protecting the natural diversity and abundance of marine life, and function, structure, and integrity of marine ecosystems, in addition to helping sustain, preserve, and protect marine life populations². These goals are directly aligned with the basic principles of climate change adaptation, and updating the MPA system will be a great step towards meeting this objective.

MPA design and implementation is keeping DFG on the path towards successfully planning for climate change related impacts. MPAs are designed using the best available science, allowing room to integrate climate change science as it emerges. Since the creation of MPAs is largely collaborative in nature, the process ensures strong partnerships and communication with stakeholders, which is vital to confronting climate change challenges. Additionally, under current guidelines, the effectiveness of MPAs is periodically evaluated to ensure that program goals are being met, which will directly

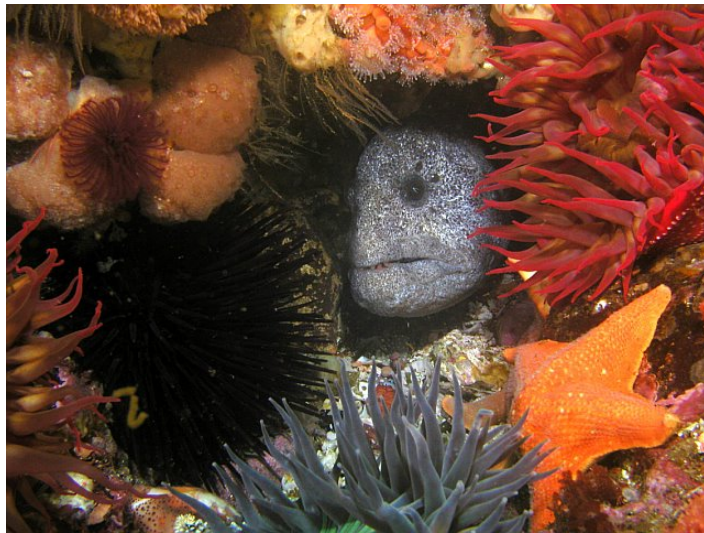
¹ DRECP Independent Science Advisors (2010). Recommendations of Independent Science Advisors for The California Desert Renewable Energy Conservation Plan. DRECP-1000-2010-008-F
<http://www.energy.ca.gov/2010publications/DRECP-1000-2010-008/DRECP-1000-2010-008-F.PDF>

² http://www.dfg.ca.gov/mlpa/pdfs/agenda_021308hb.pdf

lend itself to supporting an adaptive management framework that supports inclusion of climate change related research as appropriate.

MPAs are currently being planned and implemented by the DFG on a regional basis along the California coast. The Central Coast region and North Central Coast region have already planned and implemented new MPAs using sound science and input from a large Regional Stakeholder Group, a Science Advisory Team, a Blue Ribbon Task Force, resource managers, and members of the public. The South Coast region MPAs followed a similar process and those plans have been approved and will go into effect in October 2011. The North Coast and San Francisco Bay MPA plans are currently under development with on-going collaboration and input from stakeholders.

DFG's Marine Region staff are engaged in a variety of efforts that will support management and research needs relative to integrating climate change related concerns and impacts into MPA design and management. For example, DFG is an active member of the California Cooperative Ocean Fisheries



Investigations (CalCOFI) who, along with NOAA Fisheries Service, Scripps Institute of Oceanography, and other partners are collecting valuable data from marine environments off the California coast that can be used to help monitor and manage marine resources. DFG staff also collect and digitize data for the Commercial Fisheries Information System (CFIS) and the California Recreational Fishery Survey (CRFS), both of which are being used by researchers and managers to examine temporal trends in fisheries related to climate change. With this data, changes in stock size can be evaluated relative to changes in the oceanographic environment resulting from short-term events like El Niño as well as long term changes in climate. These monitoring efforts will be beneficial to supporting future management actions in the marine reserve system and offer the ability to consider future climate change implications as appropriate.

Objective 4: Manage for Enhanced Ecosystem Function

Maintaining and restoring ecosystem function is a cornerstone of natural resource climate change adaptation. The DFG is pursuing actions that will increase resistance to climate change, promote resilience, enable ecosystem responses, and realign restoration and management activities to better reflect changing conditions. Reducing other, non-climate stressors, such as habitat destruction and fragmentation, pollution, and invasive species will help improve the ability of natural systems to withstand or adapt to climate change. To that end, the DFG is focusing resources on restoration and other land stewardship practices that reduce environmental stressors to improve watershed conditions and restore ecosystem services on priority lands.

Ecosystem Restoration Program-Bay Delta

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. Other ERP objectives include ensuring good water quality and reliability for beneficial uses, and addressing Bay-Delta system vulnerability to catastrophic breaching of Delta levees.

To meet these goals and objectives, the DFG, along with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), have been working together with other partners to develop a long-term comprehensive plan that will restore ecosystem health and improve water management practices for the beneficial uses of the Bay-Delta System. As a reflection of the three implementing agencies (DFG, USFWS, and NMFS), the ERP conservation strategy captures what is needed at a programmatic level to achieve biological conservation and management goals while also providing a foundation for regional implementation guided by a science-based adaptive management approach. This strategy has since developed into a single “blueprint” for ecosystem restoration that integrates the NMFS recovery plan for central valley salmonids together with the USFWS delta native fish recovery plan, which is a dynamic planning accomplishment in itself.

The ERP upholds a strong commitment to environmental justice and is actively engaging local agencies, tribes, and nonprofit organizations, including many representing economically disadvantaged communities. Through this collaborative approach, more than 130,000 acres of habitat targeted for species of importance to the Delta have been enhanced, protected and restored, mostly through easements obtained by working with local land owners and communities. Protection of agricultural lands remains a high priority as well, with more than 54,000 acres protected for their significant habitat values. In 2011, the ERP is managing more than 85 ongoing and approximately 10 newly funded projects that incorporate a thorough environmental, public, and scientific review. These efforts have led to a significant rebound of salmon species in the Central Valley and

investments in protecting habitat have preserved lands and stream passage for migrating and/or spawning fish species.

