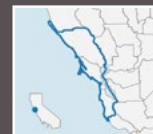


# California Red-Legged Frog

Climate Change Vulnerability  
and Adaptation Strategies for the  
Golden Gate Biosphere Region



## Species Description

The California red-legged frog (CRLF; *Rana draytonii*) is the largest native frog in western North America and is a federally threatened species endemic to California and Baja California, Mexico. CRLFs are highly aquatic, though adult frogs also utilize terrestrial habitats for estivation during the dry season and for movement between aquatic areas. CRLFs typically breed during the winter wet season in artificial or natural permanent and ephemeral ponds, lagoons, or in slow-moving waters in streams; however, they require some open water edge habitat with emergent and shoreline vegetation for egg deposition. The species utilizes a variety of habitats outside of the breeding season, including springs, creeks, tributaries, ponds, retention basins, and riparian corridors.

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## Species Vulnerability - Moderate

### Sensitivity & Exposure - High

Projected Changes	Trend
Air temperature	▲ Increase
Precipitation	▲▼ Varies
Water temperature	▲ Increase
Altered streamflow	▲▼ Varies
Sea level rise	▲ Increase
Extreme storms	▲ Increase
Pathogens	▲ Increase

#### Potential Impacts:

- More rapid drying of breeding sites due to shortened hydroperiods in aquatic habitat
- Potential reduction in breeding sites and refugia with adequate soil moisture during periods of decreased precipitation
- Reduced suitability of coastal habitats due to increasing salinity and sea level rise
- Loss or stranding of egg masses and tadpoles during more frequent and intense flood events
- Expansion of pathogens as a result of warmer water temperatures

**Non-climate stressors** may interact with climate stressors and disturbance regimes:

- *American bullfrogs* prey on and compete with CRLF for food, affecting recruitment and survival
- *Land-use change* contributes to habitat fragmentation and isolation of breeding ponds, impacting dispersal and metapopulation dynamics
- *Dams and water diversions* alter stream hydrology, impacting habitat availability and quality and, consequently, the distribution of CRLF egg masses and tadpoles
- *Roads, highways, and trails* act as barriers to dispersal and lead to habitat fragmentation



**Red-legged frogs are sensitive to factors that influence water availability and quality, breeding habitat extent, egg mass survival, and reproductive success.**

# Species Vulnerability - Moderate

## Adaptive Capacity - Moderate

### Intrinsic factors (i.e., inherent characteristics) that enhance or undermine adaptive capacity:

#### Enhance:

- Ability to travel to access new aquatic and terrestrial habitats
- Range of timing for breeding and egg-laying, allowing for adjustments in response to altered hydrology

#### Undermine:

- Reduced genetic diversity due to fragmentation of isolated populations
- Low resistance to changes in hydroperiod or thermal regimes

### Extrinsic factors (i.e., management potential) that enhance or undermine adaptive capacity:

#### Enhance:

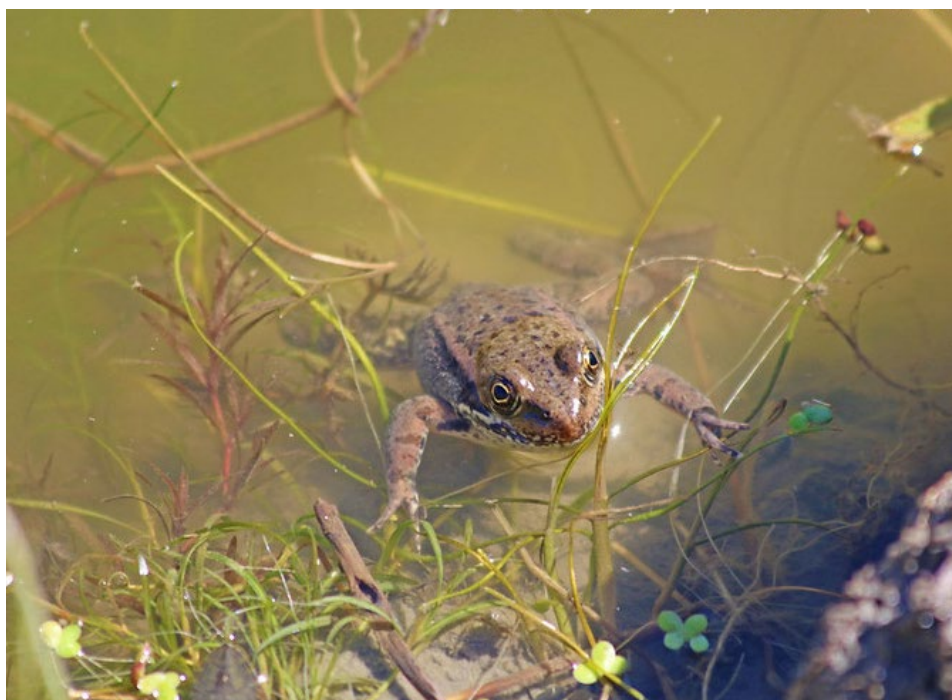
- Strong public support for species conservation
- Existing legal obligations, regulatory measures, and financial resources to protect the species

#### Undermine:

- Ongoing habitat conversion and human activity causing fragmentation, habitat degradation, and barriers to dispersal



**Fragmented populations, reduced connectivity, and barriers to dispersal limit CRLF's adaptive capacity, making it critical for conservation efforts to prioritize habitat protection, restoration, and/or creation.**



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# Adaptation Strategies & Actions

Adaptation strategies can reduce climate change vulnerability of a given ecosystem or species by addressing any or all of the three components of vulnerability (i.e., by reducing sensitivity, reducing exposure, and/or increasing adaptive capacity). The table below presents examples of adaptation strategies and actions, which fall within five categories, or approaches: Resistance/Resilience **(R)**, Acceptance **(A)**, Direct/Response **(D)**, Knowledge **(K)**, and Collaboration **(C)**. *Please note that the strategies and actions provided here should not be considered a checklist or plan, but rather as a set of examples for land managers to consider for further study when developing site- or species-specific actions.*

Adaptation Strategies	Adaptation Actions
<b>Monitor and manage California red-legged frog populations</b>	<ul style="list-style-type: none"> <li>• Monitor occupied habitats and potentially suitable unoccupied habitats of red-legged frogs to detect non-native fish and bullfrogs before establishment of breeding populations <b>(R/K)</b></li> <li>• Remove non-native fish and bullfrogs that are likely to exacerbate the impacts of climate change on frogs <b>(R)</b></li> <li>• Establish annual monitoring of red-legged frog populations, using best practices to avoid introducing pathogens during site visits <b>(R)</b></li> </ul>
<b>Restore freshwater systems to enhance habitat for red-legged frogs</b>	<ul style="list-style-type: none"> <li>• Create and/or restore ponds to promote groundwater recharge/storage and provide critical habitat for red-legged frogs <b>(R)</b></li> <li>• Identify corridors and target restoration and/or reintroduction to those areas <b>(R/K)</b></li> <li>• Upgrade culverts and road crossings to increase connectivity for CRLF and allow the passage of sediment/debris under projected flow conditions <b>(R)</b></li> </ul>
<b>Increase California red-legged frog populations and distribution</b>	<ul style="list-style-type: none"> <li>• Reintroduce red-legged frogs to formerly occupied sites that retain suitable habitat conditions <b>(R)</b></li> </ul>

*Adaptation strategies and actions suggested by individual stakeholders (not discussed during the December 2023 adaptation workshop).*



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