The ERP implementing agencies are currently in the process of developing indicators and performance measures for the program to track progress. To assist with this effort, the CALFED Science Program is developing a framework that provides general background information for how indicators should be used to inform science, management, and adaptive management. The Science Program is currently working to make the framework more flexible and useful to program elements and implementing agencies in their effort to develop and utilize indicators. In addition, the Science Program is developing indicators and performance measures for the overall CALFED Bay-Delta Program.

Continuing to implement the strategies set forth under the ERP program will contribute significantly to the DFG's climate change adaptation efforts to protect species and habitats that provide valuable ecosystem services and are an integral part of a variety of ecosystem processes. Through a science-based approach to restoration, the ERP strategic plan will remain robust in the future as our scientific knowledge about climate change-ecosystem interactions continues to advance. Furthermore, by creating a plan that is 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: Managing Endemic and Other Priority Species Populations

Efforts that actively facilitate the ability of species, habitats and ecosystems to accommodate climate change may be necessary to protect highly valued species or ecosystems when other options are insufficient. The DFG is working to identify and protect critical habitat for vulnerable and declining populations under current and future climate conditions through the use of data driven analysis and targeted restoration efforts. By evaluating and modifying management actions that address declining and vulnerable populations, adaptive management strategies can be built that will allow for appropriate adjustments to be made to help stabilize these populations in the future.

The Fisheries Restoration Grant Program

With the population of some salmon species at critically low levels, restoring anadromous salmon and steelhead habitat is a commitment the DFG and our partners have embraced. The DFG recognizes that climate change is expected to alter the behavior and distribution of ocean and coastal species as



air and water temperatures rise and natural ecosystems are altered. The 2009 *California Climate Adaptation Strategy*³ includes as a guiding principal to “Give priority to adaptation strategies that initiate, foster, and enhance existing efforts that improve economic and social well-being, public safety and security, public health and environmental justice, species and habitat protection, and ecological function.” As a near-term action, the Strategy states that for Habitat Protection, “State agencies should identify key habitats that may require more protections as a result of climate change impacts and should plan additional buffer areas where necessary to allow for climate change phenomena...”⁴

For nearly three decades, projects funded by the DFG’s Fisheries Restoration Grant Program (FRGP) have enhanced salmonid species’ adaptation potential by restoring and preserving habitat. The realization of climate change places a great urgency on DFG and its partners to accelerate and continue restoring and preserving habitat that will be

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

⁴ Fisheries Restoration Grant Program, 2010. Migration Proposal Solicitation Notice Coastal Salmon and Steelhead Migration Improvement

resilient to current and future impacts. To that end, the FRGP was established in 1981 in response to rapidly declining populations of wild salmon and steelhead trout and deteriorating fish habitat in California. To date, this competitive grant program has invested over \$180 million to support projects from sediment reduction to watershed education throughout coastal California that are helping the DFG to manage, restore, and maintain vulnerable populations in a changing climate.

Specific accomplishments include:

- 895 miles of stream have been treated
- 53 miles of stream bank have been stabilized
- 122 miles of instream habitat has been restored
- 661 miles of stream have been opened to fish passage by removing 440 barriers
- 5,467 acres of riparian habitat have been restored
- 1,283 miles of road have been treated to reduce sediment in salmonid streams
- 1,000s of children and adults have been educated about habitat necessary for anadromous fish to thrive
- [California Salmonid Stream Habitat Manual](#)
- [DFG iMaps Viewer](#) of geographic information on FRGP projects

Adaptive Management as a Response to Climate Change

Adaptive management is a key element of implementing effective science based conservation programs, especially in light of uncertainties associated with climate change. Natural communities, ecosystems, population dynamics, and the effects of stressors on the environment are inherently complex. Wildlife and



resource managers often are called upon to implement conservation strategies or actions based upon limited scientific information and despite considerable uncertainties. Adaptive management combines data from monitoring species and natural systems with new information from management and targeted studies to continually assess the effectiveness of, and adjust and improve, conservation actions. Effective **monitoring** is critical to an adaptive management approach and will provide a basis for decision making that can be applied to all climate change related activities. Without monitoring changes (both unexpected and anticipated) the Department will not be able to evaluate the effectiveness of management decisions in the face of climate change.

Scenario-based planning and **sensitivity analysis** should also be employed to the greatest extent possible to ensure that actions taken to meet the proposed objectives will be effective, or at least not harmful, if the future unfolds differently than expected.

Adaptive co-management, a process involving local residents, academic scientists, and other stakeholders, serves the dual purpose of improving the extent of information available for decisions, and informing those involved about priorities that need to be addressed and actions that can be taken. It is important to keep in mind that the outcomes of management interventions in the face of climate change differ markedly in their predictability, and while some management strategies will be robust to different future climates, others will not. Successful management will require strategies in which management actions are coupled with monitoring to provide informative feedback loops. Under this kind of planning process, managers can begin to actively address climate change despite uncertainties in future projections⁵.

⁵ Resource management in a changing and uncertain climate. Lawler, J.J.*, and T.H. Tear, , C. Pyke, M. R. Shaw, P.Gonzalez, P. Kareiva, L.Hansen, L. Hannah, K. Klausmeyer, A. Aldous, C. Bienz, and S.Pearsall, 2009. *Front Ecol Environ* 2009; 7, doi:10.1890/070146



All photos are the property of Debra Hamilton CA DFG



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